Service Manual

Greens Aerator

Preface

The purpose of this publication is to provide the service technician with information for troubleshooting, testing and repair of major systems and components on the Greens Aerator.

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

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

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

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

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

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

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Chapter 1

Safety

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Safety Instructions

The Greens Aerator is designed and tested to offer safe service when operated and maintained properly. Although hazard control and accident prevention partially are dependent upon the design and configuration of the machine, these factors are also dependent upon the awareness, concern and proper training of the personnel involved in the operation, transport, maintenance and storage of the machine. Improper use or maintenance of the machine can result in injury or death. To reduce the potential for injury or death, comply with the following safety instructions.

WARNING

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

Before Operating

1. Read and understand the contents of the Operator's Manual before starting and operating the machine. Become familiar with the controls and know how to stop the machine and engine quickly. A replacement Operator's Manual is available on the Internet at www.Toro.com or by sending the complete model and serial number to:

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

2. Keep all shields, safety devices and decals in place. If a shield, safety device or decal is defective, illegible or damaged, repair or replace it before operating the machine. Also tighten any loose nuts, bolts or screws to ensure machine is in safe operating condition.

3. Assure interlock switches are adjusted correctly so engine cannot be started unless gear shift lever is in NEUTRAL and traction drive is DISENGAGED.

4. Since gasoline is highly flammable, handle it carefully:

   A. Store fuel in containers specifically designed for this purpose.

   B. Do not remove machine fuel tank cap while engine is hot or running.

   C. Do not smoke while handling fuel.

   D. Fill fuel tank outdoors and only to within an inch of the top of the tank, not the filler neck. Do not overfill the fuel tank.

   E. Wipe up any spilled fuel.

While Operating

1. Operator should be standing at the side console when starting the engine and at the handle when operating the machine. Stay away from the coring head when it is engaged.

2. Before starting the engine

   A. Make sure gear shift lever is in neutral.

   B. Disengage the traction drive.

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

4. Do not touch engine, muffler or exhaust pipe while engine is running or soon after it is stopped. These areas could be hot enough to cause burns.

5. Before leaving the operator's position:

   A. Ensure that gear shift lever is in neutral.

   B. Raise coring head and wait for coring head to stop.

   C. Set parking brake. Stop engine and remove key from ignition switch.

6. Anytime the machine is parked (short or long term), raise coring head lock–up brackets to secure the coring head in the raised position. This eliminates the risk of the coring head accidentally lowering to the ground.

7. Do not park on slopes unless wheels are chocked or blocked.

Maintenance and Service

1. Before servicing or making adjustments, position machine on level surface, raise coring head, stop engine and remove key from the ignition switch. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

2. Make sure machine is in safe operating condition by keeping all nuts, bolts and screws tight.

3. Never store the machine or fuel container inside where there is an open flame, such as near a water heater or furnace.

4. Make sure all hydraulic line connectors are tight and all hydraulic hoses and lines are in good condition before applying pressure to the hydraulic system.

5. Keep body and hands away from pin hole leaks in hydraulic lines that eject high pressure hydraulic fluid. Use cardboard or paper to find hydraulic leaks. Hydraulic fluid escaping under pressure can penetrate skin and cause injury. Hydraulic fluid accidentally injected into the skin must be surgically removed within a few hours by a doctor familiar with this form of injury or gangrene may result.

6. Before disconnecting any hydraulic component or performing any work on the hydraulic system, all pressure in system must be relieved. To relieve hydraulic system pressure, stop engine, raise coring head lock–up brackets and lower coring head onto lock–up brackets.

7. If major repairs are ever needed or assistance is desired, contact an Authorized Toro Distributor.

8. Use care when checking or servicing the coring head: wear gloves and use caution.

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

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

11. Do not overspeed the engine by changing governor setting. To assure safety and accuracy, check maximum engine speed with a tachometer.

12. Shut engine off before checking or adding oil to the engine crankcase.

13. Disconnect battery before servicing the machine. Disconnect negative battery cable first and positive battery cable last. If battery voltage is required for troubleshooting or test procedures, temporarily connect the battery. Reconnect positive battery cable first and negative battery cable last.

14. Battery acid is poisonous and can cause burns. Avoid contact with skin, eyes and clothing. Protect your face, eyes and clothing when working with a battery.

15. Battery gases can explode. Keep cigarettes, sparks and flames away from the battery.

16. When changing tires or performing other service, use correct blocks, hoists and jacks. Make sure machine is parked on a solid level floor such as a concrete floor. Prior to raising the machine, remove any attachments that may interfere with the safe and proper raising of the machine. Always chock or block wheels. Use jack stands or solid wood blocks to support the raised machine. If the machine is not properly supported by blocks or jack stands, the machine may move or fall, which may result in personal injury (see Jacking Instructions).

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

Jacking Instructions

CAUTION

When changing attachments, tires or performing other service, use correct blocks, hoists and jacks. Make sure machine is parked on a solid level surface such as a concrete floor. Prior to raising machine, remove any attachments that may interfere with the safe and proper raising of the machine. Always chock or block wheels. Use jack stands or solid wood blocks to support the raised machine. If the machine is not properly supported by blocks or jack stands, the machine may move or fall, which may result in personal injury.

Jacking the Front End

1. Chock rear tires to prevent the machine from moving.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets (Fig. 1).

3. Position jack securely under the front of the frame on side of machine (Fig. 2).

4. Jack front of machine off the ground.

5. Position jack stands or hardwood blocks under the front of the frame to support the machine.

6. Repeat jacking and support on other side of frame.

Jacking the Rear End

1. Chock front tire to prevent the machine from moving.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets (Fig. 1).

3. Place jack securely under the main frame just inside of the rear wheel (Fig. 3).

4. Jack rear of machine off the ground.

5. Position jack stands or hardwood blocks under the frame to support the machine.

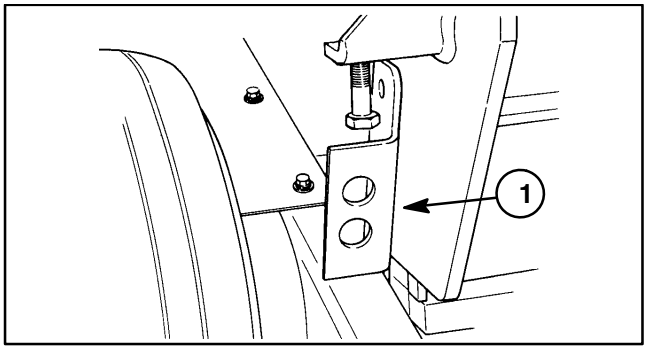

Figure 1

1. Lock–up bracket (raised position)

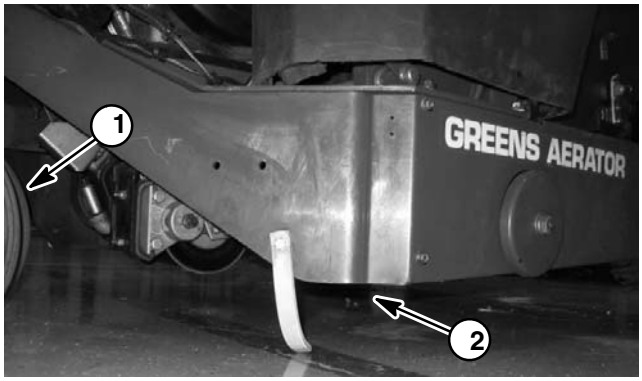

Figure 2

1. Front wheel **2. Frame jacking point**

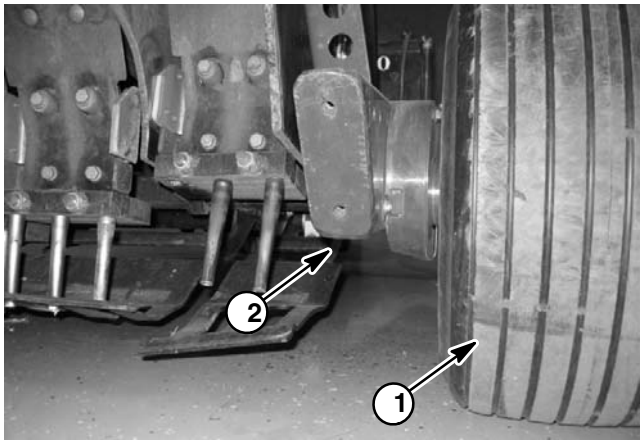

Figure 3

1. Rear wheel **2. Frame jacking point**

Safety and Instruction Decals

Numerous safety and instruction decals are affixed to the Greens Aerator. If any decal becomes illegible or damaged, install a new decal. Part numbers for replacement decals are listed in your Parts Catalog. Order replacement decals from your Authorized Toro Distributor.

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Chapter 2

Product Records and Maintenance

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Product Records

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

Maintenance

Maintenance procedures and recommended service intervals for the Greens Aerator are covered in the Operator's Manual. Refer to that publication when performing regular equipment maintenance. Refer to the Engine Operator's Manual for additional engine specific maintenance procedures.

Equivalents and Conversions

Decimal and Millimeter Equivalents

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

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

U.S.to Metric Conversions

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

Torque Specifications

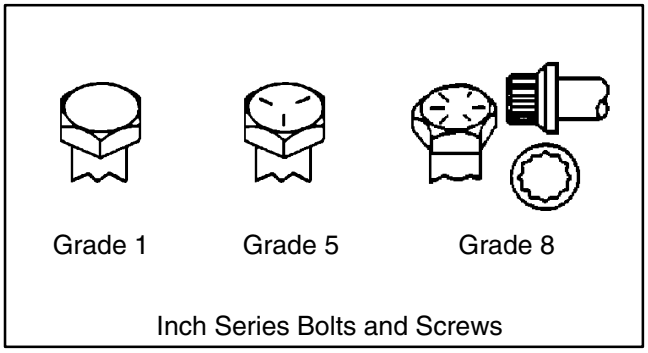
Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in this Service Manual.

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

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

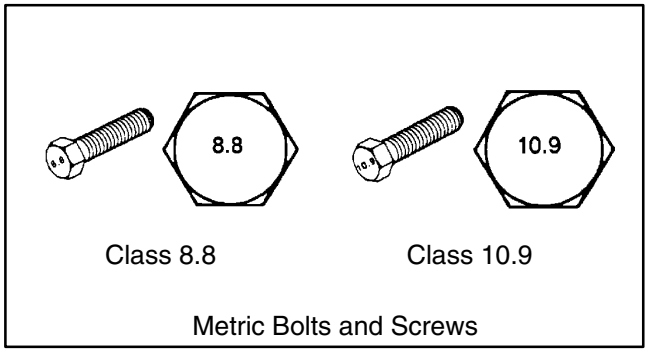
The standard method of verifying torque shall be performed by marking a line on the fastener (head or nut) and mating part, then back off fastener 1/4 of a turn. Measure the torque required to tighten the fastener until the lines match up.

Fastener Identification



Inch Series Bolts and Screws

Figure 1



Metric Bolts and Screws

Figure 2

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

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

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

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

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

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

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

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

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

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

Other Torque Specifications

SAE Grade 8 Steel Set Screws

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

Wheel Bolts and Lug Nuts

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

** For steel wheels and non–lubricated fasteners.

Thread Cutting Screws (Zinc Plated Steel)

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

Thread Cutting Screws (Zinc Plated Steel)

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

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

Conversion Factors

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

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

Chapter 3

Engine

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Introduction

This Chapter gives information about specifications and repair of the Briggs & Stratton engine used in the Greens Aerator (Model 09120).

NOTE: Greens Aerators Models 09100 and 09110 are powered by a Kohler M16 engine. Service for these machines is similar to the procedures identified in this Chapter.

General engine maintenance procedures are described in your Operator's Manual. Information on engine troubleshooting, testing, disassembly and reassembly is identified in the engine Repair Manual that is included at the end of this chapter.

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

Service and repair parts for the engine used in the Greens Aerator are supplied through your local engine dealer or distributor (Briggs & Stratton or Kohler).

Engine Specifications

Model 09120

Item	Description
Make / Designation	Briggs and Stratton, 4–cycle, V–Twin Cylinder, OHV, Air Cooled Gasoline Engine – Model 303447
Number of Cylinders	2
Bore x Stroke	2.68” x 2.60” (68 mm x 66 mm)
Total Displacement	29.3 Cubic Inches (480 cc)
Dry Weight (approximate)	72 Pounds (32.4 Kilograms)
Fuel	Unleaded, Regular Gasoline (Minimum 85 Octane)
Fuel Pump	Pulsating Crankcase Vacuum
Fuel Tank Capacity	4.5 U.S. Gallons (17 Liters)
Governor	Mechanical
Idle Speed (no load)	1400 $\pm$ 100 RPM
High Idle (no load) NOTE: High Idle when shift lever is in reverse position	3600 $\pm$ 100 RPM 1400 to 1800 RPM
Engine Oil	See Operator’s Manual
Oil Pump	Gear Driven Geroter Type
Crankcase Oil Capacity	1.75 Quarts (1.66 Liters) with New Filter
Starter	12 VDC

Models 09100 and 09110

Item	Description
Make / Designation	Kohler, 4–Cycle, Air Cooled Gasoline Engine – Model M16S
Number of Cylinders	1
Bore x Stroke	3.75” x 3.25” (95.3 mm x 82.6 mm)
Total Displacement	35.9 Cubic Inches (588 cc)
Dry Weight (approximate)	129 Pounds (58.6 Kilograms)
Fuel	Unleaded, Regular Gasoline
Fuel Pump	Mechanical
Fuel Tank Capacity	1.5 U.S. Gallons (5.7 Liters)
Governor	Mechanical
Idle Speed (no load)	1300 RPM
High Idle (no load)	3600 RPM
Engine Oil	See Operator’s Manual
Crankcase Oil Capacity	5.25 Pints (2.5 Liters)
Starter	12 VDC

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Cooling System

To ensure proper engine cooling, make sure the rotating screen, cooling fins and other external surfaces of the engine are kept clean at all times.

IMPORTANT: The engine that powers the Greens Aerator is air–cooled. Operating the engine with dirty or plugged cooling fins, a blocked rotating screen or a plugged or dirty blower housing will result in engine overheating and engine damage.

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

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

3. Clean cooling fins on both cylinder heads.

4. Clean rotating screen and blower housing of dirt and debris (Fig. 1).

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

5. Make sure rotating screen and blower housing are reinstalled to the engine if removed.

NOTE: For additional information regarding the engine cooling system, refer to the engine service manual at the end of this chapter.

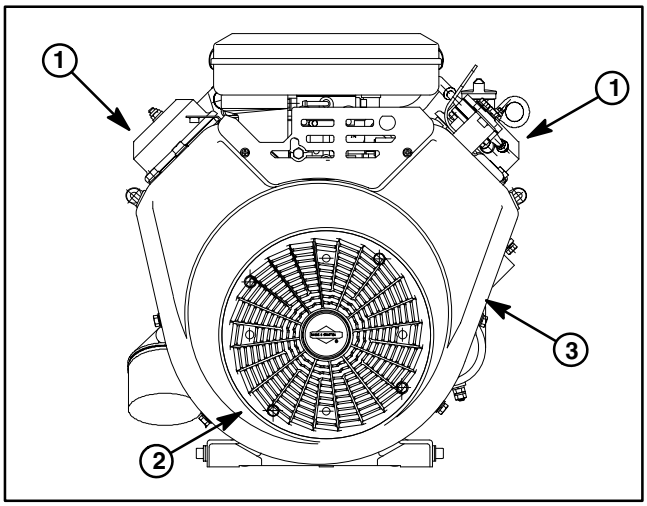

Figure 1

1. **Cylinder head**
2. **Rotating screen**
3. **Blower housing**

Fuel System

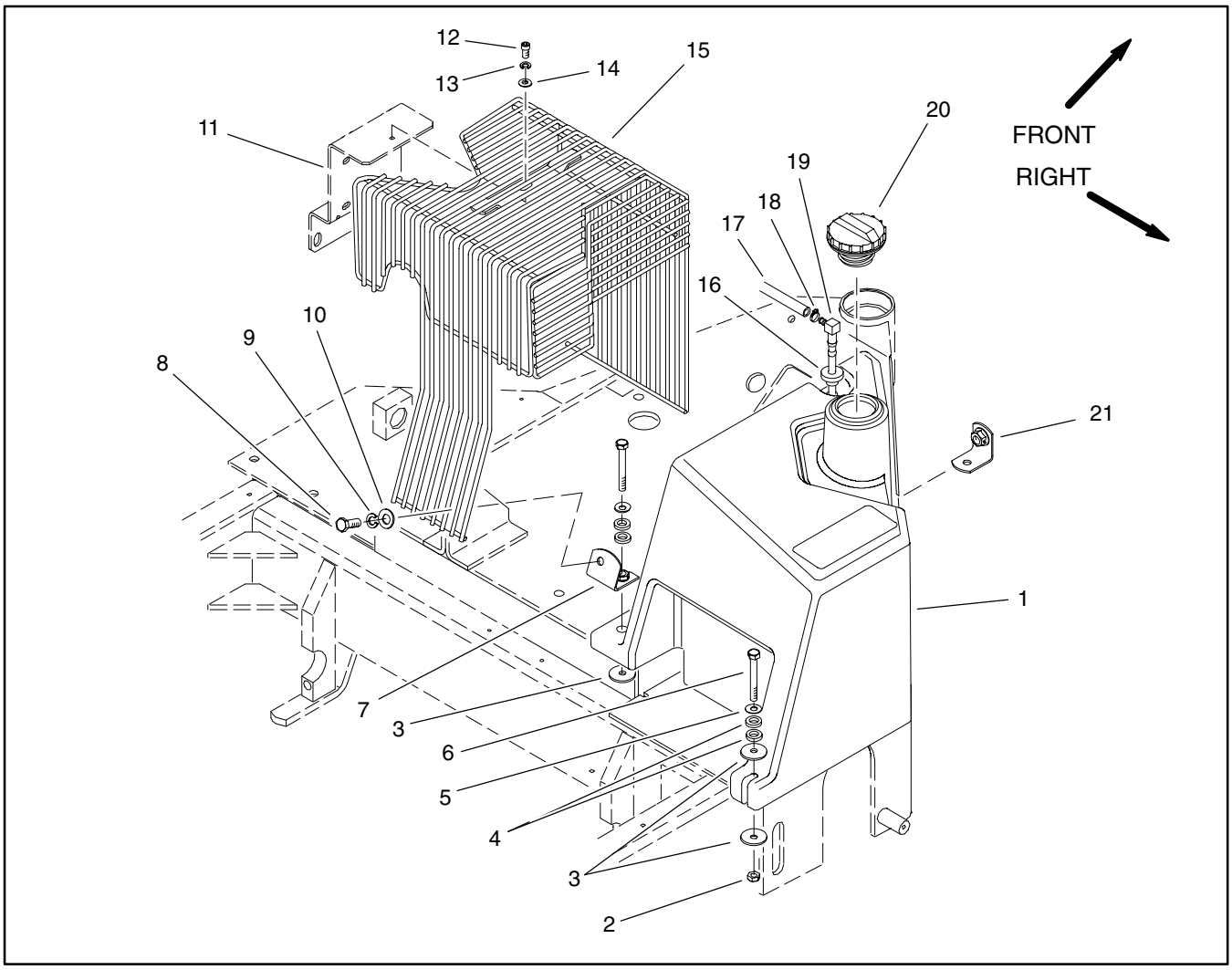

Figure 2

1. Fuel tank
2. Lock nut (3 used)
3. Flat washer (4 used)
4. Spacer (6 used)
5. Flat washer (3 used)
6. Cap screw (3 used)
7. Rear bracket
8. Cap screw (2 used)
9. Lock washer (2 used)
10. Flat washer (2 used)
11. Muffler mount
12. Socket head screw
13. Lock washer
14. Flat washer
15. Muffler guard
16. Bushing
17. Fuel hose
18. Hose clamp
19. Fuel stand pipe
20. Fuel cap
21. Front bracket

DANGER

Because gasoline is highly flammable, use caution when storing or handling it. Do not smoke while filling the fuel tank. Do not fill fuel tank while engine is running, hot or when machine is in an enclosed area. Always fill fuel tank outside and wipe up any spilled fuel before starting the engine. Store fuel in a clean, safety–approved container and keep cap in place. Use gasoline for the engine only; not for any other purpose.

Check Fuel Lines and Connections

Check fuel lines and connections periodically for deterioration, damage or leaking connections. Replace hoses, clamps and connections as necessary.

Drain and Clean Fuel Tank

Drain and clean the fuel tank if the fuel system becomes contaminated or if the machine is to be stored for an extended period.

To clean fuel tank, remove tank from machine and flush tank out with clean solvent. Make sure tank is free of contaminates and debris.

Fuel Tank Removal (Fig. 2)

NOTE: On Models 09100 and 09110 equipped with a Kohler M16 engine, the fuel tank is an engine component. On these models, refer to the Kohler Magnum Service Manual at the end of this chapter for additional fuel system information.

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Loosen hose clamp that secures fuel hose to fuel stand pipe in fuel tank. Remove fuel hose from stand pipe.

4. Remove fuel tank using Figure 2 as a guide.

5. Empty fuel tank into a suitable container.

Fuel Tank Installation (Fig. 2)

1. Install fuel tank to frame using Figure 2 as a guide.

2. Connect fuel hose to the fuel stand pipe. Secure fuel hose with hose clamp.

3. Fill fuel tank (see Operator's Manual).

4. Return coring head lock–up brackets to stored position.

Exhaust System

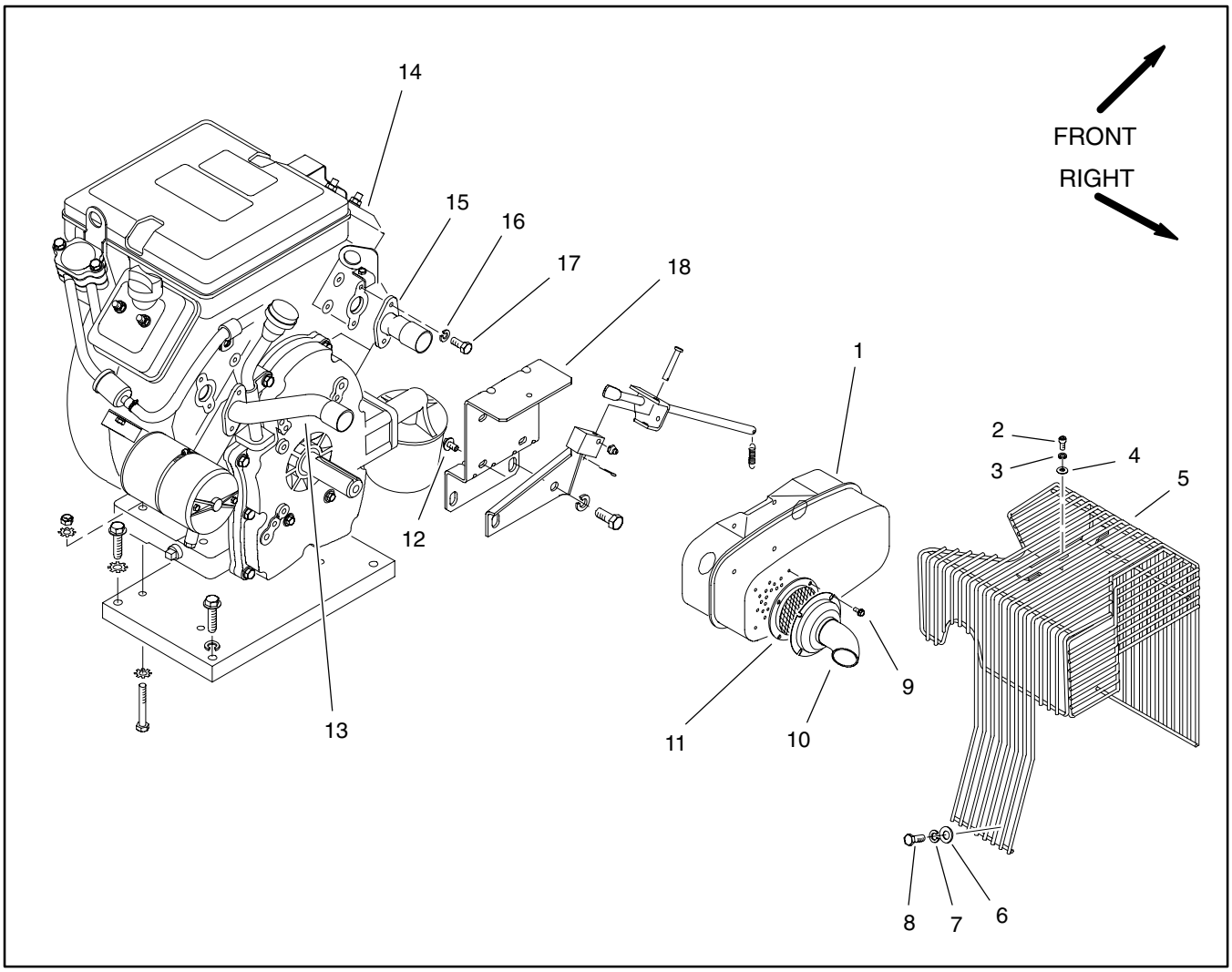

Figure 3

1. **Muffler**
2. **Socket head screw**
3. **Lock washer**
4. **Flat washer**
5. **Muffler guard**
6. **Flat washer (2 used)**
7. **Lock washer (2 used)**
8. **Cap screw (2 used)**
9. **Self tapping screw (4 used)**
10. **Exhaust outlet**
11. **Spark arrester (optional)**
12. **Self tapping screw (4 used)**
13. **Exhaust tube**
14. **Engine**
15. **Exhaust tube**
16. **Lock washer (4 used)**
17. **Cap screw (4 used)**
18. **Muffler mount**

NOTE: On Models 09100 and 09110 equipped with a Kohler M16 engine, exhaust system service is similar to the following procedure.

Removal (Fig. 3)

CAUTION

The muffler guard and exhaust system may be hot. To avoid possible burns, allow the engine and exhaust components to cool before working on the exhaust system.

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Remove fasteners that secure muffler guard to machine. Remove muffler guard from machine.

4. Remove four (4) self tapping screws (item 12) that secure muffler to muffler mount.

5. Slide muffler from muffler tubes and from machine.

6. If exhaust tubes (items 13 and 15) require removal, remove four (4) cap screws (item 17) and lock washers (item 16) from the engine. Separate the exhaust tubes from the engine.

7. Remove exhaust gaskets (not shown).

Installation (Fig. 3)

IMPORTANT: Finger tighten all exhaust system fasteners before securing so there is no preload on exhaust components.

NOTE: If exhaust tubes were removed, make sure exhaust tube flanges and engine sealing surfaces are free of debris or damage that may prevent a tight, leak–free seal.

1. If exhaust tubes were removed, position exhaust gaskets between the engine and the exhaust tube flanges. Make sure that gaskets are positioned correctly. Install four (4) cap screws with lock washers finger tight to keep exhaust tubes and gaskets in position.

2. Slide muffler onto muffler tubes.

3. Install four (4) self tapping screws (item 12) finger tight to position muffler to muffler mount.

4. Tighten cap screws to secure exhaust tubes to engine. Then tighten self tapping screws to secure muffler to muffler mount.

5. Position muffler guard to machine and secure with fasteners removed during disassembly.

6. Return coring head lock–up brackets to stored position.

Engine

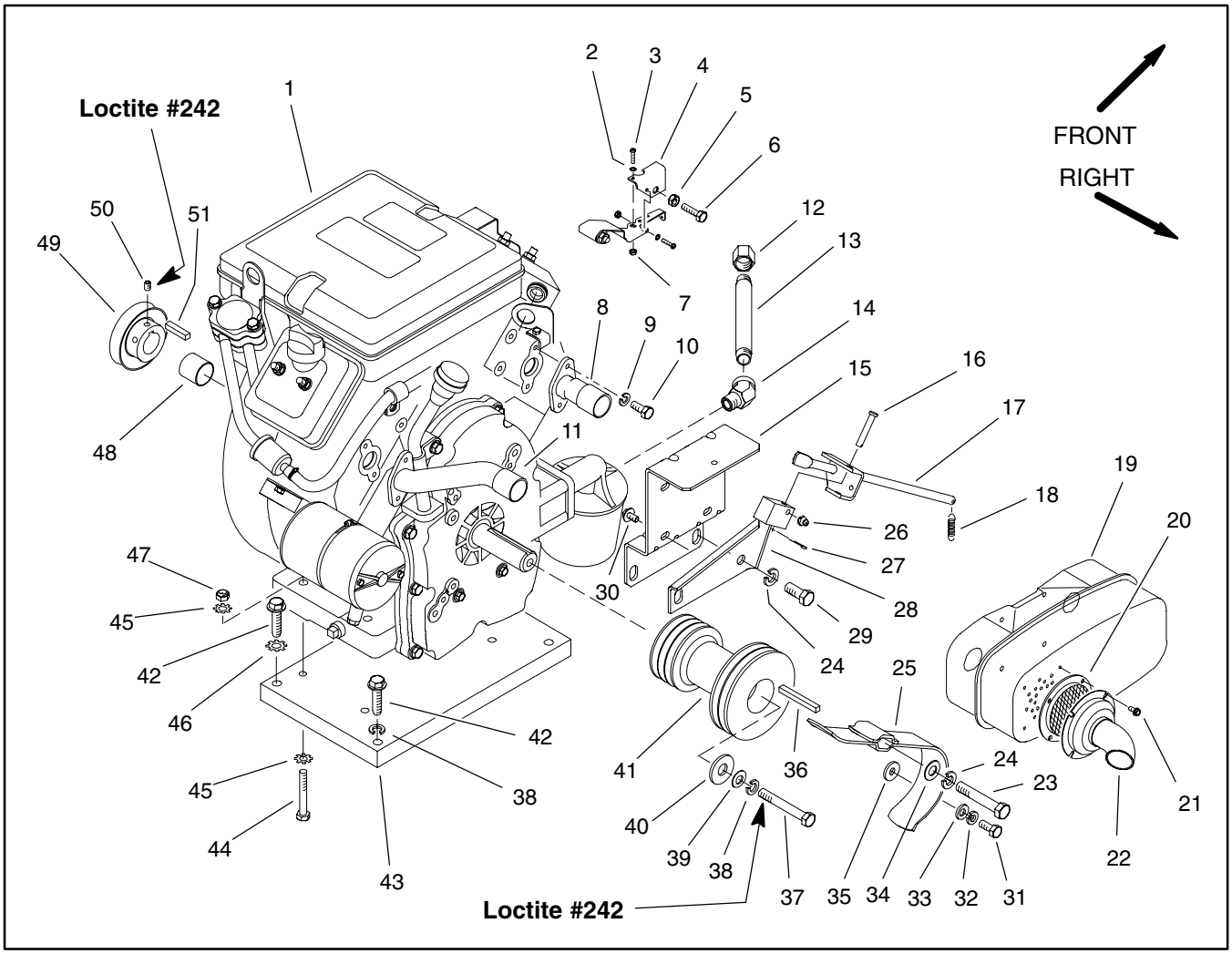

Figure 4

1. Engine
2. Lock washer (2 used)
3. Screw (2 used)
4. Throttle adjuster bracket
5. Hex nut
6. Cap screw
7. Hex nut (2 used)
8. Exhaust tube
9. Lock washer (4 used)
10. Cap screw (4 used)
11. Exhaust tube
12. Pipe cap
13. Pipe nipple
14. Elbow
15. Muffler mount
16. Clevis pin
17. Throttle control rod
18. Spring
19. Muffler
20. Spark arrester (optional)
21. Self tapping screw (4 used)
22. Exhaust outlet
23. Cap screw
24. Lock washer
25. Belt guide
26. Grease fitting
27. Cotter pin
28. Support bracket
29. Cap screw
30. Self tapping screw (4 used)
31. Cap screw
32. Lock washer
33. Flat washer
34. Flat washer
35. Washer
36. Key
37. Cap screw
38. Lock washer
39. Flat washer
40. Flat washer
41. Pulley
42. Cap screw (4 used)
43. Engine mount plate
44. Cap screw (4 used)
45. Lock washer
46. Lock washer
47. Lock nut
48. Shield
49. Pulley
50. Set screw (2 used)
51. Key

NOTE: On Models 09100 and 09110 equipped with a Kohler M16 engine, engine removal and installation is similar to the following procedure.

Removal (Fig. 4)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch. Chock wheels to keep the machine from moving.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Disconnect negative (–) and then positive (+) battery cables at the battery.

4. Remove control cover from machine (Fig. 5).

5. Remove exhaust system (see Exhaust System Removal in this section).

6. Loosen hose clamp and disconnect fuel hose from the fuel filter on the rear side of the engine. Plug fuel hose to prevent leakage and contamination. Position fuel line away from engine.

7. Disconnect electrical connections from engine. Position disconnected wires away from the engine.

NOTE: Label all electrical connections for reassembly purposes.

A. Remove positive battery cable and fused harness wire (red) from the starter motor solenoid stud (Fig. 6).

B. Disconnect harness alternator wire (white), fuel solenoid wire (white/red) and magneto ground wire (black) from engine (Fig. 6).

C. Remove remaining harness wires (double green and yellow) from starter motor solenoid side posts.

8. Remove coring head and transaxle drive belts from the engine PTO pulley (see Coring Head Drive Belt in the Service and Repairs section of Chapter 8 – Coring Head and Transaxle Drive Belt in the Service and Repairs section of Chapter 7 – Drive Train).

9. Remove hydraulic pump drive belt from the engine flywheel pulley (see Pump Drive Belt in the Service and Repairs section of Chapter 4 – Hydraulic System).

10. Disconnect spring (item 18) from clevis pin in shift plate (Fig. 8).

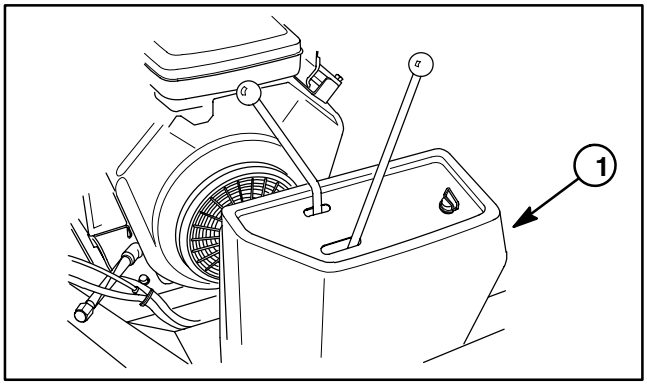

Figure 5

1. **Control cover**

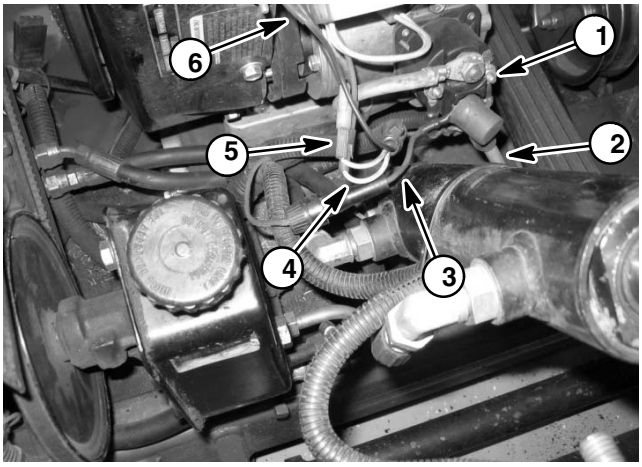

Figure 6

1. **Starter motor solenoid**
2. **Positive battery cable**
3. **Fused harness wire**
4. **Alternator wire**
5. **Fuel solenoid wire**
6. **Magneto ground wire**

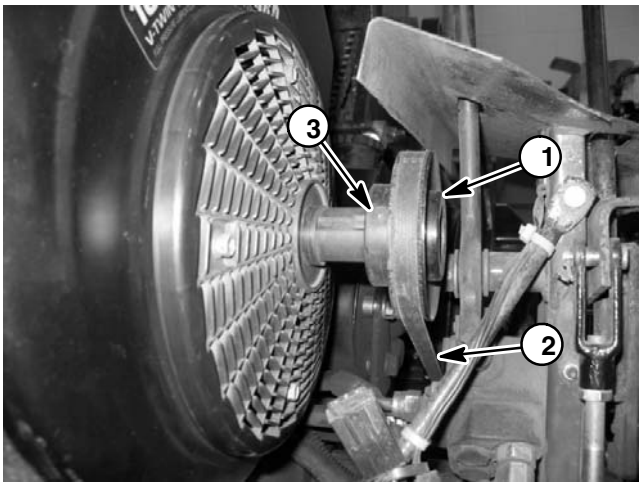

Figure 7

1. **Engine flywheel pulley**
2. **Hydraulic pump drive belt**
3. **Set screw (2 used)**

11. Remove engine from machine:

A. Connect a hoist or chain fall to lift tabs located on each of the cylinder heads.

B. Remove four (4) cap screws (item 42) and lock washers that secure the engine mount plate to the machine frame.

CAUTION

One person should operate lift or hoist while another person guides the engine out of the machine.

IMPORTANT: Make sure not to damage the engine, fuel hoses, hydraulic lines, electrical harness or other parts while removing the engine.

C. Carefully lift engine with engine mount plate attached from the machine.

12. If needed, remove engine from engine mount plate by removing four (4) cap screws (item 44), lock nuts and lock washers.

13. If needed, remove drive pulleys from engine.

Installation (Fig. 4)

1. Locate machine on a level surface with key removed from the ignition switch. Chock wheels to keep the machine from moving.

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

3. If pulleys were removed from engine:

A. Apply anti–seize lubricant to pulley bores. Position keys in shaft slots.

B. Install engine flywheel pulley with the pulley hub toward engine. Apply Loctite #242 (or equivalent) to two (2) set screws. Tighten set screws to retain pulley.

C. Slide engine PTO pulley onto crankshaft. Apply Loctite #242 (or equivalent) to cap screw and secure pulley to crankshaft with cap screw, lock washer and two (2) flat washers.

4. If engine was removed from engine mount plate, position engine on mount plate so the letter F on the mount plate is up & on the oil drain tube side of the engine (Fig. 9). Secure engine to mount plate with four (4) cap screws (item 44) and lock nuts. NOTE: Cap screw closest to flywheel on the starter motor side of the engine uses two (2) lock washers (item 45).

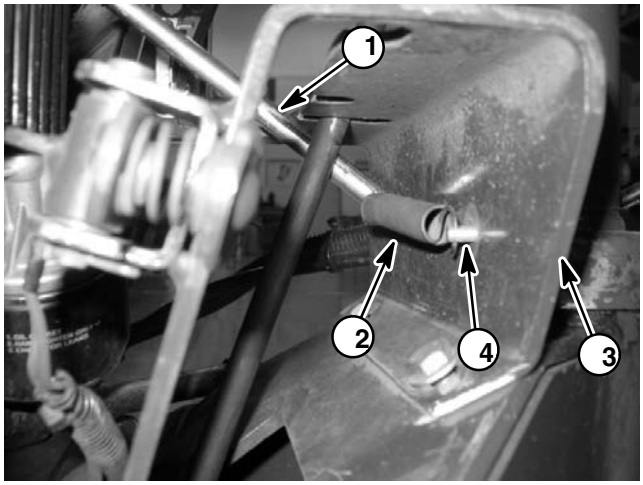

Figure 8

1. **Throttle control rod**
2. **Spring**
3. **Shift plate**
4. **Clevis pin**

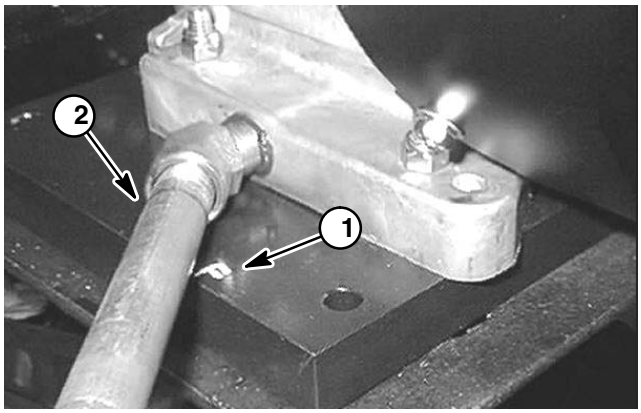

Figure 9

1. **Mounting plate F mark**
2. **Oil drain tube**

5. Reinstall engine to machine.

A. Connect a hoist or chain fall to lift tabs located on each of the cylinder heads.

CAUTION

One person should operate lift or hoist while another person guides the engine to the machine.

