

Count on it.

Service Manual

# Greensmaster<sup>®</sup> eFlex 1800, 2100 and 2120

(Model 04042—Serial No. 312000001 and Up) (Model 04043—Serial No. 312000001 and Up) (Model 04046—Serial No. 400000000 and Up) (Model 04049—Serial No. 400000000 and Up)

## **Revision History**

Revision	Date	Description
A	2012	Initial issue.
В	2017	Added eFlex 2120.
С	01/2018	Added Revision History.
D	04/2018	Updated Cutting Unit chapter.
E	03/2019	Added Model 04049 and updated models 04042, 04043, and 04046 fitted with 04069.
F	07/2020	Updated Cutting Unit and Universal Groomer Chapters.

## **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 repairing assemblies and components on the Greensmaster eFlex 1800 (Model 04043), eFlex 2100 (Model 04042), eFlex 2120 (Models 04046 and 04049), eFlex 1800 (Model 04043 fitted with 04069), eFlex 2100 (Model 04042 fitted with 04069) and eFlex 2120 (Models 04046 and 04049 fitted with 04069).

Refer to the *Operator's Manuals* for operating, maintenance, and adjustment instructions. Space is provided in Chapter 2 (page 2–1) of this book to insert the *Operator's Manuals* and *Parts Catalogs* for your machine. Additional copies of the *Operator's Manuals* and *Parts Catalogs* are available on the internet at www.toro.com.

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

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.

## 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.

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## **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 2–7).



## **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.

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## Chapter 1

## Safety

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## **Safety Instructions**

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The Greensmaster eFlex 1800/2100, and 2120 machines have been 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.

## WARNING

The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.
- Only use the charger designed for the battery pack.

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## **Before Operating the Machine**

- Review and understand the contents of the Operator's Manuals and Operator's Training DVD before starting and operating the machine. Additional copies of the Operator's Manuals are available on the internet at www.toro.com.
- Do not allow children to operate the machine or allow adults to operate it without proper instructions.
- Become familiar with the controls and know how to stop the machine and electric motor quickly.
- Keep all the shields, safety devices, and decals in place. If a shield, safety device, or decal is malfunctioning, illegible, or damaged, repair or replace it before operating the machine.
- Always wear substantial shoes. Do not operate the 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, ear protection, and a hard hat is advisable and required by some local safety and insurance regulations.
- Ensure that the work area is clear of objects which might be picked up and thrown by the cutting unit.
- Keep everyone, especially children and pets, away from the areas of operation.
- The safety interlock switches are for the operator's protection; do not disconnect them. Check the operation of the switches daily to ensure that the interlock system is operating. If a switch is damaged, replace it before operating the machine. Refer to Testing the Electrical Components (page 5–39).

## While Operating the Machine

- 1. Always stand behind the handle when starting and operating the machine.
- 2. To begin the machine operation:
  - A. Ensure that the machine wire harness is connected to the battery pack.
  - B. Check that the control lever on the handle is in the NEUTRAL position for both traction and reel drives.
  - C. Turn the key switch to the START position until the InfoCenter display lights up, then release the switch to the RUN position.
- 3. Before leaving the operator's position of the mower:
  - A. Stop the machine on a level ground.
  - B. Disengage both the traction and reel drives with the control lever and set the parking brake.
  - C. Turn the key switch to the OFF position and wait for all the machine movement to stop.
- 4. Before you remove the basket of clippings, disengage the traction and reel drives, set the parking brake, turn the key switch to the OFF position and wait for the electric motor to stop. Wait for all the machine movement to stop before removing the basket.
- 5. If the cutting unit strikes a solid object or vibrates abnormally, stop the machine operation immediately. Disengage the traction/mow lever, turn the key switch to the OFF position, wait for all the machine movement to stop. Then, disconnect the battery pack (refer to Connecting the Lithium Battery Pack (page 1–6)) and inspect the cutting unit for damage. A damaged reel or bedknife must be repaired or replaced before operation is started.
- 6. Whenever the machine is left unattended, ensure that the electric motor is stopped, cutting unit reel is not spinning, and key switch is in the OFF position. Remove the key from the key switch.

## **Maintenance and Service**

- The Traction Unit Operator's Manuals, Cutting Unit Operator's Manuals, and Groomer Operator's Manuals provide 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 making any adjustments to the machine, set the parking brake, turn the key switch to the OFF position and wait for all the machine movement to stop. Remove the key from the key switch. Disconnect the battery pack (refer to Connecting the Lithium Battery Pack (page 1–6)) to prevent unintentional machine operation.
- Ensure that the machine is in safe operating condition by keeping all the nuts, bolts, screws, and belts tight.
- To reduce potential fire hazard, keep the battery pack, electrical connectors, cutting unit, and drive components free of unwanted material.
- Wear heavy gloves and use caution when checking or servicing the cutting unit.
- If the electric motor must be running to perform maintenance or make an adjustment, keep your hands, feet, clothing, and all parts of the body away from the cutting unit and all moving parts. Keep bystanders away.
- Before installing, removing, or working on the cutting unit, disconnect the battery pack (refer to Connecting the Lithium Battery Pack (page 1–6)) to prevent unintentional machine operation.
- Do not open or change the battery pack in any way. Opening the battery pack may expose you to dangerous electrical voltage. The warranty will be voided if you attempt to open the battery pack. With the exception of the battery pack fuse, fuse cover and labels, there are no consumer serviceable parts on or in the battery pack.
- If you must ship the battery pack from your eFlex machine, you will need special packaging to comply with shipping regulations. Refer to the *Operator's Manual* for additional battery shipping information.
- If major repairs are necessary, contact your Authorized Toro Distributor.
- At the time of manufacture, the machine conformed to all applicable safety standards. To ensure optimum performance and continued safety certification of the machine, use genuine Toro replacement parts and accessories. The replacement parts and accessories of other manufacturers can result in non-conformance with the safety standards and can void the warranty.

## **Connecting the Lithium Battery Pack**

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## WARNING

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The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.
- Only use the charger designed for the battery pack.

CAUTION

Before servicing the machine, disconnect the machine from the battery pack.

This will prevent unexpected machine operation.



To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 2). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or machine components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

## **Safety and Instructional Decals**

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

## Chapter 2



**Specifications and Maintenance** 

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## **Specifications**

## **Overall Dimensions**



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## **Traction and Reel Drive System**

Item	Description
Transmission	Permanent magnet DC motor directly coupled to first stage of a multi-ribbed poly-V belt drive
	Belt tension maintained by spring loaded idler pulley
Traction drive	Transmission to traction drive uses a multi-ribbed poly-V belt
	Belt tension maintained by spring loaded idler pulley
Differential	Spur gear planetary differential
Traction brake	Band style (at differential shaft drive)
Traction drum	Dual cast aluminum, 19 cm (7.5 inches) diameter with taper on outer 5.08 cm (2 inches)
Cutting unit drive	Transmission reel clutch shaft to telescoping driveshaft
	2 beam style couplers used in reel drive system
	Final reel drive has 3 pulleys with positive drive belt
	Pulley configuration allows 6 clip adjustments

## **Electrical System**

Item	Description
Power	Lithium-Ion battery pack – nominal 53 V 35 Ah (42 to 64 V, 1.68 kWh) with integrated battery management system utilizing CAN communication with the TEC and charger. Single battery affixed to unit and charged onboard.
Electric motor	Brushless permanent magnet DC motor – nominal 1.2 kW (~20 A continuous, 30 A peak) with integral motor controller and helical gear reduction.
Battery charger	Voltage and current controlled with CAN communication to manage storage wake-up and maintenance features. Complies to maximum voltage and current limits directed by the battery management system.

## **Chassis and Controls**

ltem	Description		
Transport wheel (optional) tire pressure	83 to 103 kPa (12 to 15 psi)		

## **Cutting Unit**



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Figure 4

**Reel construction:** 12.7 cm (5 inches) diameter, 11 or 14 carbon steel blades welded to 5 stamped steel spiders. High strength low alloy steel blades are through hardened and impact resistant.

**Frame construction:** Precision machined die cast aluminum crossmember with 2 bolt-on die-cast aluminum side plates.

**Height-of-cut:** Cutting height is adjusted on the front roller by 2 vertical screws and held by 2 locknuts. Standard bench height of cut range is 1.6 to 12.7 mm (0.062 to 0.500 inch) depending on type of bedknife installed. An optional high height of cut kit is available for higher HOC adjustments. Effective HOC may vary depending on turf conditions, type of bedknife, rollers, and attachments installed.

**Clip:** Clip frequency is adjusted by moving the pulleys on the cutting unit reel drive housing. 6 clip adjustments are possible based on pulley configuration.

**Rollers:** The rear roller is a 5.1 cm (2 inches) diameter aluminum full roller. The front roller is a 6.3 cm (2.5 inches) diameter roller that is chosen from a variety of configurations (narrow spaced Wiehle front roller is shown in Figure 4).

**Bedknife and bedbar:** Single edged Edgemax<sup>™</sup> bedknife (solid tool steel construction) used with 11 and 14 blade cutting unit. A cast iron bedbar is fastened to the cutting unit. Other optional bedknives and a less aggressive bedbar are available.

**Grass shield:** Non-adjustable shield with adjustable cut-off bar to improve grass discharge from reel in wet conditions.

**Counterbalance weight:** A cast iron weight mounted on right end of the cutting unit balances the cutting unit.

## **Cutting Unit (continued)**

## Approximate weight:

eFlex 1800 with 11 blade reel	31.3 kg (69 lb)
eFlex 1800 with 14 blade reel	32.2 kg (71 lb)
eFlex 2100/2120 with 11 blade reel	32.2 kg (71 lb)
eFlex 2100/2120 with 14 blade reel	33.1 kg (73 lb)

**Note:** Approximate weights listed do not include front roller or cutting unit options (e.g., roller scraper or groomer).

## **Belt Driven Groomer**



Figure 5

Mounting: The groomer is mounted to the cutting unit side plates.

**Grooming reel construction:** 6 cm (2.375 inches) diameter, 41 steel blades with 1/2 inch blade spacing. Blade spacing can be adjusted to 1/4 inch or 3/4 inch by altering the number and position of blade spacers on the groomer. Grooming reel is available with either steel or carbide tipped blades. The groomer brush can be installed in place of grooming reel.

**Groomer height setting:** From 0.8 to 15.7 mm (0.030 to 0.620 inch) at mowing HOC range of 1.5 to 19.1 mm (0.060 to 0.750 inch).

Width-of-groomer: 49.2 cm (19.380 inches).

**Height adjustment knob:** Allows a 0.08 mm (0.003 inch) increment of height adjustment for each click of the adjuster.

**Up-down feature:** Allows grooming reel to be raised above the height/depth adjustment for no grooming reel action while mowing.

**Groomer drive:** Both forward rotating and counter rotating groomer drive systems are available for the eFlex 1800 and 2100. The groomer drive assembly is attached to the right side of the cutting unit.

## **Universal Groomer (Optional)**

Item	Description
Grooming reel diameter	6 cm (2.375 inches)
	<b>Spring Steel:</b> 40 steel blades with 1/2 inch blade spacing.
Creamar blada tura	<b>Carbide:</b> 40 steel blades with 1/2 inch blade spacing.
Groomer blade type	Thin blade: 81 steel blades with 1/4 inch blade spacing.
	The groomer brush can be installed in place of grooming reel.
Groomer mounting	The groomer is mounted to the cutting unit side plates.
Groomer height setting	Mowing: 0.8 to 15.7 mm (0.030 to 0.620 inch).
	HOC range: 1.5 to 19.1 mm (0.060 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.
Groomer drive	The groomer drive assembly is attached to the right side of the cutting unit.

## **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., Loctite), degree of lubrication on the fastener, presence of a prevailing torque feature (e.g., Nylock nut), 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.

## **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 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger 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	147 + 22	15 ± 2	169 ± 23	23 ± 3	262 ± 34
# 6 - 40 UNF	IUIZ	13 I Z	141 1 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	40 + 2	20 + 5	220 + 56	42 ± 5	475 ± 56	60 ± 6	678 ± 68
# 10 - 32 UNF	10 1 2	30 I 3	338 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:** 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.

**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.

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

Thread Size	Class 8.8 Bolt Studs with Reg (Class 8 or S	s, Screws, and ular Height Nuts tronger 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:** 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.

**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.

## **Other Torque Specifications**

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

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 per Inch		Basalina Targua**	
	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 =  $N \cdot m$ 

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

## **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	
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 before 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 (Threadlocker)	
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 before 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.	
<b>Note:</b> 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, mouldings, 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 before 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 -51°F to 232°C (-60°F to 400°F), while high temperature variants can preform in temperatures up to 343°C (650°F).	

## **Special Tools**

You can order these special tools from your Toro Distributor. Some tools may also be available from a local tool supplier.

#### **Remote Starter Switch**

After flushing the hydraulic system or replacing a hydraulic component (e.g. gear pump, piston pump, drive motor), it is necessary to prime the hydraulic pumps. A remote starter switch can be used for this purpose. A remote starter switch can be purchased locally or fabricated as follows.

# IMPORTANT: When using a remote starter switch, it is highly recommended to include a 20 amp in-line fuse between the battery and switch connector for circuit protection.

A remote stater switch can also be constructed using Toro switch #106–2027, a length of 14 gauge wire, a 20 amp in-line fuse, two (2) alligator clips and necessary connectors. Connecting the wire to switch terminals 1 and 2 will allow the momentary switch contacts to be used for the remote starter switch.

**Note:** For information on using the remote starter switch to prime the hydraulic pumps.







Remote Starter Switch (fabricated)

#### 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.



#### **Battery Terminal Protector**

#### Toro Part No. 107-0392

Use this aerosol spray on the battery terminals, ring terminals, and fork terminals to reduce corrosion problems. Apply the terminal protector to the connection after you secure the battery cable, ring terminal, or fork terminal.



#### **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.

#### **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.

# 

#### **Reel Drive Shaft**

#### Toro Part No. TOR4112

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

#### 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





#### **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 has 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.



3.

Bedbar

- Bedknife
- 2. Angle Indicator

1.



- 1. Angle indicator surface
- Bedbar
  Angle indicator
- Magnetic mount
  Bedknife
- 3. Bedkn

#### Bedknife Screw Tool

#### Toro Part No. TOR510880

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)

Toro 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.



#### **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.



## **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.



## **Adapter Wrench**

#### Toro Part No. 137-0921

Use to hold the optional Universal Groomer drive shaft securely when removing or installing the drive adapter.



## Syringe – 50cc (2 ounce)

#### Toro Part No. 137-0872

Aids in accurately filling the optional Universal Groomer gear box with oil.






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The information In this chapter is intended to help troubleshoot machine operation issues. Keep in mind there can be more than one cause for a machine malfunction.

## 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

### **Solution Confirmation**

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

## **Electrical System: Troubleshooting**

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### CAUTION

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

For the 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 and Wire Harness Drawings/Diagrams in Appendix A (page A–1)—Foldout Drawings.

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

**Note:** Check the InfoCenter display for possible operator advisories or faults whenever diagnosing machine electrical problems.

## InfoCenter Does Not Start-Up

Possible Causes	Correction
The key switch was not rotated to the START position.	Turn the key switch to the START position and wait for the InfoCenter to start.
The lithium battery pack is disconnected from the machine wire harness.	Connect the battery pack to the machine wire harness.
The lithium battery pack is discharged.	Charge the battery pack.
Machine F1-1 (30 A) or F1-2 (3 A) fuse is damaged.	Check the fuses and replace if they are damaged.
The lithium battery pack fuse is damaged.	Check the battery pack fuse and replace the fuse if damaged.
The key switch is damaged.	Check the key switch and circuit wires. Repair as necessary.
The main contactor is damaged.	Check the main contactor and circuit wires. Repair as necessary.
The wire harness connections or wires are loose or damaged.	Check the electrical connections. Repair the wire harness as necessary.
The lithium battery pack is damaged (battery charger should be used to identify a battery pack fault).	Replace the battery pack.
The TEC is damaged.	Replace the TEC.

**Note:** The parking brake latch has to be released, the operator presence control has to be engaged and the speed control has to be above the zero speed position before the traction circuit will operate.

#### **Traction Circuit is Inoperative**

Possible Causes	Correction
The traction switch is not adjusted correctly or is damaged.	Use the InfoCenter Diagnostics screen to check the traction switch operation. Adjust or replace the traction switch if necessary.
The speed control potentiometer is damaged.	Use the InfoCenter Diagnostics screen to check the speed control potentiometer operation. Check and repair the speed control potentiometer and circuit wires if necessary.

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Possible Causes	Correction
The parking brake latch switch is not adjusted correctly or is damaged.	Use the InfoCenter Diagnostics screen to check the parking brake latch switch operation. Adjust or replace the parking brake latch switch if necessary.
The wire harness connections or wires are loose or damaged.	Check the electrical connections. Repair the wire harness as necessary.
A problem exists with the traction or reel drive system.	Refer to Chapter 4: Traction and Reel Drive System (page 4–1).
The electric motor is damaged. <b>Note:</b> Fault should be displayed on the InfoCenter if the electric motor is damaged.	Use the InfoCenter Faults and Diagnostics screens to check the reel circuit operation. Check the electric motor and circuit wires. Repair as necessary.

#### **Cutting Unit Circuit is Inoperative**

Possible Causes	Correction
The reel engage switch is not adjusted or is damaged.	Use the InfoCenter Diagnostics screen to check the reel engage switch operation. Adjust or replace the reel engage switch if necessary.
The wire harness connections or wires are loose or damaged.	Check the electrical connections. Repair the wiring as necessary.
The electric motor is damaged.	Check the electric motor and circuit wires.
<b>Note:</b> Fault should be displayed on the InfoCenter if the electric motor is damaged.	Trepair as necessary.

## Machine is Inoperative and InfoCenter Power Light Indicates That a Fault Has Occurred

Possible Causes	Correction
System fault has been detected by controller.	Use the Faults screen information in the InfoCenter section of this chapter to help identify source of problem.
An electrical fault occurred that can be reset by the controller.	Attempt to restart the machine to see if the machine operation has returned to normal. If the fault still remains, use the Faults screen information in the InfoCenter section of this chapter to help identify source of problem.

**Note:** The EZ turn switch has to be ON, the mow circuit has to be engaged, and the cutting unit needs to be raised before the EZ turn system will operate.

#### EZ Turn System is Not Working

Possible Causes	Correction
The EZ turn circuit wire harness connections or wires are loose or damaged.	Check the electrical connections. Repair the wiring as necessary.
The EZ turn switch on the control panel is damaged.	Use the InfoCenter Diagnostics screen to check the EZ turn switch operation. Replace the EZ turn switch if necessary.

Possible Causes	Correction
The EZ turn sensor on the cutting unit roll frame is not adjusted correctly or is damaged.	Use the InfoCenter Diagnostics screen to check the EZ turn sensor operation. Adjust or replace the EZ turn sensor if necessary; refer to the <i>Operator's Manual</i> for EZ turn sensor adjustment.
The cutting unit pitch arms are binding on the side plate bushings.	Clean the pitch arms and bushings.

### Machine Operates But InfoCenter Display is Not Working

Possible Causes	Correction
The wire harness connections or wires to the InfoCenter display are loose or damaged.	Check the electrical connections. Repair the wiring as necessary.
The InfoCenter display is damaged.	Replace the InfoCenter display.

## **Factors That Can Affect Quality of Cut**

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

Refer to the *Cutting Unit Operator's Manual* and the Adjustments (page 7–6) and Service and Repairs (page 7–8) for detailed adjustment and repair information.

Factor	Possible Problem/Correction
1. Reel bearing condition	Check and replace the reel bearings if necessary; refer to Cutting Unit Assembly (page 7–26).
2. 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.
	The most common cause of rifling is bedknife to reel contact that is too tight.
	A new bedknife must be ground or backlapped after installation to the bedbar.
3. 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.
	Slightly dull cutting edges may be corrected by backlapping; refer to Backlapping (page 7–8).
	Excessively dull cutting edges must be corrected by grinding the reel and bedknife; refer to Preparing the Reel for Grinding (page 7–36).
4. 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.
5. Proper bedknife for height-of-cut	If the bedknife is too thick for effective height-of-cut, poor quality of cut will result.
6. Stability of bedbar	Ensure that the bedbar pivot bolts are securely seated; refer to Bedbar Assembly (page 7–10).
7. Number of reel blades	Use correct number of blades for clip frequency and optimum height-of-cut range.
8. Rear roller level	Reel and rear roller should be parallel for proper cutting performance; refer to Leveling the Rear Roller (page 7–7).
9. Roller condition	Ensure that the rollers rotate freely. Repair the roller bearings if necessary; refer to Servicing the Roller (page 7–22).
10. Traction speed	The traction drive belt may be loose or worn. Check the condition of the traction belt. Replace the traction drive belt if necessary.
11. Groomer reel operation	Refer to Factors Affecting Grooming (page 3–7) and Grooming Reel Mechanical Problems (page 3–8).

## **Factors Affecting Grooming**

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

### 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
The grooming reel rotates when it is in the raised, transport position (forward rotating groomer drive).	The grooming reel should rotate whenever the cutting unit is engaged.	Normal operation.
No rotation of the grooming reel (forward rotating groomer drive).	Seized grooming reel or idler bearing(s) in groomer side plate(s).	Identify and replace damaged bearing(s).
	Broken or damaged drive belt idler spring.	Replace idler spring.
	The groomer drive belt is worn, broken or damaged.	If the belt slips, it probably is worn and must be replaced.
		Repair or replace belt if necessary. A broken or worn belt could be the result of improper belt routing or seized bearings in groomer assembly.
No rotation of the grooming reel (counter rotating groomer drive).	Handle on groomer cover is rotated rearward so that the groomer drive is disengaged.	Handle needs to be rotated toward the front of the machine to engage the groomer drive.
	Seized grooming reel or idler bearing(s) in groomer side plate(s).	Identify and replace damaged bearing(s).
	Broken or damaged drive idler spring.	Replace idler spring.
	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, level rear roller to reel, set height-of-cut, etc.).

## **Chapter 4**



**Traction and Reel Drive System** 

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# **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.

### **Connecting the Lithium Battery Pack**

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battery pack.

### WARNING

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The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.

CAUTION

Before servicing the machine, disconnect the machine from the

• Only use the charger designed for the battery pack.

This will prevent unexpected machine operation.



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Figure 10 eFlex 2120 Model 04046 (shown)

1. Machine connector2. Battery pack3. Battery connector

To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 10). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or vehicle components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

### Disengaging the Drum Drive from the Transmission

The traction drum is driven by a multi-ribbed belt that is tensioned with a spring loaded idler assembly. To disengage the traction drum drive from the transmission, do the following procedure:

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).



2. Locate the traction engage/disengage lever next to the right drive housing drum (Figure 11).



Be careful when rotating the traction engage/disengage lever. The lever is spring loaded and may cause personal injury.

Push the lever from the front when removing belt tension to prevent unexpected movement of the lever.

- 3. Rotate the traction engage/disengage lever toward the rear of the machine to the disengaged position to remove tension from the drum drive belt.
- 4. To engage the drum drive, rotate the traction engage/disengage lever to the engaged position by rotating the lever toward the front of the machine.
- 5. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

## **Transmission Belt Tensioner**

The transmission pulleys are driven by a multi-ribbed belt that is tensioned with a spring loaded idler assembly. If the transmission belt tension needs to be engaged or disengaged, do the following procedure:

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).



2. Locate the transmission engage/disengage shaft on the inside of the transmission next to the battery pack (Figure 12).

## **Transmission Belt Tensioner (continued)**

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### CAUTION

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Be careful when rotating the transmission engage/disengage lever. The lever is spring loaded and may cause personal injury.

- 3. To disengage the spring loaded idler from the transmission drive belt, use a 3/8 inch wrench to rotate the engage/disengage shaft 1/4 turn clockwise.
- 4. To engage the idler into the transmission drive belt, use a 3/8 inch wrench to rotate the engage/disengage shaft 1/4 turn counterclockwise. The transmission belt is properly tensioned when the alignment marks on the engage/disengage shaft and the transmission cover are aligned (Figure 13).
- 5. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# **Special Tools**

## Modified Socket for Reel Clutch Bearing Collar



The modified socket is used to remove and install the reel clutch bearing collar when servicing the transmission reel clutch shaft (Figure 14). Refer to Transmission Reel Drive System (page 4–43) for complete information on servicing the reel clutch shaft assembly.

### **Socket Modification**

1. Ensure that the socket (15 mm or 9/16 inch) to be modified fits over the reel clutch shaft bearing collar.



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Figure 15

2. Drill a hole or grind slots in the socket walls to allow a 5/32 inch pin to extend through the socket. A modified socket with ground slots is shown in Figure 15.

#### IMPORTANT

function of the second second

To prevent damage, avoid using excessive clamping pressure on the reel clutch shaft assembly.

- 1. Use flats on the reel drive hub to carefully secure the reel clutch shaft assembly in a vise. Use a vise with soft jaws to prevent damage to the clutch shaft assembly components (Figure 16).
- 2. Slide the modified socket over the bearing collar.
- 3. Align the modified socket so that the 5/32 inch pin can be inserted through the socket and hole in the bearing collar.
- 4. Use the modified socket and socket wrench to loosen or tighten the bearing collar.

## **Spline Insert Tool**



Toro Part No. TOR4112

Use a spline insert tool to remove or install the drive spline into the transmission driven pulley. Refer to Transmission Drive System (page 4–50) for complete information on servicing the transmission drive system.

# Adjustments

## Adjusting the Cutting Unit Clip

The cutting unit clip adjustment on the eFlex 1800/2100, and 2120 can be changed by installing the cutting unit drive pulleys to the appropriate locations on the reel drive assembly. The clip frequency pulley locations for 11 blade and 14 blade cutting units are shown in Figure 20.

To adjust the clip frequency, do the following procedure:

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the reel drive cover and reel drive belt from side of the cutting unit; refer to Reel Drive Belt (page 4–14).



3. Loosen the 2 set screws (item 1 in Figure 19) from the drive pulleys that are to be removed. Slide the pulleys from the shafts.

## Adjusting the Cutting Unit Clip (continued)



- 1. 22 tooth pulley is aluminum color
- 3. 25 tooth pulley is red color
- 2. 24 tooth pulley is black color

20).

 Apply anti-seize lubricant to the top of the woodruff keys. Arrange the pulleys on the reel drive assembly as necessary for desired clip frequency (Figure



- 5. Secure all the pulleys with the 2 set screws; torque the screws to **8.3 to 8.9 N·m (74 to 79 in-lb)**.
- 6. Install the reel drive belt and reel drive cover to the cutting unit; refer to Reel Drive Belt (page 4–14).
- 7. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

## Adjusting the Reel Clutch

To adjust the reel clutch, do the following procedure:

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4-3).



7. Jam nut

4. Gap location

1. 2.

3.

- 2. Remove the rubber plug from the front of the transmission to view the reel drive clutch components (Figure 21).
- 3. Release the clutch cable spring tension by removing the reel clutch cable from the casting slot of the transmission as follows:
  - A. Loosen the upper jam nut that secures the reel cable to the casting slot of the transmission.
  - B. Lift the cable free from the casting slot of the transmission.
- 4. Loosen the jam nut that secures the set screw position in the reel clutch lever (Figure 21).
- 5. Apply a light upward pressure against the reel clutch lever.

## Adjusting the Reel Clutch (continued)

1.

2.



- Back out the set screw in reel clutch lever until the reel clutch hub causes the tips of the reel drive hub teeth to contact the mating reel clutch pulley (Item 2 in Figure 22).
- 7. While maintaining light pressure on the reel clutch lever, rotate the set screw clockwise until a gap of 1.0 to 1.5 mm (0.040 to 0.060 inch) is attained between the reel drive hub and the reel clutch hub.
- 8. Tighten the jam nut to secure the adjustment. Ensure that the set screw does not rotate while tightening the jam nut.
- 9. Install the rubber plug into the front of the transmission.
- 10. Install the reel cable to the casting slot of the transmission and confirm that the cable spring length is properly set; refer to Replacing the Reel Clutch Cable (page 6–10).
- 11. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# **Service and Repairs**

1.

## **Reel Drive Belt**

The eFlex machines use a positive drive belt on the left side of the machine to operate the cutting unit.

### **Removing the Reel Drive Belt**

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).



2. Remove the reel drive cover to expose the reel drive belt (Figure 23).



- 3. Loosen the bearing housing mounting nut (Figure 24).
- 4. Use a 16 mm (5/8 inch) wrench, rotate the bearing housing to release tension on the reel drive belt (Figure 24).
- 5. Remove the reel drive belt from the pulleys.

1.

2.

### Installing the Reel Drive Belt

- 1. Ensure that the battery pack is disconnected; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Use a 16 mm (5/8 inch) wrench, rotate and hold the bearing housing to allow the reel drive belt installation (Figure 24).
- 3. Place a new drive belt onto the pulleys.
- 4. Release the bearing housing to apply tension to the reel drive belt. Ensure that the bearing housing rotates freely which allows accurate belt tension.
- 5. Rotate the reel drive at least 1 full turn to ensure that the drive belt is properly tensioned.
- 6. Tighten the bearing housing mounting nut (Figure 24).
- 7. Install the reel drive cover to the machine and secure the cover with the flange-head screw (Figure 23).
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

## **Reel Drive Assembly**



**Note:** The cutting unit clip adjustment on the eFlex 1800/2100, and 2120 is adjusted by installing the cutting unit drive pulleys (items 12, 18, and 19 in Figure 25) to the appropriate locations on the reel drive assembly; refer to Adjusting the Cutting Unit Clip (page 4–10).

#### **Removing the Reel Drive Assembly**

1.

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).



- 2. Slide the telescoping coupler off the cutting unit hex shaft (Figure 26).
- 3. Remove the reel drive belt; refer to Reel Drive Belt (page 4–14).
- 4. Loosen the 2 set screws (item 11 in Figure 25) that the secure the reel pulley (item 18 in Figure 25) to the reel driveshaft. Slide the pulley from the driveshaft. Locate and retrieve the woodruff key from the shaft.
- 5. Remove the washer-head screw (item 9 in Figure 25) that secures the reel drive housing to the cutting unit side plate.

**Note:** The 2 hex nuts (item 24 in Figure 25) have adhesive applied during cutting unit production. The nuts must remain in cutting unit side plate during the reel drive housing removal.

- 6. Remove the 2 flange-head screws (item 20 in Figure 25) that secure the reel drive housing to the cutting unit side plate.
- 7. Remove the reel drive assembly from the cutting unit.
- 8. Remove the components from the reel drive housing as necessary (Figure 25).
- 9. If the idler shaft ball bearings (item 8 in Figure 25) are to be removed, use a press to remove the bearings and the bearing spacer from the shaft. Discard the bearings after removal.

**Note:** Refer to Reel Drive Bearing Housing (page 4–19) for disassembly and assembly information of bearing housing assembly (item 2 in Figure 25).

