Greensmaster® 1018/1021/1026
(models 04820, 04830 and 04840)
<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>03/2019</td>
<td>Initial issue.</td>
</tr>
<tr>
<td>B</td>
<td>03/2020</td>
<td>Updated the drum drive gear box assembly and transmission gear box assembly.</td>
</tr>
<tr>
<td>C</td>
<td>07/2020</td>
<td>Updated the traction and reel drive, cutting unit and universal groomer chapters.</td>
</tr>
</tbody>
</table>
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:

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


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

**DANGER**

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.
Figure 1
Model 04830 shown
Service Procedure Icons

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

**Critical Process**

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

**Critical Torque**

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

**Fluid Specifications**

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

**Note:** Refer to the service decal on the machine and the machine Operator’s Manual for commonly used fluid specifications and capacities.
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Chapter 1
Safety

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Safety Instructions

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

⚠️ WARNING ⚠️

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

• Review and understand the contents of the Operator’s Manuals before starting and operating the machine. Become familiar with the controls and know how to stop the machine and engine quickly. Additional copies of the Operator’s Manuals are available at www.toro.com.

• Never allow children to operate the machine. Never allow adults to operate the machine without proper instructions.

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

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

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

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

• Make sure work area is clear of objects which might be picked up and thrown by the attachments.

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

• Since the gasoline is highly flammable; handle it carefully.
  – Use an approved gasoline container.
  – Do not remove cap from fuel tank when engine is hot or running.
  – Do not smoke while handling gasoline.
  – Fill fuel tank outdoors and no higher than to the bottom of filter screen. Do not overfill fuel tank.
  – Wipe up any spilled gasoline.
  – Fuel may leak from filler neck when mower is tilted for servicing if tank is over filled.

• The safety interlock switches are for the operator’s protection; do not disconnect them. Check the operation of the switches daily to assure the interlock system is operating. If the switch is defective, replace it before operating the machine; refer to Interlock Module (Optional) (page 6–10)
While Operating the Machine

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

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

3. To start the engine:
   A. Open fuel shut-off valve. Make sure that the spark plug wire is connected to the spark plug.
   B. Verify that the control lever on handle is in NEUTRAL position for both traction and reel drives.
   C. Move ON/OFF switch to ON position, set choke to full choke position (cold start) and throttle to half throttle.
   D. Pull starter cord to start engine.

4. To stop the engine:
   A. Disengage the reel and traction drives and reduce engine speed to SLOW.
   B. Move ON/OFF switch to OFF position to stop the engine.

5. Before emptying the basket of clippings, disengage the traction and reel drives, reduce the engine speed and move ON/OFF switch to OFF position to stop the engine. Wait for all machine motion to stop before removing basket.

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

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

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

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

- The Traction Unit Operator’s Manual, Cutting Unit Operator’s Manual and Groomer Operator’s Manual provides the information regarding the operation, general maintenance and maintenance intervals for your Greensmaster machine. Refer to these publications for additional information when servicing the machine.

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

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

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

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

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

- Do not overspeed the engine by changing the governor settings. Recommended engine high idle speed is from 3,350 to 3,550 RPM. To ensure safety and accuracy, check the engine speed with a tachometer.

- Engine must be shut off and cooled down before checking oil or adding oil to the engine crankcase.

- If major repairs are ever needed or assistance is required, contact your Authorized Toro distributor.

- At the time of manufacture, the machine confirmed to all applicable safety standards. To assure optimum performance and continued safety certification of the machine, use genuine Toro replacement parts and accessories. Replacement of parts and accessories made by other manufacturers may result in non-conformance with the safety standards and can void the warranty.
Safety and Instructional Decals

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

Overall Dimensions

Figure 2

140 cm (55 in)

111.7 cm (44 in)

84 cm (33 in) - 18" reel
91 cm (36 in) - 21" reel
104 cm (41 in) - 26" reel
### Engine Specifications

**Figure 3**

1. Fuel tank  
2. Air cleaner  
3. Recoil starter  
4. Recoil-start handle  
5. Spark plug  
6. Muffler

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

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

Controls, Wheels and Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Wheel (Optional) Tire Pressure</td>
<td>83 to 103 kPa (12 to 15 PSI)</td>
</tr>
</tbody>
</table>

DPA Cutting Units

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

Cutting unit weight (approximate):

<table>
<thead>
<tr>
<th>Blade</th>
<th>18 inch</th>
<th>21 inch</th>
<th>26 inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 blade</td>
<td>-</td>
<td>23.6 kg (52 lbs)</td>
<td>26.7 kg (59 lbs)</td>
</tr>
<tr>
<td>11 blade</td>
<td>23.1 kg (51 lbs)</td>
<td>25 kg (55 lbs)</td>
<td>28.6 kg (63 lbs)</td>
</tr>
<tr>
<td>14 blade</td>
<td>24.5 kg (54 lbs)</td>
<td>26.3 kg (58 lbs)</td>
<td>-</td>
</tr>
</tbody>
</table>

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

Universal Groomer

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grooming reel diameter</td>
<td>6 cm (2.375 inches)</td>
</tr>
<tr>
<td>Groomer mounting</td>
<td>The drive assembly for the grooming reel is located on the opposite side of the cutting unit from the belt drive.</td>
</tr>
<tr>
<td>Groomer height setting</td>
<td><strong>Mowing</strong>: 0.8 to 15.7 mm (0.030 to 0.620 inch). <strong>HOC range</strong>: 1.5 to 19.1 mm (0.060 to 0.750 inch).</td>
</tr>
<tr>
<td>Width-of-groomer</td>
<td>54.6 cm (21.5 inches).</td>
</tr>
<tr>
<td>Height adjustment knob</td>
<td>Allows a 0.003 inch (0.08 mm) increment of height adjustment for each click of the adjuster.</td>
</tr>
<tr>
<td>Quick-up feature</td>
<td>Allows grooming reel to be raised above the height/depth adjustment for no grooming reel action while mowing.</td>
</tr>
</tbody>
</table>
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., Nylocknut), hardness of the surface underneath the head of the fastener, or similar condition which affects the installation.

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

The standard method of checking the torque can be performed by marking a line on the fastener (head or nut) and mating part, then back off the fastener 1/4 of a turn. Measure the torque necessary to tighten the fastener until the lines match up.
Calculating the Torque Values When Using a Drive-Adapter Wrench

![Figure 4](image)

Torque Conversion Factor = \( \frac{A}{B} \)

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

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

**Example:** The measured effective length of the torque wrench (distance from the center of the handle to the center of the square drive) is 457 mm (18 inches). The measured effective length of the torque wrench with the drive-adapter wrench installed (distance from the center of the handle to the center of the drive-adapter wrench) is 483 mm (19 inches). The calculated torque conversion factor for this torque wrench with this drive-adapter wrench would be 18/19 = 0.947. If the listed torque recommendation for a fastener is 103 to 127 N-m (76 to 94 ft-lb), the proper torque when using this torque wrench with a drive-adapter wrench would be 98 to 121 N-m (72 to 89 ft-lb).
Identifying the Fastener

Figure 5
Inch Series Bolts and Screws

1. Grade 1  2. Grade 5  3. Grade 8

Figure 6
Metric Bolts and Screws

1. Class 8.8  2. Class 10.9

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)

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Grade 1, 5 and 8 with Thin Height Nuts</th>
<th>SAE Grade 1 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)</th>
<th>SAE Grade 5 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)</th>
<th>SAE Grade 8 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in-lb</td>
<td>N-cm</td>
<td>in-lb</td>
<td>N-cm</td>
</tr>
<tr>
<td># 6 - 32 UNC</td>
<td>10 ± 2</td>
<td>13 ± 2</td>
<td>147 ± 23</td>
<td>15 ± 2</td>
</tr>
<tr>
<td># 6 - 40 UNF</td>
<td>17 ± 2</td>
<td>192 ± 23</td>
<td>25 ± 3</td>
<td>282 ± 34</td>
</tr>
<tr>
<td># 8 - 32 UNC</td>
<td>13 ± 2</td>
<td>25 ± 5</td>
<td>282 ± 56</td>
<td>29 ± 3</td>
</tr>
<tr>
<td># 8 - 36 UNF</td>
<td>31 ± 4</td>
<td>350 ± 45</td>
<td>43 ± 5</td>
<td>486 ± 56</td>
</tr>
<tr>
<td># 10 - 24 UNC</td>
<td>18 ± 2</td>
<td>30 ± 5</td>
<td>339 ± 56</td>
<td>42 ± 5</td>
</tr>
<tr>
<td># 10 - 32 UNF</td>
<td>48 ± 5</td>
<td>542 ± 56</td>
<td>68 ± 7</td>
<td>768 ± 79</td>
</tr>
<tr>
<td>1/4 - 20 UNC</td>
<td>100 ± 10</td>
<td>1130 ± 113</td>
<td>140 ± 15</td>
<td>1582 ± 169</td>
</tr>
<tr>
<td>1/4 - 28 UNF</td>
<td>115 ± 12</td>
<td>1299 ± 136</td>
<td>160 ± 17</td>
<td>1808 ± 192</td>
</tr>
<tr>
<td>5/16 - 18 UNC</td>
<td>115 ± 15</td>
<td>105 ± 15</td>
<td>1186 ± 169</td>
<td>200 ± 25</td>
</tr>
<tr>
<td>5/16 - 24 UNF</td>
<td>138 ± 17</td>
<td>128 ± 17</td>
<td>1146 ± 192</td>
<td>225 ± 25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ft-lb</th>
<th>ft-lb</th>
<th>N-m</th>
<th>ft-lb</th>
<th>N-m</th>
<th>ft-lb</th>
<th>N-m</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 - 16 UNC</td>
<td>16 ± 2</td>
<td>16 ± 2</td>
<td>22 ± 3</td>
<td>30 ± 3</td>
<td>41 ± 4</td>
<td>43 ± 5</td>
</tr>
<tr>
<td>3/8 - 24 UNF</td>
<td>17 ± 2</td>
<td>18 ± 2</td>
<td>24 ± 3</td>
<td>35 ± 4</td>
<td>47 ± 5</td>
<td>50 ± 6</td>
</tr>
<tr>
<td>7/16 - 14 UNC</td>
<td>27 ± 3</td>
<td>37 ± 4</td>
<td>50 ± 5</td>
<td>68 ± 7</td>
<td>70 ± 7</td>
<td>95 ± 9</td>
</tr>
<tr>
<td>7/16 - 20 UNF</td>
<td>29 ± 3</td>
<td>39 ± 4</td>
<td>55 ± 6</td>
<td>75 ± 8</td>
<td>77 ± 8</td>
<td>104 ± 11</td>
</tr>
<tr>
<td>1/2 - 13 UNC</td>
<td>30 ± 3</td>
<td>48 ± 7</td>
<td>65 ± 9</td>
<td>75 ± 8</td>
<td>102 ± 11</td>
<td>105 ± 11</td>
</tr>
<tr>
<td>1/2 - 20 UNF</td>
<td>32 ± 4</td>
<td>53 ± 7</td>
<td>72 ± 9</td>
<td>85 ± 9</td>
<td>115 ± 12</td>
<td>120 ± 12</td>
</tr>
<tr>
<td>5/8 - 11 UNC</td>
<td>65 ± 10</td>
<td>88 ± 12</td>
<td>119 ± 16</td>
<td>150 ± 15</td>
<td>203 ± 20</td>
<td>210 ± 21</td>
</tr>
<tr>
<td>5/8 - 18 UNF</td>
<td>75 ± 10</td>
<td>95 ± 15</td>
<td>129 ± 20</td>
<td>170 ± 18</td>
<td>230 ± 24</td>
<td>240 ± 24</td>
</tr>
<tr>
<td>3/4 - 10 UNC</td>
<td>93 ± 12</td>
<td>140 ± 20</td>
<td>190 ± 27</td>
<td>265 ± 27</td>
<td>359 ± 37</td>
<td>375 ± 38</td>
</tr>
<tr>
<td>3/4 - 16 UNF</td>
<td>115 ± 15</td>
<td>165 ± 25</td>
<td>224 ± 34</td>
<td>300 ± 30</td>
<td>407 ± 41</td>
<td>420 ± 43</td>
</tr>
<tr>
<td>7/8 - 9 UNC</td>
<td>140 ± 20</td>
<td>225 ± 25</td>
<td>305 ± 34</td>
<td>430 ± 45</td>
<td>583 ± 61</td>
<td>600 ± 60</td>
</tr>
<tr>
<td>7/8 - 14 UNF</td>
<td>155 ± 25</td>
<td>260 ± 30</td>
<td>353 ± 41</td>
<td>475 ± 48</td>
<td>644 ± 65</td>
<td>667 ± 66</td>
</tr>
</tbody>
</table>

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

**Note:** The torque values must be reduced when installing the fasteners into threaded aluminum or brass. The specified torque value should be determined based on the aluminum or base material strength, fastener size, length of thread engagement, etc.

**Note:** The nominal torque values listed above for Grade 5 and 8 fasteners are based on 75% of the minimum proof load specified in SAE J429. The tolerance is approximately ± 10% of the nominal torque value. The thin height nuts include jam nuts.
Standard Torque for Dry, Zinc Plated, and Steel Fasteners (Metric Fasteners)

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

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

**Note:** The torque values must be reduced when installing the fasteners into threaded aluminum or brass. The specified torque value should be determined based on the aluminum or base material strength, fastener size, length of thread engagement, etc.

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

## SAE Grade 8 Steel Set Screws

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Recommended Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Square Head</td>
</tr>
<tr>
<td>1/4 - 20 UNC</td>
<td>140 ± 20 in-lb</td>
</tr>
<tr>
<td>5/16 - 18 UNC</td>
<td>215 ± 35 in-lb</td>
</tr>
<tr>
<td>3/8 - 16 UNC</td>
<td>35 ± 10 ft-lb</td>
</tr>
<tr>
<td>1/2 - 13 UNC</td>
<td>75 ± 15 ft-lb</td>
</tr>
</tbody>
</table>

## Thread Cutting Screws
(Zinc Plated Steel)

### Type 1, Type 23 or Type F

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Baseline Torque**</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 6 - 32 UNC</td>
<td>20 ± 5 in-lb</td>
</tr>
<tr>
<td>No. 8 - 32 UNC</td>
<td>30 ± 5 in-lb</td>
</tr>
<tr>
<td>No. 10 - 24 UNC</td>
<td>38 ± 7 in-lb</td>
</tr>
<tr>
<td>1/4 - 20 UNC</td>
<td>85 ± 15 in-lb</td>
</tr>
<tr>
<td>5/16 - 18 UNC</td>
<td>110 ± 20 in-lb</td>
</tr>
<tr>
<td>3/8 - 16 UNC</td>
<td>200 ± 100 in-lb</td>
</tr>
</tbody>
</table>

## Wheel Bolts and Lug Nuts

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Recommended Torque*</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/16 - 20 UNF</td>
<td>65 ± 10 ft-lb</td>
</tr>
<tr>
<td>Grade 5</td>
<td></td>
</tr>
<tr>
<td>1/2 - 20 UNF</td>
<td>80 ± 10 ft-lb</td>
</tr>
<tr>
<td>Grade 5</td>
<td></td>
</tr>
<tr>
<td>M12 X 1.25</td>
<td>80 ± 10 ft-lb</td>
</tr>
<tr>
<td>Class 8.8</td>
<td></td>
</tr>
<tr>
<td>M12 X 1.5</td>
<td>80 ± 10 ft-lb</td>
</tr>
<tr>
<td>Class 8.8</td>
<td></td>
</tr>
</tbody>
</table>

*For steel wheels and non-lubricated fasteners

## Thread Cutting Screws
(Zinc Plated Steel)

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Threads per Inch</th>
<th>Baseline Torque**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type A</td>
<td>Type B</td>
</tr>
<tr>
<td>No. 6</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>No. 8</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>No. 10</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>No. 12</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

**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

\[
\text{in-lb} \times 11.2985 = \text{N·cm}
\]

\[
\text{N·cm} \times 0.08851 = \text{in-lb}
\]

\[
\text{ft-lb} \times 1.3558 = \text{N·m}
\]

\[
\text{N·m} \times 0.7376 = \text{ft-lb}
\]
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.

