

Count on it.

Form No. 18238SL Rev D

Service Manual

Greensmaster[®] 1018/1021/1026 (Models 04820, 04830 and 04840)

Revision History

Revision	Date	Description
А	03/2019	Initial issue.
В	03/2020	Updated the drum drive gearbox assembly and transmission gearbox assembly.
С	07/2020	Updated the traction and reel drive, cutting unit and universal groomer chapters.
D	07/2022	Updated the reel drive, handle, bedknife, groomer drive gearbox, idler plate, groomer reel, height adjuster chapters
ļ		
	1	1

Revision History (continued)

Revision	Date	Description

Reader Comments

The Toro Company Technical Assistance Center maintains a continuous effort to improve the quality and usefulness of its publications. To do this effectively, we encourage user feedback. Please comment on the completeness, accuracy, organization, usability, and readability of this manual by an e-mail to servicemanuals@toro.com

or Mail to:

Technical Publication Manager, Commercial The Toro Company 8111 Lyndale Avenue South Bloomington, MN 55420-1196 Phone: +1 952-887-8495

NOTES

Preface

The purpose of this publication is to provide the service technician with the information for troubleshooting, testing, and repair of the major systems and components on the Greensmaster 1018/1021/1026 (Models 04820, 04830 and 04840).

Refer to the *Operator's Manuals* and *Installation Instructions* for installing, operating, maintenance, and adjustment instructions. Keep a copy of the *Operator's Manuals*, *Installation Instructions* and *Parts Catalogs* for your machine and its accessories with this *Service Manual* for reference. Additional copies of the *Operator's Manuals*, *Installation Instructions* and *Parts Catalogs* are available at www.toro.com.

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

\	DANGER	A

This safety symbol means danger. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions could kill or cause serious permanent injury or disability.

WARNING

This safety symbol means warning. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions can result in serious injury.

A

Â

CAUTION

This safety symbol means caution. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions can result in minor to moderate injury.

IMPORTANT

The *Important* notice will give the important instructions which you must follow to prevent damage to the systems or components on the machine.

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

A

A



Figure 1 Model 04830 shown

Service Procedure Icons

The following icons appear throughout this Service Manual to bring attention to specific important details of a service procedure.



Critical Process

This icon is used to highlight:

- installing safety equipment (shields, guards, seat belts, brakes and R.O.P.S. components) that may have been removed.
- dimensions or settings that must be maintained for proper machine operation.
- a specific fastener tightening sequence.
- component orientation that may not be obvious.



Critical Torque

This icon is used to highlight an assembly torque requirement that is different than what is recommended in the Standard Torque Tables; refer to Torque Specifications (page 2–6).



Fluid Specifications

This icon is used to highlight fluid specifications and capacities that are less common, and may not appear on the machine service decal or in the machine *Operator's Manual*.

Note: Refer to the service decal on the machine and the machine *Operator's Manual* for commonly used fluid specifications and capacities.

Table of Contents

Preface	7
Chapter 1: Safety	1–1
Safety Instructions	1–2
Safety and Instructional Decals	1–6
Chapter 2: Specifications and Maintenance	2–1
Specifications	2–2
Torque Specifications	2–6
Shop Supplies	2–12
Special Tools	2–14
Chapter 3: Troubleshooting	3–1
GEARS – The Systematic Approach to Defining, Diagnosing and Solv	ing
Problems	
Starting Problems	3–3
Aftercut Appearance	3–4
Factors Affecting Grooming	3–5
Grooming Reel Mechanical Problems	3–6
Chapter 4: Gasoline Engine	4–1
General Information	4–2
Adjustments	4–4
Service and Repairs	4–5
Chapter 5: Traction and Reel Drive Systems	5–1
General Information	5–2
Adjustments	5–3
Service and Repairs	5–7
Chapter 6: Electrical System	6–1
General Information	6–2
Wiring Schematic	6–3
Component Testing	6–4
Chapter 7: Controls, Wheels, and Accessories	7–1
General Information	7–2
Service and Repairs	7–3
Chapter 8: DPA Cutting Units	8–1
General Information	8–2
Adjustments	8–4
Service and Repairs	8–6
Chapter 9: Universal Groomer (Optional)	9–1
General Information	9–2
Service and Repairs	9–3



Chapter 1

Safety

Table of Contents

Safety Instructions	1–2
Before Operating the Machine	1–3
While Operating the Machine	1-4
Maintenance and Service	1-5
Safety and Instructional Decals	1–6

Safety Instructions

Â

The Greensmaster 1018/1021/1026 machine is tested and certified by Toro for compliance with existing safety standards and specifications. Although hazard control and accident prevention are partially dependent upon the design and configuration of the machine, these factors are also dependent on the awareness, concern, and proper training of the personnel involved in the operation, transport, maintenance, and storage of the machine. The improper use or maintenance of the machine can result in injury or death.

WARNING

To reduce the potential of injury or death, comply with the following safety instructions as well as information found in the *Operator's Manuals* and the *Operator and Safety Training Videos* found on www.toro.com.

A

Before Operating the Machine

- Review and understand the contents of the *Operator's Manuals* before starting and operating the machine. Become familiar with the controls and know how to stop the machine and engine quickly. Additional copies of the *Operator's Manuals* are available at www.toro.com.
- Never allow children to operate the machine. Never allow adults to operate the machine without proper instructions.
- Become familiar with the controls and know how to stop the machine and tractor engine quickly.
- Keep all the shields, safety devices, and decals in place. If a shield, safety device, or decal is illegible or damaged, repair or replace it before operating the machine.
- 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.
- Wearing safety glasses, safety shoes, long pants and a helmet is advisable and required by some local safety and insurance regulations.
- Make sure work area is clear of objects which might be picked up and thrown by the attachments.
- Keep everyone, especially children and pets, away from the areas of operation.
- Since the gasoline is highly flammable; handle it carefully.
 - Use an approved gasoline container.
 - Do not remove cap from fuel tank when engine is hot or running.
 - Do not smoke while handling gasoline.
 - Fill fuel tank outdoors and no higher than to the bottom of filter screen. Do not overfill fuel tank.
 - Wipe up any spilled gasoline.
 - Fuel may leak from filler neck when mower is tilted for servicing if tank is over filled.
- The safety interlock switches are for the operator's protection; do not disconnect them. Check the operation of the switches daily to assure the interlock system is operating. If the switch is defective, replace it before operating the machine; refer to Interlock Module (Optional) (page 6–10)

While Operating the Machine

- 1. Do not run the engine in a confined area without adequate ventilation. Exhaust fumes are hazardous and could be deadly.
- 2. Always stand behind the handle when starting and operating the machine.
- 3. To start the engine:
 - A. Open fuel shut-off valve. Make sure that the spark plug wire is connected to the spark plug.
 - B. Verify that the control lever on handle is in NEUTRAL position for both traction and reel drives.
 - C. Move ON/OFF switch to ON position, set choke to full choke position (cold start) and throttle to half throttle.
 - D. Pull starter cord to start engine.
- 4. To stop the engine:
 - A. Disengage the reel and traction drives and reduce engine speed to SLOW.
 - B. Move ON/OFF switch to OFF position to stop the engine.
- 5. Before emptying the basket of clippings, disengage the traction and reel drives, reduce the engine speed, and move ON/OFF switch to OFF position to stop the engine. Wait for all machine motion to stop before removing basket.
- 6. Do not touch the engine, muffler, or exhaust pipe while engine is running or soon after it has stopped because these areas are hot enough to cause burns.
- 7. If the cutting unit strikes a solid object or vibrates abnormally, stop machine operation immediately, turn the engine OFF, wait for all machine motion to stop and inspect for damage. A damaged reel or bedknife must be repaired or replaced before operation is commenced.
- 8. Whenever machine is left unattended, be sure engine is stopped and cutting unit reel is not spinning.
- 9. Close the fuel shut-off valve if the machine is not used for an extended period. Also, close fuel shut-off valve if the machine is to be transported on a trailer or in a vehicle.

Maintenance and Service

- The *Traction Unit Operator's Manual*, *Cutting Unit Operator's Manual* and *Groomer Operator's Manual* provides the information regarding the operation, general maintenance, and maintenance intervals for your Greensmaster machine. Refer to these publications for additional information when servicing the machine.
- Before servicing or adjusting the machine, stop the engine and wait for all machine motion to stop. Remove the spark plug wire from the spark plug to prevent accidental starting of the engine.
- To make sure that the entire machine is in good condition, keep all nuts, bolts, screws, and belts properly tightened.
- To reduce the potential fire hazard, keep the engine area free of excessive grease, grass, leaves, and accumulation of dirt.
- Wear heavy gloves and use caution when checking or servicing the cutting unit.
- If the engine must be running to perform maintenance or make an adjustment, keep hands, feet, clothing, and all parts of the body away from the cutting unit and all moving parts. Keep the bystanders away.
- Do not overspeed the engine by changing the governor settings. Recommended engine high idle speed is from 3,350 to 3,550 RPM. To ensure safety and accuracy, check the engine speed with a tachometer.
- Engine must be shut off and cooled down before checking oil or adding oil to the engine crankcase.
- If major repairs are ever needed or assistance is required, contact your Authorized Toro distributor.
- At the time of manufacture, the machine conformed to all applicable safety standards. To assure optimum performance and continued safety certification of the machine, use genuine Toro replacement parts and accessories. Replacement of parts and accessories made by other manufacturers may result in non-conformance with the safety standards and can void the warranty.

Safety and Instructional Decals

Numerous safety and instruction decals are affixed to the traction unit and cutting units of your Groundsmaster. If any decal becomes illegible or damaged, install a new decal. Decal part numbers are listed in your *Parts Catalog*. Order replacement decals from Authorized Toro Distributor.

Chapter 2



Specifications and Maintenance

Table of Contents

Overall Dimensions	Specifications	2–2
Engine2–3 Traction and Reel Drive Systems	Overall Dimensions	2–2
Traction and Reel Drive Systems	Engine	2–3
	Traction and Reel Drive Systems	2–4
Controls, Wheels, and Accessories	Controls, Wheels, and Accessories	2–4
DPA Cutting Units	DPA Cutting Units	2–4
Universal Groomer	Universal Groomer	2–5
Torque Specifications	Torque Specifications	2–6
Calculating the Torque Values When Using a Drive-Adapter Wrench	Calculating the Torque Values When Using a Drive-Adapter Wrench	2–7
Identifying the Fastener	Identifying the Fastener	2–8
Standard Torque for Dry, Zinc Plated, and Steel Fasteners (Inch Series)	Standard Torque for Dry, Zinc Plated, and Steel Fasteners (Inch Series)	2–9
Standard Torque for Dry, Zinc Plated, and Steel Fasteners (Metric Fasteners)	Standard Torque for Dry, Zinc Plated, and Steel Fasteners (Metric Fasteners)	2–10
Other Torque Specifications	Other Torque Specifications	
Conversion Factors	Conversion Factors	
Shop Supplies	Shop Supplies	2–12
Special Tools	Special Tools	2–14

Specifications

Overall Dimensions



g262214

Engine



g238094

Figure 3

Recoil-start handle

Recoil starter

3.

4.

1. Fuel tank

2.

Air cleaner

ltem	Description
Make/Designation	Honda, 4-stroke, OHV single cylinder, air-cooled gasoline engine, GX120
Bore x Stroke	60 mm x 42 mm (2.36 x 1.65 inches)
Total displacement	118 cm³ (7.2 in³)
Compression ratio	8.5:1
Carburetor	Butterfly
Governor	Mechanical flyweight
Low-idle speed (no load)	1,800 to 2,000 rpm
High-idle speed (no load)	3,350 to 3,550 rpm
Direction of rotation	Counterclockwise (facing PTO shaft)
Fuel	unleaded gasoline fuel with an octane rating of 87 or higher with no more than 10% Ethanol
Fuel tank capacity	2 L (0.53 US gallons)
Engine oil	Refer to the Operator's Manual
Lubrication system	Splash type
Oil capacity	0.56 L (0.14 US gallons)
Air cleaner	Dual element
Ignition system	Transistorized magneto
Spark plug	NGK BPR6ES
Spark plug gap	0.7 to 0.8 mm (0.028 to 0.031 inch)
Engine weight (dry)	13 kg (28.7 lb)

Spark plug

Muffler

5.

6.

Traction and Reel Drive Systems

ltem	Description
Transmission	Engine to friction clutch
	Transmission drive uses spur gears
Traction Drive	Transmission to traction drive uses a series of spur gears
Differential	Spur gear planetary differential
Parking Brake	Band style (at differential shaft drive)
Traction Drum	Dual aluminum, 19.1 cm (7.5 inch) diameter
Cutting Reel Drive	Transmission reel output shaft with disconnect and sliding coupler
	Final reel drive has 2 pulleys with positive drive belt
	Belt tension maintained by an idler

Controls, Wheels, and Accessories

Item	Description
Transport Wheel (Optional) Tire Pressure	83 to 103 kPa (12 to 15 PSI)

DPA Cutting Units

Frame construction:	Two hexagonal crossmember with two bolt-on die-cast aluminum side plates.
Reel construction:	Reels are 53.3 cm (21 inches) in length and 12.7 cm (5 inch) in diameter. High strength, low alloy steel blades are thru hardened and impact resistant. Reels are available in 8, 11 and 14 blade configurations.
Reel bearings:	Two stainless steel ball bearings are press fit onto the reel shaft and retained by a threaded insert. Low drag seals/slingers for added protection. Reel position is maintained by a wave washer with no end play adjustment required.
Reel drive:	The reel shaft is 35 mm (1.375 inch) diameter tube with a threaded nut on each end
Height-of-cut:	Cutting height is adjusted on the front roller by two vertical screws. Standard bench height-of-cut range is 1.6 to 16 mm (0.062 to 0.625 inch) depending on type of bedknife installed. An optional high height-of-cut kit is available to obtain a cut range of 11.1 to 30 mm (0.438 to 1.2 inch). Effective HOC may vary depending on turf conditions, type of bedknife, rollers, attachments installed and rear drum position.
Bedknife and bedbar:	Replaceable single edged Edgemax [™] bedknife (solid tool steel construction) is standard. Bedknife is fastened to the bedbar with thirteen bedknife screws. A variety of optional bedknives are available.
Bedknife adjustment	Dual adjustment (one at each side of the bedbar) with 0.018 mm (0.0007 inch) bedknife movement for each detent.
Rollers:	The front roller is a 6.3 cm (2.5 inches) diameter roller that is available in full, wide spaced Wiehle and narrow spaced Wiehle configurations.
Grass shield:	Adjustable shield to improve grass discharge from reel in varying moisture conditions.
Counterbalance weight:	A cast iron weight mounted at left side of the cutting unit.

DPA Cutting Units (continued)

	18 inch	21 inch	26 inch
8 blade	-	23.6 kg (52 lbs)	26.7 kg (59 lbs)
11 blade	23.1 kg (51 lbs)	25 kg (55 lbs)	28.6 kg (63 lbs)
14 blade	24.5 kg (54 lbs)	26.3 kg (58 lbs)	-

Cutting unit weight (approximate):

Options: Refer to the *Cutting Unit Parts Catalog* or contact your local Authorized Toro Distributor for available cutting unit options.

Universal Groomer

Item	Description
Grooming reel diameter	6 cm (2.375 inches)
Groomer mounting	The drive assembly for the grooming reel is located at the left side of the cutting unit.
Groomer height setting	Height-of-cut range: 0.8 to 15.7 mm (0.030 to 0.620 inch). Height of groom range: 0.381 to 19.1 mm (0.015 to 0.750 inch).
Width-of-groomer	54.6 cm (21.5 inches).
Height adjustment knob	Allows a 0.003 inch (0.08 mm) increment of height adjustment for each click of the adjuster.
Quick-up feature	Allows grooming reel to be raised above the height/depth adjustment for no grooming reel action while mowing.

Torque Specifications

The 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 the fasteners will apply to all the fasteners which do not have a specific requirement identified in this *Service Manual*. The following factors must be considered when applying the torque: cleanliness of the fastener, use of a thread sealant (e.g., LoctiteTM), degree of lubrication on the fastener, presence of a prevailing torque feature (e.g., nylocknut), hardness of the surface underneath the head of the fastener, or similar condition which affects the installation.

As noted in the following tables, the torque values should be reduced by 25% for the lubricated fasteners to achieve the similar stress as a dry fastener. The torque values must be reduced when the fastener is threaded into the 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 checking the torque can be performed by marking a line on the fastener (head or nut) and mating part, then back off the fastener 1/4 of a turn. Measure the torque necessary to tighten the fastener until the lines match up.

Calculating the Torque Values When Using a Drive-Adapter Wrench



1. Torque wrench 2.

a205924

- 3. A (effective length of torque wrench)
- Drive-adapter wrench (crowsfoot)
- B (effective length of torque wrench and 4. drive-adapter wrench)

Using a drive-adapter wrench (e.g., crowfoot wrench) in any position other than 90° and 270° to the frame of the torque wrench will affect the torque value measured by the torque wrench because of the effective length (lever) of the torque wrench changes. When using a torque wrench with a drive-adapter wrench, multiply the listed torque recommendation by the calculated torque conversion factor (Figure 4) to determine proper tightening torque. When using a torque wrench with a drive-adapter wrench, the calculated torque will be lower than the listed torque recommendation.

Example: The measured effective length of the torque wrench (distance from the center of the handle to the center of the square drive) is 457 mm (18 inches).

The measured effective length of the torgue wrench with the drive-adapter wrench installed (distance from the center of the handle to the center of the drive-adapter wrench) is 483 mm (19 inches).

The calculated torque conversion factor for this torque wrench with this drive-adapter wrench would be 18/19 = 0.947.

If the listed torque recommendation for a fastener is 103 to 127 N·m (76 to 94 ft-lb), the proper torque when using this torque wrench with a drive-adapter wrench would be 98 to 121 N·m (72 to 89 ft-lb).

Identifying the Fastener



Fasteners with a Locking Feature

IMPORTANT

If a fastener with a locking feature or previously applied thread locking compound is reused, clean the fastener threads, and apply new thread locker to the fastener during installation.

Locking features are designed to create friction and prevent a fastener from loosening. Locking features can be found on externally or internally threaded fasteners. Common examples are plastic inserts incorporated into the fastener and pre-applied "dry" thread locking compound. Keep in mind, a fastener with a locking feature usually means there will be friction during initial installation and during removal.

Toro recommends replacing fasteners with a locking feature once they have been removed because the effectiveness of the locking feature diminishes with each reuse. If it is necessary to reuse a fastener with a locking feature; apply a thread locking compound (Loctite for example) to the fastener during installation. Use the appropriate strength and type of thread locking compound based on application, fastener size or information found in the product *Operators Manual*, *Service Manual*, or *Installation Instructions*.

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

Thread Size	Grade 1, 5 and 8 with Thin Height Nuts	SAE Grade 1 F Studs, and Regular H (SAE J995 Strong	Bolts, Screws, Sems with eight Nuts Grade 2 or er Nuts)	SAE Grade 5 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)	
	in-lb	in-lb	N·cm	in-lb	N·cm	in-lb	N∙cm
# 6 - 32 UNC	10 + 2	12 + 2	447 + 00	15 ± 2	169 ± 23	23 ± 3	262 ± 34
# 6 - 40 UNF	IUIZ	13 1 2	141 ± 23	17 ± 2	192 ± 23	25 ± 3	282 ± 34
# 8 - 32 UNC	12 + 2	25 + 5	202 + 56	29 ± 3	328 ± 34	41± 5	463 ± 56
# 8 - 36 UNF	13 1 2	20 ± 0	202 I UU	31 ± 4	350 ± 45	43 ± 5	486 ± 56
# 10 - 24 UNC	18 + 2	20 + 5	220 + 56	42 ± 5	475 ± 56	60 ± 6	678 ± 68
# 10 - 32 UNF	10 1 2	30 ± 3	339 I 30	48 ± 5	542 ± 56	68 ± 7	768 ± 79
1/4 - 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1130 ± 113	140 ± 15	1582 ± 169
1/4 - 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 12	1299 ± 136	160 ± 17	1808 ± 192
5/16 - 18 UNC	115 ± 15	105 ± 15	1186 ± 169	200 ± 25	2260 ± 282	300 ± 30	3390 ± 339
5/16 - 24 UNF	138 ± 17	128 ± 17	1146 ± 192	225 ± 25	2542 ± 282	325 ± 33	3672 ± 373
	ft-lb	ft-lb	N∙m	ft-lb	N∙m	ft-lb	N∙m
3/8 - 16 UNC	16 ± 2	16 ± 2	22 ± 3	30 ± 3	41 ± 4	43 ± 5	58 ± 7
3/8 - 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 4	47 ± 5	50 ± 6	68 ± 8
7/16 - 14 UNC	27 ± 3	27 ± 3	37 ± 4	50 ± 5	68 ± 7	70 ± 7	95 ± 9
7/16 - 20 UNF	29 ± 3	29 ± 3	39 ± 4	55 ± 6	75 ± 8	77 ± 8	104 ± 11
1/2 - 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 11	142 ± 15
1/2 - 20 UNF	32 ± 4	53 ± 7	72 ± 9	85 ± 9	115 ± 12	120 ± 12	163 ± 16
5/8 - 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 21	285 ± 28
5/8 - 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 18	230 ± 24	240 ± 24	325 ± 33
3/4 - 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 27	359 ± 37	375 ± 38	508 ± 52
3/4 - 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 30	407 ± 41	420 ± 43	569 ± 58
7/8 - 9 UNC	140 ± 20	225 ± 25	305 ± 34	430 ± 45	583 ± 61	600 ± 60	813 ± 81
7/8 - 14 UNF	155 ± 25	260 ± 30	353 ± 41	475 ± 48	644 ± 65	667 ± 66	904 ± 89

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

Note: The torque values must be reduced when installing the fasteners into threaded aluminum or brass. The specified torque value should be determined based on the aluminum or base material strength, fastener size, 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 \pm 10% of the nominal torque value. The thin height nuts include jam nuts.

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

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

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

Note: The torque values must be reduced when installing the fasteners into threaded aluminum or brass. The specified torque value should be determined based on the aluminum or base material strength, fastener size, 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 \pm 10% of the nominal torque value.

Other Torque Specifications

Thread Size	Recommended Torque		
Thread Size	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	

SAE Grade 8 Steel Set Screws

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		

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)

Thread Size	Threads	Receipe Tergue**	
	Туре А	Туре В	Baseline Torque
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

**The hole size, material strength, material thickness, and material finish must be considered when determining the specified torque values. All the torque values are based on the non-lubricated fasteners.

