Service Manual

(Models 04018, 04019, 04030, 04022, 04024, 04025, 04031)

Greensmaster® Flex 18/21

Preface

The purpose of this publication is to provide the service technician with information for troubleshooting, testing and repairing assemblies and components on the Greensmaster Flex 18 (Model 04018) and Flex 21 (Model 04022).

REFER TO THE OPERATOR'S MANUAL FOR OPERATING, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS. Space is provided in Chapter 2 of this book to insert the Operator's Manual and Parts Catalogs for your machine. Replacement Operator's Manuals and Parts Catalogs are available on the internet at www.toro.com or by sending complete Model and Serial Number to:

The Toro Company
Attn. Technical Publications
8111 Lyndale Avenue South
Minneapolis, MN 55420–1196

The Toro Company reserves the right to change product specifications or this publication without notice.

This safety symbol means DANGER, WARNING or CAUTION, PERSONAL SAFETY INSTRUCTION. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions may result in personal injury.

NOTE: A **NOTE** will give general information about the correct operation, maintenance, service, testing or repair of the machine.

IMPORTANT: The IMPORTANT notice will give important instructions which must be followed to prevent damage to systems or components on the machine.

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Chapter 1

Safety

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Safety Instructions

Although hazard control and accident prevention partially are dependent upon the design and configuration of the machine, these factors are also dependent upon the awareness, concern and proper training of the personnel involved in the operation, transport, maintenance and storage of the machine. Improper use or maintenance of the machine can result in injury or death. To reduce the potential for injury or death, comply with the following safety instructions.

WARNING

To reduce the potential for injury or death, comply with the following safety instructions.

Before Operating

1. Operate the machine only after reviewing and understanding the contents of the Operator's Manual and Operator Training DVD. A replacement Operator's Manual is available on the internet at www.toro.com or by sending the complete model and serial number to:

   The Toro Company
   Attn. Technical Publications
   8111 Lyndale Avenue South
   Minneapolis, Minnesota 55420–1196

2. Never allow children to operate the machine or allow adults to operate it without proper instructions.

3. Become familiar with the controls and know how to stop the machine and engine quickly.

4. Keep all shields, safety devices and decals in place. If a shield, safety device or decal is malfunctioning, illegible or damaged, repair or replace it before operating the machine.

5. Always wear substantial shoes. Do not operate machine while wearing sandals, tennis shoes or sneakers. Do not wear loose fitting clothing which could get caught in moving parts and cause personal injury.

6. Wearing safety glasses, safety shoes, long pants, ear protection and a helmet is advisable and required by some local safety and insurance regulations.

7. Ensure work area is clear of objects which might be picked up and thrown by the cutting reel.

8. Keep everyone, especially children and pets away from the areas of operation.

9. Since gasoline is highly flammable; handle it carefully.

   A. Use an approved gasoline container.

   B. Do not remove cap from fuel tank when engine is hot or running.

   C. Do not smoke while handling gasoline.

   D. Fill fuel tank outdoors and no higher than to the bottom of filter screen. Do not overfill fuel tank.

   E. Wipe up any spilled gasoline.

   F. Fuel may leak from filler neck when mower is tilted for servicing if tank is over filled.

10. Check the safety interlock switch daily for proper operation; see Component Testing in Chapter 5 – Electrical System. If safety switch should malfunction, replace the switch before operating machine. After every two years, replace the safety interlock switch, whether it is working properly or not.

While Operating

1. Do not run the engine in a confined area without adequate ventilation. Exhaust fumes are hazardous and could be deadly.

2. Always stand behind the handle when starting and operating the machine.

3. To start the engine:

   A. Open fuel shut-off valve. Make sure spark plug wire is connected to spark plug.

   B. Verify that the control lever on handle is in NEUTRAL position for both traction and reel drives.

   C. Move on/off switch to ON position, set choke to full choke position (cold start) and throttle to half throttle.

   D. Pull starter cord to start engine.

4. To stop the engine:

   A. Disengage reel and traction drives and reduce engine speed to SLOW.

   B. Move on/off switch to OFF position to stop engine.

5. Before emptying basket of clippings, disengage traction and reel drives, reduce engine speed and move on/off switch to OFF position to stop engine.

6. Do not touch engine, muffler or exhaust pipe while engine is running or soon after it has stopped because these areas are hot enough to cause burns.

7. If the cutting unit strikes a solid object or vibrates abnormally, stop immediately, turn engine off, wait for all motion to stop and inspect for damage. A damaged reel or bedknife must be repaired or replaced before operation is commenced.

8. Whenever machine is left unattended, be sure engine is stopped and cutting unit reel is not spinning.

9. Close fuel shut-off valve if machine is not to be used for an extended period of time. Also, close fuel shut-off valve if machine is to be transported on a trailer or in a vehicle.

Maintenance and Service

1. Before servicing or making adjustments to the machine, stop the engine and wait for all machine movement to stop. Remove the spark plug wire from the spark plug to prevent accidental starting of the engine.

2. To make sure entire machine is in good condition, keep all nuts, bolts, screws and belts properly tightened.

3. To reduce potential fire hazard, keep the engine area free of excessive grease, grass, leaves and accumulation of dirt.

4. Wear heavy gloves and use caution when checking or servicing the cutting unit.

5. If the engine must be running to perform maintenance or make an adjustment, keep hands, feet, clothing and all parts of the body away from the cutting unit and all moving parts. Keep bystanders away.

6. Do not overspeed the engine by changing governor settings. Maximum engine speed is 3600 RPM. To ensure safety and accuracy, check maximum engine speed with a tachometer.

7. Engine must be shut off before checking oil or adding oil to the engine crankcase or transmission.

8. If major repairs are ever needed or assistance is required, contact an Authorized TORO Distributor.

9. At the time of manufacture, the machine conformed to all applicable safety standards. To assure optimum performance and continued safety certification of the machine, use genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers may result in non-conformance with the safety standards and the warranty may be voided.

Safety and Instruction Decals

Safety decals and instructions are easily visible to the operator and are located near any area of potential danger. Replace any decal that is damaged or lost. Decal part numbers are listed in your Parts Catalog. Order replacement decals from your Authorized TORO Distributor.

Product Records and Maintenance

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Product Records

Insert Operator's Manual and Parts Catalog for your Greensmaster Flex 18 or Flex 21 at the end of this section. Additionally, if any optional equipment or accessories have been installed to your machine, insert the Installation Instructions, Operator's Manuals and Parts Catalogs for those options at the end of this chapter.

Maintenance

Maintenance procedures and recommended service intervals for the Greensmaster Flex 18 and Flex 21 are covered in the Operator's Manual. Refer to that publication when performing regular equipment maintenance.

Equivalents and Conversions

Decimal and Millimeter Equivalents

Fractions	Decimals	mm	Fractions	Decimals	mm
1/64	0.015625	— 0.397	33/64	0.515625	— 13.097
1/32	0.03125	— 0.794	17/32	0.53125	— 13.494
3/64	0.046875	— 1.191	35/64	0.546875	— 13.891
1/16	0.0625	— 1.588	9/16	0.5625	— 14.288
5/64	0.078125	— 1.984	37/64	0.578125	— 14.684
3/32	0.09375	— 2.381	19/32	0.59375	— 15.081
7/64	0.109275	— 2.778	39/64	0.609375	— 15.478
1/8	0.1250	— 3.175	**5/8**	0.6250	— 15.875
9/64	0.140625	— 3.572	41/64	0.640625	— 16.272
5/32	0.15625	— 3.969	21/32	0.65625	— 16.669
11/64	0.171875	— 4.366	43/64	0.671875	— 17.066
3/16	0.1875	— 4.762	11/16	0.6875	— 17.462
13/64	0.203125	— 5.159	45/64	0.703125	— 17.859
7/32	0.21875	— 5.556	23/32	0.71875	— 18.256
15/64	0.234375	— 5.953	47/64	0.734375	— 18.653
1/4	0.2500	— 6.350	**3/4**	0.7500	— 19.050
17/64	0.265625	— 6.747	49/64	0.765625	— 19.447
9/32	0.28125	— 7.144	25/32	0.78125	— 19.844
19/64	0.296875	— 7.541	51/64	0.796875	— 20.241
5/16	0.3125	— 7.938	13/16	0.8125	— 20.638
21/64	0.328125	— 8.334	53/64	0.828125	— 21.034
11/32	0.34375	— 8.731	27/32	0.84375	— 21.431
23/64	0.359375	— 9.128	55/64	0.859375	— 21.828
3/8	0.3750	— 9.525	**7/8**	0.8750	— 22.225
25/64	0.390625	— 9.922	57/64	0.890625	— 22.622
13/32	0.40625	— 10.319	29/32	0.90625	— 23.019
27/64	0.421875	— 10.716	59/64	0.921875	— 23.416
7/16	0.4375	— 11.112	15/16	0.9375	— 23.812
29/64	0.453125	— 11.509	61/64	0.953125	— 24.209
15/32	0.46875	— 11.906	31/32	0.96875	— 24.606
31/64	0.484375	— 12.303	63/64	0.984375	— 25.003
1/2	0.5000	— 12.700	**1**	1.000	— 25.400

1 mm = 0.03937 in. **0.001 in. = 0.0254 mm**

U.S.to Metric Conversions

	To Convert	Into	Multiply By
Linear Measurement	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
Area	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
Volume	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
Weight	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
Pressure	Pounds/Sq. In.	Kilopascal	6.895
	Pounds/Sq. In.	Bar	0.069
Work	Foot-pounds	Newton-Meters	1.356
	Foot-pounds	Kilogram-Meters	0.1383
	Inch-pounds	Kilogram-Centimeters	1.152144
Liquid Volume	Quarts	Liters	0.9463
	Gallons	Liters	3.785
Liquid Flow	Gallons/Minute	Liters/Minute	3.785
Temperature	Fahrenheit	Celsius	1. Subract 32° 2. Multiply by 5/9

Torque Specifications

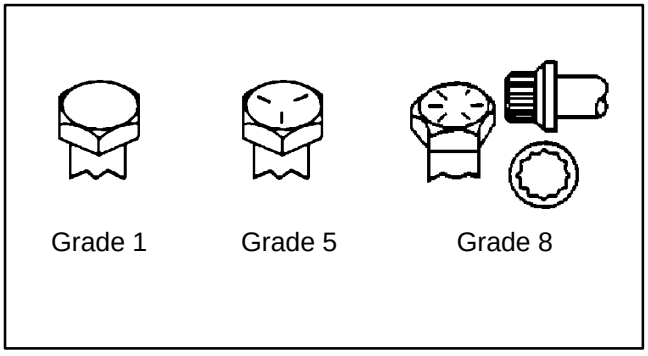
Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in this Service Manual.

These Torque Specifications for the installation and tightening of fasteners shall apply to all fasteners which do not have a specific requirement identified in this Service Manual. The following factors shall be considered when applying torque: cleanliness of the fastener, use of a thread sealant (e.g. Loctite), degree of lubrication on the fastener, presence of a prevailing torque feature (e.g. Nylock nut), hardness of the surface underneath the fastener's head or similar condition which affects the installation.

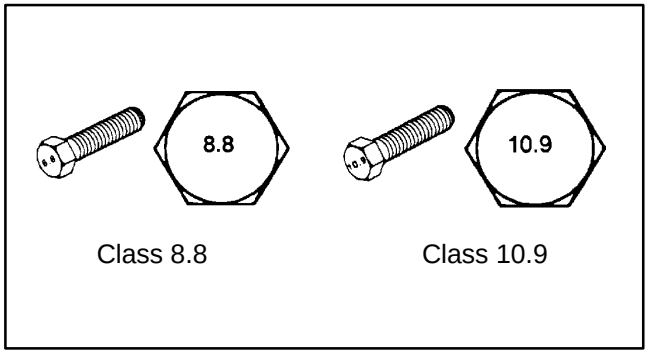
As noted in the following tables, torque values should be **reduced by 25% for lubricated fasteners** to achieve the similar stress as a dry fastener. Torque values may also have to be reduced when the fastener is threaded into aluminum or brass. The specific torque value should be determined based on the aluminum or brass material strength, fastener size, length of thread engagement, etc.

The standard method of verifying torque shall be performed by marking a line on the fastener (head or nut) and mating part, then back off fastener 1/4 of a turn. Measure the torque required to tighten the fastener until the lines match up.

Fastener Identification



Inch Series Bolts and Screws



Metric Bolts and Screws

Standard Torque for Dry, Zinc Plated and Steel Fasteners (Inch Series Fasteners)

Thread Size	Grade 1, 5 & 8 with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 5 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 5 or Stronger Nuts)	
	in–lb	**in–lb**	**N–cm**	**in–lb**	**N–cm**	**in–lb**	**N–cm**
# 6 – 32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	169 ± 23	23 ± 3	262 ± 34
# 6 – 40 UNF				17 ± 2	192 ± 23	25 ± 3	282 ± 34
# 8 – 32 UNC	13 ± 2	25 ± 5	282 ± 56	29 ± 3	328 ± 34	41 ± 5	463 ± 56
# 8 – 36 UNF				31 ± 4	350 ± 45	43 ± 5	486 ± 56
# 10 – 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 5	475 ± 56	60 ± 6	678 ± 68
# 10 – 32 UNF				48 ± 5	542 ± 56	68 ± 7	768 ± 79
1/4 – 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1130 ± 113	140 ± 15	1582 ± 169
1/4 – 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 12	1299 ± 136	160 ± 17	1808 ± 192
5/16 – 18 UNC	115 ± 15	105 ± 15	1186 ± 169	200 ± 25	2260 ± 282	300 ± 30	3390 ± 339
5/16 – 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2542 ± 282	325 ± 33	3672 ± 373
	ft–lb	**ft–lb**	**N–m**	**ft–lb**	**N–m**	**ft–lb**	**N–m**
3/8 – 16 UNC	16 ± 2	16 ± 2	22 ± 3	30 ± 3	41 ± 4	43 ± 5	58 ± 7
3/8 – 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 4	47 ± 5	50 ± 6	68 ± 8
7/16 – 14 UNC	27 ± 3	27 ± 3	37 ± 4	50 ± 5	68 ± 7	70 ± 7	95 ± 9
7/16 – 20 UNF	29 ± 3	29 ± 3	39 ± 4	55 ± 6	75 ± 8	77 ± 8	104 ± 11
1/2 – 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 11	142 ± 15
1/2 – 20 UNF	32 ± 4	53 ± 7	72 ± 9	85 ± 9	115 ± 12	120 ± 12	163 ± 16
5/8 – 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 21	285 ± 28
5/8 – 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 18	230 ± 24	240 ± 24	325 ± 33
3/4 – 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 27	359 ± 37	375 ± 38	508 ± 52
3/4 – 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 30	407 ± 41	420 ± 43	569 ± 58
7/8 – 9 UNC	140 ± 20	225 ± 25	305 ± 34	430 ± 45	583 ± 61	600 ± 60	813 ± 81
7/8 – 14 UNF	155 ± 25	260 ± 30	353 ± 41	475 ± 48	644 ± 65	667 ± 66	904 ± 89

NOTE: Torque values may have to be reduced when installing fasteners into threaded aluminum or brass. The specific torque value should be determined based on the fastener size, the aluminum or base material strength, length of thread engagement, etc.

NOTE: Reduce torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant such as engine oil or thread sealant such as Loctite.

NOTE: The nominal torque values listed above for Grade 5 and 8 fasteners are based on 75% of the minimum proof load specified in SAE J429. The tolerance is approximately ± 10% of the nominal torque value. Thin height nuts include jam nuts.

Standard Torque for Dry, Zinc Plated and Steel Fasteners (Metric Fasteners)

Thread Size	Class 8.8 Bolts, Screws and Studs with Regular Height Nuts (Class 8 or Stronger Nuts)		Class 10.9 Bolts, Screws and Studs with Regular Height Nuts (Class 10 or Stronger Nuts)	
M5 X 0.8	57 ± 6 in–lb	644 ± 68 N–cm	78 ± 8 in–lb	881 ± 90 N–cm
M6 X 1.0	96 ± 10 in–lb	1085 ± 113 N–cm	133 ± 14 in–lb	1503 ± 158 N–cm
M8 X 1.25	19 ± 2 ft–lb	26 ± 3 N–m	28 ± 3 ft–lb	38 ± 4 N–m
M10 X 1.5	38 ± 4 ft–lb	52 ± 5 N–m	54 ± 6 ft–lb	73 ± 8 N–m
M12 X 1.75	66 ± 7 ft–lb	90 ± 10 N–m	93 ± 10 ft–lb	126 ± 14 N–m
M16 X 2.0	166 ± 17 ft–lb	225 ± 23 N–m	229 ± 23 ft–lb	310 ± 31 N–m
M20 X 2.5	325 ± 33 ft–lb	440 ± 45 N–m	450 ± 46 ft–lb	610 ± 62 N–m

NOTE: Torque values may have to be reduced when installing fasteners into threaded aluminum or brass. The specific torque value should be determined based on the fastener size, the aluminum or base material strength, length of thread engagement, etc.

NOTE: Reduce torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant such as engine oil or thread sealant such as Loctite.

NOTE: The nominal torque values listed above are based on 75% of the minimum proof load specified in SAE J1199. The tolerance is approximately ± 10% of the nominal torque value.

Other Torque Specifications

SAE Grade 8 Steel Set Screws

Thread Size	Recommended Torque	
	Square Head	Hex Socket
1/4 – 20 UNC	140 ± 20 in–lb	73 ± 12 in–lb
5/16 – 18 UNC	215 ± 35 in–lb	145 ± 20 in–lb
3/8 – 16 UNC	35 ± 10 ft–lb	18 ± 3 ft–lb
1/2 – 13 UNC	75 ± 15 ft–lb	50 ± 10 ft–lb

Wheel Bolts and Lug Nuts

Thread Size	Recommended Torque**	
7/16 – 20 UNF Grade 5	65 ± 10 ft–lb	88 ± 14 N–m
1/2 – 20 UNF Grade 5	80 ± 10 ft–lb	108 ± 14 N–m
M12 X 1.25 Class 8.8	80 ± 10 ft–lb	108 ± 14 N–m
M12 X 1.5 Class 8.8	80 ± 10 ft–lb	108 ± 14 N–m

** For steel wheels and non–lubricated fasteners.

Thread Cutting Screws (Zinc Plated Steel)

Type 1, Type 23 or Type F	
Thread Size	Baseline Torque*
No. 6 – 32 UNC	20 ± 5 in–lb
No. 8 – 32 UNC	30 ± 5 in–lb
No. 10 – 24 UNC	38 ± 7 in–lb
1/4 – 20 UNC	85 ± 15 in–lb
5/16 – 18 UNC	110 ± 20 in–lb
3/8 – 16 UNC	200 ± 100 in–lb

Thread Cutting Screws (Zinc Plated Steel)

Thread Size	Threads per Inch		Baseline Torque*
	Type A	Type B	
No. 6	18	20	20 ± 5 in–lb
No. 8	15	18	30 ± 5 in–lb
No. 10	12	16	38 ± 7 in–lb
No. 12	11	14	85 ± 15 in–lb

* Hole size, material strength, material thickness & finish must be considered when determining specific torque values. All torque values are based on non–lubricated fasteners.

Conversion Factors

in–lb X 11.2985 = N–cm
ft–lb X 1.3558 = N–m

N–cm X 0.08851 = in–lb
N–m X 0.7376 = ft–lb

Chapter 3

Engine

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Specifications

Item	Description
Make / Designation	Kawasaki, 4–stroke, OHV, single cylinder, air–cooled, gasoline engine, FE120D
Bore x Stroke	2.36” x 1.73” (60 mm x 44 mm)
Total Displacement	7.6 in^3 (124 cc)
Compression Ratio	8.4:1
Carburetor	Float feed, fixed main jet
Governor	Mechanical flyweight
Low Idle Speed (no load)	2400 $\pm$ 100 RPM
High Idle Speed (no load)	3600 $\pm$ 100 RPM
Direction of rotation	Counter clockwise (facing PTO shaft)
Fuel	Unleaded, automotive grade gasoline
Fuel Tank Capacity	2.6 U.S. qt (2.5 l)
Engine Oil	See Operator’s Manual
Lubrication System	Splash type
Oil Capacity	0.63 U.S. qt (0.6 l)
Air Cleaner	Dual element
Ignition System	Transistorized flywheel magneto with ignition advance
Spark Plug	NGK BPR 5ES
Spark Plug Gap	0.028” to 0.032” (0.7 to 0.8 mm)
Dry Weight	32.4 lbs (14.7 kg)

Introduction

This Chapter gives information about specifications, maintenance, troubleshooting, testing and repair of the gasoline engine used in the Greensmaster Flex 18 and Flex 21 mowers.

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the Kawasaki FE120D Service Manual that is included at the end of this Chapter. The use of some specialized test equipment is explained. However, the cost of the test equipment and the specialized nature of some repairs may dictate that the work be done at an engine repair facility.

Service and repair parts for Kawasaki engines are supplied through your local Toro distributor. Be prepared to provide your distributor with the Toro model and serial number.

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Greensmaster machine. Refer to the Operator's Manual for additional information when servicing the machine.

Adjustments

Throttle Cable Adjustment

If a new throttle cable must be installed or the cable is out of adjustment, adjust the cable as follows:

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Move throttle control lever on the handle to the FAST position.

3. Loosen throttle cable screw that secures the throttle cable to the governor lever.

4. Make sure throttle lever is in the FAST position and the governor lever is against the high idle speed screw.

5. Tighten throttle cable screw to secure the throttle cable to the governor lever.

6. After cable adjustment, connect spark plug wire to spark plug, start engine and check engine speed with a tachometer:

   A. Low idle speed should be **2300 to 2500 RPM**. Adjust low idle speed screw in or out to attain the correct low idle speed setting.

   B. High idle speed should be **3500 to 3700 RPM**. Adjust high idle speed screw in or out to attain the correct high idle speed setting.

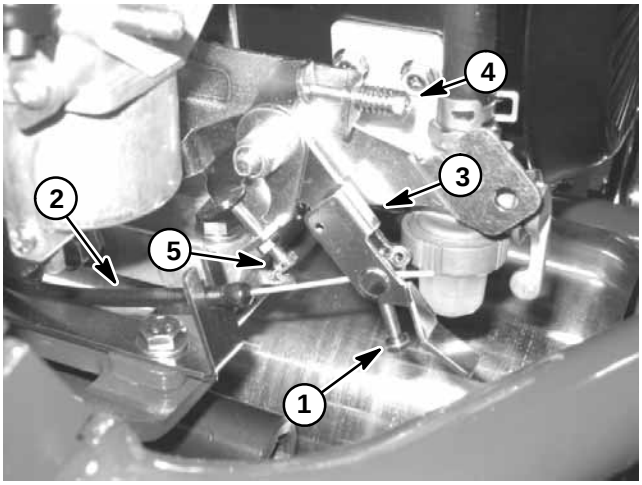


Figure 1

1. **Throttle cable screw**
2. **Throttle cable**
3. **Governor lever**
4. **Low idle speed screw**
5. **High idle speed screw**

Cooling System

IMPORTANT: The engine that powers the Flex 18 and Flex 21 is air–cooled. Operating the engine with dirty or plugged cooling fins or a plugged or dirty blower housing will result in engine overheating and damage.

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

IMPORTANT: Never clean engine with pressurized water. Water could enter and contaminate the fuel system.

2. Clean cooling fins on cylinder and cylinder head. Remove engine cylinder shroud from engine for more thorough cleaning (Fig. 2).

3. Clean blower housing of dirt and debris (Fig. 3). Remove housing if necessary.

IMPORTANT: Never operate engine without the blower housing installed. Overheating and engine damage will result.

4. Make sure blower housing and/or engine cylinder shroud are installed to the engine if removed.

5. Attach spark plug wire to spark plug.

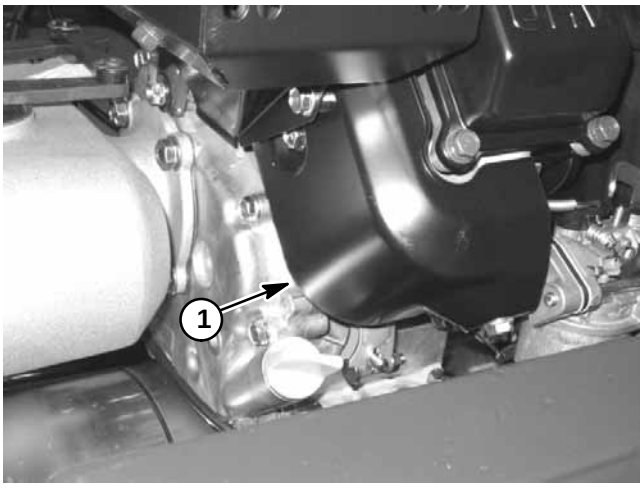


Figure 2

1. Engine cylinder shroud

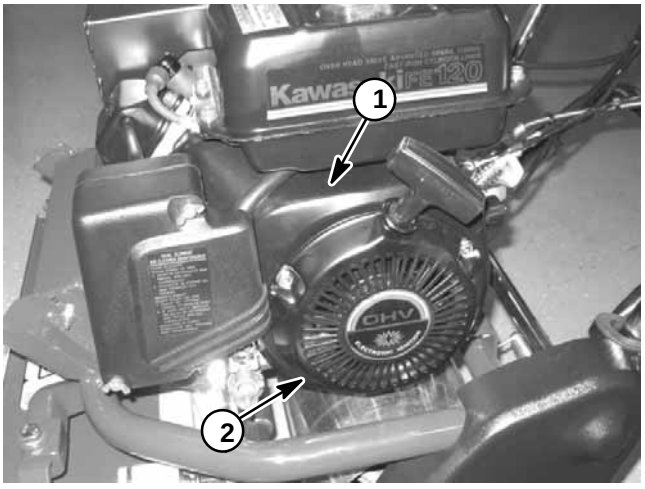


Figure 3

1. Blower housing **2. Rewind starter**

Ignition Components

Engine ignition component information is included in Chapter 5 – Electrical System.

Spark Plug

Use a NGK BPR 5ES spark plug or equivalent.

1. Make sure engine is OFF. Carefully pull spark plug wire off the spark plug.

2. Clean around spark plug and remove plug from the cylinder head.

NOTE: The condition of the spark plug can give an accurate picture of the overall condition of the engine. Use the chart on the following page as a guide to determine possible problems with the engine.

3. Inspect the spark plug.

IMPORTANT: Replace a cracked, fouled or dirty spark plug. Do not sand blast, scrape or clean spark plug electrodes because engine damage could result from grit entering cylinder.

4. Set electrode gap from 0.028” to 0.032” (0.7 to 0.8 mm). Install correctly gapped spark plug into cylinder head and torque plug to **17 ft–lb (23 N–m)**. Connect spark plug wire to spark plug.

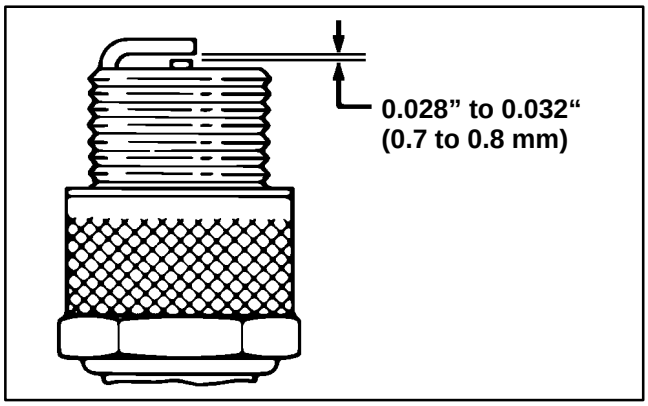
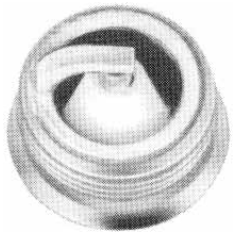
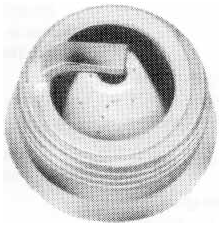


Figure 4



NORMAL

Has gray or light tan deposits on the firing tip.

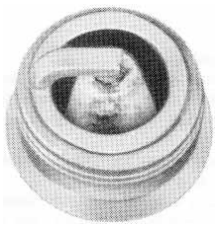


OVER HEATING

Light gray or white insulator with small gray brown or black spots. Electrode has a bluish burnt appearance.

May be caused by engine overheating, loose spark plug, wrong fuel type, plug heat range too hot or incorrect ignition timing.

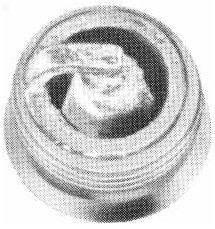
Replace spark plug.



FUSED SPOT DEPOSIT

Has spotty or melted deposits resembling blisters or bubbles.

Replace spark plug.

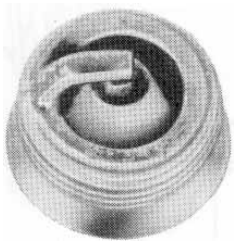


LEAD FOULED

Has dark black, gray, tan or yellow deposits. May have a fused glazed coating on the insulator tip.

Caused by highly leaded gasoline.

Replace spark plug.

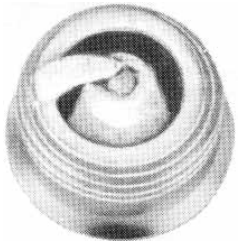


CARBON FOULED

Black dry fluffy carbon deposits are found on insulator tip, electrodes and exposed shell surfaces.

Weak ignition, plug heat range too cold, fuel mixture too rich or excessive idling may be the cause.

Replace spark plug.

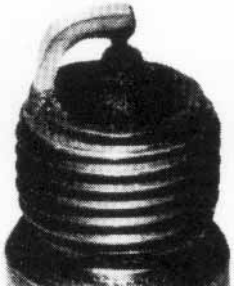


WORN

Has severely eroded or worn electrodes.

Caused by normal wear.

Replace spark plug.

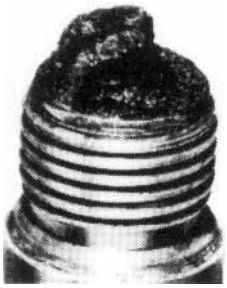


GAP BRIDGED

Gap between electrodes is closed by deposit build up.

May be caused by carbon or oil fouling.

Replace spark plug.

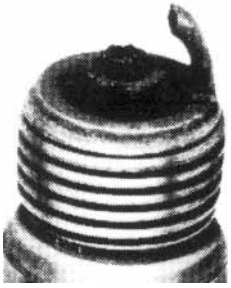


OIL FOULED

Wet black deposits can be found on electrodes, insulator and in the bore.

Excessive oil entering the combustion chamber past worn valve guides, valve stems, rings, piston and/or cylinder bore.

Replace spark plug.



PRE–IGNITION

Electrodes are melted and the insulator may be blistered. Metallic deposits on the insulator indicate engine damage.

Engine overheating, burnt valves, plug heat range too hot, incorrect ignition timing or wrong type of fuel are causes.

Replace spark plug.

Engine

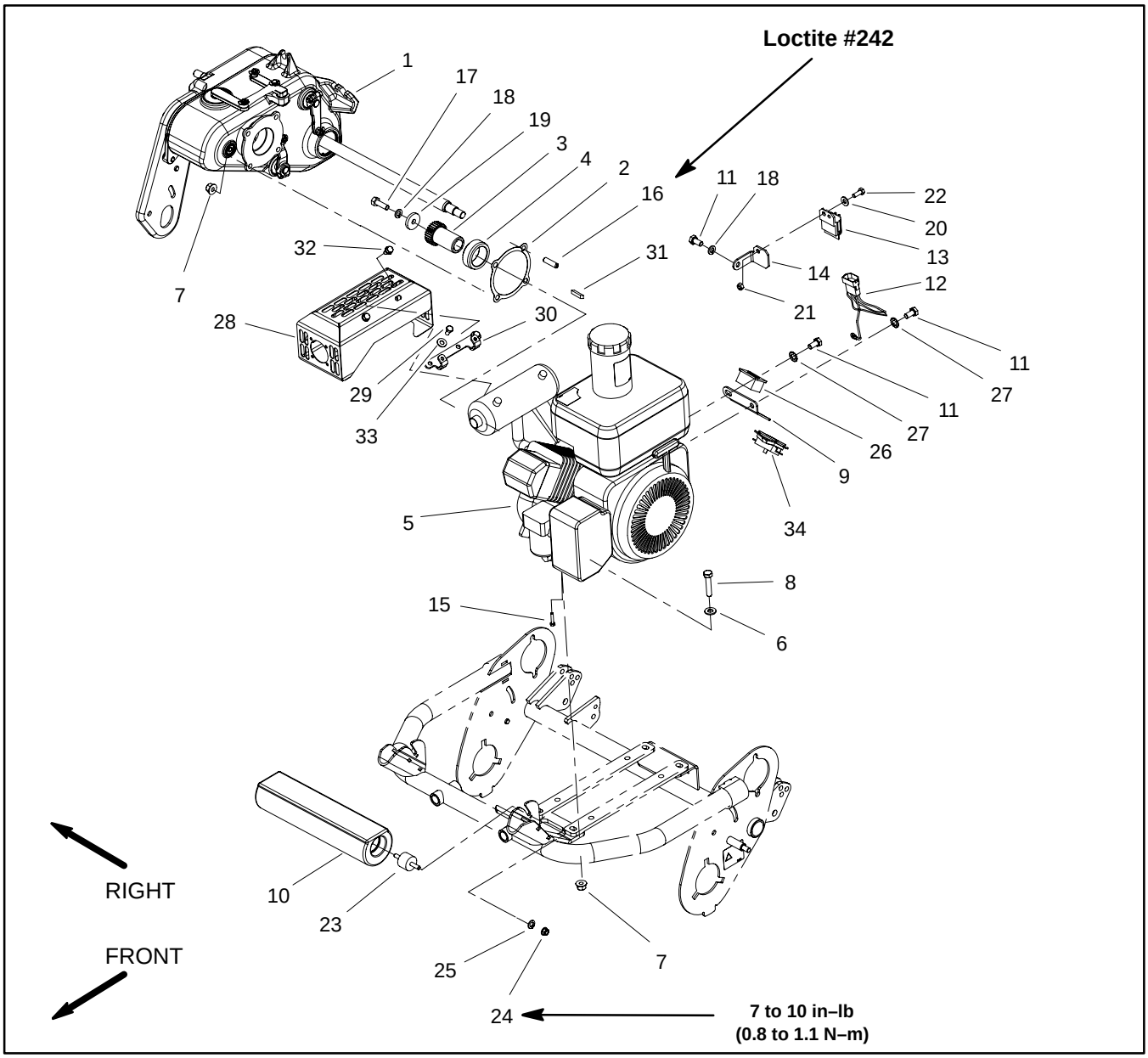


Figure 5

1. Gearbox assembly
2. Flange gasket
3. Engine gear
4. Engine adapter
5. Engine
6. Flat washer (4 used)
7. Flange nut (8 used)
8. Cap screw (4 used)
9. Hourmeter bracket
10. Damper
11. Cap screw (3 used)
12. Wire harness
13. Interlock module
14. Module bracket
15. Throttle cable screw
16. Set screw (4 used)
17. Cap screw
18. Lock washer (2 used)
19. Flat washer
20. Flat washer
21. Lock nut
22. Cap screw
23. Isolator mount (2 used)
24. Jam nut (2 used)
25. Tab washer (2 used)
26. Hourmeter
27. Lock washer (2 used)
28. Muffler guard
29. Cap screw (4 used)
30. Muffler guard bracket (2 used)
31. Square key
32. Washer head screw (4 used)
33. Flat washer (4 used)
34. Hourmeter mounting clip

Engine Removal (Fig. 5)

1. Make sure machine is parked on a level surface with the engine OFF. Remove spark plug wire from the spark plug to prevent the engine from starting. Close fuel shut–off valve.

2. If engine is to be disassembled, it may be easier to drain oil from engine before removing engine from traction unit.

3. Drain oil from gearbox.

4. Remove throttle cable from engine:

   A. Remove cap screw and flange nut that secure cable clamp to traction unit frame (Fig. 6). Locate and retrieve three (3) washers from under clamp.

   B. Loosen screw that secures throttle cable to throttle cable nut enough to slide the cable out of the nut (Fig. 7).

   C. Position throttle cable away from engine.

5. Disconnect electrical connections from engine (Fig. 8):

   A. Unplug wire harness connector from interlock module.

   B. Disconnect engine stop switch and armature wires from wire harness connectors.

   C. Disconnect wire harness ground wire from engine by removing cap screw and lock washer.

6. Remove engine from the engine base (Fig. 6):

   A. Remove four (4) flange nuts that secure gearbox assembly to set screws on engine crankcase cover.

   B. Support gearbox between mower frame and gearbox flange.

   C. Remove four (4) cap screws, flat washers and flange nuts that secure engine to engine base of traction unit.

   D. Carefully slide engine away from gearbox assembly to allow engine gear to clear gearbox. Remove and discard flange gasket (item 2).

   E. Remove the engine from the traction unit.

7. If necessary, remove cap screw, lock washer and flat washer that secure engine gear to crankshaft. Slide gear from crankshaft. Remove square key from engine crankshaft keyway.

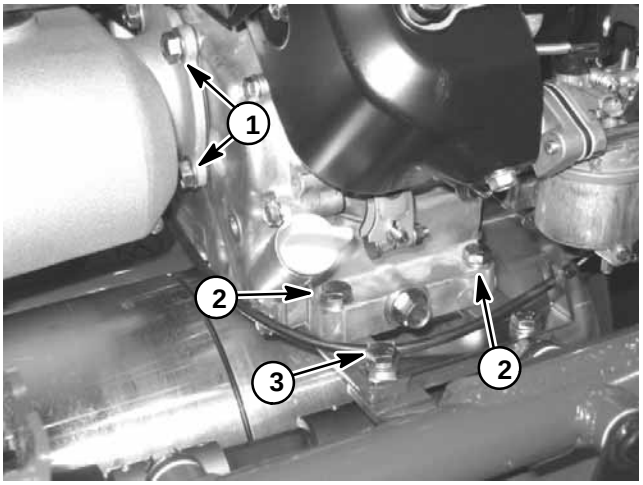


Figure 6

1. **Gearbox flange nuts**
2. **Engine mounting screws**
3. **Throttle cable clamp**

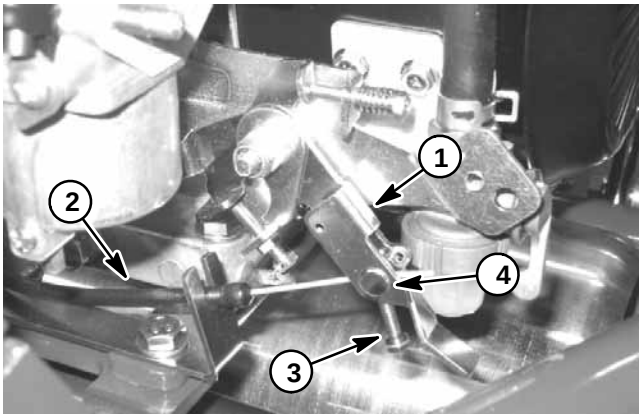


Figure 7

1. **Governor lever**
2. **Throttle cable**
3. **Throttle cable screw**
4. **Throttle cable nut**

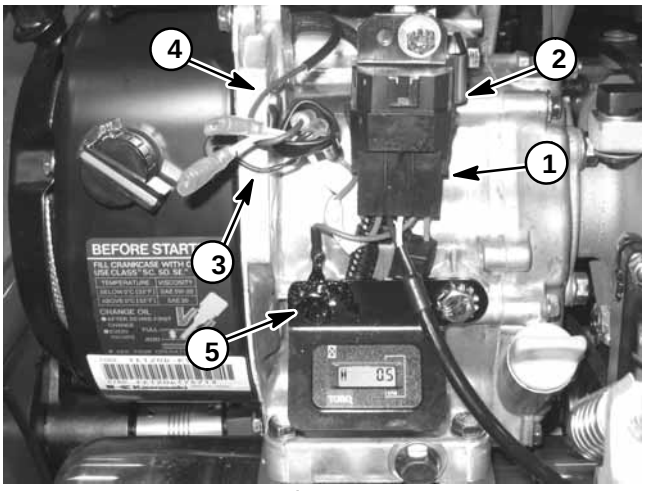


Figure 8

1. **Wire harness**
2. **Interlock module**
3. **Stop switch wire**
4. **Armature wire**
5. **Cap screw/lock washer**

Engine Installation (Fig. 5)

1. Position machine on a level surface. Make sure that spark plug wire is not connected to engine spark plug.

2. Make sure that all parts removed from the engine during maintenance or rebuilding are properly installed to the engine.

