PART NO. 01089SL (Rev. C)

TORO

Service Manual

Greensmaster® Flex 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 21.

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 reading and understanding the contents of this manual. A replacement 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 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 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 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.

   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 a switch should malfunction, replace the switch before operating machine. (After every two years, replace the interlock switch in the safety system, 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 and stop the engine:

   A. Open fuel shut-off valve.

   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.

   E. Move throttle to SLOW and on/off switch to OFF position to stop engine.

4. To transport mower from one area to another:

   A. Install transport wheels.

   B. Disengage reel drive.

   C. Start engine.

   D. Press down on handle to raise front of mower and engage traction drive.

5. Before beginning mowing operation:

   A. Disengage traction drive.

   B. Stop engine.

   C. Remove transport wheels.

   D. Start engine.

   E. Engage reel drive.

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

7. 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.

8. 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.

9. Whenever machine is left unattended, be sure engine is stopped and cutting unit reel is not spinning. Close fuel shut-off valve if machine is not to be used for an extended period of time.

Maintenance and Service

1. Before servicing or making adjustments to the machine, stop the engine and pull the high tension lead off 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. If major repairs are ever needed or assistance is required, contact an Authorized TORO Distributor.

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

5. If the engine must be running to perform a maintenance adjustment, keep hands, feet, clothing, and any parts of the body away from the cutting unit and any moving parts. Keep everyone away.

6. Do not overspeed the engine by changing governor settings. Maximum engine speed is 3600 rpm. To ensure safety and accuracy, have an Authorized TORO Distributor check maximum engine speed with a tachometer.

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

8. Engine must be shut off before checking or adding fluid to the transmission.

9. To be sure of optimum performance and safety, always purchase genuine TORO replacement parts and accessories. Replacement parts and accessories made by other manufacturers could be dangerous. Such use could void the product warranty of The Toro Company.

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. Part numbers are listed in your Parts Catalog. Order replacement decals from your Authorized TORO Distributor.

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Product Records and Manuals

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Product Records

Insert Operator's Manuals and Parts Catalogs for your Greensmaster Flex 21 at the end of this section.

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	0.9375	— 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

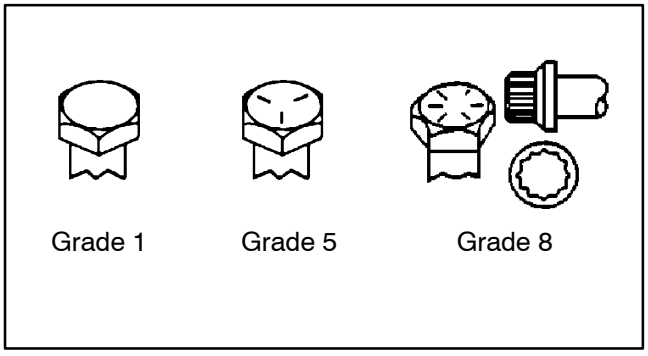
Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in this Service Manual.

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, hardness of the surface underneath the fastener's head, or similar condition which affects the installation.

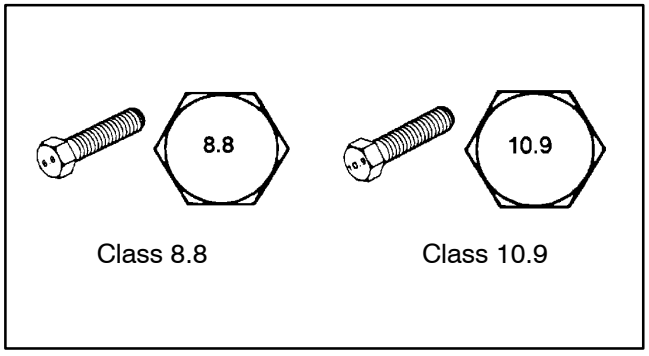
As noted in the following tables, torque values should be **reduced by 25% for lubricated fasteners** to achieve the similar stress as a dry fastener. Torque values may also have to be reduced when the fastener is threaded into aluminum or brass. The specific torque value should be determined based on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

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	170 ± 20	23 ± 2	260 ± 20
# 6 – 40 UNF				17 ± 2	190 ± 20	25 ± 2	280 ± 20
# 8 – 32 UNC	13 ± 2	25 ± 5	282 ± 30	29 ± 3	330 ± 30	41 ± 4	460 ± 45
# 8 – 36 UNF				31 ± 3	350 ± 30	43 ± 4	485 ± 45
# 10 – 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 4	475 ± 45	60 ± 6	675 ± 70
# 10 – 32 UNF				48 ± 4	540 ± 45	68 ± 6	765 ± 70
1/4 – 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1125 ± 100	140 ± 15	1580 ± 170
1/4 – 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 10	1300 ± 100	160 ± 15	1800 ± 170
5/16 – 18 UNC	115 ± 15	105 ± 17	1186 ± 169	200 ± 25	2250 ± 280	300 ± 30	3390 ± 340
5/16 – 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2540 ± 280	325 ± 30	3670 ± 340
	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 ± 4	58 ± 5
3/8 – 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 3	47 ± 4	50 ± 4	68 ± 5
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 ± 5	75 ± 7	77 ± 7	104 ± 9
1/2 – 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 10	142 ± 14
1/2 – 20 UNF	32 ± 3	53 ± 7	72 ± 9	85 ± 8	115 ± 11	120 ± 10	163 ± 14
5/8 – 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 20	285 ± 27
5/8 – 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 15	230 ± 20	240 ± 20	325 ± 27
3/4 – 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 25	359 ± 34	375 ± 35	508 ± 47
3/4 – 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 25	407 ± 34	420 ± 35	569 ± 47
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 ± 45	644 ± 61	660 ± 60	895 ± 81

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 oil, graphite, or thread sealant such as Loctite.

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: 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 ± 5 in–lb	640 ± 60 N–cm	78 ± 7 in–lb	885 ± 80 N–cm
M6 X 1.0	96 ± 9 in–lb	1018 ± 100 N–cm	133 ± 13 in–lb	1500 ± 150 N–cm
M8 X 1.25	19 ± 2 ft–lb	26 ± 3 N–m	27 ± 2 ft–lb	36 ± 3 N–m
M10 X 1.5	38 ± 4 ft–lb	52 ± 5 N–m	53 ± 5 ft–lb	72 ± 7 N–m
M12 X 1.75	66 ± 7 ft–lb	90 ± 10 N–m	92 ± 9 ft–lb	125 ± 12 N–m
M16 X 2.0	166 ± 15 ft–lb	225 ± 20 N–m	229 ± 22 ft–lb	310 ± 30 N–m
M20 X 2.5	325 ± 33 ft–lb	440 ± 45 N–m	450 ± 37 ft–lb	610 ± 50 N–m

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 oil, graphite, or thread sealant such as Loctite.

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: 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

Table of Contents

Introduction

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

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the Kawasaki FE120 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.

Specifications

Item	Description
Make / Designation	Kawasaki, 4–stroke, OHV, single cylinder, air–cooled, gasoline engine, FE120D
Bore x Stroke mm (in.)	60 x 44 (2.36 x 1.73)
Total Displacement cc (cu. in.)	124 (7.6)
Compression Ratio	8.4:1
Maximum Output kw (HP)	2.8 (3.7)
Carburetor	Float feed, fixed main jet
Governor	Mechanical flyweight
Idle Speed (no load)	2400 $\pm$ 100 RPM
High Idle (no load)	3600 $\pm$ 100 RPM
Direction of rotation	Counter clockwise (facing PTO shaft)
Fuel	Unleaded, automotive grade gasoline
Fuel Tank Capacity liter (U.S. qt.)	2.5 (2.6)
Engine Oil	See General Information
Lubrication System	Splash type
Oil Capacity liter (U.S. qt.)	0.6 (0.63)
Air Cleaner	Dual element
Ignition System	Transistorized flywheel magneto with ignition advance
RFI Suppressor	Radio suppressor plug cap and spark plug
Spark Plug	NGK BPR 5ES
Dry Weight kg (U.S. lb.)	14.6 (32.2)

Filling the Fuel Tank

DANGER

In certain conditions, gasoline is extremely flammable and highly explosive. A fire or explosion from gasoline can burn you and others and can damage property.

- **Fill the fuel tank outdoors, in an open area, when the engine is cold. Wipe up any gasoline that spills.**
- **Do not fill the fuel tank completely full. Add gasoline to the fuel tank until the level is to the bottom of the filter screen. This empty space in the tank allows gasoline to expand.**
- **Never smoke when handling gasoline, and stay away from an open flame or where gasoline fumes may be ignited by a spark.**
- **Store gasoline in an approved container and keep it out of the reach of children. Never buy more than a 30-day supply of gasoline.**
- **Always place gasoline containers on the ground away from your vehicle before filling.**
- **Do not fill gasoline containers inside a vehicle or on a truck or trailer bed because interior carpets or plastic truck bed liners may insulate the container and slow the loss of any static charge.**
- **When practical, remove gas–powered equipment from the truck or trailer and refuel the equipment with its wheels on the ground.**
- **If this is not possible, then refuel such equipment on a truck or trailer from a portable container, rather than from a gasoline dispenser nozzle.**
- **If a gasoline dispenser nozzle must be used, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete.**

WARNING

Gasoline is harmful or fatal if swallowed. Long–term exposure to vapors can cause serious injury and illness.

- **Avoid prolonged breathing of vapors**
- **Keep face away from nozzle and gas tank.**
- **Keep gas away from eyes and skin.**

IMPORTANT: Never use methanol, gasoline containing methanol, gasoline containing more than 10% ethanol, gasoline additives, premium gasoline, or white gas. Engine fuel system damage could result. Do not mix oil with gasoline.

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

2. Clean around fuel tank cap and remove cap from tank (Fig. 1). Using unleaded gasoline, fill fuel tank to bottom of filter screen. **DO NOT OVER FILL.**

3. Install fuel tank cap. Wipe up any spilled gasoline.

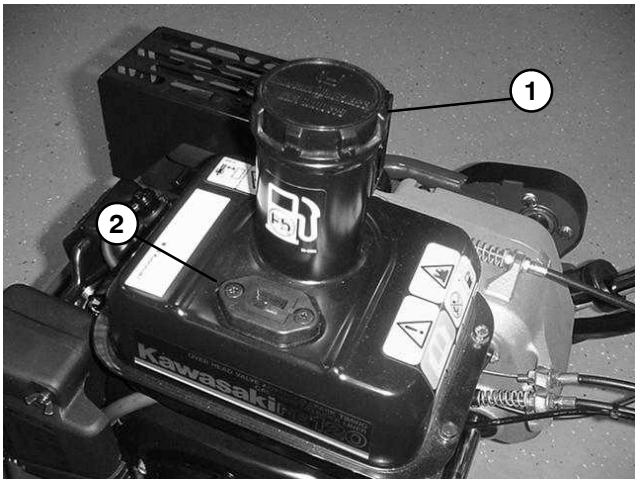


Figure 1

1. **Fuel tank cap**
2. **Fuel gauge**

Fuel Shut–off Valve

The fuel shut off valve is located on the left, rewind starter side of the engine. It has two positions: CLOSED and OPEN. Position valve to the closed position when storing or transporting the machine. Rotate valve to the open position before starting the engine.

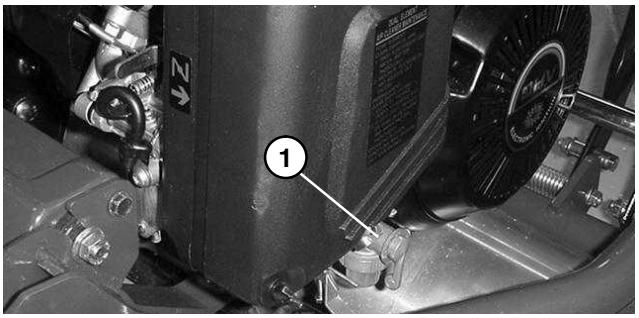


Figure 2

1. Fuel shut–off valve

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 mower on a level surface. Make sure engine is OFF. Remove high tension lead from the spark plug.

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

3. Loosen throttle cable screw securing 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 speed idle screw.

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

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

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

   B. **High idle speed should be 3500 to 3700 rpm.**

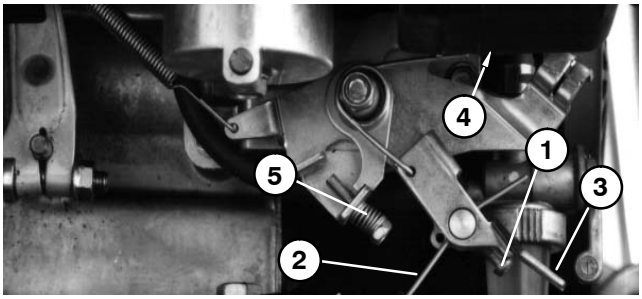


Figure 3

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

Engine Oil

The TORO Company recommends that the oil level be checked each time the mower is used or after every 5 operating hours. Initially, change oil after the first 20 hours of operation; thereafter, change oil after every 50 hours of operation. **More frequent oil changes are required in dusty or dirty conditions.**

Checking Engine Oil Level

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

2. Position mower so the engine is level. Clean around the oil level gauge (Fig. 5).

3. Remove oil level gauge by rotating it counterclockwise. Note location of O–ring on gauge.

4. Wipe oil level gauge clean and insert it into the filler port. Do not screw it into the port. Remove and check level of the oil on the gauge. If the oil level is low, add only enough oil (see Figure 4 for proper viscosity) to raise the oil level so that it is between the marks on the gauge. DO NOT OVERFILL.

Use any high quality detergent oil having the American Petroleum Institute (API) “Service Classification”— SC, SD, SE, SF, SG, or SH.

5. Reinstall oil level gauge and wipe up any spilled oil.

Changing Engine Oil

1. Start and run engine for a few minutes to warm the engine oil.

2. Park mower on a level surface. Make sure engine is OFF.

3. Place a drain pan at the rear of machine under the drain plug (Fig. 5). Remove drain plug and drain plug gasket.

4. Inspect drain plug gasket for damage and replace if needed.

5. Push down on handle to tip mower and engine backward, allowing oil to drain completely from the crankcase.

6. After thorough draining, reinstall drain plug and gasket. Tighten drain plug to 14 ft–lb (20 Nm).

7. Refill crankcase with proper oil (see Checking Engine Oil Level). Crankcase holds 20 ounces (.6 l).

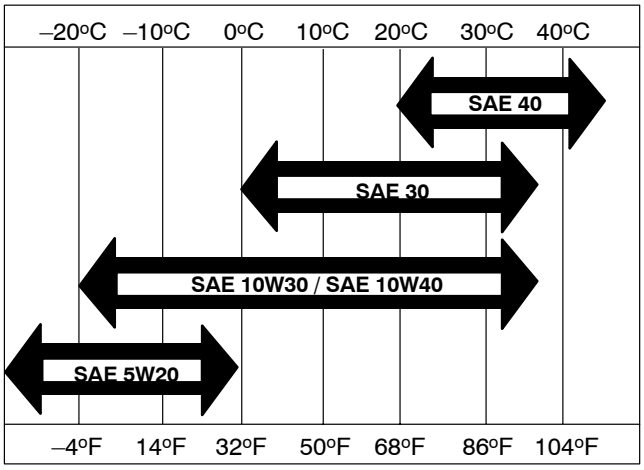


Figure 4

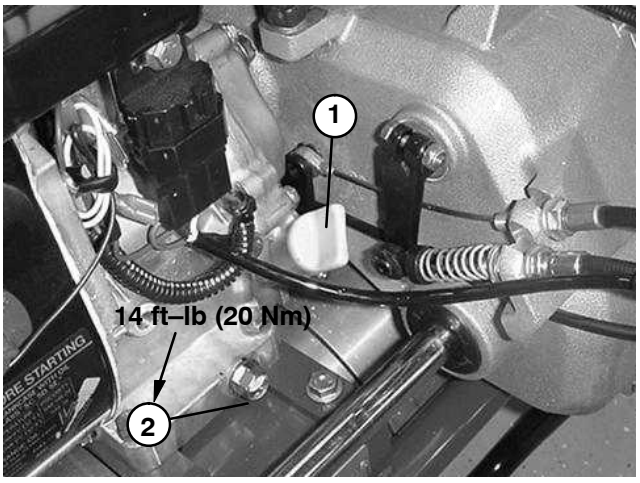


Figure 5

1. Oil level gauge
2. Drain plug

Air Cleaner

Clean air filter precleaner (foam element) after every 25 operating hours and the air cleaner filter (paper element) after every 100 operating hours. More frequent cleaning is required when the mower is operated in dusty or dirty conditions.

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

2. Remove wing nuts that secure the air cleaner cover and remove cover. Clean cover thoroughly (Fig. 6).

3. If the foam element is dirty, remove it from the paper element (Fig. 7). Clean foam element thoroughly.

   A. WASH foam element in a solution of liquid soap and warm water. Squeeze it to remove dirt. Do not twist element because foam may tear.

   B. DRY by wrapping the element in a clean rag. Squeeze rag and foam element to dry element.

   C. SATURATE element with clean engine oil. Squeeze element to remove excess oil and to distribute oil uniformly. An oil damp element is desirable.

4. When servicing the foam element, check condition of the paper element. Clean or replace paper element as required.

   A. To clean paper element, tap filter gently to remove dirt and debris. **Do not** use compressed air to clean paper element.

5. Reinstall foam element, paper element, and air cleaner cover. Tighten wing nuts.

IMPORTANT: Do not operate engine without air cleaner element because extreme engine wear and damage will likely result.

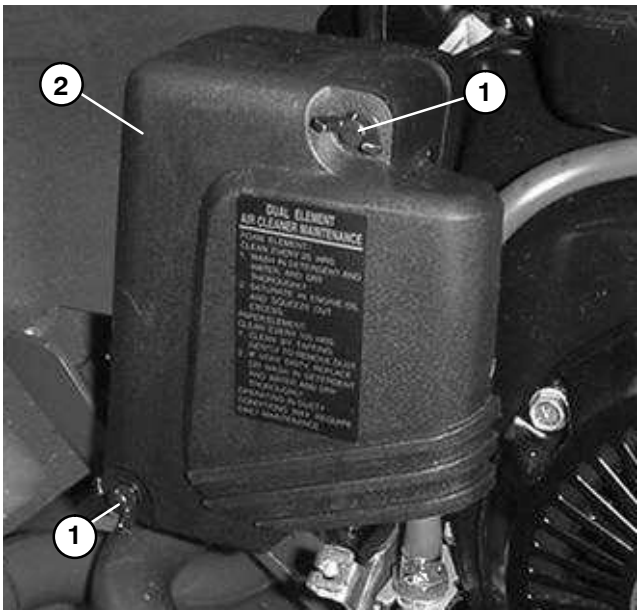


Figure 6

1. Wing nut **2. Air cleaner cover**

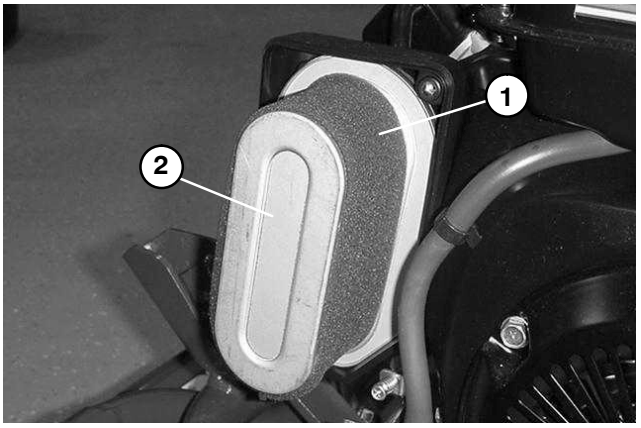


Figure 7

1. Foam element **2. Paper element**

Fuel Filter

Initially, clean fuel filter element and sediment bowl after the first 20 hours of operation; thereafter, clean after every 50 hours operation.

1. Close fuel shut–off valve and unscrew nut from the shut–off valve body. Remove sediment bowl, gasket, and filter element (Fig. 9).

2. Clean sediment bowl and filter element in clean gasoline.

3. Reinstall filter element, gasket, and sediment bowl. Secure with nut. Wipe up any spilled gasoline. Open fuel shut–off valve.

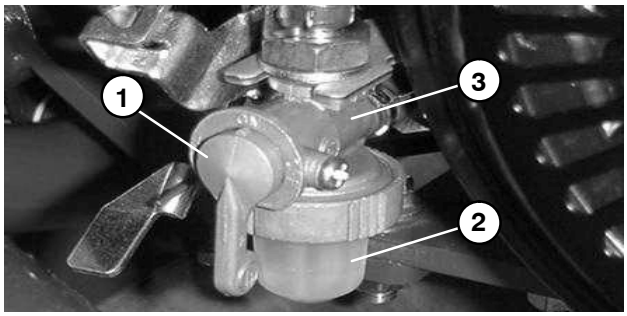


Figure 8

1. **Fuel shut–off valve**
2. **Sediment bowl**
3. **Shut–off valve body**

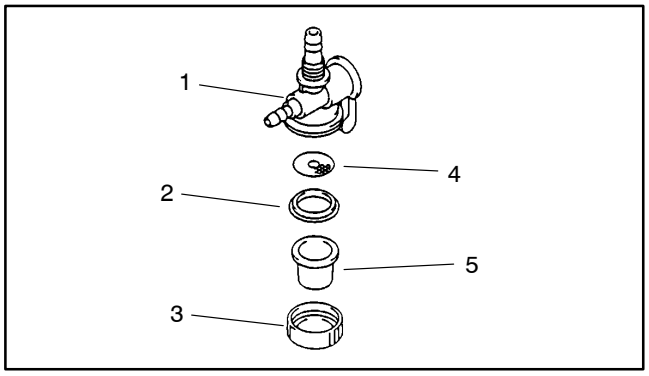


Figure 9

1. **Shut–off valve body**
2. **Gasket**
3. **Nut**
4. **Filter element**
5. **Sediment bowl**

Spark Plug

Use a **NGK BPR 5ES** spark plug or equivalent. Remove plug after every 100 operating hours and check its condition.

1. Make sure engine is OFF. Pull high tension lead 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 electrodes because engine damage could result from grit entering cylinder.

4. Set air gap from 0.028 to 0.032 inch (0.7 to 0.8 mm). Install correctly gapped spark plug into cylinder head and torque to 17 ft–lb (23 Nm). Connect high tension lead to spark plug.

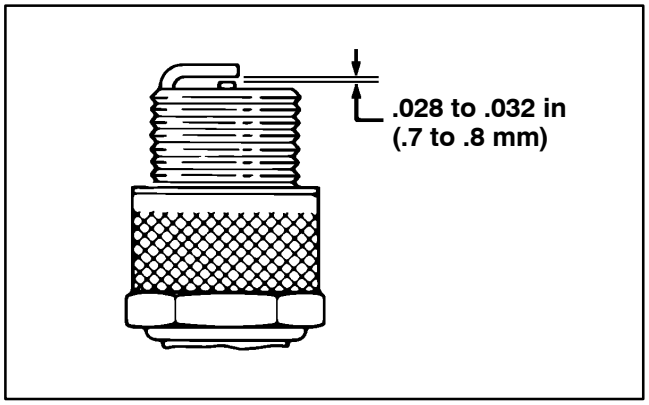
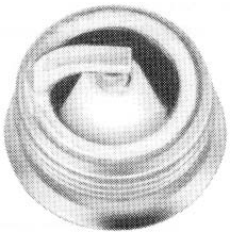
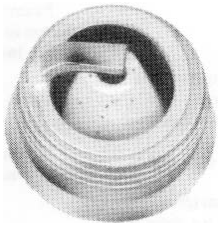


Figure 10



NORMAL

Has gray or light tan deposits on the firing tip.

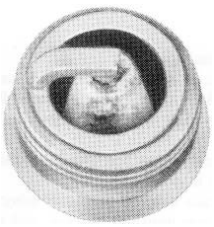


OVER HEATING

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

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

Replace spark plug.

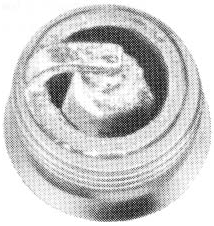


FUSED SPOT DEPOSIT

Has spotty or melted deposits resembling blisters or bubbles.

Caused by sudden acceleration.

Replace spark plug.

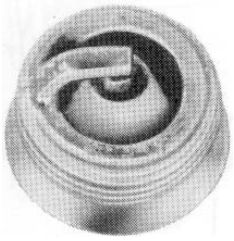


LEAD FOULED

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.

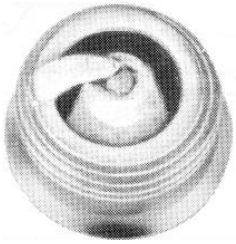


CARBON FOULED

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.

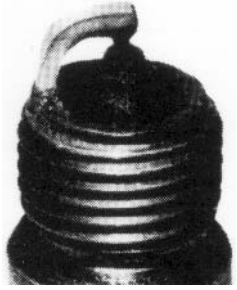


WORN

Has severely eroded or worn electrodes.

Caused by normal wear.

Replace spark plug.

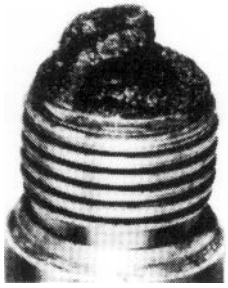


GAP BRIDGED

Gap between electrodes is closed by deposit build up.

May be caused by carbon or oil fouling.

Replace spark plug.

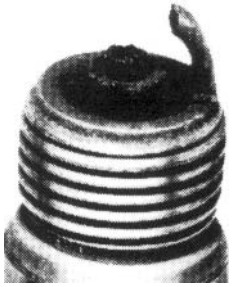


OIL FOULED

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 advance, or wrong type of fuel are causes.

Replace spark plug.

Ignition Components

Service of the ignition components is covered in Chapter 5 – Electrical System.

Cooling System

IMPORTANT: The engine that powers the 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 mower on a level surface. Make sure engine is OFF. Remove high tension lead 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 shroud from cylinder for more thorough cleaning (Fig.11).

3. Clean blower housing of dirt and debris. 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 reinstalled to the engine if removed.

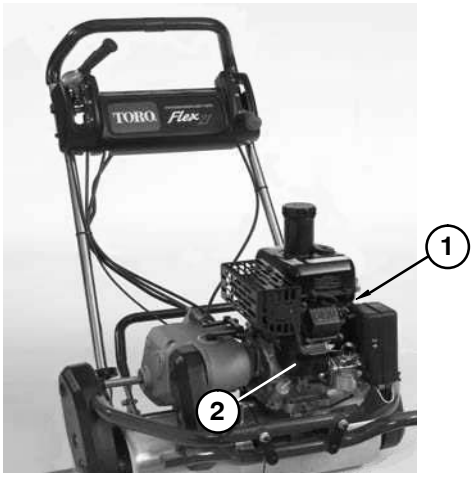


Figure 11

1. **Blower housing**
2. **Engine shroud**

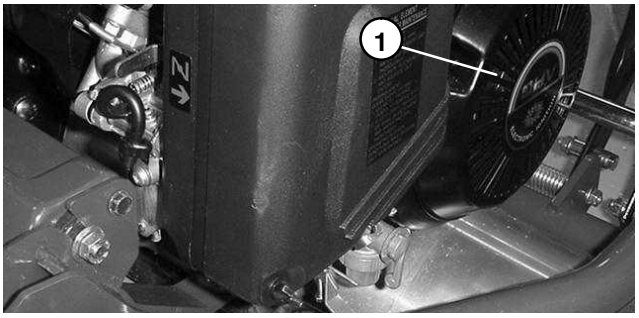


Figure 12

1. **Blower housing air intake**

Engine Removal and Installation

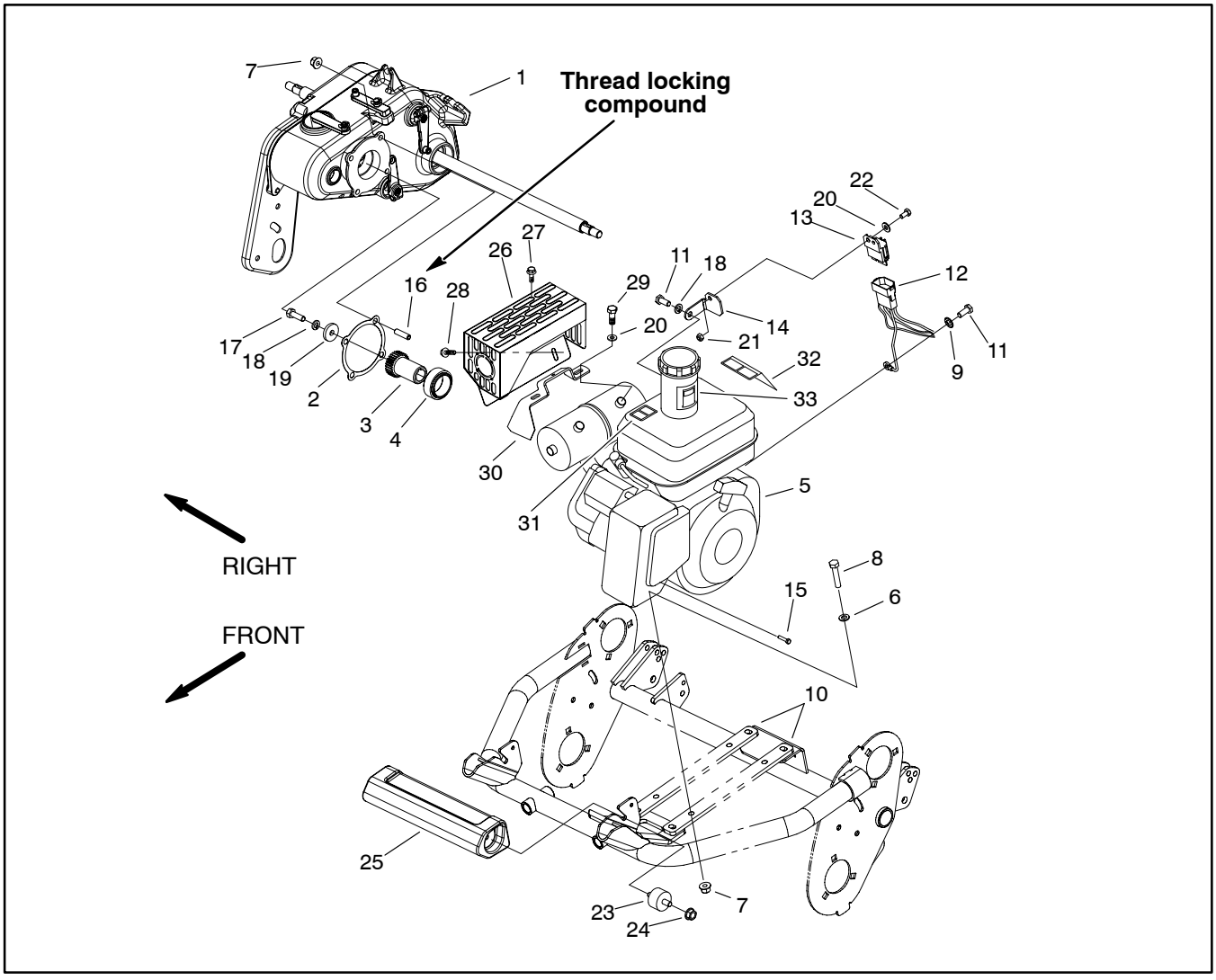


Figure 13

1. Gearbox assembly
2. Flange gasket
3. Engine gear
4. Engine adapter
5. Engine
6. Flat washer
7. Flange nut
8. Cap screw
9. Lock washer
10. Engine base
11. Cap screw
12. Wire harness (interlock module)
13. Interlock module
14. Module bracket
15. Cap screw
16. Set screw
17. Cap screw
18. Lock washer
19. Washer
20. Flat washer
21. Lock nut
22. Cap screw
23. Isolator mount
24. Flange nut
25. Damper assembly
26. Muffler guard
27. Screw with washer
28. Flange bolt
29. Cap screw
30. Muffler guard bracket
31. Decal: Hot surface
32. Decal: Danger
33. Decal: Fuel

Engine Removal

1. Make sure machine is parked on a level surface with the engine OFF. Remove high tension lead 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 transmission.

4. Remove throttle cable from engine:

   A. Loosen screw on governor lever enough to slide the throttle cable out of the nut (Fig. 14).

5. Disconnect electrical connections from engine (Fig. 15):

   A. Unplug wiring harness from interlock module.

   B. Disconnect engine stop switch and armature wires from wiring harness.

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

6. Remove engine from the engine base (Fig. 16):

   A. Remove four flange nuts that secure gearbox assembly to setscrews on engine crankcase cover flange.

   B. Support gearbox between mower frame and gearbox flange.

   C. Remove 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.

   E. Remove the engine from the traction unit.

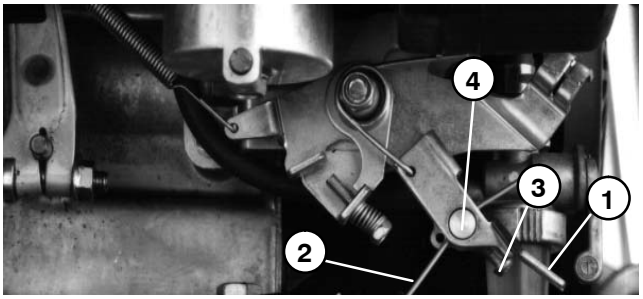


Figure 14

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

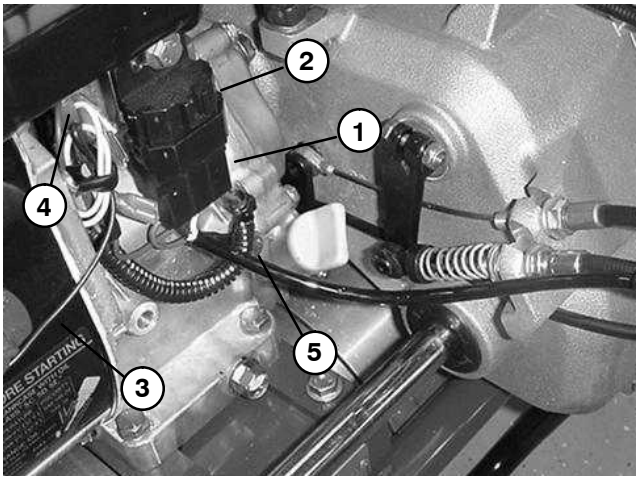


Figure 15

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

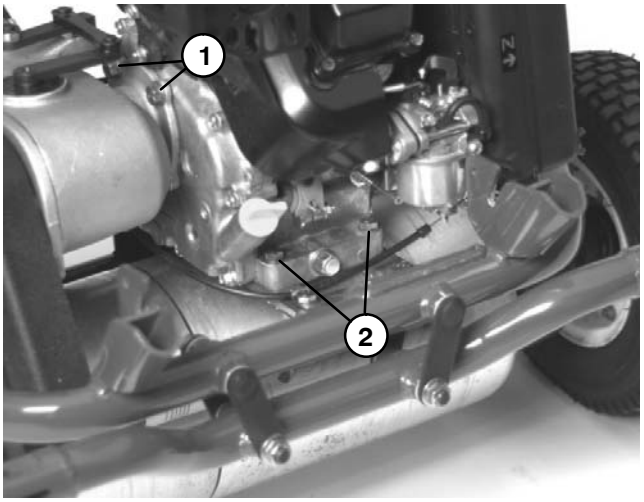


Figure 16

1. **Gearbox flange nuts**
2. **Engine mounting screws**

Engine Installation

1. Position machine on a level surface. The machine may be placed on a large work bench to make engine installation and adjustment easier. Remove high tension lead from the spark plug.

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

3. Reinstall engine to engine base (Fig. 13 and 16):

   A. Make sure that setscrews are secure in engine crankcase cover flange. If setscrews were removed for any reason, they should have thread locking compound applied to threads and be tightened securely.

   B. Install new flange gasket to setscrews on crankcase cover flange.

   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 four flange nuts that secure gearbox assembly to setscrews on engine crankcase cover flange.

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

   G. Tighten flange nuts that secure gearbox assembly to engine, then tighten flange nuts that secure engine to engine base.

4. Connect electrical connections to engine (Fig. 15):

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

   B. Install cap screw and lock washer to connect ground wire to engine.

   C. Connect wiring harness to interlock module.

5. Reconnect and adjust throttle cable (See Throttle Cable Adjustment). Make sure that throttle cable clamp is correctly positioned on engine base (Fig. 17).

6. Refill transmission to proper fluid level (See Check Gearbox Fluid in the General Information section of Chapter 4 – Traction and Reel Drive Systems).

7. Check and adjust engine oil level as needed (See Checking Engine Oil Level).

8. Open fuel shut–off valve and attach high tension lead to the spark plug before starting engine.

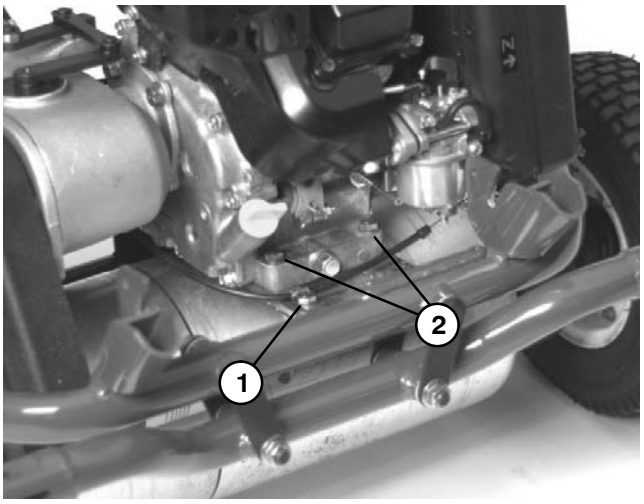


Figure 17

1. Throttle cable clamp **2. Engine mounting screws**

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 qt (2.78 l)
Differential	Integral in gearbox assembly
Brake	Band drum (in gearbox)
Traction Drum	Dual cast aluminum, 7.5 inch (19.1 cm) diameter
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

Check Gearbox Fluid

1. Park mower on its traction drum on a level surface. Make sure engine is OFF. Remove high tension lead from the spark plug.

NOTE: The gearbox is not vented. During operation, the case will develop 2–3 psi of pressure.

2. Remove the check/fill plug with o–ring from the right side of the gearbox assembly (Fig. 1). The fluid level should come to the bottom of the fill hole.

IMPORTANT: Use only the type of fluid specified. Other fluid types can cause gearbox damage or performance problems.

3. If fluid level is low, add enough of the proper fluid type (Dexron III Automatic Transmission Fluid or equivalent) until fluid level reaches the bottom of the fill hole.

4. Re–install check/fill plug with o–ring and torque plug to 240 in–lb (276 kg–cm).

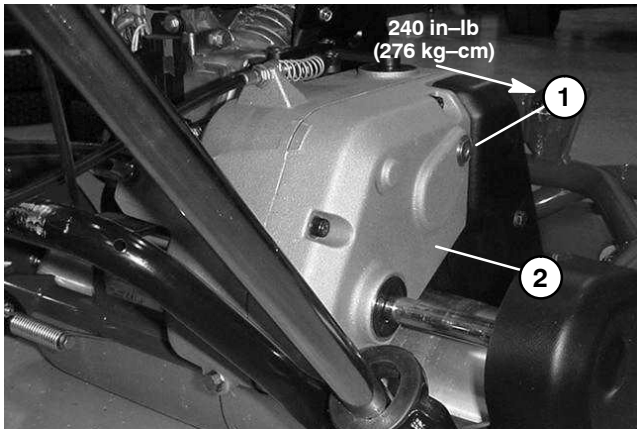


Figure 1

1. Check/fill plug
2. Gearbox assembly

Gearbox Seals

The Flex 21 uses 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.

Adjustments

Parking Brake Cable Adjustment

If parking brake slips when engaged, a cable adjustment is required. **Note:** parking brake is not designed to stop machine when the traction drive is engaged.

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

2. Move parking brake lever to the DISENGAGED position.

3. To increase cable tension, loosen front cable jam nut and tighten back cable jam nut until a force of 6 to 9 lbs (13 to 22 N) is required to engage parking brake. The force should be measured at brake lever knob. **Do not over adjust or brake band may drag**.

4. Tighten front brake cable jam nut.

5. Check parking brake control operation.

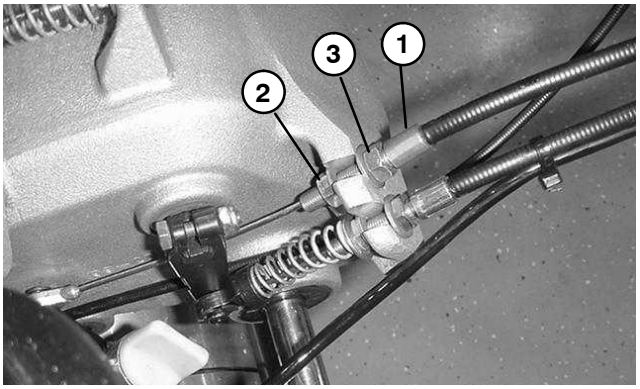


Figure 2

1. **Parking brake cable**
2. **Front cable jam nut**
3. **Back cable jam nut**

Traction Control Cable Adjustment

If traction control does not engage or it slips during operation, a cable adjustment is required.

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

2. Move traction control to NEUTRAL position.

3. To increase cable tension, loosen front cable jam nut and tighten back cable jam nut (Fig. 3) until a force of 12 to 16 lbs (54 to 72 N) is required to engage traction drive. The force should be measured at the control knob.

4. Tighten front traction cable jam nut.

5. Check traction control operation.

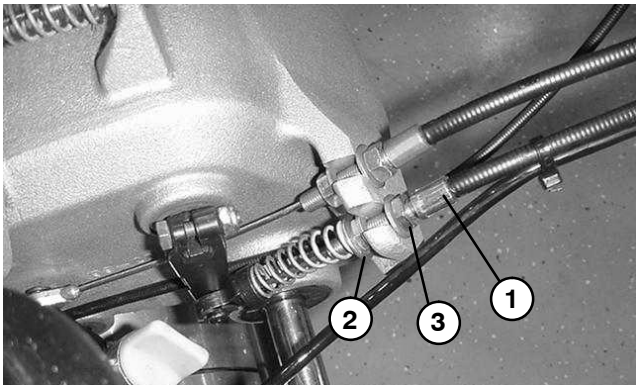


Figure 3

1. **Traction cable**
2. **Front cable jam nut**
3. **Back cable jam nut**

Reel Control Cable Adjustment

If reel control does not engage or it slips during operation, a cable adjustment is required.

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

2. Move reel and traction controls to DISENGAGED positions. Make sure that traction control is properly adjusted (see Traction Control Cable Adjustment).

3. The reel control cable force should increase the traction control force by 7 to 10 lb (32 to 45 N). The force should be measured at the control knob. For example, if the traction control force is 12 lb (54 N), the combined traction and reel force should be 19 to 22 lb (86 to 99 N).

4. To increase reel control cable tension, loosen front cable jam nut and tighten back cable jam nut (Fig. 4) until the proper adjustment is achieved.

5. Tighten front reel control cable jam nut.

6. Check reel control operation.

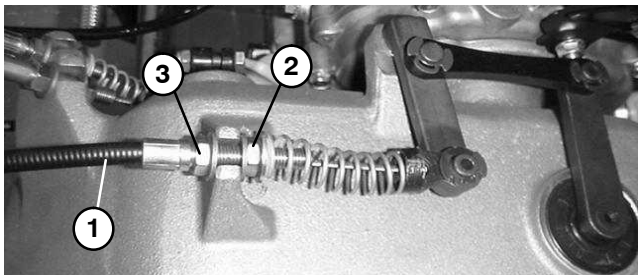


Figure 4

1. **Reel control cable**
2. **Front cable jam nut**
3. **Back cable jam nut**

Traction Drive Belt Adjustment

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

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

3. To check traction drive belt tension (procedure is identical for both sides of machine):

   A. Remove cap screw, flat washer, belt cover (Fig. 5), spacer (under cover), and flange nut (Fig. 7) to expose drive belt.

   B. Check belt tension by depressing belt at mid–span between the pulleys with 3 to 5 lbs (13 to 22 N) of force (Fig. 6). The belt should deflect 1/4 inch (6 mm).

   C. If deflection is correct, continue operation. If deflection is incorrect, proceed to next step.

4. To adjust traction drive belt tension:

   A. On back side of side plate, loosen cap screw that secures the idler bracket to the side plate (Fig. 7).

   B. With a 3/8 inch drive torque wrench, pivot the idler pulley against the backside of the belt from 35 to 40 in–lb (40 to 46 kg–cm). **Do not over tension belt.** Hold idler assembly with the torque wrench and tighten idler bracket cap screw to lock adjustment (Fig. 6).

   C. Recheck belt tension deflection.

5. Reinstall belt cover by placing the cover with spacer in position and securing with cap screw, washer, and flange nut. Tighten cap screw to 100 in–lb (114 kg–cm). Check that wheel shaft seal position is correct after cover is installed (Fig. 5).