**Note:** The reel pulleys (items 12, 18, and 19 in Figure 25) can be identified by color and number of teeth. The location of pulley can vary based on desired cutting unit clip frequency; refer to Adjusting the Cutting Unit Clip (page 4–10).

### Installing the Reel Drive Assembly

- 1. Install all the components that were removed to the reel drive housing (Figure 25). If the ball bearings (item 8 in Figure 25) were removed from the idler shaft, use a press to install new bearings and the bearing spacer onto the shaft.
- 2. Apply a light coating of grease on the reel drive housing O-rings (items 4 and 23 in Figure 25).
- 3. Position the reel drive assembly to the cutting unit. Ensure that the spring pin (item 26 in Figure 25) and compression spring are positioned between the reel drive housing and the bearing housing assembly.
- 4. Secure the reel drive assembly with the 2 flange-head screws (item 20 in Figure 25) and washer-head screw.
- 5. Install the woodruff key to the reel driveshaft (item 21 in Figure 25). Apply anti-seize lubricant at the top of the key.



- Slide the reel pulley (item 18 in Figure 25) onto the reel driveshaft until it contacts the shoulder on the shaft. Secure the reel pulley with the 2 set screws; torque the set screws to 8.3 to 8.9 N·m (74 to 79 in-lb).
- 7. Install the reel drive belt; refer to Reel Drive Belt (page 4–14). Ensure that the reel drive cover is secured to the housing after the belt installation.
- 8. Slide the telescoping coupler onto the cutting unit hex shaft (Figure 26).
- 9. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

## **Reel Drive Bearing Housing**



### **Disassembling the Reel Drive Bearing Housing**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the reel drive bearing housing from the reel drive housing; refer to Reel Drive Assembly (page 4–16).
- 3. Remove the retaining ring (item 10 in Figure 27) from the bearing housing.
- 4. Slide the reel input shaft assembly from the bearing housing. Remove the wave washer (item 7 in Figure 27) from the bearing housing.

### IMPORTANT

When removing the flex coupler (item 15 in Figure 27) from the reel input shaft, do not damage the outer surface of the coupler (e.g., grasping with pliers or mounting in a vise) as coupler may be damaged and fail prematurely.

- 5. Support the flex coupler to prevent it from being damaged during the spring pin removal. Push the spring pin from the flex coupler and reel input shaft. Slide the coupler from the shaft and discard the spring pin.
- 6. Remove the retaining ring (item 14 in Figure 27) from the shaft. Then remove the flat washer, wave spring, and flocked bearing shield from the shaft. For assembly purposes, note the orientation of the flocked bearing shield.
- 7. Press the bearings and bearing spacer from the shaft if necessary. Discard the bearings if removed.
- 8. Clean all the bearing housing components.

### Assembling the Reel Drive Bearing Housing

- 1. If the bearings were removed from the reel input shaft, install new bearings onto the shaft. Press first bearing fully onto the shaft. Position a spacer on the shaft and then press second bearing onto the shaft.
- 2. Install the flocked bearing shield, wave spring, and flat washer onto the reel input shaft. Secure the components to the shaft with the retaining ring (item 14 in Figure 27). If necessary, drive the retaining ring onto the input shaft with a tubular tool and mallet. Ensure that the retaining ring is fully seated into the shaft groove after installation.
- 3. Place the wave washer (item 7 in Figure 27) into the bearing housing.
- 4. Fill the cavity between the bearings with high temperature Mobil XHP-222 grease (or equivalent).
- 5. Install the reel input shaft assembly into the bearing housing and secure the shaft assembly with the retaining ring (item 10 in Figure 27).

#### IMPORTANT

When installing the flex coupler (item 15 in Figure 27) onto the reel input shaft, do not damage the outer surface of the coupler (e.g., grasping with pliers or mounting in a vise) as coupler may be damaged and fail prematurely.

- 6. Slide the flex coupler onto the reel input shaft, support the coupler to prevent it from being damaged during the spring pin installation. Install new spring pin into the coupler to secure it to the shaft.
- 7. Install the reel drive bearing housing to the reel drive housing; refer to Reel Drive Assembly (page 4–16).
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

## **Drum Drive Belt**



The drum drive system on the eFlex 1800/2100, and 2120 machines uses a multi-ribbed poly-V drive belt on the right side of the traction drum.

#### **Removing the Drum Drive Belt**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. If installed, remove the transport wheels; refer to Transport Wheels (Optional) (page 6–21).
- 3. If installed, remove the rail kit wheels; refer to Rail Kit Wheels (Optional) (page 6–24).

### **Removing the Drum Drive Belt (continued)**

- 4. Rotate the traction engage/disengage lever to the disengaged position to remove tension from the drum drive belt; refer to Disengaging the Drum Drive from the Transmission (page 4–4).
- 5. Remove the 7 washer-head screws (item 1 in Figure 28) that secure the drum drive cover, and remove the cover to expose the drum drive system.
- 6. Remove and discard the gasket (item 17 in Figure 28) from the cover and housing.
- 7. Remove the retaining ring (item 3 in Figure 28) that secures the brake band to the brake clevis pin. Slide the brake band from the brake clevis and brake mount pins, and remove the band from the drum drive housing.
- 8. Carefully remove 1 end of the extension spring (item 4 in Figure 28) from anchor point and rotate the spring away from the drive belt.



- 9. Pivot the idler pulley away from the drum drive belt to loosen the belt tension (Figure 29).
- 10. Remove the drum drive belt from the drive pulley and then from the differential pulley.

### Installing the Drum Drive Belt

- 1. Ensure that the battery pack is disconnected; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Place the drum drive belt onto the differential pulley and then fit the belt to the drive pulley. Ensure that the belt is on the rear side of the idler pulley.
- 3. Carefully install removed end of the extension spring (item 4 in Figure 28) to the anchor point.
- 4. Install the brake band over brake surface of the differential pulley. Slide the ends of the brake band onto the brake clevis and brake mount pins. Secure the brake band to the brake clevis pin with the retaining ring (item 3 in Figure 28).

### Installing the Drum Drive Belt (continued)

- 5. Ensure that the wave washer (item 2 in Figure 28) is pressed into the bore of the drum drive cover.
- 6. Position new gasket (item 17 in Figure 28) to the housing surface.
- 7. Slide the drum drive cover onto the drum drive assembly.
- 8. Install the 7 washer-head screws (item 1 in Figure 28) to secure the cover to the housing. Tighten the screws as follows:



- A. First, use an alternating crossing pattern, torque all the screws to **1.7 to 4.5 N·m (15 to 40 in-lb)**.
- B. Again use an alternating crossing pattern, torque all the screws to 9.6 to 10.7 N·m (85 to 95 in-lb).



 1. Traction lever (engaged)
 2. Right handle clamp

- 9. Rotate the traction engage/disengage lever to the engaged position to tension the drum drive belt (Figure 30).
- 10. Install the rail kit wheels if they were attached; refer to Rail Kit Wheels (Optional) (page 6–24).
- 11. Install the transport wheels if they were attached; refer to Transport Wheels (Optional) (page 6–21).
- 12. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

### **Drum Drive Idler Assembly**



### **Removing the Drum Drive Idler Assembly**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. If installed, remove the transport wheels; refer to Transport Wheels (Optional) (page 6–21).
- 3. If installed, remove the rail kit wheels; refer to Rail Kit Wheels (Optional) (page 6–24).
- 4. Rotate the traction engage/disengage lever to the disengaged position to remove tension from the drum drive belt; refer to Disengaging the Drum Drive from the Transmission (page 4–4).

### Removing the Drum Drive Idler Assembly (continued)

- 5. Remove the 7 washer-head screws (item 1 in Figure 31) that secure the drum drive cover, and remove the cover to expose the drum drive system.
- 6. Remove and discard the gasket (item 17 in Figure 31) from the cover and housing.
- 7. Carefully remove the end of the extension spring (item 4 in Figure 31) from the idler arm.
- 8. Remove the shoulder screw (item 10 in Figure 31) that secures the idler arm assembly to the drum drive housing, and remove the idler arm assembly from the housing.



- 9. Disassemble the idler arm assembly as necessary (Figure 32). Replace the bearings and bushings that are worn or damaged.
  - A. Remove the flange bushings from the idler bracket.
  - B. Remove the retaining ring from the idler bracket. Slide the idler pulley from the bracket shaft. Press the ball bearings from the idler pulley.

### Installing the Drum Drive Idler Assembly

- 1. If the idler arm assembly was disassembled (Figure 32), do the following steps:
  - A. Press new flange bushings into the idler bracket.
  - B. Press new ball bearings fully into the idler pulley and ensure to apply pressure to the outer bearing race only. Slide the pulley assembly onto the idler bracket and secure with a retaining ring.



- Position the idler arm assembly to the drum drive housing and secure with a shoulder screw (item 10 in Figure 31). Torque the shoulder screw to 21 to 23 N·m (15 to 17 ft-lb). Check that the idler arm assembly can pivot freely after you tighten the shoulder screw.
- 3. Carefully secure the end of the extension spring (item 4 in Figure 31) to the idler arm.
- 4. Ensure that the wave washer (item 2 in Figure 31) is pressed into the bore of the drum drive cover.
- 5. Position new gasket (item 17 in Figure 31) to the housing surface.

### Installing the Drum Drive Idler Assembly (continued)

- 6. Slide the drum drive cover onto the drum drive assembly.
- 7. Install the 7 washer-head screws to secure the cover to the housing. Tighten the screws as follows:



- A. First, use an alternating crossing pattern, torque all the screws to **1.7 to 4.5 N·m (15 to 40 in-lb)**.
- B. Again use an alternating crossing pattern, torque all the screws to **9.6 to 10.7 N·m (85 to 95 in-lb)**.
- 8. Rotate the traction engage/disengage lever to the engaged position to tension the drum drive belt; refer to Disengaging the Drum Drive from the Transmission (page 4–4).
- 9. Install the rail kit wheels if they were attached; refer to Rail Kit Wheels (Optional) (page 6–24).
- 10. Install the transport wheels if they were attached; refer to Transport Wheels (Optional) (page 6–21).
- 11. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

## **Traction Drums**



#### **Removing the Traction Drum**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. If installed, remove the transport wheels; refer to Transport Wheels (Optional) (page 6–21).

### **Removing the Traction Drum (continued)**

- 3. If installed, remove the rail kit wheels; refer to Rail Kit Wheels (Optional) (page 6-24).
- 4. Remove the handle assembly from the machine; refer to Handle Assembly (page 6-4).
- 5. Support both sides of the machine frame with the jack stands or suitable blocking to prevent the machine from moving.



Counterweight 4.

1. 2.

- Flange-head screw (3 each) 5.
- Hardened washer (4 each) 6.
- Flange nut 10.
- 11. Rear frame
- 6. Separate the left side plate from the machine (Figure 34) as follows:
  - A. Remove the flange nut, hardened washer, and carriage screw (items 10, 6, and 8 in Figure 34) that secure the left side plate to the rear frame.
  - B. Remove the 3 flange-head screws and 3 hardened washers (items 5 and 6 in Figure 34) that secure the left side plate to the frame.
  - C. Slide the left side plate from supporting bearing and remove from the machine.
- 7. Insert a bar stock or other suitable tool through the spokes of the left traction drum to keep the drum from turning.
- 8. While retaining the left drum, loosen and remove the bearing nut (item 26 in Figure 33) from the traction drum assembly. The ball bearing is pressed onto the bearing nut so it can be removed with the nut.
- 9. Slide the left traction drum (item 27 in Figure 33) from the drum shaft. Locate and retrieve the square key from the shaft.
- 10. If necessary, carefully remove the grease seal (item 28 in Figure 33) from the left traction drum, ensure that you do not damage the bore of the drum. Discard the seal that was removed.
### **Removing the Traction Drum (continued)**

- 11. If necessary, remove the left hex shaft (item 25 in Figure 33) and ball bearing from the bearing nut.
- 12. Insert a bar stock or other suitable tool through the spokes of the right traction drum to keep the drum from turning.
- 13. Remove the O-ring (item 20 in Figure 33), pin, and lock collar from the drum shaft.
- 14. While retaining remaining drum, loosen and remove the jam nut (item 29 in Figure 33) from the long spur gear.
- 15. Remove the right traction drum (item 30 in Figure 33) from the machine. Locate and retrieve the square key from the spur gear.

**Note:** If removal of the drum shaft, long spur gear, or differential assembly (items 2, 23, or 1 in Figure 33) is necessary, refer to Differential Assembly (page 4–31).

### Installing the Traction Drum

1. Ensure that the drum shaft (item 2 in Figure 33), long spur gear, and differential assembly are installed to the drum drive housing; refer to Differential Assembly (page 4–31).



- Install the left hex shaft (item 25 in Figure 33) and ball bearing to the bearing nut if they were removed. Press the bearing fully onto the bearing nut. Torque the hex shaft to 95 to 108 N⋅m (70 to 80 ft-lb).
- 3. Place the square key (item 3 in Figure 33) into the slot of the long spur gear. Apply anti-seize lubricant to the top surface of the key.
- 4. Align the slot in the right traction drum (item 30 in Figure 33) with the key on the long spur gear and slide the traction drum onto the gear.
- 5. Insert a bar stock or other suitable tool through the spokes of the right traction drum to keep the drum from turning.



- Install the jam nut (item 29 in Figure 33) onto the threads of the long spur gear to secure the right traction drum; torque the jam nut to 190 to 216 N·m (140 to 160 ft-lb).
- 7. Slide the lock collar (item 21 in Figure 33) onto the drum shaft. Align the holes in the collar and shaft and then install the pin. Fit the O-ring to the slot in the collar.

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1.



- 8. If a grease seal (item 28 in Figure 33) was removed from the left traction drum, install a new grease seal into the drum. Ensure that the seal lip is orientated toward the center of the drum. Press the seal into the drum bore so that the seal is recessed from 12.0 to 13.4 mm (0.470 to 0.530 inch) from edge of the drum (Figure 35).
- 9. Place the square key into the slot of the drum shaft. Apply anti-seize lubricant to the top surface of the key.
- 10. Align the slot in the left traction drum with the key on the drum shaft and carefully slide the traction drum onto the shaft, ensure that you do not damage the grease seal in the drum.
- 11. Insert a bar stock or other suitable tool through the spokes of the left traction drum to keep the drum from turning.



- 12. Ensure that the ball bearing (item 19 in Figure 33) is pressed onto the bearing nut. While retaining the left drum, secure the drum to the traction drum assembly with a bearing nut. Torque the bearing nut to 102 to 122 N·m (75 to 90 ft-lb).
- 13. Secure the left side plate to the machine (Figure 34) as follows:
  - A. Slide the left side plate onto the supporting bearing.
  - B. Secure the left side plate to the frame with the 3 flange-head screws and 3 hardened washers.
  - C. Secure the left side plate to the rear frame with the carriage screw, hardened washer, and flange nut.
- 14. Install the handle assembly to the machine; refer to Handle Assembly (page 6-4). Ensure that all the cable adjustments are correct.
- 15. Install the rail kit wheels if they were attached; refer to Rail Kit Wheels (Optional) (page 6-24).
- 16. Install the transport wheels if they were attached; refer to Transport Wheels (Optional) (page 6–21).
- 17. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4-3).

# **Differential Assembly**



### **Removing the Differential Assembly**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the traction drums from the machine; refer to Traction Drums (page 4–27).



- 1. Spur gear assembly2. Drum drive housing
- 3. Slide the spur gear assembly from the differential assembly in the drum drive housing (Figure 37).



- 4. If necessary, disassemble the spur gear assembly (Figure 38).
  - A. The hex shaft has left-hand threads. The shaft also has thread-locking compound on threads.
  - B. Press the ball bearing and flange bushing from the spur gear as necessary.

### **IMPORTANT**

As the drum shaft (item 2 in Figure 36) and differential assembly are removed, ensure to retrieve and note the location of the thrust washer for assembly purposes.

- 5. Push the drum shaft out of the differential assembly. Ensure to locate and retrieve the thrust washer.
- 6. Slide the differential assembly from the long spur gear and drum drive housing.

**Note:** For differential service procedure, refer to Servicing the Differential Assembly (page 4–34).

- 7. If necessary, slide the long spur gear from the drum drive housing. Inspect the straight bushings (item 5 in Figure 36) in the long spur gear for wear or damage, and replace the bushings if necessary.
- 8. The ball bearing that supports the long spur gear is pressed into the drum drive housing. Ensure that the bearing is in good condition and is pressed fully to the shoulder of the housing.

### Installing the Differential Assembly

- 1. If the long spur gear (item 23 in Figure 36) was removed from the drum drive housing, slide the gear into the ball bearing in the drive housing.
- If the spur gear assembly was disassembled, assemble as necessary (Figure 38):
  - A. Press a new ball bearing fully onto the spur gear if removed.
  - B. Press a new flange bushing into the spur gear if removed.



- C. If the hex shaft was removed from the spur gear, apply Loctite #242 (or equivalent) to the threads of the hex shaft. Install the hex shaft (left-hand threads) into the spur gear; torque the hex shaft to 95 to 108 N⋅m (70 to 80 ft-lb).
- 3. Ensure that the differential housing cavity is packed 20% to 30% full of high temperature Mobil XHP-222 grease (or equivalent). Slide the differential assembly into the drum drive housing and onto the long spur gear. Ensure that the spur gear properly engages the differential gears.
- 4. Place the thrust washer (item 4 in Figure 36) onto the drum shaft. Insert the drum shaft into the differential assembly. Ensure that the drum shaft properly engages the differential gears.
- 5. Install the traction drums to the machine; refer to Traction Drums (page 4–27).
- Install the drum drive belt to the machine; refer to Drum Drive Belt (page 4–21).
- Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# Servicing the Differential Assembly



### **Disassembling the Differential Assembly**

1. Remove the differential assembly from the machine; refer to Removing the Differential Assembly (page 4–32).



- 2. Remove the 6 socket-head screws that secure the cover to the housing. For assembly purposes, note the alignment of the index marks on the housing and cover (Figure 40).
- 3. Place the differential assembly on workbench so that the differential is resting on the cover with the housing orientated up.



- 4. Lift the housing from the differential assembly leaving the internal components positioned on the cover. For assembly purposes, note that the index mark on the housing is aligned with a pin that has 1 gear (Figure 41).
- For assembly purposes, note the locations of the projections on the inside of the cover. The projections need to be aligned with the pins that have 1 gear (Figure 42).
- 6. Slide each pin with gears and spacers from cover. Note the location of the gears and spacers on each of the 6 pins.

### **Disassembling the Differential Assembly (continued)**

7. If necessary, remove the ball bearings from the cover and housing. There are 2 holes in the cover and housing that allow use of a pin punch to remove the bearings. Discard the bearings that were removed.

### **Inspecting the Differential Assembly**

- 1. Clean all the differential components.
- 2. Inspect all the differential gears carefully looking for chipped teeth, wear, or other damage. Because gear tooth damage is rarely isolated to 1 gear, replace the gears as a complete set if there is internal damage.
- 3. Inspect the gear pins (item 5 in Figure 39) for scoring or wear.
- 4. Replace all the differential assembly components that are worn or damaged.

### Assembling the Differential Assembly

- 1. If the ball bearing was removed from either cover or housing, press new ball bearing into the bearing bore. Ensure that the bearing is fully pressed to the shoulder of the bore.
- 2. Place the cover (with the bearing installed) on the workbench.



- 3. Slide each pin with gears and spacers into the cover. Ensure that the projections on inside of the cover are aligned with the pins that have 1 gear (Figure 42).
- 4. Position the housing onto the assembly and ensure that the pin with 1 gear is positioned next to the index mark on the housing (Figure 41). Also, align the index marks on the housing and cover during assembly (Figure 40).
- 5. After the housing is installed, use 1 of the spur gears (refer to Differential Assembly (page 4–31)) to rotate the differential gears and ensure that they rotate freely without binding. If there is any binding, identify and correct the cause before securing the cover.



- 6. Secure the cover to the housing with the 6 socket-head screws; torque the screws to **11.2 to 13.6 N·m (99 to 121 in-lb)**.
- 7. Pack the differential housing cavity 20% to 30% full of high temperature Mobil XHP-222 grease (or equivalent).

### Assembling the Differential Assembly (continued)

8. Install the differential assembly to the machine; refer to Differential Assembly (page 4–31).

# **Transmission Drive Belt**



The transmission removal from the machine is not necessary to service the transmission drive belt. The transmission drive belt can be replaced by removing the battery pack from the frame, removing the transmission cover, and removing the drive belt.

### **Removing the Transmission Drive Belt**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the battery pack from the machine; refer to Removing the Lithium Battery Pack (page 5–74).
- 3. Use the tips of needle nose pliers to spread the ends of the driveshaft wire (item 6 in Figure 43) in the telescoping coupler. With the wire ends spread, slide the coupler from the transmission shaft.

### IMPORTANT

During disassembly, ensure that tension is released from the transmission belt before removing the transmission cover.

- 4. Rotate the engage/disengage shaft clockwise to remove tension on the transmission belt; refer to Transmission Belt Tensioner (page 4–5).
- 5. Remove the 7 washer-head screws (item 3 in Figure 43) that secure the transmission cover to the transmission. Carefully remove the cover from the transmission. Remove and discard the gasket.
- 6. Ensure that the wave washers (item 2 in Figure 43) remain in the bearing bores of the transmission cover.



- 7. For assembly purposes, note the transmission belt routing (Figure 44).
- 8. Remove the transmission belt from the drive and idler pulleys in the transmission.
- 9. Check the condition of all the pulleys and idler components.
- 10. Clean the inside of the transmission before installing new belt.

### IMPORTANT

During assembly, ensure that the transmission cover is installed with fasteners properly torqued before applying tension to the transmission belt.

- 1. Install new transmission belt onto the pulleys in the transmission. Ensure that the belt is correctly routed around the drive and idler pulleys (Figure 44).
- 2. Ensure that the wave washers (item 2 in Figure 43) are pressed into the bearing bores of the transmission cover. Also, ensure that the 2 dowel pins are pressed into the bores in the transmission housing.
- 3. Position a new gasket to the transmission assembly. Align the gasket to the 2 dowel pins in the transmission housing.



- 4. Install the transmission cover. If necessary, use a rubber mallet at the dowel locations (Figure 45) to seat cover to the transmission.
- 5. Install the 7 washer-head screws to secure the cover to the transmission. Tighten the screws as follows:



1.

A. First, use an alternating crossing pattern, torque all the screws to **1.7 to 4.5 N·m (15 to 40 in-lb)**.

- B. Again use an alternating crossing pattern, torque all the screws to **9.6 to 10.7 N·m (85 to 95 in-lb)**.
- 6. Rotate the engage/disengage shaft counterclockwise to apply tension to the transmission belt; refer to Transmission Belt Tensioner (page 4–5).
- 7. Slide the telescoping coupler onto the transmission shaft so that the driveshaft wire engages the hex shaft on the transmission. Ensure that the telescoping coupler is properly attached to the cutting unit hex shaft.
- 8. Install the battery pack to the machine; refer to Installing the Lithium Battery Pack (page 5–77).
- 9. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# **Transmission Idler System**



The transmission removal from the machine is not necessary to service the transmission idler system. The transmission idler components can be accessed by removing the battery pack from the frame, removing the transmission cover, and removing the drive belt.

### **Disassembling the Transmission Idler System**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the transmission drive belt; refer to Removing the Transmission Drive Belt (page 4–39).
- 3. Disassemble the idler system as necessary (Figure 46). Discard the ball bearings if they are removed from the idler pulleys.
- 4. Check the bushings (items 2 and 6 in Figure 46) for wear or damage. Replace the bushings if necessary. The bushings for engage/disengage shaft are pressed into the transmission housing and cover.

### Assembling the Transmission Idler System

- 1. Assemble the idler system as necessary (Figure 46). The ball bearings that support the idler pulleys are pressed into the pulleys.
  - A. If the bearings were removed from the idler pulleys, press new bearings fully to the shoulder of the idler pulleys.



B. If the extension spring was removed, ensure that the ends of the spring are orientated as shown in Figure 47.



1.

2.

3.

- C. If the main drive idler (item 13 in Figure 46) was removed, secure the idler to the transmission housing with the shoulder screw; torque the shoulder screw to **21 to 23 N·m (15 to 17 ft-lb)**.
- D. After securing the idler components to the transmission housing, ensure that all the idler pulleys rotate smoothly.
- 2. Install the transmission drive belt and all the machine components removed for the idler system service; refer to Transmission Drive Belt (page 4–38).
- 3. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# **Transmission Reel Drive System**



The transmission removal from the machine is not necessary to service the transmission reel drive system. The transmission reel drive components can be accessed by removing the battery pack from the frame, removing the transmission cover, and removing the drive belt.

### Removing the Reel Clutch Shaft (bearing not seized)

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Disconnect the reel clutch cable from the transmission; refer to Replacing the Reel Clutch Cable (page 6–10).

### Removing the Reel Clutch Shaft (bearing not seized) (continued)

- Remove the transmission drive belt; refer to Transmission Drive Belt (page 4–38).
- 4. Remove the retaining ring (item 28 in Figure 48) that secures the reel clutch lever in the transmission housing. Slide the reel clutch lever from the housing. Note the missing tooth in spline area of the lever which is used for alignment with the reel clutch fork (item 3 in Figure 48).
- 5. Pull the reel clutch shaft assembly from the transmission housing.

**Note:** If the ball bearing (item 24 in Figure 48) on the reel clutch shaft assembly is seized in the housing, refer to Removing the Reel Clutch Shaft (seized bearing condition) (page 4–48) for removal procedure.



Inspect the flange bushings and reel brake ring for wear or damage (Figure 49). Replace the bushings and brake ring if necessary.

### **Disassembling the Reel Clutch Shaft**

1.

2.

**Note:** The following procedure covers complete disassembly of the reel clutch shaft assembly. Depending on service needs of the machine, it may not be necessary to perform every step of this procedure.

### **IMPORTANT**

When removing the flex coupler (item 10 in Figure 48) from the clutch shaft, do not damage the outer surface of the coupler (e.g., grasping with pliers or mounting in vise) as coupler may be damaged and fail prematurely.

 Support the flex coupler to prevent it from being damaged during the spring pin removal. Push the spring pin from the flex coupler and bearing collar (item 15 in Figure 48). Slide the coupler with hex shaft from the collar. Discard the spring pin that was removed.

### **Disassembling the Reel Clutch Shaft (continued)**

- 2. Press the ball bearing (item 24 in Figure 48) from the end of the reel clutch shaft. Discard the bearing that was removed.
- 3. Carefully remove the retaining ring (item 23 in Figure 48) that secures the reel brake disc to the reel drive hub.

**Note:** Do not damage the brake disc friction material when removing the retaining ring.

- 4. Remove the reel brake disc from the reel drive hub, note the orientation of the disc for assembly purposes. The friction material side of the disc needs to be positioned toward the reel brake ring (item 2 in Figure 48) which is pressed into the transmission housing.
- 5. Slide the reel clutch hub (item 20 in Figure 48) and reel clutch fork assembly from the reel drive hub. For assembly purposes, note the correct orientation of the indicator mark on the fork. If necessary, remove the pivot pins and separate the fork from the hub.



- 2. Reel clutch shaft 3. Bearing collar
- Flocked bearing seal 5. Wave spring
- Retaining ring 8.
- 6. Use a modified socket (refer to Special Tools (page 4-7)) to remove the bearing collar assembly from the clutch shaft (Figure 50).

6.

### IMPORTANT

### To prevent damage, avoid using excessive clamping pressure on the reel clutch shaft assembly.

- A. Use the flats on the reel drive hub to carefully secure the reel clutch shaft assembly in a vise. Use a vise with soft jaws to prevent damage to the clutch shaft assembly components.
- B. Slide the modified socket over the bearing collar. Align the modified socket so that the 5/32 inch pin can be inserted through the socket and hole in the bearing collar.
- C. Use a modified socket and socket wrench to remove the bearing collar assembly from the clutch shaft.
- 7. Remove the retaining ring (item 9 in Figure 48), flat washer, wave spring, and flocked bearing shield from the bearing collar. For assembly purposes, note the orientation of the flocked bearing shield.
- 8. Press the ball bearing (item 7 in Figure 48) from the bearing collar. Discard the bearing that was removed.
- Slide the reel clutch pulley assembly and reel drive hub from the clutch shaft.

### **Disassembling the Reel Clutch Shaft (continued)**

10. If necessary, remove the ball bearings and spacer from the pulley. Discard the bearings that were removed.

### Assembling the Reel Clutch Shaft

- 1. If the ball bearings were removed from the reel clutch pulley, press new inner bearing fully to the bottom of the bore in the pulley. Install a spacer into the pulley and then press new outer bearing into the pulley until it contacts the spacer.
- 2. If the bearing was removed from the bearing collar, press the new bearing fully onto the collar.
- 3. Slide the reel clutch pulley assembly and reel drive hub onto the clutch shaft.
- 4. Use a modified socket (refer to Special Tools (page 4–7)) to install the bearing collar assembly onto the clutch shaft (Figure 50).

### **IMPORTANT**

To prevent damage, avoid using excessive clamping pressure on the reel clutch shaft assembly.

A. Use the flats on the reel drive hub to carefully secure the reel clutch shaft assembly in a vise. Use a vise with soft jaws to prevent damage to the clutch shaft assembly components.



- B. Use a modified socket, 5/32 inch pin and socket wrench to install the bearing collar assembly to the clutch shaft. Torque the bearing collar to **32 to 36 N·m (23 to 27 ft-lb)**.
- 5. Install the flocked bearing shield (item 14 in Figure 48) (flocked side orientated toward bearing location), wave spring, flat washer, and retaining ring onto the bearing collar.
- 6. If the reel clutch fork (item 3 in Figure 48) was separated from the reel clutch hub, the clutch pivot pins must be replaced (new pins have patch lock on threads) or have Loctite #242 (or equivalent) applied to the threads before installation. Secure the fork to the clutch hub with the 2 pivot pins.
- 7. Slide the reel clutch hub and reel clutch fork assembly onto the reel drive hub (item 19 in Figure 48). Ensure that the indicator mark on the fork is toward the rear of the transmission.
- 8. Install the reel brake disc (item 22 in Figure 48) onto the reel drive hub. The friction material side of the disc needs to be positioned toward the reel brake ring which is pressed into the transmission housing.
- 9. Carefully secure the reel brake disc to the reel drive hub with a retaining ring (item 23 in Figure 48).

**Note:** Do not damage the brake disc friction material when installing the retaining ring.

10. Press a new ball bearing (item 24 in Figure 48) fully to the shoulder of the reel clutch shaft.

### **IMPORTANT**

When installing the flex coupler (item 10 in Figure 48) onto the shaft, do not damage the outer surface of the coupler (e.g., grasping with pliers or mounting in vise) as coupler may be damaged and fail prematurely.

11. Slide the flex coupler onto the bearing collar (item 15 in Figure 48), support the coupler to prevent it from being damaged during the spring pin installation. Install a new spring pin into the coupler to secure the coupler to the collar.