3. If engine gear was removed from crankshaft, position square key in crankshaft keyway. Slide gear onto crankshaft. Secure gear to crankshaft with cap screw, lock washer and flat washer.

4. Install engine to engine base (Fig. 5 and 6):

   A. Make sure that four (4) set screws are secure in engine crankcase cover. If set screws were removed from engine cover, apply Loctite #242 (or equivalent) to set screw threads, install into engine cover and tighten securely.

   B. Install new flange gasket (item 2) to set screws on crankcase cover.

   C. Position engine on the engine base with the drive gear towards the gearbox assembly.

   D. Slide engine toward gearbox while guiding drive gear into gearbox input area. Crankshaft may have to be turned to mesh engine gear teeth with gearbox input gears.

   E. Install and finger tighten four (4) flange nuts that secure gearbox assembly to set screws on engine crankcase cover.

   F. Install four (4) cap screws with flat washers through the engine and engine base. Put flange nut on each cap screw and hand tighten.

   G. Fully tighten flange nuts that secure gearbox assembly to engine and then tighten flange nuts that secure engine to engine base.

5. Connect electrical connections to engine (Fig. 8):

   A. Connect wire harness connectors to engine stop switch and armature wires.

   B. Secure ground wire to engine with cap screw and lock washer.

   C. Connect wire harness to interlock module.

6. Connect throttle cable to engine.

   A. Position throttle cable to engine.

   B. Slide throttle cable through throttle cable nut (Fig. 7).

   C. Position three (3) washers and cable clamp to frame (Fig. 6). Secure with cap screw and flange nut.

   D. Adjust throttle cable (See Throttle Cable Adjustment in the Adjustment section of this chapter). Make sure that throttle cable screw is tightened after cable adjustment.

7. Fill gearbox to proper fluid level.

8. Check and adjust engine oil level as needed.

9. Attach spark plug wire to the spark plug. Open fuel shut–off valve.

Chapter 4

Traction and Reel Drive System

Table of Contents

Specifications

Item	Description
Traction Drive	Integral Gearbox Assembly Attached Directly to Engine Differential to Traction Drive has 8 mm Pitch Positive Drive Belts
Gearbox Fluid	Dexron III Automatic Transmission Fluid (or equivalent)
Gearbox Fluid Capacity	2.9 U.S. qt (2.8 l)
Differential	Integral in Gearbox Assembly
Parking Brake	Band Drum (in gearbox)
Traction Drum	Dual Cast Aluminum, 7.5 inch (19.1 cm) Diameter
Cutting Reel Drive	Gear Driven Countershaft (in gearbox) with Cone Wet Clutch Flexible Coupler Shaft Used in Reel Drive System Gearbox to Reel Drive has 8 mm Pitch Positive Drive Belts

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Greensmaster machine. Refer to the Operator's Manual for additional information when servicing the machine.

Gearbox Seals

The Greensmaster Flex 18 and Flex 21 use cannister seals in the gearbox. This type of seal is internally lubricated and, like other seals, could normally have a light lubricant film evident at the seal lips. Cannister seals will also cause a slightly higher amount of drag than other seal types.

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Reel Drive and Transmission Coupler Drive Belt Replacement (Fig. 1 and 2)

Flex 18 and Flex 21 machines use two identical positive drive belts to operate the cutting unit. Replacement of these belts requires the same procedure.

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Remove belt cover to expose appropriate drive belt: right side (Fig. 1) or left side (Fig. 2).

3. Loosen the two (2) bearing housing mounting nuts.

4. Pivot bearing housing to loosen belt tension. Remove drive belt from the two pulleys.

Installation

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Place a new drive belt onto the two pulleys.

3. Adjust drive belt tension (see Operator's Manual).

4. Install belt cover to machine and secure with flange nut. Torque flange nut **100 in–lb (11.3 N–m)**.

5. Connect spark plug wire to spark plug.

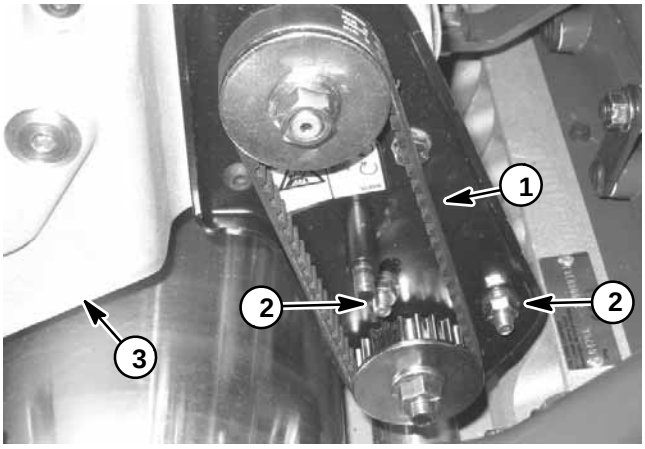

Figure 1

1. **RH reel drive belt**
2. **Bearing housing nuts**
3. **Gearbox assembly**

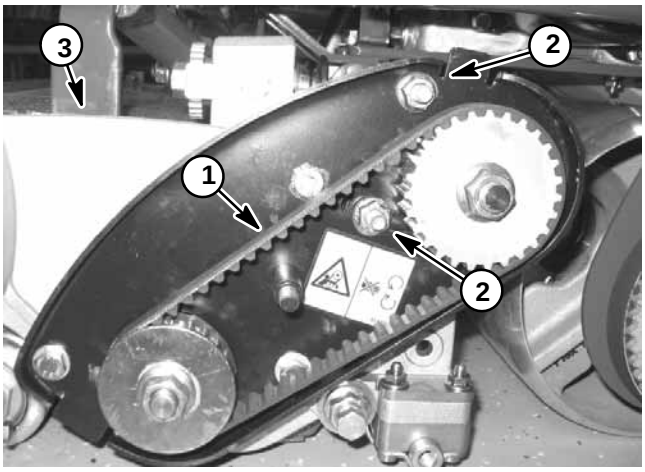

Figure 2

1. **LH reel drive belt**
2. **Bearing housing nuts**
3. **LH cutting reel sideplate**

Reel Drive Assembly

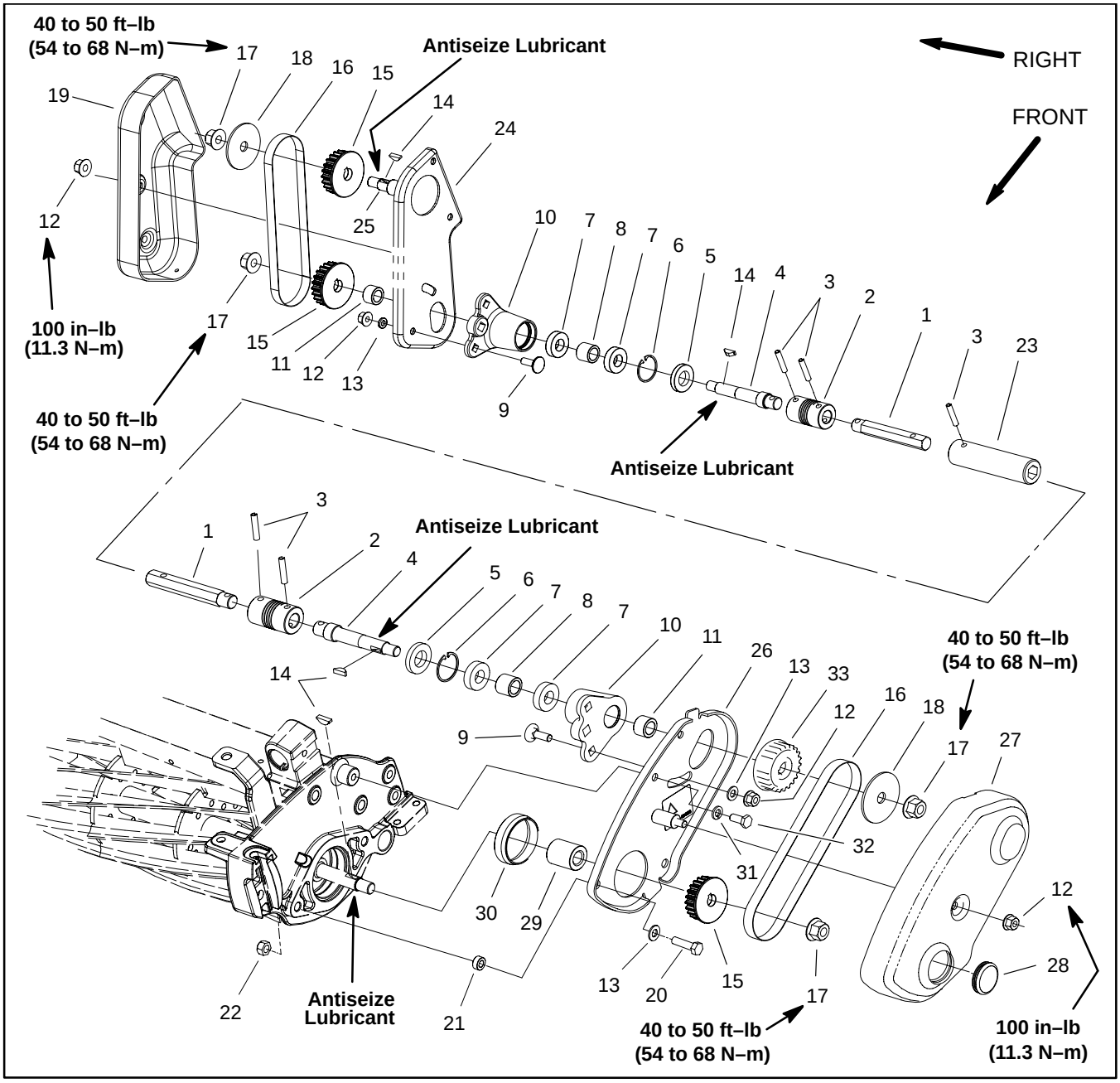

Figure 3

1. Hex shaft
2. Flex coupling
3. Spring pin
4. Shaft
5. Oil seal
6. Retaining ring
7. Bearing
8. Spacer
9. Carriage screw (2 used per housing)
10. Bearing housing
11. Spacer
12. Flange nut (2 used per housing)
13. Flat washer (2 used per housing)
14. Woodruff key
15. Pulley (22 tooth)
16. Belt
17. Flange nut
18. Pulley washer
19. Belt cover assembly
20. Cap screw (2 used)
21. Spacer (2 used)
22. Lock nut (2 used)
23. Hex tube
24. Drive shaft plate assembly
25. Gearbox shaft
26. Reel drive plate assembly
27. Reel drive cover
28. Plug
29. Spacer
30. Spacer
31. Lock washer
32. Cap screw
33. Pulley (27 tooth)

NOTE: On early production Flex 18 cutting units, the 22 tooth pulley attached to the cutting reel (left side of cutting unit) is mounted with the flange toward the cutting unit and has a pulley washer on the outside. These machines do not use a pulley washer (item 18) on the 27 tooth pulley (item 33).

Reel Drive and Transmission Coupler Bearing Housing (Fig. 3)

Service of the reel drive bearing housings on either side of the machine requires similar procedures.

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Remove the cutting unit from the traction unit (see Separating Cutting Unit From Traction Unit in the General Information section of Chapter 7 – Cutting Unit).

3. Remove belt cover and reel drive belt from the side of the mower that requires service (see Reel Drive and Transmission Coupler Drive Belt Replacement in this section).

NOTE: Do not grasp hex shaft (Fig. 6) when loosening flange nut that secures pulley as flex coupler may be damaged and fail prematurely.

4. Remove flange nut that secures pulley to the shaft (Fig. 4 and 5). Slide pulley (and pulley washer if equipped) from the shaft. Remove woodruff key and spacer.

5. Remove flange nuts and washers from carriage screws that secure bearing housing to plate assembly.

6. Slide bearing housing with shaft and coupler away from the frame.

Bearing Housing Disassembly

NOTE: When removing flex coupler from shaft, do not mar outer surface of coupler (e.g. grasping with pliers or mounting in vise) as coupler may be damaged and fail prematurely.

1. Push spring pin from flex coupler and shaft to allow coupler to be removed from shaft. Remove coupler and discard spring pin.

2. Remove seal and then retaining ring from housing.

3. Pull shaft with bearings and spacer from housing.

4. Press bearings and spacer from shaft.

Bearing Housing Assembly

1. Press first bearing fully onto shaft. Position spacer and press second bearing onto the shaft.

2. Fill cavity between bearings with Mobil High Temperature XHP–222 grease (or equivalent) (Fig. 8).

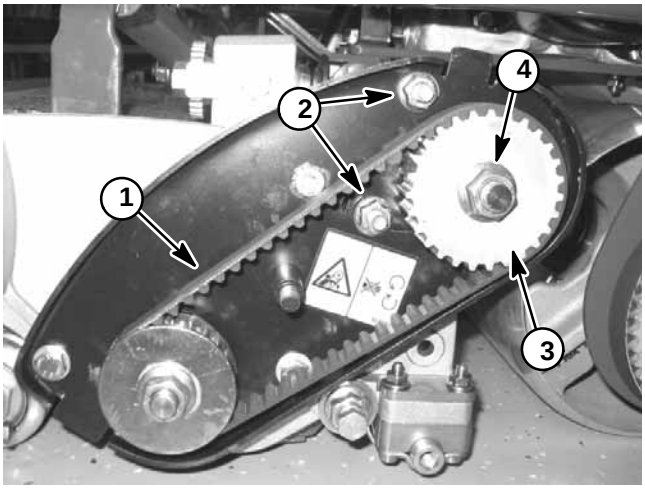

Figure 4

1. **LH reel drive belt**
2. **Flange nut/washer**
3. **Pulley (27 tooth)**
4. **Pulley flange nut**

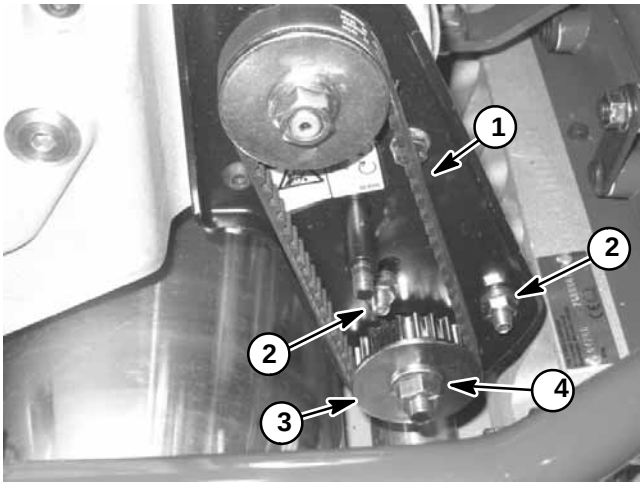

Figure 5

1. **RH reel drive belt**
2. **Flange nut/washer**
3. **Pulley (22 tooth)**
4. **Pulley flange nut**

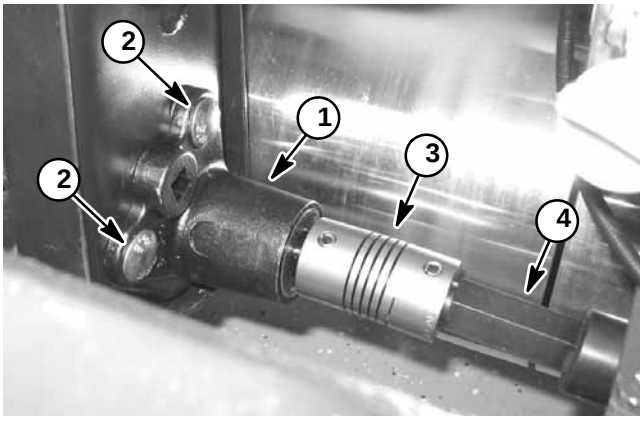

Figure 6

1. **Bearing housing (RH)**
2. **Carriage screw**
3. **Flex coupler**
4. **Hex shaft**

3. Apply grease to the bore of the bearing housing. Install shaft with bearings and spacer into housing and secure with retaining ring.

4. Fill small cavity between outer bearing and seal location in bearing housing approximately half full of Mobil High Temperature XHP–222 grease (or equivalent) (Fig. 8).

5. Pack rear cavity of oil seal with Mobil High Temperature XHP–222 grease (or equivalent) (Fig. 8). Install oil seal into housing.

NOTE: When installing flex coupler onto shaft, do not mar outer surface of coupler (e.g. grasping with pliers or mounting in vise) as coupler may be damaged and fail prematurely.

6. Slide coupler onto shaft and secure with new spring pin.

Installation

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Position bearing housing with shaft and coupler to the plate assembly.

3. Place both carriage screws through the bearing housing and plate. Install washers and flange nuts on carriage screws. Do not fully tighten flange nuts at this time.

4. Position spacer onto shaft. Place woodruff key into shaft keyslot.

5. Apply antiseize lubricant to the bore of the pulley and install pulley onto shaft:

   A. Left side pulley uses a pulley washer.

   B. Right side pulley should be installed with the flange outward.

NOTE: Do not grasp hex shaft when tightening flange nut that secures pulley as flex coupler may be damaged and fail prematurely.

6. Secure the pulley to the shaft with flange nut. Torque flange nut from **40 to 50 ft–lb (54 to 68 N–m)**.

7. Install reel drive belt to the reel drive assembly and adjust belt (see Reel Drive and Transmission Coupler Drive Belt Replacement in this section). Make sure that bearing housing flange nuts are securely tightened after drive belt adjustment.

8. Install reel drive belt cover and secure with flange nut. Torque flange nut **100 in–lb (11.3 N–m)**.

9. Attach cutting unit to the traction unit (see Separating Cutting Unit From Traction Unit in the General Information section of Chapter 7 – Cutting Unit).

10. Connect spark plug wire to spark plug.

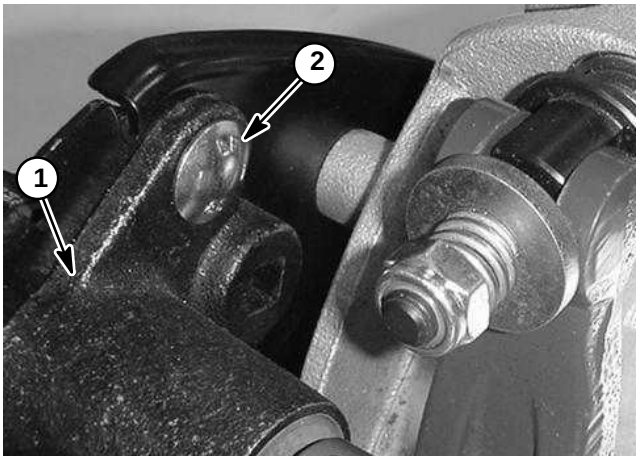

Figure 7

1. **Bearing housing (LH)**
2. **Carriage screw**

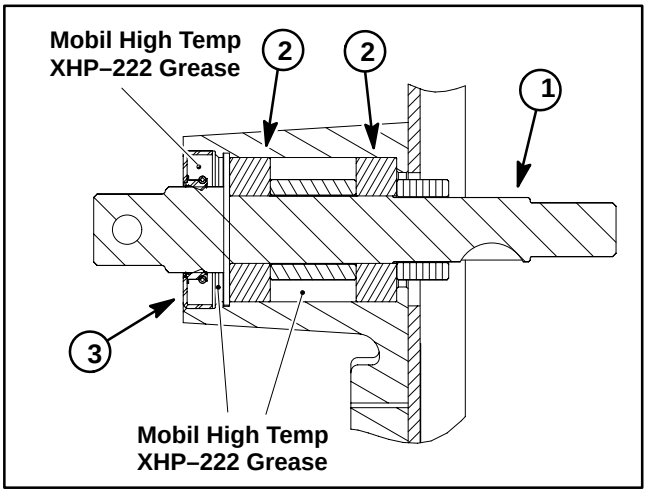

Figure 8

1. **Shaft**
2. **Bearing**
3. **Seal**

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Traction Drive Belt Replacement

The traction drive system on Flex 18 and Flex 21 machines uses a positive drive belt on both sides of the traction drum. Belt replacement on either side requires the same procedure.

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Remove transport wheels if attached (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

3. Remove flange nut that secures the belt cover (Fig. 9). Remove belt cover to expose the traction drive belt.

4. Loosen cap screw that secures idler bracket to frame (Fig. 10). Pivot the idler pulley away from the drive belt to loosen belt tension (Fig. 11).

5. Remove traction drive belt from both pulleys.

Installation

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Place traction drive belt onto both pulleys.

3. Adjust traction drive belt tension (see Operator's Manual).

4. Install traction drive belt cover and secure with flange nut. Torque flange nut **100 in–lb (11.3 N–m)**.

5. Replace transport wheels if they were attached (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls.

6. Connect spark plug wire to spark plug.

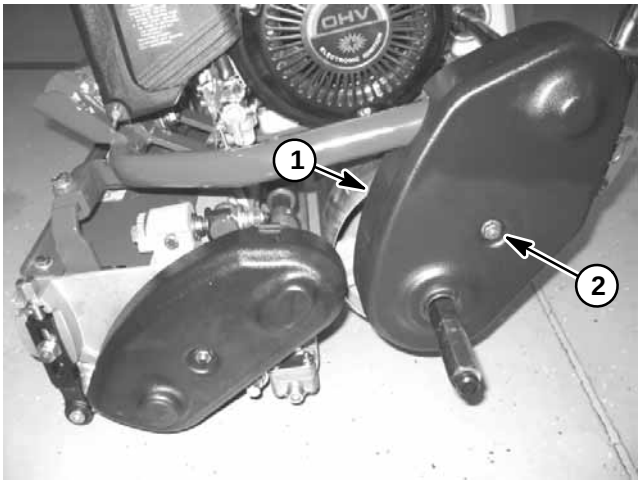

Figure 9

1. **Traction belt cover**
2. **Flange nut**

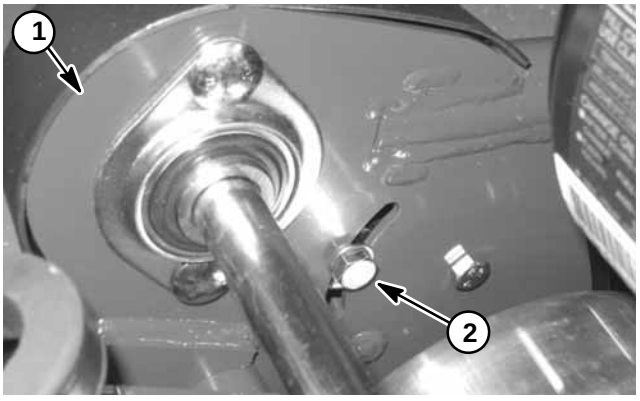

Figure 10

1. **Side plate**
2. **Idler bracket cap screw**

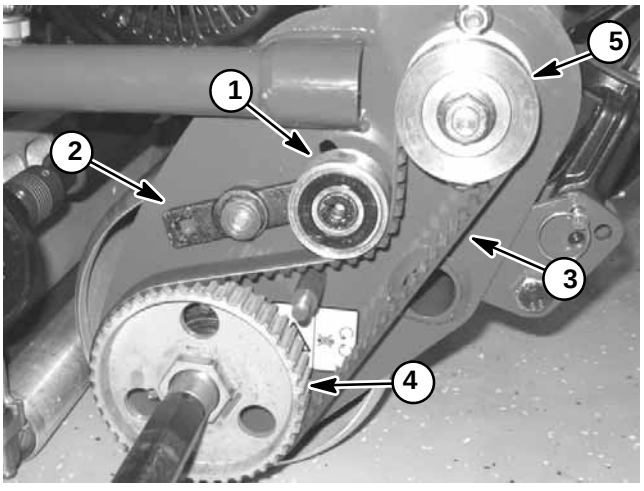

Figure 11

1. **Idler pulley**
2. **Idler bracket**
3. **Traction drive belt**
4. **Drum pulley**
5. **Gearbox axle pulley**

Traction Drive Idler Pulley and Bearings

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Remove transport wheels if attached (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

3. Remove traction drive belt cover.

4. Remove cap screw and tab washer that secures the idler bracket to the side plate of the mower (Fig. 14).

5. Remove cap screw and shoulder nut on which the idler assembly pivots (Figs. 13 and 14). Remove idler assembly.

6. If idler pulley sleeve or bearings require replacement:

   A. Pull bearings and pulley sleeve from idler.

   B. Press bearings from pulley sleeve.

Installation

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. If idler pulley sleeve or bearings were removed:

   A. Press bearings into pulley sleeve making sure to apply pressure to outer bearing race only.

   B. Install pulley assembly onto idler shaft pressing on inner bearing race.

3. Position idler assembly using cap screw and shoulder nut (Figs. 13 and 14). Tighten shoulder nut. Check that idler assembly can pivot freely after tightening shoulder nut.

4. Install cap screw and tab washer that positions the idler bracket to the side plate of the mower (Fig. 14). Make sure that washer tab is in slot and orientated down.

5. Adjust traction belt tension (see Operator's Manual).

6. Install traction drive belt cover and secure with flange nut. Torque flange nut **100 in–lb (11.3 N–m)**.

7. Replace transport wheels if they were attached (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

8. Connect spark plug wire to spark plug.

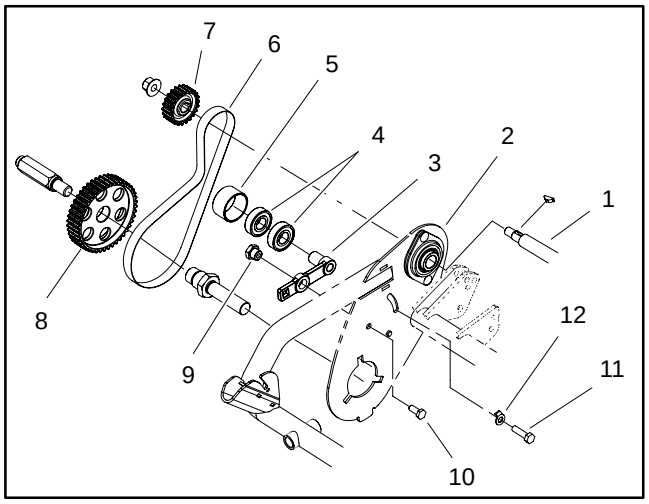

Figure 12

1. **Gearbox axle shaft**
2. **Frame**
3. **Idler bracket**
4. **Bearing**
5. **Pulley sleeve**
6. **Traction drive belt**
7. **Traction drive pulley**
8. **Traction driven pulley**
9. **Shoulder nut**
10. **Cap screw**
11. **Cap screw**
12. **Tab washer**

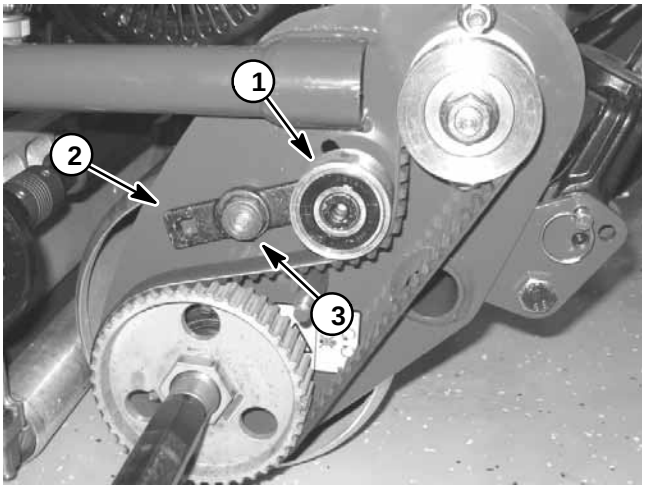

Figure 13

1. **Idler pulley**
2. **Idler bracket**
3. **Shoulder nut**

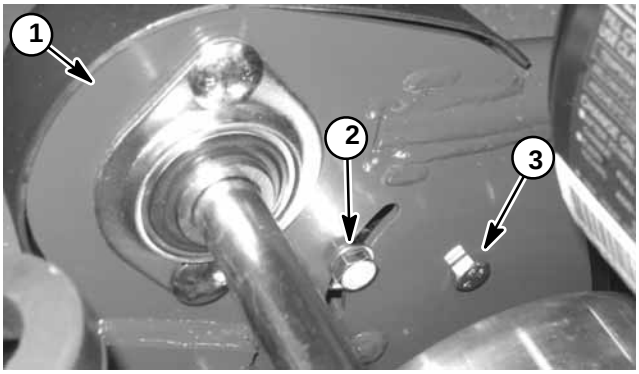

Figure 14

1. **Side plate**
2. **Idler bracket cap screw**
3. **Idler pivot cap screw**

Traction Drum Assembly

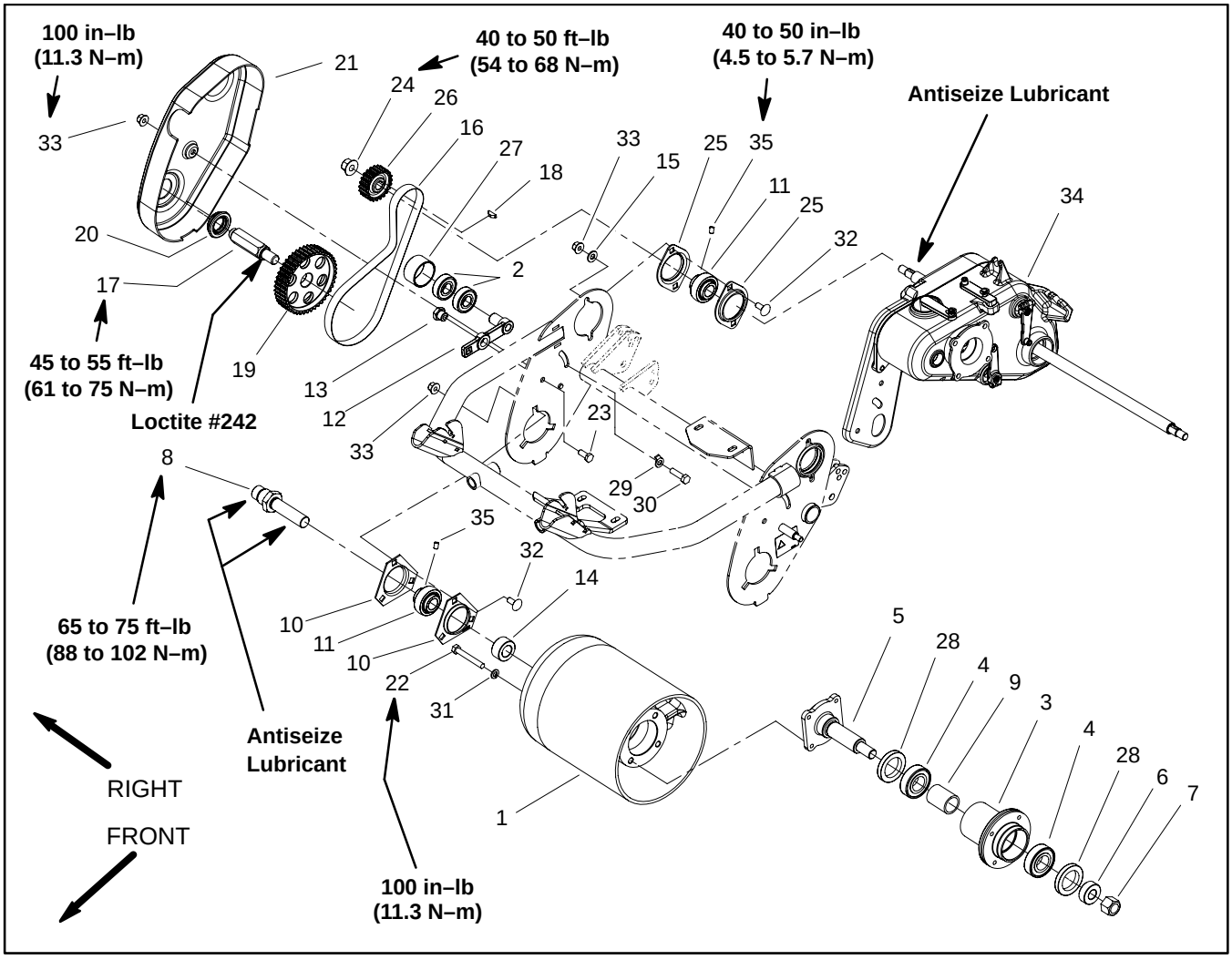

Figure 15

1. Traction drum (RH shown)
2. Ball bearing (4 used)
3. Drum hub
4. Bearing (2 used)
5. Drum spindle
6. Seal ride spacer
7. Lock nut
8. Drum shaft (RH shown)
9. Bearing spacer
10. Flange (4 used)
11. Extended race bearing (4 used)
12. Drum drive idler (2 used)
13. Shoulder nut (2 used)
14. Drum shaft spacer (2 used)
15. Flat washer (4 used)
16. Traction belt (2 used)
17. Transport wheel shaft (RH shown)
18. Woodruff key (2 used)
19. Traction pulley (RH shown)
20. Cover seal
21. Belt cover (RH shown)
22. Cap screw (8 used)
23. Cap screw (2 used)
24. Flange nut (2 used)
25. Bearing flangette (4 used)
26. Traction drive pulley (2 used)
27. Pulley sleeve (2 used)
28. Seal (2 used)
29. Tab washer (2 used)
30. Cap screw (2 used)
31. Lock washer (8 used)
32. Carriage screw (10 used)
33. Flange nut (12 used)
34. Gearbox assembly
35. Set screw (4 used)

NOTE: Components shown in the Figure 15 are from the right side of the machine.

Traction Drum Removal (Fig. 15)

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. If installed, remove transport wheels (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

3. Remove belt cover and traction drive belt from each side of mower (see Traction Drive Belt Replacement in this section).

4. Loosen set screws (item 25) that secure bearings to drum shafts.

5. Insert bar stock or other suitable tool through spokes of drum to keep drum from turning.

NOTE: The right side transport wheel shaft has left hand threads (Fig. 16).

6. Loosen and remove both transport wheel shafts (item 17).

NOTE: The left side drum pulley has left hand threads (Fig. 16).

7. Loosen and remove both drum pulleys (item 19).

NOTE: The left side drum shaft has left hand threads (Fig. 16).

8. Unscrew both drum shafts (item 8) from traction drum assembly.

9. Locate and remove drum spacer (item 41) from each side of traction drum assembly.

10. Remove traction drum assembly from the mower.

11. If necessary, remove bearing flangettes (item 10) and bearings (item 11) from machine frame.

Traction Drum Disassembly (Fig. 15)

1. Remove four (4) cap screws (item 22) and lock washers (item 34) that secure each traction drum to drum hub/spindle assembly. Separate traction drums from hub/spindle assembly.

2. Retain drum spindle (item 5) to prevent it from turning and remove lock nut (item 7). Carefully slide drum spindle from the drum hub assembly.

3. Remove seal ride spacer (item 6), seals (item 28), bearings (item 4) and bearing spacer (item 9) from drum hub.

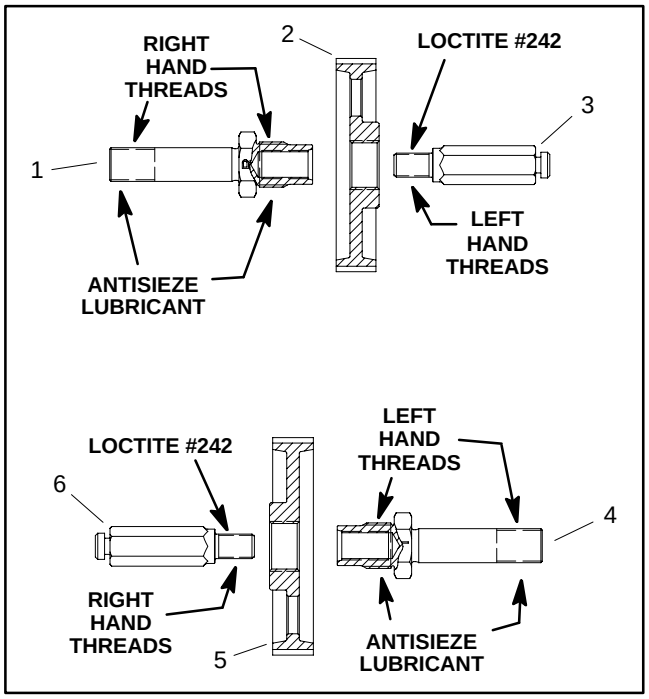

Figure 16

1. RH drum shaft
2. RH drum pulley
3. RH wheel shaft
4. LH drum shaft
5. LH drum pulley
6. LH wheel shaft

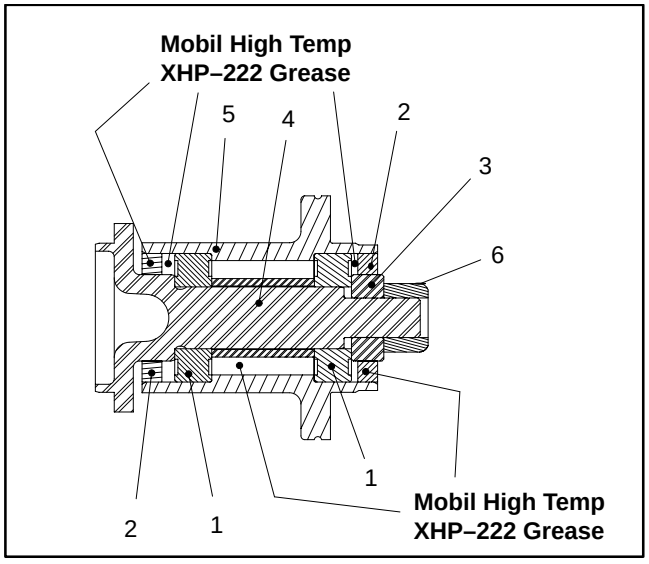

Figure 17

1. Ball bearing
2. Seal
3. Seal ride spacer
4. Drum spindle
5. Drum hub
6. Lock nut

Traction Drum Assembly (Fig. 15)

1. Assemble hub/spindle assembly (Fig. 17):

   A. Press one bearing into drum hub by applying pressure to outer bearing race. Install bearing spacer into drum hub and fill cavity between spacer and drum hub with Mobil High Temperature XHP–222 grease (or equivalent). Press second bearing into drum hub by applying pressure to outer bearing race. Make sure that spacer is centered in hub.