<table>
<thead>
<tr>
<th>SUPPLY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTI-SEIZE LUBRICANT</td>
<td>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.</td>
</tr>
<tr>
<td>GREASE</td>
<td>Can be used to pre-fill (pack) bearings, boots and seals prior to assembly, ease installation of components during assembly, or fill cavities between moving parts through grease fittings after assembly. Unless otherwise noted, refer to the machine Operator’s Manual or Installation Instructions for grease specifications.</td>
</tr>
<tr>
<td>THREAD LOCKING COMPOUND</td>
<td>Used to lock threaded fasteners in position. Available in low, medium and high strength for various size fasteners and applications. Most thread locking compounds are applied immediately prior to fastener installation. Some thread locking compounds use a “Wicking” feature, and can be applied after fastener installation. Most thread locking compounds allow the fastener to be removed with standard tools once cured. High strength thread locking compounds may require applying heat to the fastener and the surrounding area to allow fastener removal.</td>
</tr>
<tr>
<td>Note:</td>
<td>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.</td>
</tr>
<tr>
<td>RETAINING COMPOUND</td>
<td>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.</td>
</tr>
<tr>
<td>ADHESIVE</td>
<td>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.</td>
</tr>
<tr>
<td>THREAD SEALANT</td>
<td>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 form is preferred over sealant tape. The sealant should remain semi-pliable to allow for component removal with standard tools. Some thread sealants may require the use of a cleaner or primer prior to use.</td>
</tr>
<tr>
<td><strong>GASKET COMPOUND</strong></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>--</td>
</tr>
<tr>
<td>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.</td>
<td><img src="image1.png" alt="Gasket Compound" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SILICONE SEALANT</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>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).</td>
<td><img src="image2.png" alt="Silicone Sealant" /></td>
</tr>
</tbody>
</table>
Special Tools

Multimeter

Obtain this tool locally

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

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

Dielectric Gel

Toro Part No. 107-0342

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

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

Spark Tester

Toro Part No. TOR4036

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

Gauge Bar Assembly

Toro Part No. 94–9010

Use gauge bar to verify height-of-cut adjustment.
Cutting Reel Shim

**Toro Part No. 125–5611**

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

Cutting Performance Paper

**Toro Part No. 125–5610** (300 strips)

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

Backlapping Brush Assembly

**Toro Part No. 29–9100**

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

Components for the brush assembly are also available individually.

- Brush 36-4310
- Handle 29-9080
- Handle cap 2410-18

Reel Drive Shaft

**K-Line Part No. TOR4112**

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

15/16–16 Right-Hand Thread – Toro Part No. 137–0926
15/16–16 Left-Hand Thread – Toro Part No. 137–0927

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

Angle Indicator and Magnetic Mount

Angle Indicator: Toro Part No. 131–6828
Magnetic Mount: Toro Part No. 131–6829

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

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

1. Place the angle indicator on the bottom side of the bedknife with the digital display facing you as shown.
2. Press the Alt Zero button on the angle indicator.
3. Remove the angle indicator and place the magnetic mount on the edge of the bedknife so the face of the magnet is flat against the top angle of the bedknife.
4. Place the angle indicator on the mount with the digital display facing you as shown. The angle displayed on the indicator is the current bedknife top angle.

Bedknife Screw Tool
Bedknife Screw Tool (continued)

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)

K-Line Part No. TOR4105

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

Toro Part No. 04399

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

Drive Shaft Removal Tool

Toro Part No. 137–0920

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

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.
Chapter 3
Troubleshooting

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  Evaluate Potential Causes ............................................................................................................................... 3–2
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  Repair ............................................................................................................................................................. 3–2
  Solution Confirmation ..................................................................................................................................... 3–2
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Grooming Reel Mechanical Problems .............................................................................................................. 3–6
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
Starting Problems

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

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

**Note:** For engine component testing information, refer to the Honda Service Manual.

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

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 detailed adjustment procedures. Refer to Service and Repairs (page 8–6) for cutting unit repair information.

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

### Factors That Can Affect Quality of Cut

<table>
<thead>
<tr>
<th>Factor</th>
<th>Possible Problem/Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine RPM and mow speed</td>
<td>For best cutting performance and appearance, the engine should be run at high idle speed while cutting. Check and adjust the high idle speed as necessary; refer to the Traction Unit Operator’s Manual.</td>
</tr>
<tr>
<td>Reel bearing condition</td>
<td>Check and replace the reel bearings if necessary; refer to Reel Assembly (page 8–18).</td>
</tr>
<tr>
<td>Bedknife to reel adjustment</td>
<td>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.</td>
</tr>
<tr>
<td>Reel and bedknife sharpness</td>
<td>A reel and/or bedknife that has rounded cutting edges or rifling (grooved or wavy appearance) cannot be corrected by tightening the bedknife to reel contact. Grind the reel to remove taper and/or rifling. Grind the bedknife to sharpen and/or remove rifling. A new bedknife must be ground or backlapped after installation to the bedbar. Refer to Grinding the Bedknife (page 8–14) for grinding information or the Traction Unit Operator’s Manual for backlapping information.</td>
</tr>
<tr>
<td>Height-of-cut</td>
<td>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.</td>
</tr>
<tr>
<td>Proper bedknife for height-of-cut desired</td>
<td>If the bedknife is too thick for effective height-of-cut, poor quality of cut will result.</td>
</tr>
<tr>
<td>Stability of bedbar</td>
<td>Ensure that the bedbar pivot bolts are securely seated and washer free to rotate; refer to Bedbar Assembly (page 8–6).</td>
</tr>
<tr>
<td>Number of reel blades</td>
<td>Use correct number of blades for clip frequency and optimum height-of-cut range.</td>
</tr>
<tr>
<td>Roller type and condition</td>
<td>A variety of cutting unit rollers are available. Refer to the Cutting Unit Parts Manual for a listing of available accessories, or contact your local Authorized Toro Distributor for additional information. Ensure that the rollers rotate freely. Repair the roller bearings if necessary; refer to Roller Assemblies (page 8–26).</td>
</tr>
<tr>
<td>Cutting unit accessories</td>
<td>A variety of cutting unit accessories are available that can be used to enhance aftercut appearance. Refer to the Cutting Unit Parts Manual for a listing of available accessories, or contact your local Authorized Toro Distributor for additional information.</td>
</tr>
</tbody>
</table>
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

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

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

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

Operator’s Manual

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

Engine Owner’s Manual

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

Engine Service Manual

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

Engine Identification

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

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

Figure 9

1. Fuel tank insert

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

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

Throttle Cable Adjustment

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

1. Park the mower on a level surface.
   
   **Note:** Make sure that the engine is at normal operating temperature before you adjust the throttle cable.

2. Start the engine and move the throttle lever to the SLOW position.

3. Loosen the clamp retaining cable conduit.

4. Make sure that the throttle control is in the SLOW position and move the cable conduit until 1900 rpm.

5. Tighten the screw to secure the throttle cable conduit.

6. Check the engine speed with a tachometer:
   
   A. Low idle speed should be **1,800 to 2,000 RPM**; refer to *Operator’s Manual*.
   
   B. High idle speed should be **3,350 to 3,550 RPM**. Adjust the throttle stop at throttle lever to attain the correct high idle speed setting; refer to *Operator’s Manual*.

**IMPORTANT**

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

Cooling System

Figure 10

1. Engine cylinder shroud 
2. Cooling fins

IMPORTANT

The engine that powers the machine is air-cooled. Operating the engine with dirty or plugged cooling fins or a plugged or dirty blower housing will result in engine overheating and damage.

1. Park the machine on a level surface. Ensure that the engine is OFF position. Remove the spark plug wire from the spark plug.

IMPORTANT

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

2. Clean the cooling fins on the cylinder and cylinder head. Remove the engine cylinder shroud from the engine for more thorough cleaning; refer to Figure 10.
Cooling System (continued)

1. Blower housing

2. Rewind starter

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

**IMPORTANT**

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

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

5. Attach the spark plug wire to the spark plug.
Use a NGK BPR6ES spark plug or equivalent.

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

**IMPORTANT**

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

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

**Note:** Refer to Figure 13 during this procedure.

1. Park the machine on a level surface with the engine OFF. Remove the spark plug wire from the spark plug to prevent the engine from starting. Close the fuel shut-off valve on the engine.

2. If the engine is to be disassembled, it may be easier to drain oil from engine before removing the engine from the traction unit.
Removing the Engine (continued)

3. Remove the throttle cable (2) from the engine:
   A. Loosen the screw that secures the cable clamp (3) to the engine. Remove the cable clamp.
   B. Loosen the screw that secures the throttle cable (2) to the governor lever (1). Slide and remove the throttle cable from the governor lever.
   C. Position the throttle cable (2) away from the engine.
Removing the Engine (continued)

Figure 15

1. Armature wire
2. Alternator wire
3. Harness ground wire

4. Disconnect the electrical connections from the engine:
   A. Unplug the wire harness connector from the engine armature wire (1).
   B. Disconnect the wire harness ground wire (3) from engine by removing LH rear cap screw, flat washer and a flange nut.
   C. If the machine is equipped with optional lighting kit, disconnect the wire harness connectors from the engine alternator wires (2).

5. Remove the 2 bolts (13) that secures the clutch cover (12) to the bell housing. Remove the clutch cover from the bell housing.

6. Remove the 2 bolts (15) and 2 nuts (11) that secures the clutch hub clamp (10) to the external clutch hub. Remove the clutch hub clamp from the external clutch hub.

7. Remove the 4 bolts (8) and 4 washers (9) that secures the engine (14) to the bell housing.

8. Remove the 4 nuts (3), 4 washers (4) and 4 carriage bolts (6) that secures the engine (14) to the engine base (5). Remove the engine from the engine base.

9. If necessary, remove the muffler (2) from the engine (14) by removing the 2 bolts (1).
Installing the Engine

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

2. Torque tighten the bolts (1) from **4 to 5.6 N·m (35 to 50 in-lb)**.

3. Position the engine (14) onto the engine base (5) and engine output shaft in the bell housing and external clutch hub.

4. Secure the engine (14) onto the bell housing with the 4 bolts (8) and 4 washers (9). In an alternating cross pattern, torque tighten the bolts (8) from **10 to 11.3 N·m (90 to 100 in-lb)**.

5. Secure the engine (14) to the engine base (5) with the 4 carriage bolts (6), 4 washers (4) and 4 nuts (3).

6. Apply the anti-seize lubricant to the engine shaft key.

7. Install the clutch hub clamp (10) onto the external clutch hub and make sure that the clutch hub clamp integral key is aligned to the engine shaft keyway. Secure the clutch hub clamp (10) with the 2 bolts (15) and 2 nuts (11).

8. Torque tighten the bolts (15) from **10 to 12.4 N·m (90 to 110 in-lb)**.

9. Install the clutch cover (12) onto the bell housing and secure with the 2 bolts (13). Torque tighten the bolts (13) from **6.7 to 9 N·m (60 to 80 in-lb)**.

10. Connect the electrical connections to the engine:
    A. Apply dielectric gel to wire harness connectors.
    B. Connect the wire harness connectors to the engine armature wire (item 1 in Figure 15).
    C. Connect the wire harness ground wire (3) to the engine by installing the LH rear cap screw, flat washer and a flange nut.
    D. Apply a coat of dielectric grease to the wire harness ground terminal to prevent corrosion.
    E. If the machine is equipped with optional lighting kit, connect the wire harness connectors to the engine alternator wires.

11. Connect the throttle cable (item 2 in Figure 14) to the engine:
    A. Slide the throttle cable end into the governor lever (1).
    B. Place throttle cable (2) under the cable clamp (3) and secure with a screw.
    C. Adjust the throttle cable; refer to Throttle Cable Adjustment (page 4–4). Ensure that all fasteners are tightened after the cable adjustment.

12. Check and adjust the engine oil level as needed; refer to Operator's Manual.

13. Attach the spark plug wire to the spark plug. Open the fuel shut-off valve on the fuel tank.

14. Start the engine and allow it to warm to operating temperature. Check high and low idle speeds and adjust if necessary.
Removing the Engine Base

Note: Refer to Figure 16 during this procedure.

1. Park the machine on a level surface with the engine OFF. Remove the spark plug wire from the spark plug to prevent the engine from starting. Close the fuel shut-off valve on the engine.

2. Remove the throttle cable; refer to Removing the Throttle Cable (page 7–3).

3. Remove the clutch cable; refer to Removing the Clutch Cable (page 7–9).

4. Remove the brake cable; refer to Removing the Brake Cable (page 7–6).

5. Remove the reel cable; refer to Removing the Reel Cable (page 7–11).
Removing the Engine Base (continued)

6. Slide the telescopic coupler on the reel drive assembly and disconnect the reel drive shaft from the transmission drive shaft.

7. Remove the truss screw, nut and 2 washers that secures the 2 splined couplers to the transmission gear box assembly and drum drive gear box assembly.

8. Loosen the jam nut (3) and remove the slider adaptor (2) from the transmission gear box assembly (10).

9. Remove the nut (4), washers (5) and bolt (7) that secures the engine base (1) to front side of the frame assembly (6).

10. Remove the 4 nuts (11) and 2 tube clamps (8) that secures the engine base (1) to rear side of the frame assembly (6).

**WARNING**

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

11. Lift the engine base with engine and transmission together from the frame assembly.

12. Remove the 4 carriage bolts that secures the engine to the engine base.

13. Remove the 2 bolts (9) that secures the transmission gear box assembly to the engine base.

**WARNING**

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

14. Separate the engine base from the engine and transmission gear box assembly.
15. Carefully remove the nut (1 in Figure 17) and compression spring (2) that secures the reel selector hub (3) to the reel selector shaft (5). Remove the reel selector hub.

16. Carefully remove the extension spring (6) from the long and short reel levers (10 and 12).

17. Remove the bolt (13) that secures the reel selector shaft (5) to the engine base (16).

18. Remove the washer (9), long reel lever (10), washer (9), short reel lever (12), washer (9) and reel bellcrank (8) from the reel selector shaft (5).
Removing the Engine Base (continued)

19. If necessary, remove the flange bushing (7) from the reel bellcrank (8). Remove the straight bushing (11) from the long and short reel lever (10 and 12).

20. If necessary, remove the nut (14), washer (23) and socket head screw (15) from the engine base (16).

Installing the Engine Base

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

2. If removed, install the straight bushings (11) into the long and short reel levers (10 and 12) using an arbor press. Ensure that the straight bushings (3) are flush to top of the long and short reel levers (1 and 2); refer to Figure 18.

3. If removed, install the flange bushing (7) into the reel bellcrank (8) using an arbor press.

4. Slide the reel bellcrank (8), washer (9), short reel lever (12), washer (9), long reel lever (10) and washer (9) onto the reel selector shaft (5).

5. Install the reel selector shaft (5) onto engine base (16) and secure with the bolt (13).

6. Carefully position the extension spring (6) onto the long and short reel levers (10 and 12).

7. Install the reel selector hub (3) and compression spring (2) onto the reel selector shaft (5) and secure with the nut (1).

**WARNING**

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

---

**Figure 18**

1. Long reel lever 2. Short reel lever 3. Straight bushing

**IMPORTANT**

Straight bushings in the long and short reel levers must be inspected for wear or damage and replaced if needed.
Installing the Engine Base (continued)

8. Install the engine and transmission gear box assembly on the engine base.

9. Secure the transmission gear box to engine base with 2 bolts (9). Do not tighten the bolts (9).

10. Secure the engine to the engine base with 4 carriage bolts, washers and nuts.

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

12. Tighten the nut (4). Torque tighten the nuts (11) in a criss cross pattern from 3.4 to 4 N·m (30 to 35 in-lb) and then using the same pattern apply the torque from 5 to 5.6 N·m (45 to 50 in-lb).