### Installing the Reel Clutch Shaft

- 1. Before inserting the reel clutch assembly into the transmission housing, clean the reel brake ring (item 2 in Figure 48) that is pressed into the housing.
- 2. Slide the reel clutch shaft assembly into the transmission housing.
- Align the missing tooth in spline area of the reel clutch lever (item 27 in Figure 48) with the reel clutch fork. Insert the lever through the housing and fork. Secure the lever with the retaining ring.
- 4. Install the transmission drive belt and all the machine components removed for the reel drive system service; refer to Transmission Drive Belt (page 4–38).
- Check the reel clutch adjustment; refer to Adjusting the Reel Clutch (page 4–12). Adjust as necessary.
- 6. Connect the reel clutch cable to the transmission; refer to Replacing the Reel Clutch Cable (page 6–10). Ensure that the clutch cable is properly adjusted.
- 7. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# Removing the Reel Clutch Shaft (seized bearing condition)



If the reel clutch shaft assembly cannot be easily removed from the transmission housing due to bearing seizure, follow the procedure to remove the reel clutch shaft assembly.

1. Ensure that the transmission drive belt and reel clutch lever are removed from the housing; refer to Transmission Drive Belt (page 4–38).



- 2. Carefully drill 2 No. 7 (0.201 inch diameter) holes in the transmission housing using the dimples in the housing as centers for the holes (Figure 52). The holes should be drilled completely through the housing allowing external access to the ball bearing on the reel shaft.
- 3. Use a 3/16 inch punch through the drilled holes to carefully drive the bearing and reel clutch shaft from the transmission housing.

# Removing the Reel Clutch Shaft (seized bearing condition) (continued)

### IMPORTANT

The ball bearing will be damaged during this procedure. Remove the ball bearing from the reel clutch shaft and discard the bearing after the shaft has been removed from the housing; refer to Transmission Reel Drive System (page 4–43) for bearing removal information.

- 4. Clean and inspect the bearing bore in the housing. If damage is severe in the housing, replace the transmission housing.
- 5. Use a 1/4 inch-20 UNC tap to install threads in the 2 holes drilled in the transmission housing.
- 6. Install the 2 1/4 inch-20 bolts with flat washers into the tapped holes in the transmission housing. The bolts not longer than 3/8 inch in length should be used. After you install the bolts, ensure that the ends of the bolts do not extend into the ball bearing bore in the housing.
- 7. Service the reel clutch shaft assembly as necessary; refer to Transmission Reel Drive System (page 4–43). Ensure that the new ball bearing is installed on the reel clutch shaft.
- 8. Install the reel clutch shaft assembly into the transmission housing and assemble the transmission; refer to Transmission Reel Drive System (page 4–43).

# **Transmission Drive System**



The transmission removal from the machine is not necessary to service the transmission drive system shown in Figure 53. The transmission drive components can be accessed by removing the battery pack from the frame, removing the electric motor from the transmission, removing the transmission cover, and removing the drive belt.

### **Disassembling the Transmission Drive System**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the electric motor from the machine; refer to Electric Motor (page 5–69).
- 3. Remove the transmission drive belt; refer to Transmission Drive Belt (page 4–38). Ensure that the wave washer (item 11 in Figure 53) remains in the bearing bore of the transmission cover.

### **Disassembling the Transmission Drive System (continued)**

- 4. Slide the driven pulley assembly (including bearings) from the motor adapter (item 2 in Figure 53).
- 5. If necessary, remove the 4 washer-head screws (item 16 in Figure 53) that secure the motor adapter to the transmission housing, and remove the adapter from the housing.
- 6. As necessary, remove the components from the driven pulley (item 12 in Figure 53):
  - A. Remove the retaining ring (item 9 in Figure 53), flat washer, wave spring, and flocked bearing shield from the driven pulley. For assembly purposes, note the orientation of the flocked bearing shield.
  - B. Press the ball bearings (items 15 and 5 in Figure 53) from the pulley. Discard the bearings that were removed.
  - C. Remove the retaining ring (item 4 in Figure 53) and slide the splined coupler from the pulley. Clean the splined coupler and inspect the coupler for wear or damage.
  - D. Inspect the drive spline (item 13 in Figure 53) that is attached to the driven pulley. The drive spline should be free of bending, distortion, or other damage.
- 7. If the drive spline needs to be removed from the driven pulley, use the following procedure:

### IMPORTANT

# Avoid using excessive clamping pressure on the driven pulley flats to prevent damage to pulley.

- A. Use the flats on the driven pulley to carefully secure the pulley in a vise. Use a vise with soft jaws to prevent pulley damage.
- B. Remove the set screw (item 8 in Figure 53) from the end of the pulley.
- C. Slide the splined coupler onto the drive spline and use a spline insert tool (refer to Spline Insert Tool (page 4–9)) to remove the drive spline from the driven pulley.

### Assembling the Transmission Drive System

1. If the drive spline (item 13 in Figure 53) was removed from the driven pulley, secure the drive spline to the pulley as follows:

### IMPORTANT

# Avoid using excessive clamping pressure on the driven pulley flats to prevent damage to pulley.

- A. Use the flats on the driven pulley to carefully secure the pulley in a vise. Use a vise with soft jaws to prevent pulley damage.
- B. The drive spline should either be replaced (new drive spline has patch lock on the threads) or have Loctite #242 (or equivalent) applied to the threads before installation.
- C. Slide the splined coupler (item 14 in Figure 53) onto the drive spline and use a spline insert tool (refer to Spline Insert Tool (page 4–9)) to secure the drive spline into the driven pulley.

### Assembling the Transmission Drive System (continued)

- D. Install the set screw (item 8 in Figure 53) into the end of the pulley and tighten against the drive spline.
- E. Secure the splined coupler in the driven pulley with the retaining ring (item 4 in Figure 53).
- 2. Install all the components that were removed onto the driven pulley (item 12 in Figure 53).
  - A. If the ball bearings (items 15 and 5 in Figure 53) were removed from the driven pulley, press the new bearings onto the pulley.
  - B. As necessary, install the flocked bearing shield (item 6 in Figure 53) (flocked side orientated toward bearing location), wave spring, and flat washer onto the driven pulley. Secure the components with the retaining ring.
- 3. If the motor adapter (item 2 in Figure 53) was removed from the transmission housing, secure the adapter to the housing with the 4 washer-head screws. Tighten the screws as follows:



- A. First, use an alternating crossing pattern, torque all the screws to **1.7 to 4.5 N·m (15 to 40 in-lb)**.
- B. Again use an alternating crossing pattern, torque all the screws to 9.6 to 10.7 N⋅m (85 to 95 in-lb).
- 4. Slide the driven pulley assembly (including bearings) into the motor adapter.
- Install the transmission drive belt and all the machine components removed for the reel drive system service; refer to Transmission Drive Belt (page 4–38).
- 6. Fill the internal spline area of the splined coupler with high temperature Mobil XHP-222 grease (or equivalent).
- 7. Install the electric motor to the transmission; refer to Electric Motor (page 5–69).
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# **Transmission Drum Drive System**



The transmission removal from the machine is not necessary to service the transmission drum drive system shown in Figure 54. The transmission drum drive components can be accessed by removing the battery pack from the frame, removing the transmission cover, and removing the drive belt.

### **Disassembling the Transmission Drum Drive System**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Remove the transmission drive belt; refer to Transmission Drive Belt (page 4–38).
- 3. Remove the flange-head screw (item 10 in Figure 54) and hardened washer that secure the driven pulley to the shaft. Slide the pulley from the shaft. Locate and retrieve the woodruff key.
- 4. Remove the drum drive belt from the machine; refer to Drum Drive Belt (page 4–21).
- 5. Slide the traction drum drive driven pulley (item 1 in Figure 54) from the extension housing.

### **Disassembling the Transmission Drum Drive System (continued)**

- 6. If necessary, remove the ball bearings (item 2 in Figure 54), spacer, and wave washer from the extension housing.
- 7. If necessary, remove the extension housing as follows:
  - A. Loosen the fasteners (items 7, 10, and 11 in Figure 54) that secure the transmission housing to the machine frame.
  - B. Remove the 4 washer-head screws that secure the extension housing to the transmission housing.



- 3. Washer-head screw (4 each)
  - C. Remove the 4 washer-head screws that secure the extension housing to the right drum drive housing (Figure 55).
  - D. Carefully shift the position of the transmission housing to allow removal of the extension housing.

### Assembling the Transmission Drum Drive System

- 1. If the extension housing was removed, do as follows:
  - A. Position the extension housing between the transmission housing and the right drum drive housing.
  - B. Align the extension housing with the right drum drive housing. Install the 4 washer-head screws finger tight to hold the extension housing in position.
  - C. Position the transmission housing to the extension housing. Install the 4 washer-head screws finger tight to hold the extension housing in position.



D. Secure the extension housing to the transmission housing and right drum drive housing with the washer-head screws. First, torque all the washer-head screws to 1.7 to 4.5 N·m (15 to 40 in-lb). Then, use an alternating crossing pattern, torque all the screws to 9.6 to 10.7 N·m (85 to 95 in-lb).

### Assembling the Transmission Drum Drive System (continued)

- E. Secure the transmission housing to the machine frame by tightening the fasteners (items 7, 10, and 11 in Figure 54). If the fasteners were removed, ensure that the hardened washer is below the frame tube.
- 2. If removed, slide the wave washer (item 3 in Figure 54), spacer, and ball bearings into the extension housing.
- 3. Slide the shaft of the traction drum drive driven pulley (item 1 in Figure 54) through the extension housing bearings and the spacer.
- 4. Apply the anti-seize lubricant to the pulley surface of the drum drive driven pulley.
- 5. Install the woodruff key in the shaft and slide the driven pulley (item 8 in Figure 54) onto the shaft. Secure the pulley with the hardened washer and flange-head screw.
- 6. Install the drum drive belt to the machine; refer to Drum Drive Belt (page 4–21).
- Install the transmission drive belt and all the machine components removed for the drum drive system service; refer to Transmission Drive Belt (page 4–38).
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).

# **Transmission**



- Electric motor assembly 5.
- 6. Drum drive belt

- 11. Retaining ring
- 12. Extension spring
- 17. Extension housing

The transmission removal from the machine is not necessary in order to service the internal transmission components. The transmission components can be accessed by removing the battery pack from the frame, removing the transmission cover, removing the transmission drive belt. If the transmission removal is necessary, proceed with the following steps. Once the transmission has been removed from the machine, service procedures for internal transmission components are described earlier in this section.



- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).
- 2. Disconnect the reel clutch cable from the transmission; refer to Replacing the Reel Clutch Cable (page 6–10).
- 3. Slide the telescoping coupler off the cutting unit hex shaft (Figure 57).
- 4. Remove the right drum drive cover and drive belt from the machine; refer to Drum Drive Belt (page 4–21).
- 5. Remove the electric motor from the machine; refer to Electric Motor (page 5–69).
- 6. Remove the battery pack from the machine; refer to Removing the Lithium Battery Pack (page 5–74).
- 7. Remove the 4 washer-head screws (item 8 in Figure 56) that secure the extension housing to the right drum housing.
- 8. Support the transmission to prevent it from falling.
- 9. Remove the fasteners that secure the transmission to the machine frame.
  - A. The flange-head screw (item 2 in Figure 56) that secures front of the transmission to the frame.
  - B. The bolt (item 13 in Figure 56), hardened washer, and flange-head screw that secure the rear of the transmission to the frame.
- 10. Carefully move the transmission assembly toward left side of the machine until the extension housing is clear of right drum housing. Lift the transmission from the machine.
- To disassemble the transmission, refer to Transmission Drive Belt (page 4–38), Transmission Idler System (page 4–41), Transmission Reel Drive System (page 4–43), Transmission Drive System (page 4–50), and Transmission Drum Drive System (page 4–53).

### Installing the Transmission

- 1. Ensure that all the internal transmission components are correctly installed before transmission is installed to the machine frame.
- 2. Carefully install the transmission assembly toward right side of the machine so that the extension housing is inserted into the right drum housing.
- 3. Align the transmission mounting holes with the frame and right drum housing. Install and finger tighten the fasteners to secure the transmission to the machine.
  - A. The 4 washer-head screws (item 8 in Figure 56) that secure the extension housing to the right drum housing.
  - B. The bolt (item 13 in Figure 56), hardened washer, and flange-head screw that secure the rear of the transmission to the frame. Ensure that the washer is below the frame tube.
  - C. The flange-head screw (item 2 in Figure 56) that secures the front of the transmission to the frame.
- 4. Once all the fasteners have been installed, fully tighten the fasteners in the following order:



- A. The 4 washer-head screws. First, torque all the screws to 1.7 to 4.5 N·m (15 to 40 in-lb). Then, use an alternating crossing pattern, torque the screws to 9.6 to 10.7 N·m (85 to 95 in-lb).
- B. The bolt and flange-head screw that secure the rear of the transmission to the frame.
- C. The flange-head screw that secures the front of the transmission to the frame.
- 5. Install the battery pack to the machine; refer to Installing the Lithium Battery Pack (page 5–77).
- 6. Install the electric motor to the transmission; refer to Electric Motor (page 5–69).
- 7. Install the drum drive belt and right drum drive cover to the machine; refer to Drum Drive Belt (page 4–21).
- 8. Slide the telescoping coupler onto the cutting unit hex shaft (Figure 57).
- 9. Connect the reel clutch cable to the transmission; refer to Replacing the Reel Clutch Cable (page 6–10).
- 10. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 4–3).



# **Electrical System**

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# **General Information**

The Greensmaster eFlex machine uses a 53 VDC (nominal) electrical system that is an isolated circuit. The machine frame is not used for any ground connections.

After performing any repair on the machine electrical components, ensure that the wiring is routed and secured so as to prevent abrasion or contact with moving machine parts.

### **Operator's Manuals**

The *Traction Unit Operator's Manual* and *Lithium Battery Pack Charger Operator's Manual* provide information regarding the operation, general maintenance, and maintenance intervals for your Greensmaster machine and charger. Refer to these *Operator's Manuals* for additional information when servicing the machine.

# **Electrical Schematics and Diagrams**

Refer to the Electrical Schematics and Wire Harness Drawings/Diagrams in Appendix A (page A–1)—Foldout Drawings.

# **Toro Electronic Controller (TEC)**



Figure 58 eFlex 2120 Model 04046 (shown)

- 1. Lithium battery pack
- 2. TEC

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- 3. Wire harness connector
- 4. Machine connector



The Greensmaster 1800/2100, and 2120 machines use a Toro Electronic Controller (TEC) to manage the machine electrical functions. The controller is a microprocessor controlled device that senses the condition of various switches (inputs) and directs electrical power to control the appropriate machine functions (outputs) based on the inputs. The status of inputs to the controller as well as outputs from the controller can be monitored with the InfoCenter display on the console. If a problem exists that could prevent normal operation, the InfoCenter display will display an operator advisory or fault code to assist in identifying the problem.

(For models 04042, 04043 and 04046) The TEC is attached to the machine under the power center cover located behind the lithium battery pack; refer to Figure 58.

# **Toro Electronic Controller (TEC) (continued)**

(for Models 04042, 04043, 04046 and 04049 fitted with 04069) The TEC is attached to the mount bracket inside the battery cover; refer to Figure 59.

### IMPORTANT

Before performing any welding on the machine, do the following to prevent damaging the electrical system of the machine:

- Disconnect the machine connector from the lithium battery pack.
- Disconnect the wire harness connectors from the Toro Electronic Controller.

## **CAN-bus Communications**

The TEC communicates with other electrical components (lithium battery pack, electric motor, and InfoCenter display) on a CAN-bus communication system. The CAN-bus system reduces the number of electrical components and connections that are used on the machine and allows the number of wires in the wire harness to be reduced.

The CAN identifies the controller area network that is used on the Greensmaster. The 2 twisted wires form the bus. These wires provide the data pathways between the machine components. The engineering term for these 2 wires are CAN High and CAN Low. At the ends of the twisted pair of bus wires are the 120-ohm terminator resistors.

The CAN-bus link controls each of the components that requires only 4 wires to operate and communicate to the system: CAN High, CAN Low, B+ (power), and ground.

### **IMPORTANT**

The terminator resistors at the ends of the bus wires are required for proper electrical system operation.
## **Connecting the Lithium Battery Pack**

Â

A

battery pack.

### WARNING

A

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The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.

CAUTION

Before servicing the machine, disconnect the machine from the

• Only use the charger designed for the battery pack.

This will prevent unexpected machine operation.



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Figure 60 eFlex 2120 Model 04046 (shown)

1. Machine connector2. Battery pack3. Battery connector

To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 60). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or machine components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

## **Electrical System Operation**

The Greensmaster eFlex machines utilize a 53 VDC (nominal) lithium ion battery pack to supply electrical power to the Toro electronic controller (TEC), an electric motor, and a main contactor. Circuit protection for this 53 VDC (nominal) system includes 3 fuses that reside in the wire harness fuse block and a single fuse in the battery pack.

The battery pack allows a single component to be attached to the machine as the electrical power supply. This pack provides a nominal 53 V (42 V to 64 V @ 100% state of charge), 35 Ah supply and includes an integrated battery management system. The battery management system uses CAN communication with the TEC and battery charger.

A Toro Electronic Controller (TEC) is used on the eFlex machines to manage the machine electrical functions. The controller is microprocessor controlled that senses the condition of various switches (inputs) and directs electrical power to control appropriate machine functions (outputs) based on the inputs.

The electric motor used on the eFlex is a 48 VDC, 1,200 W, brushless, permanent magnet DC motor. The motor has its own integral controller and helical gear reduction. The machine TEC provides motor direction with communication via the CAN-bus system. The motor provides power for the traction drum and cutting unit when engaged by the operator.

The main contactor exists in the electrical system to connect the battery pack to the electric motor. The TEC determines when the main contactor should be engaged.

Control for the components in the electrical system is handled by integral controllers in the battery pack and electric motor along with direction from the machine TEC via the CAN-bus system.

The InfoCenter display provides information to the operator during the operation of the machine, provides electrical system diagnostic assistance for the technicians, and allows inputs for the adjustable machine settings. The status of TEC inputs and outputs can be monitored with the InfoCenter display.

The 53 VDC (nominal) system is an isolated system so that the machine frame is not used for any ground connections on the eFlex machine. A set of connectors are included on the machine, which can be used to disconnect the machine wire harness from the battery pack to prevent unexpected machine operation when performing service.

**Note:** Information about individual electrical components in the electrical system is included in Testing the Electrical Components (page 5–39).

### **Battery Charging**

The eFlex lithium ion battery pack requires regular charging that is provided by the lithium battery pack charger (included with the machine). The output voltage and current of the charger are controlled with CAN communication with the battery management system. The battery storage wake-up, maintenance features, and long-term storage discharge function are provided by the charger to improve overall battery life. Ensure that the charger is connected to the battery pack whenever the machine is not in use.

#### **Start Process**

When the key switch is turned to the START position, the machine electrical system goes through a wake-up process. The contactor in the battery pack should click as it is energized followed by the main contactor being energized (audible click). Both the TEC and electric motor controller will be initialized. Once

the InfoCenter display comes on-line, the key switch can be turned to the RUN position and the machine will be ready for operation.

#### **Run Process**

Pushing the traction engagement lever forward closes the traction switch. This closed switch is used as an input by the TEC which communicates to the electric motor to engage. The motor rotation speed and thus traction speed is determined by the speed control setting that is adjusted by the operator. Actual motor speed is monitored by the TEC and motor controller so that as traction load changes (e.g., moving up or down an incline) the motor can compensate as necessary.

Engaging the cutting unit with the engagement lever closes both the traction and reel engage switches. The electric motor will be engaged with control of motor speed handled by the TEC and motor controller based on the operator speed setting and load on the machine.

The EZ turn feature of an eFlex machine is available when the cutting unit is engaged and the EZ turn switch on the console is in the ON position. When turning the machine with EZ turn engaged, the ground speed will be reduced as the cutting unit is raised from the ground. Speed will increase as the cutting unit is lowered back to the turf after turning has been completed. The EZ turn feature is not active when the machine is in the TRANSPORT position.

# Lithium Battery Pack Charger Operation (for Models 04042, 04043 and 04046)



The lithium battery pack charger (Figure 61) is used to charge the nominal 53 V (42 V to 64 V @ 100% state of charge) 35 Ah lithium battery pack that is used to power the eFlex. The charger communicates via CAN with the battery management system (BMS) located within the lithium battery pack. The charger will respond to the CAN messaging issued by the BMS which will communicate, among other things, the immediate voltage and current needs of the battery pack. The charger is intended to be used indoors only and can be left connected to the target battery pack indefinitely.

An AC power supply cord provides power input to the charger. Power supply for the charger can be either 110/120 VAC or 220/240 VAC. The output cord from the charger to the battery pack includes a positive cable, negative cable, wake-up wire, and the CAN-bus cables. Ensure that the correct power supply and output cords are used for the lithium battery pack charger.

The charger is equipped with 3 LED's to indicate the charger is ON, the battery is CHARGING, and the battery is READY (fully charged). Additionally, the LCD message display on the charger can be used to monitor the charging process.

**Note:** Refer to your *Traction Unit Operator's Manual* and *Lithium Battery Pack Charger Operator's Manual* for additional information about the eFlex battery charger.

**Note:** Ensure that the charger is connected to the battery pack, plugged into a wall outlet, and turned ON whenever the machine is not in use.

The battery pack charging operation is fully automated. When regular charging occurs to ready the battery pack for in season mowing, battery charging states include start-up, ramp up, charging, cell balance, and standby. When the battery pack is in storage, the charger also provides a hibernate state. The LCD message display on the front of the charger will identify the present state of the charger.

The charger will automatically shut down (exit any active state and return to the start-up state) if the output cord from the charger to the battery pack is unplugged or if the AC power to the charger is interrupted (e.g., circuit breaker tripped).

## Start-Up

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 1. Bus discharge
 2. Battery pack wake
 3. Battery connected

When the battery charger power switch is initially turned on, the charger ensures that the charger bus voltage is at 0 V. If necessary, the charger discharges the bus as a step in the start-up process. This is typical in the event that the charger power is cycled OFF and then back ON.

Once the bus voltage is correct for start-up, the charger will wake the battery pack. The battery pack runs some internal diagnostics, and if all is OK, the battery main contactor closes. The charger will then send a signal on the CAN-bus to stay connected to the battery pack. If the battery pack internal diagnostics determine that all is not OK, the battery pack will send a fault message.

During start-up, the battery voltage, state of charge (as percent of fully charged), and amperage will be displayed in the LCD message display.

## Ramp Up



**Figure 63** Ramp Up Message Screen

Once the battery pack contactor is closed, the charger detects the voltage level of the battery pack. The charger bus is then pre-charged to match the battery voltage to be sure that there is not a voltage differential between the charger and the battery pack.

During ramp up, the battery voltage, state of charge (as percent of fully charged), and charging amperage will be displayed in the LCD message display.

## Charging



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Figure 64 Charging Message Screen

The lithium battery pack communicates to the charger the proper voltage and current levels required for battery charging. The charger make its output at the given voltage level and set the current limit as indicated by the pack.

During charging, the battery voltage, state of charge (as percent of fully charged), and charging amperage is displayed in the LCD message display.

## **Cell Balance**



Figure 65 Cell Balance Message Screen

Once the pack has charged to 100% state of charge (SOC), the battery pack will determine if cell balancing is necessary. If necessary, it will equalize the individual cells in the battery pack. The charger will cease to output current and voltage, and will present a high impedance connection at the high voltage terminal of the battery. If cell balancing is not necessary, the charger will progress to the standby mode.

Once the battery pack accomplishes cell balancing to the required level, it will send a CAN message to the charger to commence charging again (at the voltage and current limits indicated via CAN). The pack and charger will go through this cycle 2 to 3 times until either the battery pack is satisfied with the results of the cell equalization or 18 hours has passed. Now, the pack will change to Charge Done state, and the charger will respond by shutting down the battery pack. If the pack fails to terminate the balancing or charging within 19 hours from start of charge, the charger will terminate the charge. In either case, the charger will shut the pack down and switch to the Standby state.

During cell balancing, the battery voltage, state of charge (as percent of fully charged), and amperage will be displayed in the LCD message display.

## Standby



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Figure 66 Standby Message Screen

The charger stays in standby mode from completion of charge until 24 hours from start of charge has passed. While in standby, the charger LCD message display is held in the brightly lit mode. Once the 24 hours time period has elapsed, the charger will go into its lowest power consumption mode of Hibernate.

During standby, the battery state of charge (as percent of fully charged) will be displayed in the LCD message display. Typically, SOC for a fully charged battery will be from 98% to 100%.

## Hibernate



The hibernate state of the charger is a very low AC current draw charger mode. This state starts automatically 24 hours after the start of the latest charge operation. While in hibernate, the only thing the charger is doing is monitoring time, and displaying the status of the charger with the LCD message display at a dimmed brightness. 216 hours (9 days) after hibernate begins, the charger will power backup and wake up the battery pack. There are 2 sub-states within hibernate, assuming hibernate has not been interrupted, that prepare and maintain the battery pack during long term storage.

Upon waking up from hibernate mode, the pack and charger will establish CAN communications to determine the system status. If all is  $O\kappa$ , the charger will initiate a discharge of the battery pack. The goal of this discharge is to reduce the pack SOC from 100% to 40% within 30 days. This discharge is done because the lithium battery pack capacity can be permanently reduced if stored at too high of SOC for too long. When the battery pack reaches 40% SOC, it will indicate that the discharge is completed by changing its state to Storage. The charger will then go back into hibernate mode.

Every 10 days thereafter, the charger will power backup and monitor the status of the battery pack. If the pack reaches too low of SOC (30%) the pack will be recharged to 40% SOC.

To return the battery pack to 100% state of charge after hibernation, disconnect the battery charger from the battery and connect the battery to the eFlex machine. Turn the key switch to the START position and allow full start-up process of the machine. Then, turn the key switch to the OFF position and allow full shut down of the machine. Finally, connect the battery pack to the charger to allow the battery pack to receive full charge.

## **Charger Fault Codes**



During the battery pack charging operation, the charger may identify a problem with either the charger or the battery pack. If a fault is determined, the fault will be displayed in the charger LCD message display. The LCD message will identify either a charger or pack fault, a fault identification code, and a fault code description (Figure 68).

Should there be charging operation issues due to a fault with the charger or battery pack, a first step to remedy the issue would be to turn the battery charger power switch to the OFF position, disconnect the charger output cord from the battery pack, disconnect the charger power cord from the outlet and wait for a minute to allow complete charger and battery shutdown. Then, correctly connect the battery pack charger and restart the charging operation to see if operation has returned to normal. Some faults will be reset during the restart and will then allow normal charger operation. If a fault continues to occur, ensure that you record the fault information and contact your Toro Distributor for assistance.

# **Special Tools**

You can order these special tools from your Authorized Toro Distributor. Some tools are also available from a local supplier.

## **Electric Motor Rotor Tool Set**

1.



### Toro Part No. TOR6028

The rotor tool set for the electric motor is required to remove and install the rotor from the motor housing. The tool set includes base plate, threaded shaft, and handle (Figure 69).

**Note:** For the electric motor service procedures, refer to Servicing the Electric Motor (page 5–71).

### **Removing the Rotor**

1. Remove the gearbox cover and output gear from the motor assembly; refer to Servicing the Electric Motor (page 5–71).



z. Remove the 6 torx-head screws that secure the motor cover (Figure 7

**Note:** Do not remove the cover from the motor assembly.

- 3. Secure the tool set base plate to the motor housing with the 4 cover screws.
- 4. Install the threaded shaft into the base plate.

### IMPORTANT

The rotor magnets are very powerful and can cause the rotor to shift position very rapidly during removal. Be cautious during rotor removal to prevent component damage or personal injury.

- 5. Turn the threaded shaft with handle to remove the rotor and motor cover from the motor housing. Support the rotor to prevent it from falling from the housing during removal.
- 6. Leave the threaded shaft installed in same position in the base plate for rotor installation purposes.

### Installing the Rotor

- 1. Secure the tool set base plate to the motor housing with the 4 cover screws.
- 2. Ensure that the threaded shaft is installed into the base plate so that the end of the threaded shaft prevents the rotor body from entering the motor housing.

### IMPORTANT

The rotor magnets are very powerful and can cause the rotor to shift position very rapidly during installation. Be cautious during rotor installation to prevent component damage or personal injury.

### Installing the Rotor (continued)

3. While guiding the rotor into the motor housing, slowly rotate the threaded shaft to allow the rotor to be drawn into the housing. Once the rotor is fully installed into housing, remove the tool set from the motor housing.

## **InfoCenter Display**



The InfoCenter display used on your Greensmaster eFlex is a LCD device that is located on the handle console (Figure 71). The InfoCenter provides information to the operator during the operation of the machine, provides electrical system diagnostic assistance for the technicians, and allows inputs for the adjustable machine settings.

Power for the InfoCenter is available when energized by the TEC (the key switch is in the START or RUN position). A CAN-bus system involving the TEC, electric motor controller, lithium battery pack, and InfoCenter provide necessary machine communication for the InfoCenter operation.

**Note:** Icons that are used on the InfoCenter display are identified in the *Traction Unit Operator's Manual.* 



## **Splash Screen**



When the key switch is initially turned to the RUN or START position, the fault indicator illuminates for a few seconds to verify indicator operation and the InfoCenter splash screen appears (Figure 73). The splash screen provides the hour meter information.

After the splash screen has been displayed for 5 seconds, the main information screen will appear on the InfoCenter screen.



The InfoCenter main information screen (Figure 74) is displayed after the initial splash screen has been displayed for 5 seconds. The main information screen is the default screen as it will be displayed during normal machine operation. The main information screen provides the following information to the operator:

- Battery charge indicator
- Speed control setting

If an electrical machine fault occurs, the InfoCenter fault indicator will blink to notify the operator and a descriptive message will be displayed. Also, the fault log indicator on the InfoCenter screen will be displayed to notify the operator that recent machine faults have occurred. Accessing the fault log is described below in the Faults Screen (page 5–26).



## Main Information Screen (continued)

The main menu and additional information screens can be accessed from the InfoCenter main information screen by pressing and releasing the menu/back button (as indicated by  $\frown$  at the bottom of the screen) on the display. Once to the main menu screen (Figure 75), navigation to the menu items can occur. For information on the main menu and menu item screens; refer to Main Menu Screen (page 5–25).

### **Operator Advisories**



Operator advisories are automatically displayed by the InfoCenter when a machine function requires additional action (Figure 76). An advisory will not be logged into the fault log.

The InfoCenter advisories include the following:

**System Shutdown (#201):** This advisory notifies the operator that the machine is shutting down. Because the shutdown process takes some time, this advisory is displayed so that an operator is aware of the shutdown and machine operation is not available. The shutdown advisory will be displayed after the key switch is turned OFF.

**Low Battery Shutdown (#202):** If the battery state of charge is too low for continued machine operation, the low battery shutdown advisory will notify the operator that the machine will automatically shutdown. Battery charging is necessary before returning the machine to normal operation.