IMPORTANT: Make sure not to damage the engine, fuel hoses, hydraulic lines, electrical harness or other parts while installing the engine.

B. Reinstall engine with engine mount plate attached to the machine. Make sure fastener holes of the mount plate are aligned with the threaded holes in the machine frame.

C. Secure engine mount plate to the frame with four (4) cap screws (item 42) and lock washers.

6. Reconnect electrical connections to engine:

   A. Install harness wires (double green and yellow) to starter motor solenoid side posts.

   B. Connect harness alternator wire (white), fuel solenoid wire (white/red) and magneto ground wire (black) to engine leads (Fig. 6).

   C. Install positive battery cable and fused harness wire (red) to the starter motor solenoid stud (Fig. 6).

7. After engine installation, verify pulley alignment across engine and hydraulic pump pulley faces with a straight edge. If necessary, loosen two (2) set screws on engine flywheel pulley and adjust location of pulley. Retighten pulley set screws after alignment. Make sure that shield (item 48) behind flywheel pulley is free to rotate after pulley alignment.

8. Install hydraulic pump drive belt (see Pump Drive Belt in the Service and Repairs section of Chapter 4 – Hydraulic System).

9. Adjust hydraulic pump drive belt tension (see Operator's Manual).

10. Install coring head drive belt to the engine PTO pulley (see Coring Head Drive Belt in the Service and Repairs section of Chapter 8 – Coring Head).

11. Install transaxle drive belt to the engine PTO pulley (see Transaxle Drive Belt in the Service and Repairs section of Chapter 7 – Drive Train).

12. Remove plug installed in fuel hose during disassembly. Connect fuel hose to the fuel filter and secure with hose clamp.

13. Connect spring (item 18) to clevis pin in shift plate (Fig. 8).

14. Install exhaust system (see Exhaust System Installation in this section).

15. Check engine oil level (see Operator's Manual).

16. Check all wires, control cables and hoses to make sure that they are not contacted by rotating or moving parts.

17. Connect positive (+) and then negative (–) battery cables at the battery.

18. Install control cover to machine (Fig. 5).

19. Return coring head lock–up brackets to stored position.

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Chapter 4

Hydraulic System

Table of Contents

Specifications

Item	Description
Hydraulic Pump	Vane Pump, Belt Driven
System Relief Pressure	1300 PSI (89.6 Bar)
Hydraulic Oil	10W30 Engine Oil
Hydraulic Reservoir Capacity	2.7 Pints (1.3 Liters)

General Information

Hydraulic System Fluid

The Greens Aerator hydraulic system is designed to operate on SAE 10W–30 engine oil or, as a substitute, SAE 10W–40 engine oil. **Check level of hydraulic fluid daily.**

See Operator's Manual for fluid level checking procedure.

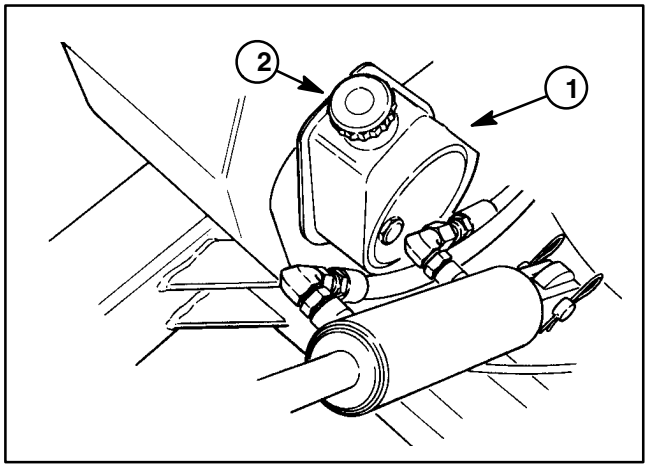


Figure 1

1. **Hydraulic pump & reservoir**
2. **Hydraulic reservoir cap & dipstick**

Relieving Hydraulic System Pressure

Before disconnecting or performing any work on the hydraulic system, all pressure in the hydraulic system must be relieved. With the coring head fully raised, turn key switch to OFF and allow engine to stop. Raise coring head lock–up brackets on each side of machine and lower coring head until coring head depth adjustment screws rest on brackets (Fig. 2). Move lift lever to both raise and lower to make sure that hydraulic system pressure is relieved.

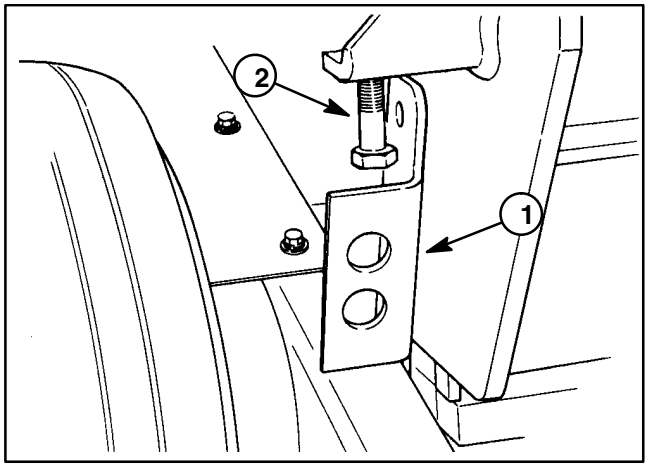


Figure 2

1. **Lock–up bracket**
2. **Depth adjustment screw**

Hydraulic Hoses

Hydraulic hoses are subject to extreme conditions such as pressure differentials during operation and exposure to weather, sun, chemicals, very warm storage conditions, or mishandling during operation and maintenance. These conditions can cause damage or premature deterioration. Some hoses are more susceptible to these conditions than others. Inspect the hoses frequently for signs of deterioration or damage.

When replacing a hydraulic hose, be sure that the hose is straight (not twisted) before tightening the fittings. This can be done by observing the imprint on the hose. Use two wrenches; hold the hose straight with one wrench and tighten the hose swivel nut onto the fitting with the other wrench.

WARNING

Before disconnecting or performing any work on hydraulic system, relieve all pressure in system by moving lift lever to both raise and lower AFTER the engine has been stopped.

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and cause serious injury. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury. Gangrene may result from such an injury.

Hydraulic Fitting Installation

O–Ring Face Seal

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.

2. Make sure the O–ring is installed and properly seated in the groove. It is recommended that the O–ring be replaced any time the connection is opened.

3. Lubricate the O–ring with a light coating of oil.

4. Put the tube and nut squarely into position on the face seal end of the fitting and tighten the nut until finger tight.

5. Mark the nut and fitting body. Hold the body with a wrench. Use another wrench to tighten the nut to the correct Flats From Finger Tight (F.F.F.T.). The markings on the nut and fitting body will verify that the connection has been tightened.

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	0.75 ± 0.25
6 (3/8 in.)	0.75 ± 0.25
8 (1/2 in.)	0.75 ± 0.25
10 (5/8 in.)	1.00 ± 0.25
12 (3/4 in.)	0.75 ± 0.25
16 (1 in.)	0.75 ± 0.25

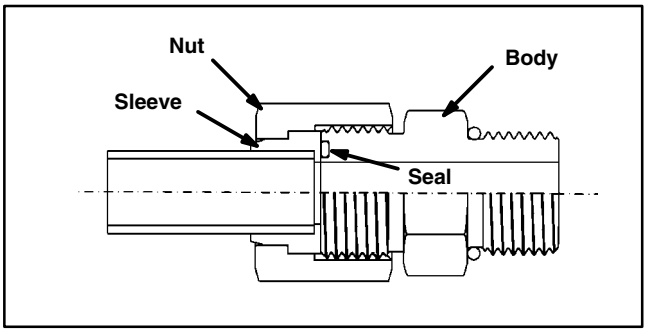


Figure 3

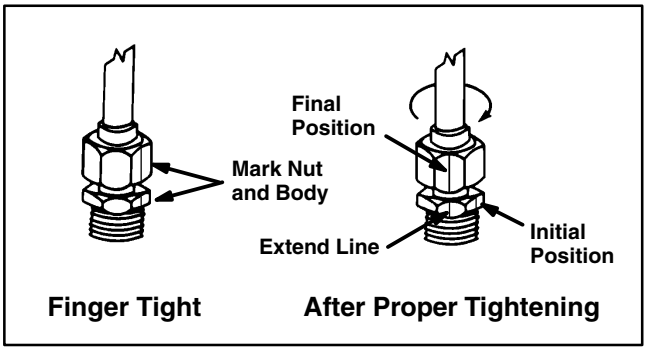


Figure 4

SAE Straight Thread O–Ring Port – Non–adjustable

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.

2. Always replace the O–ring seal when this type of fitting shows signs of leakage.

3. Lubricate the O–ring with a light coating of oil.

4. Install the fitting into the port and tighten it down full length until finger tight.

5. Tighten the fitting to the correct Flats From Finger Tight (F.F.F.T.).

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	1.00 ± 0.25
6 (3/8 in.)	1.50 ± 0.25
8 (1/2 in.)	1.50 ± 0.25
10 (5/8 in.)	1.50 ± 0.25
12 (3/4 in.)	1.50 ± 0.25
16 (1 in.)	1.50 ± 0.25

NOTE: Installation torque values for non–adjustable fittings are listed in Figure 6. These torque values should **only** be used when a fitting can be accessed with a socket. Use of an offset wrench (e.g. crowfoot wrench) will affect torque wrench accuracy and should not be used.

SAE Straight Thread O–Ring Port – Adjustable

1. Make sure both threads and sealing surfaces are free of burrs, nicks, scratches, or any foreign material.

2. Always replace the O–ring seal when this type of fitting shows signs of leakage.

3. Lubricate the O–ring with a light coating of oil.

4. Turn back the jam nut as far as possible. Make sure the back up washer is not loose and is pushed up as far as possible (Step 1).

5. Install the fitting into the port and tighten finger tight until the washer contacts the face of the port (Step 2).

6. To put the fitting in the desired position, unscrew it by the required amount, but no more than one full turn (Step 3).

7. Hold the fitting in the desired position with a wrench and turn the jam nut with another wrench to the correct Flats From Finger Tight (F.F.F.T.) (Step 4).

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	1.00 ± 0.25
6 (3/8 in.)	1.50 ± 0.25
8 (1/2 in.)	1.50 ± 0.25
10 (5/8 in.)	1.50 ± 0.25
12 (3/4 in.)	1.50 ± 0.25
16 (1 in.)	1.50 ± 0.25

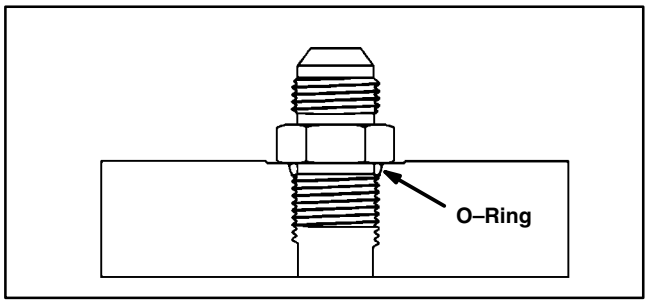


Figure 5

Fitting Size	Installation Torque
4	9–10 ft–lb (12–13 N–m)
6	20–21 ft–lb (27–28 N–m)
8	35–37 ft–lb (47–50 N–m)
10	60–66 ft–lb (81–89 N–m)
12	81–87 ft–lb (110–117 N–m)
16	121–131 ft–lb (164–177 N–m)

Figure 6

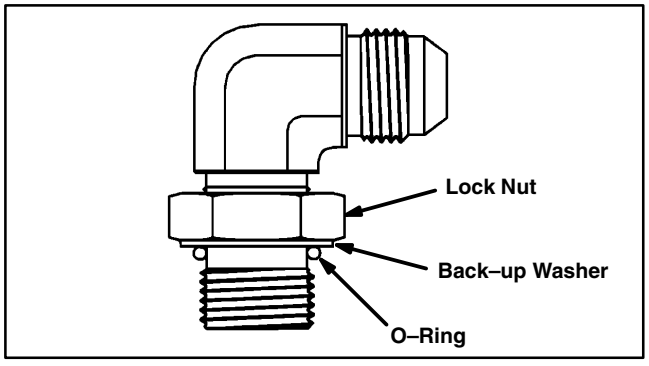


Figure 7

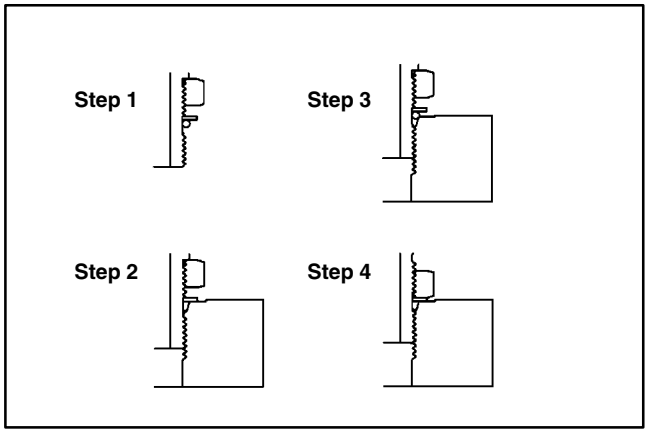
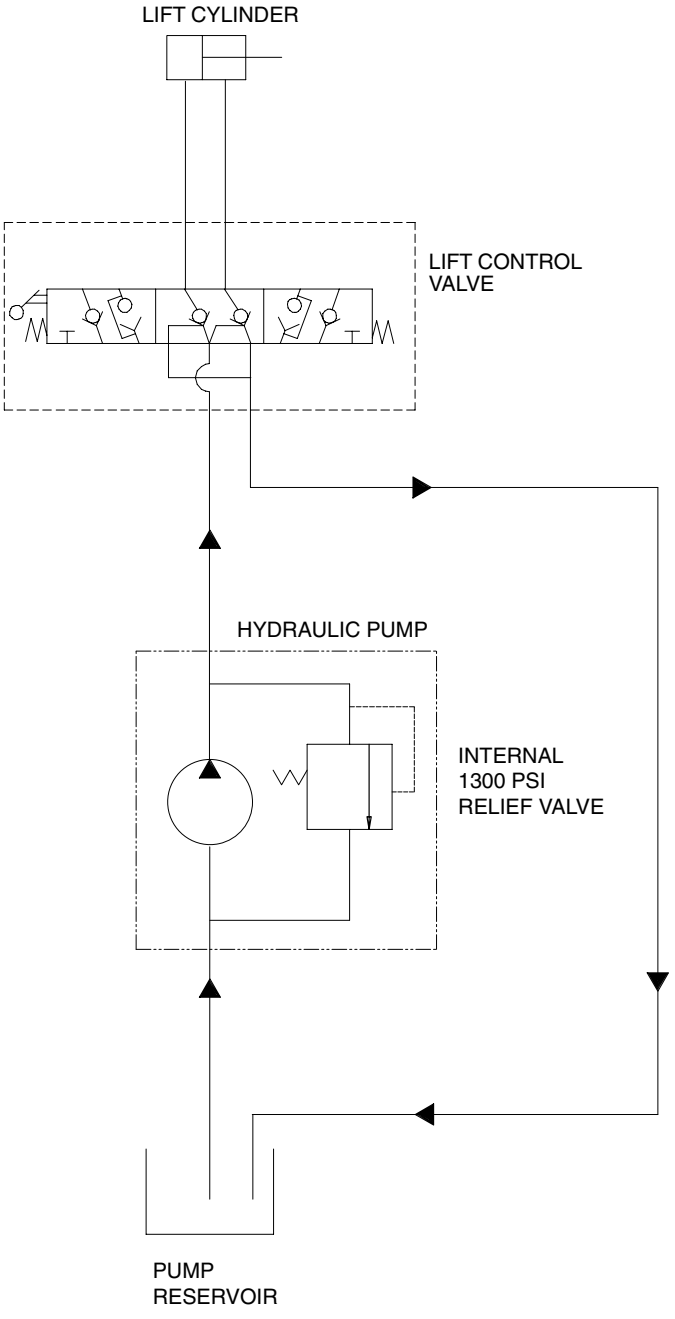


Figure 8

Hydraulic Schematic



Greens Aerator
Hydraulic Schematic

Hydraulic System Operation

Coring Head Raise/Lower

The hydraulic pump supplies hydraulic pressure for raising and lowering the coring head. The pump is belt driven. The hydraulic pump takes its suction from the hydraulic reservoir which is part of the pump assembly.

During conditions of not lifting or lowering the coring head, flow from the hydraulic pump goes to the lift control valve and is by–passed directly back to the pump reservoir.

Maximum raise/lower circuit pressure (1300 PSI) is limited by the control valve located in the hydraulic pump assembly.

Raise Coring Head

When the coring head is to be raised, the control valve spool is positioned down and flow is directed out the top of the control valve to the lower portion of the lift cylinder. Hydraulic pressure against the cylinder piston extends the cylinder to raise the coring head. At the same time, the piston pushes the hydraulic fluid in the upper portion of the lift cylinder out and through the control valve to the pump return. When the control valve lever is released, spring action returns the spool to the center position and by–passes flow back to the pump reservoir. Lift cylinder movement is stopped. The cylinder position is locked in place since there is no complete circuit of flow to and from the lift cylinder.

Lower Coring Head

Circuit operation for lowering the lift cylinder is similar to raising it. However, the control valve spool is shifted up and flow is reversed to and from the lift cylinder, thus retracting the cylinder to lower the coring head.

Special Tools

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

Hydraulic Pressure Test Kit

Part Number: **TOR47009**

Use to take various pressure readings for diagnostic tests. Quick disconnect fittings provided attach directly to mating fittings on machine test ports without tools. A high pressure hose is provided for remote readings. Contains one each: 1000 PSI (70 Bar), 5000 PSI (350 Bar) and 10000 PSI (700 Bar) gauges. Use gauges as recommended in Testing section of this chapter.

Figure 9

Hydraulic Test Fitting Kit

Part Number: **TOR4079**

This kit includes a variety of O–ring Face Seal fittings to enable connection of test gauges to the Greens Aerator hydraulic system.

The kit includes: tee's, unions, reducers, plugs, caps and male test fittings.

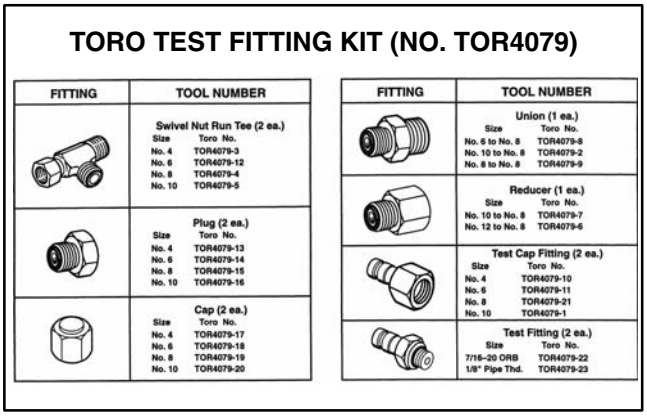


Figure 10

Troubleshooting

The cause of an improperly functioning hydraulic system is best diagnosed with the use of proper testing equipment and a thorough understanding of the complete hydraulic system.

A hydraulic system with an excessive increase in heat or noise has a potential for failure. Should either of these conditions be noticed, immediately stop the machine, turn off the engine, locate the cause of the trouble and correct it before allowing the machine to be used again. Continued use of an improperly functioning hydraulic system could lead to extensive hydraulic component damage.

The chart below contains information to assist in troubleshooting. There may possibly be more than one cause for a machine malfunction.

Refer to the Testing section of this Chapter for precautions and specific test procedures.

Problem	Possible Cause
Hydraulic oil leaks	Hydraulic fitting(s), hose(s) or tube(s) are loose or damaged. O–ring(s) or seal(s) are missing or damaged.
Foaming hydraulic fluid	Oil level in reservoir is low. Hydraulic system has wrong kind of oil. Pump suction (return) line has an air leak.
Hydraulic system operates hot	Oil level in reservoir is low. Excessive dirt and/or debris on hydraulic components. Oil is contaminated or too light. Air trapped in hydraulic system. Hydraulic pump is worn or damaged.
Coring head will not lift or lifts slowly	Engine speed is too low. Reservoir oil level is low. Pump drive belt is loose or worn. Lift cylinder is binding. Coring head is binding. Control valve in hydraulic pump is stuck open. Lift cylinder is leaking internally. Hydraulic pump is worn or damaged.
Coring head raises, but will not stay up	Lift cylinder is leaking internally. Neutral position check valves in lift valve leak.

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Testing

The most effective method for isolating problems in the hydraulic system is by using hydraulic test equipment such as pressure gauges and flow meters in the circuits during various operational checks (see Special Tools section in this Chapter).

CAUTION

Failure to use gauges with recommended pressure (PSI/Bar) rating as listed in test procedures could result in damage to gauge and possible personal injury from leaking hot oil.

Before Performing Hydraulic Tests

All obvious areas such as oil supply, binding linkage, loose fasteners, improper adjustments or improper operation must be checked before assuming that a hydraulic component is the source of the problem being experienced.

Precautions For Hydraulic Testing

WARNING

Before disconnecting or performing any work on the hydraulic system, all pressure in the system must be relieved. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate skin and cause serious injury. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury. Gangrene may result from such an injury.

1. Thoroughly clean the machine before disconnecting or disassembling any hydraulic components. Always keep in mind the need for cleanliness when working on hydraulic equipment. Hydraulic system contamination will cause excessive wear of hydraulic components.

2. Put caps or plugs on any hydraulic lines left open or exposed during testing or removal of components.

3. The engine must be in good operating condition. Use a tachometer when making a hydraulic test. Engine speed will affect the accuracy of hydraulic test results.

4. Because the hydraulic pump is belt driven, check for proper pump belt adjustment before performing any hydraulic test.

5. Install hydraulic fittings finger tight, far enough to insure that they are not cross–threaded, before tightening fitting with a wrench.

6. To prevent hose or tester damage, position the tester hoses so that moving machine parts will not make contact with them.

7. Check and adjust the oil level in the reservoir after connecting hydraulic test equipment.

8. Check the control linkage for improper adjustment, binding or broken parts. Make sure control linkage is functioning properly before conducting hydraulic tests.

9. All hydraulic tests should be made with the hydraulic oil at normal operating temperature.

TEST NO. 1: System Relief Pressure (Using Pressure Gauge)

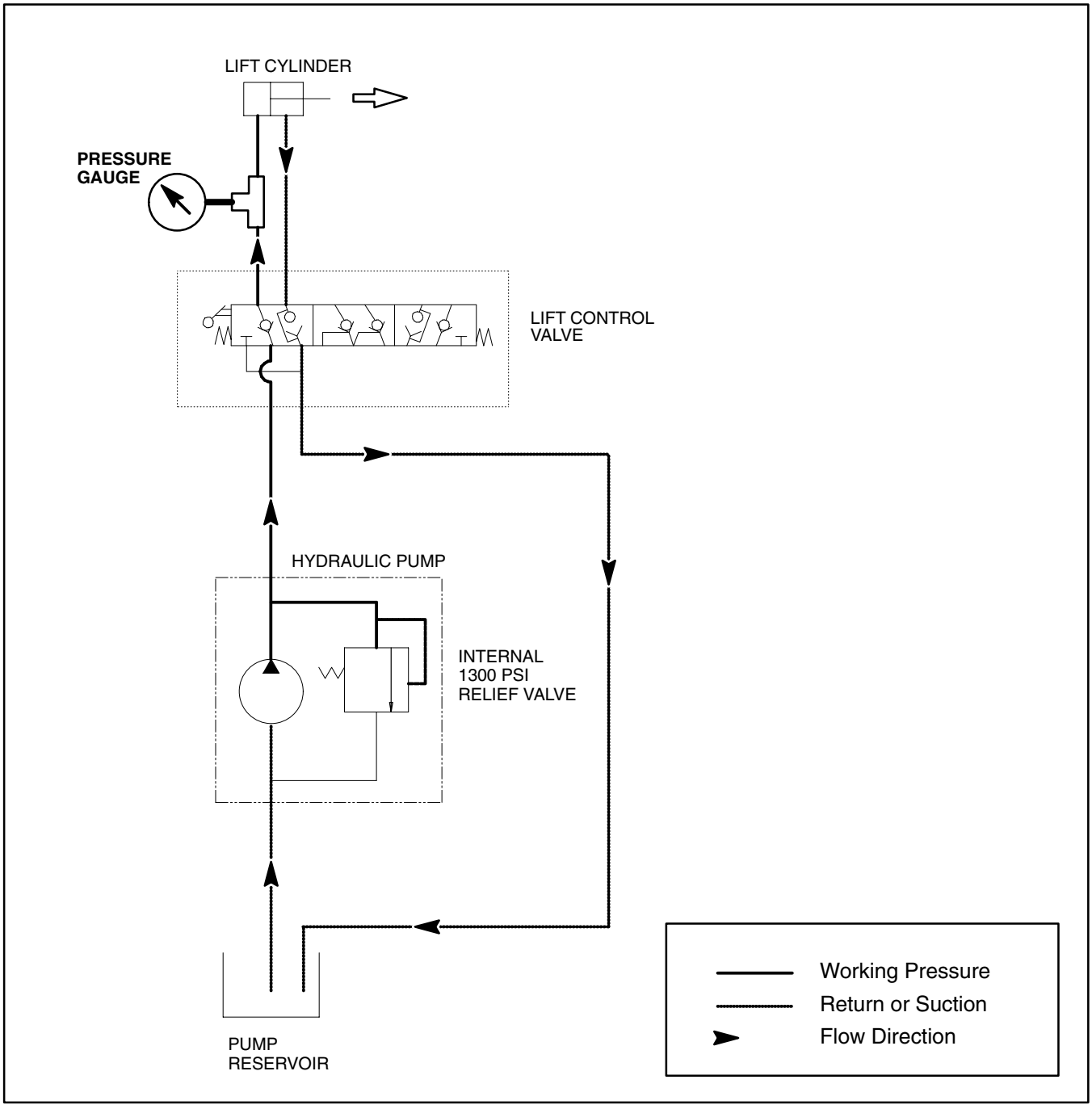

Figure 11

Procedure for System Relief Pressure Test:

1. Make sure hydraulic oil is at normal operating temperature by operating the machine for approximately 10 minutes.

2. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

3. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

4. Read Precautions For Hydraulic Testing in this section.

CAUTION

Operate all hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil.

5. With engine off, move lift control lever to raise and lower to relieve system pressure.

6. Disconnect hydraulic hose from lower fitting on lift cylinder (Fig. 12). Install T–fitting with pressure gauge between disconnected hose and lower fitting on lift cylinder.

7. Make sure that gear shift lever is in neutral and traction lever is disengaged.

8. Start engine and operate engine at full speed **(3600 ± 100 RPM)**.

9. Move lift lever to the raise position and while holding the lift lever in the raised position, watch the pressure gauge. Record pressure when the relief valve opens.

10. Return lift lever to neutral position. Shut off engine.

11. Relief valve should open at approximately **1300 PSI (89.6 Bar)**.

12. If specification is not met, inspect pressure control valve located in hydraulic pump.

13. Disconnect pressure gauge and T–fitting from hydraulic hose and lift cylinder. Connect hydraulic hose to lift cylinder.

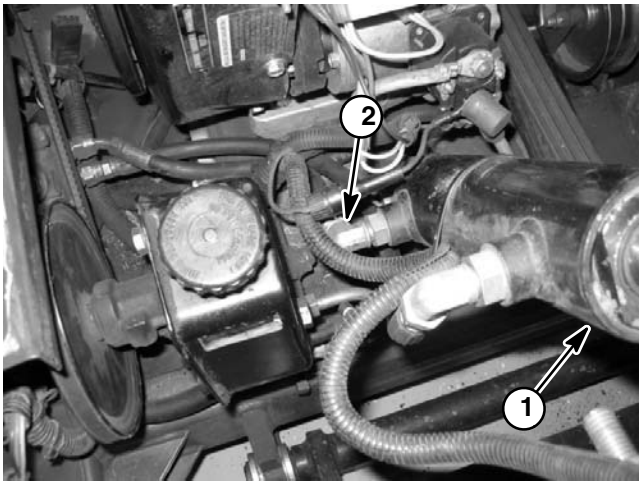

Figure 12

1. **Hydraulic lift cylinder**
2. **Lift cylinder lower fitting**

General Precautions for Removing and Installing Hydraulic System Components

Before Repair or Replacement of Components

1. Before removing any parts from the hydraulic system, park machine on a level surface, fully raise coring head, engage parking brake, stop engine and remove key from the ignition switch. Raise coring head lock–up brackets on each side of machine and lower coring head until coring head depth adjustment screws rest on brackets.

2. Clean machine before disconnecting, removing or disassembling any hydraulic components. Make sure hydraulic components, hoses connections and fittings are cleaned thoroughly. Always keep in mind the need for cleanliness when working on hydraulic equipment.

CAUTION

Before working on ANY hydraulic component, operate hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil.

3. Put caps or plugs on any hydraulic lines, hydraulic fittings or hydraulic components left open or exposed to prevent hydraulic system contamination.

4. Put labels on disconnected hydraulic lines and hoses for proper installation after repairs are completed.

5. Note the position of hydraulic fittings (especially elbow fittings) on hydraulic components before removal. Mark parts if necessary to make sure they will be aligned properly when reinstalling hydraulic hoses and fittings.

After Repair or Replacement of Components

1. Check oil level in the hydraulic pump reservoir and add correct oil if necessary. Drain and refill entire hydraulic system if component failure was severe or if hydraulic system is contaminated.

2. Lubricate O–rings and seals with clean hydraulic oil before installing hydraulic components.

3. Make sure caps or plugs are removed from the hydraulic tubes, hydraulic fittings and components before reconnecting.

4. Use proper tightening methods when installing hydraulic hoses and fittings (see Hydraulic Fitting Installation in the General Information section of this chapter).

5. After disconnecting or replacing any hydraulic components, operate machine functions slowly until air is out of system (see Hydraulic System Start Up in this section).

6. Check for hydraulic oil leaks. Shut off engine and correct leaks if necessary. Check oil level in hydraulic pump reservoir and add correct oil if necessary.

Check Hydraulic Lines and Hoses

WARNING

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and cause serious injury. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury. Gangrene may result from such an injury.

Check hydraulic lines and hoses daily for leaks, kinked lines, loose mounting supports, wear, loose fittings, weather deterioration and/or chemical deterioration. Make all necessary repairs before operating machine.

Hydraulic System Start–up

NOTE: When initially starting the hydraulic system with new or rebuilt components (pump, lift cylinder or lift control valve) it is important that this start–up procedure be used. This procedure reduces the chance of damaging the hydraulic system or its components from not purging the system of air.

1. Drain, flush and refill hydraulic reservoir if component failure was severe or if system is contaminated.

2. After the hydraulic system components have been properly installed, make sure hydraulic reservoir is full. Add correct oil if necessary (see Operator's Manual).

3. Make sure all hydraulic connections and lines are secured tightly.

4. Disconnect and ground both spark plug wires to prevent engine from starting.

5. Turn ignition key switch to start; engage starter for ten (10) seconds to prime hydraulic pump. Repeat this step again.

6. Reattach both spark plug wires.

7. Start engine and run at low idle. The hydraulic pump should pick up oil and fill the hydraulic system. If there is no indication of fill in 30 seconds, stop the engine and determine the cause.

8. Raise and lower the coring head numerous times.

9. Stop the machine. Check hydraulic reservoir level and fill if necessary. Check hydraulic components for leaks and tighten any loose connections.

Hydraulic Pump Drive Belt

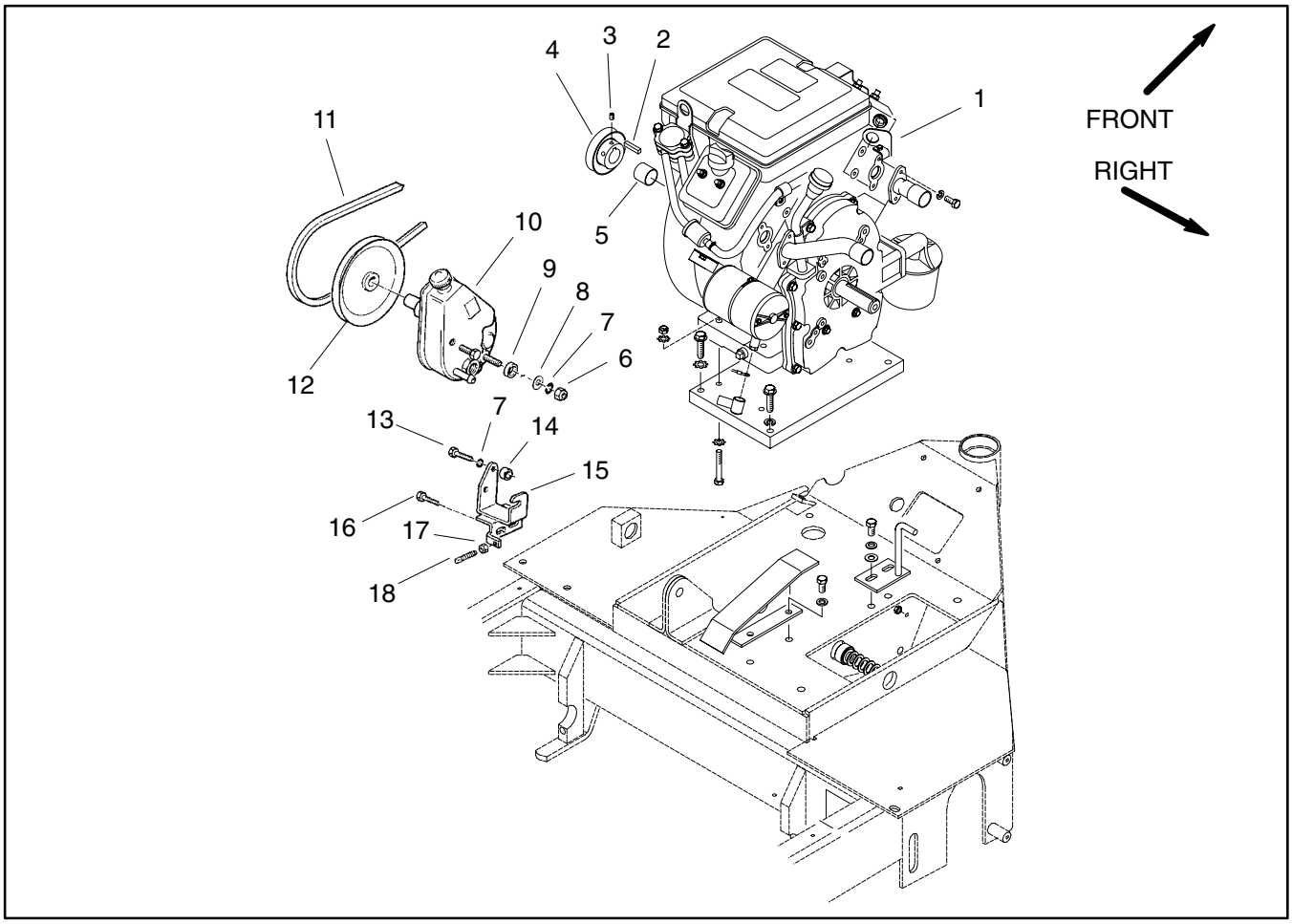

Figure 13

1. **Engine**
2. **Key**
3. **Set screw (2 used)**
4. **Engine pulley**
5. **Shield**
6. **Hex nut**
7. **Lock washer (3 used)**
8. **Flat washer**
9. **Spacer**
10. **Hydraulic pump**
11. **Pump drive belt**
12. **Hydraulic pump pulley**
13. **Cap screw (2 used)**
14. **Spacer (2 used)**
15. **Pump support bracket**
16. **Self tapping screw (2 used)**
17. **Jam nut**
18. **Square head screw**

Drive Belt Removal (Fig. 13)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Remove control cover from machine (Fig. 14).

4. Loosen two (2) self–tapping screws (item 16) that secure pump support bracket to frame. Loosen jam nut (item 17) and then loosen square head screw (item 18) to relax pump drive belt.

5. Remove drive belt from hydraulic pump and engine pulleys.

Drive Belt Installation (Fig. 13)

1. Install pump drive belt to hydraulic pump and engine pulleys.

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

3. Install control cover to machine (Fig. 14).

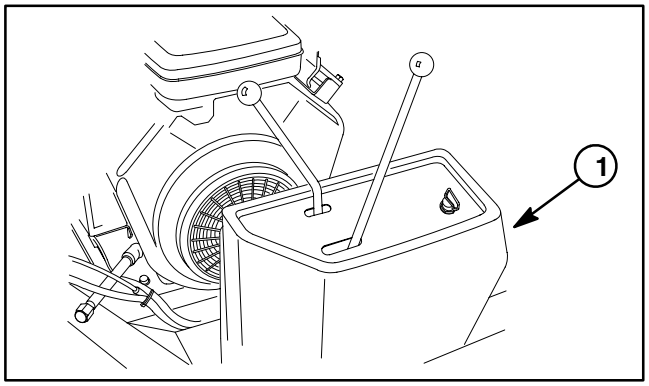

Figure 14

1. Control cover

Hydraulic Pump

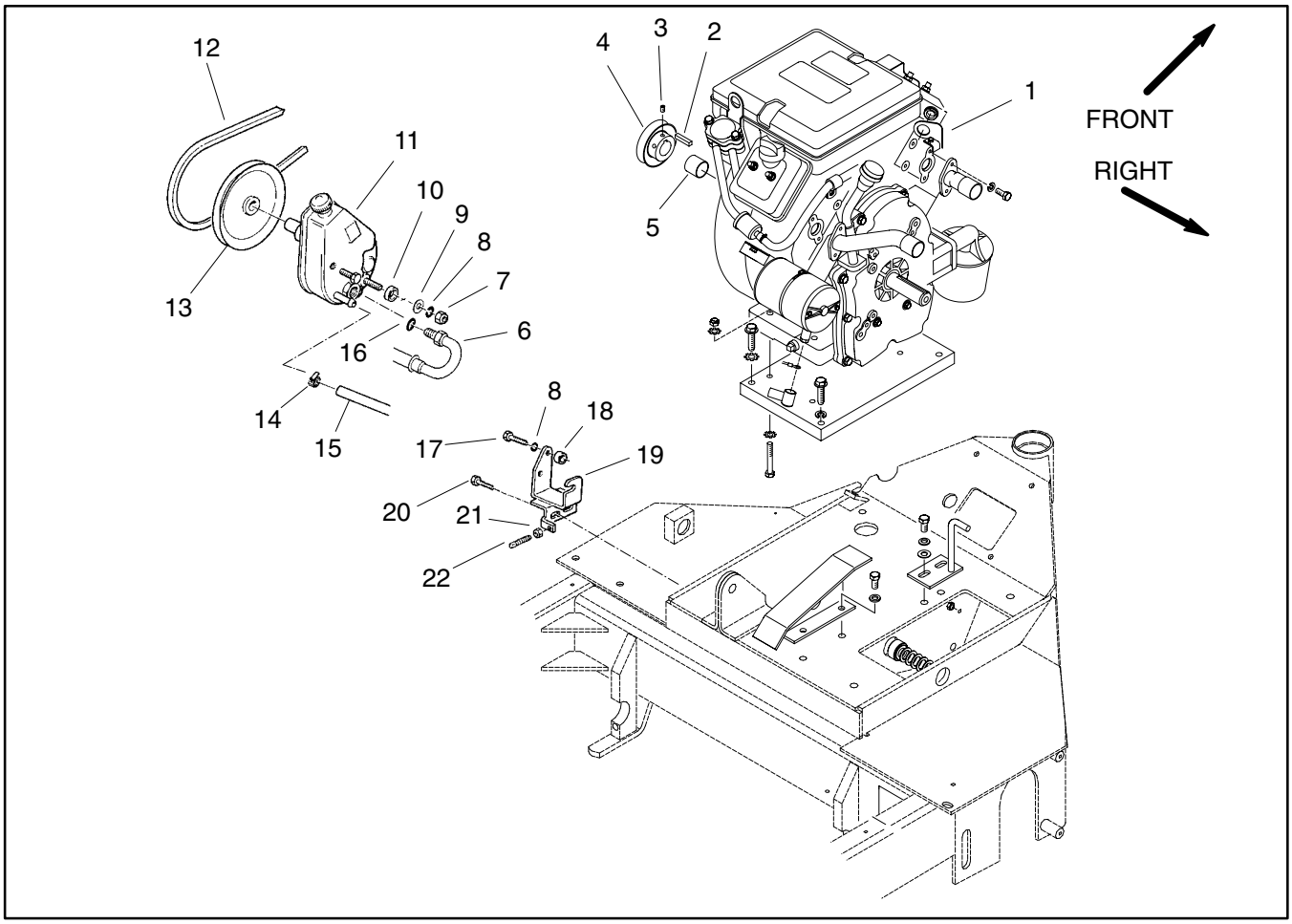

Figure 15

1. **Engine**
2. **Key**
3. **Set screw (2 used)**
4. **Pulley**
5. **Shield**
6. **Hydraulic pressure hose**
7. **Hex nut**
8. **Lock washer (3 used)**
9. **Flat washer**
10. **Spacer**
11. **Hydraulic pump**
12. **Pump drive belt**
13. **Pulley**
14. **Hose clamp**
15. **Return hydraulic hose**
16. **O–ring**
17. **Cap screw (2 used)**
18. **Spacer (2 used)**
19. **Pump support bracket**
20. **Self tapping screw (2 used)**
21. **Jam nut**
22. **Square head screw**

Removal (Fig. 15)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

CAUTION

Operate hydraulic lift control to relieve system pressure and avoid injury from pressurized hydraulic oil.

