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Count on it.

Service Manual

Reelmaster®
3550–D/3555–D/3575–D

Original Instructions (EN)

Revision History

Revision	Date	Description
--	2015	Initial Issue.
A	2015	Updated Hydraulic chapter.
B	2016	Updated Electrical System chapter.
C	2016	Updated Universal Groomer chapter.
D	02/2018	Added revision history.
E	04/2018	Revised bedknife installation procedure.
F	11/2018	Updated Hydraulic and Chassis chapter.
G	03/2019	Updated Engine and Chassis chapter.
H	06/2020	Updated Electrical Systems, Cutting Unit, Universal Groomer chapters and Foldout Drawings.
J	06/2021	Updated Engine and Hydraulic chapters.

Reader Comments

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

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NOTES

Service Manual

Reelmaster® 3550-D/3555-D/3575-D

Preface

The purpose of this publication is to provide the service technician with service information for service and repair of major systems and components on the Reelmaster 3550-D/3555-D/3375-D.

REFER TO THE TRACTION UNIT AND CUTTING UNIT OPERATOR'S MANUALS FOR OPERATING, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS. Copies of the Operator's Manuals and Parts Catalog are available on the internet at www.Toro.com.

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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General Safety Instructions

The Reelmaster has been tested and certified by Toro for compliance with existing safety standards and specifications. 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. Review and understand the contents of the Operator's Manuals and Operator's DVD before starting and operating the vehicle. Become familiar with the controls and know how to stop the vehicle and engine quickly. Additional copies of the Operator's Manual are available on the internet at www.Toro.com.

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 traction pedal is in NEUTRAL and cutting units are DISENGAGED.

4. Since diesel fuel is flammable, handle it carefully:

   A. Use an approved fuel container.

   B. Do not remove 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.

   E. Wipe up any spilled fuel.

While Operating

1. Sit on the seat when starting and operating the machine.

2. Before starting the engine:

   A. Engage the parking brake.

   B. Make sure traction pedal is in neutral and the PTO switch is OFF (disengaged).

   C. After engine is started, release parking brake and keep foot off traction pedal. Machine must not move. If movement is evident, the traction pedal linkage may be adjusted incorrectly; therefore, shut engine off and adjust traction pedal linkage until machine does not move when traction pedal is released.

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, exhaust system components or radiator while engine is running or soon after it is stopped. These areas could be hot enough to cause burns.

5. Before getting off the seat:

   A. Ensure that traction pedal is in neutral.

   B. Engage parking brake.

   C. Disengage PTO and wait for cutting unit reels to stop rotating.

   D. Stop engine and remove key from ignition switch.

   E. Toro recommends that anytime the machine is parked (short or long term), the cutting units should be lowered to the ground. This relieves pressure from the lift circuit and eliminates the risk of cutting units accidentally lowering to the ground.

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

Maintenance and Service

1. The Traction Unit and Cutting Unit Operator's Manuals provide information regarding the operation, general maintenance and maintenance intervals for your Reelmaster machine. Refer to these publications for additional information when servicing the machine.

2. Before servicing or making adjustments, lower cutting units, stop engine, set parking brake and remove key from the ignition switch.

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

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

5. 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.

6. 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. 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.

7. Before disconnecting or performing any work on the hydraulic system, all pressure in system must be relieved by stopping engine and lowering cutting units to the ground.

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

9. To reduce potential fire hazard, keep engine area free of excessive grease, grass, leaves and dirt. Clean protective screen on machine frequently.

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

11. To assure safety and accuracy, check maximum engine speed.

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 cable last. If battery voltage is required for troubleshooting or test procedures, temporarily connect the battery. Reconnect positive battery cable first and negative 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 welding on machine, disconnect both battery cables to prevent damage to machine electronic equipment. Disconnect negative battery cable first and positive cable last. Also, disconnect the wire harness connector from the machine TEC controller and disconnect the terminal connector from the alternator.

17. At the time of manufacture, the machine conformed to the safety standards for riding mowers. 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.

18. When changing attachments, tires or performing other service, use correct jacks, hoists and jack stands. Make sure machine is parked on a solid level surface 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 appropriate jack stands to support the raised machine. If the machine is not properly supported by jack stands, the machine may move or fall, which may result in personal injury (see Jacking Instructions in this chapter).

19. Make sure to dispose of potentially harmful waste (e.g. fuel, oil, engine coolant, filters, battery) in an environmentally safe manner. Follow all local codes and regulations when recycling or disposing of waste.

Jacking Instructions

CAUTION

When changing attachments, tires or performing other service, use correct jacks and supports. 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 to support the raised machine. If the machine is not properly supported by jack stands, the machine may move or fall, which may result in personal injury.

Jacking the Front End

1. If the front wheel or wheel motor is to be removed, position jack securely under the round tube of the lower frame as closely to the side plate as possible.

2. Use appropriate jack stands under the round tube to support the machine.

Jacking the Rear End

1. Chock both front wheels.

IMPORTANT: Make sure jack is as close to the rear fork as possible when raising the machine.

2. Place jack securely under the rear lift arm support as close to the fork as possible. Raise rear tire off the ground.

3. Use appropriate jack stands under the frame to support the machine.

Safety and Instruction Decals

Numerous safety and instruction decals are affixed to the Reelmaster. If any decal becomes illegible or damaged, install a new decal. Decal part numbers are listed in your Parts Catalog.

Chapter 2

Product Records and Maintenance

Product Records and Maintenance

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Product Records

Insert Operator’s Manuals and Parts Catalog for your Reelmaster at the end of this chapter. Additionally, insert Installation Instructions, Operator’s Manuals and Parts Catalogs for any accessories that have been installed on your Reelmaster at the end of this section.

Maintenance

Maintenance procedures and recommended service intervals for your Reelmaster are covered in the Traction Unit and Cutting Unit Operator’s Manuals. Refer to those publications when performing regular equipment maintenance. Several maintenance procedures have break−in intervals identified in the Operator’s Manuals. 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	0.09375	— 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 (e.g. Nylock nut), 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

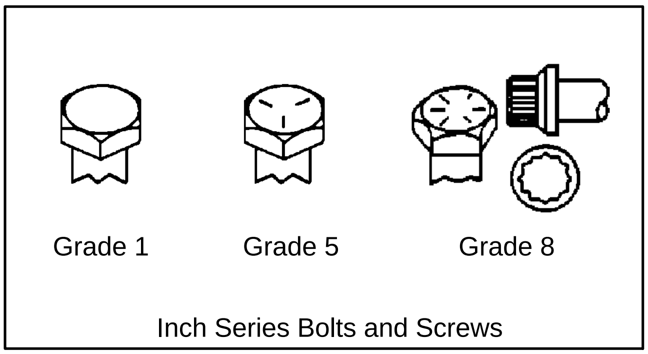

Figure 1

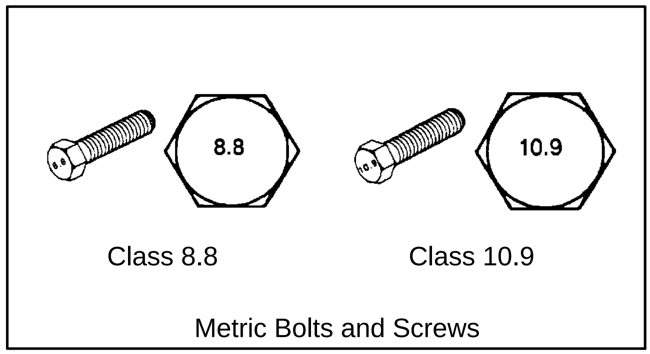

Figure 2

Using a Torque Wrench with an Offset Wrench

Use of an offset wrench (e.g. crowfoot wrench) will affect torque wrench calibration due to the effective change of torque wrench length. When using a torque wrench with an offset wrench, multiply the listed torque recommendation by the calculated torque conversion factor (Fig. 3) to determine proper tightening torque. Tightening torque when using a torque wrench with an offset wrench will be lower than the listed torque recommendation.

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

The measured effective length of the torque wrench with the offset wrench installed (distance from the center of the handle to the center of the offset wrench) is 19".

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

If the listed torque recommendation for a fastener is from 76 to 94 ft−lb, the proper torque when using this torque wrench with an offset wrench would be from 72 to 89 ft−lb.

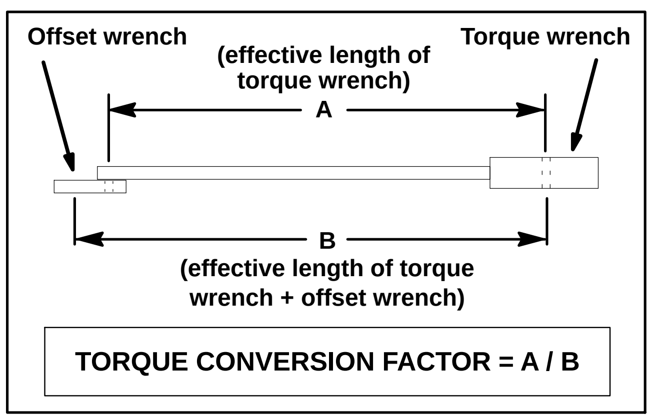

Figure 3

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 ± 30	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 Series)

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 and 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

Kubota Diesel Engine

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Kubota
Diesel Engine

Specifications

Item	Description
Make / Designation	Kubota Model D1105−E3B 4−Cycle, 3 Cylinder, Liquid Cooled, Diesel Engine
Bore x Stroke	3.07” x 3.09” (78 mm x 78.4 mm)
Total Displacement	68.5 in^3 (1123 cc)
Firing Order	1 (fan end) − 2 − 3 (flywheel end)
Compression Ratio	22.0:1
Direction of Rotation	Counterclockwise (viewed from flywheel)
Fuel	Diesel or Biodiesel (up to B20) Fuel with Low or Ultra Low Sulfur Content
Fuel Capacity	7.5 U.S. gallons (28.4 liters)
Fuel Injection Pump	Bosch MD Type Mini
Injection Nozzle	Mini Nozzle (DNOPD)
Governor	Centrifugal Mechanical
Low Idle (no load)	1400 ± 50 RPM
High Idle (no load)	3220 ± 50 RPM
Engine Oil	API CH−4, CI−4 or higher
Engine Oil Viscosity	See Traction Unit Operator’s Manual
Crankcase Oil Capacity	3.5 U.S. Quarts (3.3 Liters) with Filter
Oil Pump	Trochoid Type
Coolant Capacity	6 U.S. Quarts (5.7 Liters)
Starter	12 VDC 1.4 KW
Alternator/Regulator Alternator Output	12 VDC 40 amp
Engine Dry Weight	205 lb. (93 kg)

General Information

This Chapter gives information about specifications and repair of the diesel engine used in the Reelmaster.

General maintenance procedures are described in your Traction Unit Operator's Manual. Information on engine troubleshooting, testing, disassembly and assembly is identified in the Kubota Workshop Manual: 05 Series Diesel Engine.

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the Kubota Workshop Manual: 05 Series Diesel Engine. 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 Kubota engine in your Reelmaster are available from your Authorized Toro Distributor. If no parts list is available, be prepared to provide your distributor with the Toro model and serial number.

Kubota Engine Workshop Manual

The engine that powers your Reelmaster is a Kubota D1105 Tier 4 compliant engine. Kubota Engine Workshop Manuals are available for these engines. To ensure the correct engine workshop manual is used when servicing the engine in your machine, refer to the engine group code on the emission control information label "E" (emission) level.

1

Engine Group Code	"E" Emission Level and Workshop Manual
ES**	E2B
ET**	E3B
EF**	E4B

1. Engine Group Code

Operator's Manual

The Traction Unit Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for the Kubota diesel engine that powers your Reelmaster. Refer to this publication for additional information when servicing the machine.

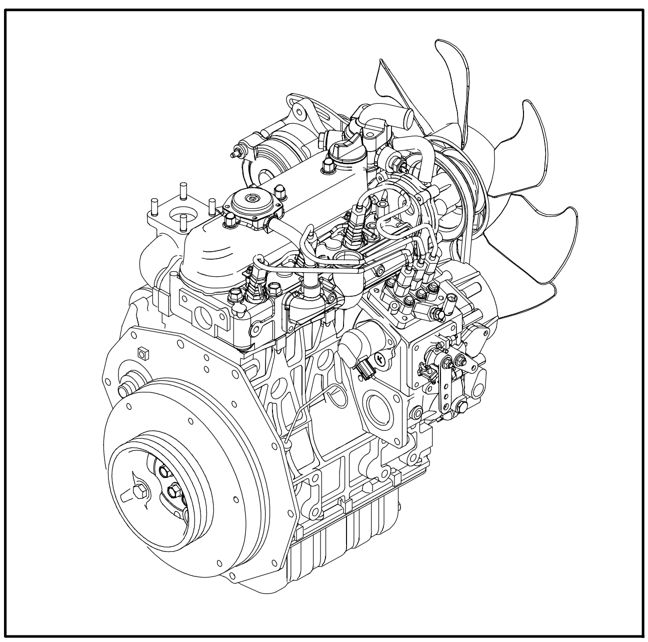

Figure 1

Service and Repairs

Air Cleaner and Muffler

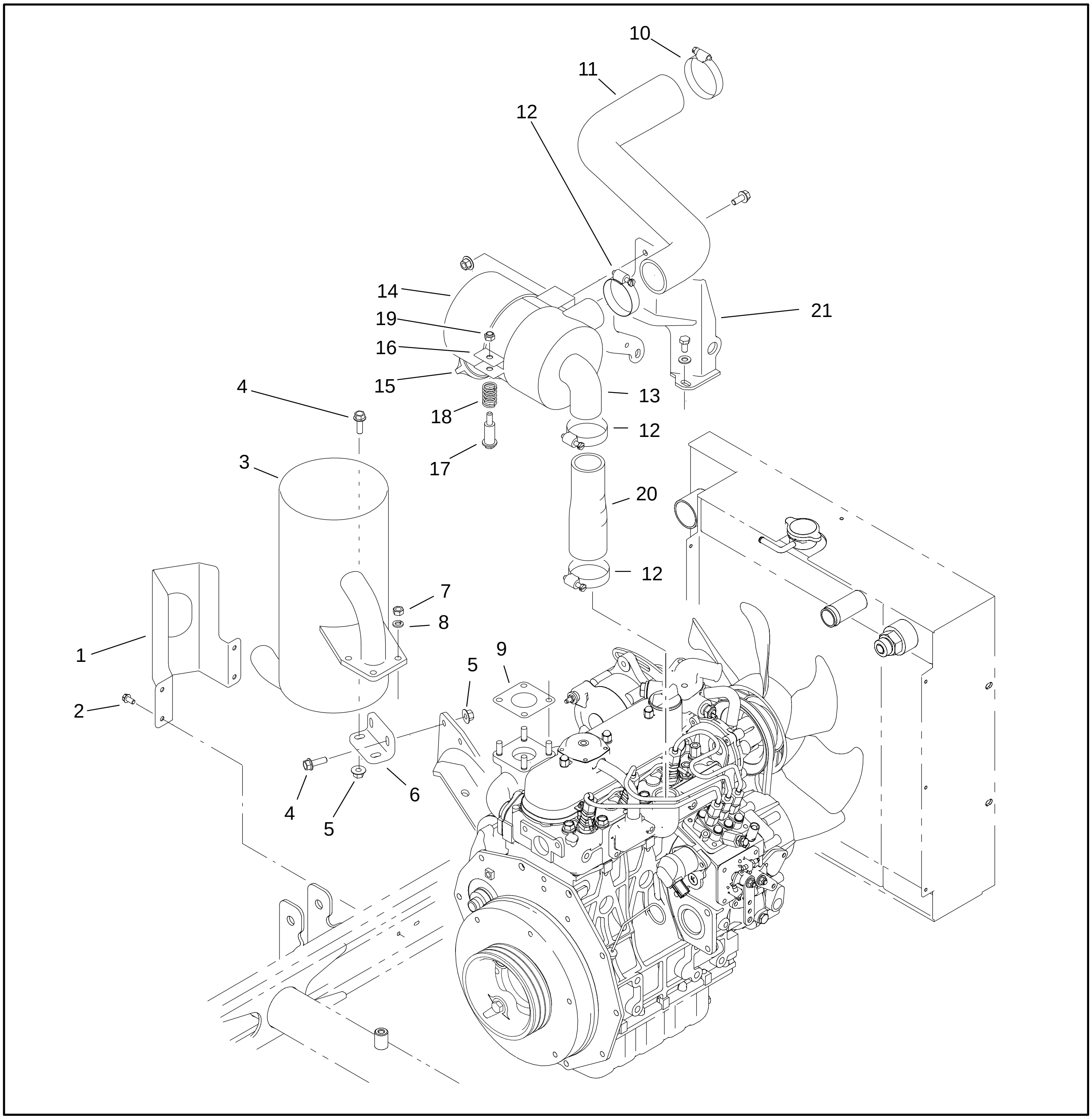

Figure 2

1. **Exhaust guard**
2. **Cap screw**
3. **Muffler**
4. **Flange head screw**
5. **Flange nut**
6. **Muffler bracket**
7. **Hex nut**
8. **Lock washer**
9. **Exhaust gasket**
10. **Hose clamp**
11. **Air inlet hose (upper)**
12. **Hose clamp (3)**
13. **Air cleaner body**
14. **Filter cover**
15. **Burp (Actuator) valve**
16. **Mounting band assembly**
17. **Shoulder bolt**
18. **Compression spring**
19. **Lock nut**
20. **Air inlet hose (lower)**
21. **Air filter mount**

Check Air Filter, Filter Cover, & Burp Valve

The air cleaner body, air filter, filter cover, and burp valve should be checked daily, prior to operation.

IMPORTANT: Any leaks in the air cleaner system will cause serious engine damage. Make sure that all air cleaner components are in good condition and are properly secured during operation.

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch. Unlatch and raise hood.

2. Check air cleaner body for damage that could cause possible air leaks. Make sure filter cover seals completely to the air cleaner body (Fig. 3).

3. Check burp (actuator) valve and filter cover for damage.

4. Make sure air hoses connecting the air cleaner to the engine and radiator are secured tightly and free of possible air leaks.

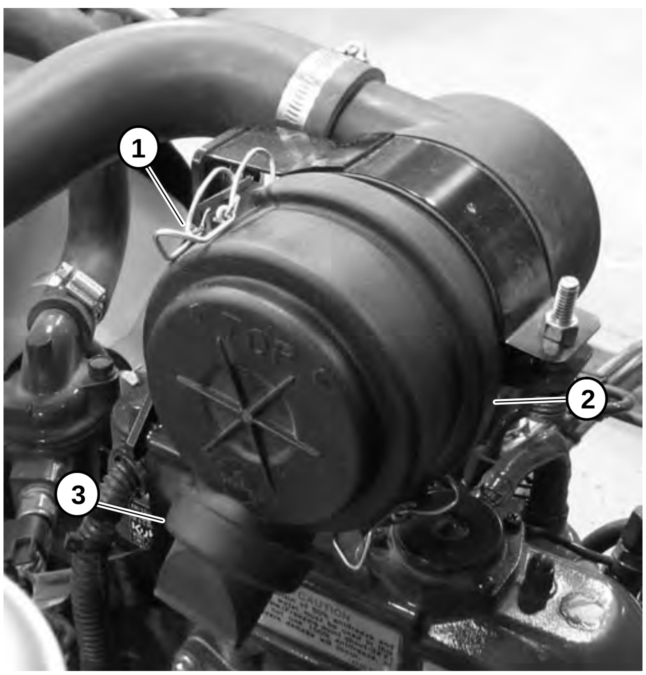

Figure 3

1. **Latch**
2. **Filter cover**
3. **Burp valve**

Muffler Removal

CAUTION

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

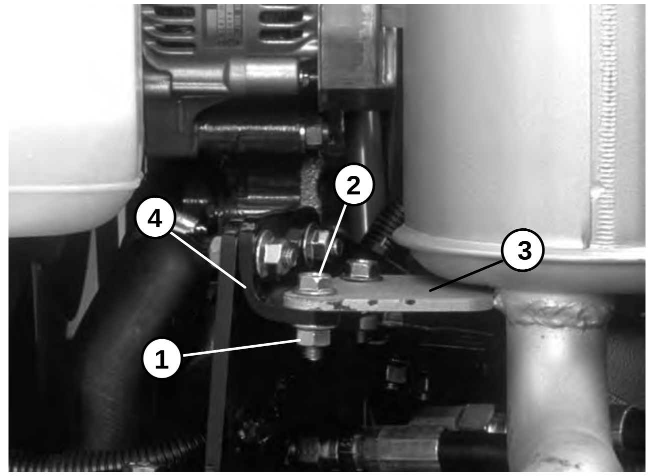

Figure 4

1. **Flange nut**
2. **Flange head screw**
3. **Muffler plate**
4. **Muffler bracket**

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Open engine hood to gain access to engine.

3. Remove exhaust guard.

4. Remove both flange head nuts and screws securing the muffler plate to the muffler bracket (Fig. 4).

5. Remove four hex nuts and lock washers from the exhaust manifold studs. Separate muffler flange from the exhaust manifold. Remove muffler from the machine.

6. Remove exhaust gasket. Replace gasket if damaged or torn.

Muffler Installation

NOTE: Make sure muffler flange and exhaust manifold sealing surfaces are free of debris or damage that may prevent a tight seal.

1. Place exhaust gasket on the exhaust manifold.

IMPORTANT: Finger tighten all fasteners before securing the muffler plate to the muffler bracket so there is no preload on the exhaust manifold.

2. Position muffler flange to the exhaust manifold with four lock washers and hex nuts.

3. Position muffler plate to the muffler bracket with both flange head screws and nuts (Fig. 4).

4. Tighten muffler flange hex nuts and then muffler plate screws and nuts.

5. Install exhaust guard.

6. Close and latch engine hood.

Fuel System

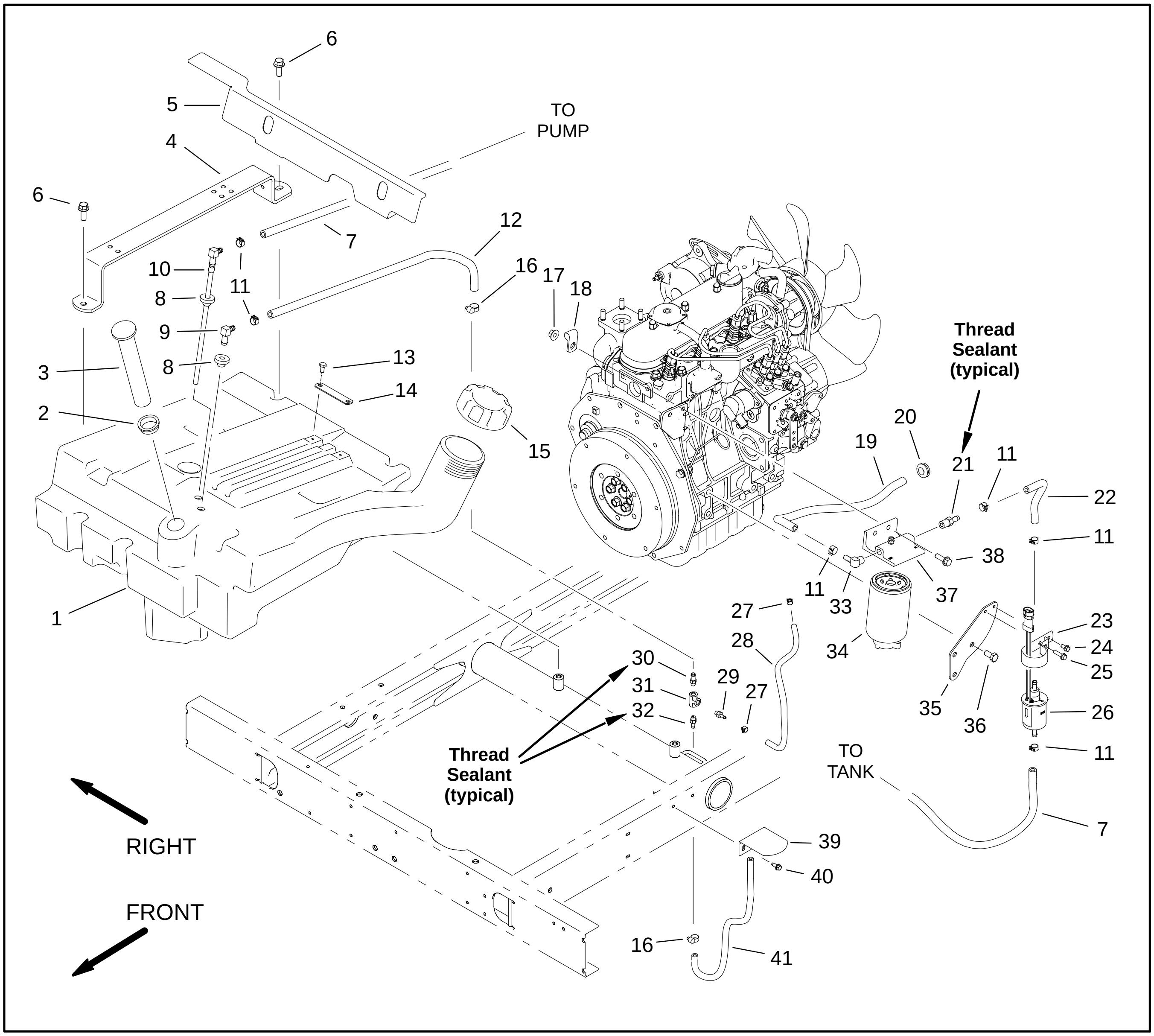

Figure 5

1. **Fuel tank**
2. **Grommet**
3. **Fuel gauge**
4. **Seat support strap (2)**
5. **Heat shield**
6. **Washer head screw (4)**
7. **Fuel hose (tank to pump)**
8. **Rubber bushing (2)**
9. **Elbow fitting**
10. **Stand pipe**
11. **Hose clamp (7)**
12. **Fuel hose (tee to tank)**
13. **Cap screw (2)**
14. **Fuel hose strap**
15. **Fuel cap**
16. **Hose clamp (2)**
17. **Flange nut (2)**
18. **R−Clamp**
19. **Fuel hose (filter to engine)**
20. **Grommet**
21. **Barbed fitting**
22. **Fuel hose (pump to filter)**
23. **Clamp**
24. **Washer head screw**
25. **Washer head screw**
26. **Fuel pump**
27. **Hose clamp (2)**
28. **Fuel hose (engine return to tee)**
29. **Barbed fitting**
30. **Barbed fitting**
31. **Tee fitting**
32. **Barbed fitting**
33. **Elbow fitting**
34. **Fuel/water separator element**
35. **Pump mount plate**
36. **Cap screw (3)**
37. **Fuel/water separator head**
38. **Flange head screw (2)**
39. **Tank support**
40. **Flange head screw (2)**
41. **Fuel hose (tee to vent tube)**

DANGER

Because diesel fuel is 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 diesel fuel before starting the engine. Store fuel in a clean, safety−approved container and keep cap in place. Use diesel fuel for the engine only; not for any other purpose.

Fuel Tank Removal (Fig. 5)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch. Unlatch and raise hood.

IMPORTANT: Follow all local codes and regulations when recycling or disposing waste fuel.

2. Drain fuel from the tank into a suitable container. If necessary.

3. Disconnect seat switch from the electrical harness. Remove seat and seat support straps from the frame.

4. Remove fuel hose strap and both fuel hoses from the fuel tank (Fig 6). Remove fuel tank from the machine.

Clean Fuel Tank

Clean the fuel tank every 2 years. Also, clean the fuel tank if the fuel system becomes contaminated or if the machine is to be stored for an extended period.

1. Remove fuel tank from the machine (see Fuel Tank Removal).

2. Flush fuel tank out with clean diesel fuel. Make sure tank is free of contaminates and debris.

3. Install fuel tank to the machine (see Fuel Tank Installation).

Fuel Tank Installation (Fig. 5)

1. Position fuel tank to the machine.

2. Connect both fuel hoses to the tank and secure with hose clamps.

3. Install fuel hose strap to top of tank making sure that fuel lines are properly positioned in grooves in tank.

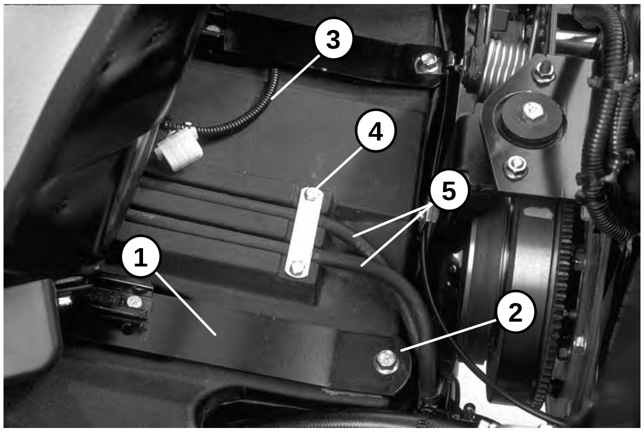

Figure 6

1. **Seat support strap**
2. **Hex flange head screw**
3. **Electrical harness**
4. **Fuel hose strap**
5. **Fuel hose**

4. Connect wire harness connector to the seat switch. Route seat switch wire under seat support strap. Secure seat support straps and seat to the frame (see Operator Seat in Chapter 6 − Chassis in this manual).

5. Check that fuel tank support contacts the bottom of the fuel tank but does not raise tank from machine frame. Adjust location of support if necessary.

6. Check for correct seat operation. Also check that seat switch wires and connector are not pinched and do not contact any moving parts.

7. Fill fuel tank.

Kubota Diesel Engine

Radiator and Oil Cooler Assembly

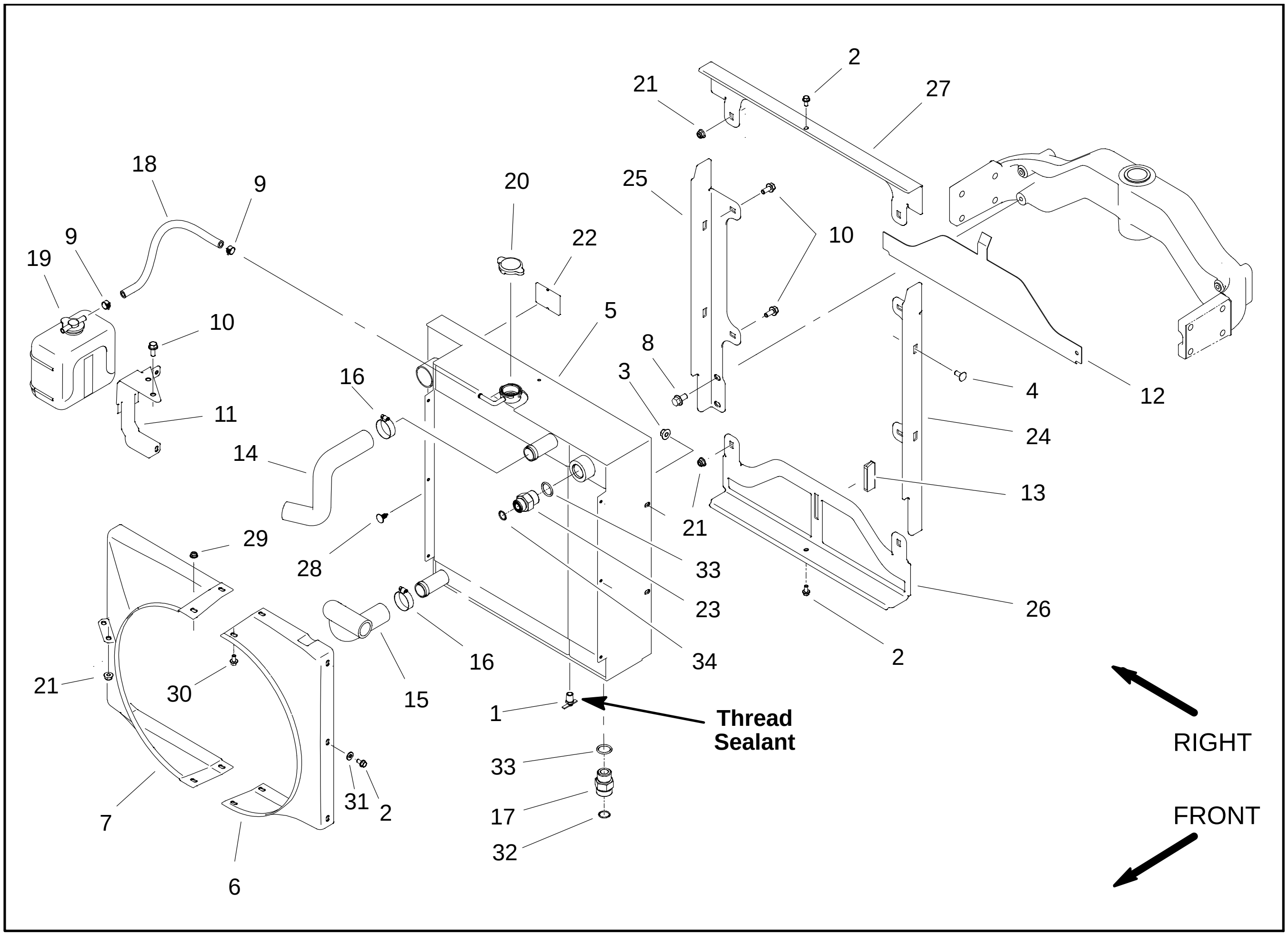

Figure 7

1. Draincock valve
2. Flange head screw (8)
3. Flange nut (4)
4. Carriage bolt (4)
5. Radiator/oil cooler assembly
6. LH fan shroud
7. RH fan shroud
8. Flange head screw (4)
9. Hose clamp (2)
10. Flange head screw (6)
11. Overflow bottle bracket
12. Radiator lower shield
13. Magnet
14. Radiator hose (upper)
15. Radiator hose (lower)
16. Hose clamp (2)
17. Straight hydraulic fitting (RM 3550−D)
    Elbow hydraulic fitting (RM 3555−D.3575−D)
18. Hose
19. Coolant expansion tank
20. Radiator cap
21. Flange nut (6)
22. Foam seal (2)
23. Straight hydraulic fitting
24. LH radiator bracket
25. RH radiator bracket
26. Bottom radiator bracket
27. Top radiator bracket
28. Plastic plug (2)
29. Flange nut (4)
30. Flange head screw (4)
31. Flat washer (4)
32. O−ring
33. O−ring
34. O−ring

Removal (Fig. 7)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Open and remove hood from the machine.