**Energy Saving Mode Active (#203):** If the battery state of charge is too low for normal machine operation, the energy saving mode active advisory will notify the operator that the machine is operating with reduced functionality (cutting unit disengaged and reduced traction speed). Battery charging is necessary before returning the machine to normal operation.

**Energy Saving Mode Warning (#204):** If the battery state of charge is too low for normal machine operation, the energy saving mode warning advisory will notify the operator that the machine will start operating with reduced functionality (cutting unit disengaged and reduced traction speed) in approximately 30 seconds. Battery charging is necessary before returning the machine to normal operation.

## **Operator Advisories (continued)**

**Battery Current Limit (#205): (for Models 04042, 04043 and 04046)** This advisory notifies the operator that the electric motor drive current has been lowered by the lithium battery pack controller. The operator may notice lower machine performance. For example, the battery current limit advisory would be displayed if the battery pack temperature is excessive.

**Use Handbrake (#206): (for Models 04042, 04043 and 04046)** This advisory notifies the operator that the electric motor regenerative braking current has been lowered by the lithium battery pack controller which will affect the motor braking system. In this instance, the operator may have to use the handbrake to slow the machine. For example, the use handbrake advisory would be displayed if the mower with a fully charged battery was going down a long hill during operation.

**Motor Current Limit (#207):** This advisory notifies the operator that the electric motor is already running at maximum current and cannot deliver any additional performance. For example, the motor current limit advisory would be displayed if the speed control was increased when the motor was already providing maximum performance.

**Motor Not Ready (#208):**This advisory notifies the operator that the electric motor is not ready to deliver the performance.

**Brake On (#209):** The brake on advisory will notify the operator that the parking brake latch is engaged when attempting to engage the traction drive system.

**High Power Consumption Run Time Reduced (#210):** The high power consumption identifies that electric motor draw is excessive and will reduce the run time of the machine. Excessive cutting unit bedknife contact or accessory use may generate this advisory.

**Motor Disabled (#212):** The motor disabled advisory will identify that electric motor operation was stopped by the controller. A fault should have been generated that will provide additional information as to cause of the issue.

**Disengage Traction (#213):** This advisory notifies the operator that the traction lever is engaged and needs to be released before operation can be continued. The disengage traction advisory will be displayed if the machine is turned on with the traction lever already engaged.

Battery Temperature Too Low (#214): (for Models 04042, 04043, 04046 and 04049 fitted with 04069) This advisory notifies that the battery operating temperature is too low and the controller was denied the motor operation.

Battery Temperature Too High (#215): (for Models 04042, 04043, 04046 and 04049 fitted with 04069) This advisory notifies that the battery operating temperature is too high and the controller was denied the motor operation.

Battery Voltage Too High (#216): (for Models 04042, 04043, 04046 and 04049 fitted with 04069) This advisory notifies that the battery operating voltage is too high and the controller was denied the motor operation.

Battery Draw Too High (#217): (for Models 04042, 04043, 04046 and 04049 fitted with 04069) This advisory notifies an over current situation and the controller was denied the motor operation.

## Main Menu Screen



The main menu screen can be accessed from the InfoCenter main information screen by pressing and releasing the menu/back button (as indicated by  $\overline{i}$  at the bottom of the screen) on the display. Once to the main menu screen (Figure 77), navigation to the 5 different menu items can occur.

The main menu screen provides access to the following menu screens:

- Faults
- Service
- Diagnostics
- Settings
- About

Press the down button (as indicated by the  $\clubsuit$  at the bottom of the screen) to highlight the desired menu screen, then press the left/right button (as indicated by the  $\clubsuit$  at the bottom of the screen) to enter the highlighted menu screen.

To return to the main information screen from the main menu screen, press the menu/back button (as indicated by the  $\mathbb{P}$  at the bottom of the screen).

## **Faults Screen**



The faults screen (Figure 78) will list all the machine electrical faults that have occurred since the faults were last cleared from the InfoCenter. The faults will be identified by a number and when the fault occurred. The faults that might occur on the eFlex machine are listed in the Fault Table (page 5–26).

The InfoCenter fault log can be cleared by selecting the clear system faults menu item. The cleared faults will be removed from the InfoCenter but will be retained in the TEC memory.

If a fault occurs during machine use, there may be a change in machine functionality due to the fault. Should there be machine operation issues due to a fault, a first step to remedy the issue would be to move the traction lever to the NEUTRAL position, turn the key switch to the OFF position, and allow all the machine functions to stop. Then, attempt to restart the machine to see if operation has returned to normal. Some faults will be reset during the restart and will then allow normal function. If a fault continues to occur, further system evaluation and possible component repair or replacement will be necessary.

To return to the main menu screen from the faults screen, press the menu/back button (as indicated by the  $\square$  at the bottom of the screen).

Fault Identification	Fault Description
#1	Internal TEC fault
#2	12 VDC supply fault
#3	5 VDC supply fault
#4	Lithium battery pack bus fault
#5	CAN-bus communication fault
#6	Motor over current fault*
#7	Motor over temperature fault
#8	Motor overspeed fault*
#9	Internal electric motor fault

#### Fault Table

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# Faults Screen (continued)

Fault Identification	Fault Description
#10	Electric motor stalled during operation
#11	Software incompatible
#12	Key switch stuck in the ON position
#13	Internal lithium battery pack fault
#15	Software fault**
#16	Contactor fault**
#17	Throttle sensor fault**

\*For Models 04042 and 04043 only.

\*\*For Models 04042, 04043, 04046 and 04049 fitted with 04069 only.

## **Service Screen**



1. Left/right button

2. Down button

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3. Menu/back button

The service screen (Figure 79) contains the following machine information:

5.

Service menu

- Hours (hours that the key switch has been in the ON position)
- Mow time (hours that the cutting unit has been engaged)
- Power use (power delivery by battery in watts)
- Battery charge (percent of battery capacity)
- Battery current (amps delivered by battery)
- Battery volts (battery potential in volts)
- Energy (total energy delivered by battery over its entire life in watt-hours)

Values listed for service menu items cannot be changed.

To return to the main menu screen from the service screen, press the menu/back button (as indicated by the  $\square$  at the bottom of the screen).

## **Diagnostics Screen**



The diagnostics screen (Figure 80) lists the various states of the machine electrical components. The diagnostics screen should be used to check the operation of the machine switches and controls.

### IMPORTANT

# When using the diagnostics screen, ensure to have the machine on kickstand to prevent unexpected machine movement as switches and controls are moved.

**Note:** Some of the component states may have description available when using the diagnostics screen. If an arrow icon is shown on the screen, pressing the left/right button (as indicated by the  $\Rightarrow$  at the bottom of the screen) will display the description if available.

The diagnostics screen includes the following:

- Key On identifies that the key switch is in the RUN position.
- Key Start indicates that the key switch is in the START position or not.

**Note:** The key start position can be verified in the diagnostics screen by rotating the switch to the START position. The motor will re-initialize.

- **PBrake Latch** identifies that the parking brake latch is engaged or not.
- EZ Turn indicates whether the EZ turn operation is ON or OFF.

**Note:** The EZ turn switch and EZ turn sensor are in series so both switch and sensor have to be ON (switch ON with the cutting unit raised for a turn) for the diagnostics screen to identify the EZ Turn operation as being ON. If either the switch is OFF or the sensor is OFF (the cutting unit lowered to the ground), the EZ Turn operation will be OFF.

- Traction identifies that the traction lever is engaged or not engaged.
- **Reel Enable** indicates whether the cutting unit is engaged or not engaged.

## **Diagnostics Screen (continued)**

- **Throttle** identifies the throttle control setting (in volts) that is used by the TEC to determine the electric motor speed. Rotating the speed wheel should change the setting. Voltage for throttle settings should range from 0.35 to 4.80 VDC depending on the speed wheel location.
- **Target RPM** lists the desired electric motor RPM based on the speed control setting. Rotating the speed wheel should change the setting.
- **Motor RPM** identifies the actual electric motor RPM. The motor RPM should be very close to the Target RPM.
- **12V Supply** indicates the supplied voltage available for the 12 VDC circuits (InfoCenter, EZ turn sensor). The 12V Supply should typically be slightly higher than 12.0 VDC.
- 5V Supply indicates the supplied voltage available for the 5 VDC circuit (speed control). The 5V Supply should typically be slightly higher than 5.0 VDC.
- **CAN bus** identifies whether the machine communication bus status is normal or not.

To return to the main menu screen from the diagnostics screen, press the menu/back button (as indicated by the  $\square$  at the bottom of the screen).

## **Settings Screen**



The settings screen (Figure 81) identifies the InfoCenter language and units (English or Metric). The settings screen also allows the operator to customize the backlight (brightness) and contrast settings for the InfoCenter display.

**Units:** Use the left/right button (as indicated by the  $\equiv$  at the bottom of the screen) to select between metric or English units of measure. Allow the desired selection to remain in view for 5 seconds.

**Language:** Use the left/right button (as indicated by the  $\equiv$  at the bottom of the screen) to select from numerous language options. Allow the desired selection to remain in view for 5 seconds.

**Backlight:** Press the left/right button (as indicated by the  $\Rightarrow$  at the bottom of the screen) then use the down button to decrease or the left/right button to increase the InfoCenter display brightness (as indicated by the – and the + at the bottom of the screen).

**Contrast:** Press the left/right button (as indicated by the  $\Rightarrow$  at the bottom of the screen) then use the down button to decrease or the left/right button to increase the InfoCenter display contrast (as indicated by the – and the + at the bottom of the screen).

To return to the main menu screen from the settings screen, press the menu/back button (as indicated by the  $\square$  at the bottom of the screen).

## **About Screen**



The about screen (Figure 82) identifies the machine model number, serial number, and TEC software revision.

To return to the main menu screen from the about screen, press the menu/back button (as indicated by the  $\mathbb{F}$  at the bottom of the screen).

# Adjustments

## Parking Brake Latch Switch



The parking brake latch switch is a normally open proximity switch. The switch is attached to the handle assembly switch panel (Figure 83).

When the parking brake latch is not applied, the latch is positioned near the target end of the parking brake latch switch so that the switch is closed. The parking brake latch is moved away from the switch when the latch is applied causing the switch to be in its normally open state.

### Adjusting the Parking Brake Latch Switch

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).



- 3. Remove the console cover from the handle to get access to the parking brake latch switch (Figure 84).
- 4. Raise the parking brake lever and engage the parking brake latch.
- 5. With the parking brake latch engaged, there should be 0.0 to 2.2 mm (0.000 to 0.090 inch) clearance between the latch and the parking brake latch switch (Figure 83).
- 6. If the clearance is incorrect, loosen the brake latch switch mounting fasteners, adjust the clearance, and tighten the fasteners. Check the clearance between the lever and switch after you tighten the fasteners. The parking brake latch should rotate freely past the switch.
- 7. After adjusting the parking brake latch switch, install the console cover to the handle.
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

## **Traction Switch**



The traction switch is a normally open proximity switch. The switch is attached to the handle assembly switch mount bracket (Figure 85).

When the traction engagement lever is not engaged, the head of the bolt in the traction lever is positioned away from the target end of the traction switch so that the switch is in its normal open state. The head of the bolt in the traction engagement lever is moved toward the switch target when the traction lever is engaged causing the switch to close.

### Adjusting the Traction Switch

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).



3. Console cover

1.

2.

- 4. Washer-head screw (4 each)
- 7. Locknut (2 each)
- 8. Switch mount bracket
- 3. Remove the console cover from the handle to get access to the traction switch (Figure 86).
- 4. Move the traction engagement lever forward to the engaged position.
- 5. With the traction engagement lever in the engaged position, there should be 0.8 to 3.0 mm (0.030 to 0.120 inch) clearance between the head of the bolt in the traction lever and the traction switch (Figure 85).

**Note:** With the traction lever pushed fully forward against its rotation stop, the head of the bolt should not deflect the traction switch more than 0.8 mm (0.030 inch). The traction lever will rotate back slightly once latched. At that point, the required clearance (0.030 to 0.120 inch) should be maintained.

- 6. If the clearance is incorrect, loosen the traction switch mounting fasteners, adjust the clearance, and tighten the fasteners. Check the clearance between the bolt head and switch after tightening the fasteners. The bolt head must not contact the switch.
- 7. After adjusting the traction switch, install the console cover to the handle.
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

## **Reel Engage Switch**



The reel engage switch is a normally open proximity switch. The switch is attached to the handle assembly switch mount bracket (Figure 87).

When the cutting unit is not engaged, the tab on the cutting unit engagement lever is positioned away from the target end of the reel engage switch so that the switch remains open. The tab on the engagement lever is moved next to the switch when the cutting unit is engaged causing the switch to close.

### Adjusting the Reel Engage Switch

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).



- 1. Engagement lever assembly
- 2. Lower handle
- 3. Console cover
- 4. Washer-head screw (4 each)
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- 5. Washer-head screw (2 each)
- 6. Locknut (2 each)
- 7. Reel engage switch
- 8. Switch mount bracket
- 3. Remove the console cover from the handle to get access to the reel engage switch (Figure 88).
- 4. Move the engagement lever forward to the cutting unit engagement position.
- 5. With the engagement lever in the cutting unit drive engagement position, there should be 0.8 to 2.2 mm (0.030 to 0.090 inch) clearance between the tab on the cutting unit engagement lever and the reel engage switch (Figure 87).
- 6. If the clearance is incorrect, loosen the reel engage switch mounting fasteners, adjust the clearance, and tighten the fasteners. Check the clearance between the lever tab and the switch after tightening the fasteners. The tab on the cutting unit engagement lever must not contact the switch.
- 7. After adjusting the reel engage switch, install the console cover to the handle.
- Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

## **Testing the Electrical Components**

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Whenever possible, check the component circuit operation with the InfoCenter display on the console. With the key switch in the RUN position, use the InfoCenter diagnostics menu to ensure that the component state changes as the component is toggled. This quick check identifies that the component and circuit wiring are working as designed. If the InfoCenter operation suggests that a component circuit is not functioning correctly, proceed to the appropriate component testing procedure found in this section. If the test procedure identifies no problem with the component, carefully inspect the wire harness and connectors for problems.

The Greensmaster eFlex uses a 53 VDC (nominal) electrical system that is an isolated circuit. The machine frame is not used for any ground connections.

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

### CAUTION

A

A

When testing a machine electrical component for continuity with a multimeter (ohms setting), ensure that the component is disconnected from the machine wire harness to prevent current flow through the component.

### CAUTION

Remove all the jewelry, especially rings and watches, before doing any electrical troubleshooting or testing. Disconnect the lithium battery pack to open the battery circuit before working on the electrical system.

## **Fuse Block**



The fuse block on the Greensmaster eFlex is attached to the machine under the power center cover (Figure 89).

### Accessing the Fuse

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. (For Models 04042, 04043, and 04046) Remove the 2 screws that secure the rear of the power center cover to the machine (Figure 89). Then, loosen the upper 2 screws on the cover, and remove the cover from the machine.



eFlex 2120 Model 04049 (shown)

1. Battery cover

g269778

2. Washer head bolt (8 each)

### Accessing the Fuse (continued)

 (For Models 04042, 04043, 04046 and 04049 fitted with 04069) Remove the 8 bolts that secures the battery cover to the mount bracket; refer to Figure 90. Remove the battery cover from the mount bracket.

### **Fuse Identification and Function**



g202432

Figure 91 eFlex 2120 Model 04046 (shown)

- 1. Fuse F1-1 (30 A)
- 2. Fuse F1-2 (3 A)

- 3. Fuse F1-3 (3 A)
- 4. Fuse F1-4 (open)



Refer to Figure 91 or Figure 92 to identify each individual fuse and its correct amperage. The fuses for the Greensmaster eFlex machines have the following functions:

Fuse F1-1 (30 A): Protects main power supply circuits.

### **Fuse Identification and Function (continued)**

Fuse F1-2 (3 A): Protects logic power supply circuits.

Fuse F1-3 (3 A): Protects optional LED work light circuit.

Fuse F1-4: This fuse block position is open.

### **Testing the Fuse**

- 1. Access the fuse block as described above.
- 2. Carefully remove the fuse from the fuse block for testing.
- 3. The fuse should have continuity between the fuse terminals.

### IMPORTANT

The eFlex machine uses special fuses that are rated for 80 V. If the fuse replacement is necessary, ensure to use the fuses as identified in your eFlex *Parts Catalog*. Do not use regular automotive fuses in your eFlex machine.

- 4. Carefully install the functional fuse into the fuse holder.
- 5. After you complete the fuse service, secure the power center cover to the machine with the 4 screws.
- 6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
Lithium Battery Pack Fuse (For Models 04042, 04043, and 04046)



The lithium battery pack that provides electrical power for the eFlex machines includes a fuse for battery circuit protection. Removal of the fuse cover on the bottom of the battery pack is required to access the fuse in the battery pack (Figure 93).

### **IMPORTANT**

Do not open the lithium battery pack. With the exception of the battery pack fuse, fuse cover, and labels, there are no consumer serviceable parts on or in the battery pack. If you open the battery pack, you will void the warranty. The battery pack is protected by tamper-alerting devices.

### Accessing the Fuse

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Raise and support the battery pack to get access to the fuse cover; refer to Lithium Battery Pack (for Models 04042, 04043, and 04046) (page 5–74).
- 4. Remove the 8 screws and 8 lock washers that secure the fuse cover to the bottom of the battery pack (Figure 94). Remove the fuse cover.
- 5. After you complete the fuse service:



- A. Secure the fuse cover to the bottom of the battery pack with the 8 screws and 8 lock washers (Figure 94); torque the screws to **0.34 N·m (3 in-lb)**.
- B. Lower and secure the battery pack to the machine; refer to Lithium Battery Pack (for Models 04042, 04043, and 04046) (page 5–74).
- C. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

### Testing the Fuse

- 1. Access the battery pack fuse as described above.
- 2. Carefully remove the fuse from the battery pack fuse holder for testing.
- 3. The fuse should have continuity between the fuse terminals.

### IMPORTANT

The fuse used in the lithium battery pack is a very fast acting 58 V fuse. If the battery pack fuse replacement is necessary, ensure to use the fuse as identified in your eFlex *Parts Catalog*.

- 4. Carefully install the functional fuse into the fuse holder.
- 5. Install the fuse cover and connect the battery pack as described in step 5.

# **Toro Electronic Controller**



g202194

Figure 95 eFlex 2120 Model 04046 (shown)

- 1. Lithium battery pack
- TEC 2.

- 3. Wire harness connector
- 4. Machine connector



- Lithium battery pack 1.
- TEC 2.

Samsung SDI controller 3.

The Greensmaster eFlex machines use a Toro Electronic Controller (TEC) to monitor the condition of various switches (inputs) and then direct electrical power output to allow certain machine functions. The controller is also connected to the CAN-bus system for communications with the electric motor and battery controllers. The TEC is attached to the machine under the power center cover behind the lithium battery pack (Figure 95) for models 04042, 04043 and 04046). The TEC is attached to the mount bracket inside the battery cover (Figure 96) for Models 04042, 04043, 04046 and 04049 fitted with 04069.

# **Toro Electronic Controller (continued)**

g202783

The inputs from the key switch, parking brake latch switch, traction switch, reel engage switch, EZ turn switch, EZ turn sensor, speed control potentiometer, and lithium battery pack status are all monitored by the TEC.

The TEC current output to the electric motor precharge circuit, main contactor, 12 VDC outputs (InfoCenter display, EZ turn sensor, and optional hour meter), and 5 VDC output (speed control potentiometer) are controlled based on the inputs received by the controller.



The diagram in Figure 97 depicts the connection terminal functions of the TEC. Two wire harness connectors attach to the controller with each of the connectors including 12 pins. The connector pins are listed in the diagram.

The InfoCenter display should be used for checking inputs and outputs of the controller used on your Greensmaster (refer to InfoCenter Display (page 5–19)). The InfoCenter display can also be used to identify faults and operator advisories that indicate operation issues with the machine.

Because of the solid state circuitry built into the controller, there is no method to test it directly. The controller may be damaged if an attempt is made to test it with an electrical test device (e.g., digital multimeter).

# **Key Switch**



The key switch allows the machine operation to be turned on and off. The key switch has 3 positions: OFF, RUN, and START. This switch is 1 of the several inputs for the TEC and is located on the switch panel (Figure 98).

Check the key switch operation with the InfoCenter on the console. With the key switch in the RUN position, the InfoCenter should allow the information screen to be displayed. With the InfoCenter in the diagnostics menu, choose the Key Start and ensure that the switch state changes as the key switch is moved to the START position and is then released. If the InfoCenter operation suggests a damaged key switch, proceed to the key switch testing below.

**Note:** If the eFlex machine is sitting idle for 5 minutes with the key switch in the RUN position, the machine will shut off.

**Note:** A damaged key switch may cause a #12 fault to be generated and displayed on the InfoCenter. Refer to the Faults Screen (page 5–26) for information on faults.

## **Testing the Key Switch**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- Remove the console cover from the handle to get access to the key switch (Figure 98).
- 4. Disconnect the wire harness electrical connector from the key switch.



5. With the use of a multimeter (ohms setting), test the switch functions to determine if continuity exists between the various terminals for each switch position. The switch terminals are marked as shown in Figure 99. The circuitry of the key switch is shown in the Circuit Logic Table (page 5–48). Check the continuity between the switch terminals.

### Circuit Logic Table

Switch Position	Circuits
OFF	None
Run	B+C+F, D+E
Start	A+B+C

- 6. Replace the key switch if necessary.
- 7. After you complete the testing, connect the wire harness electrical connector to the key switch.
- 8. Install the console cover to the handle (Figure 98).
- 9. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# Parking Brake Latch Switch





The parking brake latch switch is a normally open proximity switch. This switch is 1 of the several inputs for the TEC. The switch is attached to the handle assembly switch panel (Figure 101).

When the parking brake latch is released, the latch is positioned near the target end of the parking brake latch switch so that the switch is closed. The parking brake latch is moved away from the switch when the latch is engaged causing the switch to be in its normally open state.

## Checking the Operation of Parking Brake Latch Switch

Check the operation of parking brake latch switch with the InfoCenter on the console. With the key switch in the RUN position and the InfoCenter in the diagnostics menu, choose the P Brake Latch and ensure that the switch state changes as the parking brake latch is engaged and released. Further parking brake latch switch testing is necessary only if the switch state does not change when using the InfoCenter.

## **Testing the Parking Brake Latch Switch**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Remove the console cover from the handle to get access to the parking brake latch switch (Figure 100).
- 4. Disconnect the parking brake latch switch connector from the machine wire harness.
- 5. Connect a multimeter (ohms setting) across the switch connector terminals to check the continuity of the parking brake latch switch.
- 6. With the parking brake released, there should be continuity (zero ohms) across the switch terminals.
- 7. Check that the switch opens (infinite ohms) as the parking brake latch is engaged.

# Testing the Parking Brake Latch Switch (continued)

8. Replace the parking brake latch switch if necessary.

# Removing and Installing the Parking Brake Latch Switch

- 1. Disconnect the parking brake latch switch from the machine wire harness.
- 2. Remove the 2 washer-head screws and 2 locknuts that mount the switch to the switch panel on the handle (Figure 100), and remove the switch from the machine.

**Note:** For proper operation of parking brake latch switch, the screws and locknuts used to secure the switch are stainless steel. If these fasteners are replaced, ensure to use correct fasteners.

- 3. Position the switch to the switch panel and secure with the 2 washer-head screws and 2 locknuts (Figure 100).
- 4. Adjust the parking brake latch switch; refer to Parking Brake Latch Switch (page 5–33).
- 5. Connect the switch to the machine wire harness. Secure the console cover to the handle.
- 6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Traction Switch**



3. Console cover

- 6. Traction switch



1. Traction switch

g202427

Switch mount bracket 2.

- Bolt head 3.
- Engagement lever 4.

The traction switch is a normally open proximity switch. This switch is 1 of the several inputs for the TEC. The switch is attached to the handle assembly switch mount bracket (Figure 103).

When the traction engagement lever is not engaged, the head of the bolt in the traction lever is positioned away from the target end of the traction switch so that the switch is in its normal open state. The head of the bolt in the traction engagement lever is moved toward the switch target when the traction lever is engaged causing the switch to close.

## **Checking the Operation of Traction Switch**

Check the operation of traction switch with the InfoCenter on the console. With the key switch in the RUN position and the InfoCenter in the diagnostics menu, choose the Traction and ensure that the switch state changes as the traction lever is applied and released. Further traction switch testing is necessary only if the switch state does not change when using the InfoCenter.

## **Testing the Traction Switch**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Remove the console cover from the handle to get access to the traction switch (Figure 102).
- 4. Disconnect the traction switch connector from the machine wire harness.
- 5. Connect a multimeter (ohms setting) across the switch connector terminals to check the continuity of the traction switch.
- 6. With the traction lever in the NEUTRAL position, there should not be continuity (infinite ohms) across the switch terminals.
- 7. Check that the switch closes (zero ohms) as the traction lever is engaged.
- 8. Replace the traction switch if necessary.

## **Removing and Installing the Traction Switch**

- 1. Disconnect the traction switch from the machine wire harness.
- 2. Remove the 2 washer-head screws and 2 locknuts that mount the switch to the switch mount bracket on the handle (Figure 102), and remove the switch from the machine.

**Note:** For proper operation of traction switch, the screws and locknuts used to secure the interlock switch are stainless steel. If these fasteners are replaced, ensure to use correct fasteners.

- 3. Position the traction switch to the switch bracket and secure with the 2 washer-head screws and 2 locknuts (Figure 102).
- 4. Adjust the traction switch; refer to Traction Switch (page 5–35).

Note: Ensure that the locknuts are securely tightened after adjustment.

- 5. Connect the switch to the machine wire harness. Secure the console cover to the handle.
- 6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Reel Engage Switch**



- 2. Lower handle
- 3. Console cover

- 5. Washer-head screw (2 each)
- 6. Reel engage switch
- 8. Locknut (2 each)



g202429

- Switch mount bracket 1.
- 3. Reel lever tab
- Reel engage switch 2.

Engagement lever 4.

The reel engage switch is a normally open proximity switch. This switch is 1 of the several inputs for the TEC. The switch is attached to the handle assembly switch mount bracket (Figure 104).

When the cutting unit is not engaged, the tab on the cutting unit engagement lever is positioned away from the target end of the reel engage switch so that the switch remains open. The tab on the reel lever is moved next to the switch when the cutting unit is engaged causing the switch to close.

## Checking the Operation of Reel Engage Switch

Check the operation of reel engage switch with the InfoCenter on the console. With the key switch in the RUN position and the InfoCenter in the diagnostics menu, choose the Reel Enable and ensure that the switch state changes as the cutting unit is engaged and released. Further reel engage switch testing is necessary only if the switch state does not change when using the InfoCenter.

### **Testing the Reel Engage Switch**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Remove the console cover from the handle to get access to the reel engage switch (Figure 104).
- 4. Disconnect the reel engage switch connector from the machine wire harness.
- 5. Connect a multimeter (ohms setting) across the switch connector terminals to check the continuity of the reel engage switch.
- 6. With the cutting unit drive not engaged, there should not be continuity (infinite ohms) across the switch terminals.
- 7. Check that the switch closes (zero ohms) as the cutting unit drive is engaged.
- 8. Replace the switch if necessary.

## Removing and Installing the Reel Engage Switch

- 1. Disconnect the reel engage switch from the machine wire harness.
- 2. Remove the 2 washer-head screws and 2 locknuts that mount the switch to the switch mount bracket on the handle (Figure 104), and remove the switch from the machine.

**Note:** For proper operation of reel engage switch, the screws and locknuts used to secure the reel engage switch are stainless steel. If these fasteners are replaced, ensure to use correct fasteners.

- 3. Position the switch to the switch panel and secure with the 2 washer-head screws and 2 locknuts (Figure 104).
- 4. Connect the switch to the machine wire harness. Secure the console cover to the handle.
- 5. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **EZ Turn Switch**



The EZ turn switch allows the EZ turn feature to be turned on and off. This switch is 1 of the several inputs for the TEC. The EZ turn switch is located on the switch panel (Figure 106).

**Note:** The EZ turn function is only active when the machine is being operated with the cutting unit engaged. Also, the EZ turn switch and EZ turn sensor are in series so both switch and sensor have to be ON for the EZ Turn function being ON. If either the switch or the sensor is OFF, the EZ Turn function will be OFF.

# Checking the Operation of EZ Turn Switch

Check the operation of EZ turn switch with the InfoCenter on the console. With the key switch in the RUN position and the InfoCenter in the diagnostics menu, choose the EZ Turn and ensure that the switch state changes as the switch is toggled between ON and OFF. Further EZ turn switch testing is necessary only if the switch state does not change when using the InfoCenter.

# **Testing the EZ Turn Switch**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Remove the console cover from the handle to get access to the EZ turn switch (Figure 106).
- 4. Disconnect the EZ turn switch connector from the machine wire harness.



5. The EZ turn switch terminals are marked as shown in Figure 107. The circuitry of the switch is shown in the Circuit Logic Table (page 5–57). With the use of a multimeter (ohms setting), test the switch functions to determine if continuity exists between the various terminals for each switch position. Check the continuity between the switch terminals.

### Circuit Logic Table

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Switch Position	Normal Circuits	Other Circuits
Off	1+2	4+5
ON	2+3	5+6

- 6. Replace the EZ turn switch if necessary.
- 7. Connect the switch to the machine wire harness. Secure the console cover to the handle.
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **EZ Turn Sensor**



The EZ turn sensor is a normally open proximity sensor that mounts to a sensor bracket mounted to the cutting unit roll frame (Figure 108). The sensing plate for the sensor is a target plate attached to the top of the cutting unit assembly. The TEC monitors the operation of the EZ turn sensor.

When the traction unit is supported on the traction drum with the cutting unit supported by both front and rear rollers on level ground, the target end of the EZ turn sensor is positioned away from the target plate on the cutting unit so that the sensor is open. The EZ turn sensor is moved toward the cutting unit target plate when the cutting unit is raised for turning, causing the sensor to close.

**Note:** The EZ turn sensor LED should be illuminated whenever the machine is operational (the key switch in the RUN position) and the cutting unit is raised.

**Note:** The EZ Turn function is only active when the machine is being operated with the cutting unit engaged. Also, the EZ turn switch and EZ turn sensor are in series so both switch and sensor have to be ON for the EZ Turn function to be ON. If either the switch or the sensor is OFF, the EZ Turn function will be OFF.

**Note:** The information on EZ turn sensor adjustment is included in the *eFlex Operator's Manual*.

## **Testing the Sensor**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position.
- 2. Turn the key switch to the START position to wake up the machine and then turn the key switch to the RUN position.
- 3. Check the LED on the cable end of the EZ turn sensor:
  - A. The sensor LED should not be illuminated when the cutting unit is being supported by both front and rear rollers on level ground.
  - B. The sensor LED should be illuminated when the cutting unit is raised (handle pushed down).