3. Move lift lever to both raise and lower to make sure that hydraulic system pressure is relieved.

4. Remove control cover from machine (Fig. 16).

5. Position a drain pan under machine below hydraulic pump. Loosen hose clamp (item 14) from return hydraulic hose (item 15) and remove hose from pump fitting to allow pump to drain.

6. Loosen and remove hydraulic pressure hose (item 6) from pump. Locate and discard o–ring (item 16).

7. Loosen two (2) self–tapping screws (item 20) that secure pump support bracket to frame. Loosen jam nut (item 21) and then loosen square head screw (item 22) to relax pump drive belt. Remove drive belt from the hydraulic pump pulley.

8. Plug or cap openings of pump and hoses to prevent contamination.

CAUTION

Support hydraulic pump when removing it from the pump support bracket to prevent the pump from falling and causing personal injury or pump damage.

9. Remove fasteners that secure hydraulic pump to support bracket. Locate and retrieve spacers (items 10 and 18).

10. Lift pump assembly from the machine.

11. Remove hydraulic fitting and o–ring from the pump if required.

Installation (Fig. 15)

1. If removed, install hydraulic fitting with new o–ring to the hydraulic pump.

CAUTION

Support hydraulic pump when removing it from the pump support bracket to prevent the pump from falling and causing personal injury or pump damage.

2. Position hydraulic pump assembly to the support bracket. Secure pump to the pump support with removed fasteners. Make sure that spacers (items 10 and 18) are positioned between bracket and pump.

3. Remove any caps or plugs that were placed in pump openings and hydraulic hoses during the pump removal procedure. Connect hydraulic hoses to hydraulic pump.

4. Install pump drive belt to the pump pulley. Adjust belt tension (see Operator's Manual).

5. Fill pump reservoir with proper oil (see Operator's Manual).

6. Install control cover to machine (Fig. 16).

7. Follow Hydraulic System Start–up procedures.

8. Check for any hydraulic leaks.

9. Raise coring head and return coring head lock–up brackets to stored position.

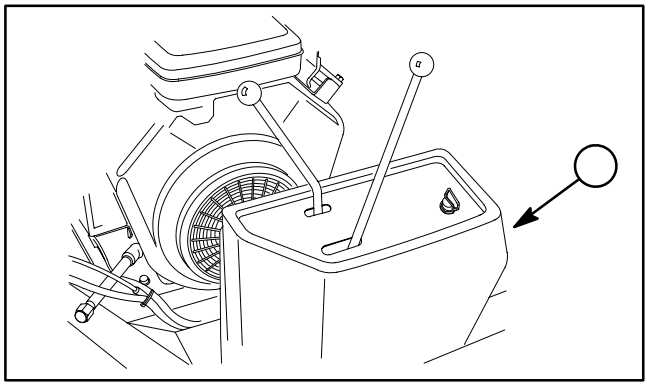

Figure 16

1. Control cover

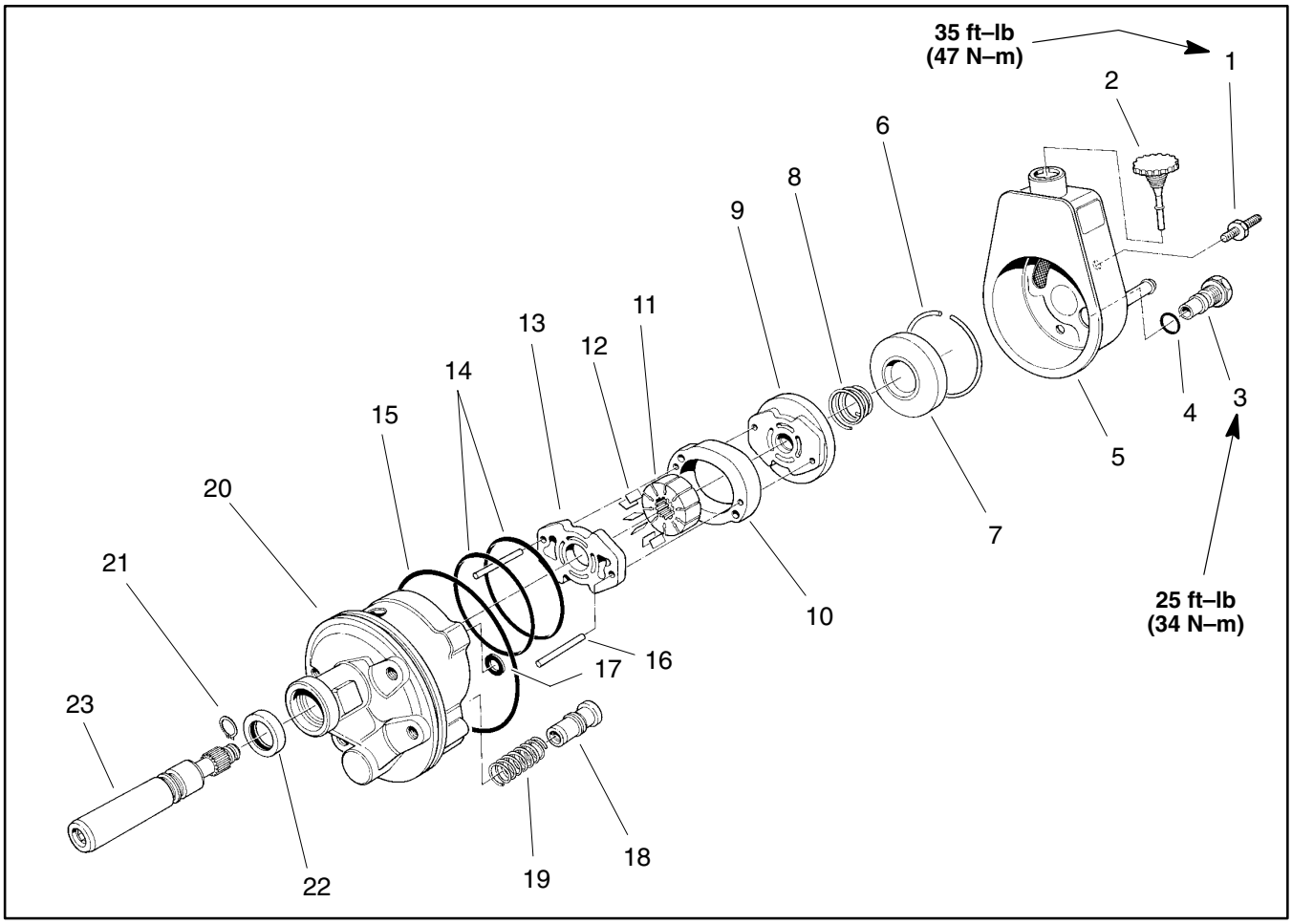

Figure 17

1. Mounting stud (2 used)
2. Reservoir cap/dipstick
3. Hydraulic fitting
4. O–ring
5. Pump reservoir
6. Retaining ring
7. End plate
8. Pressure plate spring
9. Pressure plate
10. Pump ring
11. Rotor
12. Rotor vane (10 used)
13. Thrust plate
14. O–ring
15. O–ring
16. Dowel pin (2 used)
17. Seal (2 used)
18. Control valve
19. Control valve spring
20. Pump housing
21. Retaining ring
22. Seal
23. Drive shaft

Disassembly (Fig. 17)

1. Empty any oil remaining in reservoir into a drain pan. Thoroughly clean the outside of the pump assembly.

2. Using suitable puller, remove pulley from pump shaft. Clean pump shaft with crocus cloth if any corrosion on shaft exists.

3. Remove the pump mounting studs (item 1).

4. Remove the hydraulic fitting (item 3) and o–ring (item 4). Discard o–ring.

5. Turn the pump so the shaft faces up. Remove the control valve (item 18) and control valve spring (item 19).

IMPORTANT: Prevent damage when clamping the pump in a vise. Do not close vise enough to distort pump housing.

6. Mount pump assembly in a vise clamping on the housing around the shaft seal.

7. Using a soft face hammer, tap on pump reservoir (item 5) to remove it from pump housing. Take care not to damage reservoir during removal.

8. Remove o–ring (item 15) and seals (item 17). Retain seals (item 17) to help identify correct replacement seals from seal kit as different thicknesses of seals have been used.

9. Rotate retaining ring (item 6) so end of ring is at hole in pump housing. Insert a punch into hole and remove retaining ring from housing. Remove end plate (item 7) and pressure plate spring (item 8) from pump housing.

IMPORTANT: When removing pressure plate (item 9), pump ring (item 10) and thrust plate (item 13), mark components so that they can be assembled in the same orientation.

10. Lightly tap on end of drive shaft with soft face hammer until pressure plate (item 9) and pump ring (item 10) are free of pump housing. Remove pressure plate.

11. Remove pump ring (item 10) and rotor vanes (item 12) from rotor.

12. Remove retaining ring (item 21) from pump drive shaft.

13. Complete pump disassembly by removing rotor (item 11), thrust plate (item 13), dowel pins (item 16), o–rings (item 14) and shaft seal (item 22).

Inspection

1. Inspect rotating group components:

   A. Inspect rotor vanes for scoring or wear. Also, check the fit of the vanes into the rotor for sticking or excessive play.

   B. Check rotor slots for burrs or excessive wear at thrust faces.

   C. Inspect inner surface of pump ring for scoring or excessive wear.

2. Inspect thrust plate and pressure plate for wear or scoring on thrust surfaces.

3. Inspect drive shaft for scoring or wear.

4. Inspect control valve to make sure it moves freely in valve bore.

5. Replace any components found to be damaged.

Assembly (Fig. 17)

NOTE: During the assembly process, lightly oil all pump components with 10W30 engine oil before installing them.

1. Install two (2) new o–rings (item 14) into pump housing grooves.

2. Install new shaft seal (item 22) into pump housing.

3. Install two (2) dowels pins (item 16) into pump housing.

4. Install thrust plate (item 13) onto drive shaft with countersunk side toward pulley end of shaft. Install rotor (item 11) onto shaft and secure with new retaining ring (item 21).

5. Apply coating of 10W30 engine oil to shaft bearing in pump housing.

6. Install drive shaft assembly into pump housing taking care to not damage shaft seal. Make sure that dowel pins positioned in housing extend through holes in thrust plate.

7. Install rotor vanes (item 12) into rotor making sure that rounded edges face the pump ring location.

8. Install pump ring (item 10) over vanes and rotor using identification mark made during disassembly to correctly position pump ring to thrust plate. Make sure that dowel pins are located in small holes of pump ring and thrust plate recesses are aligned with large holes of pump ring.

9. Install pressure plate (item 9) using identification mark made during disassembly to correctly position plate to pump ring.

10. Install pressure plate spring (item 8) and end plate (item 7). Compress end plate into pump housing to allow retaining ring (item 6) to be installed. Install retaining ring to secure pump assembly.

11. Install new o–ring (item 15) and seals (item 17).

IMPORTANT: Take care to not distort pump reservoir when installing reservoir to pump housing.

12. Carefully install pump reservoir onto pump housing. Install mounting studs (item 1) finger tight to retain reservoir to pump housing.

13. Install control spring (item 19) and control valve (item 18). Make sure that flat end of control valve faces outward.

14. Place new o–ring (item 4) on hydraulic fitting (item 3). Thread fitting into pump and torque fitting from 37 to 55 ft–lb (50 to 75 N–m).

15. Torque mounting studs (item 1) from 26 to 59 ft–lb (35 to 80 N–m).

16. Install pulley onto pump shaft.

Lift Cylinder

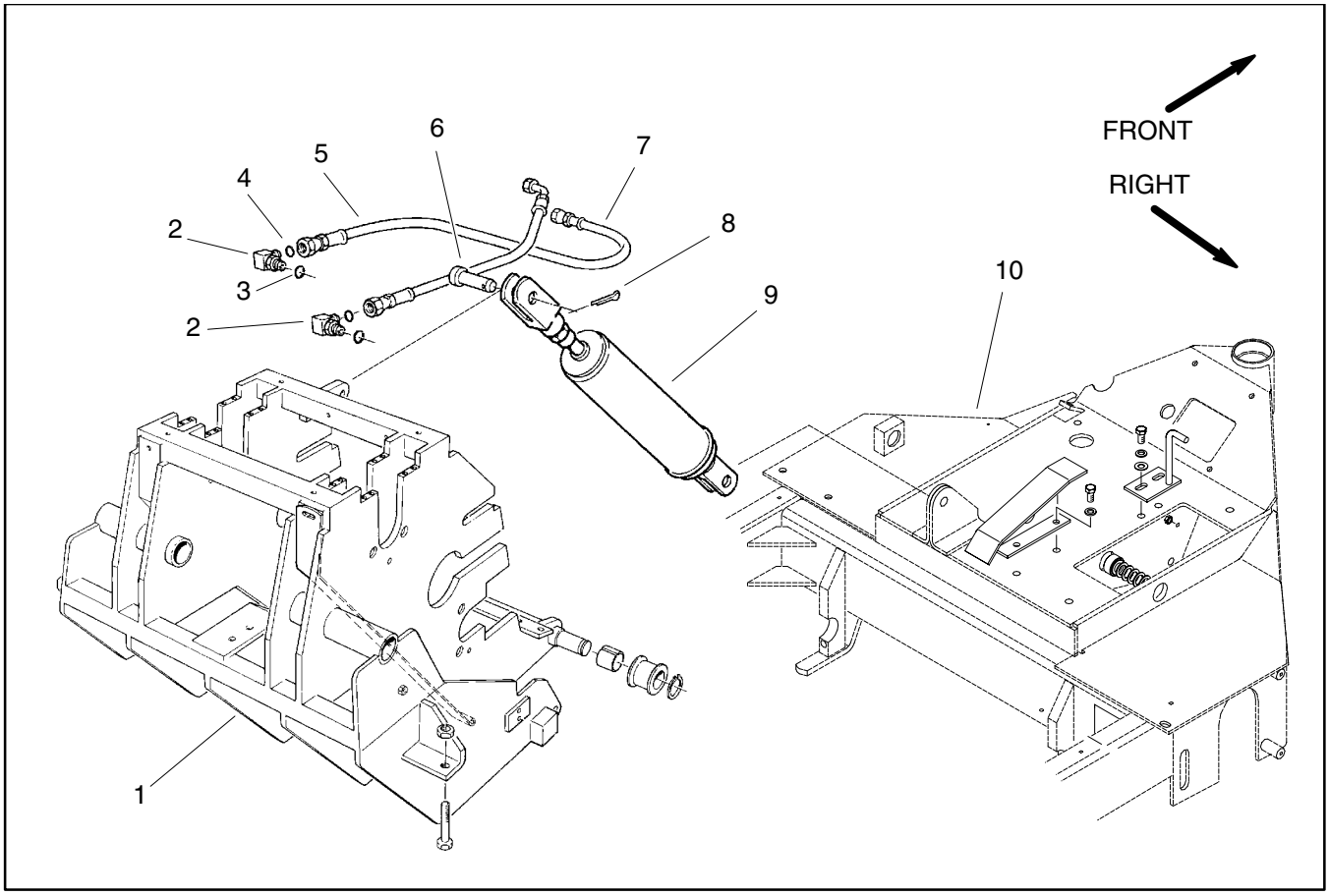

Figure 18

1. **Coring head frame**
2. **90º hydraulic fitting**
3. **O–ring (2 used)**
4. **O–ring (2 used)**
5. **Hydraulic hose**
6. **Clevis pin (2 used)**
7. **Hydraulic hose**
8. **Cotter pin (2 used)**
9. **Lift cylinder**
10. **Main frame**

Removal (Fig. 18)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

CAUTION

Operate hydraulic lift control to relieve system pressure and avoid injury from pressurized hydraulic oil.

3. Move lift lever to both raise and lower to make sure that hydraulic system pressure is relieved.

4. Remove control cover from machine (Fig. 19).

5. Disconnect hydraulic hoses from hydraulic fittings on lift cylinder. Locate and discard o–rings from between hoses and fittings. Allow hoses to drain into a suitable container.

6. Plug disconnected hoses and fittings to prevent contamination.

7. Support lift cylinder to prevent it from falling. Remove cotter pins and clevis pins that secure lift cylinder to coring head and machine frame.

8. Remove lift cylinder from the machine.

9. If needed, remove hydraulic fittings and o–rings from the lift cylinder. Discard o–rings.

Installation (Fig. 18)

1. If removed, install hydraulic fittings and new o–rings into lift cylinder.

2. Position lift cylinder to the machine mounting points. Make sure the ports of the lift cylinder face the left side of the machine.

3. Align lift cylinder mounting holes with frame and coring head mounts. Install clevis pins and secure with cotter pins.

4. Remove plugs from disconnected hoses and fittings.

5. Connect hydraulic hoses with new o–ring to hydraulic fittings on lift cylinder. Tighten hose connections.

6. Install control cover to machine (Fig. 19).

7. Check hydraulic oil level in pump reservoir and fill with proper if necessary (see Operator's Manual).

8. Follow Hydraulic System Start–up procedures.

9. Raise coring head and raise lock–up brackets on each side of machine.

10. Check hydraulic components for leaks.

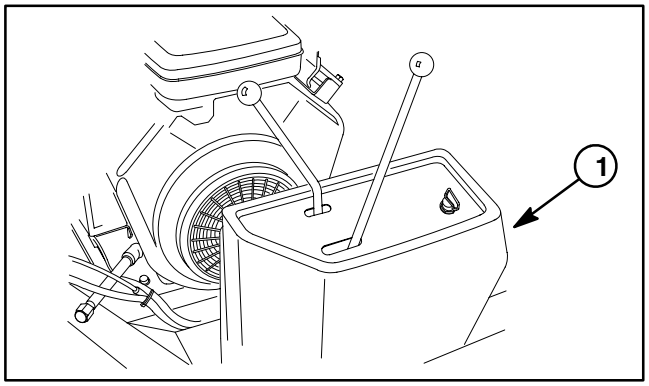

Figure 19

1. Control cover

Lift Cylinder Service

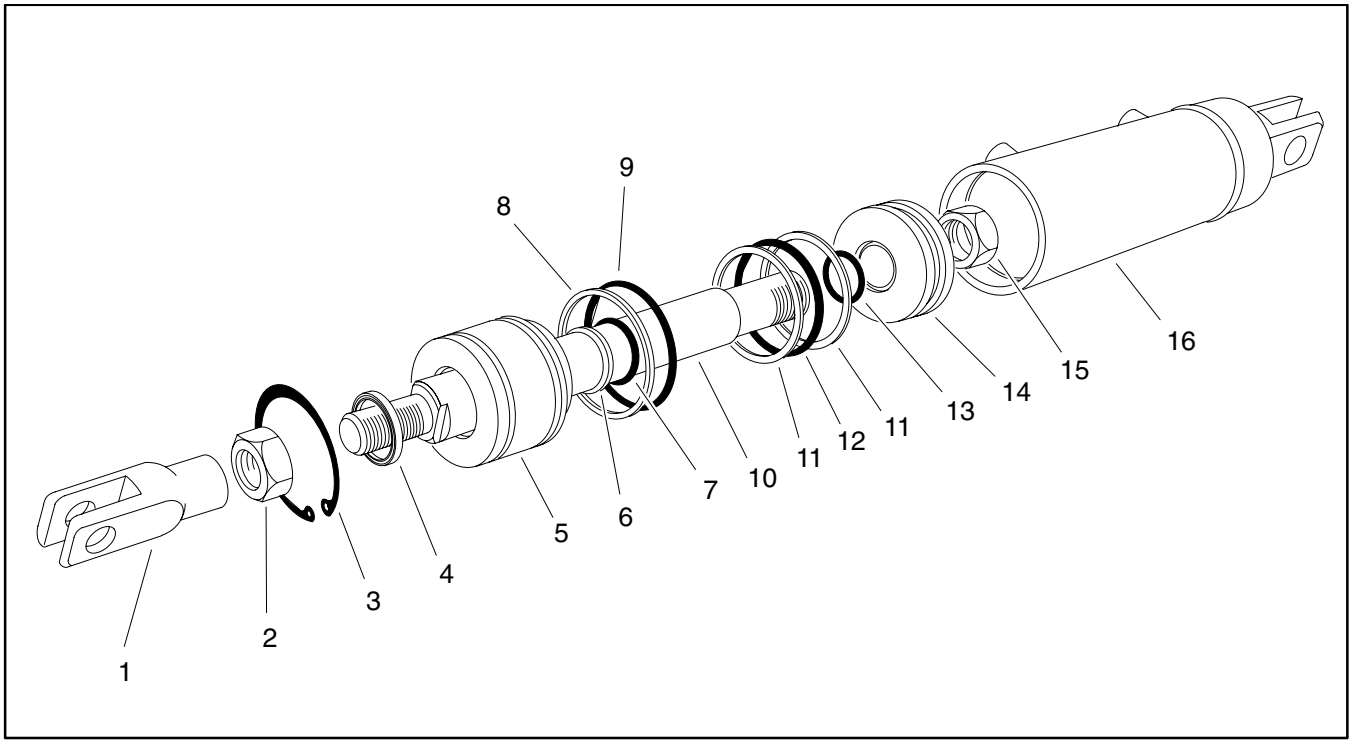

Figure 20

1. **Rod clevis**
2. **Jam nut**
3. **Retaining ring**
4. **Dust seal**
5. **Head**
6. **Back–up ring**
7. **O–ring**
8. **Back–up ring**
9. **O–ring**
10. **Rod**
11. **Back–up ring**
12. **O–ring**
13. **O–ring**
14. **Piston**
15. **Lock nut**
16. **Barrel**

Disassembly (Fig. 20)

1. Remove oil from the lift cylinder into a drain pan by **slowly** pumping the cylinder rod. Plug port and clean the outside of the lift cylinder.

IMPORTANT: Prevent damage when clamping the lift cylinder into a vise; clamp on the pivot only. Do not close vise enough to distort barrel.

2. Mount lift cylinder in a vise so that the shaft end tilts up slightly.

3. Remove retaining ring (item 3) that retains head in barrel.

4. Extract rod, head and piston by carefully twisting and pulling on the rod clevis.

IMPORTANT: Do not clamp vise jaws against rod surface. Protect rod surface before mounting in vise.

5. Mount rod securely in a vise by clamping vise on the flats of the rod clevis. Remove lock nut (item 15) from rod and carefully slide piston and head from the rod.

6. Remove and discard o–rings (items 12 and 13) and back–up rings (item 11) from the piston.

7. Remove and discard o–rings (items 7 and 9), back–up rings (items 6 and 8) and dust seal (item 4) from the head.

8. If necessary, loosen jam nut (item 2) and remove clevis (item1) from rod.

Inspection

CAUTION

Use eye protection such as goggles when using compressed air

1. Wash all parts in solvent. Dry parts with compressed air.

2. Inspect internal surface of barrel for deep scratches, out–of–roundness and bending. Replace if worn or damaged.

3. Inspect rod, piston and head for excessive pitting, scoring or wear. Replace any worn or damaged parts.

Assembly (Fig. 20)

1. Coat new o–rings (items 7, 9, 12 and 13), back–up rings (item 6, 8 and 11) and dust seal (item 4) with clean 10W30 engine oil. Carefully install sealing components to the head and piston.

2. If removed, thread jam nut (item 2) and clevis (item1) onto rod.

IMPORTANT: Do not clamp vise jaws against rod surface. Protect rod surface before mounting in vise.

3. Mount rod securely in a vise by clamping vise on the flats of the rod clevis. Carefully slide piston and head assemblies onto the rod. Secure piston to shaft with locknut.

4. Remove rod assembly from vise.

IMPORTANT: Prevent damage when clamping the barrel into a vise; clamp on the pivot end only. Do not close vise enough to distort tube.

5. Mount barrel in a vise so that the rod end tilts up slightly.

6. Coat all internal lift cylinder parts with a light coating of clean 10W30 engine oil. Slide rod, piston and head assembly into barrel being careful not to damage the seals.

7. Secure head in barrel by installing retaining ring (item 3).

8. Check that length of cylinder when fully extended is from 19 to 19.5 in (48.3 to 49.5 cm) (Fig. 21). If needed, loosen jam nut and adjust clevis position on rod to allow proper cylinder length.

9. Make sure that jam nut is fully tightened after assembly of lift cylinder.

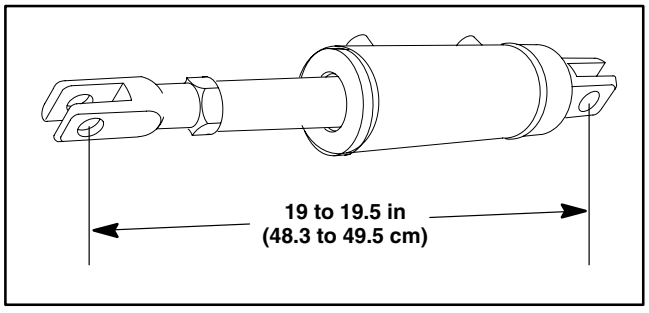

Figure 21

Lift Control Valve

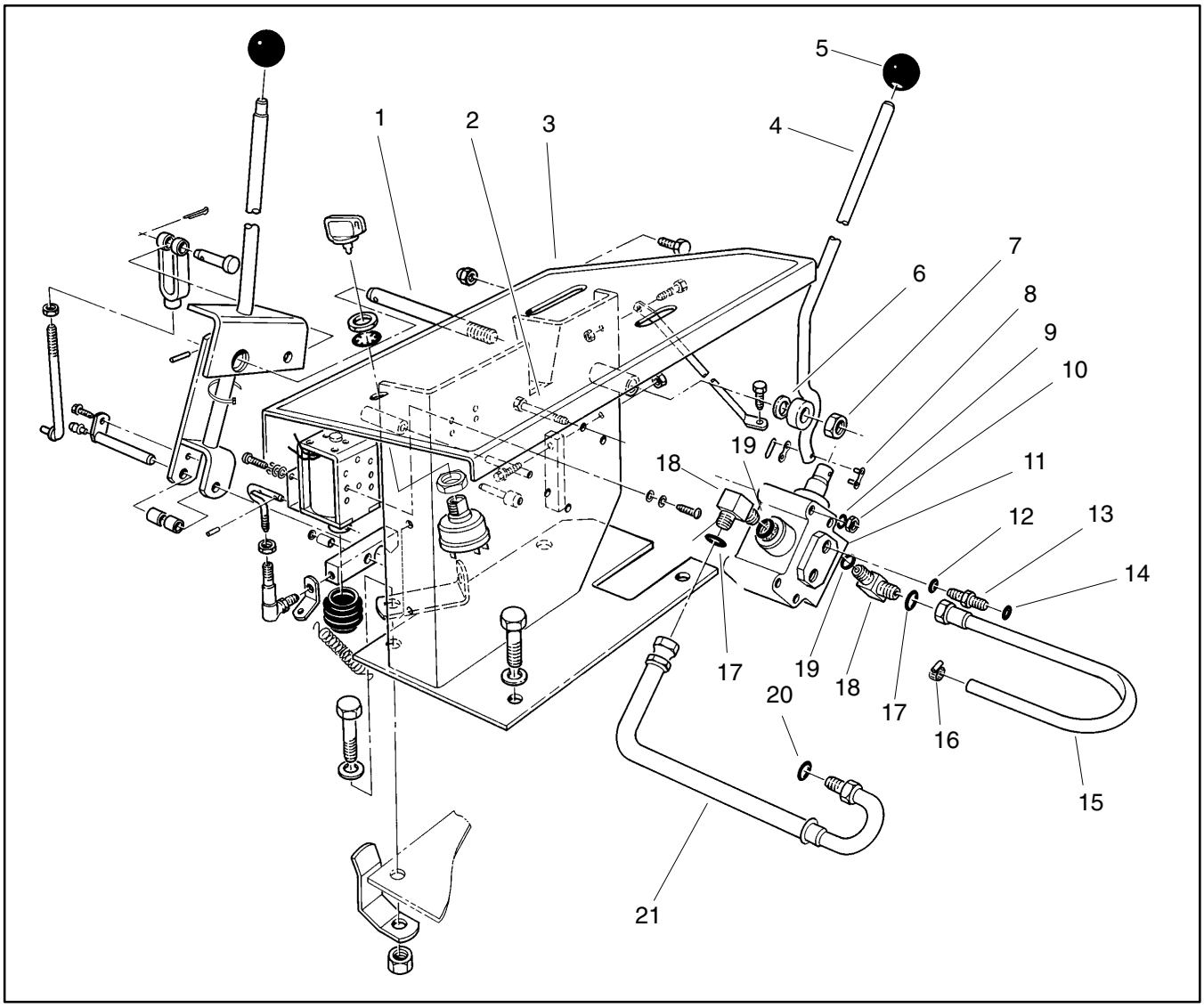

Figure 22

1. **Shaft**
2. **Cap screw (4 used)**
3. **Control panel**
4. **Lift valve handle**
5. **Knob**
6. **Flat washer**
7. **Lock nut**
8. **Connecting link**
9. **Lock washer (4 used)**
10. **Hex nut (4 used)**
11. **Lift control valve**
12. **O–ring (2 used)**
13. **Straight fitting (2 used)**
14. **O–ring (2 used)**
15. **Hydraulic return hose**
16. **Hose clamp**
17. **O–ring**
18. **90º hydraulic fitting**
19. **O–ring**
20. **O–ring**
21. **Hydraulic hose**

Removal (Fig. 22)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

CAUTION

Operate hydraulic lift control to relieve system pressure and avoid injury from pressurized hydraulic oil.

3. Move lift lever to both raise and lower to make sure that hydraulic system pressure is relieved.

4. Remove control cover from machine (Fig. 23).

5. Disconnect hydraulic hoses (items 15 and 21) from 90º hydraulic fittings (item 18) on lift control valve. Allow hoses to drain into a suitable container. Discard o–rings.

6. Tag hydraulic hoses attached to straight fittings in lift control valve ports A and B. Disconnect hoses and allow them to drain into a suitable container. Discard o–rings.

7. Remove connecting link assembly (item 8) that attaches lift valve handle to lift control.

8. Remove four (4) hex nuts (item 10), lock washers (item 9) and cap screws (item 2) that secure control valve to control panel.

9. Remove control valve from the machine.

10. If necessary, remove hydraulic fittings from control valve. Discard o–rings.

Installation (Fig. 22)

1. If fittings were removed from control valve, lightly lubricate new o–rings with clean 10W30 engine oil and install fittings to control valve.

2. Position control valve (1) to machine and secure with four (4) cap screws (item 2), lock washers (item 9) and hex nuts (item 10).

3. Attach lift valve handle to lift control with connecting link assembly (item 8).

4. Lightly lubricate new o–rings with clean 10W30 engine oil and correctly connect hydraulic hoses to fittings on lift control valve.

5. Check oil level in hydraulic reservoir and fill if necessary. Check hydraulic components for leaks and tighten any loose connections.

6. Install control cover (Fig. 23).

7. Raise coring head and raise lock–up brackets on each side of machine.

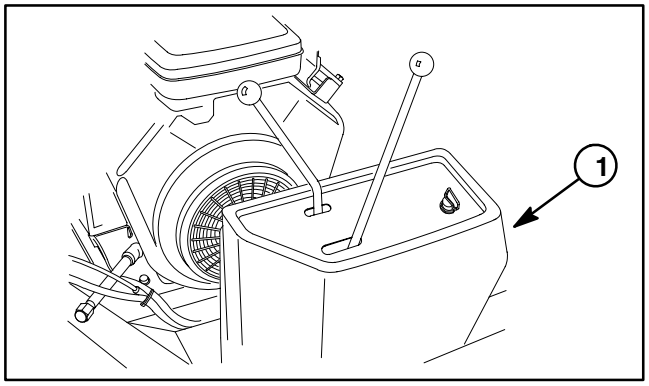

Figure 23

1. Control cover

Lift Control Valve Service

Disassembly (Fig. 24)

1. Wash control valve in solvent and dry it thoroughly.

2. Mount control valve into a vise so the mounting pads are against the jaws of the vice and snap ring faces up.

NOTE: Remove check valve seat only if it needs replacement; it is pressed into the valve body.

3. Remove plugs and o–rings from the valve body. Remove springs, balls and cam pins from the valve body.

4. Remove snap ring from the bottom of the valve body. Remove spool snap ring, spring retainer, spacer and spring.

5. Push and twist spool carefully out of the valve body. Set spool aside.

6. Remove o–rings from valve body using a soft hooked scribe or a thin screwdriver taking care not to scratch the valve bore finish.

Inspection (Fig. 24)

CAUTION

Use eye protection such as goggles when using compressed air

1. Wash all parts in solvent. Dry parts with compressed air.

2. Inspect spool for bending and flatness. Signs of wear on one side of the spool may indicate damage. Replace a worn or damaged spool if necessary.

3. Inspect other components for wear or damage, and replace damaged items as necessary.

Assembly (Fig. 24)

1. Coat all new o–rings with 10W30 engine oil. Install new o–rings into the bore of the valve body.

2. Coat spool lightly with 10W30 engine oil. Push and twist spool carefully into the valve body. Avoid damaging o–rings.

3. Install spring retainer, spring, spacer, second spring retainer and spool snap ring onto the spool. Install snap ring into the valve body.

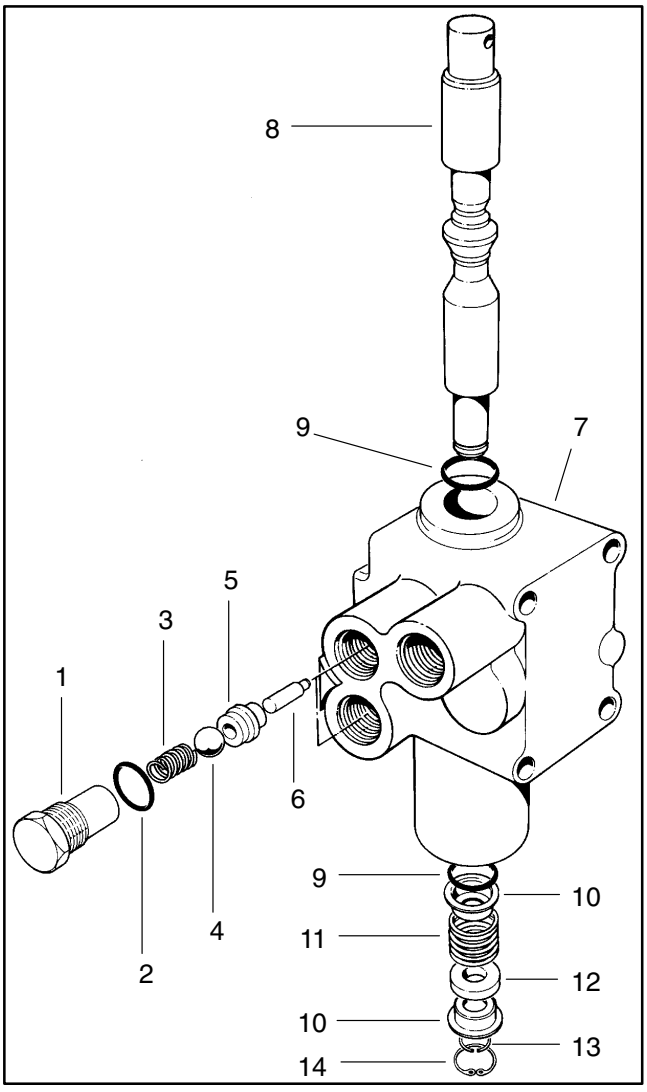

Figure 24

1. **Plug**
2. **O–ring**
3. **Spring**
4. **Ball**
5. **Check valve seat**
6. **Cam pin**
7. **Control valve body**
8. **Spool**
9. **O–ring**
10. **Spring retainer**
11. **Spring**
12. **Spacer**
13. **Spool snap ring**
14. **Snap ring**

4. If check valve seat was damaged and removed, press fit replacement into the valve body.

5. Lubricate and install cam pin, ball and spring. Place new o–ring on plug and install into the valve body. Tighten plug.

6. Repeat steps 4 and 5 for the second plug assembly.

Chapter 5

Electrical System

Table of Contents

Electrical Diagrams

The electrical schematic and wire harness drawings for the Greens Aerator are located in Chapter 9 – Electrical Diagrams.

Special Tools

Multimeter

The multimeter can test electrical components and circuits for current (amps), resistance (ohms) or voltage.

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

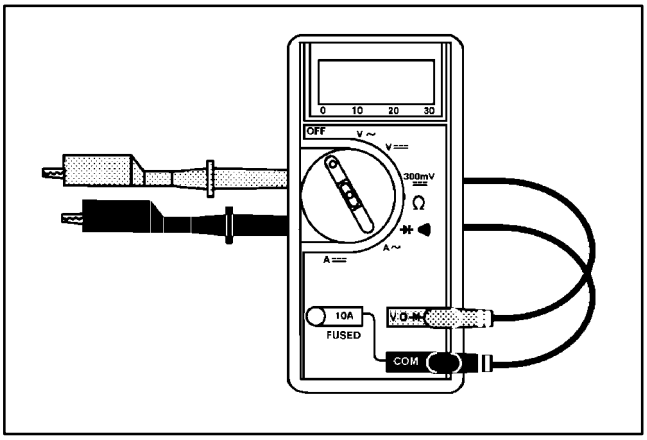

Figure 1

Battery Terminal Protector

Battery Terminal Protector (Toro Part No. 107–0392) is an aerosol spray that should be used on battery terminals to reduce corrosion problems. Apply terminal protector after battery cable has been secured to battery terminal.

Figure 2

Battery Hydrometer

Use the Battery Hydrometer when measuring specific gravity of battery electrolyte. Obtain this tool locally.

Figure 3

Troubleshooting

CAUTION

Remove all jewelry, especially rings and watches, before doing any electrical trouble-shooting or testing. Disconnect the battery cables unless the test requires battery voltage.

For effective troubleshooting and repairs, you must have a good understanding of the electrical circuits (see Chapter 9 – Electrical Diagrams) and components used on this machine.

If the machine has any interlock switches by–passed, they must be reconnected for proper troubleshooting and safety.

Starting Problems

Problem	Possible Causes
Starter solenoid clicks, but starter will not crank (If starter solenoid clicks, problem is **not** in safety interlock system).	Battery charge is low. Battery cables are loose or corroded. Battery ground to frame is loose or corroded. Wiring at starter is faulty. Starter solenoid is faulty. Starter mounting bolts are loose or not supplying a sufficient ground for solenoid. Starter is faulty.
Nothing happens when start attempt is made (gear shift lever must be in neutral position and traction drive must be in neutral for successful start).	Battery cables are loose or corroded. Battery ground to frame is loose or corroded. Battery is discharged or faulty. Coring head is not raised. 20 amp fuse is faulty. Coring head switch(es) is/are faulty. Wiring to start circuit components is loose, corroded, or damaged (see Chapter 9 – Electrical Diagrams). Ignition switch is faulty. Starter solenoid is faulty.

Starting Problems (continued)

Problem	Possible Causes
Engine cranks, but does not start.	Circuit wiring to engine magneto is grounded (see Chapter 9 – Electrical Diagrams). Circuit wiring to carburetor solenoid is loose, corroded or damaged (see Chapter 9 – Electrical Diagrams). Engine stop relay is faulty. Ignition switch is faulty. Engine or fuel system is malfunctioning (see Chapter 3 – Engine). Engine may be too cold.