13. Tighten the 2 bolts (9) that secure the transmission gear box to engine base.

14. Install the slider adapter (item 2 in Figure 16) and secure with a jam nut (3) onto the transmission gear box assembly (10). Adjust the slider adapter to make sure that the transmission output shaft is in neutral position.

15. Install the 2 splined couplers onto the transmission gear box assembly and drum drive gear box assembly and secure with the truss screw, 2 washers and nut.

16. Torque tighten the truss screw to 10 to 12.4 N·m (90 to 110 in-lb).

17. Install the reel cable; refer to Installing the Reel Cable (page 7–13).

18. Install the brake cable; refer to Installing the Brake Cable (page 7–8).

19. Install the clutch cable; refer to Installing the Clutch Cable (page 7–10).

20. Install the throttle cable; refer to Installing the Throttle Cable (page 7–5).

21. Attach the spark plug wire to the spark plug. Open the fuel shut-off valve on the fuel tank.

22. Start the engine and allow it to warm to operating temperature. Check high and low idle speeds and adjust if necessary.
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The Operator’s Manual provides information regarding the operation, general maintenance, and maintenance intervals for your machine. Refer to the Operator’s Manual for additional information when servicing the machine.

Disengaging The Drum Drive From Transmission

Figure 19

1. Transmission gear box assembly
2. Traction engage/disengage lever

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

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

2. Locate the traction engage/disengage lever on top of the transmission gear box assembly.

3. To disengage the drum drive, rotate the traction engage/disengage lever to clockwise direction (away from the center of transmission gear box assembly).

4. To engage the drum drive, rotate the traction engage/disengage lever to anti-clockwise direction (towards the center of the transmission gear box assembly).

5. Attach the spark plug wire to the spark plug.
Adjustments

Adjusting the Reel Drive Belt

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

2. Remove the 3 socket head screws (7) that secures the reel drive cover (6) to the reel drive assembly (1) and remove the reel drive cover to expose the reel drive belt (2).

3. Check tension by depressing the belt (item 2 in Figure 20) at mid span between pulleys with **18 to 22 N (4 to 5 lbs)** of force. The belt should deflect **6.35 mm (0.25 inch)**. If deflection is incorrect, proceed to next step. If deflection is correct, continue operation.
Adjusting the Reel Drive Belt (continued)

4. Adjust belt tension (2) as follows:
   A. Loosen the bolt (4) and rotate the idler arm (3) to release the tension on the reel drive belt (2).
   B. Pivot the idler arm (3) clockwise against the backside of the belt and apply a torque 3.9 to 4.5 N·m (35 to 40 in-lb) to internal hex socket on the idler arm (3). Secure the idler arm with the bolt (4). Check the belt tension as per para 3.
   C. Ensure that the reel drive gasket (5) is in position and install the reel drive cover (6) to the reel drive assembly (1) and secure with the 3 socket head screws (7).
   D. Torque tighten the socket head screws to 1.7 to 4.5 N·m (15 to 40 in-lb). Use an alternation pattern and torque tighten the socket head screws to 9.6 to 10.7 N·m (85 to 95 in-lb).

5. Attach the spark plug wire to the spark plug.
Aligning the Transmission Output Shaft to the Reel Drive Input Shaft

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

2. Check the telescopic coupler on the reel drive input shaft for free movement. If binding occurs, adjust the engine base plate as follows:

Figure 21

1. Engine base
2. Slider adapter
3. Jam nut
4. Flat head nut
5. Flat washer (2 each)
6. Frame assembly
7. Bolt
8. U-Tube clamp
9. Flat head bolt (5 each)
10. Transmission gear box assembly
11. Nut
12. Jack screw
Aligning the Transmission Output Shaft to the Reel Drive Input Shaft (continued)

A. Loosen the nut (item 2 in Figure 22) that secures the reel drive assembly to the side-plate.

B. Loosen the four nuts (item 11 in Figure 21) on the two U-tube clamps that secures the engine base to the rear side of the frame assembly.

C. Loosen the nut (item 4 in Figure 21) that secures the engine base to the front side of the frame assembly.

D. Using the jackscrew (item 12 in Figure 21), adjust the engine base up or down and move the reel drive assembly forward or aft until the transmission reel drive output shaft aligns (intersects) with the coupler of the input to the reel drive. The telescopic coupler must move freely when engaging.

E. Tighten the nut (item 4 in Figure 21) that secures the engine base to the front side of the frame assembly. Re-check the alignment of the telescopic coupler.

F. Evenly tighten the four nuts (item 11 in Figure 21) on the two U-tube clamps that secures the engine base to the rear side of the frame assembly. Torque tighten the nuts to 5 to 5.6 N·m (45 to 50 in-lb).

G. Re-check the alignment of the telescopic coupler.

H. Tighten the nut (item 2 in Figure 22) that secures the reel drive assembly to side plate.

I. Re-check the alignment telescopic coupler and ensure no binding between the transmission reel drive output shaft and reel drive input shaft.

3. Install the spark plug wire on the spark plug.
The greensmaster machines use a positive drive belt on the right side of the machine to operate the cutting unit.

Removing the Reel Drive Belt

**Note:** Refer to Figure 23 during this procedure.

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

2. Remove the 3 socket head screws (7) that secures the reel drive cover (6) to reel drive assembly (1) and remove the reel drive cover to expose the reel drive belt (2).
Removing the Reel Drive Belt (continued)

3. Remove and inspect the reel drive gasket (5) from the reel drive assembly (1). Discard the reel drive gasket (5), if damaged.

4. Loosen the bolt (4) and rotate the idler arm (3) to release the tension on the reel drive belt (2).

5. Remove the reel drive belt (2) from the pulleys.

Installing the Reel Drive Belt

1. Ensure that the bolt (4) is loose enough to move the idler arm (3) freely.

2. Place the new drive belt (2) onto the pulleys.

3. Adjust the reel belt tension; refer to Adjusting the Reel Drive Belt (page 5–3).

4. Ensure that the reel drive gasket (5) is in position and install the reel drive cover (6) to the reel drive assembly (1) and secure with the 3 socket head screws (7).

5. Torque tighten the socket head screws to 1.7 to 4.5 N·m (15 to 40 in-lb). Use an alternation pattern and torque tighten the socket head screws to 9.6 to 10.7 N·m (85 to 95 in-lb).

6. Attach the spark plug wire to the spark plug.
Removing the Reel Drive Assembly

**Note:** Refer to Figure 24 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF. Remove the spark plug wire from the engine spark plug.
2. Slide the telescopic coupler (item 8 in Figure 24) on the reel drive assembly (6) and disconnect the reel drive shaft from the transmission drive shaft (10).
3. Loosen and remove the 2 screws (1) and the nut (12) that secures the reel drive assembly (6) to RH side plate (9). Remove the reel drive assembly (6), flat washers (3), spring washers (4) and spacers (2 and 11) from the RH side plate (9).
4. Remove the V-ring seal (5) from the reel drive assembly (6).
Disassembly of Reel Drive Assembly

Figure 25

1. Reel shaft-driven
2. O-ring
3. Pivot sleeve
4. Reel drive gasket
5. Ball bearing (2 each)
6. Internal snap ring
7. Reel pulley spacer (2 each)
8. Reel pulley - 24 tooth
9. Lock nut (2 each)
10. Idler bushing
11. Socket head screw
12. Socket head screw (3 each)
13. Expansion plug
14. Reel drive cover
15. Reel pulley - 22 tooth
16. Reel belt
17. Retaining ring
18. Ball bearing (4 each)
19. Flocked bearing shield
20. Hipro key
21. Reel shaft-driver
22. Reel drive housing
23. O-ring
24. Bolt
25. Lock nut (2 each)
26. Idler arm
27. Plain washer
28. Hex bolt
29. Retaining ring

Note: Refer to Figure 25 during this procedure.

1. Remove the reel drive belt (item 16 in Figure 25); refer to Removing the Reel Drive Belt (page 5–7).
2. Remove and discard the reel drive gasket (4) from the reel drive housing (22).
3. If necessary, remove the expansion plug (13) from the reel drive cover (14).
4. Remove the hex bolt (28) and plain washer (27) from the idler arm (26) and the nut (25) from the reel drive housing (22).
5. Loosen and remove the socket head screw (11) that secures the idler arm (26) to the reel drive housing (22). Remove the idler arm and nut (25) from the reel driving housing.
6. If necessary, remove the idler bushing (10) from the idler arm (26).
7. Remove the retaining ring (29) and use a press to remove 2 ball bearings (18) from the idler arm (26). Discard the ball bearings after removal.
8. Remove the lock nut (9), reel pulley (8), hipro key (20) and spacer (7) from the reel shaft-driven (1).
Disassembly of Reel Drive Assembly (continued)

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

Assembly of Reel Drive Assembly

1. If removed install the bolt (24) into the reel drive housing (22) and new O-ring (23) onto the bolt (24).
2. Use a press to install the 2 ball bearings (18) into the reel drive housing (22) and make sure that the reel shaft-driver pushes on bearing outer raceway.
3. Slide the bearing shield (item 19 in Figure 25) onto the reel shaft-driver.
4. Install the reel shaft-driver (21) into the reel drive housing (22).
5. Install the retaining ring (17) to the reel drive housing (22).
6. Slide the spacer (7) onto the reel shaft-driver (21).
7. Install hipro key (20) to then reel shaft-driver (21). Apply anti-seize lubricant at the top of the key.
8. Install the reel pulley (15) onto the reel shaft-driver (21). Secure the reel pulley (15) with the lock nut (9).

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

15. Torque tighten the lock nut to 36.6 to 44.7 N·m (27 to 33 ft-lb).
16. If removed, install the bushing (10) into the idler arm (26).
17. Use a press to install the 2 ball bearings (18) to the idler arm (26) outer raceway and secure with a retaining ring (29).
18. Install and secure the idler arm into the reel driving housing with the socket head screw (11) and nut (10).
Assembly of Reel Drive Assembly (continued)

19. Install the bolt (28), washer (27) and nut (25) to the idler arm (26) and reel drive housing (22). Do not tighten the bolt (28).

![Diagram of reel drive assembly](image)

**Figure 26**

1. Press flush

20. If removed, install the expansion plug (13) to the reel drive cover (14) and press flush to outer surface (refer to Figure 26) of the reel drive cover.

21. Install the reel drive belt; refer to Installing the Reel Drive Belt (page 5–8).

22. Adjust the reel drive belt tension; refer to Adjusting the Reel Drive Belt (page 5–3).

Installing the Reel Drive Assembly

**Note:** Refer to Figure 24 during this procedure.

1. Place the V-ring seal (5) into the reel drive assembly (6).

2. Install the compression spring (7) and telescopic coupler (8) to the reel drive shaft.

3. Install the reel drive assembly (6), washers (3), spring washer (4) and spacers (2 and 11) to the RH side plate (9) and secure the reel drive assembly (6) with 2 screws (1) and nut (12).

4. Slide the compression spring (7) and telescopic coupler (8) to the transmission gear shaft (10).

5. Attach the spark plug wire to the spark plug.
Removing the Drum Drive Gear Box Assembly

**Note:** Refer to Figure 27 during this procedure.

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

2. Remove the transport wheel if attached; refer to Removing the Transport Wheel (page 7-27).

   **Note:** Support the machine on kickstand during this operation.

3. Move the traction engage/disengage lever to the disengage position to remove torque from the drum drive gears.
Removing the Drum Drive Gear Box Assembly (continued)

4. Remove the truss screw (11), nut (5) and washer (4) that secures the 2 splined couplers (3) to the transmission gear box assembly (1) and drum drive gear box assembly (8).

5. Remove the shoulder bolt (10) that secures the drum drive gear box assembly (8) to the frame assembly (9).

6. Remove the 3 shoulder bolts (6) that secures the drum drive gear box assembly (8) to the traction drum (2). Remove the drum drive gear box assembly from the frame assembly. Support the drum assembly.

7. If necessary, remove the hexagonal shaft (7) from the drum drive gear box assembly (8).
Disassembly of Drum Drive Gear Box Assembly

Note: Refer to Figure 28 during this procedure.

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

5. Remove the nut (12) that secures the spur gear (11) to the drum drive shaft (5). Slide and remove the spur gear (11) from the drum drive shaft (5). Locate and retrieve the key (30) from the drum drive shaft (5).

6. Remove the nut (1) and washer (2) that secures the outer drum hub (3) to the drum drive shaft (5). Slide and remove the outer drum hub (3) and V-ring seal (4) from the drum drive shaft (5). Locate and retrieve the key (30) from the drum drive shaft (5).

7. If the ball bearings (6) are to be removed, use a press to remove the oil seal (10), ball bearings (6), bearing spacer (7), spring washer (9) and drum drive shaft (5) from the drum drive housing (25). Discard the ball bearings after removal.

8. Remove the nut (17) and bearing pin (31) that secures the spur gear (20) to the drum drive housing (25).

9. Remove the spur gear (20) and bearing spacer (34) from the drum drive housing (25).

10. Remove and discard the O-ring (32) from the bearing pin (31).

11. If the spur gear bearings (19) are to be removed, remove the retaining rings (18) and use a press to remove the ball bearings (19). Discard the bearings after removal.

12. Remove the retaining ring (28) and oil seal (27) from the drum drive housing (25). Discard the oil seal (27). Remove the retaining ring (26) from the spur gear (21).

13. Use a press to remove ball bearings (23), spur gear (21) and wave washer (24) from the drum drive housing (25). Discard the ball bearings after removal.

14. Remove and discard the O-ring (29) from the drum drive housing (25).
1. Install the ball bearings (23), wave washer (24) and spur gear (21) to the drum drive housing (25).
   
   **Note:** The outer diameter and inner diameter of the ball bearings (23) must be slip fit.

2. Install the retaining ring (26) to the spur gear (21). Apply a light coat of oil to the oil seal (27). Install the oil seal (27) and retaining ring (28) to the drum driving housing (25).

3. Use a press to install the ball bearings (19) to the spur gear (20). Install the retaining rings (18) to spur gear (20).
   
   **Note:** The inner diameter of the ball bearing (19) must be slip fit.

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

5. Install the ball bearings (6), bearing spacer (7), spring washer (9) and drum drive shaft (5) to the drum drive housing (25).
   
   **Note:** The outer diameter and inner diameter of the ball bearings (6) must be slip fit.

6. Install the V-ring seal (4) onto the drum outer hub (3). Install the key (30) to the drum drive shaft (5) and apply anti-seize lubricant at the top of the key. Slide the drum outer hub (3) to the drum drive shaft (5) and secure with the washer (2) and nut (1).

7. Install the oil seal (10) into the drum drive housing (25). Install the key (30) to the drum drive shaft (5) and apply anti-seize lubricant at the top of the key. Slide the spur gear (11) to the drum drive shaft (5) and secure with the nut (12).

8. Torque tighten the nut (17) from **36.5 to 44.7 N·m (27 to 33 ft-lb)**.

9. Hold the nut (12) and torque tighten the nut (1) from **74.5 to 88 N·m (55 to 65 ft-lb)**.

10. If removed, install the oil seal (13) to the drum drive cover (14).

11. Install the gasket (8) to the drum drive housing.
Assembly of Drum Drive Gear Box Assembly (continued)

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

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

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

Installing the Drum Drive Gear Box Assembly

1. If removed, apply a coat of loctite (blue) to threads of the hexagonal shaft (7). Install the hexagonal shaft (item 7 in Figure 27) to the drum drive gear box assembly (8). Torque tighten the hexagonal shaft to 67.7 N·m (50 ft-lb).