# **Testing the Sensor (continued)**

- 4. If the EZ turn sensor LED did not function correctly:
  - A. Ensure that the EZ turn sensor is properly adjusted (refer to the *Operator's Manual*). If necessary, adjust the sensor and return to step 4 above.
  - B. Ensure that the key switch is OFF and then disconnect the EZ turn sensor connector from the machine wire harness.
  - C. Turn the key switch to the START position to wake up the machine and then turn the key switch to the RUN position.



- D. Connect the multimeter common (-) test probe to the harness connector terminal C (black wire) and second test probe to the harness connector terminal A (pink wire) (Figure 109). Check with the multimeter that the harness connector has 12 VDC circuit voltage present.
- E. If the sensor connector has circuit voltage present and sensor LED did not function, replace the EZ turn sensor. Adjust the sensor after installation (refer to the *Operator's Manual*).
- 5. After you complete the EZ turn sensor testing, plug the sensor connector into the machine wire harness.
- 6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Speed Control Potentiometer**



The speed control potentiometer controls the electric motor speed which determines the traction and cutting unit speed. The TEC uses the potentiometer setting as an input to determine the necessary signal output for the motor controller for correct electric motor speed. The speed control potentiometer is attached to the speed control assembly on the handle (Figure 110).

# **Checking the Operation of Speed Control Potentiometer**

Check the operation of speed control potentiometer with the InfoCenter. With the key switch in the RUN position and the InfoCenter in the diagnostics menu, choose the Throttle and ensure that the displayed voltage changes as the speed wheel is rotated. Further potentiometer testing is necessary only if the displayed voltage does not change when using the InfoCenter.

## **Testing the Speed Control Potentiometer**

1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.

## **Testing the Speed Control Potentiometer (continued)**

- Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Remove the console cover from the handle to get access to the speed control potentiometer.
- 4. Disconnect the machine wire harness connector from the potentiometer, and remove the potentiometer from the machine (Figure 110).

**Note:** Before taking the small resistance readings with a digital multimeter, short the multimeter test leads together. The meter displays a small resistance value (usually 0.5 ohms or less). This resistance is because of the internal resistance of the multimeter and test leads. Subtract this value from the measured value of the component that you are testing.



- 5. Use a multimeter, measure the resistances between the potentiometer terminals as follows (Figure 111):
  - A. Check that the resistance between the terminals B and C is approximately 5,000 ohms. Record the measured resistance.
  - B. Measure the resistance between the terminals A and C and then measure the resistance between the terminals A and B. Record these resistances. The total of the 2 measured resistances should be approximately 5,000 ohms.
  - C. Rotate the reel speed potentiometer to other settings and repeat the step
    B. The total of the 2 resistances should consistently be approximately
    5,000 ohms.
  - D. If measured resistances are incorrect, replace the speed control potentiometer.
- After you complete the testing, secure the potentiometer to the machine (Figure 110). Secure the wire harness connector to the potentiometer. Secure the console cover to the handle.
- Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Main Contactor**



1.

2. Screw (4 each)

3.

Locknut (2 each)



- Bolt (2 each) 1.
- Battery 2.

g269974

- Mount bracket 3.
- Controller 4

- Contactor 5. Nut (2 each) 6.
- 7. TEC

The Greensmaster eFlex machines use the main contactor to connect the lithium battery pack and the electric motor. The contactor is energized by the TEC. (For Models 04042, 04043 and 04046) The contactor is attached to the machine under the power center cover (Figure 112). (for Models 04042, 04043, 04046

and 04049 fitted with 04069) The contactor is attached to the mount bracket under the battery cover (Figure 113).

**Note:** When the key switch is turned to the START position, the contactor inside the battery pack will be energized followed shortly by the main contactor being energized. There should be an audible click as each of these contactors are energized.

**Note:** A damaged main contactor may cause a #16 fault to be generated and displayed on the InfoCenter. Refer to the Faults Screen (page 5–26) for information on faults.

### **Testing the Main Contactor**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. (For Models 04042, 04043, and 04046) Remove the 2 screws that secure the rear of the power center cover to the machine (Figure 112). Then, loosen the upper 2 screws on the cover. Carefully remove the cover from the machine.

(For Models 04042, 04043, 04046 and 04049 fitted with 04069) Remove the 8 bolts that secures the battery cover to the mount bracket; refer to Figure 90. Remove the battery cover from the mount bracket.



- 4. Ensure that the battery pack is disconnected. Use a multimeter to measure the resistance across the contactor posts as follows (Figure 114):
  - A. Resistance across the main contact posts should be infinite ohms.
  - B. Resistance across the coil posts should be approximately 195 ohms.
- 5. The machine wire harness connector for work lights can be used to access a ground connection for main contactor voltage testing:

1.

# Testing the Main Contactor (continued)

- A. Locate the wire harness connector for work lights located on the left side of the upper handle. The connector will be identified with a tag and will have a pink and a black wire attached to the connector.
- B. Remove the plug or work light harness connector (if the machine is equipped with optional work lights) from the machine wire harness work light connector.
- C. The machine wire harness work light connector leading to the harness black wire will be used for contactor voltage testing.



- 6. Use a multimeter to measure the voltage across the main contactor posts as follows:
  - A. Position the rubber boots away from the main contactor posts to get access to the posts with multimeter probes (Figure 115).
  - B. Connect the multimeter common (-) test probe to the ground connector in the work light connector (step 5).
  - C. Ensure that the traction lever is in the NEUTRAL position. Temporarily connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
  - D. Turn the key switch to the START position to wake up the machine and then turn the key switch to the RUN position. The main contactor should click as it is energized.
  - E. Use the second multimeter test probe, check that all 4 posts on the main contactor have system voltage (42 V to 64 V @ 100% state of charge) present (Figure 115). If 1 or more posts do not have system voltage present, the contactor is damaged. If none of the posts have voltage present, ensure that common (-) test probe is still connected to the work light connector and if so, look for electrical issues at other machine components as the contactor is not being energized correctly.
  - F. Turn the key switch to the OFF position. The main contactor should click as it is de-energized.
  - G. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Testing the Main Contactor (continued)**

- 7. If testing determines that the main contactor is damaged, ensure that the battery pack is disconnected and then replace the main contactor.
- 8. After you complete the main contactor testing, install the power center cover to the machine (Figure 112) (for models 04042, 04043 and 04046) and install the battery cover and secure with 8 bolts (for Models 04042, 04043, 04046 and 04049 fitted with 04069).
- 9. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **CAN-bus Terminator Resistor**



The system communication between the electrical components on the Greensmaster eFlex machines is accomplished on a CAN-bus communication system. The 2 specially designed, twisted cables form the bus for the networks used on the eFlex. These wires provide the data pathways between the machine components. At the ends of the twisted pair of bus cables are 120 ohm terminator resistors

The resistors plug into the wire harness in the following areas:

- 1. On the main wire harness near the InfoCenter under the handle console cover.
- 2. On the battery wire harness near the lithium battery pack connection.

**Note:** Refer to the Electrical Schematic and Wire Harness Drawings in Appendix A (page A–1)—Foldout Drawings for additional information on the terminator resistor locations and wire connections.

## IMPORTANT

# The terminator resistors at the ends of the bus cables are required for proper electrical system operation.

## **Testing the CAN-bus Terminator Resistor**

- 1. The CAN-bus terminator resistor (Figure 116) can be tested using a digital multimeter (ohms setting). Locate the CAN-bus terminator resistor and remove the cable tie that secures the resistor to the wire harness. Unplug the resistor from the wire harness for testing.
- 2. Use a digital multimeter (ohms setting) to measure the resistance value for the CAN-bus terminator resistor. There should be 120 ohms resistance between the terminals A and B. The terminal C is not used.
- 3. If the testing determines that the CAN-bus terminator resistor is damaged, replace the CAN-bus terminator resistor.
- 4. After you complete the testing, ensure that the CAN-bus terminator resistor is fully installed into the wire harness connector and secured to the wire harness with cable tie.

# Relay (For Models 04042, 04043, 04046 and 04049 fitted with 04069)



The relay used on the eFlex machine is 5 terminal 48 V relay and located below the TEC controller inside the battery cover: refer to Figure 117.

# **Testing the Relay**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Remove the 8 bolts that secures the battery cover to the mount bracket; refer to Figure 90. Remove the battery cover from the mount bracket.
- 4. Note the position of the connectors and wire harness on the relay for the assembly purposes. Disconnect the machine wire harness connectors from the relay. Remove the relay from the machine for ease of testing.

# Testing the Relay (continued)

- 5. Use a multimeter (ohm setting) to measure the resistance between the following relay terminals; refer to Figure 117.
  - A. Continuity should exists between terminals 30 and 87a.
  - B. There should not be continuity between terminals 30 and 87.
  - C. Resistance between terminals 85 and 86 (relay coil) should be from **2.3K** to **2.8K ohms**.
- 6. Connect a multimeter (ohms setting) to relay terminals 30 and 87. Ground the terminal 86 and apply +48 VDC to terminal 85. The relay should make and break continuity between terminals 30 and 87 as 48 VDC is applied and removed from terminal 85.
- 7. Connect a multimeter (ohms setting) to relay terminals 30 and 87a. Ground the terminal 86 and apply +48 VDC to terminal 85. The relay should make and break continuity between terminals 30 and 87a as 48 VDC is applied and removed from terminal 85.
- 8. Replace the relay if necessary.
- 9. If the relay test correctly and a circuit problem still exists, check the wire harness; refer to A Electrical Schematic-1800/2100, and 2120 (for Models 04042, 04043, 04046 and 04049 fitted with 04069) (page A–4).
- 10. If relay removed for testing, install the relay to the mount bracket and secure with 2 bolts and nuts.
- 11. Connect the cable connector and wire harness to the relay as noted during disassembly.
- 12. Install the battery cover onto the mount bracket and secure with 8 bolts.
- 13. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Service and Repairs**

# **Electric Motor**



**Note:** A damaged electric motor assembly may cause a #6, #7, #8, #9, or #10 fault to be generated and displayed on the InfoCenter display. Refer to the Faults Screen (page 5–26) for information on faults.

# **Removing the Electric Motor**

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).
- 3. Disconnect the electric motor connections from the machine wire harness.
- 4. Support the electric motor to prevent it from falling.

# **Removing the Electric Motor (continued)**

- 5. Remove the 2 flange-head screws (item 7 in Figure 118) that secure the electric motor to the transmission.
- 6. Carefully slide the electric motor from the transmission, and remove the motor from the machine.
- 7. Remove and discard the O-ring (item 6 in Figure 118) from the flange of the motor.

# Installing the Electric Motor

- 1. Apply a light coating of grease to new O-ring (item 6 in Figure 118). Install the O-ring to the flange of the electric motor.
- 2. Apply grease to the splines of the motor shaft.
- 3. Position the electric motor to the transmission, align the splines of the motor shaft to the transmission coupler, and insert the motor shaft into the coupler. Slide the motor fully to the transmission surface.



- 4. Secure the electric motor to the transmission with the 2 flange-head screws; torque the screws to **29 to 33 N·m (21 to 25 ft-lb)**.
- 5. Connect the electric motor connections to the machine wire harness.
- 6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

# **Servicing the Electric Motor**



**Note:** If the motor housing, controller, or cable damage occurs, the electric motor replacement is necessary. These components are not available separately.

**Note:** If problems with electric motor exist, an advisory or fault may be identified on the InfoCenter display. Refer to the InfoCenter Display (page 5–19) for information on advisories and faults.

## **Disassembling the Electric Motor**

- 1. Remove the 6 torx-head screws that secure the gearbox cover (item 2 in Figure 119) to the front of the motor housing.
- 2. Carefully slide the gearbox cover from the front of the motor.
- 3. Remove and discard the O-rings (items 3 and 4 in Figure 119) from the gearbox cover.
- 4. Slide the output gear assembly (items 11, 14, and 12 in Figure 119) from the motor housing, and remove the wave washer.

# **Disassembling the Electric Motor (continued)**

5. Remove the 6 torx-head screws that secure the motor cover (item 8 in Figure 119) to the rear of the motor housing.

### IMPORTANT

The rotor magnets are very powerful and can cause the rotor to shift position very rapidly during removal. Be cautious during rotor removal to prevent component damage or personal injury.

- Use an electric motor rotor tool set (refer to Electric Motor Rotor Tool Set (page 5–16)) to carefully remove the rotor assembly (items 11, 5, and 12 in Figure 119) and motor cover from the motor housing.
- 7. Remove the motor cover and wave washer from the rotor assembly. Remove and discard the O-rings (items 10 and 7 in Figure 119) from the cover.
- 8. Remove and discard the O-ring (item 3 in Figure 119) from the motor housing.

### IMPORTANT

Ensure that you do not damage the gearbox cover counterbore when removing the shaft seal from the cover.

- 9. Carefully remove the shaft seal from the gearbox cover, and discard the seal.
- 10. If necessary, remove the bearings from the output gear (item 14 in Figure 119) and rotor. Discard the bearings if they are removed.
- 11. Inspect grease in the output gear area of the motor housing. If grease is clean and not contaminated, it can remain in the housing. If grease is contaminated, clean the grease from the housing and replace with 15 ml of NLGI grade 00 grease during motor assembly.
- 12. Inspect the motor components for wear or damage. Replace the components or complete electric motor assembly if necessary.

## Assembling the Electric Motor

- 1. Ensure that all the motor components are cleaned before assembly.
- 2. If the bearings were removed from the output gear (item 14 in Figure 119) and rotor, install new bearings.

**Note:** Ensure that the bearings are fully pressed onto the shafts.

 Lubricate new inner O-ring (item 3 in Figure 119) with dielectric lubricant (refer to Dielectric Gel (page 2–15)) and install the O-ring into the rear of the motor housing.

## IMPORTANT

The rotor magnets are very powerful and can cause the rotor to shift position very rapidly during installation. Be cautious during rotor installation to prevent component damage or personal injury.

 Use an electric motor rotor tool set (refer to Electric Motor Rotor Tool Set (page 5–16)) to carefully install the rotor assembly (items 11, 5, and 12 in Figure 119) into the motor housing.

# Assembling the Electric Motor (continued)

- 5. Lubricate new O-rings (items 10 and 7 in Figure 119) with dielectric lubricant (refer to Dielectric Gel (page 2–15)) and install the O-rings into the grooves in the motor cover. Place the wave washer in the cover.
- 6. Carefully slide the motor cover onto the rotor until it contacts the motor housing. Secure the cover with the 6 torx-head screws.
- 7. Ensure that the rotor rotates before continuing with motor assembly.
- 8. Place the wave washer into the housing bore for the output gear bearing.
- 9. Ensure that the output gear area of the motor housing has clean grease remaining in housing. If grease was cleaned from housing, install 15 ml of new NLGI grade 00 grease into the housing during motor assembly.
- 10. Slide the output gear assembly (items 11, 14, and 12 in Figure 119) into the front of the housing. Ensure that the output gear teeth mesh with the rotor gear.



- 11. Install the shaft seal (item 1 in Figure 119) into the gearbox cover. Press the shaft seal into the front cover until it is flush with the cover surface. The shaft seal should have the seal lip toward the inside of the motor (Figure 120).
- 12. Lubricate new O-rings (items 3 and 4 in Figure 119) with dielectric lubricant (refer to Dielectric Gel (page 2–15)) and install the O-rings into the grooves in the gearbox cover.

# IMPORTANT

# Ensure that you do not damage the shaft seal when installing the gearbox cover.

13. Carefully slide the gearbox cover onto the output gear shaft until it contacts the motor housing. Secure the cover with the 6 torx-head screws.



14. Torque all the torx-head screws (item 9 in Figure 119) on the gearbox cover and motor cover to 4 to 5 N·m (35 to 45 in-lb).

# Lithium Battery Pack (for Models 04042, 04043, and 04046)

# CAUTION

A

The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.
- Only use the charger designed for the battery pack.

**Note:** Refer to your *Traction Unit Operator's Manual* and *Lithium Battery Pack Charger Operator's Manual* for additional information about lithium battery pack service and handling.

### **Removing the Lithium Battery Pack**

A

1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.



2. Disconnect the battery pack; refer to Service Procedure Icons (page 6). Also, disconnect the battery wire harness 6-pin connector from the machine wire harness (Figure 121).

# **Removing the Lithium Battery Pack (continued)**



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### Figure 122 eFlex 2120 Model 04046 (shown)

- 1. Lithium battery pack
- 2. Rear battery base
- 3. Tall nut
- 4. Battery base
- 5. Flange-head screw (2 each)
- 6. Flange nut (2 each)
- 7. Bolt (6 each)
- 8. Flat washer (6 each)
- 9. Foam strip
- 3. Remove the tall nut (item 3 in Figure 122) that secures the rear of the battery base to the frame.
- 4. Loosen, but do not remove the 2 flange-head screws (item 5 in Figure 122) and 2 flange nuts to allow the battery base to pivot.

# **Removing the Lithium Battery Pack (continued)**



eFlex 2120 Model 04046 (shown)

Lithium battery pack 1.

3. Bolt and flat washer (6 each)

Battery base 2.

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- Locking hole 4.
- 5. Pivot the battery base and battery pack until the locking holes in the base and frame align (Figure 123). Insert a screwdriver or other steel rod through the holes to hold the battery base in the raised position.



6. Rotate the wire harness connector locking collar counterclockwise and disconnect the connector from the battery pack (Figure 124).



The weight of the battery pack is 24.5 kg (54 lb).

Support the battery pack to prevent it from falling and causing personal injury.

7. Support the battery pack to prevent it from moving or falling.

# **Removing the Lithium Battery Pack (continued)**

- 8. Remove the 6 bolts (item 7 in Figure 122) and 6 flat washers that secure the battery pack to the battery base.
- 9. Carefully remove the battery pack from the battery base and the machine.

### IMPORTANT

Do not open the lithium battery pack. With the exception of the battery pack fuse, fuse cover, and labels, there are no consumer serviceable parts on or in the battery pack. If you open the battery pack, you will void the warranty. The battery pack is protected by tamper-alerting devices.

## Installing the Lithium Battery Pack

- 1. Ensure that the battery base is raised and supported.
- 2. Carefully position the battery pack to the battery base. The battery connector port should be toward the rear of the machine.



- 3. Secure the battery pack to the battery base with the 6 bolts (item 7 in Figure 122) and 6 flat washers; torque the bolts to **11.3 to 14 N·m (100 to 130 in-lb)**.
- 4. Connect the wire harness connector to the battery pack (Figure 124) as follows:
  - A. Line up the tabs on the inside of the wire harness connector with the slots in the battery pack receptacle and press the wire harness connector into the battery pack receptacle.
  - B. Rotate the locking collar on the harness connector clockwise until it engages with the battery pack receptacle and begins to pull in toward the battery. Continue rotating the collar approximately 120° (1/3 of a turn) until it fully seats.

## **IMPORTANT**

When pivoting battery pack to the frame, ensure to not pinch the wire harness between the machine components.

- 5. Remove the screwdriver or rod used to hold the battery base in the raised position. Carefully pivot the battery base and battery pack to the machine frame. Ensure that the wire harness is not pinched between the machine components as you lower the battery.
- 6. Secure the rear of the battery base to the frame with the tall nut (item 3 in Figure 122). Then, secure the front of the base to the frame by fully tightening the 2 flange-head screws and 2 flange nuts.
- 7. Connect the battery wire harness 6-pin connector to the machine wire harness (Figure 121).
- 8. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

### IMPORTANT

Do not open the lithium battery pack. With the exception of the battery pack fuse, fuse cover, and labels, there are no consumer serviceable parts on or in the battery pack. If you open the battery pack, you will void the warranty. The battery pack is protected by tamper-alerting devices.

## Lithium Battery Pack Care

When mowing, use the InfoCenter on your eFlex to monitor the state of charge of the lithium battery pack. Consistently operating the machine with a very low state of charge will adversely affect the life of the battery pack.

If problems with the battery pack exist, an advisory or fault may be identified on the InfoCenter display. Refer to the InfoCenter Display (page 5–19) for information on advisories and faults.

When finished with machine use for the day, park your eFlex in a clean and dry garage or storage area that is away from direct sunlight and other heat sources. Do not store the machine in a location where the battery pack temperature could rise above 45°C (113°F). If the battery is subjected regularly to excessive temperatures, the life of the battery pack will be reduced.

Charge the battery pack when you are finished mowing for the day to ensure that the battery is fully charged for the next mowing. Lithium ion batteries do not have a charge memory issue and do not need to be fully discharged before charging them. Ensure that the battery pack is charged with the Toro lithium battery pack charger that is specifically designed for the eFlex battery pack. For best battery life, connect the battery pack to the battery charger when the machine is not in use.

Keep the battery pack cover clean. A dirty cover will increase the heat in the battery pack and will reduce the energy capacity and life of the battery pack.

The eFlex lithium battery pack includes a fuse for battery circuit protection. For information on servicing the battery pack fuse, refer to Lithium Battery Pack Fuse (For Models 04042, 04043, and 04046) (page 5–43).

If the lithium battery pack service is necessary, contact your Toro Distributor for assistance.

## Lithium Battery Pack Storage

If the mower will be stored for more than 10 days, ensure that the battery is connected to the lithium battery pack charger. If the battery pack is not connected to the charger during storage, the battery pack life will be reduced.

Do not store the machine in a location where the temperature will drop below -25°C (-13°F) or rise above 45°C (113°F). Because storage temperature will affect the life of the battery pack, avoid storing your eFlex in temperatures outside of this range. Storage for long periods of time at high temperatures will reduce the life of the battery pack, especially if the pack is stored with a high charge. Where possible, store the machine in a cool (not below freezing) location.

After 10 days, the charger will enter a storage maintenance mode, adjusting the battery to a charge of 40% of maximum. This charge level during long term storage will ensure the full life of the battery. If you do not keep the battery pack connected to the charger during storage, the high state of charge in the battery pack will shorten the life of the battery, especially if stored in warm conditions.
#### Lithium Battery Pack Storage (continued)

Follow the procedure in the *eFlex Operator's Manual* for removing the machine from storage.

#### Shipping and Transporting the Lithium Battery Pack

The US Department of Transportation and international transportation authorities require that lithium ion batteries be transported using special packaging and only be transported by carriers certified to haul them. In the USA, you are allowed to transport the battery when it is installed on the machine as battery powered equipment, with some regulatory requirements. Contact the US Department of Transportation or the appropriate government body in your country for detailed regulations on transportation of your eFlex or eFlex battery.

The Toro Battery Shipping Kit includes instructions that detail information on shipping the lithium battery pack. Refer to the *Operator's Manual* for part number information. These instructions are also available for download from www.toro.com. Failure to ship the lithium battery pack correctly can result in large fines.

# Samsung Lithium Battery Pack (for Models 04042, 04043, 04046 and 04049 fitted with 04069)

#### CAUTION

The eFlex Samsung lithium battery pack contains high voltage which could burn or electrocute you.

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- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.
- Only use the charger designed for the battery pack.

**Note:** Refer to your *Traction Unit Operator's Manual* and *Lithium Battery Pack Charger Operator's Manual* for additional information about Samsung lithium battery pack service and handling.

#### **Removing the Samsung Lithium Battery Pack**

A

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- 2. Disconnect the battery pack; refer to Service Procedure Icons (page 6). Remove the 8 bolts that secures the battery cover to the mount bracket; refer to Figure 90. Remove the battery cover from the mount bracket.



1. Positive battery cable

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- 3. Negative battery cable
- 2. Interface harness cable
- 3. Remove the positive battery cable, negative battery cable and interface harness cable from the battery; refer to Figure 125.

#### Removing the Samsung Lithium Battery Pack (continued)



- 1. Flange nut (4 each)
- 2. Bolt (4 each)

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3. Washer (4 each)

- 4. Battery
- 5. Mount bracket

CAUTION

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The weight of the battery pack is 11 kg (24 lb).

# Support the battery pack to prevent it from falling and causing personal injury.

- 4. Remove the 4 bolts, washers and nuts that secures the battery to the mount bracket.
- 5. Carefully remove the battery from the mount bracket and the machine.

#### IMPORTANT

Do not open the Samsung lithium battery pack. There are no consumer serviceable parts on or in the battery pack. If you open the battery pack, you will void the warranty. The battery pack is protected by tamper-alerting devices.

#### Installing the Samsung Lithium Battery Pack

- 1. Ensure that the battery pack is clean and free from dirt.
- 2. Carefully position the battery pack onto the mount bracket. The battery connectors should be towards the mount bracket.
- 3. Secure the battery pack to the mount bracket with the 4 bolts, washers and nuts.
- 4. Connect the positive battery cable, negative battery cable and interface harness cable to the battery; refer to Figure 125.
- 5. Coat the battery terminal posts and cable connectors with the battery terminal protector to prevent corrosion.

#### Installing the Samsung Lithium Battery Pack (continued)

- 6. Install the battery cover onto the mount bracket and secure the battery cover with the 8 bolts.
- 7. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

#### Servicing the Samsung Lithium Battery pack

#### **IMPORTANT**

Do not open the Samsung lithium battery pack. There are no consumer serviceable parts on or in the battery pack. If you open battery pack, you will void the warranty. The battery pack is protected by tamper-alerting devices.

#### Samsung Lithium Battery Pack Care

When mowing, use the InfoCenter on your eFlex to monitor the state of charge of the lithium battery pack. Consistently operating the machine with a very low state of charge will adversely affect the life of the battery pack.

If problems with the battery pack exist, an advisory or fault may be identified on the InfoCenter display. Refer to the InfoCenter Display (page 5–19) for information on advisories and faults.

When finished with the machine use for the day, park your eFlex in a clean and dry garage or storage area that is away from direct sunlight and other heat sources. Do not store the machine in a location where the battery pack temperature could rise above 45°C (113°F). If the battery is subjected regularly to excessive temperatures, the life of the battery pack will be reduced.

Charge the battery pack when you are finished mowing for the day to ensure that the battery is fully charged for the next mowing. Lithium ion batteries do not have a charge memory issue and do not need to be fully discharged before charging them. Ensure that the battery pack is charged with the Toro lithium battery pack charger that is specially designed for the eFlex battery pack. For best battery life, connect the battery pack to the battery charger when the machine is not in use.

Keep the battery pack cover clean. A dirty cover will increase the heat in the battery pack and will reduce the energy capacity and life of the battery pack.

#### Samsung Lithium Battery Pack Storage

If the mower will be stored for more than 10 days, ensure that the battery is connected to the lithium battery pack charger. If the battery is not connected to the charger during storage, the battery pack life will be reduced.

Do not store the machine in a location where the temperature will drop below -25°C (-13°F) or rise above 45°C (113°F). Because storage temperature will affect the life of the battery pack, avoid storing your eFlex in temperatures outside of this range. Storage for long periods of time at high temperatures will reduce the life of the battery pack, especially if the pack is stored with a high charge. Where possible, store the machine in a cool (not below freezing) location.

Follow the procedure in the *eFlex Operator's Manual* for removing the machine from the storage.

#### Shipping and Transporting the Samsung Lithium Battery Pack

The US Department of Transportation and international transportation authorities require that lithium ion batteries be transported using special packaging and only be transported by carriers certified to haul them. In the USA, you are allowed to transport the battery when it is installed on the machine as battery powered equipment, with some regulatory requirements. Contact US Department of Transportation or the appropriate government body in your country for detailed regulations on transportation of your eFlex or eFlex battery.

The Toro Battery Shipping Kit includes instructions that detail information on shipping the lithium battery pack. Refer to the Operator's Manual for part number information. These instructions are also available for download from www.toro.com. Failure to ship the lithium battery pack correctly can result in large fines. Samsung Battery Controller (for Models 04042, 04043, 04046 and 04049 fitted with 04069)





#### Figure 127 (continued)

1.	Battery cover	8.	Samsung battery	15.	Washer	22.	Contactor
2.	Washer head bolt (8 each)	9.	Flange nut (4 each)	16.	Samsung controller	23.	Bolt (2 each)
3.	Bolt (2 each)	10.	Bolt (2 each)	17.	Bolt (4 each)	24.	Relay
4.	Bolt (2 each)	11.	Mount bracket	18.	Flat washer (4 each)	25.	Lock nut (2 each)
5.	Flange nut (4 each)	12.	Flange nut (2 each)	19.	Flange nut (2 each)	26.	Flange nut (2 each)
6.	Bolt (4 each)	13.	Spacer	20.	TEC controller		
7.	Flat washer (4 each)	14.	Bolt (2 each)	21.	Flange nut (2 each)		

The Samsung battery controller consists of safety devices, protection circuits and Battery Management System (BMS). The controller for normal operation must be connected to the battery pack.

# CAUTION

The eFlex Samsung lithium battery controller contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery controller.
- Do not place anything in the connector of the battery controller other than the wire harness connector that came with the product.
- Use extreme care when handling a battery controller with a cracked case.
- Only use the charger designed for the battery controller.

**Note:** Refer to your *Traction Unit Operator's Manual* and *Lithium Battery Pack Charger Operator's Manual* for additional information about Samsung lithium battery pack service and handling.

#### **Removing the Samsung Battery Controller**

A

- 1. Park the machine on a level surface and place the traction lever in the NEUTRAL position. Turn the key switch to the OFF position and remove the key from the key switch.
- Disconnect the battery pack; refer to Service Procedure Icons (page 6). Remove the 8 bolts that secures the battery cover to the mount bracket; refer to Figure 127. Remove the battery cover from the mount bracket.
- 3. Remove the Samsung battery pack from the mount bracket; refer to Removing the Samsung Lithium Battery Pack (page 5–80).
- 4. Note the position of the connectors and wire harness on the contactor for the assembly purposes. Remove the connectors from the contactor.
- 5. Remove the 2 nuts and bolts that secures the contactor to the mount bracket. Remove the contactor from the mount bracket.
- 6. If necessary, remove the TEC controller from the mount bracket as below:
  - A. Unplug the connectors from the TEC controller.
  - B. Remove the 2 bolts and flange nuts that secures the TEC controller to the mount bracket.
  - C. Remove the TEC controller from the mount bracket.
- 7. If necessary, remove the relay from the mount bracket as below:

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#### Removing the Samsung Battery Controller (continued)

- A. Note the position of the connectors and wire harness on the relay for assembly purposes.
- B. Remove the 2 nuts and bolts that secures the relay to the mount bracket.
- C. Remove the relay from the mount bracket.
- 8. Note the position of the connectors and wire harness on the controller for assembly purposes. Remove the connectors from the controller.
- 9. Remove the 4 bolts, washers and nuts that secures the controller to the mount bracket. Remove the controller from the mount bracket.

#### Servicing the Samsung Battery Controller

#### IMPORTANT

Do not open the Samsung battery controller. There are no consumer serviceable parts on or in the battery controller. If you open the battery controller, you will void the warranty. The controller is protected by tamper-alerting devices.

Installing the Samsung Battery Controller





- 1. Negative Power out to machine
- 2. Negative Power in from battery
- 3. COM port To machine

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- 4. COM port From battery
- 5. Positive Power in from battery
- 6. Positive Power out to machine

#### IMPORTANT

When connecting the battery pack in the system, ensure that the battery polarity is carefully checked. Damage to fuses or other system components can occur if batteries are not connected correctly.