General Run Problems

Problem	Possible Causes
Battery does not charge.	Wiring to the charging circuit components is loose, corroded or damaged (see Chapter 9 – Electrical Diagrams). Ignition switch is faulty. Battery is faulty. Engine alternator is faulty (see Chapter 3 – Engine).
Engine kills during operation.	Interlock switch on handle is not depressed. Ignition switch is faulty. Engine stop relay is faulty. Interlock switch(es) on handle is/are faulty. Coring head switch(es) is/are faulty. Circuit wiring to engine magneto is damaged (see Chapter 9 – Electrical Diagrams). Circuit wiring to carburetor solenoid is loose, corroded or damaged (see Chapter 9 – Electrical Diagrams). Engine or fuel system is malfunctioning (see Chapter 3 – Engine).

Electrical System Quick Checks

Battery Test (Open Circuit Test)

Use a multimeter to measure the voltage between the battery terminals.

Set the multimeter to the DC volts setting. The battery should be at a temperature of 60º to 100º F (16º to 38º C). The ignition key should be in the OFF position and all accessories turned off. Connect the positive (+) meter lead to the positive battery post and the negative (–) meter lead to the negative battery post. Use the table to the right to determine charge level of the battery.

NOTE: This test provides a relative condition of the battery. Load testing of the battery will provide additional and more accurate information.

Voltage Measured	Battery Charge Level
12.68 v (or higher)	Fully charged (100%)
12.45 v	75% charged
12.24 v	50% charged
12.06 v	25% charged
11.89 v	0% charged

Charging System Test

This is a simple test used to determine if the charging system is functioning. It will tell you if the charging system has an output, but not its capacity.

Use a multimeter set to the DC volts position. Connect the positive (+) meter lead to the positive battery post and the negative (–) meter lead to the negative battery post. Leave the multimeter test leads connected to the battery and record the battery voltage.

NOTE: Upon starting the engine, the battery voltage will drop and then should increase once the engine is running.

NOTE: Depending upon the condition of the battery charge and battery temperature, the charging system voltage will increase at different rates as the battery charges.

Start the engine and run at 3600 RPM (high idle). Allow the battery to charge for at least 3 minutes. Record the battery voltage.

After allowing the engine to run for at least three (3) minutes, battery voltage should be at least 0.5 volts higher than initial battery voltage (see example in table to the right).

NOTE: While engine is running, if battery voltage exceeds 15 volts, the regulator in the charging system should be inspected (see the engine Repair Manuals located after Chapter 3).

After allowing the engine to run for at least three (3) minutes, if battery voltage does not increase at least 0.5 volts, additional testing of the battery and/or charging system should be performed.

Acceptable voltage increase:	
Initial Battery Voltage	= 12.25 v
Battery Voltage after 3 Minute Charge	= 12.80 v
Difference	= +0.55 v

Check Operation of Safety Interlock System

CAUTION

Do not disconnect interlock switches. They are for the operator's protection. Check operation of the switches daily to make sure the interlock system is operating correctly. If a switch is not operating properly, adjust or replace it before operating the machine.

Interlock switch operation is described in the Greens Aerator Operator's Manual. Testing of individual interlock switches is included in the Component Testing section of this Chapter.

The Safety Interlock System of the Greens Aerator ensures the following operations:

1. The engine should crank only when the traction drive lever is disengaged and the coring head is raised.

2. With the transaxle in gear and the coring head operating, if one of the handle interlock levers is not gripped, the engine should stop running.

3. With the transaxle in gear and the coring head raised and disengaged (transport), if one of the handle interlock levers is not gripped, the traction clutch should disengage and the brake should apply at the same time. The engine should continue to run.

Component Testing

For accurate resistance and/or continuity checks, electrically disconnect the component being tested from the circuit (e.g. unplug the ignition switch connector before doing a continuity check).

NOTE: Electrical troubleshooting of any 12 Volt power connection can be performed through voltage drop tests without disconnecting the component.

NOTE: See the appropriate engine Repair Manual located after Chapter 3 for engine component testing information.

CAUTION

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

Ignition Switch

The ignition (key) switch has three positions (OFF, RUN, and START) (Fig. 4). The terminals are marked as shown in Figure 5.

Testing

The circuitry of the ignition switch is shown in the chart below. 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.

Unplug wire harness connectors from switch and verify continuity between switch terminals. Reconnect the harness connectors to the switch after testing.

POSITION	CIRCUIT
OFF	G + M + A
RUN	B + L + A
START	B + L + S

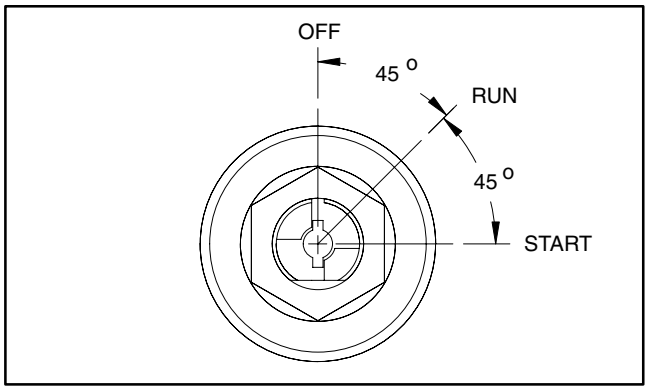

Figure 4

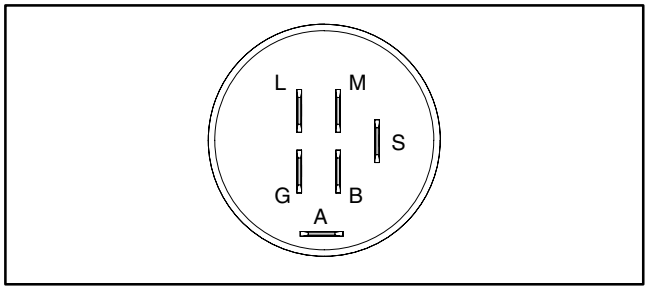

Figure 5

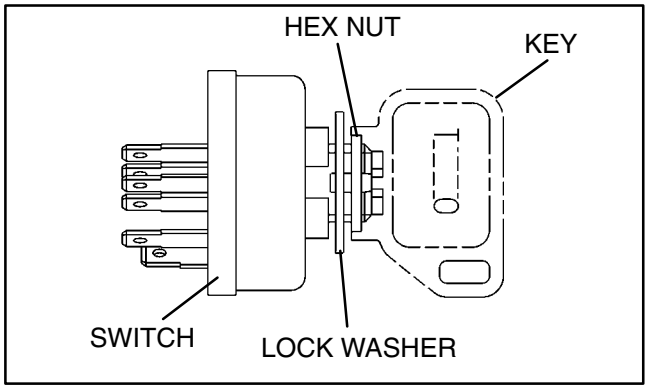

Figure 6

Engine Stop Relay

The Greens Aerator uses a relay for grounding the engine magneto and thus, stopping the engine. This relay is located under the console (Fig. 7).

Testing

NOTE: Prior to taking small resistance readings with a digital multimeter, short the meter test leads together. The meter will display a small resistance value (usually 0.5 ohms or less). This resistance is due to the internal resistance of the meter and test leads. Subtract this value from from the measured value of the component you are testing.

1. Verify coil resistance between terminals 85 and 86 with a multimeter (ohms setting). Resistance should be from 70 to 95 ohms.

2. Connect multimeter (ohms setting) leads to relay terminals 30 and 87. Ground terminal 86 and apply +12 VDC to terminal 85. The relay should make and break continuity between terminals 30 and 87 as +12 VDC is applied and removed from terminal 85.

3. Disconnect voltage from terminal 85 and multimeter lead from terminal 87.

4. Connect multimeter (ohms setting) leads to relay terminals 30 and 87A. Apply +12 VDC to terminal 85. The relay should make and break continuity between terminals 30 and 87A as +12 VDC is applied and removed from terminal 85.

5. Disconnect voltage and multimeter leads from the relay terminals.

Figure 7

1. Engine stop relay

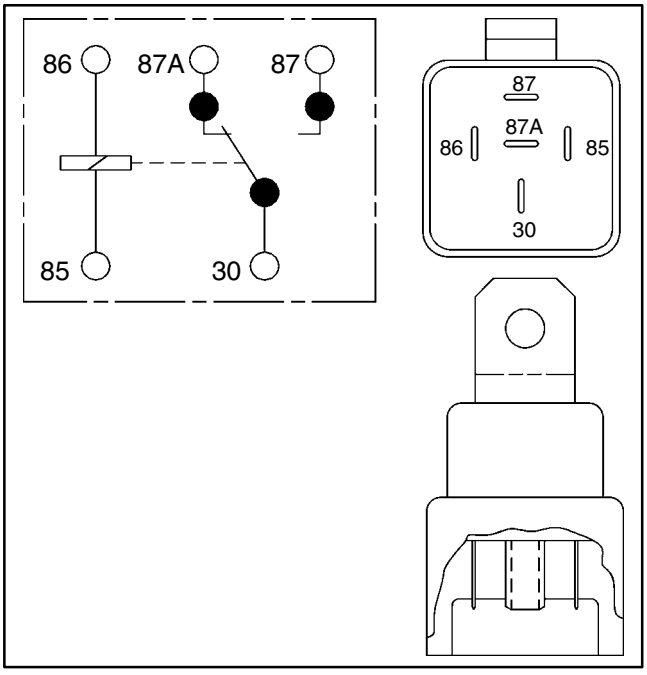

Figure 8

Interlock Lever Switches

The two interlock lever switches are located on the handle (Fig. 9). The lever switches are normally open and close when the lever is raised to the handle. The interlock lever switches are used to permit engine operation when the coring head is lowered and also allows the traction drive lever to be retained in the engaged position.

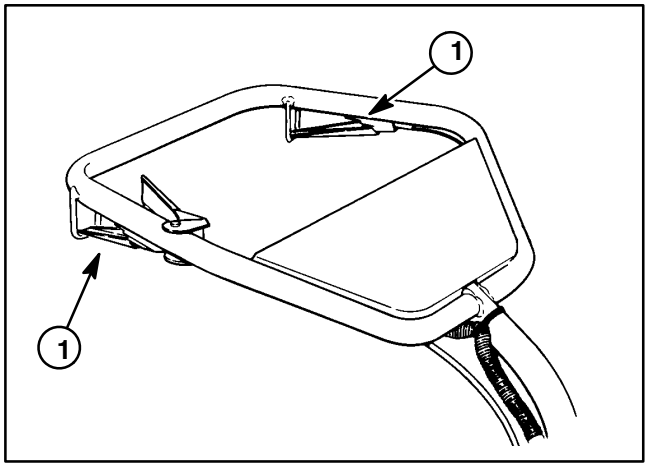

Figure 9

1. Interlock lever

Testing

1. Unplug the switch connector from the machine harness.

2. With the use of a multimeter (ohms setting), determine whether continuity exists between the switch connector terminals for each switch position.

   A. With the lever extended away from the handle, there should be no continuity (open) between the switch terminals.

   B. When the lever is raised to the handle, there should be continuity (closed) between the switch terminals.

3. Replace the interlock lever switch if necessary.

4. After testing, plug the switch connector into the machine harness.

Traction Interlock Switch

The traction interlock switch is attached to the shift plate at the front of the aerator (Fig. 10). The greens aerator uses the normally open (center) and common (ground) terminals of the switch (Fig 11).

When the gear shift lever is in a gear, the switch plunger is depressed and the switch should be closed (continuity). When shifting gears, the switch plunger extends and the switch should open (no continuity).

The interlock switch can be adjusted by loosening the mounting screws and repositioning the switch.

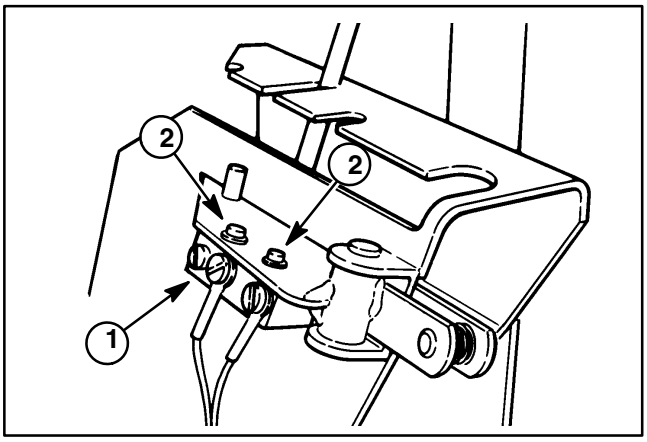

Figure 10

1. Traction interlock switch **2. Mounting screw**

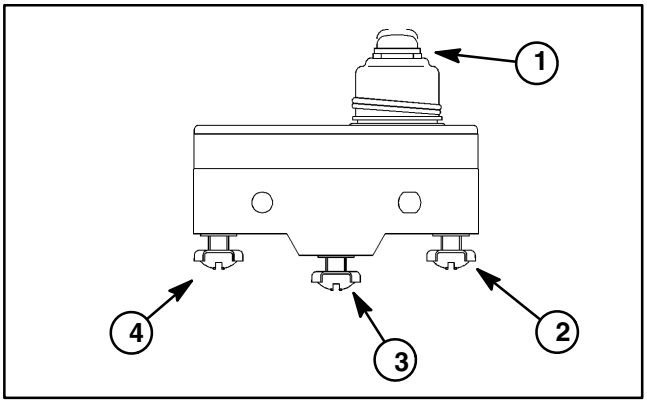

Figure 11

1. Plunger
2. Common (ground)
3. Normally open
4. Normally closed

Coring Head Switch Assembly

The coring head switch assembly monitors the position of the coring head (raised or lowered) for correct aerator operation. This switch includes two (2) normally open ball switches, one (1) normally closed ball switch, a spring loaded plunger and a housing (Fig. 13).

The plunger in the switch assembly is extended when the coring head is lowered. In this position, the switches are in their normal states (two are open and one is closed).

The plunger in the switch assembly is pushed in when the coring head is raised. In this position, the switches are **not** in their normal states (two are closed and one is open).

The adjustment procedure for the coring head switch assembly is included in Operator's Manual.

Testing

The switch can be tested for continuity at the wire harness connector as shown in Figure 14.

When the switch plunger is extended, continuity should exist across harness connector terminals B and C. Continuity should **not** exist between any other connector terminals.

When the switch plunger is pushed in, continuity should exist across harness connector terminals A and B and also between terminals C and D. Continuity should **not** exist between any other connector terminals.

If necessary, switch testing can be done at the switch terminals

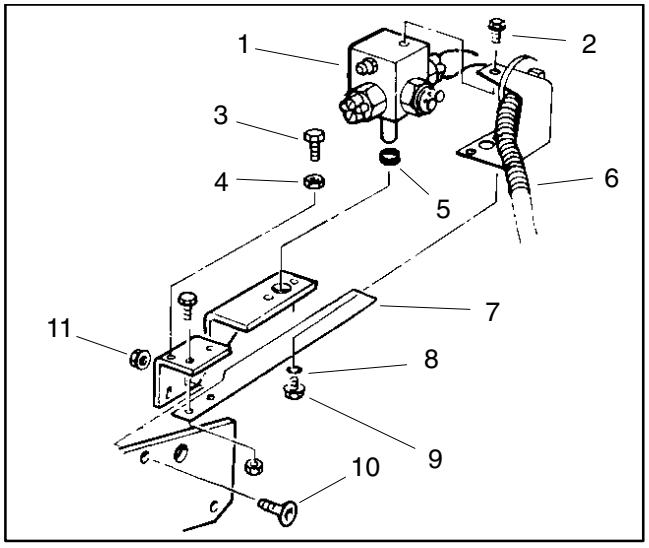

Figure 12

1. **Coring Head Switch**
2. **Self tapping screw**
3. **Adjustment screw**
4. **Jam nut**
5. **Seal**
6. **Switch harness**
7. **Switch actuator**
8. **Lock washer (2 used)**
9. **Screw (2 used)**
10. **Screw (2 used)**
11. **Flange nut (2 used)**

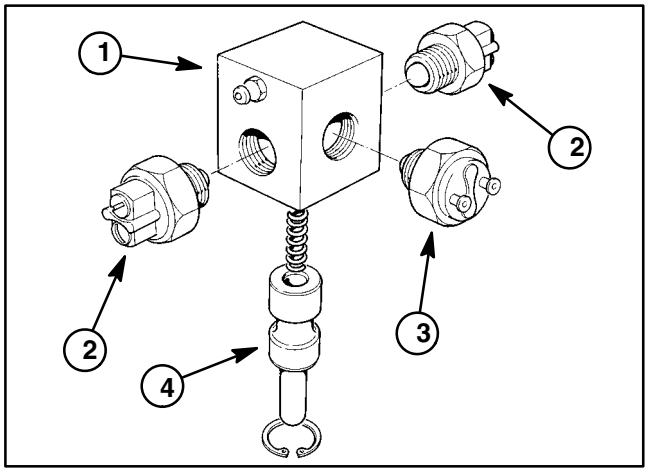

Figure 13

1. **Switch housing**
2. **Switch: normally open**
3. **Switch: normally closed**
4. **Switch plunger**

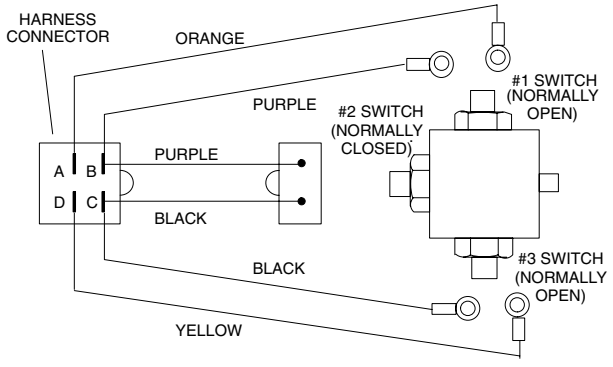

Figure 14

Clutch Solenoid

The clutch solenoid is used in conjunction with the traction interlock switch, the coring head switch assembly and the interlock lever switches in the Greens Aerator interlock system. When the clutch solenoid is energized, the solenoid plunger rotates a latch which retains the traction drive lever in the engaged position for continued traction drive operation as long as the solenoid is energized.

Testing

1. Make sure engine is off. Disconnect battery. Unplug solenoid from machine wire harness.

2. Apply 12 VDC directly across the clutch solenoid connector terminals. The solenoid should click and the solenoid shaft should retract. The shaft should stay retracted as long as the voltage is applied to the terminals.

3. Remove voltage from solenoid coil posts. The solenoid shaft should extend.

4. Replace clutch solenoid if necessary.

5. Reconnect electrical connections to solenoid.

6. Reconnect battery.

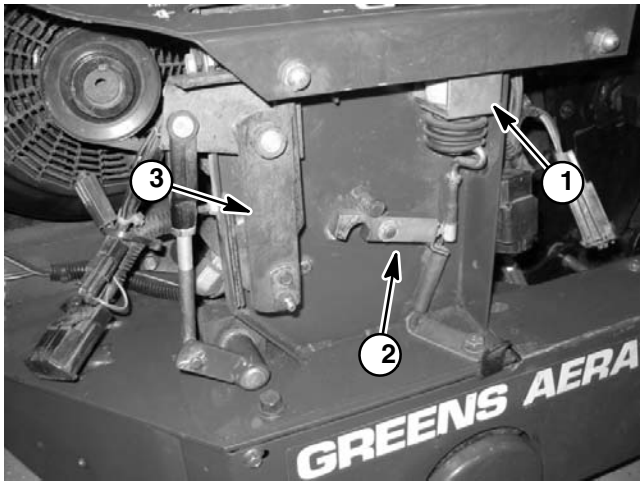

Figure 15

1. **Clutch solenoid**
2. **Latch**
3. **Traction drive lever**

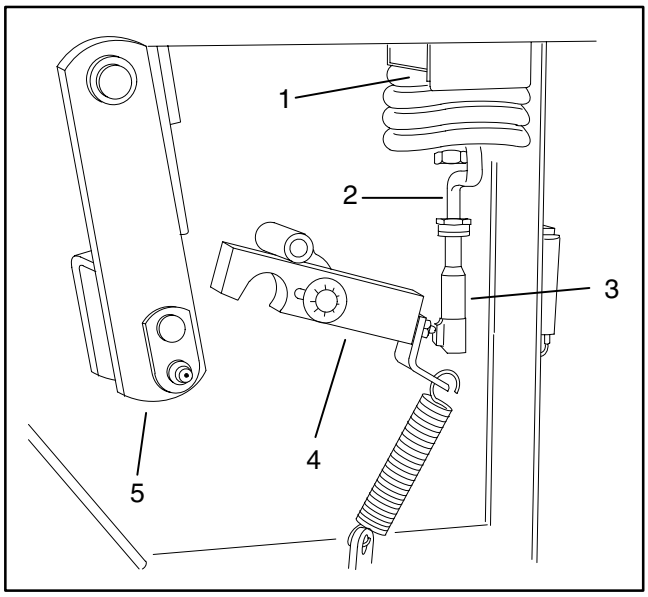

Figure 16

1. **Clutch solenoid**
2. **Adjusting rod**
3. **Ball joint**
4. **Latch**
5. **Traction drive lever**

Engine Starter Solenoid

The engine starter solenoid is attached to a bracket on the starter motor (Fig. 17).

Testing

1. Make sure engine is off. Disconnect battery. Disconnect solenoid electrical connections.

2. Apply 12 VDC directly across the solenoid coil posts. The solenoid should click. Make sure resistance across the main contact posts is less than 1 ohm (continuity).

3. Remove voltage from solenoid coil posts. The solenoid should click. Make sure resistance across the main contact posts is infinite ohms (no continuity).

4. Replace starter solenoid if necessary.

5. Reconnect electrical connections to solenoid. Torque nuts on coil posts from 15 to 20 in–lb (1.7 to 2.3 N–m) and nuts on main contact posts from 50 to 60 in–lb (5.7 to 6.8 N–m).

6. Reconnect battery.

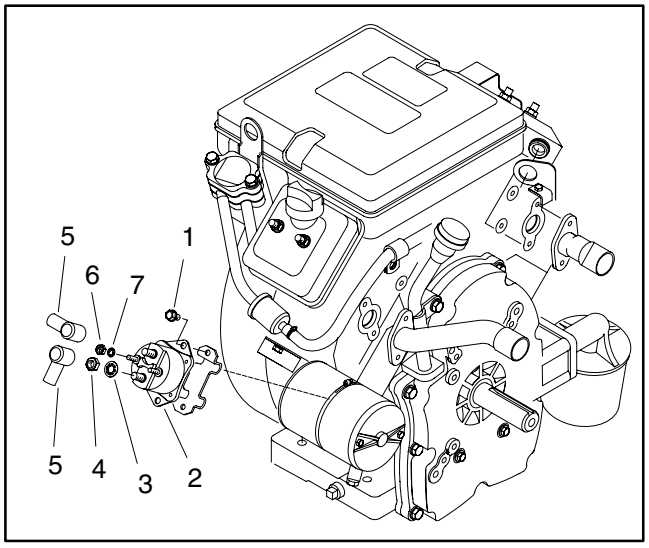

Figure 17

1. Screw (2 used)
2. Starter solenoid
3. Lock washer (2 used)
4. Hex nut (2 used)
5. Terminal boot
6. Hex nut (2 used)
7. Lock washer (2 used)

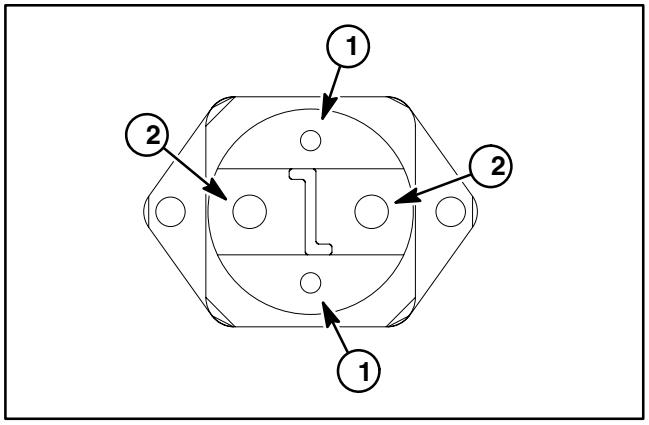

Figure 18

1. Coil post
2. Main contact post

Fuses

The greens aerator uses two (2) fuses for circuit protection.

The fuses are held in individual fuse holders and have the following functions:

20 Amp Fuse: Protects main power circuit to ignition switch terminal B. The 20 Amp fuse is located behind the engine (Fig. 19).

5 Amp Fuse: Protects circuit to clutch solenoid. The 5 Amp fuse is located under the console cover (Fig. 20).

Testing

Remove fuses from the fuse holder for testing. Fuse should have continuity between fuse terminals.

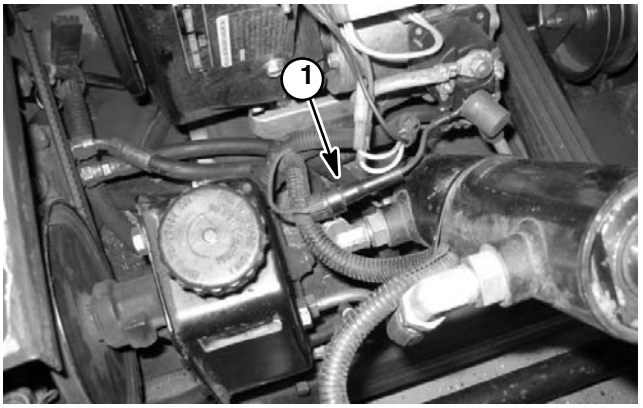

Figure 19

1. 20 Amp fuse

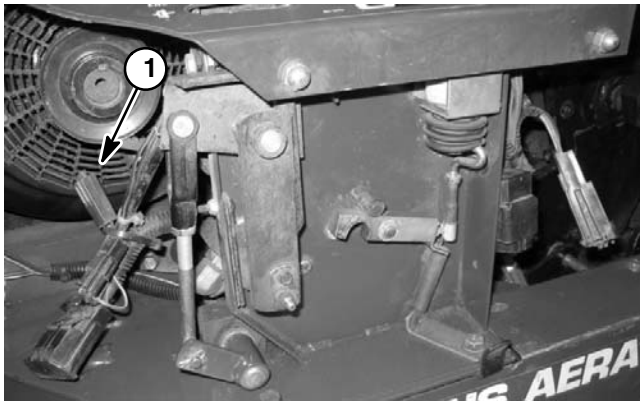

Figure 20

1. 5 Amp fuse

Diode Circuit Boards

The Greens Aerator uses two (2) diode circuit boards that are located under the console cover (Fig. 21). One of these circuit boards has three (3) diodes while the other board has four (4) diodes.

The three diode circuit board (Fig. 22) provides logic for the interlock system. Diode D3 on this board is not used.

The four diode circuit board (Fig. 23) is used for circuit protection from voltage spikes that occur when circuit solenoids are de–energized. Diode D1 on this board is not used.

Testing

The diodes can be individually tested using a digital multimeter (diode test position or ohms setting) and the diode diagrams to the right (Figures 22 and 23). The diodes should have continuity in one direction and no continuity in the other direction. If any diode is faulty, replace the diode board.

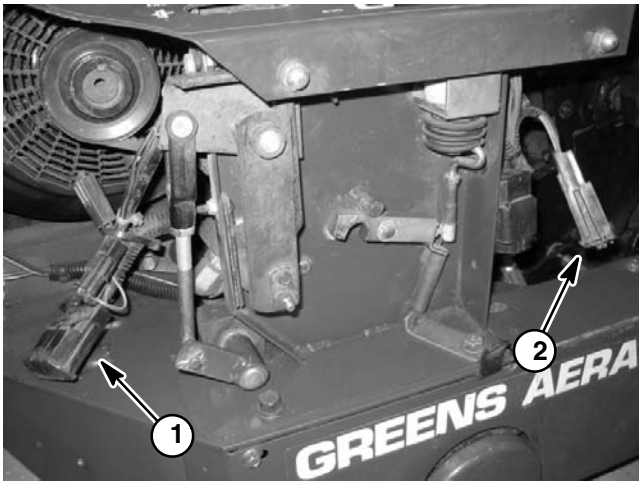

Figure 21

1. **Diode board (4 diode)**
2. **Diode board (3 diode)**

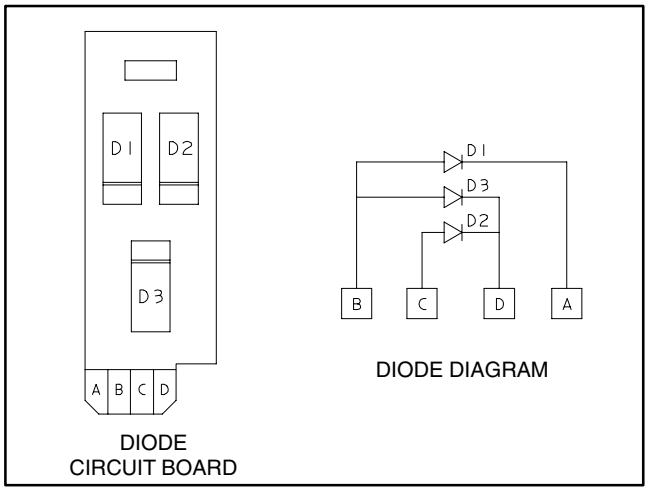

Figure 22

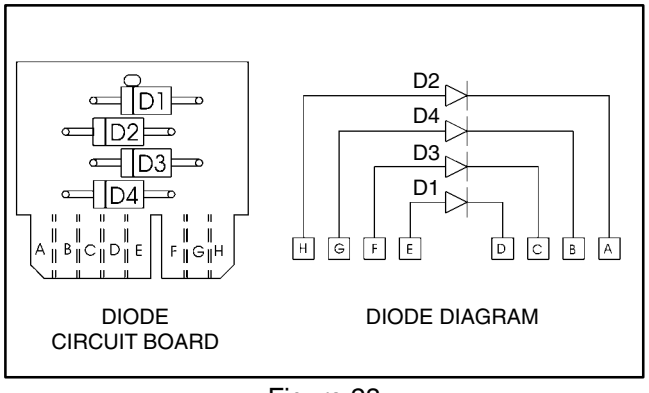

Figure 23

Service and Repairs

NOTE: See the engine Repair Manuals located after chapter 3 for engine component repair information.

Battery Storage

If the machine will be stored for more than 30 days:

1. Remove the battery and charge it fully (see Battery Service).

2. Either store battery on a shelf or on the machine.

3. Leave cables disconnected if the battery is stored on the machine.

4. Store battery in a cool atmosphere to avoid quick deterioration of the battery charge.

5. To help prevent the battery from freezing, make sure it is fully charged before storing the battery/machine (see Battery Service).

Battery Care

1. Battery electrolyte level must be properly maintained. The top of the battery must be kept clean. If the machine is stored in a location where temperatures are extremely high, the battery will discharge more rapidly than if the machine is stored in a location where temperatures are cool.

WARNING

Wear safety goggles and rubber gloves when working with electrolyte. Charge battery in a well ventilated place so gasses produced while charging can dissipate. Since the gases are explosive, keep open flames and electrical sparks away from the battery; do not smoke. Nausea may result if the gases are inhaled. Unplug battery charger from electrical outlet before connecting or disconnecting charger leads to or from battery posts.

IMPORTANT: Do not remove battery filler caps while cleaning battery.

2. Check battery condition weekly or after every 50 hours of operation. Keep terminals and entire battery case clean because a dirty battery will discharge slowly.

   A. Clean battery by washing entire case with a solution of baking soda and water. Rinse with clear water.

   B. Spray battery terminals with Battery Terminal Protector (Toro Part No. 107–0392) to prevent cable and terminal corrosion. Petroleum jelly can be used as well.

3. Battery cables must be tight on terminals to provide good electrical contact.

WARNING

Connecting cables to the wrong battery post could result in personal injury and/or damage to the electrical system.

4. If corrosion occurs at terminals, disconnect cables. Always disconnect negative (–) cable first. Clean clamps and terminals separately. Reconnect cables with positive (+) cable first. Coat battery posts and cable connectors with Battery Terminal Protector (Toro Part No. 107–0392) or petroleum jelly to prevent corrosion.

5. Check electrolyte level every 25 operating hours, and every 30 days if machine is in storage.

6. Maintain cell electrolyte level with distilled or demineralized water. Do not fill cells above the fill line.

Battery Service

The battery is the heart of the electrical system. With regular and proper service, battery life can be extended. Additionally, battery and electrical component failure can be prevented.

CAUTION

When working with batteries, use extreme caution to avoid splashing or spilling electrolyte. Electrolyte can destroy clothing and burn skin or eyes. Always wear safety goggles and a face shield when working with batteries.

Battery Specifications
BCI Group Size U1
300 CCA at 0º F (–18º C)
Reserve Capacity of 28 minutes at 80ºF (27ºC)

Dimensions (including terminal posts and handle)

Length	7.7 inches (19.6 cm)
Width	5.2 inches (13.2 cm)
Height	7.2 inches (18.3 cm)

Electrolyte Specific Gravity
Fully charged: 1.265 corrected to 80ºF (26.7ºC)
Discharged: less than 1.240

Removal and Installation (Fig. 24)

1. Loosen and remove negative (–) cable from battery. After negative cable is removed, loosen and remove positive (+) cable.

2. Remove wing nuts and washers that secure battery hold down rod. Slide hold down rod away from battery.

3. Carefully remove battery from machine.

4. Install battery in reverse order making sure to connect positive (+) cable to battery before connecting negative (–) cable.

NOTE: Before connecting the negative (ground) cable, connect a digital multimeter (set to amps) between the negative battery post and the negative (ground) cable connector. The reading should be less than 0.1 amp. If the reading is 0.1 amp or more, the machine's electrical system should be tested and repaired.

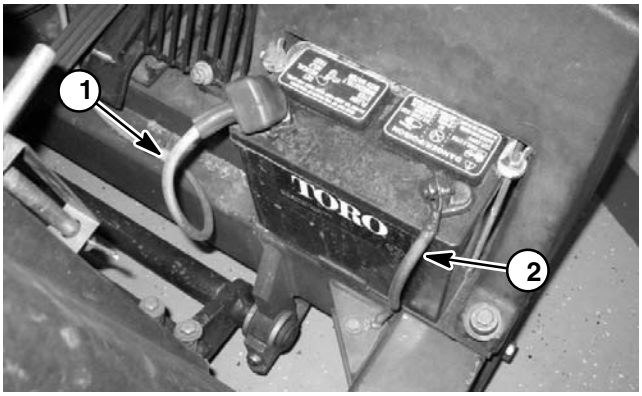

Figure 24

1. Positive battery cable **2. Negative battery cable**

Inspection and Maintenance

1. Check for cracks in battery case. Replace battery if cracked or leaking.

2. Check battery terminal posts for corrosion. Use wire brush to clean corrosion from posts.

IMPORTANT: Before cleaning the battery, tape or block vent holes to the filler caps and make sure the caps are on tightly.

3. Check for signs of wetness or leakage on the top of the battery which might indicate a loose or missing filler cap, overcharging, loose terminal post or overfilling. Also, check battery case for dirt and oil. Clean the battery with a solution of baking soda and water, then rinse it with clean water.

4. Check that the cover seal is not broken away. Replace the battery if the seal is broken or leaking.

5. Check the electrolyte level in each cell. If the level is below the tops of the plates in any cell, fill all cells with **distilled water** between the minimum and maximum fill lines. Charge at 15 to 25 amps for 15 minutes to allow sufficient mixing of the electrolyte.

Testing

1. To properly test a battery, perform a high–discharge test using an adjustable load tester. This is one of the most reliable means of testing a battery as it simulates the cold–cranking test. A commercial battery load tester is **required** to perform this test.

CAUTION

Follow the manufacturer's instructions when using a battery load tester.

A. Check the voltage across the battery terminals prior to testing the battery. If the voltage is less than 12.4 VDC, recharge the battery.

B. If the battery has been charged, apply a 150 amp load for 15 seconds to remove the surface charge. Use a battery load tester following the manufacturer's instructions.

C. Make sure battery terminals are free of corrosion.

D. Measure the temperature of the center cell.

E. Connect a battery load tester to the battery terminals **following the manufacturer's instructions**. Connect a digital multimeter to the battery terminals.

F. Apply a test load of one half the Cranking Performance (see Battery Specifications) rating of the battery for 15 seconds.

G. Take a voltage reading at 15 seconds, then remove the load.

H. Using the table below, determine the minimum voltage for the cell temperature reading:

Minimum Voltage	Battery Electrolyte Temperature	
9.6	70°F (and up)	21.1°C (and up)
9.5	60°F	15.6°C
9.4	50°F	10.0°C
9.3	40°F	4.4°C
9.1	30°F	–1.1°C
8.9	20°F	–6.7°C
8.7	10°F	–12.2°C
8.5	0°F	–17.8°C

I. If the test voltage is below the minimum, replace the battery. If the test voltage is at or above the minimum, return the battery to service.

2. If a battery load tester is not available, the battery can be tested by conducting a hydrometer test of the battery electrolyte.

IMPORTANT: Make sure the area around the cells is clean before opening the battery caps.

A. Measure the specific gravity of each cell with a hydrometer. Draw electrolyte in and out of the hydrometer barrel prior to taking a reading to warm–up the hydrometer. At the same time take the temperature of the cell.

B. Temperature correct each cell reading. For each 10°F (5.5°C) above 80°F (26.7°C) add 0.004 to the specific gravity reading. For each 10°F (5.5°C) below 80°F (26.7°C) subtract 0.004 from the specific gravity reading.

Example: Cell Temperature 100°F
Cell Gravity 1.245
100°F minus 80°F equals 20°F
(37.7°C minus 26.7°C equals 11.0°C)
20°F multiply by 0.004/10°F equals 0.008
(11°C multiply by 0.004/5.5°C equals 0.008)
ADD (conversion above) 0.008
Correction to 80°F (26.7°C) 1.253

C. If the difference between the highest and lowest cell specific gravity is 0.050 or greater or the lowest cell specific gravity is less than 1.225, charge the battery. Charge at the recommended rate and time given in **Charging** or until all cells specific gravity is 1.225 or greater with the difference in specific gravity between the highest and lowest cell less than 0.050. If these charging conditions can not be met, replace the battery.

Charging

To minimize possible damage to the battery and allow the battery to be fully charged, the slow charging method is presented here. This charging method can be accomplished with a constant current battery charger which is available in most shops.

CAUTION

Follow the manufacturer's instructions when using a battery charger.

NOTE: Using specific gravity of the battery cells is the most accurate method of determining battery condition.

1. Determine the battery charge level from either its specific gravity or open circuit voltage.

Battery Charge Level	Specific Gravity	Open Circuit Voltage
100%	1.265	12.68
75%	1.225	12.45
50%	1.190	12.24
25%	1.155	12.06
0%	1.120	11.89

2. Determine the charging time and rate **using the manufacturer's battery charger instructions** or the following table.

Battery Reserve Capacity (Minutes)	Battery Charge Level (Percent of Fully Charged)			
	75%	50%	25%	0%
80 or less	3.8 hrs @ 3 amps	7.5 hrs @ 3 amps	11.3 hrs @ 3 amps	15 hrs @ 3 amps
81 to 125	5.3 hrs @ 4 amps	10.5 hrs @ 4 amps	15.8 hrs @ 4 amps	21 hrs @ 4 amps
126 to 170	5.5 hrs @ 5 amps	11 hrs @ 5 amps	16.5 hrs @ 5 amps	22 hrs @ 5 amps
171 to 250	5.8 hrs @ 6 amps	11.5 hrs @ 6 amps	17.3 hrs @ 6 amps	23 hrs @ 6 amps
above 250	6 hrs @ 10 amps	12 hrs @ 10 amps	18 hrs @ 10 amps	24 hrs @ 10 amps

CAUTION

Do not charge a frozen battery because it can explode and cause injury. Let the battery warm to 60°F (15.5° C) before connecting to a charger.

Charge the battery in a well–ventilated place to dissipate gases produced from charging. These gases are explosive; keep open flame and electrical spark away from the battery. Do not smoke. Nausea may result if the gases are inhaled. Unplug the charger from the electrical outlet before connecting or disconnecting the charger leads from the battery posts.

3. **Following the manufacturer's instructions**, connect the charger cables to the battery. Make sure a good connection is made.