Conversion Factors

in-lb X 11.2985 = N·cm

ft-lb X 1.3558 = N·m

 $N \cdot cm \ X \ 0.08851 = in-lb$ $N \cdot m \ X \ 0.7376 = ft-lb$

Shop Supplies

The procedures found in this *Service Manual* may recommend the use of commonly used shop supplies (lubricants, sealants, and adhesives). A symbol denoting the use of a shop supply may appear in figures that support a procedure. Always refer to the written procedure for specific information regarding the type and the application of a shop supply.

IMPORTANT

Always follow manufacturers instructions when using or storing shop supplies.

ANTI-SEIZE LUBRICANT	Û
Used to prevent corrosion, galling and seizure between metal parts. Most often applied to shafts and bores during assembly. Unless otherwise specified, high viscosity regular grade lithium-graphite based anti-seize lubricant should be used.	
GREASE	
Can be used to pre-fill (pack) bearings, boots and seals prior to assembly, ease installation of components during assembly, or fill cavities between moving parts through grease fittings after assembly. Unless otherwise noted, refer to the machine <i>Operator's Manual</i> or <i>Installation Instructions</i> for grease specifications.	
THREAD LOCKING COMPOUND (Thread Locker)	
Used to lock threaded fasteners in position. Available in low, medium, and high strength for various size fasteners and applications. Most thread locking compounds are applied immediately prior to fastener installation. Some thread locking compounds use a "Wicking" feature, and can be applied after fastener installation. Most thread locking compounds allow the fastener to be removed with standard tools once cured. High strength thread locking compounds may require applying heat to the fastener and the surrounding area to allow fastener removal.	
Note: Some fasteners have a dry thread locking compound pre-applied (Patch-Loc) so no additional thread locking compound is necessary when installing a "new" fastener. These fasteners are designed to be removed and re-installed only once before applying additional thread locking compound is necessary.	Ŷ
RETAINING COMPOUND (bearings and sleeves)	
An adhesive used to secure bearings, bushings, and cylindrical parts into housings or onto shafts. When cured, bearing and sleeve retaining compound fills the gap between mating parts with a hard resin that increases load distribution and protects against corrosion.	
ADHESIVE	
Used to secure a variety of components immediately prior to assembly. May be recommended for installing new components or when reusing a component that had a pre-applied adhesive such as hood seals, moldings, and weather-stripping.	
THREAD SEALANT	
Used to seal threaded fittings and sensors from air, fuel and oil pressure leaks and prevent galling and seizure between threaded parts. A thread sealant in paste firm is preferred over sealant tape. The sealant should remain semi-pliable to allow for component removal with standard tools. Some thread sealants may require the use of a cleaner or primer prior to use.	

GASKET COMPOUND

Used to create a seal between mating parts. Gasket compounds may be used with or without the presence of a pre-formed gasket. Gasket compounds may be solvent or silicone based, and cure when exposed to air or designed to cure in an air-less environment (anaerobic). Most gasket compounds are designed to be applied to clean surfaces free of oil, chemical residue and previously used gaskets or gasket compounds.

SILICONE SEALANT

Designed for a broad variety of sealing and bonding requirements, silicone sealants are usually room temperature vulcanizing (RTV) which form a flexible silicone rubber that bonds to a wide variety of smooth or porous materials when cured. Standard silicone sealants are designed to perform in temperatures from -51F to 232C (-60F to 400F), while high temperature variants can preform in temperatures up to 343C (650F).

~G

Special Tools

Multimeter

Obtain this tool locally

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

Note: Use a digital multimeter when testing the electrical circuits. The high impedance (internal resistance) of a digital meter in the voltage mode ensures that the excess current is not allowed through the meter. This excess current can damage the circuits that are not designed to carry it.



Dielectric Gel

Toro Part No. 107-0342

Use the dielectric gel to prevent corrosion of unsealed connection terminals. To ensure complete coating of the terminals, liberally apply the gel to the component and wire harness connector, plug the connector into the component, unplug the connector, apply the gel to both surfaces again, and connect the harness connector to the component again. The connectors must be fully packed with gel for effective results.

Note: Do not use the dielectric gel on the sealed connection terminals as the gel can unseat the connector seals during assembly.

Spark Tester

Toro Part No. 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.





Gauge Bar Assembly

Toro Part No. 94-9010

Use gauge bar to verify height-of-cut adjustment.



Cutting Reel Shim

Toro Part No. 125-5611

Use the 0.05 mm (0.002 in) shim like a feeler gauge to measure the gap between the reel and the bedknife during reel adjustment.

Cutting Performance Paper

Toro Part No. 125-5610 (300 strips)

Cutting performance paper is used to test the cutting reel performance after adjusting the reel to bedknife clearance.

Backlapping Brush Assembly

Toro Part No. 29-9100

For applying lapping compound to cutting units while keeping hands a safe distance from the rotating reel.

Components for the brush assembly are also available individually.

Brush 36-4310

Handle 29-9080

Handle cap 2410-18

Reel Drive Shaft

K-Line Part No. TOR4112

Use the drive shaft for rotating the reel during cutting unit adjustment or any time the cutting unit motor is removed.











Reel Thread Repair Taps

15/16–16 Right-Hand Thread – Toro Part No. 137–0926

15/16-16 Left-Hand Thread - Toro Part No. 137-0927

Use to clean or repair the internal threads of cutting unit reels.



Angle Indicator and Magnetic Mount

Angle Indicator: Toro Part No. 131-6828

Magnetic Mount: Toro Part No. 131-6829

Because the top grind angle on bedknives is critical for edge retention, and therefore after- cut appearance, Toro develop these service tools for accurately measuring the top grind angle on all bedknives.

Since there can be variations in the mounting surface of the bedbar, it is necessary to grind the bedknife after installing it to the bedbar.

1. Place the angle indicator on the bottom side of the bedknife with the digital display facing you as shown.

2. Press the Alt Zero button on the angle indicator.

3. Remove the angle indicator and place the magnetic mount on the edge of the bedknife so the face of the magnet is flat against the top angle of the bedknife.

4. Place the angle indicator on the mount with the digital display facing you as shown. The angle displayed on the indicator is the current bedknife top angle.



Bedknife 1. 2. Angle Indicator 3. Bedbar



4.

Angle indicator surface 1.

Magnetic mount

- Bedbar Angle indicator 5.
- 3. Bedknife

2.

Bedknife Screw Tool

Bedknife Screw Tool (continued)

K-Line Part No. TOR510880A

This screwdriver-type bit is made to fit Toro bedknife attaching screws. Use this bit with a torque wrench to secure the bedknife to the bedbar.

IMPORTANT

Important: To prevent damage to the bedbar, DO NOT use an air or manual impact wrench with this tool.

Diameter/Circumference Measuring Tape

Toro Part No. TOR6023

Spring steel measuring tape for accurately measuring the circumference and outside diameter of cutting reel and other spherical components. Tape calibration is in fixed inch readings (no adjustments).





Roller Rebuilding Tools

The following combination of washers and spacers can be used to install bearings and seals into the front and rear rollers (2 each required).

Bearing installation washer: 107-8133 (black)

Seal installation spacer: 107-3505

Seal installation washer: 104-6126 (yellow)

K-Line Part No. TOR4105

As an alternative to using the washers and spacer listed above, this special tool set can be used to install bearings and seals into the front and rear rollers.



Turf Evaluator Tool

Toro Part No. 04399

Many turf discrepancies are subtle and require closer examination. In these instances, the Turf Evaluator grass viewing tool is helpful. It can assist turf managers and service technicians in determining causes for poor reel mower performance and in comparing the effective height-of-cut of one mowed surface to another. This tool should be used with the Toro Guide to Evaluation Reel Mower Performance and Using the Turf Evaluator (Toro part no. 97931SL) available from your local authorized Toro Distributor.



Drive Shaft Removal Tool

Toro Part No. 137-0920

Use to remove the optional Universal Groomer drive shaft from the reel if the drive shaft hex is damaged.



Syringe – 50cc (2 ounce)

Toro Part No. 137-0872

Aids in accurately filling the optional Universal Groomer gearbox with oil.







Troubleshooting

Table of Contents

GEARS – The Systematic Approach to Defining, Diagnosing and Solving Problems	
Gather Information	
Evaluate Potential Causes	
Assess Performance	
Repair	
Solution Confirmation	
Starting Problems	
Aftercut Appearance	
Factors Affecting Grooming	
Grooming Reel Mechanical Problems	

GEARS – The Systematic Approach to Defining, Diagnosing and Solving Problems

Gather Information

- Information reported by the customer
- Information observed by you
- Establish the "what, where, and when" of the issue

Evaluate Potential Causes

- · Consider possible causes of the problem to develop a hypothesis
- Narrow down the focus of the problem

Assess Performance

- · Ensure you have all the necessary tools for testing
- Test all potential causes of the failure
- Reevaluate and create a new hypothesis if necessary

Repair

Return the unit to service by repairing, rebuilding, or replacing parts

Solution Confirmation

- Did the issue go away?
- Was the root cause of the issue correctly repaired?
- Are there any other new symptoms?
Starting Problems

For effective troubleshooting and repairs, you must have a good understanding of the electrical circuits and components that are used on this machine; refer to the Electrical schematics in this chapter.

If the machine has any interlock switches that are bypassed, connect the switches for the correct troubleshooting and safety.

Note: For	engine	component	testing	information,	refer to	the Hor	nda	Service
Manual.								

Problem	Possible Cause	Correction
Engine will not start	ON/OFF switch is in the OFF position.	Turn the switch to On.
	Ignition spark plug wire is not connected to the spark plug.	Connect the spark plug wire to the spark plug.
	(Optional) Traction control is not in the NEUTRAL position.	Place the traction lever in the NEUTRAL position.
	An engine problem exists that prevents the engine from running.	Repair the engine.
	ON/OFF switch is faulty.	Replace the ON/OFF switch.
	Electrical wires are loose or damaged.	Check the electrical connections. Repair the wiring as needed.
	The fuel tank is empty.	Fill the fuel tank with fuel.
	The ON/OFF switch is damaged.	Replace the ON/OFF switch.
Engine will start, but will not continue to run.	Electrical wires are loose or damaged.	Refer to <i>Engine Maintenance Manual</i> .
	An engine problem exists that causes the engine to stop.	Repair the Chapter 6: Electrical System (page 6–1).

Aftercut Appearance

There are several factors that can contribute to unsatisfactory quality of cut, some of which may be turf conditions. Turf conditions such as excessive thatch, "sponginess" or attempting to cut off too much grass height may not always be overcome by adjusting the cutting unit. It is important to remember that the lower the height-of-cut, the more critical these factors are.

Refer to the *Cutting Unit Operator's Manual* detailed adjustment procedures. Refer to Service and Repairs (page 8–6) for cutting unit repair information.

Note: For additional information regarding cutting unit troubleshooting, several Reel Mower and Aftercut Appearance General Training Books can be found on the Service Reference Set available from your Authorized Toro Distributor.

Factors That Can Affect Quality of Cut

Factor	Possible Problem/Correction
Engine RPM and mow speed	For best cutting performance and appearance, the engine should be run at high idle speed while cutting. Check and adjust the high idle speed as necessary; refer to the <i>Traction Unit Operator's Manual</i> .
Reel bearing condition	Check and replace the reel bearings if necessary; refer to Reel Assembly (page 8–19).
Bedknife to reel adjustment	Check the 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.
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 the reel to remove taper and/or rifling. Grind the bedknife to sharpen and/or remove rifling.
	A new bedknife must be ground or backlapped after installation to the bedbar. Refer to Troubleshooting Bedknife Grinding (page 8–15) for grinding information or the <i>Traction Unit Operator's Manual</i> for backlapping information.
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 desired	If the bedknife is too thick for effective height-of-cut, poor quality of cut will result.
Stability of bedbar	Ensure that the bedbar pivot bolts are securely seated and washer free to rotate; refer to Bedbar Assembly (page 8–6).
Number of reel blades	Use correct number of blades for clip frequency and optimum height-of-cut range.
Roller type and condition	A variety of cutting unit rollers are available. Refer to the <i>Cutting Unit Parts Manual</i> for a listing of available accessories, or contact your local Authorized Toro Distributor for additional information.
	Ensure that the rollers rotate freely. Repair the roller bearings if necessary; refer to Roller Assemblies (page 8–27).
Cutting unit accessories	A variety of cutting unit accessories are available that can be used to enhance aftercut appearance. Refer to the <i>Cutting Unit Parts Manual</i> for a listing of available accessories, or contact your local Authorized Toro Distributor for additional information.

Factors Affecting Grooming

There are several 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.

IMPORTANT

Improper or overaggressive use of the grooming reel, such as too deep or frequent grooming, may cause unnecessary stress on the turf leading to severe turf damage. Use the groomer carefully. Read and understand the installation instructions before operating or testing groomer performance.

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

Variables that Affect the Use and Performance of Grooming Reels:

- 1. The growing season and weather conditions.
- 2. General turf conditions.
- 3. The frequency of grooming/cutting—number of cuttings per week and how many passes per cutting.
- 4. The blade spacing on the grooming reel.
- 5. The height-of-cut.
- 6. The grooming depth.
- 7. The type of grass on the green.
- 8. The amount of time that a grooming reel has been in use on a particular turf area.
- 9. The amount of traffic on the turf.
- 10. The overall turf management program (e.g., irrigation, fertilizing, weed control, coring, over-seeding, disease control, sand dressing, and pest control).
- 11. Stress periods for turf (e.g., high temperatures, high humidity, and unusually high traffic).

Grooming Reel Mechanical Problems

Problem	Possible Causes	Correction	
No rotation of the grooming reel.	Groomer drive gears are worn or damaged.	Inspect groomer drive assembly and replace damaged drive components.	
The turf is damaged or has uneven grooming.	The groomer is set too aggressively.	Refer to groomer Installation Instructions for groomer set-up information.	
	The grooming reel blades are bent, damaged or missing.	Repair or replace blades if necessary.	
	The grooming reel shaft is bent or damaged.	Replace grooming reel shaft.	
	Grooming depth is not equal on both ends of grooming reel.	Adjust depth if necessary. Check and adjust cutting unit set up (level bed knife to reel, set height-of-cut, etc.).	





Gasoline Engine

Table of Contents

General Information	
Operator's Manual	
Engine Owner's Manual	
Engine Service Manual	
Engine Identification	
Fuel Evaporative Control System	
Adjustments	
Throttle Cable Adjustment	
Service and Repairs	
Cooling System	
Spark Plug	
Engine	
Engine Base	

General Information

This chapter gives the information about specifications and repair of the Honda GX120 gasoline engine used in the Greensmaster. Described adjustments and repairs require tools that are commonly available in many service shops.

When disposing of hazardous waste products (fuel, engine oil, hydraulic fluid, filters, etc.), take them to an authorized disposal site. Waste products must not be allowed to contaminate surface water, drains, or sewer systems.

Operator's Manual

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

Engine Owner's Manual

The *Engine Owner's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for the Honda GX120 engine used on your Greensmaster machines. Contact your local Honda Engine Dealer or visit http://engines.honda.com to obtain a copy of the *Engine Owner's Manual*. Refer to the *Engine Owner's Manual* for additional information when servicing the machine.

Engine Service Manual

Detailed information on engine troubleshooting, testing, disassembly, and assembly is given in the *Honda Service Manual*. The use of some specialized tools and test equipment is explained in the *Honda Service Manual*. Contact your local Honda Engine Dealer to obtain a copy of the engine Service Manual. However, the specialized nature of some engine repairs may dictate that the work be done at a Honda engine repair facility.

Engine Identification

The engine serial number and type are stamped on the engine near the oil filler dipstick. The engine serial number and type will assist in identifying the correct parts and service information for the Honda engine in your Greensmaster machine.

Fuel Evaporative Control System

To meet worldwide emission standards, the engine that powers your Greensmaster is equipped with a fuel cap that has an integrated carbon canister. This fuel cap captures fuel vapors from the fuel tank before venting to atmosphere.



g282215

Figure 9

1. Fuel tank insert

Note: To prevent saturating the carbon canister in the fuel cap, it is important to ensure that the fuel tank is not overfilled. The maximum fuel level for the fuel tank is to the bottom of the fuel tank insert (Figure 9).

The insert also prevents the fuel from saturating the fuel cap during machine movement. Do not overfill the tank when refueling. Refer to the *Honda GX120 Owner's Manual* for additional information.

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 the mower on a level surface.

Note: Make sure that the engine is at normal operating temperature before you adjust the throttle cable.

- 2. Start the engine and move the throttle lever to the SLOW position.
- 3. Loosen the clamp retaining cable conduit.
- 4. Make sure that the throttle control is in the SLOW position and move the cable conduit until 1900 rpm.
- 5. Tighten the screw to secure the throttle cable conduit.
- 6. Check the engine speed with a tachometer:
 - A. Low idle speed should be **1,800 to 2,000 RPM**; refer to *Operator's Manual.*
 - B. High idle speed should be **3,350 to 3,550 RPM**. Adjust the throttle stop at throttle lever to attain the correct high idle speed setting; refer to *Operator's Manual*.

IMPORTANT

The engine governor control is equipped with a tamper resistant cap to prevent adjustment on a high idle speed. Modification to this cap will void the engine warranty, and may make the engine non-compliant with the emission certification of the engine.

Service and Repairs

Cooling System



IMPORTANT

The engine that powers the machine 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. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.

IMPORTANT

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

 Clean the cooling fins on the cylinder and cylinder head. Remove the engine cylinder shroud from the engine for more thorough cleaning; refer to Figure 10.

Cooling System (continued)

1.



3. Clean the blower housing of dirt and debris; refer to Figure 11. Remove the housing if necessary.

IMPORTANT

Never operate engine with the cylinder shroud and blower housing removed. Overheating and engine damage will result.

- 4. Ensure that the blower housing and/or engine cylinder shroud are installed to the engine if removed.
- 5. Attach the spark plug wire to the spark plug.

Spark Plug



Use an NGK BPR6ES spark plug or equivalent.

- 1. Ensure that the engine is shut off. Carefully remove the spark plug wire from the spark plug.
- 2. Clean the cylinder head area around the spark plug and remove the plug from the cylinder head.
- 3. Inspect the spark plug.

IMPORTANT

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

- 4. Set spark plug electrode gap from **0.7 to 0.8 mm**.
- 5. Install correctly gapped spark plug into the cylinder head and torque the spark plug to 23 N·m (17 ft-lb).
- 6. Connect the spark plug wire to the spark plug.

Engine



Removing the Engine

Note: Refer to Figure 13 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the spark plug wire from the spark plug, and close the fuel shut-off valve on the engine.
- 3. If the engine is to be disassembled, it may be easier to drain oil from engine before removing the engine from the traction unit.

Removing the Engine (continued)



g261801

2.

Figure 14

- Governor lever 1. Throttle cable
- 3. Cable clamp
 - High speed screw 4.
- 4. Remove the throttle cable (2) from the engine:
 - A. Loosen the screw that secures the cable clamp (3) to the engine. Remove the cable clamp.
 - B. Loosen the screw that secures the throttle cable (2) to the governor lever (1). Slide and remove the throttle cable from the governor lever.
 - C. Position the throttle cable (2) away from the engine.

Removing the Engine (continued)



g262386

Figure 15

- 1. Armature wire 2. Alternator wire 3. Harness ground wire
- 5. Disconnect the electrical connections from the engine:
 - A. Unplug the wire harness connector from the engine armature wire (1).
 - B. Disconnect the wire harness ground wire (3) from engine by removing LH rear cap screw, flat washer, and flange nut.
 - C. If the machine is equipped with optional lighting kit, disconnect the wire harness connectors from the engine alternator wires (2).
- 6. Remove the 2 bolts (13) that secures the clutch cover (12) to the bell housing. Remove the clutch cover from the bell housing.
- Remove the 2 bolts (15) and 2 nuts (11) that secures the clutch hub clamp (10) to the external clutch hub. Remove the clutch hub clamp from the external clutch hub.
- 8. Remove the 4 bolts (8) and 4 washers (9) that secures the engine (14) to the bell housing.
- 9. Remove the 4 nuts (3), 4 washers (4) and 4 carriage bolts (6) that secures the engine (14) to the engine base (5). Remove the engine from the engine base.
- 10. If necessary, remove the muffler (2) from the engine (14) by removing the 2 bolts (1).

Installing the Engine

1. If removed, install the muffler (2) onto the engine (14) and secure with the 2 bolts (1).



- 2. Torque tighten the bolts (1) from **4 to 5.6 N·m (35 to 50 in-lb)**.
- 3. Position the engine (14) onto the engine base (5) and engine output shaft in the bell housing and external clutch hub.
- Secure the engine (14) onto the bell housing with the 4 bolts (8) and 4 washers (9). In an alternating cross pattern, torque tighten the bolts (8) from 10 to 11.3 N·m (90 to 100 in-lb).
- 5. Secure the engine (14) to the engine base (5) with the 4 carriage bolts (6), 4 washers (4) and 4 nuts (3).
- 6. Apply the anti-seize lubricant to the engine shaft key.
- 7. Install the clutch hub clamp (10) onto the external clutch hub and make sure that the clutch hub clamp integral key is aligned to the engine shaft keyway. Secure the clutch hub clamp (10) with the 2 bolts (15) and 2 nuts (11).



- 8. Torque tighten the bolts (15) from **10 to 12.4** N·m (90 to 110 in-lb).
- Install the clutch cover (12) onto the bell housing and secure with the 2 bolts (13). Torque tighten the bolts (13) from 6.7 to 9 N·m (60 to 80 in-lb).
- 10. Connect the electrical connections to the engine:
 - A. Apply dielectric gel to wire harness connectors.
 - B. Connect the wire harness connectors to the engine armature wire (item 1 in Figure 15).
 - C. Connect the wire harness ground wire (3) to the engine by installing the LH rear cap screw, flat washer, and flange nut.
 - D. Apply a coat of dielectric grease to the wire harness ground terminal to prevent corrosion.
 - E. If the machine is equipped with optional lighting kit, connect the wire harness connectors to the engine alternator wires.
- 11. Connect the throttle cable (item 2 in Figure 14) to the engine:
 - A. Slide the throttle cable end into the governor lever (1).
 - B. Place throttle cable (2) under the cable clamp (3) and secure with a screw.
 - C. Adjust the throttle cable; refer to Throttle Cable Adjustment (page 4–4). Ensure that all fasteners are tightened after the cable adjustment.
- 12. Check and adjust the engine oil level as needed; refer to Operator's Manual.
- 13. Attach the spark plug wire to the spark plug. Open the fuel shut-off valve on the fuel tank.
- 14. Start the engine and allow it to warm to operating temperature. Check high and low idle speeds and adjust if necessary.