2. Apply a light coat of grease and install the O-ring (29) to the drum drive housing (25).

3. Install the drum drive gear box assembly (8) to the frame assembly (9) and secure with the shoulder bolt (10).

4. Install the drum drive gear box assembly (8) to the traction drum (2) and secure with the 3 shoulder bolts (6).

5. Install the 2 splined couplers onto the transmission gear box assembly (1) and drum drive gear box assembly (8) and secure with the truss screw (11), 2 washers (4) and nut (5).

6. Torque tighten the truss screw (11) to 10 to 12.4 N·m (90 to 110 in-lb).

7. If required, install the transport wheels; refer to Installing the Transport Wheel (page 7–29).

8. Attach the spark plug wire to the spark plug.
Removing the Drum Assembly

**Note:** Refer to Figure 30 during this procedure.

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

2. Remove the LH and RH drum drive gear box assemblies (item 8 in Figure 30); refer to Removing the Drum Drive Gear Box Assembly (page 5–13).

3. Remove the traction drum (2) from the frame assembly (9).
Disassembly of Drum Drive Assembly

Note: Refer to Figure 31 during this procedure.

1. Remove the 4 bolts (item 2 in Figure 31) and lock washers (3) that secures the drum hub plate (4) to the drum spindle (5).

2. Remove the 4 bolts (2) and lock washers (3) that secures the drum hub plate (4) to the drum hub (10).

3. Remove the shoulder bolts (11) that secures the drum hub plate (4) to the traction drum (1).

4. Remove the lock nut (12) that secures the drum spindle (5) and drum hub (10) together. Carefully slide and remove the drum spindle (5) out of the drum hub (10).

5. Remove the 2 seals (6) from the drum hub (10). Use a press to remove the 2 ball bearings (7) and a bearing spacer (8) from the drum hub (10). Discard the ball bearings.
Assembly of Drum Drive Assembly

Figure 32

1. Drum hub
2. Spacer
3. Lock nut
4. Spacer
5. Drum spindle
6. Seal (2 each)
7. Ball bearing (2 each)

**Note:** The seal side of each bearing (item 7 in Figure 32) should face inside of the drum hub; refer to Figure 32.

1. Use a press to install the bearings (7) and spacer (8) into the drum hub (10). Pack the bearings with grease. Fill outside space of the bearing with the grease.

2. Apply a coat of grease to the seals (6). Press the seals (6) into the drum hub (1) with its flat side facing outside; refer to Figure 32.

3. Apply grease to the shaft of the drum spindle (5). Carefully slide the drum spindle into the drum hub bearings (7). Secure the drum spindle and drum hub (1) with a spacer (2) and lock nut (3). Make sure that the drum spindle (5) can move axially relative to the drum hub (1).

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

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

**Note:** The fit between the drum hub plate (item 4 in Figure 31) and drum (1) is a close tolerance and can be easily jammed. The hub can be rotated when seated properly in the bore of the drum.

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

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

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

2. Position the LH and RH drum drive gear box assembly (item 8 in Figure 30) and traction drum (2) onto the frame assembly (9).

3. Secure the LH and RH drum drive gear box assembly (8) to the traction drum (2); refer to Installing the Drum Drive Gear Box Assembly (page 5–18).

4. Attach the spark plug wire to the spark plug.
Removing the Clutch Bearing

**Note:** Refer to Figure 33 during this procedure.

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

2. Remove the 2 bolts (12) that secures the clutch cover (11) to the bell housing (18). Remove the clutch cover from the bell housing.
Removing the Clutch Bearing (continued)

3. Remove the clutch cable from the fork shaft (17); refer to Removing the Clutch Cable (page 7–9).

4. Remove the retaining ring (13) from the fork shaft (17).

5. Slide and remove the fork shaft (17) and clutch fork (14) from the bell housing (18).

6. If necessary, remove the flange bushing (10) from the clutch fork (14).

7. Remove the 2 locknuts (22), 2 bolts (1) and clutch hub clamp (2) that secures the external clutch hub (3) to the engine drive shaft. Slide the external clutch hub (3) towards the engine.

8. Remove the transmission gear box assembly (20); refer to Removing the Transmission Gear Box Assembly (page 5–26).

9. Remove the retaining ring (4) that secures the clutch disc (5) to the transmission gear box shaft. Slide and remove the clutch disc (5), friction plate (6), compression spring (7) and slider clutch disc assembly (8).

10. Use a press to remove the bearing (9) from slider clutch disk (8). Discard the removed bearing (9).

11. Inspect the clutch component for wear or damage. Replace the components as necessary.

12. If necessary, remove the flange bushing (10) and bushing (16) from the bell housing (18).

Installing the Clutch Bearing

1. Ensure that the clutch components are cleaned before assembly.

2. If removed, install the bushing (16) and flange bushing (10) to the bell housing (18).

3. Use a press to install the bearing (9) to the slider clutch disk (8).

4. Slide and install the slider clutch disk assembly (8), compression spring (7), friction plate (6) and clutch disc (5) onto the transmission gearbox shaft (20) and secure with a retaining ring (4).

5. Install the transmission gear box assembly (20) onto the engine base; refer to Installing the Transmission Gear Box Assembly (page 5–37).

6. Slide the external clutch hub (3) onto the slider clutch disc and secure with the clutch hub clamp (2), 2 bolts (1) and 2 locknuts (22).

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

7. Torque tighten the bolts (1) to 10 to 12.4 N-m (90 to 110 in-lb).

8. If removed, install the flange bushing (10) into the clutch fork (14).

9. Apply anti-seize lubricant on splines of the fork shaft (17).

10. Position the clutch fork (14) in the bell housing (18) and slide the fork shaft (17) into the clutch fork (14) and bell housing. Secure the clutch fork with the retaining ring (13).

11. Install the clutch cable onto the fork shaft (17); refer to Installing the Clutch Cable (page 7–10).
Installing the Clutch Bearing (continued)

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

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

14. Attach the spark plug wire to the spark plug.
Transmission Gear Box Assembly

Figure 34

1. Truss screw (3 each)  
2. Splined coupler (6 each)  
3. Washer (3 each)  
4. Lock nut (3 each)  
5. Drive shaft  
6. Engine base  
7. Telescopic coupler  
8. Reel drive box assembly  
9. Slide adaptor  
10. Jam nut  
11. Bolt (2 each)  
12. Transmission gear box assembly  
13. Compression spring

Removal of transmission gear box assembly is necessary in order to service the internal components.

Removing the Transmission Gear Box Assembly

**Note:** Refer to Figure 34 during this procedure.

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

2. Disconnect the clutch cable; refer to Removing the Clutch Cable (page 7–9).

3. Disconnect the brake cable; refer to Removing the Brake Cable (page 7–6).

4. Disconnect the reel cable; refer to Removing the Reel Cable (page 7–11).
Removing the Transmission Gear Box Assembly (continued)

5. Slide the telescopic coupler (item 7 in Figure 34) on the reel drive box assembly (8) and disconnect the reel drive box assembly from the transmission gear box assembly (12).

6. Remove the nuts (4), washers (3) and truss screws (1) that secures the splined couplers (2) to the drive shaft (5). Remove the splined couplers from the drive shafts.

7. Remove the 2 bolts that secures the clutch cover. Remove the clutch cover.

8. Remove the retaining ring that secures the fork shaft. Slide and remove the fork shaft from the bell housing.

9. Loosen the nuts on the external clutch hub and slide the external clutch hub towards the engine.

10. Loosen the jam nut (10) and remove the slider adapter (9) from the transmission gear box assembly (12).

11. Remove the 3 bolts that secures the bell housing onto the transmission gear box assembly.

12. Remove the two flange head bolts (11) that secures the transmission gear box assembly (12) to the engine base (6). Remove the transmission gear box assembly from the engine base.

13. Remove the clutch bearing from the transmission gear box assembly; refer to Removing the Clutch Bearing (page 5–23).
Disassembling the Transmission Gear Box Assembly

1. Retaining ring
2. Spacer bushing
3. O-ring
4. Straight bushing (2 each)
5. Retaining ring (2 each)
6. Oil seal (2 each)
7. Flange bushing (2 each)
8. ORB plug
9. Detent spring
10. Detent ball
11. Grease seal
12. Ball bearing (2 each)
13. Spacer
14. Oil seal (2 each)
15. Oil seal
16. Sleeve bushing (2 each)
17. Dowel pin
18. O-ring seal
19. Traction selector shaft
20. Groomer pin
21. Brake mount pin
22. Transmission gasket
23. Transmission cover
24. Socket head screw (12 each)
25. Ball bearing (2 each)
26. Transmission housing
27. Hollow hex plug (2 each)
28. E-ring

**Note:** Refer to **Figure 35** during this procedure.

1. Remove the 2 hollow hex plugs (item 27 in **Figure 35**) from the transmission gear box assembly (26).

2. Remove the 12 socket head screws (24) that secures the transmission cover assembly (23) to the transmission housing assembly (26). Remove the transmission cover assembly and transmission gasket (22) from the transmission housing assembly. Discard the transmission gasket (22).
Disassembling the Transmission Gear Box Assembly (continued)

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

4. Remove the neutral spur gear assembly (item 5 in Figure 36) and wave washer (3) from the transmission housing assembly (23).

5. Use a press to remove the ball bearings (4) from the neutral slider shaft (6). Remove the square keys (7) from the neutral slider shaft (6). Discard the ball bearings.

6. Remove the differential assembly (14) from the transmission housing assembly (23).

7. Remove the 2 differential shafts (9) from the differential housing (14). Remove the retaining rings (11) and O-rings (10) from the differential shafts (9). Discard the O-rings.
Disassembling the Transmission Gear Box Assembly (continued)

8. Use a press to remove the 2 ball bearings (13) and 2 flange bearings (12) from the differential assembly (14). Remove the V-ring seal (15) from the differential assembly (14). Discard the ball bearings (13).

9. If necessary, disassemble the differential assembly (14); refer to Disassembly of Differential Assembly (page 5–39).

10. Remove the bolt (25) that secures the cable brake lever (24) onto the brake lever (19). Slide and remove the cable brake lever (24) and external retaining ring (1) from the brake lever (19).

11. Remove the 4 bolts (8) that secures the retainer plate (16) to the transmission housing assembly (23). Remove the retainer plate (16) from the transmission housing assembly (23).

12. Slide and remove the brake lever assembly (19) from the transmission housing assembly (23). Remove the flat wire spring (22) from the transmission housing assembly (23).

13. Disassemble the brake lever assembly (19) as follows:
   A. Remove the retaining ring (17) from the brake clevis pin (21).
   B. Slide and remove the brake clevis pin (21) from the brake band (18) and brake lever (19).
   C. Remove the brake lever (19) from the brake band (18).
   D. Remove and discard the O-ring (20) from the brake lever (19).
Disassembling the Transmission Gear Box Assembly (continued)

14. Slide and remove the reel clutch actuator (item 16 in Figure 37) from the transmission housing assembly (20). If necessary, remove the reel clutch shoe (15) from the reel clutch actuator (16).

15. Remove the reel drive shaft assembly (14), ball bearing (10) and wave spring (9) from the transmission housing assembly (20). If necessary, disassemble the drive shaft assembly (12) as follows:

A. Use a press to remove the ball bearings (10) from the reel drive shaft (12). Discard the bearings (10).

B. Remove the retaining ring (11) from the reel drive shaft (12).

Figure 37

1. Short bearing pin 8. Flange nut (2 each) 15. Reel clutch shoe
3. Long bearing pin 10. Ball bearing (2 each) 17. Spur gear
4. Bearing spacer (2 each) 11. Retaining ring (2 each) 18. Thin lock nut
5. Retaining ring (4 each) 12. Reel drive shaft 19. Input shaft
6. Ball bearing (5 each) 13. Square key (2 each) 20. Transmission housing assembly
7. Spur gear 14. Slider spur gear
Disassembling the Transmission Gear Box Assembly (continued)

C. Slide and remove the slider spur gear (14) from the reel drive shaft (12).
D. Remove the two key squares (13) from the reel drive shaft (12).

16. Remove the nut (8) and long bearing pin (3) that secures the spur gear assembly (7) to the transmission housing assembly (20). Remove the spur gear (7) and bearing spacer (4) from the transmission housing assembly (20).

17. Remove and discard the O-ring (2) from the long bearing pin (3).

18. If necessary, disassemble the spur gear (7) as follows:
   A. Remove the 2 retaining rings (5) from the spur gear (7).
   B. Use a press and remove the 3 ball bearings (6) from the spur gear (7).
      Discard the ball bearings.

19. Remove the nut (8) and short bearing pin (1) that secures the spur gear assembly (17) to the transmission housing assembly (20). Remove the spur gear (17) and bearing spacer (4) from the transmission housing assembly (20).

20. Remove and discard the O-ring (2) from the short bearing pin (1).

21. If necessary, disassemble the spur gear (17) as follows:
   A. Remove the 2 retaining rings (5) from the spur gear (17).
   B. Use a press and remove the 2 ball bearings (6) from the spur gear (17).
      Discard the ball bearings (6).

22. Remove the thin lock nut (18) that secures the input shaft (19) to the transmission housing assembly (20). Slide and remove the input shaft.

23. Remove the ORB plug (item 8 in Figure 35), detent spring (9) and detent ball (10) from the transmission housing assembly (26).

24. Loosen and remove the groomer pin (item 20 in Figure 35) from the traction selector shaft (19).

25. Remove the retaining ring (item 1 in Figure 35), spacer bushing (2) and O-ring (3) from the traction selector shaft (19).

26. Slide and remove the traction selector shaft (item 19 in Figure 35) and O-ring (18) from the transmission housing assembly (26).

27. Remove oil seal (item 15 in Figure 35) and sleeve bushings (16) from the transmission housing (26). Discard the oil seal (15).

28. Remove the flange bushings (item 7 in Figure 35) from the transmission housing (26).

29. Remove the oil seals (item 6 in Figure 35), grease seals (11) and retaining ring (5) from the transmission housing (26). Discard the oil seals and grease seals.

30. Use a press and remove the ball bearings (items 12 and 25 in Figure 35) and spacer (13) from the transmission housing (26). Discard the ball bearings (12 and 25).
Assembling the Transmission Gear Box Assembly

1. Use a press to install the spacer (item 13 in Figure 35) and new ball bearings (12 and 25) into the transmission housing (26).

2. Install the retaining ring (item 5 in Figure 35) into the transmission housing (26).

3. Install the new grease seal (item 11 in Figure 35) into the transmission housing (26). Ensure that the seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.

4. Install the new oil seal (item 6 in Figure 35) into the transmission housing. Ensure that the seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.

5. Install the new oil seal (item 14 in Figure 35) into the transmission housing. Ensure that the seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.

6. Press the flange bushings (item 7 in Figure 35) into the transmission housing (26).

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**Figure 38**

1. Ball bearing (2 each)  
2. Spacer  
3. Grease seal  
4. Straight bushing (2 each)
Assembling the Transmission Gear Box Assembly (continued)

1. Sleeve bushing
2. Oil seal
3. Press flush

7. Insert the sleeve bushing (Item 16 in Figure 35) into the transmission housing (26) until the sleeve bushing is flush with the transmission housing; refer to Figure 39.

8. Press the oil seal (item 15 in Figure 35) into the transmission housing (26) so that the seal is recessed from 1.27 mm (0.05 in) from the edge of the transmission housing; refer to Figure 39. Ensure that the oil seal lip is orientated toward the center of the transmission housing.

9. Apply a coat of grease to the O-ring seal (item 18 in Figure 35) and slide onto the groove of the traction selector shaft (19).

10. Insert the straight bushings (item 4 in Figure 35) into the transmission housing (26). Press the straight bushings into the transmission housing bore so that the bushings are recessed from the edge of the transmission housing; refer to Figure 38.