   B. Pack rear cavity of oil seals with Mobil High Temperature XHP–222 grease (or equivalent). Fill hub cavity between bearings and seal positions with Mobil High Temperature XHP–222 grease (or equivalent).

   C. Press seals into hub so the seals are flush with the hub surface. Lightly grease lip of both seals.

   D. Lightly grease the drum spindle and slide spindle into the hub. Slide seal ride spacer onto spindle and insert spacer into oil seal. Secure drum spindle to prevent it from turning and then secure spindle to the hub with lock nut.

2. Position traction drums to hub/spindle assembly. Secure each traction drum to hub/spindle with four (4) cap screws and lock washers. Torque cap screws **100 in–lb (11.3 N–m)**.

Traction Drum Installation (Fig. 15)

1. Position machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. If removed, loosely install bearings (item 11) and bearing flangettes (item 10) to machine frame. Make sure that extended race of bearings is positioned to the outside of the frame.

3. Pivot mower back and position traction drum assembly under the mower. Lower mower onto traction drum.

4. Position drum spacers to sides of drum.

5. Insert bar stock or other suitable tool through spokes of drum to keep drum from turning.

NOTE: The left side drum shaft has left hand threads (Fig. 16).

6. Apply antiseize lubricant to drum shaft (item 8) threads and install shafts through bearings, spacers and into drum. After both shafts are installed, torque drum shafts from **65 to 75 ft–lb (88 to 102 N–m)**.

7. Tighten the fasteners that secure the bearing flangettes (item 10) to the machine frame. Tighten the bearing set screw (item 25) to secure each bearing to the drum shaft. Torque set screws from **40 to 50 in–lb (4.5 to 5.7 N–m)**.

NOTE: The left side drum pulley has left hand threads (Fig. 16).

8. Apply antiseize lubricant to the external threads of the drum shafts. Secure both drum pulleys (item 19) to the drum shafts.

NOTE: The right side wheel shaft has left hand threads (Fig. 16).

9. Apply Loctite #242 (or equivalent) to the threads of the transport wheel shafts (item 17). Install wheel shafts into drum drive shafts. Torque wheel shafts from **45 to 55 ft–lb (61 to 75 N–m)**.

10. Install traction belts and adjust belt tension (see Traction Drive Belt Replacement in this section).

11. Install traction drive belt cover and secure with flange nut. Torque flange nut **100 in–lb (11.3 N–m)**.

12. Install transport wheels if they were attached (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

13. Connect spark plug wire to spark plug.

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Gearbox

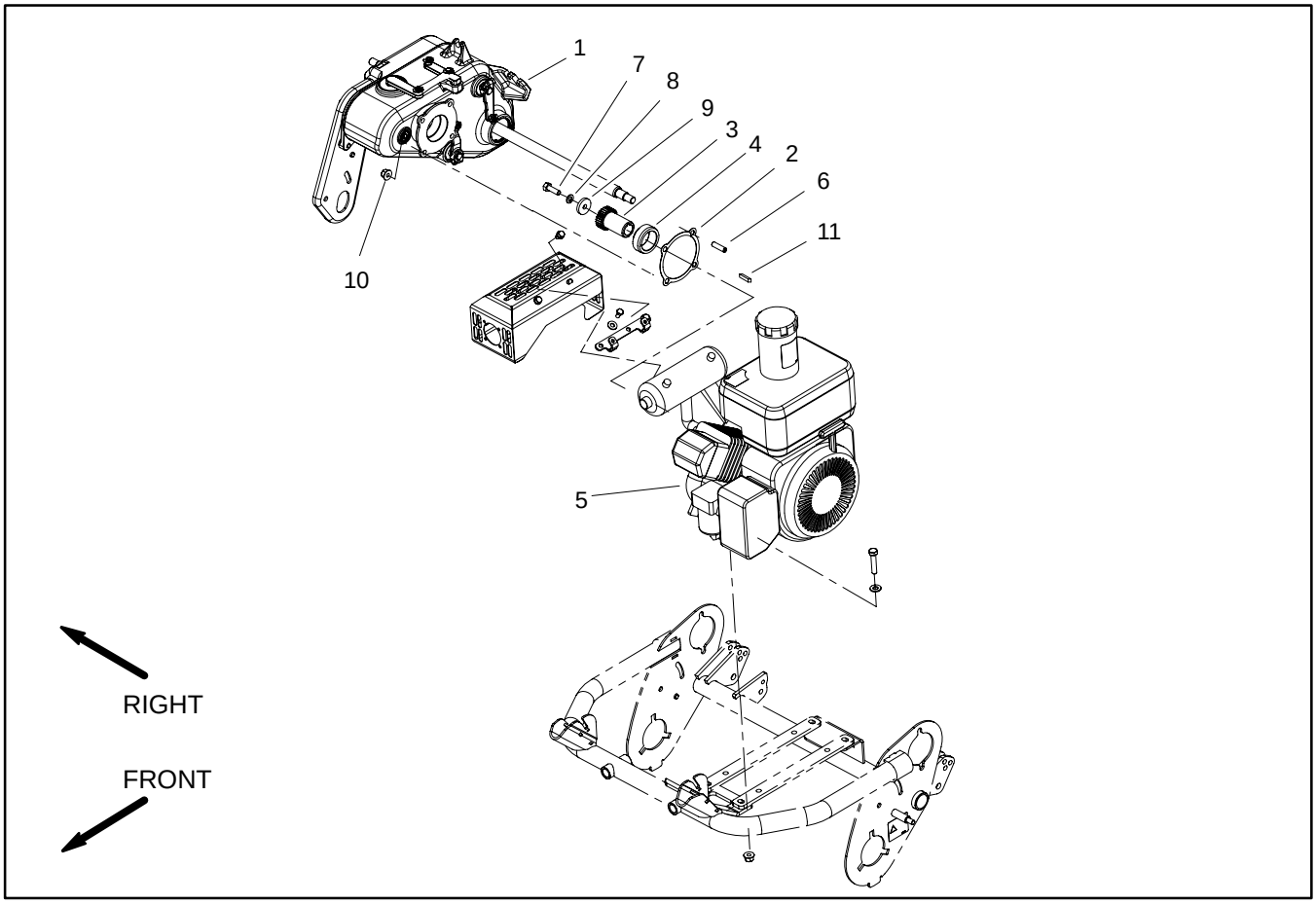

Figure 18

1. **Gearbox assembly**
2. **Flange gasket**
3. **Engine gear**
4. **Engine adapter**
5. **Engine**
6. **Set screw (4 used)**
7. **Cap screw**
8. **Lock washer**
9. **Washer**
10. **Flange nut (4 used)**
11. **Key**

Gearbox Removal

1. Park mower on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Drain oil from gearbox assembly.

3. Remove traction control and reel control cables from gearbox.

4. If installed, remove transport wheels (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

5. Remove traction drive belt covers and belts from both sides of mower (see Traction Drive Belt Replacement in this section).

6. Remove flange nut that secures traction drive pulley (Fig. 19) on both sides of mower. Remove pulley and woodruff key from both sides.

7. Loosen set screws that secure extended race bearings to gearbox axles (Fig. 19).

8. Remove carriage bolts, flange nuts and flat washers that retain bearing flangettes to frame (Fig. 19). Slide flangettes and bearings toward gearbox.

9. Loosen and remove four (4) flange nuts that secure gearbox to engine (Fig. 20).

10. Move gearbox away from the engine to allow removal of parking brake lever (with cable attached) from brake shaft of gearbox. Loosen lock nut that is used to secure brake lever to the brake shaft. Remove lever with cable attached. Note that lever and shaft splines identify correct lever location on shaft.

11. Slide gearbox assembly to the right side of mower, away from the engine. This should allow the left gearbox axle to clear the frame and the gearbox to separate from the engine gear. Rotate and pivot gearbox assembly and then slide right side axle from frame to complete gearbox removal.

12. Slide bearings and bearing flangettes from gearbox axle shafts.

13. Remove and discard flange gasket from between engine and gearbox.

Gearbox Installation

1. Park traction unit on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Place new flange gasket on four (4) set screws installed in engine mounting flange.

3. Slide bearings and bearing flangettes onto gearbox axles. Make sure that extended race of bearings is positioned toward ends of axles.

4. Insert gearbox short axle through frame on right side of mower. By rotating the gearbox, position left axle into frame and input flange of gearbox to engine.

5. Install parking brake lever (with cable attached) to brake shaft of gearbox noting location of alignment splines on shaft and lever.

6. Rotate engine crankshaft slowly with recoil starter to align crankshaft gear with gearbox input gear. Align gearbox flange onto set screws. Install and tighten four (4) flange nuts to secure gearbox to engine (Fig 20).

7. Secure extended race bearings and bearing flangettes to frame with carriage bolts, flat washers and flange nuts.

8. Check bearing alignment by rotating the long gearbox axle shaft. Shaft should rotate easily if alignment is correct.

9. Tighten the bearing set screws to secure the bearings to the gearbox axles. Torque set screws from **40 to 50 in–lb (4.5 to 5.7 N–m)**.

10. Apply antiseize lubricant to bores of traction drive pulleys. Install woodruff keys and place traction drive pulleys onto gearbox axles with the flange inward (Fig. 19). Secure pulleys to axles with flange nuts. Torque flange nuts from **40 to 50 ft–lb (54 to 68 N–m)**.

11. Install traction drive belts, properly tension belts and install belt covers (see Traction Drive Belt Replacement in this section).

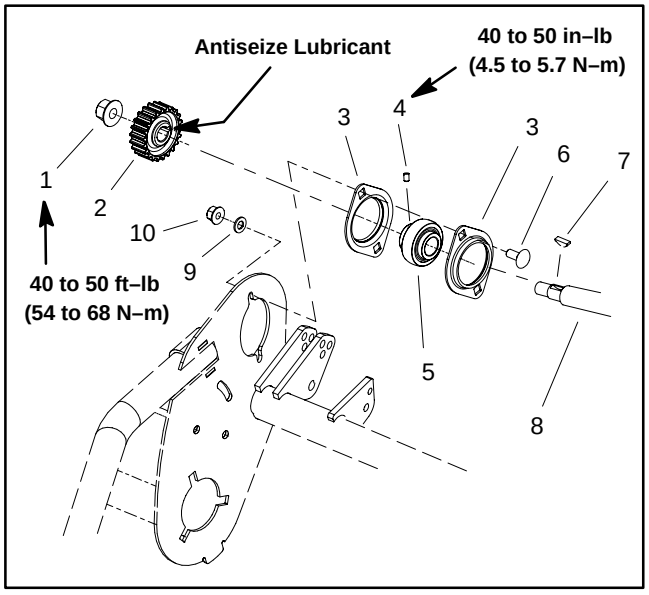

Figure 19

1. **Flange nut**
2. **Pulley**
3. **Bearing flangette**
4. **Set screw**
5. **Extended race bearing**
6. **Carriage bolt (2 used)**
7. **Woodruff key**
8. **Gearbox axle**
9. **Flat washer (2 used)**
10. **Flange nut (2 used)**

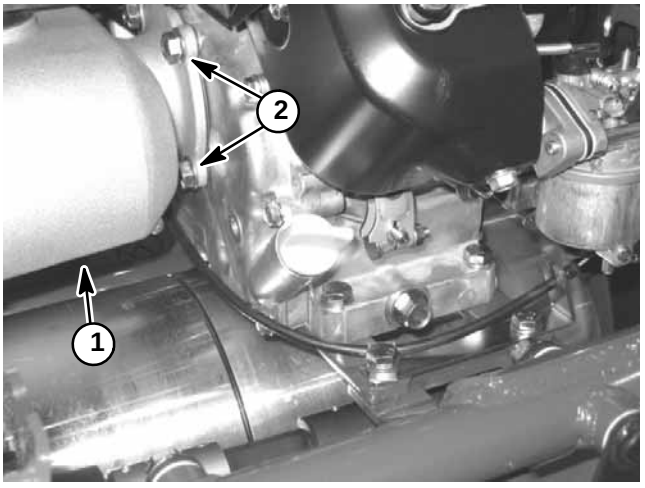

Figure 20

1. **Gearbox**
2. **Flange nut (4 used)**

12. Refill gearbox with proper amount of fluid.

13. Install traction control and reel control cables to gearbox.

14. Adjust control cables (traction, reel and parking brake) as needed.

15. Install transport wheels if they were attached (see Transport Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

16. Connect spark plug wire to spark plug.

Gearbox Service

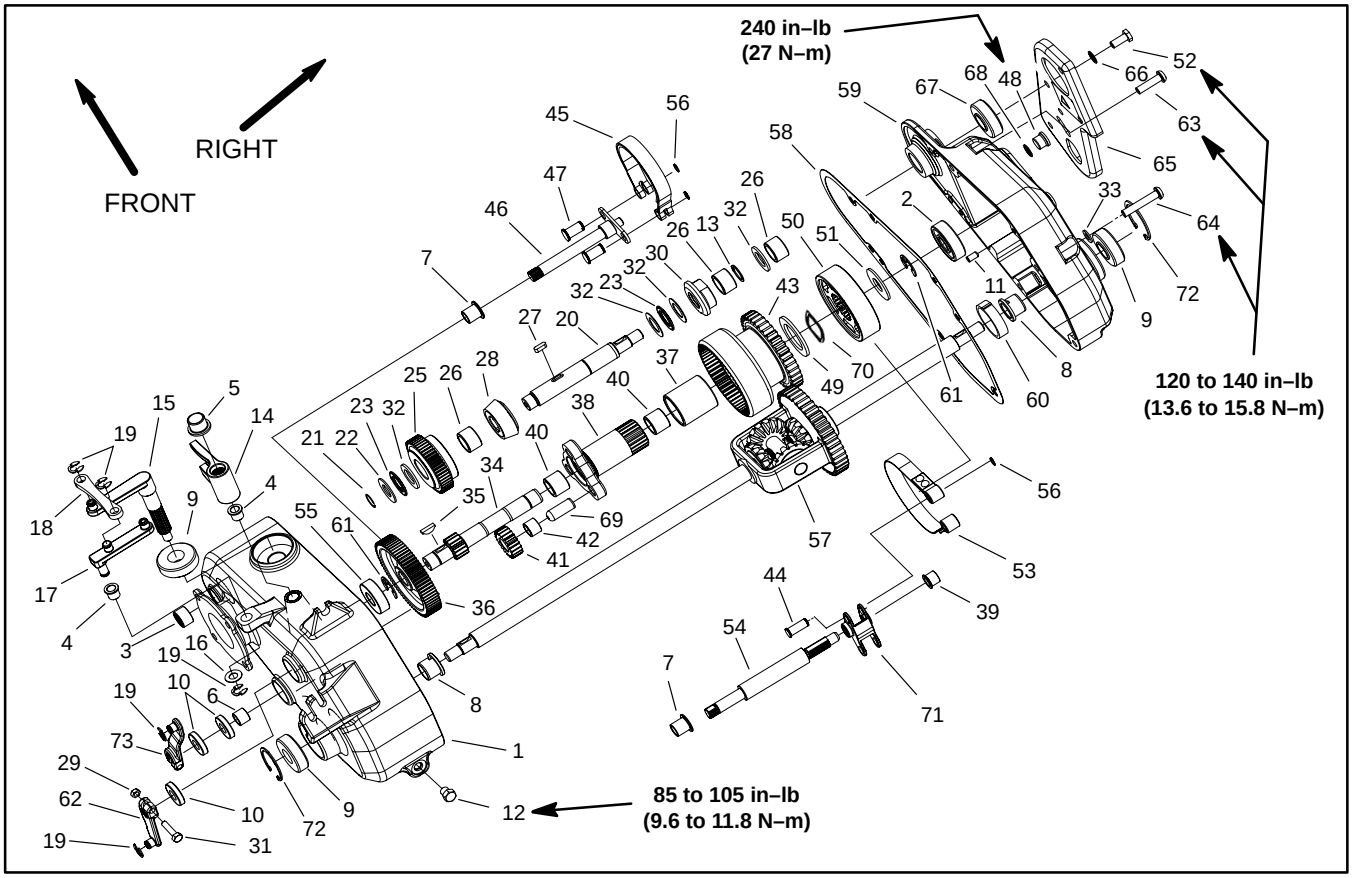

Figure 21

1. Gearbox base
2. Ball bearing
3. Caged needle bearing
4. Bushing
5. Bushing
6. Bushing
7. Bushing
8. Keyed flanged bushing
9. Oil seal
10. Oil seal
11. Dowel pin (2 used)
12. Drain plug
13. Snap ring
14. Clutch fork
15. Fork shaft
16. Thrust washer
17. Bellcrank
18. Link
19. Retaining ring
20. Clutch shaft (reel drive)
21. Retaining ring
22. Thrust washer
23. Thrust bearing
24. Thrust washer
25. Clutch gear
26. Needle bearing
27. Square key (2 used)
28. Cone assembly
29. Lock nut (2 used)
30. Plunger hub
31. Cap screw (2 used)
32. Thrust washer
33. Flat washer (4 used)
34. Sun gear
35. Woodruff key
36. Input gear
37. Carrier bushing
38. Planet gear carrier
39. Flanged bushing
40. Needle bearing
41. Planet gear (3 used)
42. Roller bearing (3 used)
43. Ring gear
44. Clevis pin (2 used)
45. Brake band
46. Brake shaft
47. Clevis pin (2 used)
48. Hollow hex plug
49. Thrust washer
50. Traction drum assembly
51. Thrust washer
52. Cap screw
53. Traction band assembly
54. Traction shaft
55. Ball bearing
56. Retaining ring (4 used)
57. Differential assembly (traction drive)
58. Gasket
59. Gearbox cover
60. Keyed bushing
61. E–ring
62. Traction drive lever
63. Socket head screw (2 used)
64. Socket head screw (4 used)
65. Drive shaft plate assembly
66. Internal lock washer
67. Oil seal (red/orange color)
68. O–ring
69. Dowel pin
70. Wave washer
71. Hub
72. Retaining ring
73. Parking brake lever

NOTE: On Flex 21 machines, it is possible to separate the gearbox cover from the base while the gearbox is still installed on the traction unit. The traction band, planetary assembly and reel drive clutch shaft assembly can be removed from the gearbox in this manner. Service to the differential, bushings and bearings requires removal of the gearbox from the traction unit.

Disassembly (Fig. 21)

1. Clean outside of the gearbox assembly.

2. Remove reel drive assembly from gearbox (Fig. 22):

   A. Loosen flange nut that secures reel drive pulley to gearbox clutch shaft.

   B. Remove reel drive belt.

   C. Remove flange nut and pulley washer from gearbox clutch shaft and slide pulley from shaft. Take woodruff key from shaft.

   D. Pull drive shaft plate from gearbox after removing three (3) fasteners: two socket head screws and one cap screw with lock washer.

3. Remove all burrs from axle and clutch shafts.

4. Loosen lock nut that is used to secure traction lever to the traction shaft. Remove lever. Note that lever and shaft splines identify correct lever location on shaft.

5. Remove four (4) remaining socket head screws and flat washers that secure gearbox cover to base.

NOTE: Gearbox cover removal will be easier by lightly lubricating external extensions of axles and shafts.

6. Pull gearbox cover from gearbox base taking care not to dislodge shafts from base. Locate thrust washer that fits on cover end of clutch shaft (Fig. 23). Remove and discard gasket.

7. Carefully remove traction shaft from the gearbox taking care to not distort traction band (Fig. 24). **Note:** On Flex 21, if gearbox is still attached to engine, traction lever on engine side of gearbox must be loosened and removed as traction shaft is removed from gearbox.

8. Slide differential assembly from gearbox (Fig. 24).

9. Pull planetary assembly (with parking brake band and shaft) from gearbox (Fig. 24). **Note:** Remove parking brake lever if still attached to brake shaft.

10. Use Figure 25 as a guide to remove components from planetary assembly. If input gear is removed, note orientation on shaft.

11. Remove retaining rings that secure link to clutch bellcrank and clutch fork shaft (Fig. 24). Remove link.

12. Rotate clutch fork shaft to allow removal of reel drive clutch shaft assembly from gearbox base (Fig. 24). Use Figure 26 as a guide to remove components from clutch shaft.

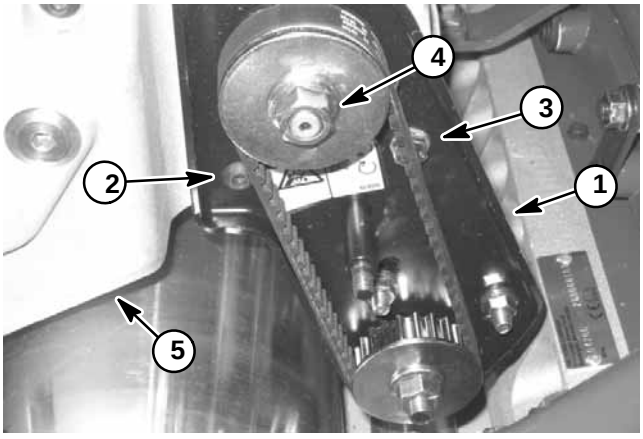

Figure 22

1. **Drive shaft plate**
2. **Socket head screw (2)**
3. **Cap screw w/lock washer**
4. **Flange nut**
5. **Gearbox assembly**

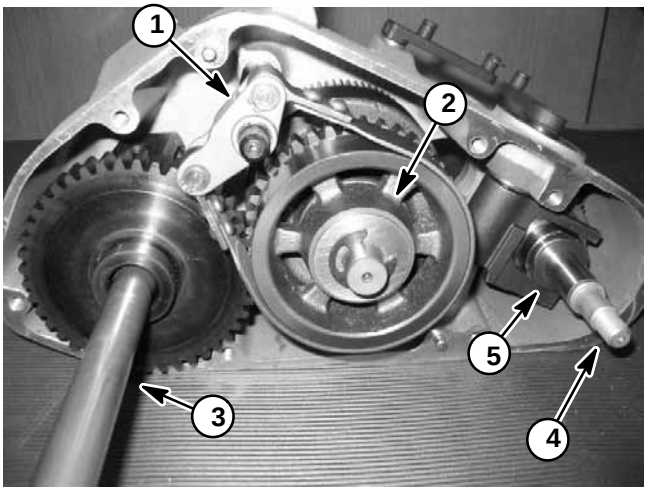

Figure 23

1. **Traction shaft with band**
2. **Planetary assembly**
3. **Differential assembly**
4. **Reel drive clutch shaft**
5. **Clutch thrust washer**

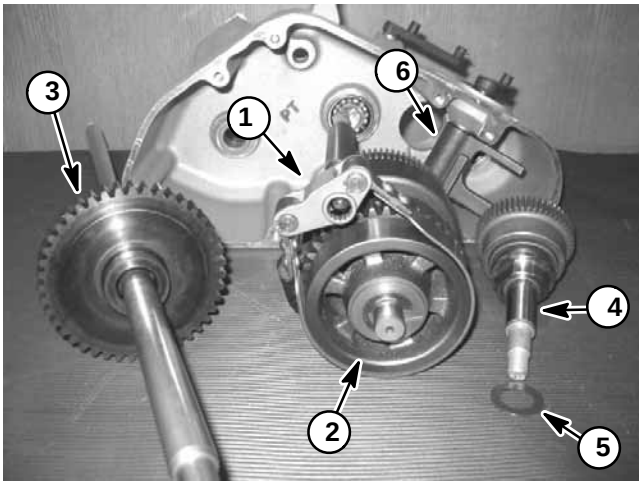

Figure 24

1. **Traction shaft with band**
2. **Planetary assembly**
3. **Differential assembly**
4. **Reel drive clutch shaft**
5. **Clutch thrust washer**
6. **Clutch fork**

13. Gearbox seals can be removed as follows:

A. Using a 1/4” thick, 3” X 3” square piece of steel, make a seal removal tool as shown in Fig. 27.

B. If seal is secured with retaining ring, remove retaining ring. Slide seal removal tool over shaft.

C. Using the tool as a template, locate, mark and drill two 7/64” (.109”) diameter holes in outer face of seal.

D. Screw two No. 8 (.164” diameter) by 3/4” long self–tapping screws into outer face of seal.

E. Install two 1/4–20 by 1” long cap screws into tapped holes in seal removal tool and alternately tighten cap screws to pull seal out of gearbox. Discard removed seals.

NOTE: Gearbox seals will be damaged when removed. Do not re–use seals that have been removed.

14. Carefully inspect all internal gears, shafts, washers, bushings and bearings. Replace all worn or damaged components.

Assembly (Fig. 21)

1. Replace all removed oil seals, bushings and bearings in the gearbox cover and base. **Note:** The oil seal for the reel drive clutch shaft is a red/orange color to differentiate it from other similarly sized seals in the gearbox. Oil seals should be installed flush or slightly recessed in seal bore. If seal is secured with retaining ring, install retaining ring. If clutch shaft caged needle bearing in gearbox base is replaced (item 3), closed end of bearing should be flush with outside of base after installation.

2. Thoroughly apply grease to seal lips in both the gearbox base and cover.

3. If clutch shaft was disassembled, use Figure 26 as a guide to install components to clutch shaft. Install clutch shaft assembly into gearbox base and rotate clutch fork to plunger hub. Place thrust washer on cover end of shaft.

4. Attach link to fork shaft and bellcrank. Secure with two (2) retaining rings.

5. Lubricate long differential axle shaft and carefully slide differential assembly into bushing and seal in base.

6. If planetary assembly was disassembled, use Figure 25 as a guide to install components to planetary assembly. If input gear was removed, install with shallow web casting toward sun gear.

7. Install planetary assembly (with brake band installed) into gearbox, engaging gears of differential assembly. **Note:** On Flex 21, if gearbox is still attached to engine, parking brake lever on engine side of gearbox (with cable) should be installed onto brake shaft as planetary assembly is installed into gearbox.

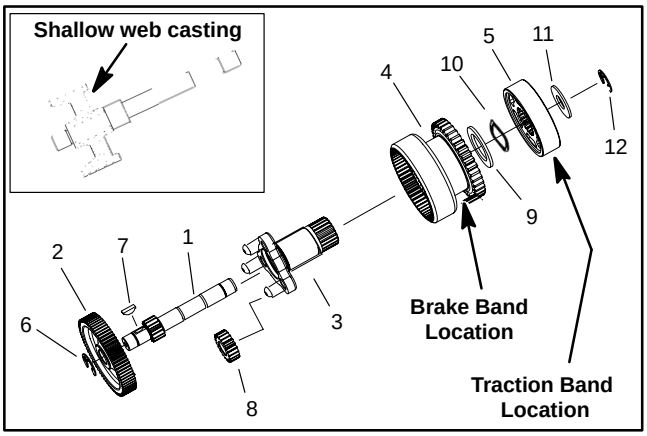

Figure 25

1. **Sun gear**
2. **Input gear**
3. **Carrier assembly**
4. **Ring gear**
5. **Traction drum**
6. **E–ring**
7. **Woodruff key**
8. **Planet gear (3 used)**
9. **Thrust washer**
10. **Wave washer**
11. **Thrust washer**
12. **E–ring**

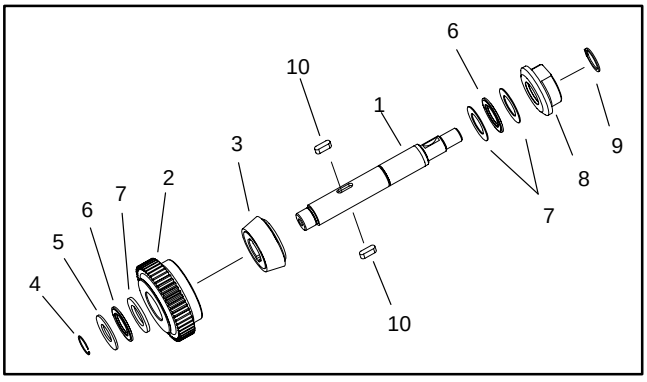

Figure 26

1. **Clutch shaft**
2. **Clutch gear/bearing**
3. **Cone clutch hub**
4. **Retaining ring**
5. **Thrust washer (sm ID)**
6. **Thrust bearing**
7. **Thrust washer**
8. **Plunger hub/bearing**
9. **Snap ring**
10. **Square key (2 used)**

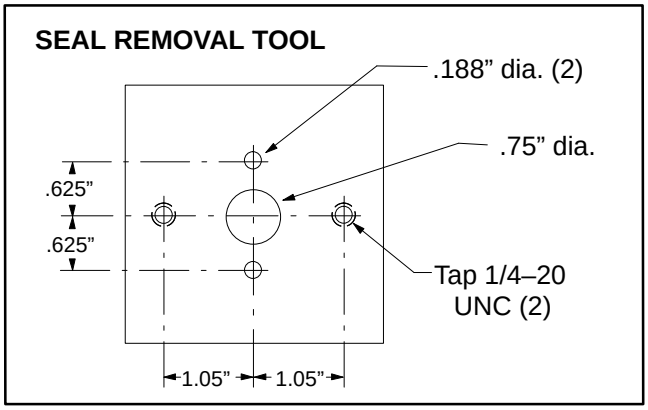

Figure 27

8. If traction band is replaced, the new band will have an ink mark on the upper end of the band (Fig. 28).

9. Carefully fit traction shaft with band to the planetary assembly and gearbox base taking care not to distort traction band. Traction band should easily slide over traction drum during installation. If traction band is improperly placed on the traction shaft or if the band is distorted, it will not fit easily on the drum. Check that planetary assembly is free to rotate with band installed. **Note:** On Flex 21, if gearbox is still attached to engine, traction lever on engine side of gearbox should be installed onto traction shaft is shaft is installed into gearbox.

10. Rotate differential shaft to verify that all gears and shafts are meshed properly.

11. Use dowel pins to position gasket to gearbox base.

12. Lubricate short differential axle shaft. Position gearbox cover to shafts and fit cover to the gearbox base.

13. Position drive shaft plate to gearbox with three fasteners: two socket head screws (shorter) and one cap screw with lock washer. Install four socket head screws (longer) and washers in remaining holes in gearbox cover. Torque gearbox fasteners from **120 to 140 in–lb (13.6 to 15.8 N–m)** in the sequence shown in Figure 29.

14. Place traction drive lever onto gearbox shaft noting location of alignment splines on shaft and lever. Mount traction lever with cable boss outward (Fig. 30). Secure lever with cap screw and lock nut. Parking brake lever installation should be done with cable attached to lever as gearbox is being installed on machine.

15. Check gearbox operation:

    A. Engage and disengage clutch, brake band and traction band. Check for smooth engagement.

    B. Turn one differential axle shaft and check that other shaft rotates in opposite direction.

    C. If smooth operation is not detected, correct problem before completing assembly.

16. Install reel drive assembly to the gearbox (Fig. 22):

    A. Apply antiseize lubricant to the bore of the reel drive pulley. Place woodruff key in gearbox shaft and slide pulley and pulley washer onto shaft. Thread flange nut onto shaft.

    B. Position reel drive belt over pulleys and properly tension belt (see Transmission Coupler Drive Belt Adjustment in this section).

    C. Tighten flange nut to secure pulley.

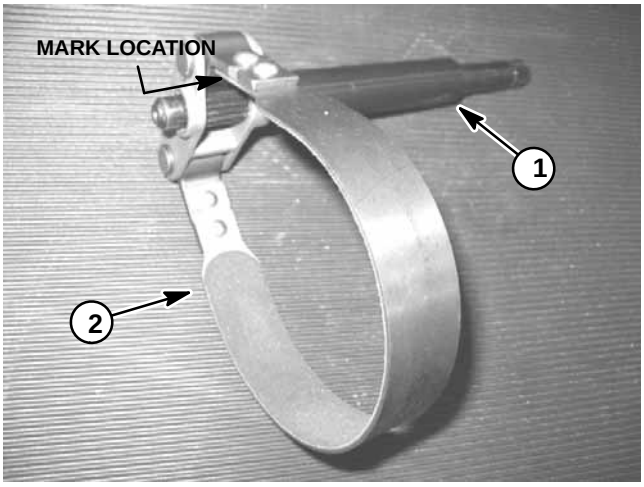

Figure 28

1. Traction shaft **2. Traction band**

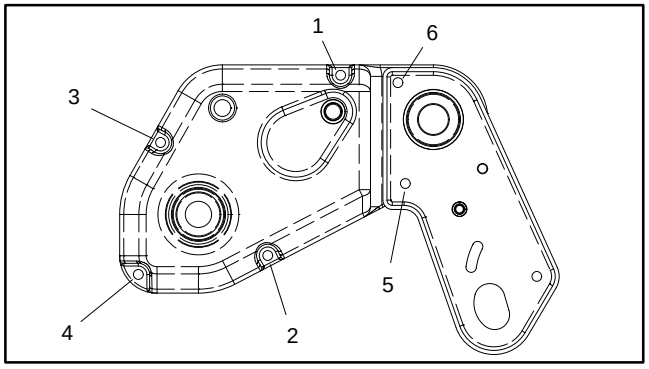

Figure 29

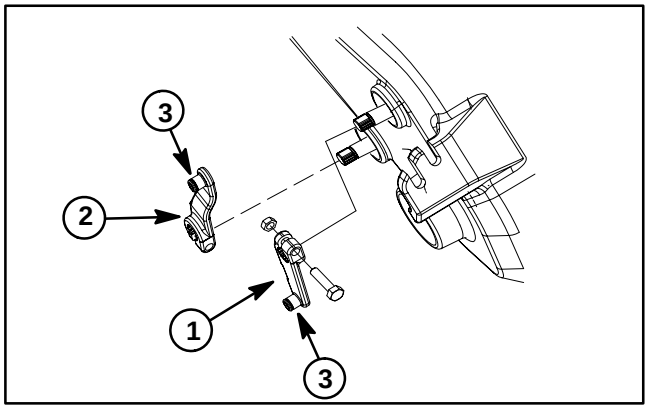

Figure 30

1. Traction drive lever
2. Parking brake lever
3. Cable mounting boss

Differential Service

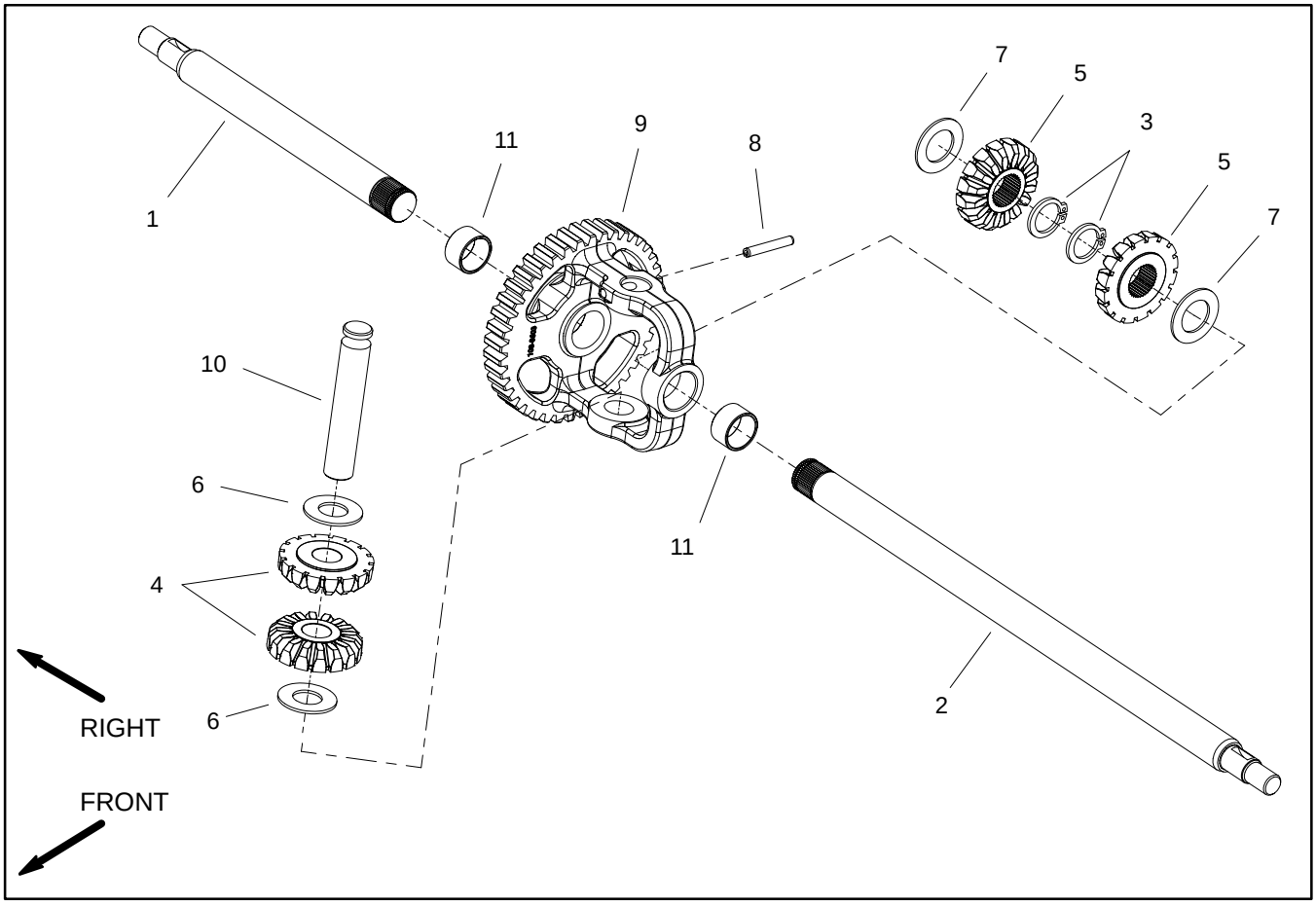

Figure 31

1. **RH (short) axle**
2. **LH (long) axle**
3. **Retaining ring**
4. **Driven bevel gear**
5. **Drive bevel gear**
6. **Washer**
7. **Washer**
8. **Roll pin**
9. **Input gear/housing**
10. **Gear shaft**
11. **Bushing**

The differential assembly is an integral component of the gearbox assembly. Service of the differential assembly requires removal and disassembly of the gearbox.

Disassembly (Fig. 31)

1. Remove gearbox from mower (see Gearbox Removal) and disassemble gearbox (see Gearbox Disassembly) to remove differential assembly.

2. Support differential assembly and drive out roll pin that locates gear shaft. Discard roll pin.

3. Remove gear shaft, two (2) thrust washers and two (2) driven bevel gears.

4. Remove retaining ring from each axle. Discard retaining rings.

5. Pull each axle free from drive bevel gear, washer and input gear/housing. Note that axle washers are different from washers used on gear shaft.

Inspection (Fig. 31)

1. Clean all differential components.

2. Inspect all differential bevel gears carefully looking for chipped teeth, wear or other damage. Because gear tooth damage is rarely isolated to one gear, replace bevel gears as a complete set.