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

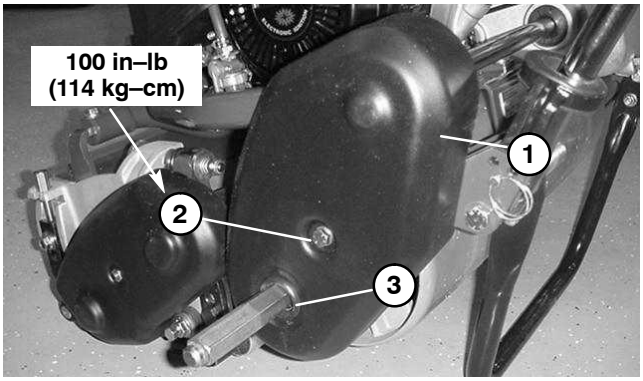


Figure 5

1. Drive belt cover (LH)
2. Cap screw and washer
3. Wheel shaft seal

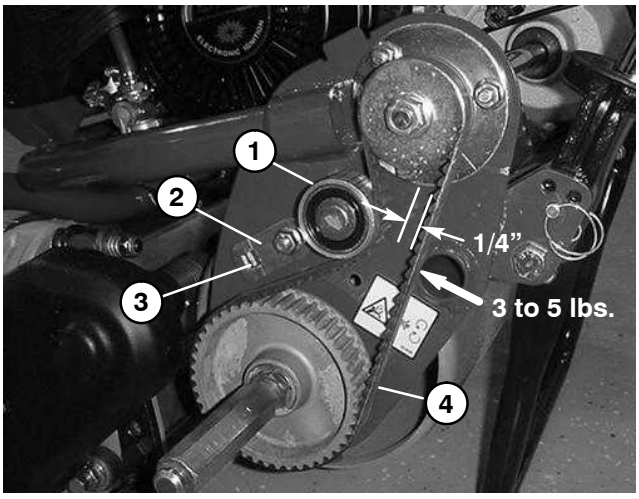


Figure 6

1. Idler pulley
2. Idler bracket
3. Torque wrench position
4. Drive belt

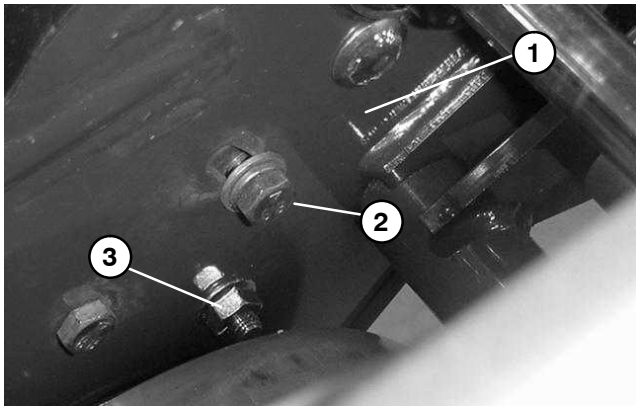


Figure 7

1. Side plate (backside)
2. Idler bracket cap screw
3. Belt cover flange nut

Reel Drive Belt Adjustment

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

2. To check reel drive belt tension:

   A. Remove flange nut and belt cover (Fig.8) to expose drive belt.

   B. Check belt tension by depressing belt at mid span between the pulleys with 3 to 5 lbs (13 to 22 N) of force (Fig. 9). The belt should deflect 1/4 inch (6 mm).

   C. If deflection is correct, continue operation. If deflection is incorrect, proceed to next step.

3. To adjust reel drive belt tension:

   A. Loosen the two bearing housing mounting nuts (Fig. 9).

   B. With a 3/8 in. drive torque wrench, pivot the bearing housing from 35 to 40 in–lb (40 to 46 kg–cm) to set belt tension (Fig. 10). **Do not over tension belt.** Hold bearing housing with the torque wrench and tighten bearing housing nuts to lock adjustment.

   C. Recheck belt tension deflection.

4. Place belt cover in position and secure with flange nut.

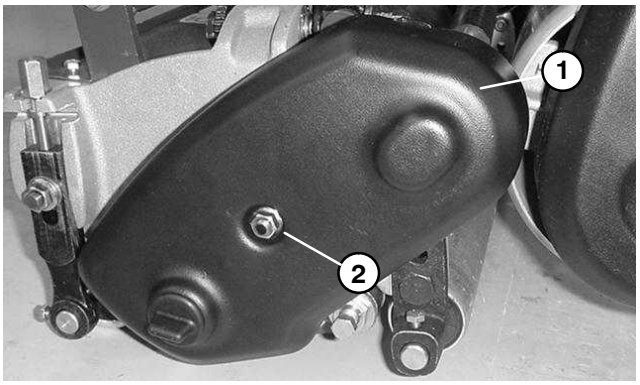


Figure 8

1. **Reel drive belt cover** 2. **Flange nut**

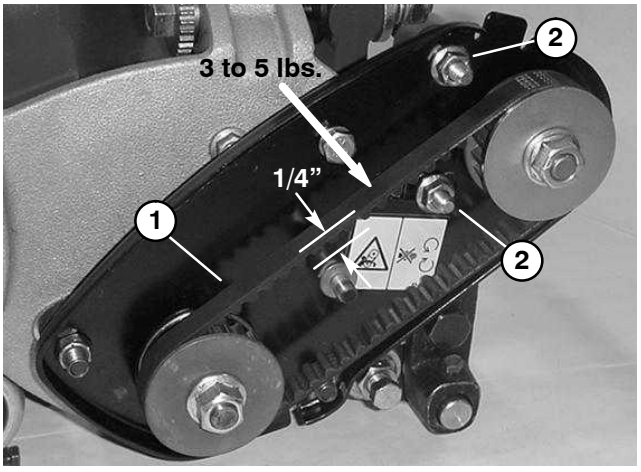


Figure 9

1. **Reel drive belt** 2. **Bearing housing nuts**

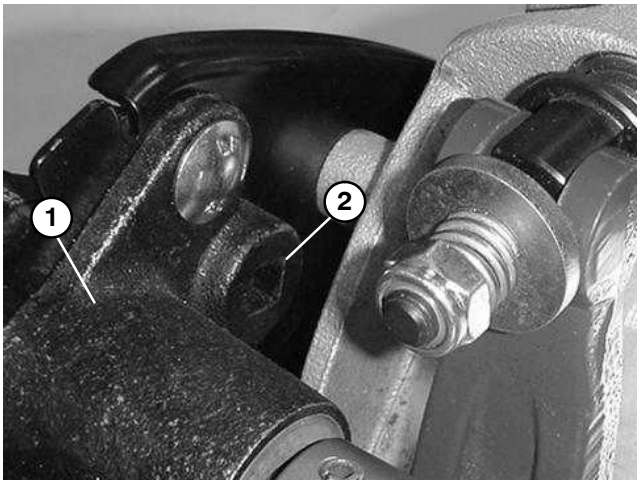


Figure 10

1. **Bearing housing** 2. **Torque wrench position**

Transmission Coupler Drive Belt Adjustment

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

2. To check transmission coupler drive belt tension:

   A. Remove cap screw, flat washer, belt cover (Fig. 11), spacer (under cover), and flange nut (Fig. 13) to expose drive belt.

   B. Check belt tension by depressing belt at mid span between the pulleys with 3 to 5 lbs (13 to 22 N) of force (Fig. 12). The belt should deflect 1/4 inch (6 mm).

   C. If deflection is correct, continue operation. If deflection is incorrect, proceed to next step.

3. To adjust drive belt tension:

   A. Loosen the two bearing housing mounting nuts (Fig. 12).

   B. With a 3/8 in. drive torque wrench, pivot the bearing housing from 35 to 40 in–lb (40 to 46 kg–cm) to set belt tension (Fig. 13). **Do not over tension belt.** Hold bearing housing with the torque wrench and tighten bearing housing mounting nuts to lock adjustment (Fig. 12).

   C. Recheck belt tension deflection.

   D. Reinstall belt cover by placing the cover with spacer in position and securing with cap screw, washer, and flange nut. Tighten cap screw to 100 in–lb (114 kg–cm).

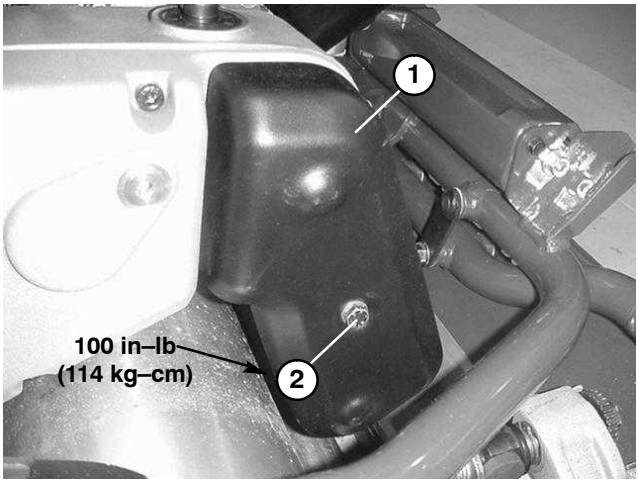


Figure 11

1. **Belt cover**
2. **Cap screw**

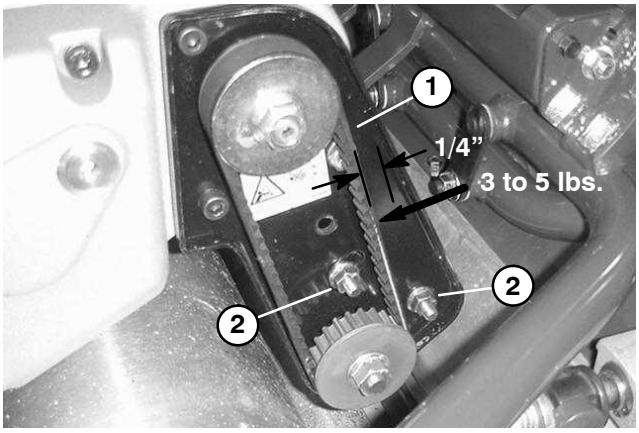


Figure 12

1. **Drive belt**
2. **Bearing housing nuts**

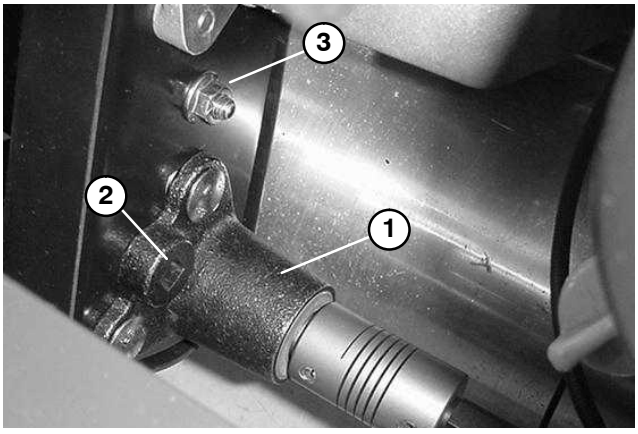


Figure 13

1. **Bearing housing**
2. **Torque wrench position**
3. **Belt cover flange nut**

Reel Drive and Transmission Coupler Belt Replacement (Fig. 14 and 15)

The Flex 21 uses two identical positive drive belts to operate the cutting unit. Replacement of these belts requires the same procedure.

Removal

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

2. Remove belt cover to expose appropriate drive belt: right side (Fig. 14) or left side (Fig. 15).

3. Loosen the two bearing housing mounting nuts.

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

Installation

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

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

3. Adjust drive belt tension (see Reel Drive Belt Adjustment in this section).

4. Reinstall belt cover.

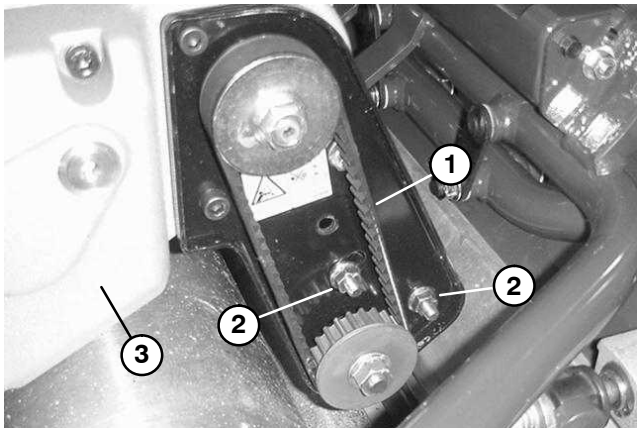


Figure 14

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

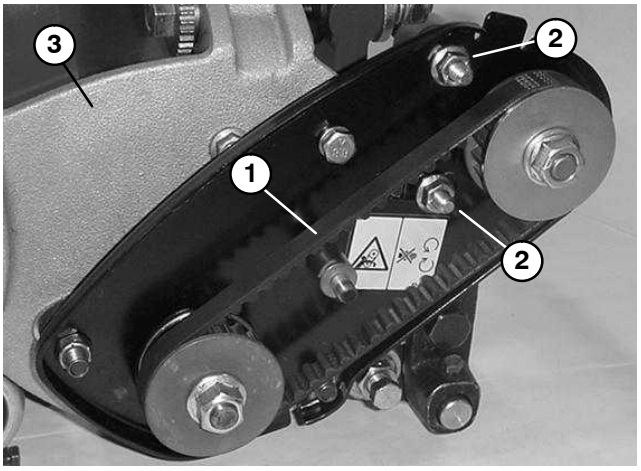


Figure 15

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

Reel Drive Assembly

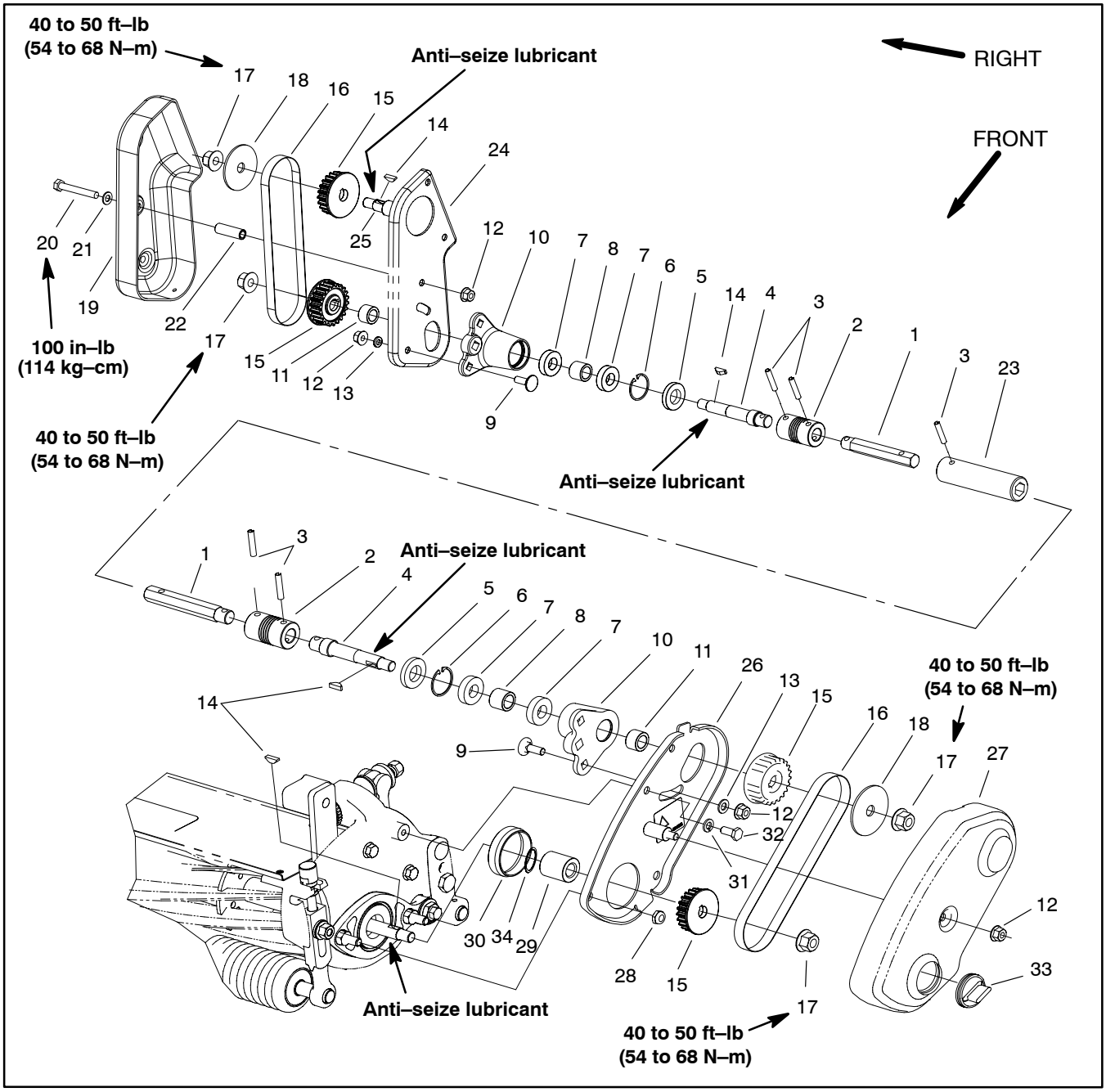


Figure 16

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

Reel Drive and Transmission Coupler Bearing Housing (Fig. 16)

Service of the reel drive bearing housings on either side of the Flex 21 requires similar procedures.

Removal

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead 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 Belt Replacement in this section).

4. Remove flange nut that secures pulley to the shaft (Fig. 17 and 19). Slide pulley from the shaft (pulley on left side of mower uses a pulley washer). 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: Do not mar outer surface of flex 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 retaining ring from housing.

3. Pull shaft, 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 grease. Also, pack rear cavity of oil seal with grease.

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

4. Install retaining ring and oil seal into housing.

5. Position coupler onto shaft and secure with new spring pin.

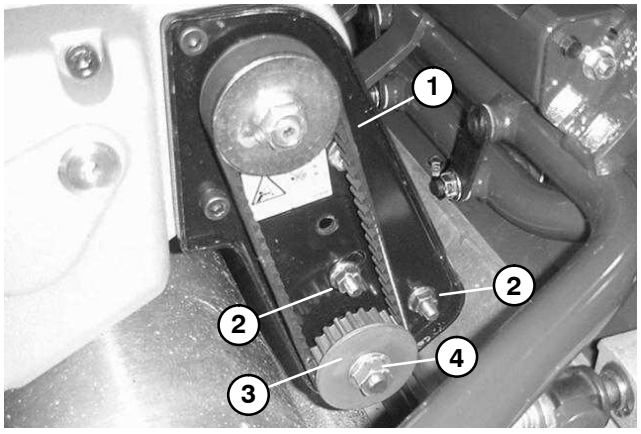


Figure 17

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

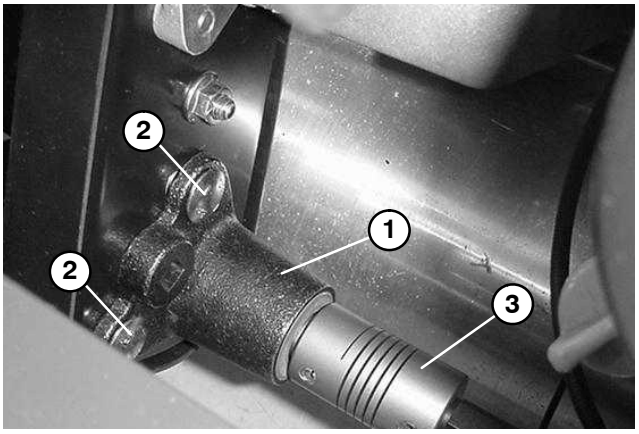


Figure 18

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

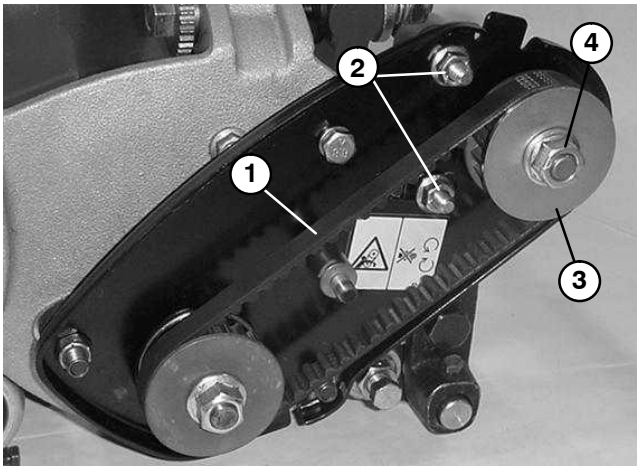


Figure 19

1. **LH reel drive belt**
2. **Flange nut/washer**
3. **Pulley with washer**
4. **Pulley flange nut**

Installation

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead 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 lock nuts and washers on carriage screws. Note: Do not tighten fasteners at this time.

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

5. Apply anti–seize 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.

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. Reinstall reel drive belt to the reel drive assembly and adjust belt (see Reel Drive Belt Replacement in this section). Make sure that bearing housing fasteners are securely tightened.

8. Install reel drive belt cover.

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

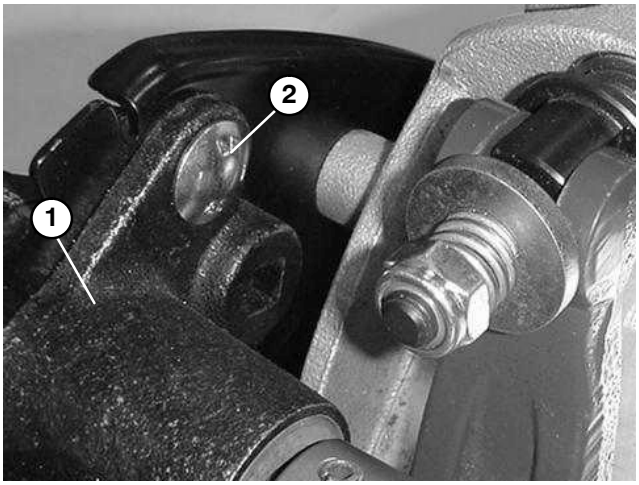


Figure 20

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

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Traction Drive Assembly

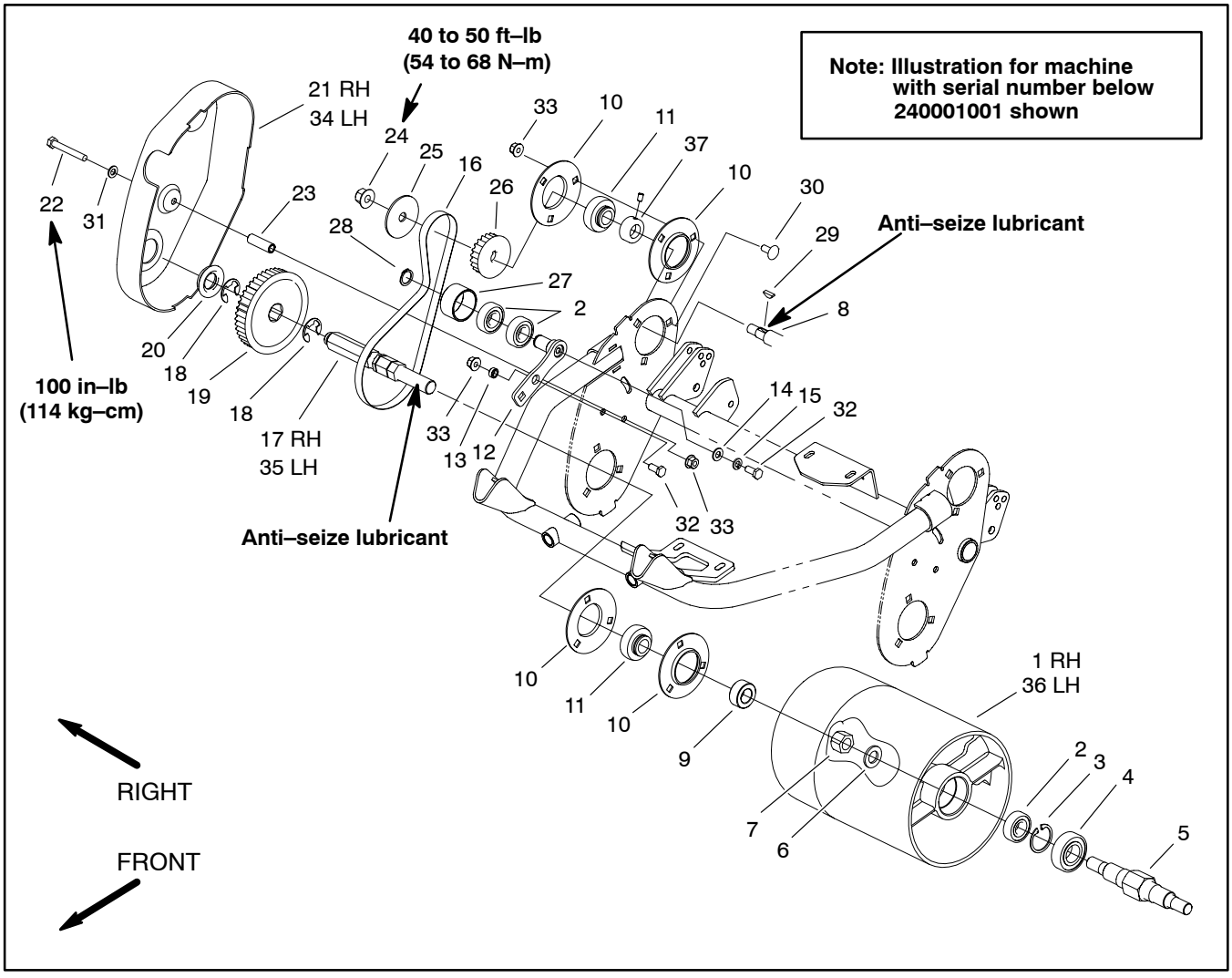

Figure 21

1. RH traction drum
2. Ball bearing
3. Retaining ring
4. Ball bearing
5. Drum spindle
6. Flat washer
7. Lock nut
8. Gearbox axle
9. Drum spacer
10. Flangette
11. Self aligning bearing
12. Idler
13. Idler arm spacer
14. Flat washer
15. Lock washer
16. Drum belt
17. RH hex shaft
18. Snap ring
19. Drum pulley
20. Drum cover seal
21. RH traction cover
22. Cap screw
23. Cover spacer
24. Flange nut
25. Pulley washer
26. Pulley (22 tooth)
27. Pulley sleeve
28. Retaining ring (early models)
29. Woodruff key
30. Carriage screw
31. Flat washer
32. Cap screw
33. Flange nut
34. LH traction cover
35. LH hex shaft
36. LH traction drum
37. Locking collar w/setscrew

NOTE: Parts on both sides of the mower frame are identical except as noted.

Traction Drive Belt Replacement

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

Removal

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

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

3. Remove cap screw, flat washer, belt cover, spacer (under cover), and flange nut (backside of side plate: Fig. 23) to expose the traction drive belt.

4. Loosen idler bracket cap screw on back of side plate (Fig. 23). Pivot the idler pulley away from the drive belt to loosen belt tension (Fig. 22).

5. Remove traction drive belt from both pulleys.

Installation

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

2. Place traction drive belt onto both pulleys.

3. Adjust traction drive belt tension (see Traction Drive Belt Adjustment in this chapter). Reinstall traction drive belt cover.

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

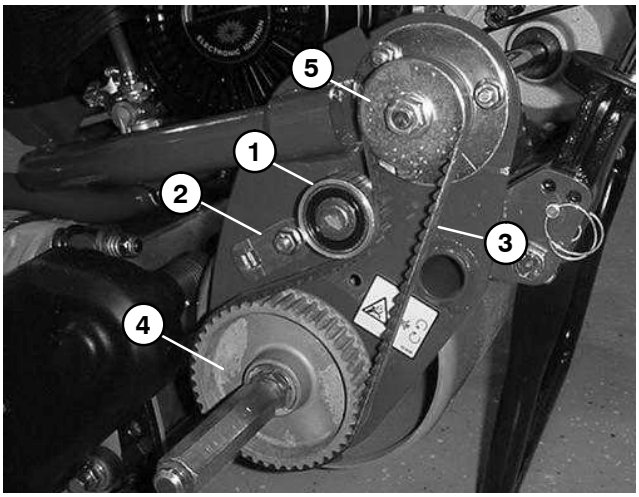

Figure 22

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

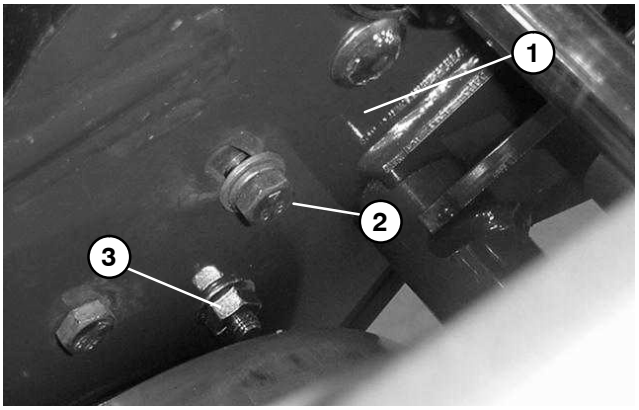

Figure 23

1. **Side plate**
2. **Idler bracket cap screw**
3. **Belt cover flange nut**

Traction Drive Idler Pulley and Bearings

Removal

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

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

3. Remove traction drive belt cover.

4. Remove cap screw, lock washer, and flat washer that positions the idler bracket to the side plate of the mower (Fig. 25).

5. Remove cap screw, spacer, and flange nut on which the idler assembly pivots (Figs. 24 and 25). Remove idler assembly.

6. If idler pulley or bearings require replacement:

   A. Remove and discard retaining ring (early models). Pull bearings and pulley from idler.

   B. Press bearings from pulley sleeve.

Installation

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

2. If idler pulley or bearings were removed:

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

   B. Install pulley assembly onto idler shaft pressing on inner bearing race. Secure with new retaining ring (early models).

3. Position idler assembly using cap screw, spacer, and flange nut (Figs. 24 and 25). Tighten flange nut. Check that idler assembly can pivot after tightening.

4. Install cap screw, lock washer, and flat washer that positions the idler bracket to the side plate of the mower (Fig. 25).

5. Adjust traction belt tension (see Traction Drive Belt Adjustment in this chapter). Reinstall drive belt cover.

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

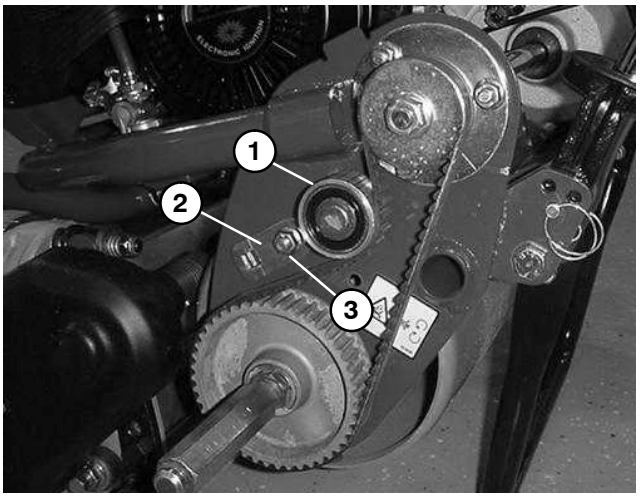

Figure 24

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

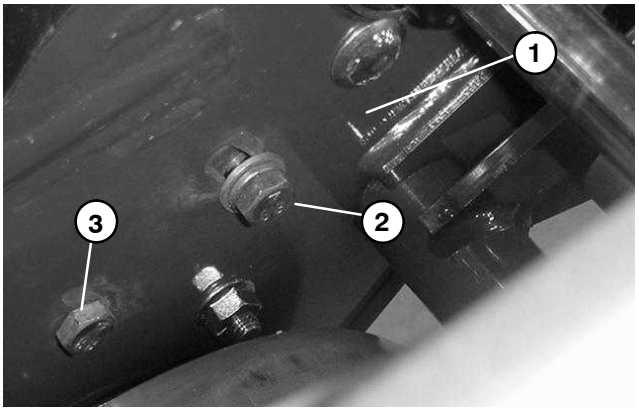

Figure 25

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

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Traction Drum Assembly (Serial Number Below 240001001)

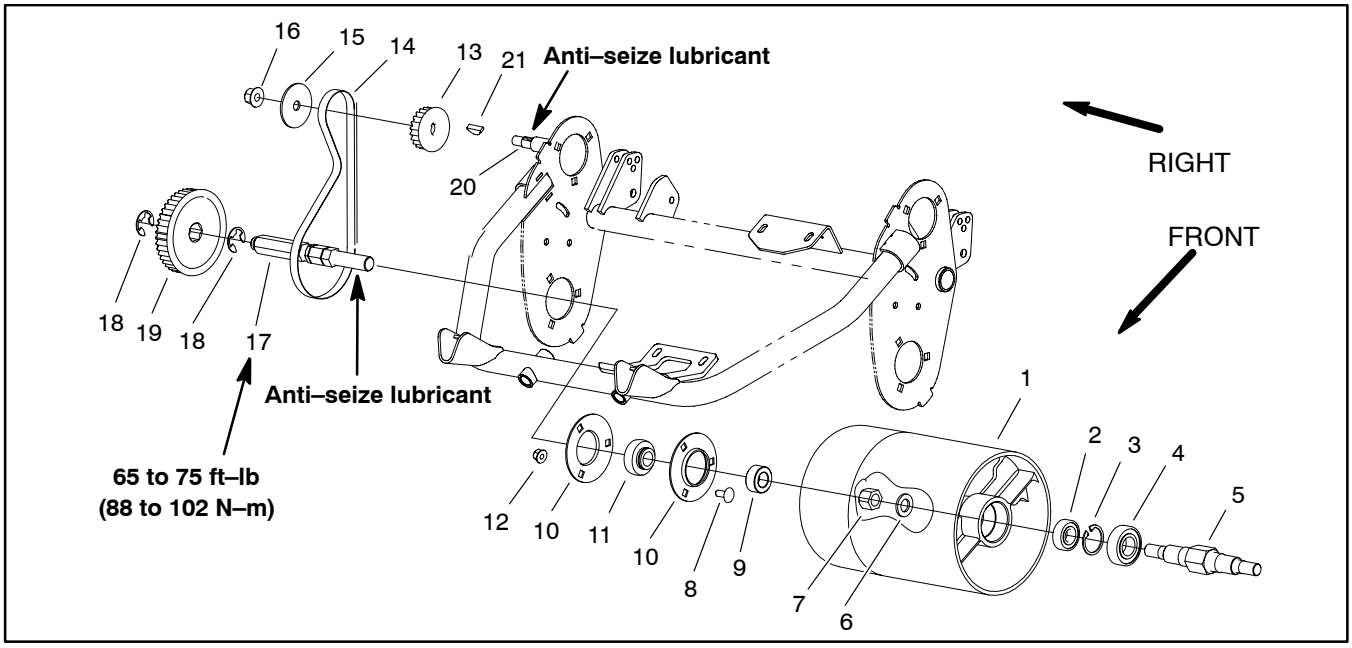

Figure 26

1. RH traction drum
2. Ball bearing
3. Retaining ring
4. Ball bearing
5. Drum spindle
6. Flat washer
7. Lock nut
8. Carriage screw
9. Drum spacer
10. Flangette
11. Self aligning bearing
12. Flange nut
13. Pulley (22 tooth)
14. Traction (drum) belt
15. Pulley washer
16. Flange nut
17. RH hex shaft
18. Snap ring
19. Drum pulley
20. Gearbox axle
21. Woodruff key

NOTE: Parts shown in the illustration are from the right side of the machine.

NOTE: See Traction Drum Assembly (Serial Number Above 240001000) in this section if newer drum assembly has been installed on machine with serial number below 240001001.

Removal

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

2. If installed, remove transport wheels (see 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).

NOTE: The left side hex shaft has left hand threads.

4. Insert bar stock or other suitable tool through spokes of drum to keep drum from turning. Unscrew both hex shafts from traction drum assembly. It is not necessary to remove drum pulley from hex shaft prior to shaft removal.

5. Locate and remove spacer from each side of drum assembly.

6. Remove drum assembly from the mower.

Disassembly

1. Remove lock nut and flat washer from one traction drum. Separate traction drums.

2. Use hex on drum spindle to hold spindle and remove lock nut and flat washer from remaining drum. Slide drum spindle out of the drum hub bearing.

3. Remove bearings from drum spindle.

4. Pull retaining ring and bearing from each drum.

Assembly

1. Press bearing (item 2) into both drum hubs by applying pressure to outer bearing race. Install retaining ring into groove in each drum.

2. Press second drum bearings (item 4) onto the drum spindle by applying pressure to inner bearing race.

3. Apply grease liberally to bearings on spindle to provide a grease pack between the bearings once the spindle is installed in the traction drum. Slide spindle into the hub in one traction drum.

4. Use hex on drum spindle to hold spindle and then secure spindle to the traction drum with flat washer and lock nut.

5. Slide remaining drum onto spindle and secure with flat washer and lock nut.

Installation

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

2. Pivot mower back and position drum assembly under the mower. Pivot mower back down.

3. Position drum spacers on sides of drum.

NOTE: The left side hex shaft and drum assembly have left hand threads.

4. Apply anti–seize lubricant to hex shaft threads and install shafts through bearings, spacers and into drum. Insert bar stock or other suitable tool through spokes of drum to keep drum from turning. Torque hex shafts from 65 to 75 ft–lb (88 to 102 N–m).

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

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

Traction Drum Assembly (Serial Number Above 240001000)

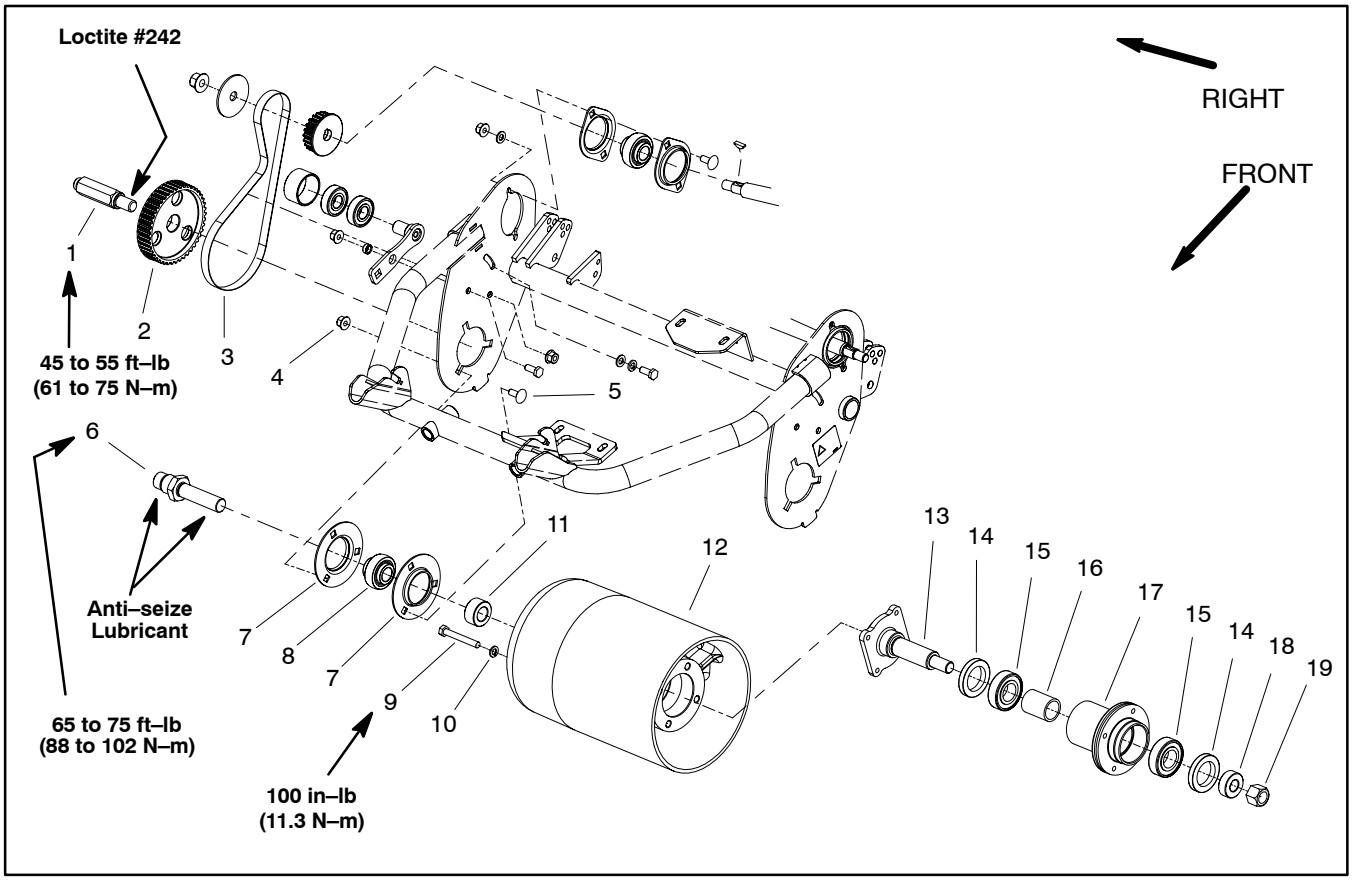

Figure 27

1. Transport wheel shaft (RH shown)
2. Drum pulley (RH shown)
3. Traction (drum) belt
4. Flange nut (3 used per side)
5. Carriage screw (3 used per side)
6. Drum shaft
7. Bearing flangette
8. Extended race bearing
9. Cap screw (4 used per side)
10. Lock washer (4 used per side)
11. Drum spacer
12. Traction drum (RH shown)
13. Drum spindle
14. Seal
15. Ball bearing
16. Bearing spacer
17. Drum hub
18. Seal ride spacer
19. Lock nut

NOTE: Components shown in the Figure 27 are from the right side of the machine.

Traction Drum Removal (Fig. 27)

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

2. If installed, remove transport wheels (see 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 that secure bearings (item 8) to drum shafts.

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

NOTE: The right side wheel shaft has left hand threads (Fig. 29).

6. Loosen and remove both transport wheel shafts (item 1).

NOTE: The left side drum pulley has left hand threads (Fig. 29).

7. Loosen and remove both drum pulleys (item 2).

NOTE: The left side drum shaft has left hand threads (Fig. 29).

8. Unscrew both drum shafts (item 6) from traction drum assembly.

9. Locate and remove drum spacer (item 11) from each side of traction drum assembly.

10. Remove traction drum assembly from the mower.

11. If necessary, remove bearing flangettes (item 7) and bearings (item 8) from machine frame.

Traction Drum Disassembly (Fig. 27)

1. Remove four (4) cap screws (item 9) and lock washers (item 10) that secure each traction drum to drum hub/spindle assembly. Separate traction drums from hub/spindle assembly.

2. Retain drum spindle (item 13) to prevent it from turning and remove lock nut (item 19). Carefully slide drum spindle from the drum hub assembly.

3. Remove seal ride spacer (item 18), seals (item 14), bearings (item 15) and bearing spacer (item 16) from drum hub.

Traction Drum Assembly (Fig. 27)

1. Assemble hub/spindle assembly (Fig. 28):

   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 grease. 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 grease. Fill cavity in hub between bearings and seal positions with grease.

   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. 27)

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

2. If removed, loosely install bearings (item 8) and bearing flangettes (item 7) to machine frame. Make sure that extended race of bearings is positioned to the outside of the frame.

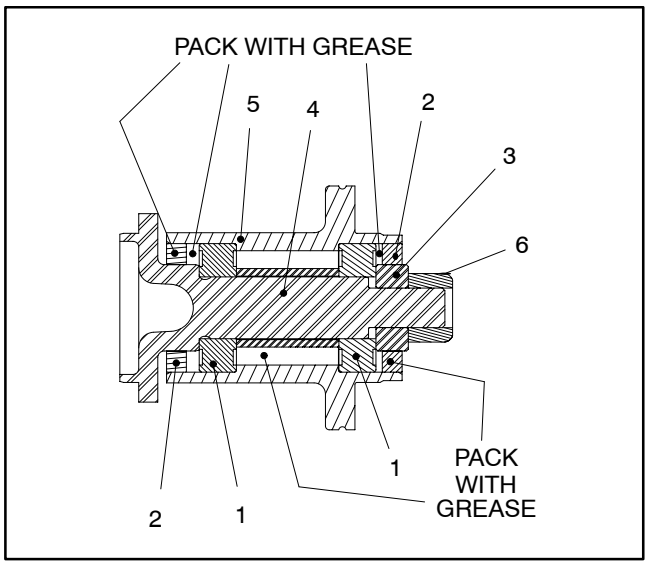

Figure 28

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

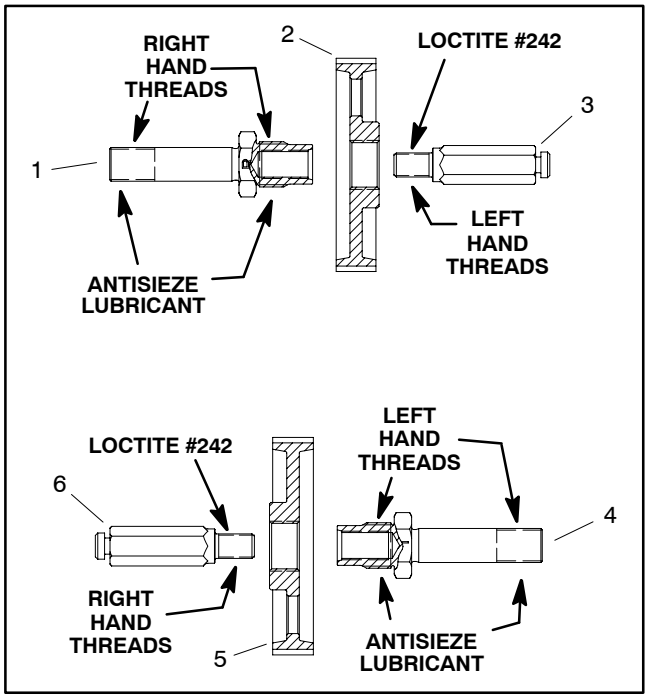

Figure 29

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

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

4. Position drum spacers on 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. 29).

6. Apply anti–seize lubricant to drum shaft (item 6) threads and install shafts through bearings, spacers and into drum. Torque drum shafts from 65 to 75 ft–lb (88 to 102 N–m).