4. Charge the battery **following the manufacturer's instructions**.

5. Occasionally check the temperature of the battery electrolyte. If the temperature exceeds 125°F (51.6°C) or the electrolyte is violently gassing or spewing, the charging rate must be lowered or temporarily stopped.

6. Three hours prior to the end of the charging, measure the specific gravity of a battery cell once per hour. The battery is fully charged when the cells are gassing freely at a low charging rate and there is less than a 0.003 change in specific gravity for three consecutive readings.

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Chapter 6

Chassis

Table of Contents

Specifications

Item	Description
Front and Rear Tire Pressure	10 PSI (.68 Bar)
Rear Wheel Lug Nut Torque	65 to 90 ft–lb (88 to 122 N–m)

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Wheels

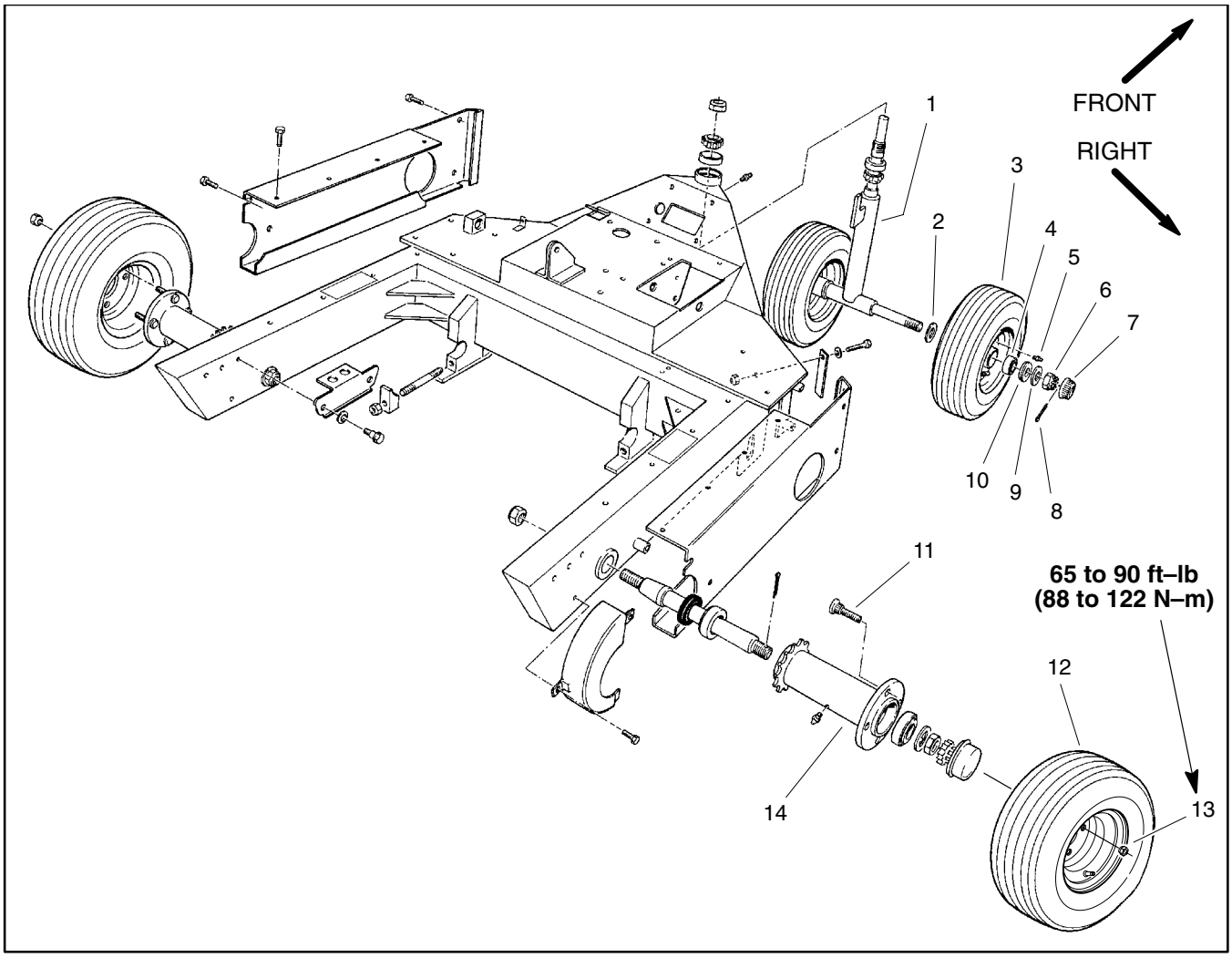

Figure 1

1. Front axle assembly
2. Thrust washer
3. Front tire and wheel assembly
4. Bearing (2 used per wheel)
5. Grease fitting
6. Slotted hex nut
7. Hub cap
8. Cotter pin
9. Washer
10. Bearing retainer (2 used per wheel)
11. Rear wheel stud (4 used per wheel)
12. Rear tire and wheel assembly
13. Lug nut (4 used per wheel)
14. Rear wheel hub

Rear Wheel Removal (Fig. 1)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets. Chock front wheels.

3. Jack rear of machine from ground and support machine with blocking or jack stands (see Jacking Instructions in Chapter 1 – Safety).

4. Loosen and remove four (4) lug nuts that secure rear wheel to be removed.

5. Remove rear wheel from machine.

Rear Wheel Installation (Fig. 1)

1. Position rear wheel to wheel hub.

2. Secure wheel to machine with four (4) lug nuts. Torque lug nuts from 65 to 90 ft–lb (88 to 122 N–m).

3. Lower machine to ground. Lower coring head lock–up brackets before machine use.

Front Wheel Removal (Fig. 1)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets. Chock rear wheels.

3. Jack front of machine from ground and support machine with blocking or jack stands (see Jacking Instructions in Chapter 1 – Safety).

4. Remove hub cap from front wheel to be removed.

5. Remove cotter pin and then remove slotted hex nut from front axle.

6. Slide washer, bearing retainers, front wheel and thrust washer from axle.

7. Inspect thrust washer, bearing retainers and wheel bearings for wear or damage. Replace components as needed.

Front Wheel Installation (Fig. 1)

1. Position thrust washer on front axle.

2. Make sure that bearing retainer is positioned on both sides of wheel. Slide front wheel onto axle with valve stem and grease fitting outward.

3. Secure front wheel to axle with washer, slotted hex nut and cotter pin.

4. Install hub cap. Lubricate wheel bearings at grease fitting in wheel.

5. Lower machine to ground. Lower coring head lock–up brackets before machine use.

Rear Wheel Hub

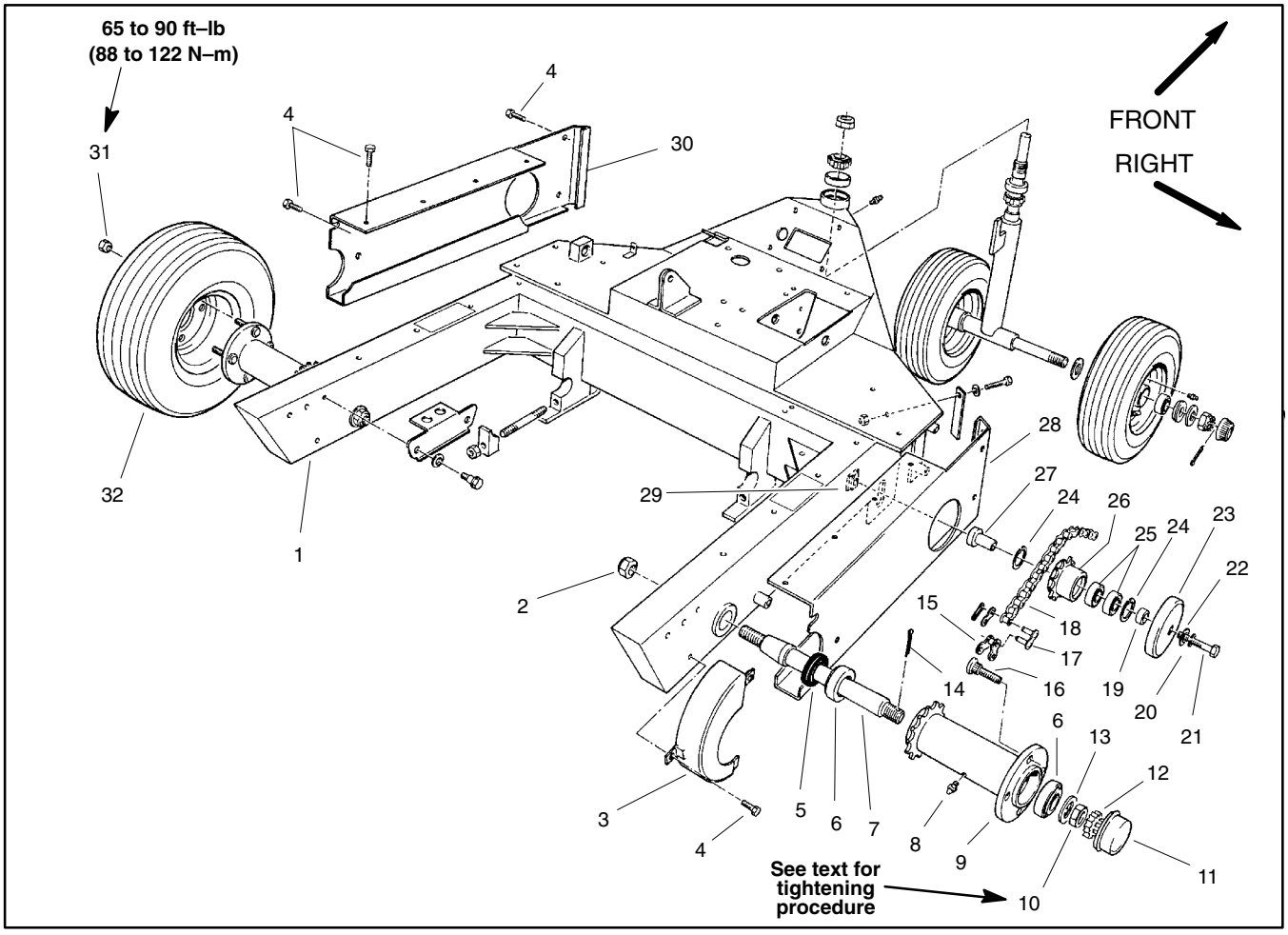

Figure 2

1. Frame
2. Lock nut
3. Sprocket guard (RH shown)
4. Cap screw
5. Shaft seal
6. Bearing
7. Shaft
8. Grease fitting
9. Hub
10. Jam nut
11. Dust cap
12. Nut retainer
13. Tab washer
14. Cotter pin
15. Half link
16. Wheel stud (4 used per hub)
17. Master link
18. Drive chain
19. Spacer
20. Lock washer
21. Cap screw
22. Flat washer
23. Idler cover
24. Retaining ring
25. Ball bearing
26. Idler sprocket
27. Bushing
28. RH chassis guard
29. Special nut
30. LH chassis guard
31. Lug nut (4 used per hub)
32. Rear wheel

Removal (Fig. 2)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Remove rear wheel (see Rear Wheel Removal in this section).

4. While holding idler sprocket, remove cap screw (item 21), lock washer (item 20), flat washer (item 22) and special nut (item 29) to allow idler cover (item 23) to be removed. Reinstall cap screw, washers and special nut to retain idler sprocket.

5. Remove sprocket guard (item 3) and chassis guard (item 28 or 30) from machine.

6. Position idler sprocket to allow slack in drive chain.

7. Remove master link from drive chain. Remove chain from sprocket on rear hub.

8. Carefully pry dust cap (item 11) from hub.

9. Remove cotter pin (item 14) from shaft.

10. Remove nut retainer (item 12), jam nut (item 10) and tab washer (item 13) that secure hub to shaft. Slide hub with bearings from shaft.

11. Disassemble wheel hub:

A. Pull shaft seal (item 5) from hub.

B. Remove bearings (item 6) from both ends of hub.

C. Inspect bearing cups and cones for wear or damage.

12. If required, remove lock nut (item 2) that secures shaft to frame and remove shaft from machine.

Installation (Fig. 2)

1. Clean all parts thoroughly before reassembly.

2. If shaft was removed from frame, clean taper on shaft and frame. Position shaft to frame and secure with lock nut (item 2).

3. Assemble wheel hub:

A. If bearing cups were removed from the wheel hub, press inner and outer cups into the hub until they seat against the hub shoulder.

B. Pack both bearing cones with grease. Install greased inner bearing into the cup on inboard side of the wheel hub.

IMPORTANT: The lip of the seal must face the bearing. The seal must be pressed in so it is flush with the end of the hub.

C. Lubricate the inside of the new lip seal and press it into the wheel hub.

4. Install the wheel hub onto the shaft taking care to not damage seal.

5. Install greased outer bearing cone, tab washer (item 13), and jam nut (item 10) onto shaft.

6. Rotate the wheel hub by hand and torque the jam nut from 75 to 180 in-lb (8.5 to 20.3 N–m) to seat bearings. Loosen nut until it is away from tab washer and hub has end play. Finally, tighten jam nut from 15 to 20 in–lbs (1.7 to 2.3 N–m) while rotating hub.

7. Install nut retainer and cotter pin to secure hub assembly.

8. Fill dust cup approximately 50% full of grease and install dust cap to hub.

9. Grease hub bearings at grease fitting on hub until grease purges from seal. Clean excess grease from seal area.

10. Position drive chain to hub sprocket (Fig. 3). Install master link to chain. Lubricate chain.

11. Install chassis guard (item 28 or 30) and sprocket guard (item 3) to machine.

12. While holding idler sprocket, remove cap screw (item 21), lock washer (item 20), flat washer (item 22) and special nut (item 29) and then install idler cover (item 23). Reinstall cap screw, washers and special nut. Make sure that special nut is correctly positioned in slot in frame.

13. Adjust drive chain tension (see Operator's Manual).

14. Install rear wheel assembly with valve stem facing out. Secure wheel to machine with four (4) lug nuts. Torque lug nuts from 65 to 90 ft–lb (88 to 122 N–m).

15. Lower machine to ground.

16. Lower lock–up brackets from coring head before machine use.

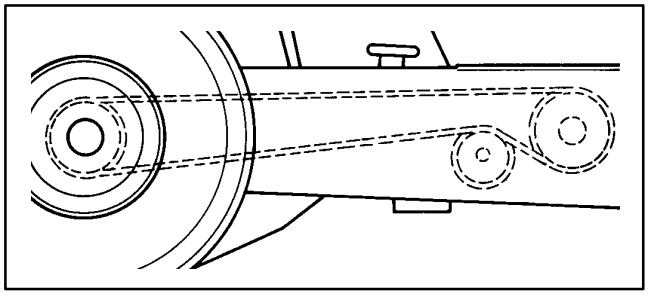

Figure 3

Steering Assembly

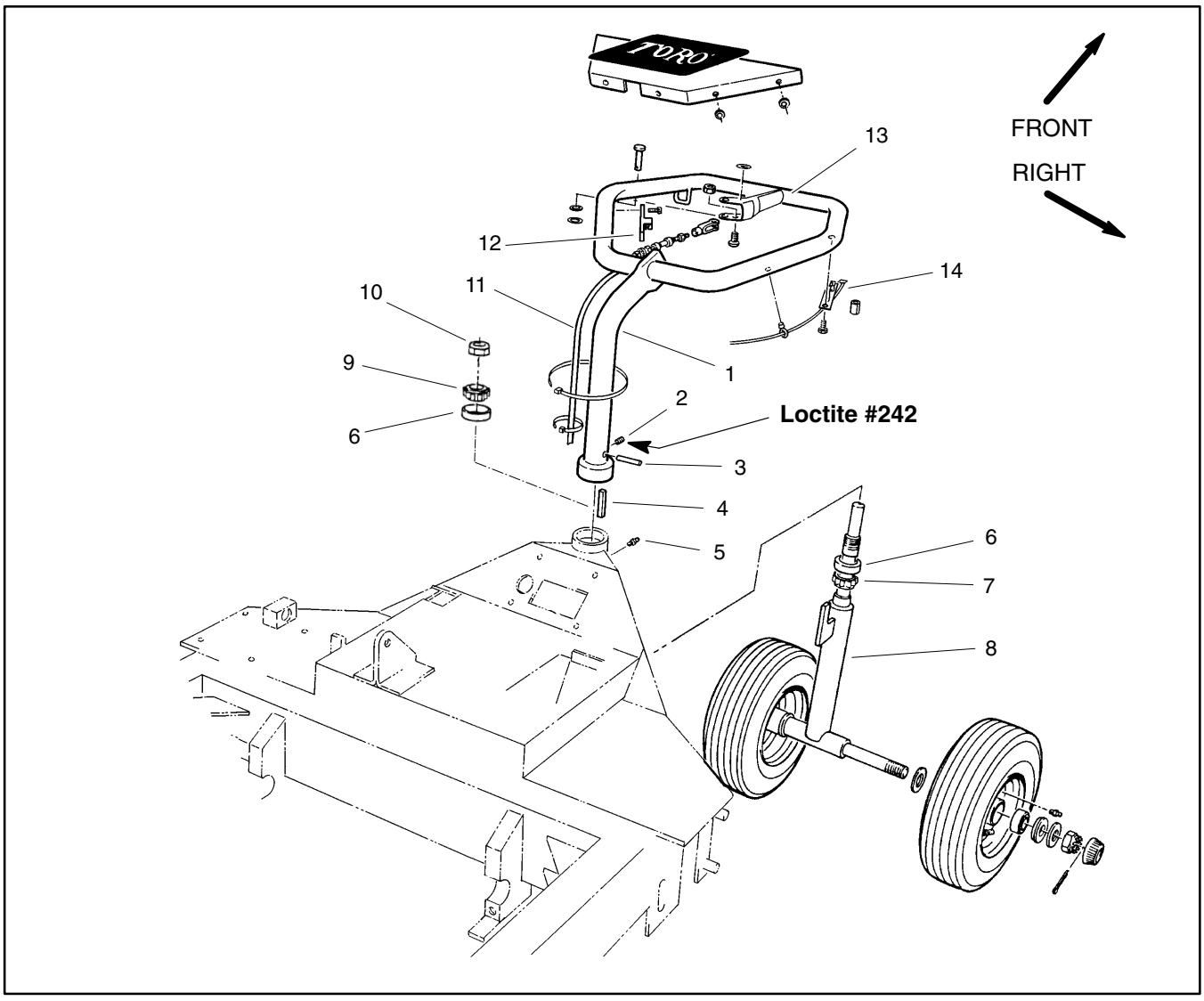

Figure 4

1. **Handle**
2. **Set screw**
3. **Roll pin**
4. **Key**
5. **Grease fitting**
6. **Bearing cup**
7. **Bearing cone**
8. **Front axle**
9. **Bearing cone**
10. **Lock nut**
11. **Brake cable**
12. **Brake cable bracket**
13. **Brake lever**
14. **Interlock switch/handle (2 used)**

Disassembly (Fig. 4)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Block rear wheels. Jack front of machine from ground and support machine with blocking or jack stands (see Jacking Instructions in Chapter 1 – Safety).

4. Remove front wheels (see Front Wheel Removal in this section).

5. Disconnect brake cable from brake lever and cable bracket on handle.

6. Disconnect interlock switch wires from machine harness.

7. Remove cable ties that retain brake cable and wire harness to handle. Position cable and wire harness away from handle.

8. Support handle. Loosen set screw (item 2). Remove roll pin (item 3) that secures handle to front axle. Slide control handle from machine taking care to not damage brake cable or wiring harness that will stay attached to machine. Locate and retrieve key (item 4).

9. Support front axle. Remove lock nut that secures front axle in frame. Lower front axle from frame.

10. Remove upper bearing cone from frame and lower bearing cone from front axle.

11. If necessary, remove bearing cups from machine frame.

12. Inspect bearing cups and cones for wear or damage. Replace worn or damaged components.

Assembly (Fig. 4)

1. If bearing cups were removed from frame, install new cups to frame. Make sure that cones are fully seated.

2. Pack bearing cones with grease. Install lower bearing cone on front axle.

3. Slide front axle shaft up through frame. Position rubber seal on lower bearing on inside of frame tube. Place upper bearing cone onto axle shaft.

4. Install lock nut onto front axle. Tighten nut completely and then back nut off slightly. Retighten nut until drag is felt while rotating front axle. Make sure that front axle rotates freely after lock nut has been tightened.

5. Position key (item 4) in front axle. Slide handle onto front axle and align roll pin holes in handle and front axle. Install roll pin so that it is flush with handle.

6. Apply Loctite #242 (or equivalent) to threads of set screw (item 2). Install set screw into handle.

7. Connect brake cable to brake lever and cable bracket on handle. Connect interlock switch wires to machine harness.

8. Retain brake cable and wire harness to handle with cable ties.

9. Install front wheels (see Front Wheel Installation in this section).

10. Lower machine to ground.

11. Make sure that steering components do not contact brake cable or wire harness.

12. Lubricate steering bearings by applying grease to grease fitting at front of frame.

13. Lower lock–up brackets from coring head before machine use.

Brake Caliper

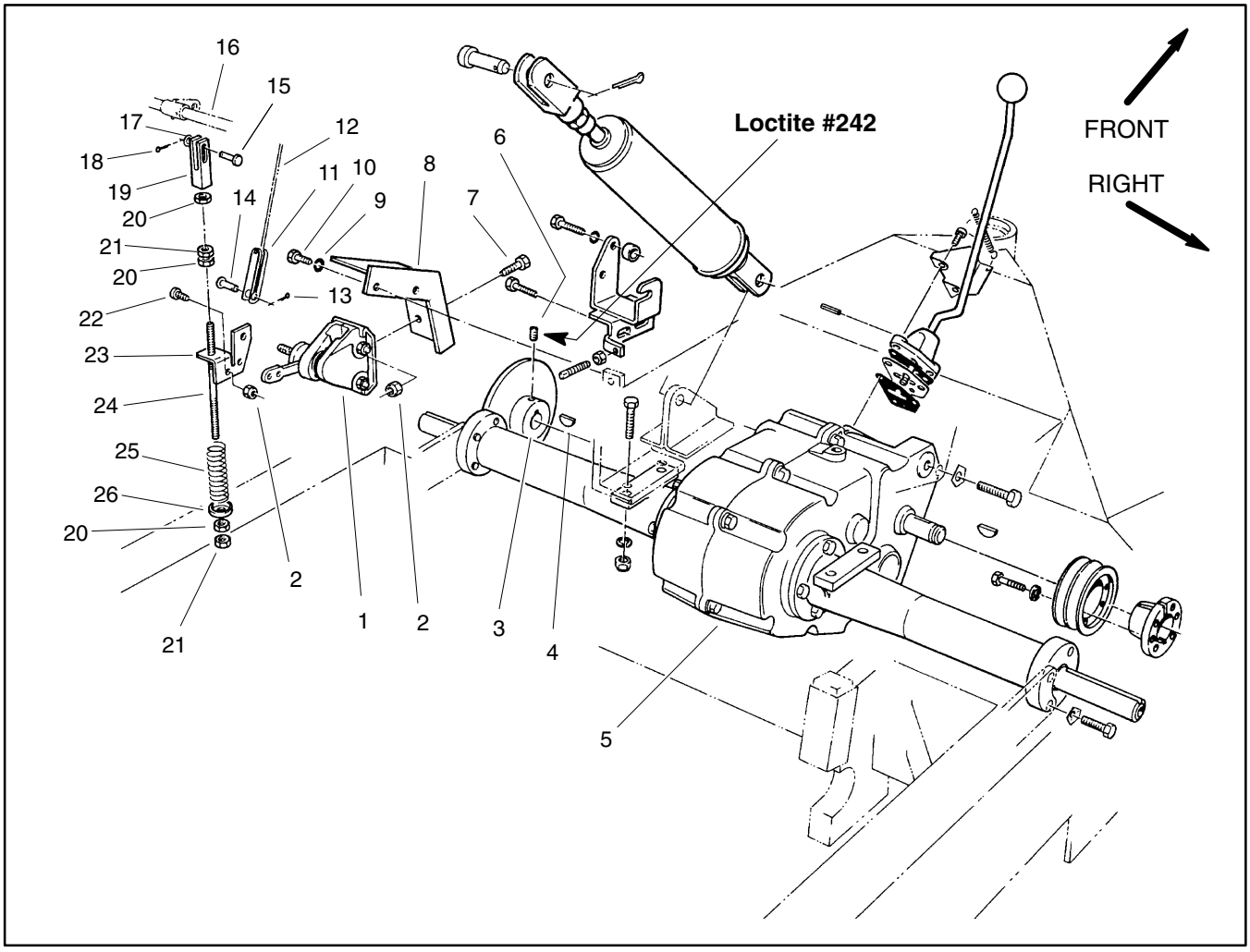

Figure 5

1. Brake caliper assembly
2. Lock nut
3. Brake disc
4. Woodruff key
5. Transaxle
6. Set screw (2 used)
7. Cap screw (2 used)
8. Brake bracket
9. Lock washer
10. Cap screw (2 used)
11. Brake cable clevis
12. Brake cable
13. Cotter pin
14. Clevis pin
15. Clevis pin
16. Clutch cross shaft
17. Flat washer
18. Cotter pin
19. Brake clevis
20. Hex nut
21. Jam nut
22. Cap screw (2 used)
23. Brake arm
24. Brake rod
25. Spring
26. Brake spring retainer

Removal (Figs. 5 and 7)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Disconnect brake arm (item 23) from brake caliper lever by removing two (2) cap screws (item 22) and lock nuts (item 2).

4. Remove two (2) cap screws (item 10) and lock washers that secure brake bracket to frame.

5. Slide brake caliper and brake bracket assembly from brake disc.

6. Brake disc can be removed from transaxle shaft by loosening two (2) set screws (item 6) and sliding disc from shaft. Locate and retrieve woodruff key (item 4).

Installation (Figs. 5 and 7)

1. If brake disc was removed:

   A. Position woodruff key in transaxle shaft and slide brake disc (hub first) onto shaft so disc hub is .060" (1.5 mm) from transaxle housing.

   B. Apply Loctite #242 (or equivalent) to threads of two (2) sets screws (item 6). Secure brake disc on shaft with set screws.

2. Slide brake caliper and brake bracket assembly onto brake disc.

3. Secure brake bracket to frame with two (2) cap screws (item 10) and lock washers.

4. Connect brake arm (item 23) to brake caliper lever with two (2) cap screws (item 22) and lock nuts (item 2).

5. Check and adjust location of nuts on brake rod (Fig. 7):

   A. Make sure that traction drive lever is disengaged.

   B. Spring length from bottom of brake arm to bottom of spring retainer should be 1.75" (44.5 mm).

   C. There should be approximately .125" (3.2 mm) between top of brake arm and hex nut directly above arm.

   D. If adjustment is necessary, loosen appropriate jam nut, change position of hex nut and tighten jam nut to secure adjustment.

6. Check and adjust brake as needed (see Operator's Manual).

7. Lower lock–up brackets from coring head before machine use.

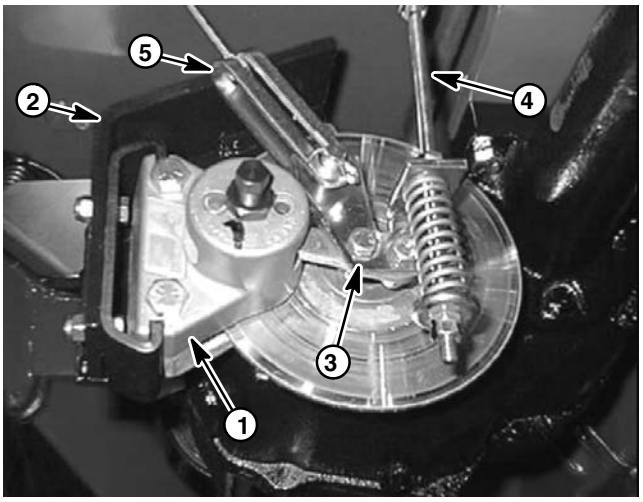

Figure 6

1. **Brake caliper**
2. **Brake bracket**
3. **Brake arm**
4. **Brake rod**
5. **Brake cable**

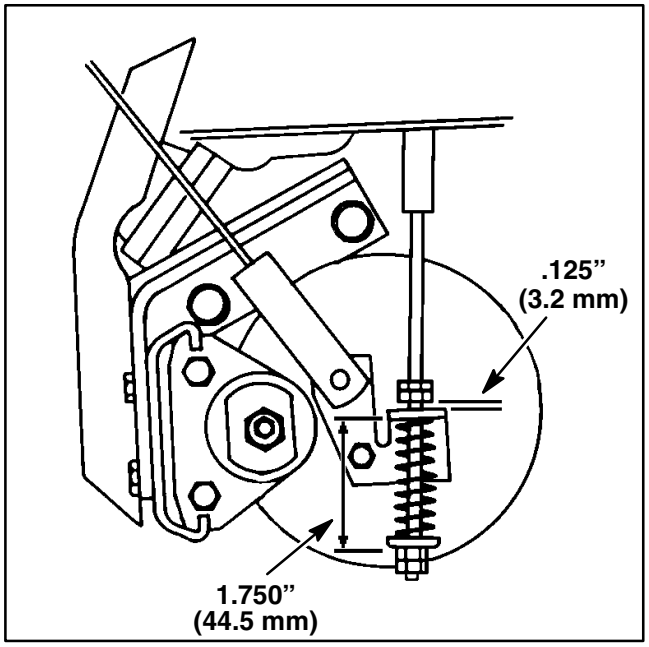

Figure 7

Brake Caliper Service

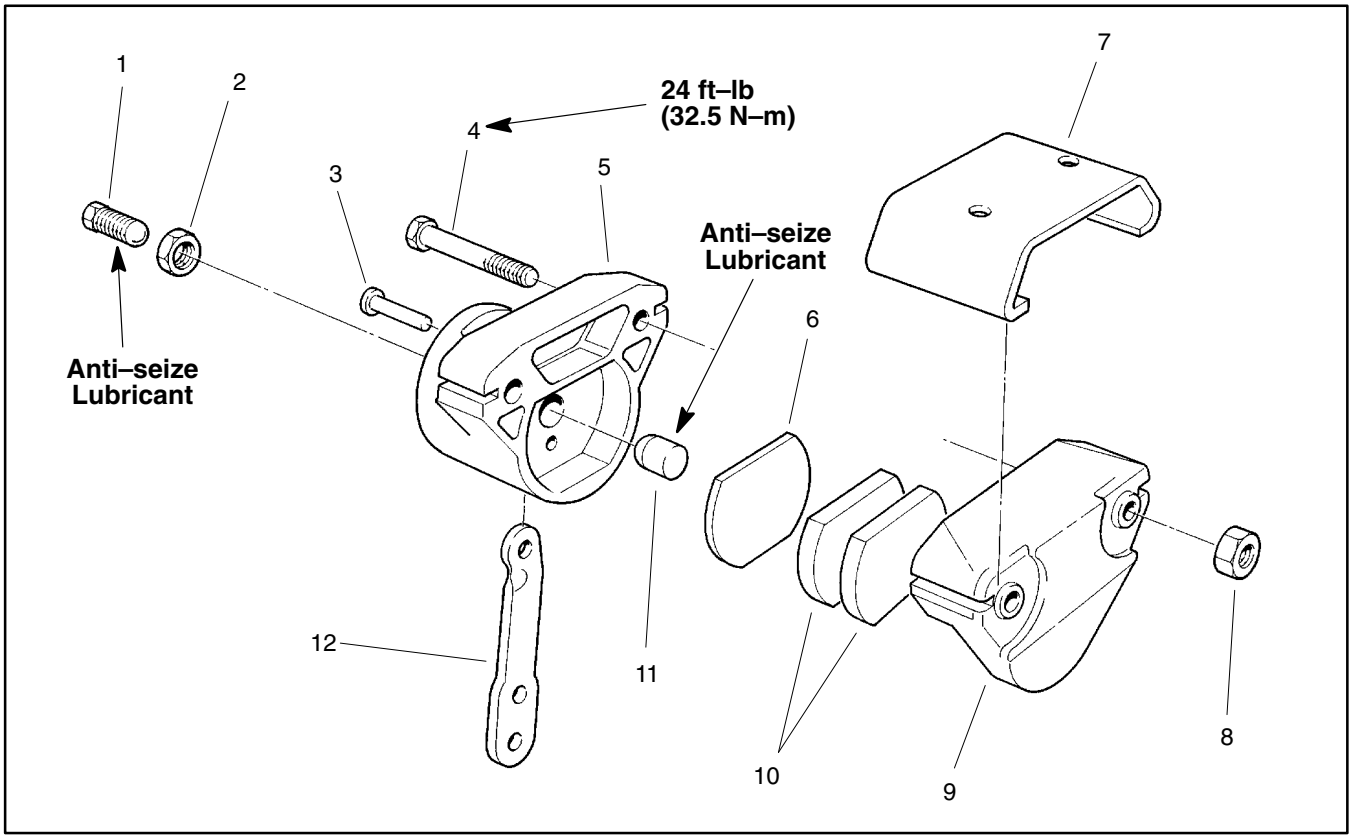

Figure 8

1. **Adjustment pin**
2. **Jam nut**
3. **Groove pin**
4. **Cap screw (2 used)**
5. **Live side housing**
6. **Backing plate**
7. **Floating bracket**
8. **Lock nut (2 used)**
9. **Anvil housing**
10. **Brake lining**
11. **Actuator pin**
12. **Cam lever**

Disassembly (Fig. 8)

1. Disassemble brake caliper using Figure 8 as a guide.

NOTE: Brake lining on anvil housing side may have adhesive to secure it to housing.

2. Clean and inspect all caliper parts after disassembly. Replace components that are worn or damaged.

Assembly (Fig. 8)

1. Assemble brake caliper using Figure 8 as a guide noting the following items:

A. Apply anti–seize lubricant to actuator pin and adjustment pin before assembly.

B. Secure the caliper assembly by torquing the cap screws 24 ft–lb (32.5 N–m).

C. Make sure that caliper assembly moves freely on the floating bracket.

Chapter 7

Drive Train

Table of Contents

Specifications

Item	Description
Transaxle	Peerless Model #2361, Manual shift 2 forward speeds and reverse
Transaxle Fluid Capacity	2 quarts (1.9 liters)
Transaxle Fluid	SAE E.P. 90 Wt Oil

Adjustments

Adjust Shift Tower

If the shift tower on the front of the aerator frame is not positioned correctly, the shift lever will not properly engage the transaxle gears. Perform the following procedure to position the shift tower is transaxle shifting is difficult.

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Position shift lever into the neutral slot in shift tower.

4. Loosen four (4) cap screws, flat washers and lock nuts that secure shift tower to machine (Fig. 1).

5. While rotating drive pulley on transaxle, adjust position of shift lever and shift tower until sprockets on transaxle output shafts do not move.

6. Secure shift tower in position with four (4) cap screws, flat washers and lock nuts.

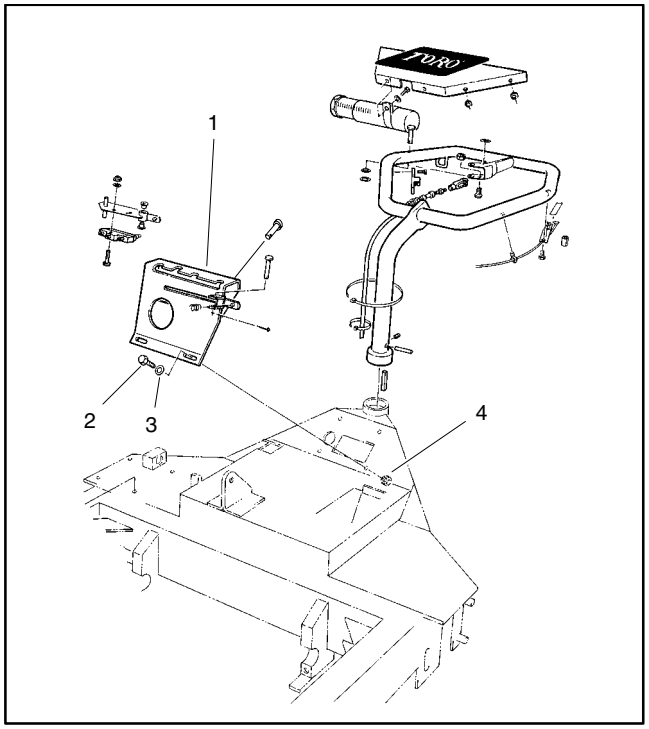

Figure 1

1. **Shift tower**
2. **Cap screw (4 used)**
3. **Flat washer (4 used)**
4. **Lock nut (4 used)**

Traction Drive Belt

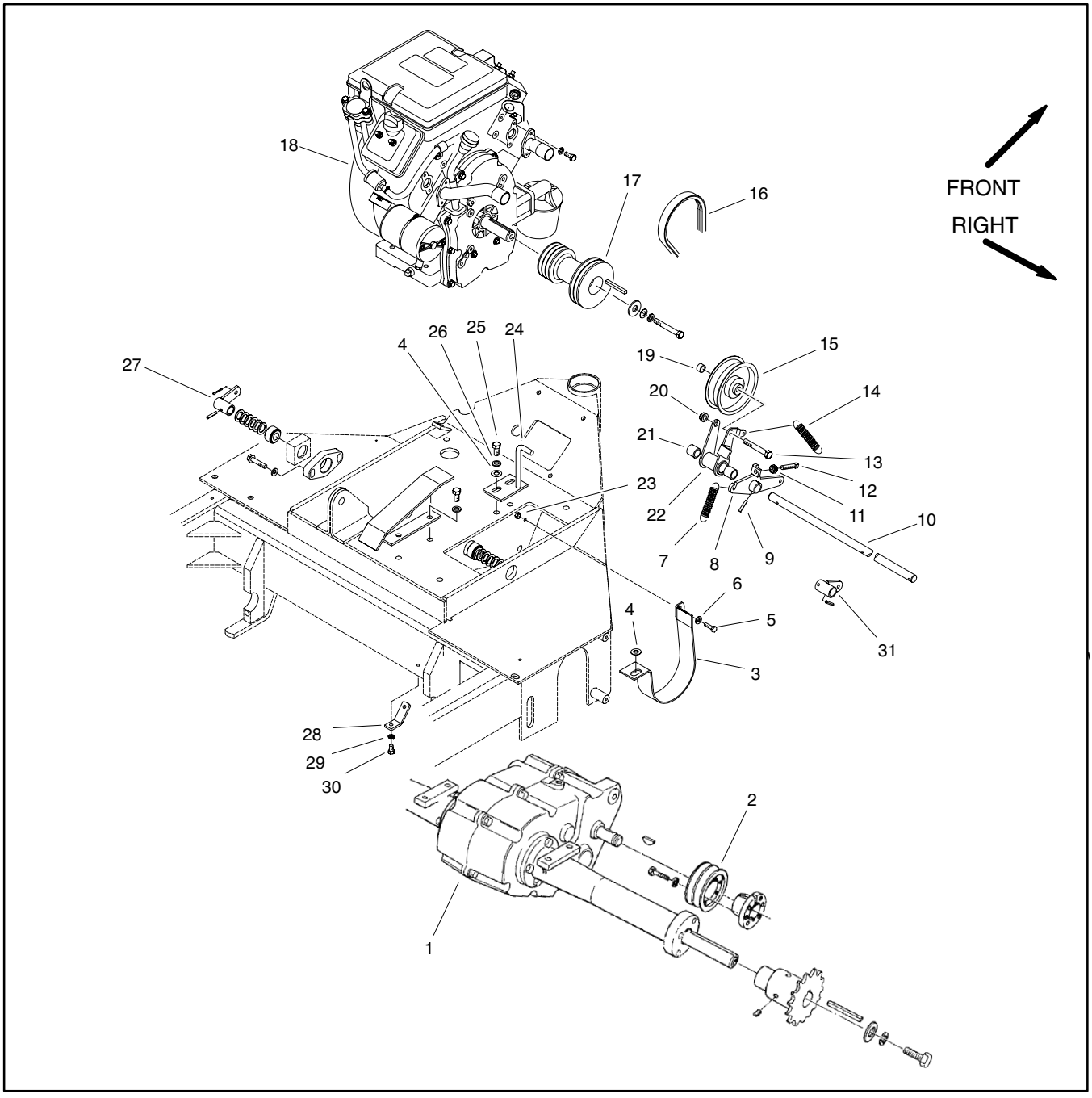

Figure 2

1. Transaxle
2. Transaxle pulley
3. Belt guide
4. Flat washer
5. Cap screw
6. Flat washer
7. Spring
8. Clutch arm
9. Roll pin
10. Cross shaft
11. Jam nut
12. Set screw
13. Cap screw
14. Spring
15. Idler pulley
16. Transaxle drive belt
17. Engine pulley
18. Engine
19. Spacer
20. Lock nut
21. Bushing (2 used)
22. Bracket
23. Lock nut
24. Belt guide
25. Cap screw
26. Lock washer
27. Cross shaft arm: traction drive
28. Spring bracket
29. Lock washer
30. Cap screw
31. Cross shaft arm: brake

Removal (Fig. 2)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Remove exhaust muffler guard (see Exhaust System Removal in Service and Repair section of Chapter 3 – Engine).