3. Inspect axle shafts and gear shaft for scoring or wear.

4. Inspect gear teeth, axle bearing areas and gear shaft bores of the input gear/housing. Replace bushings if damaged.

5. Replace all worn or damaged differential assembly components.

Assembly (Fig. 31)

1. Insert RH (short) axle into input gear/housing on the gear side. Install washer, drive bevel gear and new retaining ring on short axle. Install LH (long) axle into remaining side of input gear/housing using the same procedure.

2. Through the open sides of the input gear/housing, align two driven bevel gears and rotate axle to move them into their correct position.

3. Place a washer between input gear/housing and each driven bevel gear. Install gear shaft with grooved end located at roll pin hole.

4. Check gear and shaft alignment by rotating one axle. The other axle should turn in the opposite direction without any binding. Once free axle movement is checked, install new roll pin to secure gear shaft.

5. Install differential assembly in gearbox and assemble gearbox (see Gearbox Assembly). Install gearbox to traction unit (see Gearbox Installation).

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Chapter 5

Electrical System

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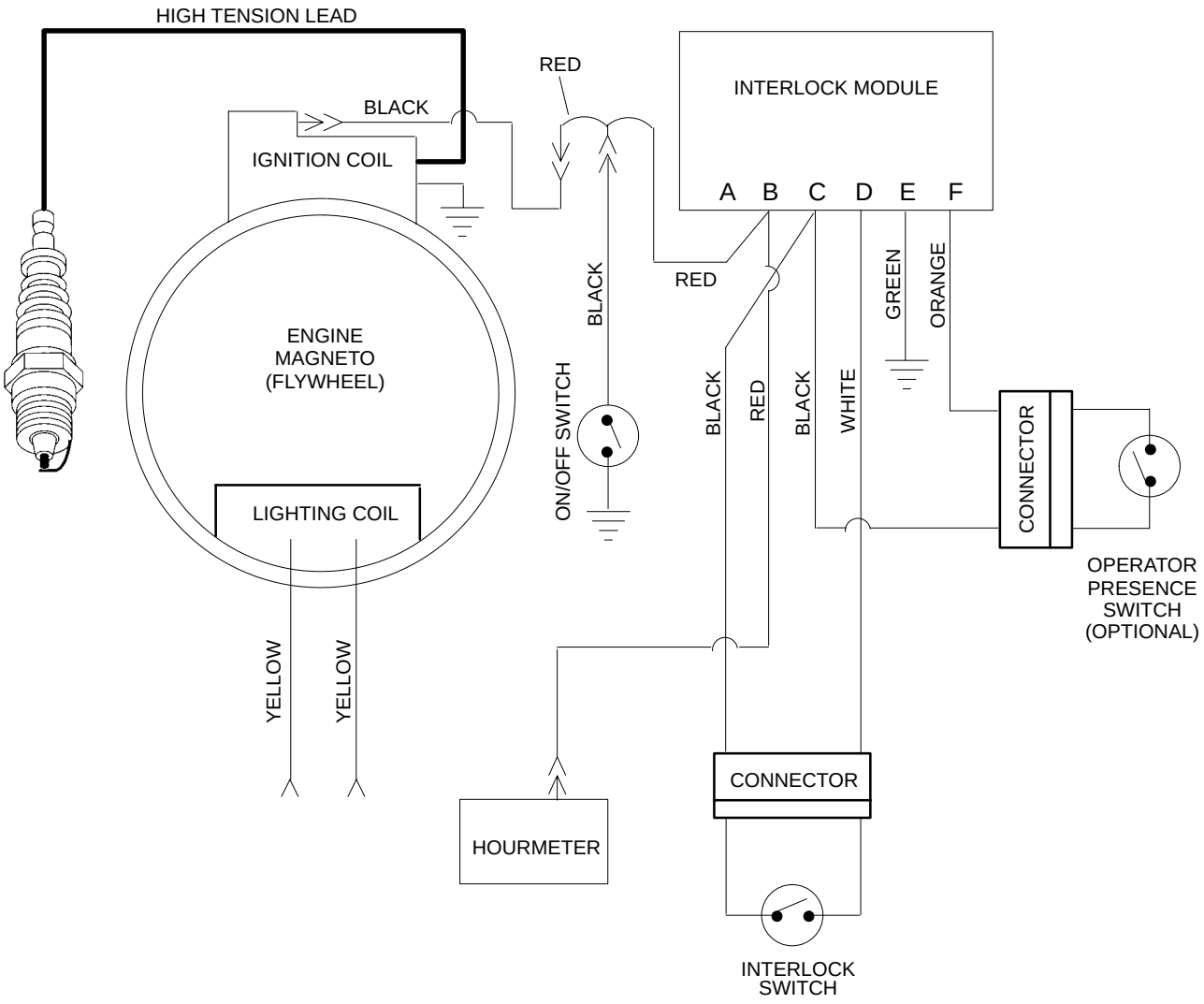
Wiring Schematic



Kawasaki FE120 Engine

ON\OFF SWITCH is open in the ON position
INTERLOCK SWITCH is closed when traction lever is in NEUTRAL
OPERATOR PRESENCE SWITCH is closed when bail is against handle

Special Tools

Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*.

Some tools may also be available from a local supplier.

Multimeter

The multimeter can test electrical components and circuits for current, resistance or voltage.

NOTE: Toro recommends the use of a DIGITAL Volt–Ohm–Amp multimeter when testing electrical circuits. The high impedance (internal resistance) of a digital meter in the voltage mode will make sure that excess current is not allowed through the meter. This excess current can cause damage to circuits not designed to carry it.

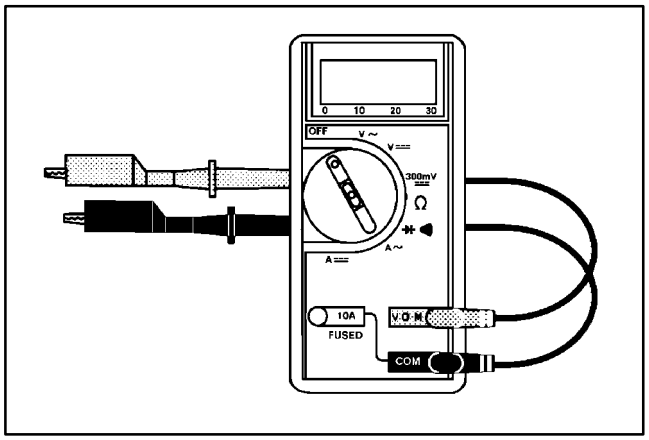


Figure 1

Skin–Over Grease

Toro Part Number: **505–165**

Special non–conductive grease which forms a light protective skin to help waterproof electrical switches and contacts.

Figure 2

Dielectric Gel

Toro Part Number: **107–0342**

Dielectric gel should be used to prevent corrosion of connection terminals. To ensure complete coating of terminals, liberally apply gel to both component and wire harness connector, plug connector to component, unplug connector, reapply gel to both surfaces and reconnect harness connector to component. Connectors should be thoroughly packed with gel for effective results.

Figure 3

Spark Tester

Toro Part Number: **TOR4036**

For testing electronic ignitions. Saves time because you will know if the ignition is causing the problem on a non–starting engine. The tester determines if ignition spark is present.

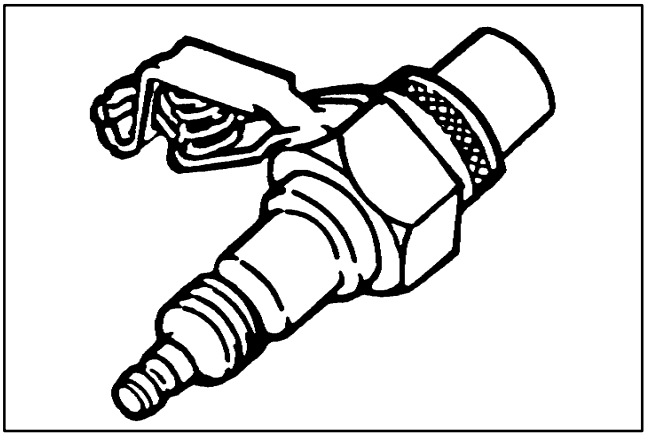


Figure 4

Troubleshooting

CAUTION

Remove all jewelry, especially rings and watches, before doing any electrical testing or troubleshooting.

For effective troubleshooting and repairs, there must be a good understanding of the electrical circuits and components used on this machine (see Wiring Schematic section of this chapter).

The interlock switch must not be by–passed, it must be connected for proper electrical troubleshooting and safety.

NOTE: See the **Kawasaki FE120 Service Manual** at the end of Chapter 3 – Engine for additional engine ignition system troubleshooting information.

Starting Problems

Problem	Possible Causes	Correction
Engine will not start.	ON/OFF switch is in the OFF position or is grounded.	Turn switch to ON or replace switch.
	Ignition spark plug wire is not connected to spark plug.	Connect spark plug wire to spark plug.
	Electrical wires are loose or damaged.	Check electrical connections. Repair wiring.
	Interlock switch is not adjusted or is faulty.	Adjust or replace interlock switch.
	Interlock module is faulty.	Replace interlock module.
Engine will start, but will not continue to run.	Electrical wires are loose or damaged.	Check electrical connections. Repair wiring.
	Interlock module is faulty.	Replace interlock module.

Component Testing

For accurate resistance and/or continuity checks, electrically disconnect the component being tested from the circuit (e.g. unplug the ON/OFF switch connector before doing a continuity check). Individual components should be electrically isolated (e.g. disconnect all leads or remove from circuit) from the circuit when tested.

CAUTION

When testing electrical components for continuity with a multimeter (ohms setting), make sure that engine is not running to prevent current flow through the component.

NOTE: See the **Kawasaki FE120 Service Manual** at the end of Chapter 3 – Engine for more component testing information.

WARNING

The ignition system produces a dangerously high voltage. Do not touch the spark plug, ignition coil or spark plug lead when the engine is running; you can receive a severe electrical shock.

Ignition System Operation

The engine on Flex 18 and Flex 21 machines has a magneto ignition system consisting of an ignition coil, spark plug and permanent flywheel magnets. A flywheel key maintains proper ignition timing.

Testing the Ignition System

NOTE: Do not remove spark plug from the engine when testing the ignition system. The spark plug is necessary to maintain normal starting speeds.

1. With engine not running, remove spark plug wire from the spark plug and connect it to the spark tester (see Special Tools in this chapter).

2. Connect spring clip of tester to a good, unpainted ground on the engine block.

3. Make sure ON/OFF switch is in the ON position.

4. Pull the engine starter rope and observe the spark tester. Visible and audible sparks should be produced.

5. If visible and audible sparks are produced, the ignition system is operating properly.

NOTE: If a sheared flywheel key exists, the spark tester may indicate an operating ignition system but ignition timing will be incorrect.

6. If visible and audible sparks are not produced, the ignition system is not operating properly.

   A. Check wires and connectors of the ON/OFF switch and ignition coil for grounding or damaged insulation.

   B. If wires and connectors are good, test the ON/OFF switch and ignition coil individually (see **Kawasaki FE120 Service Manual** at the end of Chapter 3 – Engine).

   C. If the ON/OFF switch and ignition coil test properly, see Interlock Module and Switch in this section for further testing.

Ignition Coil

A commercial coil tester can be used to test the ignition coil. The coil can be tested for a badly shorted or broken winding with a digital multimeter. However, a multimeter can not detect layer shorts and shorts resulting from insulation breakdown under high running voltages. See **Kawasaki FE120 Service Manual** at the end of Chapter 3 – Engine for ignition component testing information**.**

Interlock Module and Switch

The interlock module prevents the engine from starting unless the interlock switch is closed (traction lever in NEUTRAL). After a safe start, the engine will continue to run with the interlock switch open (traction lever FORWARD) or closed.

If the engine will not start, perform the following tests to determine if the interlock module or interlock switch is at fault.

1. Check that there is a good ground between the interlock module (green wire) and the engine (Fig. 5). Check all other electrical connections and the interlock module for damage. Repair or replace any damaged wiring or components.

2. Check the adjustment and continuity of the interlock switch (located on equipment handle).

   A. Disconnect interlock switch wire connector from wiring harness.

   B. Place traction lever in the FORWARD position. The switch should be open (no continuity).

   C. Place traction lever in the NEUTRAL position. The switch should be closed (continuity).

   D. Adjust interlock switch until it opens and closes properly when the traction lever is in the FORWARD and NEUTRAL positions (See Interlock Switch in the Service and Repairs section of this Chapter).

   E. Connect interlock switch to wiring harness.

3. With engine ON/OFF switch in the ON position, attempt to start the engine. If the engine does not start, check the interlock module using the following steps:

   A. Disconnect red wire (male connector) where it connects to the black wire leading to the ignition coil (Fig 5).

   B. Attempt to start the engine. The engine should start.

   C. Ground the red wire (male connector) to the engine block and attempt to start the engine. The engine **should not** start.

   D. Connect the red wire to the black wire.

4. Disconnect interlock switch on handle from wiring harness. Position engine ON/OFF switch to ON.

   A. Attempt to start the engine. The engine **should not** start.

   B. Jumper across the wire harness connector terminals and attempt to start the engine. The engine should start.

   C. Remove jumper and connect interlock switch to wiring harness.

5. Replace interlock module if it fails either of the tests in step 3 or 4.

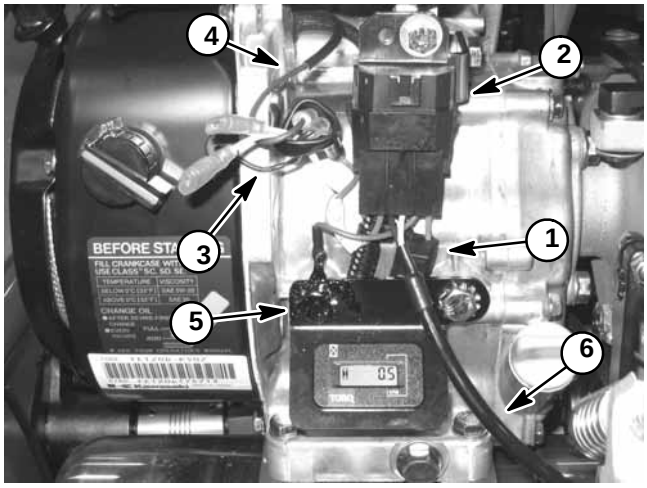


Figure 5

1. **Wire harness**
2. **Interlock module**
3. **Stop switch wire**
4. **Armature wire**
5. **Ground connection**
6. **Wires to interlock switch**

Lighting Coil

The engine on the Greensmaster Flex 18 and Flex 21 is equipped with a lighting coil to provide electrical current for an optional lighting kit. The coil is located under the engine flywheel and uses permanent magnets on the flywheel to operate. See the **Kawasaki FE120 Service Manual** at the end of Chapter 3 – Engine for lighting coil testing information.

Service and Repairs

NOTE: See the **Kawasaki FE120 Service Manual** at the end of Chapter 3 – Engine for additional repair information.

Interlock Switch

Adjustment

1. Make sure the engine is OFF and the traction lever is in the NEUTRAL position.

2. Loosen interlock switch mounting fasteners.

3. Hold traction lever against the neutral stop (Fig. 6).

4. Position switch to allow from 0.032“ to 0.062” (0.81 to 1.58 mm) clearance between the traction lever and the interlock switch (Fig. 6).

5. Tighten interlock switch mounting fasteners. Recheck clearance between lever and switch after tightening fasteners. The traction lever must not contact the switch.

6. Engage traction lever and verify that the switch opens (no continuity).

Removal

1. Disconnect switch from the wires leading from the Interlock module.

2. Remove fasteners and spacers that mount switch to control bracket on handle (Fig. 7). Remove switch from bracket.

Installation

1. Position switch to control bracket with fasteners and spacers (Fig. 7).

2. Adjust interlock switch (see Adjustment above) as necessary. Make sure that lock nuts are securely tightened after adjustment.

3. Connect switch to wires from the interlock module.

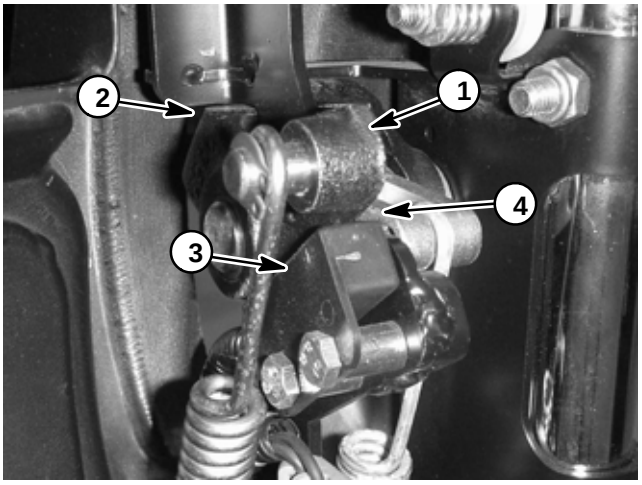


Figure 6

1. **Traction lever**
2. **Neutral stop**
3. **Interlock switch**
4. **Clearance**

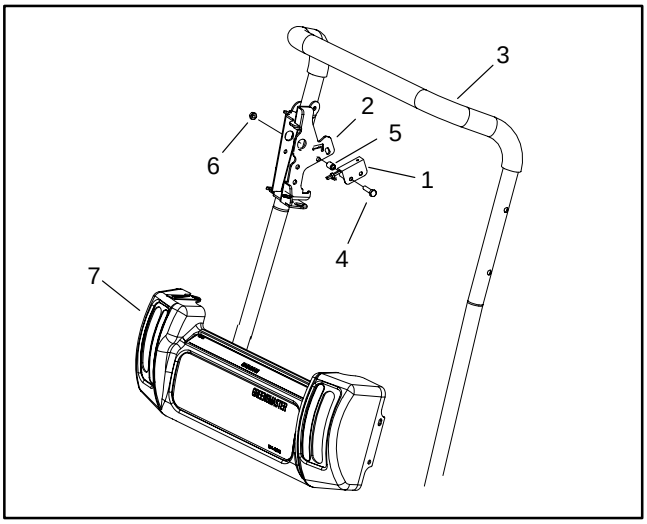


Figure 7

1. **Interlock switch**
2. **Control bracket**
3. **Handle**
4. **Cap screw (2 used)**
5. **Spacer (2 used)**
6. **Lock nut (2 used)**
7. **Console**

Operator Presence Switch (Optional)

The optional Operator Presence Kit for the Flex 18 and Flex 21 uses a switch mounted on the equipment handle that is operated by a bail. When the operator holds the bail against the handle, the switch closes, allowing the engine to run.

The common terminal and normally open terminal of the switch are used for the operator presence system on the Flex 18 and Flex 21 (Fig. 8). The normally closed terminal is not used.

Testing

Using a multimeter, the operator presence switch can be tested as follows:

1. With the bail released (away from the handle), there should be no continuity between the two terminals used on the Operator Presence Kit switch (Fig. 8).

2. With the bail held against the handle, there should be continuity between the same two terminals.

Adjustment

1. Mount operator presence switch to allow switch plunger to be depressed 0.080” (2.0 mm) when operator presence bail is engaged.

2. Switch plunger should be fully extended when operator presence bail is released.

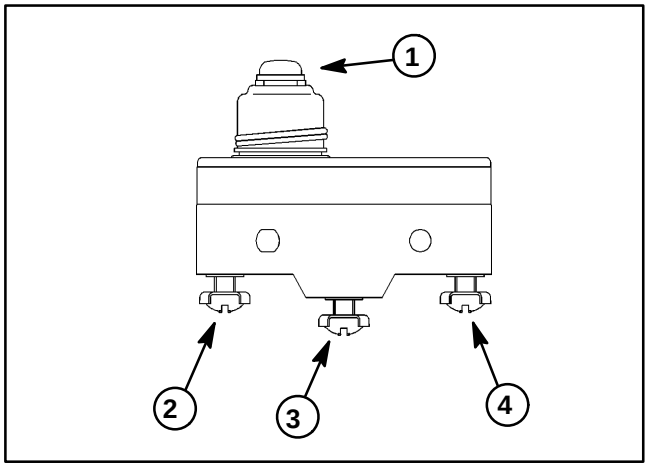


Figure 8

1. **Plunger**
2. **Common**
3. **Normally open**
4. **Normally closed**

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Chapter 6

Chassis and Controls

Table of Contents

Specifications

Item	Description
Transport Wheel (Optional) Tire Pressure	12 to 15 PSI (0.83 to 1.04 bar)

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, adjustment procedures and general maintenance for your Greensmaster machine. Refer to the Operator's Manual for additional information when servicing the machine.

Handle Assembly

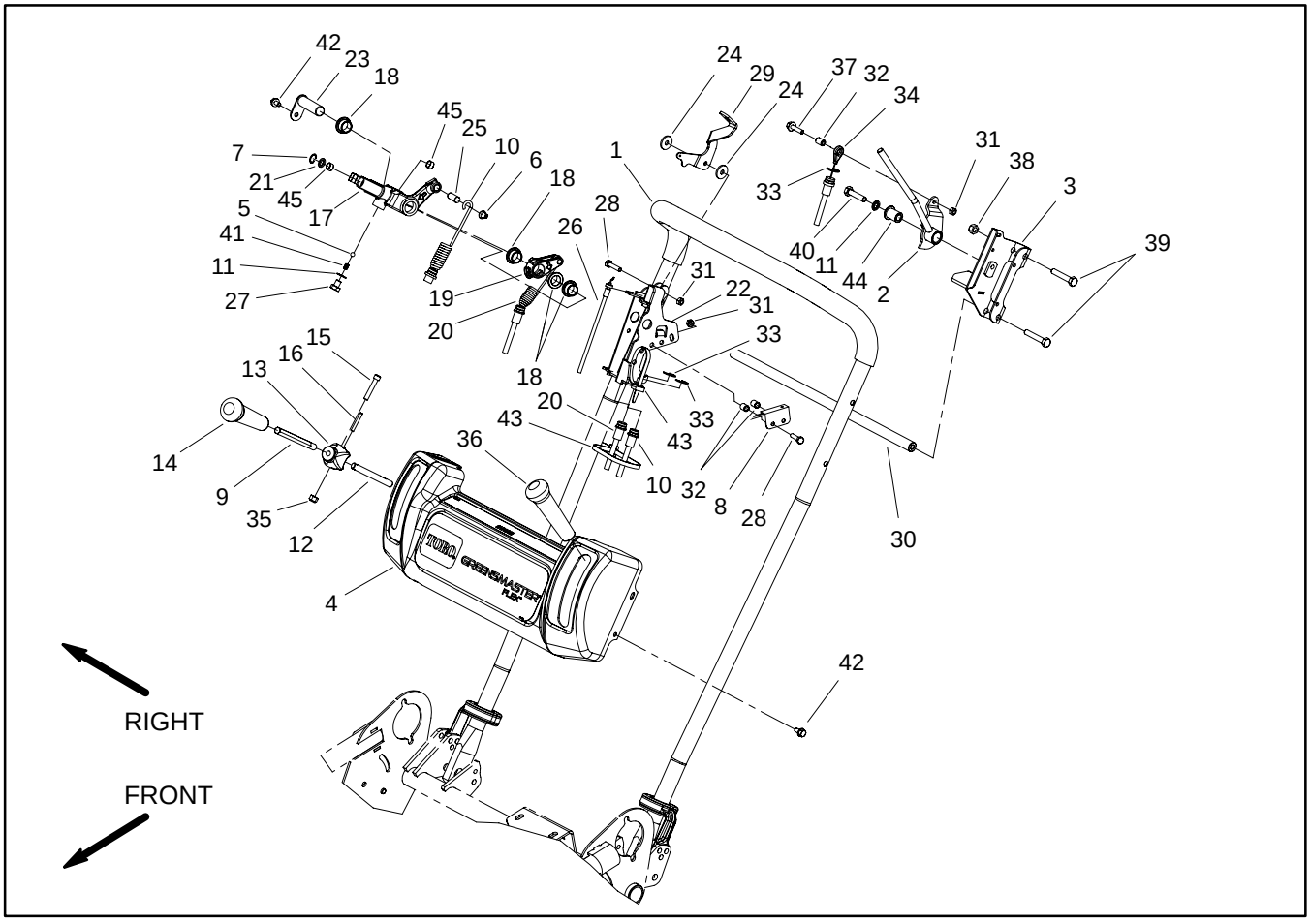

Figure 1

1. Handle
2. Brake lever
3. Brake bracket assembly
4. Console assembly
5. Detent ball
6. Retaining ring
7. Retaining ring
8. Interlock switch (proximity)
9. Handle rod
10. Traction cable
11. Lock washer (2 used)
12. Pin
13. Handle hub mount
14. Traction/reel drive knob (black)
15. Socket head screw
16. Roll pin
17. Traction control lever
18. Bushing (4 used)
19. Reel lever
20. Reel clutch cable
21. Wiper
22. Control bracket
23. Reel lever pin
24. Friction washer (2 used)
25. Dowel pin
26. Throttle cable
27. Cap screw
28. Cap screw (3 used)
29. Throttle lever
30. Support rod
31. Lock nut (4 used)
32. Spacer (3 used)
33. Retaining ring (3 used)
34. Brake cable
35. Lock nut
36. Brake knob (red)
37. Flange head screw
38. Lock nut (2 used)
39. Cap screw (4 used)
40. Cap screw
41. Detent spring
42. Washer head screw (5 used)
43. Cable tie (4 used)
44. Flange bushing
45. Bronze bushing (2 used)

Handle Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Note location of cable ties used to secure control cables. Remove cable ties.

3. Disconnect:

   A. Reel control and traction cables from gearbox (see Cable Replacement in this section).

   B. Parking brake cable from brake bracket assembly (see Cable Replacement in this section).

   C. Throttle cable from engine (see Throttle Cable Replacement in this section).

   D. Interlock switch wire connection.

4. Loosen and remove flange nut from cap screw on each end of the handle (Fig. 3).

5. Remove handle from frame.

Handle Installation

1. Slide handle ends through the holes in the handle arms with grommets. Install handle to the frame using cap screw, pivot pin and flange nut on each side.

2. Attach and adjust:

   A. Reel control, traction and parking brake cables (see Cable Replacement in this section).

   B. Throttle cable (see Throttle Cable Replacement in this section).

   C. Interlock switch wire connection.

3. Secure cables to handle with cable ties.

4. Attach spark plug wire to spark plug.

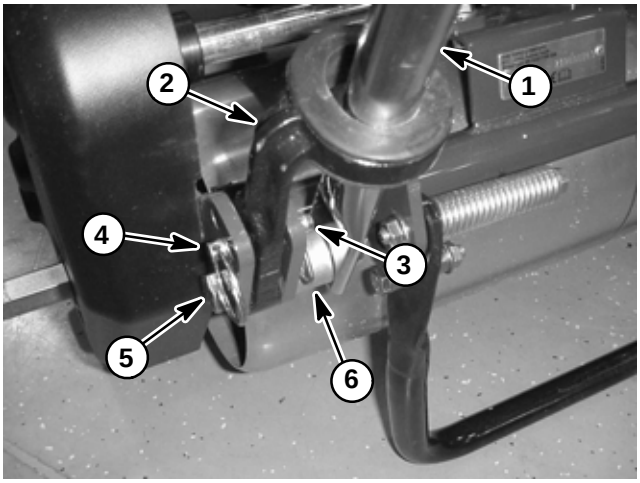

Figure 2

1. **Handle end**
2. **Handle arm w/grommet**
3. **Hairpin cotter**
4. **Ring pin**
5. **Cap screw**
6. **Pivot pin**

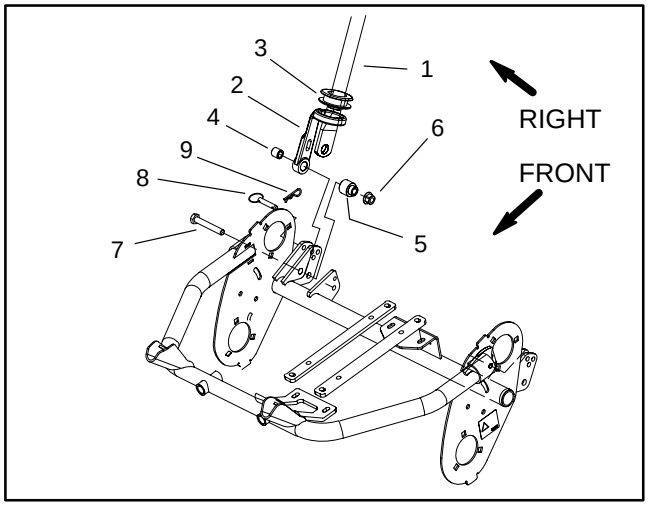

Figure 3

1. **Handle**
2. **Handle arm**
3. **Handle grommet**
4. **Handle support spacer**
5. **Pivot pin**
6. **Flange nut**
7. **Cap screw**
8. **Ring pin**
9. **Hairpin cotter**

Parking Brake Cable Replacement

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Disengage parking brake to release tension on the brake cable. Remove cable ties that secure cable.

3. Remove parking brake cable from the gearbox as follows (Fig. 4):

   A. Loosen front cable jam nut and lift cable free from casting slot on gearbox.

   B. Loosen lock nut that secures gearbox brake lever to splined gearbox shaft. Slide lever toward engine to allow room for cable eyelet removal.

   C. Remove retaining ring from the gearbox brake lever.

   D. Remove brake cable eyelet from brake lever.

4. Remove flange head screw, spacer and lock nut that secures brake cable eyelet to brake lever on machine handle (Fig. 5).

5. Remove retaining ring securing the brake cable to the brake bracket (Fig. 5). Remove cable from the bracket.

6. Remove brake cable from the machine.

Installation

1. Secure brake cable eyelet to the brake lever on the machine handle with flange head screw, spacer and lock nut (Fig. 5).

2. Position cable to the brake bracket and install retaining ring (Fig. 5).

3. Route brake cable to the gearbox assembly. Install brake cable to the gearbox and gearbox brake lever as follows (Fig. 4):

   A. Position brake lever on splined gearbox shaft to allow room for cable eyelet installation.

   B. Install cable eyelet to the brake lever and secure with retaining ring.

   C. Slide brake lever toward gearbox and secure with lock nut.

   D. Attach brake cable to the casting slot on gearbox with a washer and jam nut on each side of the slot.

4. Adjust brake cable (see Operator's Manual).

5. Secure brake cable with cable ties.

6. Attach spark plug wire to spark plug.

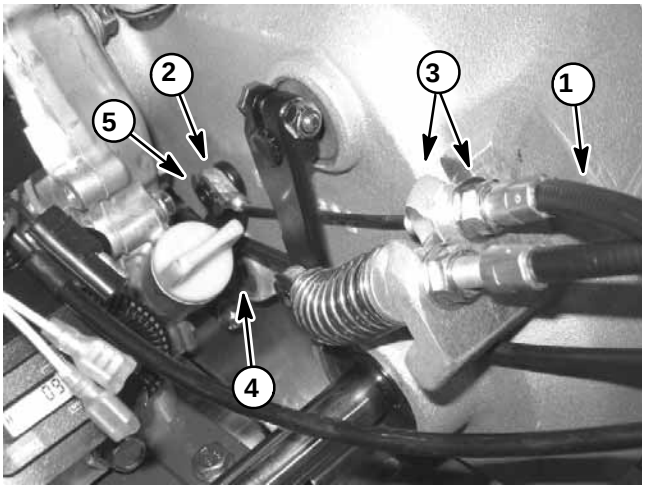

Figure 4

1. **Brake cable**
2. **Cable eyelet**
3. **Cable jam nuts**
4. **Gearbox brake lever**
5. **Retaining ring**

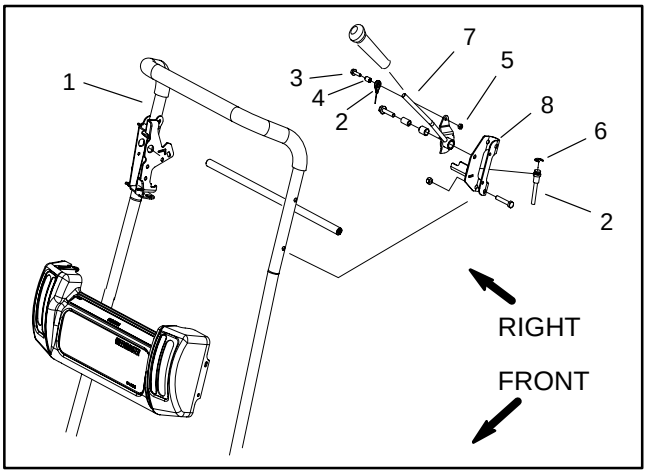

Figure 5

1. **Handle**
2. **Brake cable**
3. **Flange head screw**
4. **Spacer**
5. **Lock nut**
6. **Retaining ring**
7. **Brake lever**
8. **Brake bracket**

Traction Control Cable Replacement

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Move traction lever to the DISENGAGED position. Remove cable ties that secure traction cable.

3. Remove traction cable from the gearbox as follows (Fig. 6):

   A. Loosen front cable jam nut and lift traction cable free from casting slot of gearbox.

   B. Remove retaining ring that secures cable eyelet to gearbox traction lever.

   C. Remove traction cable from gearbox.

4. Remove traction cable from the traction lever assembly as follows (Fig. 7):

   A. Remove retaining ring that secures the traction cable housing to the control bracket.

   B. Remove retaining ring that secures cable spring to pin on traction lever assembly.

   C. Remove cable from traction lever assembly.

5. Remove traction cable from the machine.

Installation

1. Secure traction cable spring to the traction lever assembly (Fig. 7):

   A. Install cable spring to pin on traction lever assembly and secure with retaining ring.

   B. Secure the cable housing to the control bracket with retaining ring.

2. Route traction cable to the gearbox. Install cable to the gearbox as follows (Fig. 6):

   A. Secure cable eyelet to gearbox traction lever with retaining ring.

   B. Position traction cable to the casting slot of gearbox with a washer and jam nut on each side of the slot.

3. Adjust traction cable (see Operator's Manual).

4. Install cable ties to secure traction cable. Attach spark plug wire to spark plug.

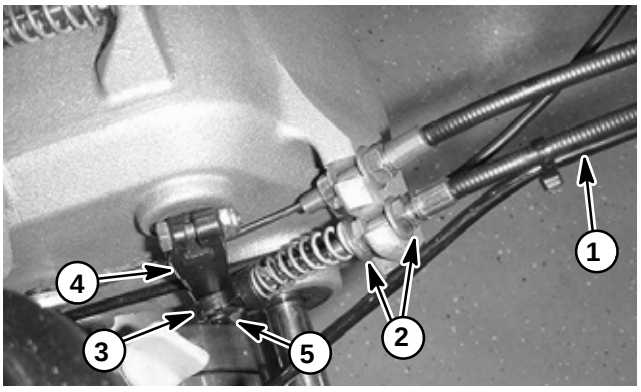

Figure 6

1. **Traction cable**
2. **Cable jam nuts**
3. **Cable eyelet**
4. **Gearbox traction lever**
5. **Retaining ring**

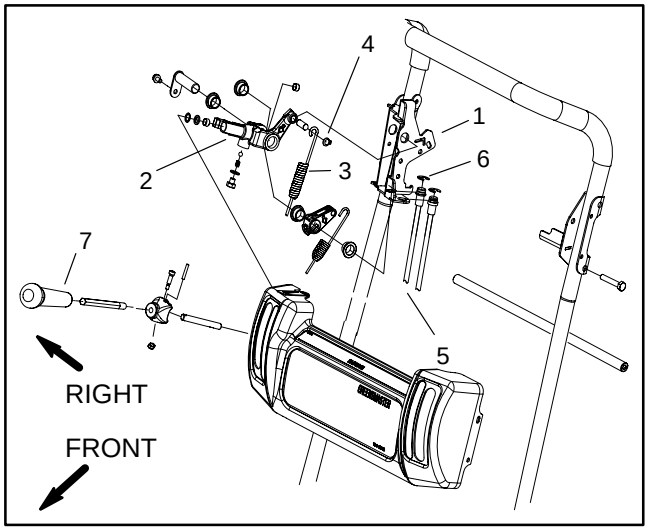

Figure 7

1. **Control bracket**
2. **Traction lever assembly**
3. **Traction cable spring**
4. **Retaining ring**
5. **Cable housing**
6. **Retaining ring**
7. **Control knob**

Reel Control Cable Replacement

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Assure reel drive lever is in the DISENGAGED position. Remove cable ties that secure reel control cable.

3. Remove reel control cable from the gearbox as follows (Fig. 8):

   A. Loosen front cable jam nut and lift cable free from casting slot of gearbox.

   B. Remove retaining ring that secures cable eyelet to reel control bellcrank.

   C. Remove reel drive cable from gearbox.

4. Remove reel control cable from the reel control lever as follows (Fig. 9):

   A. Remove retaining ring that secures the cable housing to the control bracket.

   B. Unhook reel control cable spring from reel control lever.

5. Remove reel control cable from the machine.

Installation

1. Secure reel control cable to the reel control lever (Fig. 9):

   A. Hook cable spring to reel control lever.

   B. Secure the cable housing to the control bracket with retaining ring.

2. Route reel control cable to the gearbox. Install cable to the gearbox as follows (Fig. 8):

   A. Secure cable eyelet to the reel control bellcrank with retaining ring.

   B. Position reel cable to the casting slot on gearbox with a washer and jam nut on each side of the slot.

3. Adjust reel control cable (see Operator's Manual).

4. Secure reel control cable with cable ties.

5. Attach spark plug wire to spark plug.

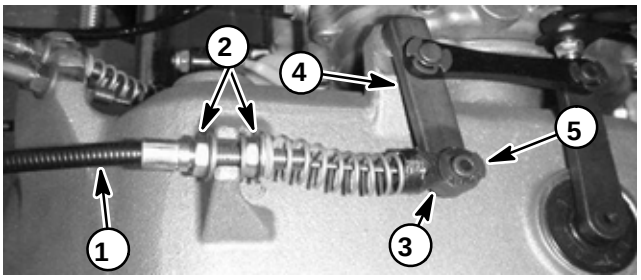

Figure 8

1. **Reel control cable**
2. **Cable jam nuts**
3. **Cable eyelet**
4. **Reel control bellcrank**
5. **Retaining ring**

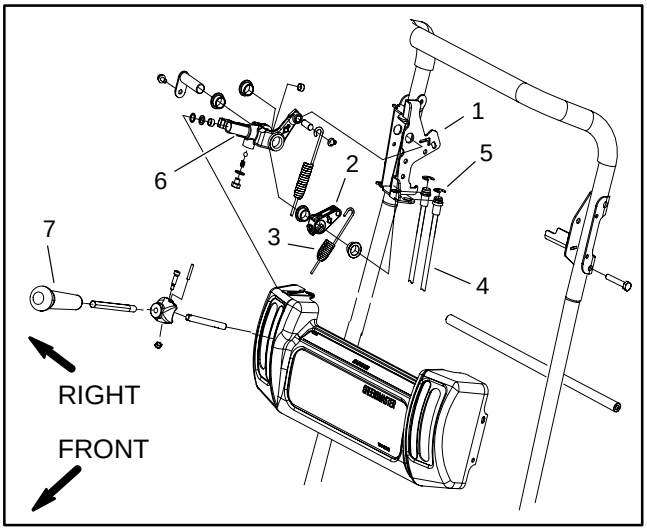

Figure 9

1. **Control bracket**
2. **Reel control lever**
3. **Reel control cable spring**
4. **Cable housing**
5. **Retaining ring**
6. **Traction lever assembly**
7. **Control knob**

Throttle Cable Replacement

Removal

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Remove cable tie that secures throttle cable.