CAUTION

Do not open radiator cap or drain coolant if the radiator or engine is hot. Pressurized, hot coolant can escape and cause burns.
Ethylene−glycol antifreeze is poisonous. Dispose of coolant properly or store it in a properly labeled container away from children and pets.

IMPORTANT: Follow all local codes and regulations when recycling or disposing engine coolant.

3. Drain radiator into a suitable container either by using the draincock near the lower left side corner of the radiator or by removing the lower radiator hose from the radiator.

4. Disconnect radiator hoses from the radiator.

5. Remove air cleaner inlet hose from radiator opening.

6. Read the General Precautions for Removing and Installing Hydraulic System Components in the Service and Repairs section of Chapter 4 − Hydraulic System in this manual.

7. Thoroughly clean hydraulic lines at oil cooler ports. Disconnect hydraulic lines and put caps or plugs on lines to prevent contamination. Label disconnected hydraulic lines for proper installation.

8. Remove coolant expansion tank and bracket from machine.

9. Remove fan shrouds from machine.

10. Remove fasteners that secure radiator to the upper, lower and side radiator brackets.

11. Carefully separate radiator/oil cooler assembly from brackets and remove from the machine.

12. If necessary, remove hydraulic fittings from oil cooler and discard O−rings.

13. Plug all radiator and hose openings to prevent contamination.

Installation (Fig. 7)

1. Inspect seals around radiator location for wear or damage. Replace seals if necessary.

2. If hydraulic fittings were removed from oil cooler, lubricate and place new O−rings onto fittings. Install fittings into port openings and tighten fittings (see Hydraulic Fitting Installation in the General Information section of Chapter 4 − Hydraulic System in this manual).

3. If draincock valve was removed from radiator, apply thread sealant to draincock threads before installing it into radiator.

4. Remove all plugs placed in radiator and hose openings during the removal procedure.

5. Carefully position radiator to the radiator brackets.

6. Secure radiator to the side radiator brackets with four (4) carriage bolts and flange nuts. Secure top and bottom of radiator to brackets with flange head screws.

7. Connect hydraulic lines to fittings in oil cooler ports (see Hydraulic Hose and Tube Installation in the General Information section of Chapter 4 − Hydraulic System in this manual).

8. Position fan shrouds to radiator and secure with removed fasteners.

9. Secure coolant expansion tank and bracket to machine.

10. Connect radiator hoses to the radiator and secure with hose clamps.

11. Install and secure air cleaner inlet hose.

12. Make sure radiator draincock valve is closed. Fill radiator with coolant.

13. Install hood to the machine. Close and latch hood.

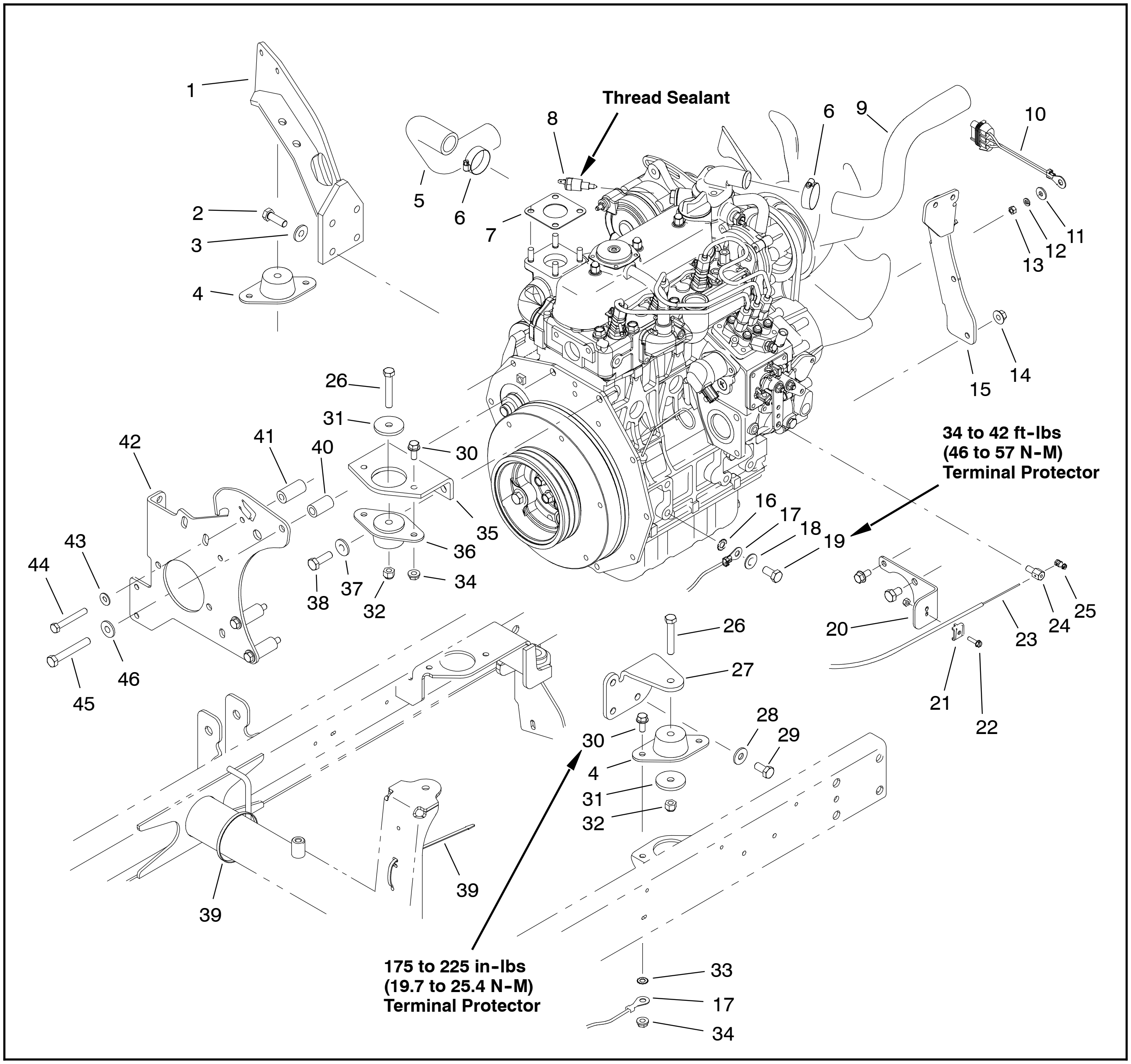

Figure 8

1. Engine mount bracket - RH
2. Cap screw
3. Hardened washer
4. Engine mount (2)
5. Lower radiator hose
6. Hose clamp (2)
7. Exhaust flange gasket
8. Coolant temperature switch
9. Upper radiator hose
10. Wire Harness - fusible link
11. Flat washer
12. Lock washer
13. Hex nut
14. Flange nut
15. Fuel filter bracket
16. External tooth lock washer
17. Engine ground wire
18. Flat washer
19. Cap screw
20. Throttle cable bracket
21. Cable clamp
22. Cap screw
23. Throttle cable
24. Swivel clamp
25. Cable stop
26. Cap screw (3)
27. Engine mount bracket - LH
28. Hardened washer
29. Cap screw
30. Flange head screw
31. Hardened washer (3)
32. Hex nut (3)
33. Lock washer
34. Flange nut
35. Engine mount bracket - front
36. Engine mount
37. Hardened washer
38. Cap screw
39. Cable tie
40. Spacer (1)
41. Spacer (4)
42. Pump mount plate
43. Hardened washer
44. Cap screw
45. Cap screw
46. Hardened washer

Removal (Fig. 8)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Open and remove engine hood from the machine. Slide seat all the way forward.

3. Disconnect air hose from the air cleaner and radiator. Remove air cleaner assembly from the engine.

4. Disconnect both battery cables at the battery (see Battery Service in Chapter 5 − Electrical System).

5. Remove muffler from the exhaust manifold and muffler bracket (see Muffler Removal in this Chapter).

6. Drain radiator from the drain cock valve into a suitable container (see Radiator Removal in this Chapter). Disconnect coolant hoses from the water pump and engine block.

7. Remove coolant expansion tank and bracket from the top fan shroud. Remove top fan shroud from the radiator (see Radiator Removal in this Chapter).

8. Disconnect wire harness and electrical wires from the following:

   A. Battery, wire harness and engine grounds (Fig. 9).

   B. Glow plug bus (Fig. 10) and fuel stop solenoid.

   C. Engine temperature sensor, alternator, and low oil pressure switch (Fig. 11).

9. Disconnect throttle cable from the support and swivel on the speed control lever (Fig. 9).

10. Disconnect fuel hose from the fuel pump (Fig. 9) and front injector nozzle.

11. Remove traction control cable from the neutral arm assembly on the piston pump. Remove all hydraulic hoses from the piston and gear pumps (see Piston Pump Removal in Chapter 4− Hydraulic System).

12. Remove cable ties securing the wire harness to the front lift tab and other engine parts. Connect hoist or lift to the front and rear lift tabs (Fig. 10).

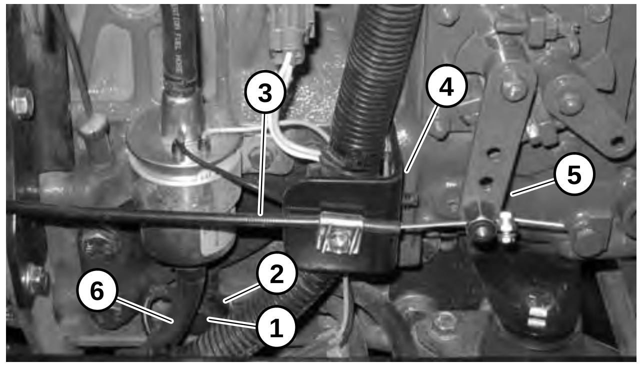

Figure 9

1. Battery ground cable
2. Wire harness ground
3. Throttle cable
4. Support bracket
5. Speed control lever
6. Fuel hose

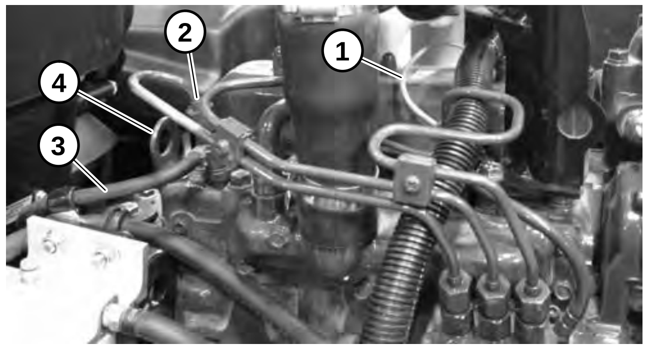

Figure 10

1. Glow plug wire
2. Rear injector nozzle
3. Fuel hose
4. Lift tab

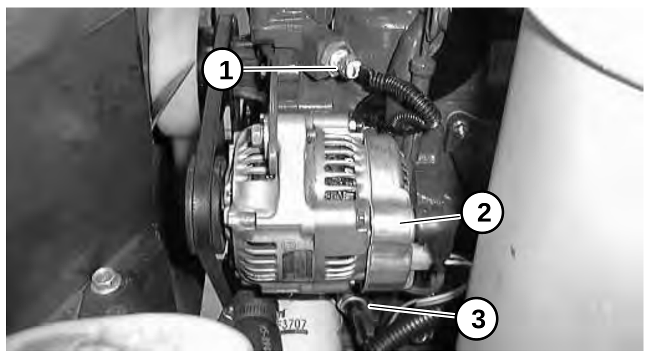

Figure 11

1. Engine temp. sensor
2. Alternator
3. Oil pressure switch

Kubota Diesel Engine

CAUTION

Make sure lift or hoist can support the total weight of the engine before removing the cap screws from the engine and engine brackets.

13. Remove hex nuts, cap screws, and washers from the center of the three engine mounts.

CAUTION

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

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

14. Remove engine slowly from the machine.

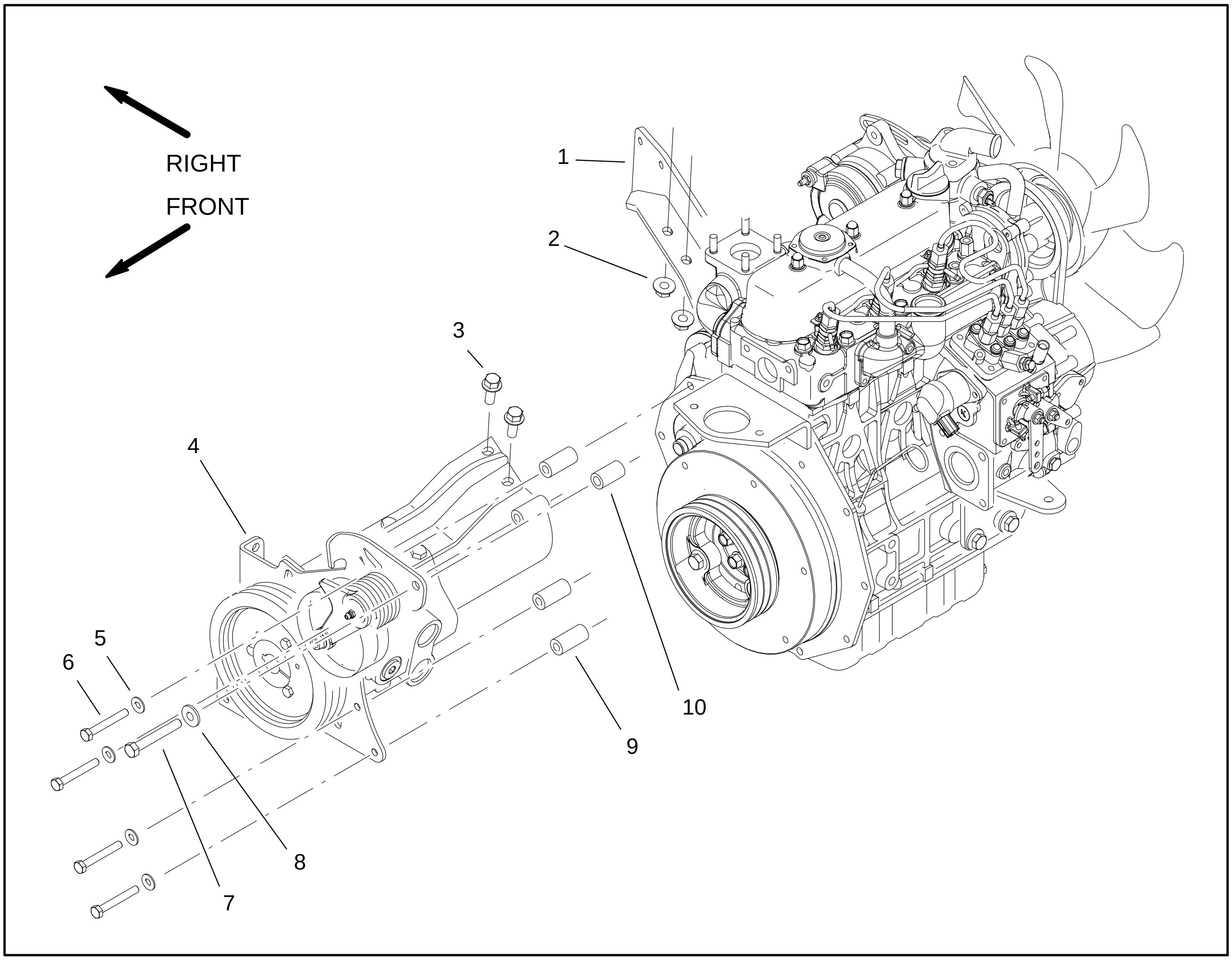

Figure 12

1. **Engine mount bracket**
2. **Flange nut (2)**
3. **Flange screw (2)**
4. **Pump mount plate**
5. **Hardened washer (4)**
6. **10 mm cap screw (4)**
7. **8 mm cap screw**
8. **Hardened washer**
9. **Long spacer (4)**
10. **Short spacer**

15. Separate hydrostat and pump assembly from the engine as follows (Fig. 12):

A. Remove traction belt from the engine flywheel and hydrostat pulleys.

B. Remove five cap screws, washers, and spacers securing the pump mount plate to the engine.

C. Remove two cap screws and flange nuts securing the pump support to the engine mount bracket and remove the hydrostat and pump assembly from the engine.

16. As necessary, remove engine mounts, front engine mounting bracket, throttle support bracket and left engine mounting bracket.

Installation (Fig. 8)

1. If removed, install engine mounts, front engine mounting bracket, throttle support bracket and left engine mounting bracket. Also, make sure that all switches and sensors are installed on engine.

2. Install hydrostat and pump assembly to the engine as follows (Fig. 12):

A. Secure the pump support to the engine mount bracket with two flange nuts and cap screws.

B. Secure pump mount plate to the engine with five spacers, washers, and cap screws.

C. Install traction belt to the engine flywheel and hydrostat pulleys.

3. Connect hoist or lift to the front and rear engine lift tabs (Fig. 10).

CAUTION

One person should operate lift or hoist while the other person guides the engine into the machine.

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

4. Position engine slowly into the machine.

5. Secure all three engine mounts to the engine mounting brackets with cap screws, washers, and hex nuts.

6. Secure wire harness to the front lift tab and the engine with cable ties.

7. Install all hydraulic hoses to the piston and gear pumps. Install traction control cable to the neutral arm assembly on the piston pump (see Piston Pump Installation in Chapter 4- Hydraulic System).

8. Connect fuel hose to the fuel pump (Fig. 9) and front injector nozzle.

9. Install top fan shroud to the radiator. Install expansion tank and bracket to the top fan shroud (see Radiator Installation in this Chapter).

10. Connect wire harness and electrical wires to the following:

A. Engine grounds to the battery and wire harness (Fig. 9). Torque the engine ground bolt to **34 to 42 ft-lbs (46 to 57 N-m)** and apply a coat of terminal protector.

B. Torque the frame ground bolt to **175 to 225 in-lbs (19.7 to 25.4 N-m)** and apply a coat of terminal protector.

Note: Make sure that the engine and frame ground surfaces are free from corrosion, oil and paint.

C. Glow plug bus (Fig. 10) and fuel stop solenoid.

D. Engine temperature sensor, alternator, and low oil pressure switch (Fig. 11).

11. Secure wire harness to engine with cable ties at locations noted during engine removal.

12. Connect coolant hoses to the water pump and engine block. Make sure drain cock valve is closed. Fill radiator with coolant.

13. Install muffler to the exhaust manifold and muffler bracket (see Muffler Installation in this Chapter).

14. Connect throttle cable to the support and swivel on the speed control lever (Fig. 9).

15. Connect both battery cables at the battery (see Battery Service in Chapter 6 - Electrical system).

16. Install air cleaner to the engine. Connect air hose to air cleaner and radiator.

17. Adjust throttle cable.

18. Bleed air from the fuel system.

19. Install engine hood to the machine. Close and latch hood.

20. Fill the hydraulic fluid tank.

21. Start the unit and run engine to normal operating temperature. Use all of the hydraulic controls while the engine is running to distribute the hydraulic fluid throughout the system.

22. Stop the engine and check the hydraulic fluid and coolant levels. Adjust as necessary.

23. Adjust traction drive for neutral.

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Chapter 4

Hydraulic System

Table of Contents

Specifications

Item	Description
Piston Pump (Hydrostat) Charge Pressure Maximum Displacement Traction Circuit Relief Pressure (Forward Only)	Variable displacement piston pump Specification:100 to 150 PSI (6.9 to 10.3 bar) Tested: 150 to 200 PSI (10.3 to 13.8 bar) 1.44 in^3/rev (23.6 cc/rev) 3500 PSI (241 bar)
Tandem Gear Pump Maximum Displacement Section 1 (P1 − mow) Maximum Displacement Section 2 (P2 − steering & lift)	2 section positive displacement gear type pump 0.58 in^3/rev (9.45 cc/rev) 0.33 in^3/rev (5.34 cc/rev)
Wheel Motors (see note) Front Wheel Motor Displacement Rear Wheel Motor Displacement	Orbital geroller motor 12.0 in^3/rev (195 cc/rev) 24.7 in^3 (405 cc)
Mow Circuit Relief Pressures Front Cutting Units (PRV) Rear Cutting Units (RV)	 3000 PSI (207 bar) 1500 PSI (103 bar)
Lift Circuit Relief Pressure (RV1)	Lower: 500 PSI (34.5 bar) Raise: 1000 PSI (69 bar)
Cutting Unit Motors (Reelmaster 3550−D & 3555−D) Displacement (5 in. Reels)	Gear motor 0.73 in^3/rev (11.96 cc/rev)
Cutting Unit Motors (Reelmaster 3575−D) Displacement (7 in. Reels) Cross Over Relief Valve Pressure	Gear motor 0.97 in^3/rev (15.89 cc/rev) 1450 PSI (100 bar)
Steering Control Valve Displacement Relief Valve Pressure	Distributor valve with rotary meter 6.1 in^3/rev (100 cc/rev) 1000 PSI (69 bar)
Hydraulic Filters In−line Suction Strainer	10 Micron, spin−on cartridge type 100 mesh (in tank)
Hydraulic Tank Capacity	6 U.S. Gallons (22.6 Liters)
Hydraulic Fluid	See Traction Unit Operator’s Manual

NOTE: The three wheel motors are similar in construction with only minor differences. The right front wheel motor and rear wheel motor have a reverse timed manifold, and the front left wheel motor does not. The end cover of the rear motor has a check valve consisting of a ball and spring, and both front motors lack this feature.

General Information

Operator’s Manual

The Traction Unit and Cutting Unit Operator’s Manuals provide information regarding the operation, general maintenance and maintenance intervals for your Reelmaster machine. Refer to these publications for additional information when servicing the machine.

Relieving Hydraulic System Pressure

Before disconnecting or performing any work on the hydraulic system, all pressure in the hydraulic system must be relieved. Park machine on a level surface, lower cutting units fully, stop engine and apply parking brake.

To relieve hydraulic pressure in traction circuit, move traction pedal to both forward and reverse directions. To relieve hydraulic pressure in steering circuit, rotate steering wheel in both directions.

System pressure in mow circuit is relieved when the cutting units are disengaged (reel enable/disable switch in DISENGAGE position).

To relieve hydraulic pressure in lift circuit, fully lower the cutting units to the ground. Turn ignition switch to OFF.

NOTE: Moving steering wheel with engine off may unseat implement relief valve. If steering or lift circuits appear weak or inoperative after machine is returned to service, repeat relieving hydraulic system pressure procedure.

Traction Circuit Component Failure

The traction circuit on Reelmaster machines is a closed loop system that includes the piston (traction) pump, two (2) front wheel motors and the rear wheel motor. If a component in the traction circuit should fail, debris and contamination from the failed component will circulate throughout the traction circuit. This contamination can damage other components in the circuit so it must be removed to prevent additional component failure.

The recommended method of removing traction circuit contamination would be to temporarily install the Toro high flow hydraulic filter (see Special Tools in this chapter) into the circuit. This filter should be used when connecting hydraulic test gauges in order to test traction circuit components or after replacing a failed traction circuit component (e.g. traction (piston) pump or wheel motor). The filter will ensure that contaminates are removed from the closed loop and thus, do not cause additional component damage.

Once the Toro high flow hydraulic filter kit has been placed in the circuit, raise and support the machine with all drive wheels off the ground. Then, operate the traction circuit to allow oil flow throughout the circuit. The filter will remove contamination from the traction circuit during operation. Because the Toro high flow filter is bi−directional, the traction circuit can be operated in both the forward and reverse direction. The filter should be removed from the machine after contamination has been removed from the traction circuit. See Filtering Closed−Loop Traction Circuit in the Service and Repairs section of this chapter for additional information on using the Toro high flow hydraulic filter.

The alternative to using the Toro high flow hydraulic filter kit after a traction circuit component failure would be to disassemble, drain and thoroughly clean all components, tubes and hoses in the traction circuit. If any debris remains in the traction circuit and the machine is operated, the debris can cause additional circuit component failure.

NOTE: If traction circuit contamination exists, the traction pump case drain could allow contaminates to enter other hydraulic circuits on the machine.

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 hose damage and deterioration. Some hoses are more susceptible to these conditions than others. Inspect all machine hydraulic hoses frequently for signs of deterioration or damage:

Hard, cracked, cut, abraded, charred, leaking or otherwise damaged hose.

Kinked, crushed, flattened or twisted hose.

Blistered, soft, degraded or loose hose cover.

Cracked, damaged or badly corroded hose fittings.

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 (layline) 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 (See Hydraulic Hose and Tube Installation in this section in this chapter). If the hose has an elbow at one end, tighten the swivel nut on that end before tightening the nut on the straight end of the hose.

For additional hydraulic hose information, refer to Toro Service Training Book, Hydraulic Hose Servicing (Part Number 94813SL).

WARNING

Before disconnecting or performing any work on hydraulic system, relieve all pressure in system (see Relieving Hydraulic System Pressure in this 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 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 Hose and Tube Installation (O−Ring Face Seal Fitting)

1. Make sure threads and sealing surfaces of the hose/tube and the fitting are free of burrs, nicks, scratches or any foreign material.

2. As a preventative measure against leakage, it is recommended that the face seal O−ring be replaced any time the connection is opened. Make sure the O−ring is installed and properly seated in the fitting groove. Lightly lubricate the O−ring with clean hydraulic oil.

3. Place the hose/tube against the fitting body so that the flat face of the hose/tube sleeve fully contacts the O−ring in the fitting.

4. Thread the swivel nut onto the fitting by hand. While holding the hose/tube with a wrench, use a torque wrench to tighten the swivel nut to the recommended installation torque (Fig. 3). This tightening process will require the use of an offset wrench (e.g. crowfoot wrench). Use of an offset wrench will affect torque wrench calibration due to the effective length change of the torque wrench. Tightening torque when using a torque wrench with an offset wrench will be lower than the listed installation torque (see Using a Torque Wrench with an Offset Wrench in the Torque Specifications section of Chapter 2 − Product Records and Maintenance).

5. If a torque wrench is not available or if space at the swivel nut prevents use of a torque wrench, an alternate method of assembly is the Flats From Wrench Resistance (F.F.W.R.) method (Fig. 2).

A. Using a wrench, tighten the swivel nut onto the fitting until light wrench resistance is reached (approximately 30 in−lb).

B. Mark the swivel nut and fitting body. Hold the hose/tube with a wrench to prevent it from turning.

C. Use a second wrench to tighten the nut to the correct Flats From Wrench Resistance (F.F.W.R.). The markings on the nut and fitting body will verify that the connection has been properly tightened.

Size	**F.F.W.R.**
4 (1/4 in. nominal hose or tubing)	1/2 to 3/4
6 (3/8 in.)	1/2 to 3/4
8 (1/2 in.)	1/2 to 3/4
10 (5/8 in.)	1/2 to 3/4
12 (3/4 in.)	1/3 to 1/2
16 (1 in.)	1/3 to 1/2

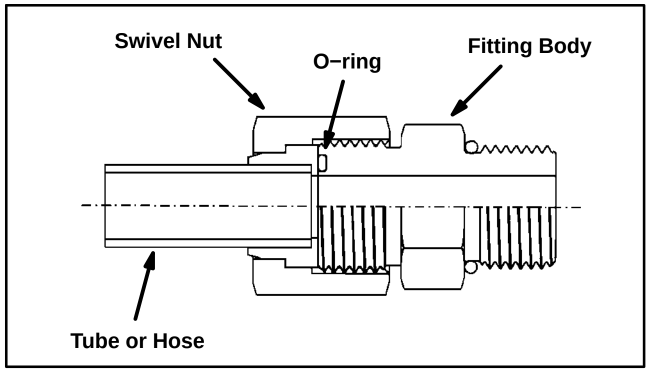


Figure 1

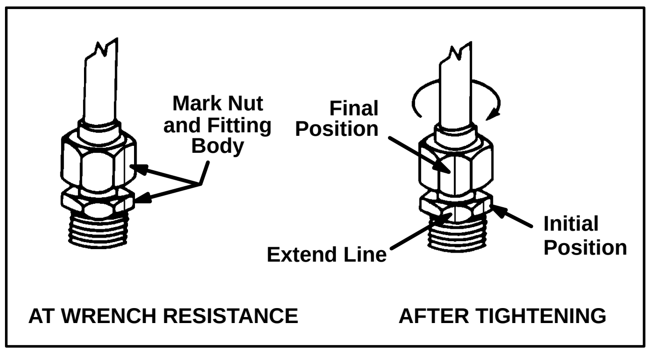


Figure 2

Fitting Dash Size	Hose/Tube Side Thread Size	Installation Torque
4	9/16 − 18	18 to 22 ft−lb (25 to 29 N−m)
6	11/16 − 16	27 to 33 ft−lb (37 to 44 N−m)
8	13/16 − 16	37 to 47 ft−lb (51 to 63 N−m)
10	1 − 14	60 to 74 ft−lb (82 to 100 N−m)
12	1 3/16 − 12	85 to 105 ft−lb (116 to 142 N−m)
16	1 7/16 − 12	110 to 136 ft−lb (150 to 184 N−m)
20	1 11/16 − 12	140 to 172 ft−lb (190 to 233 N−m)

Figure 3

Hydraulic Fitting Installation (SAE Straight Thread O−Ring Fitting into Component Port)

Non−Adjustable Fitting (Fig. 4)

1. Make sure all threads and sealing surfaces of fitting and component port are free of burrs, nicks, scratches or any foreign material.

2. As a preventative measure against leakage, it is recommended that the O−ring be replaced any time the connection is opened.

3. Lightly lubricate the O−ring with clean hydraulic oil. Fitting threads should be clean with no lubricant applied.

IMPORTANT: Before installing fitting into port, determine port material. If fitting is to be installed into an aluminum port, installation torque is reduced.

4. Install the fitting into the port. Then, use a torque wrench and socket to tighten the fitting to the recommended installation torque (Fig. 5).

NOTE: Use of an offset wrench (e.g. crowfoot wrench) will affect torque wrench calibration due to the effective length change of the torque wrench. Tightening torque when using a torque wrench with an offset wrench will be less than the recommended installation torque. See Using a Torque Wrench with an Offset Wrench in the Torque Specifications section of Chapter 2 − Product Records and Maintenance to determine necessary conversion information.

5. If a torque wrench is not available, or if space at the port prevents use of a torque wrench, an alternate method of assembly is the Flats From Finger Tight (F.F.F.T.) method.

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

B. If port material is steel, tighten the fitting to the listed F.F.F.T. If port material is aluminum, tighten fitting to 60% of listed F.F.F.T.

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

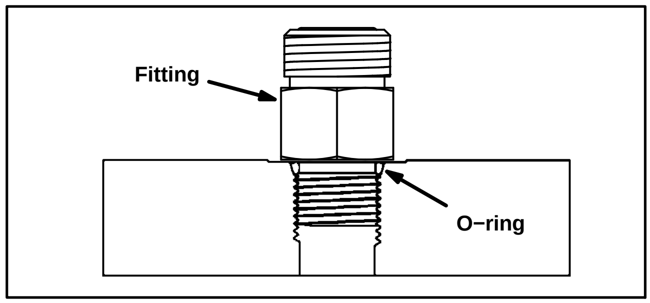


Figure 4

Fitting Dash Size	Fitting Port Side Thread Size	Installation Torque Into Steel Port	Installation Torque Into Aluminum Port
4	7/16 − 20	15 to 19 ft−lb (21 to 25 N−m)	9 to 11 ft−lb (13 to 15 N−m)
5	1/2 − 20	18 to 22 ft−lb (25 to 29 N−m)	11 to 15 ft−lb (15 to 20 N−m)
6	9/16 − 18	34 to 42 ft−lb (47 to 56 N−m)	20 to 26 ft−lb (28 to 35 N−m)
8	3/4 − 16	58 to 72 ft−lb (79 to 97 N−m)	35 to 43 ft−lb (48 to 58 N−m)
10	7/8 − 14	99 to 121 ft−lb (135 to 164 N−m)	60 to 74 ft−lb (82 to 100 N−m)
12	1 1/16 − 12	134 to 164 ft−lb (182 to 222 N−m)	81 to 99 ft−lb (110 to 134 N−m)
14	1 3/16 − 12	160 to 196 ft−lb (217 to 265 N−m)	96 to 118 ft−lb (131 to 160 N−m)
16	1 5/16 − 12	202 to 248 ft−lb (274 to 336 N−m)	121 to 149 ft−lb (165 to 202 N−m)
20	1 5/8 − 12	247 to 303 ft−lb (335 to 410 N−m)	149 to 183 ft−lb (202 to 248 N−m)

Figure 5

Adjustable Fitting (Fig. 6)

1. Make sure all threads and sealing surfaces of fitting and component port are free of burrs, nicks, scratches or any foreign material.

2. As a preventative measure against leakage, it is recommended that the O−ring be replaced any time the connection is opened.

3. Lightly lubricate the O−ring with clean hydraulic oil. Fitting threads should be clean with no lubricant applied.

4. Turn back the lock nut as far as possible. Make sure the back up washer is not loose and is pushed up as far as possible (Step 1 Fig. 7).

IMPORTANT: Before installing fitting into port, determine port material. If fitting is to be installed into an aluminum port, installation torque is reduced.

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 use a torque wrench to tighten the fitting to the recommended installation torque (Fig. 5). This tightening process will require the use of an offset wrench (e.g. crowfoot wrench). Use of an offset wrench will affect torque wrench calibration due to the effective length change of the torque wrench. Tightening torque when using a torque wrench with an offset wrench will be lower than the listed installation torque (see Using a Torque Wrench with an Offset Wrench in the Torque Specifications section of Chapter 2 − Product Records and Maintenance).