4. Loosen fasteners that secure belt guide (item 3) to machine.

5. Remove drive belt from engine pulley and transaxle pulley. Pull drive belt from machine.

Installation (Fig. 2)

1. Position drive belt to transaxle and engine pulleys noting correct belt routing (Fig. 3).

2. Secure belt guide (item 3) to machine with fasteners loosened during belt removal. After guide is secured, there should be .030" to .090" (.8 to 2.3 mm) clearance between the guide and the drive belt (Fig. 4).

3. Check and adjust drive belt tension (see Operator's Manual).

4. Install exhaust muffler guard (see Exhaust System Installation in Service and Repair section of Chapter 3 – Engine).

5. Lower lock–up brackets from coring head before machine use.

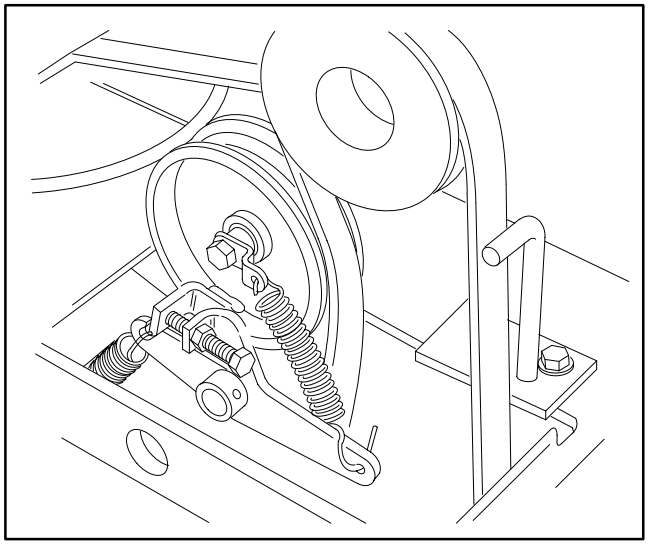

Figure 3

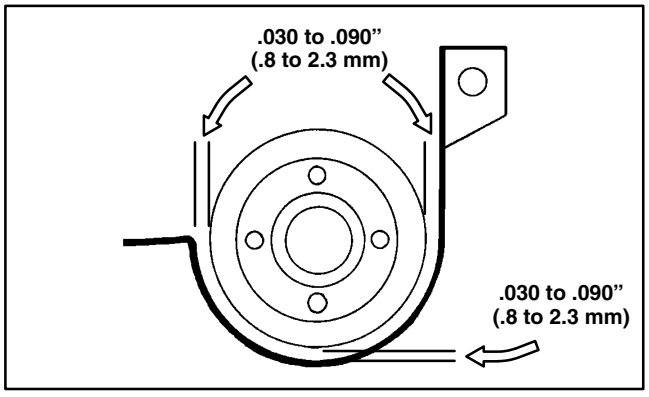

Figure 4

Drive Chain

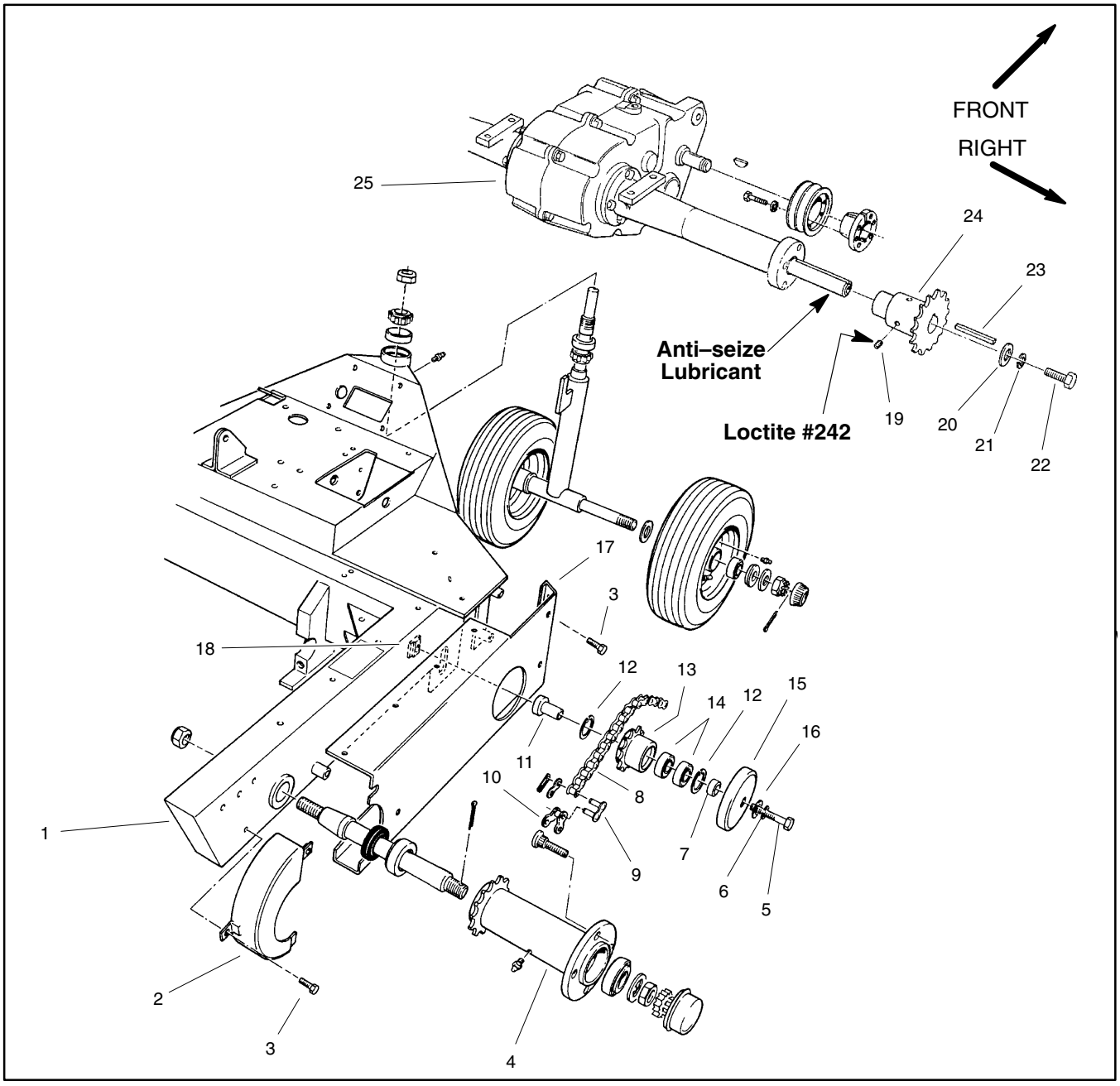

Figure 5

1. Frame
2. Sprocket guard (RH shown)
3. Cap screw
4. Wheel hub
5. Cap screw
6. Lock washer
7. Spacer
8. Drive chain
9. Master link
10. Half link
11. Bushing
12. Retaining ring
13. Idler sprocket
14. Bearing
15. Idler cover
16. Flat washer
17. Chassis guard (RH shown)
18. Special nut
19. Set screw (2 used per sprocket)
20. Thrust washer
21. Lock washer
22. Cap screw
23. Key
24. Sprocket
25. Transaxle

Disassembly (Fig. 5)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Remove rear wheel (see Rear Wheel Removal in Service and Repairs section of Chapter 6 – Chassis).

4. While holding idler sprocket, remove cap screw (item 5), lock washer (item 6), flat washer (item 16) and special nut (item 18) to allow idler cover (item 15) to be removed. Reinstall cap screw, washers and special nut to retain idler sprocket.

5. Remove sprocket guard (item 2) and chassis guard (item 17) from machine.

6. Remove components as needed using Figure 5 as a guide.

Assembly (Fig. 5)

1. Install removed components using Figure 5 as a guide.

   A. If idler sprocket was removed, attach idler to frame as shown but don't install idler cover (item 15) and leave cap screw (item 5) finger tight.

   B. If sprocket (item 24) was removed from transaxle shaft, apply antiseize lubricant to transaxle shaft before installing sprocket. Install and tighten cap screw (item 20), lock washer (item 21) and thrust washer (item 22). Slide sprocket out to installed thrust washer. Apply Loctite #242 (or equivalent) to set screws (item 19) and install set screws to secure sprocket.

2. Position drive chain to sprockets (Fig. 6). Install master link to chain. Lubricate chain.

3. Install chassis guard (item 17) and sprocket guard (item 2) to machine.

4. While holding idler sprocket, remove cap screw (item 5), lock washer (item 6), flat washer (item 16) and special nut (item 18) and then install idler cover (item 15). Reinstall cap screw, washers and special nut. Make sure that special nut is correctly positioned in slot in frame.

5. Adjust drive chain tension (see Operator's Manual).

6. Install rear wheel assembly with valve stem facing out. Secure wheel to machine with four (4) lug nuts. Torque lug nuts from 65 to 90 ft–lb (88 to 122 N–m).

7. Lower machine to ground.

8. Lower lock–up brackets from coring head before machine use.

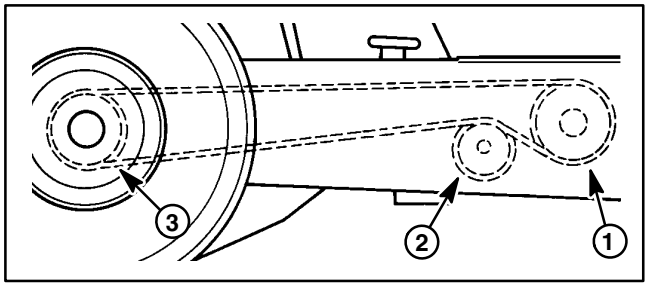

Figure 6

1. **Transaxle sprocket**
2. **Idler sprocket**
3. **Wheel hub sprocket**

Transaxle

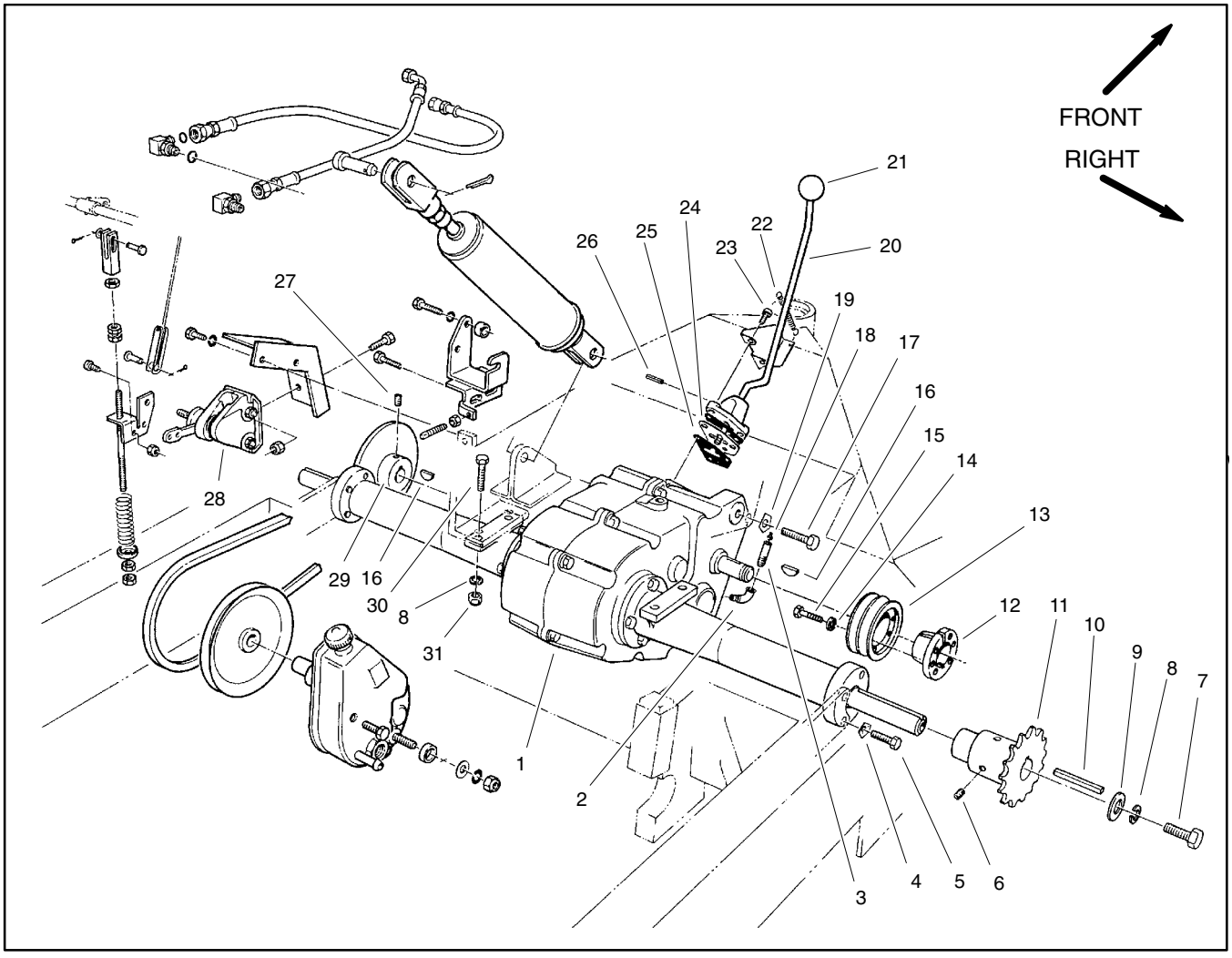

Figure 7

1. **Transaxle**
2. **Elbow**
3. **Oil tube**
4. **Pyramidal washer (4 used)**
5. **Cap screw (4 used)**
6. **Set screw (2 used per sprocket)**
7. **Cap screw**
8. **Lock washer**
9. **Thrust washer**
10. **Key**
11. **Sprocket**
12. **Taper lock bushing**
13. **Pulley**
14. **Lock washer (3 used)**
15. **Cap screw (3 used)**
16. **Woodruff key**
17. **Cap screw**
18. **Oil plug**
19. **Pyramidal washer**
20. **Shift lever assembly**
21. **Knob**
22. **Spring**
23. **Socket head screw (3 used)**
24. **Shift guide plate**
25. **Gasket (2 used)**
26. **Roll pin**
27. **Set screw (2 used)**
28. **Brake caliper**
29. **Brake disc**
30. **Cap screws (4 used)**
31. **Nut (4 used)**

Removal (Fig. 7)

1. Park machine on a level surface, fully raise coring head, stop engine and remove key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Remove brake caliper from machine (see Brake Caliper Removal in Service and Repairs section of Chapter 6 – Chassis).

4. Remove drive belt from machine (see Traction Drive Belt Removal in this section).

5. Remove drive chain from both transaxle sprockets (see Drive Chain Disassembly in this section).

6. Pull knob from shift lever.

7. Support transaxle to prevent it from falling.

8. Remove fasteners that secure transaxle to frame:

   A. Cap screw (item 17) and pyramidal washer (item 19).

   B. Four (4) cap screws (item 5) and pyramidal washers (item 4).

   C. Four (4) cap screws (item 30), lock washers (item 8) and nuts (item 31). NOTE: One of these cap screws is used to secure belt guide (Fig. 8).

9. Carefully lower transaxle and remove from machine.

10. If necessary, brake disc (item 29) can be removed from transaxle brake shaft by loosening two (2) set screws (item 27) and sliding disc from shaft. Locate and retrieve woodruff key (item 16).

11. If needed, remove pulley from transaxle input shaft:

   A. Remove three (3) cap screws (item 15) and lock washers (item 14) that secure taper lock bushing to pulley.

IMPORTANT: When removing taper lock bushing, tighten cap screws progressively and evenly. Excessive or unequal pressure on the screws can break the taper lock bushing flange.

   B. Insert cap screws into threaded removal holes of the bushing. Tighten screws progressively and evenly until the pulley is loose on the bushing.

   C. Remove pulley and bushing from transaxle shaft.

   D. Locate and retrieve woodruff key (item 16) that locates bushing on transaxle shaft.

Installation (Fig. 7)

1. If brake disc was removed:

   A. Position woodruff key in transaxle brake shaft slot and slide brake disc (hub first) onto shaft so disc hub is .060" (1.5 mm) from transaxle housing.

   B. Apply Loctite #242 (or equivalent) to threads of two (2) sets screws (item 27). Secure brake disc on shaft with set screws.

2. If pulley was removed from transaxle input shaft:

   A. Make sure that tapered surfaces of pulley and taper lock bushing are thoroughly clean (no oil, grease, dirt, rust, etc.).

   B. Place woodruff key (item 16) in input shaft slot. Slide pulley (item 13) and then taper lock bushing (item 12) onto transaxle shaft making sure that tapered surfaces of pulley and bushing align.

   C. Align threaded holes of pulley with non–threaded holes of bushing. Loosely install three (3) cap screws with lock washers into pulley threads.

IMPORTANT: When tightening cap screws, tighten in three equal steps and in a circular pattern to prevent bushing flange damage.

   D. Align the outside of bushing with the inside of the groove on the input shaft (approx 1/8" from end of shaft). Tighten three (3) cap screws to a torque from 90 to 120 in–lb (10.2 to 13.6 N–m) in three equal steps and in a circular pattern to secure pulley and taper lock bushing.

3. If sprocket (item 11) was removed from transaxle shaft, apply antiseize lubricant to transaxle shaft before installing sprocket. Also, apply Loctite #242 (or equivalent) to set screws (item 6) before installation.

4. Position transaxle to the frame. Attach transaxle to the frame with fasteners removed during disassembly:

   A. Four (4) cap screws (item 30), lock washers (item 8) and nuts (item 31). NOTE: Leave front cap screw on input shaft side of transaxle loose until belt guide is installed (Fig. 8).

   B. Four (4) cap screws (item 5) and pyramidal washers (item 4).

   C. Cap screw (item 17) and pyramidal washer (item 19).

5. Install knob to shift lever.

6. Install drive belt to transaxle and engine pulleys (see Traction Drive Belt Installation in this section).

7. Install brake caliper to machine (see Brake Caliper Installation in Service and Repairs section of Chapter 6 – Chassis).

8. Install drive chain to both transaxle sprockets (see Drive Chain Assembly in this section).

9. Check and adjust transaxle oil level (see Operator's Manual).

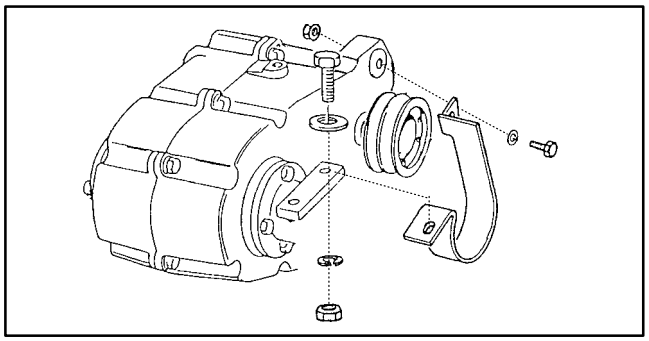

Figure 8

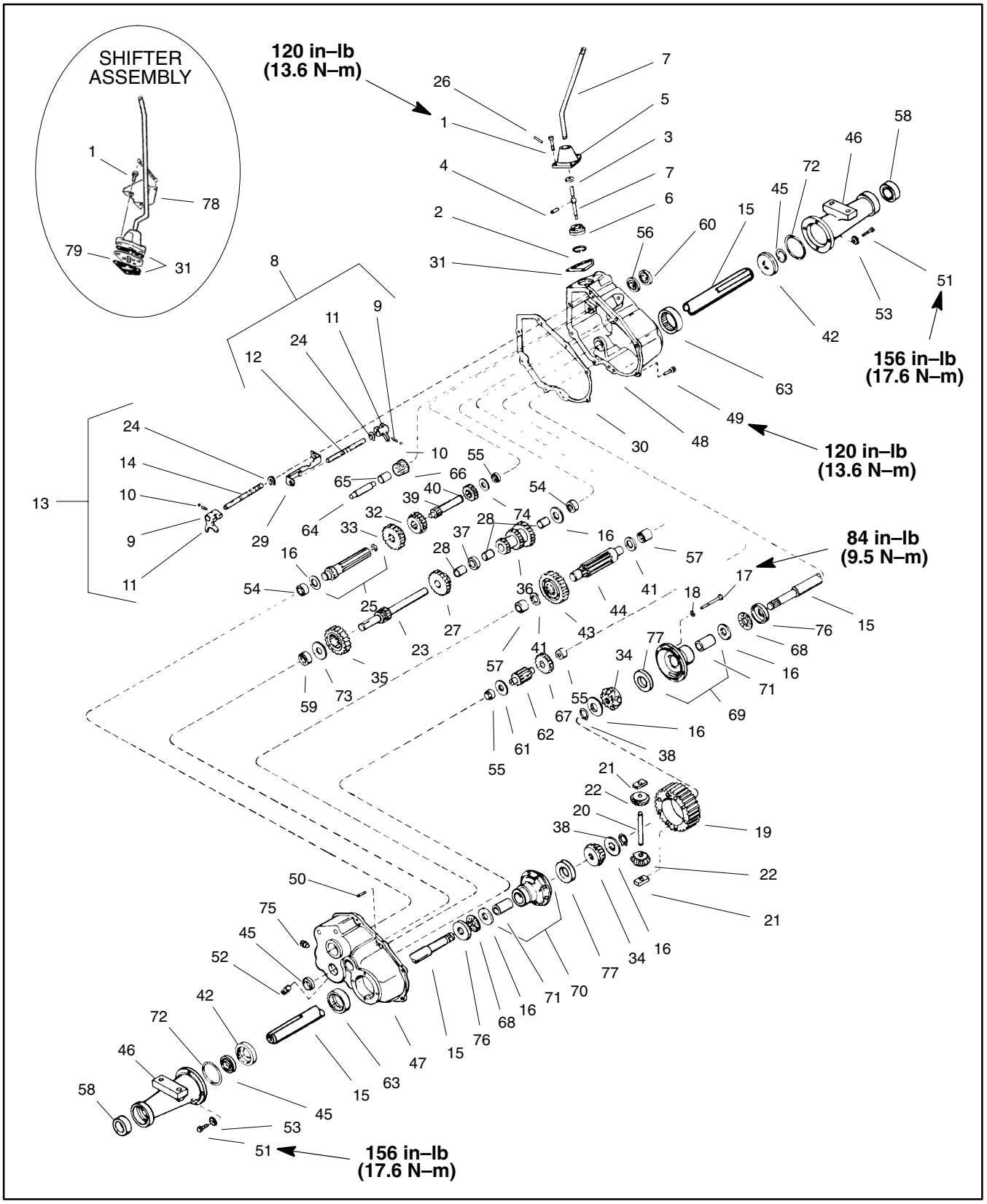
SHIFTER ASSEMBLY
120 in–lb (13.6 N–m)
156 in–lb (17.6 N–m)
120 in–lb (13.6 N–m)
84 in–lb (9.5 N–m)
156 in–lb (17.6 N–m)

Figure 9

Figure 9 (Continued)

1. Socket head screw (3 used)
2. Snap ring
3. Quad ring
4. Roll pin
5. Shift lever housing
6. Shift lever keeper
7. Shift lever
8. Shift rod assembly
9. Spring
10. Detent ball
11. Shifter fork
12. Shifter rod (3rd & 4th: 3 grooves)
13. Shift rod assembly
14. Shifter rod (Low: 4 grooves)
15. Axle
16. Thrust washer (1/32" thick, 7/8" ID)
17. Cap screw (8 used)
18. Lock washer (8 used)
19. Ring gear
20. Drive pin
21. Drive block
22. Bevel pinion gear
23. Brake shaft & gear
24. Snap ring
25. Pinion shaft & bearing
26. Roll pin
27. Two gear cluster
28. Bushing
29. Shifter stop
30. Gasket
31. Shift lever housing gasket
32. Shifting gear
33. Shifting gear
34. Bevel gear
35. Idler gear
36. Three gear cluster
37. Spacer
38. Snap ring
39. Input shaft
40. Input shaft spur gear
41. Thrust washer (1/16" thick, 15/16"ID)
42. Oil seal retainer
43. Output gear
44. Output shaft
45. Oil seal
46. Axle housing
47. Transaxle cover
48. Transaxle case
49. Flange head screw (11 used)
50. Dowel pin (2 used)
51. Cap screw (8 used)
52. Drain plug
53. Lock washer (8 used)
54. Needle bearing
55. Needle bearing
56. Ball bearing
57. Needle bearing
58. Sealed ball bearing
59. Needle bearing
60. Oil seal
61. Thrust washer (1/16" thick, 3/4" ID)
62. Low gear shaft and pinion
63. Needle bearing
64. Reverse idler shaft
65. Reverse idler spacer
66. Reverse idler gear
67. Spur gear (22 teeth)
68. Thrust bearing
69. Differential carrier
70. Differential carrier
71. Bushing
72. O–ring
73. Thrust washer (1/32" thick, 1" ID)
74. Thrust washer (1/32" thick, 3/4" ID)
75. Pipe plug
76. Thrust race
77. Washer
78. Bracket
79. Shift guide plate

Transaxle Disassembly (Fig. 9)

1. Drain lubricant from transaxle and clean outside of transaxle before disassembly.

2. Place the transaxle in neutral. Remove three (3) socket head screws (item 1) that secure shift lever assembly to transaxle. Lift shift lever assembly, gaskets and shift guide plate from transaxle. See Shift Lever Service in this section for shift lever assembly service.

3. For assembly purposes, mark axle housings and transaxle to identify orientation of axle housings. Remove cap screws (item 51) and lock washers (item 53) that secure axle housings to the transaxle. Pull axle housings from the transaxle case and cover.

4. Use exposed axles as a ram to separate seal retainers from transaxle case and cover. Remove and discard seals (item 45) and o–rings (item 72) from retainers.

5. Support transaxle so it is resting on the cover with no weight on the brake shaft. Make sure that transaxle is well supported to prevent it from shifting or falling during disassembly procedure.

6. Tap two (2) dowel pins (item 50) into the cover and then remove eleven (11) flange head screws (item 49).

7. Lift the case 1 1/2 to 2 inches (38 to 50.8 mm) and tilt case so that the shifter rods will clear the edge of the case. Rotate case so the boss hidden inside will clear the gears. Lift case from transaxle (Fig. 10).

NOTE: Refer to Figure 11 for transaxle gear and shaft identification during disassembly.

8. Remove thrust washer (item 16) and three gear cluster (item 36) from the brake shaft.

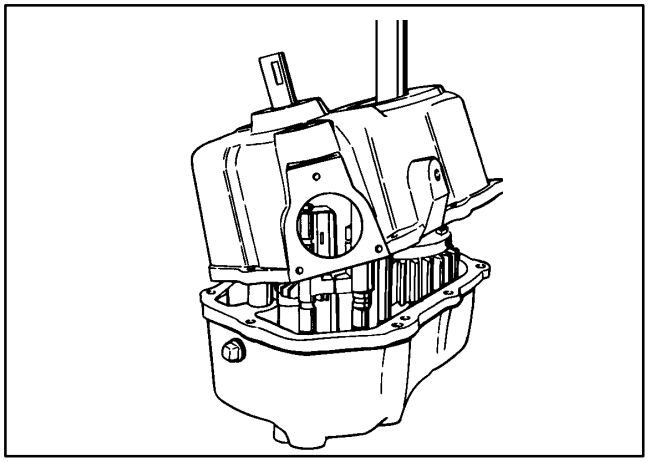

Figure 10

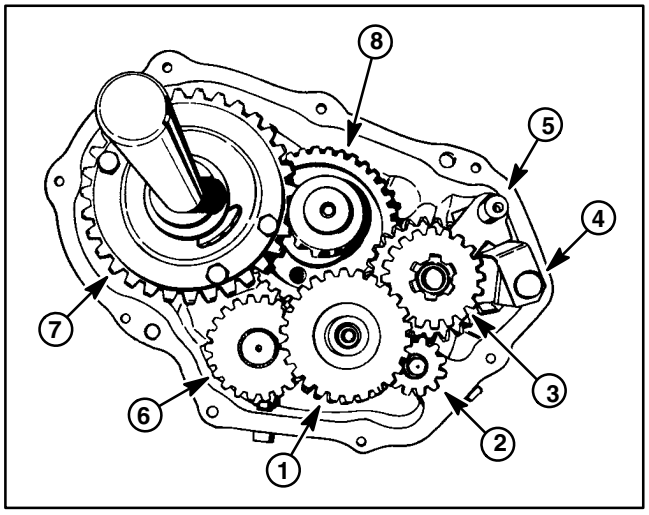

Figure 11

1. Three gear cluster
2. Reverse idler gear
3. Pinion shaft
4. Shifter rod (Low)
5. Shifter rod (3rd & 4th)
6. Low gear
7. Differential assembly
8. Output gear

9. Remove the reverse idler gear (item 66), spacer (item 65) and reverse idler shaft (item 64) from the boss in the cover. Note that spacer goes between the gear and cover and the gear bevels go down.

10. Squeeze top end of shifter rods and lift shifter assembly from cover (Fig. 12). Shifter assembly includes pinion shaft (item 25), shifting gears (items 32 and 33) and shift rod assemblies (items 8 and 13). See Shifter Assembly Service in this section for information regarding shifter service.

11. Remove low gear shaft and pinion (item 62), and spur gear (item 67). Separate the gear and shaft. Locate and retrieve thrust washer (item 61).

12. Remove spacer (item 37) and two gear cluster (item 27) from brake shaft (Fig. 13).

13. Lift differential assembly from the cover. See Differential Assembly Service in this section for information regarding differential service.

14. Remove output shaft (item 44) and output gear (item 43) from cover (Fig. 14). Locate and retrieve thrust washer (item 41) from both ends of shaft.

15. Remove brake shaft (item 23) and idler gear (item 35) from cover. Locate and retrieve thrust washer (item 73).

16. Remove input shaft (item 39) and spur gear (item 40) from case by tapping end of shaft with soft–faced hammer. Locate and retrieve thrust washer (item 74).

17. Remove and discard seals from transaxle cover and case.

Transaxle Inspection

1. Thoroughly clean all transaxle components.

2. Inspect all transaxle gears:

   A. Check gear bevels for wear, chipping or breaks. Wear or chipping on transaxle gear bevels indicates improper transaxle shifting.

   B. Check face of teeth for wear. Large, shiny areas indicate excessive tooth contact and possible excessive wear.

   C. Check that shifting gears (items 32 and 33) slide freely on pinion shaft. Also, check that splines of shifting gears are not worn. Worn shifting gear splines allow the gears to cock on the shaft causing difficult shifting.

   D. Replace gears that are damaged or show excessive wear.

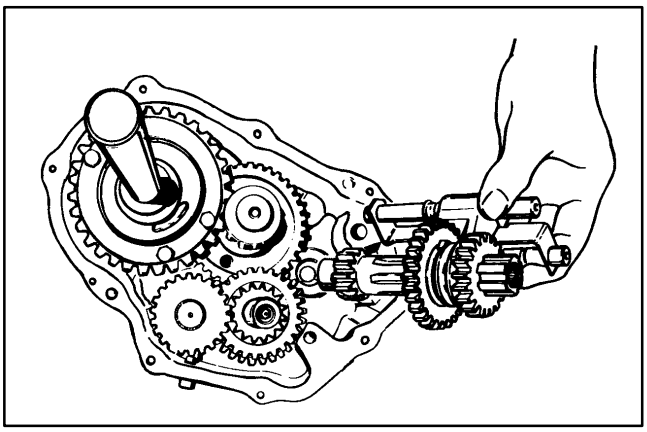

Figure 12

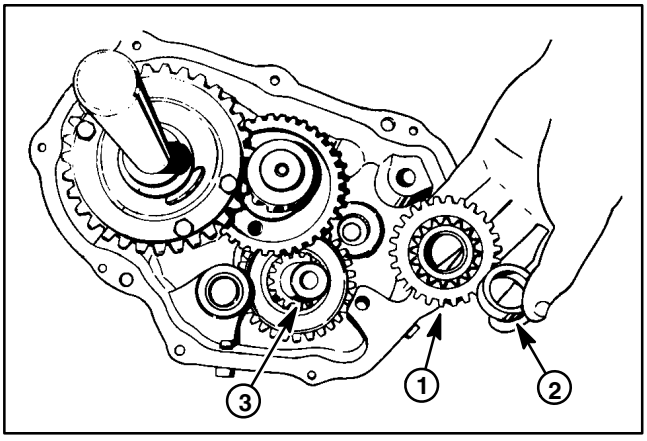

Figure 13

1. **Two gear cluster**
2. **Spacer**
3. **Brake shaft**

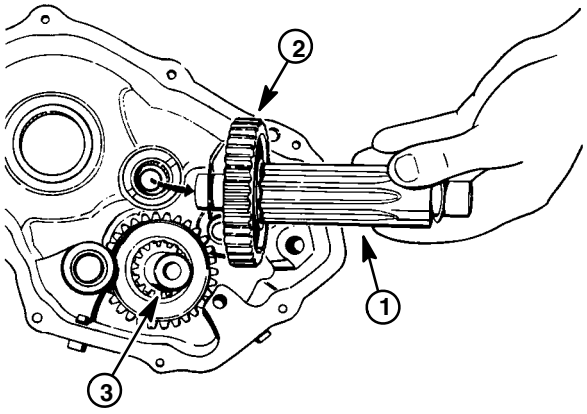

Figure 14

1. **Output shaft**
2. **Output gear**
3. **Brake shaft**

3. Inspect shafts and axles:

A. Carefully check shaft and axle surfaces for rust, pitting, scratches or wear. Use crocus cloth to repair rust, burrs or sharp edges if needed.

B. Check keyways, splines, threads and grooves for wear.

C. Replace worn or damaged components.

4. Inspect case and cover for cracks, stripped threads, metal chips, flat sealing surfaces and rust. Replace damaged components as necessary.

5. Check thrust washers and spacers for shiny surfaces which indicate wear. Try to determine the cause of thrust washer wear (e.g. lack of end play due to reuse of old gasket or incorrect placement of thrust washer). Replace any worn components.

6. Examine bearings and bushings for scuffing, wear, pitting and any abnormal conditions. Bearings should not exhibit any roughness when rotated. Replace any worn or damaged bearings and bushings.

7. Examine the external bearing surface of the differential assembly. If wear or pitting are identified, disassemble differential and repair or replace components as needed.

Shift Lever Service (Figs. 9 and 15)

1. Place shift lever in a vise so the shift lever housing is at lease one inch (25.4 mm) from the top of the vise jaws.

2. Remove snap ring (item 2) that retains shift lever keeper (item 6) in housing. Remove shift lever assembly from vise.

3. Remove shift lever (item 7) and quad ring (item 3) from housing. Discard quad ring.

4. Inspect roll pin (item 4) that is installed in shift lever ball. If roll pin is damaged, remove roll pin and replace. Roll pin should be centered in shift lever ball with equal lengths protruding from sides of ball.

5. Inspect roll pin (item 26) that is installed in housing to align shift lever keeper in housing. Replace roll pin if damaged.

6. Lightly oil new quad seal. Install quad seal into housing.

7. Slide shift lever up through housing.

8. Install shift lever keeper into housing making sure to align keeper with roll pin. Install snap ring to secure shift lever assembly in housing.

Shifter Assembly Service (Figs. 9 and 16)

1. Slide shifter stop (item 29) from shift rods.

2. Carefully slide shifter forks from shift rods. Locate and retrieve spring (item 9) and detent ball (item 10) from hole in fork.

3. Check shift rods, shifter forks and shifter stop for wear or damage. Replace all worn or damaged components.

4. Lightly oil parts before assembly.

5. Slide shifter fork onto shift rod until the rod end aligns with the shifter fork hole. Install spring and detent ball through shifter fork hole and into cavity in opposite side of fork. Use a small, flat blade screwdriver to press detent ball into cavity and move the fork completely onto the rod. Repeat for other shift rod.

6. Move shifter forks to the neutral position which is the second groove from the snap ring.

7. Install shifter stop onto shift rods.

8. When the shifter forks are properly assembled to the shifter rods and positioned in neutral, the ends of the notches in the forks should be aligned (Fig. 16).

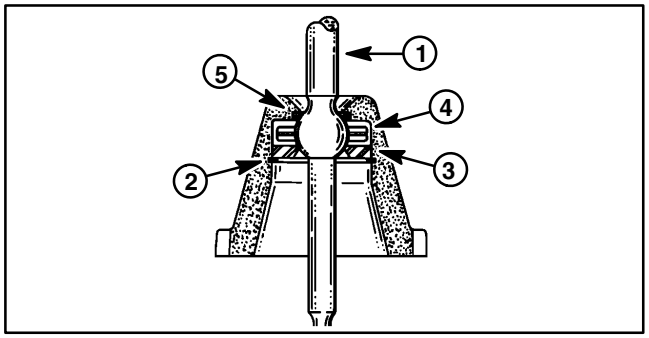

Figure 15

1. **Shift lever**
2. **Snap ring**
3. **Shift lever keeper**
4. **Roll pin**
5. **Quad ring**

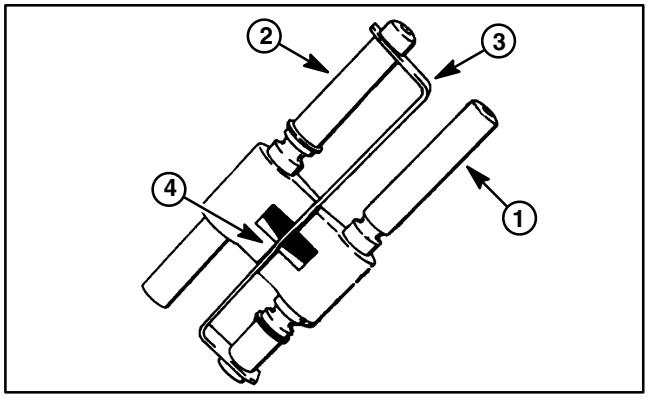

Figure 16

1. **Shifter rod (Low)**
2. **Shifter rod (3rd & 4th)**
3. **Shifter stop**
4. **Aligned notches**

Differential Assembly Service (Figs. 9 and 17)

1. Place differential assembly in a large vise with soft jaws with the cap screw heads up. Do not clamp the vise on the bearing race of the differential carrier or the seal area of the axle.

2. Remove cap screws (item 17) and lock washers (item 18) that secure the differential carriers together. Lift upper axle and carrier from the assembly. If necessary, tap lightly on the ring gear with a soft–faced hammer to loosen it from carrier.

3. Remove the drive blocks (item 21), bevel pinion gears (item 22) and drive pin (item 20) from the ring gear.

4. Lift ring gear (item 19) from lower axle and differential carrier. If necessary, tap lightly on the ring gear with a soft–faced hammer to loosen it from carrier.

5. Remove snap ring (item 38) from end of axles. Slide differential components from axle using Figure 9 as a guide.

6. Inspect differential components:

   A. Replace bushings in differential carriers if the bushings are worn in excess of .878” (22.3 mm).

   B. Check internal splines of bevel gears and axles for wear or damage.

   C. Inspect drive blocks and drive pin for wear or damage.

   D. Replace differential components that are worn or damaged.

7. Assemble the differential in the reverse order of disassembly using Figure 9 as a guide. Lightly oil components before installation into differential. Make sure that thrust washers (item 16) and thrust races (item 76) are placed on the correct sides of thrust bearings (item 68).

8. Secure the differential assembly with lock washers and cap screws. Torque cap screws 84 in–lb (9.5 N–m).

9. After assembly, test differential action by holding the upper axle vertically and spinning the differential. Next, place the assembly on the bench and rotate both axles in opposite directions. In both tests, the assembly should rotate freely without binding. If any binding is noted, check cap screw torque, gear meshing and bearings. Little or no play should be evident between the axles and carriers.