3. Remove throttle cable from the engine governor linkage as follows (Fig. 10):

   A. Unscrew throttle cable screw enough to release the throttle cable from the nut in the governor lever.

   B. Remove cap screw and flange nut that secure cable clamp to traction unit frame (Fig. 11). Locate and retrieve three (3) washers from under clamp.

   C. Pull throttle cable clear of the nut in the governor lever.

4. Remove four (4) screws securing the console to the handle and move console forward and away from the handle.

5. Remove throttle cable from the throttle lever assembly (Fig. 12):

   A. Unsnap the cable housing from the control bracket.

   B. Unhook cable end from throttle lever.

6. Remove throttle cable from the machine.

Installation

1. Connect throttle cable to the throttle lever. Snap throttle cable housing to the control bracket (Fig. 12).

2. Position console to handle and secure console with four (4) screws.

3. Route throttle cable to the governor lever.

4. Install cable to the governor lever as follows (Fig. 10):

   A. Insert throttle cable into the nut.

   B. Tighten throttle cable screw to hold cable in the nut. Do not fully tighten screw.

   C. Position three (3) washers and cable clamp to frame. Secure with cap screw and flange nut.

5. Adjust throttle cable (see Throttle Cable Adjustment in the Adjustments section of Chapter 3 – Engine).

6. Secure throttle cable with cable tie. Attach spark plug wire to spark plug.

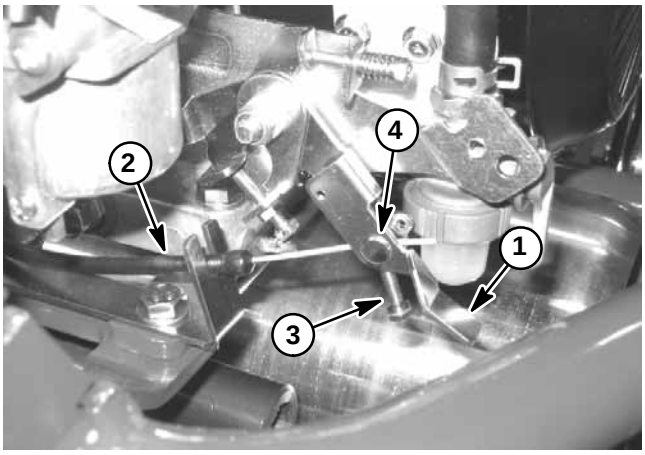

Figure 10

1. Governor lever
2. Throttle cable
3. Throttle cable screw
4. Throttle cable nut

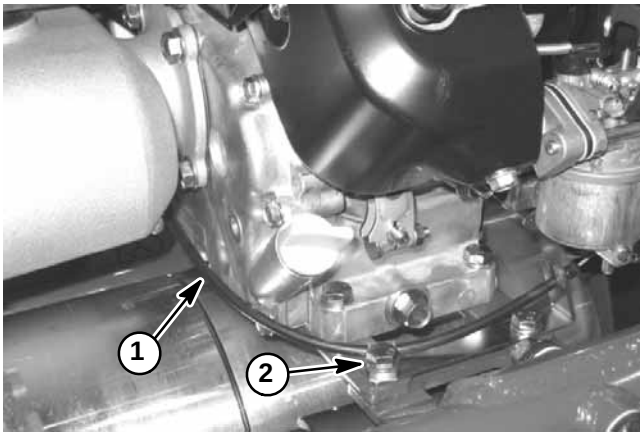

Figure 11

1. Throttle cable
2. Cable clamp

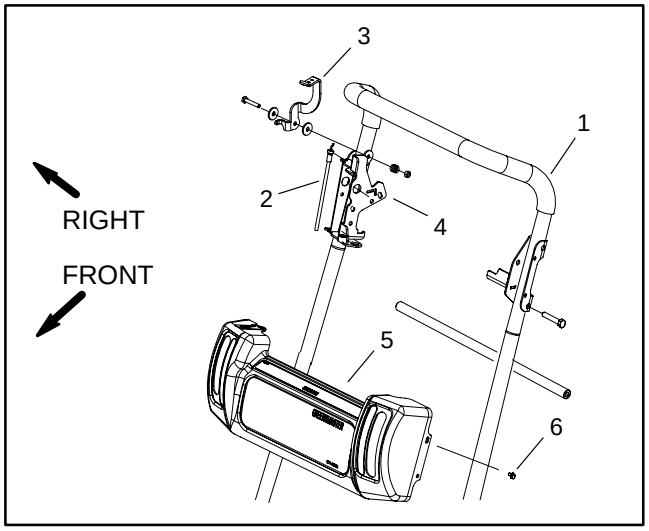

Figure 12

1. Handle
2. Throttle cable
3. Throttle lever
4. Control bracket
5. Console
6. Screw (4 used)

Transport Wheels (Optional)

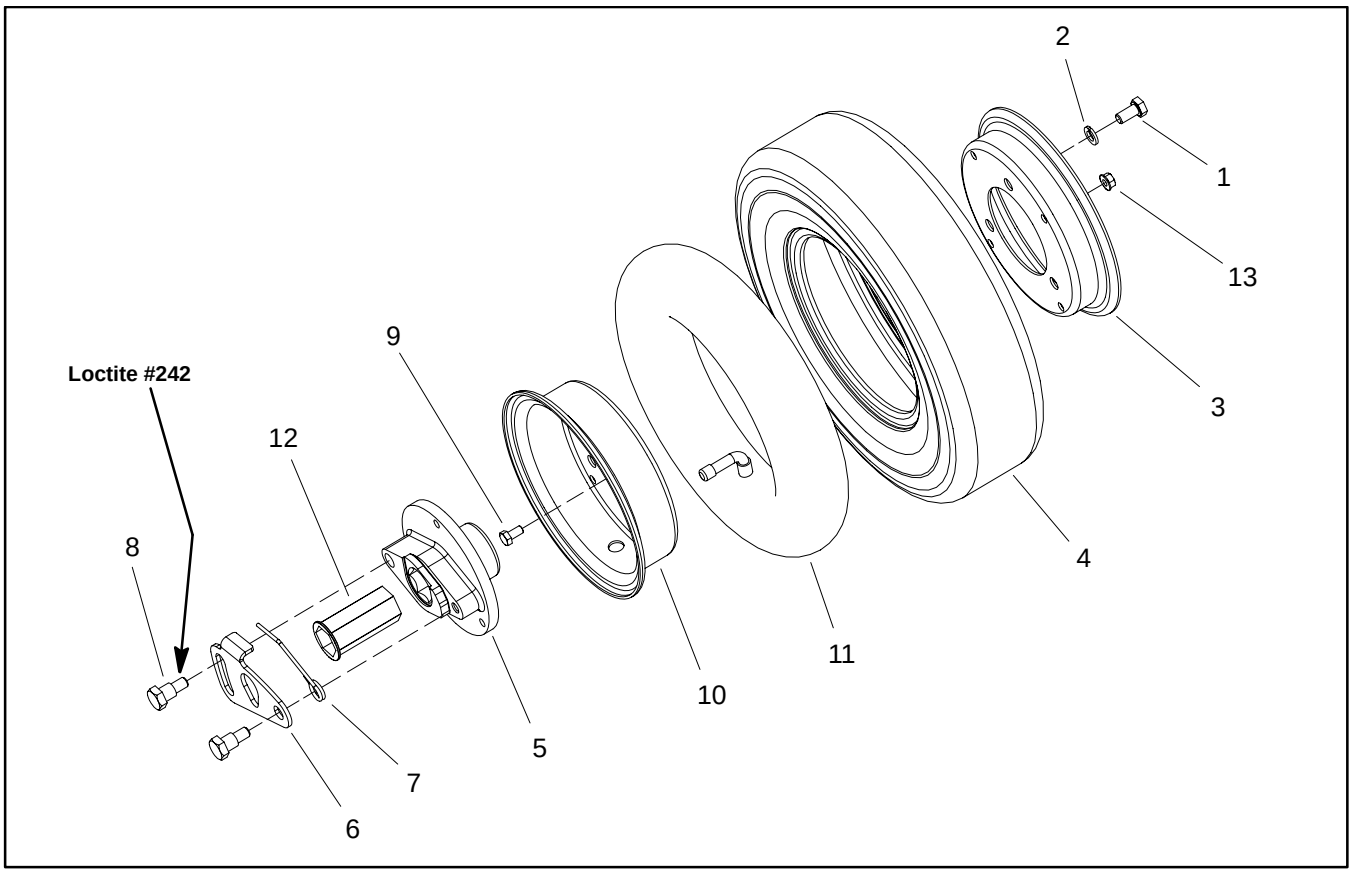

Figure 13

1. **Cap screw (3 used)**
2. **Lock washer (3 used)**
3. **Shallow rim**
4. **Tire**
5. **Hub**
6. **Wheel retaining lever**
7. **Torsion spring**
8. **Shoulder screw (2 used)**
9. **Cap screw (4 used)**
10. **Deep rim**
11. **Inner tube**
12. **Hub bushing**
13. **Flange nut (4 used)**

Wheel Removal (Fig. 14)

1. Park machine on a level surface. Make sure the engine is OFF.

2. Support the machine on the kickstand.

3. Pivot wheel retaining lever away from the center of the wheel. Slide transport wheel off the wheel hex shaft.

Wheel Disassembly (Fig. 13)

1. Remove three (3) cap screws and lock washers from the shallow rim and hub. Remove hub from deep rim.

2. Inspect hub bushing (item 12). If worn or damaged, replace bushing.

3. Remove four (4) cap screws and flange nuts from the deep rim and shallow rim. Remove shallow rim from the deep rim.

4. Separate tire, tube and deep rim.

5. If necessary, remove shoulder screws, torsion spring and retaining lever from the hub.

Wheel Assembly (Fig. 13)

1. If shoulder screws were removed from hub, apply Loctite #242 (or equivalent) to threads of shoulder screws. Secure torsion spring and retaining lever to the hub with shoulder screws.

2. Assemble tire, tube and deep rim.

3. Install shallow rim into the tire. Align and secure shallow rim to the deep rim with four (4) cap screws and flange nuts. Tighten fasteners.

4. Install hub into deep rim. Secure hub to deep rim with three (3) cap screws and lock washers. Tighten fasteners.

Wheel Installation (Fig. 14)

1. Make sure machine is parked on a level surface and the engine is OFF.

2. Support the machine on the kick stand.

3. Apply antiseize lubricant to the exposed end of the wheel hex shaft (Fig. 15).

4. Slide transport wheel completely onto the wheel hex shaft until the wheel retaining lever is secured into the groove on the wheel hex shaft.

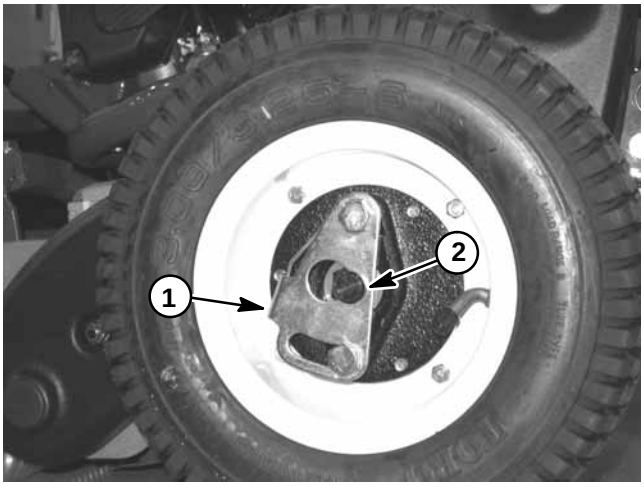

Figure 14

1. Wheel retaining lever **2. Wheel hex shaft**

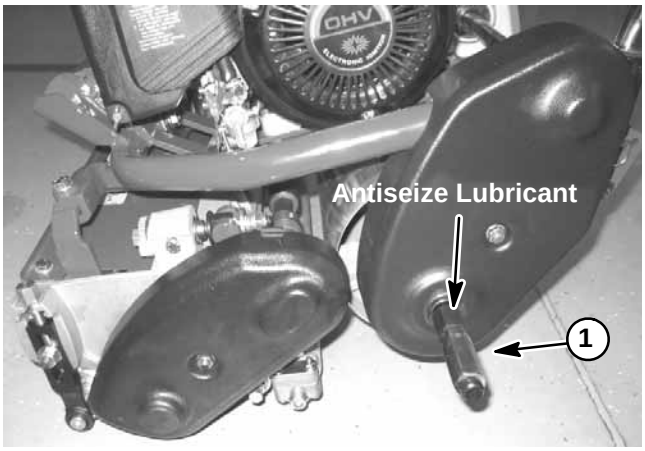

Figure 15

1. Wheel hex shaft

Kickstand

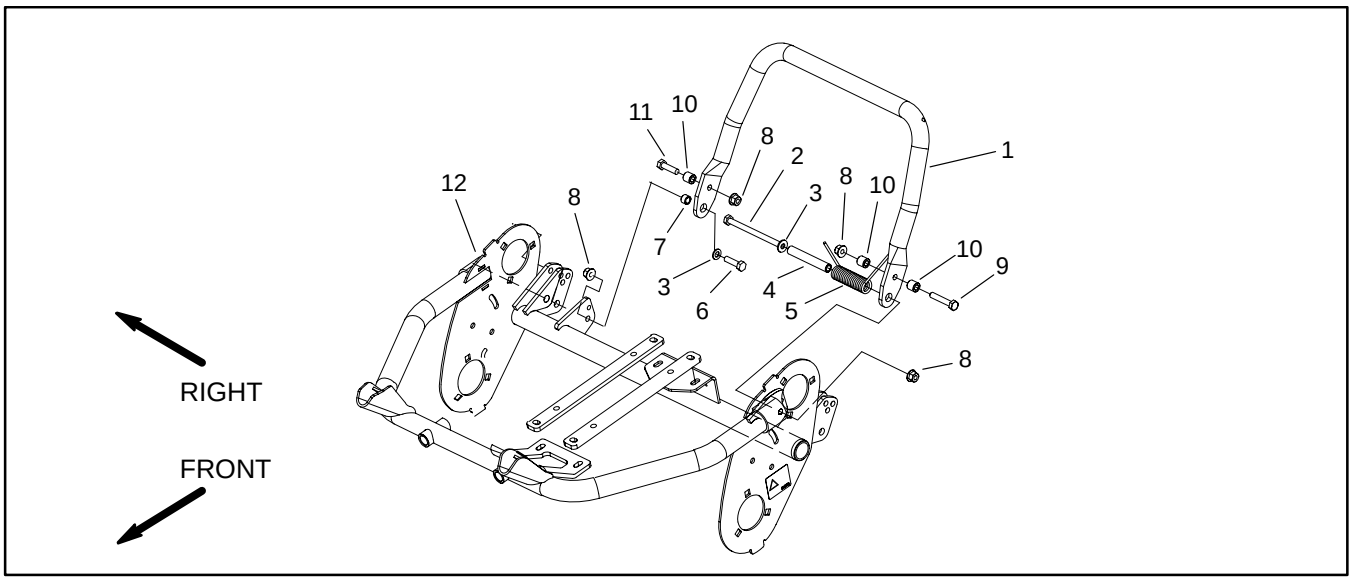

Figure 16

1. **Kickstand**
2. **Cap screw**
3. **Flat washer**
4. **Long spacer**
5. **Torsion spring**
6. **Cap screw**
7. **Spacer**
8. **Flange nut**
9. **Cap screw**
10. **Support bushing**
11. **Cap screw**
12. **Frame assembly**

Removal (Fig. 16)

1. Park machine on a level surface. Make sure the engine is OFF.

2. Pivot kickstand up and hold against the frame stops.

CAUTION

Be careful when removing or applying tension from or to the torsion spring of the kickstand. The spring is under heavy load and may cause personal injury.

3. Use a nutdriver or small diameter pipe over the end of the torsion spring. Push the torsion spring down and in to release spring tension (Fig. 17).

4. Remove flange nuts, cap screws, flat washers, spacers and torsion spring from the kickstand and frame. Note that long spacer and torsion spring is on the left side of the machine and short spacer is on the right.

5. Remove kickstand from the frame.

Installation (Fig. 16)

1. Make sure machine is parked on a level surface and the engine is OFF.

2. Position kickstand inside the machine frame. Insert cap screws through the washers, kickstand, spacers and frame (Fig. 16).

3. Secure cap screws with flange nuts. Tighten fasteners.

4. Pivot kickstand up and hold against the frame stops. Use a nutdriver or small diameter pipe over the end of the torsion spring. Push the spring end down and out to install spring (Fig. 17).

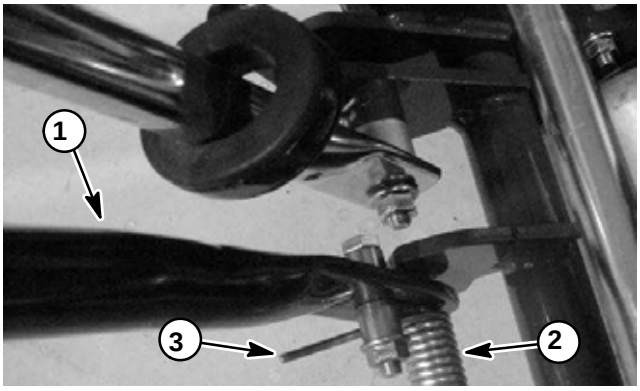

Figure 17

1. **Kickstand**
2. **Torsion spring**
3. **Torsion spring end**

Chapter 7

Cutting Unit

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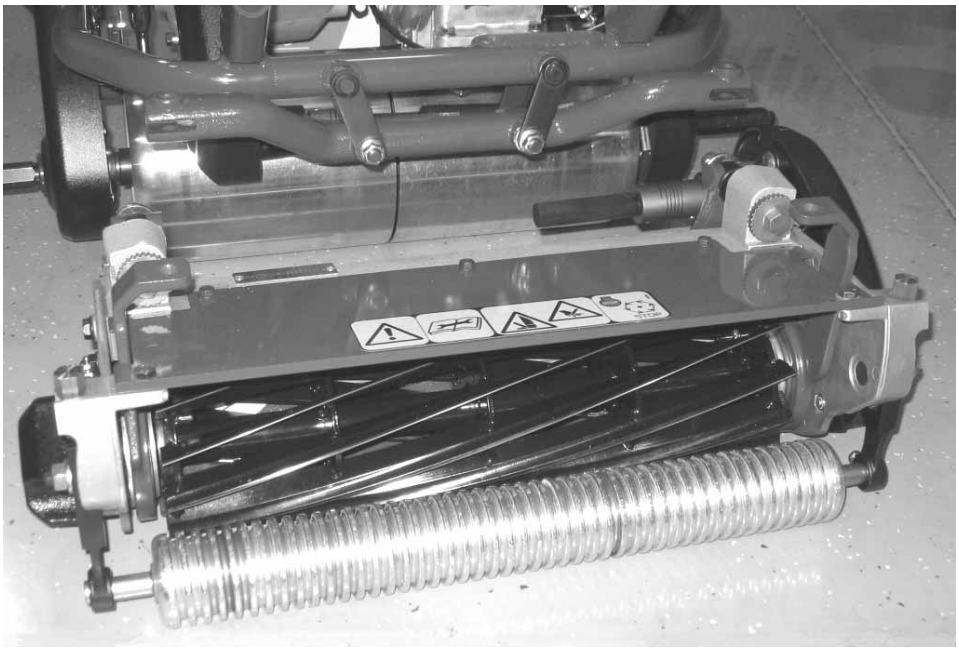
Specifications



REEL CONSTRUCTION: 5–inch (12.7 cm) diameter, 11 carbon steel blades welded to 5 stamped steel spiders. High strength low alloy steel blades are thru hardened and impact resistant. An optional 8 blade cutting reel is available.

FRAME CONSTRUCTION: Precision machined die cast aluminum cross member with two bolt–on die–cast aluminum side plates.

HEIGHT–OF–CUT: Cutting height is adjusted on the front roller by two vertical screws and held by two lock nuts. Standard bench height of cut range is 1/16 to 19/64 inch (1.6 to 7.5 mm) depending on type of bedknife installed. Effective HOC may vary depending on turf conditions, type of bedknife, rollers and attachments installed.

CLIP: 0.14 inch (3.56 mm) with 11 blade reel.
0.19 inch (4.83 mm) with optional 8 blade reel.

BEDKNIFE AND BEDBAR: Single edged high carbon steel bedknife, hardened to RC 48-54. A cast iron bedbar is fastened to the cutting unit.

GRASS SHIELD: Non–adjustable shield with adjustable cut–off bar to improve grass discharge from reel in dry conditions.

COUNTERBALANCE WEIGHT: A cast iron weight mounted on right end of cutting unit balances the cutting unit.

APPROXIMATE WEIGHT:

Flex 18 with11 Blade Reel	81 lb. (36.7 kg)
Flex 21 with 11 Blade Reel	89 lb. (40.4 kg)

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for the cutting unit on your Greensmaster machine. Refer to this publication for additional information when servicing the cutting unit.

Separating Cutting Unit from Traction Unit

1. Position mower on a flat, level work surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Lower kickstand. Insert a 1/4" diameter pin (or equivalent) into frame hole above kickstand mounting bolt to lock kickstand in place (Fig. 1).

3. Remove grass basket, if installed.

4. Remove two (2) cap screws and flat washers securing cutting unit pitch arms to traction unit front frame (Fig. 2).

5. Rotate pitch arms forward and rest traction unit on locked kickstand.

6. Pull cutting unit forward about 2 inches (51 mm) and then to the right to disengage the transmission coupler (Fig. 3).

7. Slide cutting unit away from machine.

8. Reverse procedure to install cutting unit to traction unit.

9. Attach spark plug wire to engine spark plug.

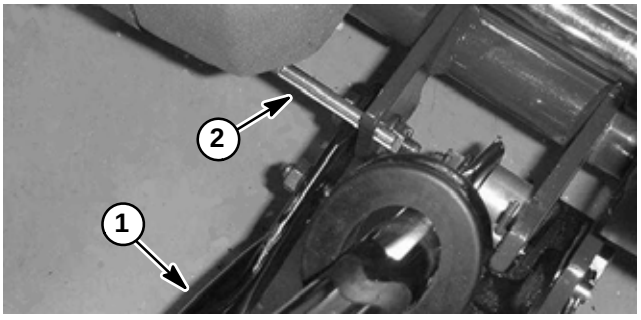


Figure 1

1. **Kickstand**
2. **1/4 inch pin**

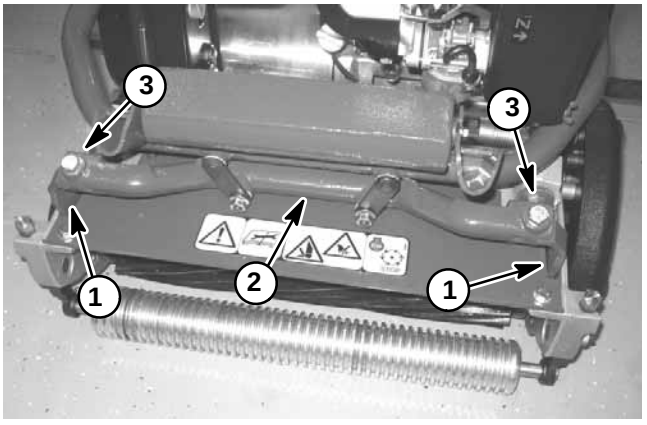


Figure 2

1. **Cutting unit pitch arm**
2. **Traction unit front frame**
3. **Cap screw / flat washer**

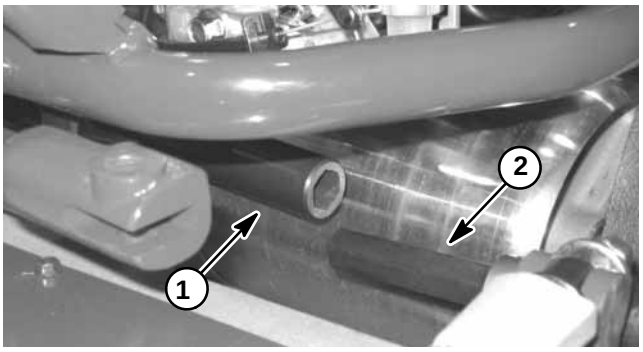


Figure 3

1. **Coupler hex tube**
2. **Coupler hex shaft**

Special Tools

Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*.

Some tools may have been supplied with your mower or are available as TORO parts. Some tools may also be available from a local supplier.

Gauge Bar Assembly

Toro Part Number: **13–8199**

Used to verify height–of–cut.

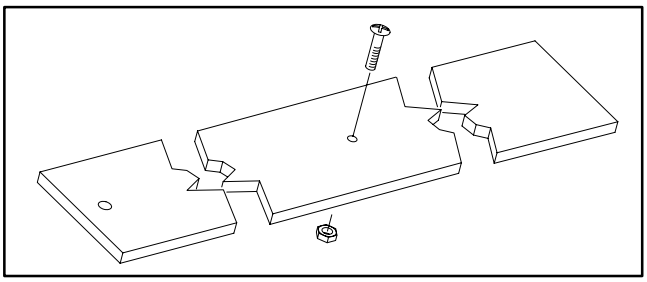


Figure 4

Backlapping Brush Assembly

Toro Part Number: **TOR299100**

Used to apply lapping compound to cutting units while keeping the operator's hands at a safe distance from the rotating reel.

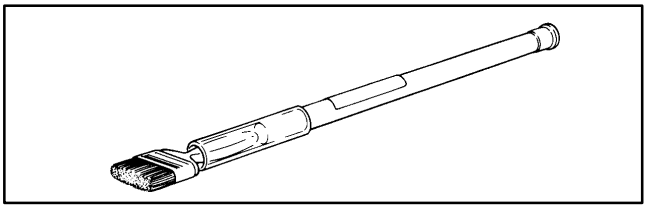


Figure 5

Bedknife Screw Tool

Toro Part Number: **TOR510880**

This screwdriver–type bit is made to fit Toro bedknife attaching screws. Use this bit with a 3/8" drive torque wrench to secure the bedknife to the bedbar.

DO NOT use an air or manual impact wrench with this tool.

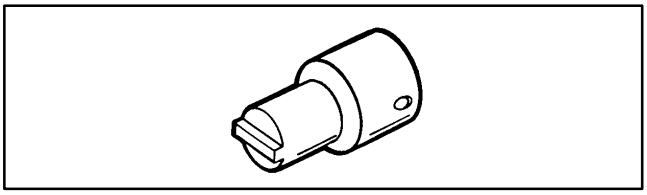


Figure 6

Roller Bearing Installation Tools

Washers and spacer used to install bearings and seals into front and rear rollers.

Seal installation washer (black): **107–8133**
Seal installation spacer: **107–3505**
Bearing installation washer (yellow): **104–6126**

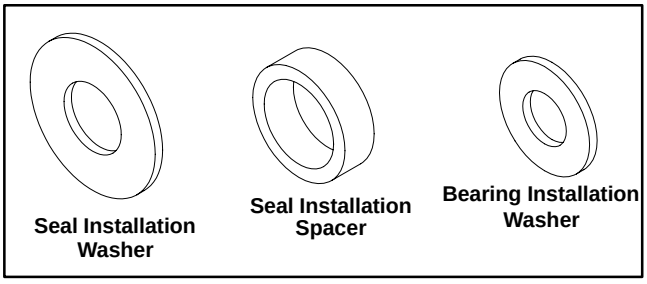


Figure 7

Bearing and Seal Installer

Toro Part Number: **TOR4105**

Used to install bearings and seals into front and rear rollers.

NOTE: TOR4105 is an alternative to using washers and spacers listed above.

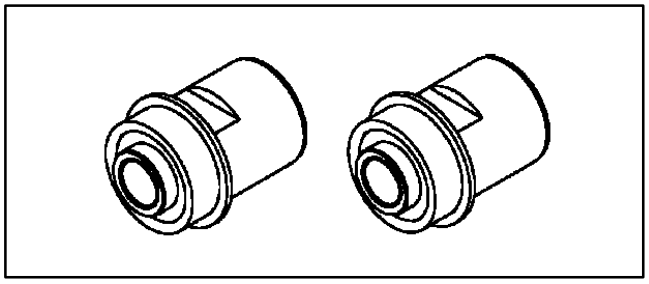


Figure 8

Sleeve Driver

Toro Part Number: **TOR4107**

Used to drive the wear sleeve into position on the cutting reel shaft.

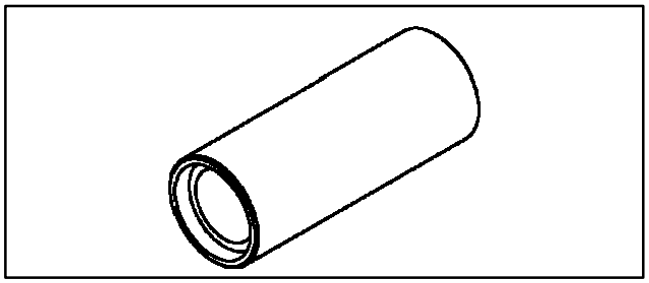


Figure 9

Sleeve Driver and Bearing and Seal Installer Set

Toro Part Number: **TOR4108**

Set includes both TOR4105 and TOR4107 in a plastic storage case with foam inserts.

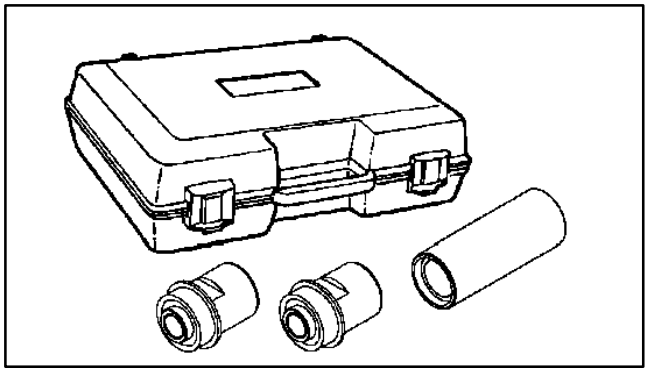


Figure 10

Factors That Can Affect Quality of Cut

There are a number of factors that can contribute to unsatisfactory quality of cut, some of which may be turf conditions. Turf conditions such as excessive thatch, “sponginess,” or attempting to cut off too much grass height may not always be overcome by adjusting the cutting unit. It is important to remember that the lower the height–of–cut, the more critical these factors are. See Cutting Unit Operator’s Manual and the Adjustments section and Service and Repairs section of this chapter for detailed adjustment and repair information.

Factor	**Possible Problem/Correction**
Governed engine speed.	Check maximum governed engine speed. Adjust engine to specifications if necessary (see Adjustments section in Chapter 3 – Engine).
Reel bearing condition.	Check and replace reel bearings if necessary (see Cutting Reel in the Service and Repairs section of this chapter).
Reel and bedknife sharpness.	A reel and/or bedknife that has rounded cutting edges or “rifling” (grooved or wavy appearance) cannot be corrected by tightening the bedknife to reel contact. Grind reel to remove taper and/or rifling. Grind bedknife to sharpen and/or remove rifling. The most common cause of rifling is bedknife to reel contact that is too tight. **A new bedknife must be ground or backlapped after installation to the bedbar.**
Bedknife to reel adjustment.	Check bedknife to reel contact daily. The bedknife must have light contact across the entire reel. No contact will dull the cutting edges. Excessive contact accelerates wear of both edges. Quality of cut is adversely affected by both conditions. Slightly dull cutting edges may be corrected by backlapping (see Backlapping in the Service and Repairs section of this chapter). Excessively dull cutting edges must be corrected by grinding the reel and bedknife (see Preparing Reel for Grinding in the Service and Repairs section of this chapter).
Height–of–cut.	“Effective” or actual height–of–cut depends on the mower weight and turf conditions. Effective height–of–cut will be different than the bench set height–of–cut.
Proper bedknife for height–of–cut.	If the bedknife is too thick for effective height–of–cut, poor quality of cut will result.
Stability of bedbar.	Make sure bedbar pivot bolts are securely seated (see Bedbar in Service and Repairs section of this chapter).
Number of reel blades.	Use correct number of blades for clip frequency and optimum height–of–cut range.

Factor	Possible Problem/Correction
Rear roller level.	Reel and rear roller should be parallel for proper cutting performance (see Leveling Rear Roller in Adjustments section of this chapter).
Roller condition.	Make sure rollers rotate freely. Repair roller bearings if necessary (see Roller Service in Service and Repairs section of this chapter).
Traction speed.	Check maximum governed engine speed. Adjust engine to specifications if necessary (see Adjustments section in Chapter 3 – Engine). The traction drive belts may be loose or worn. Check the condition of the traction belts. Adjust or replace traction drive belts as necessary.
Groomer reel operation.	See Troubleshooting section of Chapter 8 – Groomer.

Adjustments

CAUTION

Never work on the cutting unit with the engine running. Always stop the engine and remove the spark plug wire from the spark plug first.

DANGER

Contact with the reel, bedknife or other cutting unit parts can result in personal injury. Use heavy gloves when handling the cutting reel or bedknife.

Leveling Rear Roller

The precision machined components of the cutting unit frame keep the rear roller and cutting reel in alignment (parallel). If the side plates are disassembled or as the cutting reel wears, a limited amount of side plate adjustment is possible to make sure that the cutting unit is properly aligned.

1. Place the assembled cutting unit on a surface plate.

2. On both sides of cutting unit, loosen bedbar adjuster screw by turning screw counterclockwise (Fig. 11).

3. Back off the spring tension lock nuts until the washer is no longer tensioned against the bedbar (Fig. 11).

4. Loosen, but do not remove, two (2) cap screws and lock nuts that secure the grass shield to the side plates (Fig. 12).

5. Loosen, but do not remove, four (4) shoulder bolts that secure the side plates to the crossmember (Fig. 12).

6. Adjust the position of the side plates to parallel the rear roller and cutting reel. Then, tighten the four (4) shoulder bolts to a torque from **210 to 240 in–lb (23.7 to 27.1 N–m)**.

7. Tighten the cap screws and lock nuts that secure the grass shield to the cutting unit side plates.

8. Tighten each spring tension lock nut until the adjuster spring is fully compressed, then loosen lock nut 1/2 turn.

9. Complete cutting unit set–up and adjustment sequence.

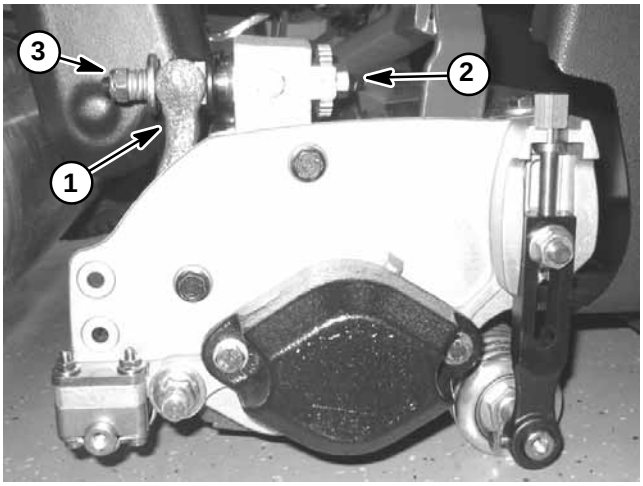


Figure 11

1. **Bedbar**
2. **Bedbar adjuster screw**
3. **Spring tension lock nut**

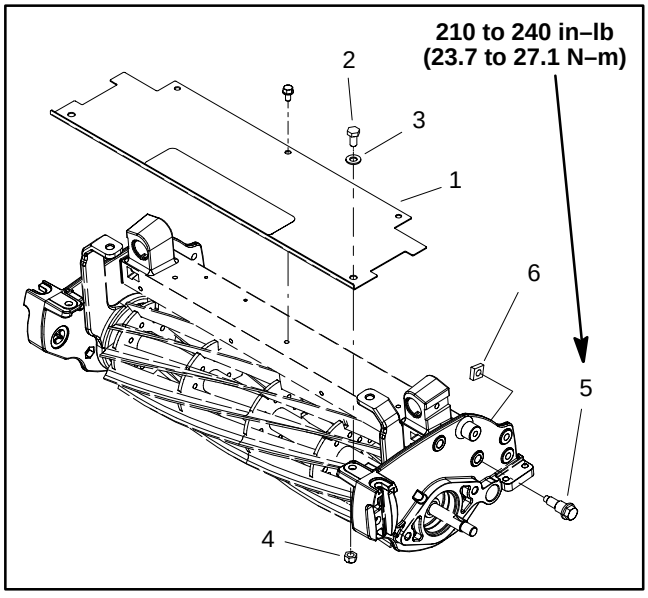


Figure 12

1. **Grass shield**
2. **Cap screw (2 used)**
3. **Flat washer (2 used)**
4. **Lock nut (2 used)**
5. **Shoulder bolt (4 used)**
6. **Square nut (4 used)**

Backlapping

1. Park cutting unit on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Make sure reel drive lever is DISENGAGED.

3. Remove plug from the reel drive cover on the left side of the reel assembly (Fig. 13).

4. Insert a 18 mm socket onto hex flange nut on left side of reel shaft.

DANGER

Contact with the reel or other moving parts can result in personal injury.

Stay away from the reel when backlapping.

Never use a short handled paint brush for applying lapping compound. Part Number TOR299100 backlapping brush assembly (see Special Tools) is available from your local Authorized Toro Distributor.

5. Backlap according to procedure in **TORO Sharpening Reel and Rotary Mowers Manual, Form No. 80300 SL**.

NOTE: For a better cutting edge, run a file across the front face of the bedknife when the lapping operation is completed. This will remove any burrs or rough edges that may have built up on the cutting edge.