8. If a torque wrench is not available, or if space at the port prevents use of a torque wrench, an alternate method of assembly is the Flats From Finger Tight (F.F.F.T.) method. Hold the fitting in the desired position with a wrench and, if port material is steel, tighten the lock nut with a second wrench to the listed F.F.F.T (Step 4). If port material is aluminum, tighten fitting to 60% of listed 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

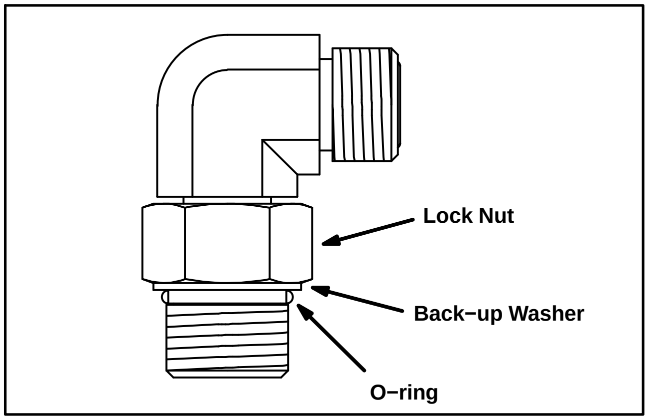


Figure 6

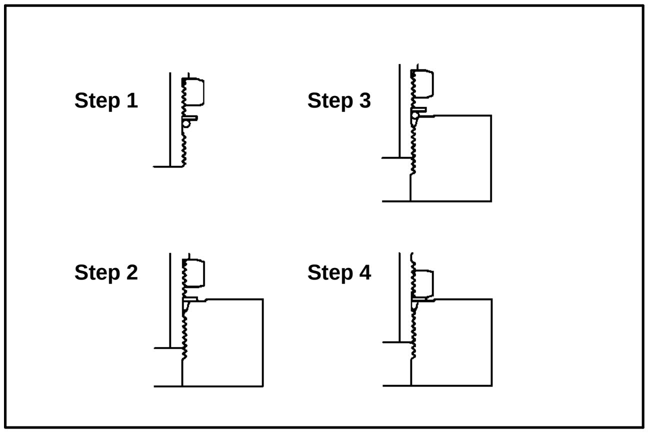


Figure 7

Hydraulic System

Special Tools

Order the following special tools from your Toro Distributor.

Hydraulic Pressure Test Kit

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.

Toro Part Number: TOR47009

Figure 8

Hydraulic Tester (Pressure and Flow)

Use to test hydraulic circuits and components for flow and pressure capacities as recommended in the Testing section of this chapter. This tester includes the following:

1. INLET HOSE: Hose connected from the system circuit to the inlet side of the hydraulic tester.

2. LOAD VALVE: A simulated working load is created in the circuit by turning the valve to restrict flow.

3. PRESSURE GAUGE: Glycerine filled 0 to 5000 PSI gauge to provide operating circuit pressure.

4. FLOW METER: This meter measures actual oil flow in the operating circuit with a gauge rated from 1 to 15 GPM (5 to 55 LPM).

5. OUTLET HOSE: A hose from the outlet side of the hydraulic tester connects to the hydraulic system circuit.

6. FITTINGS: An assortment of hydraulic fittings are included with this kit.

Toro Part Number: TOR214678

Figure 9

40 GPM Hydraulic Tester (Pressure and Flow)

Use to test hydraulic circuits and components for flow and pressure capacities as recommended in the Testing section of this chapter. This tester includes the following:

1. LOAD VALVE: A simulated working load is created in the circuit by turning the valve to restrict flow.

2. PRESSURE GAUGE: Glycerine filled 0 to 5000 PSI gauge to provide operating circuit pressure.

3. FLOW METER: This meter measures actual oil flow in the operating circuit with a gauge rated from 4 to 40 GPM (20 to 150 LPM).

Toro Part Number: AT40002

NOTE: This tester does not include hydraulic hoses (see Hydraulic Hose Kit TOR6007 below).

Figure 10

Hydraulic Hose Kit

This kit includes hydraulic fittings and hoses needed to connect 40 GPM hydraulic tester (AT40002) or high flow hydraulic filter kit (TOR6011) to machine hydraulic traction system components.

Toro Part Number: TOR6007

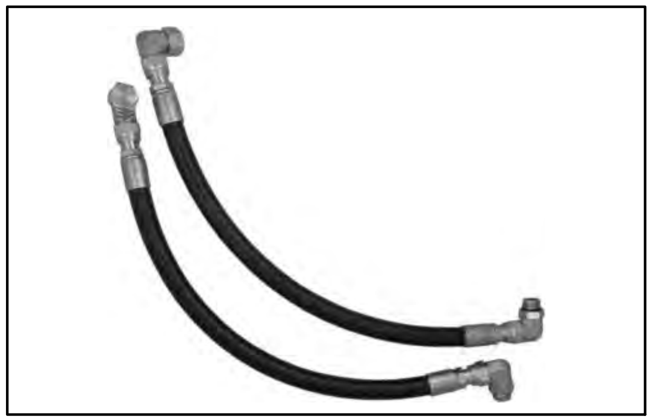


Figure 11

High Flow Hydraulic Filter Kit

The high flow hydraulic filter kit is designed with large flow (40 GPM/150 LPM) and high pressure (5000 PSI/345 bar) capabilities. This kit provides for bi−directional filtration which prevents filtered debris from being allowed back into the circuit regardless of flow direction.

If a component failure occurs in the closed loop traction circuit, contamination from the failed part will remain in the circuit until removed. When connecting hydraulic test gauges in order to test traction circuit components or after replacing a failed traction circuit component (e.g. piston (traction) pump or wheel motor), the high flow hydraulic filter can be installed in the traction circuit. The filter will ensure that contaminates are removed from the closed loop and thus, do not cause additional component damage.

Figure 12

Toro Part Number: TOR6011

NOTE: This kit does not include hydraulic hoses (see Hydraulic Hose Kit TOR6007 above).

NOTE: Replacement filter element is Toro part number TOR6012. Filter element canister tightening torque is 25 ft−lb (34 N−m).

Hydraulic Test Fitting Kit

This kit includes a variety of O−ring Face Seal fittings to enable you to connect test gauges into the system.

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

Toro Part Number: TOR4079

Figure 13

Measuring Container

Use this container for doing hydraulic motor efficiency testing (motors with case drain lines only). Measure efficiency of a hydraulic motor by restricting the outlet flow from the motor and measuring leakage from the case drain line while the motor is pressurized by the hydraulic system.

The table in Figure 15 provides gallons per minute (GPM) conversion for measured milliliter or ounce motor case drain leakage.

Toro Part Number: TOR4077

Figure 14

GPM	Milliliters in 15 sec.	Ounces in 15 sec.
.1	95	3.2
.2	189	6.4
.3	284	9.6
.4	378	12.8
.5	473	16.0
.6	568	19.2
.7	662	22.4
.8	756	25.6
.9	852	28.8
1.0	946	32.0

Figure 15

O−ring Kit

The kit includes O−rings in a variety of sizes for face seal and port seal hydraulic connections. It is recommended that O−rings be replaced whenever a hydraulic connection is loosened.

Toro Part Number: 117−2727

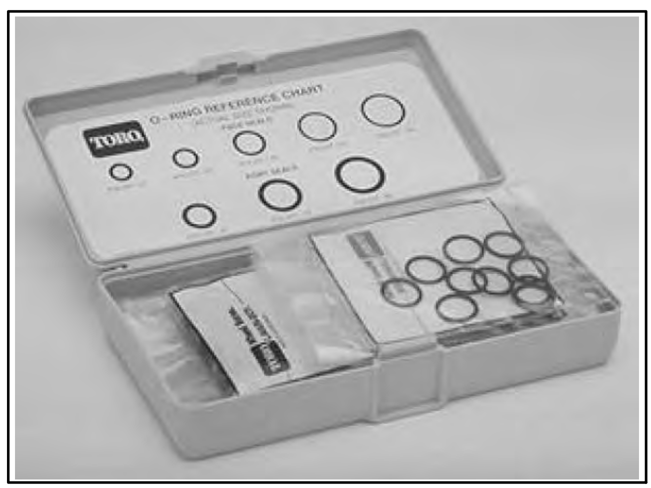


Figure 16

Remote Starter Switch

After flushing the hydraulic system or replacing a hydraulic component (e.g. gear pump, piston pump, wheel motor), it is necessary to prime the hydraulic pumps. A remote starter switch (Fig. 17) can be used for this purpose. Obtain a remote starter switch locally.

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

A remote stater switch can also be constructed using Toro switch #106−2027, a length of 14 gauge wire, a 20 amp in−line fuse, two (2) alligator clips and necessary connectors. Connecting the wire to switch terminals 1 and 2 will allow the momentary switch contacts to be used for the remote starter switch (Fig. 18).

NOTE: For information on using the remote starter switch to prime the hydraulic pumps, see Flush Hydraulic System in the Service and Repairs section of this chapter.

Figure 17

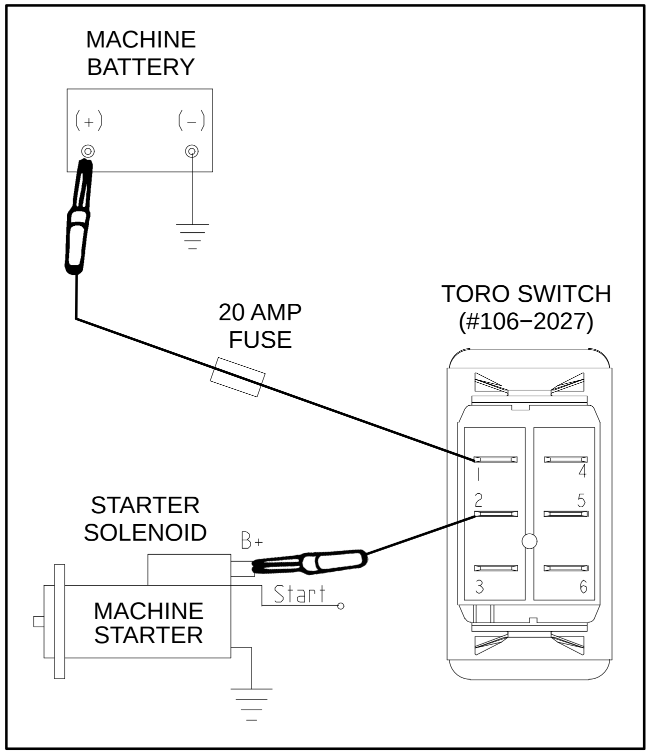


Figure 18

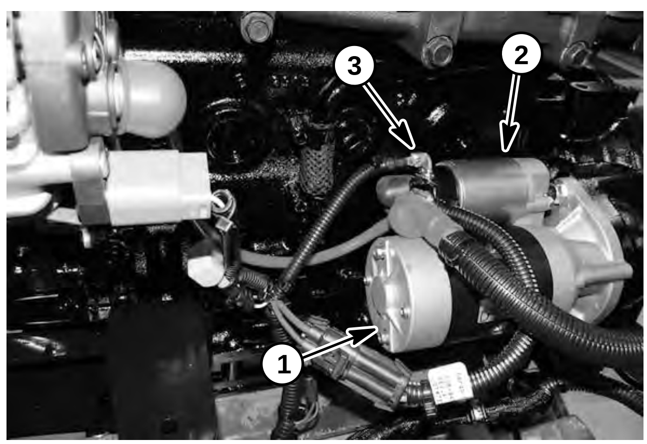


Figure 19

1. **Starter motor**
2. **Starter solenoid**
3. **B+ terminal**

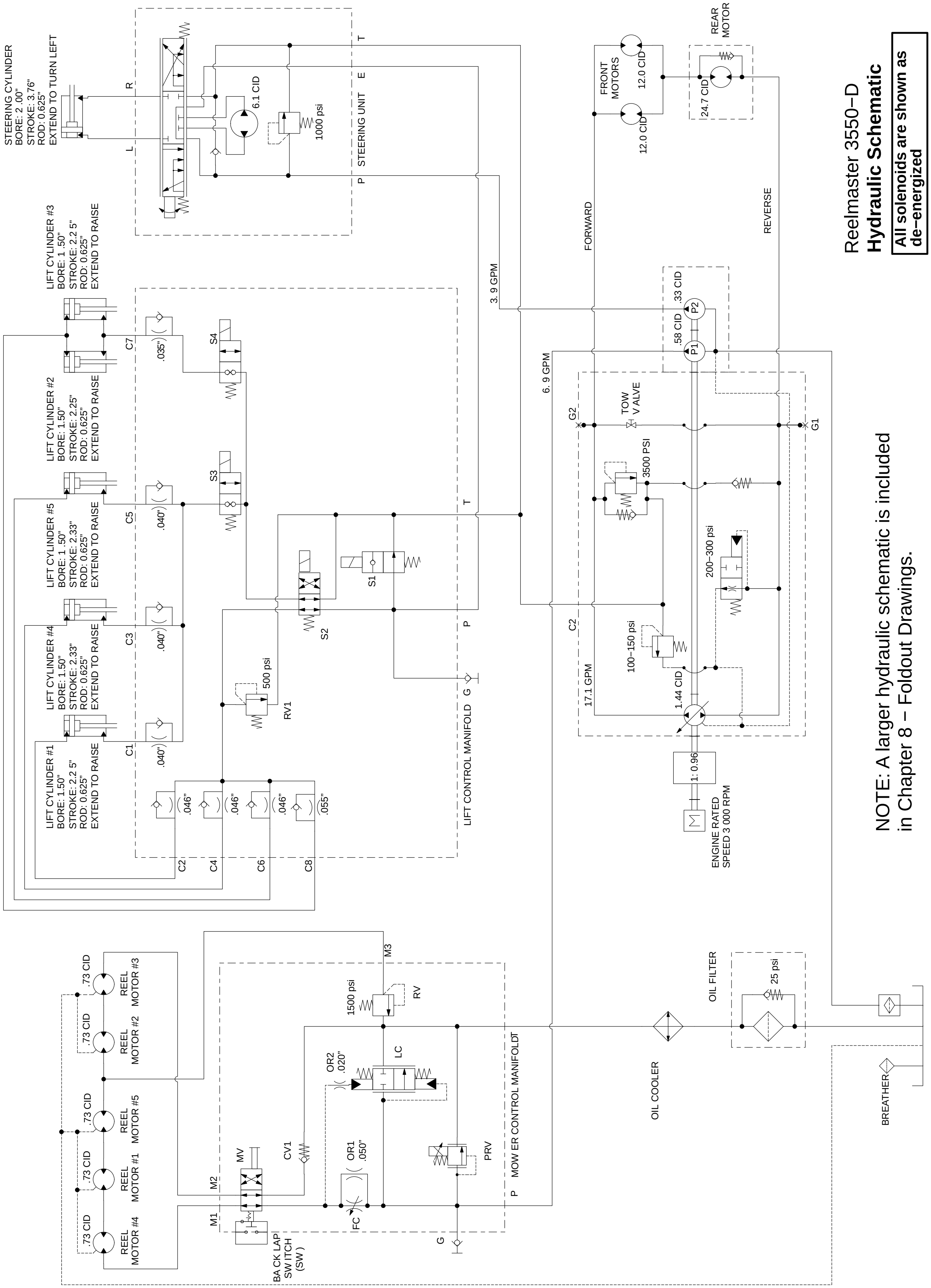
Wheel Hub Puller

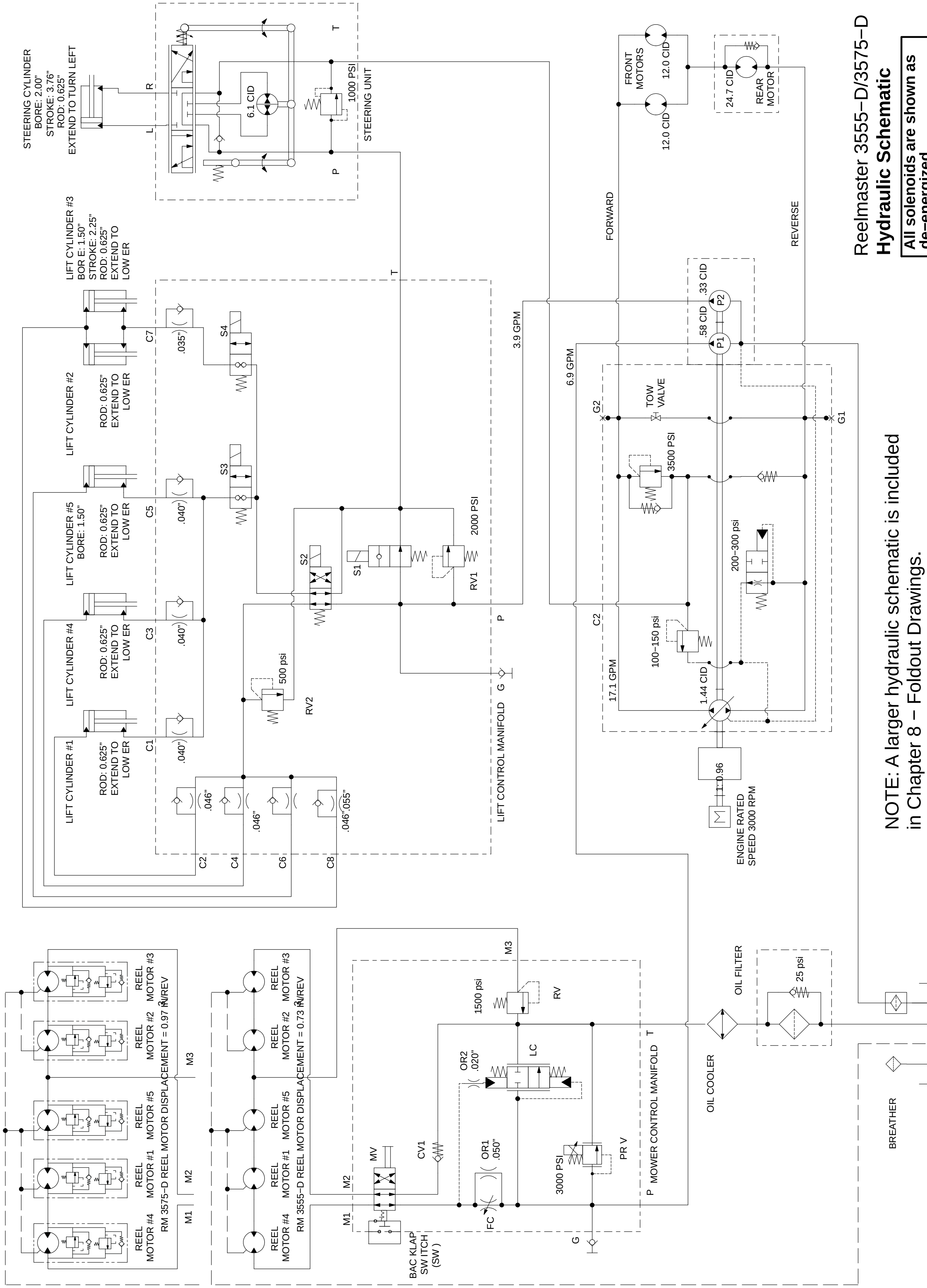
Toro Part Number: **TOR4097**

The wheel hub puller allows safe removal of the wheel hub from the shaft of wheel motors.

Figure 20

Hydraulic System


Reelmaster 3550–D
Hydraulic Schematic
All solenoids are shown as de–energized
NOTE: A larger hydraulic schematic is included in Chapter 8 – Foldout Drawings.
STEERING CYLINDER
BORE: 2.00"
STROKE: 3.76"
ROD: 0.625"
EXTEND TO TURN LEFT
STEERING UNIT
6.1 CID
1000 psi
LIFT CYLINDER #3
LIFT CYLINDER #2
LIFT CYLINDER #5
LIFT CYLINDER #4
LIFT CYLINDER #1
EXTEND TO RAISE
LIFT CONTROL MANIFOLD
RV1
500 psi
S1
S2
S3
S4
FRONT MOTORS
12.0 CID
REAR MOTOR
24.7 CID
FORWARD
REVERSE
3. 9 GPM
6. 9 GPM
17.1 GPM
.58 CID
.33 CID
1.44 CID
TOW VALVE
3500 PSI
200–300 psi
100–150 psi
ENGINE RATED SPEED 3 000 RPM
REEL MOTOR #1
REEL MOTOR #2
REEL MOTOR #3
REEL MOTOR #4
REEL MOTOR #5
.73 CID
MOWER CONTROL MANIFOLD
1500 psi
RV
LC
PRV
OR1 .050"
OR2 .020"
CV1
MV
FC
BACKLAP SWITCH (SW)
OIL COOLER
OIL FILTER
25 psi
BREATHER



Reelmaster 3555–D/3575–D

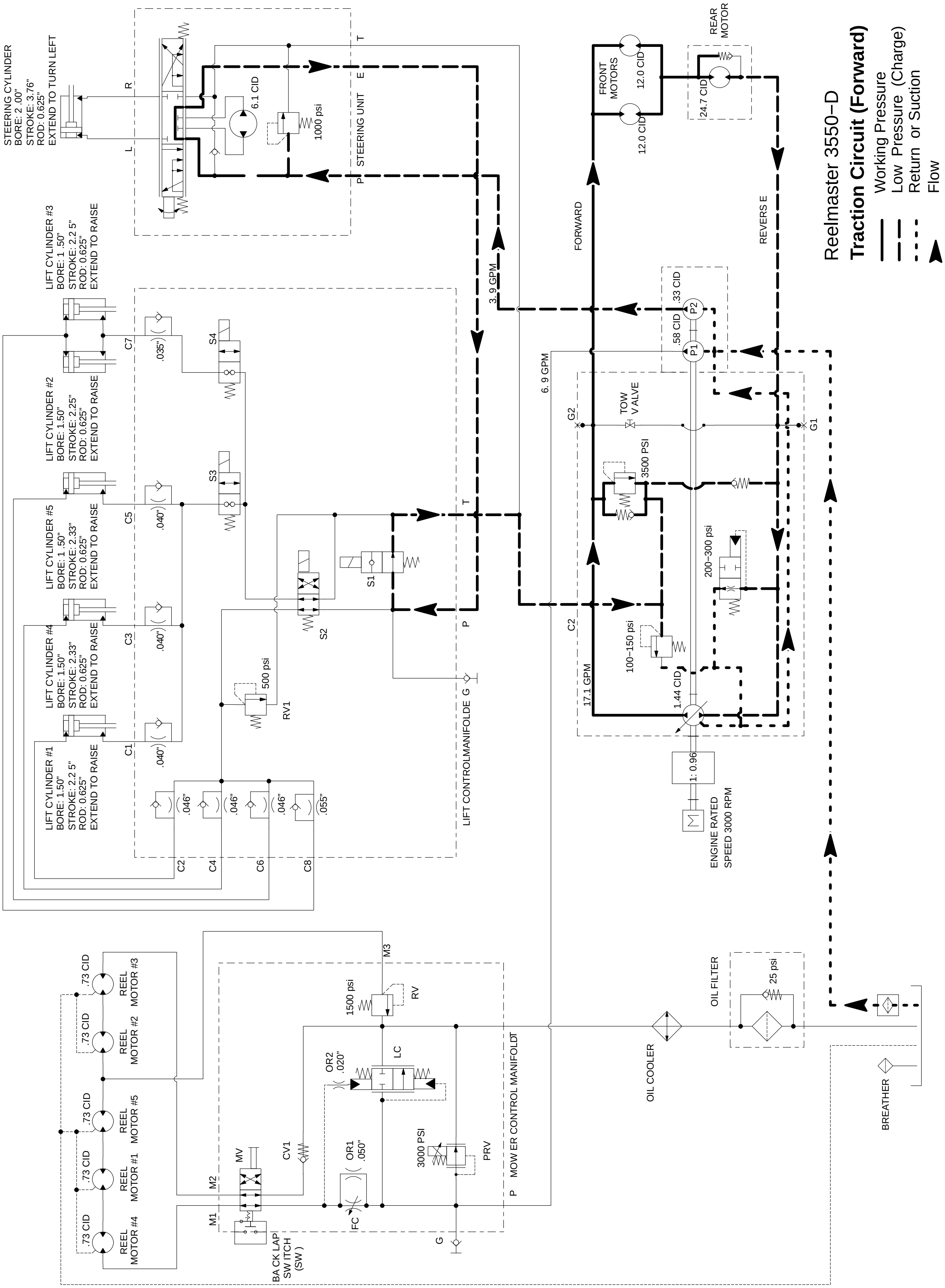
Hydraulic Schematic

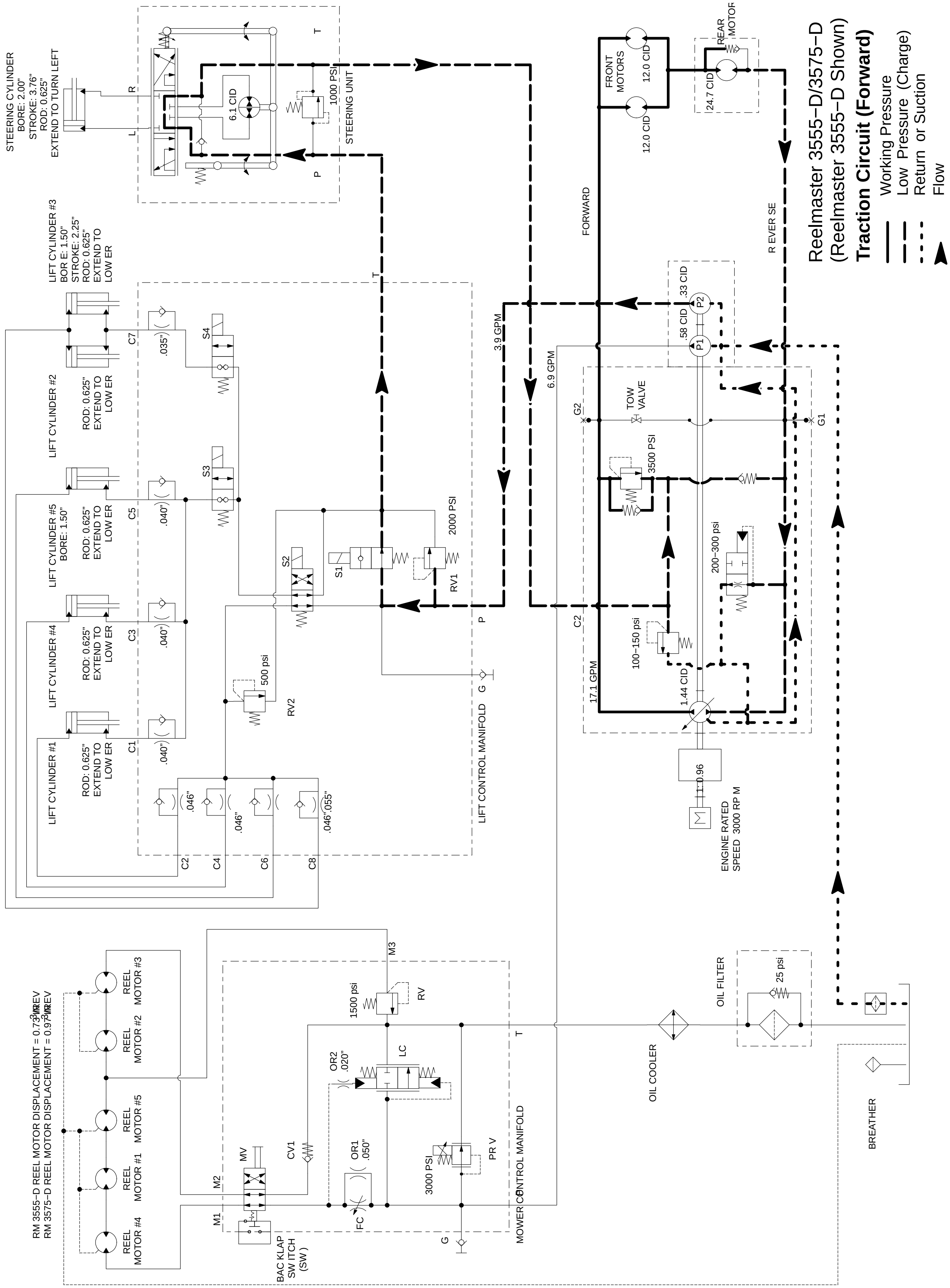
All solenoids are shown as de–energized

NOTE: A larger hydraulic schematic is included in Chapter 8 – Foldout Drawings.

Hydraulic System

Hydraulic Flow Diagrams





Hydraulic System

Traction Circuit

The traction circuit of the hydraulic system consists of a hydrostat connected in a closed loop circuit to three orbital geroller wheel motors.

The mow/transport slide control on the machines has positions for mow and transport. The mow position allows traction pedal inputs that are appropriate for mow speeds by limiting the movement of the traction pedal and the piston pump swash plate. The transport position allows full movement of the traction pedal so complete pump swash rotation is possible.

Forward

The engine drives traction pump (P3) indirectly through pulleys and a V−belt. The traction pump is a variable displacement piston pump/hydrostat. The traction pedal connects through a cable to the trunnion shaft and swash plate of the pump. With the engine running and the traction pedal in the neutral position, traction pump (P3) supplies no flow to the wheel motors. When the traction pedal is pressed to the forward position, the cable from the pedal positions the swash plate in the traction pump so fluid flows out of the hydrostat lower port. Fluid flow out of the lower port goes to the front wheel motors first, turning them in the forward direction. Fluid flowing out of the front wheel motors flows to the rear wheel motor, turning it in a forward direction. Fluid flowing out of the rear wheel motor returns to the upper port of the hydrostat and is continuously pumped out of the lower port.

Operating pressure in the closed traction circuit is determined by the amount of load developed by the wheel motors. As the load increases, circuit pressure can increase to the relief valve setting of **3500 psi (241 bar)**. In forward operation, fluid flows through the internal hydrostat relief valve to the low pressure side of the traction circuit when circuit pressure exceeds the relief setting.

Reverse

The traction circuit operates essentially the same in reverse as it does in forward. However, there are a few differences in operation.

When the reverse traction pedal is depressed, the cable from the pedal positions the swash plate in the traction pump (P3) so fluid flows out of the hydrostat upper port. Fluid flow out of the upper port goes to the rear wheel motor where an internal check valve allows the hydraulic fluid to bypass the motor. Fluid flow out of the rear wheel motor flows to the front wheel motors, turning them in the reverse direction. Fluid flow out of the front wheel motors returns to the lower port of the hydrostat and is continuously pumped out of the upper port.

NOTE: Due to the inclusion of a bypass valve in the rear wheel motor, the rear wheel motor does not help propel the traction unit in reverse.

Charge Circuit

The traction pump uses a small amount of hydraulic fluid for internal lubrication. Fluid is designed to leak across internal pump parts into the case drain. This leakage results in the loss of hydraulic fluid from the closed loop circuit that must be replenished via the charge circuit.

The gear pump (P2) is directly coupled to the hydrostat through gear pump (P1) and driven by the engine. Gear pump (P2) supplies hydraulic pressure for operating the cutting unit lift/lower system and the power steering system. On Reelmaster 3550−D machines, the oil flows first to the steering circuit and then to the lift/lower circuit. On Reelmaster 3555−D/3575−D machines, the oil flows first to the lift/lower circuit and then to the steering circuit.

Gear pump (P2) may also be referred to as the charge pump as flow from the gear pump returns to the hydrostat and replenishes the closed loop traction circuit. A relief valve located in the hydrostat provides sufficient resistance so that flow is guided to the low pressure side of the traction circuit through two (2) check valves (charge circuit). Charge pump flow in excess of **100 to 150 PSI (6.9 to 10.3 bar)** is relieved through the relief valve back to the gear pump inlet and hydraulic tank.

Traction Circuit Cooling

The traction circuit is cooled by a bleed off circuit in the piston pump. The piston pump includes an internal bleed valve which allows a small amount of hydraulic oil to pass from the return side of the pump while operating the traction unit in the forward direction. The charge circuit replenishes oil that is bled from the traction circuit by the bleed valve.

When operating the traction circuit in the reverse direction, the bleed valve closes once reverse pressure reaches **200 to 300 PSI (13.8 to 20.6 bar)** to allow normal reverse operation.

NOTE: The bleed valve threads into the piston pump back plate. Access to the bleed valve requires removal of the back plate from the piston pump.