- 1. Ensure that the ignition switch and all accessories are off.
- 2. Ensure that the battery controller component is clean.

#### Installing the Samsung Battery Controller (continued)

- 3. Ensure that the controller cables, components and posts are in good condition.
- Connect the battery positive power in from battery cable (item 5 in Figure 128) to the battery positive post in the controller and secure with a washer and nut.
- 5. Connect the battery negative power in from battery cable (2) to the battery negative post in the controller and secure with a washer and nut.
- 6. Connect the COM port wire harnesses (3) to the controller; refer to Figure 128.
- 7. Connect the positive power out to machine cable (6) to the controller; refer to Figure 128.
- 8. Connect the negative power out to machine cable (1) to the controller; refer to Figure 128.
- 9. Coat the controller posts and cable connectors with the battery terminal protector to prevent corrosion.
- 10. Install the controller onto the mount bracket and secure with the 4 bolts, washers and nuts.
- 11. If removed, install the TEC controller to the mount bracket as below:
  - A. Install the TEC controller to the mount bracket and secure with 2 bolts and flange nuts; refer to Figure 127.
  - B. Connect the connectors to the TEC controller.
- 12. If removed, install the relay to the mount bracket as below:
  - A. Install the relay to the mount bracket and secure with 2 bolts and lock nuts; refer to Figure 127.
  - B. Connect the connectors to the relay.
- 13. Install the contactor onto the mount bracket and secure with 2 bolts and nuts.
- 14. Connect the cable connectors to the contactor as noted during disassembly.
- 15. Install the Samsung battery pack onto the mount bracket; refer to Installing the Samsung Lithium Battery Pack (page 5–81).
- 16. Install the battery cover onto the mount bracket and secure with 8 bolts.
- 17. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 5–7).

### Lithium Battery Pack Charger (for Models 04042, 04043 and 04046)





The lithium battery pack charger (Figure 129) is used to charge the nominal 53 V (42 V to 64 V @ 100% state of charge), 35 Ah lithium ion battery pack that is used to power the eFlex. The charger communicates via CAN with the battery management system (BMS) located within the lithium battery pack. Refer to the *eFlex Operator's Manual, Lithium Battery Pack Charger Operator's Manual,* and Lithium Battery Pack Charger Operation (for Models 04042, 04043 and 04046) (page 5–10) in this chapter for additional information about the eFlex battery charger.

**Note:** Ensure that the charger is connected to the battery pack, plugged into a wall outlet, and turned ON whenever the machine is not in use.

The LED's and LCD message display on the charger should identify charger status during normal operation. If the LED's and LCD display do not illuminate when the charger is connected to the power supply with the power switch turned ON, ensure that the AC power supply is available for the charger. Also, consider that the charger fuse located in the fuse tray under the charger power switch may be damaged.

# Lithium Battery Pack Charger (for Models 04042, 04043 and 04046) (continued)

The charger LCD message display may indicate a problem with either the charger or the battery pack during charger operation. Should there be charging operation issues due to a fault with the charger or battery pack, a first step to remedy the issue would be to turn the battery charger power switch to OFF, disconnect the charger output cord from the battery pack, disconnect the charger power cord from the outlet, and wait for a minute to allow complete charger and battery shutdown. Then, correctly connect the battery pack charger and restart the charging operation to see if operation has returned to normal. Some faults will be reset during the restart and will then allow normal charger operation. If a fault continues to occur, ensure to record the fault information from the charger LCD display and contact your Toro Distributor for assistance.

With the exception of the battery charger fuse, power supply cord and labels, there are no consumer serviceable parts on or in the lithium battery pack charger. If a charger is inoperative and fuse and power supply cord are not damaged, charger replacement may be necessary.

# Lithium Battery Pack Charger (for Models 04042, 04043, 04046 and 04049 fitted with 04069)



- 1. Error indicator light
- 2. USB port cover

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- 3. AC power indicator light
- 4. Battery charging indicator light
- 5. Charging output indicator light

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- 6. LCD display
- 7. Select button

#### 

#### WARNING

Battery charging is dangerous when done improperly. Do not allow untrained people to operate this equipment. Thoroughly review the safety instructions before you operate this equipment.

- Do not attempt to open the battery pack charger.
- Do not place anything in the connector of the battery pack charger other than the power supply cord that came with the product.

Refer to *Lithium Battery Charger Operator's Manual* for additional information and troubleshooting.





# **Chassis and Controls**

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# **General Information**

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

### **Connecting the Lithium Battery Pack**

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lithium battery pack.

#### WARNING

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The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.

CAUTION

Before servicing the machine, disconnect the machine from the

• Only use the charger designed for the battery pack.

This will prevent unexpected machine operation.



g202195

Figure 132 eFlex 2120 Model 04046 (shown)

1. Machine connector2. Battery pack3. Battery connector

To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 132). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or machine components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

# **Service and Repairs**

## Handle Assembly



#### **Removing the Handle Assembly**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).
- 2. Remove the console cover from the handle assembly (Figure 133).
- Disconnect the reel clutch and brake cables from the transmission; refer to Replacing the Brake Cable (page 6–7) and Replacing the Reel Clutch Cable (page 6–10).
- 4. For assembly purposes, label all the wire harness connections. Disconnect the wire harness connections from the electrical components on the handle. Position the wire harness away from the handle.
- 5. Note the height adjustment of the handle for assembly purposes.
- 6. Support the handle assembly to prevent it from moving.

#### Removing the Handle Assembly (continued)



**Note:** The offset handle clamps on eFlex 2100/2120 machines are mounted on the outside of the side plates (Figure 134). On eFlex 1800 machines, the offset handle clamps are mounted on the inside of the side plates.

- 7. Remove the handle clamps from the handle assembly (Figure 134) as follows:
  - A. Remove the carriage screws and flange nuts that secure the handle clamps to the offset handle clamps.
  - B. Remove the flange nuts that secure the shoulder bolts at the bottom of the handle clamps.
  - C. Remove the inner handle clamps. Leave the shoulder bolts and outer handle clamps in place on the handle.
- 8. Remove the handle assembly from the machine.

#### Installing the Handle Assembly

- 1. Position the handle assembly to the outer handle clamps on the machine.
- 2. Fit the inner handle clamps to the handle assembly and secure with removed fasteners (Figure 134). Adjust the handle height before you fully tighten the fasteners.

**Note:** The handle is traditionally operated with the handle adjusted to the maximum height.

#### Installing the Handle Assembly (continued)

- Attach the reel clutch and brake cables to the transmission; refer to Replacing the Brake Cable (page 6–7) and Replacing the Reel Clutch Cable (page 6–10). Check the operation of the cables and adjust if necessary.
- 4. Connect the wire harness connections to the electrical components on the handle.
- 5. Secure the console cover to the handle assembly (Figure 133).
- 6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).

### **Replacing the Brake Cable**



#### **Removing the Brake Cable**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).
- 2. Remove the brake cable from the brake lever shaft on the drum drive housing (Figure 136) as follows:
  - A. Loosen the front cable jam nut that secures the cable to the casting slot on the drum drive housing. Separate the cable from the slot.

#### **Removing the Brake Cable (continued)**

- B. Remove the retaining ring that secures the cable eyelet to the brake shaft on the drum drive housing.
- C. Remove the brake cable eyelet from the brake lever shaft.
- 3. Remove the console cover from the handle assembly to get access to the upper end of the brake cable.
- 4. Remove the flange nut (item 14 Figure 135) that secures the brake cable eyelet to the brake lever on the machine handle.
- 5. Loosen the lower brake cable jam nut and lift the cable free from the brake cable bracket on the lower handle assembly. Remove the cable from the bracket.
- 6. Remove the brake cable from the machine.

#### Installing the Brake Cable

- 1. Secure the brake cable eyelet to the brake lever on the machine handle with the flange nut (item 14 in Figure 135).
- 2. Attach the brake cable to the brake cable bracket on the handle assembly with a washer and jam nut on each side of the bracket. Adjust the jam nuts so that equal amount of cable threads are visible above and below the jam nuts. Leave the jam nuts snug until final cable adjustment.



- 3. Route the brake cable to the drum drive housing and secure the brake cable to the brake lever shaft on the drum drive housing (Figure 136) as follows:
  - A. Install the cable eyelet to the brake lever and secure with the retaining ring.
  - B. Attach the brake cable to the casting slot on the drum drive housing with a washer and jam nut on each side of the slot. Adjust the jam nuts so that equal amount of cable threads are visible above and below the jam nuts.
- 4. Adjust the cable jam nuts at the brake cable bracket on the handle assembly so that it requires 15.9 kg (35 lb) applied to the brake lever to release the parking brake latch. After final cable adjustment, ensure that the brake does not drag.
- 5. Install the console cover to the handle assembly.

1.

2.

#### Installing the Brake Cable (continued)

6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).

## **Replacing the Reel Clutch Cable**



#### **Removing the Reel Clutch Cable**

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).



- 2. Remove the reel clutch cable from the transmission (Figure 138) as follows:
  - A. Loosen the front cable jam nut and lift the cable free from the casting slot of the transmission.
  - B. Remove the retaining ring that secures the cable eyelet to the reel clutch lever and slide the cable eyelet from the lever.
  - C. Remove the cable tie that secures the reel drive cable to the transmission bracket.
- 3. Remove the console cover from the handle assembly to get access to the upper end of the reel clutch cable.

#### **Removing the Reel Clutch Cable (continued)**



- 4. Remove the reel clutch cable from the traction lever assembly (Figure 139) as follows:
  - A. Loosen the bottom cable jam nut that secures the reel clutch cable to the shift mount bracket on the handle. Slide the cable from the bracket.
  - B. Remove the cable spring from the spring anchor on the traction lever assembly. Note the orientation of the cable spring hook on the traction lever assembly for assembly purposes.
- 5. Remove the reel clutch cable from the machine.

#### Installing the Reel Clutch Cable

- 1. Secure the reel clutch cable to the traction lever assembly (Figure 139) as follows:
  - A. Install the cable spring to the spring anchor on the traction lever assembly. Orientate the cable spring hook end toward front of the machine.
  - B. Slide the cable housing into the shift mount bracket slot. Ensure that a jam nut, flat washer, and lock washer are on both sides of the bracket. Adjust the jam nuts so that equal amount of cable threads are visible above and below the jam nuts. Leave the jam nuts snug until final cable adjustment.
- 2. Route the reel clutch cable to the transmission and install the cable (Figure 138) as follows:
  - A. Secure the cable eyelet to the transmission reel clutch lever with the retaining ring.
  - B. Position the reel clutch cable to the casting slot of the transmission with a jam nut, flat washer, and lock washer on each side of the slot.
  - C. Adjust and tighten the jam nuts to compress the cable spring to a length from **70.6 to 72.4 mm (2.780 to 2.850 inches)**.
  - D. Remove the rubber plug at front of the transmission to view reel clutch. Ensure that the reel clutch teeth disengage when the clutch is released.

#### Installing the Reel Clutch Cable (continued)

Also, check that the clutch teeth do not bottom out when the clutch is engaged.

- E. Secure the reel clutch cable to the transmission bracket with the cable tie.
- 3. Make final reel clutch cable adjustment at the traction lever assembly (Figure 139) as follows:
  - A. Loosen both top and bottom cable jam nuts at the shift mount bracket.
  - B. Pull down lightly on outer sheath of the clutch cable.
  - C. Rotate the bottom cable jam nut up on the cable threads until the bottom lock washer just contacts the shift mount bracket.
  - D. While holding the bottom jam nut in place, tighten the top cable jam nut.
- 4. Install the console cover to the handle assembly.
- 5. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).

### **Traction and Reel Drive Engagement Lever Assembly**



g198904

- Shift handle 1.
- 2. Bushing (10 each)
- Reel cam lever 3.
- 4. Bumper (2 each)
- Extension spring 5.
- Retaining ring (3 each) 6.
- 7. Spring lever
- Shifter link 8.
- Locknut 9.
- Detent ball 10.

#### Figure 140

- 11. Detent spring
- 12. Flat washer
- Bolt 13.
  - 14. Reel shift lever
  - 15. Spring collar
  - 16. Extension spring
  - 17. Washer-head screw
  - 18. Ball bearing
    - Shoulder screw
  - 19. 20. Locknut (2 each)

- 21. Flat washer (2 each)
- 22. Shoulder screw (2 each)
- 23. Shift arm link
- 24. Latch pin
- 25. Roll pin
- 26. Shifter latch
- 27. Spacer
- 28. Transport lever
- 29. Screw

#### Disassembling the Traction and Reel Drive Engagement Lever Assembly

g198905

1.

2.

4.

5.

6.

7.

Flange nut (4 each)

3.

1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).



- 14. Flange nut (2 each)
- 2. Remove the console cover from the handle to get access to the traction lever assembly (Figure 141).
- 3. Disconnect the reel clutch cable from the traction lever assembly; refer to Replacing the Reel Clutch Cable (page 6–10). Position the end of the cable away from the traction lever assembly.
- 4. Disconnect the wire harness connectors from the traction and reel engage switches (Figure 141).
- 5. Disconnect the spring (item 4 in Figure 141) that connects operator presence control with the traction lever assembly.
- 6. Remove the 4 flange-head screws (item 5 in Figure 141) and 4 flange nuts that secure the traction lever assembly and brackets to the handle. Remove the assembly (including lever assembly, shifter bracket, shift mount, and switch mount bracket) from the handle.
- 7. Remove the 2 flange-head screws (item 13 in Figure 141) and 2 flange nuts that secure the switch mount bracket and shift mount to the shifter bracket. Separate the brackets to allow disassembly of the traction lever assembly.
- 8. Disassemble the traction lever assembly (Figure 140 and Figure 141). Note the orientation of the end hooks on all the springs for assembly purposes.

#### Assembling the Traction and Reel Drive Engagement Lever Assembly

1. Assemble the traction lever assembly (Figure 140 and Figure 141).



- 1.
- Shifter bracket 2.

2.

**Clearance** location 5.

- 3. Screw and nut
- 2. If the shift arm link (item 23 in Figure 140) was removed from the transport lever, ensure that the tab on the shift arm link is positioned toward the solid end of the latch pin (Figure 142).

Note: One of the mounting holes in both the switch mount bracket and shift mount is elongated to allow for adjustment of clearance between the transport lever (item 28 in Figure 140) and the reel shift lever (item 14 in Figure 140).

3. Secure the switch mount bracket and shift mount to the shifter bracket with the 2 flange-head screws (item 13 in Figure 141) and 2 flange nuts. Before you fully tighten the fasteners, position the legs of the shifter bracket to get 1.0 mm (0.040 inch) clearance between the transport lever and the reel shift lever (Figure 143).

#### Assembling the Traction and Reel Drive Engagement Lever Assembly (continued)

- 4. Position the traction lever assembly (including lever assembly, shifter bracket, shift mount, and switch mount bracket) to the handle. Secure the assembly in place with the 4 flange-head screws (item 5 in Figure 141) and 4 flange nuts.
- 5. Connect the spring (item 4 in Figure 141) between the traction lever assembly and the operator presence control.
- 6. Connect the wire harness connectors to the traction and reel engage switches (Figure 141).
- Connect the reel clutch cable to the traction lever assembly; refer to Replacing the Reel Clutch Cable (page 6–10). Check the operation of the cable and adjust as necessary.
- 8. Check the adjustment of the traction and reel engage switches; refer to Traction Switch (page 5–35) and Reel Engage Switch (page 5–37). Adjust the switches if necessary.
- 9. Install the console cover to the handle.
- 10. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).

### **Kickstand**



**Note:** The offset handle clamps on eFlex 2100/2120 machines are mounted on the outside of the side plates. On eFlex 1800/2120 machines, the offset handle clamps are mounted on the inside of the side plates. The illustration in Figure 144 shows the eFlex 2100/2120.

#### **Removing the Kickstand**

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).
- 2. Pivot the kickstand up and hold against the frame stops.

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#### CAUTION

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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.



- Use a nut driver or small diameter pipe over the end of the torsion spring. Push the torsion spring down and in to release the spring tension (Figure 145). Slide the torsion spring from the pin on the rear frame.
- 4. Remove the bolt (item 7 in Figure 144), spacer, and flange nut that secure the left side of the kickstand to the rear frame.
- 5. Remove the kickstand from the machine.
- 6. If necessary, disassemble and remove the service position locking pin assembly (items 3, 4, 5, and 6 in Figure 144) from the rear frame.

#### Installing the Kickstand

- 1. Ensure that the machine is parked on a level surface and key is removed from the key switch.
- 2. If the service position locking pin assembly (items 3, 4, 5, and 6 in Figure 144) was removed from the rear frame, install removed locking pin components.
- 3. Position the kickstand inside the machine frame. Insert the bolt (item 7 in Figure 144) through the rear frame, kickstand, and spacer. Thread the flange nut on the bolt and tighten to secure the kickstand.
- 4. Slide the torsion spring onto the pin on the rear frame. Place the end of the spring in the slotted hole in the bottom of the rear frame.
- 5. Pivot the kickstand up and hold against the frame stops. Use a nut driver or small diameter pipe over the end of the torsion spring. Push the spring end down and out to install the spring (Figure 145).

#### Installing the Kickstand (continued)

6. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 6–3).

## **Transport Wheels (Optional)**





1. Wheel retaining lever



- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch.
- 2. Support the machine on the kickstand.
- 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. Ensure that the tire is fully deflated before disassembly of wheel.
- 2. Remove the 3 bolts (item 1 in Figure 146) and 3 lock washers from the shallow rim and hub, and remove the hub from the deep rim.
- 3. Inspect the hub bushing (item 11 in Figure 146). Replace the bushing, if worn or damaged.
- 4. Remove the 4 bolts (item 12 in Figure 146) 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.

#### **Disassembling the Transport Wheel (continued)**

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 to the deep rim with the 4 bolts (item 12 in Figure 146) 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 (item 1 in Figure 146) 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 and the key is removed from the key switch.
- 2. Support the machine on the kickstand.
- 3. Slide the transport wheel completely onto the wheel hex shaft until the wheel retaining lever is secured into the groove on the wheel hex shaft.

## Rail Kit Wheels (Optional)

#### Removing the Rail Kit Wheel

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch.
- 2. Support the machine on the kickstand.



- 3. Remove the wheel clip (item 2 in Figure 149), and remove the rail kit wheel from the wheel hex shaft on each side.
- 4. If necessary, install the transport wheels; refer to Transport Wheels (Optional) (page 6–21).

#### Installing the Rail Kit Wheel

1.

- 1. Ensure that the machine is parked on a level surface and the key is removed from the key switch.
- 2. Support the machine on the kickstand.
- 3. If installed, remove the transport wheels; refer to Transport Wheels (Optional) (page 6–21).

**Note:** The eFlex 1800, 2100, and 2120 series requires a different wheel offset than all other Toro Greensmowers. Ensure to read and follow the mounting instructions molded into the sides of the wheels.

4. Slide the rail kit wheel (item 3 in Figure 149) onto the wheel hex shaft and secure the wheel with a wheel clip.


# **Cutting Unit**

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# **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 unit on your Greensmaster machine. Additionally, if optional kits have been installed on the cutting unit (e.g., grooming reel), the installation instructions for the kit includes set-up and operation information. Refer to those publications for additional information when servicing the cutting unit.

### Supporting the Cutting Unit when Servicing



Whenever the cutting unit has to be tipped to expose the bedknife or cutting unit, support the rear of the cutting unit to ensure that the locknuts on the back of the bedbar adjuster screws are not resting on the work surface.

### **Connecting the Lithium Battery Pack**

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battery pack.

#### WARNING

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The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.

CAUTION

Before servicing the machine, disconnect the machine from the

• Only use the charger designed for the battery pack.

This will prevent unexpected machine operation.



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Figure 151 eFlex 2120 Model 04046 (shown)

1. Machine connector2. Battery pack3. Battery connector

To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 151). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or machine components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

### Separating the Cutting Unit from the Traction Unit



- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).
- 3. Lower the kickstand and push in the locking pin to lock the kickstand in the service position. Allow the kickstand and machine to rest against the locking pin (Figure 152).
- 4. Remove the grass basket from the cutting unit, if installed.



5. Slide the telescoping coupler off the cutting unit hex shaft (Figure 153).

## Separating the Cutting Unit from the Traction Unit (continued)



- Loosen the 2 flange-head screws that secure cutting unit pitch arms to the traction unit roll frame. It is not necessary to completely remove the screws (Figure 154).
- 7. Rotate the pitch arms forward and rest traction unit against the kickstand.
- 8. Roll the cutting unit away from the machine.
- 9. Reverse the procedure to install the cutting unit to the traction unit.
- 10. After the cutting unit is installed to the traction unit, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

# Adjustments

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### CAUTION

A

Before working on the cutting unit, always turn the key switch OFF position and disconnect the battery pack from the wire harness. This will prevent unexpected machine operation.

DANGER A

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

Use heavy gloves when handling the cutting unit or bedknife.

### Leveling the Rear Roller



The precision machined components of the cutting unit frame keep the rear roller and cutting unit in alignment (parallel). If the side plates are disassembled, ensure that the rear roller is properly aligned to the reel. The reel should not have any cone to this procedure.

- 1. Place the assembled cutting unit on a surface plate.
- 2. Ensure that the bedknife is properly adjusted to the cutting unit.
- 3. Use the surface plate, check if the rear roller is level to the cutting unit by using a 0.13 mm (0.005 inch) shim at each end of the rear roller. If the shim will pass under the roller at one end but not the other, a frame adjustment should be made.
- 4. Loosen, but do not remove the 2 shoulder bolts that secure the side plate to the frame opposite the side that is not level (Figure 155).



- 5. Adjust the position of the side plate to parallel the rear roller and cutting unit. Torque the shoulder bolts to **24 to 27 N·m (210 to 240 in-lb)**.
- 6. After tightening the side plate, check the rear roller. If necessary, loosen and adjust the second side plate.
- 7. After leveling the rear roller, complete the cutting unit set-up and adjustment sequence.

# Service and Repairs

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## Backlapping

### DANGER

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To avoid personal injury or death:

- Do not place your hands or feet in the reel area while backlapping. Stay away from the reel when backlapping.
- Do not attempt to restart the reel by hand or foot.
- Do not adjust the cutting unit while backlapping.
- Do not use a short handled paint brush for applying lapping compound. Toro Part No. TOR299100 backlapping brush assembly (refer to Backlapping Brush Assembly (page 2–16)) is available from your local Authorized Toro Distributor.

**Note:** Additional instructions and procedures on backlapping are available in the *Toro General Service Training Book*, Reel Mower Basics (Toro Part No. 09168SL).

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).



1. Telescoping coupler

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- 2. Cutting unit hex shaft
- 3. The backlapping operation can be done with the cutting unit either removed or attached to the traction unit. If the cutting unit is attached to the traction unit, slide the telescoping coupler off the cutting unit hex shaft before backlapping. Also, ensure that the reel drive lever is disengaged (Figure 156).
- 4. Make initial reel to the bedknife adjustments appropriate for backlapping on the cutting unit.

### **Backlapping (continued)**



g207288

Figure 157

- 1. Cover plug
- 5. Remove the plug from the reel drive cover on the left side of the reel assembly (Figure 157).
- 6. Insert a 1/2 inch socket onto the hex of reel driveshaft.
- 7. Backlap according to procedure in *Toro General Service Training Book*, Reel Mower Basics (Toro Part No. 09168SL).



g207289



1. Top angle

Front surface
 Front angle

- 2. Top surface
- 3. Remove burr
- 8. When the backlapping operation is completed and the cutting unit is stopped, run a file across the front face of the bedknife (Figure 158). This will remove any burrs or rough edges that may have built up on the cutting edge.
- 9. Install the reel drive cover plug when backlapping operation is completed (Figure 157).

#### IMPORTANT

When adjusting the bedknife to cutting unit, ensure that the contact is as light as possible to lengthen the amount of work the machine will perform on each charge.

- 10. Adjust the cutting unit reel to bedknife as necessary.
- 11. If cutting unit is attached to the traction unit, slide the telescoping coupler onto the cutting unit hex shaft. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

## **Bedbar Assembly**



#### **Removing the Bedbar**

- 1. Park the machine on a level surface, turn the key switch to the OFF position and remove the key from the switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).
- 3. Remove the cutting unit from the machine and place the cutting unit on a flat work area.

#### **Removing the Bedbar (continued)**

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- 4. Tip the cutting unit to expose the bedknife. Support the rear of the cutting unit; refer to Supporting the Cutting Unit when Servicing (page 7–2).
- 5. Loosen the locknuts (item 9 in Figure 159) on the end of each bedbar adjuster assembly until the washer is loose.
- 6. Loosen the locknuts (item 17 in Figure 159) on each bedbar pivot bolt.
- 7. Remove the 2 bedbar pivot bolts, 4 metal washers, and 4 plastic washers from the cutting unit side plates.
  - CAUTION

A

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

#### Use heavy gloves when handling the bedbar.

- 8. Remove the bedbar assembly from the cutting unit.
- 9. Inspect the nylon bushings (item 15 in Figure 159) and rubber bushings in side plates for wear or damage. Remove the bushings and replace if necessary.

#### Installing the Bedbar

- 1. If the rubber bushing was removed from either cutting unit side plate, apply grease to the outside surface of new bushing and install into the side plate. The bushing should flush with the inside of the side plate.
- 2. If removed, install the nylon bushings (item 15 in Figure 159) with flange facing outward. Apply anti-seize lubricant to the inside of flange bushing.
- 3. Apply anti-seize lubricant to the bedbar threads and the shoulder area of each bedbar pivot bolt.

#### IMPORTANT

When installing the washers (items 7 and 6 in Figure 159), ensure that the plastic washers are positioned on either side of the cutting unit side plate (Figure 160).

4. Slide a metal washer (item 6 in Figure 159) and then a plastic washer onto each bedbar pivot bolt.

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

Use heavy gloves when handling the bedbar.



- 5. Position the bedbar into the cutting unit. Ensure that the top of each bedbar arm is between the washer (item 11 in Figure 159) and the adjuster screw flange.
- 6. Position a metal washer and a plastic washer between the bedbar and each cutting unit side plate (Figure 160).



- Install the bedbar pivot bolt assemblies. Ensure that the plastic washers are not caught on the threads of the pivot bolts. Torque each bedbar pivot bolt to 22 to 27 N·m (190 to 240 in-lb).
- 8. Tighten both the locknuts (item 17 in Figure 159) until outside washers do not have any endplay but still can be rotated. Do not overtighten the locknuts as this can distort the side plates and affect the reel bearing adjustment. When the locknut is correctly tightened, there may be a gap at the inside washers.
- 9. Tighten the locknut (item 9 in Figure 159) on each bedbar adjuster assembly until the adjuster spring is fully compressed, then loosen the locknut 1/2 turn.

#### **IMPORTANT**

When adjusting the bedknife to cutting unit, ensure that the contact is as light as possible to lengthen the amount of work the machine will perform on each charge.

- 10. Adjust the cutting unit; refer to the Cutting Unit Operator's Manual.
- 11. Install the cutting unit to the machine.
- 12. After all necessary adjustments have been made, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

### Servicing the Bedknife



#### **Removing the Bedknife**

1. Remove the bedbar from the cutting unit; refer to Removing the Bedbar (page 7–10).

**Note:** EFlex 1800 cutting units use 11 screws to secure bedknife to bedbar. EFlex 2100/2120 cutting units use 13 screws to secure bedknife to bedbar.

- Remove the screws from the bedbar with a socket wrench and a bedknife screw tool; refer to Bedknife Screw Tool (page 2–17). Discard the screws. Remove the bedknife from the bedbar.
- 3. Refer to Grinding the Bedknife (page 7–14) 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**

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

- Use new screws to secure bedknife to bedbar. 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.
- 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 7–14). Grind only enough so the top surface of the bedknife is true; refer to Figure 163.



#### **IMPORTANT**

Do Not grind the bedknife below it's service limit; refer to Figure 164. 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.

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 has developed special service tools for accurately measuring the top grind angle on all bedknives; refer to Angle Indicator and Magnetic Mount (page 2–17).

- 1. Use 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 7–11).

**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.

### Servicing the Bedbar Adjuster



1.

Crossmember

2.

Bolt

Detent

3.

**Note:** The detent used on eFlex 2100/2120 is toward the center of the cutting unit as shown in Figure 165. On eFlex 1800 cutting units, the detent is mounted on the outside of the cutting unit crossmember (Figure 166). Cutting unit service procedures are the same on all models.

#### Removing the Bedbar Adjuster

- 1. Remove the locknut (item 4 in Figure 165), compression spring, and washer from the bedbar adjuster screw.
- 2. Remove the bedbar; refer to Removing the Bedbar Adjuster (page 7–17).

Note: The bedbar adjuster shaft (item 11 in Figure 165) has left-hand threads.

- 3. Unscrew the bedbar adjuster shaft from the bedbar adjuster screw.
- 4. Remove the retaining ring (item 8 in Figure 165) and wave washer from the adjuster shaft and remove the adjuster shaft from the cutting unit frame.
- 5. Inspect the flange bushings (item 10 in Figure 165) in the cutting unit side plate and remove if necessary.
- 6. If the detent is damaged, remove it from the cutting unit side plate by removing the bolt.

#### Installing the Bedbar Adjuster

- 1. If the detent (item 1 in Figure 165) was removed, secure the detent to the cutting unit side plate with the bolt.
- 2. If the flange bushings (item 10 in Figure 165) were removed, align the key on the bushing to the slot in the frame and install the bushings in the cutting unit side plates.
- 3. Slide the bedbar adjuster shaft (item 11 in Figure 165) into the flange bushings in the cutting unit side plate. Secure the adjuster shaft with the wave washer and retaining ring.

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

- 4. Apply anti-seize lubricant to the threads of the bedbar adjuster screw (item 7 in Figure 165) that fits into the adjuster shaft. Thread the bedbar adjuster screw into the adjuster shaft.
- 5. Install the bedbar; refer to Installing the Bedbar (page 7–11).
- 6. Install the washer (item 6 in Figure 165), compression spring, and locknut onto the adjuster screw. Tighten the locknut on the each bedbar adjuster assembly until the compression spring is fully compressed, then loosen the locknut 1/2 turn.
- 7. Adjust the cutting unit; refer to the Cutting Unit Operator's Manual.

## **Front Roller**

### **Removing the Front Roller**

1.

2.

3.





- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

#### **Removing the Front Roller (continued)**

- 3. Remove the cutting unit from the machine and place on a level working surface. Use appropriate support to raise the front roller from the work surface.
- 4. Loosen the bolt (item 6 in Figure 167) that secures the front roller shaft to the each front height-of-cut arm.
- 5. On one of the height-of-cut arms, remove the HOC nut (item 5 in Figure 167), HOC washer, and plow bolt that secure the HOC arm to the cutting unit side plate. Remove the HOC arm from the cutting unit.
- 6. Slide the front roller assembly from the remaining HOC arm on the cutting unit.
- 7. If necessary, remove the second HOC arm from the cutting unit.