Engine Base



Removing the Engine Base

Note: Refer to Figure 16 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the spark plug wire from the spark plug, and close the fuel shut-off valve on the engine.
- 3. Remove the throttle cable; refer to Removing the Throttle Cable (page 7–3).
- 4. Remove the clutch cable; refer to Removing the Clutch Cable (page 7–9).
- 5. Remove the brake cable; refer to Removing the Brake Cable (page 7–6).

Removing the Engine Base (continued)

- 6. Remove the reel cable; refer to Removing the Reel Cable (page 7–11).
- 7. Slide the telescopic coupler on the reel drive assembly and disconnect the reel drive shaft from the transmission drive shaft.
- 8. Remove the truss screw, nut and 2 washers that secures the 2 splined couplers to the transmission gearbox assembly and drum drive gearbox assembly.
- 9. Loosen the jam nut (3) and remove the slider adaptor (2) from the transmission gearbox assembly (10).
- 10. Remove the nut (4), washers (5) and bolt (7) that secures the engine base (1) to front side of the frame assembly (6).
- 11. Remove the 4 nuts (11) and 2 tube clamps (8) that secures the engine base (1) to rear side of the frame assembly (6).

WARNING

A

Support the engine and transmission to prevent it from dropping and causing personal injury when removing.

- 12. Lift the engine base with engine and transmission together from the frame assembly.
- 13. Remove the 4 carriage bolts that secures the engine to the engine base.
- 14. Remove the 2 bolts (9) that secures the transmission gearbox assembly to the engine base.

A

WARNING

Support the engine and transmission to prevent it from dropping and causing personal injury when removing.

15. Separate the engine base from the engine and transmission gearbox assembly.



- 4. Retaining ring
- 5. Reel selector shaft
- 6. Extension spring
- 7. Flange bushing
- Reel bellcrank 8.

- 11. Straight bushing
- 12. Short reel lever
- Flat head bolt 13.
- 14. Nut

16.

- 15.
- Socket head screw
- 19. Engine mount bracket
- 20. Bolt
- 21. Cable guide
- 22. Washer
- 23. Washer
- 16. Carefully remove the nut (1 in Figure 17) and compression spring (2) that secures the reel selector hub (3) to the reel selector shaft (5). Remove the reel selector hub.
- 17. Carefully remove the extension spring (6) from the long and short reel levers (10 and 12).
- 18. Remove the bolt (13) that secures the reel selector shaft (5) to the engine base (16).
- 19. Remove the washer (9), long reel lever (10), washer (9), short reel lever (12), washer (9) and reel bellcrank (8) from the reel selector shaft (5).

Engine base

Removing the Engine Base (continued)

- If necessary, remove the flange bushing (7) from the reel bellcrank (8). Remove the straight bushing (11) from the long and short reel lever (10 and 12).
- 21. If necessary, remove the nut (14), washer (23) and socket head screw (15) from the engine base (16).

Installing the Engine Base

1. If removed, install the socket head screw (item 15 in Figure 17), washer (23) and nut (14) into the engine base (16).



IMPORTANT

Straight bushings in the long and short reel levers must be inspected for wear or damage and replaced if needed.

- 2. If removed, install the straight bushings (11) into the long and short reel levers (10 and 12) using an arbor press. Ensure that the straight bushings (3) are flush to top of the long and short reel levers (1 and 2); refer to Figure 18.
- 3. If removed, install the flange bushing (7) into the reel bellcrank (8) using an arbor press.
- 4. Slide the reel bellcrank (8), washer (9), short reel lever (12), washer (9), long reel lever (10) and washer (9) onto the reel selector shaft (5).
- 5. Install the reel selector shaft (5) onto engine base (16) and secure with the bolt (13).
- 6. Carefully position the extension spring (6) onto the long and short reel levers (10 and 12).
- 7. Install the reel selector hub (3) and compression spring (2) onto the reel selector shaft (5) and secure with the nut (1).

A

WARNING

Support the engine and transmission to prevent it from dropping and causing personal injury when installing.

Installing the Engine Base (continued)

- 8. Install the engine and transmission gearbox assembly on the engine base.
- 9. Secure the transmission gearbox to engine base with 2 bolts (9). Do not tighten the bolts (9).
- 10. Secure the engine to the engine base with 4 carriage bolts, washers, and nuts.
- 11. Secure the engine base (item 1 in Figure 16) to the frame assembly (6) with a bolt (7), 2 washers (5) and nut (4) in front side and 2 tube clamps (8) and 4 nuts (11) in rear side of the frame assembly (6). Do not tighten the nuts (4 and 11).



- 12. Tighten the nut (4). Torque tighten the nuts (11) in an alternating cross pattern from **3.4 to 4 N·m (30 to 35 in-lb)** and then using the same pattern apply the torque from **5 to 5.6 N·m (45 to 50 in-lb)**.
- 13. Tighten the 2 bolts (9) that secure the transmission gearbox to engine base.
- 14. Install the slider adapter (item 2 in Figure 16) and secure with a jam nut (3) onto the transmission gearbox assembly (10). Adjust the slider adapter to make sure that the transmission output shaft is in neutral position.
- 15. Install the 2 splined couplers onto the transmission gearbox assembly and drum drive gearbox assembly and secure with the truss screw, 2 washers and nut.



- 16. Torque tighten the truss screw to **10 to 12.4 N·m (90 to 110 in-lb)**.
- 17. Install the reel cable; refer to Installing the Reel Cable (page 7–13).
- 18. Install the brake cable; refer to Installing the Brake Cable (page 7–8).
- 19. Install the clutch cable; refer to Installing the Clutch Cable (page 7–10).
- 20. Install the throttle cable; refer to Installing the Throttle Cable (page 7-5).
- 21. Attach the spark plug wire to the spark plug. Open the fuel shut-off valve on the fuel tank.
- 22. Start the engine and allow it to warm to operating temperature. Check high and low idle speeds and adjust if necessary.

Chapter 5



Traction and Reel Drive Systems

Table of Contents

General Information	
Disengaging The Drum Drive From Transmission	
Adjustments	
Adjusting the Reel Drive Belt	
Aligning the Transmission Output Shaft to the Reel Drive Input Shaft	
Service and Repairs	
Reel Drive Belt	
Reel Drive Assembly	
Drum Drive Gearbox Assembly	
Drum Assembly	
Clutch Bearing	
Transmission Gearbox Assembly	
Differential Assembly	

General Information

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

Disengaging The Drum Drive From Transmission



1. Transmission gearbox assembly

a258467

2. Traction engage/disengage lever

The traction drum is driven by series of spur gears inside the transmission gearbox assembly. To disengage the traction drum drive from the transmission, do the following procedure:

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Locate the traction engage/disengage lever on top of the transmission gearbox assembly.
- 3. To disengage the drum drive, rotate the traction engage/disengage lever to clockwise direction (away from the center of transmission gearbox assembly).
- 4. To engage the drum drive, rotate the traction engage/disengage lever to anti-clockwise direction (towards the center of the transmission gearbox assembly).
- 5. Attach the spark plug wire to the spark plug.

Adjustments

Adjusting the Reel Drive Belt



- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the 3 socket head screws (7) that secure the reel drive cover (6) to the reel drive housing (1), and remove the cover to expose the reel drive belt (2).
- Check the tension of the belt (item 2 in Figure 20) by pressing it at mid span between pulleys with 18 to 22 N (4 to 5 lbs) of force. If the belt deflects 6.35 mm (0.25 inch), belt tension is correct - continue operation. If belt tension is not correct, proceed to next step.

1.

2.

3.

Adjusting the Reel Drive Belt (continued)

- 4. Adjust belt tension as follows:
 - A. Loosen the bolt (4) and rotate the idler arm (3) to remove tension from the belt (2).



B. Use a beam-style torque wrench to apply **6 to 7 N·m (55 to 60 in-lb)** of force to the upper idler-arm socket-head screw as shown in Figure 21, and tighten the bolt (4) to secure the idler arm (3). Check the belt tension; refer to step 3.



Figure 21

- 1. Upper idler-arm socket-head screw 2. Beam-style torque wrench
 - C. Ensure that the reel drive gasket (5) is in position, and assemble the reel drive cover (6) to the reel drive housing (1) with the 3 socket head screws (7).



- D. Initially torque the socket head screws to 1.7 to 4.5 N·m (15 to 40 in-lb). Then using an alternating pattern torque the screws to 9.6 to 10.7 N·m (85 to 95 in-lb).
- 5. Attach the spark plug wire to the spark plug.

Aligning the Transmission Output Shaft to the Reel Drive Input Shaft



- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Check the telescopic coupler on the reel drive input shaft for free movement. If binding occurs, adjust the engine base plate as follows:

Aligning the Transmission Output Shaft to the Reel Drive Input Shaft (continued)



- 1. Reel-drive assembly 2. Nut
 - A. Loosen the nut (item 2 in Figure 23) that secures the reel drive assembly to the side-plate.
 - B. Loosen the four nuts (item 11 in Figure 22) on the two U-tube clamps that secures the engine base to the rear side of the frame assembly.
 - C. Loosen the nut (item 4 in Figure 22) that secures the engine base to the front side of the frame assembly.
 - D. Using the jackscrew (item 12 in Figure 22), adjust the engine base up or down and move the reel drive assembly forward or aft until the transmission reel drive output shaft aligns (intersects) with the coupler of the input to the reel drive. The telescopic coupler must move freely when engaging.
 - E. Tighten the nut (item 4 in Figure 22) that secures the engine base to the front side of the frame assembly. Re-check the alignment of the telescopic coupler.



g278571

- F. Evenly tighten the four nuts (item 11 in Figure 22) on the two U-tube clamps that secures the engine base tot he rear side of the frame assembly. Torque tighten the nuts to **5 to 5.6 N·m (45 to 50 in-lb)**.
- G. Re-check the alignment of the telescopic coupler.
- H. Tighten the nut (item 2 in Figure 23) that secures the reel drive assembly to side plate.
- I. Re-check the alignment telescopic coupler and ensure no binding between the transmission reel drive output shaft and reel drive input shaft.
- 3. Install the spark plug wire on the spark plug.

Service and Repairs

Reel Drive Belt



The Greensmaster machines use a positive drive belt at the right side of the machine to operate the cutting unit.

Removing the Reel Drive Belt

1.

2.

3.

Note: Refer to Figure 24 during this procedure.

1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.

Removing the Reel Drive Belt (continued)

- 2. Remove the 3 socket head screws (7) that secure the reel drive cover (6) to the reel drive housing (1), and remove the cover to expose the reel drive belt (2).
- 3. Remove and inspect the reel drive gasket (5) from the reel drive housing (1). Replace the reel drive gasket (5) if it is worn or damaged.
- 4. Loosen the bolt (4) and rotate the idler arm (3) to remove the tension from the belt (2).
- 5. Remove the belt (2) from the pulleys.

Installing the Reel Drive Belt

- 1. Ensure that the bolt (4) is loose enough to freely move the idler arm (3).
- 2. Place the new drive belt (2) over the pulleys.
- 3. Adjust the reel drive belt tension; refer to Adjusting the Reel Drive Belt (page 5–3).
- 4. Align the reel drive gasket (5) to the reel drive housing (1), and install the reel drive cover (6) to the housing with the 3 socket head screws (7).



- Initially torque the socket head screws to 1.7 to 4.5 N·m (15 to 40 in-lb). Then using an alternating pattern torque the socket head screws to 9.6 to 10.7 N·m (85 to 95 in-lb).
- 6. Attach the spark plug wire to the spark plug.

Reel Drive Assembly



Removing the Reel Drive Assembly

Note: Refer to Figure 25 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Slide the telescopic coupler (item 8 in Figure 25) on the reel drive assembly (6) and disconnect the reel drive shaft from the transmission drive shaft (10).
- 3. Loosen and remove the 2 screws (1) and the nut (12) that secures the reel drive assembly (6) to RH side plate (9). Remove the reel drive assembly

Removing the Reel Drive Assembly (continued)

- (6), flat washers (3), spring washers (4) and spacers (2 and 11) from the RH side plate (9).
- 4. Remove the V-ring seal (5) from the reel drive assembly (6).

Disassembly of Reel Drive Assembly



- Reel shaft-driven 1.
- O-ring 2.
- 3. Pivot sleeve
- 4. Reel drive gasket
- Ball bearing (2 each) 5.
- 6. Internal snap ring
- 7. Reel pulley spacer (2 each)
- Reel pulley 24 tooth 8.
- Locknut (2 each) 9.
- 10. Idler bushing

- 11. Socket head screw
- 12. Socket head screw (3 each)
- 13. Expansion plug
- 14. Reel drive cover
- Reel pulley 22 tooth 15.
- 16. Reel belt
- 17. Retaining ring
- Ball bearing (4 each) 18.
- 19. Flocked bearing shield
- 20. Hipro key

- 21. Reel shaft-driver
- 22. Reel drive housing
- 23. O-ring
- 24. Bolt
- 25. Locknut (2 each)
- 26. Idler arm
- 27. Plain washer
- 28. Hex bolt
- 29. Retaining ring

Note: Refer to Figure 26 during this procedure.

- 1. Remove the reel drive belt (item 16 in Figure 26); refer to Removing the Reel Drive Belt (page 5-7).
- 2. Remove and discard the reel drive gasket (4) from the reel drive housing (22).
- 3. If necessary, remove the expansion plug (13) from the reel drive cover (14).
- 4. Remove the hex bolt (28) and plain washer (27) from the idler arm (26) and the nut (25) from the reel drive housing (22).
- 5. Loosen and remove the socket head screw (11) that secures the idler arm (26) to the reel drive housing (22). Remove the idler arm and nut (25) from the reel driving housing.

Disassembly of Reel Drive Assembly (continued)

- 6. If necessary, remove the idler bushing (10) from the idler arm (26).
- Remove the retaining ring (29) and use a press to remove 2 ball bearings (18) from the idler arm (26). Discard the ball bearings after removal.
- 8. Remove the locknut (9), reel pulley (8), hipro key (20) and spacer (7) from the reel shaft-driven (1).
- 9. Remove the retaining ring (6) from the reel drive housing (22).
- 10. Slide the reel shaft-driven from the bearings.
- 11. Use a press to remove the 2 ball bearings (5) and reel shaft-driven (1) from the reel drive housing (22). Discard the ball bearings after removal.
- 12. If necessary, remove the pivot sleeve (3) from the reel drive housing (22). Remove and discard the O-ring from the pilot sleeve.
- 13. Remove the nut (9), reel pulley (15), hipro key (20) and spacer (7) from the reel shaft-driver (21).
- 14. Remove the retaining ring (17) from the reel drive housing (22).
- 15. Slide the reel shaft-driver from the bearings.
- 16. Use a press to remove the 2 ball bearings (18), bearing shield (19) and reel shaft-driver (21) from the reel drive housing (22). Discard the ball bearings after removal.
- 17. Remove and discard the O-ring (23) from the bolt (24). If necessary, remove the bolt (24) from the reel drive housing (22).

Assembly of Reel Drive Assembly

- 1. If removed install the bolt (24) into the reel drive housing (22) and new O-ring (23) onto the bolt (24).
- 2. Use a press to install the 2 ball bearings (18) into the reel drive housing (22) and make sure that the reel shaft-driver pushes on bearing outer raceway.
- 3. Slide the bearing shield (item 19 in Figure 26) onto the reel shaft-driver.
- 4. Install the reel shaft-driver (21) into the reel drive housing (22).
- 5. Install the retaining ring (17) to the reel drive housing (22).
- 6. Slide the spacer (7) onto the reel shaft-driver (21).
- 7. Install hipro key (20) to then reel shaft-driver (21). Apply anti-seize lubricant at the top of the key.
- 8. Install the reel pulley (15) onto the reel shaft-driver (21). Secure the reel pulley (15) with the locknut (9).



- 9. Torque tighten the locknut to **36.6 to 44.7** N·m (27 to 33 ft-lb).
- 10. If removed, install the O-ring (2) onto the pivot sleeve (3). Slide the pivot sleeve onto the reel drive housing (22).
- 11. Use a press to install the 2 ball bearings (5) into housing (22) outer raceway. Install the reel shaft-driven (1) to the reel drive housing (22).
- 12. Install the retaining ring (6) and spacer (7) o the reel drive housing (22).
- 13. Install the hipro key (20) onto the reel shaft-driven (1). Apply anti-seize lubricant at the top of the key.
- 14. Install the reel pulley (8) onto the reel shaft-driven (1). Secure the reel pulley with the locknut (9).



Assembly of Reel Drive Assembly (continued)

- 15. Torque tighten the locknut to 36.6 to 44.7 N·m (27 to 33 ft-lb).
- 16. If removed, install the bushing (10) into the idler arm (26).
- 17. Use a press to install the 2 ball bearings (18) to the idler arm (26) outer raceway and secure with a retaining ring (29).
- 18. Install and secure the idler arm into the reel driving housing with the socket head screw (11) and nut (10).
- 19. Install the bolt (28), washer (27) and nut (25) to the idler arm (26) and reel drive housing (22). Do not tighten the bolt (28).



- 1. Press flush
- 20. If removed, install the expansion plug (13) to the reel drive cover (14) and press flush to outer surface (refer to Figure 27) of the reel drive cover.
- 21. Install the reel drive belt; refer to Installing the Reel Drive Belt (page 5–8).
- 22. Adjust the reel drive belt tension; refer to Adjusting the Reel Drive Belt (page 5–3).

Installing the Reel Drive Assembly

Note: Refer to Figure 25 during this procedure.

- 1. Place the V-ring seal (5) into the reel drive assembly (6).
- 2. Install the compression spring (7) and telescopic coupler (8) to the reel drive shaft.
- 3. Install the reel drive assembly (6), washers (3), spring washer (4) and spacers (2 and 11) to the RH side plate (9) and secure the reel drive assembly (6) with 2 screws (1) and nut (12).
- 4. Slide the compression spring (7) and telescopic coupler (8) to the transmission gear shaft (10).
- 5. Attach the spark plug wire to the spark plug.

Drum Drive Gearbox Assembly



Removing the Drum Drive Gearbox Assembly

Note: Refer to Figure 28 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the transport wheel if attached; refer to Removing the Transport Wheel (page 7–26).

Note: Support the machine on kickstand during this operation.

3. Move the traction engage/disengage lever to the disengage position to remove torque from the drum drive gears.

Removing the Drum Drive Gearbox Assembly (continued)

- 4. Remove the truss screw (11), nut (5) and washer (4) that secures the 2 splined couplers (3) to the transmission gearbox assembly (1) and drum drive gearbox assembly (8).
- 5. Remove the shoulder bolt (10) that secures the drum drive gearbox assembly (8) to the frame assembly (9).
- 6. Remove the 3 shoulder bolts (6) that secures the drum drive gearbox assembly (8) to the traction drum (2). Remove the drum drive gearbox assembly from the frame assembly. Support the drum assembly.
- 7. If necessary, remove the hexagonal shaft (7) from the drum drive gearbox assembly (8).



Note: Refer to Figure 29 during this procedure.

- 1. Remove the 5 socket head screws (15) that secures the drum drive cover (14) to the drum drive housing (25).
- 2. Remove and discard the gasket (8) from the drum drive housing (25).
- 3. If necessary, remove the hollow plugs (16) from the drum drive cover (14).
- 4. If necessary, remove and discard the oil seal (13) from the drum drive cover (14).

Disassembly of Drum Drive Gearbox Assembly (continued)

- Remove the nut (12) that secures the spur gear (11) to the drum drive shaft (5). Slide and remove the spur gear (11) from the drum drive shaft (5). Locate and retrieve the key (30) from the drum drive shaft (5).
- 6. Remove the nut (1) and washer (2) that secures the outer drum hub (3) to the drum drive shaft (5). Slide and remove the outer drum hub (3) and V-ring seal (4) from the drum drive shaft (5). Locate and retrieve the key (30) from the drum drive shaft (5).
- 7. If the ball bearings (6) are to be removed, use a press to remove the oil seal (10), ball bearings (6), bearing spacer (7), spring washer (9) and drum drive shaft (5) from the drum drive housing (25). Discard the ball bearings after removal.
- 8. Remove the nut (17) and bearing pin (31) that secures the spur gear (20) to the drum drive housing (25).
- 9. Remove the spur gear (20) and bearing spacer (34) from the drum drive housing (25).
- 10. Remove and discard the O-ring (32) from the bearing pin (31).
- 11. If the spur gear bearings (19) are to be removed, remove the retaining rings (18) and use a press to remove the ball bearings (19). Discard the bearings after removal.
- 12. Remove the retaining ring (28) and oil seal (27) from the drum drive housing (25). Discard the oil seal (27). Remove the retaining ring (26) from the spur gear (21).
- Use a press to remove ball bearings (23), spur gear (21) and wave washer (24) from the drum drive housing (25). Discard the ball bearings after removal.
- 14. Remove and discard the O-ring (29) from the drum drive housing (25).
Assembly of Drum Drive Gearbox Assembly



1. Install the ball bearings (23), wave washer (24) and spur gear (21) to the drum drive housing (25).

Note: The outer diameter and inner diameter of the ball bearings (23) must be slip fit.

- 2. Install the retaining ring (26) to the spur gear (21). Apply a light coat of oil to the oil seal (27). Install the oil seal (27) and retaining ring (28) to the drum driving housing (25).
- 3. Use a press to install the ball bearings (19) to the spur gear (20). Install the retaining rings (18) to spur gear (20).

Note: The inner diameter of the ball bearing (19) must be slip fit.

- 4. Apply a light coat of grease and install the O-ring (32) to the bearing pin (31). Install the bearing spacer (34), spur gear (20) onto the drum drive housing (25) and secure with the bearing pin (31) and nut (17).
- 5. Install the ball bearings (6), bearing spacer (7), spring washer (9) and drum drive shaft (5) to the drum drive housing (25).

Note: The outer diameter and inner diameter of the ball bearings (6) must be slip fit.