Hydraulic System

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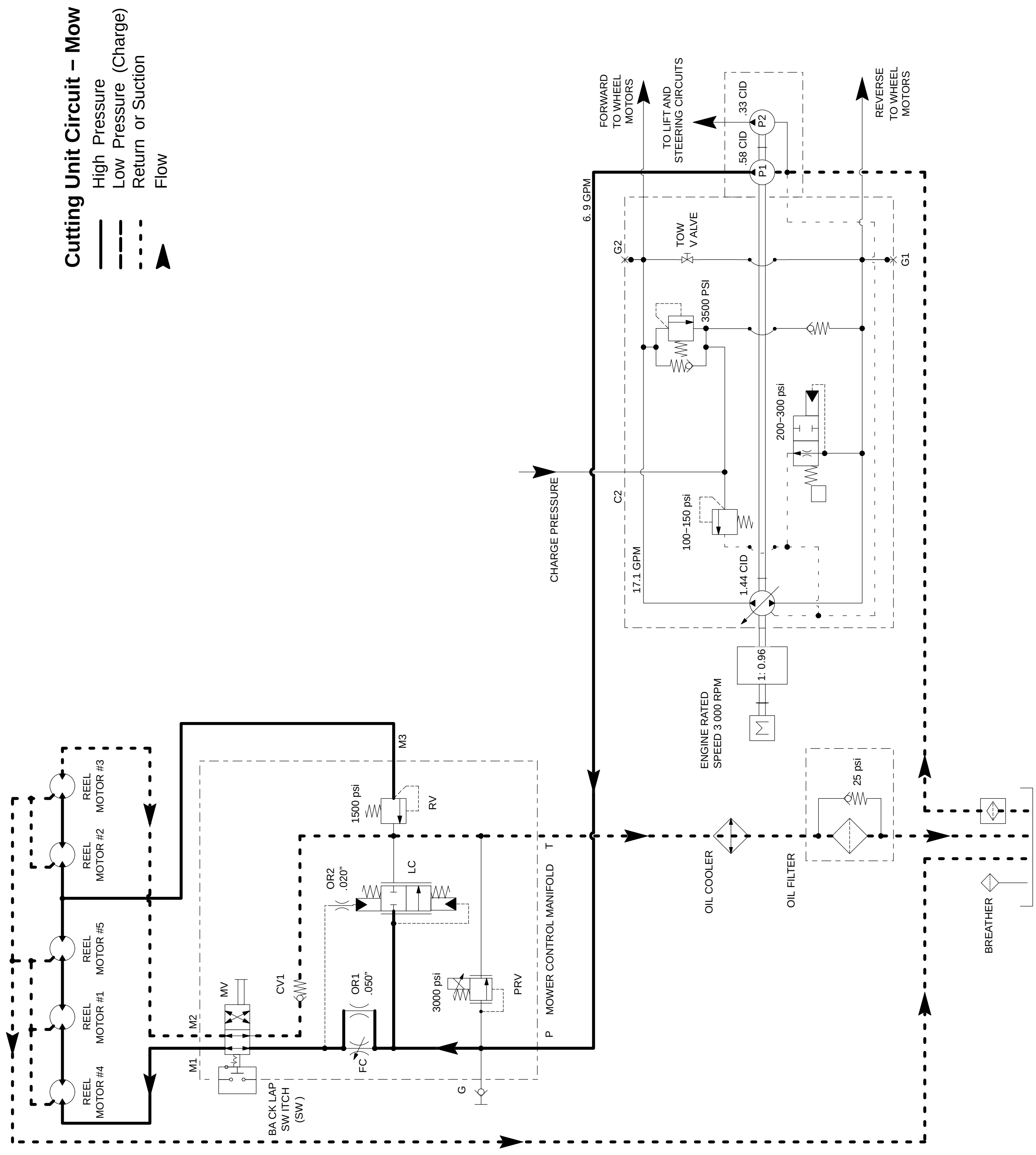

Cutting Unit Circuit – Mow
High Pressure
Low Pressure (Charge)
Return or Suction
Flow
FORWARD TO WHEEL MOTORS
TO LIFT AND STEERING CIRCUITS
.33 CID
P2
.58 CID
P1
REVERSE TO WHEEL MOTORS
6. 9 GPM
G2
TOW VALVE
G1
3500 PSI
200–300 psi
CHARGE PRESSURE
C2
100–150 psi
17.1 GPM
1.44 CID
1: 0.96
ENGINE RATED SPEED 3 000 RPM
25 psi
OIL COOLER
OIL FILTER
BREATHER
M3
1500 psi
RV
T
LC
OR2 .020"
MOWER CONTROL MANIFOLD
OR1 .050"
3000 psi
PRV
P
CV1
MV
M2
M1
FC
G
BACK LAP SWITCH (SW)
REEL MOTOR #3
REEL MOTOR #2
REEL MOTOR #5
REEL MOTOR #1
REEL MOTOR #4

Cutting Unit Circuit

Mow

The tandem gear pump is directly coupled to the piston pump/hydrostat which is belt driven by the engine. The front section of the gear pump (P1) supplies hydraulic flow for the cutting unit circuit. The gear pump takes its suction from the hydraulic tank.

Proportional relief valve (PRV) in the mow control manifold is de−energized with the engine running when either the reel enable/disable switch is in the DISABLE position, the cutting units are raised or the mow/transport slide is in the TRANSPORT position. The de−energized PRV allows gear pump flow directly to the hydraulic tank, by−passing the reel motors so the cutting reel blades remain stationary.

Proportional relief valve (PRV) is energized by the TEC controller with the engine running when the reel enable/disable switch is in the ENABLE position, the cutting units are down and the mow/transport slide is in the MOW position. In the energized position, this valve directs gear pump oil flow toward the reel motors and also functions as the relief valve for the front reel motors. Maximum front reel motor pressure is **3000 PSI (207 bar)**. Front reel motor circuit pressure can be monitored at the test fitting in mow control manifold port G.

When the mow circuit is engaged, oil flow from manifold port P flows through the flow control valve (FC) used to adjust reel speed. With the backlap valve (MV) in the MOW position, oil flows through the backlap valve (MV), out the manifold port (M1), and to the reel motors that are connected in series. Any excess flow above the flow control valve setting is by−passed to the reservoir through the logic cartridge valve (LC). The logic cartridge valve (LC) reduces fluctuations in reel speed by compensating for pressure variations across the flow control valve (FC).

Mow circuit oil flows through the front reel motors and then the rear reel motors as it turns the motors in the mow direction. Manifold relief valve (RV) provides relief protection for the rear reel motors at a pressure less than the proportional relief valve (PRV). If pressure to the rear motors reaches **1500 PSI (103 bar)**, relief valve (RV) opens.

Oil flow from the reel motors returns into mow control manifold port (M2), through backlap valve (MV), through manifold check valve CV1 and exits the manifold through pot (T). Oil returns to the hydraulic tank through the oil cooler and oil filter.

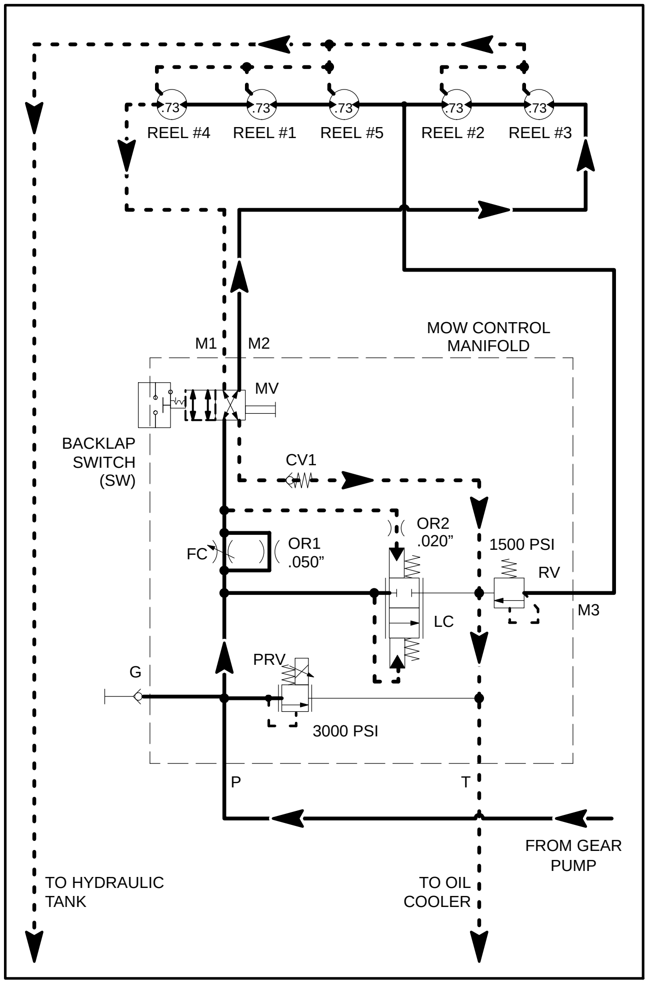
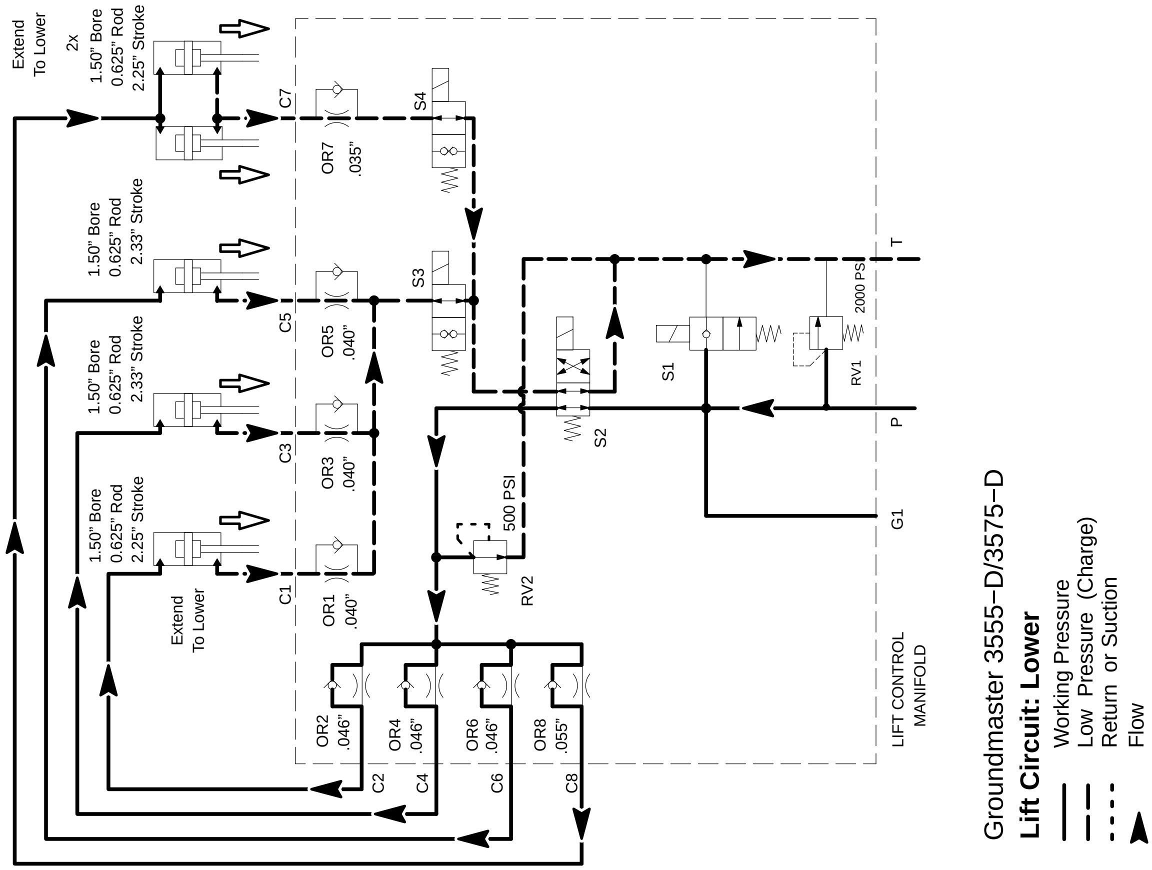
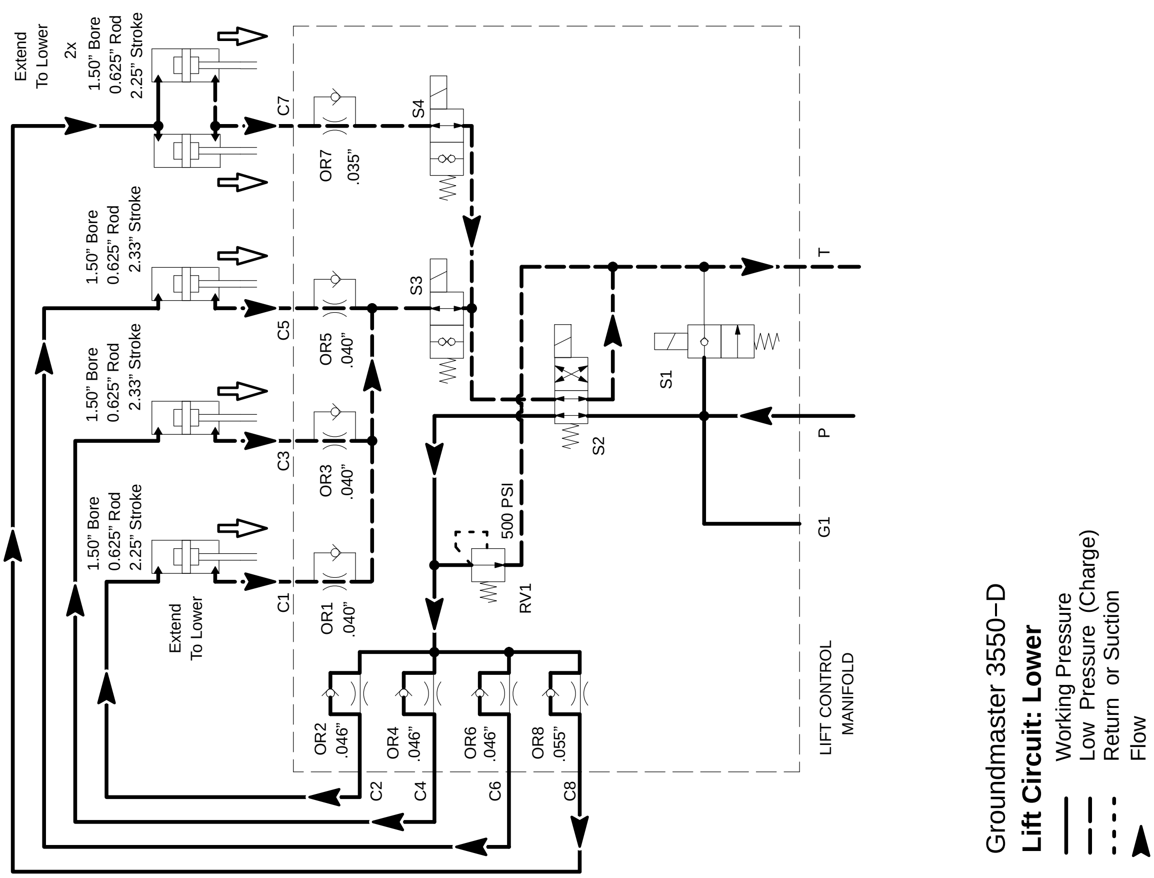


Figure 21

Backlap (Fig. 21)

Backlapping operation is the similar to mowing operation, except for the position of the backlap valve (MV). When the backlap valve (MV) is in the BACKLAP position, oil flows through the rear reel motors and then the front reel motors as it turns the motors in the backlap direction.


Groundmaster 3555−D/3575−D
Lift Circuit: Lower
Working Pressure
Low Pressure (Charge)
Return or Suction
Flow
Extend
To Lower
2x
1.50" Bore
0.625" Rod
2.25" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.25" Stroke
Extend
To Lower
C7
C5
C3
C1
OR7
.035"
OR5
.040"
OR3
.040"
OR1
.040"
S4
S3
S2
S1
RV1
2000 PSI
RV2
500 PSI
T
P
G1
OR2
.046"
OR4
.046"
OR6
.046"
OR8
.055"
C2
C4
C6
C8
LIFT CONTROL
MANIFOLD


Groundmaster 3550−D
Lift Circuit: Lower
Working Pressure
Low Pressure (Charge)
Return or Suction
Flow
Extend
To Lower
2x
1.50" Bore
0.625" Rod
2.25" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.25" Stroke
Extend
To Lower
C7
C5
C3
C1
OR7
.035"
OR5
.040"
OR3
.040"
OR1
.040"
S4
S3
S2
S1
RV1
500 PSI
T
P
G1
OR2
.046"
OR4
.046"
OR6
.046"
OR8
.055"
C2
C4
C6
C8
LIFT CONTROL
MANIFOLD

Lift Circuit: Lower

The tandem gear pump is directly coupled to the variable displacement piston pump/hydrostat which is belt driven by the engine. The rear section of the tandem gear pump (P2) supplies hydraulic flow for the steering circuit, for raising and lowering the cutting units and for the traction charge circuit. The gear pump takes its suction from the hydraulic tank. On Reelmaster 3550−D machines, the oil flow from gear pump (P2) moves through the steering circuit first, then through the lift circuit. To provide separate relief pressures for each circuit on Reelmaster 3555−D/3575−D machines, the oil flow from gear pump (P2) moves through the lift circuit first, then through the steering circuit.

The maximum steering circuit pressure of **1000 PSI (69 bar)** is limited by the relief valve located in the power steering valve. On Reelmaster 3550−D machines, the maximum lift circuit pressure is also controlled by the relief valve located in the power steering valve. Due to the increased size and weight of the cutting units on Reelmaster 3555−D/3575−D machines, the maximum lift circuit pressure of **2000 PSI (138 bar)** is controlled by an additional relief valve located in the lift control manifold. Lift circuit pressure can be monitored at the test fitting in lift control manifold port G.

The lift control manifold includes four (4) electrically operated solenoid valves. Solenoid valve S1 causes circuit flow to by−pass the lift cylinders when de−energized and directs flow to the cylinders when energized. Directional solenoid valve S2 is used to direct oil flow to raise the cutting units when energized and lower them when de−energized. When energized, solenoid valve S3 allows hydraulic flow to and from the front cutting unit lift cylinders (#1, #4 and #5) and prevents oil passage to and from these lift cylinders when de−energized. When energized, solenoid valve S4 allows hydraulic flow to and from the rear cutting unit lift cylinders (#2 and #3) and prevents oil passage to and from these lift cylinder when de−energized.

While operating the machine during conditions of not raising or lowering the cutting units (joystick in the neutral (center) position), all of the lift manifold solenoid valves (S1, S2, S3 and S4) are de−energized. Flow not required for lifting or steering is made available for the traction charge circuit. Flow in excess of charge circuit needs then returns to the gear pump inlet.

The console joystick is used to raise and lower the cutting units. The joystick acts as an input to the Toro Electronic Controller (TEC) which sends electrical outputs to the appropriate lift control manifold solenoid coils in order to raise or lower the cutting units.

When the reel enable/disable switch is in the DISABLE position, the cutting unit lift and lower operation is under complete control of the joystick (momentary control) and the cutting units move up or down only as long as the joystick is held in position.

When the reel enable/disable switch is in the ENABLE position, the cutting unit lower operation is controlled by the TEC (sequential control). Momentarily “bumping” the joystick forward lowers the cutting units to the full down or “Mow” position.

Lower Cutting Units

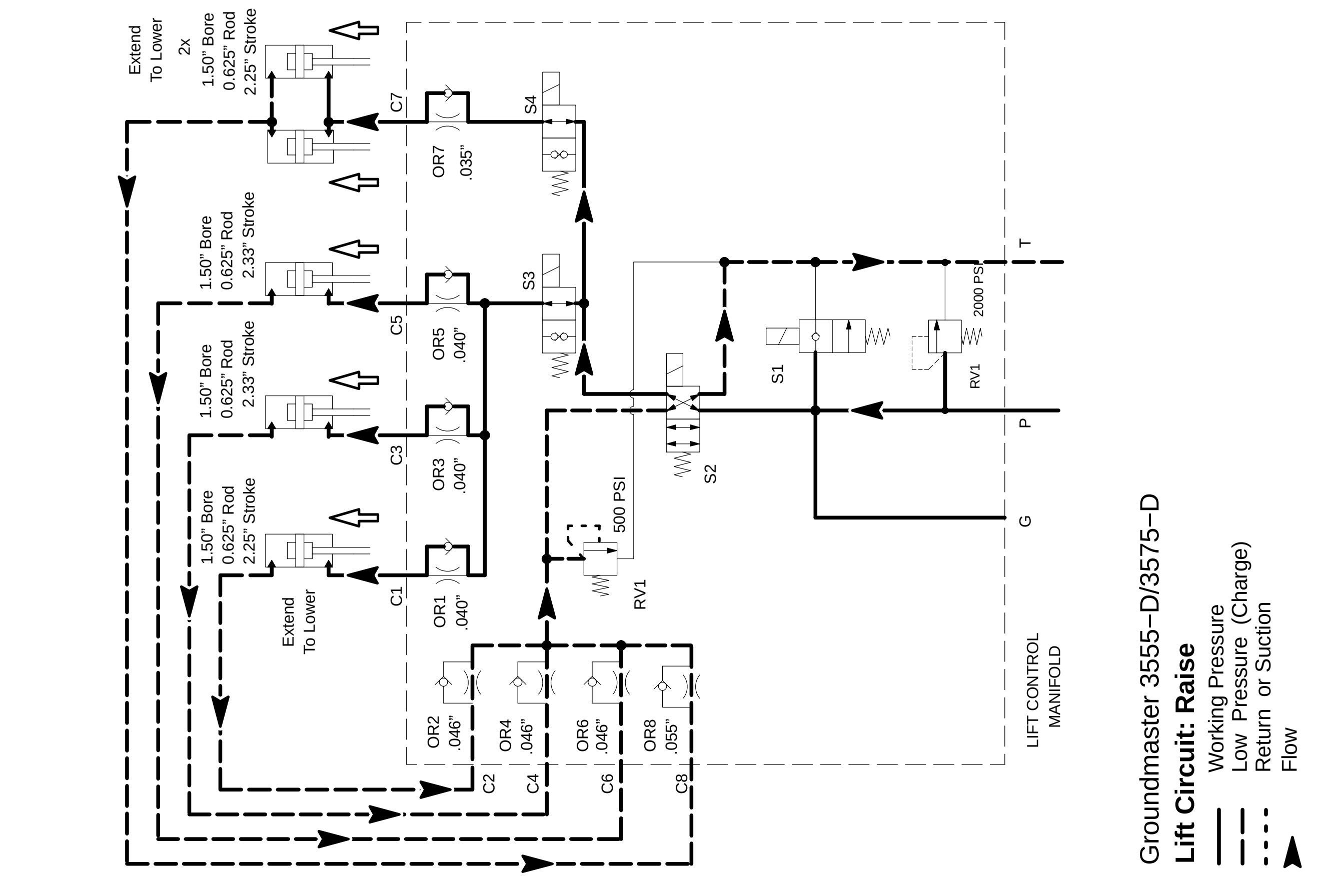
The operator must be in the operator seat and the mow/transport switch must be in the MOW position in order to lower the cutting units. The cutting units will not lower if the mow/transport switch is in the TRANSPORT position.

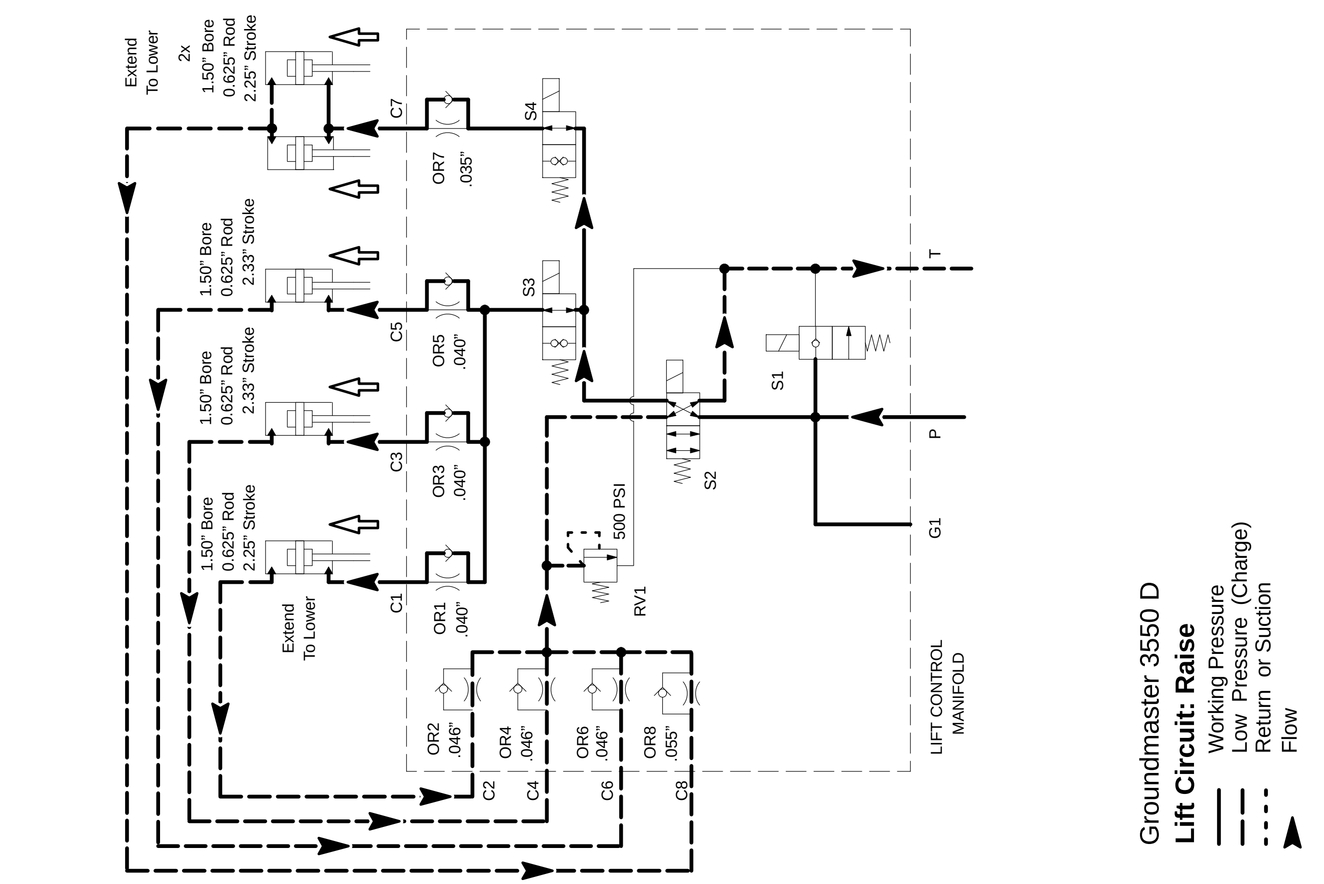
When the joystick is moved to the lower position by the operator, solenoid valve S1, S3 and S4 are energized by the Toro Electronic Controller (TEC). To allow the front cutting units to be lowered before the rear cutting units, the controller slightly delays energizing solenoid S4 after the joystick is moved. The energized solenoid valves direct gear pump oil flow to the cap end of the lift cylinders. Flow control orifices in the lift control manifold (OR2, OR4, OR6 and OR8) are bypassed when lowering the cutting units.

Hydraulic pressure along with cutting unit weight causes the lift cylinder shafts to extend, and lower the cutting units. Flow control orifices in the lift control manifold (OR1, OR3, OR5 and OR7) control the cutting unit lowering speed by providing a restriction for the return flow from the lift cylinders.

Because cutting unit weight assists in extending the lift cylinders when lowering the cutting units, less hydraulic pressure is necessary during the cutting unit lowering operation. Lift circuit relief valve (RV) allows lift circuit pressure to be limited to **500 PSI (34 bar)** while lowering the cutting units. The lift cylinders and cutting units stop lowering when solenoid valves S1, S3 and S4 are de−energized.

NOTE: Adjustment of the lift control manifold lift circuit relief valve (Reelmaster 3550−D = RV1) or (Reelmaster 3555−D/375−D = RV2) is not recommended.


Groundmaster 3555−D/3575−D
Lift Circuit: Raise
Working Pressure
Low Pressure (Charge)
Return or Suction
Flow
Extend
To Lower
2x
1.50" Bore
0.625" Rod
2.25" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.25" Stroke
Extend
To Lower
C7
C5
C3
C1
OR7
.035"
OR5
.040"
OR3
.040"
OR1
.040"
S4
S3
S2
S1
500 PSI
RV1
2000 PSI
RV1
T
P
G
OR2
.046"
OR4
.046"
OR6
.046"
OR8
.055"
C2
C4
C6
C8
LIFT CONTROL
MANIFOLD


Groundmaster 3550 D
Lift Circuit: Raise
Working Pressure
Low Pressure (Charge)
Return or Suction
Flow
Extend
To Lower
2x
1.50" Bore
0.625" Rod
2.25" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.33" Stroke
1.50" Bore
0.625" Rod
2.25" Stroke
Extend
To Lower
C7
C5
C3
C1
OR7
.035"
OR5
.040"
OR3
.040"
OR1
.040"
S4
S3
S2
S1
500 PSI
RV1
T
P
G1
OR2
.046"
OR4
.046"
OR6
.046"
OR8
.055"
C2
C4
C6
C8
LIFT CONTROL
MANIFOLD

Lift Circuit: Raise

The tandem gear pump is directly coupled to the variable displacement piston pump/hydrostat which is belt driven by the engine. The rear section of the tandem gear pump (P2) supplies hydraulic flow for the steering circuit, for raising and lowering the cutting units and for the traction charge circuit. The gear pump takes its suction from the hydraulic tank. On Reelmaster 3550−D machines, the oil flow from gear pump (P2) moves through the steering circuit first, then through the lift circuit. To provide separate relief pressures for each circuit on Reelmaster 3555−D/3575−D machines, the oil flow from gear pump (P2) moves through the lift circuit first, then through the steering circuit.

The maximum steering circuit pressure of **1000 PSI (69 bar)** is limited by the relief valve located in the power steering valve. On Reelmaster 3550−D machines, the maximum lift circuit pressure is also controlled by the relief valve located in the power steering valve. Due to the increased size and weight of the cutting units on Reelmaster 3555−D/3575−D machines, the maximum lift circuit pressure of **2000 PSI (138 bar)** is controlled by an additional relief valve located in the lift control manifold. Lift circuit pressure can be monitored at the test fitting in lift control manifold port G.

The lift control manifold includes four (4) electrically operated solenoid valves. Solenoid valve S1 causes circuit flow to by−pass the lift cylinders when de−energized and directs flow to the cylinders when energized. Directional solenoid valve S2 is used to direct oil flow to raise the cutting units when energized and lower them when de−energized. When energized, solenoid valve S3 allows hydraulic flow to and from the front cutting unit lift cylinders (#1, #4 and #5) and prevents oil passage to and from these lift cylinders when de−energized. When energized, solenoid valve S4 allows hydraulic flow to and from the rear cutting unit lift cylinders (#2 and #3) and prevents oil passage to and from these lift cylinder when de−energized.

While operating the machine during conditions of not raising or lowering the cutting units (joystick in the neutral (center) position), all of the lift manifold solenoid valves (S1, S2, S3 and S4) are de−energized. Flow not required for lifting or steering is made available for the traction charge circuit. Flow in excess of charge circuit needs then returns to the gear pump inlet.

The console joystick is used to raise and lower the cutting units. The joystick acts as an input to the Toro Electronic Controller (TEC) which sends electrical outputs to the appropriate lift control manifold solenoid coils in order to raise or lower the cutting units.

When the reel enable/disable switch is in the DISABLE position, the cutting unit lift and lower operation is under complete control of the joystick (momentary control) and the cutting units move up or down only as long as the joystick is held in position.

When the reel enable/disable switch is in the ENABLE position, the cutting unit raise operation is controlled by the TEC (sequential control). Momentarily “bumping” the joystick rearward raises the cutting units to the full up position on Reelmaster 3550−D machines, or to the partially raised “Turn Around” position on Reelmaster 3555−D/3575−D machines. Hold the joystick rearward to raise the cutting units to the full up position on Reelmaster 3555−D/3575−D machines.

Raise Cutting Units

NOTE: The operator must be in the operator seat in order to raise the cutting units.

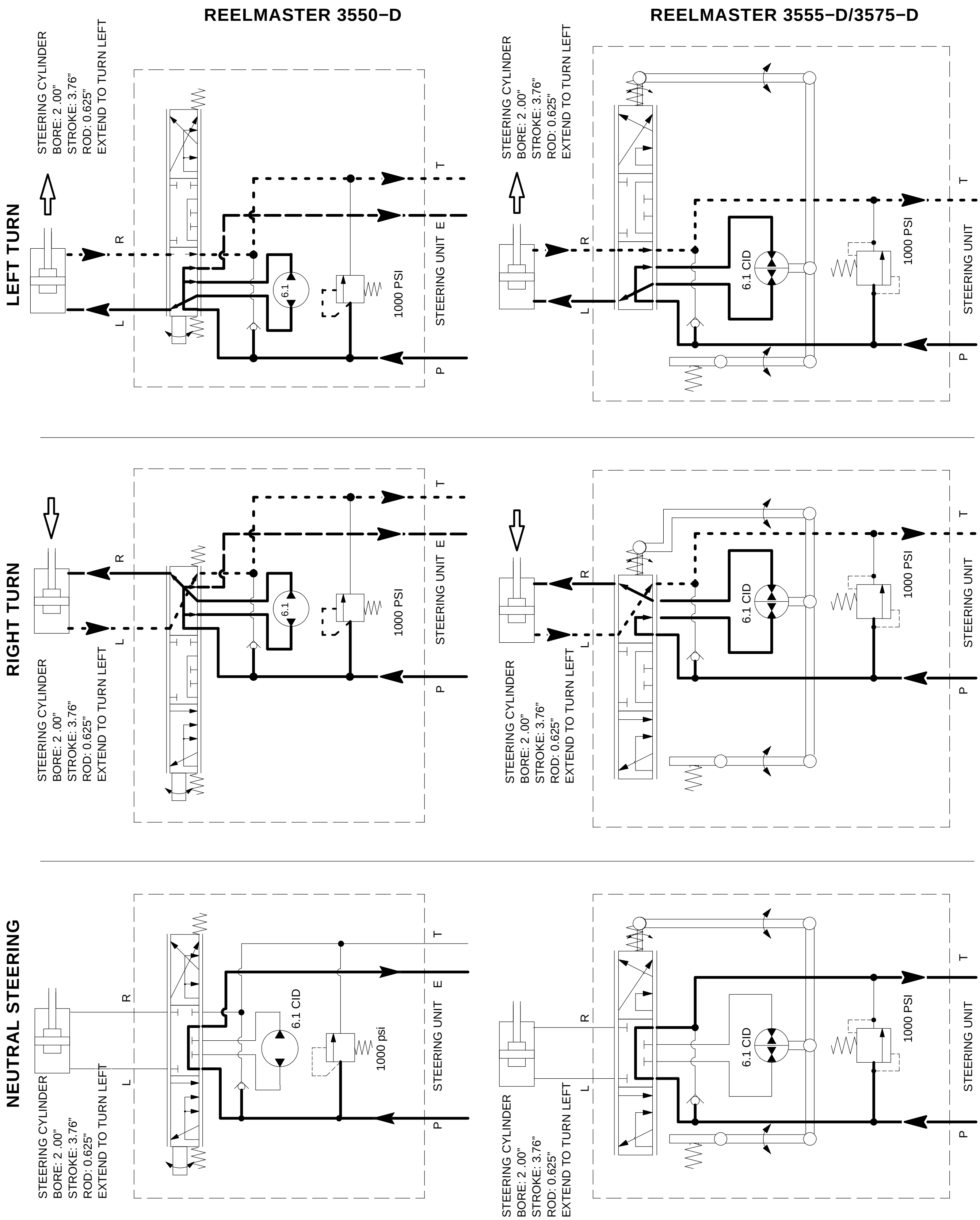
When the joystick is moved to the raise position by the operator, solenoid valve S1, S2, S3 and S4 are energized by the Toro Electronic Controller (TEC). To allow the front cutting units to be raised before the rear cutting units, the controller slightly delays energizing solenoid S4 after the joystick is moved. The energized solenoid valves direct gear pump oil flow to the rod end of the lift cylinders. Flow control orifices in the lift control manifold (OR1, OR3, OR5 and OR7) are bypassed when raising the cutting units.