7. Tighten the fasteners that secure the bearing flangettes (item 7) to the machine frame. Tighten the bearing set screw to secure the bearings to the drum shafts. 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. 29).

8. Apply anti–seize lubricant to the external threads of the drum shafts. Secure both drum pulleys (item 2) to the drum shafts.

NOTE: The right side wheel shaft has left hand threads (Fig. 29).

9. Apply Loctite #242 (or equivalent) to the threads of the transport wheel shafts (item 1). 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 transport wheels if they were attached (see Wheels in the Service and Repairs section of Chapter 6 – Chassis and Controls).

Change Gearbox Fluid

The gearbox fluid should be changed after the first 50 hours of operation and every 2 years of operation thereafter.

1. Park mower with engine OFF. Remove high tension lead from the spark plug.

2. Place a drain pan at the rear of the mower.

3. Remove the drain plug from the rear of the gearbox assembly (Fig. 30).

4. Push down on the handle and tip the machine back. Remove the check/fill plug with O–ring from the right side of the gearbox (Fig. 30).

5. Allow the gearbox fluid to drain completely. When drained, install drain plug. Torque drain plug from 85 to 105 in–lb (97 to 124 kg–cm).

6. Make sure that mower is on its traction drum on a level surface.

IMPORTANT: Use only the type of fluid specified. Other fluid types can cause gearbox damage or performance problems.

7. Fill the gearbox with approximately 2.9 qt (2.78 l) of the proper fluid (Dexron III Automatic Transmission Fluid or equivalent) until the level reaches the bottom of the check/fill hole (see Check Gearbox Fluid).

8. Install the check/fill plug with O–ring and torque plug to 240 in–lb (276 kg–cm).

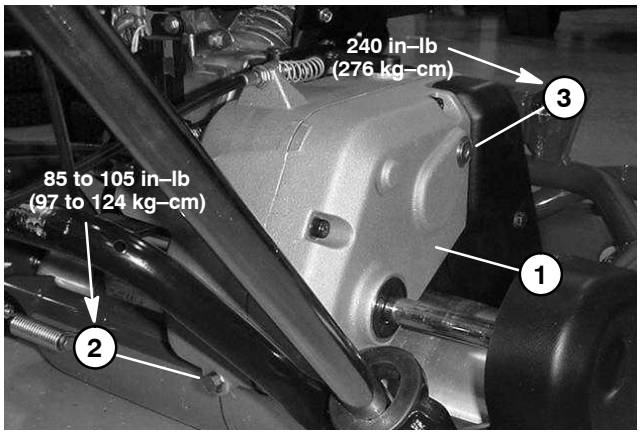

Figure 30

1. Gearbox assembly
2. Drain plug
3. Check/fill plug

Gearbox (Serial Number Below 240001001)

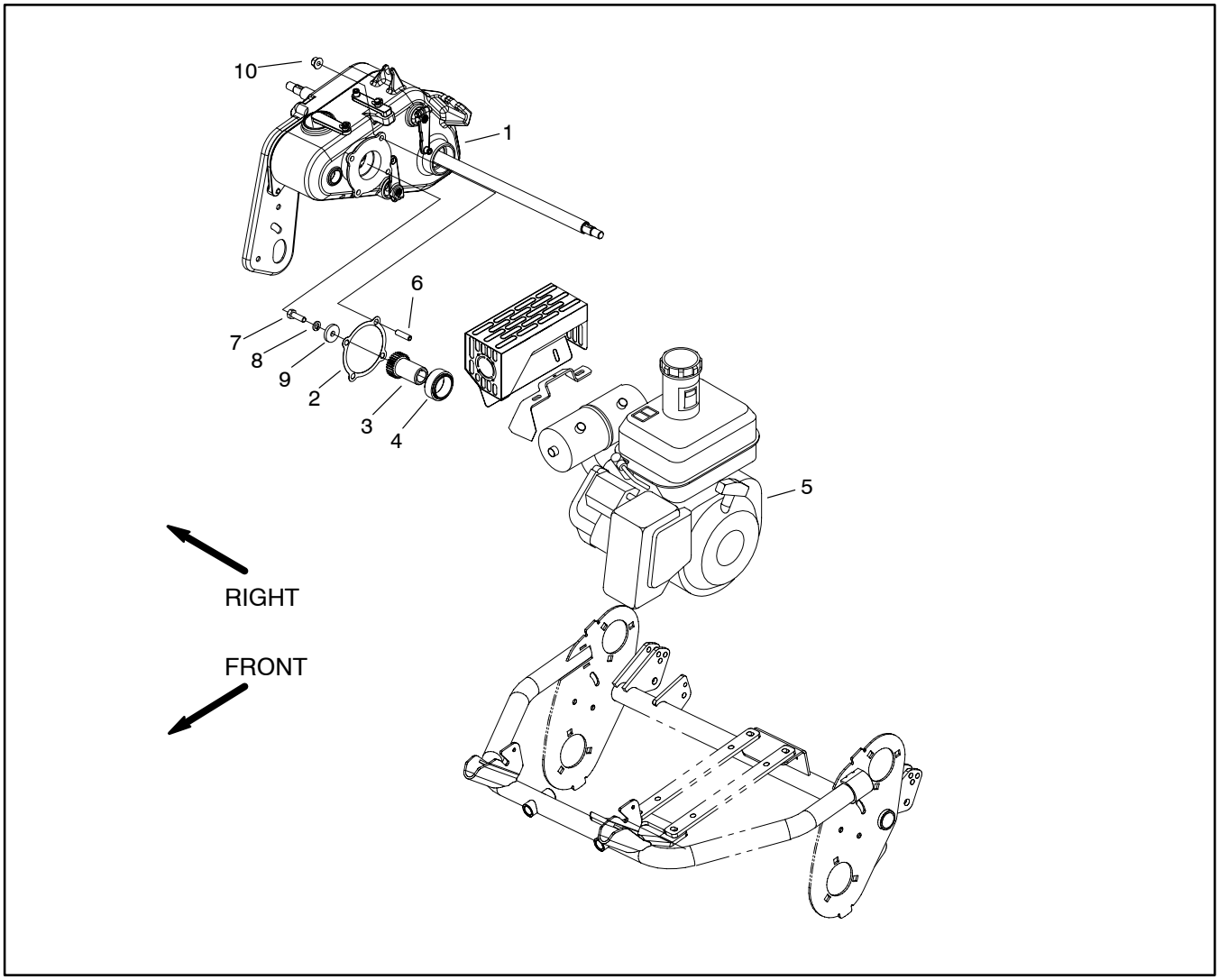

Figure 31

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

Gearbox Removal

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

2. Drain oil from gearbox assembly (see Change Gearbox Fluid in this section).

3. Remove traction control and reel control cables from gearbox (see Control Cable Replacement in the Service and Repairs section of Chapter 6 – Chassis and Controls).

4. If installed, remove transport wheels (see 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. 32) on both sides of mower. Remove pulley washer, pulley and woodruff key from both sides.

7. Unlock self aligning bearing collars on differential axle shafts (Fig. 33):

A. Loosen setscrew on locking collar.

B. Using setscrew hole as an impact point, unlock collar by striking it with a punch in the opposite direction of shaft rotation (Fig. 34).

C. Slide locking collar toward gearbox.

D. Remove carriage bolts and flange nuts that retain bearing flangettes to frame. Slide flangettes and self aligning bearings from gearbox axles.

8. Loosen and remove four flange nuts that secure gearbox to engine (Fig. 35).

9. Move gearbox away from the engine to allow removal of parking brake lever (with cable attached) from brake shaft of gearbox. Loosen locknut 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.

10. 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 angle gearbox assembly and slide right side axle from frame to complete gearbox removal.

11. Slide locking collars from axle shafts.

12. 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 high tension lead from the spark plug.

2. Place new flange gasket on four setscrews installed in engine mounting flange.

3. Position locking collars on gearbox 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 onto 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 setscrews. Install and tighten four flange nuts that secure gearbox to engine (Fig 35).

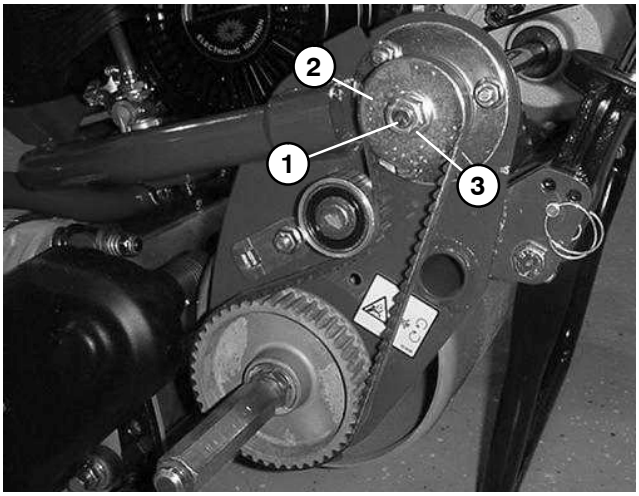

Figure 32

1. Gearbox axle
2. Pulley washer
3. Flange nut

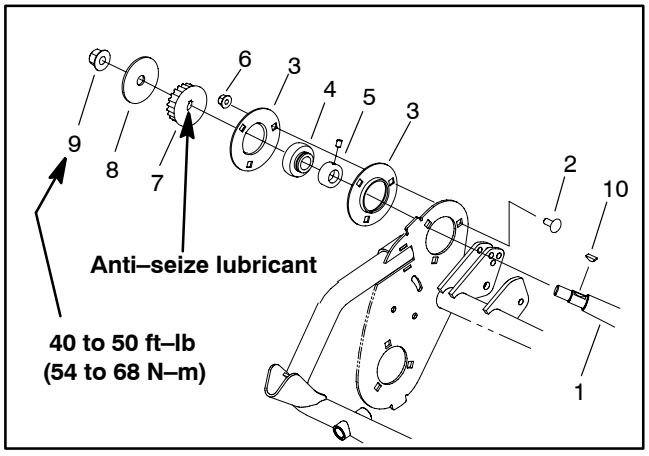

Figure 33

1. Gearbox axle
2. Carriage bolt
3. Bearing flangette
4. Self aligning bearing
5. Locking collar/setscrew
6. Flange nut
7. Pulley
8. Pulley washer
9. Flange nut
10. Woodruff key

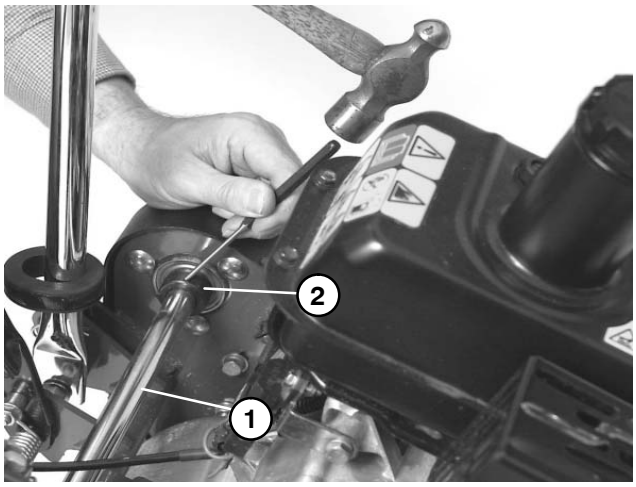

Figure 34

1. Gearbox axle (LH)
2. Locking collar (loosen)

7. Slide self aligning bearings and bearing flangettes onto gearbox axles. Install carriage bolts and flange nuts that retain flangettes to frame.

8. Install locking collars to self aligning bearings (Fig. 33):

A. Slide locking collars to self aligning bearings.

B. Lock collars by striking with a punch in the direction of shaft rotation (Fig. 36).

C. Tighten setscrew to fix bearing to axle.

D. Check bearing alignment by rotating the long differential drive shaft. Shaft should rotate easily if alignment is correct. If necessary, readjust position of bearings and locking collars.

9. Apply anti–seize lubricant to bores of traction drive pulleys. Install woodruff keys and place traction drive pulleys onto gearbox axles (Fig. 32). Secure pulleys to axles with pulley washers and flange nuts. Torque flange nuts from 40 to 50 ft–lb (54 to 68 N–m).

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

11. Refill gearbox with proper amount of fluid (see Change Gearbox Fluid in this section).

12. Install traction control and reel control cables to gearbox (see Cable Replacement in the Service and Repairs section of Chapter 6 – Chassis and Controls).

13. Adjust control cables (traction, reel and parking brake) as needed (see Control Cable Adjustment in this chapter).

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

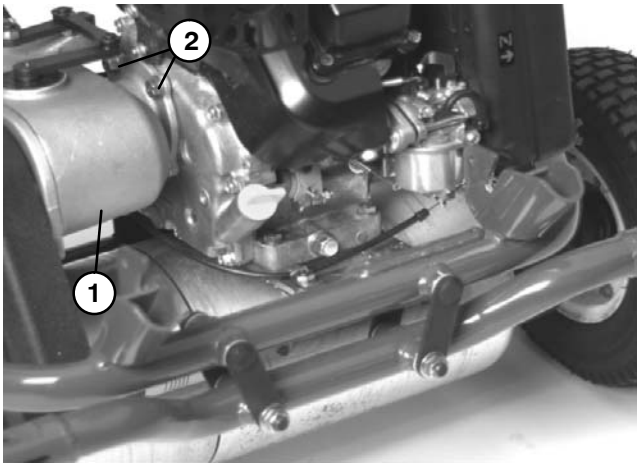

Figure 35

1. Gearbox **2. Flange nut**

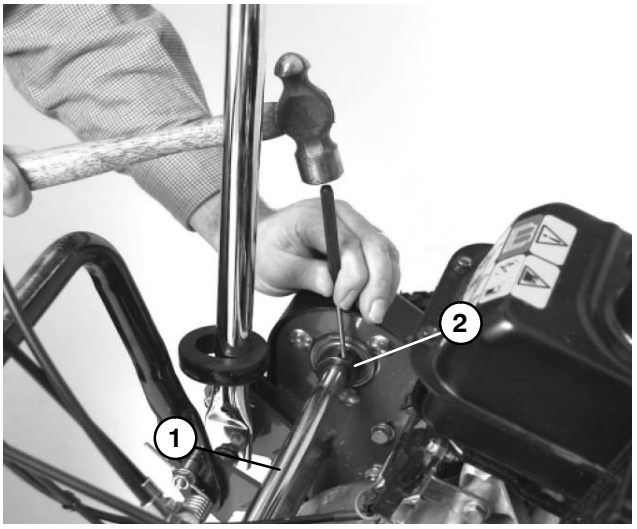

Figure 36

1. Gearbox axle (LH) **2. Locking collar (tighten)**

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Gearbox (Serial Number Above 240001000)

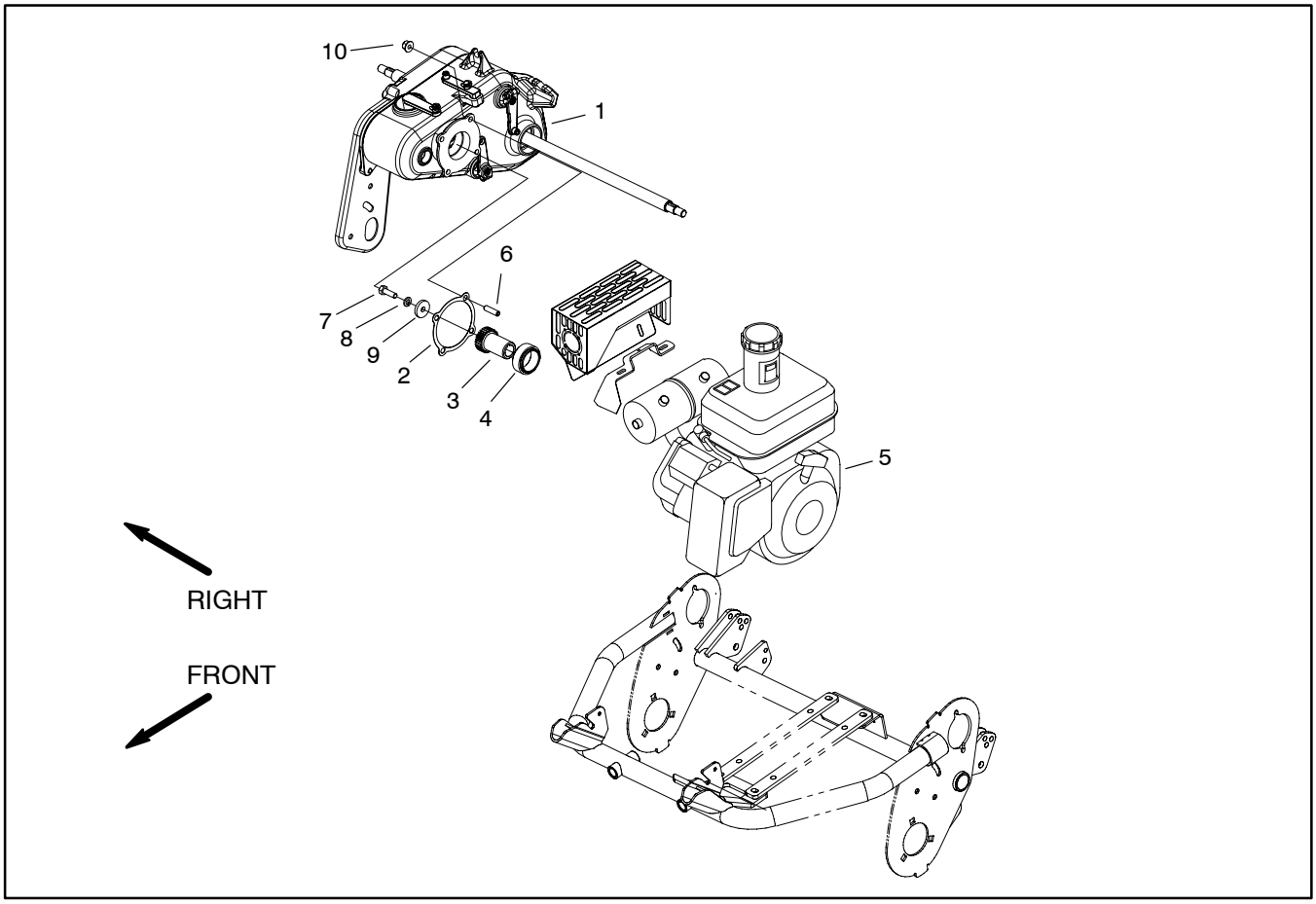


Figure 37

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

Gearbox Removal

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

2. Drain oil from gearbox assembly (see Change Gearbox Fluid in this section).

3. Remove traction control and reel control cables from gearbox (see Control Cable Replacement in the Service and Repairs section of Chapter 6 – Chassis and Controls).

4. If installed, remove transport wheels (see 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. 38) on both sides of mower. Remove pulley washer, pulley and woodruff key from both sides.

7. Loosen set screws that secure extended race bearings to gearbox axles (Fig. 38).

8. Remove carriage bolts, flange nuts and flat washers that retain bearing flangettes to frame (Fig. 38). Slide flangettes and bearings toward gearbox.

9. Loosen and remove four flange nuts that secure gearbox to engine (Fig. 39).

10. Move gearbox away from the engine to allow removal of parking brake lever (with cable attached) from brake shaft of gearbox. Loosen locknut 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 angle gearbox assembly and slide right side axle from frame to complete gearbox removal.

12. Slide bearings and bearing flangettes from 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 high tension lead from the spark plug.

2. Place new flange gasket on four setscrews installed in engine mounting flange.

3. Slide bearings and bearing flangettes on gearbox axles. Make sure that extended race of bearings is positioned toward outside of mower.

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 onto 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 setscrews. Install and tighten four flange nuts that secure gearbox to engine (Fig 39).

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 differential drive 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 anti–seize lubricant to bores of traction drive pulleys. Install woodruff keys and place traction drive pulleys onto gearbox axles (Fig. 38). Secure pulleys to axles with pulley washers and flange nuts. Torque flange nuts from 40 to 50 ft–lb (54 to 68 N–m).

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

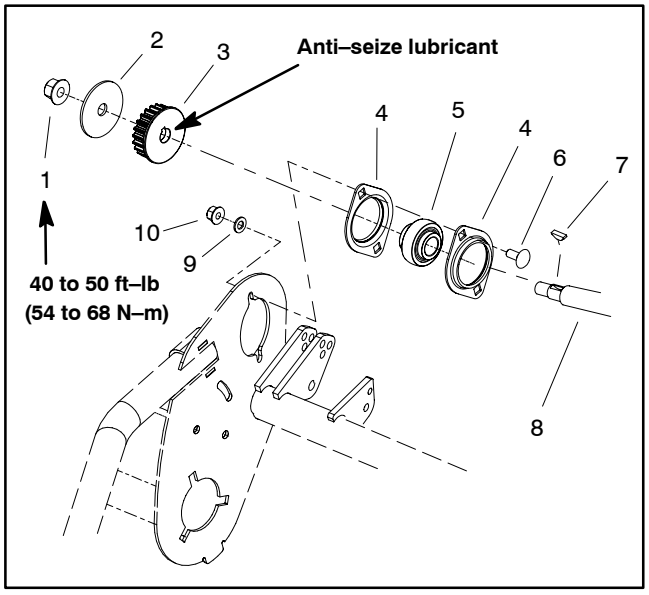


Figure 38

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

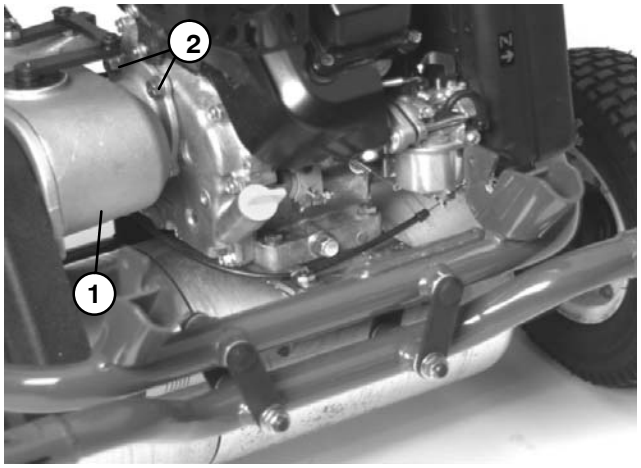


Figure 39

1. Gearbox
2. Flange nut

12. Refill gearbox with proper amount of fluid (see Change Gearbox Fluid in this section).

13. Install traction control and reel control cables to gearbox (see Cable Replacement in the Service and Repairs section of Chapter 6 – Chassis and Controls).

14. Adjust control cables (traction, reel and parking brake) as needed (see Control Cable Adjustment in this chapter).

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

Gearbox Assembly

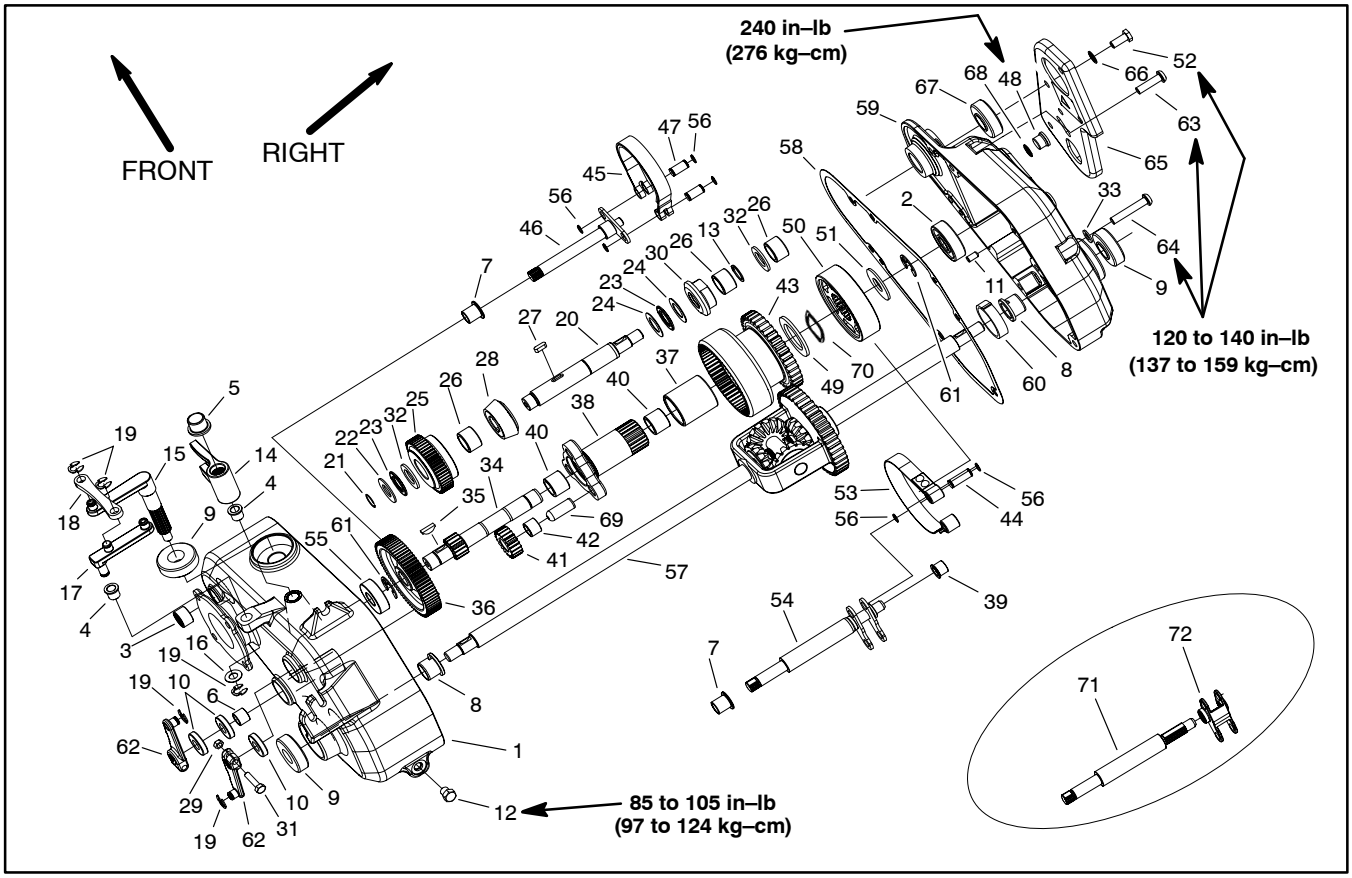


Figure 40

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
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
30. Plunger hub
31. Cap screw
32. Thrust washer
33. Flat washer
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
42. Roller bearing
43. Ring gear
44. Clevis pin
45. Brake band
46. Brake shaft
47. Clevis pin
48. Hollow hex plug
49. Thrust washer
50. Traction drum assembly
51. Thrust washer
52. Cap screw
53. Traction band assembly
54. Traction shaft (SN below 230000001)
55. Ball bearing
56. Retaining ring
57. Differential assembly (traction drive)
58. Gasket
59. Gearbox cover
60. Keyed bushing
61. E–ring
62. Gearbox lever
63. Socket head screw
64. Socket head screw
65. Drive shaft plate assembly
66. Internal lock washer
67. Oil seal (red/orange color)
68. O–ring
69. Dowel pin
70. Wave washer (if equipped)
71. Traction shaft (SN above 230000000)
72. Hub (SN above 230000000)

NOTE: 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, if necessary. Service to the differential, bushings and bearings requires removal of the gearbox from the traction unit.

Gearbox Disassembly (Fig. 40)

1. Clean outside of the gearbox assembly.

2. Remove reel drive assembly from gearbox (Fig. 41):

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

   B. Remove reel drive belt (see Reel Drive Belt Replacement).

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

3. Pull drive shaft plate from gearbox after removing three fasteners: two socket head screws and one cap screw with lockwasher.

4. Remove any burrs from axle and clutch shafts.

5. Loosen locknut 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.

6. Loosen and remove four remaining socket head screws and washers that secure gearbox cover to base.

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

7. 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. 42). Remove and discard gasket.

8. Carefully remove traction shaft from the gearbox taking care not to distort traction band (Fig. 43). **Note:** If gearbox is still attached to engine, traction lever on engine side of gearbox will have to be loosened and removed as traction shaft is pulled from gearbox.

9. Slide differential assembly from gearbox (Fig. 43).

10. Pull planetary assembly (with parking brake assembly) from gearbox (Fig. 43). **Note:** Parking brake lever will need to be removed if still attached to brake shaft. Use Figure 44 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. 43). Remove link.

12. Rotate clutch fork shaft to allow removal of reel drive clutch shaft assembly from gearbox base (Fig. 43). Use Figure 45 as a guide to remove components from clutch shaft.

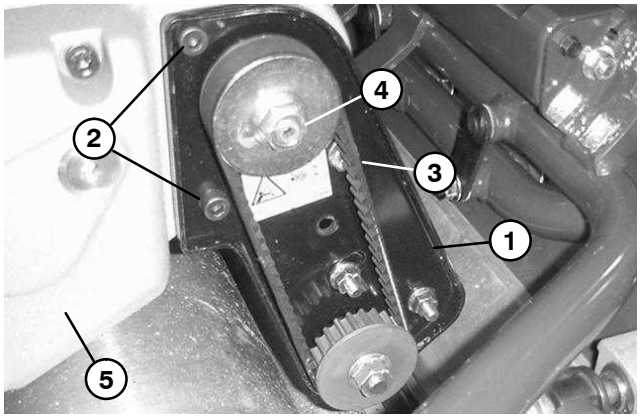


Figure 41

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

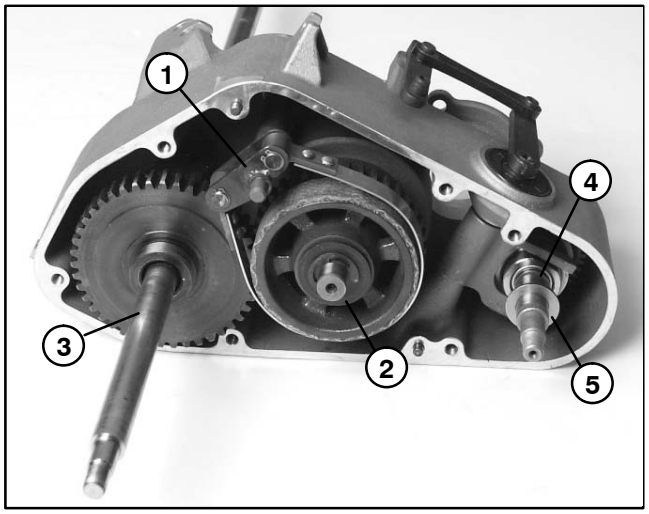


Figure 42

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

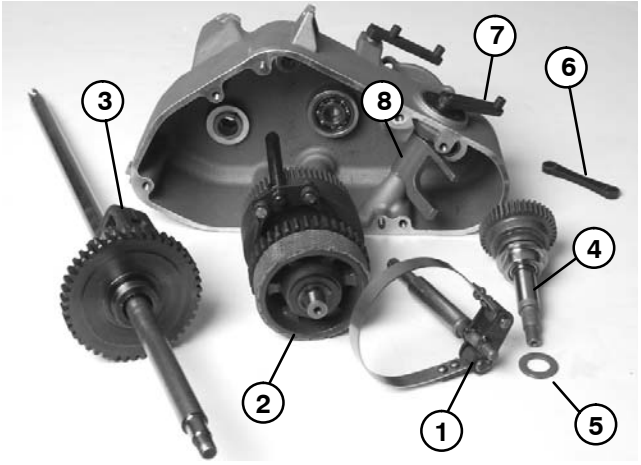


Figure 43

1. **Traction shaft with band**
2. **Planetary assembly**
3. **Differential assembly**
4. **Reel drive clutch shaft**
5. **Clutch thrust washer**
6. **Link**
7. **Clutch fork shaft**
8. **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. 46.

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 seal removal tool and alternately tighten cap screws to pull seal out of gearbox. Discard removed seals.

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

14. Carefully inspect all internal gears, shafts, washers, bushings and bearings. Replace any worn, chipped, bent or cracked parts.

Gearbox Assembly (Fig. 40)

1. Replace any removed oil seal, bushing or bearing in either the gearbox cover or 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, closed end of bearing should be flush with outside of gearbox base after installation.

2. Thoroughly apply grease to lip seals in both the gearbox base and cover.

3. If clutch shaft was disassembled, use Figure 45 as a guide to install components to clutch shaft. Rotate clutch fork to allow clutch shaft assembly to be positioned into gearbox base. Place thrust washer on cover end of shaft.

4. Place link to fork shaft and bellcrank. Secure link with two retaining rings.

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

6. If disassembled, use Figure 44 as a guide to install components to planetary assembly. If input gear was removed, install with shallow web casting toward sun gear. Install planetary assembly (with brake band installed) into gearbox engaging gears of differential assembly. **Note:** 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.

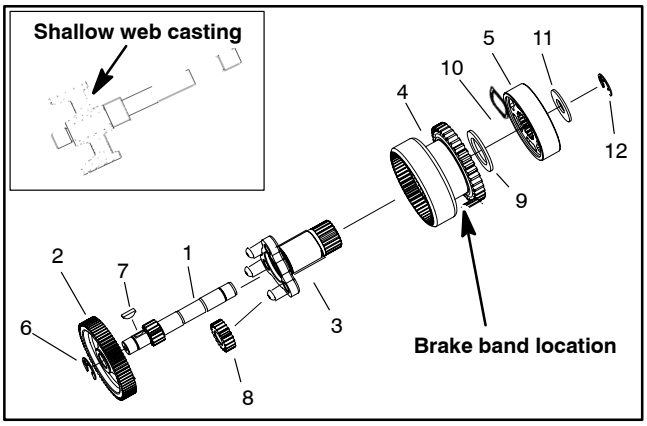
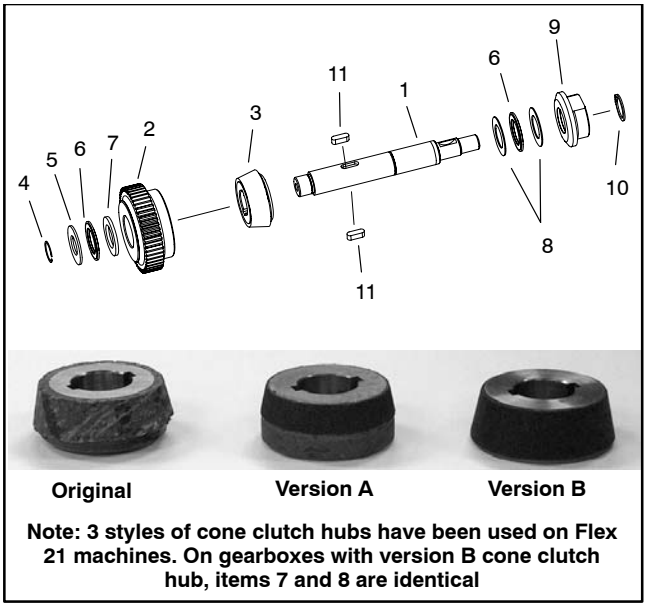


Figure 44

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 (if used)**
11. **Thrust washer**
12. **E–ring**



Note: 3 styles of cone clutch hubs have been used on Flex 21 machines. On gearboxes with version B cone clutch hub, items 7 and 8 are identical

Figure 45

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 (thick)**
8. **Thrust washer (thin)**
9. **Plunger hub/bearing**
10. **Snap ring**
11. **Square key (2 used)**

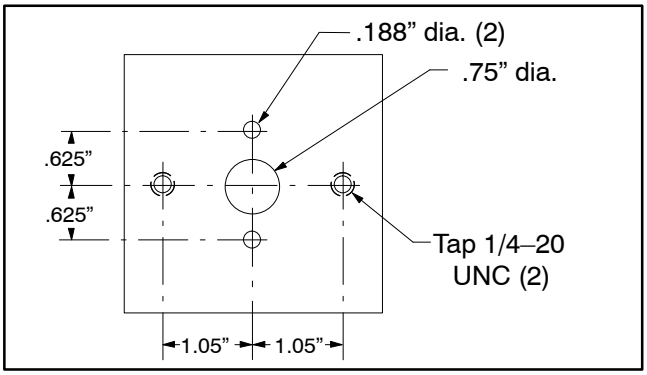


Figure 46

7. If traction band is replaced, the new band will have an ink mark on the upper end of the band (Fig. 47).

8. 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:** If gearbox is still attached to engine, traction lever on engine side of gearbox should be installed onto traction shaft as shaft is installed into gearbox.

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

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

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

12. Position drive shaft plate to gearbox with three fasteners: two socket head screws (shorter) and one cap screw with lockwasher. Install four socket head screws (longer) and washers in remaining holes in cover. Torque gearbox fasteners from 120 to 140 in–lb (137 to 159 kg–cm) in the sequence shown in Figure 48.

13. Place traction drive lever onto gearbox shaft noting location of alignment splines on shaft and lever. Mount traction lever with cable boss outward (Fig. 49). Secure lever with cap screw and locknut. Parking brake lever installation should be done with cable attached to lever as gearbox is being installed on machine.

14. 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.

15. Install reel drive assembly to the gearbox (Fig. 41):

    A. Apply anti–seize 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 chapter).

    C. Tighten flange nut to secure pulley.

16. Mount gearbox to machine (see Gearbox Installation in this section).

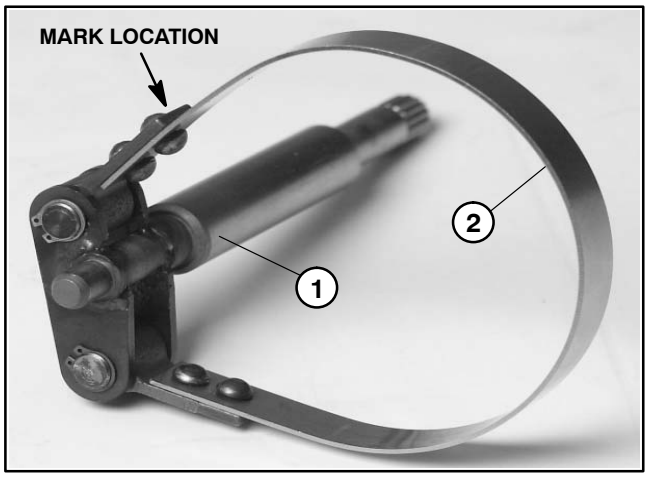


Figure 47

1. Traction shaft
2. Traction band

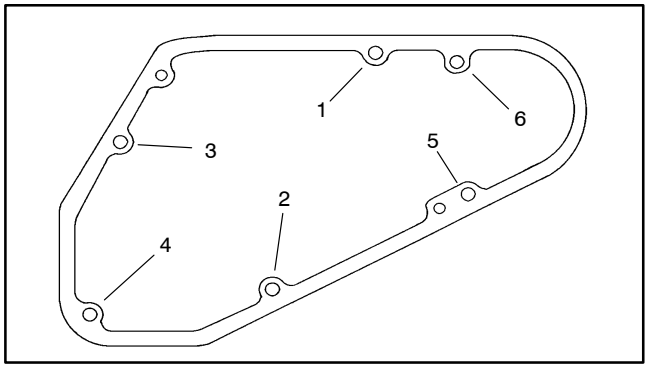


Figure 48

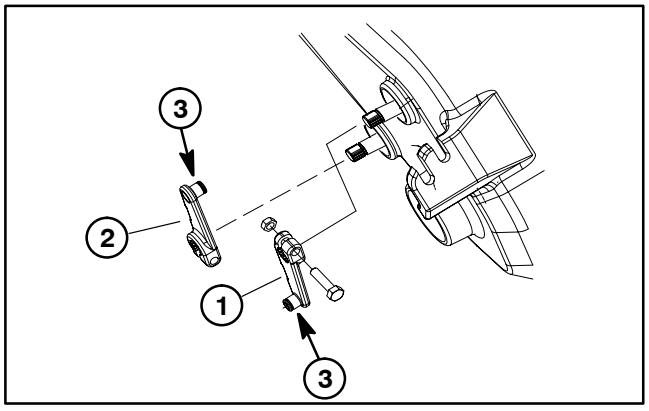


Figure 49

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

Differential Assembly

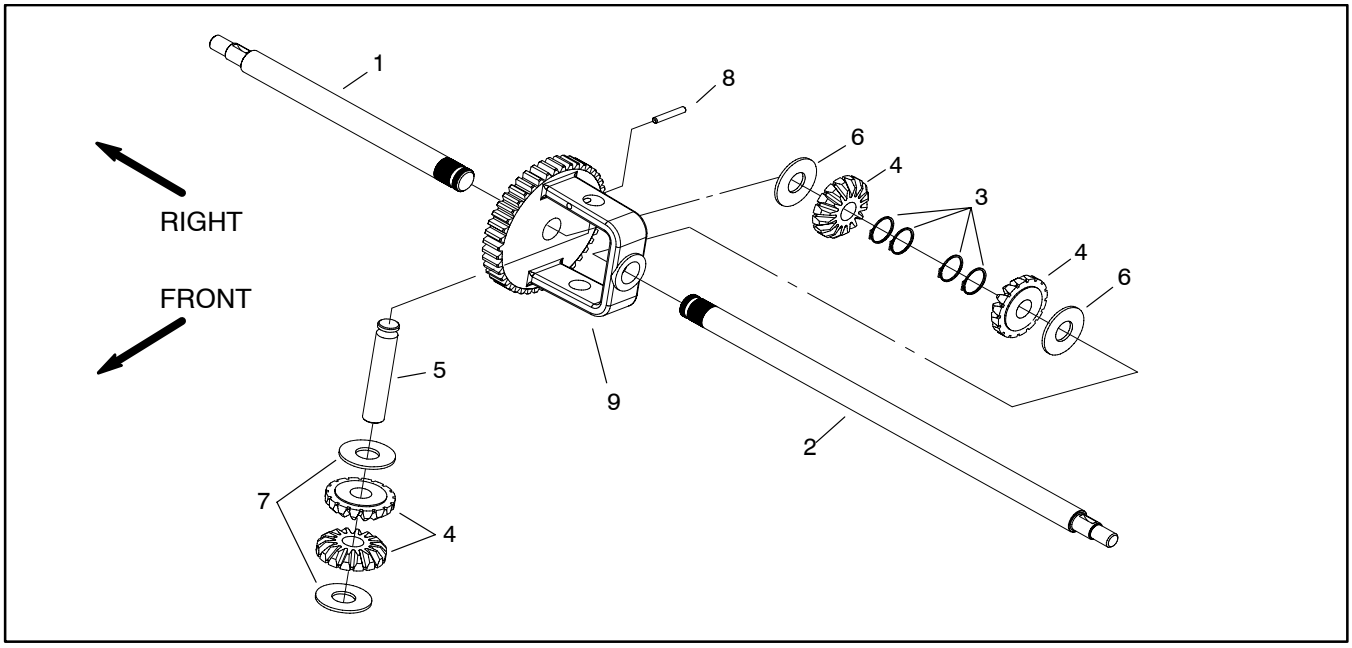


Figure 50

1. RH (short) axle
2. LH (long) axle
3. Retaining ring
4. Differential bevel gear set
5. Drive pin
6. Washer
7. Thrust washer
8. Roll pin
9. Input gear/housing

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. 50)

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 drive pin. Discard roll pin.

3. Remove drive pin, two thrust washers, and two bevel gears.

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

5. Pull each axle free from gear, thrust washer, and differential input gear housing. Note that axle thrust washers are different from thrust washers used on drive pin.

Inspection (Fig. 50)

1. Clean all differential components.

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

3. Scoring or wear on axle shafts or drive pin require component replacement.

4. Damage to the input gear/housing requires the replacement of the entire differential assembly. Inspect gear teeth, axle bearing areas, and drive pin bores.

Assembly

1. Insert RH (short) axle into input gear/housing on the gear side. Install thrust washer, gear and two new retaining rings 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 remaining two bevel gears and rotate axle to move them into their correct position.

3. Place a thrust washer between input gear/housing and each bevel gear. Install drive pin 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 drive pin.

5. Install differential assembly in gearbox and reassemble gearbox (see Gearbox Assembly). Install gearbox to mower (see Gearbox Installation).