6. Install reel drive cover plug when backlapping operation is completed (Fig. 13).

7. Attach spark plug wire to engine spark plug.

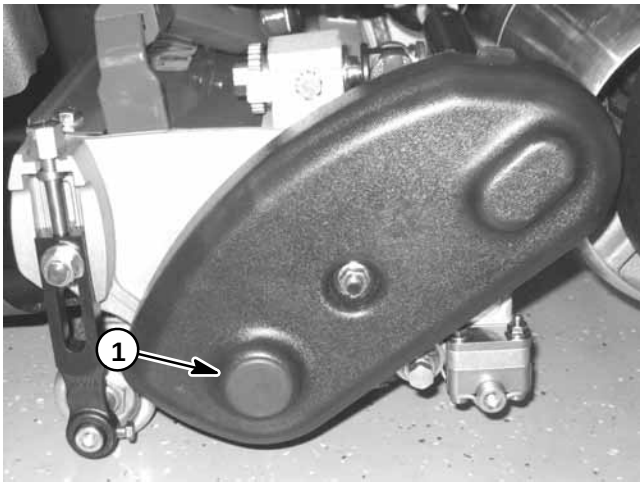


Figure 13

1. Cover plug

Bedbar

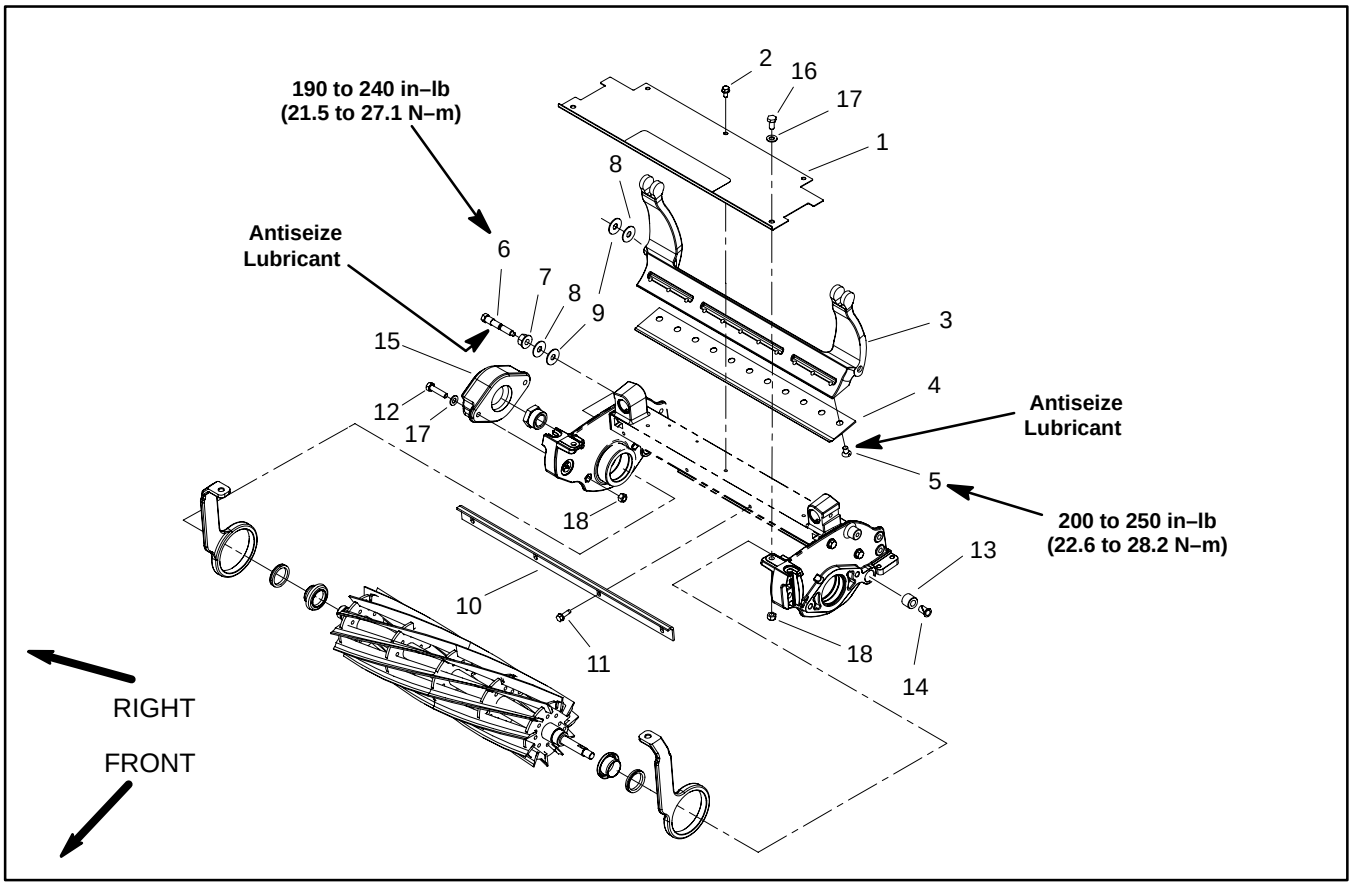


Figure 14

1. Grass shield
2. Washer head screw (3 used)
3. Bedbar
4. Bedknife
5. Screw
6. Bedbar bolt (2 used)
7. Flange nut (2 used)
8. Flat washer (4 used)
9. Plastic washer (4 used)
10. Cutoff bar
11. Screw (4 used)
12. Cap screw (2 used)
13. Rubber bushing (2 used)
14. Nylon bushing (2 used)
15. Weight
16. Cap screw (2 used)
17. Flat washer (4 used)
18. Lock nut (4 used)

Removal (Fig. 14)

1. Position machine on a flat, level work surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. On both sides of cutting unit, loosen bedbar adjuster screw by turning screw counterclockwise (Fig. 15).

3. Back off the spring tension lock nut until the washer is no longer tensioned against the bedbar (Fig. 15).

4. Loosen flange nuts securing the bedbar pivot bolts on both sides of the cutting unit. Remove both pivot bolts with flange nut, nylon washer and metal washer (Figs. 15 and 16). Locate and retrieve second nylon and metal washers from between bedbar and cutting unit side plate.

DANGER

Contact with the reel, bedknife or other cutting unit parts can result in personal injury. Use heavy gloves when handling the cutting reel or bedknife.

5. Remove bedbar from the cutting unit by pulling downward.

6. Inspect nylon bushings and rubber bushings in cutting unit side plates. Remove and replace bushings if necessary.

Installation (Fig. 14)

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the spark plug.

2. Install bedbar from bottom of cutting unit frame making sure that bedbar mounting ears are positioned between washer and bedbar adjuster screw (Fig. 15).

3. Thread flange nuts fully onto bedbar pivot bolts with flange away from head of pivot bolt. Apply antiseize lubricant to threads and shank of pivot bolts.

4. Slide metal washer and then nylon washer onto each bedbar pivot bolt. The metal washer must contact the flange nut.

5. Position metal washer and nylon washer between bedbar and cutting unit side plate. The nylon washer should be placed next to the side plate.

6. Slide each bedbar pivot bolt assembly through side plate and washers and then thread into bedbar. After both bedbar bolts have been installed, torque bedbar pivot bolts from **190 to 240 in–lb (21.5 to 27.1 N–m)**.

7. Tighten flange nuts until all end play is removed from outside washers. Do not overtighten flange nuts. After tightening flange nuts, inner washers still might rotate.

8. Tighten spring tension lock nut to fully compress spring and then back off lock nut 1/2 turn (Fig. 15).

9. Adjust bedbar (see Bedknife to Reel Adjustment in this section).

10. After adjustments are complete, attach spark plug wire to engine spark plug.

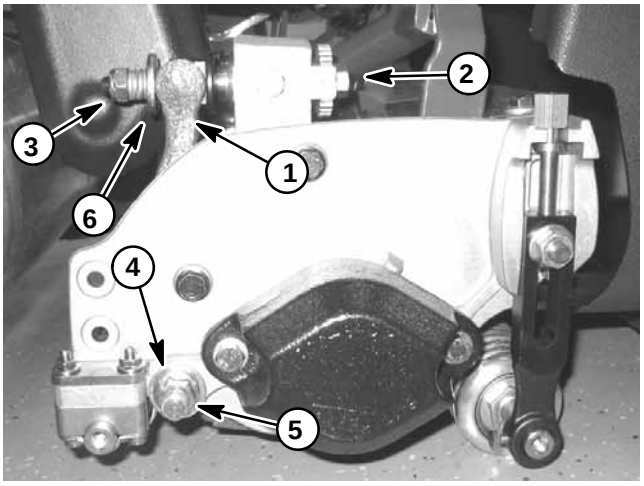


Figure 15

1. **Bedbar**
2. **Bedbar adjuster screw**
3. **Spring tension lock nut**
4. **Flange nut**
5. **Bedbar bolt**
6. **Washer**

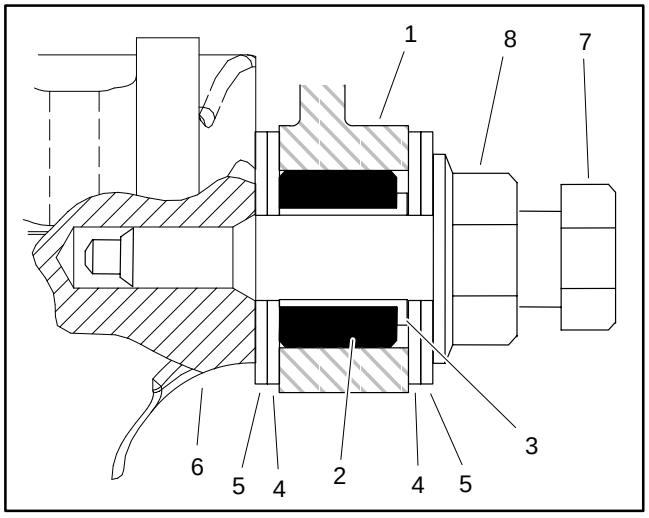


Figure 16

1. **Side plate**
2. **Rubber bushing**
3. **Nylon bushing**
4. **Nylon washer**
5. **Metal washer**
6. **Bedbar**
7. **Bedbar pivot bolt**
8. **Flange nut**

Bedknife Service

Bedknife Removal

1. Remove bedbar from cutting unit frame (see Bedbar Removal in this section).

2. Remove screws that fasten bedknife to bedbar using a socket wrench and bedknife screw tool (see Special Tools). Discard screws. Remove bedknife from bedbar (Fig. 17).

Bedknife Installation

1. Use a scraper to remove all rust, scale and corrosion from bedbar surface before installing new bedknife. Also, make sure bedbar threads are clean. If necessary, use 5/16 – 18UNC 2A tap to chase threads in bedbar.

2. Use new screws to secure bedknife to bedbar. Apply antiseize lubricant to the screws before installing. Take care to keep antiseize lubricant from taper on screw heads.

IMPORTANT: Do not use an impact wrench to tighten screws into the bedbar.

3. Install all screws but do not tighten fully. Then, using a torque wrench and bedknife screw tool, torque screws from **200 to 250 in–lb (22.6 to 28.2 N–m)**. Use a torquing pattern working from the center toward each end of the bedknife (Fig. 18).

4. Grind bedknife after installation onto bedbar.

Bedknife Grinding

Since there can be variations in the mounting surface of the bedbar, a new bedknife will not be perfectly flat after it is installed. It is therefore necessary to grind a new bedknife after installing it to the bedbar. Follow the existing bedknife angle and grind only enough to make sure the top surface is true (Fig. 19). The bedbar needs to be removed from mower for proper bedknife grinding.

NOTE: When grinding bedknife, be careful to not overheat the bedknife. Remove small amounts of material with each pass of the grinder. Also, clean and dress grinding stone often during the grinding process.

1. For bedknife grinding information, refer to **TORO Sharpening Reel and Rotary Mowers Manual, Form No. 80-300 PT**.

Bedknife Grinding Specifications	
Standard bedknife relief angle	3º (see Fig. 20)
Extended bedknife relief angle	7º (see Fig. 20)
Front Angle	13º
Front Angle Range	13º to 17º

2. After bedknife grinding is complete, install bedbar to the mower (see Bedbar Installation in this section).

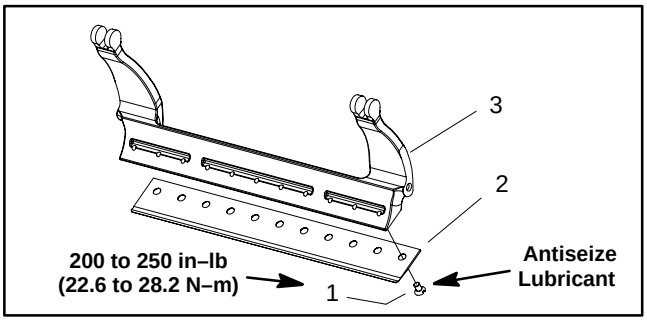


Figure 17

1. **Screw**
2. **Bedknife**
3. **Bedbar**

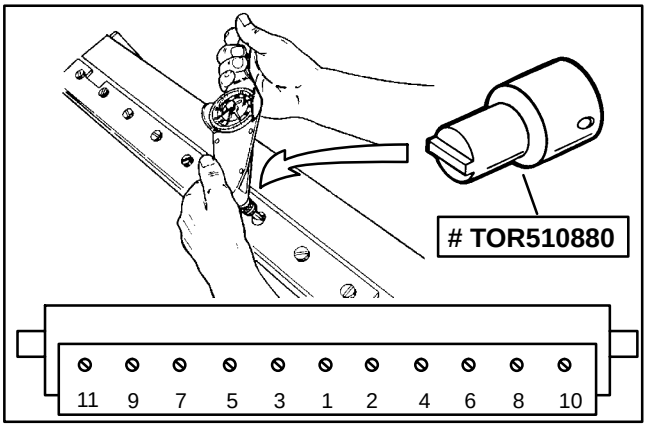


Figure 18

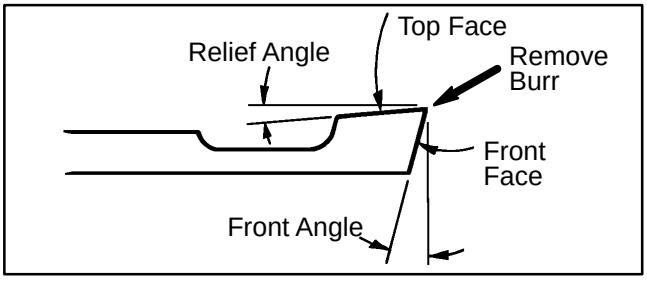


Figure 19

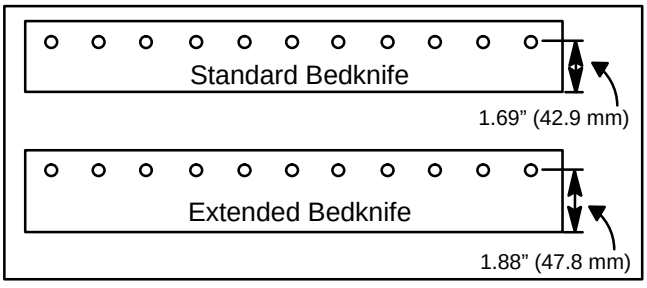


Figure 20

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Bedbar Adjuster Service

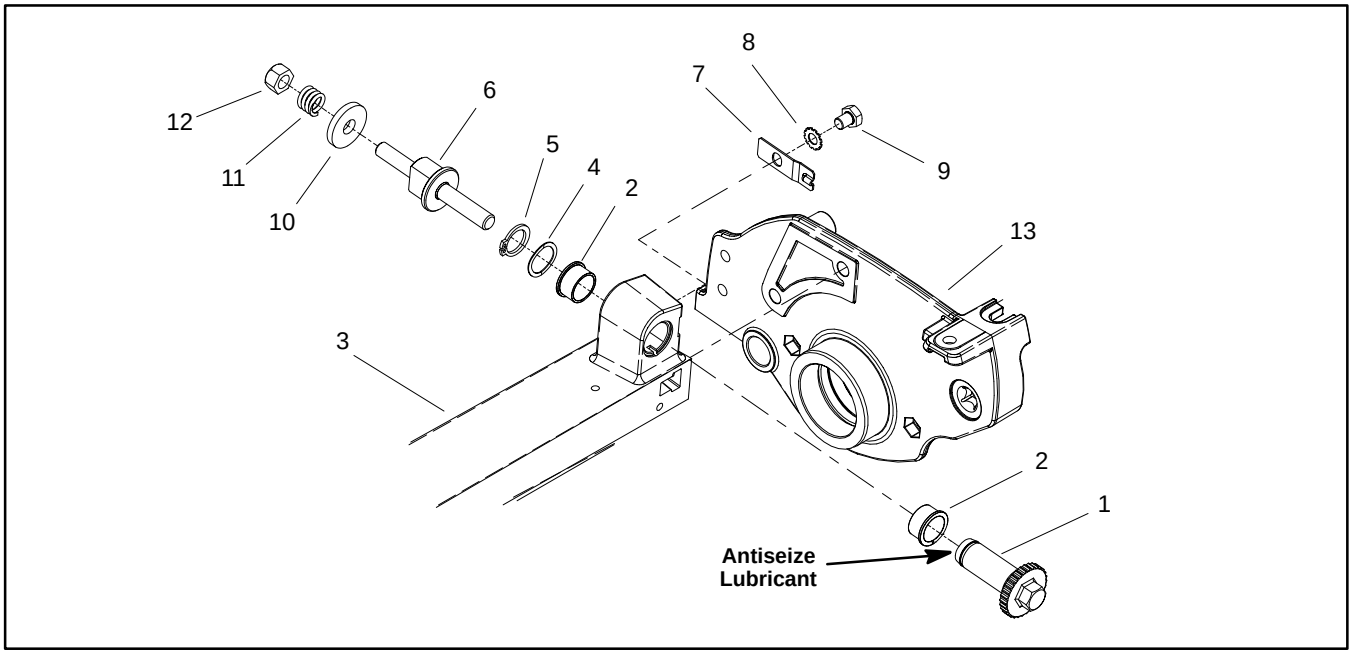

Figure 21

1. **Adjuster shaft**
2. **Flange bushing**
3. **Cutting unit frame**
4. **Wave washer**
5. **Retaining ring**
6. **Adjuster screw**
7. **Detent**
8. **Lock washer**
9. **Cap screw**
10. **Washer**
11. **Spring**
12. **Lock nut**
13. **Cutting unit side plate (LH shown)**

Removal (Fig. 21)

1. Position machine on a flat, level work surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. Remove bedbar (see Bedbar Removal in this section).

3. Remove lock nut (item 12), spring (item 11) and washer (item 10) from adjuster screw.

NOTE: The adjuster shaft (item 1) has left hand threads.

4. Unscrew adjuster screw (item 6) from the adjuster shaft (item 1).

5. Remove retaining ring (item 5) and wave washer (item 4) from adjuster shaft and remove adjuster shaft from cutting unit frame.

6. Inspect flange bushings (item 2) and remove from cutting unit frame if necessary.

7. If the detent (item 7) is damaged, remove it from the cutting unit frame by removing the cap screw (item 9) and lock washer (item 8).

Installation (Fig. 21)

1. If the detent (item 7) was removed, secure detent to the cutting unit frame with cap screw and lock washer.

2. If flange bushings (item 2) were removed, align key on bushing to slot in frame and install bushings.

3. Apply antiseize lubricant on internal threads of adjuster shaft (item 1) and slide into flange bushings in cutting unit frame.

4. Install wave washer (item 4) and retaining ring (item 5) to secure adjuster shaft to cutting unit frame.

5. Thread adjuster screw (item 6) into adjuster shaft.

6. Install washer (item 10), spring (item 11), and lock nut (item 12) onto adjuster screw.

7. Install bedbar (see Bedbar Installation in this section).

8. Adjust cutting unit.

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Rollers

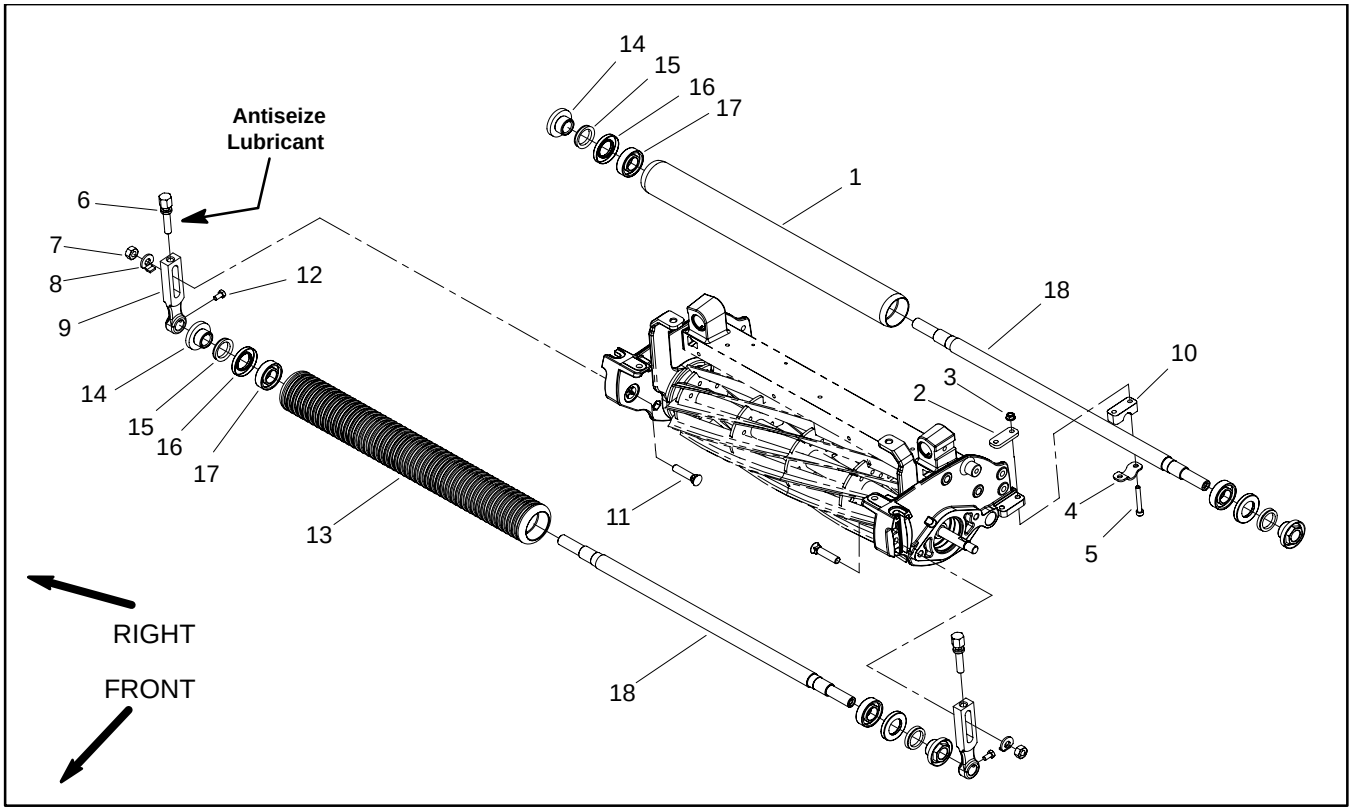

Figure 22

1. **Rear roller**
2. **Roller shim (2 used)**
3. **Flange nut (4 used)**
4. **Shaft retainer (2 used)**
5. **Socket head screw (4 used)**
6. **Height–of–cut screw (2 used)**
7. **Lock nut (2 used)**
8. **Height–of–cut washer (2 used)**
9. **Height–of–cut arm (2 used)**
10. **Roller spacer (2 used)**
11. **Plow bolt (2 used)**
12. **Cap screw (2 used)**
13. **Front roller**
14. **Bearing lock (2 used per roller)**
15. **V–ring (2 used per roller)**
16. **Seal (2 used per roller)**
17. **Bearing (2 used per roller)**
18. **Roller shaft**

Roller Removal (Fig. 22)

1. Park machine on a level surface. Make sure engine is OFF. Remove spark plug wire from the engine spark plug.

2. To remove front roller assembly:

   A. Loosen cap screw that secures front roller shaft to height–of–cut arm on both sides of the mower.

   B. On one side of cutting unit, remove lock nut and height–of–cut washer that secure height–of–cut arm to side plate.

   C. If equipped with groomer, remove lock nut and spring washer that secures groomer side plate to height–of–cut arm loosened in step B.

   D. Slide height–of–cut arm from end of front roller shaft.

   E. Remove front roller from height–of–cut arm that remains secured to cutting unit side plate.

3. To remove rear roller assembly:

   A. On one side of the cutting unit, loosen two (2) flange nuts that secure rear roller.

   B. On other side of cutting unit, remove two (2) flange nuts, socket head screws, roller shim, roller spacer and shaft retainer that secure rear roller. Note location of roller shim for assembly purposes.

   C. Remove rear roller from retainer that remains secured to cutting unit side plate.

Roller Installation (Fig. 22)

1. To install front roller:

   A. Insert one end of front roller into height–of–cut arm that is secured to cutting unit side plate.

   B. Slide second height–of–cut arm onto front roller shaft. Secure height–of–cut arm to side plate with height–of–cut washer and lock nut.

   C. If equipped with groomer, secure groomer side plate to height–of–cut arm with lock nut and spring washer.

2. To install rear roller:

   A. Place rear roller shaft between roller spacer and shaft retainer that are still attached to the cutting unit side plate.

   NOTE: Place roller shim above side plate flange when HOC is from 1/16” to 1/4” (1.6 to 6.3 mm). Place roller shim below side plate flange when HOC is from 1/8” to 1” (3.2 to 25.4 mm).

   B. Install roller spacer and shaft retainer onto rear roller shaft on the opposite side of the cutting unit. Install two (2) socket head screws, roller shim and flange nuts but do not tighten fully (Fig. 22).

3. Center installed roller evenly between the sides of the cutting unit. Secure roller in place by tightening the fasteners.

4. If front roller was removed, check height–of–cut and adjust as necessary.

5. Attach spark plug wire to engine spark plug.

Roller Service

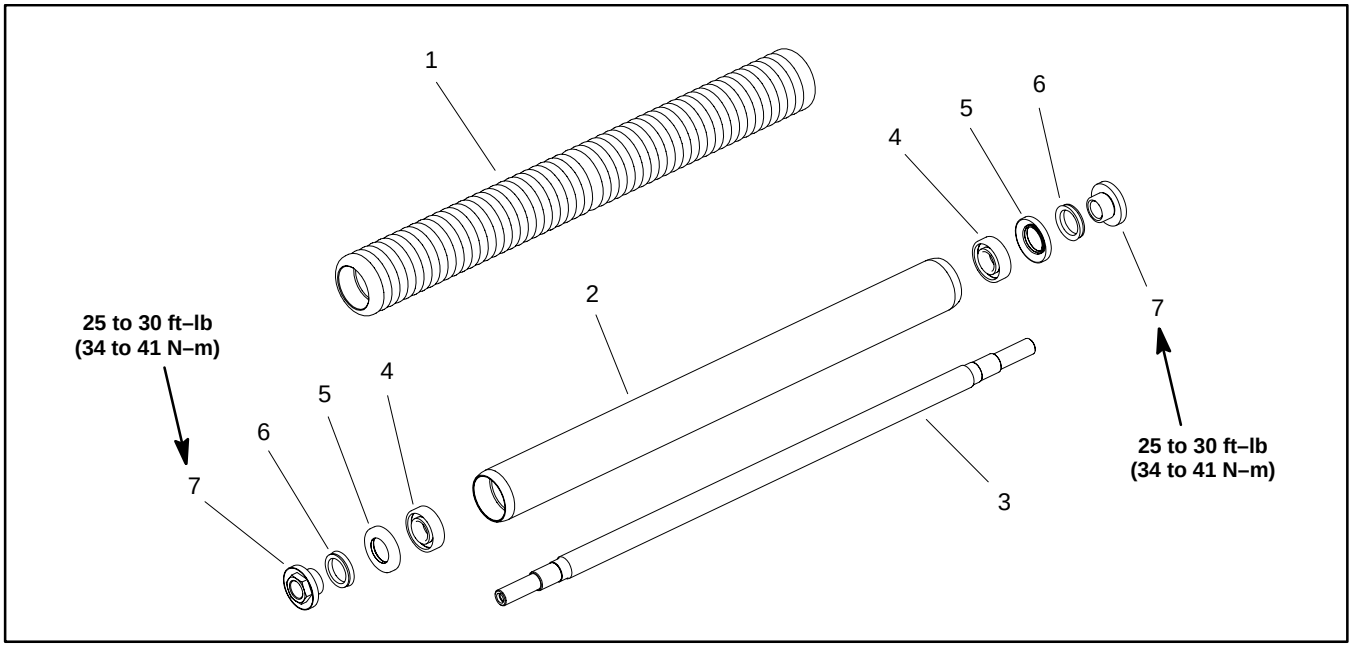

Figure 23

1. **Wiehle roller**
2. **Smooth roller**
3. **Roller shaft**
4. **Ball bearing**
5. **Seal**
6. **V–ring**
7. **Bearing lock nut**

NOTE: Several different rollers are available for the Flex 18 and Flex 21 cutting unit. Roller service procedures are identical for all types of rollers.

Disassembly (Fig. 23)

1. To hold roller shaft for bearing lock nut removal, install a 3/8–24 UNF 2B screw into threaded end of roller shaft and secure in place with jam nut.

2. While retaining shaft, loosen and remove bearing lock nut from each end of roller shaft.

3. Remove v–ring from each end of roller.

4. Carefully inspect seating surface and threads of bearing lock nuts. Replace lock nut if any damage is found.

5. Loosely secure roller assembly in bench vise and lightly tap one end of roller shaft until seal and bearing are removed from roller cavity in the opposite end of the roller. Remove second seal and bearing from roller cavity by tapping on other end of shaft.

6. Clean bearing cavity in roller and remove any corrosion with crocus cloth.

7. Discard removed bearings and seals.

Assembly (Fig. 23)

1. Place roller shaft into clean roller.

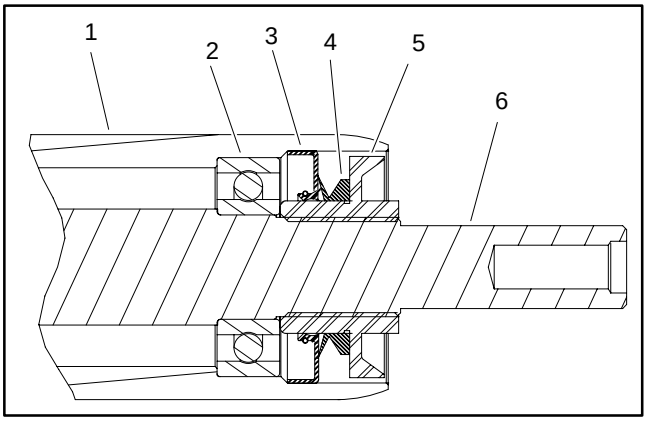

Figure 24

1. **Roller**
2. **Ball bearing**
3. **Seal**
4. **V–ring**
5. **Bearing lock nut**
6. **Roller shaft**

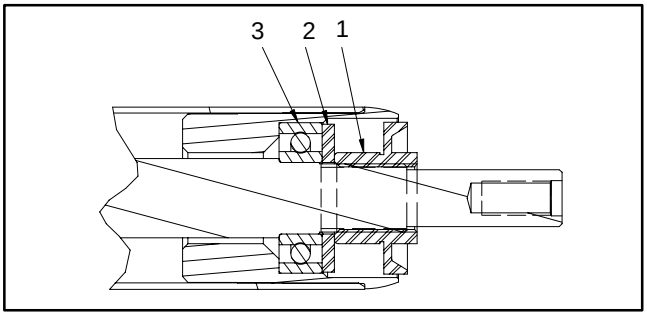

Figure 25

1. **Bearing lock nut**
2. **Black assembly washer**
3. **Bearing**

2. If tool TOR4105 is **not** available, install seals and bearings with installation washers and spacers (see Special Tools) as follows:

NOTE: If bearing lock nuts are being replaced, use original lock nuts for assembly purposes, if possible. This will preserve the patch lock feature in the new lock nuts. Use the new nuts only after new bearings and seals have been installed.

A. Position a new bearing, black assembly washer (see Special Tools) and original lock nut onto each end of the roller shaft (Fig. 25).

B. Tighten nuts until the bearings are seated into each end of the roller. Remove nut and black assembly washer from each end of the roller.

IMPORTANT: Failure to grease bearing lock nut before seal installation may cause seal damage.

C. Apply a coating of grease to bearing lock nut shoulder surface to prevent seal damage during seal installation (Fig. 26).

D. Carefully install seals onto bearing lock nuts. Pack the back of the seal 75 to 90% full with #2 grease (Fig. 26).

E. Install a nut with seal onto each end of the roller shaft. Tighten nuts until they bottom against bearings (Fig. 27). Remove nuts from roller shaft.

F. Position an assembly spacer and yellow assembly washer (see Special Tools) on each end of roller shaft (Fig. 28). Thread nut onto each end of shaft.

G. Tighten each nut until the yellow assembly washers bottom out against the roller housing. Remove nuts, assembly washers and assembly spacers from roller shaft.

3. If tool TOR4105 (see Special Tools) **is** available, install seals and bearings with tool TOR4105 as follows:

A. Position a new bearing and tool TOR4105 onto each end of the roller shaft.

B. Tighten tools until the bearings are fully seated into each end of the roller. Remove tool from each end of the roller.

IMPORTANT: Failure to grease tool shoulder before seal installation may result in seal damage.

C. Apply a coating of grease to tool shoulder to prevent seal damage during seal installation.

D. Carefully install seal onto each of the tools. Pack the back of the seal 75 to 90% full with #2 grease (Fig. 26).

E. Install tool (with seal installed) onto each end of the roller shaft. Tighten each tool until the tool shoulder bottoms out against the roller housing. Remove tools from roller shaft.

4. Lubricate lips of installed seals with #2 grease.

5. Insert a v–ring seal onto each bearing lock nut with the thick shoulder of the v–ring seal toward the lock nut (Fig. 24).

NOTE: If original bearing lock nut(s) are being used, apply Loctite #242 (or equivalent) to threads of lock nut(s).

6. Install bearing lock nut with v–ring onto each end of the roller shaft. Torque lock nuts from **25 to 30 ft–lb (34 to 41 N–m)**.

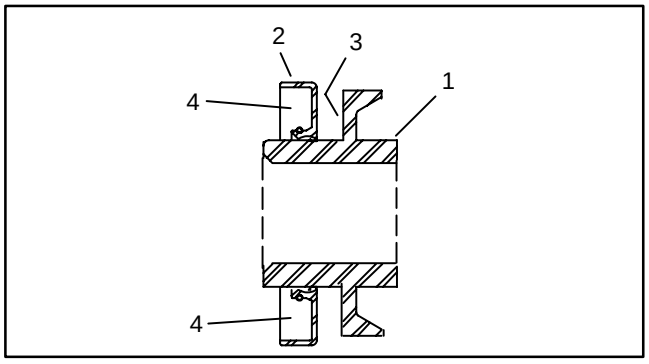

Figure 26

1. **Bearing lock nut**
2. **Seal**
3. **Grease nut surface**
4. **Pack with grease**

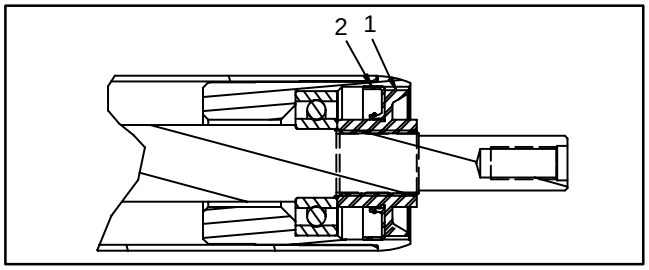

Figure 27

1. **Bearing lock nut**
2. **Seal**

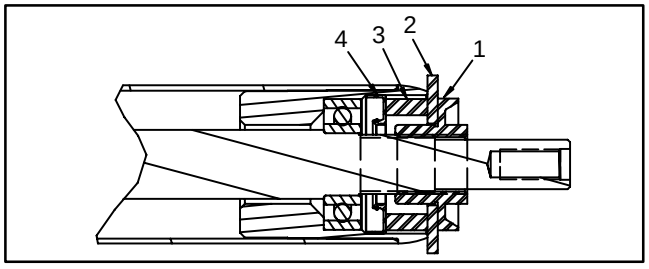

Figure 28

1. **Bearing lock nut**
2. **Yellow assembly washer**
3. **Assembly spacer**
4. **Seal**

Cutting Reel

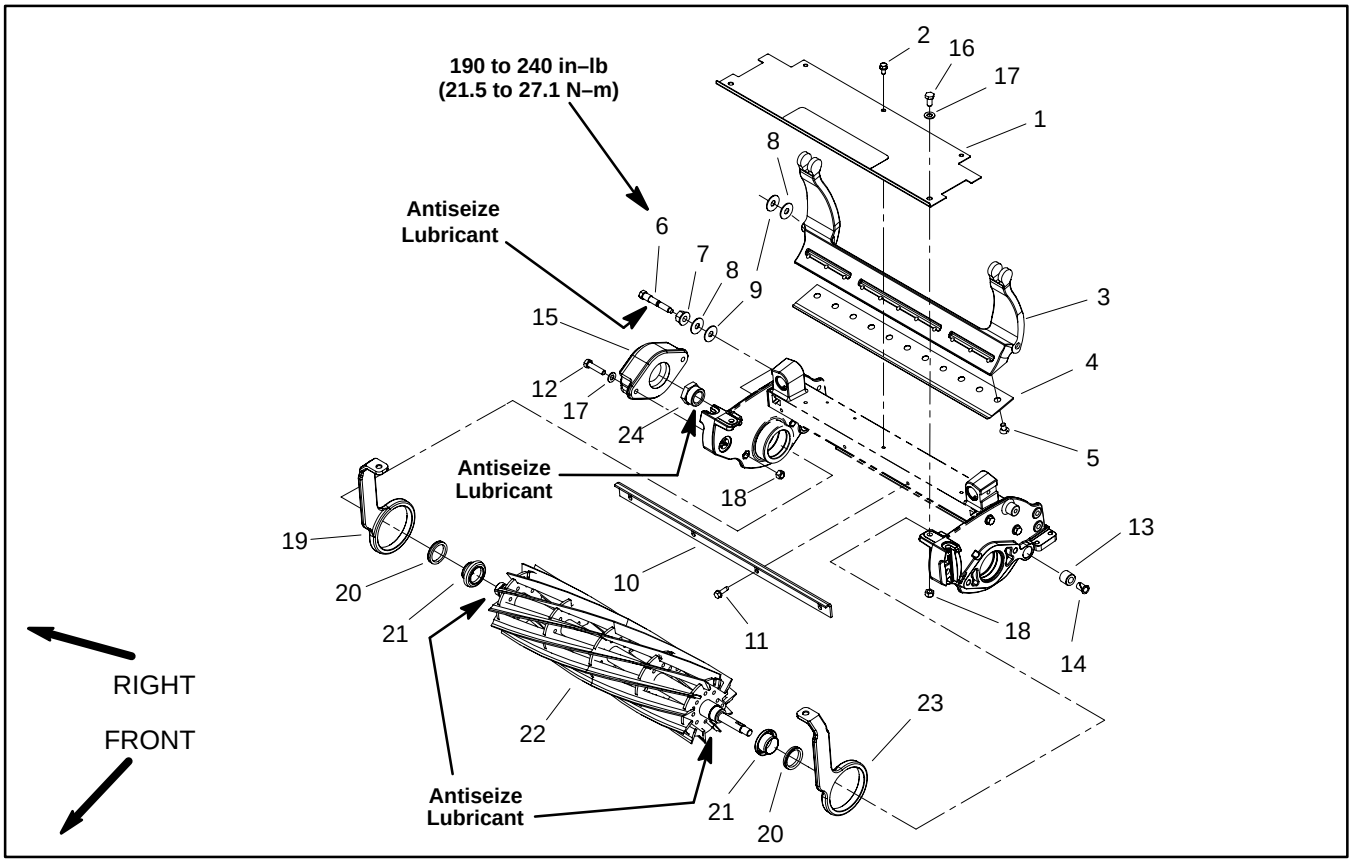

Figure 29

1. **Grass shield**
2. **Washer head screw (3 used)**
3. **Bedbar**
4. **Bedknife**
5. **Screw (11 used)**
6. **Bedbar bolt (2 used)**
7. **Flange nut (2 used)**
8. **Flat washer (4 used)**
9. **Plastic washer (4 used)**
10. **Cutoff bar**
11. **Screw (4 used)**
12. **Cap screw (2 used)**
13. **Rubber bushing (2 used)**
14. **Flange bushing (2 used)**
15. **Weight**
16. **Cap screw (2 used)**
17. **Flat washer (4 used)**
18. **Lock nut (4 used)**
19. **RH pitch arm**
20. **V–ring**
21. **Wear sleeve**
22. **Cutting reel**
23. **LH pitch arm**
24. **Bearing lock nut**

Cutting Reel Removal (Fig. 29)

1. Remove cutting unit from machine (see Separating Cutting Unit from Traction Unit in this chapter). Place cutting unit on a flat level surface or on a stable work bench.