11. Apply a coat of grease to the O-ring (item 18 in Figure 35) and slide onto the traction selector shaft (item 19 in Figure 35). Insert the traction selector shaft (item 19 in Figure 35) into the transmission housing (26).

12. Apply a coat of a grease to the O-ring (item 3 in Figure 35) and slide onto the groove of the traction selector shaft (19). Slide the spacer bushing (2) onto the traction selector shaft (19) and secure with a retaining ring (1).

13. Install the groomer pin (item 20 in Figure 35) onto the traction selector shaft (19).

14. Install the detent ball (item 10 in Figure 35), detent spring (9) and plug (8) into the transmission housing assembly (26).

15. Insert the input shaft (item 19 in Figure 37) into the transmission housing assembly (20) and secure with the thin lock nut (18). Torque tighten the thin lock nut to 47.5 to 61 N·m (35 to 45 ft-lbs).

16. Use a press to install the 2 new ball bearings (item 6 in Figure 37) into the spur gear (17) and secure with the 2 retaining rings (5).

17. Apply a coat of grease to the O-ring (item 2 in Figure 37) and slide the O-ring onto the short bearing pin (1). Install the spur gear assembly (17) and
Assembling the Transmission Gear Box Assembly (continued)

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

18. Use a press to install the 3 new ball bearings (item 6 in Figure 37) into the spur gear (7) and secure with the 2 retaining rings (5).

19. Apply a coat of grease to the O-ring (item 2 in Figure 37) and slide the O-ring onto the long bearing pin (3). Install the spur gear assembly (7) and bearing spacer (4) onto the transmission housing assembly (20) and secure with the long bearing pin (3) and nut (8).

20. Insert the square keys (item 13 in Figure 37) into the reel drive shaft (12) and apply a coat of grease to outside of the keys.

21. Slide the slider spur gear (item 14 in Figure 37) onto the reel drive shaft (12) and secure with the retaining rings (11). Press the new ball bearings (10) onto the reel drive shaft (12).

22. Install the wave spring (item 9 in Figure 37) and reel drive assembly (14) into the transmission housing assembly (20).

23. Insert the reel clutch shoe (item 15 in Figure 37) into the reel clutch actuator (16). Slide the reel clutch actuator (16) into the transmission housing assembly (20).

24. Assemble the brake lever assembly (item 19 in Figure 36) as follows:

A. Apply a coat of grease to the O-ring (item 20 in Figure 36) and slide the O-ring onto the brake lever.

B. Place the brake lever (item 19 in Figure 36) onto the brake band (18) and secure with the brake clevis pin (21) and retaining ring (17).

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**Figure 40**

1. Transmission housing
2. Dowel pin
Assembling the Transmission Gear Box Assembly (continued)

25. Slide and install the brake lever assembly (item 19 in Figure 36) into the transmission housing assembly (23).

26. If removed, insert the brake mount pin through brake band into the transmission housing assembly (item 23 in Figure 36) and place the flat wire spring (22) onto the transmission housing assembly.

27. Place the retainer plate (item 16 in Figure 36) onto the transmission housing assembly (23) and secure it with the 4 bolts (8).

28. Slide and install the external retaining ring (item 1 in Figure 36), cable brake lever (24) onto the brake lever (19) and secure it with the bolt (25).

29. If disassembled, assemble the differential assembly (item 14 in Figure 36); refer to Assembly of Differential Assembly (page 5–40).

30. Pack the differential assembly (item 14 in Figure 36) with grease and use a press to install the 2 ball bearing (13) and 2 flange bearings (12) into the differential assembly.

31. Slide the V-ring seal (item 15 in Figure 36) onto the differential assembly (14).

32. Apply a coat of grease to the 2 O-rings (item 10 in Figure 36) and slide the O-rings to the differential shafts (9). Install the retaining rings (11) onto the differential shaft (9).

33. Insert the 2 differential shafts (item 9 in Figure 36) into the differential housing (14).

34. Insert the differential housing assembly (item 14 in Figure 36) into the transmission housing assembly (23).

35. Insert the square keys (item 7 in Figure 36) into the neutral slider shaft (6). Apply a coat of grease to outer surface of the square keys (7).

36. Insert the neutral slider shaft (item 6 in Figure 36) into the neutral spur gear (5).

37. Use a press and insert the bearings (item 4 in Figure 36) onto the neutral slider shaft (6).

38. Insert the wave washer (item 3 in Figure 36) and neutral spur gear assembly (5) into the transmission housing assembly (23). Make sure that the traction selector shaft (item 19 in Figure 35) is engaged in shift selection neutral spur gear (item 5 in Figure 36).

39. Apply a coat of grease to ORB plug (item 8 in Figure 35) and install the detent ball (10), detent spring (9) and ORB plug (8) into the transmission housing (26).

40. Torque tighten the ORB plug (8) from **3.6 to 4.7 N·m (32 to 42 in-lb)**.

41. Use a press and insert the ball bearing (item 25 in Figure 35) into the transmission cover (23). Install the retaining ring (5) and oil seal (6) into the transmission cover (23).

42. Ensure that the oil seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.

43. Install the oil seal (item 14 in Figure 35) into the transmission cover (23).

44. Ensure that the oil seal lip is orientated toward the center of the transmission housing. Press the seal into the transmission housing bore so that the seal is flush to the edge of the transmission housing.

45. If removed, insert the 2 dowel pins (item 17 in Figure 35) into the transmission housing assembly (26).
Assembling the Transmission Gear Box Assembly (continued)

**Note:** Ensure that the dowel pins is recessed outboard to 4.5 mm (0.18 in) from the edge of the transmission housing; refer to Figure 40.

46. Install the new transmission gasket (item 22 in Figure 35) and transmission cover assembly (23) onto the transmission housing (26) by aligning the holes. Secure the transmission cover assembly with 12 bolts (24) and torque tighten to 1.7 to 4.5 N·m (15 to 40 in-lb). Use an alternation pattern and torque tighten the bolts to 9.6 to 10.7 N·m (85 to 95 in-lb).

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

47. Fill the transmission gear box assembly (26) with 1.35 lbs (24 oz) of Mobil SHC 007 grease.

48. Apply a coat of grease to the O-rings and insert onto the hollow hex plugs. Install the 2 hollow hex plugs (item 27 in Figure 35) into the transmission gear box assembly (26).

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

**Installing the Transmission Gear Box Assembly**

1. Install the clutch bearing onto the transmission gear box assembly; refer to Installing the Clutch Bearing (page 5–24).

2. Position the transmission gear box assembly (12) onto the bell housing and secure with 3 bolts. Keep the engine bolts loose, slide the engine transmission assembly laterally until the transmission contacts the mounting surface on the engine base. Tighten the engine bolts and secure the transmission with 2 flange bolts.

3. Install and adjust the slider adapter (9) until the neutral position is achieved and lock the position with jam nut (10) onto the transmission gear box assembly (12).

4. Slide the external clutch hub onto the slider clutch disc and secure with the clutch hub clamp, 2 bolts and 2 locknuts; refer to Installing the Clutch Bearing (page 5–24).

5. Slide and install the fork shaft into the bell housing; refer to Installing the Clutch Bearing (page 5–24). Secure the fork shaft with a retaining ring.

6. Install the clutch cover onto the bell housing and secure with 2 bolts.

7. Install the splined couplers (item 2 in Figure 34) to the drive shaft (5) and secure with truss screws (1), washers (3) and nuts (4). Torque tighten the truss screws to 10 to 12.4 N·m (90 to 110 in-lb).

8. Slide the telescopic coupler (7) from the reel drive box assembly (8) to the transmission gear box shaft.

9. Check and adjust the alignment of transmission drive shaft and reel drive shaft; refer to Installing the Engine Base (page 4–15).

10. If removed, install the reel cable; refer to Installing the Reel Cable (page 7–13).

11. Install the brake cable; refer to Installing the Brake Cable (page 7–8).

12. Install the clutch cable; refer to Installing the Clutch Cable (page 7–10).

13. Attach the spark plug wire to the spark plug.
Removing the Differential Assembly

To remove the differential assembly from the transmission gear box assembly; refer to Disassembling the Transmission Gear Box Assembly (page 5–28).
Disassembly of Differential Assembly

**Figure 42**

1. Differential housing (2 each)  
2. Differential pin (6 each)  
3. Differential spur gear (6 each)  
4. Differential gear  
5. Socket head screw (6 each)

---

1. Remove the 6 socket head screws (item 5 in Figure 42) that secures the differential housing assembly (1) to the differential gear (4). Remove the differential gear from the differential housing assembly.

2. Place the differential housing assembly on workbench. Pull each differential housings (1) apart.

3. Use a press to remove the 6 differential pins (2) and 6 differential spur gears (3) from the differential housings (1).

---

**Inspecting the Differential Assembly**

1. Clean all the differential assembly components.

2. Inspect all the differential spur gears (3) carefully looking for chipped teeth, wear or other damage. Because gear tooth damage is rarely isolated to 1 gear, replace the gears as complete set if there is a internal damage.

3. Inspect the differential pins (2) for the scoring or wear.

4. Replace all the differential assembly components that are worn or damaged.
Assembly of Differential Assembly

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

![Figure 43](image_url)

**Figure 43**

1. Differential spur gears with shoulder up  
2. Press flush

3. The differential pins (2) must be inserted in alternate holes of the differential housing (1) and ensure that the differential pins (2) are flush to the surface of the differential housing; refer to Figure 43.

4. Apply a coat of grease to the differential spur gears (3) and the differential pins (2).

5. Insert the differential spur gears (3) to the differential pins (2) by pointing the gears shoulder up.

6. Fill the differential housing assembly (1) with 0.08 lb (1.25 oz) of grease.

7. Attach the 2 differential housings (1) to each other.

8. Slide and install the differential housing assembly (1) into the differential gear (4) and secure with the 6 socket head screws (5).

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

Installing the Differential Assembly

Install the differential assembly into the transmission gear box; refer to Assembling the Transmission Gear Box Assembly (page 5–33).
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The Operator’s Manual provides information regarding the operation, general maintenance, and maintenance intervals for your Greensmaster machine. Refer to the Operator’s Manual for additional information when servicing the machine.
Wiring Schematic

Figure 44
Component Testing

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

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

---

**CAUTION**

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

---

**WARNING**

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

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

Testing the Ignition System

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

1. With the engine not running, remove the spark plug wire from the spark plug and connect it to the spark tester.

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

3. Ensure that the ON/OFF switch is in the ON position. Also, ensure that the traction control is in the NEUTRAL position.

4. Pull the engine starter rope and observe the spark tester. Visible and audible sparks should be produced if the ignition system is operating properly.

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

5. If visible and audible sparks are not produced, a problem exists either with engine ignition components or with machine components. To identify whether the problem exists with the engine or the machine, disconnect the wire harness connector (violet wire) from the engine primary wire and repeat step 4 above.

   A. If visible and audible sparks are not produced with the engine primary wire disconnected, the engine ignition system is not operating properly. Refer to the Honda Service Manual for engine information.

   B. If visible and audible sparks are produced with the engine primary wire disconnected, machine components (e.g. on/off switch, interlock module, machine wire harness) are damaged or faulty. Refer to machine component testing information in this section.
ON/OFF Switch

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

Testing the ON/OFF switch

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

4. With the use of a multimeter (ohms setting), the switch functions may be tested to determine whether continuity exists between the various terminals for each switch position. The switch terminals are marked as shown in Figure 46. The circuitry of the ON/OFF switch is shown in below table. Verify the continuity between switch terminals.
Testing the ON/OFF switch (continued)

<table>
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<td>-</td>
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<tr>
<td>ON</td>
<td>2 + 3</td>
<td>-</td>
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5. Replace the switch, if necessary.

6. When the switch testing is complete, connect the wire harness electrical connector to the ON/OFF switch.

7. Install the control cover to the handle assembly.
The hour meter used on the Greensmower records the amount of time that the engine is running.

**Testing the Hour Meter**

1. Ensure that the key switch is in the OFF position.
2. Remove the spark plug wire from the engine spark plug.
3. Locate the wire harness connector at the rear of the hour meter. Unplug the harness connector from the hour meter.
Testing the Hour Meter (continued)

Figure 48

1. Hourglass icon
2. Negative terminal (BK)
3. Positive terminal (Y)

4. Connect the positive (+) terminal of a 12 VDC source to the positive (+) terminal of the hour meter.
5. Connect the negative (-) terminal of the voltage source to the other terminal of the hour meter.
6. The hour meter should move 1/10 of an hour in 6 minutes.
7. Disconnect the voltage source from the hour meter.
8. Replace the hour meter if necessary.
9. Connect the wire harness connector to the hour meter.
10. Connect the spark plug wire to the engine spark plug.
The interlock module prevents the engine from starting unless the traction control is disengaged.

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

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

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

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

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

Operator’s Manual

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

**Note:** Refer to Figure 50 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
Removing the Throttle Cable (continued)

Figure 51

1. Governor lever
2. Throttle cable
3. Cable clamp
4. High speed screw

2. Remove the throttle cable (item 2 in Figure 51) from the engine governor linkage (1) as follows:
   A. Loosen the screw that secures the cable clamp (3) to engine bracket. Remove the throttle cable (2) from the cable clamp (3).
   B. Loosen the screws that secure the throttle cable (2) to the governor lever (1). Slide the throttle cable from the governor lever.
   C. Separate the throttle cable (2) from the engine.

3. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the throttle cable (item 3 in Figure 50).

4. Remove the throttle arm from the handle assembly. Loosen the lock nut (2) on the throttle cable and slide the throttle cable and throttle arm from the upper receiver weldment (1).

5. Remove the throttle cable from the throttle arm.

6. Remove the throttle cable from the machine.
Installing the Throttle Cable

1. Connect the throttle cable end to the throttle arm (9).
2. Slide the throttle cable (3) into the upper receiver weldment (1) and tighten the lock nut (2).
3. Install the throttle arm to the handle assembly.
4. Route the throttle cable (3) to the engine. Ensure that the throttle cable is routed on the left side of the engine.
5. Install the throttle cable (item 2 in Figure 51) to the engine governor linkages (1) as follows:
   A. Slide and secure the throttle cable end into the governor lever (1).
   B. Place the throttle cable under the cable clamp (3).
   C. Ensure that the throttle cable is in the SLOW position and with engine running slide the cable through the cable clamp to achieve 1850 to 1950 rpm.
   D. Tighten the screw on the cable clamp to secure the throttle cable.
6. Check the throttle cable adjustment; refer to Operator's Manual.
7. Install the lower cover and control cover to the handle assembly.
Removing the Brake Cable

**Note:** Refer to Figure 52 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL and parking brake is released.

2. Remove the spark plug wire from the engine spark plug.
Removing the Brake Cable (continued)

3. Remove the brake cable (item 5 in Figure 53) from the brake lever shaft on the transmission gear box assembly as follows:
   A. Loosen the front cable jam nut (4) that secures the brake cable to the casting slot on the transmission gear box assembly. Remove the brake cable from the slot.
   B. Remove the retaining ring (1) that secures the cable eyelet (2) to the brake lever (3) on the transmission gear box assembly.
   C. Remove the brake cable eyelet (2) from the brake lever (3).

4. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the brake cable.

5. Remove the brake cable (item 9 in Figure 52) from the brake lever assembly as follows:
   A. Loosen the lower brake cable jam nut (8) that secures the brake cable (9) to the upper receiver weldment (4). Slide the brake cable from the upper receiver weldment.
   B. Remove the brake cable spring (7) from the spring anchor on the brake lever assembly (3). Note the orientation of the brake cable spring hook on the brake lever assembly for assembly purpose.