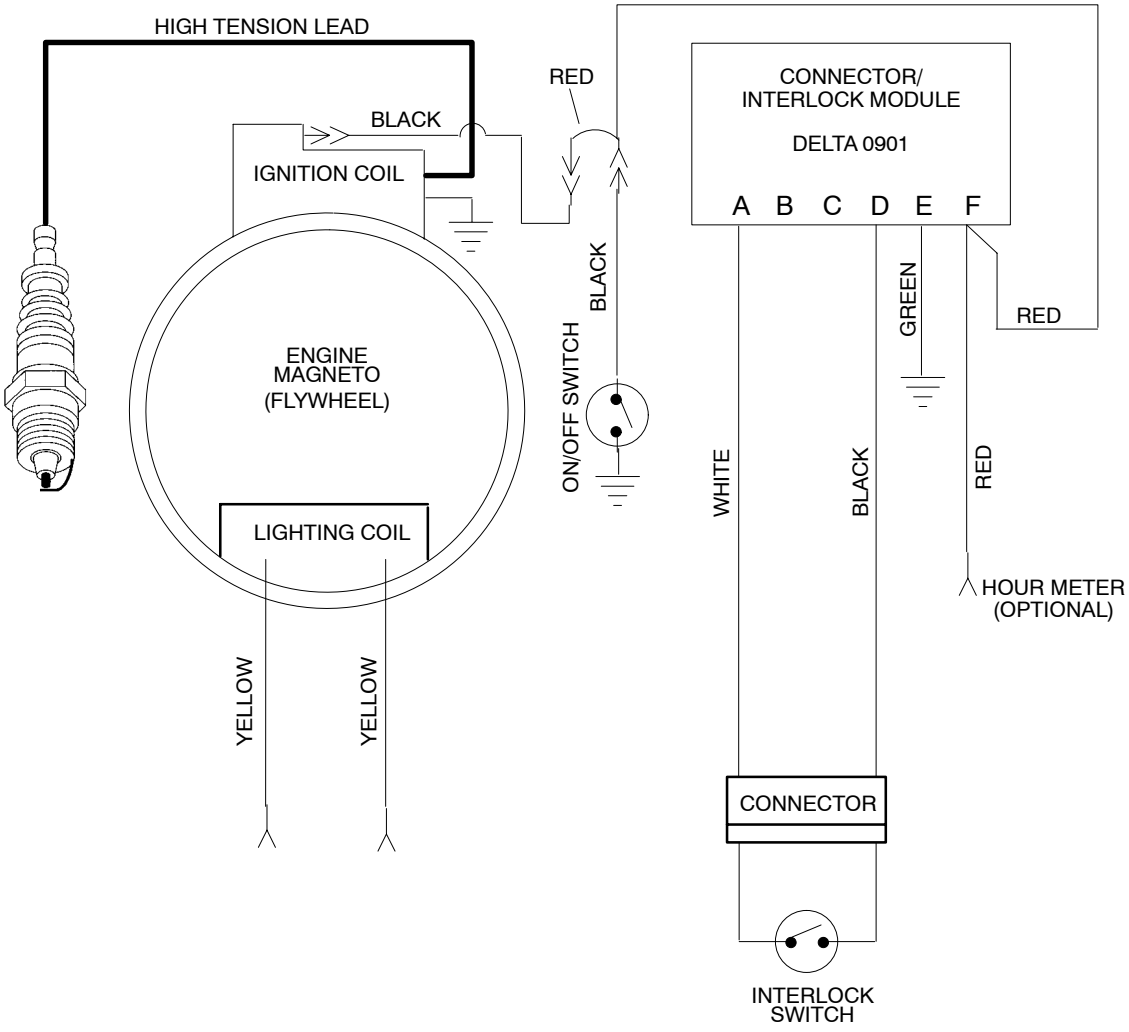
Chapter 5

Electrical System

Table of Contents

Wiring Schematics

EARLY MODELS (NO PROVISION FOR OPERATOR PRESENCE SYSTEM)

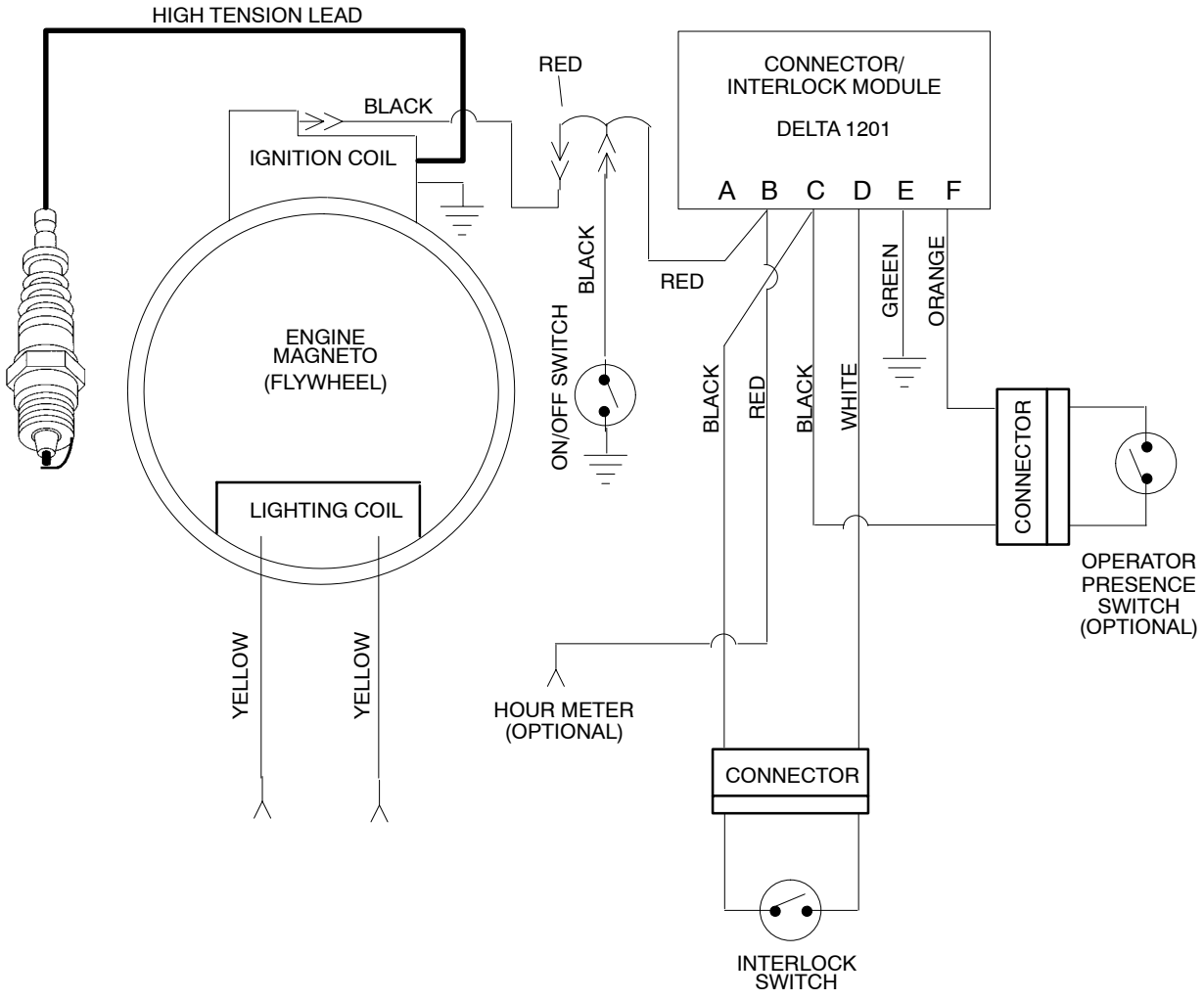


Kawasaki FE120 Engine

ON\OFF SWITCH is open in the ON position

INTERLOCK SWITCH is closed when traction lever is in NEUTRAL

LATER MODELS (EQUIPPED FOR OPERATOR PRESENCE SYSTEM)



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 meter 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.

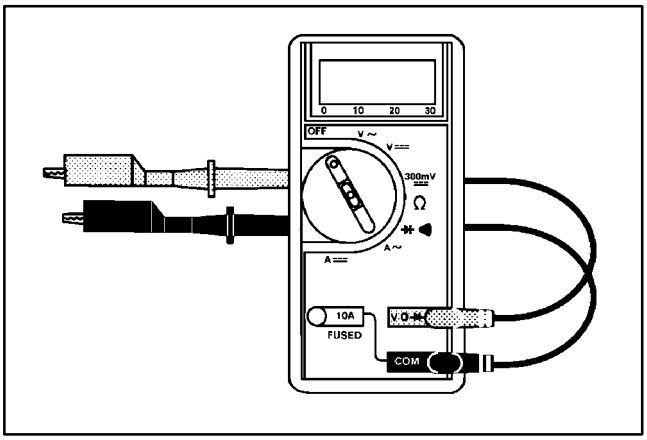


Figure 1

Skin–Over Grease – TOR50547

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

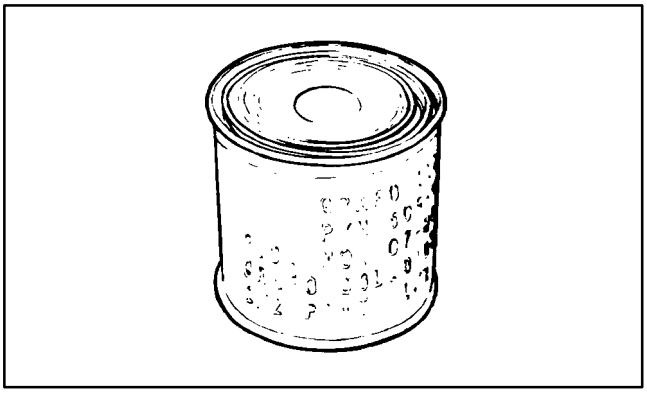


Figure 2

Spark Tester – 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.

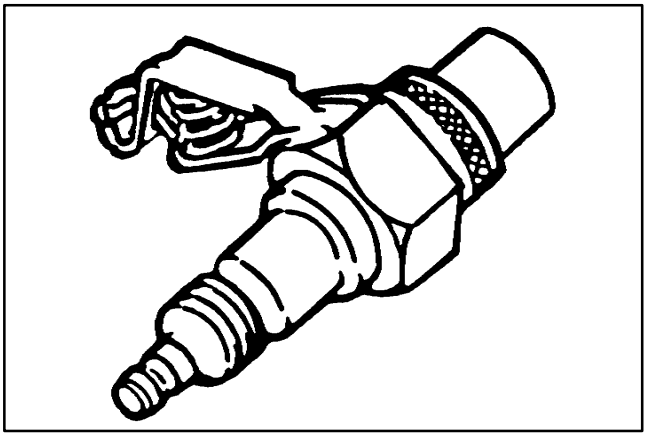


Figure 3

Troubleshooting

CAUTION

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

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 troubleshooting and safety.

NOTE: See the **Kawasaki FE120 Service Manual** in Chapter 3 – Engine for troubleshooting of electrical problems related to the ignition system. Some ignition system testing is covered in this chapter.

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 high tension lead is not connected.	Make sure high tension lead is connected.
	Electrical wires are loose or damaged.	Check electrical connections. Repair wiring.
	Interlock switch is not adjusted or 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 power to the circuit has been disconnected.

NOTE: See the **Kawasaki FE120 Service Manual** in 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 the Flex 21 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. The spark plug is necessary to maintain normal starting speeds.

1. With engine not running, remove high tension lead from the spark plug, and connect it to the spark tester (Fig. 4).

2. Connect spring clip of tester to a good 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.

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** in 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.

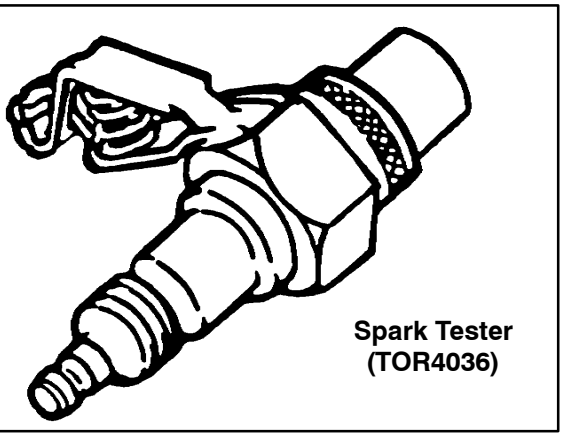


Figure 4

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** in 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. 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. Reconnect 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.

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

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

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

   C. Reconnect the red wire to the black wire.

5. 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 reconnect interlock switch to wiring harness.

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

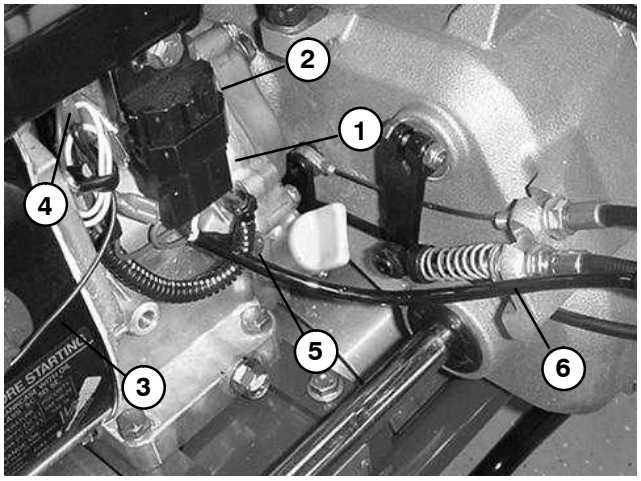


Figure 5

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 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** in Chapter 3 – Engine for lighting coil testing information.

Service and Repairs

NOTE: See the **Kawasaki FE120 Service Manual** in Chapter 3 – Engine for more engine component 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. Place a .032" (.8 mm) thick shim between the traction lever and the interlock switch.

5. Tighten interlock switch mounting fasteners. Recheck gap. 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.

2. Adjust interlock switch (see Adjustment above) as necessary.

3. Connect switch to wires from the interlock module.

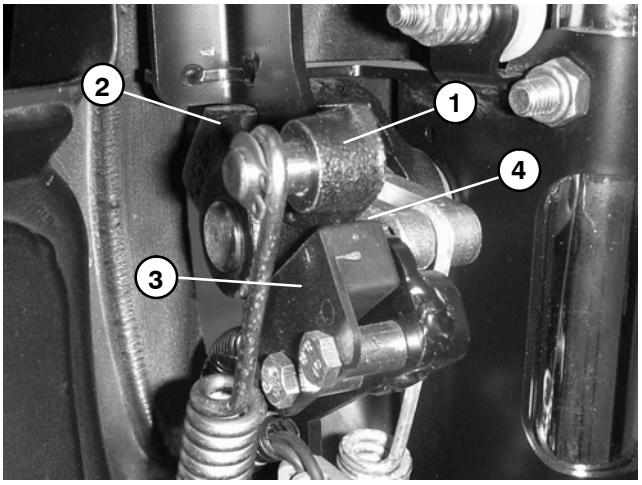


Figure 6

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

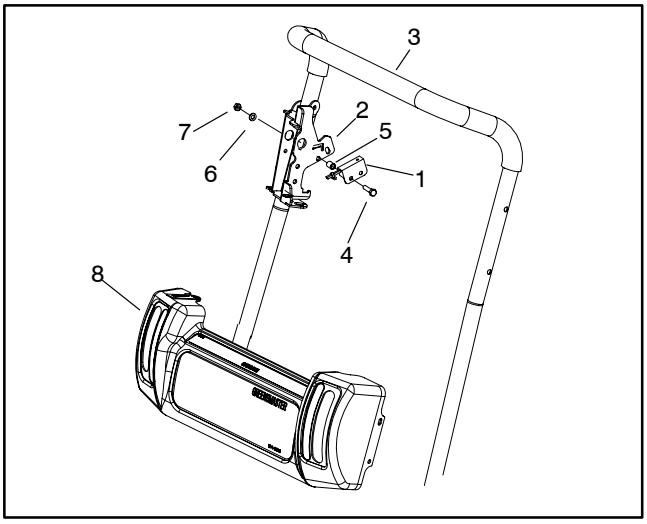


Figure 7

1. **Interlock switch**
2. **Control bracket**
3. **Handle**
4. **Cap screw**
5. **Spacer**
6. **Flat washer (early units)**
7. **Locking nut**
8. **Console**

Operator Presence Switch

The optional Operator Presence Kit for the 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.

Using a multimeter, this 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.

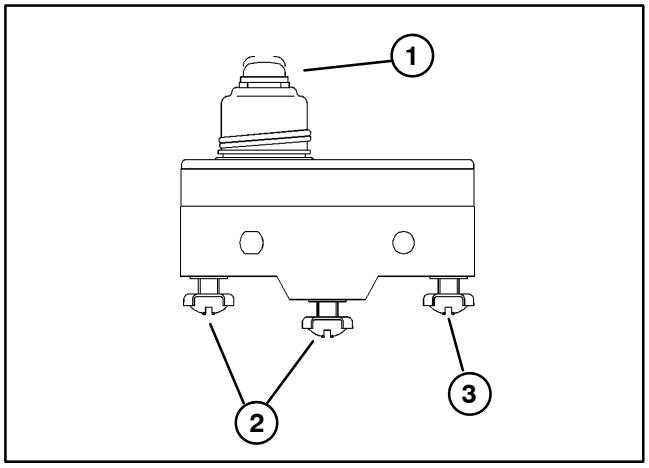


Figure 8

1. **Plunger**
2. **Switch terminals used**
3. **Not used**

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Chapter 6

Chassis and Controls

Table of Contents

Specifications

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

Adjustments

Handle Height Adjustment

1. Make sure mower is parked on a level surface with the engine OFF.

2. Remove hairpin cotters from the ring pins on each side of the mower handle.

3. Support handle and remove ring pins from each side of the mower handle. Raise or lower handle to the desired operating position.

4. Align holes. Reinstall ring pins and hairpin cotters.

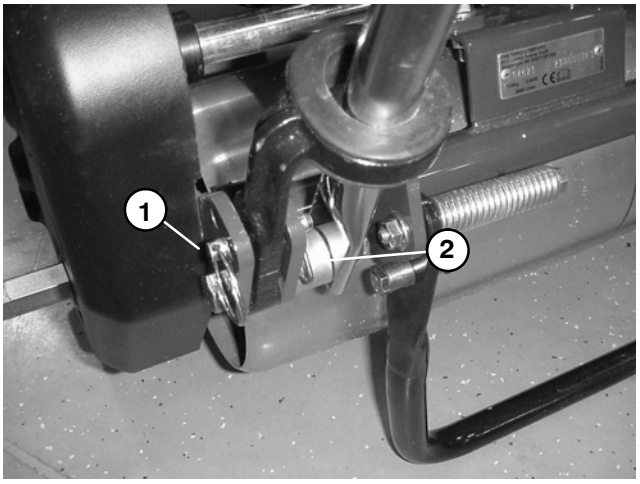

Figure 1

1. **Ring pin**
2. **Hairpin cotter**

Handle Assembly

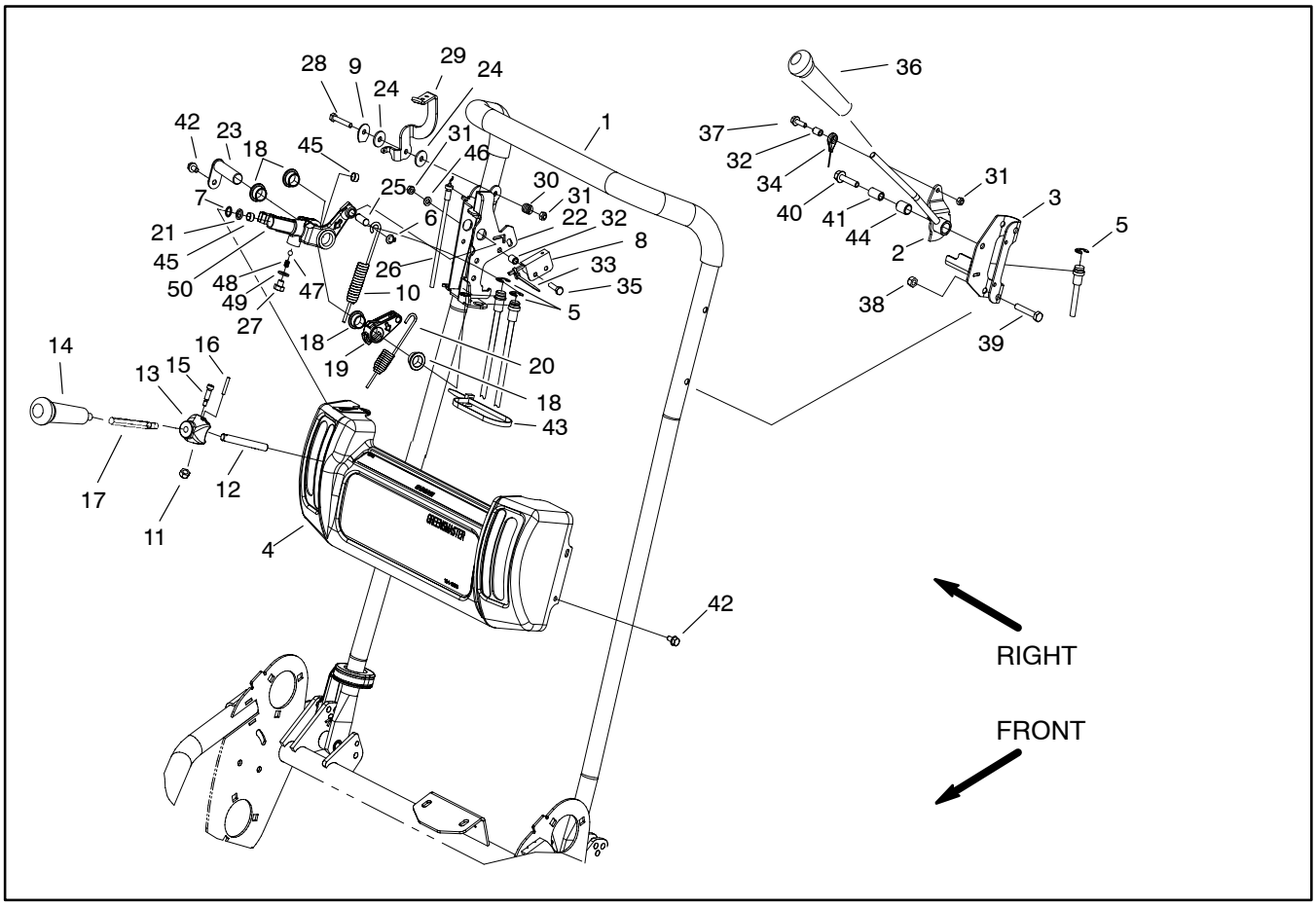

Figure 2

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

Handle Removal

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

2. Cut cable ties that secure cables.

3. Disconnect:

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

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

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

   D. Interlock switch wire connection.

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

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).

   B. Throttle cable (see Throttle Cable Replacement).

   C. Interlock switch wire connection.

3. Secure cables with cable ties.

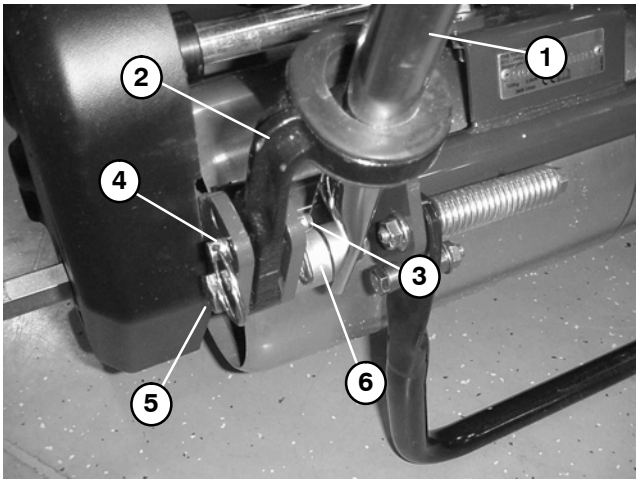

Figure 3

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

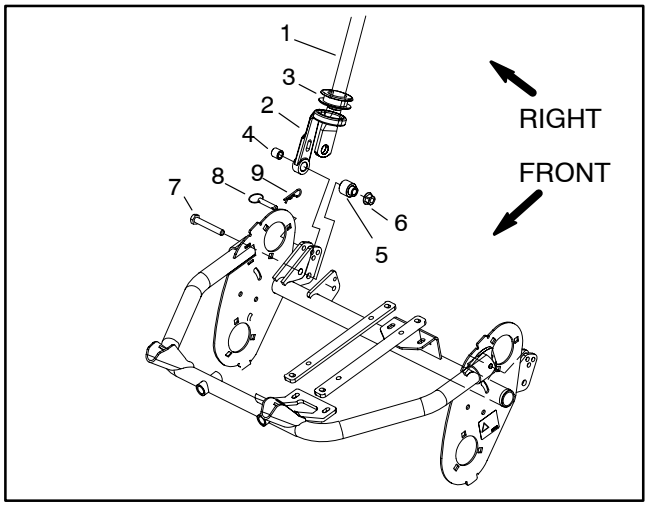

Figure 4

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 mower on a level surface. Make sure engine is OFF. Remove high tension lead from the 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. 5):

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

   B. Loosen locknut 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 attaches brake cable eyelet to brake lever on mower handle (Fig. 6).

5. Remove retaining ring securing the brake cable to the brake bracket (Fig. 6). Remove cable from the bracket.

6. Remove brake cable from the mower.

Installation

1. Secure brake cable eyelet to the brake lever on the mower handle with flange head screw, spacer, and lock nut (Fig. 6).

2. Position cable to the brake bracket and install retaining ring (Fig. 6).

3. Route brake cable to the gearbox assembly. Install brake cable to the gearbox and gearbox brake lever as follows (Fig. 5):

   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 locknut.

   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 Parking Brake Adjustment in Chapter 4 – Traction and Reel Drive Systems).

5. Secure brake cable with cable ties.

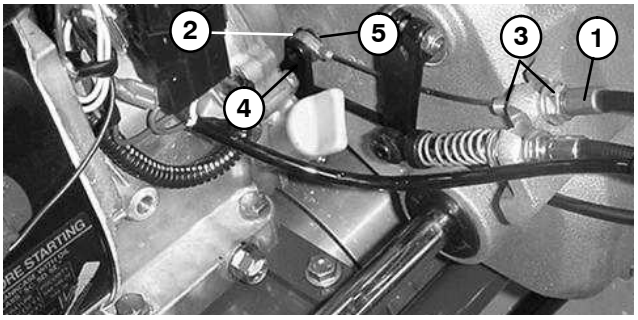

Figure 5

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

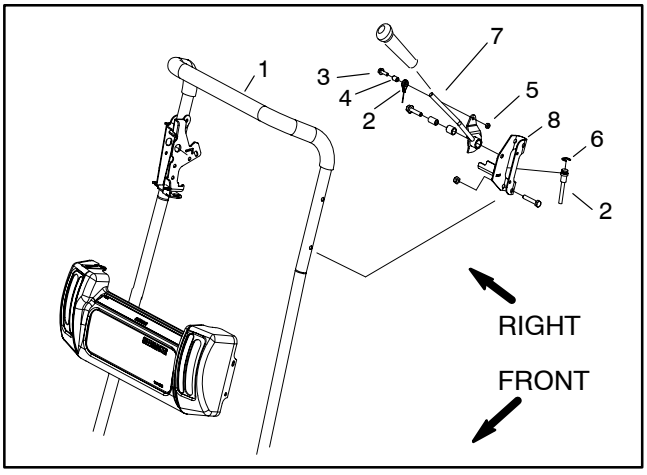

Figure 6

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

Traction Cable Replacement

Removal

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead from the 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. 7):

   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. 8):

   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 mower.

Installation

1. Secure traction cable spring to the traction lever assembly (Fig. 8):

   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. 7):

   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 Traction Control Adjustment in Chapter 4 – Traction and Reel Drive Systems).

4. Install cable ties to secure traction cable.

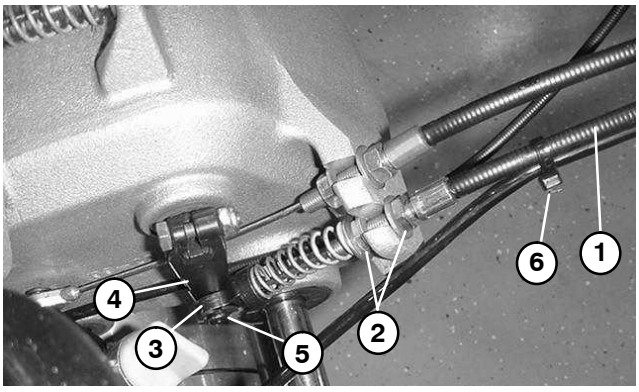

Figure 7

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

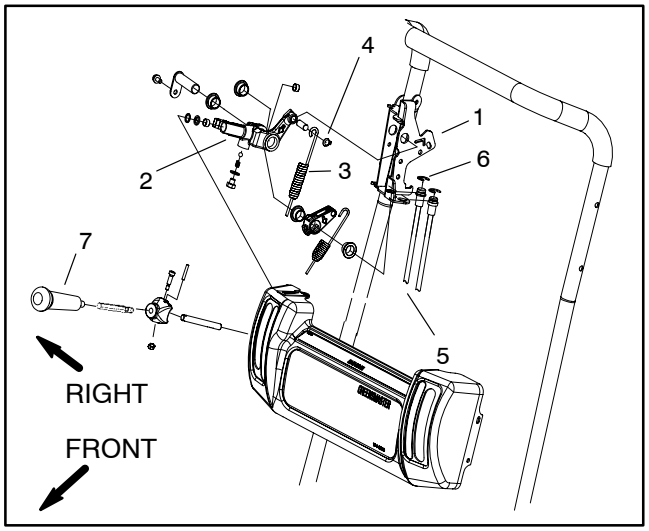

Figure 8

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 mower on a level surface. Make sure engine is OFF. Remove high tension lead from the 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. 9):

   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. 10):

   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 mower.

Installation

1. Secure reel control cable to the reel control lever (Fig. 10):

   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. 9):

   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 Reel Control Adjustment in Chapter 4 – Traction and Reel Drive Systems).

4. Secure reel control cable with cable ties.

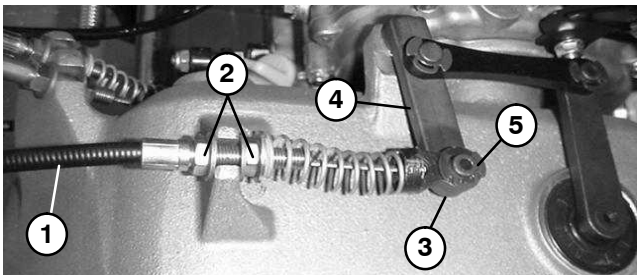

Figure 9

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

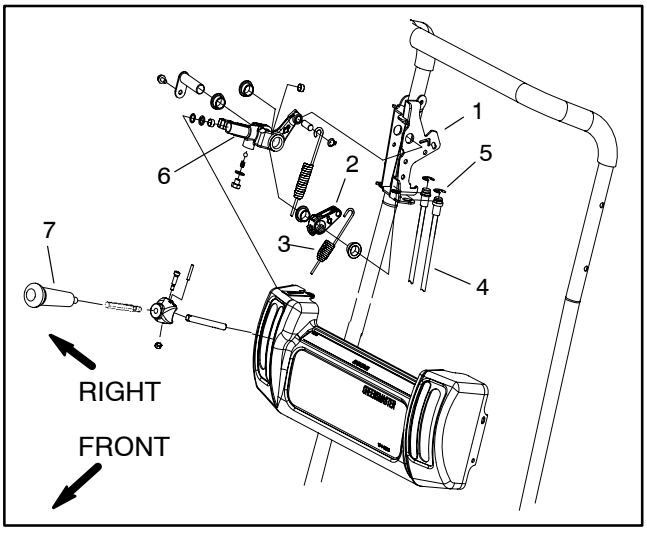

Figure 10

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 mower on a level surface. Make sure engine is OFF. Remove high tension lead from the spark plug.

2. Remove cable tie that secures throttle cable.

3. Remove throttle cable from the engine governor linkage as follows (Fig. 11):

   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 locate cable clamp to traction unit frame (Fig. 12).

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

4. Remove four 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. 13):

   A. Unsnap the cable housing from the control bracket.

   B. Unhook cable end from throttle lever.

6. Remove throttle cable from the mower.

Installation

1. Connect throttle cable to the throttle lever. Snap throttle cable housing to the control bracket (Fig. 13).

2. Position console to handle and secure console with four screws.

3. Route throttle cable to the governor lever.

4. Install cable to the governor lever as follows (Fig. 11):

   A. Insert throttle cable into the nut.

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

   C. Install and secure cap screw and flange nut that locates cable clamp to frame and engine base.

5. Adjust throttle cable (see Throttle Linkage Adjustment in Chapter 3 – Engine).

6. Secure throttle cable with cable tie.

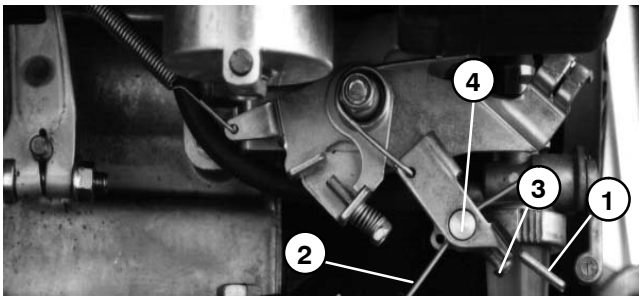

Figure 11

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

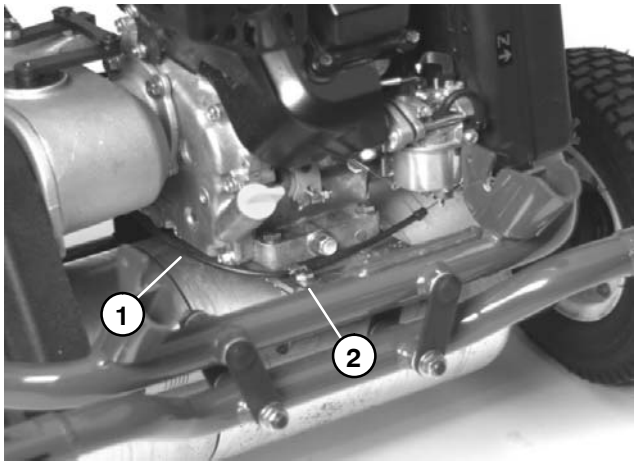

Figure 12

1. Throttle cable
2. Cable clamp

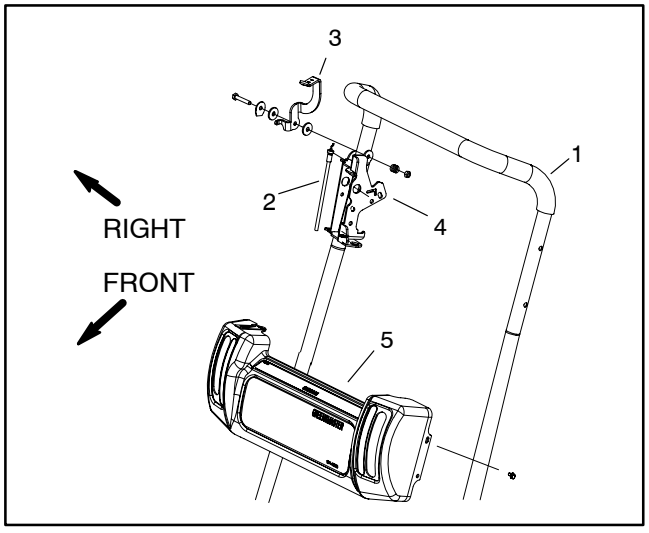

Figure 13

1. Handle
2. Throttle cable
3. Throttle lever
4. Control bracket
5. Console

Wheels

Removal

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

2. Push kickstand down with one foot while pulling up on the handle. This will support the mower on the kick-stand.

3. Pivot wheel locking clip away from the center of the wheel. Slide wheel off the wheel hex shaft.

Installation

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

2. Push kickstand down with one foot while pulling up on the handle. This will support the mower on the kick stand.

3. Apply anti–seize lubricant to the exposed end of the wheel hex shaft.

4. Slide wheel completely onto the wheel hex shaft until the locking clip is secured into the groove on the wheel hex shaft.

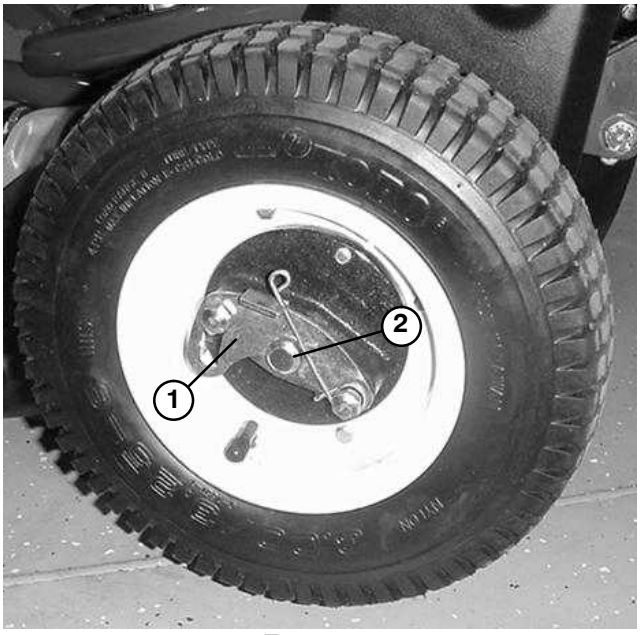

Figure 14

1. **Wheel locking clip** 2. **Wheel hex shaft**

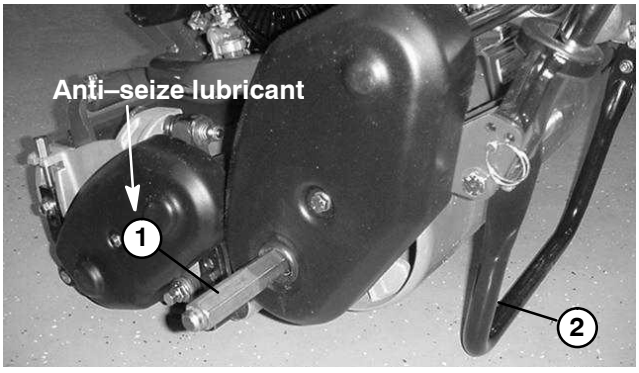

Figure 15

1. **Wheel hex shaft** 2. **Kickstand**

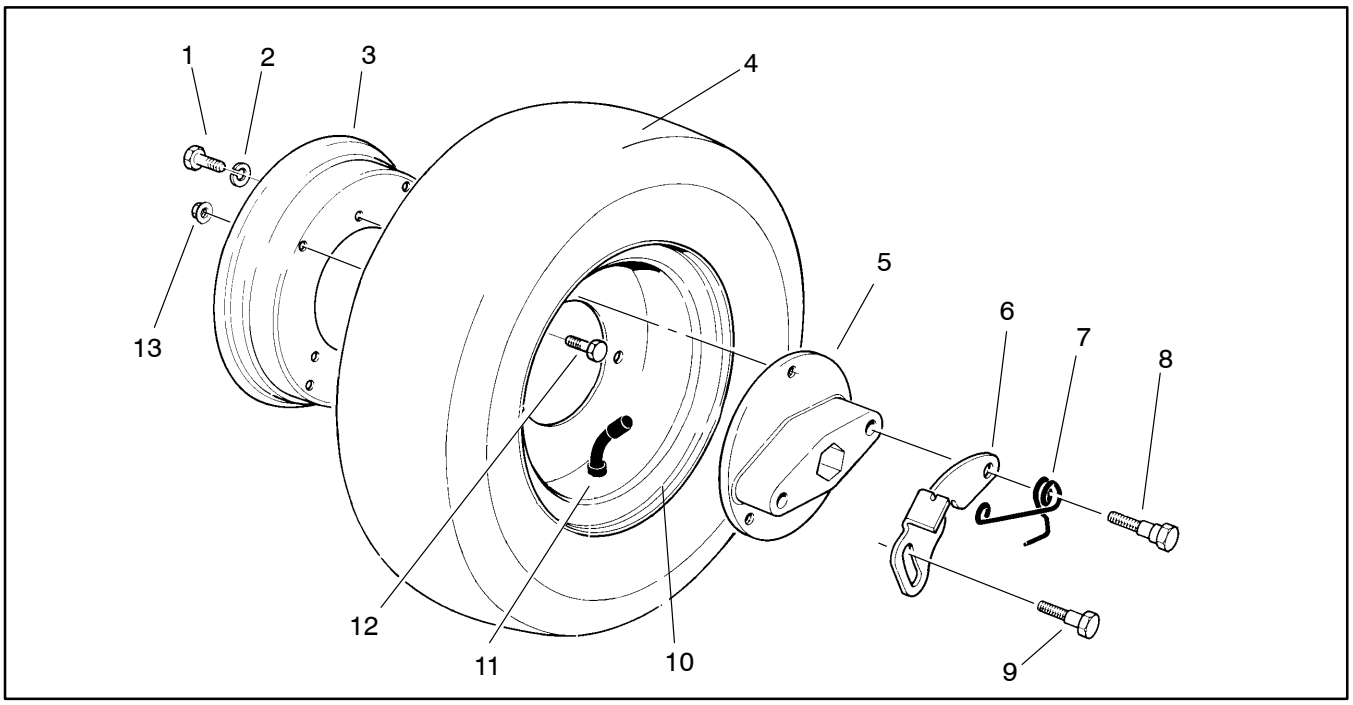

Figure 16

1. **Cap screw**
2. **Lock washer**
3. **Shallow rim**
4. **Tire**
5. **Hub**
6. **Wheel locking clip**
7. **Spring**
8. **Bolt**
9. **Bolt**
10. **Deep rim**
11. **Inner tube**
12. **Cap screw**
13. **Flange nut**

Disassembly

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

2. Remove four cap screws and flange nuts from the deep rim and shallow rim. Remove shallow rim from the deep rim.

3. Remove bolt from the hub. Remove bolt, spring, and locking clip from the hub.

Reassembly

1. Reinstall locking clip, spring, and bolt to the hub. Reinstall bolt to the hub. Tighten both bolts.

2. Reinstall shallow rim into the deep rim. Secure shallow rim to the deep rim with the four cap screws and flange nuts. Tighten fasteners.

3. Reinstall hub into deep rim. Secure hub to deep rim with three cap screws and lock washers. Tighten fasteners.

Kickstand

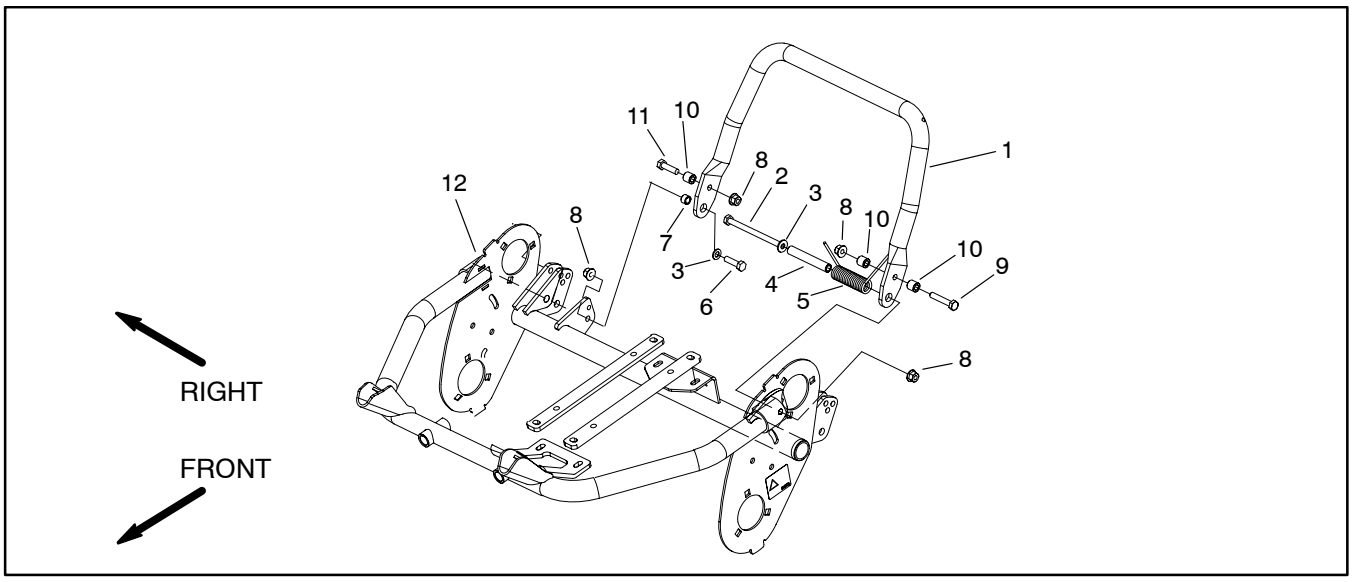

Figure 17

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

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

2. Pivot kickstand up against the stops and hold in position.

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. 18).

4. Remove flange nuts, cap screws, flat washers, spacers, and torsion spring from the kickstand and frame. Note: 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

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

2. Position kickstand inside the mower frame. Insert cap screws through the washers, kickstand, spacers, and frame (Fig. 17).

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

4. Pivot kickstand up against the stops and hold in position. Use a nutdriver or small diameter pipe over the end of the torsion spring. Push the extension spring down and out to install spring (Fig. 18).

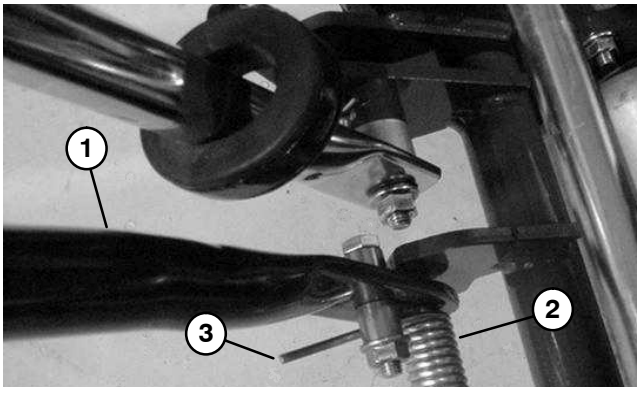

Figure 18

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

Chapter 7

Cutting Unit

Table of Contents

Specifications

REEL CONSTRUCTION: 5–inch (12.7 cm) diameter, 11 carbon steel blades (optional 8 blades) welded to 5 stamped steel spiders.