- 6. Install the V-ring seal (4) onto the drum outer hub (3). Install the key (30) to the drum drive shaft (5) and apply anti-seize lubricant at the top of the key. Slide the drum outer hub (3) to the drum drive shaft (5) and secure with the washer (2) and nut (1).
- 7. Install the oil seal (10) into the drum drive housing (25). Install the key (30) to the drum drive shaft (5) and apply anti-seize lubricant at the top of the key. Slide the spur gear (11) to the drum drive shaft (5) and secure with the nut (12).



- 8. Torque tighten the nut (17) from **36.5 to 44.7** N·m (27 to 33 ft-lb).
- 9. Hold the nut (12) and torque tighten the nut (1) from **74.5 to 88 N⋅m (55 to 65 ft-lb)**.
- 10. If removed, install the oil seal (13) to the drum drive cover (14).
- 11. Install the gasket (8) to the drum drive housing.

Assembly of Drum Drive Gearbox Assembly (continued)



Install the drum drive cover (14) to the drum drive housing (25) and secure with 5 socket head screws (15). Torque tighten the socket head screws to
1.7 to 4.5 N·m (15 to 40 in-lb). Use an alternation pattern and torque tighten the socket head screws to **9.6 to 10.7 N·m (85 to 95 in-lb)**.



13. Fill the drum drive gearbox assembly with **10 oz (0.56 lb)** of Mobil SCH007 grease.



14. Torque tighten the hollow plugs (16) from **12.4 to 14.6 N·m (110 to 130 in-lb)**.

Installing the Drum Drive Gearbox Assembly



- If removed, apply a coat of Loctite (blue) to threads of the hexagonal shaft (7). Install the hexagonal shaft (item 7 in Figure 28) to the drum drive gearbox assembly (8). Torque tighten the hexagonal shaft to 67.7 N·m (50 ft-lb).
 - 2. Apply a light coat of grease and install the O-ring (29) to the drum drive housing (25).
 - 3. Install the drum drive gearbox assembly (8) to the frame assembly (9) and secure with the shoulder bolt (10).
 - 4. Install the drum drive gearbox assembly (8) to the traction drum (2) and secure with the 3 shoulder bolts (6).
 - 5. Install the 2 splined couplers onto the transmission gearbox assembly (1) and drum drive gearbox assembly (8) and secure with the truss screw (11), 2 washers (4) and nut (5).



- 6. Torque tighten the truss screw (11) to **10 to 12.4** N·m (90 to 110 in-lb).
- 7. If required, install the transport wheels; refer to Installing the Transport Wheel (page 7–28).
- 8. Attach the spark plug wire to the spark plug.

Drum Assembly



Removing the Drum Assembly

Note: Refer to Figure 31 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the LH and RH drum drive gearbox assemblies (item 8 in Figure 31); refer to Removing the Drum Drive Gearbox Assembly (page 5–13).
- 3. Remove the traction drum (2) from the frame assembly (9).

Disassembly of Drum Drive Assembly



Note: Refer to Figure 32 during this procedure.

- 1. Remove the 4 bolts (item 2 in Figure 32) and lock washers (3) that secures the drum hub plate (4) to the drum spindle (5).
- 2. Remove the 4 bolts (2) and lock washers (3) that secures the drum hub plate (4) to the drum hub (10).
- 3. Remove the shoulder bolts (11) that secures the drum hub plate (4) to the traction drum (1).
- 4. Remove the locknut (12) that secures the drum spindle (5) and drum hub (10) together. Carefully slide and remove the drum spindle (5) out of the drum hub (10).
- 5. Remove the 2 seals (6) from the drum hub (10). Use a press to remove the 2 ball bearings (7) and a bearing spacer (8) from the drum hub (10). Discard the ball bearings.

Assembly of Drum Drive Assembly

3.



Note: The seal side of each bearing (item 7 in Figure 33) should face inside of the drum hub; refer to Figure 33.

- 1. Use a press to install the bearings (7) and spacer (8) into the drum hub (10). Pack the bearings with grease. Fill outside space of the bearing with the grease.
- 2. Apply a coat of grease to the seals (6). Press the seals (6) into the drum hub (1) with its flat side facing outside (Figure 33).
- 3. Apply grease to the shaft of the drum spindle (5). Carefully slide the drum spindle into the drum hub bearings (7). Secure the drum spindle and drum hub (1) with a spacer (2) and locknut (3). Make sure that the drum spindle (5) can move axially relative to the drum hub (1).

Note: The locknut (3) turns hard on the drum spindle (5) when tightened. Ensure that all rotation has stopped when tightening. A good solid sound indicates the nut is full tight.

4. Install the drum hub plate (4) into the traction drum (1) and secure with shoulder bolt (11).

Note: The fit between the drum hub plate (item 4 in Figure 32) and drum (1) is a close tolerance and can be easily jammed. The hub can be rotated when seated properly in the bore of the drum.

- 5. Secure the drum hub plate (4) to the drum hub (10) with the 4 bolts (2) and washers (3). Tighten the bolts using an alternating pattern. Repeat tightening sequence a second time.
- 6. Secure the drum hub plate (4) to the drum spindle (5) with the 4 bolts (2) and washers (3). Tighten the bolts using an alternating pattern. Repeat tightening sequence a second time.

Installing the Drum Drive Assembly

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Position the LH and RH drum drive gearbox assembly (item 8 in Figure 31) and traction drum (2) onto the frame assembly (9).
- 3. Secure the LH and RH drum drive gearbox assembly (8) to the traction drum (2); refer to Installing the Drum Drive Gearbox Assembly (page 5–18).
- 4. Attach the spark plug wire to the spark plug.

Clutch Bearing



Removing the Clutch Bearing

Note: Refer to Figure 34 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- Remove the 2 bolts (12) that secures the clutch cover (11) to the bell housing (18). Remove the clutch cover from the bell housing.

Removing the Clutch Bearing (continued)

- 3. Remove the clutch cable from the fork shaft (17); refer to Removing the Clutch Cable (page 7–9).
- 4. Remove the retaining ring (13) from the fork shaft (17).
- 5. Slide and remove the fork shaft (17) and clutch fork (14) from the bell housing (18).
- 6. If necessary, remove the flange bushing (10) from the clutch fork (14).
- 7. Remove the 2 locknuts (22), 2 bolts (1) and clutch hub clamp (2) that secures the external clutch hub (3) to the engine drive shaft. Slide the external clutch hub (3) towards the engine.
- 8. Remove the transmission gearbox assembly (20); refer to Removing the Transmission Gearbox Assembly (page 5–26).
- 9. Remove the retaining ring (4) that secures the clutch disc (5) to the transmission gearbox shaft. Slide and remove the clutch disc (5), friction plate (6), compression spring (7) and slider clutch disc assembly (8).
- 10. Use a press to remove the bearing (9) from slider clutch disk (8). Discard the removed bearing (9).
- 11. Inspect the clutch component for wear or damage. Replace the components as necessary.
- 12. If necessary, remove the flange bushing (10) and bushing (16) from the bell housing (18).

Installing the Clutch Bearing

- 1. Ensure that the clutch components are cleaned before assembly.
- 2. If removed, install the bushing (16) and flange bushing (10) to the bell housing (18).
- 3. Use a press to install the bearing (9) to the slider clutch disk (8).
- 4. Slide and install the slider clutch disk assembly (8), compression spring (7), friction plate (6) and clutch disk (5) onto the transmission gearbox shaft (20) and secure with a retaining ring (4).
- 5. Install the transmission gearbox assembly (20) onto the engine base; refer to Installing the Transmission Gearbox Assembly (page 5–37).
- 6. Slide the external clutch hub (3) onto the slider clutch disc and secure with the clutch hub clamp (2), 2 bolts (1) and 2 locknuts (22).

Note: The inner mating surfaces of the clutch disk (5) and the external clutch hub must be flush and with in **0.75 mm (0.03 inch)**.



- 7. Torque tighten the bolts (1) to 10 to 12.4 N·m (90 to 110 in-lb).
- 8. If removed, install the flange bushing (10) into the clutch fork (14).
- 9. Apply anti-seize lubricant on splines of the fork shaft (17).
- 10. Position the clutch fork (14) in the bell housing (18) and slide the fork shaft (17) into the clutch fork (14) and bell housing. Secure the clutch fork with the retaining ring (13).
- 11. Install the clutch cable onto the fork shaft (17); refer to Installing the Clutch Cable (page 7–10).

Installing the Clutch Bearing (continued)

12. Install the clutch cover (11) onto the bell housing (18) and secure with the 2 bolts (12).



- 13. Torque tighten the bolts (12) to 6.8 to 9 N·m (60 to 80 in-lb).
- 14. Attach the spark plug wire to the spark plug.

Transmission Gearbox Assembly



Removal of transmission gearbox assembly is necessary to service the internal components.

Removing the Transmission Gearbox Assembly

Note: Refer to Figure 35 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Disconnect the clutch cable; refer to Removing the Clutch Cable (page 7–9).
- 3. Disconnect the brake cable; refer to Removing the Brake Cable (page 7–6).

- 4. Disconnect the reel cable; refer to Removing the Reel Cable (page 7–11).
- 5. Slide the telescopic coupler (item 7 in Figure 35) on the reel drive box assembly (8) and disconnect the reel drive box assembly from the transmission gearbox assembly (12).
- 6. Remove the nuts (4), washers (3) and truss screws (1) that secures the splined couplers (2) to the drive shaft (5). Remove the splined couplers from the drive shafts.
- 7. Remove the 2 bolts that secures the clutch cover. Remove the clutch cover.
- 8. Remove the retaining ring that secures the fork shaft. Slide and remove the fork shaft from the bell housing.
- 9. Loosen the nuts on the external clutch hub and slide the external clutch hub towards the engine.
- 10. Loosen the jam nut (10) and remove the slider adapter (9) from the transmission gearbox assembly (12).
- 11. Remove the 3 bolts that secures the bell housing onto the transmission gearbox assembly.
- 12. Remove the two flange head bolts (11) that secures the transmission gearbox assembly (12) to the engine base (6). Remove the transmission gearbox assembly from the engine base.
- 13. Remove the clutch bearing from the transmission gearbox assembly; refer to Removing the Clutch Bearing (page 5–23).

Disassembling the Transmission Gearbox Assembly



Note: Refer to Figure 36 during this procedure.

- 1. Remove the 2 hollow hex plugs (item 27 in Figure 36) from the transmission gearbox assembly (26).
- 2. Remove the 12 socket head screws (24) that secures the transmission cover assembly (23) to the transmission housing assembly (26). Remove the transmission cover assembly and transmission gasket (22) from the transmission housing assembly. Discard the transmission gasket (22).

3. Remove the oil seal (6), retaining ring (5) from the transmission cover (23). Use a press to remove the ball bearing (25) from the transmission cover (23). Discard the oil seals and ball bearing.



- 4. Remove the neutral spur gear assembly (item 5 in Figure 42) and wave washer (3) from the transmission housing assembly (23).
- 5. Use a press to remove the ball bearings (4) from the neutral slider shaft (6). Remove the square keys (7) from the neutral slider shaft (6). Discard the ball bearings.
- 6. Remove the differential assembly (14) from the transmission housing assembly (23).
- Remove the 2 differential shafts (9) from the differential housing (14). Remove the retaining rings (11) and O-rings (10) from the differential shafts (9). Discard the O-rings.

- 8. Use a press to remove the 2 ball bearings (13) and 2 flange bearings (12) from the differential assembly (14). Remove the V-ring seal (15) from the differential assembly (14). Discard the ball bearings (13).
- 9. If necessary, disassemble the differential assembly (14); refer to Disassembly of Differential Assembly (page 5–39).
- 10. Remove the bolt (25) that secures the cable brake lever (24) onto the brake lever (19). Slide and remove the cable brake lever (24) and external retaining ring (1) from the brake lever (19).
- 11. Remove the 4 bolts (8) that secures the retainer plate (16) to the transmission housing assembly (23). Remove the retainer plate (16) from the transmission housing assembly (23).
- 12. Slide and remove the brake lever assembly (19) from the transmission housing assembly (23). Remove the flat wire spring (22) from the transmission housing assembly (23).
- 13. Disassemble the brake lever assembly (19) as follows:
 - A. Remove the retaining ring (17) from the brake clevis pin (21).
 - B. Slide and remove the brake clevis pin (21) from the brake band (18) and brake lever (19).
 - C. Remove the brake lever (19) from the brake band (18).
 - D. Remove and discard the O-ring (20) from the brake lever (19).



- 6. Ball bearing (5 each)
- 7. Spur gear

- 13. Square key (2 each)
- 14. Slider spur gear
- 20. Transmission housing assembly
- 14. Slide and remove the reel clutch actuator (item 16 in Figure 38) from the transmission housing assembly (20). If necessary, remove the reel clutch shoe (15) from the reel clutch actuator (16).
- 15. Remove the reel drive shaft assembly (14), ball bearing (10) and wave spring (9) from the transmission housing assembly (20). If necessary, disassemble the drive shaft assembly (12) as follows:
 - A. Use a press to remove the ball bearings (10) from the reel drive shaft (12). Discard the bearings (10).
 - B. Remove the retaining ring (11) from the reel drive shaft (12).

- C. Slide and remove the slider spur gear (14) from the reel drive shaft (12).
- D. Remove the two key squares (13) from the reel drive shaft (12).
- 16. Remove the nut (8) and long bearing pin (3) that secures the spur gear assembly (7) to the transmission housing assembly (20). Remove the spur gear (7) and bearing spacer (4) from the transmission housing assembly (20).
- 17. Remove and discard the O-ring (2) from the long bearing pin (3).
- 18. If necessary, disassemble the spur gear (7) as follows:
 - A. Remove the 2 retaining rings (5) from the spur gear (7).
 - B. Use a press and remove the 3 ball bearings (6) from the spur gear (7). Discard the ball bearings.
- 19. Remove the nut (8) and short bearing pin (1) that secures the spur gear assembly (17) to the transmission housing assembly (20). Remove the spur gear (17) and bearing spacer (4) from the transmission housing assembly (20).
- 20. Remove and discard the O-ring (2) from the short bearing pin (1).
- 21. If necessary, disassemble the spur gear (17) as follows:
 - A. Remove the 2 retaining rings (5) from the spur gear (17).
 - B. Use a press and remove the 2 ball bearings (6) from the spur gear (17). Discard the ball bearings (6).
- 22. Remove the thin locknut (18) that secures the input shaft (19) to the transmission housing assembly (20). Slide and remove the input shaft.
- 23. Remove the ORB plug (item 8 in Figure 36), detent spring (9) and detent ball (10) from the transmission housing assembly (26).
- 24. Loosen and remove the groomer pin (item 20 in Figure 36) from the traction selector shaft (19).
- 25. Remove the retaining ring (item 1 in Figure 36), spacer bushing (2) and O-ring (3) from the traction selector shaft (19).
- 26. Slide and remove the traction selector shaft (item 19 in Figure 36) and O-ring (18) from the transmission housing assembly (26).
- 27. Remove oil seal (item 15 in Figure 36) and sleeve bushings (16) from the transmission housing (26). Discard the oil seal (15).
- 28. Remove the flange bushings (item 7 in Figure 36) from the transmission housing (26).
- 29. Remove the oil seals (item 6 in Figure 36), grease seals (11) and retaining ring (5) from the transmission housing (26). Discard the oil seals and grease seals.
- 30. Use a press and remove the ball bearings (items 12 and 25 in Figure 36) and spacer (13) from the transmission housing (26). Discard the ball bearings (12 and 25).

Assembling the Transmission Gearbox Assembly



- 1. Use a press to install the spacer (item 13 in Figure 36) and new ball bearings (12 and 25) into the transmission housing (26).
- 2. Install the retaining ring (item 5 in Figure 36) into the transmission housing (26).
- 3. Install the new grease seal (item 11 in Figure 36) into the transmission housing (26). Ensure that the seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.
- 4. Install the new oil seal (item 6 in Figure 36) into the transmission housing. Ensure that the seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.
- 5. Install the new oil seal (item 14 in Figure 36) into the transmission housing. Ensure that the seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.
- 6. Press the flange bushings (item 7 in Figure 36) into the transmission housing (26).



2. Oil seal

a259956

1.

- 7. Insert the sleeve bushing (Item 16 in Figure 36) into the transmission housing (26) until the sleeve bushing is flush with the transmission housing; refer to Figure 40.
- 8. Press the oil seal (item 15 in Figure 36) into the transmission housing (26) so that the seal is recessed from 1.27 mm (0.05 in) from the edge of the transmission housing (Figure 40). Ensure that the oil seal lip is orientated toward the center of the transmission housing.
- 9. Apply a coat of grease to the O-ring seal (item 18 in Figure 36) and slide onto the groove of the traction selector shaft (19).
- 10. Insert the straight bushings (item 4 in Figure 36) into the transmission housing (26). Press the straight bushings into the transmission housing bore so that the bushings are recessed from the edge of the transmission housing; refer to Figure 39.
- 11. Apply a coat of grease to the O-ring (item 18 in Figure 36) and slide onto the traction selector shaft (item 19 in Figure 36). Insert the traction selector shaft (item 19 in Figure 36) into the transmission housing (26).
- 12. Apply a coat of a grease to the O-ring (item 3 in Figure 36) and slide onto the groove of the traction selector shaft (19). Slide the spacer bushing (2) onto the traction selector shaft (19) and secure with a retaining ring (1).
- 13. Install the groomer pin (item 20 in Figure 36) onto the traction selector shaft (19).
- 14. Install the detent ball (item 10 in Figure 36), detent spring (9) and plug (8) into the transmission housing assembly (26).



- 15. Insert the input shaft (item 19 in Figure 38) into the transmission housing assembly (20) and secure with the thin locknut (18). Torque tighten the thin locknut to 47.5 to 61 N·m (35 to 45 ft-lbs).
- 16. Use a press to install the 2 new ball bearings (item 6 in Figure 38) into the spur gear (17) and secure with the 2 retaining rings (5).
- 17. Apply a coat of grease to the O-ring (item 2 in Figure 38) and slide the O-ring onto the short bearing pin (1). Install the spur gear assembly (17) and

bearing spacer (4) onto the transmission housing assembly (20) and secure with the short bearing pin and nut (8).

- 18. Use a press to install the 3 new ball bearings (item 6 in Figure 38) into the spur gear (7) and secure with the 2 retaining rings (5).
- 19. Apply a coat of grease to the O-ring (item 2 in Figure 38) and slide the O-ring onto the long bearing pin (3). Install the spur gear assembly (7) and bearing spacer (4) onto the transmission housing assembly (20) and secure with the long bearing pin (3) and nut (8).
- 20. Insert the square keys (item 13 in Figure 38) into the reel drive shaft (12) and apply a coat of grease to outside of the keys.
- 21. Slide the slider spur gear (item 14 in Figure 38) onto the reel drive shaft (12) and secure with the retaining rings (11). Press the new ball bearings (10) onto the reel drive shaft (12).
- 22. Install the wave spring (item 9 in Figure 38) and reel drive assembly (14) into the transmission housing assembly (20).
- Insert the reel clutch shoe (item 15 in Figure 38) into the reel clutch actuator (16). Slide the reel clutch actuator (16) into the transmission housing assembly (20).
- 24. Assemble the brake lever assembly (item 19 in Figure 42) as follows:
 - A. Apply a coat of grease to the O-ring (item 20 in Figure 42) and slide the O-ring onto the brake lever.
 - B. Place the brake lever (item 19 in Figure 42) onto the brake band (18) and secure with the brake clevis pin (21) and retaining ring (17).



- 25. Slide and install the brake lever assembly (item 19 in Figure 42) into the transmission housing assembly (23).
- 26. If removed, insert the brake mount pin through brake band into the transmission housing assembly (item 23 in Figure 42) and place the flat wire spring (22) onto the transmission housing assembly.
- 27. Place the retainer plate (item 16 in Figure 42) onto the transmission housing assembly (23) and secure it with the 4 bolts (8).
- 28. Slide and install the external retaining ring (item 1 in Figure 42), cable brake lever (24) onto the brake lever (19) and secure it with the bolt (25).
- 29. If disassembled, assemble the differential assembly (item 14 in Figure 42); refer to Assembly of Differential Assembly (page 5–40).
- 30. Pack the differential assembly (item 14 in Figure 42) with grease and use a press to install the 2 ball bearing (13) and 2 flange bearings (12) into the differential assembly.
- 31. Slide the V-ring seal (item 15 in Figure 42) onto the differential assembly (14).
- 32. Apply a coat of grease to the 2 O-rings (item 10 in Figure 42) and slide the O-rings to the differential shafts (9). Install the retaining rings (11) onto the differential shaft (9).
- 33. Insert the 2 differential shafts (item 9 in Figure 42) into the differential housing (14).
- 34. Insert the differential housing assembly (item 14 in Figure 42) into the transmission housing assembly (23).
- 35. Insert the square keys (item 7 in Figure 42) into the neutral slider shaft (6). Apply a coat of grease to outer surface of the square keys (7).
- 36. Insert the neutral slider shaft (item 6 in Figure 42) into the neutral spur gear (5).
- 37. Use a press and insert the bearings (item 4 in Figure 42) onto the neutral slider shaft (6).
- 38. Insert the wave washer (item 3 in Figure 42) and neutral spur gear assembly (5) into the transmission housing assembly (23). Make sure that the traction selector shaft (item 19 in Figure 36) is engaged in shift selection neutral spur gear (item 5 in Figure 42).
- 39. Apply a coat of grease to ORB plug (item 8 in Figure 36) and install the detent ball (10), detent spring (9) and ORB plug (8) into the transmission housing (26).



- 40. Torque tighten the ORB plug (8) from **3.6 to 4.7** N·m (32 to 42 in-lb).
- 41. Use a press and insert the ball bearing (item 25 in Figure 36) into the transmission cover (23). Install the retaining ring (5) and oil seal (6) into the transmission cover (23).
- 42. Ensure that the oil seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.
- 43. Install the oil seal (item 14 in Figure 36) into the transmission cover (23).
- 44. Ensure that the oil seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.
- 45. If removed, insert the 2 dowel pins (item 17 in Figure 36) into the transmission housing assembly (26).

Note: Ensure that the dowel pins is recessed outboard to **4.5 mm (0.18 in)** from the edge of the transmission housing; refer to Figure 41.



46. Install the new transmission gasket (item 22 in Figure 36) and transmission cover assembly (23) onto the transmission housing (26) by aligning the holes. Secure the transmission cover assembly with 12 bolts (24) and torque tighten to 1.7 to 4.5 N·m (15 to 40 in-lb). Use an alternation pattern and torque tighten the bolts to 9.6 to 10.7 N·m (85 to 95 in-lb).