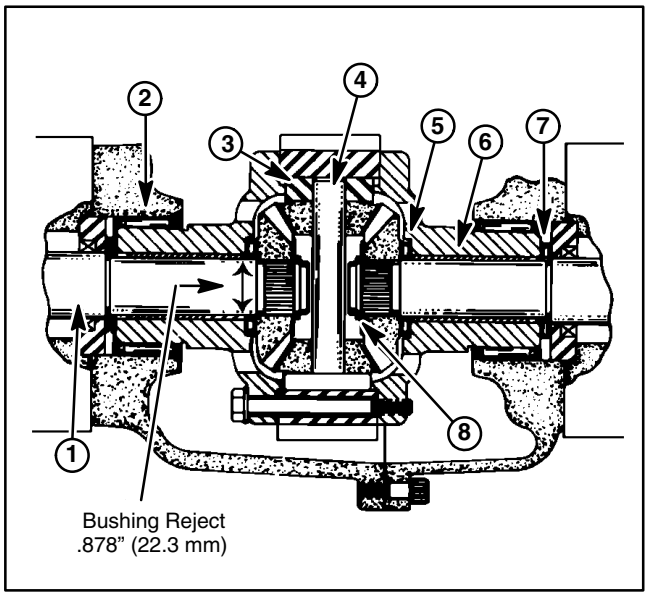

Figure 17

1. **Axle**
2. **Needle bearing**
3. **Drive block**
4. **Drive pin**
5. **Thrust washer**
6. **Bushing**
7. **Thrust bearing**
8. **Snap ring**

Transaxle Assembly (Fig. 9)

1. During assembly of transaxle, lightly oil components before installation into transaxle.

2. Use a press and appropriate installation tool to press all removed bearings into transaxle cover and case (Figs. 18 and 19).

IMPORTANT: When installing needle bearings, press only on stamped side of bearing.

A. If installing needle bearings for low gear shaft (item 62), press bearings into housing .010" (.254 mm) below the thrust surface.

B. If installing needle bearing into pinion shaft (item 25), press bearing into shaft until it is recessed .010" (.254 mm).

C. Remaining needle bearings should be pressed into housing .015" to .020" (.381 to .508 mm) below the thrust surface.

3. Slide spur gear (item 40) (flat side of gear toward center of transaxle) and thrust washer (item 74) on input shaft (item 39). Install input shaft into case. Use a press or soft–faced hammer to fully seat the shaft into the case. If input shaft is not fully seated, transaxle binding will occur.

4. Center thrust washer (item 73) on the cover brake shaft needle bearing. Slide idler gear (item 35) onto brake shaft (item 23) with the chamfer side of the gear away from the cover. Install brake shaft assembly into cover (Fig. 20).

5. Center thrust washer (item 41) on the output shaft bearing. Slide output gear (item 43) onto output pinion (item 44). Install output shaft assembly into cover. Place thrust washer (item 41) on output pinion.

6. Insert differential assembly into the cover making sure to orientate the differential bolt heads toward the center of the transaxle.

7. Install the two gear cluster (item 27) and spacer (item 37) onto brake shaft (Fig. 21).

8. Install thrust washer (item 61), low gear shaft and pinion (item 62) and spur gear (item 67) into cover. Make sure that the small gear meshes with the larger gear of the two gear cluster.

9. Slide shifting gears onto pinion shaft. Position shifter assembly to sifting gears and pinion shaft making sure that shift forks engage gear slots.

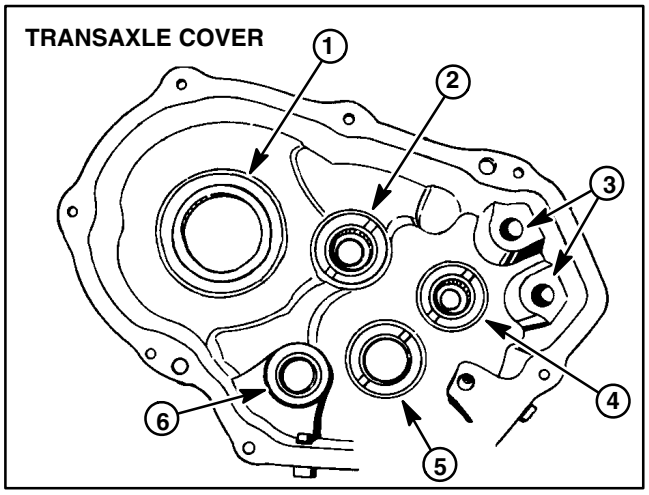

Figure 18

1. Differential bearing
2. Output shaft bearing
3. Shifter rod socket
4. Pinion shaft bearing
5. Brake shaft bearing
6. Low gear shaft bearing

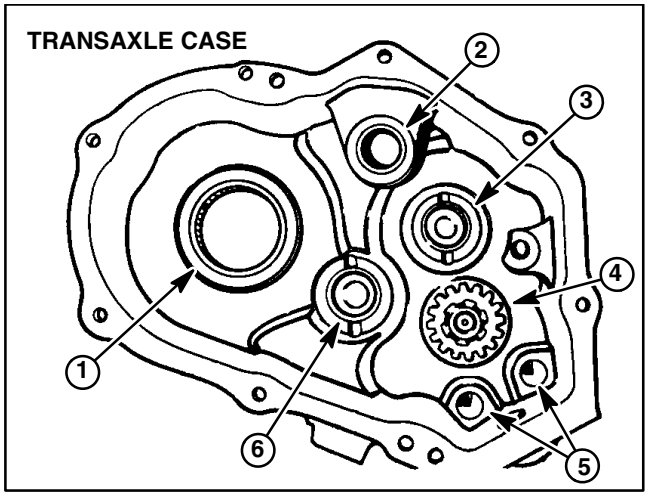

Figure 19

1. Differential bearing
2. Low gear shaft bearing
3. Brake shaft bearing
4. Input shaft and gear
5. Shifter rod socket
6. Output shaft bearing

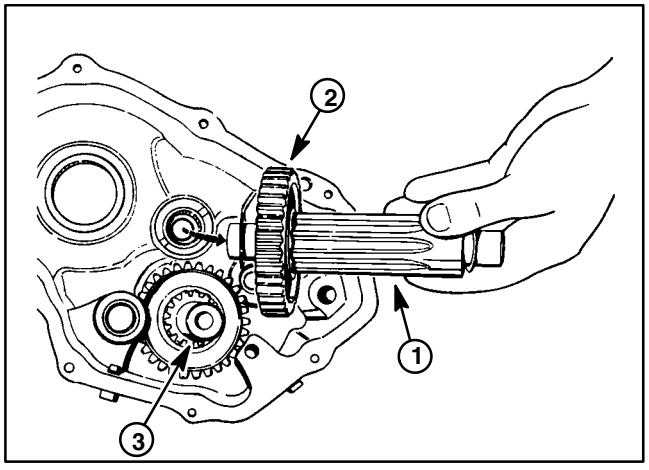

Figure 20

1. Output shaft
2. Output gear
3. Brake shaft

10. Center thrust washer (item 16) on the pinion shaft bearing. While squeezing shifter rods to hold shifter assembly together, install pinion shaft and shifter assembly into cover (Fig. 22).

11. Install reverse idler shaft (item 64), spacer (item 65) and reverse idler gear (item 66) into cover. Note that spacer goes between the gear and cover and the beveled side of idler gear should be down into the cover.

12. Install three gear cluster (item 36) onto brake shaft. Place thrust washer (item 16) on brake shaft.

13. Place gasket (item 30) on cover sealing surface and then install case over differential shaft. Make sure the case boss goes under the gears and the case edge goes over the shaft rods by tilting and rotating the case in the opposite manner in which it was removed.

14. If necessary to close the case to the cover:

    A. Turn input shaft to make sure all gears mesh properly.

    B. Using needle nose pliers, agitate shifter rod ends into their machined recesses in the case.

15. Align the case and cover with two (2) dowel pins. Install eleven (11) flange head screws. Torque screws to 10 ft–lb (13.6 N–m).

NOTE: Use seal protectors during seal installation to prevent damage to oil seals.

16. Lubricate new oil seals. Install input shaft seal (item 60) into case and brake shaft seal (item 45) into cover.

17. Lubricate and install new oil seals (item 45) and o–rings (item 72) to oil seal retainers (item 42). Install seal retainers to transaxle case and cover.

18. Position axle housings to transaxle noting marks made during disassembly for correct housing orientation. Secure axle housings with lock washers (item 53) and cap screws (item 51). Torque cap screws to 156 in–lb (17.6 N–m).

19. Coat both sides of new shift lever housing gaskets (item 31) with Permatex #2 (or equivalent). Install gaskets, shift guide plate (item 79), bracket (item 78) and shift lever to transaxle. Secure assembly to transaxle with three (3) socket head screws (item 1). Torque screws to 120 in–lb (13.6 N–m).

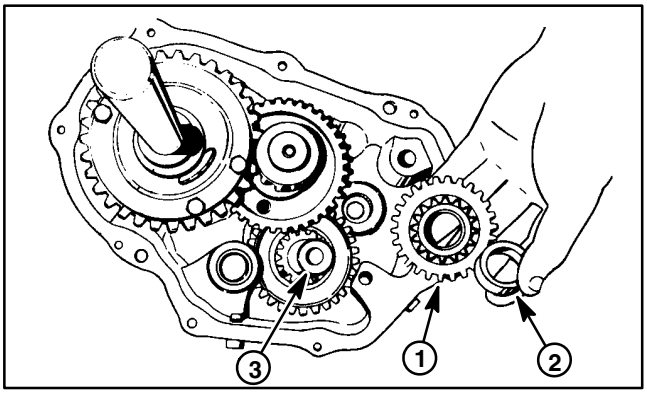

Figure 21

1. **Two gear cluster**
2. **Spacer**
3. **Brake shaft**

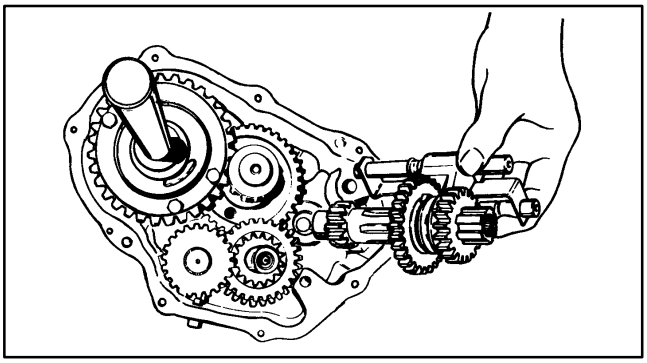

Figure 22

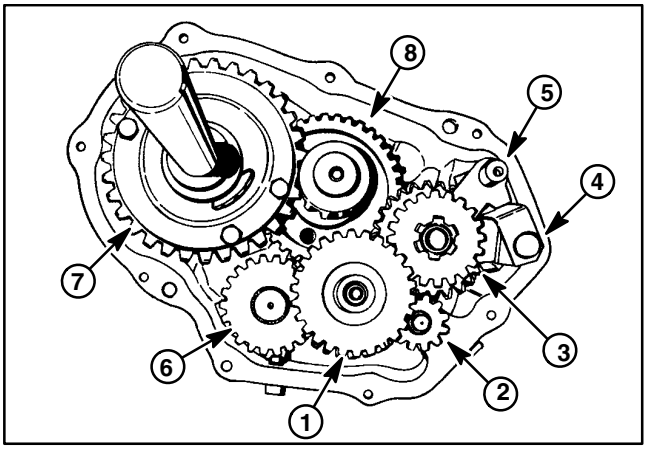

Figure 23

1. **Three gear cluster**
2. **Reverse idler gear**
3. **Input/pinion shafts**
4. **Shifter rod (Low)**
5. **Shifter rod (3rd & 4th)**
6. **Low gear**
7. **Differential assembly**
8. **Output gear**

Chapter 8

Coring Head

Table of Contents

General Information

Coring Head Operation

The coring head of the Greens Aerator consists of a pivoting coring frame, two coring crank sets, tine arms with connecting rods to provide vertical tine motion, turf guards, tine holders and aerating tines.

Drive for the coring head comes from the engine mounted pulley through a 3V section drive belt that is tensioned by a spring loaded idler pulley. The drive belt rotates the power shaft located on the coring head which in turn drives the coring crank sets with roller chains.

The two coring crank sets are composed of welded sprocket and crankarm assemblies that are supported by bearings and bearing caps. For assembly purposes, proper crank position is identified by alignment holes that exist in crank gears and the coring frame. Crank sets are timed to ensure minimal machine vibration.

A variety of aerating tines and tine holders are available for use on the Greens Aerator. Refer to the Operator's Manual for available options.

Figure 1

Coring Head Lock–Up Brackets

Whenever service is to be performed on coring head components, fully raise coring head and raise lock–up brackets on each side of machine. Once lock–up brackets are raised, lower coring head until it rests on brackets (Fig. 2).

After service is completed, raise coring head and lower lock–up brackets.

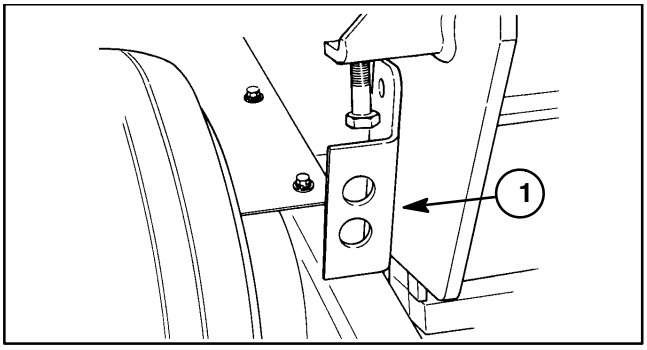

Figure 2

1. Lock–up bracket (raised position)

Coring Head Adjustments

See Operator's Manual for adjustment procedures for the coring head on the Greens Aerator.

CAUTION

Never work on the coring head with the engine running. Always fully raise coring head, stop engine, remove key from the ignition switch and install the coring head lock–up brackets before performing any service to coring head components.

Coring Head Bearing Caps

The Greens Aerator coring head frame includes several bearing caps used to position the power shaft and crank arms. Line boring of the coring head frame during manufacture determines location of the bearing caps. If any of the bearing caps are removed during repairs, they need to be reinstalled in the exact position that they were removed from. Matchmark bearing cap and frame location before removing a bearing cap from the coring head frame.

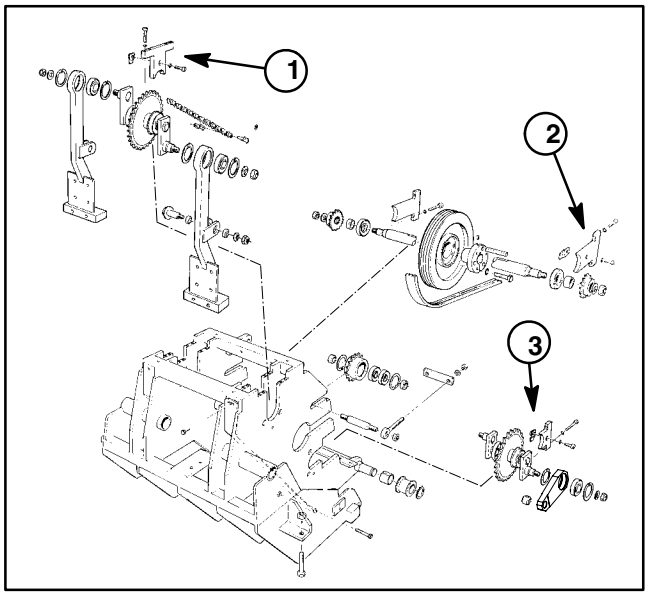

Figure 3

1. **Upper crank arm bearing cap**
2. **Power shaft bearing cap**
3. **Lower crank arm bearing cap**

Coring Head Chain

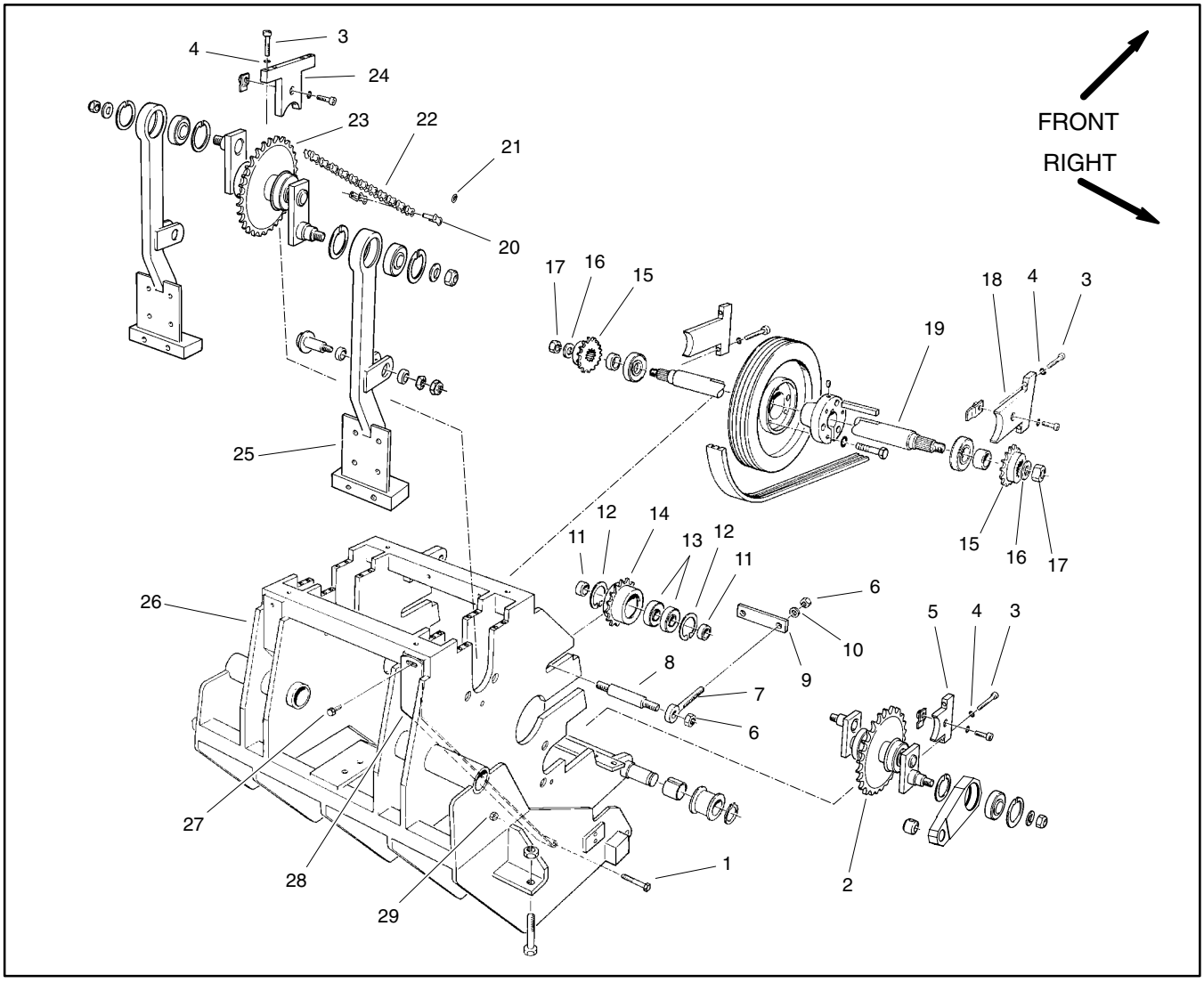

Figure 4

1. Cap screw
2. Lower crank arm assembly
3. Socket head screw
4. Lock washer
5. Bearing cap (short crank)
6. Lock nut
7. Eye bolt
8. Idler sprocket shaft
9. Keeper bar
10. Flat washer
11. Bushing
12. Retaining ring
13. Bearing
14. Idler sprocket
15. Drive sprocket
16. Flat washer
17. Lock nut
18. Bearing cap (power shaft)
19. Power shaft
20. Connecting link
21. Connecting link o–ring
22. Roller chain
23. Upper crank arm assembly
24. Bearing cap (long crank)
25. Tine arm
26. Coring frame
27. Tap screw
28. Chain guard
29. Lock nut

Removal (Fig. 4)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Unlatch and remove coring head cover.

4. Loosen two (2) lock nuts (item 6) to allow chain slack.

5. Rotate coring assembly by hand to locate drive chain connecting link. Remove connecting link from drive chain.

6. Remove drive chain from coring head.

Installation (Fig. 4)

1. Route end of drive chain down between upper crank arm assembly sprocket and chain guard.

2. Insert alignment pins through holes in coring head plates and crank arm sprockets (see Fig. 5 and Operator's Manual).

3. Place lower end of chain onto approximate center of lower crank arm assembly sprocket. Pull chain slack upward and position chain onto upper crank arm assembly sprocket.

4. Route upper free end of chain downward in front of idler sprocket, behind drive sprocket on power shaft and then around front of lower crank arm assembly sprocket to opposite end of chain (Fig. 6).

5. Install connecting link to attach chain ends:

   A. Lubricate connecting link pins, chain bushings and connecting link o–rings.

   B. Place o–ring on both connecting link pins and insert connecting link to chain ends.

   C. Place o–ring on both connecting link pins and install connecting link side plate.

   D. Secure connecting link with spring lock making sure that spring lock fits into grooves of connecting link.

6. Adjust coring head chain tension (see Operator's Manual). Lubricate chain.

7. Install coring head cover.

8. Lower coring head lock–up brackets before machine use.

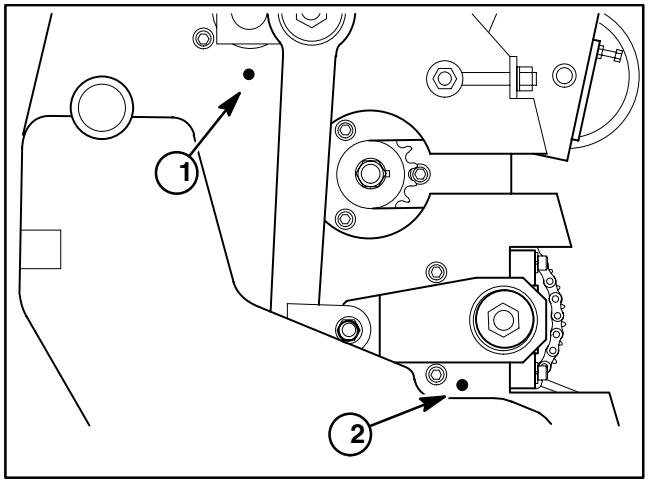

Figure 5

1. **Upper crank arm alignment hole**
2. **Lower crank arm alignment hole**

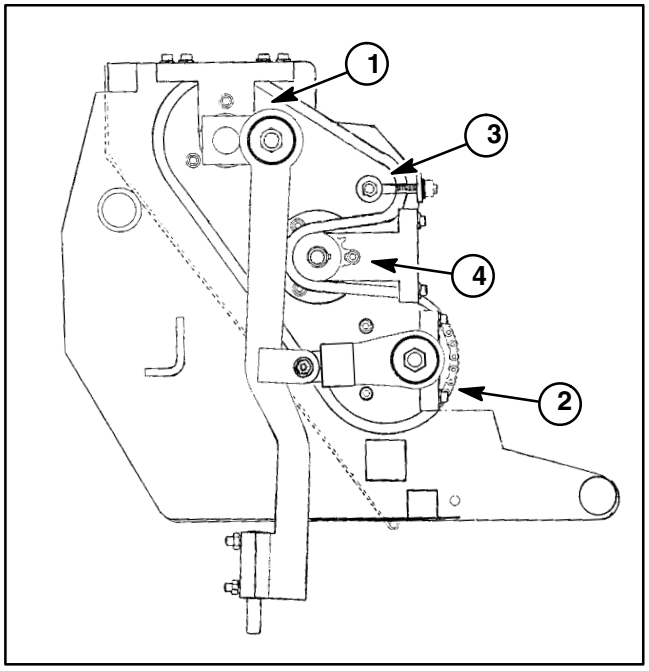

Figure 6

1. **Upper crank sprocket**
2. **Lower crank sprocket**
3. **Idler sprocket**
4. **Drive sprocket**

Tine Arms

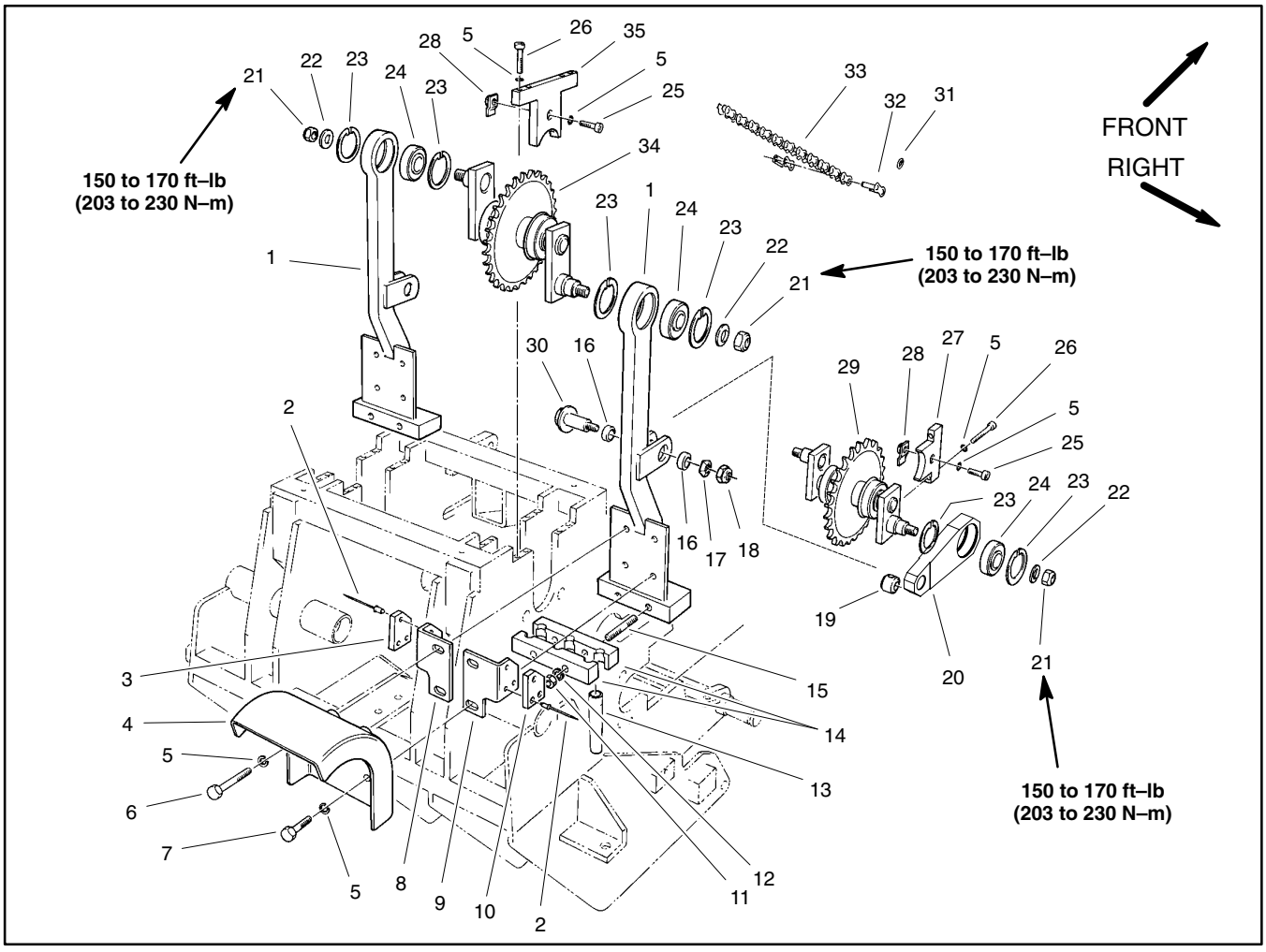

Figure 7

1. Tine arm
2. Rivet
3. LH wear plate
4. Kickout deflector
5. Lock washer
6. Cap screw
7. Cap screw
8. LH wear plate bracket
9. RH wear plate bracket
10. RH wear plate
11. Hex nut
12. Lock washer
13. Aerating tine
14. Tine holder
15. Stud
16. Bushing
17. Pyramidal washer
18. Lock nut
19. Rubber bushing
20. Connecting rod
21. Lock nut
22. Flat washer
23. Retaining ring
24. Bearing
25. Socket head screw
26. Socket head screw
27. Bearing cap (short crank)
28. Retaining clip
29. Lower crank arm assembly
30. Shoulder bolt
31. O–ring
32. Connecting link
33. Roller chain
34. Upper crank arm assembly
35. Bearing cap (long crank)

Removal (Fig. 7)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Unlatch and remove coring head cover.

4. Remove coring head chain (see Coring Head Chain Removal in this section).

5. Remove lock nut (item 21) and flat washer (item 22) that secure tine arm to upper crank arm (item 34).

6. Remove lock nut (item 21) and flat washer (item 22) that secure connecting rod to lower crank arm (item 29).

7. Slide tine arm from upper crank arm and connecting rod from lower crank arm. Lower tine arm assembly out bottom of coring frame.

8. Dissasemble tine arm using Figure 7 as a guide.

Installation (Fig. 7)

1. Assemble tine arm using Figures 7 and 8 as guides.

   A. If stud (item 14) was removed from tine arm, apply Loctite #271 (red) (or equivalent) to threads of stud before installing stud into tine arm.

   B. If connecting rod (item 20) was removed, install rod with the straight side down.

   C. When installing shoulder bolt (item 30), align the bolt head to the center of coring head.

2. Raise tine arm assembly up from bottom of coring frame. Position tine arm to upper crank arm and connecting rod to lower crank arm.

3. Install flat washer (item 22) and lock nut (item 21) to crank arms to retain tine arm and connecting rod. Torque lock nuts from 150 to 170 ft–lb (203 to 230 N–m).

IMPORTANT: When installing coring head chain, make sure that alignment pins are used to properly time the crank arm assemblies.

4. Install coring head chain (see Coring Head Chain Installation in this section).

5. After assembly, rotate coring crankshaft by hand to make sure that no binding occurs.

6. Install coring head cover.

7. Lower coring head lock–up brackets before machine use.

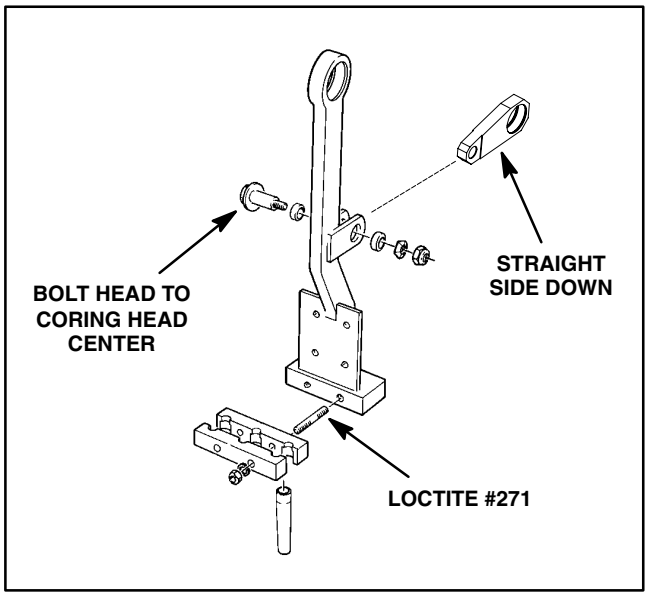

Figure 8

Crank Arms

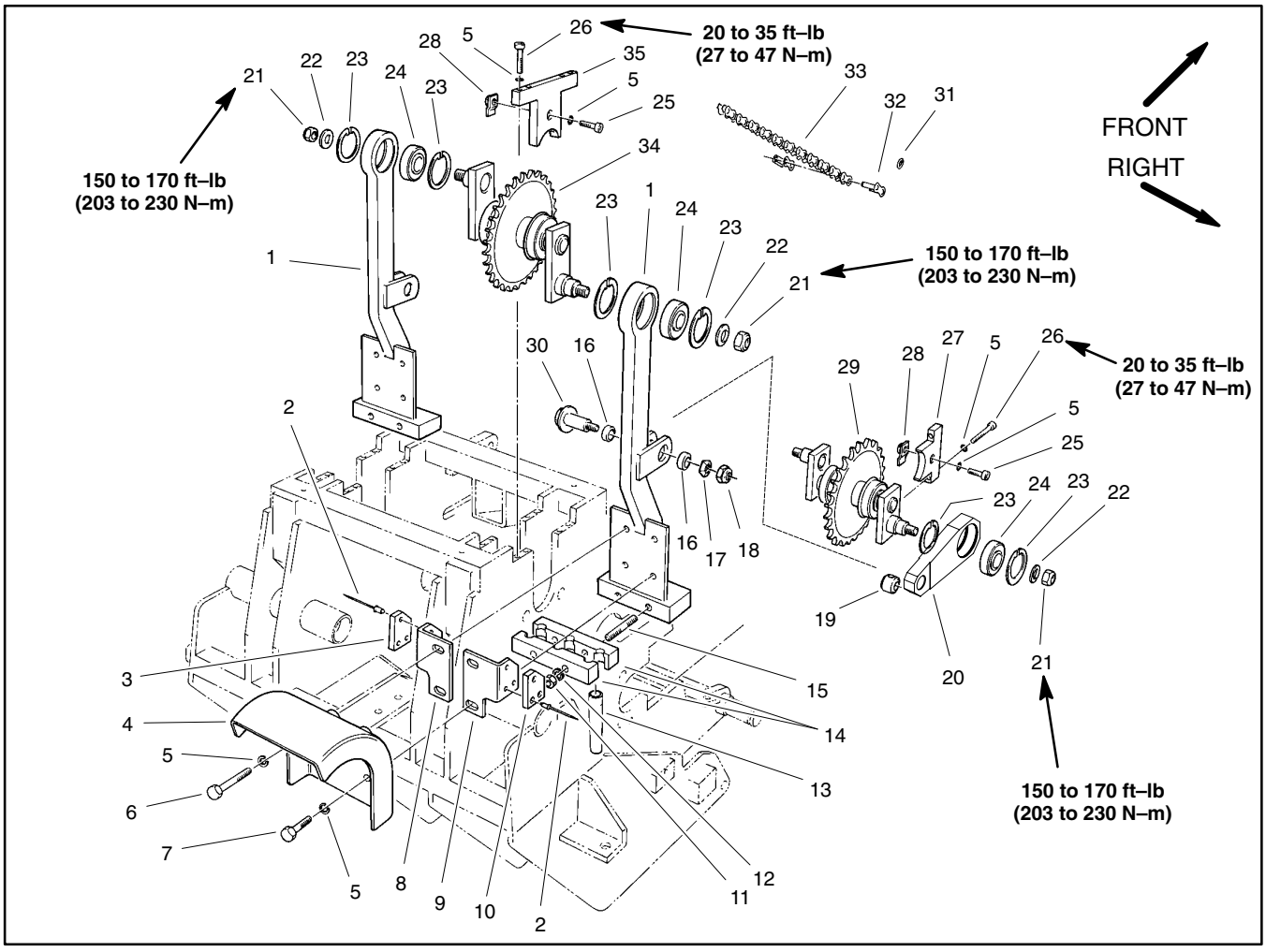

Figure 9

1. Tine arm
2. Rivet
3. LH wear plate
4. Kickout deflector
5. Lock washer
6. Cap screw
7. Cap screw
8. LH wear plate bracket
9. RH wear plate bracket
10. RH wear plate
11. Hex nut
12. Lock washer
13. Aerating tine
14. Tine holder
15. Stud
16. Bushing
17. Pyramidal washer
18. Lock nut
19. Rubber bushing
20. Connecting rod
21. Lock nut
22. Flat washer
23. Retaining ring
24. Bearing
25. Socket head screw
26. Socket head screw
27. Bearing cap (short crank)
28. Retaining clip
29. Lower crank arm assembly
30. Shoulder bolt
31. O–ring
32. Connecting link
33. Roller chain
34. Upper crank arm assembly
35. Bearing cap (long crank)

Removal (Fig. 9)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Unlatch and remove coring head cover.

4. Remove coring head chain (see Coring Head Chain Removal in this section).

5. Remove both tine arms from crank arm assembly that is to be removed (see Tine Arm Removal in this section).

IMPORTANT: Matchmark bearing cap and coring head frame bore before removing bearing cap. Bearing caps must be installed in the same position they were removed from.

6. Remove socket head screws and lock washers that secure bearing cap to coring head frame. Remove bearing cap from coring head frame.

7. Pull crank arm assembly from coring head frame.

8. If necessary, remove retaining clip(s) from bearing cap and/or coring head frame.

Installation (Fig. 9)

1. Make sure that bores of coring head frame and bearing caps are free of nicks, burrs or corrosion. If necessary, use 320 grit emery cloth to remove imperfections in bores. Clean bores thoroughly before installation of crank arms.

2. If any retaining clips were removed, secure retaining clips with lock washer and socket head screw. Make sure that clips are perpendicular to bearing bore prior to tightening screw.

3. Position crank arm assembly to coring head frame. Make sure that bearing with retaining ring is placed at retaining clips on the outer coring head frame plate (Fig. 10).

IMPORTANT: Bearing caps must be installed in the same position they were removed from.

4. Install bearing cap noting matchmark made during removal to ensure that bearing cap is properly positioned. Secure bearing cap to coring head frame with lock washers and socket head screws. Torque screws from 20 to 35 ft–lb (27 to 47 N–m).

5. Install both tine arms to crank arm assembly that was removed (see Tine Arm Installation in this section).

IMPORTANT: When installing coring head chain, make sure that alignment pins are used to properly time the crank arm assemblies.