HEIGHT–OF–CUT RANGE: 1/16 to 19/64 inch (1.6 to 7.5 mm).

WIDTH–OF–CUT: 21 inches (53.3 cm).

CLIP: 0.16 inch (0.41 cm).

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

Grass Basket Installation

1. Grasp basket by top lip and slide the basket frame into the receivers.

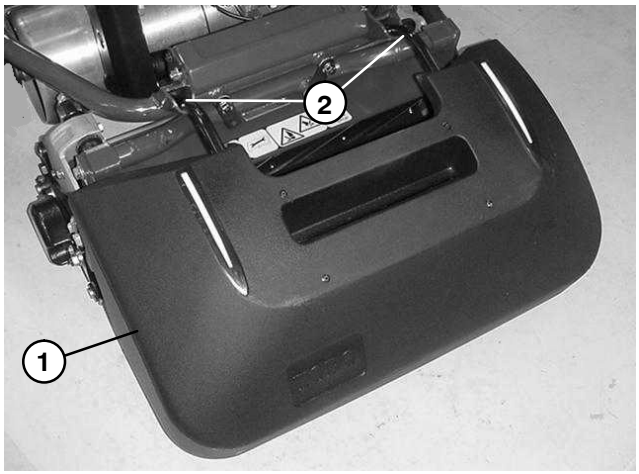

Figure 1

1. **Grass basket**
2. **Basket receivers**

Separating Cutting Unit from Traction Unit

1. Position mower on a flat, level work surface. Make sure engine is OFF. Remove high tension lead from the 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. 2).

3. Remove grass basket, if installed.

4. Remove two cap screws securing cutting unit pivot arms to traction unit frame tube (Fig. 3).

5. Rotate pivot arms forward and rest traction unit on restrained kickstand.

6. Pull cutting unit forward about 2 inches (51 mm) and then to the right to disengage the transmission coupler (Fig. 4).

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

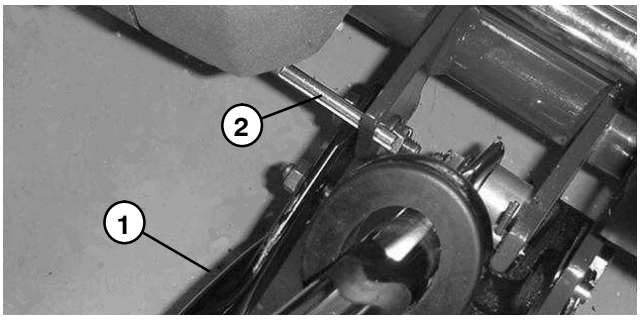

Figure 2

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

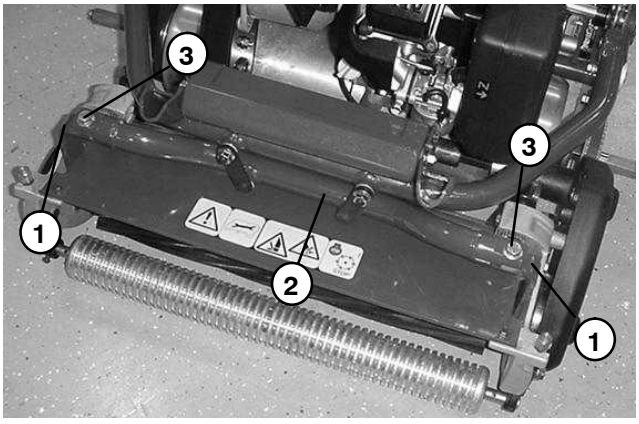

Figure 3

1. **Cutting unit pivot arm**
2. **Traction unit frame tube**
3. **Cap screw**

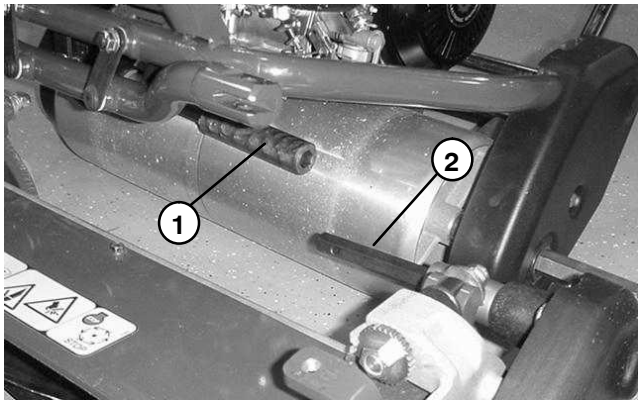

Figure 4

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

Cutting Reel and Roller Seals

The Flex 21 uses cannister seals in the cutting reel and rollers. 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.

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 available as TORO parts. Some tools may also be available from a local supplier.

Gauge Bar Assembly (13–8199)

Used to verify height–of–cut.

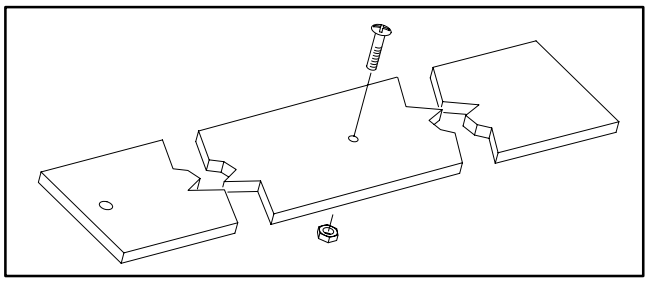

Figure 5

Backlapping Brush Assembly (TOR299100)

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

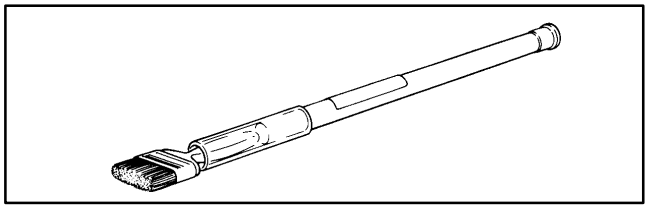

Figure 6

Bedknife Screw Tool (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.

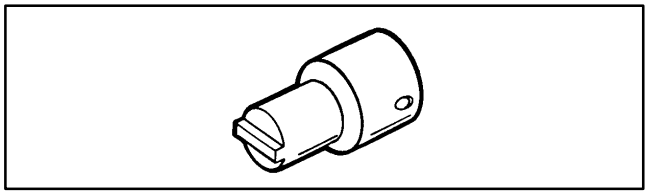

Figure 7

Roller Bearing Installation Tools

Washers and spacer used to install bearings and seals into front and rear rollers that have a threaded roller shaft.

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

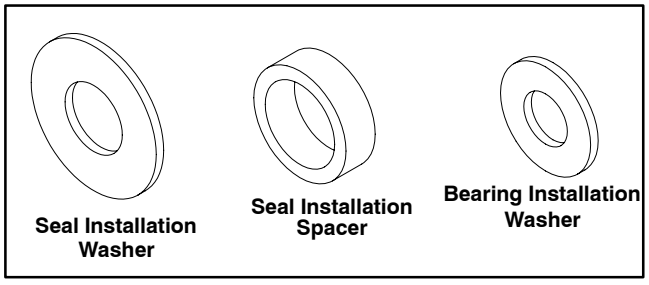

Figure 8

Bearing and Seal Installer (TOR4105)

Used to install bearings and seals into front and rear rollers that have a threaded roller shaft.

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

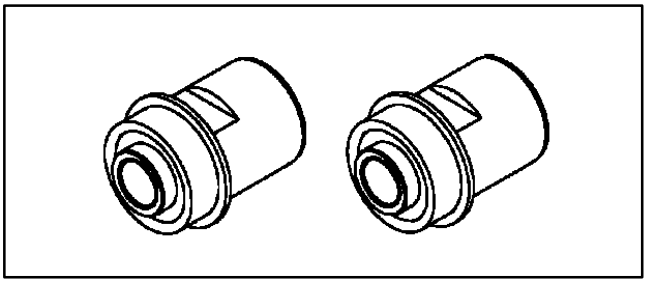

Figure 9

Sleeve Driver (TOR4107)

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

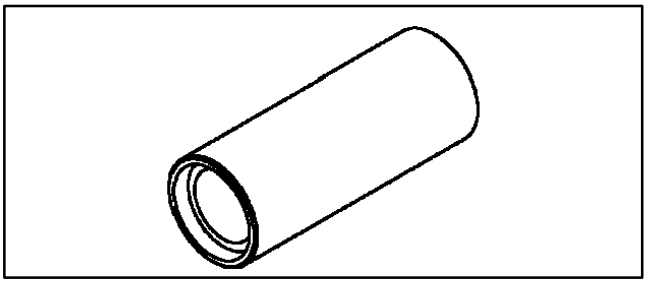

Figure 10

Sleeve Driver and Bearing and Seal Installer Set (TOR4108)

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

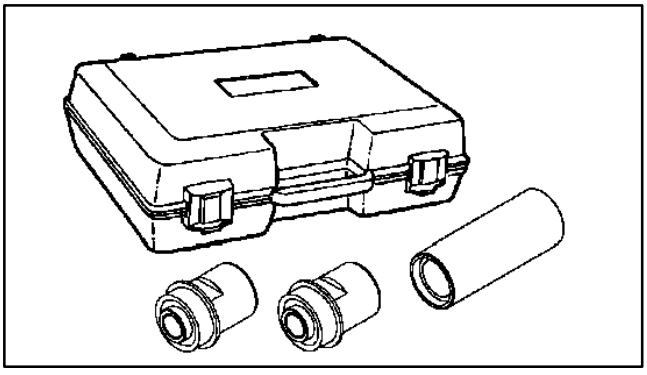

Figure 11

Troubleshooting

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 mower. It is important to remember that the lower the height–of–cut, the more critical these factors are. See Adjustments and Service and Repairs sections for detailed adjustments and repair information.

Factors That Can Affect Quality of Cut

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. Make sure bearing housings are secured properly. See Cutting Reel in the Service and Repairs section.
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 (see Bedknife to Reel Adjustment). Slightly dull cutting edges may be corrected by backlapping (see Backlapping). Excessively dull cutting edges must be corrected by grinding the reel and bedknife (see Preparing Reel for Grinding).
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.

Factor	Possible Problem/Correction
Stability of bedbar.	Make sure bedbar pivot bolts are securely seated. See Bedbar in Service and Repairs section.
Number of reel blades.	Use correct number of blades for clip frequency and optimum height–of–cut range.
Rear roller level.	Reel and rear roller should be parallel for proper cutting performance. See Leveling Rear Roller in Adjustments section.
Rear roller position.	The rear roller position is determined by the height–of–cut. See Rear Roller Height Adjustment in Adjustments section.
Roller condition.	Make sure rollers rotate freely. Repair bearings as necessary. See Roller Bearing Replacement in Service and Repairs section.
Traction speed.	Check maximum governed engine speed. Adjust engine to specifications if necessary. The drive belts may be loose or worn. Check the condition of the belts and adjust or replace as necessary. See Adjustments section in Chapter 3 – Engine and Chapter 4 – Traction and Reel Drive System. Also, see Service and Repairs section in Chapter 4.
Groomer reel operation.	See Troubleshooting section of Chapter 8 – Groomer (Model 04201) or Chapter 9 – Groomer (Model 04204).

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 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.

Bedknife to Reel Adjustment

1. Position mower on a flat level work surface. Make sure engine is OFF. Remove high tension lead from the spark plug. Remove reel contact by turning bedbar adjusting screws counterclockwise (Fig. 12).

2. Tilt mower back on handle to expose bedknife and reel.

NOTE: Each time the bedbar adjusting screw is rotated one click clockwise on the Flex 21, the bedknife moves 0.0007 inch (0.018 mm) closer to the reel. **DO NOT OVERTIGHTEN THE ADJUSTING SCREWS.**

3. On one end of the reel (Fig. 13):

   A. From the front and parallel to the bedknife, insert a long strip of newspaper between the reel and bedknife.

   B. While slowly rotating the reel forward, turn bedbar adjusting screw clockwise one click at a time until the paper is pinched lightly.

   C. A slight drag on the paper should result when the paper is pulled.

4. Check for light contact at the other end of the reel using newspaper and adjust as required (Fig. 13).

5. After the adjustment is accomplished, check to see if the reel can pinch a strip of paper when inserted from the front and cut the paper when inserted at a right angle to the bedknife (Fig. 13).

   A. Paper should be cut with minimum contact between the bedknife and the reel blades.

NOTE: The Flex 21 will have slightly greater reel drag than other Toro greens mowers due to the reel seal design.

   B. Should excessive reel drag be evident, it will be either necessary to backlap or re–grind the reel and bedknife to achieve the sharp edges needed for precision cutting (see TORO Sharpening Reel and Rotary Mowers Manual, Form No. 80-300 PT).

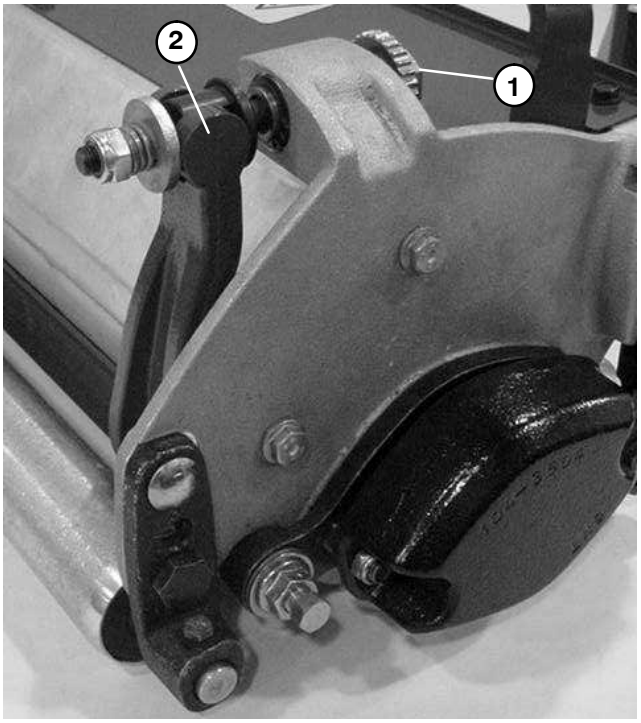

Figure 12

1. Bedbar adjusting screw **2. Bedbar**

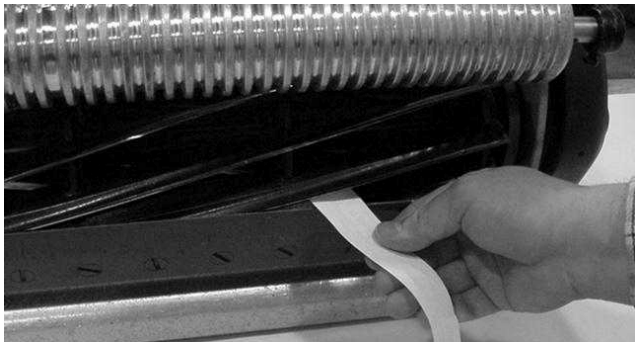

Figure 13

Leveling Rear Roller

1. Remove cutting unit from mower and position it on a flat, level surface, preferably a precision ground surface plate.

2. Place a 1/4 inch (6.4 mm) or thicker plate under the reel blades and against the front edge of bedknife.

NOTE: The plate should cover the full length of the reel blades. Three blades should contact the plate for adjustment purposes.

3. Firmly press down on cutting unit and maintain pressure on rear roller. Attempt to insert a piece of paper under each end of the roller. If the gap is greater than the piece of paper, on either end, an adjustment is needed: proceed to step 4.

4. Loosen locknuts securing right rear roller bracket to cutting unit sideplate (Fig. 14).

5. While holding reel securely on surface plate and maintaining pressure on the rear roller, rotate lower right roller mounting bolt. This bolt has an offset, which when rotated, acts as an eccentric to raise or lower the roller. The bolt head has an identification dot to identify the offset location. This dot indicates in which direction the right end of roller moves when the bolt is turned and should always be in the rear half of the arc as shown in Figure 15.

NOTE: If additional adjustment is needed, replace the shoulder bolt on left hand roller bracket with a second eccentric bolt (see illustrated parts list for part number). Ensure that both rear roller brackets are mounted using the same hole position.

6. Verify level of roller by attempting to insert piece of paper under each end of roller.

7. Tighten locknuts on roller bracket when roller is level.

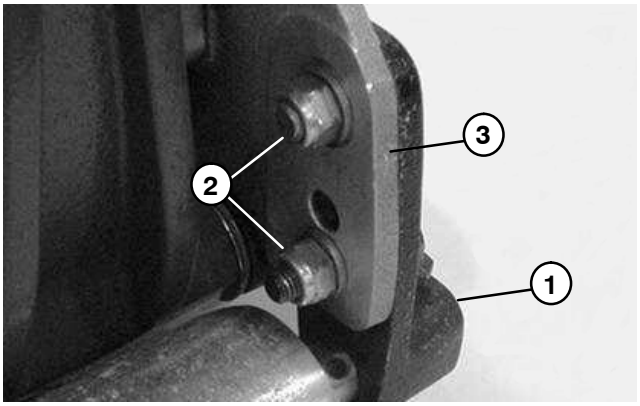

Figure 14

1. **RH rear roller bracket**
2. **Locknut**
3. **Cutting unit sideplate**

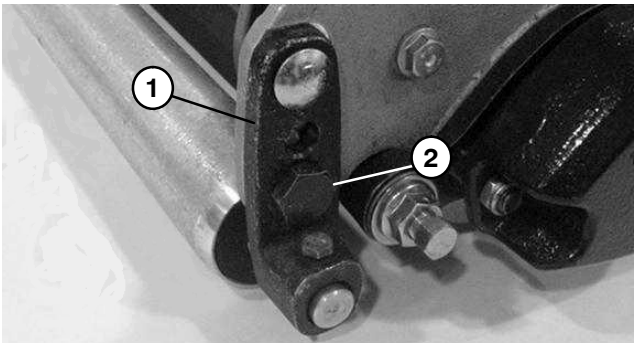

Figure 15

1. **RH rear roller bracket**
2. **Eccentric bolt**

Rear Roller Height Adjustment

The rear roller of the Flex 21 has two height positions. Rear roller height should be matched to the height–of–cut setting. The upper roller position (shown in Fig. 16) should be used for height–of–cut range .062 to .156 inch (1.6 to 4 mm). The lower position should be used for height–of–cut range .125 to .296 inch (3.2 to 7.5 mm).

1. Remove rear roller (see Roller Removal).

2. Loosen locknuts that secure roller brackets to mower side plates.

3. Move eccentric bolt (mower right side) and shoulder bolt (mower left side) to allow desired position of roller.

4. Re–install rear roller to brackets (see Roller Installation).

5. Level rear roller (see Leveling Rear Roller). Tighten locknuts.

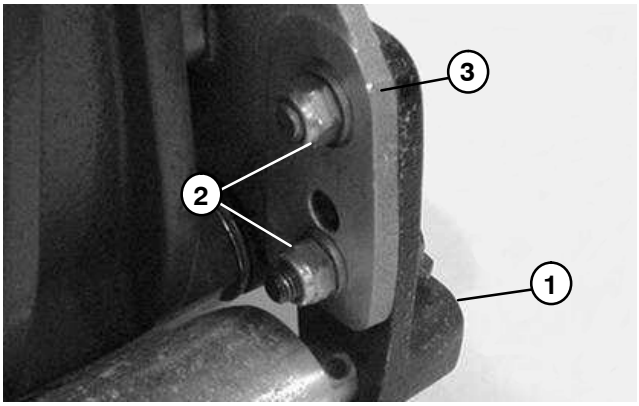

Figure 16

1. **RH rear roller bracket**
2. **Locknut**
3. **Cutting unit sideplate**

Height–of–Cut Adjustment

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

2. Verify that the rear roller is level (see Leveling Rear Roller) and that the bedknife to reel contact is correct (see Bedknife to Reel Adjustment). Tip mower back on it's handle to expose front roller, rear roller and bedknife.

3. Loosen locknuts securing height–of–cut arms to cutting unit side plates (Fig. 17).

4. Use Gauge Bar to determine height–of–cut (see Special Tools).

5. Loosen nut on gauge bar and set adjusting screw to desired height-of-cut. Distance between bottom of screw head and face of bar is height-of-cut (Fig. 18). Tighten nut on gauge bar.

6. Hook adjusting screw head on the cutting edge of the bedknife. Rest the rear end of the bar on the rear roller (Fig. 19).

7. Rotate height–of–cut screw until the front roller contacts the front of the gauge bar. Adjust both ends of the roller until the entire roller is parallel to the bedknife.

IMPORTANT: When set properly, both rollers should contact the gauge bar, and the adjusting screw should be snug against the bedknife. This assures that the height–of–cut is identical at both ends of the bedknife.

8. Tighten both lock nuts to secure the height–of–cut adjustment (Fig. 17).

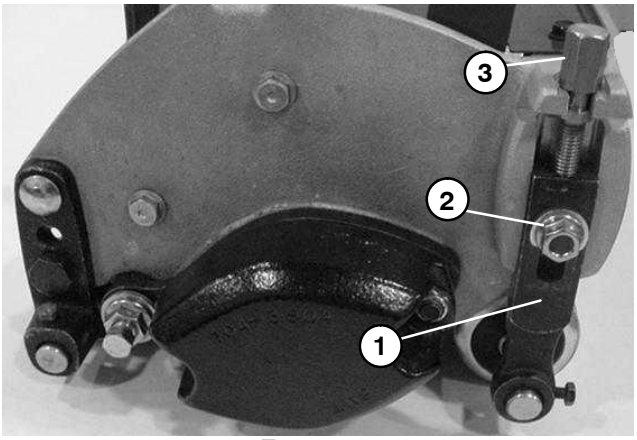

Figure 17

1. **Height–of–cut arm**
2. **Lock nut**
3. **Height–of–cut screw**

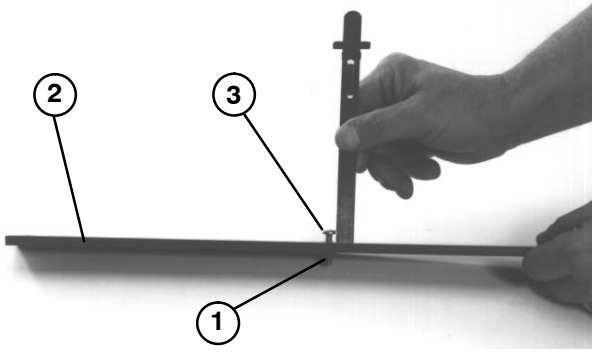

Figure 18

1. **Nut**
2. **Gauge bar**
3. **Adjusting screw**

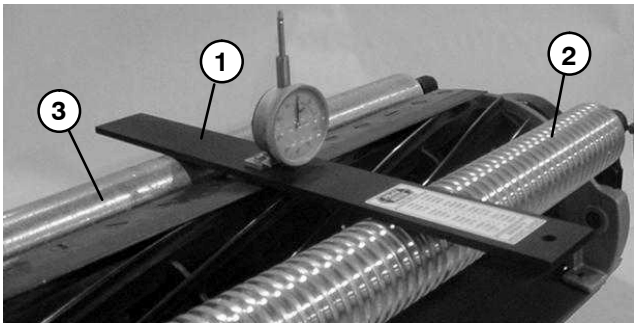

Figure 19

1. **Gauge bar**
2. **Front roller**
3. **Rear roller**

Cut–off Bar Adjustment

Adjust cut–off bar to assure clippings are cleanly discharged from the reel area.

The cut–off bar is adjustable to compensate for changes in turf conditions. The bar should be adjusted closer to the reel when turf is extremely dry. By contrast, adjust cut–off bar further away from the reel when turf conditions are wet. The bar should be parallel to the reel to assure optimum performance and should be adjusted whenever the reel is sharpened.

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

2. Loosen screws securing the cut–off bar to the cutting unit (Fig. 20). Adjust cut–off bar to allow a .060 inch (1.5 mm) feeler gauge to be inserted between the top of the reel and the bar. Use thicker or thinner feeler gauge based on turf conditions.

3. Tighten screws so that the distance between the cut–off bar and reel is equal for the complete length of the reel.

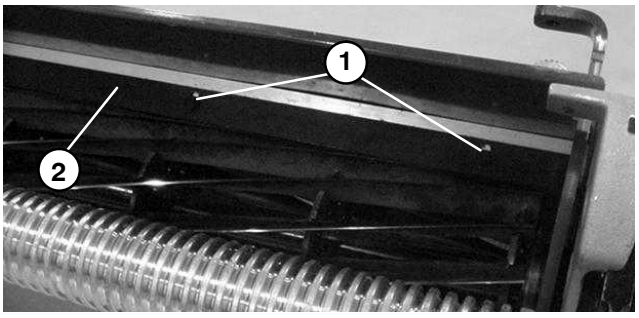

Figure 20

1. **Screw**
2. **Cut–off bar**

Backlapping

1. Park mower on a level surface. Make sure engine is OFF. Remove high tension lead from the 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. 21).

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 No. TOR299100 backlapping brush assembly (complete or individual components) 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. Reinstall plug when backlapping operation is completed.

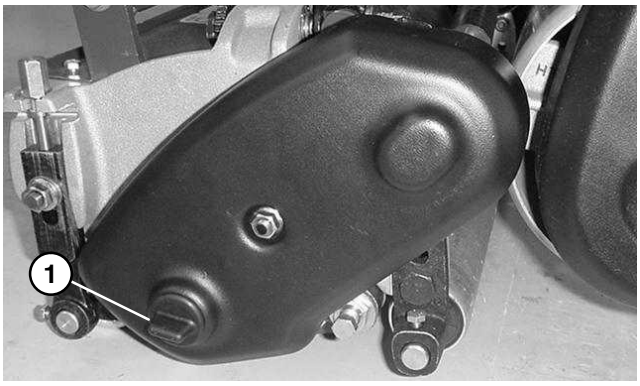

Figure 21

1. **Cover plug**

Bedbar

Removal

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

2. On both sides of cutting unit, loosen bedbar adjusting screw by turning screw counterclockwise (Fig. 22).

3. Back off the spring tension locknut until the washer is no longer tensioned against the bedbar (Fig. 22).

4. Loosen jam nuts securing the bedbar bolts on both sides of the mower. Remove both bedbar bolts (Fig. 22).

CAUTION

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 mower by pulling downward. Locate and retrieve 2 nylon and 2 metal washers from each side of bedbar (Fig. 23).

Installation

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

2. Install bedbar from bottom of mower frame making sure that bedbar mounting ears are positioned between washer and bedbar adjusting screw (Fig. 22).

3. Apply anti–seize lubricant to threads and shank of bedbar bolts.

4. Secure bedbar to each side plate with bedbar bolts (jam nuts threaded onto bolts) and 8 washers (Fig. 23). A nylon washer should be positioned on each side of bedbar pivot. A steel washer should be placed outside of each nylon washer.

5. Torque both bedbar bolts from 190 to 240 in–lb (21.5 to 27.1 N–m).

6. Tighten the right side jam nut until all end play is removed from bedbar and the thrust washers can still be rotated. Then, tighten left side jam nut until the outside thrust washers are snug but can still be rotated. After jam nut tightening, the washers next to the bedbar might be loose.

7. Tighten spring tension locknut to fully compress spring and then back off locknut 1/2 turn (Fig. 22).

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

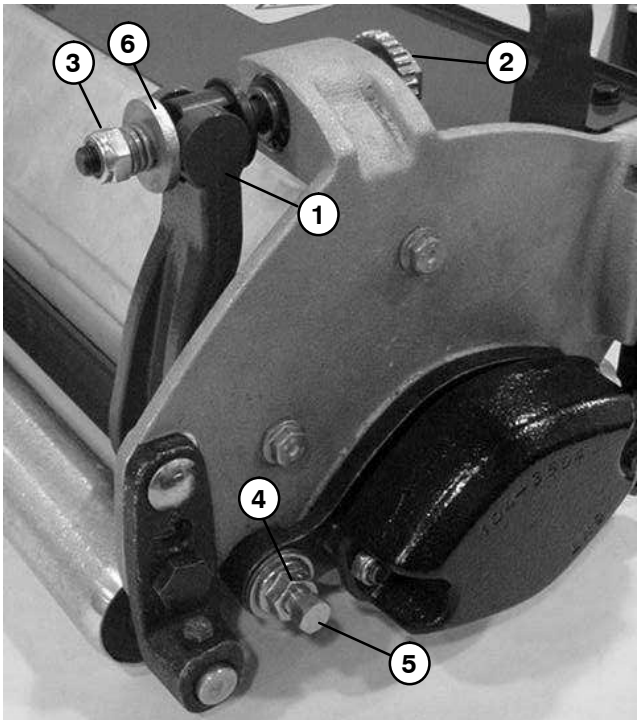

Figure 22

1. Bedbar
2. Bedbar adjusting screw
3. Spring tension locknut
4. Jam nut
5. Bedbar bolt
6. Washer

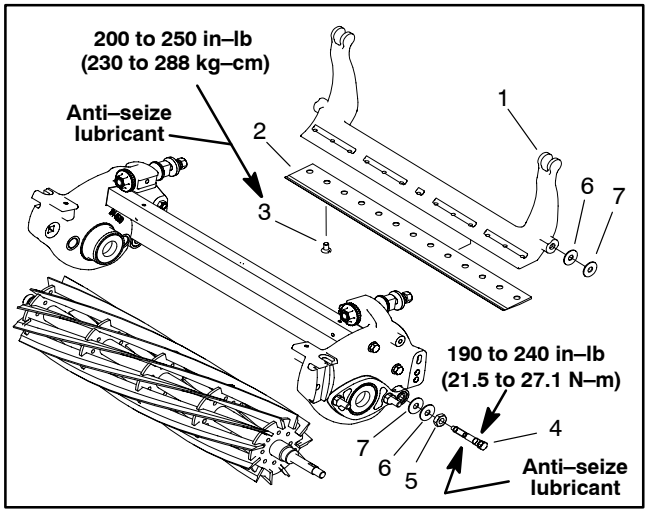

Figure 23

1. Bedbar
2. Bedknife
3. Bedknife screw
4. Bedbar bolt
5. Jam nut
6. Flat washer (metal)
7. Flat washer (nylon)

Bedknife Service

Bedknife Removal

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

2. Remove screws that fasten bedknife to bedbar using a socket wrench and bedknife screw tool. Discard screws. Remove bedknife from the bedbar (Fig. 24).

3. Use a scraper to remove all rust, scale and corrosion from bedbar surface before installing new bedknife.

Bedknife Installation

1. Make sure bedbar threads are clean. If necessary, use 5/16 – 18UNC 2A tap to chase threads.

2. Use new screws to secure bedknife to bedbar. Apply anti–seize lubricant to the screws before installing.

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

3. Using a torque wrench and bedknife screw tool, tighten screws to a torque of 200 to 250 in–lb (230 to 288 kg–cm). Use a torquing pattern working from the center toward each end of the bedknife (Fig. 25).

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. Because of this, it is necessary to backlap or grind a new bedknife after installing it to the bedbar. Follow the existing angle that was ground into the bedknife and grind only enough to make sure the top surface is true (Fig. 26). Bedbar needs to be removed from mower for proper bedknife grinding.

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

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	3° (see Fig. 27)
Extended bedknife relief angle	7° (see Fig. 27)
Front Angle	13º
Front Angle Range	13º to 17º

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

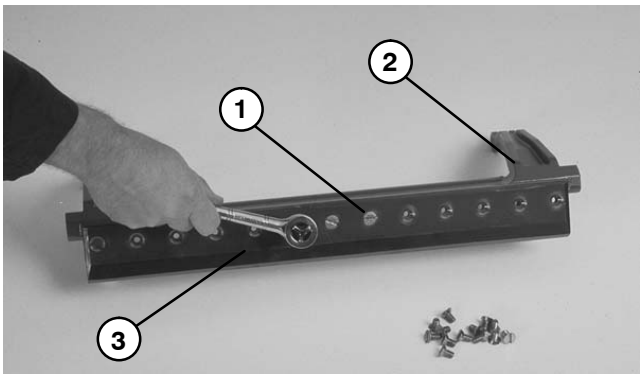

Figure 24

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

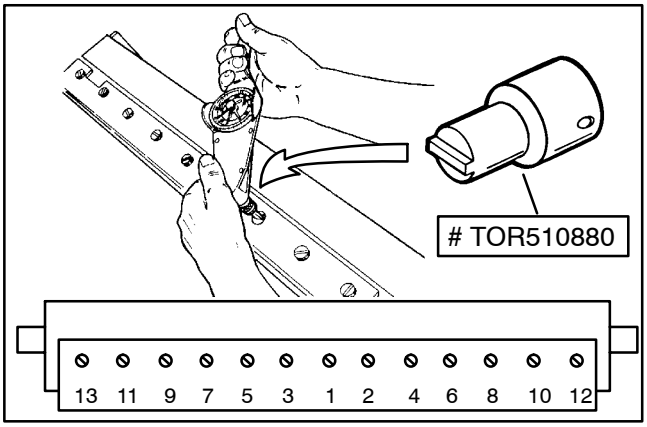

Figure 25

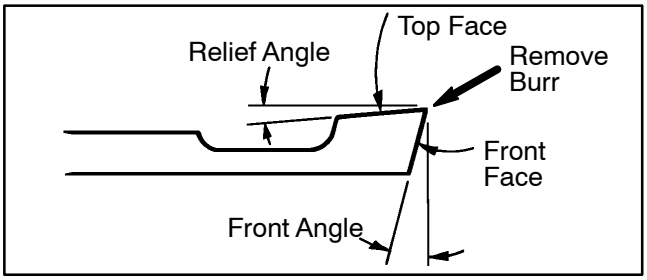

Figure 26

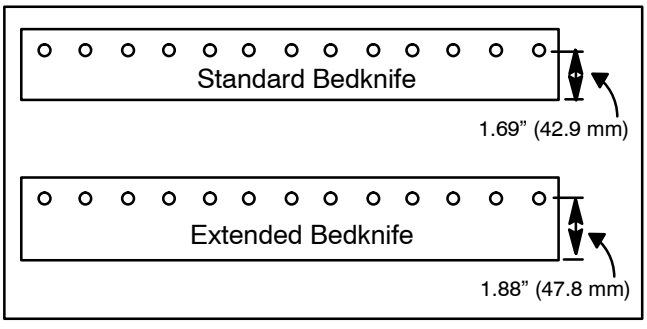

Figure 27

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Rollers

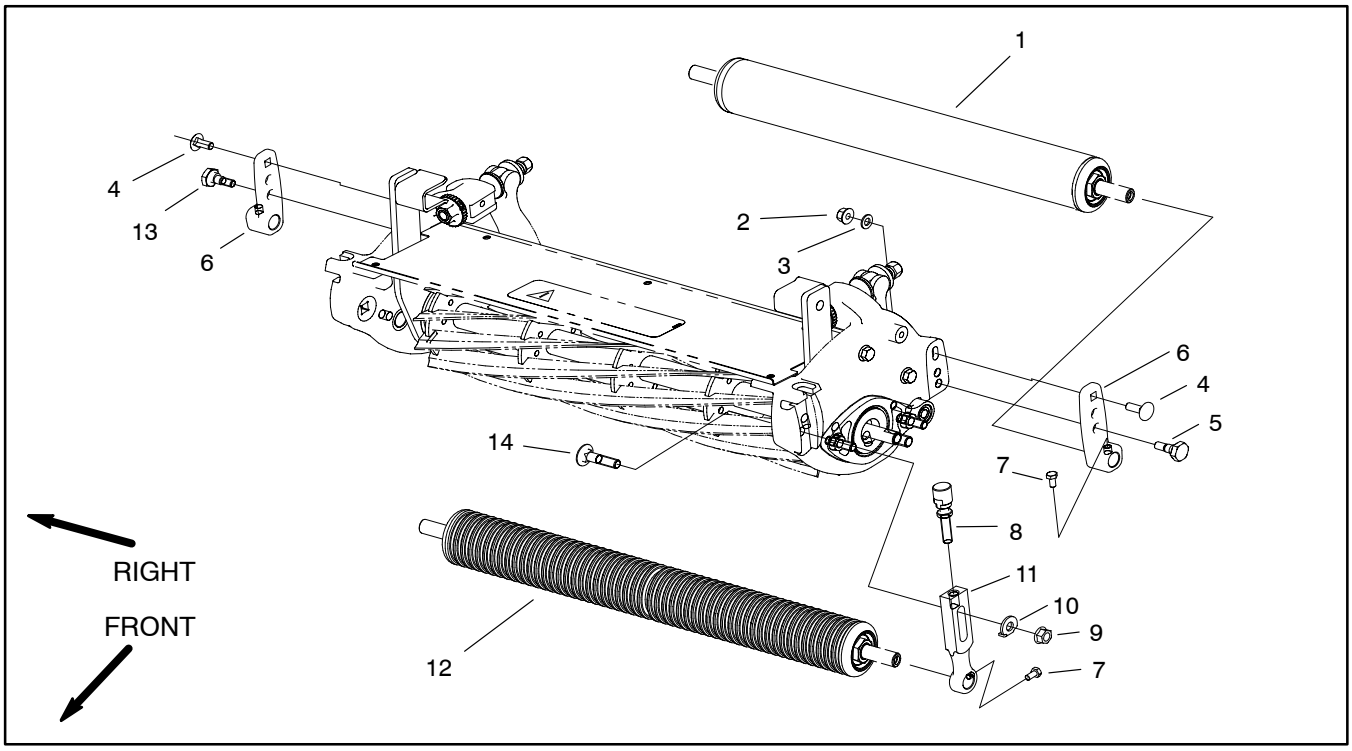

Figure 28

1. **Rear roller assembly**
2. **Flange nut**
3. **Flat washer**
4. **Carriage screw**
5. **Shoulder bolt**
6. **Rear roller bracket**
7. **Cap screw**
8. **Height–of–cut screw**
9. **Flange nut**
10. **Height–of–cut washer**
11. **Height–of–cut arm**
12. **Front roller assembly**
13. **Eccentric bolt**
14. **Carriage screw**

Roller Removal

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

2. Loosen cap screw that secures roller shaft on both sides of the mower.

3. To remove front roller assembly:

   A. Slide roller to one side of cutting unit so opposite end of roller can be removed from height–of–cut arm.

   B. Remove roller from the other height–of–cut arm.

4. To remove rear roller assembly:

   A. Remove flange nuts, flat washers, carriage screw, and shoulder bolt that secures left rear roller bracket to cutting unit side plate.

   B. Pull the rear roller bracket from the roller shaft.

   C. Remove roller from the other roller bracket.

Roller Installation

1. To install front roller, insert one end of roller into height–of–cut arm. Push roller far enough to allow other end of shaft to be positioned in other height–of–cut arm.

2. To install rear roller:

   A. Place roller shaft into the rear roller bracket that is still attached to the mower.

   B. Install roller bracket on the opposite side of the cutting unit onto roller shaft. Secure to mower side plate with carriage bolt, shoulder bolt, flat washers and flange nuts (Fig. 28).

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

4. If front roller was removed, check front roller for height–of–cut (see Height–of–Cut Adjustment). If rear roller was removed, check roller to reel level (see Leveling Rear Roller) and rear roller height (see Rear Roller Height Adjustment). Adjust as necessary.

Roller Service (Roller Shaft with Circlip)

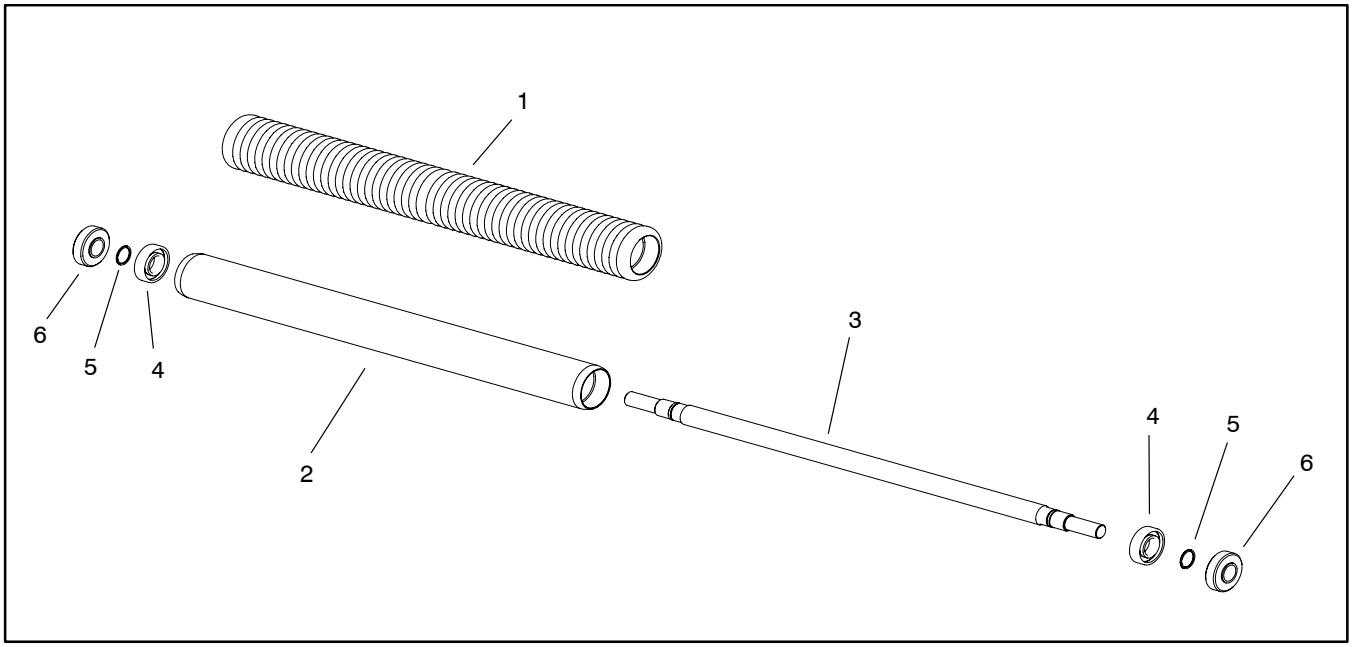

Figure 29

1. **Wiehle roller**
2. **Smooth roller**
3. **Roller shaft**
4. **Roller bearing**
5. **Spiral retaining ring**
6. **Roller seal**

Seal Removal

1. Using a 1/4 inch thick, 3" X 3" square piece of steel, make a seal removal tool as shown in Figure 30.

2. Slide seal removal tool over roller shaft.

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

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

5. Install two 1/4–20 by 1 inch long cap screws into seal removal tool.

6. Alternately tighten cap screws to pull seal out of roller assembly. Discard removed seals.

NOTE: Seals will be destroyed when servicing the rollers. Do not re–use seals that have been removed.

Bearing Removal

NOTE: It is recommended to replace bearings at both ends of the roller after bearing failure.

1. Remove both seals from roller (See Seal Removal). Remove both spiral retaining rings from roller shaft: catch ring removal notch with pick and pull ring from shaft.

NOTE: Roller bearings are pressed into rollers and slip fit on roller shafts.

2. Loosely secure roller assembly in bench vise and lightly tap one end of roller shaft until shaft and bearing are free from roller cavity.

3. Remove second bearing from roller cavity by supporting roller assembly and tapping on roller shaft.

4. Clean bearing cavity in roller and remove any rust with crocus cloth.

5. Inspect bearings, shaft, retaining rings and roller for damage. Replace components as needed.

Bearing Installation (Fig. 31)

1. Press bearing into one end of roller. Apply pressure to outer bearing race only.

2. Install shaft into roller and bearing.

3. Place spiral retaining ring on same end of shaft as installed bearing.

4. Install second bearing into roller. Apply pressure to outer bearing race until the outer race contacts shoulder of roller tube.

5. Position second spiral retaining ring on roller shaft.

6. Install new seals into roller (see Seal Installation).

Seal Installation

1. Lightly grease new oil seal ID and roller shaft surface. Also, apply light coating of grease on outer surface of installed bearing.

IMPORTANT: Do not use a hammer to install oil seals in roller as hammer impacts can damage seal.

2. Using a seal installation tool or tubing that contacts as much of the seal face as possible, press seal into roller. Seal face should be flush with roller surface when correctly installed (Fig. 31).

3. After seal installation, rotate the roller several times to allow the seal to seat.

4. After seating the seals, measure the rolling resistance using one of the following procedures:

   A. Wrap a string several times around the roller and connect the end of the string to a spring scale. Pull the spring scale to identify the rolling resistance of the roller (Fig. 32). The roller should rotate before the spring scale registers 6 lbs (2.7 kg).

   B. Wedge a 12 point, 15 mm socket on the end of roller shaft. Using a light–duty, inch–pound torque wrench, measure the rolling resistance of the roller. The roller should rotate with less than 6 in–lbs (.68 N–m) resistance.

5. If the rolling resistance of the roller is excessive, lightly tap the roller shaft back and forth several times and follow by again rotating the roller several times. Measure rolling resistance. If necessary, continue this process until the rolling resistance is correct.