#### Installing the Front Roller

- 1. Place the cutting unit on a level working surface and use appropriate support to support the front of the cutting unit.
- 2. Inspect the condition of the HOC screws (item 3 in Figure 167) in both HOC arms. If the screw replacement is necessary, apply anti-seize lubricant to the threads of new HOC screw. Thread the new HOC screw into the HOC arm.

**Note:** When assembling HOC arms to the side plates, ensure that the ring on HOC screw fits into the notch on the side plate.

- 3. If both the HOC arms were removed from the cutting unit side plate, position one of the arms to the side plate. Secure the arm to the side plate with the plow bolt (item 2 in Figure 167), HOC washer, and HOC nut. The tab on the HOC washer should be positioned into the HOC arm slot and orientated down toward the roller.
- 4. Slide the front roller shaft into the arm attached to the cutting unit. Slide the second HOC arm onto the other end of the roller shaft. Secure the second arm to the cutting unit side plate with the plow bolt (item 2 in Figure 167), HOC washer, and HOC nut.
- 5. Center the front roller to the cutting unit and secure to the HOC arms with the bolts.
- 6. Adjust the cutting unit; refer to the Cutting Unit Operator's Manual.
- 7. Install the cutting unit to the machine.
- 8. After all necessary adjustments have been made, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

## Rear Roller

### Removing the Rear Roller

1.



- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).
- 3. Remove the cutting unit from the machine and place on a level working surface. Place the support blocks under the bedbar to raise the rear roller from work surface.
- 4. Loosen the 2 flange nuts that secure the rear roller shaft to each rear roller bracket.
- 5. On one of the rear roller brackets:

**Note:** On cutting units equipped with optional high height-of-cut kit, there will be additional roller shims installed between the rear roller bracket and the cutting unit side plate.

- A. For assembly purposes, note the quantity and location of the roller shims.
- B. Remove the flange nuts and socket-head screws that secure the rear roller bracket and roller shims to the cutting unit side plate.
- C. Remove the roller bracket and roller shims from the rear roller and cutting unit.
- 6. Slide the rear roller assembly from the remaining rear roller bracket on the cutting unit.
- 7. If necessary, remove the second rear roller bracket and roller shims from the cutting unit.

#### Installing the Rear Roller

1. Place the cutting unit on a level working surface.

**Note:** Refer to *Cutting Unit Operator's Manual* for number of roller shims required for various height-of-cut settings.

- 2. If both the rear roller brackets were removed from the cutting unit side plate, position the brackets and roller shims to 1 of the side plates. Install the 2 carriage screws and 2 flange nuts to retain the bracket in position. Do not fully tighten the flange nuts.
- 3. Slide the rear roller shaft into the rear roller bracket attached to the cutting unit. Slide the second rear roller bracket onto the other end of the roller shaft. Secure the second roller bracket and shims to cutting unit side plate with the 2 carriage screws and 2 flange nuts. Do not fully tighten the flange nuts.
- 4. Center the rear roller to the cutting unit and secure in place by tightening the 4 flange nuts.
- 5. Adjust the cutting unit; refer to the Cutting Unit Operator's Manual.
- 6. Install the cutting unit to the machine.
- 7. After all necessary adjustments have been made, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

### Servicing the Roller



#### **Disassembling the Roller**

- 1. To hold the roller shaft (item 7 in Figure 170) for bearing locknut removal, install a 3/8-24 UNF 2B screw into threaded end of the roller shaft and secure the screw in place with the jam nut. While retaining the shaft, remove the bearing locknut from each end of the roller shaft.
- 2. Remove the V-ring (item 2 in Figure 170) from each end of the roller.
- 3. Carefully inspect the seating surface and threads of the bearing locknuts (item 1 in Figure 170). Replace the locknut if there is any damage.
- 4. Loosely secure the roller assembly in a bench vise and lightly tap one end of the roller shaft until the seal and bearing are removed from the roller cavity. Remove the second seal and bearing from the roller cavity by tapping on the shaft.
- 5. Clean the bearing cavity in the roller and remove any rust with crocus cloth.



1. Place the roller shaft (item 6 in Figure 171) into the roller.

**Note:** If the bearing locknuts (item 5 in Figure 171) are being replaced, use the original locknuts for assembly purposes, if possible. This will preserve the patch lock feature in the new locknuts. Use the new nuts only after new bearings and seals have been installed.

**Note:** Special tool TOR4105 (refer to Roller Rebuilding Tools (page 2–18)) can be used instead of washers and spacer when installing the bearings and seals in roller.



- Position a new bearing, black assembly washer (refer to Roller Rebuilding Tools (page 2–18)) and original locknut onto each end of the roller shaft (Figure 172).
- 3. Tighten the nuts until the bearings are seated into each end of the roller.
- 4. Remove the bearing locknut and black assembly washer from each end of the roller.

#### IMPORTANT

Failure to grease bearing locknut before seal installation may result in seal damage.



- 5. Apply a coating of grease to the nut surface to prevent the seal damage during seal installation (Figure 173).
- 6. Carefully install the seals onto the bearing locknuts. Pack the back of the seal 75 to 90% full with #2 grease (Figure 173).



7. Install a nut with seal onto each end of the roller shaft. Tighten the nuts until they bottom against bearings (Figure 174). Remove the nuts from the roller shaft.

#### Assembling the Roller (continued)



- Position an assembly spacer and yellow assembly washer (refer to Roller Rebuilding Tools (page 2–18)) on each end of the roller shaft (Figure 175). Thread the nut onto each end of the shaft.
- 9. Tighten each nut until the yellow assembly washers bottom out against the roller housing. Remove the nuts, assembly washers, and assembly spacers from the roller shaft.
- 10. Lubricate the lips of installed seals with #2 grease.
- 11. Carefully slide a dry V-ring onto each bearing locknut. The V-rings should be installed without any lubrication.

**Note:** If original bearing locknut(s) are being used, apply Loctite #242 (or equivalent) to the threads of the locknut(s).



12. Install the bearing locknut with V-ring onto each end of the roller shaft; torque the locknuts to **34 to 41 N·m (25 to 30 ft-lb)**.

## **Cutting Unit Assembly**



**Note:** This section provides the procedure for removing and installing the cutting unit assembly (cutting unit, flocked seals, reel bearings, bearing lock screw, and reel nut) from the cutting unit; refer to Servicing the Cutting Unit Assembly (page 7–33) for information on servicing the cutting unit assembly.

**Note:** EFlex 2100/2120 cutting units use shoulder bolts and flange nuts to secure the side plates to the crossmember as shown in Figure 176. On eFlex 1800 cutting units, square nuts are used instead of flange nuts. Cutting unit service procedures are the same on all models.

#### **Removing the Cutting Unit Assembly**

**Note:** Removal of the cutting unit can be completed by removing the right side plate from the cutting unit crossmember. The left side plate (including the reel drive assembly) does not have to be removed from the crossmember when using the following procedure.

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

Use heavy gloves when handling the bedbar.

- 1. Park the machine on a level surface, turn the key switch to the OFF position, and remove the key from the key switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).
- 3. Remove the cutting unit from the machine and place the cutting unit on a flat work area.



4. Remove the reel drive cover and belt from the reel drive assembly, and remove the reel pulley from the reel driveshaft; refer to Chapter 4: Traction and Reel Drive System (page 4–1) for procedure to remove these components.

#### **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 rollers.

### **Removing the Cutting Unit Assembly (continued)**



1. Cutting unit

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- 2. Flocked seal (2 each)
- 3. Bearing (2 each)

- 4. Bearing lock screw (right-hand threads)
- 5. Reel driveshaft (left-hand threads)
- 6. Reel groove location
- 5. Loosen the bearing lock screw (item 4 in Figure 178) and the reel drive shaft (item 5):
  - A. Tip up the cutting unit to access the bottom of the reel.



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1. Bearing lock screw

3. Support plate, weld side

2. Reel shaft

- Support plate, weic
  Pry bar
- 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 179.

#### 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 lefthand 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.

#### IMPORTANT

If the reel driveshaft (item 5 in Figure 178) is to be loosened, use appropriate wrench or socket on 1 inch hex surface of shaft. Do not use 1/2 inch extension on the end of the reel driveshaft when loosening or tightening the driveshaft. The 1/2 inch hex is intended for backlapping 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 rollers.
- Remove the bedbar pivot bolt and washers from the right side plate. For assembly purposes, note the location of plastic and steel washers; refer to Removing the Bedbar (page 7–10).
- Loosen the fasteners that secure the front and rear rollers to the right side plate; refer to Removing the Front Roller (page 7–18) and Removing the Rear Roller (page 7–20).
- 8. Support the cutting unit to prevent it from shifting or falling.
- 9. Remove the shoulder bolts (item 8 in Figure 176) and flange nuts that secure the right side plate to the cutting unit crossmember. Remove the right side plate from the reel shaft, rollers, bedbar, and cutting unit crossmember. Remove the right pitch arm and compression spring from the right side plate.
- Carefully slide the cutting unit assembly with the flocked seals (item 2 in Figure 178), reel bearings, bearing lock screw, and reel driveshaft from the left slide plate. Locate and remove the flat wire spring (item 15 in Figure 176).
- 11. Thoroughly clean any grease and corrosion from the reel bearing bores in the side plates.
- 12. Inspect the remaining cutting unit components for corrosion, wear, or damage and replace the components as necessary.

#### Installing the Cutting Unit Assembly

A

- 1. Clean the side plates and other cutting unit components. Inspect the side plates and pitch arms for wear or damage and replace the components if necessary.
- 2. Ensure that the flocked seals, reel bearings, bearing lock screw, and reel driveshaft are properly positioned on the cutting unit; refer to Servicing the Cutting Unit Assembly (page 7–33).

#### CAUTION

A

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

Use heavy gloves when handling the bedbar.

- 3. Position the cutting unit on a flat work area. The rollers, bedbar, and cutting unit crossmember should be attached to the left side plate. Ensure that the left pitch arm (item 16 in Figure 176) and compression spring are fitted to the left side plate.
- 4. Place the flat wire spring into the bearing bore of the left side plate. Carefully slide the cutting unit assembly (with the flocked seals, reel bearings, bearing lock screw, and reel driveshaft) into the left side plate. Ensure that the bearing is fully seated into the side plate.
- 5. Carefully slide the right side plate with the right pitch arm (item 2 in Figure 176) and compression spring onto the cutting unit assembly, front roller and rear roller. Ensure that the side plate is fully seated onto bearing on the reel shaft.



- Install the shoulder bolts (item 8 in Figure 176) and flange nuts to secure the right side plate to the crossmember; torque the shoulder bolts to 24 to 27 N·m (210 to 240 in-lb).
- 7. Secure front and rear rollers to RH side plate (see Installing the Front Roller (page 7–19) and Installing the Rear Roller (page 7–21)).
- 8. Secure the bedbar assembly to the right side plate; refer to Installing the Bedbar (page 7–11). Ensure that the plastic and steel washers are properly positioned.
- 9. If loosened during cutting reel service, tighten the bearing lock screw and the reel drive shaft.

#### Installing the Cutting Unit Assembly (continued)



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 180.

#### **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 lefthand 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

If the reel driveshaft (item 5 in Figure 178) is to be tightened, use appropriate wrench or socket on 1 inch hex surface of shaft. Do not use 1/2 inch extension on the end of the reel driveshaft when loosening or tightening the driveshaft. The 1/2 inch hex is intended for backlapping only.

#### Installing the Cutting Unit Assembly (continued)

- 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)**.
- 10. Adjust the cutting unit; refer to the Cutting Unit Operator's Manual.

**Note:** The parallel position of the rear roller to the cutting unit is controlled by the precision machined crossmember and side plates of the cutting unit. If necessary, the cutting unit side plates can be loosened and a slight adjustment can be made to parallel the rear roller with the cutting unit; refer to Leveling the Rear Roller (page 7-7).

- 11. Install the reel pulley, belt, and reel drive cover to the reel drive assembly; refer to Chapter 4: Traction and Reel Drive System (page 4–1) for procedure to install and adjust these components.
- 12. Install the cutting unit to the machine.
- 13. After all necessary adjustments have been made, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 7–3).

## Servicing the Cutting Unit Assembly



#### **Disassembling the Cutting Unit**

#### IMPORTANT

When removing the reel driveshaft (item 5 in Figure 181), use appropriate wrench or socket on 1 inch hex surface of shaft. Do not use 1/2 inch extension on the end of the reel driveshaft when loosening or tightening the driveshaft. The 1/2 inch hex is intended for backlapping only.

### **Disassembling the Cutting Unit (continued)**



- 1. Remove the bearing lock screw (item 4 in Figure 181) and reel driveshaft from the cutting unit. The reel driveshaft has left-hand threads and is in the end of the reel shaft identified with a groove (item 3 in Figure 182) that is just inside of the reel spider.
- 2. Slide the bearings (item 3 in Figure 181) from the reel driveshaft.
- 3. For assembly purposes, note the orientation of the flocked seals (item 2 in Figure 181). Remove the seals from the reel shaft.

#### **Inspecting the Cutting Unit**

- 1. Inspect the reel bearings to ensure that they spin freely and have minimal axial play.
- 2. Inspect the reel shaft as follows. If reel damage is detected, replace the cutting unit.
  - A. Check the reel shaft for bending and distortion by placing the shaft ends in V-blocks.
  - B. Check the reel blades for bending or cracking.
  - C. Check the service limit of the reel diameter; refer to Preparing the Reel for Grinding (page 7–36).
  - D. Check the threads in the ends of the reel shaft.
- Check the woodruff key slot and hex drive on the reel driveshaft (item 5 in Figure 181) for excessive wear or distortion. Replace the driveshaft if there is any damage.

#### Assembling the Cutting Unit

1. If the bearings and/or flocked seals were removed from the reel shaft, discard and replace the components that were removed.

#### **IMPORTANT**

# The flocked seal should be installed so that the flocked side of the seal is toward the bearing location.

- 2. Press the flocked seals onto the reel shaft with the flocked side orientated toward the bearing location. The seal should be perpendicular to the reel shaft after installation.
- 3. Slide the bearings fully onto the reel shaft. The bearings should bottom on the reel shaft shoulder.

#### **IMPORTANT**

When installing the reel driveshaft (item 5 in Figure 181), use appropriate wrench or socket on 1 inch hex surface of shaft. Do not use 1/2 inch extension on the end of the reel driveshaft when loosening or tightening the driveshaft. The 1/2 inch hex is intended for backlapping only.



4. Install the bearing lock screw (item 4 in Figure 181) and reel driveshaft into the reel shaft to secure the bearings. The reel driveshaft has left-hand threads and should be installed in the end of the reel shaft identified with a groove that is just inside of reel spider.

**Note:** Installation torque for bearing lock screw and reel driveshaft is **123 to 149** N·m (90 to 110 ft-lb). It is easiest to torque these items after the cutting unit is installed in the cutting unit frame; refer to Removing the Cutting Unit Assembly (page 7–27) and Installing the Cutting Unit Assembly (page 7–30).

## Preparing the Reel for Grinding



Reel diameter taper = D1 - D2

**Note:** Before grinding a cutting unit, ensure that all the cutting unit components are in good condition. Depending on the type of grinder used, damaged cutting unit components can affect grinding results.

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

- Follow the reel grinder manufacturer's instructions to grind the cutting unit to Toro specifications; refer to the Reel Grinding Specifications Table (page 7–36). Additional reel grinding information can be found in the *Toro General Service Training Book*, Reel Mower Basics (Toro Part No. 09168SL).
- 2. After completing the reel grinding process, adjust the cutting unit; refer to the *Cutting Unit Operator's Manual*.

#### **Reel Grinding Specifications Table**

Reel diameter (new)	128.5 mm (5.060 inches)
Reel diameter (service limit)	114.3 mm (4.500 inches)
Reel diameter taper (service limit)	0.25 mm (0.010 inch)
Reel shaft diameter (outer diameter)	34.9 mm (1.375 inches)
Blade relief angle	28° to 32°
Blade land width	0.8 to 1.2 mm (0.030 to 0.050 inch)


# **Belt Driven Groomer**

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# **General Information**

## Installation Instructions

The Installation Instructions for the groomer provide information regarding the operation, general maintenance procedures and maintenance intervals for the groomer assembly on your Greensmaster eFlex machine. Refer to this publication for additional information when servicing the groomer assembly.

## **Connecting the Lithium Battery Pack**

Â

A

battery pack.

#### WARNING

A

A

The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.

CAUTION

Before servicing the machine, disconnect the machine from the

• Only use the charger designed for the battery pack.

This will prevent unexpected machine operation.



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Figure 184 eFlex 2120 Model 04046 (shown)

1. Machine connector2. Battery pack3. Battery connector

To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 184). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or machine components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

# Adjustments

CAUTION

A

Before working on the cutting unit, always turn the key switch OFF and disconnect the battery pack from the wire harness. This will prevent unexpected machine operation.

**Note:** Refer to the Groomer Installation Instructions (page 8–2) for adjustment procedures for the groomer on your Greensmaster.

## Adjusting the Height/Depth of the Groomer

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

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).
- 3. Ensure that the rollers are clean and cutting unit is set to the desired height-of-cut; refer to *Cutting Unit Operator's Manual* for cutting unit adjustment procedures.



4. Position the grooming reel to the lowered, grooming position (Figure 185).

**Note:** Improper or over-aggressive use of the grooming reel (i.e., too deep or too frequent grooming) may cause unnecessary stress on the turf leading to severe greens damage. Use the groomer cautiously.

- 5. On one end of the grooming reel, measure the distance from the lowest tip of the groomer blade to the working surface. Lift and turn height adjustment knob to raise or lower the blade tip (Figure 185). Each notch on the adjustment knob changes the groomer height approximately 0.08 mm (0.003 inch).
- 6. Repeat step 4 on the opposite end of the groomer. Then, check setting on the first side of groomer. Height setting on both ends of groomer should be identical.

1.

## Adjusting the Height/Depth of the Groomer (continued)

7. After groomer adjustment is completed, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

# **Service and Repairs**

## **Replacing the Groomer Belt (Forward Rotating Groomer Drive)**

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).



3. Remove 3 locknuts that secure groomer drive cover, then remove cover (Figure 186).



- Pivot idler pulley by placing a 12 mm wrench on pulley nut and rotating idler bracket to relax belt tension. Slip groomer drive belt off pulleys (Figure 187). Carefully release idler bracket.
- 5. Install new drive belt to drive pulley, idler pulley, and driven pulley observing correct belt routing (Figure 187).
- 6. Secure belt cover to machine with 3 locknuts (Figure 186).
- 7. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

## **Groomer Cover (Counter Rotating Groomer Drive)**

On eFlex machines with the counter rotating groomer, the groomer cover includes a handle which engages and disengages the groomer drive. When the handle is rotated toward the front of the machine, the groomer is engaged.

#### **Removing the Groomer Cover (Counter Rotating Groomer Drive)**

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- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).
- 3. Ensure that the handle on groomer cover is rotated toward front of machine so that the groomer drive is engaged.



1.	Groomer cover assembly	3.	Gasket
2.	Flange-head screw (5 each)	4.	Handle

- 4. Remove groomer cover assembly from machine (Figure 188):
  - A. Remove 5 flange-head screws that secure groomer cover assembly to right drive plate.
  - B. Remove groomer cover assembly and gasket from machine. Discard gasket.
- 5. If necessary, remove shaft from groomer cover (Figure 189):
  - A. Loosen set screw on top of shaft and slide handle from shaft.
  - B. Remove retaining ring and thrust washer from shaft.
  - C. Remove plunger detent from groomer cover.
  - D. Slide shaft out of groomer cover. Remove and discard O-ring from shaft.
- 6. Remove grease from inside groomer cover and right drive plate on cutting unit. Thoroughly clean and inspect all groomer drive components.

#### Installing the Groomer Cover (Counter Rotating Groomer Drive)



- 1. If removed, install shaft into groomer cover (Figure 189):
  - A. Install new O-ring into groove of shaft.
  - B. Apply anti-seize lubricant to shaft surface that is below the retaining ring groove.

#### Installing the Groomer Cover (Counter Rotating Groomer Drive) (continued)



- C. Slide shaft up through bore of cover and secure with thrust washer and retaining ring. Position shaft in cover so that the cam point of shaft is located away from the gasket surface (Figure 190).
- D. Install plunger detent into groomer cover so that the end of plunger if from flush to 0.5 mm (0.020 inch) extending from cover surface (Figure 190).
- E. Slide handle into shaft so that it extends toward the front of the cover.
- F. Apply Loctite #242 (or equivalent) to threads of set screw. Install set screw into end of shaft to secure handle in place.
- 2. Install groomer cover assembly to right drive plate assembly (Figure 188):
  - A. Ensure that the handle on groomer cover is rotated toward the front of the machine.
  - B. Fill groomer cover with approximately 142 g (5 fl oz) of Mobil XHP221 grease (or equivalent).
  - C. Install new gasket and then groomer cover assembly to right drive plate. Secure cover with 5 flange-head screws.
- 3. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

1.

## **Grooming Reel (Forward Rotating Groomer Drive)**



Remove the grooming reel to replace individual blades, to replace worn groomer components, to reverse the blades on the shaft (if not equipped with carbide blades) or to replace the grooming shaft.

#### **Removing the Grooming Reel (Forward Rotating Groomer Drive)**

17.

18.

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

8.

9.

Groomer shim

Right groomer arm assembly

Right cutting unit side plate Left cutting unit side plate

#### Removing the Grooming Reel (Forward Rotating Groomer Drive) (continued)

- 3. Remove the cutting unit from the machine and place cutting unit on a flat work area.
- 4. Remove groomer drive cover (item 2 in Figure 191) and groomer drive belt from groomer drive; refer to Replacing the Groomer Belt (Forward Rotating Groomer Drive) (page 8–6).
- 5. Loosen 2 bolts (item 10 in Figure 191) that secure front roller shaft to groomer arms.



g228151

Figure 192

- 1. Front roller bolt
- 3. Locknut
- 5. Groomer arm lift rod



4. Spring washer



- 6. Remove locknut (item 13 in Figure 191) and spring washer that secure right groomer arm lift rod to drive plate assembly (Figure 192).
- 7. Remove HOC nut (item 21 in Figure 191), HOC washer, and plow bolt that secure right groomer arm assembly to drive plate assembly. Do not change height-of-cut screw adjustment. Remove right groomer arm assembly from cutting unit.
- 8. Remove front roller assembly from cutting unit.

**Note:** To prevent grooming reel shaft from turning when removing driven pulley, use wrench on shaft flats to hold shaft.

9. Remove the locknut (item 1 in Figure 191) that secures driven pulley to grooming reel shaft. Remove driven pulley from shaft.

#### Removing the Grooming Reel (Forward Rotating Groomer Drive) (continued)

**Note:** To prevent cutting unit from turning when removing drive pulley, use a 1/2 inch socket on hex of reel driveshaft that is used for back lapping the cutting unit.

- 10. Loosen and remove drive pulley (item 4 in Figure 191) from the cutting unit shaft.
- 11. Remove 2 shoulder bolts (item 5 in Figure 191) that secure the groomer right drive plate assembly to the cutting unit frame. Remove the right drive plate assembly from grooming shaft and cutting unit. Locate and retrieve groomer shim.
- 12. Carefully pull the grooming reel from the left support plate assembly (item 14 in Figure 191).
- 13. Inspect seals, bushings, and bearings in right drive plate, left support plate, and groomer arms for wear or damage. Replace components as necessary.

#### Installing the Grooming Reel (Forward Rotating Groomer Drive)

- 1. Apply a light coating of grease to ends of grooming shaft and also to seal lips in right drive and left support plates. Ensure that all bearings, bushings, and seals are properly installed.
- 2. Ensure that the O-ring (item 25 in Figure 191) is installed on grooming reel shaft. Apply light coating of grease to O-ring.
- 3. Carefully place grooming reel assembly into the left support plate taking care to not damage seal in support plate or O-ring on shaft.
- 4. Apply light coating of grease to O-ring on right drive plate assembly pivot hub and pilot bore of cutting unit side plate.
- 5. Position groomer shim (item 8 in Figure 191) to right drive plate assembly.
- 6. Carefully place right drive plate assembly onto groomer shaft taking care to not damage seals in drive plate. Position drive plate to the cutting unit frame and secure with 2 shoulder bolts (item 5 in Figure 191). Ensure that the right drive plate rotates freely after installation.
- 7. Apply light coating of grease to hub on driven pulley (item 19 in Figure 191) taking care to not get grease on belt surface of pulley. Slide driven pulley onto the grooming reel shaft taking care to not damage seal in right drive plate.

**Note:** To prevent grooming reel shaft from turning when installing driven pulley, use wrench on shaft flats to hold shaft.



8. Secure driven pulley to grooming reel shaft with locknut (item 1 in Figure 191); torque locknut to **24 to 28 N·m (17 to 21 ft-lb)**.

**Note:** To prevent cutting unit from turning when installing drive pulley, use a 1/2 inch socket on hex of reel driveshaft that is used for back lapping the cutting unit.

- 9. Secure drive pulley (item 4 in Figure 191) to cutting unit shaft; torque pulley to **135 N·m (100 ft-lb)**.
- 10. Insert front roller into left groomer arm assembly.
- 11. Ensure that the bushing (item 11 in Figure 191) is installed in drive plate assembly.
- 12. Apply anti-seize lubricant to threads of right groomer arm lift rod.
- 13. Position right groomer arm assembly to front roller, right drive plate assembly, and cutting unit frame. Secure groomer arm to cutting unit with plow bolt (item 22 in Figure 191), HOC washer, and HOC nut.

#### Installing the Grooming Reel (Forward Rotating Groomer Drive) (continued)

- 14. Secure right groomer arm assembly to drive plate with spring washer (item 12 in Figure 191) and locknut.
- 15. Center front roller to cutting unit and tighten bolts (item 10 in Figure 191) to secure roller.
- 16. Install groomer drive belt (item 3 in Figure 191) and groomer drive cover to right drive plate; refer to Replacing the Groomer Belt (Forward Rotating Groomer Drive) (page 8–6).
- 17. Check grooming reel height and mower height-of-cut settings. Adjust as necessary.
- 18. Install cutting unit to the machine.
- 19. Lubricate groomer bearings; refer to Installation Instructions (page 8–2).
- 20. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

**Note:** After greasing groomer bearings, operate groomer for 30 seconds, stop machine, and wipe excess grease from groomer shaft and seals.

## **Grooming Reel (Counter Rotating Groomer Drive)**



Remove the grooming reel to replace individual blades, to replace worn groomer components, to reverse the blades on the shaft (if not equipped with carbide blades) or to replace the grooming shaft.

#### Removing the Grooming Reel (Counter Rotating Groomer Drive)

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

#### Removing the Grooming Reel (Counter Rotating Groomer Drive) (continued)

- 3. Remove the cutting unit from the machine and place cutting unit on a flat work area.
- 4. Ensure that the handle on groomer cover is rotated toward front of machine so that the groomer drive is engaged.
- Remove groomer cover assembly (item 22 in Figure 194) and gasket from machine; refer to Groomer Cover (Counter Rotating Groomer Drive) (page 8–7). Discard gasket.



1. Extension spring

g228291

2. 43T idler gear

- 3. 47T idler gear
- 4. Groomer drive gear
- 6. Carefully remove extension spring from anchor points on right drive plate (Figure 195).



- 7. Remove the 2 idler gears (43T and 47T) from the right drive plate assembly (Figure 196). The bearings are pressed into the gears.
- 8. Loosen 2 bolts (item 7 in Figure 194) that secure front roller shaft to groomer arms.

#### Removing the Grooming Reel (Counter Rotating Groomer Drive) (continued)



- 9. Remove locknut and spring washer that secure right groomer arm lift rod to right drive plate assembly (Figure 197).
- 10. Remove HOC nut (item 2 Figure 194), HOC washer, and plow bolt that secure right groomer arm assembly to right drive plate assembly. Do not change height-of-cut screw adjustment. Remove right groomer arm assembly from cutting unit.
- 11. Remove front roller from cutting unit.

**Note:** To prevent grooming reel shaft from turning when removing driven pulley, use wrench on shaft flats to hold shaft.

12. Remove the locknut (item 15 in Figure 194) that secures driven gear to grooming reel shaft. Remove driven gear from shaft.

**Note:** To prevent cutting unit from turning when removing groomer drive gear, use a 1/2 inch socket on hex of reel driveshaft that is used for backlapping the cutting unit.

- 13. Loosen and remove groomer drive gear (item 17 inFigure 194) from the cutting unit shaft.
- 14. Remove 4 button-head screws (item 30 in Figure 194) that secure the right drive plate assembly to the support plate on the cutting unit frame. Remove the right drive plate assembly from grooming shaft and cutting unit.
- 15. Carefully pull the grooming reel from the left support plate.
- 16. Inspect seals, bushings, and bearings in right drive plate, left support plate and groomer arms for wear or damage. Also, inspect gears and idler components for wear or damage. Replace components as necessary.

#### Installing the Grooming Reel (Counter Rotating Groomer Drive)

- 1. Apply a light coating of grease to ends of grooming reel shaft and also to seal lips in right drive plate and left support plate. Ensure that all bearings, bushings, and seals are properly installed.
- 2. Ensure that the O-ring (item 11 in Figure 194) is installed on grooming reel shaft. Apply light coating of grease to O-ring.
- 3. Carefully place grooming reel assembly into the left support plate taking care to not damage seal in support plate or O-ring on shaft.

#### Installing the Grooming Reel (Counter Rotating Groomer Drive) (continued)

- 4. Apply light coating of grease to O-ring on right drive plate assembly pivot hub and pilot bore of cutting unit side plate.
- Carefully slide right drive plate onto grooming reel shaft taking care to not damage seals in drive plate. Position drive plate to the support plate on the cutting unit frame and secure with 4 button-head screws (item 30 in Figure 194). Ensure that the drive plate rotates freely after installation.
- 6. Install driven gear (item 14 in Figure 194) onto grooming reel shaft:
  - A. Apply light coating of grease to hub on driven gear.
  - B. Carefully slide driven gear onto the grooming reel shaft taking care to not damage seal in drive plate.

**Note:** To prevent grooming reel shaft from turning when installing driven gear, use wrench on shaft flats to hold shaft.



C. Secure gear to shaft with locknut (item 15 in Figure 194); torque locknut to 24 to 28 N·m (17 to 21 ft-lb).

**Note:** To prevent cutting unit from turning when installing groomer drive gear, use a 1/2 inch socket on hex of reel driveshaft that is used for backlapping the cutting unit.