Note: Transmission gearbox assembly (26) must be leak free. Apply a pressure of 2.5 PSI for 30 seconds without dropping more than 1 PSI.



- 47. Fill the transmission gearbox assembly (26) with **1.35 lbs (24 oz)** of Mobil SHC 007 grease.
- 48. Apply a coat of grease to the O-rings and insert onto the hollow hex plugs. Install the 2 hollow hex plugs (item 27 in Figure 36) into the transmission gearbox assembly (26).



49. Torque tighten the hollow hex plugs from **12.4 to 14.7 N·m (110 to 130 in-lb)**.

Installing the Transmission Gearbox Assembly

- 1. Install the clutch bearing onto the transmission gearbox assembly; refer to Installing the Clutch Bearing (page 5–24).
- Position the transmission gearbox assembly (12) onto the bell housing and secure with 3 bolts. Keep the engine bolts loose, slide the engine transmission assembly laterally until the transmission contacts the mounting surface on the engine base. Tighten the engine bolts and secure the transmission with 2 flange bolts.
- 3. Install and adjust the slider adapter (9) until the neutral position is achieved and lock the position with jam nut (10) onto the transmission gearbox assembly (12).
- 4. Slide the external clutch hub onto the slider clutch disc and secure with the clutch hub clamp, 2 bolts and 2 locknuts; refer to Installing the Clutch Bearing (page 5–24).
- 5. Slide and install the fork shaft into the bell housing; refer to Installing the Clutch Bearing (page 5–24). Secure the fork shaft with a retaining ring.
- 6. Install the clutch cover onto the bell housing and secure with 2 bolts.



- Install the splined couplers (item 2 in Figure 35) to the drive shaft (5) and secure with truss screws (1), washers (3) and nuts (4). Torque tighten the truss screws to 10 to 12.4 N·m (90 to 110 in-lb).
- 8. Slide the telescopic coupler (7) from the reel drive box assembly (8) to the transmission gearbox shaft.
- 9. Check and adjust the alignment of transmission drive shaft and reel drive shaft; refer to Installing the Engine Base (page 4–15).
- 10. If removed, install the reel cable; refer to Installing the Reel Cable (page 7-13).
- 11. Install the brake cable; refer to Installing the Brake Cable (page 7–8).
- 12. Install the clutch cable; refer to Installing the Clutch Cable (page 7–10).
- 13. Attach the spark plug wire to the spark plug.

Differential Assembly



Removing the Differential Assembly

To remove the differential assembly from the transmission gearbox assembly; refer to Disassembling the Transmission Gearbox Assembly (page 5–28).



Differential housing (2 each) 1. Differential pin (6 each)

2.

- Differential spur gear (6 each)
- 5. Socket head screw (6 each)
- 4. Differential gear

3.

- 1. Remove the 6 socket head screws (item 5 in Figure 43) that secures the differential housing assembly (1) to the differential gear (4). Remove the differential gear from the differential housing assembly.
- 2. Place the differential housing assembly on workbench. Pull each differential housings (1) apart.
- 3. Use a press to remove the 6 differential pins (2) and 6 differential spur gears (3) from the differential housings (1).

Inspecting the Differential Assembly

- 1. Clean all the differential assembly components.
- 2. Inspect all the differential spur gears (3) carefully looking for chipped teeth, wear, or other damage. Because gear tooth damage is rarely isolated to 1 gear, replace the gears as complete set if there is internal damage.
- 3. Inspect the differential pins (2) for the scoring or wear.
- 4. Replace all the differential assembly components that are worn or damaged.

Assembly of Differential Assembly

- 1. Place the differential housings (1) on the work bench.
- 2. Insert the 3 differential pins (2) in each differential housing.



- 1. Differential spur gears with shoulder up 2. Press flush
- 3. The differential pins (2) must be inserted in alternate holes of the differential housing (1) and ensure that the differential pins (2) are flush to the surface of the differential housing; refer to Figure 44.
- 4. Apply a coat of grease to the differential spur gears (3) and the differential pins (2).
- 5. Insert the differential spur gears (3) to the differential pins (2) by pointing the gears shoulder up.



- 6. Fill the differential housing assembly (1) with **0.08 lb (1.25 oz)** of grease.
- 7. Attach the 2 differential housings (1) to each other.
- 8. Slide and install the differential housing assembly (1) into the differential gear (4) and secure with the 6 socket head screws (5).



9. In alternate pattern torque tighten the socket head screws (5) to **10 to 12.4 N·m (90 to 110 in-lb)**.

Installing the Differential Assembly

Install the differential assembly into the transmission gearbox; refer to Assembling the Transmission Gearbox Assembly (page 5–33).





Electrical System

Table of Contents

General Information	6-2
Operator's Manual	6–2
Wiring Schematic	6–3
Component Testing	6-4
Ignition System Operation	6–5
Ŏn/Off Świtch	6–6
Hour Meter	6-8
Interlock Module (Optional)	<mark>∋–10</mark>
Lighting Coil	3–11

General Information

Operator's Manual

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

Wiring Schematic



Component Testing

A

shock.

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 electronically isolated (e.g., disconnect all leads or remove the circuit) from the circuit when tested.

Note: See the *Honda Service Manual* for the engine components testing information.

A CAUTION A

When testing the electrical components for the continuity with a multimeter (ohm setting), ensure that the power to the circuit has been disconnected.

WARNING

The ignition system produces a dangerously high voltage. Do not touch the spark plug lead ignition coil, igniter, or spark plug lead

while the engine is running; you can receive a severe electrical

A

Ignition System Operation

The engine on the Greensmaster has a magneto ignition system consists of an ignition coil, a spark plug and permanent flywheel magnets. A flywheel key maintains proper ignition timing.

Testing the Ignition System

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

- 1. With the engine not running, remove the spark plug wire from the spark plug and connect it to the spark tester.
- 2. Connect the spring clip of the tester to a good, unpainted ground on the engine block.
- 3. Ensure that the ON/OFF switch is in the ON position. Also, ensure that the traction control is in the NEUTRAL position.
- 4. Pull the engine starter rope and observe the spark tester. Visible and audible sparks should be produced if the ignition system is operating properly.

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

- 5. If visible and audible sparks are not produced, a problem exists either with engine ignition components or with machine components. To identify whether the problem exists with the engine or the machine, disconnect the wire harness connector (violet wire) from the engine primary wire and repeat step 4 above.
 - A. If visible and audible sparks are not produced with the engine primary wire disconnected, the engine ignition system is not operating properly. Refer to the *Honda Service Manual* for engine information.
 - B. If visible and audible sparks are produced with the engine primary wire disconnected, machine components (e.g., on/off switch, interlock module, machine wire harness) are damaged or faulty. Refer to machine component testing information in this section.

On/Off Switch



The On/Off switch is located on the console on the handle. This rocker switch allows the engine to be turned on and off.

Testing the On/Off switch

1

g262084

- 1. Ensure that the engine is shut off and the traction control is in the NEUTRAL position.
- 2. Remove the controls cover from the handle assembly to allow access to the On/Off switch.
- 3. Disconnect the wire harness electrical connector from the On/Off switch.



 With the use of a multimeter (ohms setting), the switch functions may be tested to determine whether continuity exists between the various terminals for each switch position. The switch terminals are marked as shown in Figure 47. The circuitry of the On/Off switch is shown in below table. Verify the continuity between switch terminals.

Testing the On/Off switch (continued)

SWITCH POSITION	NORMAL CIRCUITS	OTHER CIRCUITS
Off	-	-
On	2 + 3	-

5. Replace the switch, if necessary.

- 6. When the switch testing is complete, connect the wire harness electrical connector to the On/Off switch.
- 7. Install the control cover to the handle assembly.



The hour meter used on the machine records the amount of time that the engine has run.

Testing the Hour Meter

1.

2.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Locate the wire harness connector at the rear of the hour meter. Unplug the harness connector from the hour meter.



g238110

Figure 49

- 1. Hourglass icon
- 2. Negative terminal (BK)

- 3. Positive terminal (Y)
- 3. Connect the positive (+) terminal of a 12 VDC source to the positive (+) terminal of the hour meter.
- 4. Connect the negative (-) terminal of the voltage source to the other terminal of the hour meter.
- 5. The hour meter should move 1/10 of an hour in 6 minutes.
- 6. Disconnect the voltage source from the hour meter.
- 7. Replace the hour meter if necessary.
- 8. Connect the wire harness connector to the hour meter.
- 9. Connect the spark plug wire to the engine spark plug.

Interlock Module (Optional)



The interlock module prevents the engine from starting unless the traction control is disengaged.

The interlock module controls grounding of the engine ignition system. When the engine starter rope is pulled, the engine magneto will begin to produce current. The interlock module uses that current through the traction switch to determine the state of the switch. If switch state is correct, the interlock module opens the magneto to ground circuit so the engine can start and run. Once running, the interlock module allows the engine to continue to operate.

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

- 1. Check operation of the engine ignition system; refer to Ignition System Operation (page 6–5).
- 2. Check the operation of traction switch. Adjust or replace switch if necessary.
- 3. Check wire harness for damage (see Wiring Schematic and Wire Harness Drawings in this chapter). Repair or replace any damaged wire harness components.
- 4. If the engine ignition system, traction switch and wire harness all prove to be operating correctly and engine does not start, replace interlock module.

Lighting Coil

The engine on Greensmaster machines is equipped with a lighting coil to provide electrical current for an optional LED light kit. The coil is located under the engine flywheel and uses permanent magnets on the flywheel to operate. The lighting coil has a 12 VAC output that is rated at 50 watts. See the *Honda Service Manual* for additional lighting coil information.

Note: If lights are desired on the Greensmaster machine, use the recommended Toro LED light kit that is available from your Toro Distributor. Incandescent or halogen lights will not operate with the engine lighting coil that is on these machines.
Chapter 7



Controls, Wheels, and Accessories

Table of Contents

General Information	7–2
Operator's Manual	7–2
Service and Repairs	7–3
Replacing the Throttle Cable	7–3
Replacing the Brake Cable	7–6
Replacing the Clutch Cable	7–9
Replacing the Reel Cable	7–11
Clutch and Reel Drive Engagement Lever Assembly	7–14
Brake Latch Shaft	
Handle Assembly	
Kickstand	
Transport Wheels (Optional)	
Rail Kit Wheels (Optional)	7–29
Transport Wheels (Optional) Rail Kit Wheels (Optional)	7–26 7–29

General Information

Operator's Manual

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

Service and Repairs

Replacing the Throttle Cable



- Throttle cable 3.
- Bolt 4.

1.

2.

g261770

- 7. Throttle lever
- 8. Flange bushing (2 each)
- Handle assembly 11.
- 12. Washer

Removing the Throttle Cable

Note: Refer to Figure 51 during this procedure.

1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the Operator's Manual.

Removing the Throttle Cable (continued)



g261801

Figure 52

Governor lever 1.

3. Cable clamp

Throttle cable 2.

- 4. High speed screw
- 2. Remove the throttle cable (item 2 in Figure 52) from the engine governor linkage (1) as follows:
 - A. Loosen the screw that secures the cable clamp (3) to engine bracket. Remove the throttle cable (2) from the cable clamp (3).
 - B. Loosen the screws that secure the throttle cable (2) to the governor lever (1). Slide the throttle cable from the governor lever.
 - C. Separate the throttle cable (2) from the engine.
- 3. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the throttle cable (item 3 in Figure 51).
- 4. Remove the throttle arm from the handle assembly. Loosen the locknut (2) on the throttle cable and slide the throttle cable and throttle arm from the upper receiver weldment (1).
- 5. Remove the throttle cable from the throttle arm.
- 6. Remove the throttle cable from the machine.

Installing the Throttle Cable

- 1. Connect the throttle cable end to the throttle arm (9).
- 2. Slide the throttle cable (3) into the upper receiver weldment (1) and tighten the locknut (2).
- 3. Install the throttle arm to the handle assembly.
- 4. Route the throttle cable (3) to the engine. Ensure that the throttle cable is routed on the left side of the engine.
- 5. Install the throttle cable (item 2 in Figure 52) to the engine governor linkages (1) as follows:
 - A. Slide and secure the throttle cable end into the governor lever (1).
 - B. Place the throttle cable under the cable clamp (3).
 - C. Ensure that the throttle cable is in the SLOW position and with engine running slide the cable through the cable clamp to achieve 1850 to 1950 rpm.
 - D. Tighten the screw on the cable clamp to secure the throttle cable.
- 6. Check the throttle cable adjustment; refer to Operator's Manual.
- 7. Install the lower cover and control cover to the handle assembly.

Replacing the Brake Cable



Removing the Brake Cable

1.

2.

3.

Note: Refer to Figure 53 during this procedure.

1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.

Removing the Brake Cable (continued)

2.



- 2. Remove the brake cable (item 5 in Figure 54) from the brake lever shaft on the transmission gearbox assembly as follows:
 - A. Loosen the front cable jam nut (4) that secures the brake cable to the casting slot on the transmission gearbox assembly. Remove the brake cable from the slot.
 - B. Remove the retaining ring (1) that secures the cable eyelet (2) to the brake lever (3) on the transmission gearbox assembly.
 - C. Remove the brake cable eyelet (2) from the brake lever (3).
- 3. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the brake cable.
- 4. Remove the brake cable (item 9 in Figure 53) from the brake lever assembly as follows:
 - A. Loosen the lower brake cable jam nut (8) that secures the brake cable (9) to the upper receiver weldment (4). Slide the brake cable from the upper receiver weldment.
 - B. Remove the brake cable spring (7) from the spring anchor on the brake lever assembly (3). Note the orientation of the brake cable spring hook on the brake lever assembly for assembly purpose.
- 5. Remove the brake cable (9) from the machine.

Installing the Brake Cable

- 1. Secure the brake cable (9) to the brake lever assembly as follows:
 - A. Install the cable spring (7) to the spring anchor on the brake lever assembly (3).
 - B. Slide the brake cable into the shift mount bracket slot. Ensure that the jam nut (8), flat washer and lock washer are both sides of the bracket. Adjust the jam nuts so that equal amount of cable threads are visible above and below jam nuts. Leave jam nuts snug until final cable adjustment.
- 2. Route the brake cable (9) to the transmission gearbox assembly and install the brake cable to the transmission gearbox assembly as follows:
 - A. Install the brake cable eyelet (2) onto the brake lever (3) on transmission gearbox assembly and secure with a snap ring (1).
 - B. Position the brake cable (5) to the casting slot of the transmission gearbox assembly with a jam nut (4), flat washer and lock washer at each side of the slot. Adjust and tighten the jam nuts so that equal amount of cable threads are visible above and below jam nuts.
- 3. Make final adjustment of the brake cable at the brake cable lever assembly. Adjust the cable jam nuts to remove the slack in the brake cable.
- 4. Check the brake cable adjustment; refer to Operator's Manual.
- 5. Install the lower cover and control cover to the handle assembly.
- 6. Attach the spark plug wire to the engine spark plug.

Replacing the Clutch Cable



Removing the Clutch Cable

Note: Refer to Figure 55 during this procedure.

1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.



2. Remove the clutch cable (item 1 in Figure 56) from the transmission assembly as follows:

Removing the Clutch Cable (continued)

- A. Loosen the front cable jam nut (2) and lift the clutch cable (1) from the casting slot of the engine base.
- B. Remove the retaining ring (4) that secures the clutch cable eyelet (3) to the clutch lever (5) and slide and remove the clutch cable eyelet from the clutch lever.
- 3. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the clutch cable (item 1 in Figure 55).
- 4. Remove the clutch cable (1) from the link assembly (7) as follows:
 - A. Loosen the lower cable jam nut (2) that secures the clutch cable to the upper receiver weldment (9). Slide the clutch cable from the upper receiver weldment.
 - B. Remove the cable spring (3) from the link assembly (7). Note the orientation of cable spring hook on the shaft assembly for assembly purposes.
- 5. Remove the clutch cable (1) from the machine.

Installing the Clutch Cable

- 1. Secure the clutch cable (item 1 in Figure 55) to the clutch lever assembly as follows:
 - A. Install the cable spring (3) to the link assembly. Orientate the cable spring hook end toward front of the machine.
 - B. Slide the cable housing into the upper receiver weldment (9). Ensure that the jam nut (2), flat washer and lock washer are on both sides of the bracket. Adjust jam nuts so that equal amount of cable threads are visible above the jam nuts. Leave the jam nuts snug until final cable adjustment.
- 2. Route the clutch cable (item 1 in Figure 56) to the transmission and install the cable as follows:
 - A. Slide the cable eyelet (3) to the clutch lever (5) and secure with a retaining ring (4).
 - B. Position the clutch cable (1) to the casting slot of the engine base with a jam nut (2), flat washer, and lock washer at each side of the slot.
- 3. Make final adjustment of the clutch cable at the clutch cable lever assembly. Adjust the cable jam nuts to remove the slack in the clutch cable.
- 4. Check the clutch cable adjustment; refer to Operator's Manual.
- 5. Install the lower cover and control cover to the handle assembly.
- 6. Attach the spark plug wire to the engine spark plug.

Replacing the Reel Cable



Removing the Reel Cable

Note: Refer to Figure 57 during this procedure.

1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.

Removing the Reel Cable (continued)

g262054

1.

2.



- 2. Remove the reel cable (item 4 in Figure 58) from the reel selector assembly (2) as follows:
 - A. Loosen the front cable jam nut (3) and lift the reel cable (4) from the casting slot of the engine base.
 - B. Remove the retaining ring (1) that secures the reel cable eyelet to the reel selector assembly (2) and slide the reel cable eyelet from the selector assembly.
- 3. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the reel cable.
- 4. Remove the reel cable (item 1 in Figure 57) from the traction lever assembly as follows:
 - A. Loosen the lower cable jam nut (2) that secures the reel cable (1) to the upper receiver weldment (12). Slide the cable from the upper receiver weldment.
 - B. Remove the cable spring (3) from the clevis connector (10) on the reel lever assembly (5). Note the orientation of cable spring hook on the shaft assembly for assembly purposes.
- 5. Remove the reel cable (1) from the machine.

Installing the Reel Cable

- 1. Secure the reel cable (item 1 in Figure 57) to the traction lever assembly as follows:
 - A. Install the cable spring (3) to the clevis connector (10) on the reel lever assembly (7). Orientate the cable spring hook end toward front of the machine.
 - B. Slide the cable (1) into the upper receiver weldment (12). Ensure that the jam nut (2), flat washer and lock washer are on both sides of the bracket. Adjust jam nuts so that equal amount of cable threads are visible above the jam nuts. Leave the jam nuts snug until final cable adjustment.
- 2. Route the reel cable to the reel selector assembly (item 2 in Figure 58) and install the reel cable (4) as follows:
 - A. Slide the cable eyelet to the reel selector assembly (2) and secure with a retaining ring (1).
 - B. Position the reel cable (4) to the casting slot of the engine base with a jam nut (3), flat washer, and lock washer at each side of the slot.
- 3. Make final adjustment of the reel cable at the reel cable lever assembly. Adjust the cable jam nuts to remove the slack in the clutch cable.
- 4. Check the reel cable adjustment; refer to Operator's Manual.
- 5. Install the lower cover and control cover to the handle assembly.
- 6. Attach the spark plug wire to the engine spark plug.

Clutch and Reel Drive Engagement Lever Assembly



- 2. Reel lever handle rod
- 3. Knob
- 4. Retaining ring
- 5. Control shaft clamp (2 each)
- 6. Socket head screw (4 each)
- 7. Extension spring (2 each)
- 8. Controls cover
- 9. Bolt and washer assembly (8 each) 18.

- 11. Reel cable
- 12. Clutch cable
- 13. Cotter pin clip
- 14. Link assembly
- 15. Main control shaft
- 16. Split bushing (2 each)
- 17. Socket cap
 - 8. Cotter pin clip

- 20. Clevis pin (4 each)
- 21. Extension spring
- 22. Shoulder screw
- 23. Reel lock lever assembly
- 24. Bail latch spacer
- 25. Upper receiver weldment
- 26. Flange nut
- 27. Reel lever assembly

Disassembling the Clutch and Reel Drive Engagement Lever Assembly

Note: Refer to Figure 59 during this procedure.

1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.

Disassembling the Clutch and Reel Drive Engagement Lever Assembly (continued)

- 2. Remove the bolts and washers (9) that secures the controls covers (item 8 and 10) to the upper receiver weldment (25) and handle assembly.
- 3. Remove the reel lever handle rod (2) from the reel lever assembly (27).
- 4. If necessary, remove the reel lever knob (3) from the reel lever handle (2).
- 5. Remove the cotter pin (18) and clevis pin (20) that secures the link assembly (14) to the main control shaft (15).
- 6. Remove the cotter pin (18) and clevis pin (20) that secures the clevis connector (19) to the reel lever assembly (27).
- 7. Remove the extension spring (21) from the reel lock lever (23).
- 8. Remove the flange nut (26) and shoulder screw (22) that secures the reel lock lever (23) to the upper receiver weldment (25). Remove the reel lock lever (23) and bail latch spacer (24).
- 9. Remove the retaining ring (4) and V-ring seal (1) that secures the reel lever assembly (27) to the main control shaft (15). Slide and remove the reel lever assembly.
- 10. Remove the socket head screws (6) and control shaft clamps (5) that secures the main control shaft (15) to the upper receiver weldment (23).
- 11. Remove the main control shaft (15). If necessary, remove the split bushing (16) from the main control shaft.

Assembling the Clutch and Reel Drive Engagement Lever Assembly

Note: Refer to Figure 59 during this procedure.

- 1. If removed, install the split bushing (16) onto the main control shaft (15).
- 2. Position the main control shaft (15) on the upper receiver weldment (25) and secure the main control shaft (15) with control shaft clamps (5) and the bolts (6).
- 3. Slide the reel lever assembly (27) and V-ring seal (1) onto the main control shaft (15) and secure reel lever assembly with the retaining ring (4).
- 4. Install the reel lock lever (23) and bail latch spacer (24) to the upper receiver weldment (25) and secure with the shoulder screw (22) and flange nut (26).
- 5. Install the link assembly (14) to the main control shaft (15) with clevis pin (20). Secure the clevis pin with the cotter pin clip (13).
- 6. Install the clevis connector (19) to the reel lever assembly (27) with clevis pin (20) and secure the clevis pin with the cotter pin clip (18).
- 7. Install the reel lever handle rod (2) to the reel lever assembly (27).
- 8. If removed, install the reel lever knob (3) to reel lever handle rod (2).
- 9. Install the control covers (8 and 10) to the handle assembly with bolts and washers (9).
- 10. Attach the spark plug wire to the engine spark plug.