6. Install coring head chain (see Coring Head Chain Installation in this section).

7. After assembly, rotate coring crankshaft by hand to make sure that no binding occurs.

8. Install coring head cover.

9. Lower coring head lock–up brackets before machine use.

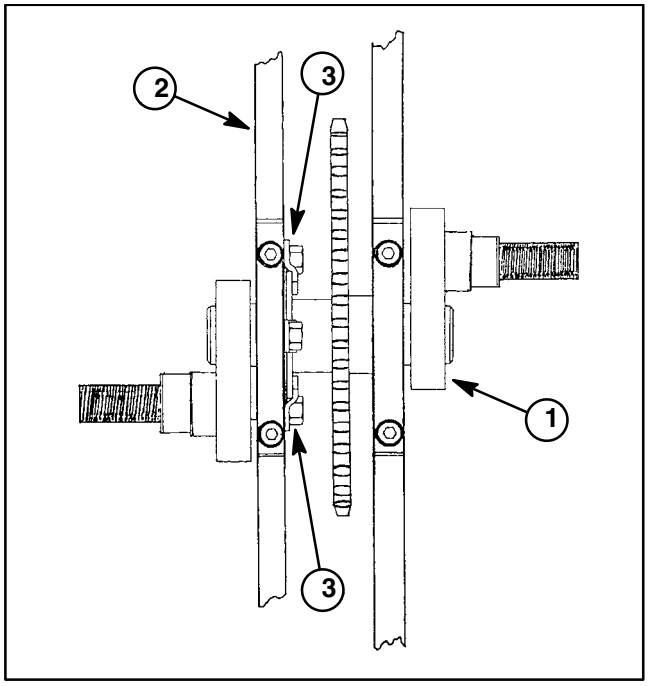

Figure 10

1. **Crank arm**
2. **Outer frame plate**
3. **Retaining clip**

Coring Head Drive Belt

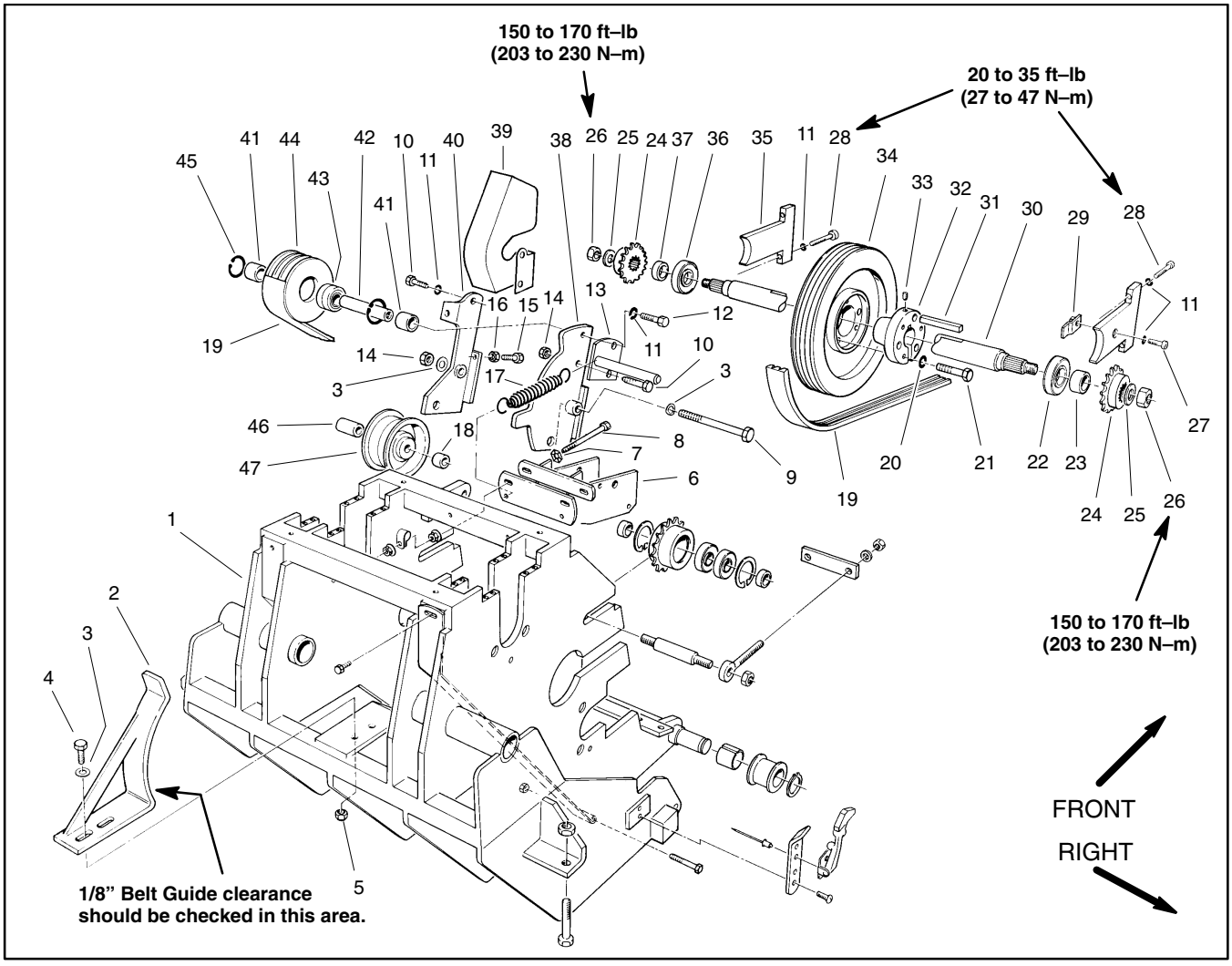

Figure 11

1. Coring head frame
2. Belt guide
3. Flat washer
4. Cap screw (2 used)
5. Lock nut (2 used)
6. Idler pulley pivot bracket
7. Pyramidal washer (2 used)
8. Cap screw (2 used)
9. Cap screw
10. Cap screw (2 used)
11. Lock washer
12. Cap screw
13. Handle
14. Lock nut
15. Square head screw (2 used)
16. Jam nut (2 used)
17. Extension spring (2 used)
18. Spacer (.500" long)
19. Coring head drive belt
20. Lock washer (3 used)
21. Cap screw (3 used)
22. Bearing
23. Spacer (.740" long)
24. Sprocket
25. Flat washer
26. Lock nut
27. Socket head screw (3 used)
28. Socket head screw
29. Retaining clip (3 used)
30. Power shaft
31. Key
32. Taper lock bushing
33. Set screw
34. Pulley
35. Bearing cap
36. Bearing
37. Spacer (.560" long)
38. RH idler bracket
39. Pulley guard
40. LH idler bracket
41. Spacer
42. Idler shaft
43. Bearing (2 used)
44. Idler pulley
45. Retaining ring
46. Spacer (1.060" long)
47. Idler pulley

Removal (Fig. 11)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Unlatch and remove coring head cover.

4. Remove exhaust muffler guard (see Exhaust System Removal in Service and Repair section of Chapter 3 – Engine).

5. Remove traction drive belt from engine pulley (see Traction Drive Belt Removal in Service and Repairs section of Chapter 7 – Drive Train).

6. Remove both coring head chains (see Coring Head Chain Removal in this section).

7. Remove lock nuts (item 26) that secure sprockets (item 24) to power shaft. Pull flat washer (item 25), sprocket and spacer (items 23 and 37) from both ends of shaft. Note that length of spacers is different.

8. Remove cap screws (items 10 and 12) and lock washers that secure idler pulley (item 44) to idler brackets. Pull idler pulley from brackets. Locate and retrieve two (2) spacers (item 41) from sides of pulley.

IMPORTANT: Matchmark bearing cap and coring head frame bore before removing bearing cap. Bearing caps must be installed in the same position they were removed from.

9. Remove socket head screws (item 28) and lock washers (item 11) that secure bearing caps to coring head frame. Slide bearing caps from frame.

10. Carefully reposition power shaft in coring head frame to allow coring head drive belt to be removed from pulley and shaft. After belt has been removed, support power shaft to prevent it from falling.

11. Remove coring head drive belt from idler bracket, engine pulley and machine.

Installation (Fig. 11)

1. Make sure that bores of coring head frame and bearing caps are free of nicks, burrs or corrosion. If necessary, use 320 grit emery cloth to remove imperfections in bores. Clean bores thoroughly before installation of power shaft into coring head frame.

2. If any retaining clips were removed, secure retaining clips with lock washer and socket head screw. Make sure that clips are perpendicular to bearing bore prior to tightening screw.

3. Carefully position power shaft in coring head frame to allow coring head drive belt to be placed around power shaft and pulley. Install belt and support power shaft to prevent it from falling.

4. Position power shaft to coring head frame. Make sure that shaft bearing with retaining ring is placed at retaining clips on the right side of the coring head frame.

IMPORTANT: Bearing caps must be installed in the same position they were removed from.

5. Install bearing caps noting matchmarks made during removal to ensure that bearing caps are properly positioned. Secure bearing caps to coring head frame with lock washers (item 11) and socket head screws (item 28). Torque screws from 20 to 35 ft–lb (27 to 47 N–m).

6. Position coring head drive belt to the right side of the pulley. The left pulley groove should be unused (Fig. 12).

7. Position idler pulley (item 44) to idler brackets. Place spacer (item 41) on each side of pulley. Secure idler pulley to idler brackets with cap screws (items 10 and 12) and lock washers.

8. Place coring head drive belt onto engine pulley.

9. Slide spacer (items 23 and 37), sprocket (item 24) and flat washer (item 25) onto each end of power shaft. Sprocket and shaft splines have marks that should be aligned during assembly. Install lock nuts (item 26) on shaft and torque from 150 to 170 ft–lb (203 to 230 N–m).

10. Check that coring head drive belt alignment is still correct. If needed, readjust location of power shaft pulley and/or idler bracket to align drive belt.

11. Check that 1/8" (3.2 mm) clearance exists between bottom of belt guide (item 2) and installed belt. Reposition guide if needed.

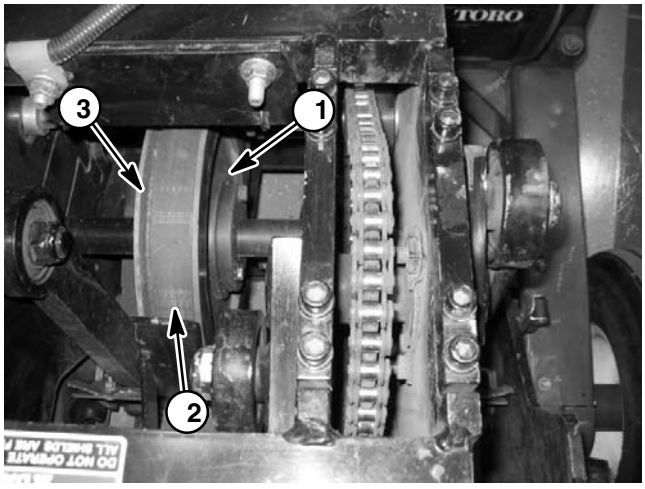

Figure 12

1. **Pulley**
2. **Drive belt**
3. **Unused pulley groove**

12. Install traction drive belt to engine pulley (see Traction Drive Belt Installation in Service and Repairs section of Chapter 7 – Drive Train).

13. Install exhaust muffler guard (see Exhaust System Installation in Service and Repair section of Chapter 3 – Engine).

IMPORTANT: When installing coring head chain, make sure that alignment pins are used to properly time the crank arm assemblies.

14. Install coring head chain (see Coring Head Chain Installation in this section).

15. After assembly, rotate coring crankshaft by hand to make sure that no binding occurs.

16. Install coring head cover.

17. Lower coring head lock–up brackets before machine use.

18. Check and adjust coring head drive belt tension (see Operator's Manual).

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Coring Head Drive

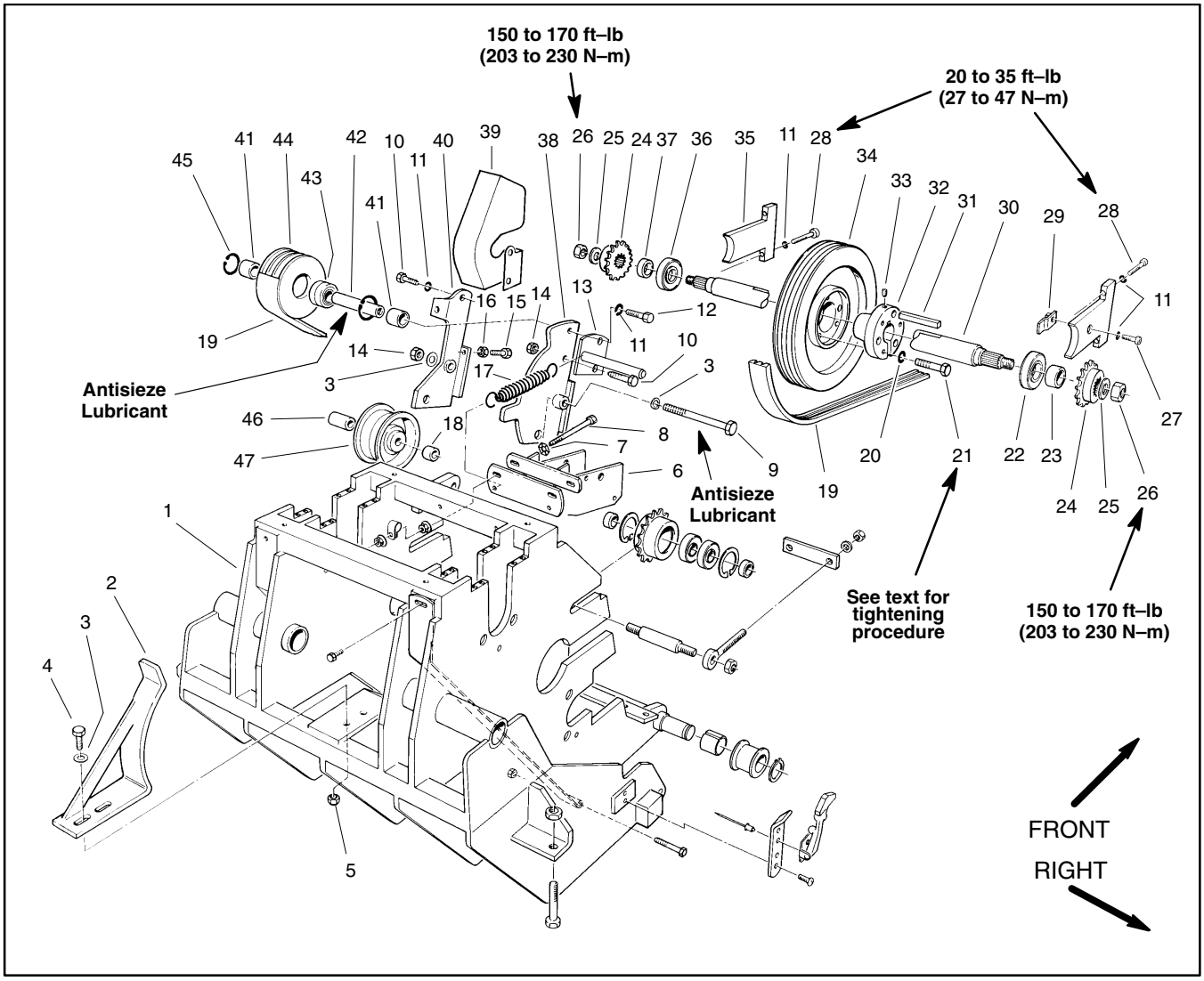

Figure 13

1. Coring head frame
2. Belt guide
3. Flat washer
4. Cap screw (2 used)
5. Lock nut (2 used)
6. Idler pulley pivot bracket
7. Pyramidal washer (2 used)
8. Cap screw (2 used)
9. Cap screw
10. Cap screw (2 used)
11. Lock washer
12. Cap screw
13. Handle
14. Lock nut
15. Square head screw (2 used)
16. Jam nut (2 used)
17. Extension spring (2 used)
18. Spacer (.500" long)
19. Coring head drive belt
20. Lock washer (3 used)
21. Cap screw (3 used)
22. Bearing
23. Spacer (.740" long)
24. Sprocket
25. Flat washer
26. Lock nut
27. Socket head screw (3 used)
28. Socket head screw
29. Retaining clip (3 used)
30. Power shaft
31. Key
32. Taper lock bushing
33. Set screw
34. Pulley
35. Bearing cap
36. Bearing
37. Spacer (.560" long)
38. RH idler bracket
39. Pulley guard
40. LH idler bracket
41. Spacer
42. Idler shaft
43. Bearing (2 used)
44. Idler pulley
45. Retaining ring
46. Spacer (1.060" long)
47. Idler pulley

Power Shaft Disassembly (Fig. 13)

1. Park the machine on a level surface, fully raise the coring head and stop the engine. Remove the key from the ignition switch.

2. Raise lock–up brackets on each side of machine and lower coring head until it rests on brackets.

3. Unlatch and remove coring head cover.

4. Remove coring head drive belt (see Coring Head Drive Belt Removal in this section).

5. Remove power shaft assembly from machine.

6. Press bearings from power shaft. Note that right side bearing has retaining ring used to locate bearing in coring frame.

7. Measure and record distance from shaft end to location of taper lock bushing to ease reassembly.

8. Loosen pulley (item 34) from taper lock bushing (item 32):

A. Remove three (3) cap screws (item 21) and lock washers (item 20) that secure pulley to taper lock bushing.

IMPORTANT: Excessive or unequal pressure on the cap screws can break the taper lock bushing flange. When removing taper lock bushing, tighten screws progressively and evenly.

B. Insert cap screws into threaded removal holes of the bushing. Tighten screws progressively and evenly until the pulley is loose on the bushing.

9. Loosen set screw (item 33) that secures taper lock bushing to power shaft. Remove bushing and pulley from the shaft. Locate and retrieve key (item 31) that locate bushing on shaft.

Power Shaft Assembly (Fig. 13)

NOTE: Power shaft is not symmetrical. Keyway in shaft is closer to right side of machine.

1. Install key (item 31) into keyway in power shaft.

2. Using measurement made during disassembly, locate taper lock bushing on shaft and secure in place with set screw (item 33).

3. Position pulley to bushing making sure that tapered surfaces of pulley and bushing align. Align threaded holes of pulley with non–threaded holes of bushing.

IMPORTANT: When securing pulley to taper lock bushing, tighten cap screws progressively and evenly to prevent bushing flange damage.

4. Secure pulley to taper lock bushing with three (3) cap screws (item 21) and lock washers (item 20). Tighten cap screws to a torque from 160 to 200 in–lb (18.1 to 22.6 N–m) in three equal steps and in a circular pattern.

5. Install bearings on power shaft. Make sure that right side bearing has retaining ring toward the middle of the shaft.

6. Position power shaft assembly into coring head frame.

7. Install coring head drive belt (see Coring Head Drive Belt Installation in this section). During assembly, make sure to check belt alignment. If necessary, loosen set screw on taper lock bushing and adjust location of pulley on power shaft. Re–tighten set screw when alignment is correct.

Belt Tensioner Disassembly (Fig. 13)

CAUTION

Be careful when removing extension springs on idler assembly. The springs are under heavy load and may cause personal injury.

1. Disassemble belt tensioner components as required using Figure 13 as a guide.

Belt Tensioner Assembly (Fig. 13)

1. Assemble belt tensioner components as required using Figure 13 as a guide noting the following:

A. When installing the idler pulley (item 47), position short spacer (item 18) on the hub side of the pulley.

B. Liberally apply antisieze lubricant to the shaft of cap screw (item 9) before installation of the cap screw into the idler brackets and idler pulley.

C. Make sure that idler brackets (items 38 and 40) pivot freely after tightening the lock nut (item 14) that secures idler pulley (item 47).

D. If bearings were removed from idler pulley (item 44), install one retaining ring, press bearings into pulley and then install second retaining ring.

E. Coat idler shaft (item 42) with antisieze lubricant before installation.

2. After assembly of belt tensioner components, make sure to check belt alignment. If necessary, loosen fasteners that secure idler pivot pulley bracket (item 6) and adjust location of bracket on coring head frame.

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Chapter 9

Electrical Diagrams

Table of Contents

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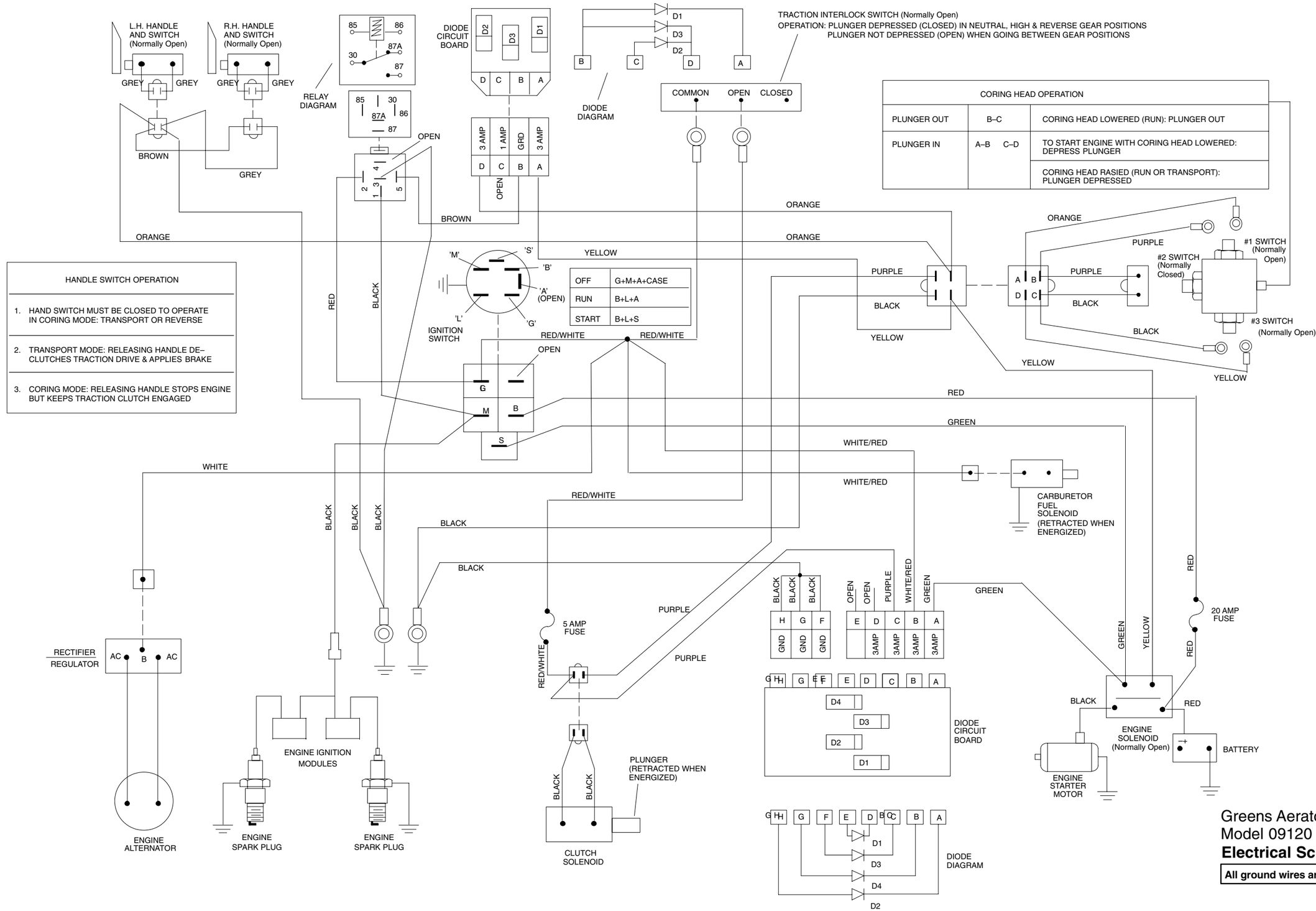
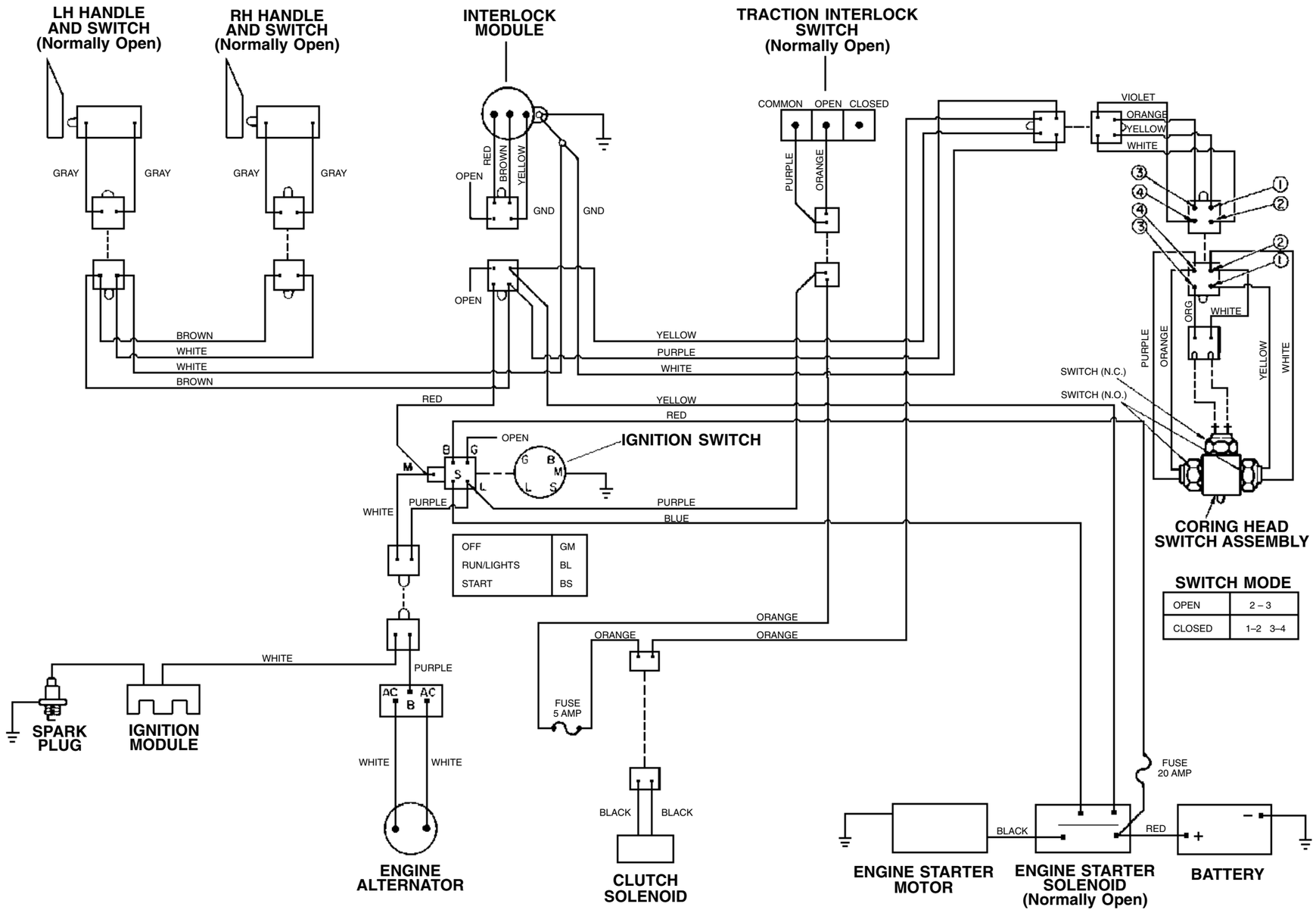


Greens Aerator
Model 09120
Electrical Schematic

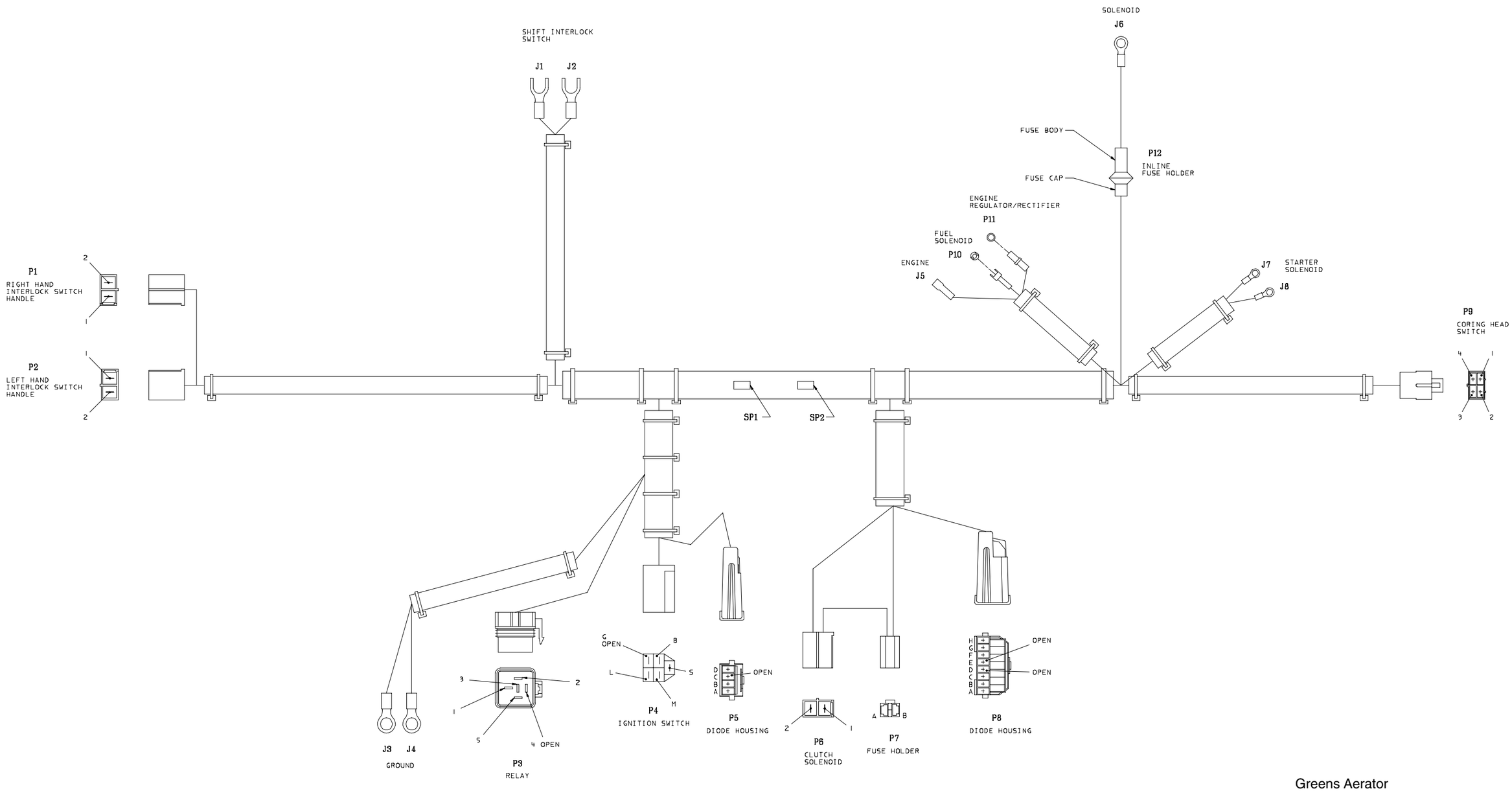
All ground wires are black.



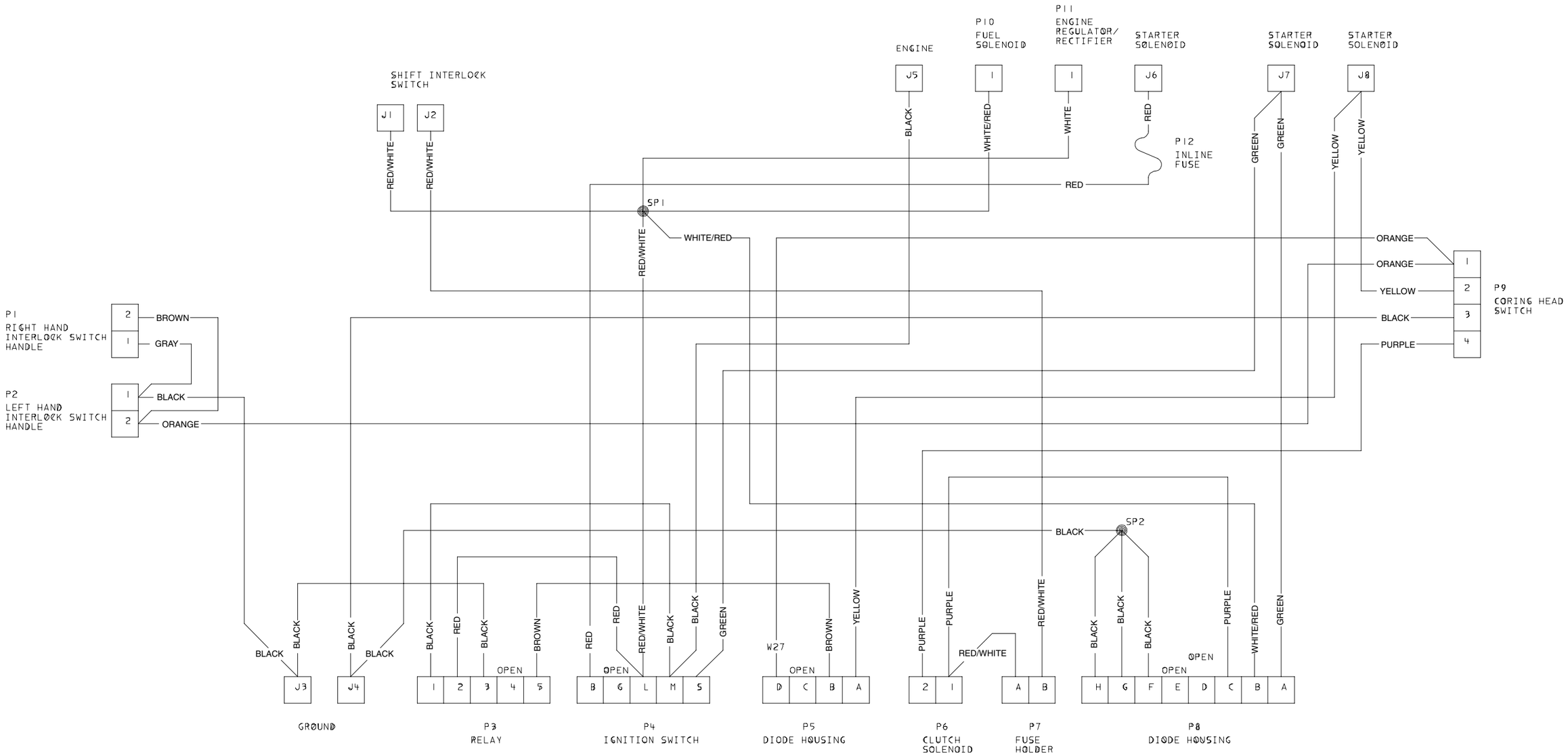
Greens Aerator
Model 09110

Electrical Schematic

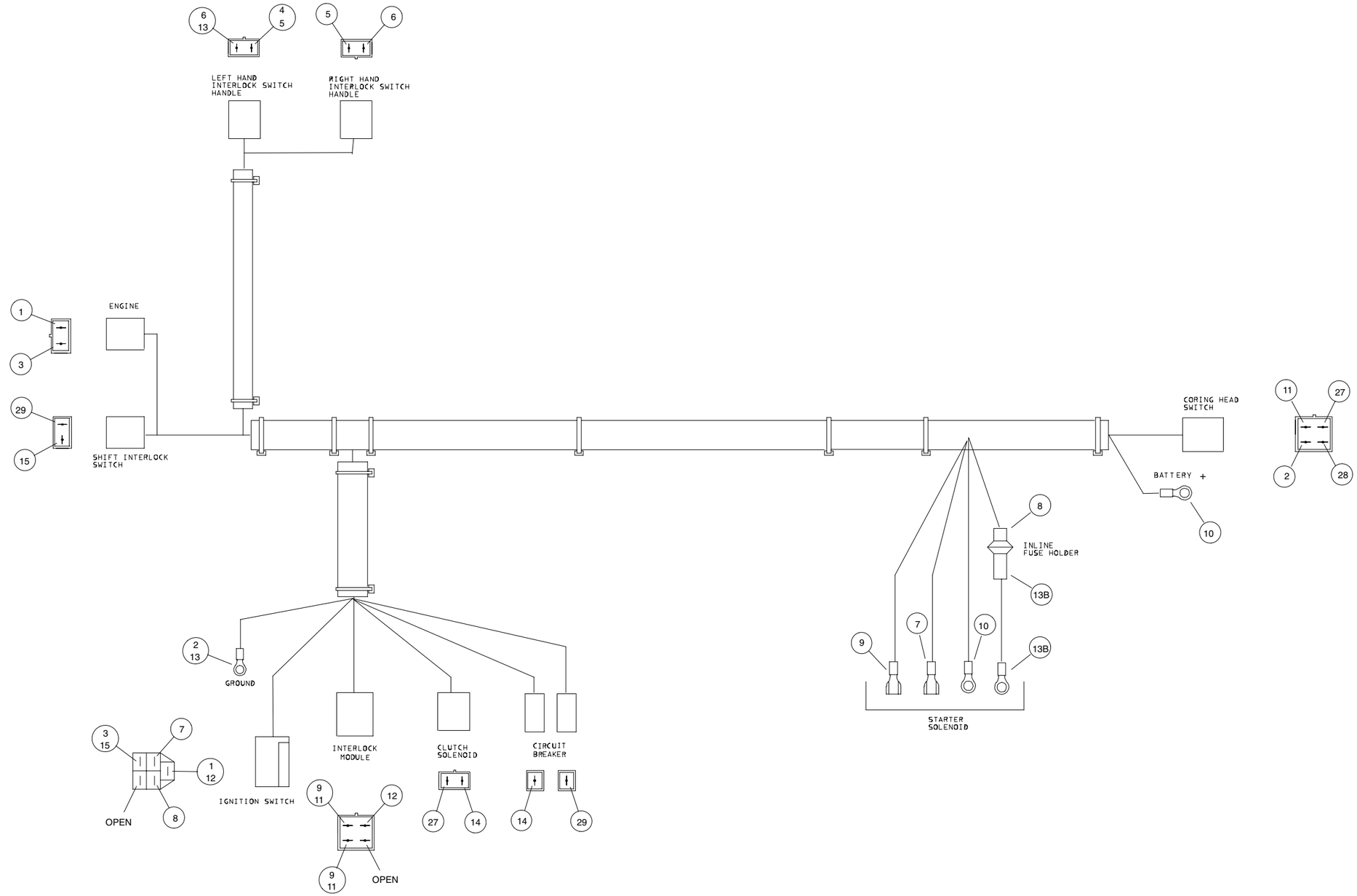
All ground wires are black.



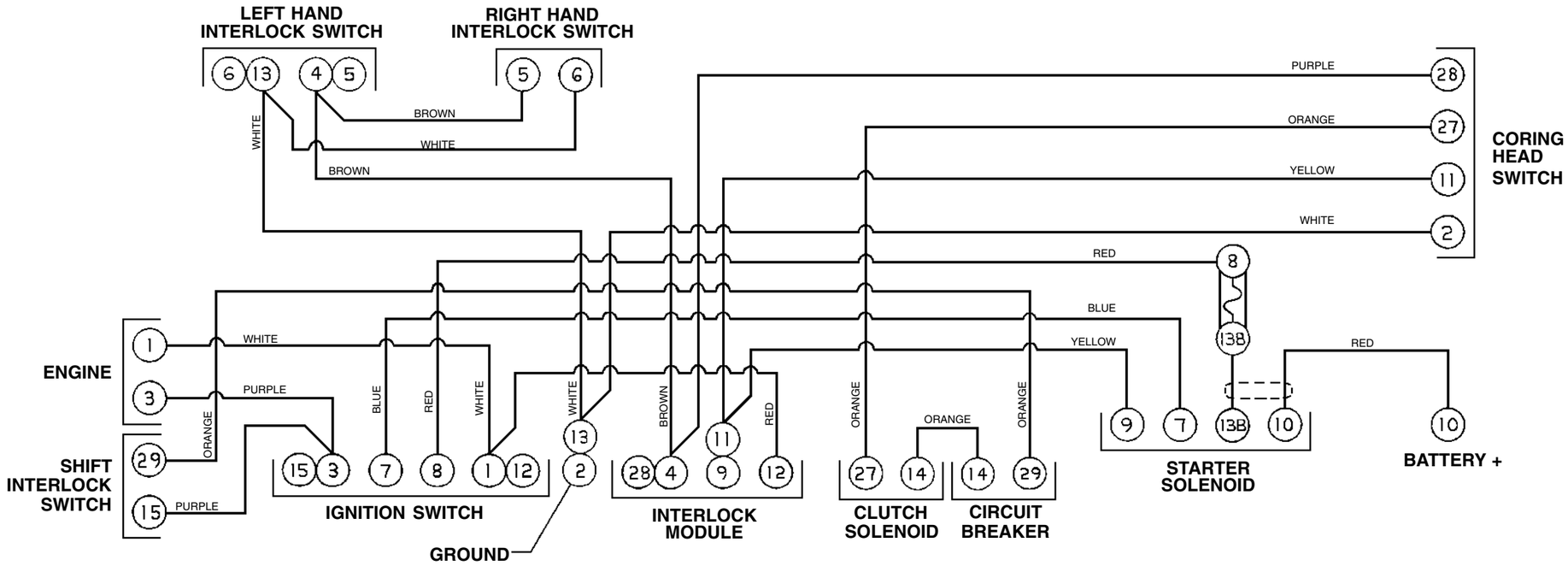
Greens Aerator
Model 09120
Wire Harness Drawing



Greens Aerator
Model 09120
Wire Harness Diagram



Greens Aerator
Model 09110
Wire Harness Drawing


LEFT HAND INTERLOCK SWITCH
RIGHT HAND INTERLOCK SWITCH
6 13 4 5
5 6
BROWN
WHITE
WHITE
BROWN
PURPLE
ORANGE
YELLOW
WHITE
RED
BLUE
YELLOW
28
27
11
2
8
138
CORING HEAD SWITCH
ENGINE
1
3
WHITE
PURPLE
ORANGE
SHIFT INTERLOCK SWITCH
29
15
PURPLE
BLUE
RED
WHITE
15 3 7 8 1 12
IGNITION SWITCH
WHITE
13
2
GROUND
BROWN
RED
28 4 9 12
INTERLOCK MODULE
ORANGE
ORANGE
ORANGE
27 14
14 29
CLUTCH SOLENOID
CIRCUIT BREAKER
RED
9 7 138 10
STARTER SOLENOID
10
BATTERY +