Hydraulic pressure causes the lift cylinder shafts to retract, and raise the cutting units. Flow control orifices in the lift control manifold (OR2, OR4, OR6 and OR8) control the cutting unit raising speed by providing a restriction for the return flow from the lift cylinders.

When the joystick is released, solenoid valves S1, S2, S3 and S4 are de−energized so the lift cylinders and cutting units are held in position.

Steering Circuit

Working Pressure
Low Pressure (Charge)
Return or Suction
Flow



Steering Circuit

The tandem gear pump is directly coupled to the variable displacement piston pump/hydrostat which is belt driven by the engine. The rear section of the tandem gear pump (P2) supplies hydraulic flow for the steering circuit, for raising and lowering the cutting units and for the traction charge circuit. The gear pump takes its suction from the hydraulic tank. Maximum steering circuit pressure of **1000 PSI (69 bar)** is limited by the relief valve located in the power steering valve.

With the engine running and the steering control valve in the centered position (steering wheel not being turned), hydraulic flow enters the steering control valve at the P port and goes through the control valve, by−passing the rotary meter and steering cylinder. On Reelmaster 3550−D machine, the steering circuit comes before the lift circuit. Flow leaves the steering control valve through the E port to supply the lift circuit and then the traction charge circuit. On Reelmaster 3555−D and 3575−D machines, the steering circuit comes after the lift circuit. Flow leaves the steering control valve at the T port to supply the traction charge circuit.

Right Turn

When a right turn is made with the engine running, the turning of the steering wheel positions the control valve so that flow goes through the bottom of the valve. Gear pump flow entering the steering control valve at the P port goes through the valve and is routed to two places. First, most of the flow is by−passed through the steering valve and exits out the E port (Reelmaster 3550−D) or T port (Reelmaster 3555−D and 3575−D). Second, the remainder of the flow is drawn through the rotary meter in the steering control valve and out port R to the steering cylinder. Flow retracts the steering cylinder for a right turn. The rotary meter ensures that the oil flow to the steering cylinder is proportional to the amount of the steering wheel rotation. Fluid leaving the steering cylinder flows back through the steering control valve then through the T port and on to the traction charge circuit.

The steering control valve returns to the neutral position when turning is complete.

Left Turn

When a left turn is made with the engine running, the turning of the steering wheel positions the steering control valve so that flow goes through the top of the valve. Gear pump flow entering the steering control valve at the P port goes through the spool and is routed to two places. As in a right turn, most of the flow is by−passed through the steering valve and exits out the E port (Reelmaster 3550−D) or T port (Reelmaster 3555−D and 3575−D). Also like a right turn, the remainder of the flow is drawn through the rotary meter in the steering control valve but goes out port L to the steering cylinder. Flow extends the steering cylinder for a left turn. The rotary meter ensures that the oil flow to the cylinder is proportional to the amount of the turning on the steering wheel. Fluid leaving the steering cylinder flows back through the steering control valve then through the T port and on to the traction charge circuit.

The steering control valve returns to the neutral position when turning is complete.

Troubleshooting

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

Review the hydraulic schematic and information on hydraulic system operation in the Hydraulic Flow Diagrams section of this Chapter. This information will be useful during the hydraulic troubleshooting process.

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

General Hydraulic System Problems

Problem	Possible Cause
Hydraulic oil leaks from system.	Hydraulic fitting(s), hose(s) or tube(s) are loose or damaged. O−ring(s) or seal(s) are missing or damaged.
Hydraulic fluid foams.	Oil level in hydraulic tank is low. Hydraulic system has wrong type of hydraulic oil. The pump suction line has an air leak. Incompatible hydraulic oils are mixed in the hydraulic system. Water contamination is in the hydraulic system.
Hydraulic system operates hot (above 200F (93C).	Traction pressure is high due to excessive load or brake applied. Oil level in hydraulic tank is low, or inlet filter is loose or clogged (**NOTE:** Other hydraulic systems are affected as well). Hydraulic oil is contaminated or oil viscosity is too light. Oil cooler is damaged or plugged. Bypass valve in traction pump/hydrostat is open or defective. Charge pressure is low. Wheel motor(s) or cutting unit motor(s) are worn or damaged. Traction pump/hydrostat is worn or damaged.

Traction Circuit Problems

Problem	Possible Cause
Neutral is difficult to find or machine operates in one direction only.	External control linkage is misadjusted, disconnected, binding or damaged. Traction pump/hydrostat is worn or damaged.
Traction response is sluggish.	Bypass valve in traction pump/hydrostat is open or defective. Brake is not released. Hydraulic oil is very cold. Traction charge pressure is low. Traction pump/hydrostat or wheel motor(s) are worn or damaged.
No traction exists in either direction.	Brake is not released. Oil level in hydraulic tank is low **NOTE:** Other hydraulic systems are affected as well. Bypass valve in traction pump/hydrostat is open or defective. Traction pump/hydrostat drive belt is loose or broken. Traction relief valve is damaged − open. Traction charge pressure is low. Traction pump/hydrostat or wheel motor(s) are worn or damaged.
Wheel will not turn.	Brakes are binding. Key on wheel motor shaft is sheared or missing. Internal parts in wheel motor are damaged.
Unit rolls when stopped on an incline − Engine Running (up to 10% grade and parking brake disengaged).	Make up fluid from charge pump is not available. Hydrostat check valves are damaged.
Unit rolls when stopped on an incline − Engine Not Running (up to 10% grade, wheels straight and parking brake disengaged).	Wheel motor(s) are worn or damaged (see Testing in this Chapter). **NOTE:** If unit rolls away straight, both front wheel motors are worn. If the unit turns to one side as it rolls away, the wheel motor on the outside of the turn is worn.

Lift Circuit Problems

Problem	Possible Cause
Cutting units will not lift or lift slowly.	Engine speed is too low. Hydraulic tank oil level is low **NOTE:** Other hydraulic systems are affected as well. An electrical problem exists that prevent lift control manifold solenoids from being energized (see Chapter 5 − Electrical System in this manual) Lift arm bushings are binding. Implement relief valve (in steering control valve) is stuck open. Relief valve (RV2) in lift control manifold is stuck open (Reelmaster 3555−D and 3575−D only) Lift cylinders leak internally. Gear pump (P2) is worn or damaged **NOTE:** Steering and traction charge systems are affected as well.
Cutting units raise, but will not stay up as the traction units travels between adjacent fairways or fields. **NOTE:** Lift circuit components cannot provide an absolutely perfect seal. The lift arms will eventually lower if left in the raised position during storage.	Lift circuit hydraulic lines or fittings are leaking. Lift control manifold cartridge valve(s) has damaged seals or is faulty. Lift cylinders leak internally.
Cutting units will not lower. **NOTE:** To lower the cutting units, the seat must be occupied and the mow/transport switch must be in the MOW position.	Lift arm pivots are binding. An electrical problem exists that prevents the solenoid valve (S1) in lift control manifold from being energized (See Chapter 5 − Electrical System in this manual). Solenoid valve (S1) in lift control manifold is faulty. Lift cylinder(s) for affected cutting unit(s) is damaged.

Steering Circuit Problems

Problem	Possible Cause
Steering inoperative or sluggish	Oil level in hydraulic reservoir is low **NOTE:** Other hydraulic systems are affected as well. Steering components (e.g. steering fork assembly, steering cylinder ends) are worn or binding. Relief valve in steering control valve is damaged − open. Steering cylinder leaks internally. Steering control valve is worn or damaged (see Troubleshooting Guide in the Sauer/Danfoss Steering Unit Type OSPM Service Manual.). Gear pump (P2) is worn or damaged **NOTE:** The lift/lower and traction charge circuits are affected as well.
Turning steering wheel turns machine in the wrong direction.	Hoses to the steering cylinder are reversed.

Mow Circuit Problems

Problem	Possible Cause
Gear pump is noisy (cavitation).	Hydraulic tank oil level is low **NOTE:** Other hydraulic systems are affected as well. Suction line is restricted. Suction line has an air leak.
None of the cutting reels will turn. **NOTE:** To engage the mow circuit, the seat must be occupied, the cutting units must be fully lowered, the mow/transport switch must be in the MOW position and the reel enable/disable switch must be in the ENABLE position.	Solenoid valve (PRV) is stuck open. An electrical problem exists that prevents the PRV solenoid valve in mow control manifold from being energized (See Chapter 5 − Electrical System in this manual). On Reelmaster 3555−D and 3575−D machines, the problem may include an improperly adjusted or malfunctioning turn around switch. Gear pump is worn or damaged.
Poor after−cut appearance (cutting blades(s) turn too slowly). **NOTE:** If possible, have another person observe the machine while mowing in dense turf prior to hydraulic testing. A bad reel motor will run slower, produce fewer clippings, and may cause marcelling (a washboard appearance) on the turf.	All Cutting Units: Flow control (FC) in mow control manifold requires adjustment. Solenoid valve (PRV) is faulty. Gear pump (P1) is inefficient (see Testing in this chapter). One or more Cutting Units: Cutting unit motor has internal leakage (see Testing in this chapter). Rear Cutting Units: Relief valve (RV) is out of adjustment or faulty. Single Cutting Unit: Cutting unit reel bearing(s) is (are) damaged.

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 various hydraulic circuits to perform various operational checks (See the Special Tools section in this chapter).

Remember that pressure specifications that appear on hydraulic schematics are the design specifications for the specific component. Actual system pressure will vary depending on oil temperature, the location of the test port, and the specific components used in the hydraulic circuit.

IMPORTANT: The hydraulic test procedures listed in this manual represent actual performance for this machine. To correctly measure product or component performance, be sure to follow the test procedures provided.

Before Performing Hydraulic Tests

All obvious areas such as fluid supply, filter, binding linkages, loose fasteners, or improper adjustments must be checked before assuming that a hydraulic component is the source of the problem.

Precautions for Hydraulic Testing

WARNING

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Do not use hands to search for leaks; use paper or cardboard. 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.

CAUTION

Failure to use gauges with recommended pressure (psi) rating as listed in test procedures could result in damage to the gauge and possible personal injury from leaking hot hydraulic fluid.

CAUTION

All testing should be performed by two (2) people. One person should be in the seat to operate the machine, and the other should read and record test results.

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

2. Put metal caps or plugs on any hydraulic lines left open or exposed during testing or while hydraulic components are removed.

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.

3. The engine must be in good operating condition. Use a phototach (non−contact tachometer) when performing a hydraulic test. Engine speed can affect the accuracy of the test readings. Monitor engine RPM during hydraulic testing. Use the information below when performing hydraulic system tests. If engine RPM is above or below the specified speed during a test, you will need to adjust the expected hydraulic performance parameters (aprox. 3% per 100 engine rpm at full throttle)

IMPORTANT: Hydraulic component output volume relates directly to engine RPM. For every 100 engine rpm the following component output volumes will change by the volume listed.

Hydrostat: 100 engine RPM = 0.59 GPM or 76.6 oz. (2265 cc) of hydraulic fluid displaced per minute

Gear Pump (P1): 100 engine RPM = 0.24 GPM or 30.8 oz. (912 cc) of hydraulic fluid displaced per minute

Gear Pump (P2): 100 engine RPM = 0.14 GPM or 17.5 oz. (519 cc) of hydraulic fluid displaced per minute

NOTE: Engine−to−Pump ratio is 1:0.96. In other words, 1 engine RPM = 0.96 pump RPM.

4. The inlet and the outlet hoses must be properly connected and not reversed (hydraulic tester with pressure and flow capabilities) to prevent damage to the hydraulic tester or components.

5. When using a hydraulic tester with pressure and flow capabilities, open load valve completely in the hydraulic tester to minimize the possibility of damaging components.

6. Install fittings finger tight and far enough to make sure that they are not cross−threaded before tightening them with a wrench.

7. Position hydraulic tester hoses to prevent moving machine parts from contacting and damaging the hoses or tester.

8. Check fluid level in the hydraulic tank. After connecting test equipment, make sure tank is full.

9. Check control linkages for improper adjustment, binding, or broken parts.

10. All hydraulic tests should be made with the hydraulic fluid at normal operating temperature.

Hydraulic Test Selection

Before beginning any hydraulic test, identify if the problem is related to the traction circuit, cutting (mow) circuit or steering and lift/sidewinder circuit. Once the faulty system has been identified, perform tests that relate to that circuit.

If a traction circuit problem exists, consider performing one or more of the following tests: Charge Pressure Test, Wheel Motor Efficiency Test, and/or Piston Pump/ Hydrostat Flow and Relief Valve Tests.

If a cutting (mow) circuit problem exists, consider performing one or more of the following tests: Circuit Pressure Test, Reel Motor Efficiency/Case Drain Test, Mow Control Manifold Relief Pressure Test, and/or Gear Pump (P1) Test.

If a steering or lift/sidewinder circuit problem exists, consider performing one or more of the following tests: Gear Pump (P2) Flow Test, Relief Valve Pressure Test, and/or Steering Control Valve and Steering Cylinder Test.

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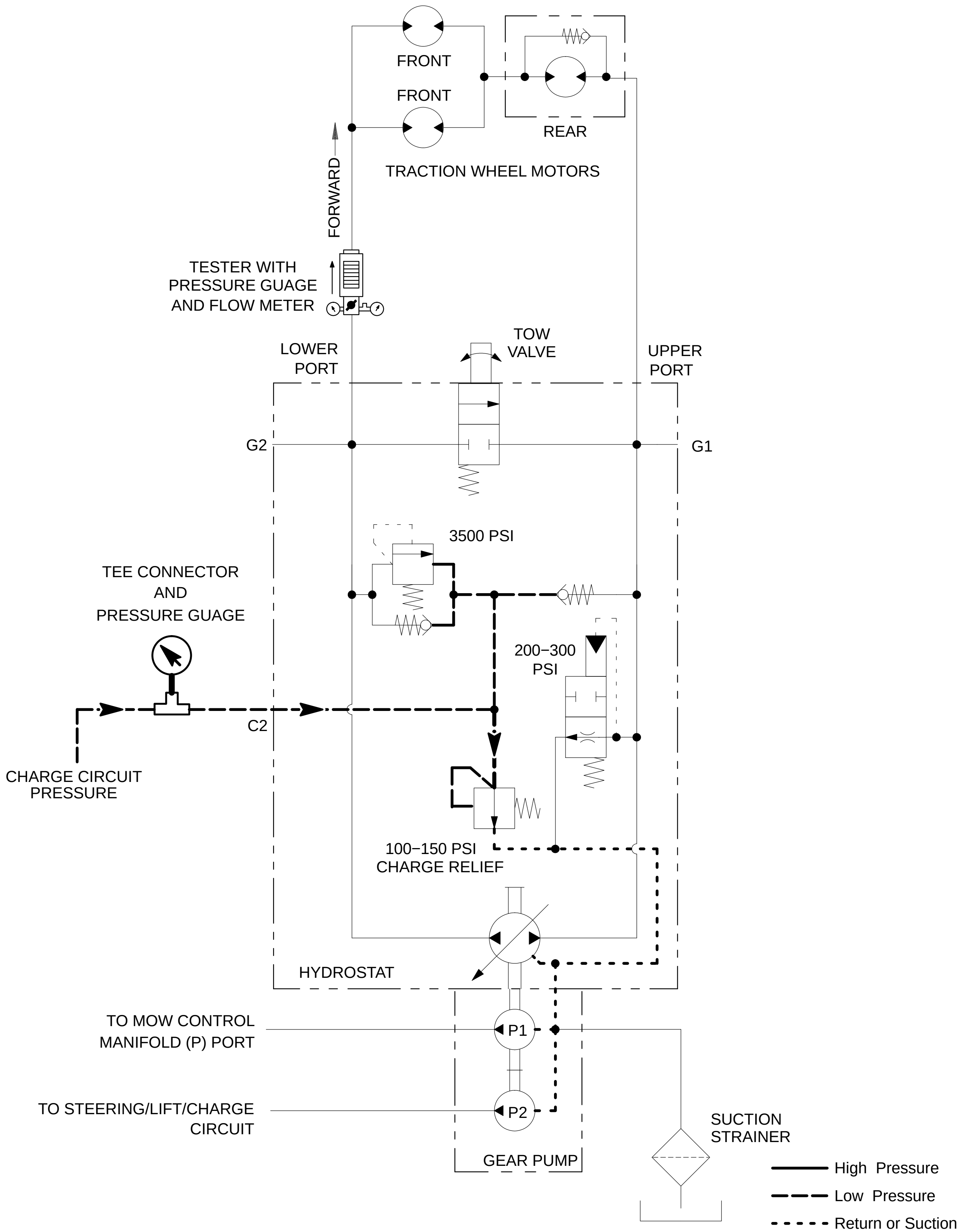
Traction Circuit Testing − Charge Pressure Test



Traction Circuit Testing − Charge Pressure Test:

The charge pressure test is the first in a series of tests recommended to determine traction circuit performance. A charge pressure drop of more than **20%** indicates an internal leak in the piston pump/hydrostat. Continued unit operation can generate excessive heat, cause damage to seals and other components in the hydraulic system, and affect overall machine performance.

Special Equipment Required:

- Pressure Gauge
- Flow Meter with Pressure Gauge that has at least an 18 GPM (68 LPM) capacity.
- Phototach (non−contact tachometer).

1. Park machine on a level surface with the cutting units lowered and the reel engage/disengage switch is in the disengage position. Make sure engine is off and the parking brake is engaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Make sure that traction pedal is adjusted to the neutral position.

4. Disconnect the hydraulic hose at the piston pump/hydrostat fitting just to the rear of the tow valve. This hose comes from the steering control valve (T) port (Fig. 22).

5. Install a T−connector and pressure gauge between the fitting and disconnected hose.

6. Disconnect hose from the lower hydraulic fitting on the engine side of the hydrostat (Fig. 23).

7. Install tester in series with the pump and the disconnected hose. Make sure the tester flow control valve is fully open.

8. Attach a heavy chain to the rear of the machine frame and an immovable object to prevent the machine from moving during testing.

9. Chock the wheels to prevent wheel rotation during testing.

10. Start engine. Move throttle to full speed **(3220 ± 50 RPM)**.

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

12. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

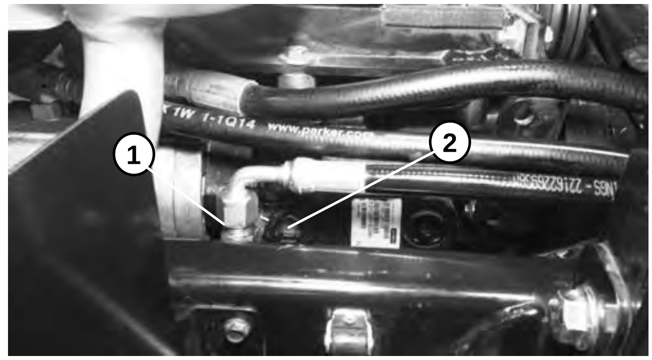


Figure 22

1. **Hydraulic hose** 2. **Piston pump tow valve**

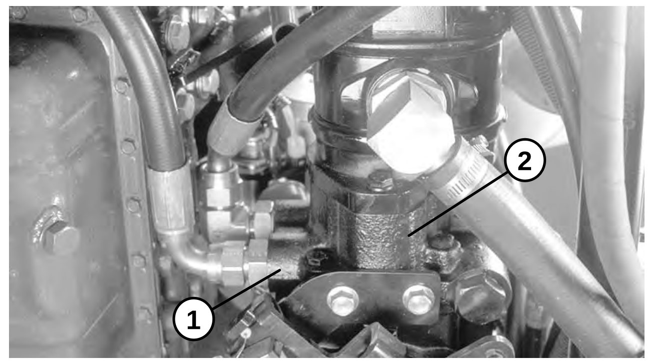


Figure 23

1. **Lower hydraulic fitting** 2. **Piston pump**

13. Record reading on pressure gauge from the lift control manifold (T) port. Charge pressure (without load) should read from **150 to 200 PSI (10.3 to13.8 Bar).** If charge relief pressure specification is not met, consider the following:

    A. Gear pump (P2) is faulty (steering/lift circuit performance will also be affected). Test gear pump (P2) flow (see Gear Pump (P2) Flow Test in this chapter).

    B. The piston pump charge relief valve is faulty. Repair or replace the piston pump charge relief valve (see Piston Pump Service in this chapter).

14. Sit in the operator's seat, release the parking brake, and slowly depress the forward traction pedal until **1000 to 1500 PSI (68.9 to 103.4 Bar)** is reached on the flow meter pressure gauge.

15. Record reading on pressure gauge from lift control manifold (T) port (under load). Charge pressure (under load) should not drop **more than 20%** when compared to charge pressure (without load) recorded in step 13.

If specifications are not met, perform Piston Pump/Hydrostat Flow and Traction Relief Pressure Test as outlined in this chapter.

16. Release traction pedal, move throttle to low speed and turn the engine off.

Hydraulic System

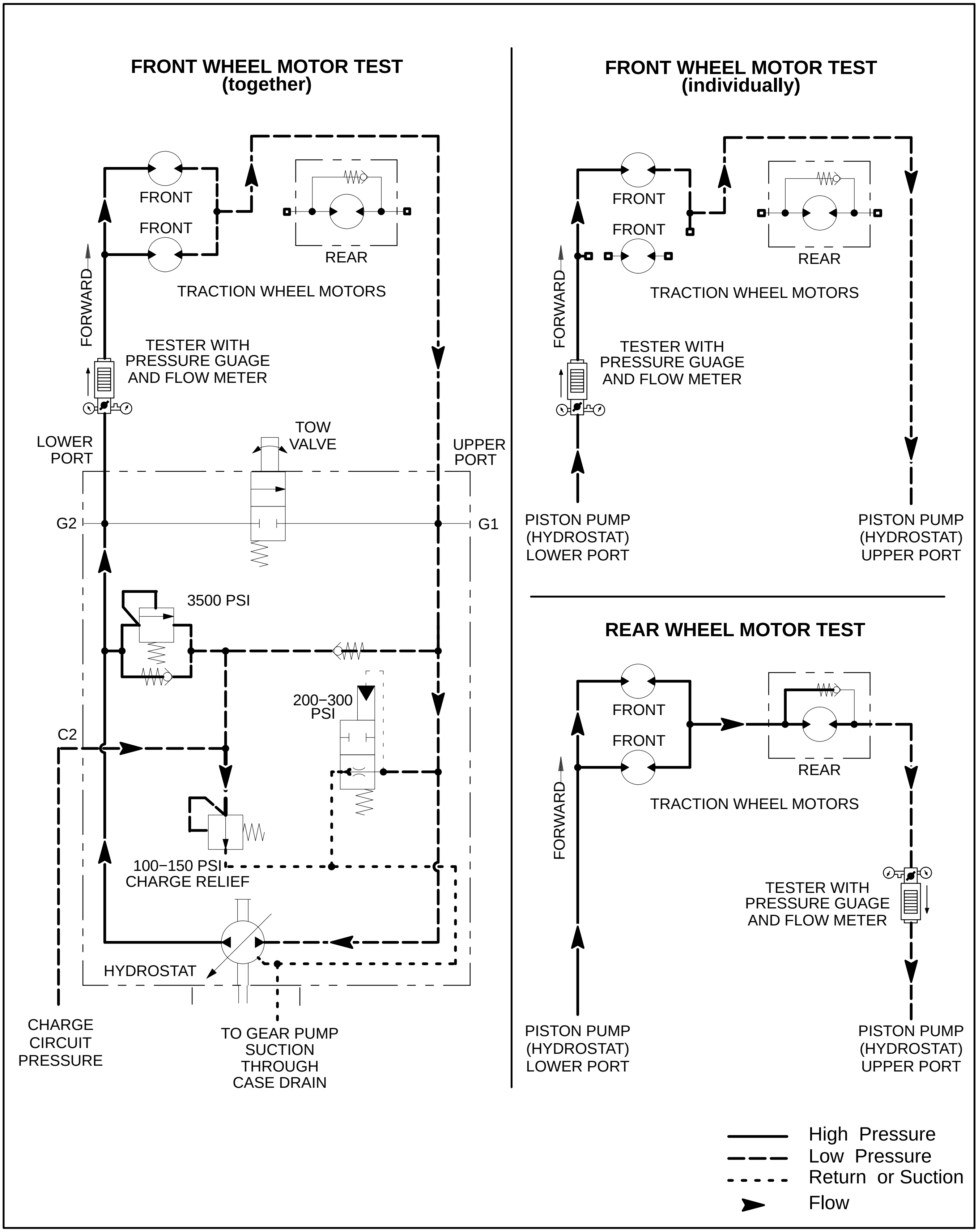

FRONT WHEEL MOTOR TEST
(together)
FRONT
FRONT
REAR
TRACTION WHEEL MOTORS
FORWARD
TESTER WITH
PRESSURE GUAGE
AND FLOW METER
TOW
VALVE
LOWER
PORT
UPPER
PORT
G2
G1
3500 PSI
200−300
PSI
C2
100−150 PSI
CHARGE RELIEF
HYDROSTAT
CHARGE
CIRCUIT
PRESSURE
TO GEAR PUMP
SUCTION
THROUGH
CASE DRAIN
FRONT WHEEL MOTOR TEST
(individually)
FRONT
FRONT
REAR
TRACTION WHEEL MOTORS
FORWARD
TESTER WITH
PRESSURE GUAGE
AND FLOW METER
PISTON PUMP
(HYDROSTAT)
LOWER PORT
PISTON PUMP
(HYDROSTAT)
UPPER PORT
REAR WHEEL MOTOR TEST
FRONT
FRONT
REAR
TRACTION WHEEL MOTORS
FORWARD
TESTER WITH
PRESSURE GUAGE
AND FLOW METER
PISTON PUMP
(HYDROSTAT)
LOWER PORT
PISTON PUMP
(HYDROSTAT)
UPPER PORT
High Pressure
Low Pressure
Return or Suction
Flow

Figure 24

Traction Circuit Testing − Wheel Motor Efficiency Test:

Wheel motor efficiency is the second in a series of tests recommended to determine traction circuit performance. Hydraulic fluid flow of **1.5 GPM (5.7 LPM)** or more through a stationary wheel motor under load indicates an internal leak in the wheel motor. A worn wheel motor is less efficient. Eventually, enough fluid by−pass will cause the wheel motor to stall under heavy load conditions. Continued operation can generate excessive heat, cause damage to seals and other components in the hydraulic system, and affect overall machine performance.

There are moments during wheel motor operation (geroller position) when fluid flow through the motor is less restricted. If a wheel motor is tested in this position, the test results will be higher should not be used to determine wheel motor efficiency. Test wheel motors in three (3) different wheel positions to obtain accurate test results. Record test readings for all three (3) wheel positions.

Hydraulic fluid flows through both front wheel motors (in parallel) before passing through the rear wheel motor (in series). In this configuration, the rear wheel motor can mask front wheel motor performance issues, and the front wheel motors can mask rear wheel motor performance issues. Start by testing both front wheel motors together, then individually if necessary. Finish by testing the rear wheel motor.

Special Equipment Required:

- Pressure Gauge
- Flow Meter with Pressure Gauge that has at least an 18 GPM (68 LPM) capacity
- Phototach (non−contact tachometer)

1. Park machine on a level surface with the cutting units lowered and the reel engage/disengage switch is in the disengage position. The engine should be off and the parking brake engaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Make sure that traction pedal is adjusted to the neutral position.

4. Attach a heavy chain to the rear of the machine frame and an immovable object to prevent the machine from moving during testing.

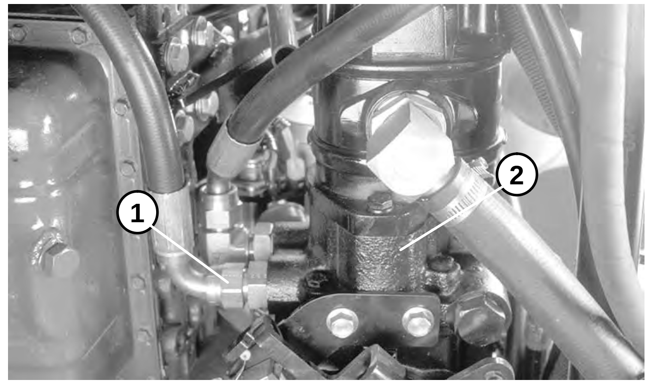


Figure 25

1. **Lower hydraulic fitting** 2. **Piston pump**

Front Wheel Motor Tests

Hydraulic fluid flows through both front wheel motors (in parallel) before passing through the rear wheel motor (in series). To accurately test the front wheel motors, the rear wheel motor must be removed from the traction circuit.

1. Disconnect hose from the lower hydraulic fitting on the bottom of the hydrostat (Fig. 25).

NOTE: An alternate testing location would be at the hydraulic tube supplying the front wheel motors under the left floor plate.

2. Install flow tester between the hydrostat and the disconnected hydraulic line. Make sure the tester flow control valve is fully open.

3. Disconnect both hydraulic lines from the rear wheel motor, then reconnect the lines to each other. Plug ports in wheel motor to prevent contamination.

4. Chock front wheels to prevent wheel rotation.

5. Start engine. Move throttle to full speed **(3220 ± 50 RPM)**.

6. Make sure hydraulic fluid is at normal operating temperature by operating the machine for approximately 10 minutes. Make sure the hydraulic tank is full.

7. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

CAUTION

Use extreme caution when performing wheel motor tests. The wheel motors will be trying to move the machine forward.

8. Sit in the operators seat, release the parking brake, and set the Mow/Transport slide to the transport position.

Hydraulic System

9. Slowly depress forward traction pedal until **1000 to 1500 PSI (68.9 to 103.4 Bar)** is displayed on the pressure gauge.

Flow meter should read **less than 1.5 GPM (5.7 LPM)**.

10. Release traction pedal, shut engine off, and record test results.

11. Rotate each front wheel 120 degrees and retest. Repeat this procedure until each wheel motor has been tested in three (3) different positions.

Proceed to testing rear wheel motor If test results are within specification. If specifications are not met, test front wheel motors individually as follows:

12. Disconnect hydraulic lines from front wheel motor that is not being tested. Cap disconnected hydraulic lines and plug ports in wheel motor to prevent contamination.

13. Chock front wheel being tested to prevent wheel rotation.

14. Start engine. Move throttle to full speed.

CAUTION

Use extreme caution when performing wheel motor tests. The wheel motors will be trying to move the machine forward.

15. Sit in the operators seat, release the parking brake, and set the Mow/Transport slide to the transport position.

16. Slowly depress forward traction pedal until **1000 to 1500 PSI (68.9 to 103.4 Bar)** is displayed on the pressure gauge.

Flow meter should read **less than 1.5 GPM (5.7 LPM)**.

17. Release traction pedal, shut engine off, and record test results.

18. Rotate front wheel 120 degrees and retest. Repeat this procedure until wheel motor has been tested in three (3) different positions.

19. Reconnect hydraulic lines to front wheel motor and repeat procedure for remaining front wheel motor.

20. If specifications are not met, repair or replace worn wheel motor.

Rear Wheel Motor Test:

Hydraulic fluid flows through both front wheel motors (in parallel) before passing through the rear wheel motor (in series). To accurately test the rear wheel motor, the front wheel motors must be allowed to rotate.

1. Disconnect hose from the upper hydraulic fitting of the rear wheel motor (Fig. 26).

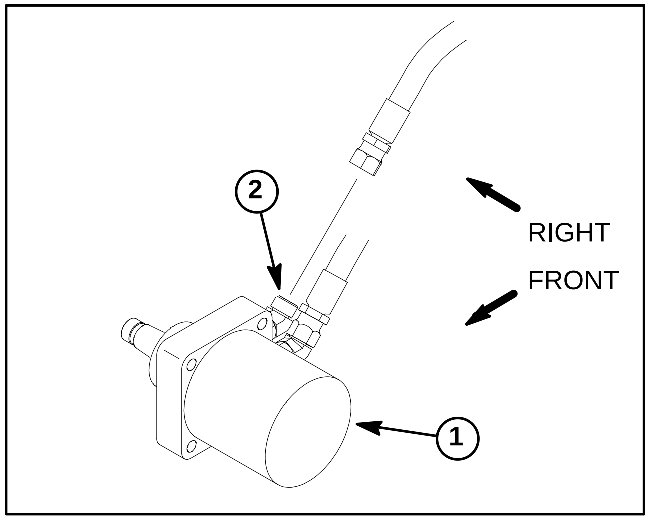


Figure 26

1. **Rear wheel motor** 2. **Upper fitting**

2. Install flow tester between the disconnected hydraulic hose and the rear wheel motor. Make sure the tester flow control valve is fully open.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

3. Raise off the floor and support both front wheels.

4. Chock rear wheel to prevent wheel rotation.

5. Start engine. Move throttle to full speed.

CAUTION

Use extreme caution when performing wheel motor tests. The wheel motors will be trying to move the machine forward.

6. Sit in the operators seat, release the parking brake, and set the Mow/Transport slide to the transport position.

7. Slowly depress forward traction pedal until **1000 to 1500 PSI (68.9 to 103.4 Bar)** is displayed on the pressure gauge.