Brake Latch Shaft



Disassembling the Brake Latch Shaft

Note: Refer to Figure 60 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the bolts and washers that secures the controls covers to the upper receiver weldment.
- 3. Using the drift pin, remove the roll pin (5) from the brake lock lever (4).

Disassembling the Brake Latch Shaft (continued)

- 4. Slide and remove the brake lock lever (4) from the brake latch shaft (9).
- 5. Slide and remove the brake latch shaft (9) from the upper receiver weldment (12).
- 6. Slide and remove the torsion spring (10) from the brake latch shaft (9).

Assembling the Brake Latch Shaft

Note: Refer to Figure 60 during this procedure.

- 1. Slide and position the torsion spring (10) onto the brake latch shaft (9).
- 2. Slide and position the brake latch shaft (9) into the upper receiver weldment (12).
- 3. Slide and position the brake lock lever (4) onto the brake latch shaft (9). Secure the brake lock lever with the roll pin (5).
- 4. Install the control covers to the handle assembly with bolts and washers.
- 5. Attach the spark plug wire to the engine spark plug.

Handle Assembly



Disassembling the Handle Assembly

Note: Refer to Figure 59, Figure 61, Figure 62, and Figure 63 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the 4 bolts that secures the controls cover to the handle assembly, and remove the cover from the handle; refer to Figure 59.
- 3. Remove the 4 bolts that secures the lower handle cover to the handle assembly, and remove the cover from the handle; refer to Figure 59.
- 4. Remove the wire harness from bottom controls cover (Figure 61).
- 5. Remove the 2 nuts (7) and 4 bolts (25 and 33) that secure the bottom controls cover (26) to the upper receiver weldment (8), and remove the cover from the upper receiver.
- 6. Remove the throttle cable; refer to Removing the Throttle Cable (page 7-3).
- 7. Remove the clutch cable; refer to Removing the Clutch Cable (page 7–9).
- 8. Remove the brake cable; refer to Removing the Brake Cable (page 7–6).
- 9. Remove the reel cable; refer to Removing the Reel Cable (page 7–11).
- 10. Remove the clutch and reel drive lever assembly; Disassembling the Clutch and Reel Drive Engagement Lever Assembly (page 7–14).
- 11. Remove the brake latch shaft; Disassembling the Brake Latch Shaft (page 7-16).
- 12. Remove the flange nut (7) and bolt (38)—which function as a throttle arm stop bolt—from the upper receiver weldment (8); refer to Figure 61.
- 13. Remove the nut (37), bolt (30) and compression spring (31) that secures the throttle arm (36) to the handle assembly (3), and remove the arm from the handle.
- 14. If necessary, remove the screw (32) that secures the throttle lever (34) to the throttle arm (36), and remove the lever from the arm.
- 15. If necessary, remove the flange bushings (35) from the throttle arm (36).
- 16. Disconnect the wire harness.
- 17. Remove the engine ON/OFF switch from the handle assembly.
- 18. Remove 4 plastite screws (1) that secure the handle notepad plate (2) to the handle assembly (3), and remove the handle plate from the handle.
- 19. Remove the flange nut (item 7) and shoulder screw (4) that secure the brake lever (6) to the upper receiver weldment (8), and remove the brake lever from the receiver.
- 20. If necessary, remove the flange bushings (5), flange nut (13) and bolt (12) from the brake lever (6).
- 21. Remove the 2 bolts (11 and 16) that secure the lift assist handle (27) to the upper receiver weldment (8).
- 22. Remove the conduit clamp from upper receiver, and separate the wire harness conduit from the receiver.
- 23. Remove the nut (9) and bolt (29) that secures the upper receiver weldment (8) to the lower handle (19).
- 24. Remove the upper receiver weldment from the lower handle assembly
- 25. Remove the nut (15) and bolt (21) that secures the handle adjuster assembly (22) to the upper receiver weldment (8).

Disassembling the Handle Assembly (continued)

- 26. Remove the handle adjuster assembly from the upper receiver weldment, and separate handle torsion spring (23) and spring spacer (24) from the handle adjuster assembly (22).
- 27. If necessary, remove the 3 nuts (item 15 in Figure 61), 3 bolts (21), and 3 spacers (20) from the upper receiver weldment (8).



g260771

Left bail bracket Bolt (2 each)

- 3. Flange bushing (4 each)
- 4. Clutch bail assembly
- 5. Clutch bail link
- 6. Compression spring
- 7. Handle mount

- Figure 62
- 8. Flange nut (4 each)
- 9. Cotter pin
- 10. Conduit clamp (2 each)
- 11. Socket head screw (2 each)
- 12. Flange bushing(2 each)
- 13. Clevis pin
- 14. Nut (2 each)

- 15. Upper receiver weldment
- 16. Bolt (2 each)
- 17. Spacer (2 each)
- 18. Torques-head screw (2 each)
- 19. Right bail bracket
- 20. Handle
- 21. Bolt (2 each)
- 28. Remove the 2 nuts (item 8 in Figure 62) and 2 bolts (21) that secure handle (20) to handle mount (7), and remove the handle from the clutch bail assembly and the handle mount.

Disassembling the Handle Assembly (continued)

- 29. If necessary, remove the 2 screws (18) that secure the left and right bail brackets (1 and 19) to the handle (20).
- Remove the flange nut (8), and bolt (2) that secure the clutch bail link (5) to the handle mount (7). Remove the 2 flange bushings (3) and spacer tube (17) from the handle mount.
- 31. Remove the flange nut (8) and bolt (2) that secure the clutch bail assembly (4) to the handle mount (7). Remove the clutch bail assembly from the handle mount. Remove the compression spring (6), 2 flange bushings (3) and spacer tube (17) from the handle mount.
- 32. Remove the 2 nuts (item 14 in Figure 62) and 2 bolts (16) that secure the handle mount (7) to the upper receiver weldment (15). Remove the handle mount from the upper receiver weldment.



If necessary, remove the 2 bolts (item 2 in Figure 63), anti-rotation washer (3), and washer (4) that secure the lower handle assembly (1) to the frame assembly (5).

Assembling the Handle Assembly

- 1. If removed, clean the threads of the frame assembly and the 2 bolts (2), and apply a coat to medium strength thread-locking compound as shown in Figure 63.
- 2. If removed, install the lower handle assembly (1) onto the frame assembly (5) and secure with the 2 bolts (2), anti-rotation washer (3), and washer (4).



3. Lift the lower handle assembly until it contacts the stop, and torque the 2 bolts (item 2 in Figure 63) to **95 to 101** N·m (70 to **75 ft-lb**).

- 4. Install the handle mount (item 7 in Figure 62) to the upper receiver weldment (15) and secure with 2 bolts (16) and 2 nuts (14).
- Position the clutch bail link (5) in the handle mount (7). Install the spacer tube (17) and 2 flange bushings (3) to the handle mount. Secure the clutch bail link to the handle mount with the bolt (2) and flange nut (8).
- 6. Position the compression spring (6), spacer tube (17) and 2 bushings (3) into the handle mount (7). Install the clutch bail assembly (4) to the handle mount (7) and secure with the bolt (2) and flange nut (8).
- 7. If removed, install the left and right bail brackets (1 and 19) to the handle (20) with the 2 torques-head screws (18).
- 8. Install the clutch bail assembly (item 4 in Figure 62) to the handle (20). Secure the handle to the handle mount (7) with the 2 bolts (21) and 2 nuts (8).
- 9. If removed, install the 3 spacers (item 20 in Figure 61), 3 bolts (21) and 3 nuts (15) to the upper receiver weldment (8).
- 10. Position the spring spacer (24) and handle torsion spring (23) into the handle adjuster assembly (22). Install the handle adjuster assembly to the upper receiver weldment (8) with the bolt (21) and nut (15).
- 11. If removed, install the lift assist handle (27) to the upper receiver weldment (8) and secure with the bolts (11 and 16).
- 12. Slide the upper receiver weldment (item 8 in Figure 61) into the lower handle assembly (19) and secure with the bolt (29) and flange nut (9).

Note: Do not tighten bolt and nut. Install the nut to engage locking feature. The upper receiver weldment (8) must be free to slide.

- 13. Reposition the wire harness.
- 14. Install the conduit clamps (Item 10 in Figure 62) to the upper receiver weldment (8) and lower handle assembly (19) and secure with screws (11).
- 15. If removed, install the flange bushings (item 5 in Figure 61), bolt (12) and flange nut (13) into the brake lever (6).Reposition the wire harness.
- 16. Position the brake lever (6) to the upper receiver weldment (8) and secure with the shoulder screw (4) and flange nut (7).
- 17. Install the handle notepad plate (item 2 in Figure 61) to the handle assembly (3) and secure with the 4 plastite screws (1).
- 18. Install the engine ON/OFF switch into the handle assembly.
- 19. Install the wire harness.
- 20. If removed, install the flange bushings (35) inside the throttle arm (36).
- 21. If removed, slide the throttle lever (34) onto the throttle arm (36) and secure with screw (32).



22. Torque tighten the bolt from 2.2 to 3.4 N·m (20 to 30 in-lb).

23. Install the throttle arm (36) to the handle assembly (3) and secure with bolt (30), compression spring (31) and flange nut (37).

Assembling the Handle Assembly (continued)

- 24. Install the bolt (item 38 in Figure 61) and 2 flange nuts (7) to the upper receiver weldment (8). Ensure that the head of the bolt is resting the on throttle arm (36).
- 25. Install the brake latch shaft; refer to Assembling the Brake Latch Shaft (page 7-17).
- 26. Install the clutch and reel drive lever assembly; refer to Assembling the Clutch and Reel Drive Engagement Lever Assembly (page 7–15).
- 27. Install the reel cable; refer to Installing the Reel Cable (page 7–13).
- 28. Install the brake cable; refer to Installing the Brake Cable (page 7-8).
- 29. Install the clutch cable; refer to Installing the Clutch Cable (page 7–10).
- 30. Install the throttle cable; refer to Installing the Throttle Cable (page 7–5).
- 31. Reposition the wire harness to the bottom control cover (26 in Figure 61). Install the cover to the upper receiver weldment (8) with the 2 screw and washer assemblies (25), 2 bolts (33) and 2 flange nuts (7).
- 32. Install the lower handle cover to the handle assembly and secure with the 4 bolts; refer to Figure 59.
- 33. Install the controls cover to the handle assembly and secure with the 4 bolts; refer to Figure 59.
- 34. Attach the spark plug wire to the engine spark plug.

Kickstand



Removing the Kickstand

CAUTION A

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.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Pivot the kickstand up and hold against the frame stops.

Removing the Kickstand (continued)

- 3. Remove the bolt (item 11 in Figure 64) that secures the spring mount pin (3) and torsion spring (2) to the kickstand (16).
- 4. Remove the spring mount pin (3) and torsion spring (2) from the kickstand (16).
- 5. Remove the bolt (11), spacer (10) and nut (5) that secures the kickstand (16) to the frame (9).
- 6. Remove the kickstand (16) from the frame (1).
- 7. If necessary, remove the spring retainer (14) by removing the nut (15), washer (13) and bolt (12).
- 8. If necessary, remove the spacers (10) from the kickstand (16).

Installing the Kickstand



2. Torsion spring

g260998

1.

- 1. If removed, install the spacers (10) to the kickstand (16).
- 2. If removed, secure the spring retainer (14) to kickstand with the bolt (12), washer (13) and nut (15).
- 3. Secure the kickstand (16) to the frame (9) with the torsion spring (2), spring mount pin (3) and bolt (11).
- 4. Secure the kickstand (16) to the frame (9) with spacer (10), bolt (11) and nut (5).
- 5. Attach the spark plug wire to the engine spark plug.

Transport Wheels (Optional)



Removing the Transport Wheel

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Support the machine onto the machine onto the kickstand.

Removing the Transport Wheel (continued)



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

Disassembling the Transport Wheel



1. Wheel hex shaft

g261682

- 1. Ensure that the tire is fully deflated before disassembly of the wheel.
- 2. Remove the 3 bolts and 3 lock washers from the shallow rim and hub. Remove the hub from the deep rim.
- 3. Inspect the hub bushing. Replace the bushing, if worn or damaged.
- 4. Remove the 4 bolts and 4 flange nuts from the deep rim and shallow rim. Remove the shallow rim from the deep rim.
- 5. Separate the tire, tube, and deep rim.
- 6. If necessary, remove the shoulder screws, torsion spring, and retaining lever from the hub.

Assembling the Transport Wheel

- 1. If the shoulder screws were removed from the hub, apply Loctite #242 (or equivalent) to the threads of the shoulder screws. Secure the torsion spring and retaining lever to the hub with the shoulder screws.
- 2. Assemble the tire, tube, and deep rim.
- 3. Install the shallow rim into the tire. Align and secure the shallow rim tot he deep rim with 4 bolts and 4 flange nuts. Tighten the fasteners.
- 4. Install the hub into the deep rim. Secure the hub to the deep rim with the 3 bolts and 3 lock washers. Tighten the fasteners.
- 5. Inflate the tire to 83 to 103 kPa (12 to 15 psi).

Installing the Transport Wheel

- 1. Ensure that the machine is parked on a level surface.
- 2. Support the machine onto the kickstand.
- 3. Slide the transport wheel completely onto the wheel hex shaft until the wheel retaining lever is secured into the groove onto the wheel hex shaft.

Rail Kit Wheels (Optional)



Removing the Rail Kit Wheel

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Support the machine onto the kickstand.
- 3. Remove the wheel clip, and remove the rail kit wheel from the wheel hex shaft at each side.
- 4. If necessary, install the transport wheels; refer to Transport Wheels (Optional) (page 7–26).

Installing the Rail Kit Wheel

- 1. Ensure that the machine is parked on a level surface.
- 2. Support the machine onto the kickstand.
- 3. If installed, remove the transport wheels; refer to Transport Wheels (Optional) (page 7–26).
- 4. Slide the rail kit wheel onto the wheel hex shaft and secure the wheel with a wheel clip.

Chapter 8



DPA Cutting Units

Table of Contents

General Information	
Cutting Unit Operator's Manual	
Grass Basket Installation	
Supporting the Cutting Unit when Servicing	
Adjustments	
DPA Cutting Unit Characteristics	
Grass Shield Height Adjustment	
Service and Repairs	
Bedbar Assembly	
Servicing the Bedbar Adjuster	
Bedknife	
Cutting Unit Assembly	
Reel Assembly	
Roller Assemblies	

General Information

Cutting Unit Operator's Manual

The *Cutting Unit Operator's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for the cutting units on your machine. Additionally, if optional kits have been installed on the cutting units (e.g., groomer), the *Installation Instructions* for the kit includes set-up, operation, and maintenance information. Refer to the *Cutting Unit Operator's Manual* and the kit *Installation Instructions* for additional information when servicing the cutting units.

Grass Basket Installation



Grasp the grass basket by top rear lip and slide on or off the basket mounting rods.

Supporting the Cutting Unit when Servicing



Whenever the cutting unit is tipped to expose the bedknife or cutting reel, support the rear of the cutting unit making sure the back of the bedbar adjuster screws are not resting on the work surface.

Adjustments

DPA Cutting Unit Characteristics

A

CAUTION

Never install or work on or near a cutting unit or cutting unit suspension with the engine running. Always stop the engine and remove the key before working on or near a cutting unit.

Note: When adjusting reel to bedknife or grinding/backlapping, cutting unit assembly must be attached to traction unit or frame fixture.

The dual point adjust (DPA) bedknife-to-reel adjustment system incorporated in this cutting unit simplifies the adjustment procedure needed to deliver optimum mowing performance. The precise adjustment possible with this design gives the necessary control to provide a continual self-sharpening action. This feature maintains sharp cutting edges, assures good quality of cut, and reduces the need for routine backlapping.

If a cutting unit is determined to be out of adjustment, complete the following procedures in the specified order to adjust the cutting unit properly.

- 1. Adjust the bedknife to reel contact; refer to the *Cutting Unit Operator's Manual.*
- 2. Adjust the height-of-cut; refer to the Cutting Unit Operator's Manual.
- 3. Adjust the top shield; refer to the Cutting Unit Operator's Manual.

A

Grass Shield Height Adjustment



Adjust the grass shield to assure proper grass clipping discharge into the basket.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Place 1.5 mm (0.06 inch) shim between the reel assembly and grass shield.

Note: The shield can be lowered for drier conditions (clippings fly over top of the basket) or raised to allow for heavy wet grass conditions (clippings build up on rear of the basket).

- 3. Loosen the bolts that secures each end of the shield to the side plates. Adjust the shield to the correct height and tighten the fasteners.
- 4. Attach the spark plug wire to the engine spark plug.

Service and Repairs

Bedbar Assembly



- 1. Side plate
- 2. Keyed flanged bushing (4 each)
- 3. Bedbar adjuster shaft (2 each)
- 4. Rubber bushing assembly (2 each) 11.
- 5. Nylon bushing (2 each)
- 6. Plastic washer (2 each)
- 7. Flat washer (2 each)

Figure 73

- 8. Bedbar bolt (2 each)
- 9. Locknut (2 each)
- 10. Wave washer (2 each)
 - . Retaining ring (2 each)
- 12. Bedbar adjuster screw (2 each)
- 13. Detent (2 each)
- 14. Bolt (2 each)

- 15. Plastic washer (2 each)
- 16. Bedbar assembly
- 17. Washer (2 each)
- 18. Compression spring
- 19. Nut (2 each)
Removing the Bedbar

A

Note: Refer to Figure 73 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Loosen the nuts (19) on the end of each bedbar adjuster assembly (3) until the washer (17) is loose.
- 3. Loosen the locknuts (9) on each bedbar bolt (8).
- 4. Remove the 2 bedbar bolts (8), 2 flat washers (7) and 4 plastic washers (6 and 15) from the cutting unit side plates (1).

CAUTION

A

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

- 5. Remove the bedbar assembly (6) from the cutting unit.
- 6. Inspect the nylon bushings (5) and rubber bushings (4) in the side plates for wear or damage. Replace the bushings if necessary.



- If rubber bushing (item 4 in Figure 74) was removed from either side plate, apply grease to outside surface of new bushing and install into side plate (1). The bushing (4) should be installed flush with the inside surface of the side plate; refer to Figure 74.
- 2. If removed, install the nylon bushings (5) with flange facing outward.
- 3. Apply anti-seize lubricant to the threads and shank of each bedbar bolt (8); refer to Figure 74.

A

CAUTION

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

Note: If a new bedknife is attached to the bedbar, there may be interference between the bedknife and the reel when installing the bedbar. Turn the bedbar adjusting screws counterclockwise to increase bedknife clearance if necessary.

4. Position the bedbar assembly (16) into the cutting unit. Make sure that the top of each bedbar arm is between the washer (17) and adjuster screw flange (12).

IMPORTANT

When installing the washers, make sure that the plastic washers (6 and 15) are positioned against the side plate.

- 5. Position one plastic washer (6 and 15) between the bedbar (16) and each side plate (1).
- 6. Slide a metal washer (7) onto the bedbar bolt (8).

A

Installing the Bedbar (continued)



 Install the bedbar bolt assemblies (8). Make sure that the washers are not caught on the threads of the pivot bolts. Torque tighten each bedbar bolt (8) from 22 to 27 N·m (190 to 240 in-lb).

IMPORTANT

Do not over tighten the locknuts as this can distort the side plates and affect reel bearing alignment. When the locknut is correctly tightened, the inside washers may be loose.

- 8. Tighten both locknuts (9) until outside metal washers do not have any end play and can still rotate.
- 9. Tighten the nut (19) on each bedbar adjuster assembly (16) until the adjuster spring (18) is fully compressed, then loosen the nut (19) to 1/2 turn.
- 10. Adjust the bedknife to reel contact; refer to the *Cutting Unit Operator's Manual*.
- 11. Attach the spark plug wire to the engine spark plug.

Servicing the Bedbar Adjuster

Removing the Bedbar Adjuster

1. 2.

3.

4.



Note: Refer to Figure 75 during this procedure.

- 1. Remove bedbar; refer to Removing the Bedbar (page 8-7).
- 2. Remove the locknut (11), compression spring (10) and washer (9) from the bedbar adjuster screw (7).

Note: The bedbar adjuster shaft (1) has left-hand threads.

- 3. Unscrew the bedbar adjuster shaft (1) from the bedbar adjuster screw (7).
- 4. Remove the retaining ring (6) and wave washer (5) from the adjuster shaft (7) and remove the adjuster shaft.
- 5. Inspect the flange bushings (2) in the cutting unit side plate (12) and replace them if necessary.
- 6. Inspect the detent (3) and replace it if necessary.

Installing the Bedbar Adjuster

- 1. If previously removed, secure the detent (3) to the side plate (12) with the bolt (4).
- 2. If previously removed, align the key on the flange bushings (2) to the slots in the cutting unit side plate (12) and install.
- 3. Slide adjuster shaft (1) into flange bushings (2) and secure with a wave washer (5) and a retaining ring (6).

Note: The bedbar adjuster shaft (1) has left-hand threads.

- 4. Apply anti-seize lubricant to the threads of the bedbar adjuster screw (7) that fit into adjuster shaft (1) (the left-hand threads) and thread the bedbar adjuster screw into the adjuster shaft.
- 5. Install the washer (9), compression spring (10) and locknut (11) onto the adjuster screw (7).
- 6. Install the bedbar (8); refer to Installing the Bedbar (page 8–8).

Bedknife

Removing the Bedknife



- 1. Remove the bedbar from the cutting unit; refer to Removing the Bedbar (page 8–7).
- 2. Using a socket wrench and the bedknife screw tool, remove screws that secure the bedknife to the bedbar, and remove the bedknife; refer to Bedknife Screw Tool (page 2–16).

IMPORTANT

Discard the old bedknife screws.

3. Refer to Troubleshooting Bedknife Grinding (page 8–15) for additional information.

Installing the Bedknife

- 1. Use a scraper to remove all rust, scale, and corrosion from the bedbar surface under the bedknife. Lightly oil the bedbar surface before installing the bedknife.
- 2. Make sure that screw threads in bedbar (5/16-18UNC-2A) are clean.