6. Remove the brake cable (9) from the machine.
Installs the Brake Cable

1. Secure the brake cable (9) to the brake lever assembly as follows:
   A. Install the cable spring (7) to the spring anchor on the brake lever assembly (3).
   B. Slide the brake cable into the shift mount bracket slot. Ensure that the jam nut (8), flat washer and lock washer are both sides of the bracket. Adjust the jam nuts so that equal amount of cable threads are visible above and below jam nuts. Leave jam nuts snug until final cable adjustment.

2. Route the brake cable (9) to the transmission gear box assembly and install the brake cable to the transmission gear box assembly as follows:
   A. Install the brake cable eyelet (2) onto the brake lever (3) on transmission gear box assembly and secure with a snap ring (1).
   B. Position the brake cable (5) to the casting slot of the transmission gear box assembly with a jam nut (4), flat washer and lock washer on each side of the slot. Adjust and tighten the jam nuts so that equal amount of cable threads are visible above and below jam nuts.

3. Make final adjustment of the brake cable at the brake cable lever assembly. Adjust the cable jam nuts to remove the slack in the brake cable.

4. Check the brake cable adjustment; refer to Operator’s Manual.

5. Install the lower cover and control cover to the handle assembly.

6. Attach the spark plug wire to the engine spark plug.
Replacing the Clutch Cable

Figure 54

1. Clutch cable  
2. Jam nut  
3. Cable spring  
4. Split bushing  
5. Main control shaft  
6. Clevis pin  
7. Link assembly  
8. Cotter pin  
9. Upper receiver weldment

Removing the Clutch Cable

Note: Refer to Figure 54 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.

2. Remove the spark plug wire from the engine spark plug.

3. Remove the clutch cable (item 1 in Figure 55) from the transmission assembly as follows:
   A. Loosen the front cable jam nut (2) and lift the clutch cable (1) from the casting slot of the engine base.
Removing the Clutch Cable (continued)

B. Remove the retaining ring (4) that secures the clutch cable eyelet (3) to the clutch lever (5) and slide and remove the clutch cable eyelet from the clutch lever.

4. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the clutch cable (item 1 in Figure 54).

5. Remove the clutch cable (1) from the link assembly (7) as follows:
   A. Loosen the lower cable jam nut (2) that secures the clutch cable to the upper receiver weldment (9). Slide the clutch cable from the upper receiver weldment.
   B. Remove the cable spring (3) from the link assembly (7). Note the orientation of cable spring hook on the shaft assembly for assembly purposes.

6. Remove the clutch cable (1) from the machine.

Installing the Clutch Cable

1. Secure the clutch cable (item 1 in Figure 54) to the clutch lever assembly as follows:
   A. Install the cable spring (3) to the link assembly. Orientate the cable spring hook end toward front of the machine.
   B. Slide the cable housing into the upper receiver weldment (9). Ensure that the jam nut (2), flat washer and lock washer are on both sides of the bracket. Adjust jam nuts so that equal amount of cable threads are visible above the jam nuts. Leave the jam nuts snug until final cable adjustment.

2. Route the clutch cable (item 1 in Figure 55) to the transmission and install the cable as follows:
   A. Slide the cable eyelet (3) to the clutch lever (5) and secure with a retaining ring (4).
   B. Position the clutch cable (1) to the casting slot of the engine base with a jam nut (2), flat washer and a lock washer on each side of the slot.

3. Make final adjustment of the clutch cable at the clutch cable lever assembly. Adjust the cable jam nuts to remove the slack in the clutch cable.

4. Check the clutch cable adjustment; refer to Operator’s Manual.

5. Install the lower cover and control cover to the handle assembly.

6. Attach the spark plug wire to the engine spark plug.
Replacing the Reel Cable

[Diagram of the Reel Cable with numbered parts]

Figure 56

5. Reel lever handle rod  10. Clevis connector

Removing the Reel Cable

Note: Refer to Figure 56 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Remove the spark plug wire from the engine spark plug.
Removing the Reel Cable (continued)

Figure 57

1. Retaining ring
2. Reel selector assembly
3. Jam nut
4. Reel cable

3. Remove the reel cable (item 4 in Figure 57) from the reel selector assembly (2) as follows:
   A. Loosen the front cable jam nut (3) and lift the reel cable (4) from the casting slot of the engine base.
   B. Remove the retaining ring (1) that secures the reel cable eyelet to the reel selector assembly (2) and slide the reel cable eyelet from the selector assembly.

4. Remove the control cover and lower cover from the handle assembly to allow access to upper end of the reel cable.

5. Remove the reel cable (item 1 in Figure 56) from the traction lever assembly as follows:
   A. Loosen the lower cable jam nut (2) that secures the reel cable (1) to the upper receiver weldment (12). Slide the cable from the upper receiver weldment.
   B. Remove the cable spring (3) from the clevis connector (10) on the reel lever assembly (5). Note the orientation of cable spring hook on the shaft assembly for assembly purposes.

6. Remove the reel cable (1) from the machine.
Installing the Reel Cable

1. Secure the reel cable (item 1 in Figure 56) to the traction lever assembly as follows:
   
   A. Install the cable spring (3) to the clevis connector (10) on the reel lever assembly (7). Orientate the cable spring hook end toward front of the machine.
   
   B. Slide the cable (1) into the upper receiver weldment (12). Ensure that the jam nut (2), flat washer and lock washer are on both sides of the bracket. Adjust jam nuts so that equal amount of cable threads are visible above the jam nuts. Leave the jam nuts snug until final cable adjustment.

2. Route the reel cable to the reel selector assembly (item 2 in Figure 57) and install the reel cable (4) as follows:
   
   A. Slide the cable eyelet to the reel selector assembly (2) and secure with a retaining ring (1).
   
   B. Position the reel cable (4) to the casting slot of the engine base with a jam nut (3), flat washer and a lock washer on each side of the slot.

3. Make final adjustment of the reel cable at the reel cable lever assembly. Adjust the cable jam nuts to remove the slack in the clutch cable.

4. Check the reel cable adjustment; refer to Operator’s Manual.

5. Install the lower cover and control cover to the handle assembly.

6. Attach the spark plug wire to the engine spark plug.
Disassembling the Clutch and Reel Drive Engagement Lever Assembly

**Note:** Refer to Figure 58 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Remove the spark plug wire from the engine spark plug.
Disassembling the Clutch and Reel Drive Engagement Lever Assembly (continued)

3. Remove the bolts and washers (item 9 in Figure 58) that secures the controls covers (item 8 and 10) to the upper receiver weldment (25) and handle assembly.

4. Remove the reel lever handle rod (2) from the reel lever assembly (27).

5. If necessary, remove the reel lever knob (3) from the reel lever handle (2).

6. Remove the cotter pin (18) and clevis pin (20) that secures the link assembly (14) to the main control shaft (15).

7. Remove the cotter pin (18) and clevis pin (20) that secures the clevis connector (19) to the reel lever assembly (27).

8. Remove the extension spring (21) from the reel lock lever (23).

9. Remove the flange nut (26) and shoulder screw (22) that secures the reel lock lever (23) to the upper receiver weldment (25). Remove the reel lock lever (23) and bail latch spacer (24).

10. Remove the retaining ring (4) and V-ring seal (1) that secures the reel lever assembly (27) to the main control shaft (15). Slide and remove the reel lever assembly.

11. Remove the socket head screws (6) and control shaft clamps (5) that secures the main control shaft (15) to the upper receiver weldment (23).

12. Remove the main control shaft (15). If necessary, remove the split bushing (16) from the main control shaft.

Assembling the Clutch and Reel Drive Engagement Lever Assembly

1. If removed, install the split bushing (item 16 in Figure 58) onto the main control shaft (15).

2. Position the main control shaft (15) on the upper receiver weldment (25) and secure the main control shaft (15) with control shaft clamps (5) and the bolts (6).

3. Slide the reel lever assembly (27) and V-ring seal (1) onto the main control shaft (15) and secure reel lever assembly with the retaining ring (4).

4. Install the reel lock lever (23) and bail latch spacer (24) to the upper receiver weldment (25) and secure with the shoulder screw (22) and flange nut (26).

5. Install the link assembly (14) to the main control shaft (15) with clevis pin (20). Secure the clevis pin with the cotter pin clip (13).

6. Install the clevis connector (19) to the reel lever assembly (27) with clevis pin (20) and secure the clevis pin with the cotter pin clip (18).

7. Install the reel lever handle rod (2) to the reel lever assembly (27).

8. If removed, install the reel lever knob (3) to reel lever handle rod (2).

9. Install the control covers (8 and 10) to the handle assembly with bolts and washers (9).

10. Attach the spark plug wire to the engine spark plug.
Disassembling the Brake Latch Shaft

**Note:** Refer to Figure 59 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Remove the spark plug wire from the engine spark plug.
3. Remove the bolts and washers that secures the controls covers to the upper receiver weldment.
4. Using the drift pin, remove the roll pin (5) from the brake lock lever (4).
5. Slide and remove the brake lock lever (4) from the brake latch shaft (9).
Disassembling the Brake Latch Shaft (continued)

6. Slide and remove the brake latch shaft (9) from the upper receiver weldment (12).
7. Slide and remove the torsion spring (10) from the brake latch shaft (9).

Assembling the Brake Latch Shaft

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

Figure 60

1. Plastite screw (4 each)  14. Nut  27. Lift assist handle
5. Flange bushing (2 each)  18. Throttle cable  31. Compression spring
7. Flange nut (4 each)  20. Spacer (3 each)  33. Bolt (2 each)
13. Flange nut  26. Bottom control cover
Disassembling the Handle Assembly

**Note:** Refer to Figure 60 during this procedure.

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

26. If necessary, remove the 3 nuts (15), 3 bolts (21) and 3 spacers (20) from the upper receiver weldment (8).

27. Remove the 2 nuts (item 8 in Figure 61) and 2 bolts (21) that secures the handle (20) to handle mount (7). Remove the handle from the clutch bail assembly and the handle mount.

28. If necessary, remove the 2 screws (18) that secures the LH and RH bail brackets (1 and 19) to the handle (20).
Disassembling the Handle Assembly (continued)

29. Remove the flange nut (item 8 in Figure 61), and bolt (2) that secure the clutch bail link (5) to the handle mount (7). Remove the 2 flange bushings (3) and spacer tube (17) from the handle mount.

30. Remove the flange nut (8) and bolt (2) that secure the clutch bail assembly (4) to the handle mount (7). Remove the clutch bail assembly from the handle mount. Remove the compression spring (6), 2 flange bushings (3) and spacer tube (17) from the handle mount.

31. Remove the 2 nuts (14) and 2 bolts (16) that secures the handle mount (7) to the upper receiver weldment (15). Remove the handle mount from the upper receiver weldment.

32. If necessary, remove the nut (item 4 in Figure 62), washers (3) and bolt (2) that secures the lower handle assembly (1) to the frame assembly (5).

Assembling the Handle Assembly

1. If removed, install the lower handle assembly (item 1 in Figure 62) onto the frame assembly (5) and secure with the bolt (2), washers (3) and nut (4).

2. Lift the lower handle assembly to maximum top position and torque tighten the bolt (2) to 5.6 to 6.2 N·m (50 to 55 ft·lb).

3. Install the handle mount (7) to the upper receiver weldment (15) and secure with 2 bolts (16) and 2 nuts (14).
Assembling the Handle Assembly (continued)

4. Position the clutch bail link (5) in the handle mount (7). Install the spacer tube (17) and 2 flange bushings (3) to the handle mount. Secure the clutch bail link to the handle mount with the bolt (2) and flange nut (8).

5. Position the compression spring (6), spacer tube (17) and 2 bushings (3) into the handle mount (7). Install the clutch bail assembly (4) to the handle mount (7) and secure with the bolt (2) and flange nut (8).

6. If removed, install the LH and RH bail brackets (1 and 19) to the handle (20) with the 2 screws (18).

7. Install the clutch bail assembly (4) to the handle (20). Secure the handle to the handle mount (7) with the 2 bolts (21) and 2 nuts (8).

8. If removed, install the 3 spacers (item 20 in Figure 60), 3 bolts (21) and 3 nuts (15) to the upper receiver weldment (8).

9. Position the spring spacer (24) and handle torsion spring (23) into the handle adjuster assembly (22). Install the handle adjuster assembly to the upper receiver weldment (8) with the bolt (21) and nut (15).

10. If removed, install the lift assist handle (27) to the upper receiver weldment (8) and secure with the bolts (16 and 11).

11. Slide the upper receiver weldment (8) in to the lower handle assembly (19) and secure with the bolt (29) and flange nut (9).

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

12. Reposition the wire harness.

13. Install the conduit clamps (10) to the upper receiver weldment (8) and lower handle assembly (19) and secure with screws (11).

14. If removed, install the flange bushings (5), bolt (12) and flange nut (13) into the brake lever (6).

15. Position the brake lever (6) to the upper receiver weldment (8) and secure with the shoulder screw (4) and flange nut (7).

16. Install the handle notepad plate (2) to the handle assembly (3) and secure with the 4 plastite screws (1).

17. Install the engine ON/OFF switch to the handle assembly.

18. Install the wire harness.

19. If removed, install the flange bushings (35) inside the throttle arm (36).

20. If removed, slide the throttle lever (34) onto the throttle arm (36) and secure with screw (32).

21. Torque tighten the bolt from \(2.2 \text{ to } 3.4 \text{ N}\cdot\text{m (20 to 30 in-lb)}\).

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

23. Install the bolt (38) and 2 flange nuts (7) to the upper receiver weldment (8). Ensure that the head of the bolt is resting the on throttle arm (36).

24. Install the brake latch shaft; refer to Assembling the Brake Latch Shaft (page 7–17).

25. Install the clutch and reel drive lever assembly; refer to Assembling the Clutch and Reel Drive Engagement Lever Assembly (page 7–15).

26. Install the reel cable; refer to Installing the Reel Cable (page 7–13).

27. Install the brake cable; refer to Installing the Brake Cable (page 7–8).

28. Install the clutch cable; refer to Installing the Clutch Cable (page 7–10).
Assembling the Handle Assembly (continued)

29. Install the throttle cable; refer to Installing the Throttle Cable (page 7–5).

30. Install the bottom controls cover and re-position the wire harness to the upper receiver weldment and secure with the 4 bolts and 2 nuts.

31. Install the lower handle cover to the handle assembly and secure with the 4 bolts.

32. Install the controls cover to the handle assembly and secure with the 4 bolts.

33. Attach the spark plug wire to the engine spark plug.
Removing the Kickstand

**CAUTION**

Be careful when removing or applying tension from or to the torsion spring of the kickstand.

The spring is under heavy load and may cause personal injury.
Removing the Kickstand (continued)

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Remove the spark plug wire from the engine spark plug.
3. Pivot the kickstand up and hold against the frame stops.
4. Remove the bolt (item 11 in Figure 63) that secures the spring mount pin (3) and torsion spring (2) to the kickstand (16).
5. Remove the spring mount pin (3) and torsion spring (2) from the kickstand (16).
6. Remove the bolt (11), spacer (10) and nut (5) that secures the kickstand (16) to the frame (9).
7. Remove the kickstand (16) from the frame (1).
8. If necessary, remove the spring retainer (14) by removing the nut (15), washer (13) and bolt (12).
9. If necessary, remove the spacers (10) from the kickstand (16).