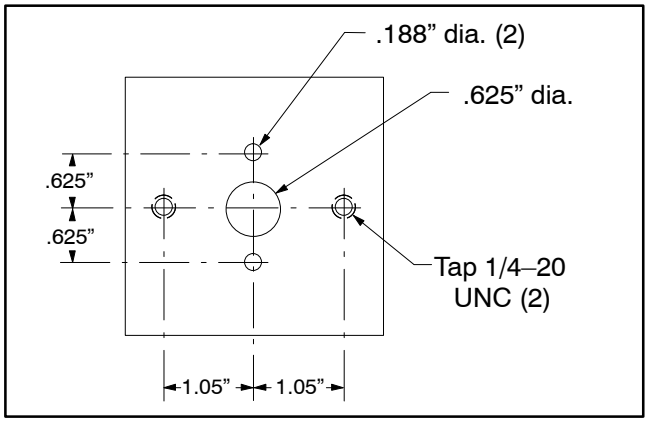

Figure 30

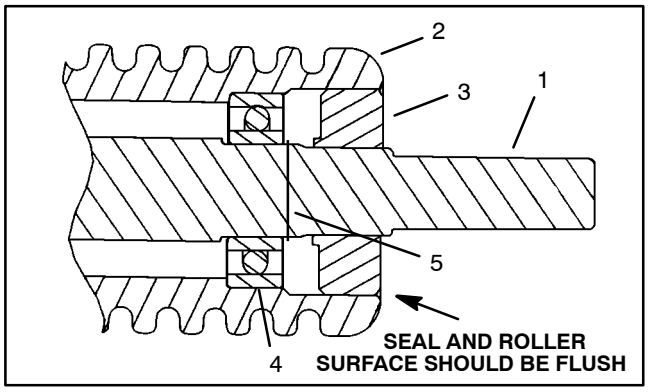

Figure 31

1. **Roller shaft**
2. **Roller**
3. **Seal**
4. **Bearing**
5. **Spiral retaining ring**

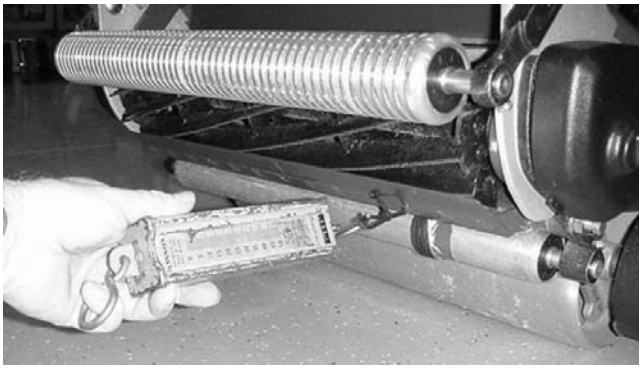

Figure 32

Roller Service (Threaded Roller Shaft)

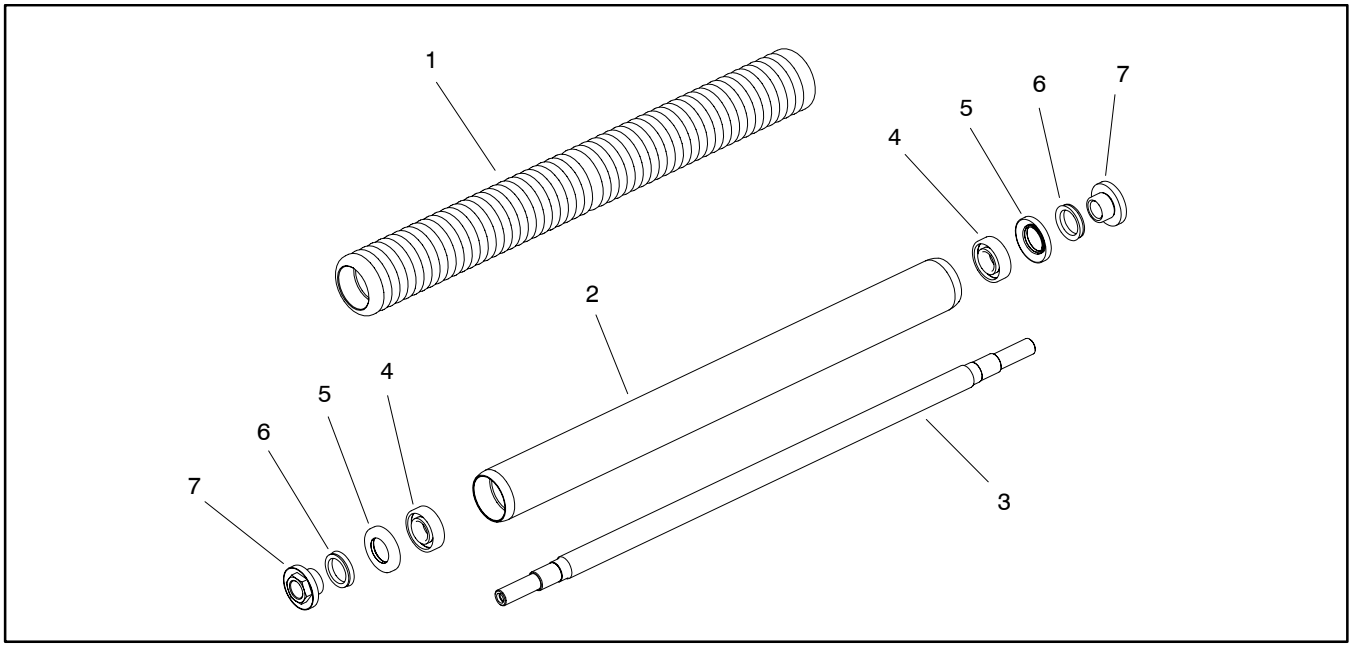

Figure 33

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

Disassembly

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

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

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

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

5. Clean bearing cavity in roller and remove any rust with crocus cloth.

Assembly

1. Place roller shaft into roller.

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.

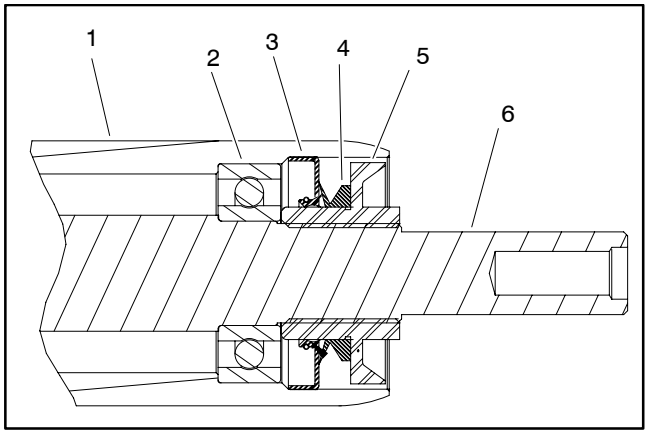

Figure 34

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

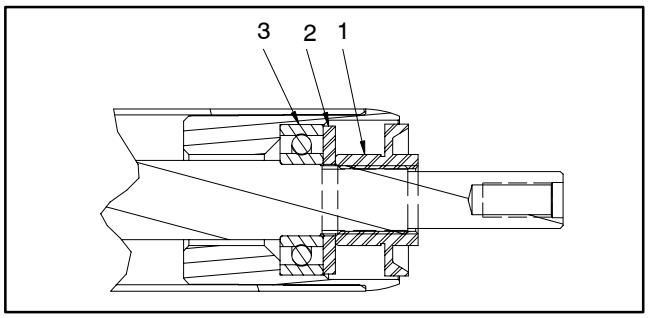

Figure 35

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

NOTE: Special tool TOR4105 (see Special Tools) can be used instead of washers and spacer when installing bearings and seals in roller.

2. Position a new bearing, black assembly washer (see Special Tools) and original lock nut onto each end of the roller shaft (Fig. 35).

3. Tighten nuts until the bearings are seated into each end of the roller.

4. Remove nut and black assembly washer from each end of the roller.

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

5. Apply a coating of grease to the nut surface to prevent seal damage during seal installation (Fig. 36).

6. Carefully install seals onto bearing lock nuts. Pack the back of the seal 75 to 90% full with #2 grease (Fig. 36).

7. Install a nut with seal onto each end of the roller shaft. Tighten nuts until they bottom against bearings (Fig. 37). Remove nuts from roller shaft.

8. Position an assembly spacer and yellow assembly washer (see Special Tools) on each end of roller shaft (Fig. 38). Thread nut onto each end of shaft.

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

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

10. Insert a V–ring onto each bearing lock nut.

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

12. 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).

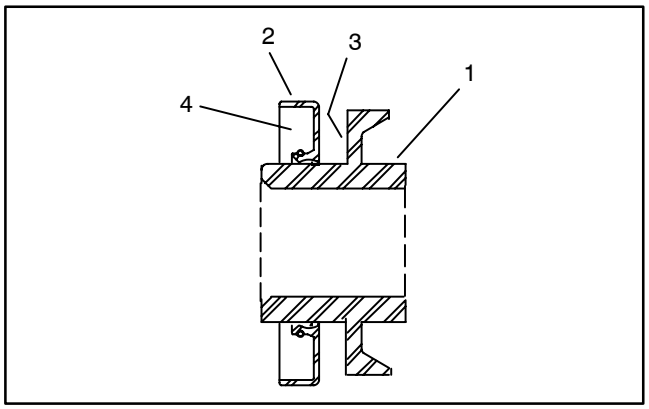

Figure 36

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

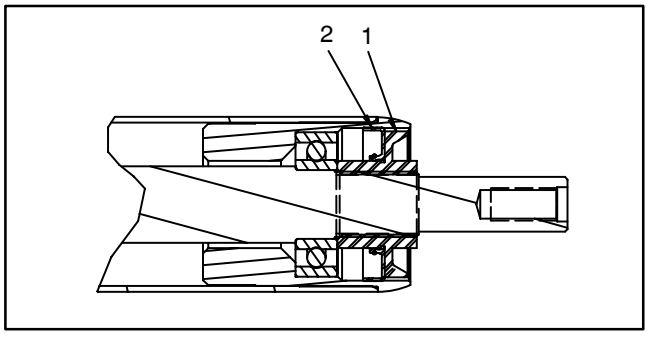

Figure 37

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

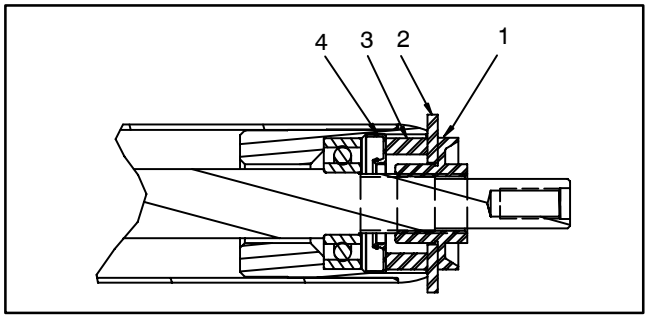

Figure 38

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

Cutting Reel

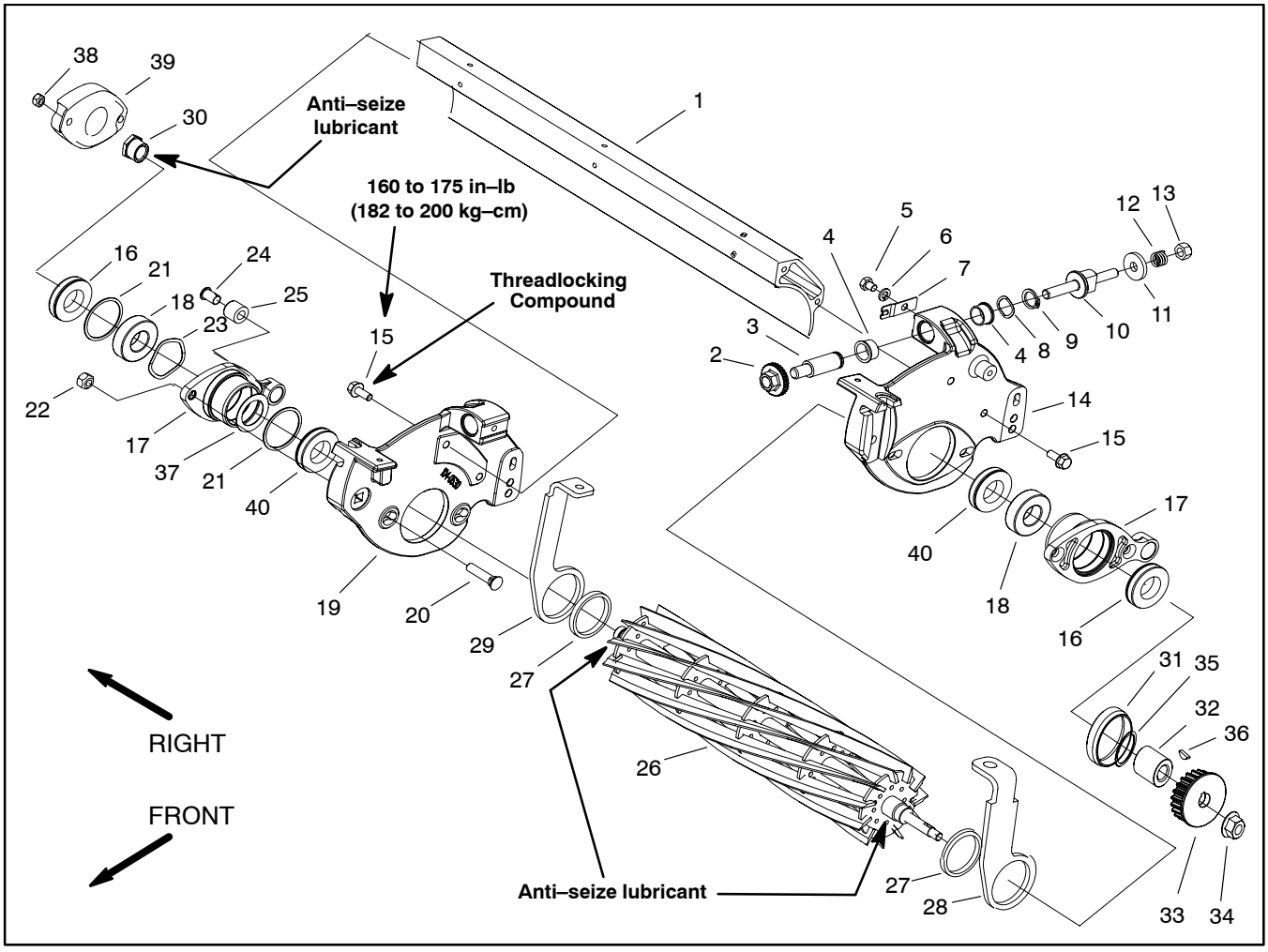

Figure 39

1. Shield frame
2. Adjust nut
3. Bedbar adjuster nut
4. Flange bearing
5. Cap screw
6. Lock washer
7. Detent
8. Spring wave washer
9. Retaining ring
10. Bedbar adjuster screw
11. Washer
12. Compression spring
13. Lock nut
14. LH side plate
15. Flange head screw (2 used per side)
16. Outer oil seal
17. Reel bearing housing
18. Ball bearing
19. RH side plate
20. Plow bolt (2 used per side)
21. Retaining ring
22. Tapered nut (2 used per side)
23. Wave washer
24. Nylon bushing
25. Bushing
26. Reel assembly
27. Pitch arm bushing
28. LH pitch arm
29. RH pitch arm
30. Reel bearing lock nut
31. Spacer
32. Pulley spacer
33. Drive pulley
34. Flange nut
35. Retaining ring (if equipped)
36. Woodruff key
37. Thrust washer (if equipped)
38. Lock nut
39. Counterweight
40. Inner oil seal

Removal (Fig. 39)

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.

NOTE: If a groomer is installed, remove the cutting reel using the procedures in Cutting Reel in the Service and Repairs Section of Chapter 8 – Groomer (Model 04201) or Chapter 9 – Groomer (Model 04204).

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

3. Remove belt cover and reel drive belt from the left side of the cutting unit (see Reel Drive Belt Replacement in Chapter 4 – Traction and Reel Drive Systems).

4. Block reel with a piece of wood to prevent reel from turning. Remove flange nut that secures drive pulley to the reel shaft. Pull pulley from the shaft. Remove woodruff key and pulley spacer from reel shaft.

5. Loosen and remove two locknuts, cap screw and lockwasher that secure reel drive plate assembly to side of cutting unit (Fig. 40). Pull assembly from mower. Remove spacer from behind reel drive plate.

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

7. Remove counterweight on right side of cutting unit after removing two lock nuts.

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

8. Remove reel bearing lock nut from right side of reel.

9. Remove tapered nuts that fasten the reel bearing housings to the mower side plates.

CAUTION

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

IMPORTANT: Support reel to prevent it from falling as bearing housings are removed.

10. Pull both bearing housings from the frame and reel. Remove reel from the mower.

11. Later production reels use a wear sleeve and v–ring seal (Fig. 42). Remove these items from the reel if equipped.

12. Cutting unit side plates and shield frame can be separated by removing two flange head screws per side.

Installation (Fig. 39)

1. Place cutting unit on a flat level surface or on a stable work bench.

2. If separated, attach side plates to shield frame with two flange head screws per side. Apply medium strength threadlocking compound to screw threads and torque from 160 to 175 in–lb (182 to 200 kg–cm).

3. Apply anti–seize lubricant to bearing journals of cutting reel.

NOTE: To prevent damage to wear sleeve, special tool TOR4107 (see Special Tools) should be used to install wear sleeve onto reel.

4. If equipped, install wear sleeve and v–ring seal to reel (Fig. 42 and 43).

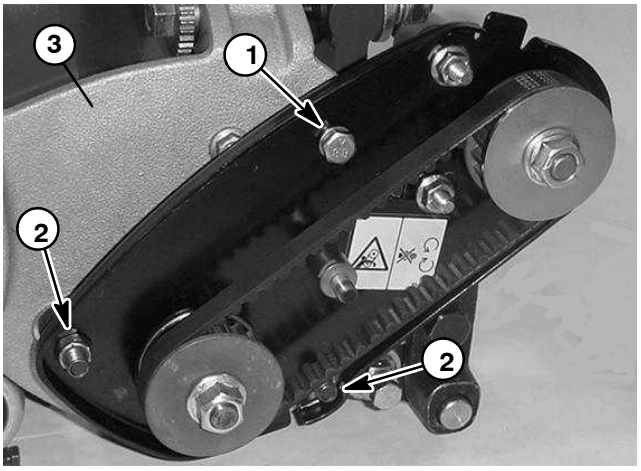

Figure 40

1. Cap screw w/lockwasher
2. Lock nut
3. LH cutting reel sideplate

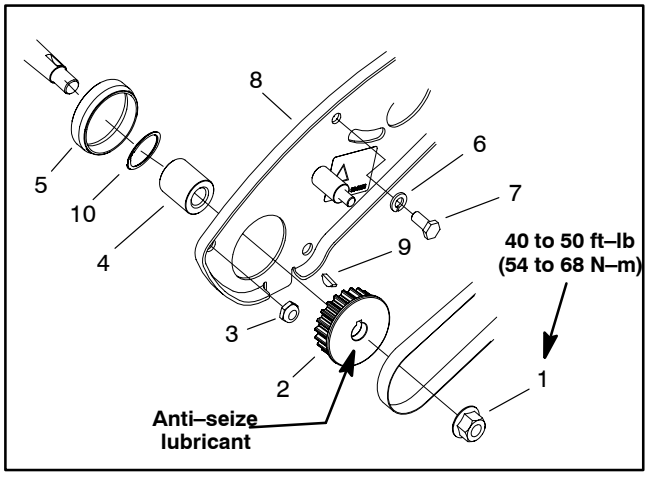

Figure 41

1. Flange nut
2. Drive pulley
3. Lock nut
4. Pulley spacer
5. Spacer
6. Lockwasher
7. Cap screw
8. Reel drive plate
9. Woodruff key
10. Retaining ring (if used)

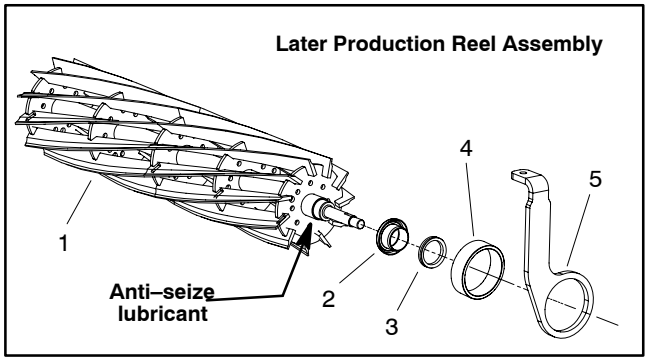

Figure 42

1. Cutting reel
2. Wear sleeve
3. V–Ring
4. Pitch arm bushing
5. Pitch arm

CAUTION

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

5. Position reel with pitch arms and bushings in frame to accept bearing housings. The reel shaft end with keyway should be on the left side of the frame.

6. Attach both bearing housings to frame and reel shaft:

IMPORTANT: On cutting units equipped with cannister seals, make sure that inner (black) seal bore is completely free of lubricant before installing bearing housings. Lubricant in the inner (black) seal bore will allow cutting reel to rotate inside the seal and reduce effectiveness of seal. Outer (blue) seal will be easier to install and will not be adversely affected with grease applied to inner bore.

A. Slide assembled bearing housings onto reel shaft until the bearing inner race contacts the reel shaft shoulder.

B. Install two plow bolts and tapered nuts and tighten only enough to hold bearing housings in position.

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

C. Align bearing to cutting reel by installing the reel bearing lock nut (right end of cutting reel) or the pulley spacer, pulley and flange nut (left end of reel) and tightening until contact with the bearing inner race is made.

D. Using light, steady hand pressure, press bearing housing to side plate. As an alternate method, slowly tighten reel bearing lock nut (right end of cutting reel) or the pulley spacer, pulley and flange nut (left end of reel) to evenly install bearing housing.

E. Tighten two plow bolts and tapered nuts to secure bearing housing to side plate.

F. Remove reel bearing lock nut, pulley spacer, pulley and flange nut from reel.

7. Apply anti–seize 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.

8. Install spacer in left side reel bearing housing. Position reel drive plate assembly and fit two locknuts, cap screw and lockwasher that secure reel drive plate assembly to side of cutting unit (Fig. 41). Tighten fasteners to secure assembly.

9. Install pulley spacer and woodruff key to reel shaft. Apply anti–seize lubricant to internal bore of drive pulley and position pulley on reel shaft. Install and tighten flange nut that secures pulley to the reel shaft. Torque flange nut from 40 to 50 ft–lb (54 to 68 N–m).

NOTE: The Flex 21 will have slightly greater reel drag than other Toro greens mowers due to the reel seal design.

10. Check for free movement of reel assembly by rotating reel with pulley nut. Using an appropriate torque wrench, make sure that reel rotates with less than 15 in–lbs (1.7 N–m) force applied to pulley nut. If binding is noted, identify and correct problem.

11. Install reel weight on right side of cutting unit with two lock nuts.

12. Install reel drive belt to the pulley and drive assembly (see Reel Drive Belt Replacement in Chapter 4 – Traction and Reel Drive Systems). Adjust drive belt tension and install belt cover.

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

14. Install bedbar to the mower (see Bedbar Installation in this section).

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

16. Complete mower set–up and adjustment sequence (see Adjustments section of this chapter).

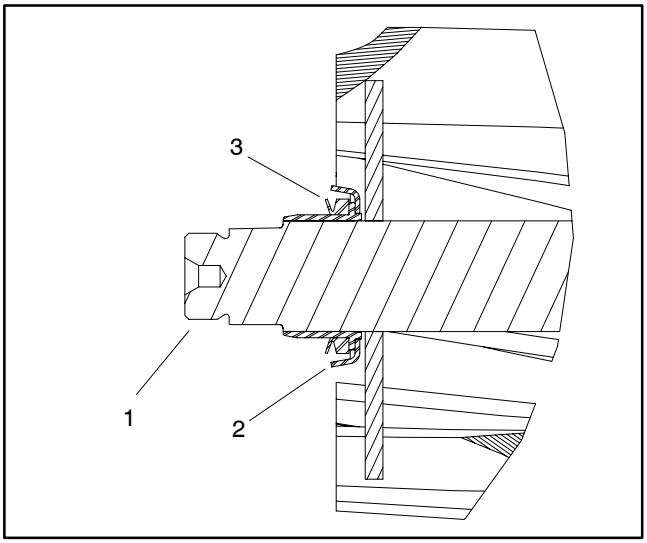

Figure 43

1. **Cutting reel shaft**
2. **Wear sleeve**
3. **V–Ring seal**

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Cutting Reel Bearing Service (Cannister Style Seals)

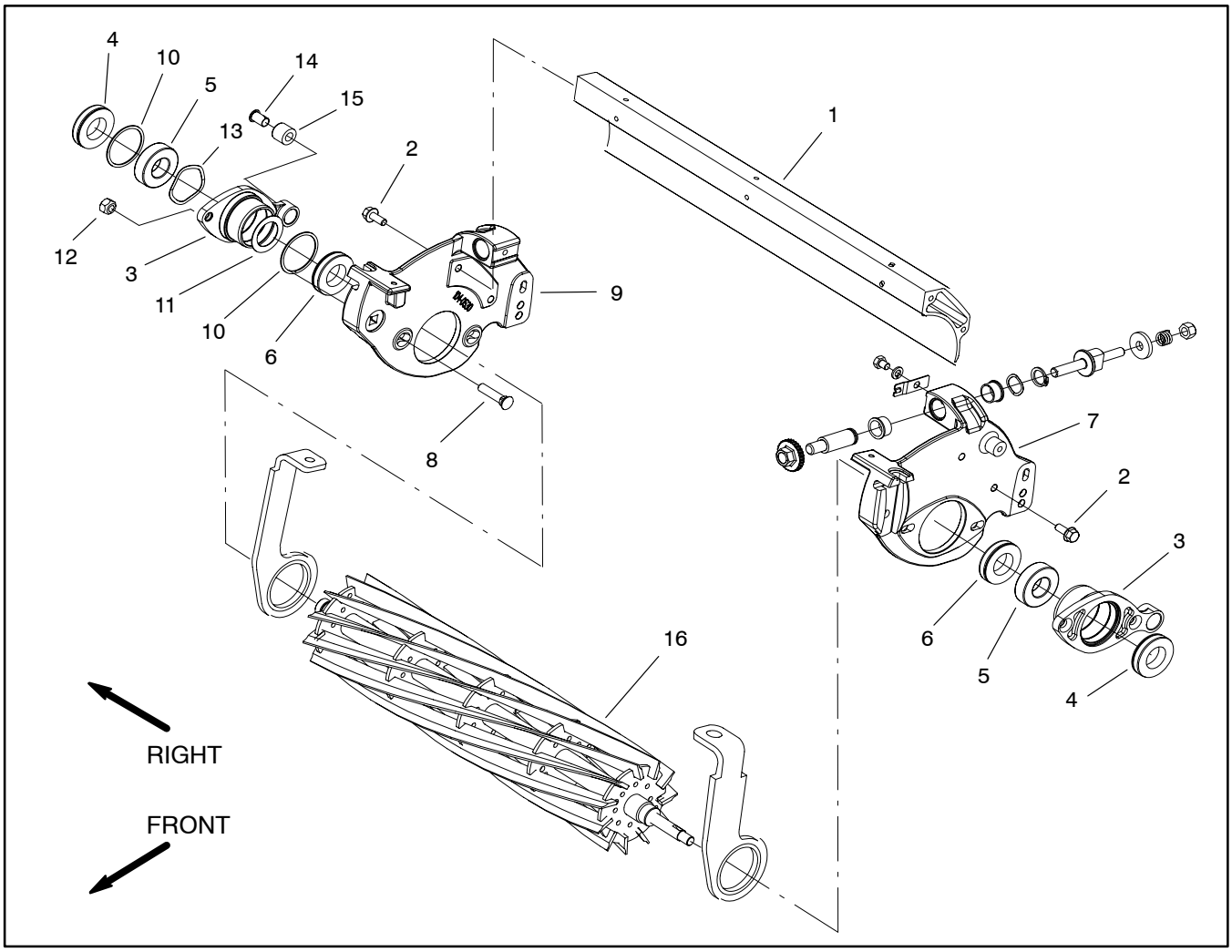

Figure 44

1. **Shield frame**
2. **Flange head screw (2 used per side)**
3. **Reel bearing housing**
4. **Outer reel seal**
5. **Reel bearing**
6. **Inner reel seal**
7. **LH side plate**
8. **Plow bolt (2 used per side)**
9. **RH side plate**
10. **Retaining ring**
11. **Thrust washer (if equipped)**
12. **Tapered nut (2 used per side)**
13. **Wave washer**
14. **Nylon bushing**
15. **Bushing**
16. **Cutting reel**

NOTE: Cutting units with serial numbers below 240001001 were produced with the cannister style reel seal package shown in Figure 44.

NOTE: To reduce rolling resistance of cutting reel, the seal package (including seals, v–ring seals, wear sleeves, reel bearing lock nut and pulley spacer) from later production machines can be used to replace cannister seals (see Cutting Reel Bearing Service (V–Ring Style Seals) in this section).

Disassembly (Fig. 44)

1. Remove reel bearing housings from mower frame (see Cutting Reel Removal in this section).

NOTE: It is recommended to replace bearings on both sides of reel.

2. Remove bearings from left side bearing housing:

   A. Remove both oil seals from the bearing housing.

   B. Once seals have been extracted from left side bearing housing, bearing can be removed.

3. Remove bearings from right side bearing housing:

   A. Remove both oil seals from the bearing housing.

   B. Remove inner retaining ring from housing. Then remove thrust washer (if equipped) and wave washer from housing. Discard wave washer.

   C. Remove bearing from bearing housing.

Assembly (Fig. 44)

1. To assemble left side bearing housing:

   A. Pack **new** bearing with grease and press bearing into the bearing housing with a bearing driver. Bearing should be positioned between grooves inside bearing housing after installation.

   B. Fill bearing housing cavity approximately half full with multi–purpose grease.

NOTE: Inner and outer reel seals on early production machines are identical black cannister seals. Later production machines have a blue outer cannister seal and a black inner cannister seal. It is recommended on all machines to use a blue outer seal and a black inner seal when servicing the reel bearings.

   C. With the flat side of the seal out, push seals into the bearing housing by hand. Seals should be flush with the housing. Do not strike seals during installation as seal damage could occur.

2. To assemble right side bearing housing:

   A. The right side bearing housing should have outer retaining ring installed prior to bearing installation.

   B. Pack **new** bearing with grease and press bearing into the bearing housing with a bearing driver. Use the installed retaining ring to position the bearing.

   C. Place **new** wave washer on the reel side of the bearing and then install thrust washer (if equipped) into housing.

   D. Install and seat second retaining ring into the groove of the housing.

   E. Fill bearing housing cavity approximately half full with multi–purpose grease.

NOTE: Inner and outer reel seals on early production machines are identical black cannister seals. Later production machines have a blue outer cannister seal and a black inner cannister seal. It is recommended on all machines to use a blue outer seal and a black inner seal when servicing the reel bearings.

   F. With the flat side of the seal out, push seals into the bearing housing by hand. Seals should be flush with the housing. Do not strike seals during installation as seal damage could occur.

IMPORTANT: On cutting units equipped with cannister seals, make sure that inner (black) seal bore is completely free of lubricant before installing bearing housings to cutting unit. Lubricant in the inner (black) seal bore will allow cutting reel to rotate inside the seal and reduce effectiveness of seal. Outer (blue) seal will be easier to install and will not be adversely affected with grease applied to inner bore.

3. Install reel bearing housings to mower frame (see Cutting Reel Installation in this section).

Cutting Reel Bearing Service (V–Ring Style Seals)

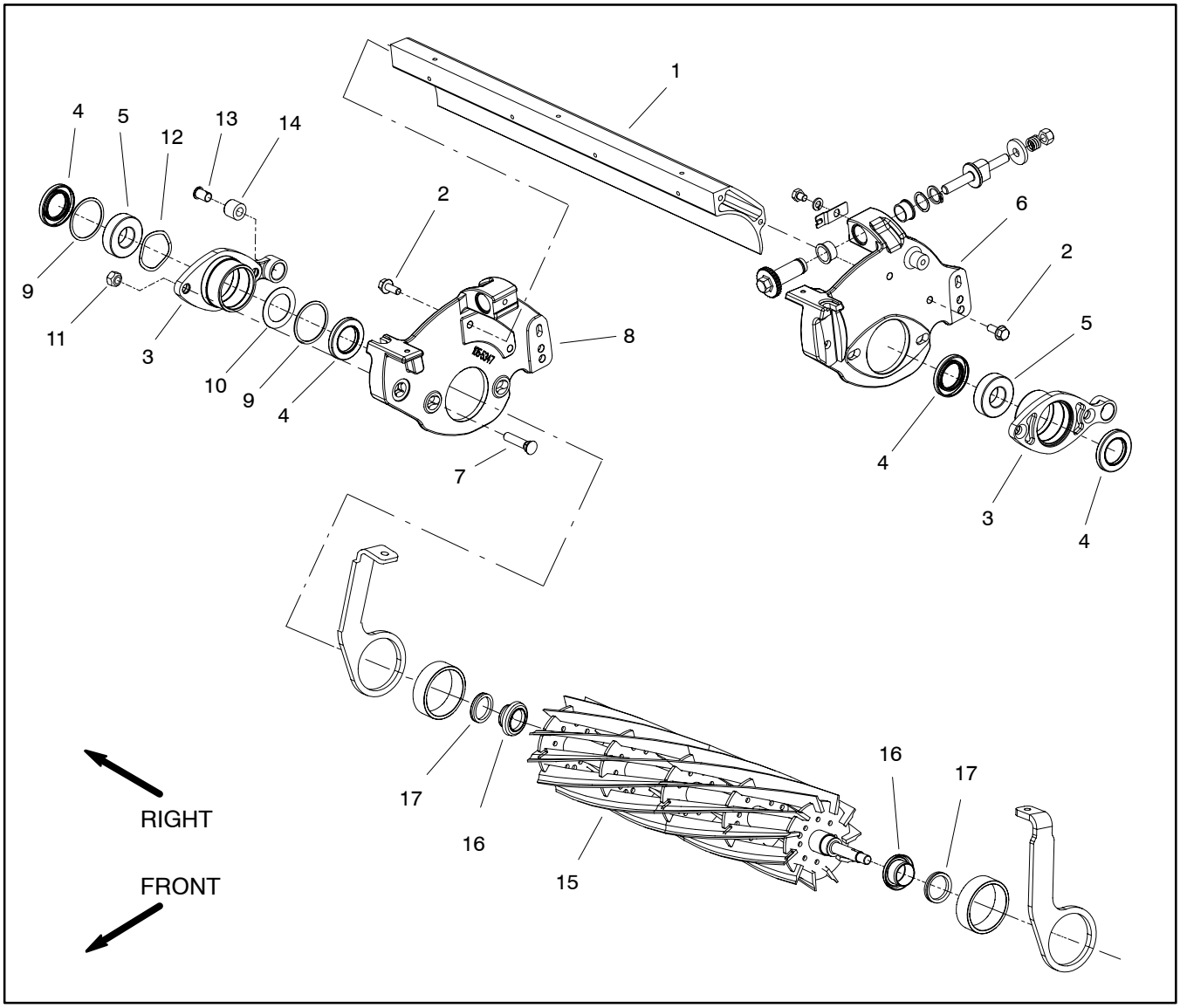

Figure 45

1. **Shield frame**
2. **Flange head screw (2 used per side)**
3. **Reel bearing housing**
4. **Reel seal**
5. **Reel bearing**
6. **LH side plate**
7. **Plow bolt (2 used per side)**
8. **RH side plate**
9. **Retaining ring**
10. **Thrust washer**
11. **Tapered nut (2 used per side)**
12. **Wave washer**
13. **Nylon bushing**
14. **Bushing**
15. **Cutting reel**
16. **Wear sleeve**
17. **V–Ring seal**

NOTE: Cutting units with serial numbers above 240001000 were produced with the v–ring style reel seal package shown in Figure 45.

NOTE: Cutting units that were originally equipped with cannister type seals can be converted to use the v–ring style seal package shown. Such a conversion requires that reel seals, v–ring seals, wear sleeves, reel bearing lock nut and pulley spacer be installed.

Disassembly (Fig. 45)

1. Remove reel bearing housings from mower frame (see Cutting Reel Removal in this section).

NOTE: It is recommended to replace bearings on both sides of reel.

2. Remove bearings from left side bearing housing:

   A. Remove both oil seals from the bearing housing.

   B. Once seals have been extracted from left side bearing housing, bearing can be removed.

3. Remove bearings from right side bearing housing:

   A. Remove both oil seals from the bearing housing.

   B. Remove inner retaining ring from housing. Then remove thrust washer and wave washer from housing. Discard wave washer.

   C. Remove bearing from bearing housing.

Assembly (Fig. 45)

1. Pack **new** reel bearings with grease. Fill cavity on back of seals with grease.

2. To assemble right side bearing housing (Fig. 46):

   A. The right side bearing housing should have the outer retaining ring installed prior to bearing installation.

   B. Press grease packed bearing into the bearing housing with a bearing driver. Use the installed retaining ring to position the bearing.

   C. Place **new** wave washer on the reel side of the bearing and then install thrust washer into housing.

   D. Install and seat second retaining ring into the groove of the housing.

   E. Fill bearing housing cavity 75% to 95% full with multi–purpose grease.

NOTE: Bearing housings originally equipped with cannister seals (cutting units with serial numbers below 240001000) are deeper than bearing housings used on later production machines. Inner seal should be recessed into these housings 0.188” (4.78 mm).

   F. Using a seal driver, press grease packed seals into the bearing housing with the flat side out. Inner seal should be flush with the housing and outer seal should be flush with the step in the housing.

3. To assemble left side bearing housing:

   A. Press grease packed bearing into the bearing housing with a bearing driver. Bearing should be positioned between grooves inside bearing housing after installation.

   B. Fill bearing housing cavity 75% to 95% full with multi–purpose grease.

NOTE: Bearing housings originally equipped with cannister seals (cutting units with serial numbers below 240001000) are deeper than bearing housings used on later production machines. Inner seal should be recessed into these housings 0.188” (4.78 mm).

   C. Using a seal driver, press grease packed seals into the bearing housing with the flat side out. Inner seal should be flush with the housing and outer seal should be flush with the step in the housing.

4. Grease lips of seals for assembly purposes.

5. Install reel bearing housings to mower frame (see Cutting Reel Installation in this section).

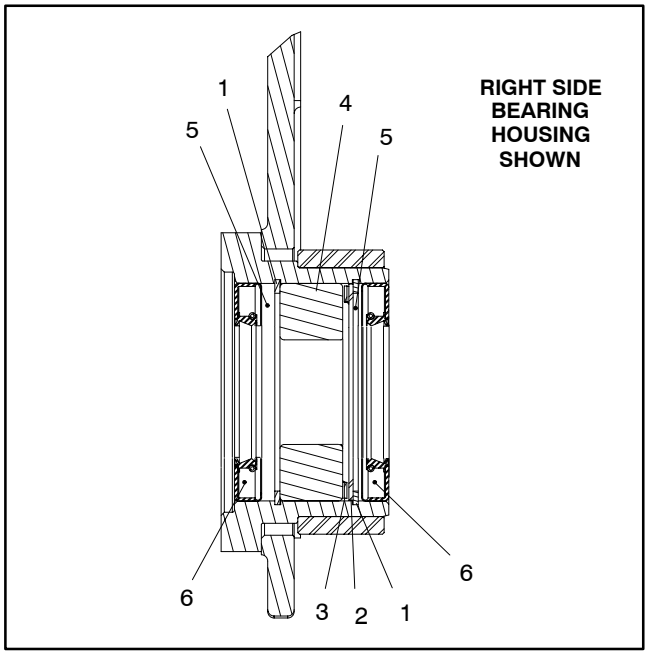

Figure 46

1. **Retaining ring**
2. **Thrust washer**
3. **Wave washer**
4. **Bearing**
5. **75% to 95% grease fill**
6. **Grease packed seal**

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 groomer reel, if installed (see Groomer Reel in the Service and Repairs Section of Chapter 8 – Groomer (Model 40201) or Chapter 9 – Groomer (Model 40204)).

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

NOTE: Some older 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 the reel being ground to the desired cylinder shape.

NOTE: When grinding reel, be careful not to 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. Install front roller (see Roller Installation in this section).

   B. If removed, re–install groomer reel (see Groomer Reel in the Service and Repairs Section of Chapter 8 – Groomer (Model 40201) or Chapter 9 – Groomer (Model 40204)).

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

   D. Complete mower set–up and adjustment sequence (see Adjustments section of this chapter).

Reel Grinding Specifications	
Nominal Reel Diameter	5 in (126 mm)
Service Limit Reel Diameter	4.5 in (114 mm)
Blade Relief Angle	30º
Relief Angle Range	20º to 40º
Blade Land Width	0.040 in (1.0 mm)
Blade Land Width Range	0.030 to 0.060 in (0.7 to 1.5 mm)
Max. Reel Taper	0.040 in (1.0 mm)

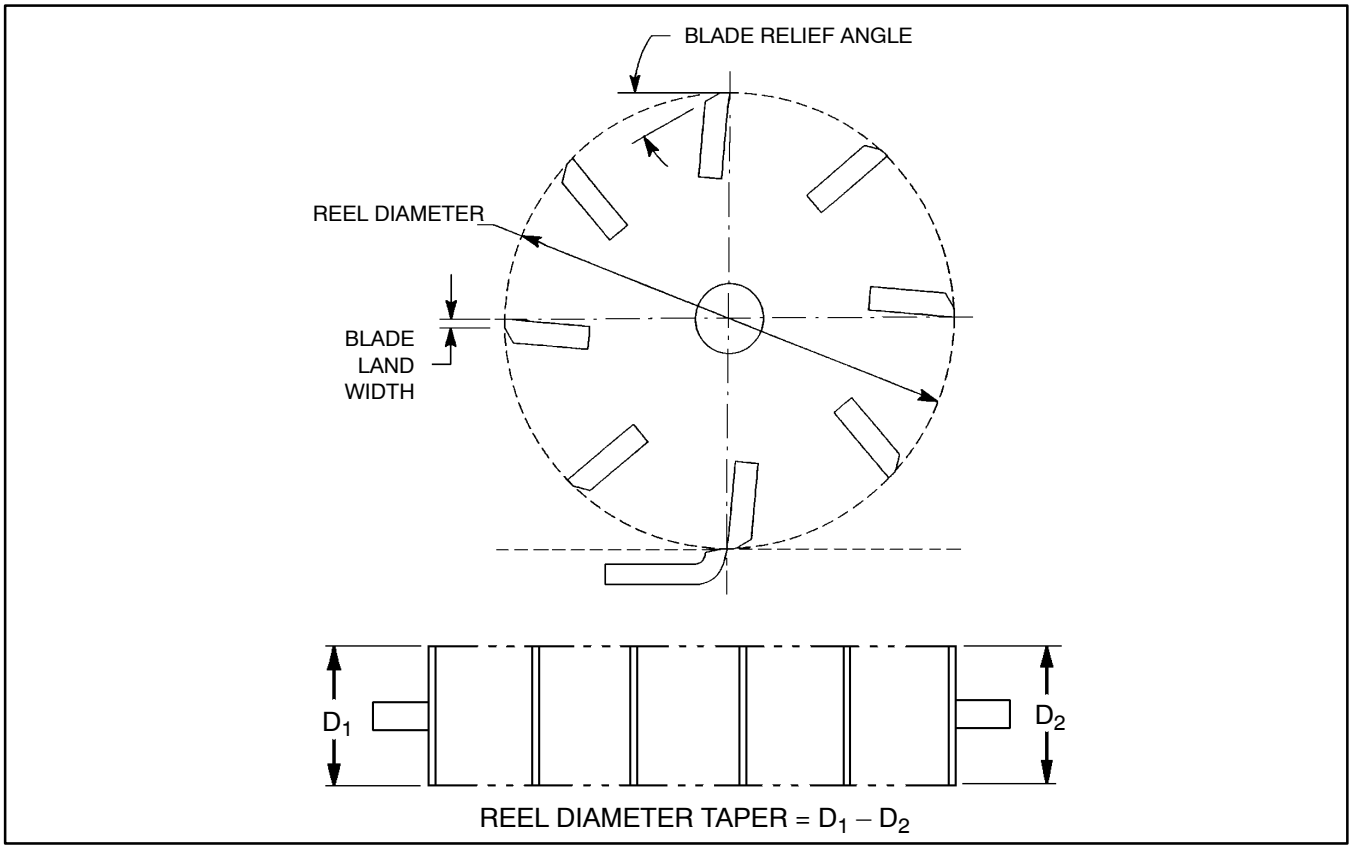

Figure 47

Chapter 8

Groomer (Model 04201)

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Specifications

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

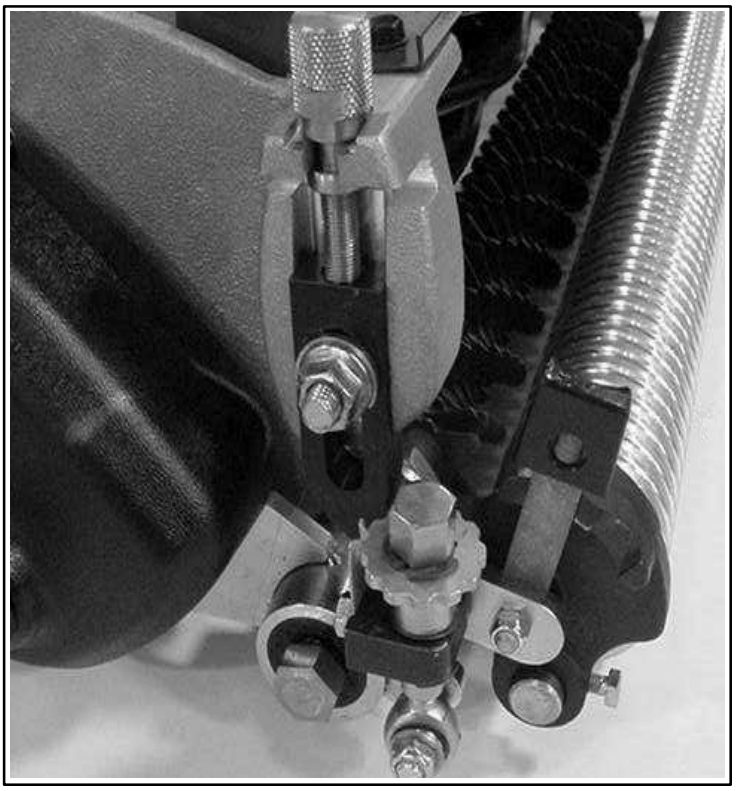
REEL CONSTRUCTION: 2.375 inch (6 cm) diameter, 41 steel blades with 1/2–inch blade spacing. Spacing is also adjustable to 1/4 and 3/4–inch (6.4 and 19.1 mm) spacing by varying the number of blades and spacers.