IMPORTANT

Use new bedknife screws when installing the bedknife.

- 3. Assemble the bedknife to bedbar using new bedknife screws. Apply anti-seize lubricant to the threads of new screws. Do not apply anti-seize lubricant to the taper of the screw heads.
- 4. Install all screws but do not tighten.

IMPORTANT

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





- 5. Using a torque wrench and bedknife screw tool, tighten the 2 outer screws to **1 N·m (10 in-lb)**.
- 6. Working from the center of the bedknife toward each end, tighten screws from **23 to 28 N·m (200 to 250 in-lb)**.
- 7. After installing the bedknife to bedbar, grind the bedknife.

Grinding the Bedknife

Bedknife Grinding Specifications

Standard Bedknife Relief Angle	3° minimum
Fairway Bedknife Relief Angle	3° minimum
Extended Bedknife Relief Angle	7° minimum
Front Angle Range	13° to 17°

Since there can be variations in the mounting surface of the bedbar, it is necessary to grind the bedknife after installing it to the bedbar. Follow the bedknife grinding specifications provided; refer to Bedknife Grinding Specifications (page 8–14). Grind only enough material so that the top surface of the bedknife is true; refer to Figure 78.



1. Top angle

g207289

- 2. Top surface
- 3. Remove burr

IMPORTANT

4

5.

Front surface

Front angle

Do not grind the bedknife below the service limit; refer to Figure 79. Operating the cutting unit with the bedknife below the service limit may result in poor after-cut appearance and reduce the structural integrity of the bedknife.



- 1. Service limit (reel contacts back of bedknife scallop during operation)
- 2. Service limit (bottom of bedknife scallop reached when grinding)

The bedknife service limit occurs when the reel contacts the back of the bedknife scallop during operation. Check for reel contact marks at the back of the bedknife scallop prior to grinding. The bedknife service limit may also occur when the bottom of the bedknife scallop is reached when grinding the bedknife.

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

IMPORTANT

EdgeMax® bedknives are extremely hard. Using a diamond grinding wheel is recommended to prevent overheating or damaging the bedknife edge while grinding.

Because the top grind angle on bedknives is critical for edge retention and therefore after-cut appearance, Toro developed special service tools for accurately measuring the top grind angle on all bedknives; refer to Angle Indicator and Magnetic Mount (page 2–16).

- 1. Use the Toro General Service Training Book, Reel Mower Basics (part no. 09168SL) and grinder manufacturer's instructions for bedknife grinding information.
- 2. After grinding the bedknife, install the bedbar assembly in the cutting unit; refer to Installing the Bedbar (page 8–8).

Note: Always adjust the cutting unit after grinding the reel and/or bedknife; refer to the Cutting Unit *Operator's Manual*. If a properly adjusted cutting unit does not cut paper cleanly after grinding, the grind angle may be incorrect. To extend the cutting unit performance by allowing the reel and the bedknife to hold their edge longer, an additional adjustment may be required after the first few minutes of operation as the reel and bedknife conform to each other.

Troubleshooting Bedknife Grinding

Perform this troubleshooting procedure is a newly ground bedknife does not cut test paper at the center of the knife.

1. Place a .002 inch shim (Part No. 140-5531) between the outer most left and right magnets and the bedbar-bedknife assembly when placing it in the grinder (Figure 80).

Note: If a bedknife does not cut paper more than 2 inches from each end, place the shims on the inner magnets instead of the outer magnets.



- 1. 1 inch between the outer edge of the 3. Inner magnets bedknife and the outer magnet
- 2. Outer magnets

- 4. .002 inch shim (Part No. 140-5531)
- 2. Ensure that you are following the grinder manufacturer instructions and grind the bedknife.
- 3. In most cases the outside of each outer magnet should be 1 inch (25 mm) from the outside edge of the bedknife.

Troubleshooting Bedknife Grinding (continued)

- 4. Remove the bedbar-bedknife assembly from the grinder.
- 5. If you have a precision flat granite surface plate, check the bedbar-bedknife; refer to Checking the Bedknife on a Granite Surface Plate (page 8–16).
- 6. Install the bedbar-bedknife assembly to the cutting unit and adjust the cutting unit; refer to your Cutting Unit Operator's Manual.
- 7. Test the cut across the entire length of the bedknife, if the paper does not cut across the entire length, complete this procedure again with an additional shim installed on each magnet (maximum of 4 shims total).

Note: If a properly adjusted cutting unit does not cut the test paper cleanly across the entire length of the bedbar-bedknife after grinding, check the grind angle to be sure it is ground to the bedknife grinding specification; refer to Bedknife Grinding Specifications (page 8–14).

Note: If there are still gaps after grinding with 2 shims at either the outer or inner magnets (maximum of 4 shims total), there may be a separate issue; contact the Technical Assistance Center.

Checking the Bedknife on a Granite Surface Plate

1. Place bedbar-bedknife assembly on a precision flat granite surface plate with the cutting edge down. Look for visible light between the granite and the bedknife, or use a shim to test for .002 inch or greater gaps (Figure 81).



2. If there is a gap that the shim fits through, or light shows between the granite and the cutting edge after grinding with 1 shim, regrind the bedknife with an additional shim installed (maximum of 4 shims total, 2 per magnet); refer to Troubleshooting Bedknife Grinding (page 8–15).

Cutting Unit Assembly



Removing the Cutting Unit Assembly

Note: Refer to Figure 82 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Slide the telescopic coupler (6) on the reel drive assembly (2) from the transmission drive shaft.

Note: If necessary, remove the reel drive assembly (2) from the cutting unit assembly (1); refer to Removing the Reel Drive Assembly (page 5–9).

3. Remove the 4 socket head screws (3) that secures the cutting unit assembly (1) to the frame assembly (5).

Note: Support the traction unit and lock the kick stand.

- 4. Slide and remove the cutting unit assembly (1) from the frame assembly (5).
- 5. If necessary, remove the dowel pins (4) from the frame assembly (5).

Installing the Cutting Unit Assembly

- 1. If removed, install the dowel pins (4) into the frame assembly (5).
- 2. If removed, install the reel drive assembly (2) onto the cutting unit assembly (item 1); refer to Installing the Reel Drive Assembly (page 5–12).
- 3. Install the cutting unit assembly (1) onto the frame assembly (5).
- 4. Secure the cutting unit assembly (1) with 4 socket head screws (3).
- 5. Align the reel drive assembly shaft to transmission gearbox drive shaft. Slide the telescopic coupler (6) on the reel drive assembly (2) to the transmission gear shaft.
- 6. Attach the spark plug wire to the engine spark plug.



This section provides the procedure for removing and installing the reel assembly (reel, reel bearing, bearing lock screw, reel nut and seals) from the cutting unit.

Removing the Reel Assembly

Note: Refer to Figure 83 during this procedure.

- 1. on a level surface, shut off the engine, and ensure that the traction control is in NEUTRAL. Remove the spark plug wire from the spark plug.
- If the cutting unit is equipped with an optional groomer, remove the drive components for those options from cutting unit. Refer to Removing the Gearbox Assembly (page 9–4) for universal groomer, and Universal Groomer (page 2–5) for additional information.
- 3. Remove the cutting unit assembly from the frame assembly; refer to Removing the Cutting Unit Assembly (page 8–17).
- 4. Remove the reel drive assembly; refer to Removing the Reel Drive Assembly (page 5–9).

IMPORTANT

If the reel bearings or seals are being replaced, the bearing lock screw and the reel drive shaft must be removed. Use the following procedure to restrain the reel and loosen the components before removing the roller.



- 5. Loosen the reel drive nut (11) and bearing locknut (2).
 - A. Tip up the cutting unit to access the bottom of the reel.
 - B. Insert a long- handled pry bar (3/8 x 12 inch with screwdriver handle recommended) through the bottom of the cutting unit. The pry bar should pass between the top of the reel shaft and the backs of the reel blades so that the reel will not move; refer to Figure 84.

IMPORTANT

To avoid grinding the reel, do not contact the cutting edge of any blade with the pry bar as this may damage the cutting edge and/or cause a high blade.

C. Move the pry bar against the weld side of the reel support plate closest to the bearing lock screw.

IMPORTANT

The reel drive shaft on the left end of the cutting reel has left-hand threads. The bearing lock screw on the right end of the cutting reel has right- hand threads.

D. Rest the handle of the pry bar against the front roller and loosen the bearing lock screw.

A

IMPORTANT

Do not use 1/2" extension on end of reel drive shaft when loosening or tightening drive shaft. The 1/2" hex is intended for back lapping only.

- E. Position the pry bar in the same manner on the opposite end of the reel and use the appropriate wrench or socket on the 1" hex portion of the shaft to loosen the reel drive shaft.
- F. Tip the cutting unit back onto its roller.
- 6. Remove the bedbar; refer to Removing the Bedbar (page 8-7).
- 7. Remove the front roller; refer to Removing the Front Roller (page 8–27).

CAUTION

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

- 8. Support the cutting reel to prevent it from shifting or falling and remove the 2 socket head screws (3 and 17) that secure the LH side plate (4) to the reel assembly (8).
- 9. Remove the bolt (16) and washer (15) that secures the grass shield assembly (18) to the LH side plate (4).
- 10. Remove the LH side plate (4) from the reel assembly (8).
- 11. Remove the 2 socket head screws (3 and 17) that secure the RH side plate (10) to the reel assembly (8).
- 12. Remove the bolt (16) and washer (15) that secures the grass shield assembly (18) to the RH side plate (10).
- 13. Remove the RH side plate (10), grass shield assembly (18) and 2 frame support rods (9 and 14) from the reel assembly (8).
- 14. Carefully slide the cutting reel assembly (with seals, bearings, and reel nuts) from the opposite side plate. Retrieve the flat wire spring from the reel bearing bore of the left side plate.
- 15. Thoroughly clean any grease and corrosion from the reel bearing bores in the side plates.
- 16. Inspect the remaining cutting unit components for corrosion, wear, or damage and replace the components as necessary.

A



- 1. Remove the reel nuts from the cutting reel.
- 2. Slide the bearings and seals from the reel shaft. Discard the seals and inspect the reel bearings to ensure that they spin freely and have a minimal amount of axial play.
- 3. Inspect the reel as follows:
 - A. Place the reel shaft ends in V-blocks and check the reel shaft for distortion.
 - B. Check the threads in the ends of the reel shaft.
 - C. Check the reel blades for bending or cracking.
 - D. Check the service limit of the reel diameter; refer to Preparing the Reel for Grinding (page 8–25).
- 4. Replace the reel if damage is evident.

IMPORTANT

The seal must be installed with the flocked side (red) of the seal toward the bearing.

5. Slide the new flocked seals and the bearings onto the reel shaft until they contact the shoulder of the reel shaft.

Inspecting the Reel Assembly (continued)

Note: The reel nut on the left end of the cutting reel has a black finish and has left-hand threads. The left end of the cutting reel shaft is identified with a groove cut just inside of the left-most reel spider. Tighten the reel nuts to the specified torque once the cutting reel is installed in the cutting unit.

6. Install the reel nuts finger tight.

Installing the Reel Assembly

1. Position the cutting unit on a flat work area.

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

- 2. Apply a thin coat of grease to the outside of the cutting reel bearings and carefully slide the cutting reel assembly into the right side plate. Make sure that the reel bearing is fully seated in the RH side plate, and that the reel nut on the left (exposed) end of the cutting reel has a black finish.
- 3. Place the grass shield assembly (18), frame support rods (9 and 14) onto the RH side plate (10).
- 4. Place the flat wire spring into bearing bore of LH side plate and carefully slide the left side plate onto the cutting reel assembly as far as possible.



- 5. Install the 4 socket head screws (3 and 17) that secure the RH and LH side plates (4 and 10) to the frame support rods (9 and 14). Tighten the socket head screws from **24 to 27 N·m (18 to 20 ft-lb)**.
- 6. If loosened during cutting reel service, tighten the bearing lock screw and the reel drive nut.



A. Insert a long- handled pry bar (3/8 x 12 inch with a screwdriver handle recommended) through the front of the cutting unit. The pry bar should

pass between the top of the reel shaft and the backs of the reel blades so that the reel will not move; refer to Figure 86.

IMPORTANT

To avoid grinding the reel, do not contact the cutting edge of any blade with the pry bar as this may damage the cutting edge and/or cause a high blade.

B. Move the pry bar against the weld side of the reel support plate closest to the bearing lock screw.

IMPORTANT

The reel drive shaft on the left end of the cutting reel has left-hand threads. The bearing lock screw on the right end of the cutting reel has right- hand threads.

C. Rest the handle of the pry bar against the front roller and tighten the bearing lock screw from **123 to 149 N·m (90 to 110 ft-lb)**

IMPORTANT

Do not use 1/2" extension on end of reel drive shaft when loosening or tightening drive shaft. The 1/2" hex is intended for back lapping only.

- D. Position the pry bar in the same manner on the opposite end of the reel and use the appropriate wrench or socket on the 1" hex portion of the shaft to tighten the reel drive shaft from **123 to 149 N·m (90 to 110 ft-lb)**.
- 7. Secure the grass shield assembly (18) to the RH and LH side plates (4 and 10) with the 2 washers (15) and 2 bolts (16).
- Install the reel drive assembly; refer to Installing the Reel Drive Assembly (page 5–12). Grease the splines with high temp Mobil XHP-222 grease or equivalent.
- 9. Install the bedbar assembly; refer to Installing the Bedbar (page 8-8).
- 10. Install the front roller; refer to Installing the Front Roller (page 8–29).
- 11. Install the cutting unit assembly to the frame assembly; refer to Installing the Cutting Unit Assembly (page 8–18).
- 12. If the cutting unit is equipped with an optional groomer, install the components for those options. Refer to Installing the Gear Box Assembly (page 9–13) for universal groomer, and Installation Instructions (page 9–2) for additional information.

Preparing the Reel for Grinding

Reel Grinding Specifications

Reel Diameter New (D)	128.5 mm (5.06 inch)
Reel Diameter Service Limit	114.3 mm (4.50 inch)
Reel Diameter Taper Limit (D1 – D2)	0.25 mm (0.01 inch)
Blade Land Width	0.8 to 1.2 mm (0.03 to 0.05 inch)
Blade Relief Angle	30° ±2°
Reel Shaft Diameter	34.9 mm (1.375 inch)





Before grinding a cutting reel, make sure that all the cutting unit components are in good condition. Depending on the type of grinder used, faulty cutting unit components can affect the grinding results. When grinding, be careful to not overheat the cutting reel blades. Remove small amounts of material with each pass of the grinder.

Follow reel grinder manufacturer's instructions to grind cutting reel to Toro specifications; refer to Reel Grinding Specifications (page 8–25). Additional reel grinding information can be found in the *Cutting Unit Operator's Manual*. An additional resource is the Toro Basics Series Training Book, Reel Mower Basics (part no. 09168SL) found on the Service Reference Set available from your Authorized Toro Distributor.

Relief grind the reel blades to the minimum blade land width if the reel blade land width exceeds the service limit. Spin grind the reel to establish the specified blade land width or to restore the reel's cylindrical shape.

Preparing the Reel for Grinding (continued)

Note: Always adjust the cutting unit after grinding the reel and/or bedknife; refer to the *Cutting Unit Operator's Manual*. To extend the cutting unit performance by allowing the reel and the bedknife to hold their edge longer, an additional adjustment may be required after the first few minutes of operation as the reel and bedknife conform to each other.

Roller Assemblies

Removing the Front Roller



Mounting rod (2 each) 4.

1.

- Height-of-cut arm (2 each) 5.
- Cutting unit assembly 9.

Note: Refer to Figure 88 during this procedure.

- 1. Loosen the pinch bolts (8) that secure the front roller shaft (3) to the front height-of-cut arms (5).
- 2. Remove the locknut (6) and plow bolt (1) that secures one of the height-of-cut arms (5) to the cutting unit side plate (10) and remove the height-of-cut arm.
- 3. Slide the front roller assembly (3) from the remaining height-of-cut arm (5).
- 4. Remove the remaining height-of-cut arm (5) from the cutting unit (10) if necessary.



- 1. To hold the roller shaft (5) stationary while removing the bearing locknut (1), install a 3/8-24 UNF 2B screw with a jam nut into the threaded end of the roller shaft (5) and tighten the jam nut against the roller shaft. Remove the bearing locknuts (1).
- 2. Carefully inspect the seating surface and threads of the bearing locknuts (1) and replace them if damaged.
- 3. Loosely secure the roller assembly (4) in a bench vise and lightly tap on the roller shaft (5) to remove the sealing washers (2) and bearings (3). Discard the sealing washers (2).
- 4. Clean and carefully remove any corrosion from the bearing cavities of the roller.



- 2. Place the roller shaft into the roller.
- 3. Press the 2nd bearing into the roller (support both).



4. Install the sealing washer and bearing locknut onto each end of the roller shaft. Tighten the locknuts to **34 to 41 N·m (25 to 30 ft-lb)**.

Installing the Front Roller

- 1. Place the cutting unit on a level work surface. Use an appropriate support to raise the front of the cutting unit off the work surface.
- 2. Inspect the condition of both height-of-cut screws (9) and replace them if necessary. Apply anti-seize lubricant to the threads of a new height-of-cut screw (9).

Note: When installing the height-of-cut arms (5), make sure that the tab of the side plate fits between the head and the washer of the height-of-cut screw (9).

- 3. Secure one of the height-of-cut arms (5) to the side plate with a plow bolt (1) and locknut (6).
- 4. Slide the front roller shaft (3) into the height-of-cut arm (5) attached to the cutting unit (10).

Installing the Front Roller (continued)

- 5. Slide the remaining height-of-cut arm (5) onto the other end of roller shaft. Secure the remaining height-of-cut arm to the side plate with a plow bolt and locknut.
- 6. Center the front roller (3) in the cutting unit and tighten the pinch bolts (8) that secure the front roller shaft to the height-of-cut arms.
- 7. Install the cutting unit assembly to the frame assembly; refer to Installing the Cutting Unit Assembly (page 8–18), (If necessary).
- 8. Adjust the cutting unit height-of-cut; refer to the *Cutting Unit Operator's Manual.*

Chapter 9



Universal Groomer (Optional)

Table of Contents

General Information	
Installation Instructions	
Service and Repairs	
Groomer Drive Gearbox	
Idler Plate	
The Groomer Reel	
Height Adjuster Assembly	
The Height Adjuster Assembly	
The Grooming Brush (Optional)	
- · · · · · · · · · · · · · · · · · · ·	

General Information

Installation Instructions

The *Installation Instructions* for the groomer provides information regarding the set-up, operation, general maintenance procedures, and maintenance intervals for the groomer assembly on your Greensmaster machine. Refer to the *Installation Instructions* for additional information when servicing the groomer assembly.

Service and Repairs



A

1.

2.

3.

CAUTION

Never work on the groomer with the engine running. Always stop the engine and wait for all machine movement to stop before working on the groomer.



The groomer gearbox assembly is located on the opposite side of the cutting unit from the reel drive.

Removing the Gearbox Assembly

Refer to Figure 93 and Figure 94 for this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the cutting unit from the machine and place it on a level work surface; refer to *Operator's Manual*.
- 3. Remove the groomer reel assembly; refer to Removing the Groomer Reel (page 9–19).

A

- 4. Remove the cap from the lip of the groomer drive gearbox cover (Figure 93).
- 5. Tip up the cutting unit to access the bottom of the reel to remove the drive shaft assembly.

IMPORTANT

To avoid grinding the reel, do not contact the cutting edge of any blade with the pry bar as this may damage the cutting edge and/or cause a high blade.

- 6. Insert a long-handled pry bar (3/8 x 12 inch with screwdriver handle recommended) through the bottom of the cutting unit. The pry bar should pass between the bottom of the reel shaft and the backs of the reel blades so that the reel will not move.
- 7. Move the pry bar against the weld side of the reel support plate closest to the groomer gearbox, and lift the pry bar so that it contacts the front roller.



- 1. Shoulder screw (cutting units with a single-lug gearbox)
- 2. Eye bolt
- 3. Hardened washer (cutting units with a single-lug gearbox)
- 4. Single-lug groomer drive gearbox
- 5. Input shaft assembly

10. Reel shaft

Adjuster pin

11. Weld side of reel support plate

2-lug groomer drive gearbox

6. 5/16-18 X 5/8 inch square head set screw 12. Pry bar

IMPORTANT

8.

9.

The square head set screw is needed to reinforce the hex end of the drive shaft when you remove or install the gearbox. Do not apply thread-locking compound to the square head set screw.

- Install a 5/16-18 X 5/8 inch square head set screw (Toro Part No. 1-803022) in the end of the drive shaft and tighten to 13 N·m (120 in-lb); refer to Figure 94.
- 9. Disassemble the eye bolt of the groomer adjuster from the gearbox cover:

- Machines with a Single-Lug Groomer-Drive Gearbox: remove the shoulder screw and hardened washer from the eye bolt and gearbox-cover lug.
- Machines with a 2-Lug Groomer-Drive Gearbox: remove the cotter pin and adjuster pin from the eye bolt and gearbox-cover lugs. Discard the cotter pin.

IMPORTANT

You must use a 6-point socket with a heavy wall to remove the gearbox from the reel. Do not use an impact wrench. Groomer gearboxes installed on the left side of the cutting unit use a left-hand thread; turn the drive shaft clockwise to remove the gearbox.

- 10. Use a heavy wall, 6 point socket and breaker bar at the outboard end of the groomer gearbox drive shaft, and rotate the socket clockwise to loosen and remove the gearbox driveshaft from the reel shaft.
- 11. If the hex head on the end of the drive shaft is damaged during removal, perform the following steps:
 - A. Rotate the cutting unit as shown in Figure 95.



- B. Remove the drain/fill plug and drain the oil from the gearbox, and drain the oil.
- C. Remove the 4 socket-head screws that secure the gearbox cover to the gearbox housing, and cover. Remove and discard the cover gasket.
- D. Remove the thrust washer, sun gear, and ring gear from the gearbox housing.
- E. Remove the driven gear from the drive shaft and planet gears from the pins on the gearbox housing.
- F. Remove the retaining ring from the drive shaft.
- G. Remove the groomer housing assembly from the drive shaft.
- H. Tip up the cutting unit to access the bottom of the reel.



- 3. Reel shaft
 - I. Insert a long-handled pry bar (3/8 x 12 inch with screwdriver handle recommended) through the bottom of the cutting unit. The pry bar should pass between the bottom of the reel shaft and the backs of the reel blades so that the reel will not move.