DANGER

Contact with the reel, bedknife or other cutting unit parts can result in personal injury. Use heavy gloves when handling the cutting reel.

2. Remove bedbar from the cutting unit (see Bedbar Removal in this section).

3. If cutting unit is equipped with a groomer, remove grooming reel (see Grooming Reel in the Service and Repairs section of Chapter 8 – Groomer).

4. Remove belt cover and reel drive belt from the left side of the cutting unit.

NOTE: On early production Flex 18 cutting units, the 22 tooth pulley attached to the cutting reel (left side of cutting unit) is mounted with the flange toward the cutting unit and has a pulley washer on the outside.

5. Block reel with a piece of wood to prevent reel from turning. Remove flange nut that secures drive pulley to reel shaft (Fig. 31). Remove pulley washer (if equipped) and pulley from the shaft. Remove woodruff key and seal spacer from reel shaft.

6. Remove reel drive plate from cutting unit (Fig. 31):

   A. Remove fasteners that secure reel drive plate to cutting unit side plate.

   B. Pull drive plate assembly from cutting unit.

C. If cutting unit is equipped with a groomer, remove LH groomer side plate (see Groomer Reel Bearing Replacement in the Service and Repairs section of Chapter 8 – Groomer).

D. Locate and retrieve three (3) spacers (items 4 and 5) from between reel drive plate and side plate.

7. Remove front and rear rollers from cutting unit (see Roller Removal in this section).

8. Support reel weight on right side of the cutting unit to prevent it from falling. Remove two (2) cap screws and flat washers that secure weight. Remove reel weight from cutting unit.

NOTE: The reel bearing lock nut has left hand threads.

9. Block reel with a piece of wood to prevent reel from turning. Remove reel bearing lock nut from right side of reel.

10. Remove cap screw, flat washer and lock nut that secures grass shield to RH side plate.

IMPORTANT: Support reel to prevent it from falling as side plate is removed.

11. Remove two (2) shoulder bolts and square nuts that secure RH side plate to crossmember (Fig. 32). Slide RH side plate and pitch arm from reel shaft.

12. Slide cutting reel from the LH side plate and cutting unit.

13. If necessary, remove LH side plate and pitch arm from crossmember and grass shield.

14. Refer to Cutting Reel Service in this section for information on reel inspection and wear sleeve and v–ring seal service.

Cutting Reel Installation (Fig. 29)

1. Use a flat level surface or a stable work bench to install cutting reel.

2. If separated, attach LH side plate to crossmember with two (2) shoulder bolts and square nuts (Fig. 32). Torque shoulder bolts from **210 to 240 in–lb (23.7 to 27.1 N–m)**. Make sure that LH pitch arm is installed on bushing on side plate.

3. Apply antiseize lubricant to bearing journals of cutting reel.

4. Make sure that wear sleeve and v–ring seal are properly installed on both ends of reel shaft (see Cutting Reel Service in this section).

5. Apply grease to lips of grease seals in side plates to ease reel installation.

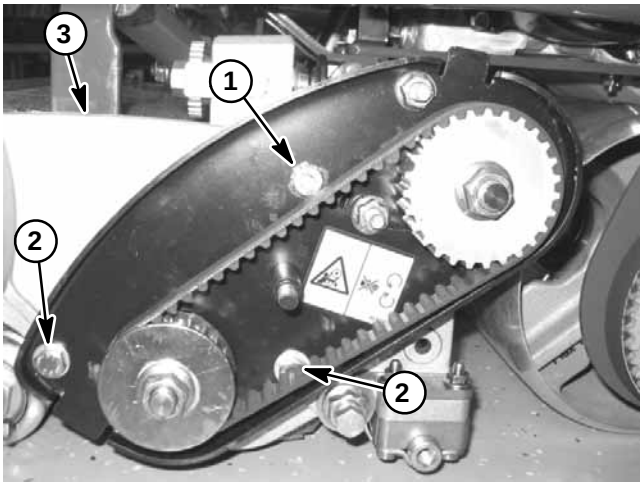

Figure 30

1. Cap screw w/lock washer
2. Cap screw w/flat washer
3. LH cutting reel sideplate

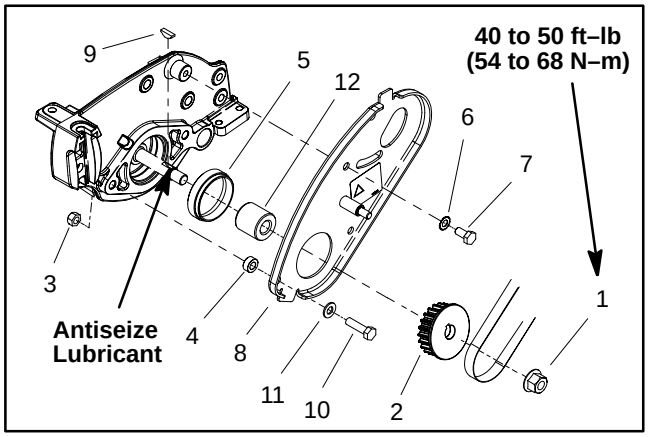

Figure 31

1. Flange nut
2. Drive pulley (22 tooth)
3. Lock nut (2 used)
4. Spacer (2 used)
5. Spacer
6. Lock washer
7. Cap screw
8. Reel drive plate
9. Woodruff key
10. Cap screw (2 used)
11. Flat washer (2 used)
12. Seal spacer

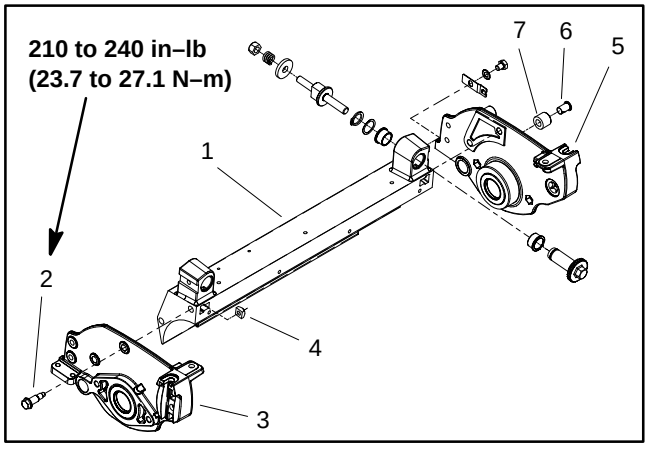

Figure 32

1. Crossmember
2. Shoulder bolt (4 used)
3. RH side plate
4. Square nut (4 used)
5. LH side plate
6. Nylon bushing
7. Rubber bushing

DANGER

Contact with the reel, bedknife or other cutting unit parts can result in personal injury. Use heavy gloves when handling the cutting reel.

IMPORTANT: When installing cutting reel, take care to not nick or scratch the wear sleeve surfaces as grease seal failure could result.

6. Carefully insert cutting reel into LH side plate grease seals and bearing taking care to not damage wear seal or grease seals. The reel shaft end with keyway should be on the left side of the frame.

7. Carefully slide RH side plate and pitch arm onto reel shaft taking care to not damage wear seal or grease seals. Secure RH side plate to crossmember with two (2) shoulder bolts and square nuts (Fig. 32). Torque shoulder bolts from **210 to 240 in–lb (23.7 to 27.1 N–m)**.

NOTE: The reel bearing lock nut has left hand threads.

8. Apply antiseize lubricant to internal threads of reel bearing lock nut. Block reel with a piece of wood to prevent it from turning. Install and tighten the reel bearing lock nut to the reel shaft.

9. Install reel weight on right side of cutting unit with two (2) cap screws and flat washers.

10. Install reel drive plate to cutting unit (Fig. 31):

A. Position spacer (item 5) to LH side plate.

B. If cutting unit is equipped with a groomer, install LH groomer side plate (see Groomer Reel Bearing Replacement in the Service and Repairs section of Chapter 8 – Groomer).

C. Position two (2) spacers (item 4) and reel drive plate to LH side plate.

D. Install two (2) cap screws, flat washers and lock nuts.

E. Install cap screw and lock washer.

F. Tighten fasteners to secure reel drive plate to cutting unit.

G. Carefully install spacer (item 12) into grease seal in LH side plate taking care not to damage seal.

11. Apply antiseize lubricant to end of reel shaft. Position woodruff key, drive pulley and washer (if equipped) on reel shaft. Block reel with a piece of wood to prevent it from turning. Install flange nut that secures pulley to reel shaft. Torque flange nut from **40 to 50 ft–lb (54 to 68 N–m)**.

12. Secure grass shield to side plates with removed fasteners.

13. Check for free movement of reel assembly by rotating pulley. If binding is noted, identify and correct problem before continuing.

14. Install reel drive belt, adjust belt tension and install belt cover (see Reel Drive Belt and Transmission Coupler Drive Belt Replacement in Service and Repairs section of Chapter 4 – Traction and Reel Drive System).

15. If cutting unit is equipped with a groomer, install grooming reel (see Grooming Reel in the Service and Repairs section of Chapter 8 – Groomer).

16. Install front and rear rollers (see Roller Installation in this section).

17. Install bedbar to the cutting unit (see Bedbar Installation in this section).

18. Complete cutting unit set–up and adjustment sequence.

NOTE: The parallel position of the rear roller to the cutting reel is controlled by the precision machined components of the assembled cutting unit. If necessary, a limited amount of adjustment is possible to parallel the rear roller to the cutting reel (see Leveling Rear Roller in the Adjustment section of this chapter).

19. Install cutting unit to the traction unit (see Separating Cutting Unit from Traction Unit in this chapter).

Cutting Reel Service (Fig. 33)

NOTE: Install new reel components on each end of the reel shaft that mates with newly serviced side plate components.

1. Remove the v–ring seal from the reel shaft.

2. Using a flat blade screw driver or similar tool, carefully remove wear sleeve from the reel shaft taking care to not damage the reel shaft surface. Discard wear sleeve after removal.

3. Inspect the reel shaft as follows. Reel should be replaced if damage or wear is determined.

   A. Check the reel shaft for bending and distortion by placing the shaft ends in V–blocks.

   B. Check the reel blades for bending or cracking.

   C. Check the threads on the ends of the reel shaft for wear or damage. Also, inspect woodruff keyslot for damage.

   D. Check the service limit of the reel diameter (see Preparing Reel for Grinding in this section).

IMPORTANT: During installation, do not nick or scratch the wear sleeve surface as grease seal failure could result.

4. Apply grease to reel shaft to ease wear sleeve installation. Using tool TOR4105 (see Special Tools), press the wear sleeve onto the reel shaft. Make sure that wear sleeve is flush to 0.015” (flush to 0.4 mm) past the bearing shoulder.

5. Slide the v–ring seal onto the reel shaft with the thick shoulder of the v–ring seal facing inward.

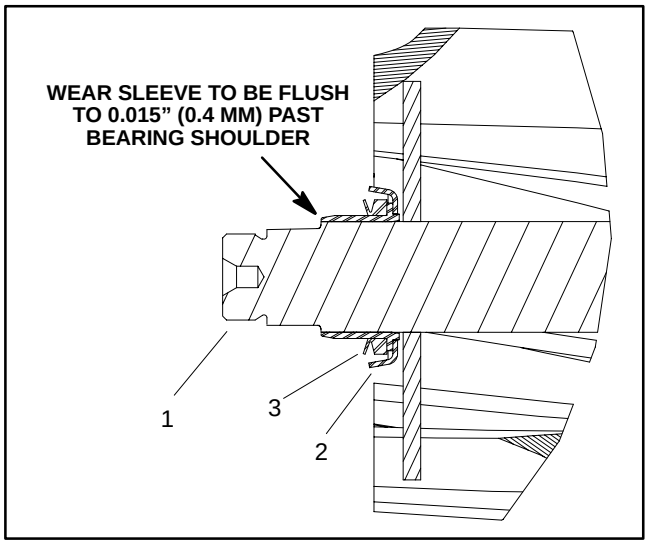

Figure 33

1. **Reel shaft**
2. **Wear sleeve**
3. **V–ring seal**

Side Plate Service

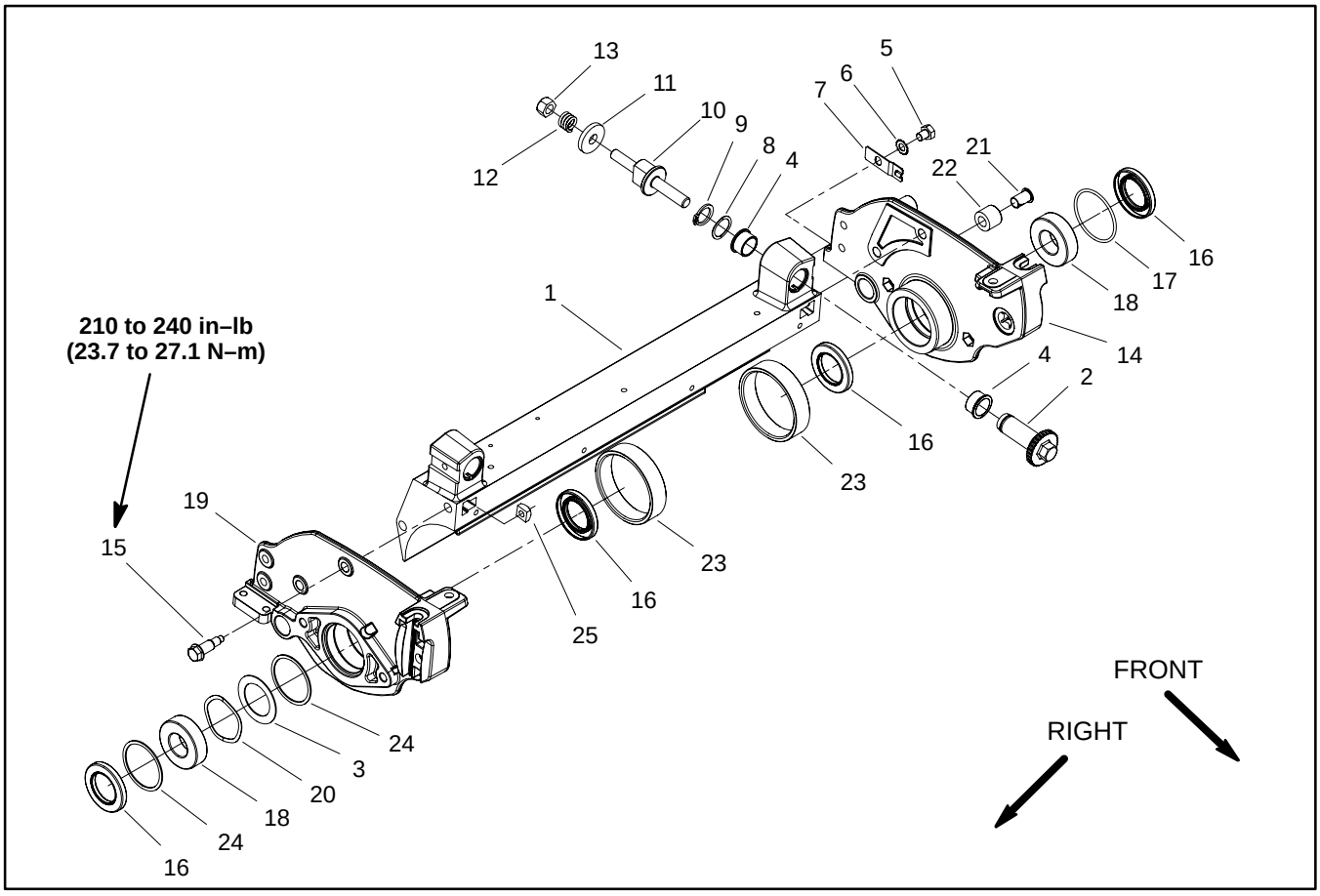

Figure 34

1. Crossmember
2. Adjuster shaft (2 used)
3. Thrust washer
4. Flange bushing (4 used)
5. Cap screw (2 used)
6. Lock washer (2 used)
7. Detent (2 used)
8. Wave washer (2 used)
9. Retaining ring (2 used)
10. Adjuster screw (2 used)
11. Washer (2 used)
12. Compression spring (2 used)
13. Lock nut (2 used)
14. LH side plate
15. Shoulder bolt (4 used)
16. Oil seal (4 used)
17. O–ring
18. Ball bearing (2 used)
19. RH side plate
20. Wave washer
21. Nylon bushing (2 used)
22. Rubber bushing (2 used)
23. Pitch bushing (2 used)
24. Retaining ring (2 used)
25. Square nut (4 used)

Disassembly (Fig. 34)

1. Remove side plate(s) from cutting unit (see Cutting Reel Removal in this section).

2. Remove inner and outer grease seals (item 16) from side plate.

3. On RH side plate, remove outer retaining ring (item 24) that secures the bearing in the side plate.

4. Remove bearing (item 18) from side plate. Inspect bearing to insure that it spins freely and has minimal axial play. The bearing balls must be free of deformation and scoring. Replace the bearing if necessary.

5. On LH side plate, remove o–ring (item 17) from the groove in the side plate bore. Discard o–ring.

6. On RH side plate, remove wave washer (item 20) and thrust washer (item 3) from side plate. Inner retaining ring can remain in the side plate.

7. Remove all grease from the side plate bore. Thoroughly clean side plate. Inspect side plate and replace if wear or damage is found.

8. Inspect pitch bushing for wear or damage. If necessary, remove bushing from side plate and press new bushing fully onto side plate.

9. Inspect nylon bushings (item 21) and rubber bushings (item 22) in side plates. Remove and replace bushings if necessary.

Assembly (Fig. 34)

1. On RH side plate, if inner retaining ring (item 24) was removed, install inner retaining ring. Insert thrust washer (item 3) and then wave washer (item 20) into the side plate.

2. On LH side plate, insert o–ring (item 17) into groove in side plate. Make sure that o–ring is not twisted and is seated in side plate groove. Apply a light coating of grease onto the o–ring and side plate bore.

3. Pack bearing (item 18) with Mobil High Temperature XHP–222 grease (or equivalent). Press bearing into the side plate.

4. On RH side plate, install outer retaining ring (item 24) into side plate groove.

5. Pack the inner cavity of seals (item 16) with Mobil High Temperature XHP–222 grease (or equivalent). Also, fill side plate cavity between installed bearing and both seal locations 75% to 95% full with Mobil High Temperature XHP–222 grease (or equivalent) (Fig. 35).

6. Press grease packed inner and outer seals into the side plate until seals are flush with the surface of the side plate bore. Seal lips of both inner and outer seals should be toward the bearing.

7. Install side plate(s) to cutting unit (see Cutting Reel Installation in this section).

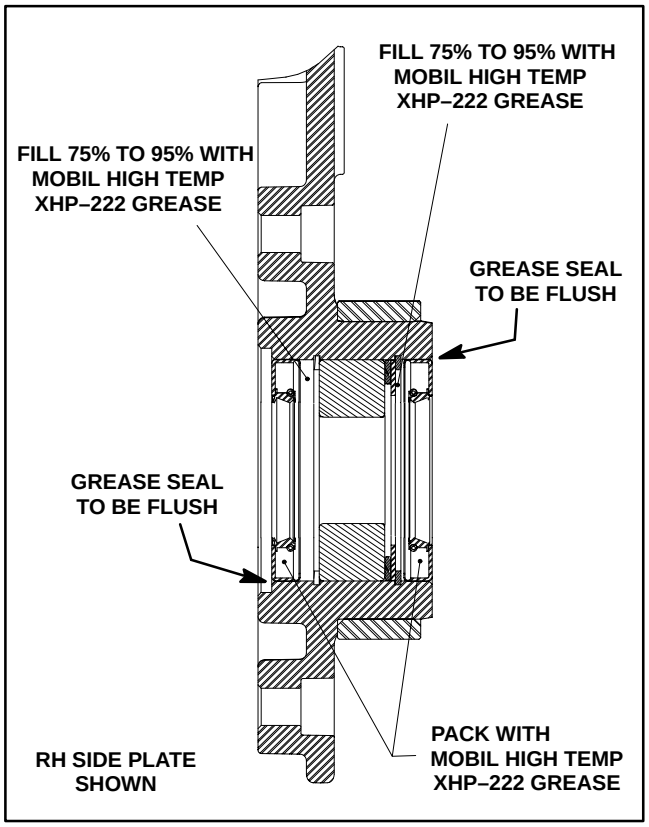

Figure 35

Preparing Reel for Grinding

NOTE: Check to make sure the reel bearings are in good condition before grinding a reel.

1. Remove bedbar assembly (see Bedbar Removal in this section).

2. Remove front roller (see Roller Removal in this section).

3. Remove grooming reel, if installed (see Grooming Reel in the Service and Repairs Section of Chapter 8 – Groomer).

NOTE: Some grinding machines may require that the cutting reel be removed from the mower.

NOTE: The cutting unit must be aligned so the grinding wheel will travel parallel to the reel shaft. This will result in the reel being ground to the desired cylinder shape.

NOTE: When grinding the cutting reel, be careful to not overheat the reel blades. Remove small amounts of material with each pass of the grinder.

4. Grind cutting reel (refer to **TORO Sharpening Reel and Rotary Mowers Manual, Form No. 80-300 PT**).

5. After completing grinding process:

   A. If equipped, install grooming reel (see Grooming Reel in the Service and Repairs Section of Chapter 8 – Groomer).

   B. Install front roller (see Roller Installation in this section).

   C. Install bedbar assembly (see Bedbar Installation in this section).

   D. Complete mower set–up and adjustment sequence.

Reel Grinding Specifications	
Nominal Reel Diameter	5 in (127 mm)
Service Limit Reel Diameter	4.5 in (114 mm)
Blade Relief Angle	30^o
Relief Angle Range	20^o to 40^o
Blade Land Width	0.040 in (1.0 mm)
Blade Land Width Range	0.030 to 0.060 in (0.8 to 1.5 mm)
Max. Reel Taper	0.040 in (1.0 mm)

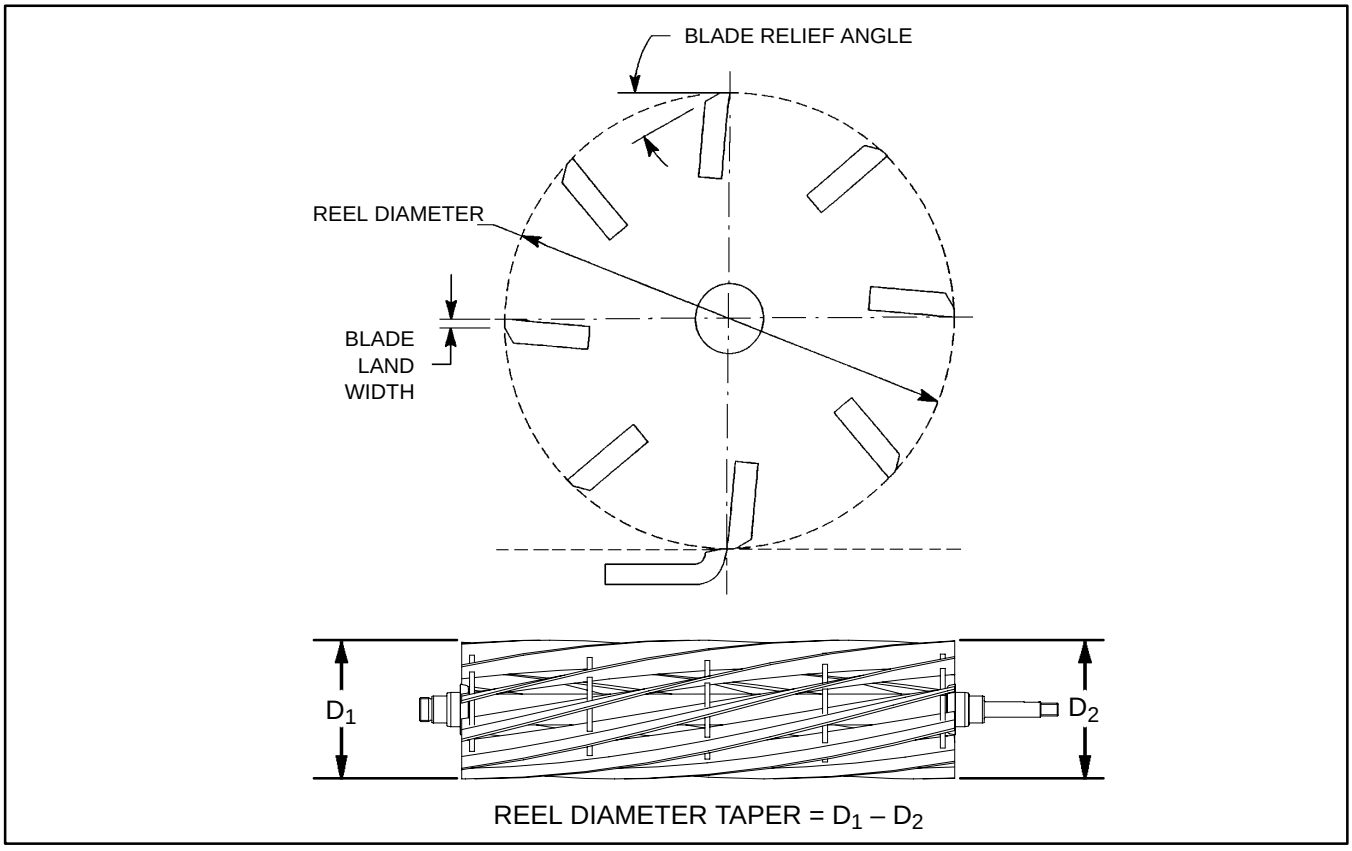

Figure 36

Chapter 8

Groomer

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Specifications

MOUNTING: The groomer drive kit is mounted to the mower reel bearing housings and frame.

REEL CONSTRUCTION: 2.375 inch (6 cm) diameter, 35 steel blades with 1/2 inch (12.7 mm) blade spacing. Spacing is also adjustable to 1/4 and 3/4 inch (6.4 and 19.1 mm) spacing by varying the number of blades and spacers.

GROOMER PENETRATION: From .410 inch (10.4 mm) above ground level to 0.125 inch (3.2 mm) below ground level, at mowing HOC range of .062 to .296 inch (1.6 to 7.5 mm).

HEIGHT ADJUSTMENT KNOB: Allows a 0.003 inch (0.08 mm) increment of height adjustment for each click of the adjuster.

QUICK UP–DOWN FEATURE: Allows grooming reel to be raised above the height/depth adjustment for no grooming while cutting.

WIDTH–OF–GROOMER:

Flex 18	16 inches (40.6 cm).
Flex 21	19 inches (48.3 cm).

Transport Mode

IMPORTANT: Before changing groomer position, make certain that the reel drive lever is in the disengaged position and that the cutting reel is not rotating.

IMPORTANT: When transporting the mower, make sure the cutting unit is disengaged and the grooming reel is raised to its transport position.

To place the grooming reel in the raised, transport position, remove the lock screw and rotate the lift arm to raise the grooming reel. Install the lock screw to retain the grooming reel in the transport position (Fig. 1).

To place the grooming reel in the lowered, grooming position, remove the lock screw and rotate the lift arm to lower the grooming reel. Install the lock screw to retain the grooming reel in the grooming position (Fig. 2).

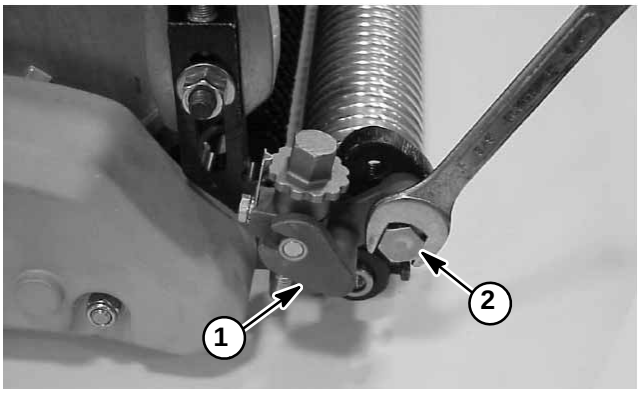

Figure 1

1. Lift arm
2. Lock screw (transport)

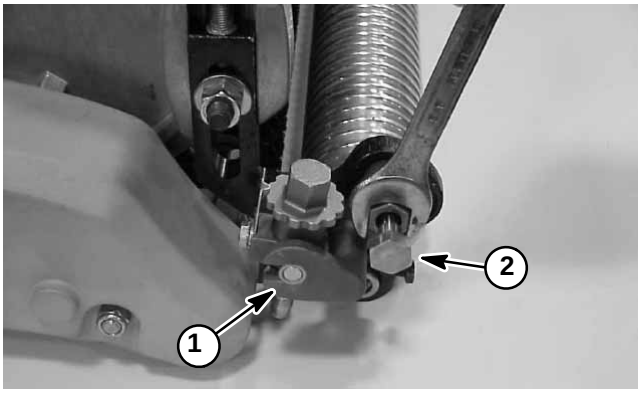

Figure 2

1. Lift arm
2. Lock screw (grooming)

Troubleshooting

Factors Affecting Grooming Performance

There are a number of factors that can affect the performance of grooming. These factors vary for different golf courses and from green to green. It is important to inspect the turf frequently and vary the grooming practice with turf needs.

It is important to remember that factors affecting quality of cut also affect grooming performance.

IMPORTANT: Improper or overaggressive use of the grooming reel, such as too deep or frequent grooming, may cause unnecessary stress on the turf leading to severe turf damage. Use the groomer carefully. READ AND UNDERSTAND THE OPERATION INSTRUCTIONS BEFORE OPERATING OR TESTING GROOMER PERFORMANCE.

Variables That Affect the Use and Performance of Grooming Reels:

1. The growing season and weather conditions.

2. General turf conditions.

3. The frequency of grooming/cutting – number of cuttings per week and how many passes per cutting.

4. The blade spacing on the grooming reel.

5. The height–of–cut.

6. The grooming depth.

7. The type of grass on the green.

8. The amount of time that a grooming reel has been in use on a particular turf area.

9. The amount of traffic on the turf.

10. The overall turf management program – irrigation, fertilizing, weed control, coring, overseeding, disease control, sand dressing and pest control.

11. Stress periods for turf – high temperatures, high humidity, unusually high traffic.

Grooming Reel Mechanical Problems

Problem	Possible Causes	Correction
The grooming reel rotates when it is in the raised, transport position.	The grooming reel should rotate whenever the cutting reel is engaged.	Normal operation.
No rotation of the grooming reel.	Seized grooming reel or idler bearing(s) in groomer side plate(s).	Identify and replace faulty bearing(s).
	Broken or damaged idler spring.	Replace spring.
	The groomer belt is worn, broken or damaged.	If the groomer belt slips, it probably is worn and must be replaced.
		Repair or replace belt if necessary. A broken or worn belt could be the result of improper belt routing or seized bearings in groomer assembly.
The turf is damaged or has uneven grooming.	The grooming reel blades are bent, damaged or missing.	Repair or replace blades if necessary.
	The grooming reel shaft is bent or damaged.	Replace grooming reel shaft.
	Grooming depth is not equal on both ends of grooming reel.	Adjust depth if necessary. Check and adjust cutting unit set up (level bedknife to reel, level rear roller to reel, set height–of–cut, etc.).

Adjustments

CAUTION

Never work on the mower with the engine running. Always stop the engine and remove the high tension lead from the spark plug before working on the mower.

Height/Depth of Groomer Adjustment

NOTE: Grooming is performed above the soil level. When adjusting groomer height/depth, grooming blades should never penetrate the soil.

1. Position mower on a flat, level working surface. Make sure engine is OFF. Remove high tension lead from the engine spark plug.

2. Make sure rollers are clean and cutting reel is set to the desired height–of–cut (see Adjustments section of Chapter 7 – Cutting Unit).

3. Position the grooming reel to the lowered, grooming position (Fig. 3).

NOTE: Improper or over–aggressive use of the grooming reel (i.e. too deep or too frequent grooming) may cause unnecessary stress on the turf leading to severe greens damage. Use the groomer cautiously.

4. On one end of the grooming reel, measure the distance from the lowest tip of the grooming blade to the working surface. Lift and turn height adjustment knob to raise or lower the blade tip (Fig. 3). Each notch on the adjustment knob changes the groomer height approximately 0.003 inch (0.08 mm).

5. Repeat step 4 on the opposite end of the groomer. Then, recheck setting on the first side of groomer. Height setting on both ends of groomer should be identical.

6. Attach spark plug wire to engine spark plug.

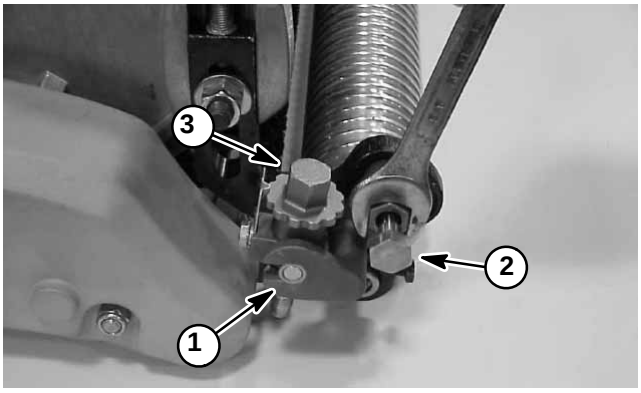

Figure 3

1. **Lift arm**
2. **Lock screw (grooming)**
3. **Height adjustment knob**

Groomer Drive Belt Replacement

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead from the engine spark plug.

2. Remove two (2) lock nuts that secure groomer belt cover to cutting unit, then remove cover (Fig. 4).

3. Pivot idler pulley by placing a 10mm wrench on pulley nut and rotating clockwise to relax belt tension. Slip groomer drive belt off pulleys (Fig. 5). Release idler.

IMPORTANT: When installing groomer drive belt, make sure that belt is centered on the pulleys and in the grooves.

4. Install new groomer drive belt to drive pulley, idler pulley and driven pulley observing correct belt routing (Fig. 5). Make sure that groomer belt is centered in pulleys.

5. Rotate drive pulley a few revolutions to make sure that drive belt remains centered in pulleys during operation.

6. Position belt cover to cutting unit and secure with two (2) lock nuts.

7. Attach spark plug wire to engine spark plug.

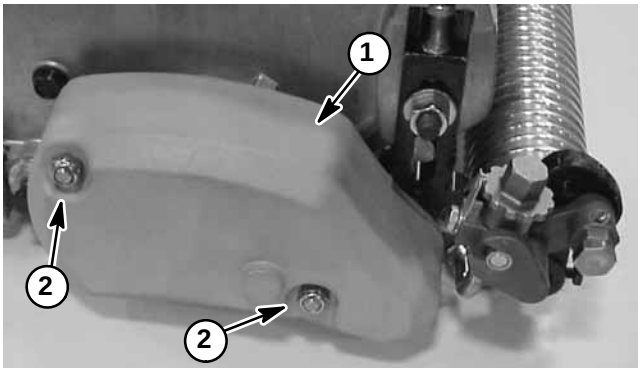

Figure 4

1. Groomer belt cover
2. Lock nut

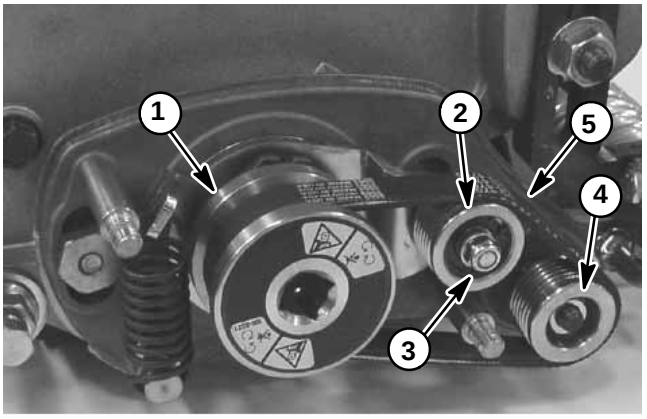

Figure 5

1. Drive pulley
2. Idler pulley
3. Idler pulley nut
4. Driven pulley
5. Groomer drive belt

Grooming Reel

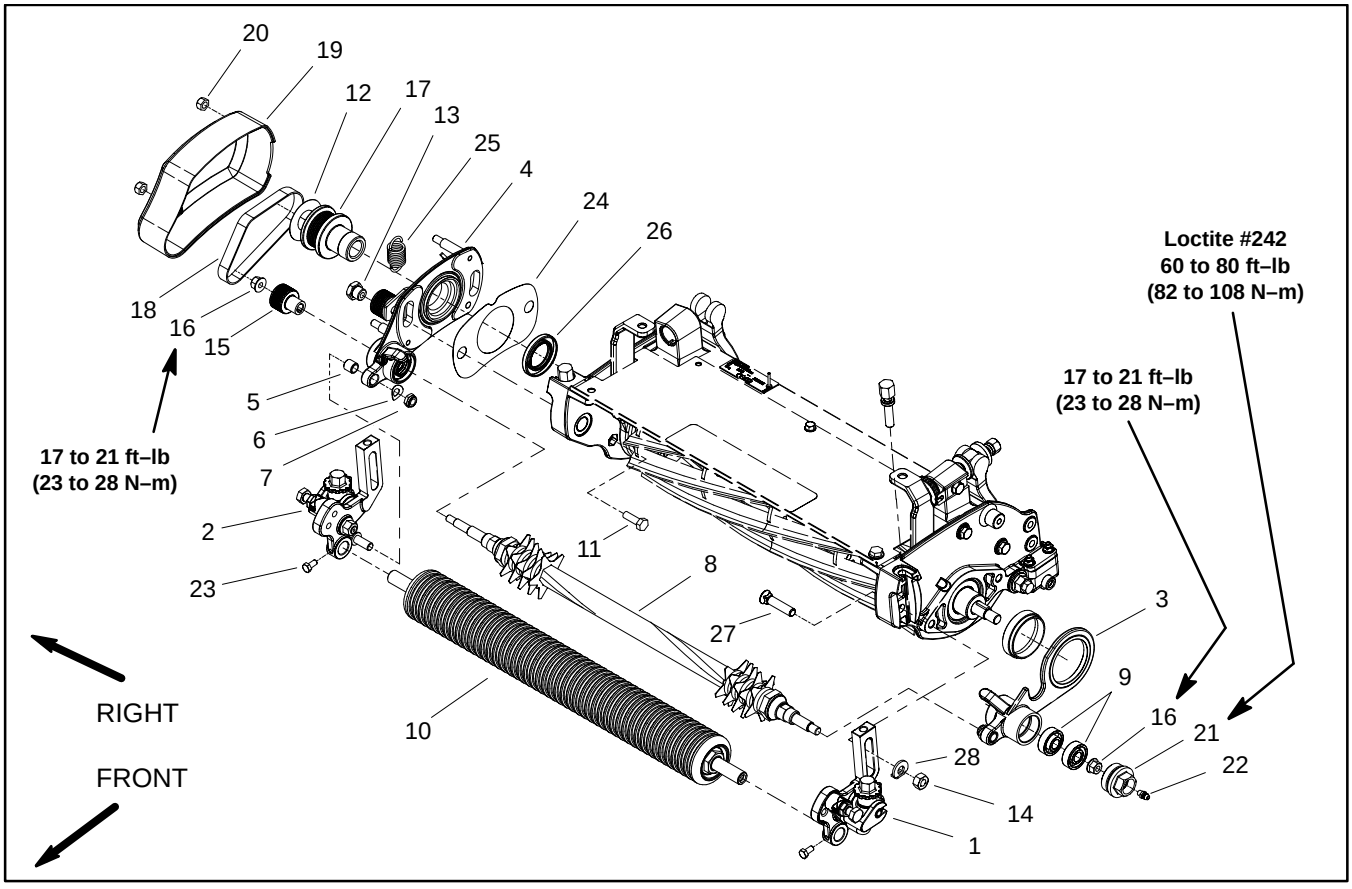

Figure 6

1. **LH groomer arm**
2. **RH groomer arm**
3. **Non–drive side plate**
4. **Drive side plate**
5. **Bushing (2 used)**
6. **Spring washer (2 used)**
7. **Lock nut (2 used)**
8. **Grooming shaft assembly**
9. **Extended race bearing (2 used)**
10. **Front roller**
11. **Cap screw (2 used)**
12. **Decal**
13. **Shoulder nut (2 used)**
14. **Lock nut (2 used)**
15. **Driven pulley**
16. **Flange nut (2 used)**
17. **Drive pulley**
18. **Groomer belt**
19. **Groomer belt cover**
20. **Lock nut (2 used)**
21. **Cap plug**
22. **Grease fitting**
23. **Cap screw (2 used)**
24. **Groomer shim**
25. **Extension spring**
26. **Oil seal**
27. **Plow bolt (2 used)**
28. **HOC washer (2 used)**

Removal

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead from the engine spark plug.