GROOMING PENETRATION: Maximum of 0.125 inch (3.2 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 groomer reel to be raised above the height/depth adjustment for no grooming while cutting or transport.

WIDTH–OF–GROOMING: 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 groomer reel is raised to its transport position.

1. To raise the groomer reel to the transport position, push down on both quick–up levers.

2. To position the groomer reel for operation (grooming), pull up on both quick–up levers.

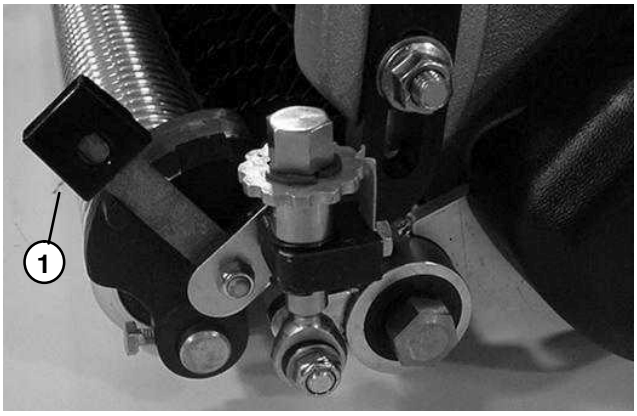


Figure 1

1. **Raised position (transport)**

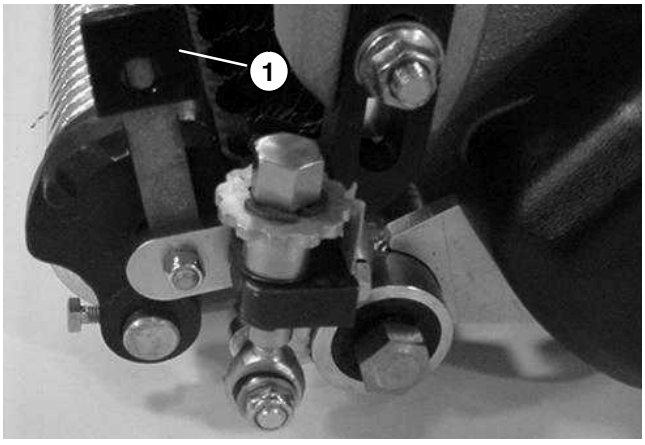


Figure 2

1. **Lowered position (grooming)**

Troubleshooting

Factors Affecting Grooming

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 groomer 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 groomer 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 groomer 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, sand dressing, and disease and pest control.

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

Groomer Reel Mechanical Problems

Problem	Possible Causes	Correction
The groomer reel rotates when it is in the raised, transport position.	The groomer reel should rotate whenever the cutting reel is engaged.	Normal operation.
No rotation of the groomer reel.	Seized groomer 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 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 groomer reel blades are bent, damaged, or missing.	Repair or replace blades if necessary.
	The groomer reel shaft is bent or damaged.	Replace groomer reel shaft.
	Grooming depth is not equal on both ends of groomer 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, groomer 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 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. Use quick–up levers on both sides of the mower to lower the groomer reel to the grooming position (Fig. 3).

NOTE: Improper or over–aggressive use of the groomer 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 groomer reel, measure the distance from the lowest tip of the groomer 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. Raise groomer reel to the transport position.

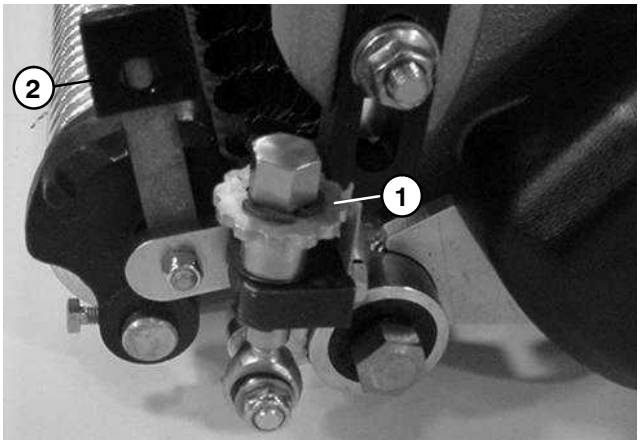


Figure 3

1. Height adjustment knob **2. Quick–up lever**

Drive Belt Replacement

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

2. Remove two lock nuts that secure groomer belt cover, 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. Release idler (Fig. 5).

4. Install new drive belt to drive pulley, idler pulley, and driven pulley observing correct belt routing (Fig. 5).

5. Secure belt cover to housing with two lock nuts.

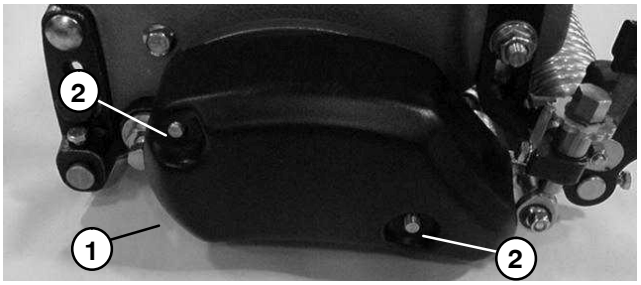


Figure 4

1. **Groomer belt cover**
2. **Lock nut**

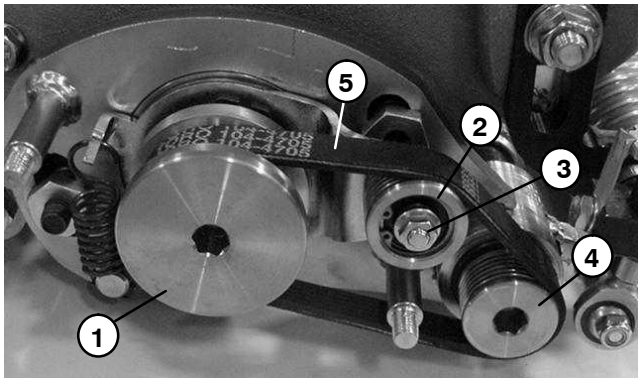


Figure 5

1. **Drive pulley**
2. **Idler pulley**
3. **Idler pulley nut**
4. **Driven pulley**
5. **Groomer drive belt**

Groomer Reel

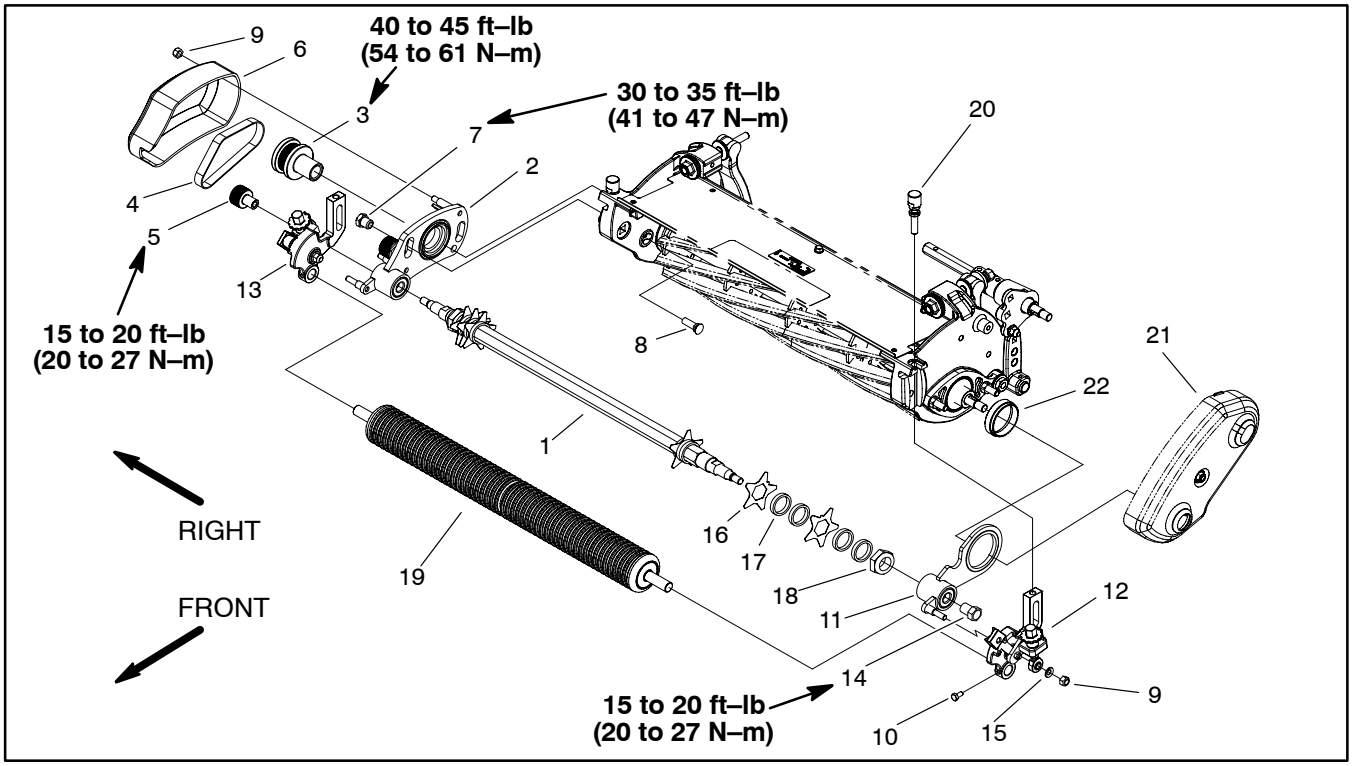


Figure 6

1. Groomer shaft
2. RH side plate
3. Drive pulley
4. Groomer belt
5. Driven pulley
6. Groomer belt cover
7. Tapered nut
8. Plow bolt
9. Locknut
10. Cap screw
11. LH side plate
12. LH adjuster arm
13. RH adjuster arm
14. Seal nut
15. Belleville washer
16. Groomer blade
17. Spacer
18. Lock nut
19. Front roller
20. Height–of–cut screw
21. Reel drive cover
22. Spacer

The groomer reel should be removed to reverse the shaft, replace individual blades, or replace the entire shaft. The shaft can be reversed so that the sharpest edge of the blades are forward.

Removal

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

2. Remove groomer belt cover and drive belt from right side of mower (see Drive Belt Replacement).

3. Loosen cap screws securing front roller shaft to RH (Fig. 7) and LH adjuster arms.

4. Remove locknut and belleville washer securing RH adjuster arm rod end to RH groomer side plate pin (Fig. 7).

5. Remove carriage bolt, flange nut, and washer securing RH adjuster arm assembly to mower side plate. Do not change height–of–cut screw adjustment. Remove RH adjuster arm.

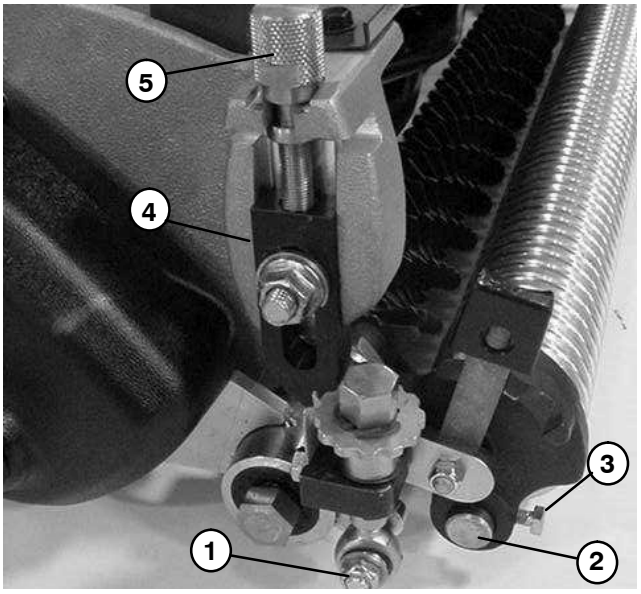


Figure 7

1. Locknut with belleville washer
2. Front roller shaft
3. Cap screw
4. RH adjuster arm
5. Height–of–cut screw

6. Pull front roller assembly out of LH adjuster arm.

NOTE: To prevent groomer shaft from turning when removing driven pulley, use wrench on shaft flats.

7. Using an allen wrench, remove the driven pulley from the end of the groomer shaft (Fig. 9).

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 an allen wrench to remove drive pulley from the cutting reel shaft (Fig. 9).

9. Remove two tapered nuts that secure the groomer RH side plate to the bearing housing and mower side plate (Fig. 9). Remove the groomer RH side plate.

10. Remove the seal nut that secures the groomer shaft to the groomer LH side plate (Fig. 10).

11. Pull the groomer shaft from the LH side plate.

Installation

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

2. Place groomer reel shaft assembly into the LH side plate bearing. Screw seal nut onto the shaft threads. **Do not tighten** (Fig. 10).

3. Insert groomer shaft into RH side plate bearing and then position side plate to cutting unit frame. Secure with two tapered nuts (Fig. 9). Tighten nuts from 30 to 35 ft–lb (41 to 47 N–m).

NOTE: The drive pulley has **left handed** threads.

4. Install drive pulley onto the reel shaft and torque from 40 to 45 ft–lb (54 to 61 N–m). Install driven pulley onto the groomer shaft and torque from 15 to 20 ft–lb (20 to 27 N–m).

5. Torque seal nut on left end of groomer shaft from 15 to 20 ft–lb (20 to 27 N–m).

6. Insert front roller into LH adjuster arm.

7. Position RH adjuster arm to front roller, groomer side plate pin, and mower frame. Secure to mower with carriage bolt, washer, and flange nut (Fig. 7).

8. Install belleville washer and locknut securing RH adjuster arm rod end to RH groomer side plate pin.

9. Center front roller and tighten cap screws on roller ends.

10. Reinstall groomer drive belt and belt cover to right side of mower (see Drive Belt Replacement in this section).

11. Check groomer reel height and mower height–of–cut settings. Adjust as needed.

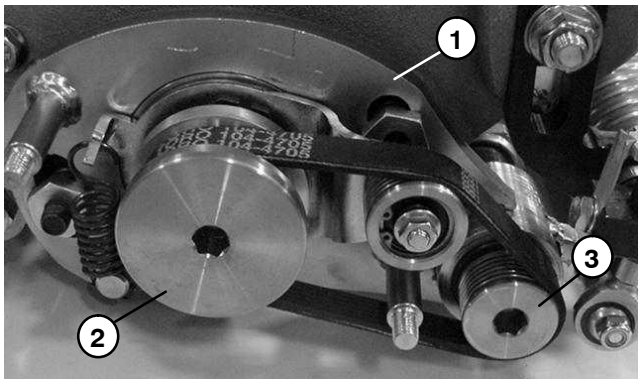


Figure 8

1. **RH side plate**
2. **Drive pulley**
3. **Driven pulley**

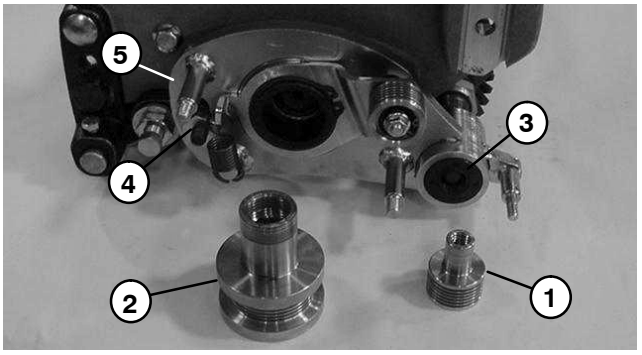


Figure 9

1. **Driven pulley**
2. **Drive pulley**
3. **Bearing support**
4. **Tapered nut**
5. **RH side plate**

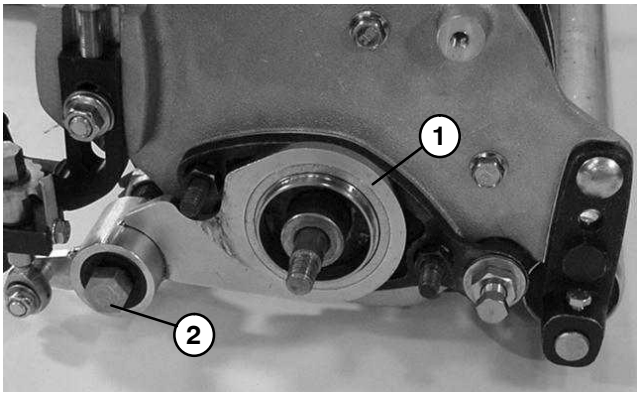


Figure 10

1. **LH side plate (reel drive removed)**
2. **Seal nut**

Shaft Disassembly

Inspect groomer reel blades frequently for damage and wear. Straighten bent blades with a pliers. Either replace worn blades or reverse the groomer reel shaft to put the sharpest blade edge forward (Fig. 11). Blades that are rounded to the midpoint of the blade tip must be reversed or replaced for reasonable groomer performance.

1. Remove groomer reel (see Groomer Reel Removal in this section).

2. Remove lock nut from either end of the shaft (Fig. 12).

3. Remove spacers and blades as necessary.

Shaft Reassembly

1. Start by placing two spacers against a lock nut installed on one end of groomer shaft. Then, place first blade against spacers (Fig. 12).

2. Rotate location mark on each installed blade one flat of the shaft, either in a clockwise or counterclockwise direction. The direction of location mark rotation must remain constant on the shaft.

3. For 1/2 inch (1.3 cm) spacing, make sure there are two spacers between blades (Fig. 12).

4. When all blades have been installed, place final 2 spacers on shaft and then thread lock nut onto the shaft.

5. Position lock nuts to allow blades and spacers to be centered on the shaft. Torque lock nuts from 200 to 250 in–lb (230 to 288 kg–cm) so spacers are **not** free to rotate.

6. Install groomer reel back on cutting unit (see Groomer Reel Installation in this section).

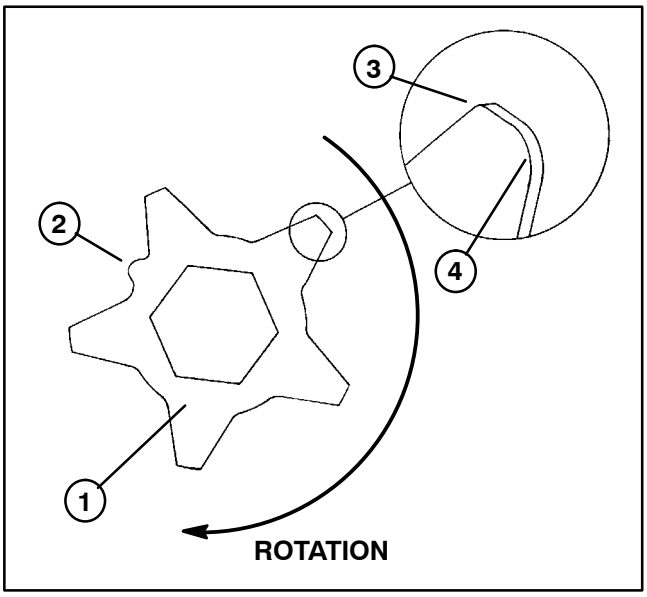


Figure 11

1. **Groomer blade**
2. **Location mark**
3. **Sharp edge**
4. **Dull (rounded) edge**

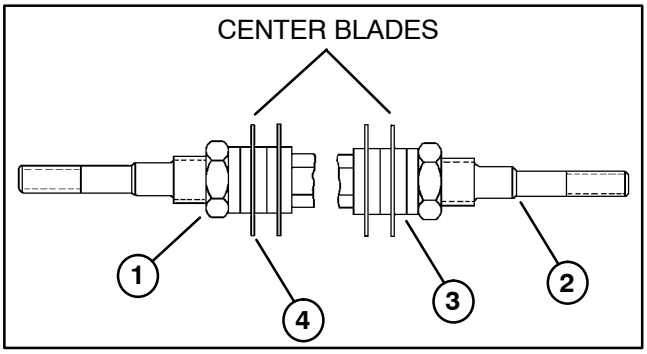


Figure 12

1. **Lock nut**
2. **Shaft**
3. **Spacer**
4. **Blade**

Groomer Reel Bearing Replacement

1. Remove RH groomer side plate and groomer reel (see Groomer 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 locknut and belleville washer securing LH adjuster arm rod to LH groomer side plate pin (Fig. 13).

   C. Remove LH groomer side plate from mower.

3. Replace bearings in **both** side plate assemblies (Figures 14 and 15):

   A. Remove inner and outer seals from groomer side plate. Discard seals.

   B. Take out one retaining ring and push bearing out of housing.

   C. Slide new bearing into housing using the installed retaining ring to position the bearing.

   D. Install second retaining ring into housing.

   E. Press new seals into both sides of bearing. **Note:** Seals are a two piece design. Seals should be installed so the lip side of the seal assembly is facing out (see inset in Figure 14).

4. Reinstall LH groomer side plate to mower:

   A. Position LH groomer side plate to mower making sure that side plate pin extends through bearing in LH adjuster arm.

   B. Place belleville washer and locknut on pin threads. Tighten locknut.

   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).

5. Install groomer reel and RH groomer side plate (see Groomer Reel Installation in this section).

6. Check and adjust groomer reel height and mower height–of–cut settings.

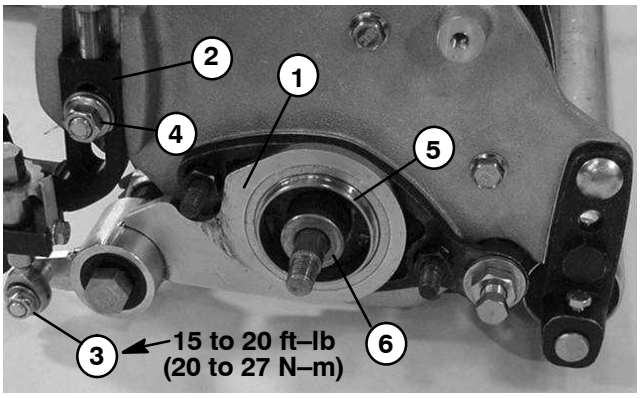


Figure 13

1. LH groomer side plate
2. LH adjuster arm
3. Locknut w/belleville washer
4. Flange nut w/washer
5. Reel drive spacer
6. Pulley spacer

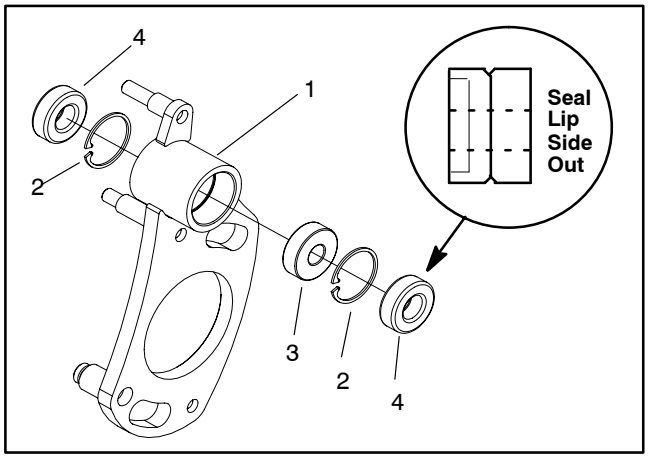


Figure 14

1. RH groomer side plate
2. Retaining ring
3. Ball bearing
4. Seal

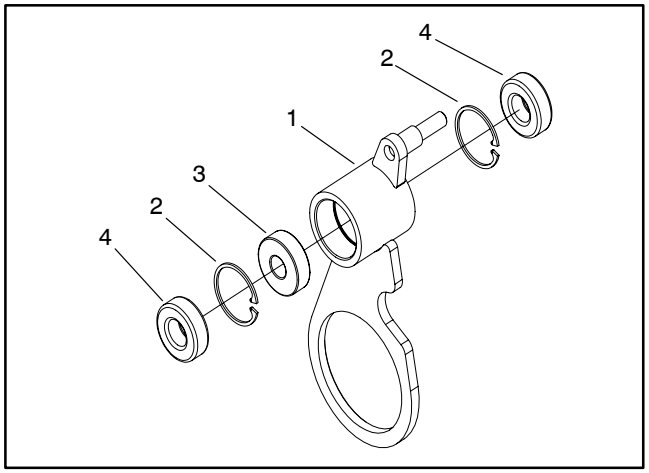


Figure 15

1. LH groomer side plate
2. Retaining ring
3. Ball bearing
4. Seal

Idler Assembly

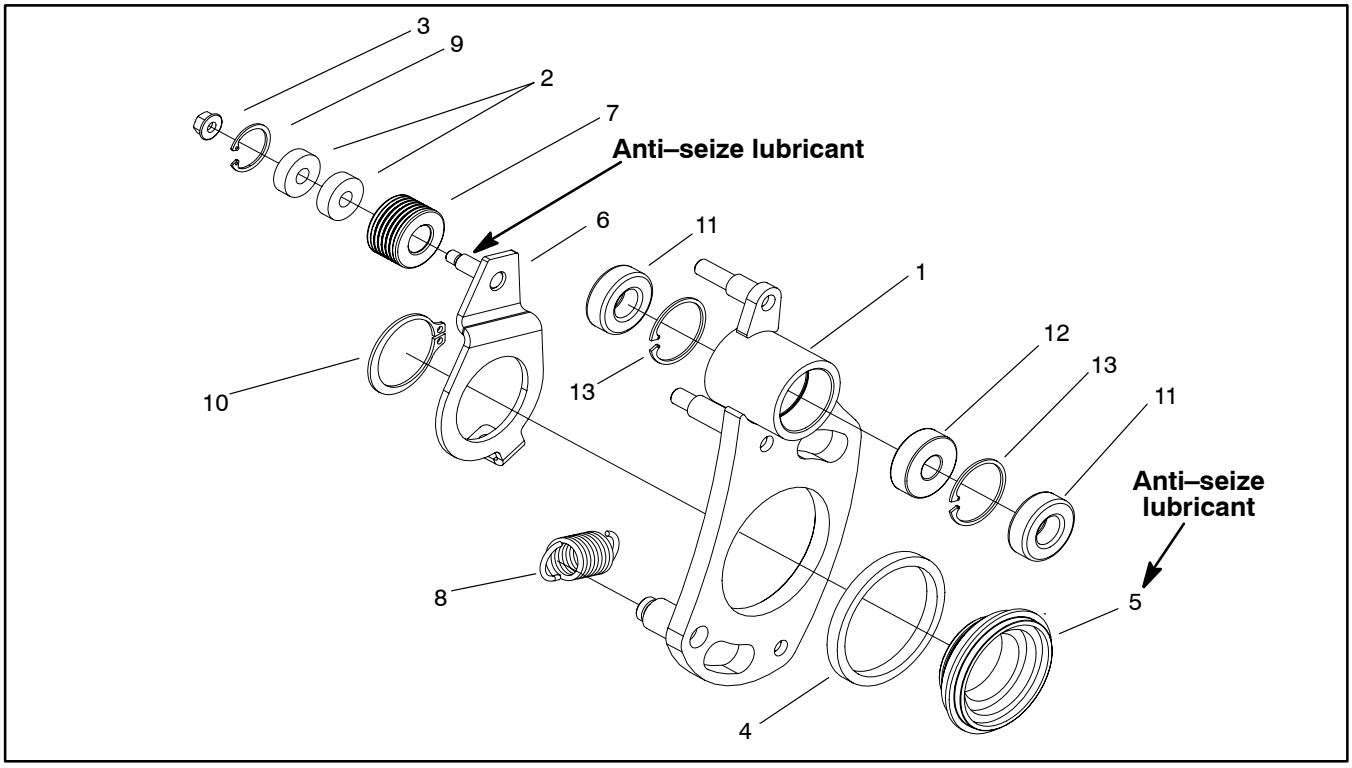


Figure 16

1. RH side plate
2. Idler bearing
3. Flange nut
4. Bushing
5. Pivot hub
6. Idler bracket
7. Idler pulley
8. Idler spring
9. Retaining ring
10. Retaining ring
11. Seal
12. Bearing
13. Retaining ring

The right side plate assembly of the Flex 21 groomer 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 Groomer Reel Removal in this section).

2. Using Figures 16 and 17 as guides, remove idler bracket, idler pulley and/or idler bearings for service as needed.

Installation

1. Apply anti–seize lubricant to the pivot hub and idler bracket pin.

2. Reassemble components using Figures 16 and 17 as guides.

NOTE: When properly installed, the idler pulley should move freely from side to side on the idler bracket pin.

3. Install drive pulley, drive belt, and belt cover to right side of mower (see Groomer Reel Installation in this section).

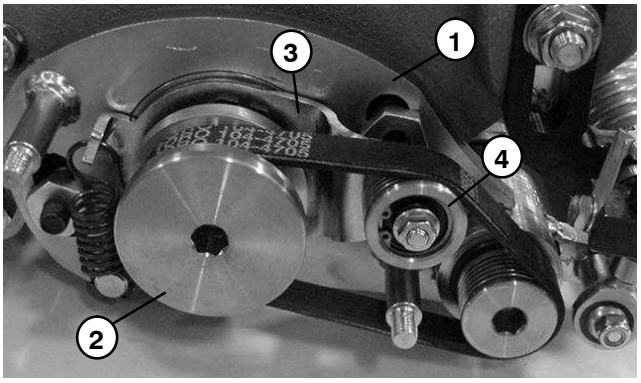


Figure 17

1. RH side plate
2. Drive pulley
3. Idler bracket
4. Idler pulley w/bearings

Adjuster Arm Assembly

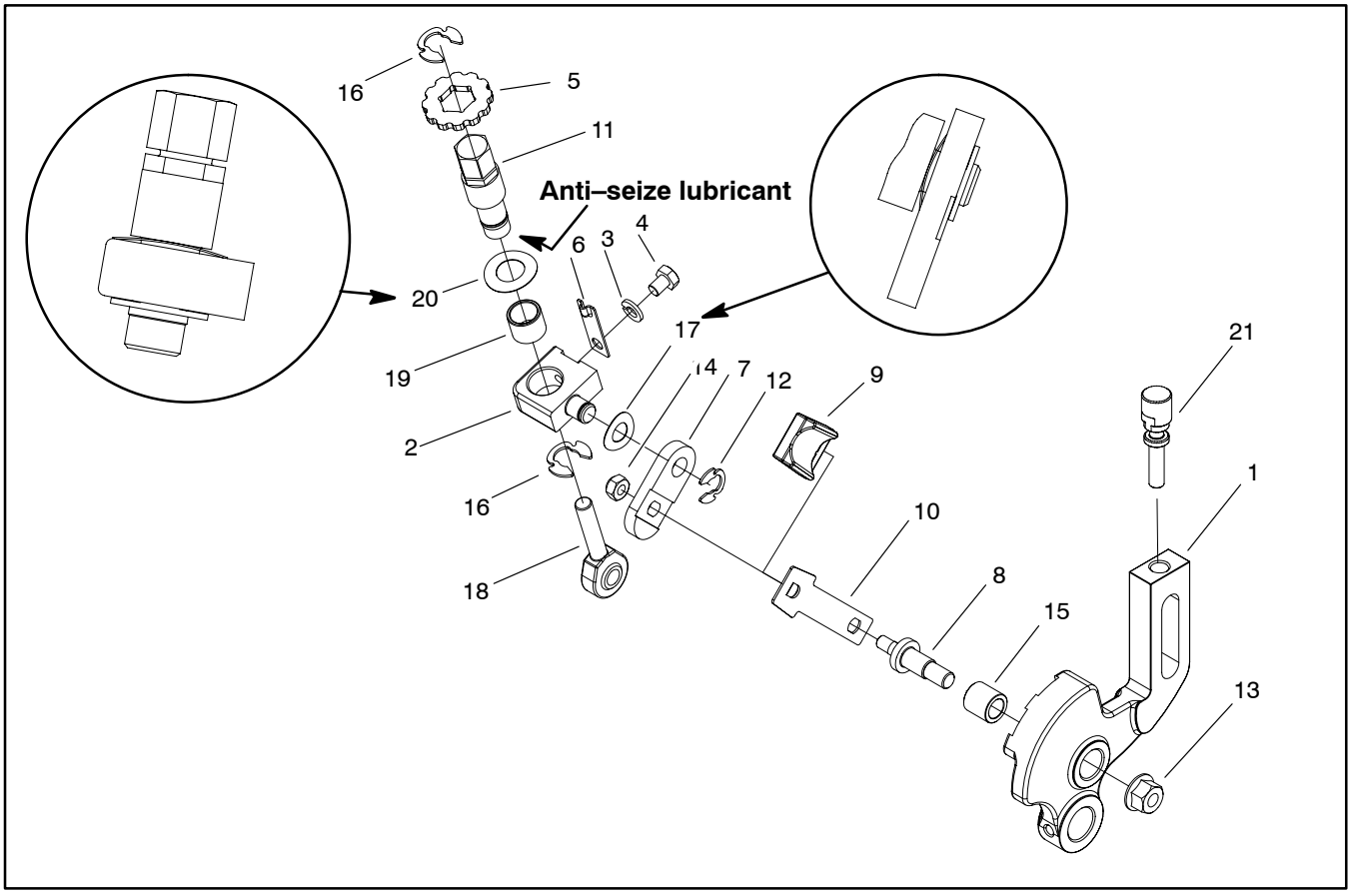


Figure 18

1. **Adjuster arm (RH shown)**
2. **Block assembly**
3. **Spring washer**
4. **Cap screw**
5. **Engage plate**
6. **Detent spring**
7. **Lift cam**
8. **Lift pivot**
9. **Lift arm knob**
10. **Lift arm**
11. **Adjust shaft**
12. **Retaining ring**
13. **Flange nut**
14. **Lock nut**
15. **Lift spacer**
16. **Retaining ring**
17. **Spring washer**
18. **Groomer shaft end bearing**
19. **Bushing**
20. **Curved washer**
21. **Height–of–cut screw**

Disassembly

1. Remove adjuster arm from cutting unit (see Groomer Reel Removal in this section).

2. Disassemble adjuster arm using Figure 18 as a guide. **Note:** Right and left side adjuster arms are different; other components in Figure 18 are the same on both sides.

Assembly

1. Apply anti–seize lubricant to internal threads of adjust shaft.

2. Assemble adjuster arm using Figure 18 as a guide. **Note:** Orientation of spring washer (17) and curved washer (20) is important for correct operation. See insets in Figure 18 for proper washer installation.

3. Install adjuster arm onto cutting unit (see Groomer Reel Installation in this section).

4. Check height–of–cut and adjust as needed.

Cutting Reel

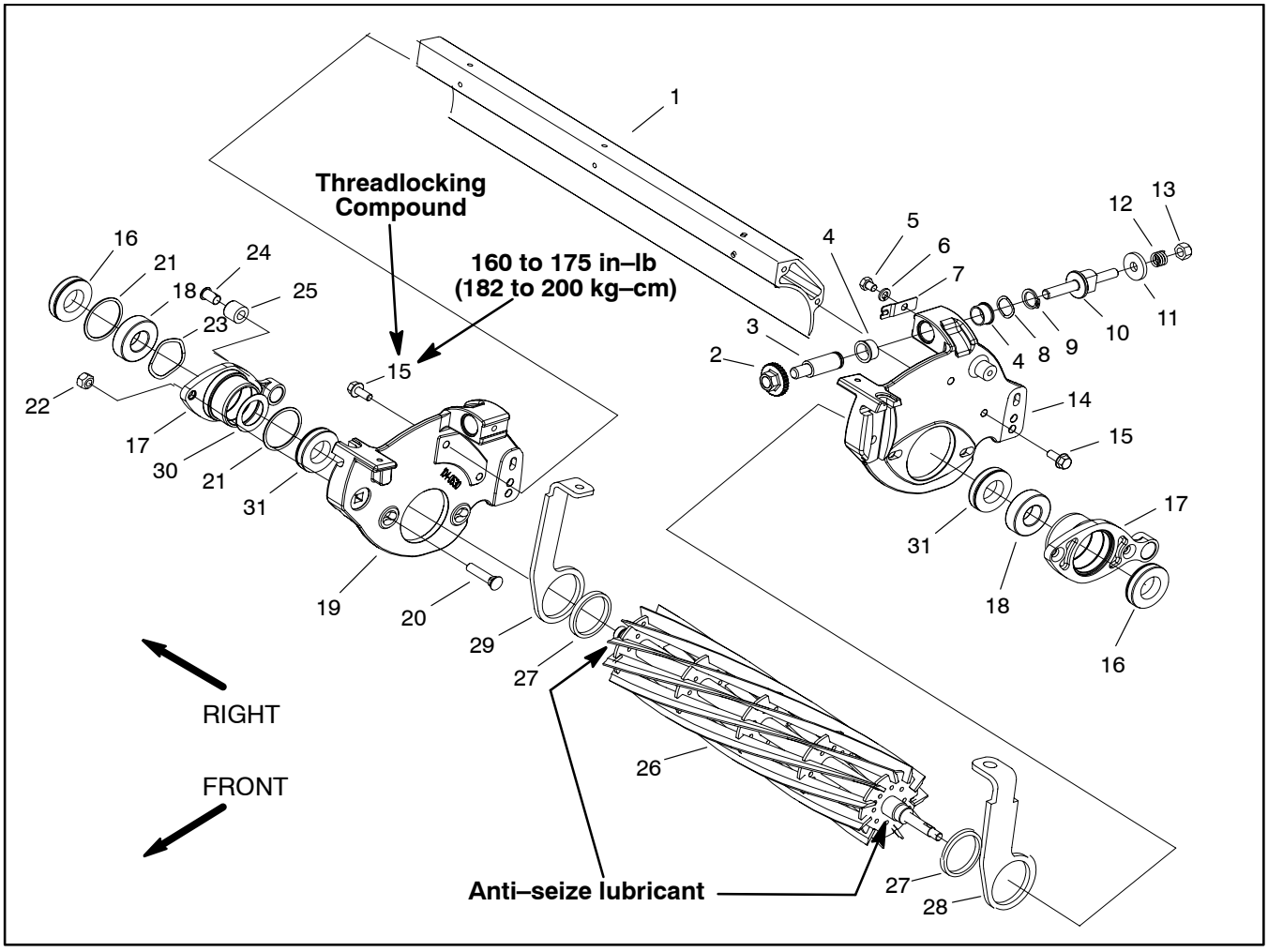


Figure 19

1. Shield frame
2. Adjust nut
3. Bedbar adjuster nut
4. Flange bearing
5. Cap screw
6. Lock washer
7. Detent
8. Spring wave washer
9. Retaining ring
10. Bedbar adjuster screw
11. Washer
12. Compression spring
13. Lock nut
14. LH side plate
15. Flange head screw
16. Outer oil seal
17. Reel bearing housing
18. Ball bearing
19. RH side plate
20. Plow bolt
21. Retaining ring
22. Tapered nut
23. Wave washer
24. Nylon bushing
25. Bushing
26. Reel assembly
27. Bushing
28. LH pitch arm
29. RH pitch arm
30. Washer (if equipped)
31. Inner oil seal

Removal (Fig. 19)

1. Remove cutting unit from machine (see Separating Cutting Unit from Traction Unit in the General Information section of Chapter 7 – Cutting Unit). Place cutting unit on a flat level surface or on a stable work bench.

2. Remove groomer reel (see Groomer Reel Removal in this section) and LH groomer side plate (see Groomer Reel Bearing Replacement in this section) from cutting unit.

3. Slide spacers from LH reel shaft and LH reel bearing housing (Fig. 20).

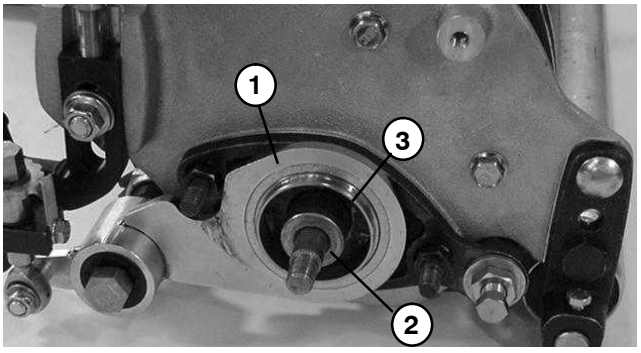


Figure 20

1. Groomer LH side plate
2. Reel shaft spacer
3. Reel housing spacer

4. Remove bedbar from the cutting unit (see Bedbar Removal in the Service and Repairs section of Chapter 7 – Cutting Unit).

5. Remove tapered nuts that fasten the bearing housings to the mower side plates.

CAUTION

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

IMPORTANT: Support reel to prevent it from falling as bearing housings are removed.

6. Pull both bearing housings from the frame and reel. Remove the reel with pitch arms and bushings from the mower.

7. If reel bearings are worn or need replacement for maintenance purposes, see Cutting Reel Bearing Service in Chapter 7 – Cutting Unit.

8. Cutting unit side plates and shield frame can be separated by removing two flange head screws per side.

Installation (Fig. 19)

1. Place cutting unit on a flat level surface or on a stable work bench.

2. If separated, attach side plates to shield frame with two flange head screws per side. Apply medium strength threadlocking compound to bolt threads and torque from 160 to 175 in–lb (182 to 200 kg–cm).

CAUTION

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

3. Apply anti–seize lubricant to bearing journals of cutting reel. Position reel with pitch arms and bushings in frame to accept bearing housings. The reel shaft end with keyway should be on the left side of the frame.

4. Attach both bearing housings assemblies through the frame onto the reel shaft.

   A. Push housing onto reel shaft. If necessary, tap into position with a soft hammer.

   B. Attach both bearing housings to the side plates of the cutting unit with two plow bolts and tapered nuts. Tighten nuts securely.

5. Check for free rotation of reel assembly. If binding is noted, identify and correct problem.

6. Reinstall bedbar to the mower (see Bedbar Installation in the Service and Repairs section of Chapter 7 – Cutting Unit).

7. Slide spacers onto LH reel shaft and LH reel bearing housing (Fig. 20).

8. Assemble LH groomer side plate to mower:

   A. Install LH groomer side plate to cutting unit.

   B. Position LH adjuster arm to mower making sure that side plate pin extends through bearing in LH adjuster arm.

   C. Place belleville washer and locknut on pin threads. Install carriage bolt, flange nut and washer to secure adjuster arm to mower side plate.

   D. 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).

9. Install groomer reel and RH groomer side plate (see Groomer Reel Installation in this section).

10. Install cutting unit to traction unit (see Separating Cutting Unit from Traction Unit in the General Information section of Chapter 7 – Cutting Unit).

11. Complete mower set–up and adjustment sequence (see Adjustments section of Chapter 7 – Cutting Unit).

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Chapter 9

Groomer (Model 04204)

Table of Contents

Specifications

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

REEL CONSTRUCTION: 2.375 inch (6 cm) diameter, 41 steel blades with 1/2 inch 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 groomer reel to be raised above the height/depth adjustment for no groomer reel action while cutting.

WIDTH–OF–GROOMER: 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 groomer reel is raised to its transport position.

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

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

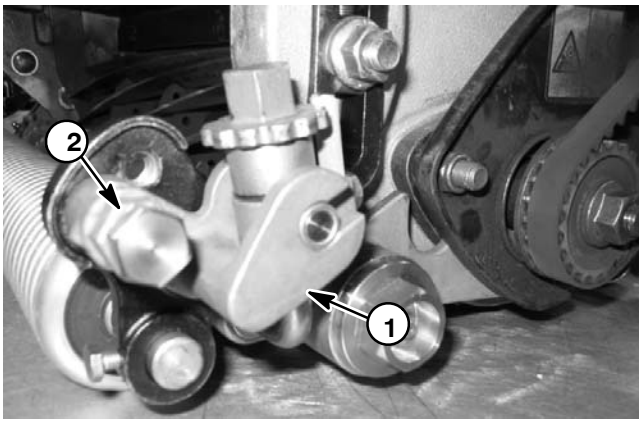

Figure 1

1. Lift arm
2. Lock screw (transport)

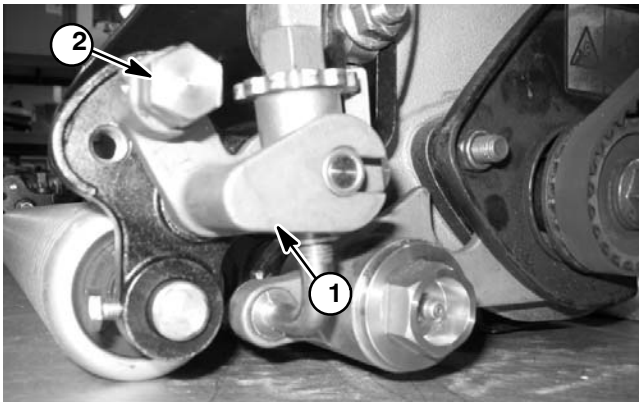

Figure 2

1. Lift arm
2. Lock screw (grooming)

Troubleshooting

Factors Affecting Grooming

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 groomer 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 groomer 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 groomer 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, sand dressing and disease and pest control.