Installing the Kickstand

![Diagram of kickstand installation](image)

Figure 64

1. Kickstand (raised)
2. Torsion spring
3. Kickstand (lowered)
Installing the Kickstand (continued)

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

Figure 65

2. Flange nut (4 each)  7. Hub  12. Bolt (4 each)
3. Shallow rim  8. Torsion spring  13. Lock washer (3 each)
4. Tire  9. Wheel retaining lever
5. Inner tube  10. Shoulder screw (2 each)

Removing the Transport Wheel

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Support the machine onto the machine onto the kickstand.
Removing the Transport Wheel (continued)

1. Wheel retaining lever

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

Disassembling the Transport Wheel

1. Wheel hex shaft

1. Ensure that the tire is fully deflated before disassembly of the wheel.

2. Remove the 3 bolts and 3 lock washers from the shallow rim and hub. Remove the hub from the deep rim.

3. Inspect the hub bushing. Replace the bushing, if worn or damaged.

4. Remove the 4 bolts and 4 flange nuts from the deep rim and shallow rim. Remove the shallow rim from the deep rim.

5. Separate the tire, tube and deep rim.

6. If necessary, remove the shoulder screws, torsion spring, and retaining lever from the hub.
Assembling the Transport Wheel

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

2. Assemble the tire, tube, and deep rim.

3. Install the shallow rim into the tire. Align and secure the shallow rim to the deep rim with 4 bolts and 4 flange nuts. Tighten the fasteners.

4. Install the hub into the deep rim. Secure the hub to the deep rim with the 3 bolts and 3 lock washers. Tighten the fasteners.

5. Inflate the tire to 83 to 103 kPa (12 to 15 psi).

Installing the Transport Wheel

1. Ensure that the machine is parked on a level surface.

2. Support the machine onto the kickstand.

3. Slide the transport wheel completely onto the wheel hex shaft until the wheel retaining lever is secured into the groove onto the wheel hex shaft.
Rail Kit Wheels (Optional)

Removing the Rail Kit Wheel

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Support the machine onto the kickstand.
3. Remove the wheel clip, 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 7–27).

Installing the Rail Kit Wheel

1. Ensure that the machine is parked on a level surface.
2. Support the machine onto the kickstand.
3. If installed, remove the transport wheels; refer to Transport Wheels (Optional) (page 7–27).
4. Slide the rail kit wheel onto the wheel hex shaft and secure the wheel with a wheel clip.

Figure 68

1. Wheel hex shaft
2. Wheel clip
3. Rail kit wheel
**Chapter 8**

**DPA Cutting Units**

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

Grass Basket Installation

Grasp the grass basket by top rear lip and slide on or off the basket mounting rods.
Supporting the Cutting Unit when Servicing

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

Figure 70

1. Bedbar adjuster screws
2. Support
Adjustments

DPA Cutting Unit Characteristics

⚠️ CAUTION ⚠️

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

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

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

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

1. Adjust the bedknife to reel contact; refer to the Cutting Unit Operator’s Manual.
2. Adjust the height-of-cut; refer to the Cutting Unit Operator’s Manual.
3. Adjust the top shield; refer to the Cutting Unit Operator’s Manual.
Grass Shield Height Adjustment

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

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.

2. Remove the spark plug wire from the engine spark plug.

3. Place 1.5 mm (0.06 inch) shim between the reel assembly and grass shield.

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

4. Loosen the bolts that secures each end of the shield to the side plates. Adjust the shield to the correct height and tighten the fasteners.

5. Attach the spark plug wire to the engine spark plug.
Bedbar Assembly

Figure 72

1. Side plate
2. Keyed flanged bushing (4 each)
3. Bedbar adjuster shaft (2 each)
4. Rubber bushing assembly (2 each)
5. Nylon bushing (2 each)
6. Plastic washer (2 each)
7. Flat washer (2 each)
8. Bedbar bolt (2 each)
9. Lock nut (2 each)
10. Wave washer (2 each)
11. Retaining ring (2 each)
12. Bedbar adjuster screw (2 each)
13. Detent (2 each)
14. Bolt (2 each)
15. Plastic washer (2 each)
16. Bedbar assembly
17. Washer (2 each)
18. Compression spring
19. Nut (2 each)
Removing the Bedbar

**Note:** Refer to Figure 72 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.
2. Remove the spark plug wire from the engine spark plug.
3. Loosen the nuts (19) on the end of each bedbar adjuster assembly (3) until the washer (17) is loose.
4. Loosen the locknuts (9) on each bedbar bolt (8).
5. Remove the 2 bedbar bolts (8), 2 flat washers (7) and 4 plastic washers (6 and 15) from the cutting unit side plates (1).

---

**CAUTION**

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

---

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

Figure 73

1. Side plate 5. Metal washer
2. Rubber bushing 6. Bedbar
3. Nylon bushing 7. Bedbar pivot bolt
4. Plastic washer (2 each) 8. Lock nut

1. If rubber bushing (item 4 in Figure 73) was removed from either side plate, apply grease to outside surface of new bushing and install into side plate (1). The bushing (4) should be installed flush with the inside surface of the side plate; refer to Figure 73.

2. If removed, install the nylon bushings (5) with flange facing outward.

3. Apply anti-seize lubricant to the threads and shank of each bedbar bolt (8); refer to Figure 73.

⚠️ CAUTION ⚠️

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

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

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

**IMPORTANT**

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

5. Position one plastic washer (6 and 15) between the bedbar (16) and each side plate (1).

6. Slide a metal washer (7) onto the bedbar bolt (8).
7. Install the bedbar bolt assemblies (8). Make sure that the washers are not caught on the threads of the pivot bolts. Torque tighten each bedbar bolt (8) from 22 to 27 N·m (190 to 240 in-lb).

**IMPORTANT**

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

8. Tighten both lock nuts (9) until outside metal washers do not have any end play and can still be rotated.

9. Tighten the nut (19) on each bedbar adjuster assembly (16) until the adjuster spring (18) is fully compressed, then loosen the nut (19) to 1/2 turn.

10. Adjust the bedknife to reel contact; refer to the *Cutting Unit Operator's Manual*.

11. Attach the spark plug wire to the engine spark plug.
Servicing the Bedbar Adjuster

Removing the Bedbar Adjuster

Note: Refer to Figure 74 during this procedure.

1. Remove bedbar; refer to Removing the Bedbar (page 8–7).

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

2. Remove the lock nut (11), compression spring (10) and washer (9) from the bedbar adjuster screw (7).

3. Unscrew the bedbar adjuster shaft (1) from the bedbar adjuster screw (7).

4. Remove the retaining ring (6) and wave washer (5) from the adjuster shaft (7) and remove the adjuster shaft.

5. Inspect the flange bushings (2) in the cutting unit side plate (12) and replace them if necessary.

6. Inspect the detent (3) and replace it if necessary.

---

**Figure 74**

1. Bedbar adjuster shaft (2 each)
2. Keyed flanged bushing (4 each)
3. Detent (2 each)
4. Bolt (2 each)
5. Wave washer (2 each)
6. Retaining ring (2 each)
7. Bedbar adjuster screw (2 each)
8. Bedbar assembly
9. Washer (2 each)
10. Compression spring
11. Nut (2 each)
12. Side plate
Installing the Bedbar Adjuster

1. If previously removed, secure the detent (3) to the side plate (12) with the bolt (4).

2. If previously removed, align the key on the flange bushings (2) to the slots in the cutting unit side plate (12) and install.

3. Slide adjuster shaft (1) into flange bushings (2) and secure with a wave washer (5) and a retaining ring (6).

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

4. Apply anti-seize lubricant to the threads of the bedbar adjuster screw (7) that fit into adjuster shaft (1) (the left hand threads) and thread the bedbar adjuster screw into the adjuster shaft.

5. Install the washer (9), compression spring (10) and lock nut (11) onto the adjuster screw (7).

6. Install the bedbar (8); refer to Installing the Bedbar (page 8–8).
Bedknife

Removing the Bedknife

1. Bedknife screw (13 used)   3. Bedbar
2. Bedknife

1. Remove the bedbar from the cutting unit; refer to Removing the Bedbar (page 8–7).
2. Remove screws from bedbar using a socket wrench and bedknife screw tool; refer to Bedknife Screw Tool (page 2–16). Discard the screws. Remove bedknife from the bedbar.
3. Refer to Grinding the Bedknife (page 8–14) 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.
Installing the Bedknife (continued)

**IMPORTANT**

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

3. 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

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Since there can be variations in the mounting surface of the bedbar, it is necessary to grind the bedknife after installing it to the bedbar. Follow the bedknife grinding specifications provided; refer to Bedknife Grinding Specifications (page 8–14). Grind only enough so the top surface of the bedknife is true; refer to Figure 77.

**IMPORTANT**

Do not grind the bedknife below it's service limit; refer to Figure 78. 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.
Grinding the Bedknife (continued)

**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 2–16).

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 8–8).

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

**Note:** Refer to Figure 79 during this procedure.

1. Park the machine on a level surface on the traction drum. Ensure that the engine is OFF and the traction control is in NEUTRAL.

2. Remove the spark plug wire from the engine spark plug.

3. Slide the telescopic coupler on the reel drive assembly (2) from the transmission drive shaft.

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

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

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

5. Slide and remove the cutting unit assembly (1) from the frame assembly (5).

6. If necessary, remove the dowel pins (4) from the frame assembly (5).
Installing the Cutting Unit Assembly

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

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

Removing the Reel Assembly

**Note:** Refer to Figure 80 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.

2. Remove the spark plug wire from the engine spark plug.

3. If the cutting unit is equipped with an optional groomer, remove the drive components for those options from cutting unit. Refer to Removing the Gear Box Assembly (page 9–4) for universal groomer, and Universal Groomer (page 2–5) for additional information.

4. Remove the cutting unit assembly from the frame assembly; refer to Removing the Cutting Unit Assembly (page 8–16).

5. Remove the reel drive assembly; refer to Removing the Reel Drive Assembly (page 5–9).

---

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

Removing the Reel Assembly

**Note:** Refer to Figure 80 during this procedure.

1. Park the machine on a level surface. Ensure that the engine is OFF and the traction control is in NEUTRAL.

2. Remove the spark plug wire from the engine spark plug.

3. If the cutting unit is equipped with an optional groomer, remove the drive components for those options from cutting unit. Refer to Removing the Gear Box Assembly (page 9–4) for universal groomer, and Universal Groomer (page 2–5) for additional information.

4. Remove the cutting unit assembly from the frame assembly; refer to Removing the Cutting Unit Assembly (page 8–16).

5. Remove the reel drive assembly; refer to Removing the Reel Drive Assembly (page 5–9).
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.

6. Loosen the reel drive nut (11) and bearing lock nut (2).
   A. Tip up the cutting unit to access the bottom of the reel.
   B. Insert a long-handled pry bar (3/8 x 12 inch with screwdriver handle recommended) through the bottom of the cutting unit. The pry bar should pass between the top of the reel shaft and the backs of the reel blades so that the reel will not move; refer to Figure 81.

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.

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

D. Rest the handle of the pry bar against the front roller and loosen the bearing lock screw.
Removing the Reel Assembly (continued)

**IMPORTANT**

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

---

E. Position the pry bar in the same manner on the opposite end of the reel and use the appropriate wrench or socket on the 1” hex portion of the shaft to loosen the reel drive shaft.

F. Tip the cutting unit back onto its rollers.

7. Remove the bedbar; refer to Removing the Bedbar (page 8–7).

8. Remove the front roller; refer to Removing the Front Roller (page 8–26).

**CAUTION**

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

---

**Note:** If the reel bearings or seals are being replaced, the reel nuts must be removed. Use a block of wood between the cutting reel blades to prevent the reel from rotating and loosen the reel nuts before removing the reel from the cutting unit. The reel nut on the left end of the cutting reel has a black finish and has left-hand threads. The left end of the cutting reel shaft is identified with a groove cut just inside of the left-most reel spider. The reel nut on the right end of the cutting reel has a silver finish and has right-hand threads.

9. Support the cutting reel to prevent it from shifting or falling and remove the 2 socket head screws (3 and 17) that secure the LH side plate (4) to the reel assembly (8).

10. Remove the bolt (16) and washer (15) that secures the grass shield assembly (18) to the LH side plate (4).

11. Remove the LH side plate (4) from the reel assembly (8).

12. Remove the 2 socket head screws (3 and 17) that secure the RH side plate (10) to the reel assembly (8).

13. Remove the bolt (16) and washer (15) that secures the grass shield assembly (18) to the RH side plate (10).

14. Remove the RH side plate (10), grass shield assembly (18) and 2 frame support rods (9 and 14) from the reel assembly (8).

15. Carefully slide the cutting reel assembly (with seals, bearings and reel nuts) from the opposite side plate. Retrieve the flat wire spring from the reel bearing bore of the left side plate.

16. Thoroughly clean any grease and corrosion from the reel bearing bores in the side plates.

17. Inspect the remaining cutting unit components for corrosion, wear, or damage and replace the components as necessary.
Inspecting the Reel Assembly

1. Remove the reel nuts from the cutting reel.
2. Slide the bearings and seals from the reel shaft. Discard the seals and inspect the reel bearings to insure that they spin freely and have a minimal amount of axial play.
3. Inspect the reel as follows:
   A. Place the reel shaft ends in V-blocks and check the reel shaft for distortion.
   B. Check the threads in the ends of the reel shaft.
   C. Check the reel blades for bending or cracking.
   D. Check the service limit of the reel diameter; refer to Preparing the Reel for Grinding (page 8–24).
4. Replace the reel if damage is evident.

**IMPORTANT**

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

5. Slide the new flocked seals and the bearings onto the reel shaft until they contact the shoulder of the reel shaft.
Inspecting the Reel Assembly (continued)

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

6. Install the reel nuts finger tight.

Installing the Reel Assembly

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

CAUTION

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

2. Apply a thin coat of grease to the outside of the cutting reel bearings and carefully slide the cutting reel assembly into the right side plate. Make sure that the reel bearing is fully seated in the RH side plate, and that the reel nut on the left (exposed) end of the cutting reel has a black finish.

3. Place the grass shield assembly (18), frame support rods (9 and 14) onto the RH side plate (10).

4. Place the flat wire spring into bearing bore of LH side plate and carefully slide the left side plate onto the cutting reel assembly as far as possible.

5. Install the 4 socket head screws (3 and 17) that secure the RH and LH side plates (4 and 10) to the frame support rods (9 and 14). Tighten the socket head screws from 24 to 27 N-m (18 to 20 ft-lb).

6. If loosened during cutting reel service, tighten the bearing lock screw and the reel drive nut.

![Figure 83](image_url)

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 83.
Installing the Reel Assembly (continued)

**IMPORTANT**

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

---

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

**IMPORTANT**

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

---

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

**IMPORTANT**

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

---

D. Position the pry bar in the same manner on the opposite end of the reel and use the appropriate wrench or socket on the 1” hex portion of the shaft to tighten the reel drive shaft from 123 to 149 N·m (90 to 110 ft-lb).

7. Secure the grass shield assembly (18) to the RH and LH side plates (4 and 10) with the 2 washers (15) and 2 bolts (16).

8. If the reel nuts were loosened during cutting reel service, put a block of wood between the cutting reel blades to prevent the reel from rotating and tighten the reel nuts from 123 to 149 N·m (90 to 110 ft-lb).

9. Install the reel drive assembly; refer to Installing the Reel Drive Assembly (page 5–12). Grease the splines with high temp Mobil XHP−222 grease or equivalent.

10. Install the bedbar assembly; refer to Installing the Bedbar (page 8–8).

11. Install the front roller; refer to Installing the Front Roller (page 8–28).

12. Install the cutting unit assembly to the frame assembly; refer to Installing the Cutting Unit Assembly (page 8–17).

13. If the cutting unit is equipped with an optional groomer, install the components for those options. Refer to Installing the Gear Box Assembly (page 9–10) for universal groomer, and Installation Instructions (page 9–2) for additional information.
Preparing the Reel for Grinding

### Reel Grinding Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reel Diameter New (D)</td>
<td>128.5 mm (5.06 inch)</td>
</tr>
<tr>
<td>Reel Diameter Service Limit</td>
<td>114.3 mm (4.50 inch)</td>
</tr>
<tr>
<td>Reel Diameter Taper Limit (D1 – D2)</td>
<td>0.25 mm (0.01 inch)</td>
</tr>
<tr>
<td>Blade Land Width</td>
<td>0.8 to 1.2 mm (0.03 to 0.05 inch)</td>
</tr>
<tr>
<td>Blade Relief Angle</td>
<td>30° ±2°</td>
</tr>
<tr>
<td>Reel Shaft Diameter</td>
<td>34.9 mm (1.375 inch)</td>
</tr>
</tbody>
</table>

**Figure 84**
(R = Direction of Rotation)

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

Follow reel grinder manufacturer’s instructions to grind cutting reel to Toro specifications; refer to Reel Grinding Specifications (page 8–24). Additional reel grinding information can be found in the Cutting Unit Operator’s Manual. An additional resource is the Toro Basics Series Training Book, Reel Mower Basics (part no. 09168SL) found on the Service Reference Set available from your Authorized Toro Distributor.