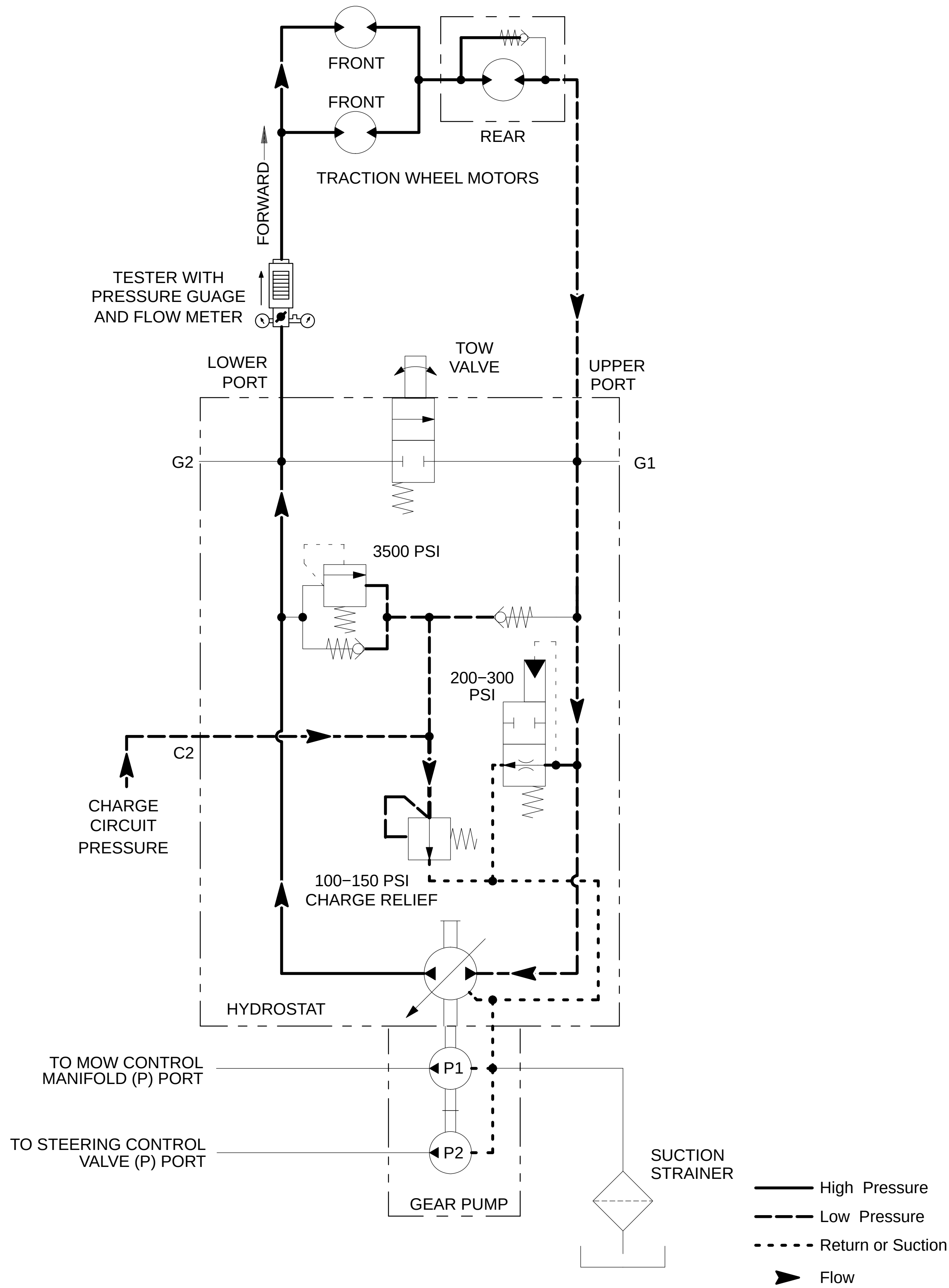
Flow meter should read **less than 1.5 GPM (5.7 LPM)**.

8. Release traction pedal, shut engine off, and record test results.

9. Rotate rear wheel 120 degrees and retest. Repeat this procedure until wheel motor has been tested in three (3) different positions.

10. If specifications are not met, repair or replace worn wheel motor.

Traction Circuit Testing − Piston Pump/Hydrostat Flow and Relief Pressure Test



Traction Circuit Testing – Piston Pump/Hydrostat Flow and Relief Pressure Test:

The hydrostat flow test is the third in a series of tests recommended to determine traction circuit performance. The final traction circuit test is verifying the hydrostat relief valve operation. This test compares fluid flow at No Load with fluid flow Under Load. A drop in flow under load of more than **12%** indicates an internal leak or malfunctioning relief valve in the piston pump/hydrostat. A worn hydrostat or malfunctioning relief valve is less efficient. Eventually, enough fluid by–pass will cause the unit to stall under heavy load conditions. Continued operation can generate excessive heat, cause damage to seals and other components in the hydraulic system, and affect overall machine performance.

Special Equipment Required:

- Pressure Gauge
- Flow Meter with Pressure Gauge that has at least an 18 GPM (68 LPM) capacity.
- Phototach (non–contact tachometer).

1. Park machine on a level surface with the cutting units lowered and the reel engage/disengage switch in the disengage position. The engine should be off and the parking brake engaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Make sure that traction pedal is adjusted to the neutral position.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.

4. Raise off the floor and support both front wheels and the rear wheel.

5. Disconnect hose from the lower hydraulic fitting on the engine side of the hydrostat (Fig. 27).

6. Install tester in series with the pump and the disconnected hose. Make sure the tester flow control valve is fully open.

7. Start engine. Move throttle to full speed **(3220 ± 50 RPM)**.

8. Make sure hydraulic fluid is at normal operating temperature by operating the machine for approximately 10 minutes. Make sure the hydraulic tank is full.

9. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

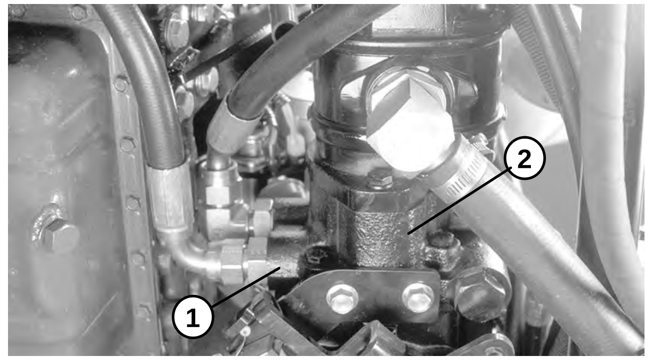


Figure 27

1. **Lower hydraulic fitting** 2. **Piston pump**

10. Sit in the operator's seat, release the parking brake, and set the Mow/Transport slide to the transport position.

CAUTION

Use extreme caution when performing hydrostat flow tests. The traction unit wheels will be rotating during the test.

11. Verify pump flow at No Load as follows:

A. Slowly depress forward traction pedal to full forward position.

B. Record tester pressure and flow readings. Unrestricted pump output should be approximately **18 GPM (69 LPM)** at **650 PSI (44.8 Bar).**

12. Verify pump flow Under Load as follows:

A. Slowly depress forward traction pedal to full forward position.

B. Apply an **additional load of 1000 to 1500 PSI (68.9 to 103.4 Bar)** by slowly closing the flow meter. The flow meter pressure gauge should read **1700 to 2100 PSI (117.2 to 144.8 Bar)**.

C. Record tester pressure and flow readings.

13. Verify traction relief valve operation as follows:

A. Return the traction pedal to neutral.

B. Fully close the flow meter flow control valve.

C. Depress the traction pedal slowly.

System pressure should reach **3600 to 3650 PSI (248 to 251 Bar)** before the relief valve opens.

Hydraulic System

NOTE: The relief valve setting is **3500 PSI (241 Bar).** An additional **100 to 200 PSI (6.9 to 10.3 Bar)** is necessary to overcome system charge pressure before the relief valve opens.

D. Record tester pressure reading.

E. Release traction pedal, open flow control valve fully, move throttle to low speed and turn the engine off.

14. If relief pressure can not be met or is greater than specified, the traction relief valve is faulty and should be replaced.

15. The Under Load test flow reading (step 12.) should not drop **more than 12%** when compared to the No Load test flow reading (step 11.). A difference of more than 12% may indicate:

A. The traction belt is worn and/or slipping.

B. The piston pump/hydrostat is worn and should be repaired or replaced.

16. Disconnect tester and reconnect hose to pump.

Hydraulic System

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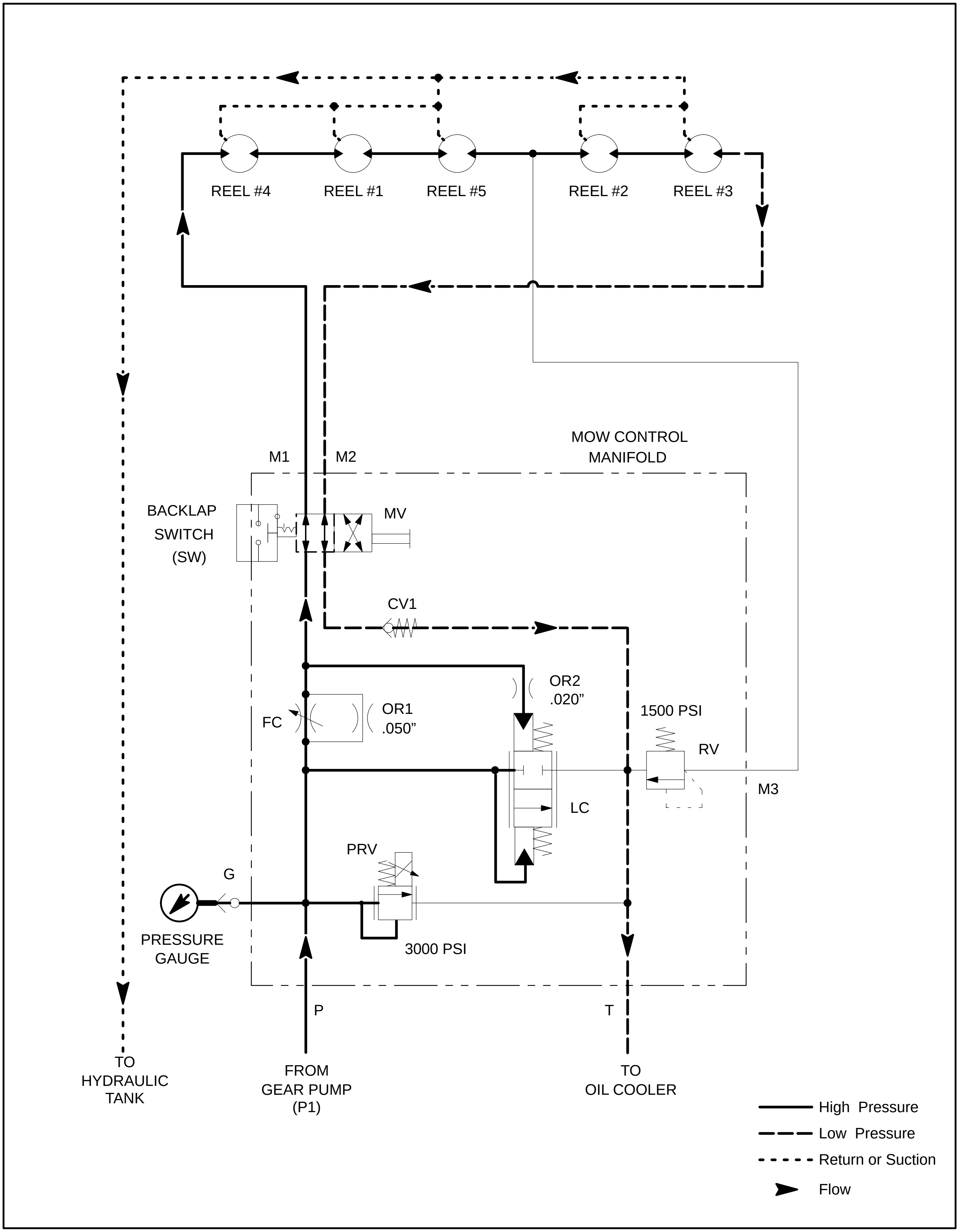
Cutting Unit Circuit Testing − Pressure Test



Cutting Unit Circuit Testing − Pressure Test:

Cutting unit circuit pressure is the first in a series of tests recommended to check cutting unit circuit performance. The results from this test will help determine which component(s) are the cause of cutting unit performance issues.

Special Equipment Required:

- Pressure Gauge with extension hose
- Phototach (non−contact tachometer).

1. Park machine on a level surface with the cutting units lowered, the reel engage/disengage switch in the DISENGAGE position, and the mow/transport switch in the MOW position. Make sure engine is off and the parking brake is disengaged.

2. Make sure backlap knob on the hydraulic manifold is in the MOW position. Make sure reel speed knob is set for typical mowing conditions.

3. Read Precautions for Hydraulic Testing in this chapter.

4. Remove cap from test fitting at mow control manifold port (OR1/G) and install a pressure gauge with hydraulic hose to the test fitting (Fig. 28).

CAUTION

Keep away from cutting units during test to prevent personal injury from the cutting blades.

5. Sit in the Operator's seat, start the engine, and move throttle to full speed **(3220 ± 50 RPM)**.

6. Make sure hydraulic fluid is at normal operating temperature by operating the machine for approximately 10 minutes. Make sure the hydraulic tank is full.

7. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

8. Set the cutting unit speed control to #9 (maximum) and engage the cutting units.

When engaged, the cutting circuit pressure may exceed manifold relief valve pressure setting of **3000 PSI (207 Bar)** momentarily opening the relief valve. Circuit pressure should then stabilize at approximately **1200 PSI (83 Bar)**.

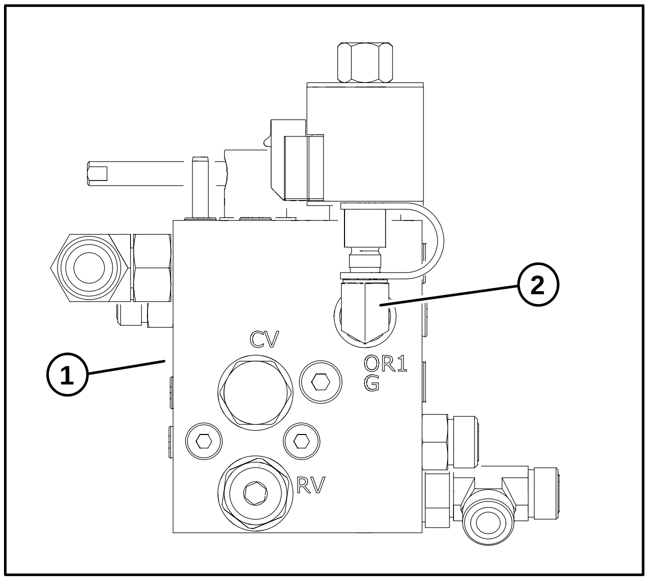


Figure 28

1. **Mow control manifold**
2. **Test fitting (port OR1/G)**

9. Safely secure the test pressure gauge and operate the machine under your specific mowing conditions. Monitor test gauge while mowing. Cutting unit circuit pressure should be approximately: **1500 to 2000 PSI (103 to 138 Bar)** under low to normal load conditions.

10. Disengage cutting units, move throttle to low speed and shut off engine.

11. If pressure readings are within specifications and cutting unit performance is still in question, test cutting unit motors individually (see Cutting Unit Circuit Testing − Reel Motor Efficiency/Case Drain Test).

12. If pressure specifications are not met, consider the following:

A. Proportional relief valve (PRV) is faulty (see Cutting Unit Circuit Testing − Proportional Relief Valve (PRV) Pressure Test in this chapter).

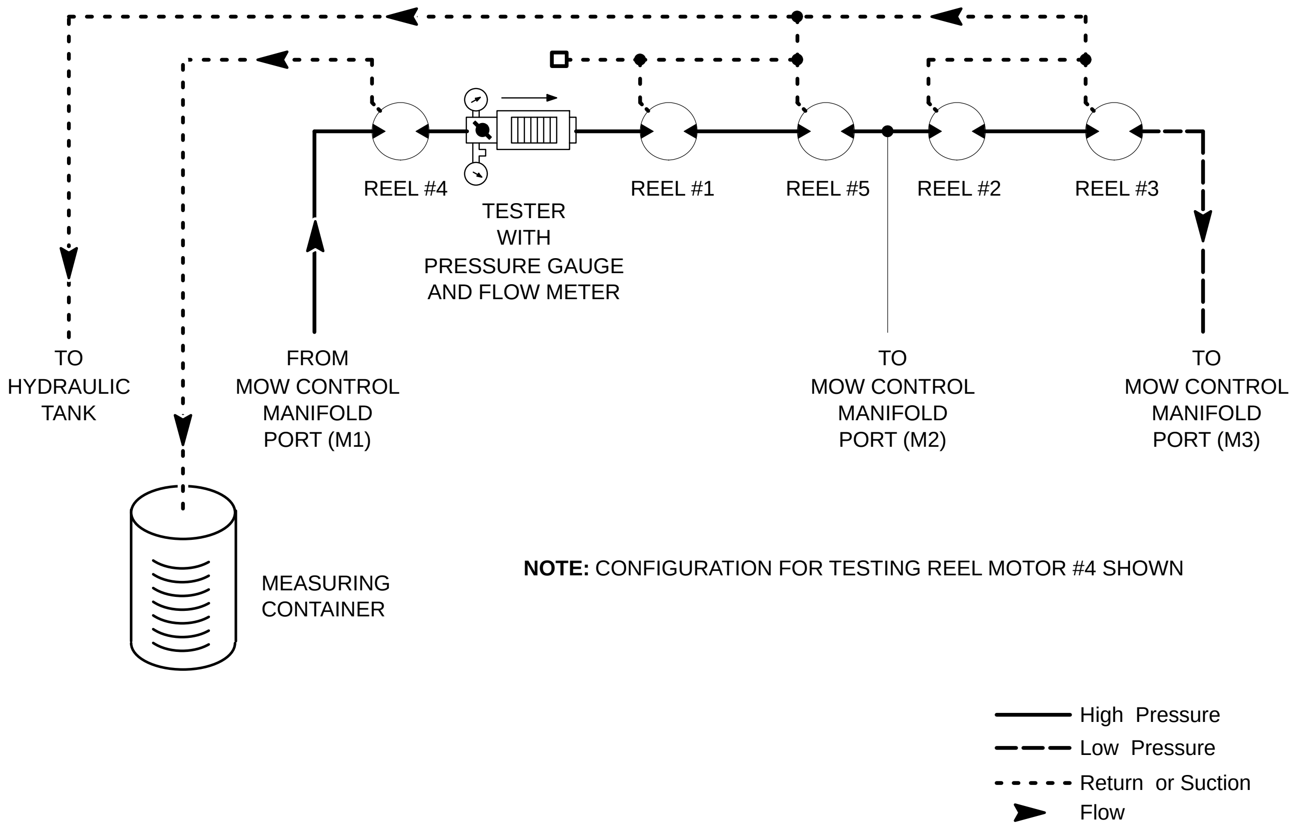
B. Relief valve (RV) is faulty (see Cutting Unit Circuit Testing − Relief Valve (RV) Pressure Test in this chapter).

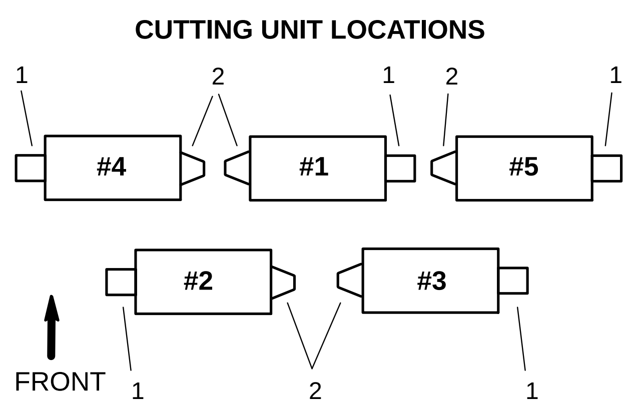
C. Logic Cartridge (LC) Is faulty (see Control Manifold Cartridge Valve Service in this chapter).

D. Gear pump (P1) is faulty (see Cutting Unit Circuit Testing − Gear Pump (P1) Flow Under Load Test in this chapter).

13. Disconnect test equipment from hydraulic manifold.

Hydraulic System





1. **Reel motor location**
2. **Weight location**

Cutting Unit Circuit Testing − Reel Motor Efficiency/ Case Drain Test

The reel motor efficiency/case drain test is the second in a series of tests recommended to check cutting unit circuit performance. Over a period of time, a reel motor can wear internally. This test measures case drain volume while restricting flow across the motor ports. Case drain volume under load of more than **9%** of total motor flow indicates the gears and wear plates in the motor have worn. A worn motor may by−pass hydraulic fluid to its case drain causing the motor to be less efficient. Eventually, enough fluid loss will cause the reel motor to stall under heavy cutting conditions. Continued operation with a worn, inefficient motor can generate excessive heat, cause damage to seals and other components in the hydraulic system, and affect quality of cut.

NOTE: One method to find a failing or malfunctioning cutting unit motor is to have another person observe the machine while mowing in dense turf. A bad motor will run slower, produce fewer clippings and may cause a different appearance on the turf.

Special Equipment Required:

- Flow Meter with Pressure Gauge that has at least a 12 GPM (45 LPM) capacity.
- Phototach (non−contact tachometer).

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

2. Park the machine on a level surface with the cutting units lowered and the reel enable/disable switch in the disable position. Make sure engine is off and the parking brake is disengaged.

3. Read Precautions for Hydraulic Testing in this chapter.

4. Make sure that traction pedal is adjusted to the neutral position.

NOTE: The cutting unit motors are connected in series. If a faulty reel motor is not obvious (based on quality of cut issues) you may have to test all the reel motors in the circuit. If testing all reel motors, start with the first motor in the series (#4 cutting unit).

5. Hydraulic oil passes through each reel motor from the front to the rear. Disconnect the return hose from the motor (hose at the rear of the reel motor).

6. Install hydraulic tester between the motor and the disconnected return hose. Make sure the tester flow control valve is fully open.

7. Make sure backlap knob on the hydraulic manifold is in the MOW position and reel speed is set to maximum.

8. Disconnect hose from reel motor case drain at the hydraulic tube (#1 cutting unit), or from the bulkhead fitting (#2, 3, 4, & 5 cutting units). Cap the hydraulic tube or bulkhead fitting to prevent system contamination.

9. Place open end of disconnected case drain hose into a drain pan.

10. Two people are required to complete the following steps. One person should sit in the operator’s seat and operate the machine while another person reads the tester and measures reel motor case drain volume.

11. Start the engine, and move throttle to full speed **(3220 ± 50 RPM)**.

12. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

CAUTION

Keep away from reels during test to prevent personal injury from the rotating reel blades.

13. Engage cutting units and slowly close tester flow control valve until **1200 PSI (82.7 Bar)** is obtained.

14. Hold disconnected motor case drain hose into a container graduated in ounces or milliliters (e.g. Toro #TOR4077) and collect hydraulic fluid for **30** seconds. After **30** seconds, remove hose end from container.

15. Record amount of fluid collected in the container.

16. Disengage cutting units, set throttle to low speed, and stop engine.

17. If volume is more than **43 oz (1265 milliliters)**, repair or replace the tested reel motor.

18. Remove tester and reconnect hydraulic hoses.

19. Check hydraulic fluid level (see Traction Unit Operator’s Manual).

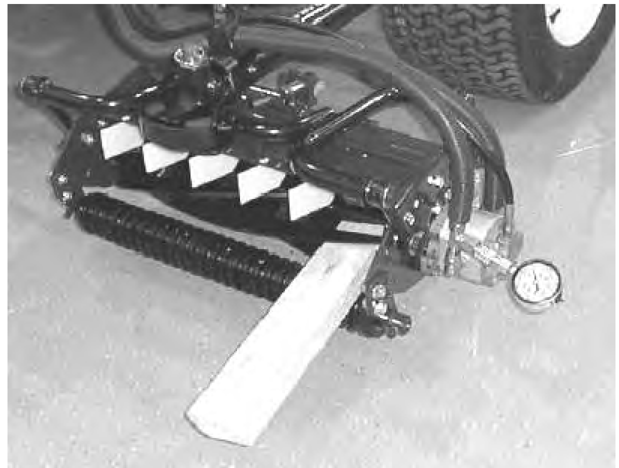
20. Repeat test for remaining reel motors as needed.

Cutting Unit Circuit Testing − Reel Motor Cross−Over Relief Pressure Test (Reelmaster 3575−D)

USE A TEE FITTING TO INSTALL PRESSURE GAUGE IN BOTH INLET AND OUTLET LINES OF MOTOR BEING TESTED.

NOTE: INLET IS FRONT HOSE. OUTLET IS REAR HOSE.

TESTING FRONT LEFT REEL MOTOR SHOWN



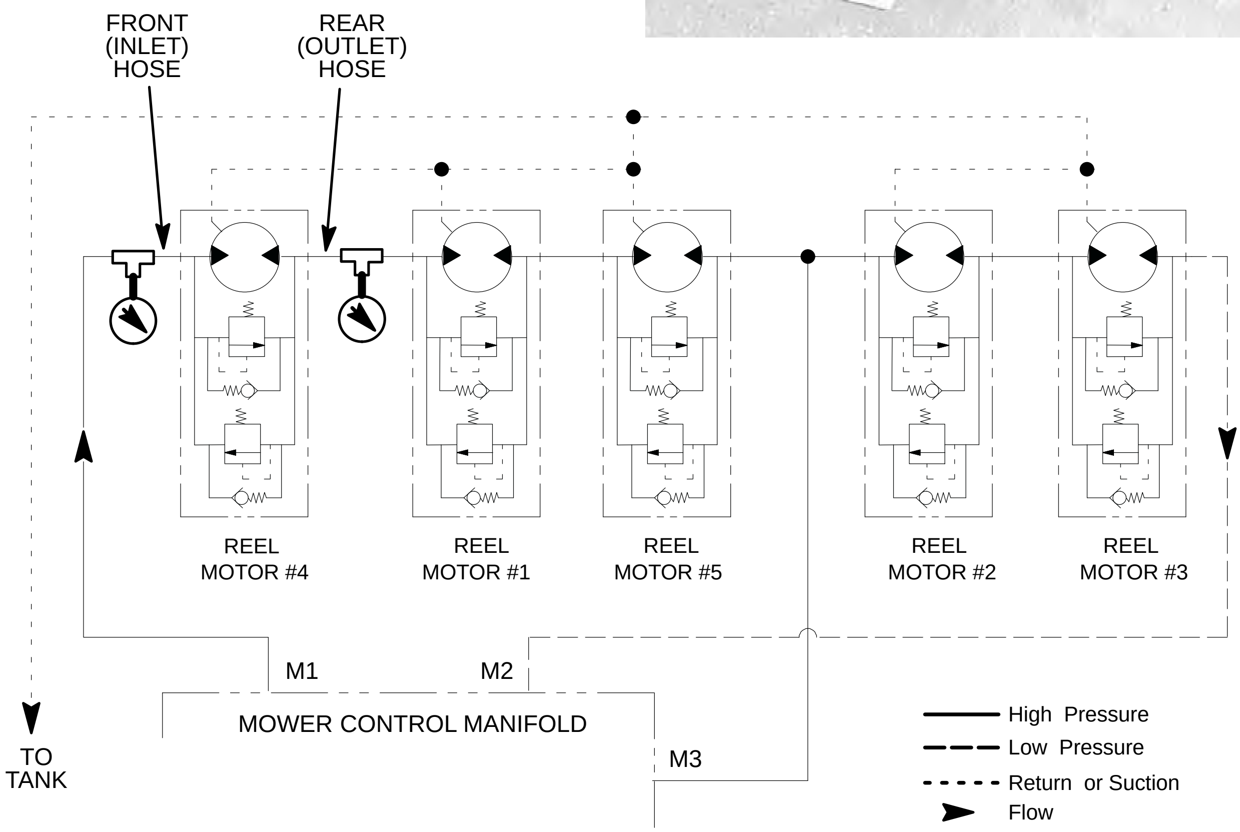


Figure 29

NOTE: One way to find a faulty reel motor is to have another person observe the machine while mowing in dense turf. A faulty motor will typically run slower, produce fewer clippings and may cause clip marks (a choppy appearance) on the turf.

IMPORTANT: DO NOT perform the Cutting Reel Motor Cross−Over Relief Pressure Test on Reelmaster 3550−D OR 3555−D machines. The reel motors on these machines do not have cross−over relief valves.

NOTE: Before testing the cutting reel motor cross−over relief pressure, make sure that reel motor is in good condition by performing the Cutting Reel Motor Efficiency Test (see Reel Motor Efficiency/Case Drain Test in this section).

Cutting Unit Circuit Testing − Reel Motor Cross−Over Relief Pressure Test (Reelmaster 3575−D)

1. Determine which cutting reel motor needs to be tested by observing the machine during mowing.

2. Park machine on a level surface with the cutting units lowered and reel engage switch OFF. Make sure engine is off and mow/transport lever is in mow. Apply the parking brake.

3. Read Precautions For Hydraulic Testing in this section.

> **CAUTION**
>
> **Before opening hydraulic system, operate all hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.**

NOTE: The reel motors are connected in series. To isolate a faulty motor, all motors in the circuit may have to be tested by starting with the first motor in the series.

4. On the reel motor to be tested, thoroughly clean motor inlet and outlet fittings and hydraulic hoses (Fig. 30). Loosen and remove both hoses from fittings. Install a tee fitting with a 5000 PSI (350 bar) pressure gauge between the fitting and hose for both the motor inlet and outlet.

5. Make sure backlap knob on the hydraulic manifold is in the MOW position and reel speed is set to maximum.

6. Insert a block of wood between cutting unit reel blades and carrier frame of cutting unit being tested to prevent reel from turning (Fig. 29).

7. Start engine and run at low idle speed. Check for any hydraulic leakage from test connections and correct before proceeding with test.

8. Make sure hydraulic oil is at normal operating temperature by operating the machine under load for approximately ten (10) minutes. DO NOT engage cutting units.

> **CAUTION**
>
> **Adjacent cutting unit reels will rotate when performing the cross−over relief pressure test. Keep away from cutting units during test to prevent personal injury from rotating reel blades. Do not stand in front of the machine.**

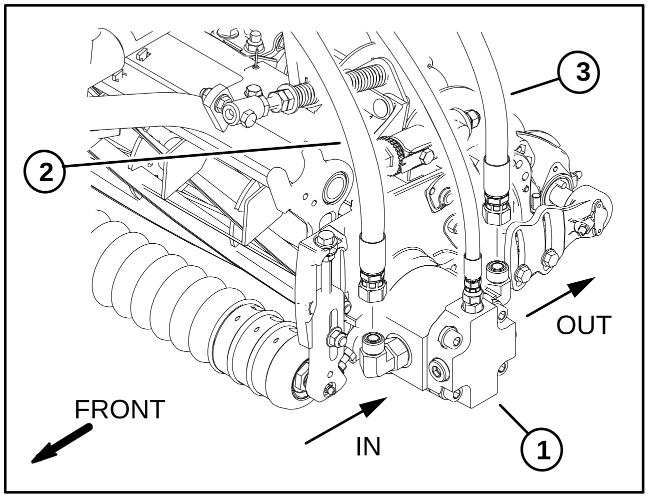


Figure 30

1. **Cutting unit motor**
2. **Motor inlet hose**
3. **Motor outlet hose**

9. One person should sit on the seat and operate the machine while a second person closely monitors both pressure gauges connected to the reel motor. Make sure that engine speed is at low idle position **(1400 ± 50 RPM RPM)** and engage the cutting units.

10. There should be a slight hesitation in pressure increase on the inlet side of motor as the cross−over relief valve opens. Record the pressure reading on both the inlet and outlet side pressure gauges.

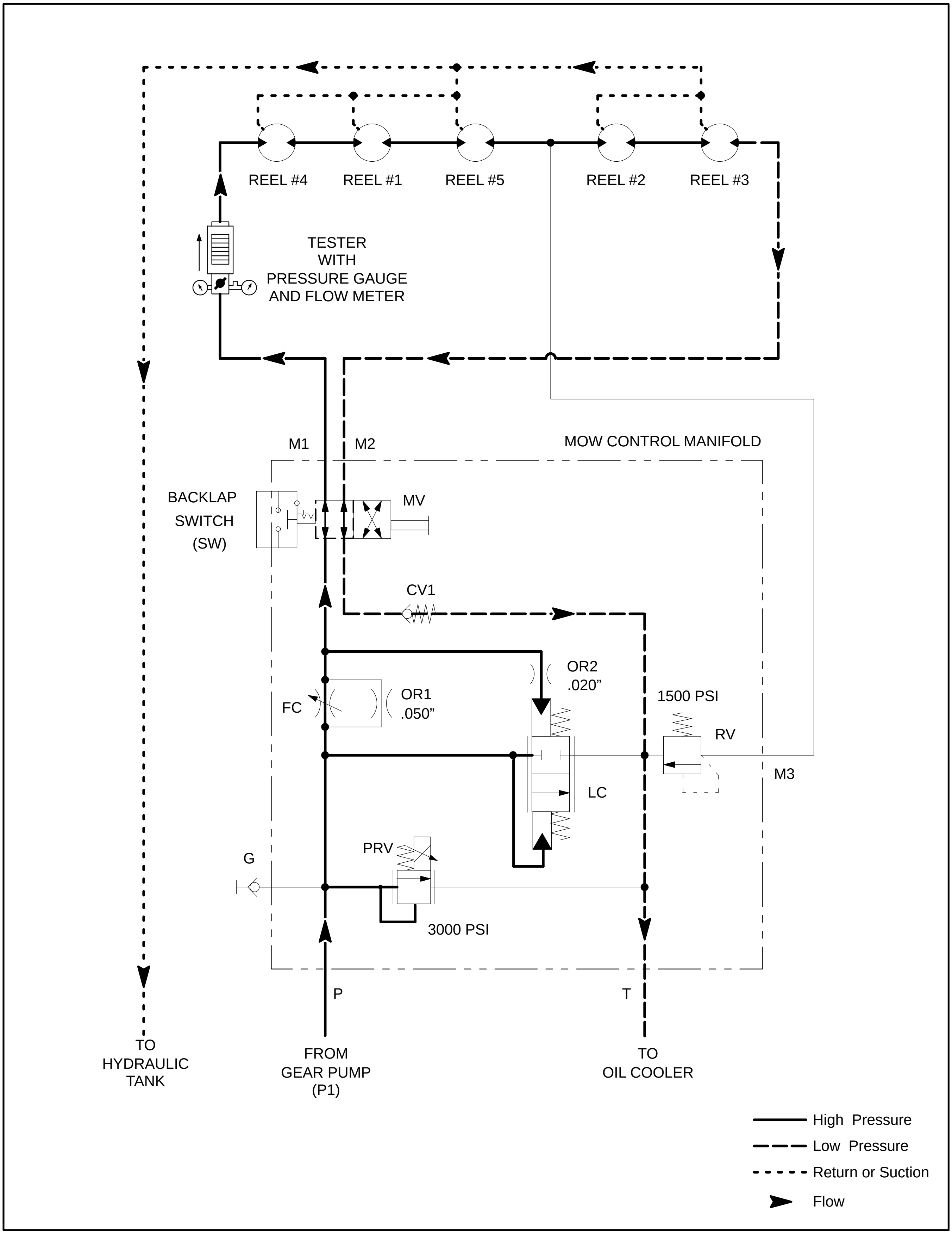
11. Disengage the cutting units and stop the engine.