- 7. Secure groomer drive gear (item 17 in Figure 194) to cutting unit shaft; torque gear to **170 N·m (125 ft-lb)**.
- Install the 2 idler gears (43T and 47T) to right drive plate assembly (Figure 196). Secure gears with flange nuts and torque flange nuts 13.5 N·m (120 in-lb).
- 9. Install extension spring to right drive plate assembly (Figure 195).
- 10. Insert front roller into left groomer arm assembly.
- 11. Ensure that the bushing (item 3 in Figure 194) is installed in right drive plate assembly.
- 12. Apply anti-seize lubricant to threads of right groomer arm lift rod.
- Position right groomer arm assembly to front roller, right drive plate, and cutting unit frame. Secure groomer arm to cutting unit with plow bolt (item 31 in Figure 194), HOC washer, and HOC nut.
- 14. Secure right groomer arm assembly to drive plate with spring washer (item 4 in Figure 194) and locknut.
- 15. Center front roller to cutting unit and tighten bolts (item 7 in Figure 194) to secure roller.
- 16. Fill groomer cover with approximately 142 g (5 fl oz) of Mobil XHP221 grease (or equivalent). Install new gasket and then groomer cover assembly to right drive plate; refer to Groomer Cover (Counter Rotating Groomer Drive) (page 8–7).
- 17. Check grooming reel height and mower height-of-cut settings. Adjust as necessary.
- 18. Install cutting unit to the machine.
- 19. Lubricate groomer bearings; refer to Installation Instructions (page 8–2).
- 20. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

**Note:** After greasing groomer bearings, operate groomer for 30 seconds, stop machine, and wipe excess grease from groomer shaft and seals.

## Servicing the Grooming Reel

Inspect grooming reel blades frequently for damage and wear. Straighten bent blades with a pliers. Replace blades that are worn or damaged.



Carbide tipped grooming blades (Figure 198) should be replaced if the carbide tip is worn, loose or missing. Also, if the blade is eroded around the carbide insert, the blade should be replaced.



Grooming blades without a carbide tip (Figure 199) should be replaced if worn or damaged. Blades without a carbide tip that are rounded to the midpoint of the blade tip can be reversed on the grooming shaft to extend the life of the blade.

#### **Disassembling the Grooming Reel**



#### **Disassembling the Grooming Reel (continued)**

- 1. Remove grooming reel from cutting unit; refer to Removing the Grooming Reel (Forward Rotating Groomer Drive) (page 8–10) or Removing the Grooming Reel (Counter Rotating Groomer Drive) (page 8–14).
- 2. Remove locknut from either end of the shaft (Figure 200).

#### IMPORTANT

If grooming reel is equipped with carbide tipped blades, note position of blades on groomer shaft as they are removed. Correct direction of blades is required for proper groomer operation.

3. Remove spacers and blades from groomer shaft as necessary.

#### Assembling the Grooming Reel

1. Start by placing thick spacer against the locknut installed on one end of groomer shaft. Then, place first blade against installed spacer (Figure 200).

#### IMPORTANT

If groomer is equipped with blades with carbide tips, ensure that the blades are installed with the tips in the same, correct direction.

- 2. For 1.3 cm (1/2 inch) blade spacing, ensure there are 2 blade spacers between blades (Figure 200).
- 3. When all blades have been installed, place second thick spacer on shaft and then thread second locknut onto the shaft.



g228297

Figure 201

 1. Locknut
 2. Center blades on shaft
 3. Grooming shaft



- Position locknuts to allow blades and spacers to be centered on the shaft (Figure 201); torque locknuts to 23 to 28 N·m (200 to 250 in-lb) so that the spacers are not free to rotate.
- Install grooming reel back onto cutting unit; refer to Installing the Grooming Reel (Forward Rotating Groomer Drive) (page 8–12) or Installing the Grooming Reel (Counter Rotating Groomer Drive) (page 8–16).

## **Replacing the Grooming Reel Bearing**

#### **Removing the Grooming Reel Bearing**

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position. Engage parking brake.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).
- 3. Remove the cutting unit from the machine and place cutting unit on a flat work area.
- 4. To remove groomer drive plate assembly from right side of cutting unit, remove front roller, grooming reel, and then drive plate assembly; refer to Grooming Reel (Forward Rotating Groomer Drive) (page 8–10) or Grooming Reel (Counter Rotating Groomer Drive) (page 8–14).



- 5. To remove support plate assembly from left side of cutting unit (Figure 202):
  - A. Remove reel drive cover, drive belt, reel pulley and then reel drive assembly from cutting unit; refer to Reel Drive Assembly (page 4–16).



B. Remove locknut and spring washer that secure left groomer arm lift rod to support plate (Figure 203).Remove support plate from cutting unit.

#### **Removing the Grooming Reel Bearing (continued)**



Figure 204 Forward rotating groomer

- 1. Right drive plate assembly
- 3. Seal (2 each)

Bearing (2 each) 2.

g228300

4. Seal lips (toward center of cutting unit)



Figure 205 Counter rotating groomer

- 1. Right drive plate assembly
- Seal (2 each) 3.

Bearing (2 each) 2.

g228301

- Seal lips (toward center of cutting unit) 4.



g228302

- Left support plate 1.
- 2. Bearing
- 3. Seal

- 4. Plug
  - 5. Seal lips (toward center of cutting unit)

#### **Removing the Grooming Reel Bearing (continued)**

6. Remove grooming reel seals and bearings from right drive plate and left support plate assemblies (Figure 204, Figure 205, and Figure 206). Discard all removed seals and bearings.

#### Installing the Grooming Reel Bearing



1. Install new grooming reel bearings and seals into right drive plate and left support plate assemblies (Figure 207):

#### IMPORTANT

Bearings should be installed with extended inner races toward center of housing. Also, apply pressure equally to inner and outer bearing races when installing bearings.

- A. Press new outer bearing fully to shoulder of right drive plate bore. Then, install new inner bearing until inner race contacts outer bearing race.
- B. Press new bearing into left support plate until it is flush with shoulder of bearing bore.
- C. Install new seals into groomer side plates.

**Note:** Seals should be installed so that the lip side of the seal will face the center of the cutting unit. When bearings are greased, grease will purge from inner seals.

- 2. Install left support plate to left side of cutting unit:
  - A. Apply anti-seize lubricant to threads of left groomer arm lift rod.
  - B. Position support plate to cutting unit making sure that left groomer arm lift rod is positioned through bushing in support plate.
  - C. Place spring washer and locknut on lift rod threads (Figure 203). Tighten locknut.
  - D. Install reel drive assembly, reel pulley, reel drive belt and then reel drive cover to left side of cutting unit; refer to Reel Drive Assembly (page 4–16).

#### Installing the Grooming Reel Bearing (continued)

- 3. Install grooming reel, front roller, and right drive plate to right side of cutting unit; refer to Grooming Reel (Forward Rotating Groomer Drive) (page 8–10) or Grooming Reel (Counter Rotating Groomer Drive) (page 8–14).
- 4. Check and adjust grooming reel height and mower height-of-cut settings.
- 5. Install cutting unit to the machine.
- 6. Lubricate groomer bearings.
- 7. Connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

**Note:** After greasing groomer bearings, operate groomer for 30 seconds, stop machine, and wipe any excess grease from groomer shaft and seals.

## Idler Assembly (Forward Rotating Groomer Drive)



The groomer right drive plate assembly incorporates the idler system for tensioning the groomer drive belt. The idler system uses a spring to maintain proper belt tension.

#### Removing the Idler Assembly (Forward Rotating Groomer Drive)

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position. Engage parking brake.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).
- 3. If idler pulley (item 10 in Figure 208) needs to be serviced, remove locknut and slide pulley with bearings from idler bracket. Remove retaining ring and bearings from idler pulley.
- 4. If idler bracket (item 4 in Figure 208) or pivot hub are to be removed from drive plate:
  - A. Remove right drive plate assembly from right side of cutting unit; refer to Grooming Reel (Forward Rotating Groomer Drive) (page 8–10).

1.

2.

3.

4.

5.

#### Removing the Idler Assembly (Forward Rotating Groomer Drive) (continued)



B. Remove idler components from drive plate as necessary (Figure 208 and Figure 209).

#### Installing the Idler Assembly (Forward Rotating Groomer Drive)

1. Assemble idler components to drive plate (Figure 208 and Figure 209).

**Note:** When properly installed, the idler bracket (item 4 in Figure 208) should pivot freely on pivot hub. Also, the idler pulley should move freely from side to side on the idler bracket pin.

- 2. Install right drive plate assembly to right side of cutting unit; refer to Grooming Reel (Forward Rotating Groomer Drive) (page 8–10).
- 3. Check and adjust grooming reel height and mower height-of-cut settings.
- 4. When all adjustments have been completed, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

## Idler Assembly (Counter Rotating Groomer Drive)





The groomer right drive plate assembly incorporates the idler system for engaging the groomer gear drive.

#### Disassembling the Idler Assembly (Counter Rotating Groomer Drive)

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position. Engage parking brake.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).
- 3. Ensure that the handle on groomer cover is rotated toward front of machine so that the groomer drive is engaged.
- 4. Remove groomer cover assembly and gasket from machine; refer to Groomer Cover (Counter Rotating Groomer Drive) (page 8-7).
- 5. Remove right drive plate assembly from right side of cutting unit; refer to Grooming Reel (Counter Rotating Groomer Drive) (page 8–14).
- 6. Remove idler components from right drive plate as necessary (Figure 210).

#### Assembling the Idler Assembly (Counter Rotating Groomer Drive)

1. Assemble idler components to right drive plate (Figure 210). Ensure that the retaining ring is fully seated in groove of reel hub after assembly.

**Note:** When properly installed, the idler bracket (item 4 in Figure 210) should pivot freely on reel hub.

2. Install right drive plate assembly to right side of cutting unit; refer to Grooming Reel (Counter Rotating Groomer Drive) (page 8-14). Ensure that the groomer drive gear and grooming reel driven gear are properly torgued. Do not install idler gears, extension spring or groomer cover assembly to drive plate assembly.



- 2. Idler bracket stop 4.
- Check adjustment of adjustment cam (Figure 212):
  - A. Rotate idler bracket so that the bracket stop is against the adjustment cam.
  - B. While holding bracket stop against the cam, measure the distance between the idler gear bearing surfaces on the idler bracket and the drive plate. This distance should be 37.7 mm (1.484 inch).
  - C. If distance is incorrect, loosen flange nut that secures adjustment cam to drive plate. Rotate the adjustment cam until distance is correct. Then, tighten flange nut to secure adjustment. Ensure that the distance is still correct after tightening the nut.

1.

#### Assembling the Idler Assembly (Counter Rotating Groomer Drive) (continued)





- 4. Install idler gears to drive plate assembly (Figure 213); torque flange nuts that secure idler gears to 13.5 N·m (120 in-lb).
- 5. Install extension spring to idler bracket and adjustment cam.
- Fill groomer cover with approximately 142 g (5 fl oz) of Mobil XHP221 grease (or equivalent). Install new gasket and then groomer cover assembly to right drive plate; refer to Groomer Cover (Counter Rotating Groomer Drive) (page 8–7).
- 7. Check and adjust grooming reel height and mower height-of-cut settings.
- 8. When all adjustments have been completed, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

## Lift Arm Assembly



#### **Disassembling the Lift Arm Assembly**

- 1. Park machine on level surface. Turn key switch to the OFF position and remove key from the switch. Ensure that the traction lever is in the NEUTRAL position. Engage parking brake.
- 2. Disconnect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).
- 3. Remove flange nut (item 2 in Figure 214) that secures lift arm to HOC groomer arm. Remove locknut and spring washer that secure lift arm to side plate. Loosen lock screw completely.
- 4. Remove lift arm from cutting unit.
- 5. Disassemble lift arm (Figure 214).

**Note:** Right and left side HOC groomer arms and lift arm assemblies are different; other components shown in Figure 214 are the same on both sides of cutting unit.

**Note:** Grooved pin (item 3 in Figure 214) is used to retain lock screw to lift arm assembly.

#### Assembling the Lift Arm Assembly

- 1. Assemble lift arm (Figure 214).
- 2. Apply anti-seize lubricant to threads of groomer lift rod (item 5 in Figure 214) and lift arm assembly stud.
- 3. Install lift arm onto cutting unit. Secure with flange nut (item 2 in Figure 214) and locknut with spring washer.
- 4. Secure groomer in raised or lowered position with lock screw (item 6 in Figure 214).
- 5. Check and adjust grooming reel height and mower height-of-cut settings.
- 6. When all adjustments have been completed, connect the battery pack; refer to Connecting the Lithium Battery Pack (page 8–3).

## **Groomer Brush**



The groomer brush attaches to the groomer drive in place of the grooming reel. Removal and installation of the groomer brush uses the same procedure as removal and installation of the grooming reel; refer to Grooming Reel (Forward Rotating Groomer Drive) (page 8–10) or Grooming Reel (Counter Rotating Groomer Drive) (page 8–14).



To remove the groomer brush from the shaft, remove the locknut and J-bolt from both ends of the brush and slide the brush from the shaft. When assembling the brush to the shaft, secure the assembly with J-bolts and locknuts. Ensure that the J-bolts are installed with the threaded portion on the outside of the brush (Figure 216); torque locknuts to **2.3 to 2.8 N·m (20 to 25 in-lb)**.

## **Chapter 9**



**Universal Groomer (Optional)** 

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# **General Information**

## Installation Instructions

The installation instructions for the groomer provide information regarding the operation, general maintenance procedures, and maintenance intervals for the groomer assembly on your Greensmaster eFlex machine. Refer to this publication for additional information when servicing the groomer assembly.

### **Connecting the Lithium Battery Pack**

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A

battery pack.

#### WARNING

A

A

The eFlex lithium battery pack contains high voltage which could burn or electrocute you.

- Do not attempt to open the battery pack.
- Do not place anything in the connector of the battery pack other than the wire harness connector that came with the product.
- Use extreme care when handling a battery pack with a cracked case.

CAUTION

Before servicing the machine, disconnect the machine from the

• Only use the charger designed for the battery pack.

This will prevent unexpected machine operation.



g202195

Figure 217 eFlex 2120 Model 04046 (shown)

1. Machine connector2. Battery pack3. Battery connector

To prevent unexpected machine operation during service, disconnect the machine from the battery pack as the first step in any repair (Figure 217). Once the battery pack has been disconnected, the electrical system on the machine can be safely worked on. During repairs, ensure that you do not allow tools or machine components to complete the battery circuit that was opened with the cable removal.

Connect the machine wire harness to the battery pack as the last step in any repair.

# **Service and Repairs**



CAUTION

A

Do not work on the groomer with the engine running. Always shut off the engine, remove the key from the key switch and wait for all machine movement to stop before working on the groomer.

**Note:** The *Groomer Operator's Manual* provides information regarding the installation, set-up, operation, and maintenance of the universal groomer on your machine. Refer to these instructions for additional information when servicing the groomer.

A

1.

2.
### **Gear Box Assembly**



**Note:** The groomer gear box assembly is located on the right side of the cutting unit.

#### **Removing the Gear Box Assembly**

- 1. Park the machine on a clean and level surface, lower the cutting units completely to the ground, set the parking brake, and remove the key from the key switch.
- 2. Remove the groomer reel assembly; refer to Removing the Groomer Reel (page 9–16).
- 3. Remove the drive shield.



- 4. Install a 5/16–18 X 5/8 inch square head set screw (Toro p/n 1-803022) in the end of the drive shaft and tighten to **13 N⋅m (120 in-lb)**; refer to Figure 3.
- 5. Remove the cotter pin and clevis pin from the height adjustment rod at the front of the groomer gear box. Discard the cotter pin.
- 6. Tip up the cutting unit to access the bottom of the reel to remove the drive shaft assembly.
- 7. 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.

#### 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.

8. Move the pry bar against the weld side of the reel support plate closest to the groomer gear box.

#### IMPORTANT

You must use a 6-point socket with a heavy wall to remove the gear box from the reel. Do not use an impact wrench. Groomer gear boxes installed on the right side of the cutting unit use a standard right hand thread; turn the drive shaft counterclockwise to remove the gear box.

Rest the handle of the pry bar against the front roller and turn the drive shaft counterclockwise to loosen it from the reel. Continue to unscrew the drive shaft and remove the gear box from the cutting unit.



- 11. Retaining ring
  - 12. Gear box housing assembly
  - 13. Damaged drive shaft

Ring gear 7. Flange bushing

Driven gear

Thrust washer

4.

5.

6.

- 10. If the hex head on the end of the drive shaft is damaged during removal:
  - A. Remove the drain/fill plug and drain the oil from the gear box.
  - B. Remove the 4 socket-head screws and remove the gear box cover assembly and driven gear. Remove and discard the cover gasket.
  - C. Slide the thrust washer, ring gear and bushing from the gear box housing.
  - D. Slide the sun gear, and planet gears and bushings from the pins on the gear box housing.
  - E. Remove the retaining ring from the drive shaft.

#### **Removing the Gear Box Assembly (continued)**

- F. Slide the groomer housing assembly from the drive shaft.
- G. Tip up the cutting unit to access the bottom of the reel to remove the drive shaft assembly.



- 1. Damaged input shaft assembly
- 4. Weld side of reel support plate
- Drive shaft removal tool
  - 5.
- 3. Reel shaft

2.

H. 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.

Pry bar

#### 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.

- I. Move the pry bar against the weld side of the reel support plate closest to the drive shaft assembly.
- J. Use the drive shaft removal tool on the large flats of the drive shaft assembly; refer to Special Tools (page 2–14).
- K. Rest the handle of the pry bar against the front roller and turn the drive shaft counterclockwise to loosen it from the reel.
- 11. Tip the cutting unit back onto its rollers.

#### **Removing the Gear Box Assembly (continued)**

12. Clean the threads in 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).

#### **Disassembling the Groomer Drive Assembly**



#### **Disassembling the Groomer Drive Assembly (continued)**

- 1. Remove the drain/fill plug (item 6 in Figure 223) and drain the oil from the gear box.
- 2. Remove the 4 socket-head screws (item 35 in Figure 223) and separate the gear box cover and housing.
- 3. Remove and discard the cover gasket.
- 4. Slide the sun gear (item 31 in Figure 223), ring gear, and planet gears from the pins on the gear box housing.
- 5. Continue to disassemble the gear box as necessary.

### CAUTION

Use the 1-3/8 inch flats on the input shaft to prevent the input shaft from rotating during adapter removal. Do not use the 1/2 inch hex on the input shaft during adapter removal as input shaft damage may occur.



- 6. If the drive adapter requires replacement, apply high strength threadlocker (loctite 243 or equivalent) to the 5/8 inch threads of the drive adapter and tighten the adapter to **150 to 173 N·m (110 to 120 ft-lb)**.
- 7. Carefully clean all the gasket material from the gear box housing and cover.
- 8. Inspect the V-ring (item 19 in Figure 223), seals, bearings, gears, and bushings in the gear box assembly. Replace the damaged or worn components as necessary.

#### Assembling the Groomer Drive Assembly

A

#### 

### CAUTION

Use the 1-3/8 inch flats on the input shaft to prevent the input shaft from rotating during adapter installation. Do not use the 1/2 inch hex on the input shaft during adapter installation as input shaft damage may occur.

- 1. If the sun gear, ring gear, or the gear box housing bearings are replaced, press the bearings all the way to shoulder in part.
- 2. If the flange bushings are replaced, ensure that the flange bushing is fully seated against the part.
- 3. Ensure that all the retaining rings and O-rings are fully seated in the ring groove.
- 4. Lubricate the seal lips and O-rings before installing the shafts.
- 5. Lubricate the planet gear and sun gear pins in the gear box housing with the gear oil and install the planet, ring, and sun gears.
- 6. Clean the gasket surface on the gear box housing and cover with the solvent and install new gasket.



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

A

A

#### Assembling the Groomer Drive Assembly (continued)

 Fill the gear box with 80W-90 gear oil and tighten the drain/fill plug to 4 to 5 N·m (32 to 42 in-lb).

The gear box oil capacity for reel cutting units is 50 ml (1.7 fl oz).

9. Operate the groomer gear box by hand to check for proper operation prior to installation.

#### Installing the Gear Box Assembly

1. Park the machine on a clean and level surface, lower the cutting units completely to the ground, set the parking brake, and remove the key from the key switch.



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

Use heavy gloves when handling the cutting unit.

2. Safely prevent the reel from rotating by blocking the cutting unit with a piece of wood near one of the reel spiders.

#### IMPORTANT

# The groomer gear box use a right-hand thread. Turn the input shaft clockwise to install the gear box.

3. Apply medium strength thread locking compound (Loctite 243 or equivalent) to the threads in the reel and allow the thread locking compound to cure for 15 minutes before continuing this procedure.



- 3. Groomer gear box assembly 6. Pry bar
- 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.
- 5. Move the pry bar against the weld side of the reel support plate closest to the gear box assembly and rest the handle of the pry bar against the front roller.
- 6. Position the gear box assembly against the cutting unit and turn the drive shaft assembly clockwise until it is seated against the reel.

#### **IMPORTANT**

You must use a 6-point socket with a heavy wall to install the gear box to the reel. Do not use an impact wrench. Groomer gear boxes installed on the right side of the cutting unit use a standard right hand thread; turn the drive shaft clockwise to install the gear box.



- 7. Tighten the drive shaft assembly from 135 to 150 N·m (100 to 110 ft-lb).
- 8. Remove the square head set screw from the end of the drive shaft.
- 9. Install the clevis pin and a new cotter pin to secure the height adjustment rod to the front of the groomer gear box.
- 10. Apply a retaining compound (Loctite 609 or equivalent) to the lip of the drive housing and install the drive shield.
- 11. Install the rear roller brush drive shield if previously removed.

#### Installing the Gear Box Assembly (continued)

12. Install the groomer reel assembly; refer to Installing the Groomer Reel (page 9–17).

# **Idler Assembly**



**Note:** The groomer idler assembly is located on the opposite side of the groomer gearbox assembly.

#### **Removing the Idler Assembly**

- 1. Park the machine on a clean and level surface, lower the cutting units completely to the ground, set the parking brake, and remove the key from the key switch.
- 2. Remove the electric motor from the cutting unit; refer to Electric Motor (page 5–69).
- 3. Remove the groomer reel assembly; refer to Removing the Groomer Reel (page 9–16).
- 4. Remove the cotter pin and clevis pin from the height adjustment rod at the front of the idler arm. Discard the cotter pin.
- 5. Inspect the shields, bearing, and bushing in the idler assembly. Remove and discard the components that are worn or damaged.

#### Installing the Idler Assembly

- 1. If the shields, bearing, or bushing was removed from the idler arm, install new components as follows:
  - A. Press the bushing into a groomer plate until the bushing is centered in the idler arm bore.

#### Installing the Idler Assembly (continued)

- B. Press the bearing into the idler arm so that the bearing contacts the shoulder in idler arm bore and install the bearing retaining ring.
- C. Install the bearing shields with flocked side of shield toward the bearing.





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- D. Check the idler arm orientation (left or right cutting unit) and insert the stub shaft (item 10 in Figure 225) through shields and bearing. Use the through hole in the shaft to prevent shaft from rotating, tighten the flange nut to **37 to 45 N·m (27 to 33 ft-lb)**.
- E. If the collar was removed from the idler arm, install the collar and tighten to **33 to 41 N·m (24 to 30 ft-lb)**.
- 2. Apply anti-seize lubricant to the outside diameter of the adaptor (Figure 226). Position the idler arm over the adaptor.
- 3. Apply Loctite to the 2 socket-head screws and secure the adaptor and idler arm to the cutting unit side plate.
- 4. Install a new cotter pin and clevis pin and secure the height adjustment rod to the front of the idler arm.
- 5. Install the electric motor to the cutting unit; refer to Electric Motor (page 5–69).

### **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**

1. Park the machine on a clean and level surface, lower the cutting units completely to the ground, set the parking brake, and remove the key from the key switch. If necessary, remove the cutting unit from the machine; refer to the *Traction Unit Operator's Manual*.



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

Use heavy gloves when handling the groomer reel.

- 2. Carefully remove the 4 jam nuts (item 2 in Figure 227), 4 bolts, and 4 shaft clamps that secure the groomer reel to the output and stub shafts.
- 3. Lift the groomer reel from the cutting unit.
- Inspect the seal, shields, bushing, and bearings for wear or damage. Replace the components as necessary; refer to (page ) and Idler Assembly (page 9–14).

#### Installing the Groomer Reel

- 1. Position the cutting unit on a level surface. If the cutting unit is attached to the traction unit, set the parking brake, and remove the key from the key switch.
- 2. Position the groomer reel between the groomer output and stub shafts.



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

### Servicing the Groomer Reel



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 (Figure 228). The blades that are rounded to the midpoint of the blade tip must be reversed or replaced for best groomer performance.

#### **Disassembling the Groomer Reel**

- 1. Park the machine on a clean and level surface, lower the cutting units completely to the ground, set the parking brake, and remove the key from the key switch.
- 2. Remove the groomer reel from the cutting unit; refer to Removing the Groomer Reel (page 9–16).



3. Remove the locknut from either end of the shaft (Figure 229).

#### **Disassembling the Groomer Reel (continued)**

- 4. Remove the spacers and blades from the groomer shaft. If necessary, remove second locknut from the shaft.
- 5. Inspect and replace the components that are worn or damaged.

#### Assembling the Groomer Reel

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

- 1. Install the locknut on drive end of the groomer shaft. Place the groomer blade on the groomer shaft.
- 2. Alternately install 11.6 mm (0.46 inch) spacers and blades, ensure that all the blades are separated by a spacer.
- 3. When all the blades have been installed, install the second locknut onto the shaft. Center the blades on shaft by adjusting locknuts.



- 4. Use the through holes in shaft to prevent the shaft from rotating, tighten the second locknut to 42 to 48 N·m (31 to 35 ft-lb). After tightening the locknut, spacers should not be free to rotate and the groomer blades should be centered on the shaft.
- 5. Install the O-ring on the non-drive end of the groomer shaft.
- 6. Install the groomer reel back onto the cutting unit; refer to Installing the Groomer Reel (page 9–17).

# Height Adjuster Assembly

1.

2.

3.

4.

5.



**Note:** Early universal groomers used 2 compression springs on non-adjustable height adjustment rods. Retrofitting the assemblies on each side of the cutting unit with new compression springs, height adjustment rods, and adding flange nuts to enable spring adjustment is recommended (Figure 230).

#### **Disassembling the Height Adjuster Assembly**

- 1. Park the machine on a clean and level surface, lower the cutting units completely to the ground, set the parking brake, and remove the key from the key switch.
- 2. Remove the cotter pins and clevis pins that secure the height adjustment rods to the groomer gear box and idler arm. Discard the cotter pins.
- 3. Loosen the 2 height adjustment bolts (item 15 in Figure 230) and 2 locknuts.
- 4. Remove the flange nut (item 4 in Figure 230) and carriage bolt that secure the height adjuster assembly to the cutting unit side plate, and remove the front roller and height adjuster from the cutting unit.
- 5. Disassemble the height adjuster assembly (Figure 230).
- 6. Clean all the components and inspect for wear or damage. Replace all the components that are worn or damaged.

#### Assembling the Height Adjuster Assembly

- 1. Apply anti-seize lubricant to the upper threads of the adjustment rod and lower threads of the height adjusters. Assemble the height adjuster assembly (Figure 230).
- 2. If both the height adjusters are removed, fit 1 height adjuster assembly to the cutting unit side plate and secure it with the carriage bolt and flange nut. Do

#### Assembling the Height Adjuster Assembly (continued)

not tighten the flange nut at this time. Ensure that the height adjustment bolt and 1 washer is above the slot in the side plate and 1 washer and locknut is below the slot in the side plate.

- 3. Position front roller between the height adjuster assemblies and secure height adjuster assembly to cutting unit side plate with carriage bolt and flange nut. Do not tighten the flange nut at this time. Ensure the height adjustment bolt and 1 washer is above slot in side plate and 1 washer and locknut is below slot in side plate.
- 4. Install new cotter pins and clevis pins and secure the height adjustment rods to the groomer gear box and idler arm.
- 5. Adjust the cutting unit height-of-cut; refer to Cutting Unit Operators Manual.
- 6. Check the groomer reel height and adjust as necessary.



1. Height adjustment knob

7. Adjust the flange nuts (item 8 in Figure 230) on the groomer height adjustment rods until the springs are compressed to 16 mm (0.625 inch).

# Servicing 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 Groomer Reel (page 9-16).

The grooming brush element or shaft can be serviced separately (Figure 232).

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, ensure that the J-bolts are installed with the threaded portion on the outside of the brush and tighten the locknuts to **2.3 to 2.8 N·m (20 to 25 in-lb)**.



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# **Electrical Drawing Designations**

**Note:** A splice used in a wire harness will be identified on the wire harness diagram by SP. The manufacturing number of the splice is also identified on the wire harness diagram (e.g., SP01 is splice number 1).

#### Wire Color

The following abbreviations are used for wire harness colors on the electrical schematics and wire harness drawings in this chapter.

ABBREVIATION	COLOR
ВК	BLACK
BR or BN	BROWN
BU	BLUE
GN	GREEN
GY	GRAY
OR	ORANGE
РК	PINK
R or RD	RED
Т	TAN
VIO	VIOLET
W or WH	WHITE
Y or YE	YELLOW

Numerous harness wires used on the Toro machines include a line with an alternate color. These wires are identified with the wire color and line color with either a / or \_ separating the color abbreviations listed above (e.g., R/BK is a red wire with a black line, OR\_BK is an orange wire with a black line).

#### Wire Size

The individual wires of the electrical harness diagrams in this chapter identify both the wire color and the wire size.

Examples:

- 16 BK = 16 AWG (American Wire Gauge) wire that has a black insulator
- 050 R = 0.5 mm metric wire that has a red insulator (AWG equivalents for metric wire appear in the following table)

AWG Equivalents for Metric Wire				
Diagram Label	Metric Size	AWG Equivalent		
050	0.5 mm	20 GA		
175	0.75 mm	18 GA		
100	1.0 mm	16 GA		
150	1.5 mm	14 GA		



### Electrical Schematic-1800/2100, and 2120 (for Models 04042, 04043, and 04046)





# Wire Harness Drawing-Main-1800/2100 (for Models 04042 and 04043)

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### Wire Harness Diagram-Main-1800/2100 (for Models 04042 and 04043)





# Wire Harness Drawing-Main-2120 (for Model 04046)



g207443

### Wire Harness Diagram-Main-2120 (for Model 04046)



Greensmaster eFlex 2120 (Model 04046), Drawing 122-0967 Rev B, Sheet 2 of 2



g271034



# Wire Harness Drawing-Main-1800/2100 and 2120 (for Models 04042, 04043, 04046 and 04049 fitted with 04069)

g271035

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Wire Harness-Li Battery-1800/2100, and 2120 (for Model 04042, 04043 and 04046)



G G G G G G G G G G G G G G	2	1	
GR GR POJ C MACHINE HARNESS /CHARGER POJ POJ POJ B B C C C C C C C C C C C C C			D
		6 R POS MACHINE HARNESS /CHARGER	С
		I 8 B U S I S I S ZS Z Z	В
A			A

# Wire Harness-Li Diagnostic-1800/2100, and 2120 (for Model 04042, 04043 and 04046)





# Wire Harness-Li Adapater-1800/2100, and 2120 (for Model 04042, 04043 and 04046)

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# Count on it.