Relief grind the reel blades to the minimum blade land width if the reel blade land width exceeds the service limit. Spin grind the reel to establish the specified blade land width or to restore the reel’s cylindrical shape.
Preparing the Reel for Grinding (continued)

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

Removing the Front Roller

Figure 85

1. Plow bolt (2 each) 6. Lock nut (2 each)
2. Socket head screw (4 each) 7. Height-of-cut washer (2 each)
3. Front roller assembly 8. Pinch bolt (2 each)
4. Mounting rod (2 each) 9. Height-of-cut screw (2 each)
5. Height-of-cut arm (2 each) 10. Cutting unit assembly

Note: Refer to Figure 85 during this procedure.

1. Loosen the pinch bolts (8) that secure the front roller shaft (3) to the front height-of-cut arms (5).

2. Remove the lock nut (6), height-of-cut washer (7) and plow bolt (1) that secures one of the height-of-cut arms (5) to the cutting unit side plate (10) and remove the height-of-cut arm.

3. Slide the front roller assembly (3) from the remaining height-of-cut arm (5).

4. Remove the remaining height-of-cut arm (5) from the cutting unit (10) if necessary.
Disassembling the Roller

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bearing lock nut (2 each)</td>
</tr>
<tr>
<td>2.</td>
<td>Sealing washer (2 each)</td>
</tr>
<tr>
<td>3.</td>
<td>Ball bearing (2 each)</td>
</tr>
<tr>
<td>4.</td>
<td>Wiehle roller</td>
</tr>
<tr>
<td>5.</td>
<td>Roller shaft</td>
</tr>
</tbody>
</table>

1. To hold the roller shaft (5) stationary while removing the bearing lock nut (1), install a 3/8-24 UNF 2B screw with a jam nut into the threaded end of the roller shaft (5) and tighten the jam nut against the roller shaft. Remove the bearing lock nuts (1).

2. Carefully inspect the seating surface and threads of the bearing lock nuts (1) and replace them if damaged.

3. Loosely secure the roller assembly (4) in a bench vise and lightly tap on the roller shaft (5) to remove the sealing washers (2) and bearings (3). Discard the sealing washers (2).

4. Clean and carefully remove any corrosion from the bearing cavities of the roller.

Figure 86

![Diagram of roller assembly](image-url)
Assembling the Roller

**Figure 87**
1. Roller
2. Ball bearing
3. Seal
4. Bearing lock nut
5. Roller shaft

**Figure 88**
1. Bearing
2. Seal
3. Bearing lock nut

1. Press the bearing into the roller (support both inner and outer raceways).
2. Place the roller shaft into the roller.
3. Press the 2nd bearing into the roller (support both).
4. Install the sealing washer and bearing lock nut onto each end of the roller shaft. Tighten the lock nuts to **34 to 41 N·m (25 to 30 ft-lb)**.

Installing the Front Roller

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

**Note:** When installing the height-of-cut arms (5), make sure that the tab of the side plate fits between the head and the washer of the height-of-cut screw (9).
3. Secure one of the height-of-cut arms (5) to the side plate with a plow bolt (1), height-of-cut washer (7) and lock nut (6). The tab on the height-of-cut washer should be oriented downward and fit into the slot of the height-of-cut arm.
4. Slide the front roller shaft (3) into the height-of-cut arm (5) attached to the cutting unit (10).
Installing the Front Roller (continued)

5. Slide the remaining height-of-cut arm (5) onto the other end of roller shaft. Secure the remaining height-of-cut arm to the side plate with a plow bolt (2), height-of-cut washer and lock nut.

6. Center the front roller (3) in the cutting unit and tighten the pinch bolts (8) that secure the front roller shaft to the height-of-cut arms.

7. Install the cutting unit assembly to the frame assembly; refer to Installing the Cutting Unit Assembly (page 8–17), (if necessary).

8. Adjust the cutting unit height-of-cut; refer to the Cutting Unit Operator’s Manual.
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General Information

Installation Instructions

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

Grooming Performance

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

**IMPORTANT**

Improper or overaggressive use of the groomer (e.g., too deep or too frequent grooming) may cause unnecessary stress on the turf leading to severe turf damage. Use the groomer carefully. Read and understand the groomer operation instructions before operating or testing the groomer performance.

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

Variables that Affect the Use and Performance of the Groomer:

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 height-of-cut.
5. The grooming depth.
6. The type of grass.
7. The amount of time that a groomer reel has been in use on a particular turf area.
8. The amount of traffic on the turf.
9. The overall turf management program–irrigation, fertilizing, weed control, coring, over-seeding, sand dressing, disease control, and pest control.
10. Stress periods for turf–high temperatures, high humidity, and unusually high traffic.
1. Gear box assembly
2. Idler assembly
3. Groomer reel
4. Height adjuster assembly (2 each)

CAUTION

Never work on the groomer with the engine running. Always stop the engine and wait for all machine movement to stop before working on the groomer.
The gear box assembly is located on the opposite side of the cutting unit from the reel drive.

Removing the Gear Box Assembly

1. Remove the groomer reel assembly; refer to Removing the Groomer Reel (page 9–14).
2. Safely prevent the reel from rotating by blocking the cutting reel with a piece of wood near one of the reel spiders.

**IMPORTANT**

The groomer gear box for this machine is installed on the left side of the cutting unit. Groomer gear boxes installed on the left side of the cutting unit use a left hand thread. Turn the input shaft clockwise to remove the gear box.
Removing the Gear Box Assembly (continued)

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 91.

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.
Removing the Gear Box Assembly (continued)

9. 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.

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.
    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.
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.

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.

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).
Servicing the Gear Box

Figure 94

1. Drive adapter
2. Input shaft
3. O-ring (3 each)
4. V-ring
5. Oil seal
6. Groomer housing
7. Ball bearing (2 each)
8. Retaining ring
9. Driven gear
10. Actuator shaft
11. Pin
12. O-ring
13. Knob
14. Retaining ring
15. Thrust washer
16. O-ring
17. O-ring
18. Dowel pin (2 each)
19. Drain/fill plug (4 each)
20. Straight bushing (2 each)
21. Detent ball
22. Detent spring
23. Oil seal
24. Socket-head screw(4 each)
25. Groomer cover
26. Gasket
27. Thrust washer
28. Ball bearing
29. Ring gear
30. Flange bushing
31. Sun gear
32. Bearing
33. Planet gear (3 each)
34. Flange bushing (3 each)
35. Locknut
36. Driver gear
37. Bearing (2 each)
38. Oil seal
39. Driven shaft
40. Shield
Servicing the Gear Box (continued)

Note: Refer to Figure 94 during this procedure.

1. Remove the drain/fill plug and drain the oil from the gear box.
2. Remove the 4 socket-head screws and separate the gear box cover and housing. Remove and discard the cover gasket.
3. Slide the sun gear, ring gear, and planet gears from the pins on the gear box housing.
4. 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 drive adapter removal and installation. DO NOT use the 1/2 inch hex on the input shaft for drive adapter removal or installation as input shaft damage may occur.

5. If the drive adapter requires replacement, apply high strength thread locker (Loctite 243 or equivalent) to the 5/8 inch threads of the drive adapter and tighten the adapter from 150 to 163 N·m (110 to 120 ft-lb).

6. Carefully clean all the gasket material from the gear box housing and cover.
7. Inspect the V-ring, seals, bearings, gears, and bushings in the gear box assembly. Replace the damaged or worn components as necessary.
8. If the sun gear, ring gear, or the gear box housing bearings are replaced, press the bearings all the way to shoulder into the part.
9. If the flange bushings are replaced, ensure that the flange bushing is fully seated against the part.
10. Assembly the gearbox.
   - Ensure that all the retaining rings and O-rings are fully seated in the ring groove during assembly.
   - Lubricate the seal lips and O-rings before installing the shafts.
   - Lubricate the planet gear and sun gear pins in the gear box housing with the gear oil prior to installing the gears.
11. Clean the gasket surface on the gear box housing and cover with the solvent and install new gasket.
12. Fit the gear box cover over dowel pins and install the 4 socket-head screws. Tighten the screws from 1.7 to 4.5 N·m (15 to 40 in-lb). In an alternating cross pattern, tighten the screws from 8.4 to 9.6 N·m (75 to 85 in-lb).
13. Fill the gear box with 80W–90 gear oil and tighten the drain/fill plug from 4 to 5 N·m (32 to 42 in-lb).
   The gear box oil capacity is 50 ml (1.7 fluid ounces).
14. Operate the groomer gear box by hand to check for proper operation prior to installation.
Installing the Gear Box Assembly

1. Safely prevent the reel from rotating by blocking the cutting reel with a piece of wood near one of the reel spiders.

--- IMPORTANT ---

The groomer gear box for this machine is installed on the left side of the cutting unit. Groomer gear boxes installed on the left side of the cutting unit use a left hand thread. Turn the input shaft counter-clockwise to install the gear box.

2. 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.

![Image of the gear box assembly]

**Figure 95**

1. 5/16–18 X 5/8 inch square head set screw
2. Input shaft assembly
3. Groomer gear box assembly
4. Reel shaft
5. Weld side of reel support plate
6. Pry bar

3. 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.

4. 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.

5. Tighten the drive shaft assembly from **135 to 150 N·m (100 to 110 ft-lb)**.
6. Remove the square head set screw from the end of the drive shaft.
7. Install the clevis pin and a new cotter pin to secure the height adjustment rod to the front of the groomer gear box.
8. Apply a retaining compound (Loctite 609 or equivalent) to the lip of the drive housing and install the drive shield.
9. Install the groomer reel assembly; refer to Installing the Groomer Reel (page 9–16).
The Idler Assembly

37 to 45 N·m
(27 to 33 ft·lb)

Figure 96

1. Cotter pin
2. Flange nut
3. Flocked seal (2 each)
4. Bushing
5. Stub shaft
6. Shield
7. Retaining ring
8. Bearing
9. Idler arm
10. Clevis pin

The groomer idler assembly is located on the opposite side of the groomer gear box.

Removing the Idler Assembly

Note: Refer to during this procedure.
1. Remove the reel drive from the cutting unit; refer to Removing the Reel Assembly (page 8–18).
2. Remove the groomer reel assembly; refer to Removing the Groomer Reel (page 9–14).
3. Remove the cotter pin and clevis pin from the height adjustment rod at the front of the idler arm. Discard the cotter pin.
4. Remove the flange nut that secures the idler arm to the stub shaft. Remove the idler assembly.
5. Inspect the shields, bearing, and bushing in the idler assembly. Replace any components that are worn or damaged.
Installing the Idler Assembly

1. If the shields, bearing, or bushing was removed from the idler arm:
   A. Press the bushing into a groomer plate until the bushing is centered in the idler arm bore.
   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 the flocked side of the shield toward the bearing.
   D. Insert the stub shaft through the shields and bearing. Use the through hole in the shaft to prevent the shaft from rotating and tighten the flange nut from 37 to 45 N-m (27 to 33 ft-lb).

2. Install the clevis pin and a new cotter pin to secure the height adjustment rod to the front of the idler arm.

3. Install the reel drive; refer to Installing the Reel Assembly (page 8–22).
The Groomer Reel

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

Removing the Groomer Reel

**CAUTION**

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

Use heavy gloves when handling the groomer reel.

1. Carefully remove the 4 jam nuts, 4 bolts, and 4 shaft clamps that secure the groomer reel to the output and stub shafts.
2. Lift the groomer reel from the cutting unit.
3. Inspect the shields, stub shaft, driven shaft and shaft bearings for wear or damage and replace components as necessary; refer to (page ) and The Idler Assembly (page 9–12).
Inspect the groomer reel blades frequently for any damage and wear. Straighten the bent blades. Either replace the worn blades or reverse the individual blades to put the sharpest blade edge forward: refer to Figure 98.

1. Remove the groomer reel from the cutting unit; refer to Removing the Groomer Reel (page 9–14).
2. Remove the lock nut from either end of the groomer reel shaft.
3. Remove the blades from the groomer shaft. If necessary, remove second lock nut from the shaft.
4. Inspect and replace worn or damaged components.
5. Assemble the groomer reel as follows:

   **Note:** New lock nuts have an adhesive patch to prevent the lock nut from loosening. If a used lock nut is being installed, apply a medium strength thread locker (Loctite #242 or equivalent) to the threads of the lock nut.
   A. Install a lock nut on one end of the groomer reel shaft.
   B. Install a groomer blade against the lock nut.
   C. Install the remaining spacers and blades in an alternating manner making sure that all blades are separated by a spacer.
Servicing the Groomer Reel (continued)

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

E. Use the through holes in shaft to prevent the shaft from rotating and tighten the second lock nut to 42 to 48 N·m (375 to 425 in-lb). After tightening the lock nut, spacers should not be free to rotate and the groomer blades should be centered on the shaft.

6. Install the groomer reel back onto the cutting unit; refer to Installing the Groomer Reel (page 9–16).

Installing the Groomer Reel

1. Position the groomer reel between the groomer driven and stub shafts.

2. Secure the groomer reel to the cutting unit with the 4 jam nuts, 4 bolts, and 4 shaft clamps. Tighten the bolts from 5 to 7 N·m (45 to 60 in-lb).

3. Check the groomer reel height and mower height-of-cut settings and adjust as necessary.
The Height Adjuster Assembly

![Diagram of the Height Adjuster Assembly]

Figure 99

1. Cotter pin 7. Compression spring 13. Quick up cover
5. Washer (2 each) 11. Height-of-cut bracket 17. Height adjustment bolt

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; refer to .

Disassembling the Height Adjuster

Note: Refer to during this procedure.

1. Remove the cutting unit from the machine.
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 pinch bolts that secure the front roller to the height-of-cut brackets.
Disassembling the Height Adjuster (continued)

4. Remove the hex nuts and plow bolts that secure the height-of-cut brackets to the cutting unit side plates, and remove the height adjusters and front roller from the cutting unit.

5. Disassemble the height adjuster assembly as necessary.

6. Replace components that are worn or damaged.

Assembling the Height Adjuster

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.

2. If both the height adjusters are removed, fit 1 height adjuster assembly to the cutting unit side plate and secure it with a plow bolt, tabbed washer and lock nut. Tighten the lock nut finger tight.

3. Position front roller between the height adjuster assemblies and secure the remaining height adjuster assembly to the cutting unit side plate with a plow bolt and lock nut. Tighten the lock nut finger tight.

4. Center the front roller between the height-of-cut brackets and tighten the front roller pinch bolts.

5. Install new cotter pins and clevis pins and secure the height adjustment rods to the groomer gear box and idler arm.

6. Adjust the cutting unit height-of-cut; refer to Cutting Unit Operators Manual.

7. Check the groomer reel height and adjust as necessary.

8. Adjust the flange nuts on the groomer height adjustment rods until the springs are compressed to 19 mm (0.75 inch).
The optional grooming brush attaches to the groomer in place of the groomer reel. The grooming brush is removed and installed from the groomer in the same manner as the groomer reel; refer to The Groomer Reel (page 9–14).

The grooming brush element or shaft can be serviced separately.

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