12. Calculate the pressure differential between the two gauges. If the pressure differential is not approximately **1450 PSI (100 bar)**, the cross-over relief valves on the tested motor may be leaking or damaged. Inspect relief valves in the reel motor and replace if necessary (see Cutting Reel Motor Service − Reelmaster 3575−D in this chapter).

13. After testing is completed, relieve cutting unit hydraulic system pressure (see Relieving Hydraulic System Pressure in the General Information section of this chapter). Remove pressure gauges and tee fittings from machine. Connect hydraulic hoses to reel motor fittings.

14. If necessary, test cross−over relief pressure on other cutting reel motors.

15. Operate machine and check for leaks before returning machine to service.



REEL #4
REEL #1
REEL #5
REEL #2
REEL #3
TESTER
WITH
PRESSURE GAUGE
AND FLOW METER
M1
M2
MOW CONTROL MANIFOLD
BACKLAP
SWITCH
(SW)
MV
CV1
OR2
.020”
1500 PSI
FC
OR1
.050”
RV
M3
LC
G
PRV
3000 PSI
P
T
TO
HYDRAULIC
TANK
FROM
GEAR PUMP
(P1)
TO
OIL COOLER
High Pressure
Low Pressure
Return or Suction
Flow

Cutting Unit Circuit Testing − Proportional Relief Valve (PRV) Pressure Test:

Test the performance of the mow control manifold proportional relief valve (PRV) to make sure that the maximum amount of fluid is available to the cutting unit motors up to the set relief pressure. This test also ensures that pump (P1) is capable of generating enough pressure to open a properly functioning proportional relief valve.

Special Equipment Required:

- Flow Meter with Pressure Gauge that has at least a 12 GPM (45 LPM) capacity.
- Phototach (non−contact tachometer).

1. Park machine on a level surface with the cutting units lowered, reel engage/disengage switch in the disengage position, and the mow/transport switch in the MOW position. Engine should be off and the parking brake disengaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Disconnect the inlet hose from the front hydraulic fitting of the front left (#4) reel motor (Fig. 32).

4. Install tester between the hose and hydraulic fitting. Make sure the flow control valve on tester is fully open.

5. Make sure backlap knob on the hydraulic manifold is in the MOW position, and the reel speed knob is set to maximum.

6. Start the engine, and move throttle to full speed **(3220 $\pm$ 50 RPM)**.

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

8. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

CAUTION

Keep away from reels during test to prevent personal injury from the rotating reel blades.

9. Engage cutting units.

10. Watch pressure gauge carefully while slowly closing the flow control valve.

11. System pressure should reach **3000 PSI (207 Bar)** before the relief valve opens.

12. Set throttle to low speed and shut off engine.

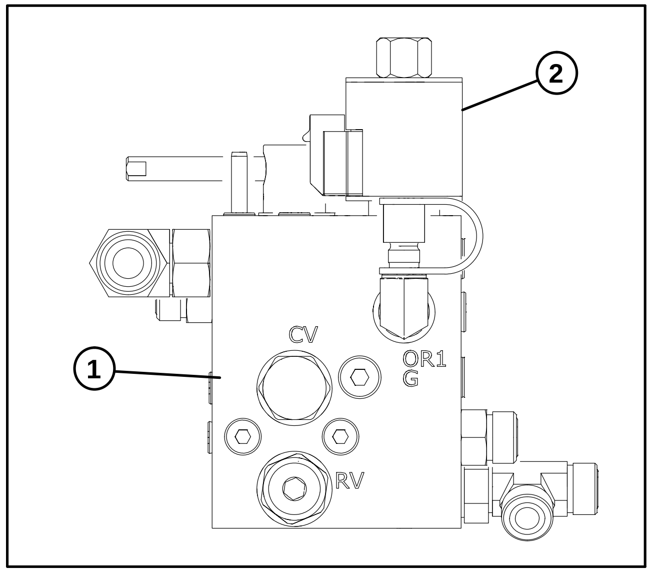


Figure 31

1. **Mow control manifold**
2. **Proportional relief valve (PRV)**

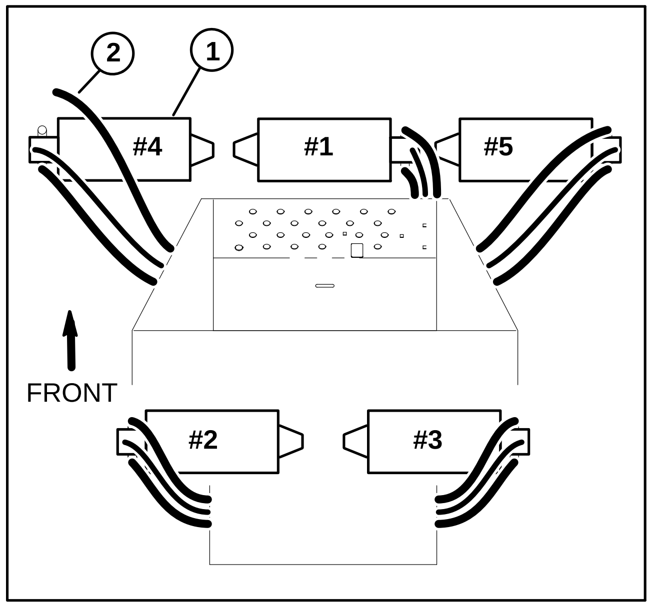


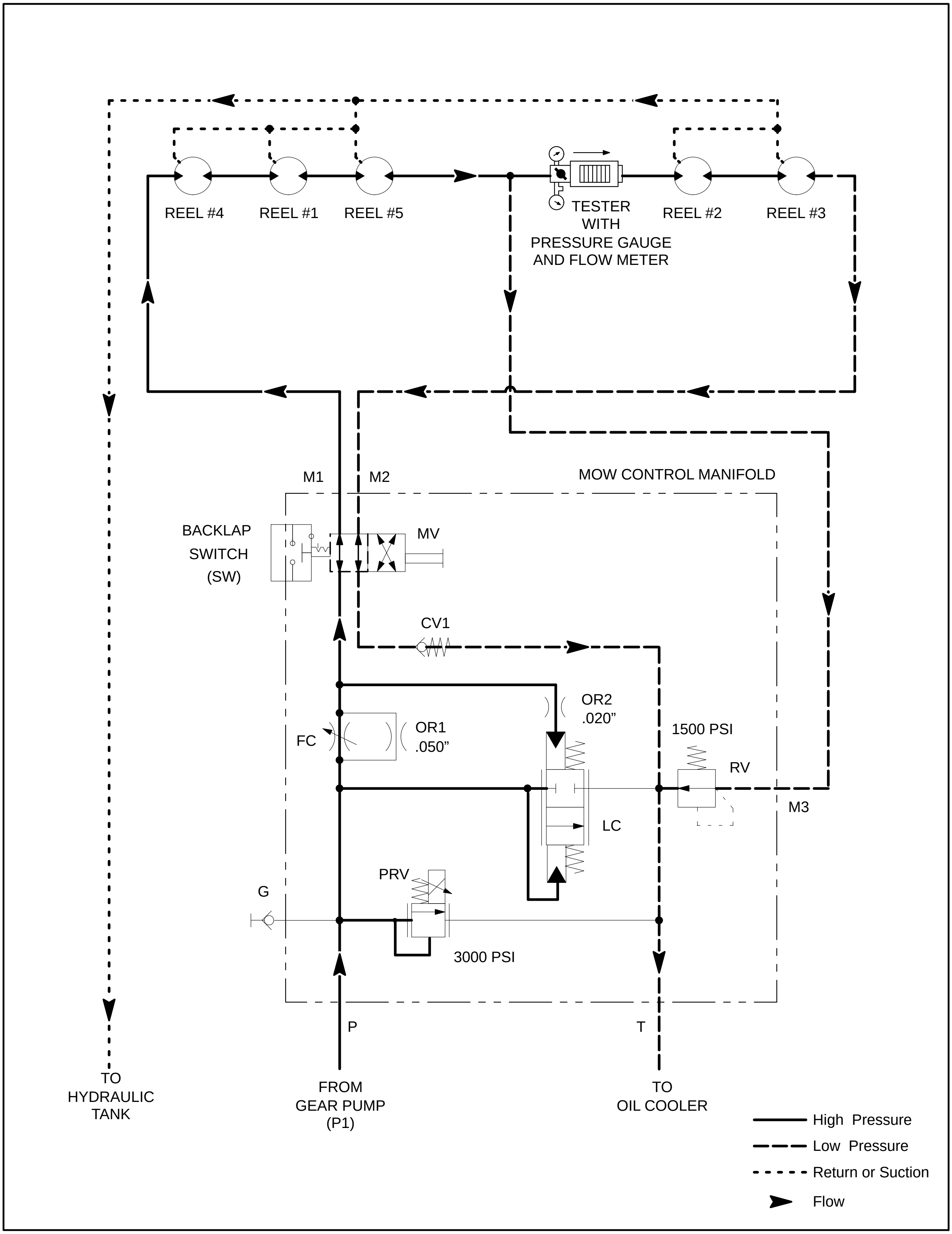
Figure 32

1. **Reel motor #4**
2. **Inlet hose**

13. If specification is met, test pump (P1) flow (see Cutting Unit Circuit Testing − Gear Pump (P1) Flow Test in this chapter) If specification is not met, test relief valve (PRV) solenoid, clean or replace valve (see Hydraulic Manifold Service in this chapter) and retest.

14. Disconnect tester and reconnect hydraulic hose.

Hydraulic System


REEL #4
REEL #1
REEL #5
TESTER
WITH
PRESSURE GAUGE
AND FLOW METER
REEL #2
REEL #3
M1
M2
MOW CONTROL MANIFOLD
BACKLAP
SWITCH
(SW)
MV
CV1
OR2
.020”
FC
OR1
.050”
1500 PSI
RV
M3
LC
PRV
G
3000 PSI
P
T
TO
HYDRAULIC
TANK
FROM
GEAR PUMP
(P1)
TO
OIL COOLER
High Pressure
Low Pressure
Return or Suction
Flow

Cutting Unit Circuit Testing − Mow Control Manifold Relief Valve (RV) Pressure Test:

If a rear cutting unit suddenly becomes obstructed during operation, mow control manifold relief valve (RV) protects the obstructed cutting unit from additional damage by diverting the oil flow from the front cutting units. Test the performance of the mow control manifold relief valve (RV) to make sure that the relief valve opens at the specified pressure.

Special Equipment Required:

- Flow Meter with Pressure Gauge that has at least a 12 GPM (45 LPM) capacity.
- Phototach (non−contact tachometer).

1. Park machine on a level surface with the cutting units lowered, reel engage/disengage switch in the disengage position, and the mow/transport switch in the MOW position. Engine should be off and the parking brake disengaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Disconnect the inlet hose for the rear left (cutting unit #2) reel motor at the frame bulkhead fitting (Fig. 33).

4. Install tester between the disconnected hydraulic hose and the bulkhead fitting. Make sure the tester flow direction is from the bulkhead fitting toward the reel motor, and that the tester flow control valve is fully open.

5. Make sure backlap knob on the hydraulic manifold is in the MOW position, and the reel speed knob is set to maximum.

6. Start the engine, and move throttle to full speed **(3220 ± 50 RPM)**.

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

8. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

CAUTION

Keep away from reels during test to prevent personal injury from the rotating reel blades.

9. Engage cutting units.

10. Watch pressure gauge carefully while slowly closing the flow control valve.

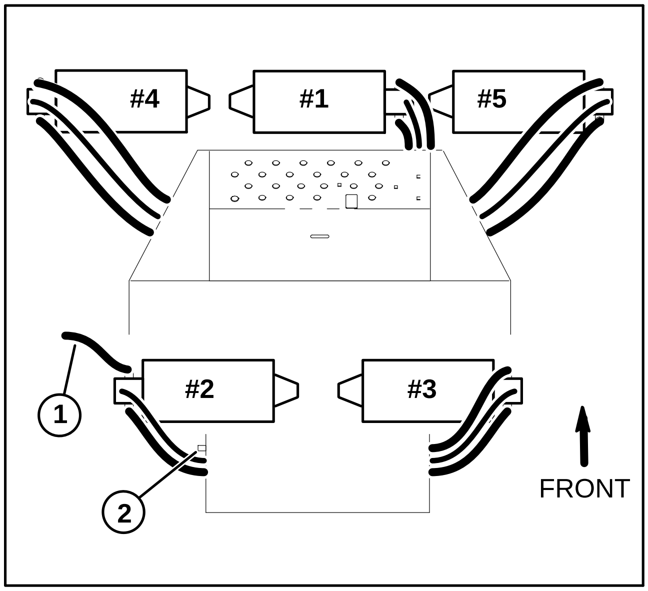


Figure 33

1. Reel motor #2 inlet hose
2. Frame bulkhead fitting

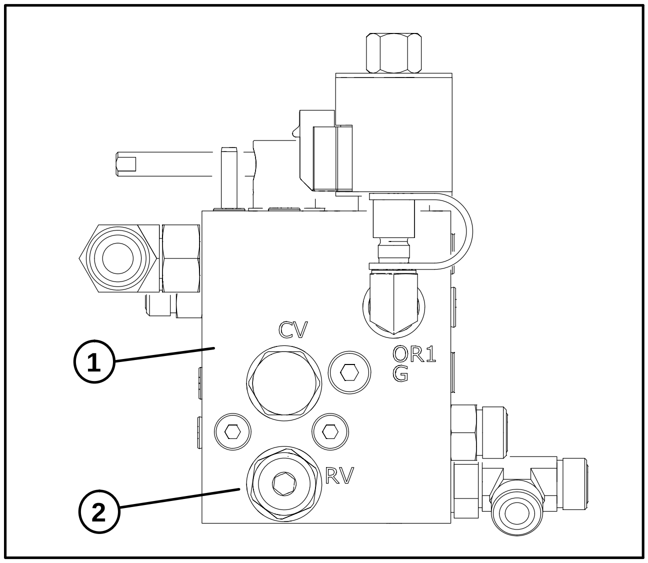


Figure 34

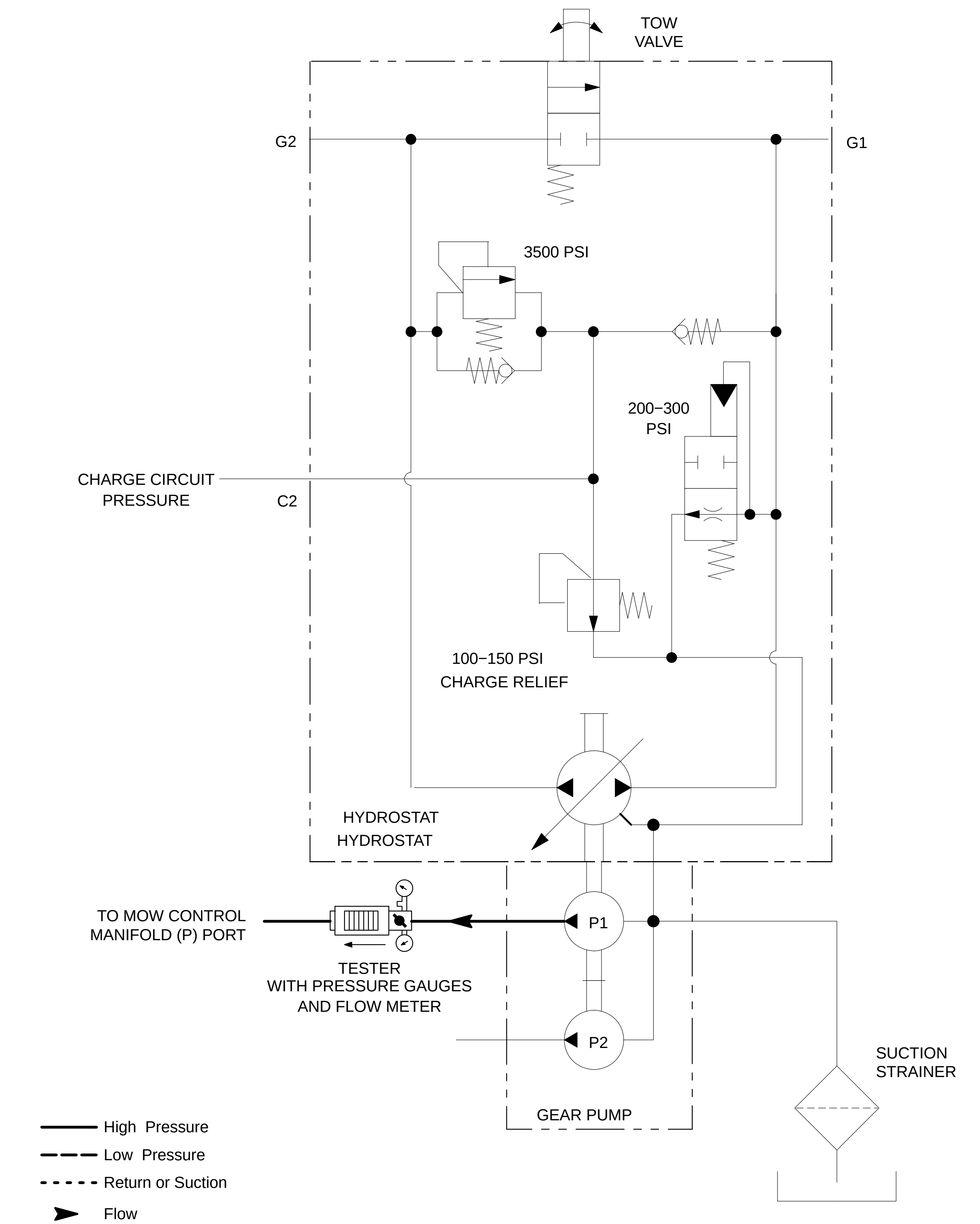
1. Mow control manifold
2. Relief valve (RV)

11. System pressure should reach **1500 PSI (103.4 Bar)** before the relief valve opens.

12. Set throttle to low speed and shut off engine.

13. If specification is met, test pump (P1) flow (see Cutting Unit Circuit Testing − Gear Pump (P1) Flow Test in this chapter) If specification is not met, adjust relief valve (RV) (see Adjustments in this chapter) and retest. If specification is still not met, clean or replace relief valve (RV) (see Hydraulic Manifold Service in this chapter) and retest.

14. Disconnect tester and reconnect hydraulic hoses.


TOW
VALVE
G2
G1
3500 PSI
200−300
PSI
CHARGE CIRCUIT
PRESSURE
C2
100−150 PSI
CHARGE RELIEF
HYDROSTAT
HYDROSTAT
TO MOW CONTROL
MANIFOLD (P) PORT
P1
TESTER
WITH PRESSURE GAUGES
AND FLOW METER
P2
SUCTION
STRAINER
GEAR PUMP
High Pressure
Low Pressure
Return or Suction
Flow

Cutting Unit Circuit Testing − Gear Pump (P1) Flow Test:

The gear pump (P1) flow test is the last in a series of tests recommended to determine cutting unit circuit performance. This test compares fluid flow at No Load with fluid flow Under Load. A drop in flow under load of more than **15%** indicates the gears and wear plates in the pump have worn. A worn pump will by−pass hydraulic fluid and make the pump less efficient. Eventually, enough fluid loss will occur to cause the cutting unit motors to stall under heavy cutting conditions. Continued operation with a worn, inefficient pump can generate excessive heat and cause damage to the seals and other components in the hydraulic system.

Special Equipment Required:

- Flow Meter with Pressure Gauge that has at least a 12 GPM (45 LPM) capacity.
- Phototach (non−contact tachometer).

1. Park machine on a level surface with the cutting units lowered and reel enable/disable switch in the disengage position. Make sure engine is off and the parking brake is engaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Disconnect hose connection on the gear pump (P1) leading to port (P) on the mow control manifold (Fig. 35).

4. Install tester between the gear pump and the disconnected hose.

5. Make sure the flow control valve on the tester is fully open.

6. Sit in the operator's seat and start the engine. Move the throttle to full speed **(3220 ± 50 RPM)**.

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

8. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

9. Verify pump flow at No Load as follows:

   Record tester pressure and flow reading at no load. Unrestricted pump output should be approximately **7.3 GPM (29.3 LPM)**.

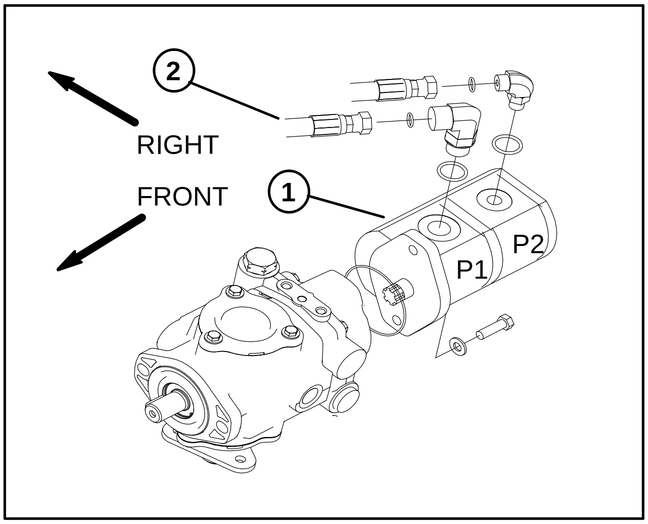


Figure 35

1. **Gear pump assembly**
2. **To mow control manifold (P) port**

10. Verify pump flow Under Load as follows:

> **CAUTION**
>
> **Do not close tester valve fully when performing this test. In this test, the hydraulic tester is positioned before the manifold relief valve. Pump damage can occur if the fluid flow is fully restricted by fully closing the tester flow control valve.**

   A. Watch flow meter pressure gauge carefully while slowly closing the flow control valve until **2000 PSI (137.9 Bar)** is obtained on gauge.

   B. Record tester pressure and flow readings under load.

11. Set throttle to low speed and shut off engine.

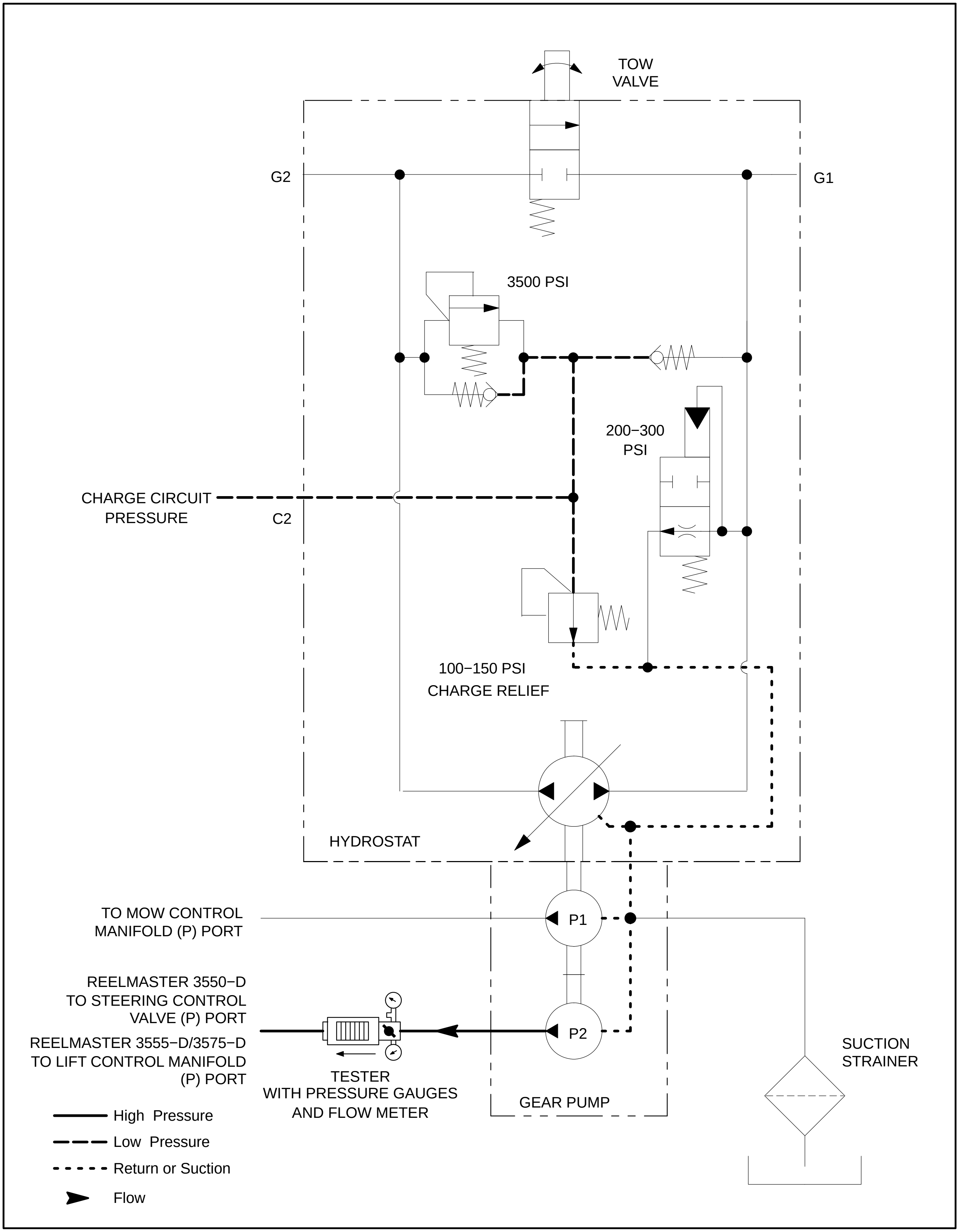
12. The under load test flow reading (step 10.B) should not drop **more than 15%** when compared to no load test flow reading (step 9.A). A difference in flow of more than 15%, or the inability to achieve specified pressure may indicate:

   A. A restriction in the pump intake line

   B. A Worn and/or slipping traction belt

   C. The gear pump (P1) is worn and should be repaired or replaced

13. Disconnect tester and reconnect hose to pump.



TOW VALVE
G2
G1
3500 PSI
200−300 PSI
CHARGE CIRCUIT PRESSURE
C2
100−150 PSI CHARGE RELIEF
HYDROSTAT
TO MOW CONTROL MANIFOLD (P) PORT
P1
REELMASTER 3550−D TO STEERING CONTROL VALVE (P) PORT
REELMASTER 3555−D/3575−D TO LIFT CONTROL MANIFOLD (P) PORT
P2
TESTER WITH PRESSURE GAUGES AND FLOW METER
GEAR PUMP
SUCTION STRAINER
High Pressure
Low Pressure
Return or Suction
Flow

Steering/Lift Circuit Testing − Gear Pump (P2) Flow Test:

Gear pump (P2) is designed to satisfy both steering cylinder and lift cylinder needs simultaneously (at full speed throttle). The Gear Pump (P2) Flow Test compares fluid flow at No Load with fluid flow Under Load. A drop in flow under load of more than **15%** indicates the gears and wear plates in the pump have worn. Continued operation with a worn pump can generate excessive heat and cause damage to the seals and other components in the hydraulic system.

If unit steering is sluggish or otherwise performs poorly, see Steering/Lift Circuit − Steering Control Valve and Steering Cylinder Test in this chapter.

If cutting unit lift operation is unsatisfactory, check lift control manifold solenoid valves and/or lift cylinders. Additional information on these components is available in this chapter.

If both steering and lift operations perform poorly, perform the gear pump (P2) flow test and circuit relief valve pressure test (see Steering/Lift Circuit − Relief Valve Pressure Test in this chapter).

Special Equipment Required:

- Flow Meter with Pressure Gauge that has at least a 5 GPM (16 LPM) capacity.
- Phototach (non−contact tachometer).

1. Park machine on a level surface with the cutting units lowered and reel enable/disable switch in the disable position. The engine should be off and the parking brake engaged.

2. Read Precautions for Hydraulic Testing in this chapter.

NOTE: Disconnect hose connection on the gear pump (P2) (Fig. 36). On Reelmaster 3550−D machines, the connection at gear pump (P2) leads to the steering control valve (P) port. On Reelmaster 3555−D/3575−D machines, the connection at gear pump (P2) leads to the lift control manifold (P) port.

3. Install tester between gear pump and the disconnected hose.

4. Make sure the tester flow control valve is fully open.

5. Sit in the operator's seat and start the engine. Move the throttle to full speed **(3220 $\pm$ 50 RPM)**.

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

7. Verify with a phototach that the **pump speed** is approximately **3090 RPM.**

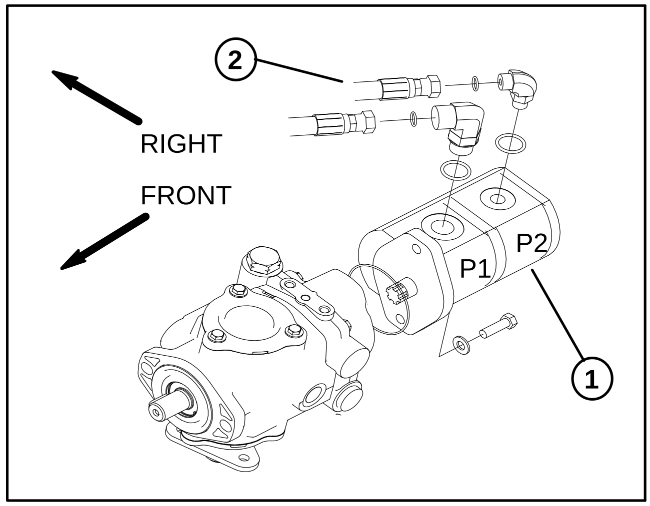


Figure 36

1. **Gear pump assembly**
2. **Hydraulic hose**

8. Verify pump flow at No Load as follows:

   Record tester pressure and flow readings at no load. Unrestricted pump output should be approximately **4.2 GPM (15.8 LPM)**.

9. Verify pump flow Under Load as follows:

CAUTION

Do not close tester valve fully when performing this test. In this test, the hydraulic tester is positioned before the manifold relief valve. Pump damage can occur if the fluid flow is fully restricted by fully closing the tester flow control valve.

   A. Watch pressure gauge carefully while slowly closing the flow control valve until **800 PSI (55.2 Bar)** is obtained on gauge.