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

Groomer Reel Mechanical Problems

Problem	Possible Causes	Correction
The groomer reel rotates when it is in the raised, transport position.	The groomer reel should rotate whenever the cutting reel is engaged.	Normal operation.
No rotation of the groomer reel.	Seized groomer 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 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 groomer reel blades are bent, damaged or missing.	Repair or replace blades if necessary.
	The groomer reel shaft is bent or damaged.	Replace groomer reel shaft.
	Grooming depth is not equal on both ends of groomer 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, groomer 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 groomer reel to the lowered, grooming position (Fig. 3).

NOTE: Improper or over–aggressive use of the groomer 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 groomer reel, measure the distance from the lowest tip of the groomer 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.

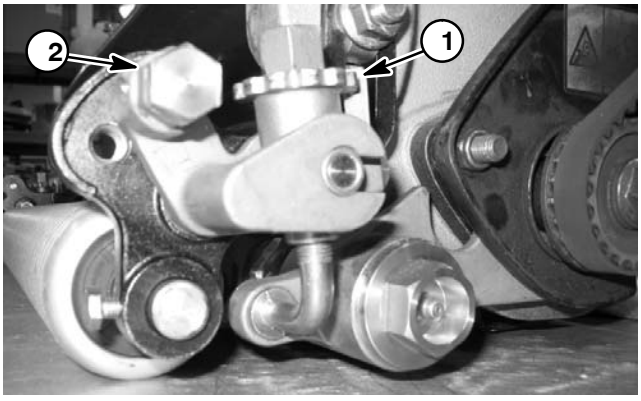

Figure 3

1. Height adjustment knob **2. Lock screw (lowered)**

Groomer Belt Replacement

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

2. Remove two lock nuts that secure groomer belt cover, 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.

4. Install new drive belt to drive pulley, idler pulley and driven pulley observing correct belt routing (Fig. 5).

5. Secure belt cover to housing with two lock nuts.

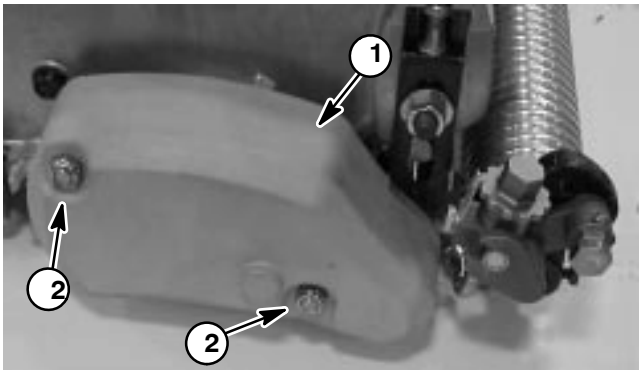

Figure 4

1. **Groomer belt cover**
2. **Lock nut**

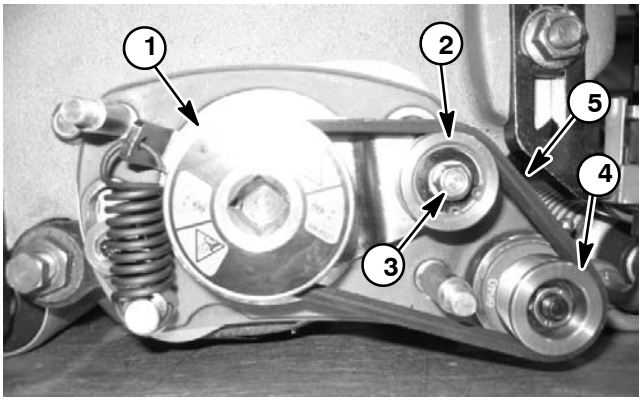

Figure 5

1. **Drive pulley**
2. **Idler pulley**
3. **Idler pulley nut**
4. **Driven pulley**
5. **Groomer drive belt**

Groomer Reel

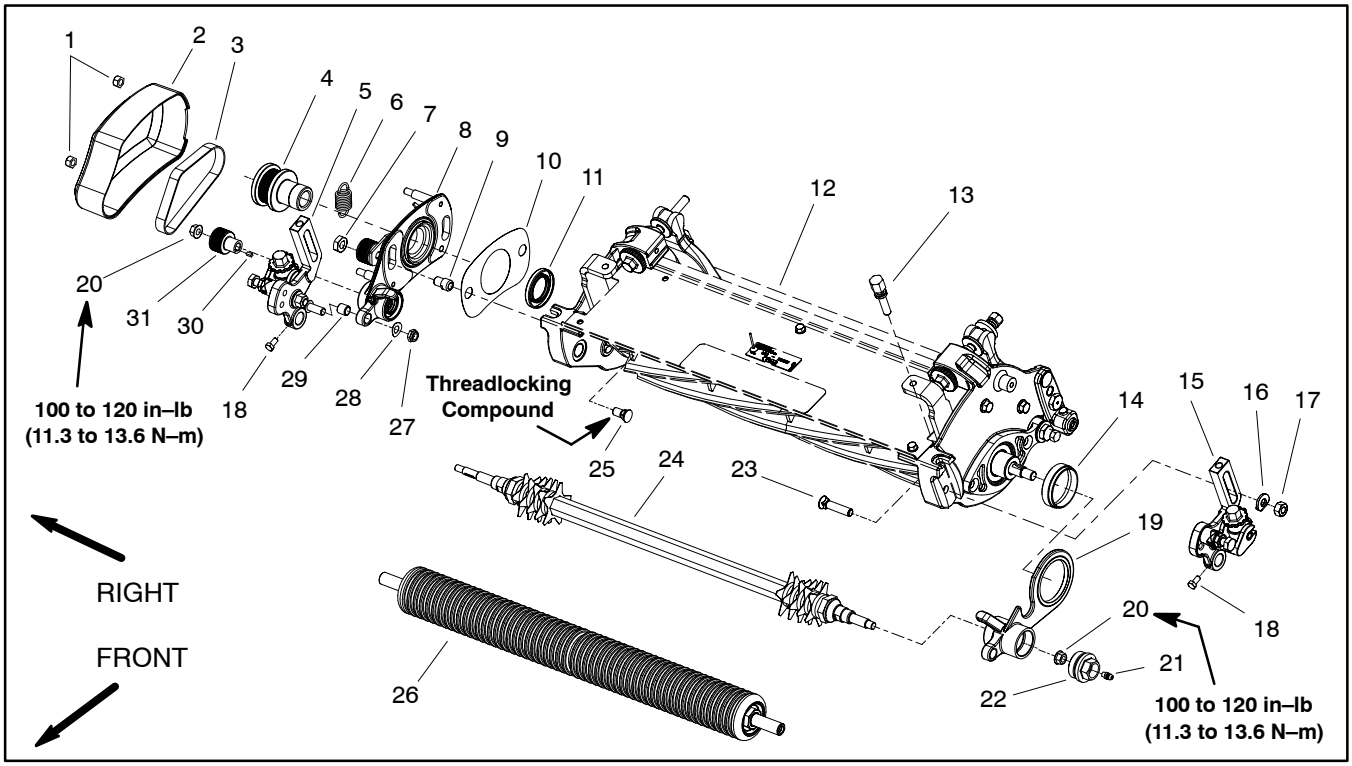

Figure 6

1. Lock nut
2. Groomer belt cover
3. Groomer belt
4. Drive pulley (LH thread)
5. RH groomer arm assembly
6. Spring
7. Lock nut (2 used)
8. RH side plate
9. Side plate adapter (2 used)
10. Groomer shim
11. Oil seal
12. Cutting reel assembly
13. Height–of–cut screw (2 used)
14. Spacer
15. LH groomer arm assembly
16. Height of cut washer (2 used)
17. Lock nut (2 used)
18. Cap screw (2 used)
19. LH side plate
20. Flange nut
21. Grease fitting
22. Cap plug
23. Carriage bolt (2 used)
24. Groomer reel assembly
25. Plow bolt (2 used)
26. Front roller
27. Lock nut (2 used)
28. Spring washer (2 used)
29. Bushing (2 used)
30. Square key
31. Driven pulley

Remove the groomer reel to reverse the shaft, replace individual blades or replace the shaft. The shaft can be reversed so that the sharpest edge of the groomer blades are forward.

Removal

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

2. Remove groomer belt cover and groomer belt from right side of mower (see Groomer 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 27) and spring washer (item 28) that secure RH groomer arm lift rod to RH side plate (Fig. 7).

5. Remove lock nut (item 17), washer (item 16) and carriage bolt (item 23) 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 groomer 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 31) to groomer shaft. Remove driven pulley from shaft. Locate and retrieve square key (item 30) that locates pulley on 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 in. drive wrench to remove drive pulley (item 4) from the cutting reel shaft.

9. Hold the side plate adapters (item 9) with an allen wrench to keep from turning. Remove two lock nuts (item 7) that secure the groomer RH side plate to the side plate adapters. Remove the groomer RH side plate.

10. Remove the cap plug from LH side plate (Fig. 8).

11. Remove the nut that secures the groomer shaft to the LH side plate.

12. Pull the groomer 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 groomer reel assembly into the LH side plate bearings taking care not to damage seal in side plate. Thread flange nut onto the shaft threads but **do not tighten**.

4. Carefully place RH side plate onto groomer shaft taking care not to damage seals in side plate. Position side plate to the sideplate adapters. Secure side plate with two lock nuts. Tighten lock nuts until the side plate will no longer rotate. Then, hold the side plate adapters with an allen wrench and loosen lock nuts 1/4 turn.

NOTE: The drive pulley has **left handed** threads.

5. Apply a light coating of grease to drive pulley hub taking care not to get grease on belt surface. Install and tighten drive pulley onto the reel shaft.

6. Place square key in groomer shaft slot and install driven pulley onto the groomer shaft. Thread flange nut onto the shaft threads but **do not tighten.**

7. Secure groomer reel by tightening flange nuts on both ends of groomer shaft. Torque flange nuts from 100 to 120 in–lb (11.3 to 13.6 N–m).

8. Install cap plug (item 22) into LH side plate (Fig. 8).

9. Insert front roller into LH groomer arm.

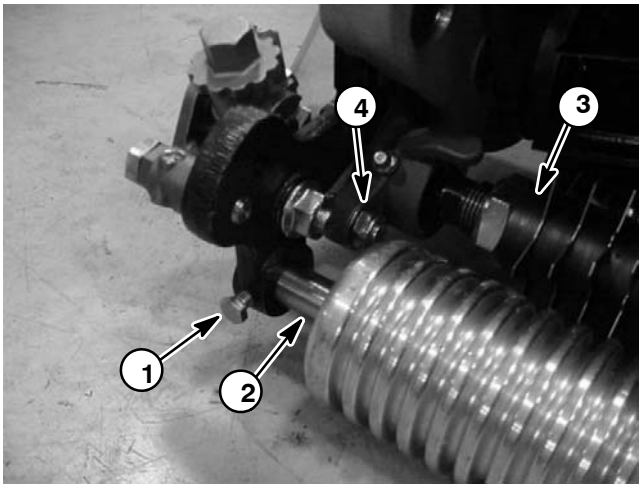

Figure 7

1. **Cap screw**
2. **Front roller shaft**
3. **Groomer shaft assembly**
4. **Locknut/spring washer**

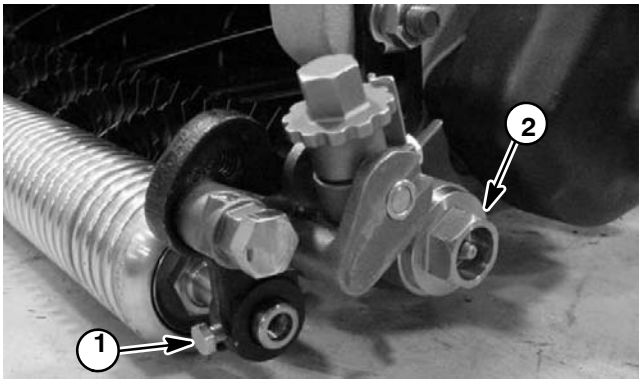

Figure 8

1. **Roller retaining cap screw**
2. **Cap plug**

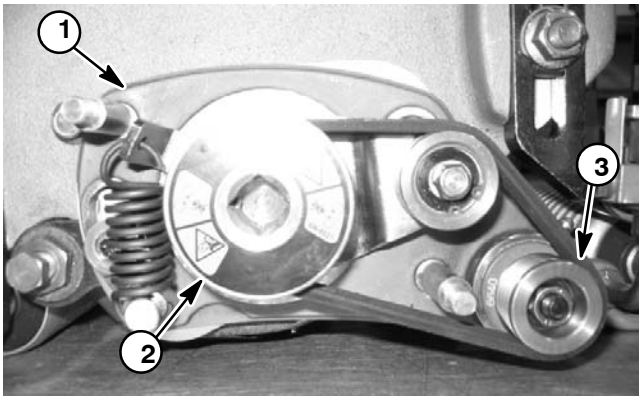

Figure 9

1. **RH side plate**
2. **Drive pulley**
3. **Driven pulley**

10. 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.

11. Install spring washer and lock nut to secure RH groomer arm lift rod to RH groomer side plate (Fig. 7).

12. Center front roller and tighten cap screws to secure roller (Figs. 7 and 8).

13. Reinstall groomer drive belt and belt cover to right side of mower (see Groomer Belt Replacement in this section).

14. 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.

15. Check groomer reel height and mower height–of–cut settings. Adjust as needed.

Groomer Reel Service

Disassembly (Fig. 10)

Inspect groomer reel blades frequently for damage and wear. Straighten bent blades with a pliers. Either replace worn blades or reverse the position of the blades to put the sharpest blade edge forward (Fig. 11). Blades that are rounded to the midpoint of the blade tip must be replaced or reversed for best groomer performance.

1. Remove groomer reel (see Groomer Reel Removal in this section).

2. Remove lock nut from either end of the shaft (Fig. 12).

3. Remove spacers and blades as necessary.

Assembly (Fig. 10)

1. Start by placing two spacers against a lock nut installed on one end of groomer shaft. Then, place first blade against spacers (Fig. 12).

2. Rotate location mark on each installed blade one flat of the shaft, either in a clockwise or counterclockwise direction. The direction of location mark rotation must remain constant on the shaft.

3. For 1/2 inch (1.3 cm) spacing, make sure there are two spacers between blades (Fig. 12).

4. When all blades have been installed, place final 2 spacers on shaft and then thread lock nut onto the shaft.

5. 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.

6. Install groomer reel back on cutting unit (see Groomer Reel Installation in this section).

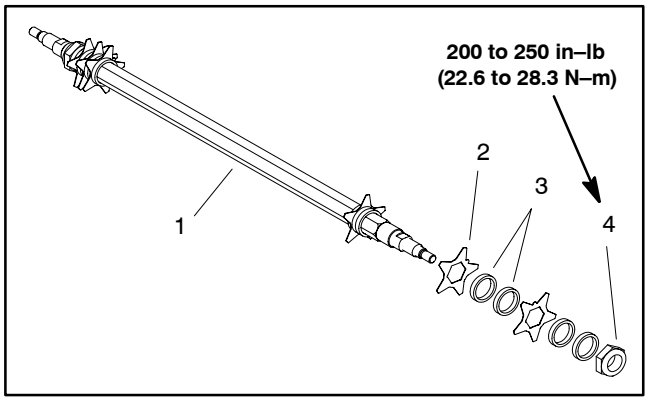

Figure 10

1. Groomer reel shaft
2. Groomer blade
3. Spacer
4. Lock nut

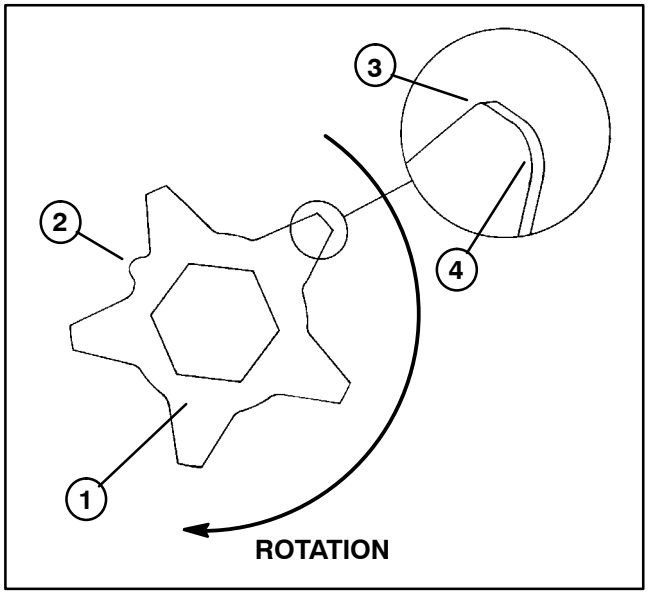

Figure 11

1. Groomer blade
2. Location mark
3. Sharp edge
4. Dull (rounded) edge

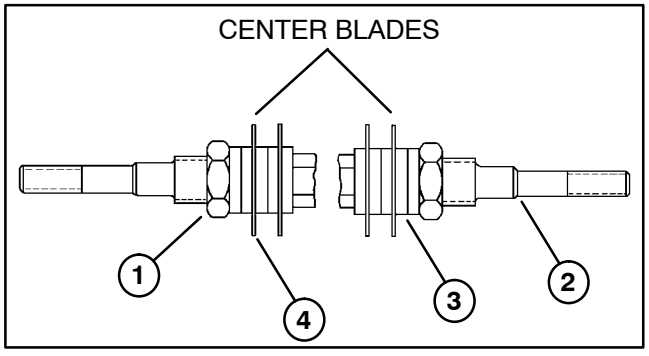

Figure 12

1. Lock nut
2. Shaft
3. Spacer
4. Blade

Groomer Reel Bearing Replacement

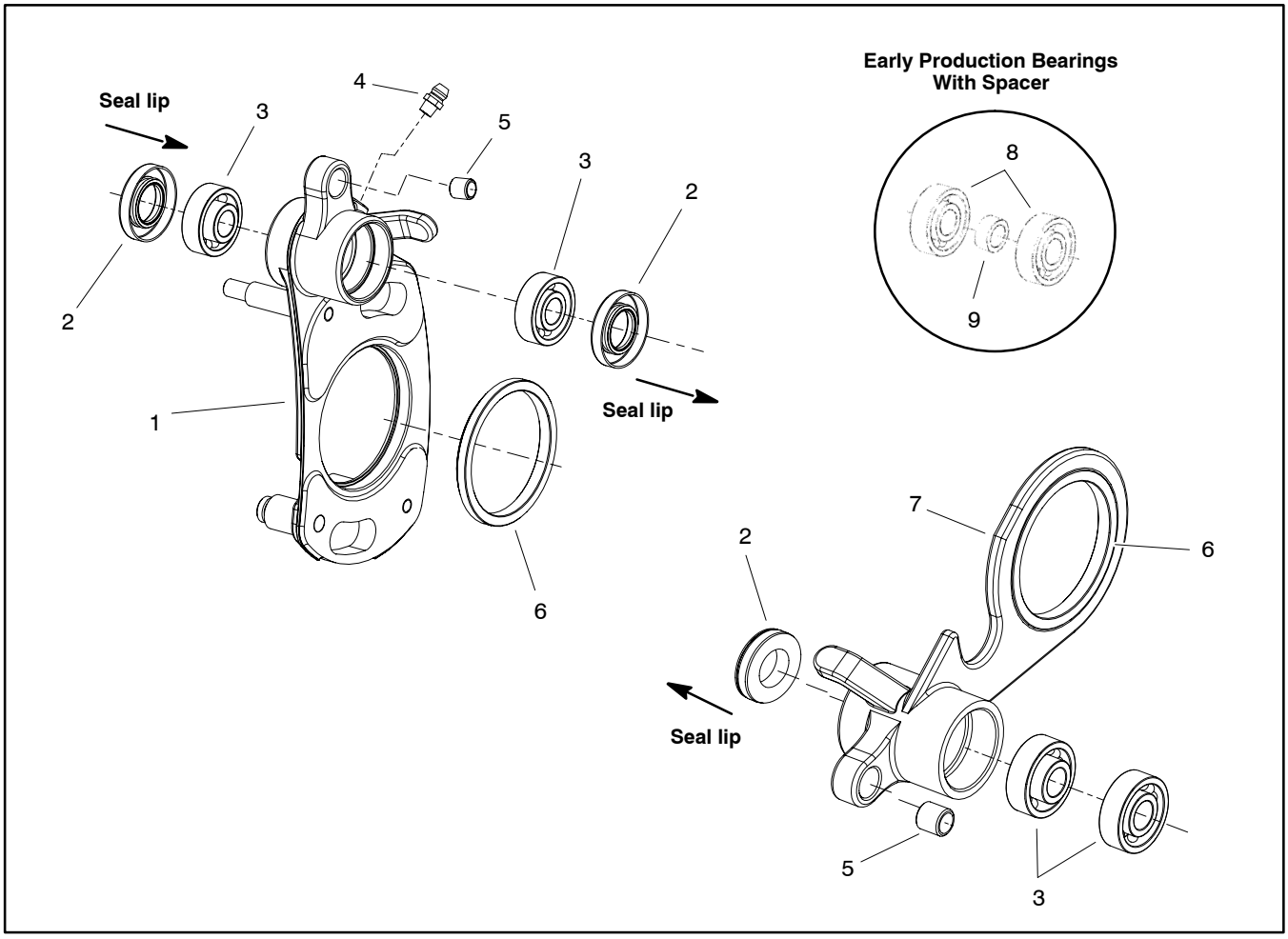

Figure 13

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**
8. **Bearing (early production)**
9. **Bearing spacer (early production)**

Bearing Removal

1. Remove front roller, RH groomer side plate and groomer reel (see Groomer 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.

NOTE: Early production groomers are equipped with a spacer between the bearings. Later production groomers have bearings with an extended inner race and no spacer.

   B. Push bearings out of housing. Discard bearings. If equipped, locate and retrieve spacer.

Bearing Installation

1. Install new bearings in **both** side plate assemblies (Fig. 13):

   A. Slide new bearings into side plates. If bearings have extended inner race, position race extensions toward center of housing. If bearings do not have extended inner race, position spacer between bearings.

   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. Reinstall 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 groomer reel and RH groomer side plate (see Groomer 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 groomer reel height and mower height–of–cut settings.

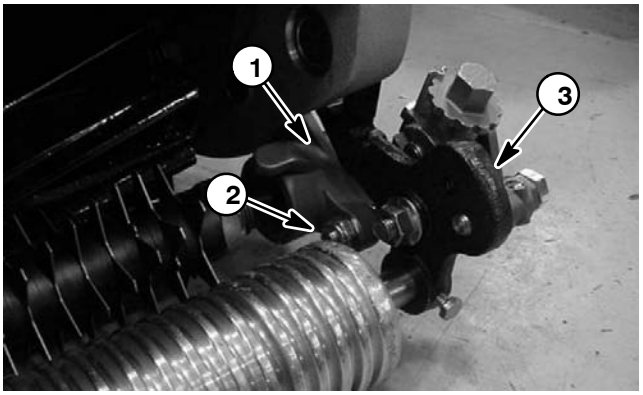

Figure 14

1. **LH groomer side plate**
2. **Lock nut/spring washer**
3. **LH groomer arm**

Idler Assembly

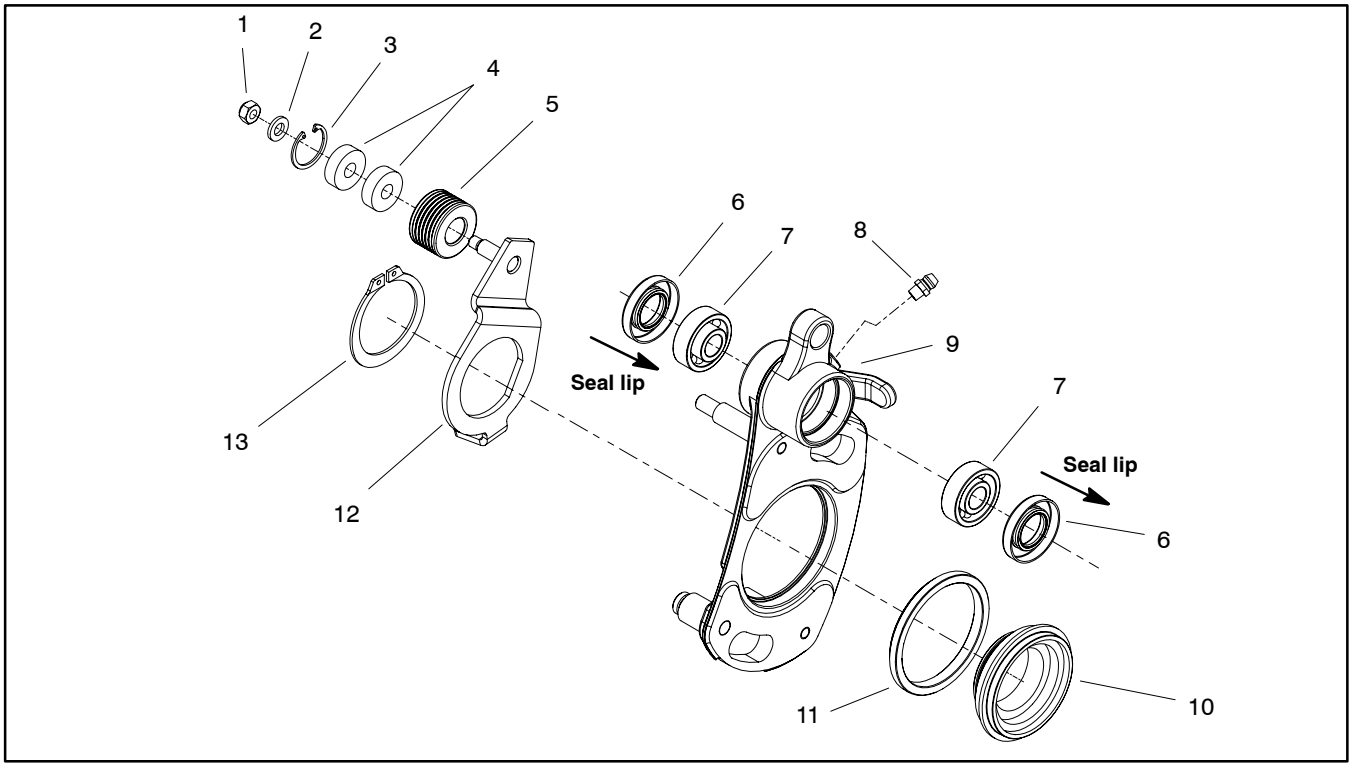

Figure 15

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 Flex 21 groomer 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 Groomer 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. Reassemble 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 Groomer Reel Installation in this section).

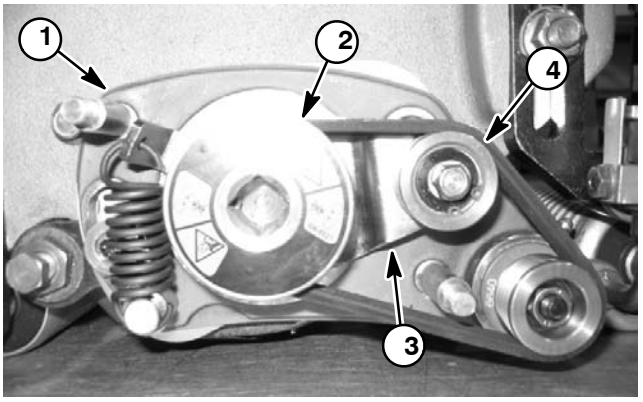

Figure 16

1. **RH side plate**
2. **Drive pulley**
3. **Idler bracket**
4. **Idler pulley w/bearings**

Groomer Arm Assembly

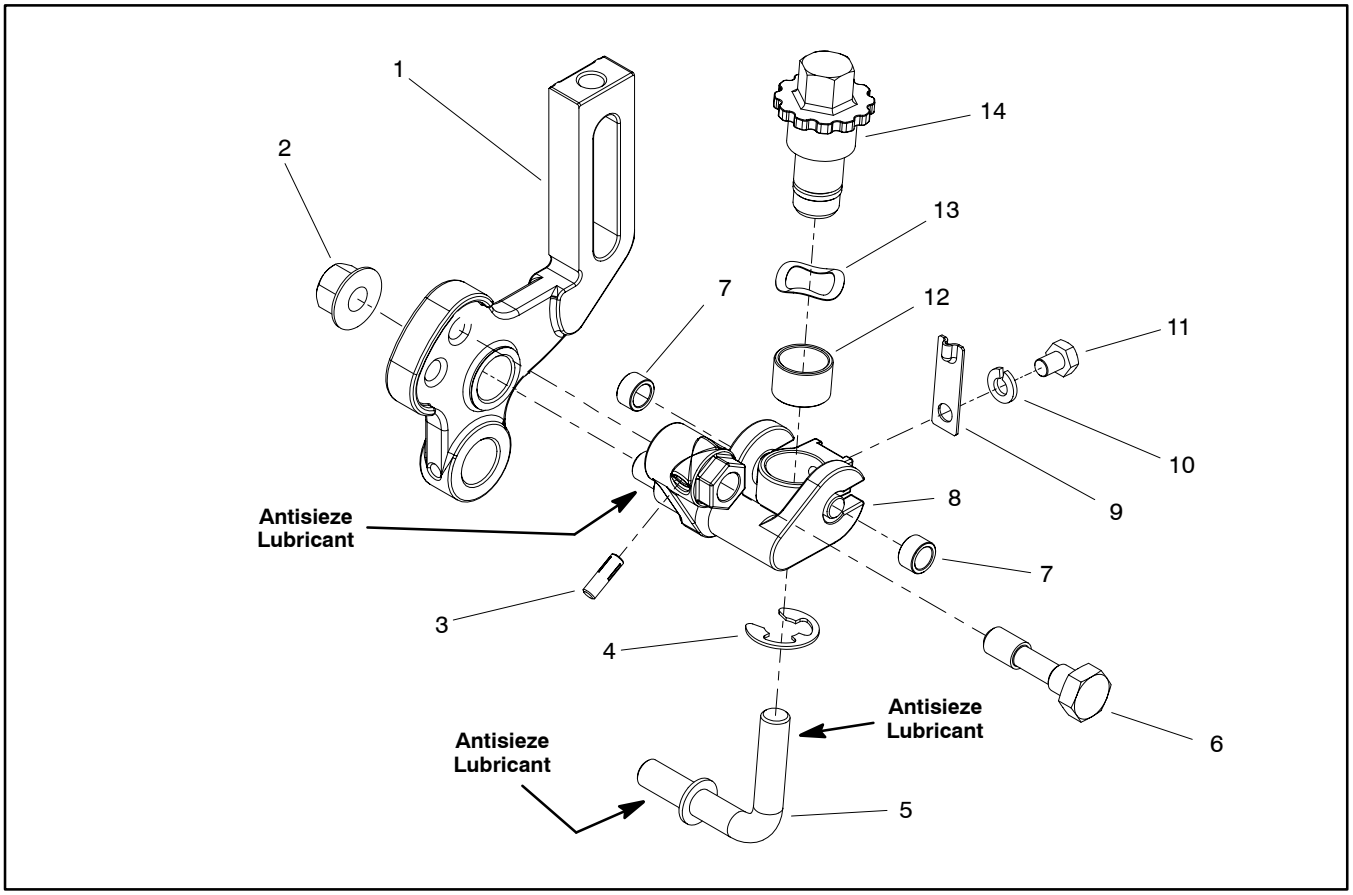

Figure 17

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

1. Remove groomer arm from cutting unit (see Groomer Reel Removal in this section).

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

1. Apply antisieze 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 (see Groomer Reel Installation in this section).

3. Check height–of–cut and adjust as needed.

Cutting Reel

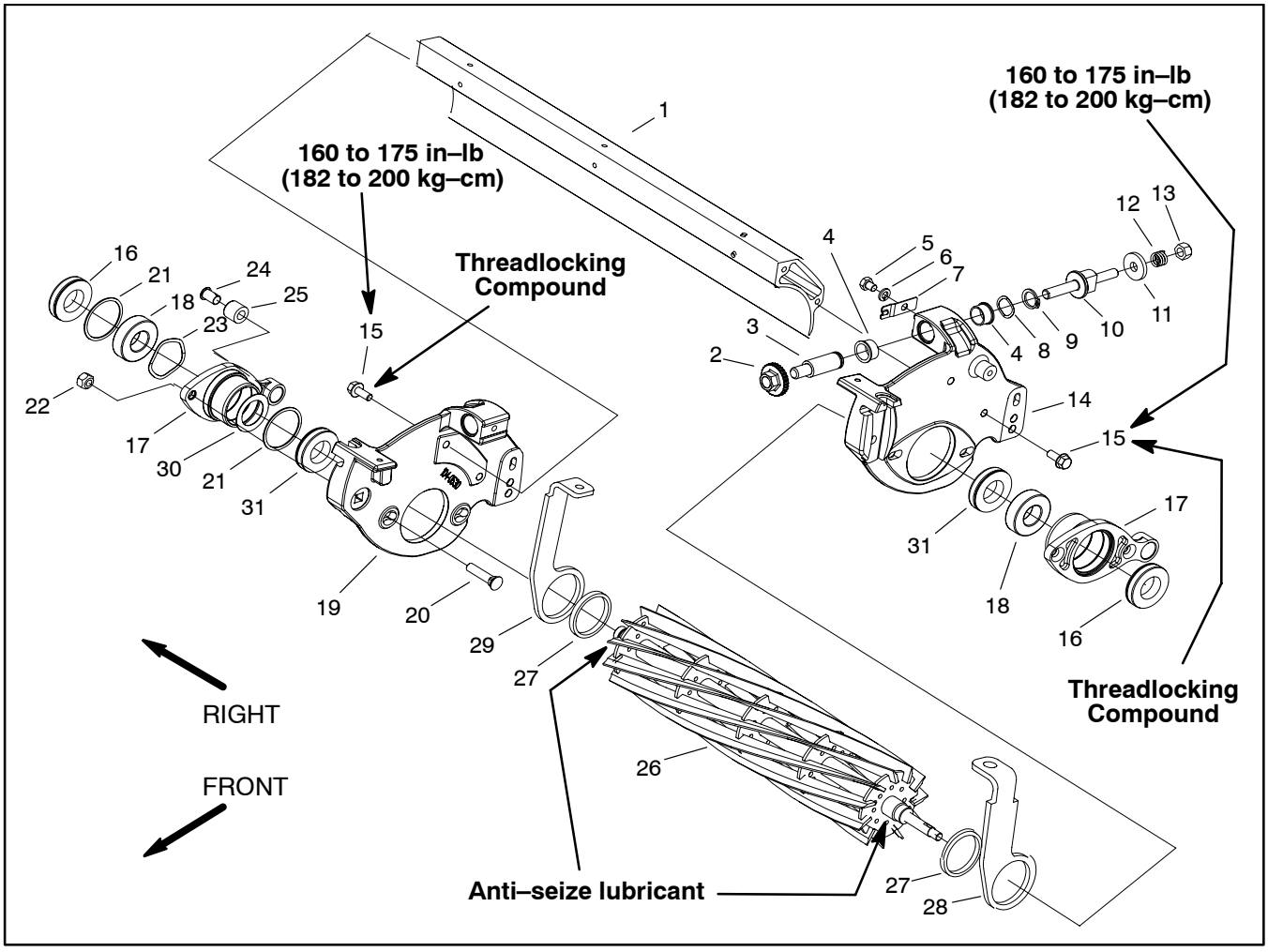

Figure 18

1. Shield frame
2. Adjust nut
3. Bedbar adjuster nut
4. Flange bearing
5. Cap screw
6. Lock washer
7. Detent
8. Spring wave washer
9. Retaining ring
10. Bedbar adjuster screw
11. Washer
12. Compression spring
13. Lock nut
14. LH side plate
15. Flange head screw
16. Outer oil seal
17. Reel bearing housing
18. Ball bearing
19. RH side plate
20. Plow bolt
21. Retaining ring
22. Tapered nut
23. Wave washer
24. Nylon bushing
25. Bushing
26. Reel assembly
27. Bushing
28. LH pitch arm
29. RH pitch arm
30. Washer (if equipped)
31. Inner oil seal

Removal (Fig. 18)

1. Remove cutting unit from machine (see Separating Cutting Unit from Traction Unit in the General Information section of Chapter 7 – Cutting Unit). Place cutting unit on a flat level surface or on a stable work bench.

2. Remove groomer reel (see Groomer Reel Removal in this section) and LH groomer side plate (see Groomer Reel Bearing Replacement in this section) from cutting unit.

3. Slide spacers from LH reel shaft and LH reel bearing housing (Fig. 19).

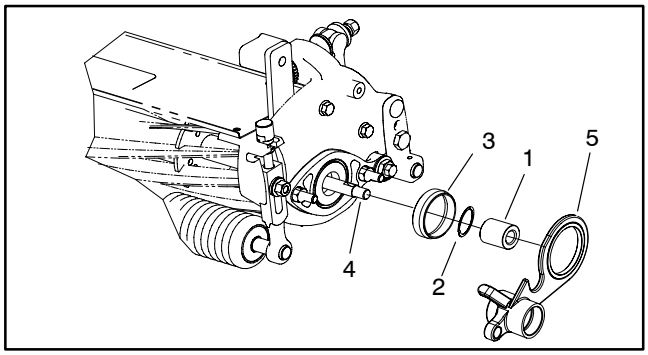

Figure 19

1. Spacer
2. Retaining ring
3. Spacer
4. Cutting reel shaft

4. Remove bedbar from the cutting unit (see Bedbar Removal in the Service and Repairs section of Chapter 7 – Cutting Unit).

5. Remove tapered nuts that fasten the bearing housings to the mower side plates.

CAUTION

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

IMPORTANT: Support reel to prevent it from falling as bearing housings are removed.

6. Pull both bearing housings from the frame and reel. Remove the reel with pitch arms and bushings from the mower.

7. Later production reels use a wear sleeve and v–ring seal (Fig. 20). Remove these items from the reel if equipped.

8. If reel bearings are worn or need replacement for maintenance purposes, see Cutting Reel Bearing Service in Chapter 7 – Cutting Unit.

9. If necessary, cutting unit side plates and shield frame can be separated by removing two flange head screws per side.

Installation (Fig. 18)

1. Place cutting unit on a flat level surface or on a stable work bench.

2. If separated, attach side plates to shield frame with two flange head screws per side. Apply medium strength threadlocking compound to screw threads and torque from 160 to 175 in–lb (182 to 200 kg–cm).

3. Apply anti–seize lubricant to bearing journals of cutting reel.

4. If equipped, (later production reels) install wear sleeve and v–ring seal to reel (Fig. 20).

CAUTION

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

5. Position reel with pitch arms and bushings in frame to accept assembled bearing housings. The reel shaft end with keyway should be on the left side of the frame.

6. Attach both bearing housings through the frame onto the reel shaft.

   A. Push housing onto reel shaft. If necessary, tap into position with a soft hammer.

   B. Attach bearing housing to the side plate of the cutting unit with the two plow bolts and tapered nuts. Tighten nuts securely.

7. Check for free rotation of reel assembly. If binding is noted, identify and correct problem.

8. Reinstall bedbar to the mower (see Bedbar Installation in the Service and Repairs section of Chapter 7 – Cutting Unit).

9. Slide spacers onto LH reel shaft and LH reel bearing housing (Fig. 19).

10. Assemble LH groomer side plate to mower (see Groomer Reel Bearing Replacement in this section)

11. Install groomer reel and RH groomer side plate (see Groomer Reel Installation in this section).

12. Install cutting unit to traction unit (see Separating Cutting Unit from Traction Unit in the General Information section of Chapter 7 – Cutting Unit).

13. Complete mower set–up and adjustment sequence (see Adjustments section of Chapter 7 – Cutting Unit).

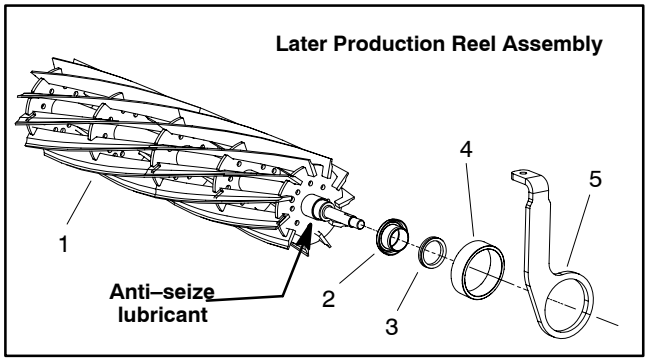

Figure 20

1. Cutting reel
2. Wear sleeve
3. V–ring
4. Pitch arm bushing
5. Pitch arm

Groomer Brush

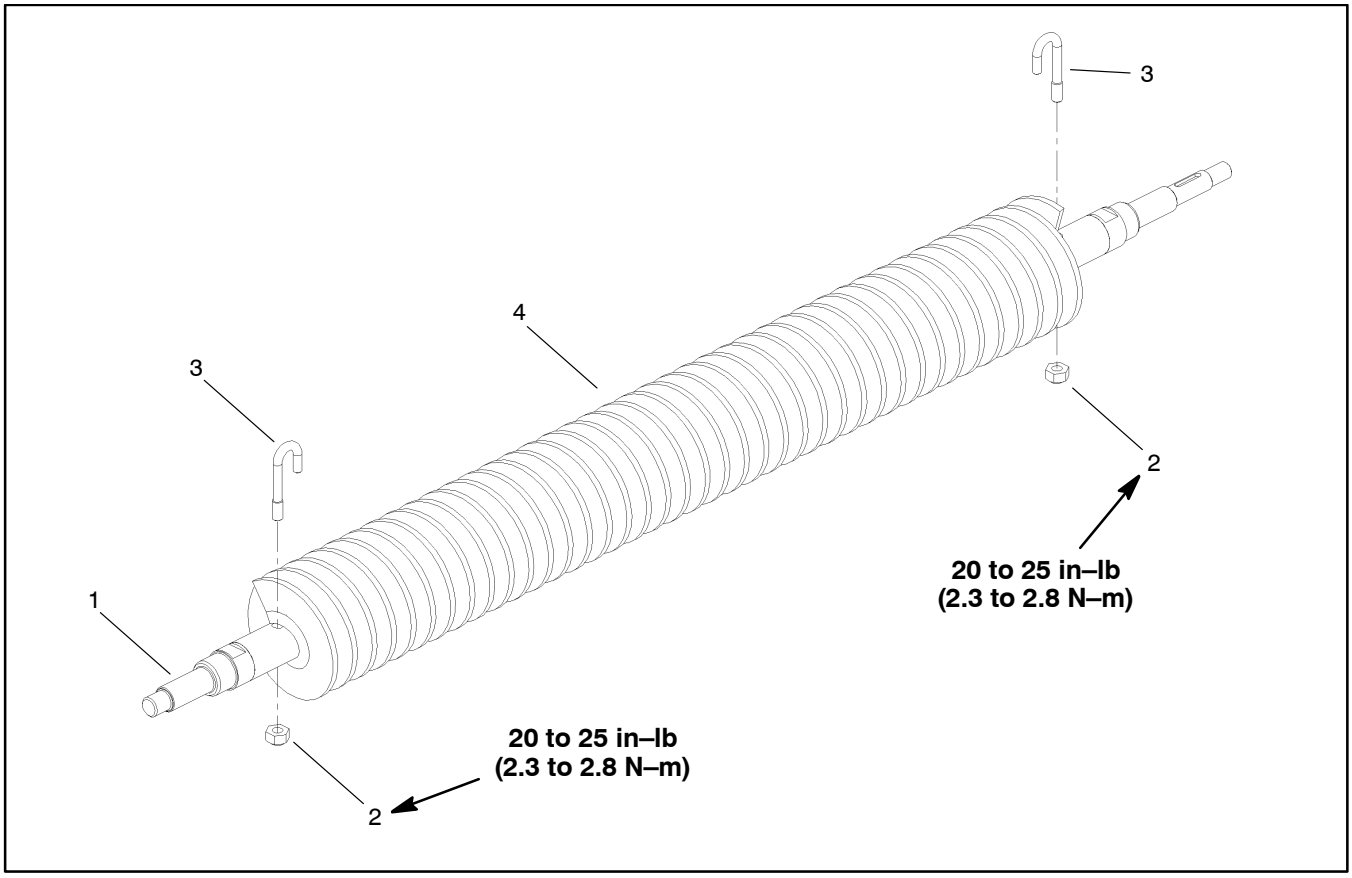

Figure 21

1. **Groomer brush shaft**
2. **Lock nut**
3. **J–bolt**
4. **Groomer brush**

The groomer brush attaches to the groomer drive in place of the groomer reel. Removal and installation of the groomer brush uses the same procedure as removal and installation of the groomer reel (see Groomer Reel in this section).

To remove the groomer brush from the shaft, remove the lock nut and J–bolt from both ends of the brush and slide the brush 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. 22). Torque lock nuts from 20 to 25 in–lb (2.3 to 2.8 N–m).

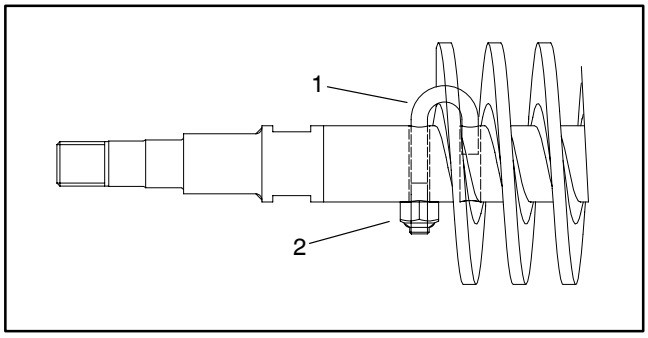

Figure 22

1. **J–bolt**
2. **Lock nut**