IMPORTANT

To avoid grinding the reel, do not contact the cutting edge of any blade with the pry bar as this may damage the cutting edge and/or cause a high blade.

- J. Move the pry bar against the weld side of the reel support plate closest to the groomer gearbox, and lift the pry bar so that it contacts the front roller.
- K. Use the drive shaft removal tool on the large flats of the drive shaft assembly, and rotate the tool clockwise to loosen and remove the gearbox driveshaft from the reel shaft; refer to Special Tools (page 2–14).
- L. Rest the handle of the pry bar against the front roller and rotate the drive shaft removal tool clockwise to loosen the drive shaft from the reel.
- 12. Remove the pry bar, and tip the cutting unit back onto its roller.
- 13. Clean the threads at the end of the reel shaft. A right-hand thread and left-hand thread tap is available to clean or repair the threads if necessary; refer to Special Tools (page 2–14).

Servicing the Gearbox Assembly



Actuator shaft 22. Straight bushing (2 each) 33.

11.

Flange bushing

A

Note: Refer to Figure 97 during this procedure.

- 1. Remove the drain/fill plug and drain the oil from the gearbox, and drain the oil.
- 2. Remove the 4 socket-head screws and separate the gearbox cover and housing. Remove and discard the cover gasket.
- 3. Remove the thrust washer, sun gear, ring gear, and planet gears from the pins on the gearbox housing.
- 4. Continue to disassemble the gearbox as necessary.

CAUTION

A

Use the large 34.9 mm (1-3/8 inch) flats on the drive shaft to prevent it from rotating when removing or installing the drive adapter.

Do Not use the 12.7 mm (1/2 inch) hex head of the drive shaft when removing or installing the drive adapter—drive shaft damage may occur.

5. If the drive adapter requires replacement, apply medium strength thread locking compound (Loctite 243 or equivalent) to the internal threads of the groomer gearbox drive shaft.

Note: A special tool is available to hold the drive shaft if necessary; refer to Special Tools (page 2–14).



- 6. Torque the drive adapter to **150 to 163 N·m (110 to 120 ft-lb)**. Allow the thread locking compound to cure for 15 minutes before continuing this procedure.
- 7. Carefully clean all the gasket material from the gearbox housing and cover.
- 8. Inspect the V-ring, seals, bearings, gears, and bushings in the gearbox assembly. Replace the damaged or worn components as necessary.
- 9. If the bearings for the sun gear, ring gear, or the gearbox housing are replaced, press the bearing all the way to shoulder of the bore.
- 10. If the flange bushings are replaced, ensure that the flange bushing is fully seated against the part.
- 11. Assembly the gearbox.
 - Ensure that all the retaining rings and O-rings are fully seated in the ring groove during assembly.
 - Lubricate the seal lips and O-rings before installing the shafts.
 - Lubricate the planet gear and sun gear pins in the gearbox housing with the gear oil prior to installing the gears.
- 12. Clean the gasket surface on the gearbox housing and cover with the solvent and install new gasket.
- 13. Ensure that the trust washer is assembled to the pin that supports the ring gear and sun gear, and the washer is located between the sun-gear bearing and the gearbox cover.



14. Fit the gearbox cover over dowel pins and install the 4 socket-head screws. Tighten the screws from **1.7 to 4.5 N·m (15 to 40 in-lb)**. In an alternating cross pattern, torque the screws to **8.4 to 9.6 N·m (75 to 85 in-lb)**.

15. If removed, lubricate the O-rings for the drain/fill plug with Mobile XHP-222 or an equivalent grease.





 Install all the plugs into the gearbox cover, except for the plug for the face of the cover (located between the 4 socket-head screws). Torque the plugs to 4 to 5 N·m (32 to 42 in-lb).



17. Add **50 ml (1.7 fluid ounces)** 80W-90 gear oil into the gearbox through the hole in the face of the cover.



- 18. Install drain/fill plug into the hole in the face of gearbox cover, and tighten the plug to **4 to 5 N·m (32 to 42 in-lb)**.
- 19. Operate the groomer gearbox by hand to check for proper operation prior to installation.
Installing the Gear Box Assembly



Refer to Figure 99 for this procedure.

IMPORTANT

The square head set screw is needed to reinforce the hex end of the drive shaft when you remove or install the gearbox. Do not apply thread-locking compound to the square head set screw.

- 1. Install a 5/16-18 X 5/8 inch square head set screw (Toro Part No.1-803022) into the end of the drive shaft for the groomer drive gearbox, and tighten the set screw to **13 N·m (120 in-lb)**; refer to Figure 99.
- 2. Clean the threads in the end of the reel shaft of any debris or grease.
- 3. Apply medium strength thread locking compound (Loctite 243 or equivalent) to the threads in the reel shaft.
- 4. Insert a long-handled pry bar through the front of the cutting unit. The pry bar should pass between the top of the reel shaft and the backs of the reel blades so that the reel will not move.

Installing the Gear Box Assembly (continued)

- 5. Move the pry bar against the weld side of the reel support plate closest to the gearbox assembly and rest the handle of the pry bar against the front roller.
- 6. Position the groomer drive gearbox assembly against the cutting unit, and rotate the drive shaft assembly counterclockwise until it is seated against the reel shaft.

IMPORTANT

You must use a 6-point socket with a heavy wall to install the gearbox to the reel. Do not use an impact wrench. A Groomer gearbox installed on the left side of the cutting unit use a left-hand thread; turn the drive shaft counterclockwise to install the gearbox.



- 7. Torque the drive shaft assembly from **135 to 150** N·m (**100 to 110 ft-lb**). Allow the thread locking compound to cure for 15 minutes.
- 8. Remove the square head set screw from the end of the drive shaft.
- 9. Apply a retaining compound (Loctite 609 or equivalent) to the cap for the gearbox cover and install the cap to the lip of the cover.



Installing the Gear Box Assembly (continued)



Figure 101

- 1. Shoulder screw
- Single-lug groomer drive 7. Cotter pin gearbox

- 2. Eye bolt
- 3. Hardened washer
- 5. Adjuster pin

4.

- 6. 2-lug groomer drive gearbox
- 10. Assemble the eye bolt of the groomer adjuster to the gearbox cover (Figure 101).

• Cutting Units with a Single-Lug Groomer-Drive Gearbox

- A. Apply a coat of medium-duty thread-locking compound to the shoulder screw.
- B. Align the hardened washer between the eye bolt and the gearbox-cover lug.
- C. Assemble the eye bolt and hardened washer to the gearbox lug with the shoulder screw. Torque the shoulder screw to 16.3 to 20.3
 N·m (12 to 15 ft-lb).

Cutting Units with a 2-Lug Groomer-Drive Gearbox

- D. Align the eye bolt between the gearbox-cover lugs.
- E. Assemble the eye bolt to the lugs with the adjuster pin and cotter pin.
- 11. Install the groomer reel assembly; refer to Installing the Groomer Reel (page 9–21).

Idler Plate



The groomer idler assembly is located at the opposite side of the groomer gearbox.

Note: Early universal groomers used 2 non-adjustable compression springs on eye bolts for the 2-lug gearbox and idler plate. The single-lug gearbox and idler plate assemblies are the current groomer drive configuration, and use shim washers to preload the springs; refer to Figure 102.

Removing the Idler Assembly

Note: Refer to Figure 102 during this procedure.

- 1. Remove the reel drive from the cutting unit; refer to Removing the Reel Assembly (page 8–19).
- Remove the groomer reel assembly; refer to Removing the Groomer Reel (page 9–19).
- 3. Remove the eye bolt of the groomer adjuster from the idler plate as follows:
 - Cutting units with a Single-Lug Idler Plate: remove the shoulder screw and hardened washer that secure the eye bolt to the idler plate.
 - Cutting units with a 2-Lug Idler Plate: remove the cotter pin and adjuster pin that secure the eye bolt to the idler plate.

Removing the Idler Assembly (continued)

Note: Discard the cotter pin.

- 4. Remove the idler assembly.
- 5. Inspect the shields, bearing, and bushing of the idler assembly. Replace worn or damaged components.

Installing the Idler Assembly

- 1. If the shields, bearing, or bushing were removed from the idler plate, install new components as follows:
 - A. Press the bushing into the idler plate until the bushing is centered in the bore.
 - B. Press the bearing into the idler plate so that the bearing contacts the shoulder in bore, and secure the bearing with the retaining ring.
 - C. Assemble the 2 bearing shields to the idler plate with flocked side of shield toward the bearing.



D. Insert the stub shaft through the shields and bearing. Use the through hole in the shaft to prevent it from rotating, and torque the flange nut to **37 to 45 N·m (27 to 33 ft-lb)**.



g396616

Figure 103

1. Shoulder screw

Hardened washer

- 4. Single lug idler plate
- 7. Cotter pin

2. Eye bolt

3.

- 5. Adjuster pin
- 6. 2 lug idler plate
- 2. Assemble the eye bolt of the groomer adjuster to the idler plate (Figure 103) as follows:

Cutting Units with a Single-lug idler plate

- A. Apply a coat of medium-duty thread-locking compound to the shoulder screw.
- B. Align the hardened washer between the eye bolt and the idler plate lug.

Installing the Idler Assembly (continued)

- C. Assemble the eye bolt and hardened washer to the idler plate with the shouldered screw.
- D. Torque the shoulder screw to 21 to 25 N·m (15 to 19 ft-lb).
- Cutting Units with a 2-lug idler plate: assemble the eye bolt to the idler plate lugs with the adjuster pin and a new cotter pin.
- 3. Install the reel drive; refer to Installing the Reel Assembly (page 8-23).

The Groomer Reel



Remove the groomer reel to replace individual groomer blades or replace the shaft. The groomer reel can be reversed to provide additional blade life.

Removing the Groomer Reel



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

Use heavy gloves when handling the groomer reel.

- 1. Carefully remove the 4 jam nuts, 4 bolts, and 4 shaft clamps that secure the groomer reel to the stub shafts of the idler plate and the gearbox driven shaft.
- 2. Lift the groomer reel from the cutting unit.
- Inspect the shields, stub shaft, driven shaft, and shaft bearings for wear or damage and replace components as necessary; refer to Groomer Drive Gearbox (page 9–4)and Idler Plate (page 9–16).



Inspect the groomer reel blades frequently for any damage and wear. Straighten the bent blades. Either replace the worn blades or reverse the individual blades to put the sharpest blade edge forward: refer to Figure 105.

- 1. Remove the groomer reel from the cutting unit; refer to Removing the Groomer Reel (page 9–19).
- 2. Remove the locknut from either end of the groomer reel shaft.
- 3. Remove the blades from the groomer shaft. If necessary, remove second locknut from the shaft.
- 4. Inspect and replace worn or damaged components.
- 5. Assemble the groomer reel as follows:

Note: New locknuts have an adhesive patch to prevent the locknut from loosening. If a used locknut is being installed, apply a medium strength thread locker (Loctite #242 or equivalent) to the threads of the locknut.

- A. Install a locknut on one end of the groomer reel shaft.
- B. Install a groomer blade against the locknut.
- C. Install the remaining spacers and blades in an alternating manner making sure that all blades are separated by a spacer.

Servicing the Groomer Reel (continued)

D. When all the blades have been installed, install the second locknut onto the shaft. Center the blades and spacers on the shaft by adjusting the locknuts.



- E. Use the through holes in shaft to prevent the shaft from rotating and tighten the second locknut to **42 to 48 N·m (375 to 425 in-lb)**. After tightening the locknut, spacers should not be free to rotate, and the groomer blades should be centered on the shaft.
- 6. Install the groomer reel back onto the cutting unit; refer to Installing the Groomer Reel (page 9–21).

Installing the Groomer Reel

1. Position the groomer reel between the gearbox driven shaft and stub shafts of the idler plate.



- 2. Secure the groomer reel to the cutting unit with the 4 jam nuts, 4 bolts, and 4 shaft clamps. Tighten the bolts from **5 to 7 N·m (45 to 60 in-lb)**.
- 3. Check the groomer reel height and mower height-of-cut settings and adjust as necessary.



Single-Lug Groomer Gearbox and Idler Plate

Note: The single-lug gearbox and idler plate assemblies are the current groomer drive configuration, and use shim washers to preload the springs.

Early universal groomers used 2 non-adjustable compression springs on eye bolts for the 2-lug gearbox and idler plate. The single-lug gearbox and idler plate assemblies are the current groomer drive configuration, and use shim washers to preload the springs; refer to Figure 106

Disassembling the Height Adjuster

Note: Refer to Figure 106 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the cutting unit from the machine; refer to the Operator's Manual.
- 3. Remove the shoulder screws and hardened washers that secure the eye bolts to the lugs of the groomer gearbox and the idler plate.
- 4. Loosen the lock screws that secure the front roller to the height-of-cut arms.
- 5. Loosen the flange locknuts for the height-of-cut bolts that are located below the slot in the height-of-cut arms.
- 6. Remove the locknuts, height-of-cut washers, and plow bolts that secure the height-of-cut arms to the cutting unit side plates, and remove the arms from the cutting unit.
- 7. Remove the height-of-cut bolts, 22 x 12 mm (7/8 x 7/16 inch) washers, spring washers, and flange locknuts from the groomer height-of-cut arms.
- 8. Disassemble the height adjuster assembly as necessary.
- 9. Clean all the components and inspect for wear or damage. Replace all the worn or damaged components.

Assembling the Height Adjuster

- 1. If disassembled, assemble a 22 x 12 mm (7/8 x 7/16 inch) washer, spring washers, a second 22 x 12 mm (7/8 x 7/16 inch) washer, and flange locknut onto each height-of-cut bolts. Tighten the locknuts until the flange of the nut is aligned with the end of the threads toward the head of the bolt.
- 2. Apply anti-seize lubricant to the upper threads of the eye bolts and lower threads of the height-of-cut bolts.
- 3. Assemble the height-of-cut bolts, washers, and flange locknuts to each of the groomer height-of-cut arms. Thread the bolts into the arms until the end of the bolt is flush with the slot in the arm.
- 4. Assemble an eye bolt to each of the height-of-cut arms with a Belleville washer, inner and outer springs, shim washers, and 20.6 x 14.3 mm (0.813 x 0.563 inch) washer below the slot in the arms, and the quick up handle, quick up cover, and height adjuster knob above the slots.
- 5. If both the height-of-cut arms are removed, align 1 height-of-cut arm and height-of-cut bolt to the cutting unit side plate with the washer 22 x 12 mm (7/8 x 7/16 inch), spring washer, and second washer 22 x 12 mm (7/8 x 7/16 inch) above the slot in the side plate, and the flange locknut aligned below the slot.
- 6. Tighten the flange locknut until it contacts shoulder of the height-of-cut bolt.
- 7. Loosely assemble the height-of-cut arm to the side plate with the plow bolt, plow bolt, height-of-cut washer, and locknut. Do not tighten the flange locknut.
- 8. Loosely assemble the front roller shaft to the height-of-cut arm.
- 9. Assemble the other height-of-cut bracket to the front roller shaft. Assemble height-of-cut arm and height-of-cut bolt to the cutting unit side plate as described in 5.
- 10. Assemble the height-of-cut arm to the side plate with the plow bolt, plow bolt, height-of-cut washer, and locknut. Tighten the 2 locknuts and 2 plow bolts finger tight.
- 11. Adjust the height-of-cut bolts so that the height-of-cut arm are the same.
- 12. Center the front roller between the height-of-cut arms, and tighten the lock screws in the height-of-cut arms.
- 13. Align the hardened washers between the eye bolts to the groomer gearbox and idler arm lugs, and loosely assemble the eye bolts and washers to the gearbox and idler plate lugs with the shoulder screws.
- 14. Adjust the cutting unit height-of-cut; refer to Cutting Unit Operators Manual.
- 15. Adjust the groomer reel height; refer to *Universal Groomer Drive Kit Installation Instructions*.
- 16. Ensure that both groomer quick up handles are in the OPERATING position.

Assembling the Height Adjuster (continued)



17. Measure the distance between the washers (the current spring length) as shown in Figure 108.



^{18.} Subtract the desired (.75 inch or 19 mm) spring length from the current spring length, and divide this difference by 0.06 inches to determine how many shim washers you need to add to achieve the desired spring length.

Assembling the Height Adjuster (continued)

- 19. Repeat steps 17 and 18.
- 20. Remove the eye bolts and hardened washers from the groomer gearbox and idler arm lugs, and adjust the shim washers as you calculated in step 18.
- 21. Apply medium strength thread locking compound to the threads of the shoulder screws.
- 22. Align the hardened washers between the eye bolts to the groomer gearbox and idler arm lugs, and loosely assemble the eye bolts and washers to the gearbox and idler plate lugs with the shoulder screws.



23. Torque the shoulder screws to 21 to 25 N·m (15 to 19 ft-lb).

The Height Adjuster Assembly



2-Lug Groomer Gearbox and Idler Plate

1.	Height adjuster knob	7.	Compression spring (inner)	13.	Quick up handle	19.	Washer 22.2 x 11.8 mm (7/8 x 7/16 inch)
2.	Quick up cover	8.	Washer 20.6 x 10.3 mm (0.813 x 0.406 inch)	14.	Detent spring	20.	Spring washer
3.	Groomer height-of-cut arm	9.	Eye bolt	15.	Screw	21.	Flange locknut
4.	Height-of-cut washer	10.	Compression spring (outer)	16.	Side plate (cutting unit)	22.	Cotter pin
5.	Locknut	11.	Washer 20.6 x 14.3 mm (0.813 x 0.563 inch)	17.	Plow bolt	23.	Adjuster pin
6.	Bumper	12.	Lock screw	18.	Height-of-cut bolt	24.	2-lug gearbox

Note: The single-lug gearbox and idler plate assemblies are the current groomer drive configuration, and use shim washers to preload the springs.

Early universal groomers used 2 non-adjustable compression springs on eye bolts for the 2-lug gearbox and idler plate. The single-lug gearbox and idler plate assemblies are the current groomer drive configuration, and use shim washers to preload the springs; refer to Figure 109

Disassembling the Height Adjuster

Note: Refer to Figure 109 during this procedure.

- 1. Ensure that the cutting-unit-drive lever is in the DISENGAGE position, park the machine on a level surface, release the clutch bail, engage the service and parking brake, shut off the engine, and remove the spark plug wire from the spark plug; refer to the *Operator's Manual*.
- 2. Remove the cutting unit from the machine; refer to the Operator's Manual.
- 3. Remove the cotter pins and adjuster pins that secure the eye bolts to the lugs of the groomer gearbox and the idler plate.
- 4. Loosen the lock screws that secure the front roller to the height-of-cut arms.
- 5. Loosen the flange locknuts for the height-of-cut bolts that are located below the slot in the height-of-cut arms.
- 6. Remove the locknuts, height of cut washers, and plow bolts that secure the height-of-cut arms to the cutting unit side plates, and remove the arms from the cutting unit.
- 7. If needed, remove the height-of-cut bolts, 22 x 12 mm (7/8 x 7/16 inch) washers, spring washers, and flange locknuts from the groomer height of cut arms.
- 8. Clean all the components and inspect for wear or damage. Replace all the worn or damaged components.

IMPORTANT

If the cutting unit is equipped with an eyebolt and flange nut used to adjust the spring pretension for the height of groom adjuster, replace the flange nut with washers to eliminate premature hardware wear.

Assembling the Height Adjuster

- 1. If disassembled, assemble a 22 x 12 mm (7/8 x 7/16 inch) washer, spring washers, a second 22 x 12 mm (7/8 x 7/16 inch) washer, and flange locknut onto each height-of-cut bolts. Tighten the locknuts until the flange of the nut is aligned with the end of the threads toward the head of the bolt.
- 2. Apply anti-seize lubricant to the upper threads of the eye bolts and lower threads of the height-of-cut bolts.
- 3. Assemble an eye bolt to each of the height-of-cut arms with a washer 20.6 x 10.3 mm (0.813 x 0.406 inch), inner and outer springs, and washer 20.6 x 14.3 mm (0.813 x 0.563 inch) washer below the slot in the arms, and the quick up handle, quick up cover, and height adjuster knob above the slots.
- 4. If both the height-of-cut arms are removed, align 1 height-of-cut arm and height-of-cut bolt to the cutting unit side plate with the washer 22 x 12 mm (7/8 x 7/16 inch), spring washer, and second washer 22 x 12 mm (7/8 x 7/16 inch) above the slot in the side plate, and the flange locknut aligned below the slot.
- 5. Tighten the flange locknut until it contacts shoulder of the height-of-cut bolt.
- 6. Loosely assemble the height-of-cut arm to the side plate with the plow bolt, plow bolt, height of cut washer, and locknut. Do not tighten the flange locknut.
- 7. Loosely assemble the front roller shaft to the height-of-cut arm.
- 8. Assemble the other height of cut bracket to the front roller shaft. Assemble height-of-cut arm and height-of-cut bolt to the cutting unit side plate as described in 4.
- 9. Assemble the height-of-cut arm to the side plate with the plow bolt, plow bolt, height of cut washer, and locknut. Tighten the locknut finger tight.
- 10. Adjust the height-of-cut bolts so that the height-of-cut arm are the same.
- 11. Center the front roller between the height-of-cut arms, and tighten the lock screws in the height-of-cut arms.
- 12. Secure the eye bolts to the groomer gearbox and idler arm lugs with the adjuster pins and cotter pins.
- 13. Adjust the cutting unit height-of-cut; refer to Cutting Unit Operators Manual.
- 14. Ensure that both groomer quick up handles are in the OPERATING position.

Assembling the Height Adjuster (continued)



15. Adjust the groomer reel height; refer to *Universal Groomer Drive Kit Installation Instructions*.



16. Add or remove washers on the groomer eye bolts until the springs are compressed to **19 mm (0.75 inch)**.

The Grooming Brush (Optional)



The optional grooming brush attaches to the groomer in place of the groomer reel. The grooming brush is removed and installed from the groomer in the same manner as the groomer reel; refer to The Groomer Reel (page 9–19).

The grooming brush element or shaft can be serviced separately.

To remove the spiral grooming brush from the shaft, remove the locknut and J-bolt from both ends of the brush assembly and slide the brush from the shaft. When assembling the spiral brush to the shaft, make sure that the J-bolts are installed with the threaded portion on the outside of the brush and tighten the locknuts from **2.3 to 2.8 N·m (20 to 25 in-lb)**.



Count on it.