2. Remove groomer belt cover and groomer belt from right side of mower (see Groomer Drive Belt Replacement in this section).

3. Loosen cap screws that secure front roller shaft to RH and LH groomer arms (Figs. 7 and 8).

4. Remove lock nut (item 7) and spring washer (item 6) that secure RH groomer arm lift rod to RH side plate (Fig. 7).

5. Remove lock nut (item 29), HOC washer (item 28) and plow bolt (item 27) that secure RH groomer arm assembly to RH side plate. Do not change height–of–cut screw adjustment. Remove RH groomer arm assembly.

6. Pull front roller assembly out of LH groomer arm and remove from mower.

NOTE: To prevent grooming shaft from turning when removing driven pulley, use wrench on shaft flats to hold shaft.

7. Remove the flange nut that secures driven pulley (item 15) to grooming shaft. Remove driven pulley from shaft.

NOTE: The drive pulley has **left handed** threads. To prevent cutting reel from turning when removing drive pulley, block reel with piece of wood.

8. Use a 3/8” drive socket wrench to remove drive pulley (item 17) from the cutting reel shaft.

9. Remove two (2) shoulder nuts (item 13) that secure the groomer RH side plate to the cutting unit side plate. Remove the groomer RH side plate.

10. Remove the cap plug from LH side plate (Fig. 8).

NOTE: To prevent the grooming shaft from turning when removing flange nut, use wrench on shaft flats to hold shaft.

11. Remove the flange nut that secures the grooming shaft to the LH side plate.

12. Pull the grooming reel from the LH side plate.

13. Inspect seals, bushings and bearings in side plates for wear or damage. Replace components as needed.

Installation

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead from the spark plug.

2. Apply a light coating of grease to seal lips in RH and LH side plates. Make sure that seals, bushings and bearing are properly positioned in side plates.

3. Carefully place grooming reel assembly into the LH side plate bearings taking care to not damage seal in side plate. Thread flange nut onto the shaft threads but **do not fully tighten**.

4. Carefully place RH side plate onto grooming shaft taking care not to damage seals in side plate. Position side plate to the cutting unit. Secure side plate with two (2) shoulder nuts (item 13).

NOTE: The drive pulley has **left handed** threads. To prevent cutting reel from turning when installing drive pulley, block reel with piece of wood.

5. Apply a light coating of grease to drive pulley hub taking care to not get grease on belt surface. Install and tighten drive pulley onto the reel shaft.

6. Align splines of driven pulley to grooming shaft and install pulley onto the shaft. Thread flange nut onto the shaft threads but **do not fully tighten**.

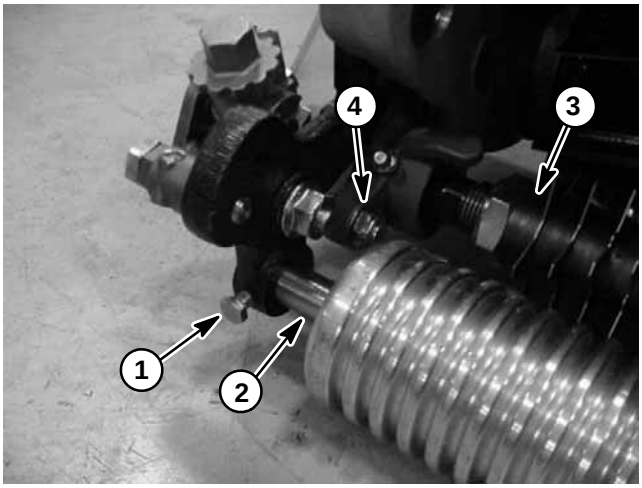

Figure 7

1. **Cap screw**
2. **Front roller shaft**
3. **Grooming shaft**
4. **Locknut/spring washer**

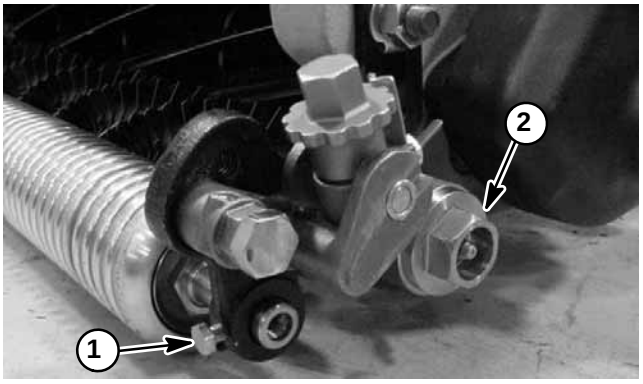

Figure 8

1. **Roller retaining cap screw**
2. **Cap plug**

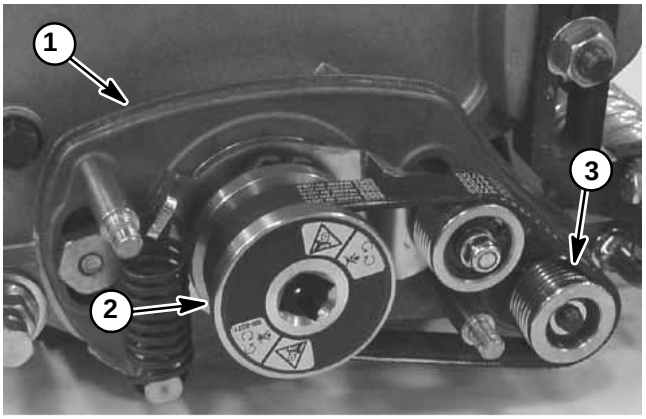

Figure 9

1. **RH side plate**
2. **Drive pulley**
3. **Driven pulley**

NOTE: To prevent grooming shaft from turning when installing flange nuts, use wrench on shaft flats to hold shaft.

7. Secure grooming reel by tightening flange nuts on both ends of grooming shaft. Torque flange nuts from **17 to 21 ft–lb (23 to 28 N–m)**.

8. Insert front roller into LH groomer arm.

9. Position RH groomer arm to front roller, groomer RH side plate and mower frame. Secure groomer arm to mower with carriage bolt, washer and flange nut.

10. Install spring washer and lock nut to secure RH groomer arm lift rod to RH groomer side plate (Fig. 7).

11. Center front roller and tighten cap screws to secure roller (Figs. 7 and 8).

IMPORTANT: When installing groomer drive belt, make sure that belt is centered on the pulleys and in the grooves.

12. Install groomer drive belt to right side of mower (see Groomer Drive Belt Replacement in this section). Do not install belt cover at this time.

13. Check grooming reel height and mower height–of–cut settings. Adjust as needed.

DANGER

Contact with the reel, bedknife or other cutting unit parts can result in personal injury. Use heavy gloves when rotating the cutting reel.

14. After groomer height has been adjusted, rotate cutting reel by hand to make sure that the grooming shaft is seated in the bearings and rotates without binding. Also, make sure that the groomer drive belt is tracking straight in the pulleys. After rotating the reel, re–check the torque on the flange nuts on both ends of grooming shaft. Flange nut torque should be from **17 to 21 ft–lb (23 to 28 N–m)**.

15. Apply Loctite #242 (or equivalent) to threads of cap plug (item 21). Install cap plug into LH side plate and torque from **60 to 80 ft–lb (82 to 108 N–m)** (Fig. 8).

16. Install groomer belt cover to cutting unit.

17. Lubricate groomer bearings.

18. Attach spark plug wire to engine spark plug.

NOTE: After greasing groomer bearings, operate groomer for 30 seconds, stop machine and wipe excess grease from grooming shaft and seals.

Grooming Reel Service

Inspect grooming reel blades frequently for damage and wear. Straighten bent blades with a pliers. Replace blades that are worn or damaged (Fig. 12). Blades that are rounded to the midpoint of the blade tip must be replaced.

Carbide tipped grooming blades (Fig. 11) should be replaced if the carbide tip is worn, loose or missing. Also, if the blade is eroded around the carbide insert, the blade should be replaced.

Grooming blades without a carbide tip (Fig. 12) should be replaced if worn or damaged. Blades that are rounded to the midpoint of the blade tip can be reversed on the grooming shaft to extend the life of the blade.

Disassembly (Fig. 10)

1. Remove grooming reel from cutting unit (see Grooming Reel Removal in this section).

2. Remove lock nut from either end of the shaft.

3. Remove spacers and grooming blades as necessary.

Assembly (Fig. 10)

1. Start by placing two (2) spacers against a lock nut installed on one end of grooming shaft. Then, place first blade against spacers.

2. For 1/2 inch (12.7 mm) spacing, make sure there are two (2) spacers between blades.

3. When all blades have been installed, place final two (2) spacers on shaft and then thread lock nut onto the shaft.

4. Position lock nuts to allow blades and spacers to be centered on the shaft. Torque lock nuts from **200 to 250 in–lb (22.6 to 28.3 N–m)** so spacers are **not** free to rotate.

5. Install grooming reel back on cutting unit (see Grooming Reel Installation in this section).

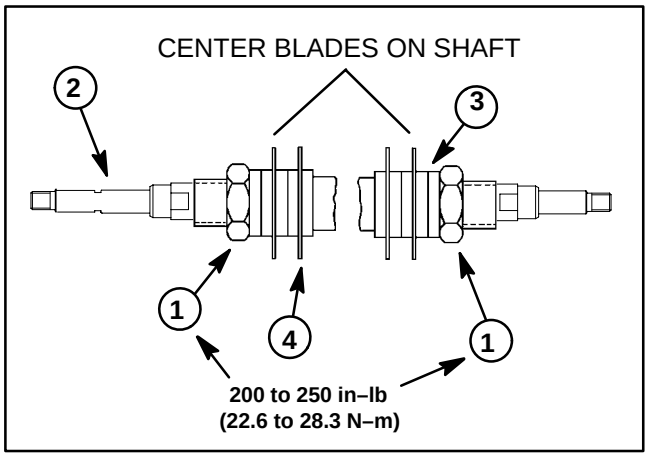

Figure 10

1. **Lock nut**
2. **Shaft**
3. **Spacers**
4. **Grooming blade**

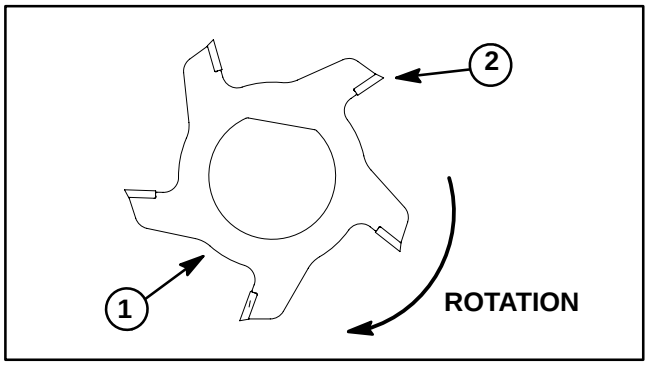

Figure 11

1. **Grooming blade**
2. **Carbide tip**

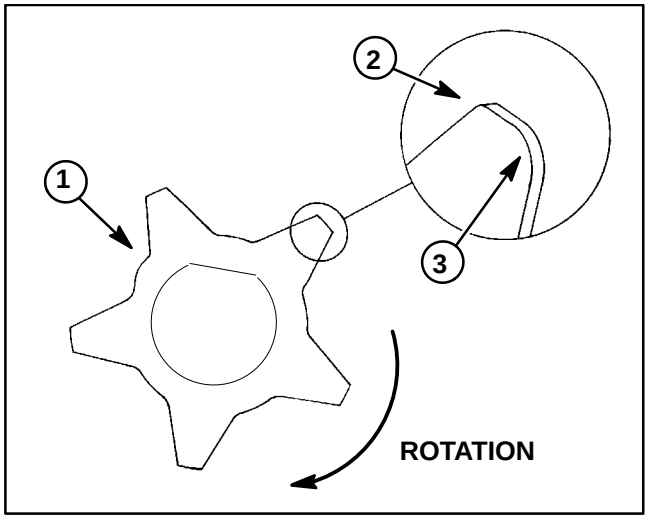

Figure 12

1. **Grooming blade**
2. **Sharp edge**
3. **Dull (rounded) edge**

Groomer Reel Bearing Replacement

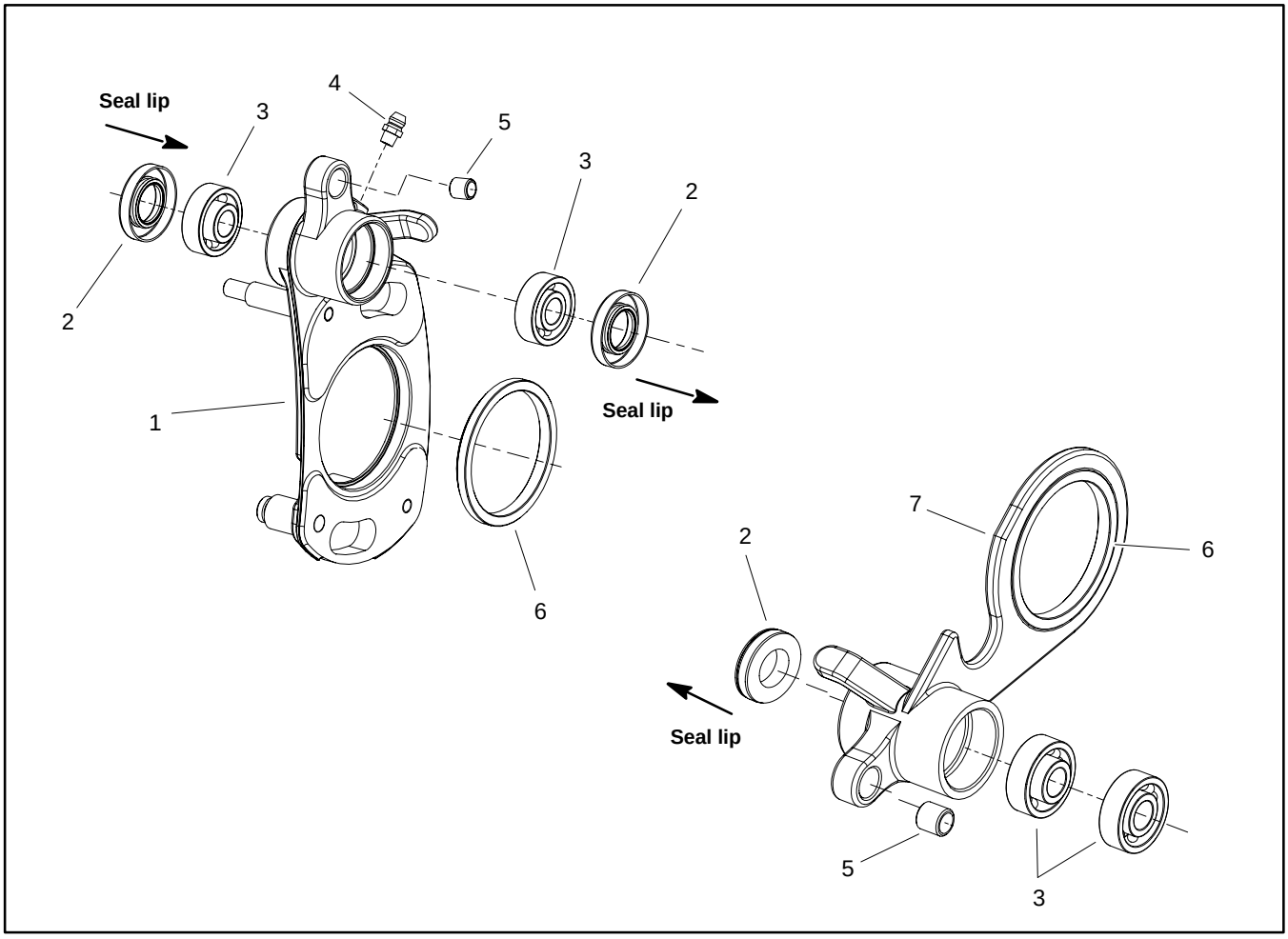

Figure 13

1. **RH groomer side plate**
2. **Oil seal**
3. **Bearing (w/extended inner race)**
4. **Grease fitting**
5. **Bushing**
6. **Side plate bushing**
7. **LH groomer side plate**

Bearing Removal (Fig. 13)

1. Remove front roller, RH groomer side plate and grooming reel (see Grooming Reel Removal in this section).

2. Remove LH groomer side plate:

   A. Take reel drive assembly from left side of cutting unit (see Cutting Reel Removal in the Service and Repairs section of Chapter 7 – Cutting Unit).

   B. Remove lock nut and spring washer that secure LH groomer arm lift rod to LH groomer side plate (Fig. 14). Remove LH groomer side plate from mower.

3. Replace bearings in **both** side plate assemblies (Fig. 13):

   A. Remove seals from groomer side plates. Discard seals.

   B. Push bearings out of housing. Discard bearings.

Bearing Installation (Fig. 13)

1. Install new bearings in **both** side plate assemblies (Fig. 13):

   A. Slide new bearings into side plates. Position race extensions toward center of housing.

   B. Install new seals into side plates. **Note:** Seals should be installed so the lip side of the seal will face the center of the cutting reel. When bearings are greased, grease will purge from inner seals.

2. Install LH groomer side plate to mower:

   A. Position LH groomer side plate to mower making sure that groomer arm lift rod is positioned through bushing in side plate.

   B. Place spring washer and lock nut on lift rod threads (Fig. 14). Tighten lock nut.

   C. Install reel drive assembly to left side of cutting unit (see Cutting Reel Installation in the Service and Repairs section of Chapter 7 – Cutting Unit).

3. Install grooming reel and RH groomer side plate (see Grooming Reel Installation in this section).

4. Lubricate groomer bearings (see Groomer Reel Kit Installation Instructions).

NOTE: After greasing groomer bearings, operate groomer for 30 seconds, stop machine and wipe excess grease from groomer shaft and seals.

5. Check and adjust grooming reel height and mower height–of–cut settings.

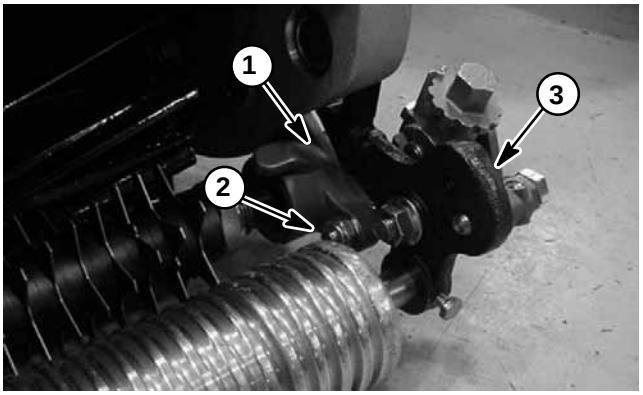

Figure 14

1. **LH groomer side plate**
2. **Lock nut/spring washer**
3. **LH groomer arm**

Idler Assembly

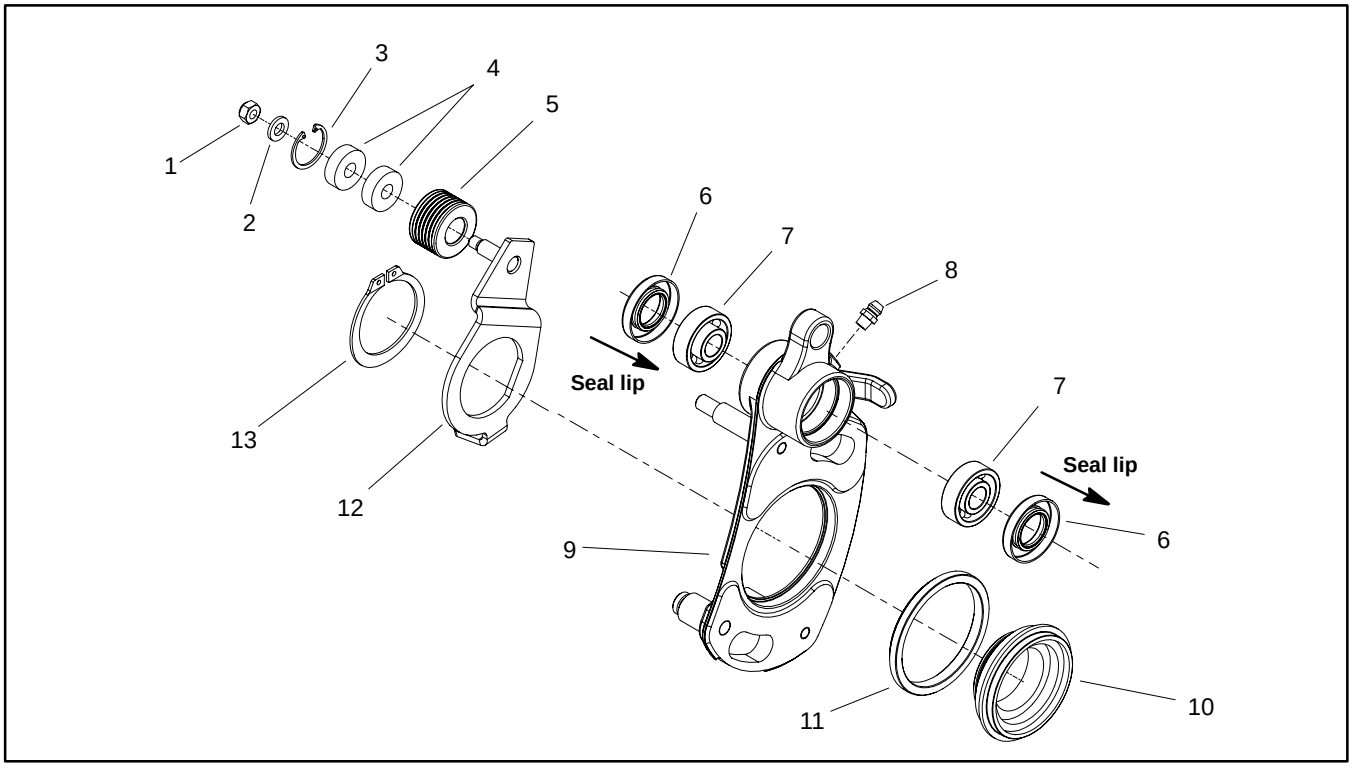

Figure 15

1. **Lock nut**
2. **Flat washer**
3. **Retaining ring**
4. **Idler bearing**
5. **Idler pulley**
6. **Seal**
7. **Bearing**
8. **Grease fitting**
9. **RH side plate**
10. **Pivot hub**
11. **Bushing**
12. **Idler bracket**
13. **Retaining ring**

The right side plate assembly of the groomer drive kit incorporates the idler system for tensioning the groomer drive belt. The idler system uses a spring to maintain proper belt tension.

Removal

1. Remove groomer belt cover, drive belt and drive pulley from right side of mower (see Grooming Reel Removal in this section).

2. Using Figures 15 and 16 as guides, remove idler bracket, idler pulley and/or idler bearings for service as needed.

Installation

1. Assemble components using Figures 15 and 16 as guides.

NOTE: When properly installed, the idler pulley should move freely from side to side on the idler bracket pin.

2. Install drive pulley, drive belt and belt cover to right side of mower (see Grooming Reel Installation in this section).

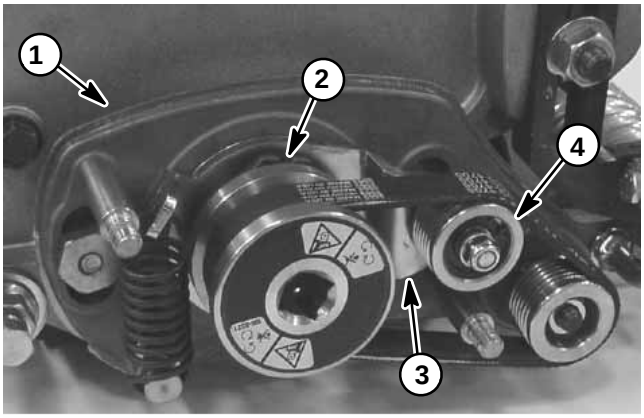

Figure 16

1. **RH side plate**
2. **Drive pulley**
3. **Idler bracket**
4. **Idler pulley w/bearings**

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Groomer Arm Assembly

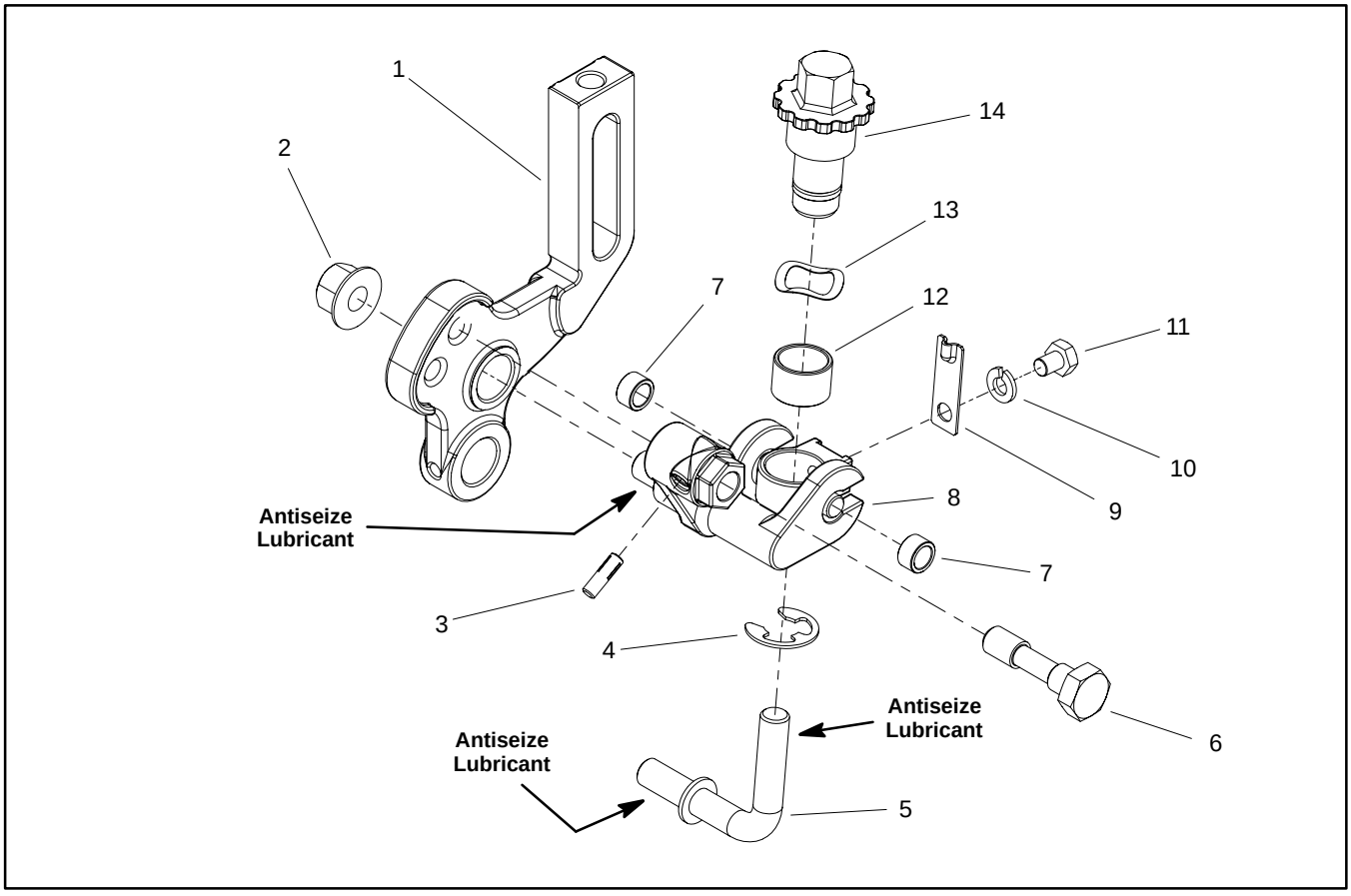

Figure 17

1. HOC groomer arm (LH shown)
2. Flange nut
3. Grooved pin
4. E–ring
5. Groomer lift rod
6. Lock screw
7. Bushing
8. Lift arm assembly (LH shown)
9. Detent spring
10. Spring washer
11. Cap screw
12. Bushing
13. Wave washer
14. Groomer adjuster

Disassembly (Fig. 17)

1. Remove groomer arm from cutting unit (Fig. 18):

   A. Loosen cap screw that secures front roller to groomer arm.

   B. Remove lock nut and spring washer that secure groomer lift rod to cutting unit side plate.

   C. Remove lock nut and HOC washer that secure groomer arm to cutting unit side plate.

   D. Slide groomer arm from front roller and cutting unit.

2. Disassemble groomer arm using Figure 17 as a guide.

NOTE: Right and left side HOC groomer arms and lift arm assemblies are different; other components shown in Figure 17 are the same on both sides of machine.

NOTE: Grooved pin (item 3) is used to retain lock screw (item 6) to lift arm assembly.

Assembly (Fig. 17)

1. Apply antiseize lubricant to threads of groomer lift rod (item 5) and lift arm assembly (item 8). Assemble groomer arm using Figure 17 as a guide.

2. Install groomer arm onto cutting unit (Fig. 18):

   A. Slide groomer arm onto front roller shaft and to cutting unit.

   B. Secure groomer arm to cutting unit side plate with HOC washer and lock nut.

   C. Secure groomer lift rod to cutting unit side plate with spring washer and lock nut.

   D. Make sure that front roller is centered to cutting unit. Secure front roller to groomer arm with cap screw.

3. Check height–of–cut and adjust as needed.

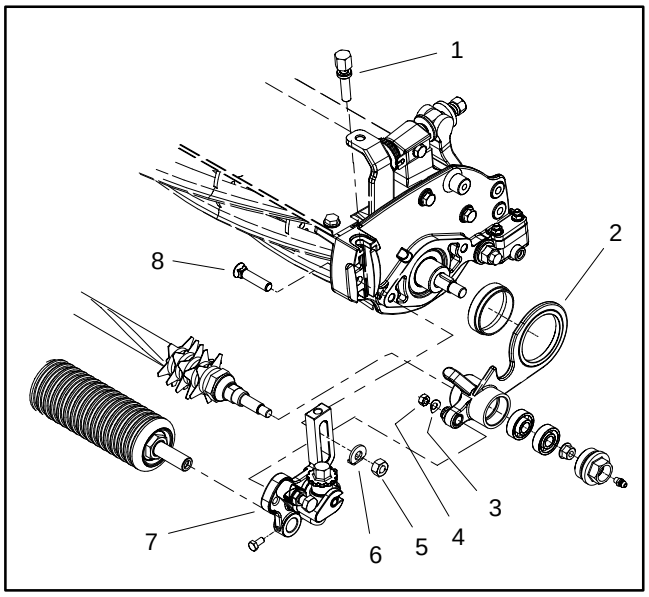

Figure 18

1. **HOC screw**
2. **Groomer sideplate**
3. **Spring washer**
4. **Lock nut**
5. **Lock nut**
6. **HOC washer**
7. **Groomer arm**
8. **Plow bolt**

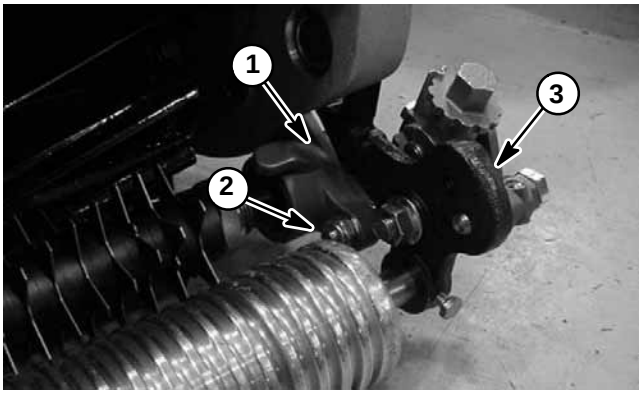

Figure 19

1. **LH groomer side plate**
2. **Lock nut/spring washer**
3. **LH groomer arm**

Grooming Brush

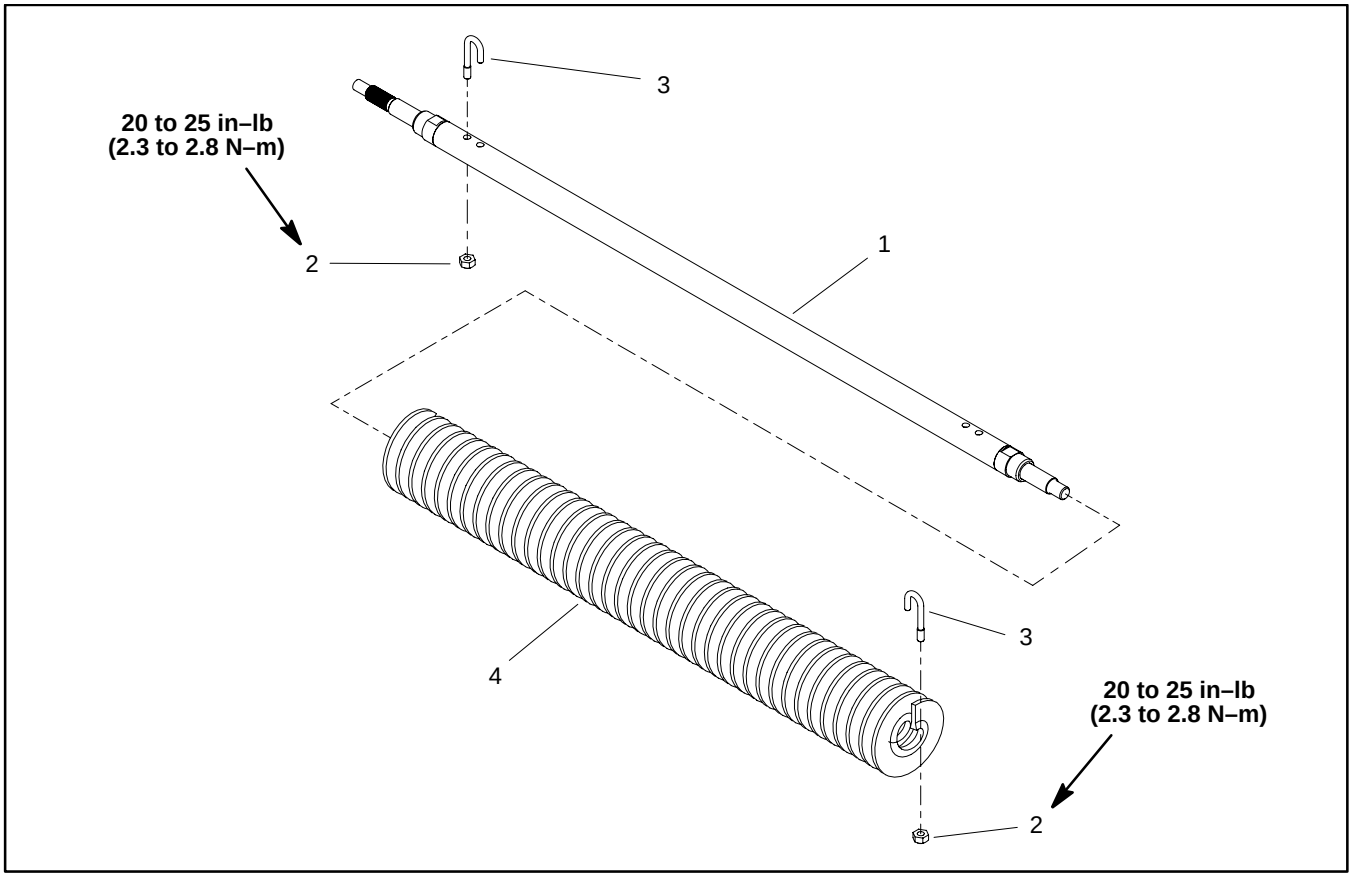

Figure 20

1. **Grooming brush shaft**
2. **Lock nut**
3. **J–bolt**
4. **Grooming brush**

The grooming brush attaches to the groomer drive in place of the grooming reel. Removal and installation of the grooming brush use the same procedure as removal and installation of the grooming reel (see Grooming Reel in this section).

To remove the grooming brush from the shaft, remove the lock nut and J–bolt from both ends of the brush. While retaining the shaft, rotate the brush and slide from the shaft. When assembling the brush to the shaft, secure the assembly with J–bolts and lock nuts. Make sure that the J–bolts are installed with the threaded portion on the outside of the brush (Fig. 21). Torque lock nuts from **20 to 25 in–lb (2.3 to 2.8 N–m)**.

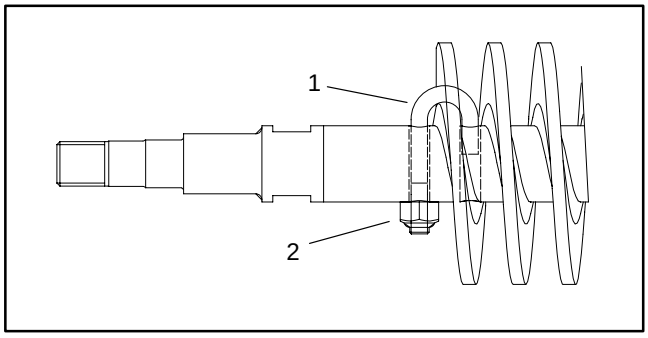

Figure 21

1. **J–bolt**
2. **Lock nut**