   B. Record tester pressure and flow readings under load.

10. Set throttle to low speed and shut off engine.

11. The under load test flow reading (step 9.B) should not drop **more than 15%** when compared to the no load test flow reading (step 8.A). A difference in flow of more than 15%, or the inability to achieve specified pressure may indicate:

   A. A restriction in the pump intake line

   B. A Worn and/or slipping drive belt

   C. The gear pump (P1) is worn and should be repaired or replaced

12. Disconnect tester and reconnect hose to pump.

Steering/Lift Circuit Testing − Lift Relief Valve (RV1) Pressure Test (Reelmaster 3555−D and 3575−D)

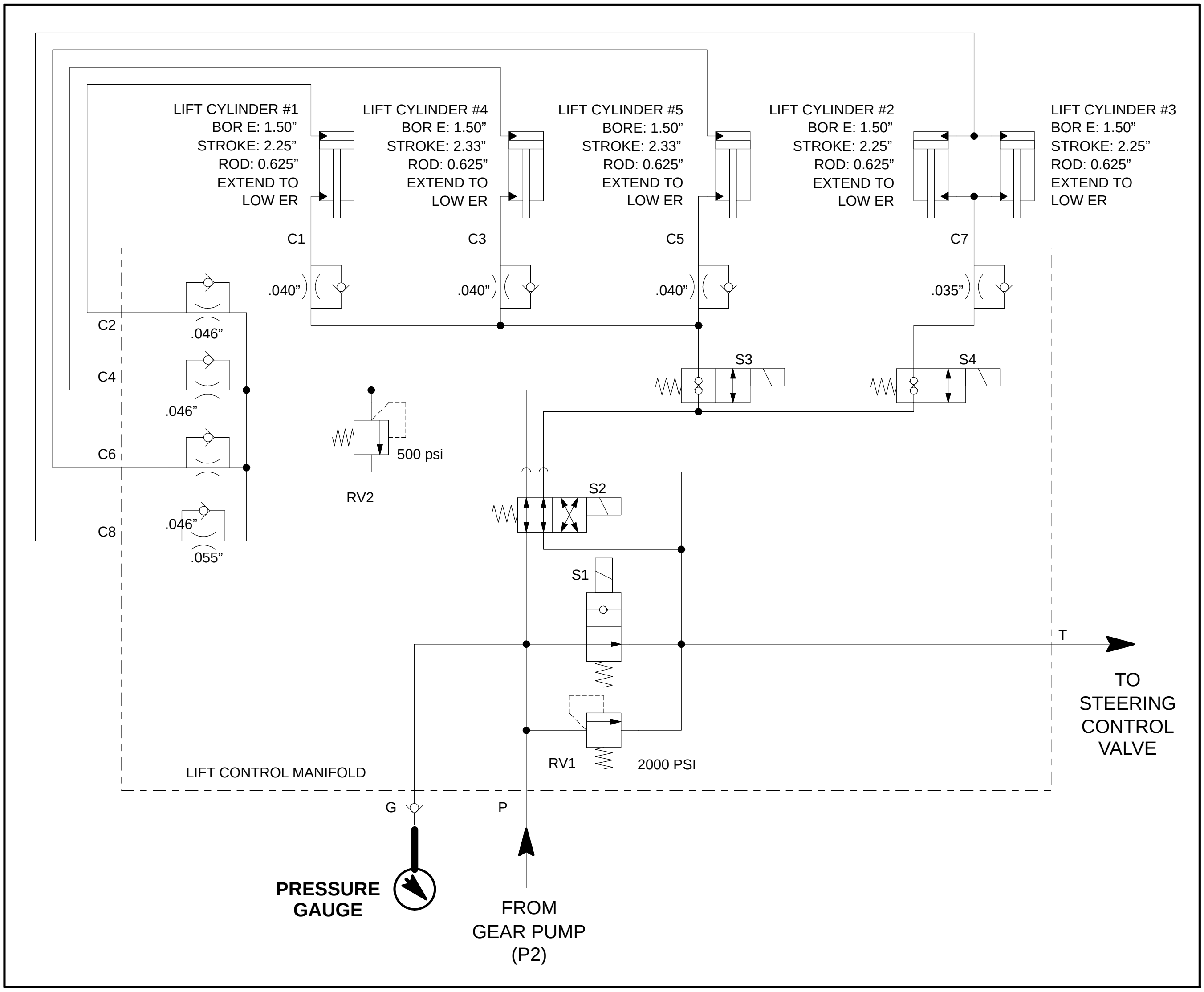


Figure 37

Steering/Lift Circuit Testing − Lift Relief Valve (RV1) Pressure Test (Reelmaster 3555−D and 3575−D)

1. Park machine on a level surface with the cutting units lowered and reel engage switch OFF. Make sure engine is OFF and apply the parking brake.

2. Read Precautions For Hydraulic Testing in this section.

CAUTION

Before opening hydraulic system, operate all hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

3. Gain access to hydraulic lift control manifold from below front of machine.

4. Thoroughly clean test port (G) on the right side of the lift control manifold (Fig. 38). Access to test port can be obtained from below the right side of the machine behind the front axle. Connect a 5000 PSI (350 bar) pressure gauge to test port.

5. After installing pressure gauge to manifold test port, start engine and run at idle speed. Check for any hydraulic leakage from test connections and correct before proceeding with test.

6. Make sure hydraulic oil is at normal operating temperature by operating the machine under load for approximately ten (10) minutes.

7. Make sure that engine is running at high idle speed.

IMPORTANT: Do not allow pressure to exceed 2500 PSI (172 bar). Hold Lower − Mow/Raise lever in the raise position only long enough to get a system pressure reading. Holding the lever in the raise position for an extended period may damage system components.

8. Make sure that reel engage switch is OFF and then pull Lower − Mow/Raise lever rearward to pressurize lift circuit. While holding lever in the raise (rearward) position, watch pressure gauge carefully. As the cutting units fully raise and the lift relief valve lifts, system pressure should be **a**pproximately **2000 PSI (138 bar)**.

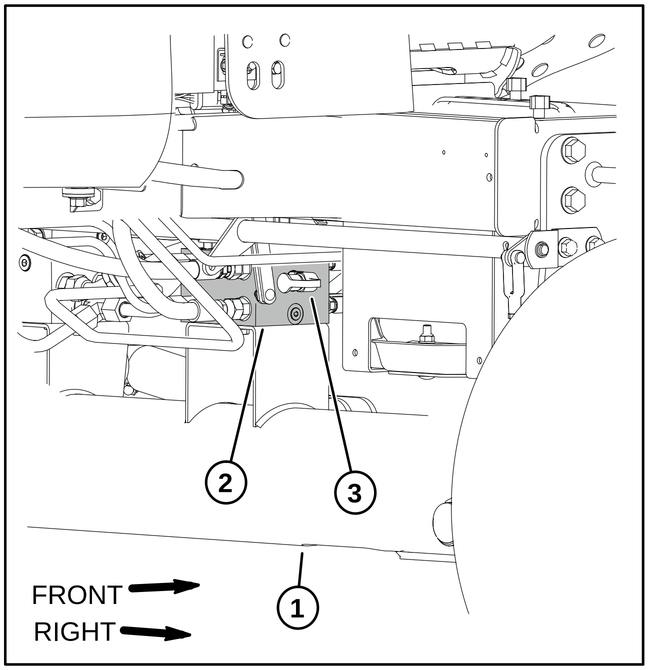


Figure 38

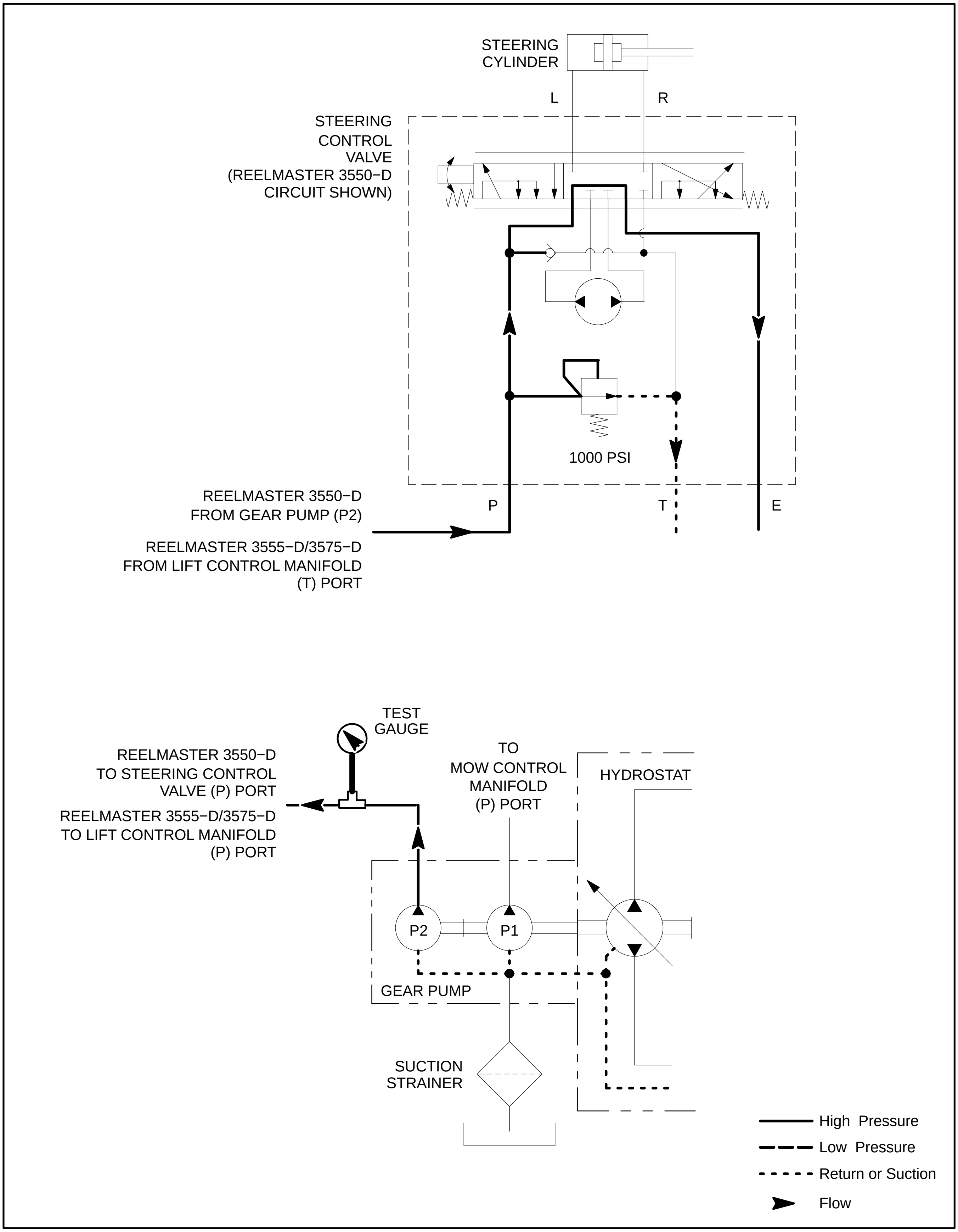
1. **Front axle**
2. **Lift control manifold**
3. **Test port (G)**

9. Return the Lower − Mow/Raise lever to the neutral position and stop the engine. Record test results.

10. If measured pressure is incorrect, remove solenoid relief valve (RV1) on lift control manifold and clean or replace valve (see Lift Control Manifold Service in the Service and Repairs section of this chapter). Also, if pressure is low, check for restriction in pump intake line. lift cylinder internal leakage would also cause low lift circuit pressure (see Lift Cylinder Internal Leakage Test in this chapter). If the steering circuit is performing poorly as well, gear pump (P2) could also be suspected of wear, damage or inefficiency.

11. After testing is completed, make sure that engine is stopped and disconnect the pressure gauge from lift control manifold test port (G).

Hydraulic System


STEERING
CYLINDER
L
R
STEERING
CONTROL
VALVE
(REELMASTER 3550−D
CIRCUIT SHOWN)
1000 PSI
REELMASTER 3550−D
FROM GEAR PUMP (P2)
REELMASTER 3555−D/3575−D
FROM LIFT CONTROL MANIFOLD
(T) PORT
P
T
E
TEST
GAUGE
REELMASTER 3550−D
TO STEERING CONTROL
VALVE (P) PORT
REELMASTER 3555−D/3575−D
TO LIFT CONTROL MANIFOLD
(P) PORT
TO
MOW CONTROL
MANIFOLD
(P) PORT
HYDROSTAT
P2
P1
GEAR PUMP
SUCTION
STRAINER
High Pressure
Low Pressure
Return or Suction
Flow

Steering/Lift Circuit Testing − Steering Relief Valve Pressure Test:

The relief valve for the steering and lift circuits (RM 3550−D), or for the steering circuit only (RM 3555−D/3575−D) is integrated into the steering control valve. If both steering and lift operations (RM 3550−D), or just the steering circuit (RM 3555−D/3575−D) perform poorly, perform the relief valve pressure test and gear pump (P2) flow test (see Steering/Lift Circuit − Gear Pump (P2) Flow Test in this chapter).

1. Park machine on a level surface with the cutting units lowered and reel engage/disengage switch in the disengage position. Make sure engine is off and the parking brake is engaged.

2. Read Precautions for Hydraulic Testing in this chapter.

3. Install a T−connector with a pressure gauge between the gear pump and the hydraulic hose connection on gear pump (P2) (Fig. 39).

4. Make sure steering wheel is positioned so the rear wheel points directly ahead.

5. Start the engine, and move throttle to full speed **(3220 ± 50 RPM)**.

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

7. Watch pressure gauge carefully while turning the steering wheel completely in one direction and holding.

CAUTION

Do not allow pressure to exceed 1500 PSI. Hold steering wheel at full lock only long enough to get a system pressure reading. Holding the steering wheel against the stop for an extended period may damage the steering control valve.

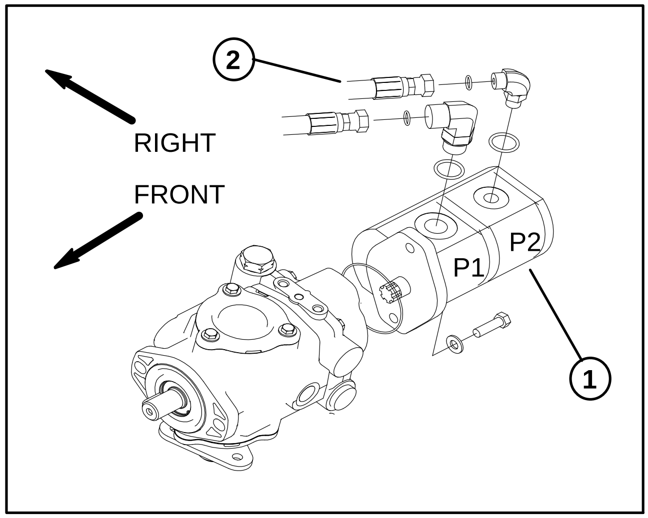


Figure 39

1. **Gear pump assembly** 2. **Hydraulic hose**

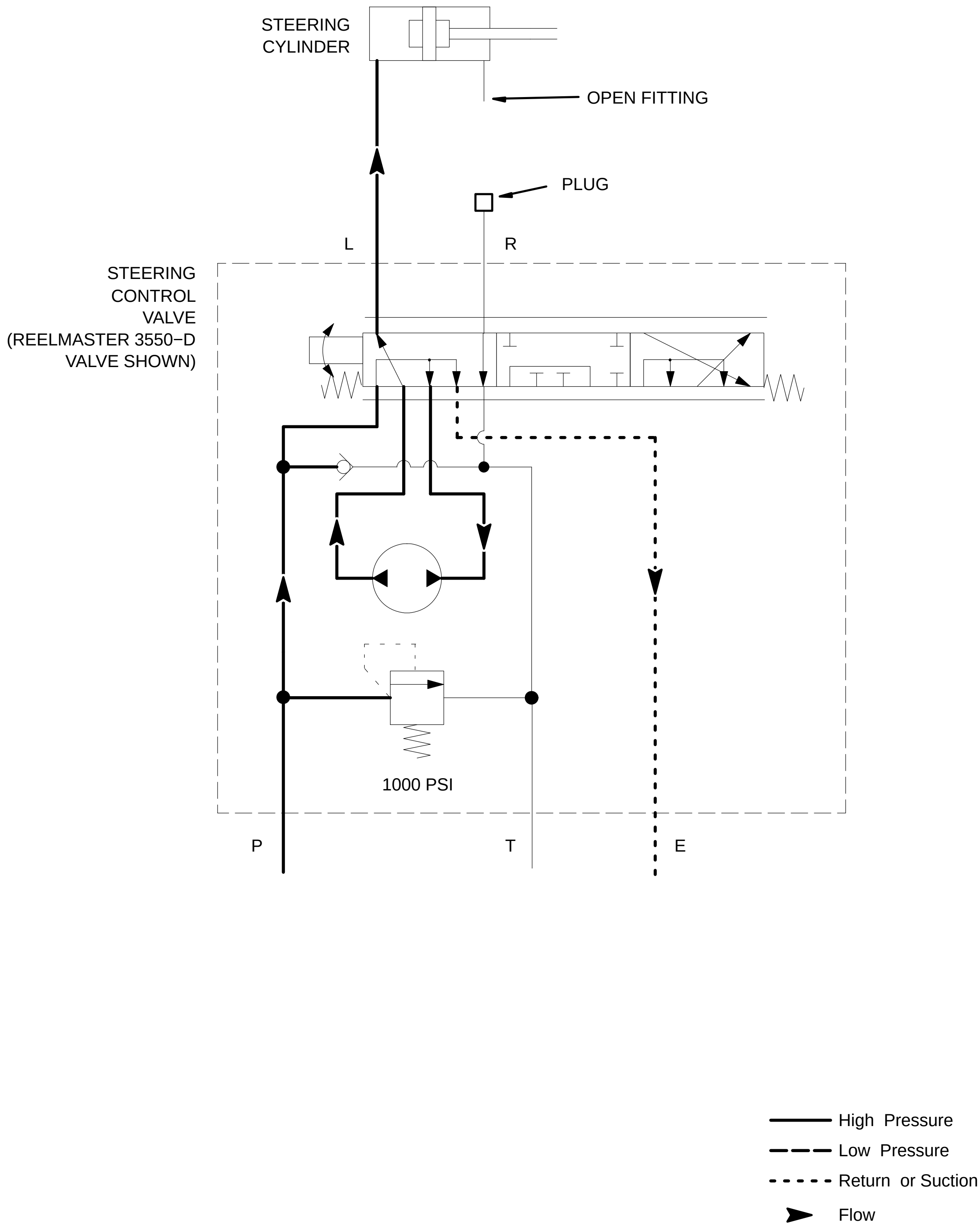
8. System pressure should reach **940 to 1015 PSI (65 to 70 Bar)** as the relief valve opens.

9. Return steering wheel to the center position and shut off engine.

10. If specification is not met, repair or replace steering control valve.

11. Disconnect T−connector with pressure gauge and reconnect hydraulic hose to gear pump.

Hydraulic System


STEERING
CYLINDER
OPEN FITTING
PLUG
L
R
STEERING
CONTROL
VALVE
(REELMASTER 3550−D
VALVE SHOWN)
1000 PSI
P
T
E
High Pressure
Low Pressure
Return or Suction
Flow

Steering/Lift Circuit Testing − Steering Control Valve and Steering Cylinder Test:

Unit steering performance will be affected by incorrect rear tire pressure, binding in the hydraulic steering cylinder, extra weight on the vehicle, and/or binding of the steering fork assembly. Make sure that these conditions are checked and functioning properly before proceeding with any steering system hydraulic testing.

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

2. Drive machine slowly in a figure eight on a flat level surface.

   A. There should be no shaking or vibration in the steering wheel or rear wheel.

   B. Steering wheel movements should be followed immediately by a corresponding rear wheel movement without the steering wheel continuing to turn.

3. Stop unit with the engine running. Turn steering wheel with small quick movements in both directions. Let go of the steering wheel after each movement. The steering control valve should respond to each steering wheel movement.

4. If either of these performance tests indicate a steering problem, determine if the steering cylinder is faulty using the following procedure.

   A. Park machine on a level surface with the cutting units lowered, reel enable/disable switch in the disable position, and the parking brake engaged.

   B. With the engine running, turn the steering wheel to the left (counterclockwise) until the steering cylinder rod is fully extended and turn the engine off.

   C. Read Precautions for Hydraulic Testing in this chapter.

   D. Remove hydraulic hose from the fitting on the rod end of the steering cylinder. Plug the end of the hose removed.

   E. With the engine off, continue turning the steering wheel to the left (counterclockwise) with the steering cylinder fully extended. Observe the open fitting on the steering cylinder as the wheel is turned. If hydraulic fluid comes out of the fitting while turning the steering wheel to the left, the steering cylinder has internal leakage and must be repaired or replaced.

   F. Remove plug from the hydraulic hose and reconnect the hose.

5. If steering problem exists and steering cylinder passed test, perform the Gear Pump (P2) Flow Test and Circuit Relief Valve Pressure Test (see specific test procedures in this chapter) to make sure the steering control valve and cylinder are receiving adequate fluid flow and pressure. Based on the results of these tests, repair or replace steering control valve as necessary (see Steering Control Valve and Steering Control Valve Service in this chapter).

Adjust Control Manifold Relief Valves

The hydraulic control manifolds on your Reelmaster include the following adjustable relief valves:

All machines − Mow control manifold relief valve RV should be set to **1500 PSI (103 Bar)**.

Reelmaster 3550−D − Lift control manifold relief valve RV1 should be set to **500 PSI (34.5 Bar)**.

Reelmaster 3555−D and 3575−D − Lift control manifold relief valve RV1 should be set to **2000 PSI (138 Bar)**. Lift control manifold relief valve RV2 should be set to **500 PSI (34.5 Bar)**.

Adjust the relief valves to the recommended settings as necessary.

NOTE: Do not remove relief valve from the hydraulic manifold for adjustment.

1. Locate relief valve on control manifold.

2. Remove cap on relief valve with an allen wrench.

3. To **increase** pressure setting, turn the adjustment socket on the valve in a clockwise direction. A 1/8 turn on the socket will make a measurable change in relief pressure.

4. To **decrease** pressure setting, turn the adjustment socket on the valve in a counterclockwise direction. A 1/8 turn on the socket will make a measurable change in relief pressure.

5. Install and tighten cap on relief valve.

6. Recheck relief pressure and readjust as needed.

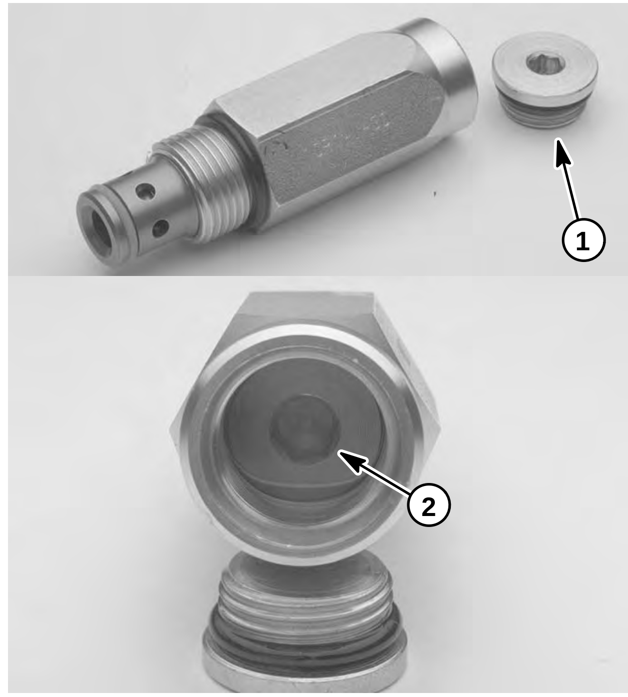


Figure 40

1. Relief valve cap **2. Adjustment socket**

Service and Repairs

General Precautions for Removing and Installing Hydraulic System Components

Before Repair or Replacement of Hydraulic Components

1. Before removing any parts from the hydraulic system, park machine on a level surface, engage parking brake, lower cutting units and stop engine. Remove key from the ignition switch.

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

Operate all hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. Controls must be operated with the ignition switch in RUN and the engine OFF. Make sure all electrically operated control valves are actuated. Return ignition switch to OFF when pressure has been relieved. Remove key from the ignition switch.

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

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

5. Record 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 installing hydraulic hoses and tubes.

After Repair or Replacement of Hydraulic Components

1. Check oil level in the hydraulic tank and add correct oil if necessary. Drain and refill hydraulic tank and change oil filter if component failure was severe or system is contaminated (see Flush Hydraulic System in this section of this chapter).

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 repairs, check control linkages or cables for proper adjustment, binding or broken parts.

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

7. Check for hydraulic oil leaks. Shut off engine and correct leaks if necessary. Check oil level in hydraulic tank 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.

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

Priming Hydraulic Pumps

Whenever the hydraulic system is flushed, the hydraulic system is charged or hydraulic components are removed, it is important to properly prime the hydraulic pumps. Hydraulic pump priming ensures that the gear pump and piston (traction) pump have adequate oil during initial start−up and running. The pumps can be primed by using a remote starter switch (see Special Tools in this chapter) to crank engine which allows the pumps to prime.

Use the following procedure to prime the hydraulic pumps:

1. Make sure that ignition switch is in the OFF position and key is removed from switch.

2. Check hydraulic reservoir oil level and adjust if necessary.

NOTE: It may not be necessary to remove the wire from the starter solenoid B+ terminal when connecting a remote starter switch.

3. Connect remote starter switch electrical leads to the starter motor solenoid B+ terminal (Fig. 41) and the positive (+) terminal at the starter or battery.

4. Engage remote starter switch and crank starter for thirty (30) seconds to prime hydraulic pumps. Wait thirty (30) seconds to allow the starter motor and starter solenoid to cool. Repeat cranking procedure a second time.

5. Disconnect remote starter switch leads from starter motor solenoid terminal and positive post of the battery.

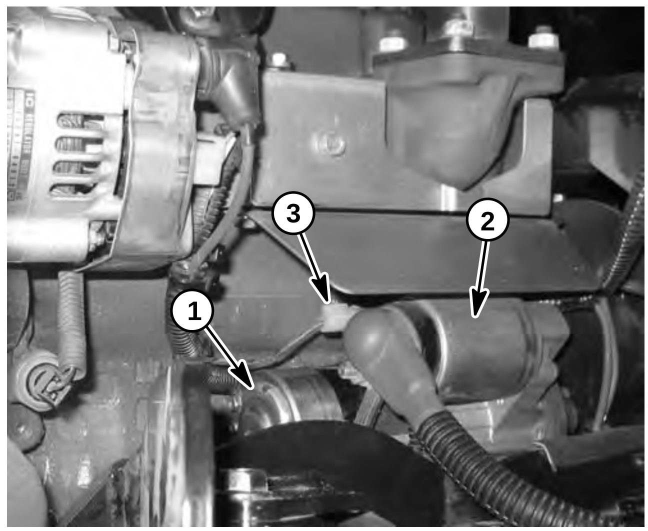


Figure 41

1. **Starter motor**
2. **Starter solenoid**
3. **B+ terminal**

Flush Hydraulic System

IMPORTANT: Flush the hydraulic system any time there is a severe component failure or if the system is contaminated (fluid appears milky, black, or contains metal particles).

IMPORTANT: Flush hydraulic system when changIng from petroleum base hydraulic fluid to a biodegradable fluid such as Toro Biodegradable Hydraulic Fluid. Operate machine under normal operating conditions for at least four (4) hours before draining.

IMPORTANT: If a component failure occurred in the traction circuit, refer to Traction Circuit (Closed Loop) Component Failure in this chapter for information regarding the importance of removing contamination from the traction circuit.

1. Park machine on a level surface. Lower cutting units, disengage reel enable/disable switch. stop engine, and engage parking brake. Remove key from the ignition switch.

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 this chapter.

IMPORTANT: Make sure to clean around any hydraulic connections that will be disassembled.

2. Drain hydraulic tank.

3. Drain hydraulic system. Drain all hoses, tubes, and components while the system is warm.

4. Change and replace hydraulic fluid filter.

5. Inspect and clean hydraulic fluid tank (see Hydraulic Tank Inspection in this chapter).

IMPORTANT: Follow all local codes and regulations when recycling or disposing hydraulic fluid and filters.

6. Reconnect all hydraulic hoses, lines, and components that were disconnected while draining system.

NOTE: Use only hydraulic fluids specified (see Traction Unit Owner's Manual). Other fluids may cause system damage.

7. Fill hydraulic tank with new hydraulic fluid.

8. Prime hydraulic pumps (see Priming Hydraulic Pumps in this chapter).

9. Start engine and let it idle at low speed for a minimum of 2 minutes. Increase engine speed to high speed for a minimum of 1 minute under no load.

10. Raise and lower cutting units several times. Turn steering wheel fully left and right several times.

11. Move reel enable/disable switch to ENABLE to engage cutting units and let them run for several minutes. Move reel enable/disable switch to DISABLE.

12. Shut off engine and check for hydraulic fluid leaks. Check fluid level in hydraulic tank and add correct amount of hydraulic fluid if necessary.

13. Operate the machine for 2 hours under normal operating conditions.

14. Check condition of hydraulic fluid. If the new fluid shows any signs of contamination, repeat steps 1 through 14 again until fluid is clean. If changing to biodegradable fluid, repeat steps 1 through 14 again at least once and until the fluid is clean.

15. Assume normal operation and follow recommended maintenance intervals.

Filtering Closed−Loop Traction Circuit

Filtering of a closed−loop hydraulic system after a major component failure (e.g. traction (piston) pump or wheel motor) is a requirement to prevent debris from transmitting throughout the system. If a closed−loop hydraulic system filtering tool is not used (to ensure system cleanliness) repeat failures and subsequent damage to other hydraulic components in the system will occur. To effectively remove contamination from closed−loop traction circuit, use of the Toro high flow hydraulic filter and hydraulic hose kit are recommended (see Special Tools in this chapter).

1. Park machine on a level surface, stop engine and remove key from ignition switch.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

2. Raise and support machine so all wheels are off the ground.

NOTE: If a wheel motor was replaced, install high flow filter to the inlet (when traveling forward) of new wheel motor instead of to the inlet (when traveling forward) of the traction pump. This will prevent system contamination from entering and damaging the new motor.

3. Thoroughly clean junction of hydraulic hose and lower fitting on rear wheel motor (Fig. 42). Disconnect hose from lower fitting on wheel motor.

4. Connect Toro high flow hydraulic filter in series between wheel motor fitting and disconnected hose. Use hydraulic hose kit (see Special Tools in this chapter) to connect filter to machine. Make sure that fitting and hose connections are properly tightened.

IMPORTANT: Use only hydraulic fluids specified in Operator's Manual. Other fluids could cause system damage.

5. After installing high flow filter to machine, check and fill hydraulic reservoir with new hydraulic oil as required.

6. Start engine. Run engine at low idle speed and check for any hydraulic leakage from filter and hose connections. Correct any leaks before proceeding.

IMPORTANT: While engaging the traction circuit, monitor the high flow hydraulic filter indicator. If the indicator should show red, either reduce traction pedal setting or reduce engine speed to decrease hydraulic flow through the filter.

7. With engine running at low idle speed, slowly depress the forward traction pedal to the full forward position to allow flow through the traction circuit and high flow filter. Keep traction circuit engaged for five (5) minutes while gradually increasing both forward pressure on traction pedal and engine speed. Monitor filter indicator to make sure that green color is showing during operation.

8. With engine running at high idle speed and traction pedal moved to the forward direction, periodically apply brakes to increase pressure in traction circuit. While monitoring filter indicator, continue this process for an additional five (5) minutes.

IMPORTANT: If using a filter that is not the bi−directional Toro high flow filter, do not press the traction pedal in the reverse direction. If flow is reversed when using a filter that is not bi−directional, debris from the filter will re−enter the traction circuit.

9. With engine running at high idle speed, alternately move traction pedal from forward to reverse. While monitoring filter indicator, continue this process for an additional five (5) minutes.

10. Shut engine off and remove key from ignition switch.

11. Remove high flow hydraulic filter and hydraulic hose kit from machine. Reconnect hydraulic hose to rear wheel motor fitting. Make sure to properly tighten hose (see Hydraulic Hose and Tube Installation in the General Information section of this chapter).

12. Lower machine to ground.

13. Check oil level in hydraulic reservoir and add correct oil if necessary.

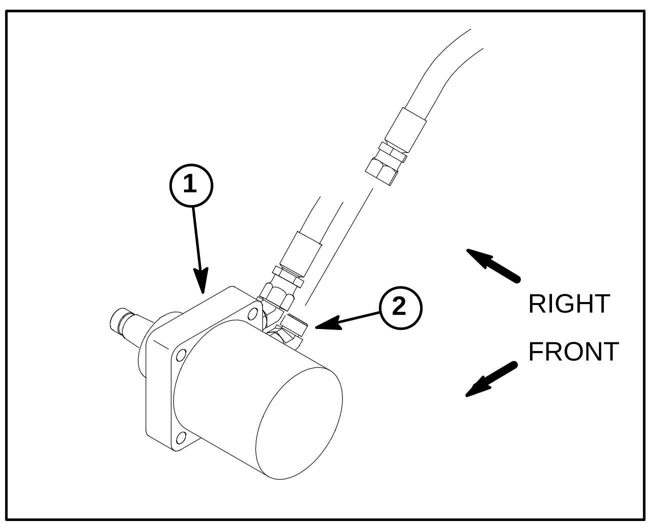


Figure 42

1. **Rear wheel motor**
2. **Lower fitting**

Charge Hydraulic System

NOTE: When initially starting the hydraulic system with new or rebuilt components such as motors, pumps, or lift cylinders, it is important that the hydraulic system be charged properly. Air must be purged from the system and its components to reduce the chance of damage.

IMPORTANT: Change hydraulic fluid filter whenever hydraulic components are repaired or replaced.

1. Park machine on a level surface. Lower cutting units, disengage reel enable/disable switch. stop engine, and engage parking brake. Remove key from the ignition switch.

2. Make sure all hydraulic connections, lines, and components are secured tightly.

3. If component failure was severe or the system is contaminated, flush and refill hydraulic system and tank (see Flush Hydraulic System in this chapter).

4. Make sure hydraulic tank is full. Add correct hydraulic fluid if necessary.

5. Prime hydraulic pumps (see Priming Hydraulic Pumps in this chapter).

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

6. Raise all 3 wheels off the floor and safely support the traction unit.

IMPORTANT: During initial operation, check hydraulic reservoir oil level frequently and add oil as necessary.

7. Make sure traction pedal is in neutral. Sit in the operator's seat and start engine and let it idle at low speed. The hydraulic pumps should pick up hydraulic fluid and fill the hydraulic system. If there is no indication of fill in **30 seconds**, stop the engine and determine the cause.

8. After the hydraulic system starts to show signs of fill, actuate lift control switch until the lift cylinders move in and out several times. If the cylinders do not move after **15 seconds** or the pump emits abnormal sounds, shut the engine off immediately and determine cause or problem. Inspect for the following:

   A. Loose filter or suction lines.

   B. Incorrect hydraulic hose routing.

   C. Blocked suction line.

   D. Faulty charge relief valve in traction pump.

   E. Faulty gear pump.

9. Operate the traction pedal in the forward and reverse directions. The wheels should rotate in the proper direction. If the wheels rotate in the wrong direction, stop engine, remove lines from rear of hydrostat pump, and reverse the connections.

10. Make sure that traction pedal returns to the neutral position when released from the forward or reverse direction.

11. Check operation of the traction interlock switches (see Check Operation of Interlock Switches in Chapter − 5, Electrical System in this manual).

12. Stop the engine and lower machine.

13. If the traction (traction) pump or a wheel motor was replaced or rebuilt, run the traction unit so all wheels turn slowly for 10 minutes.

14. Operate traction unit by gradually increasing its work load to full over a 10 minute period.

15. Stop the machine. Check hydraulic tank and fill if necessary. Check hydraulic components for leaks and tighten any loose connections.

Hydraulic Tank

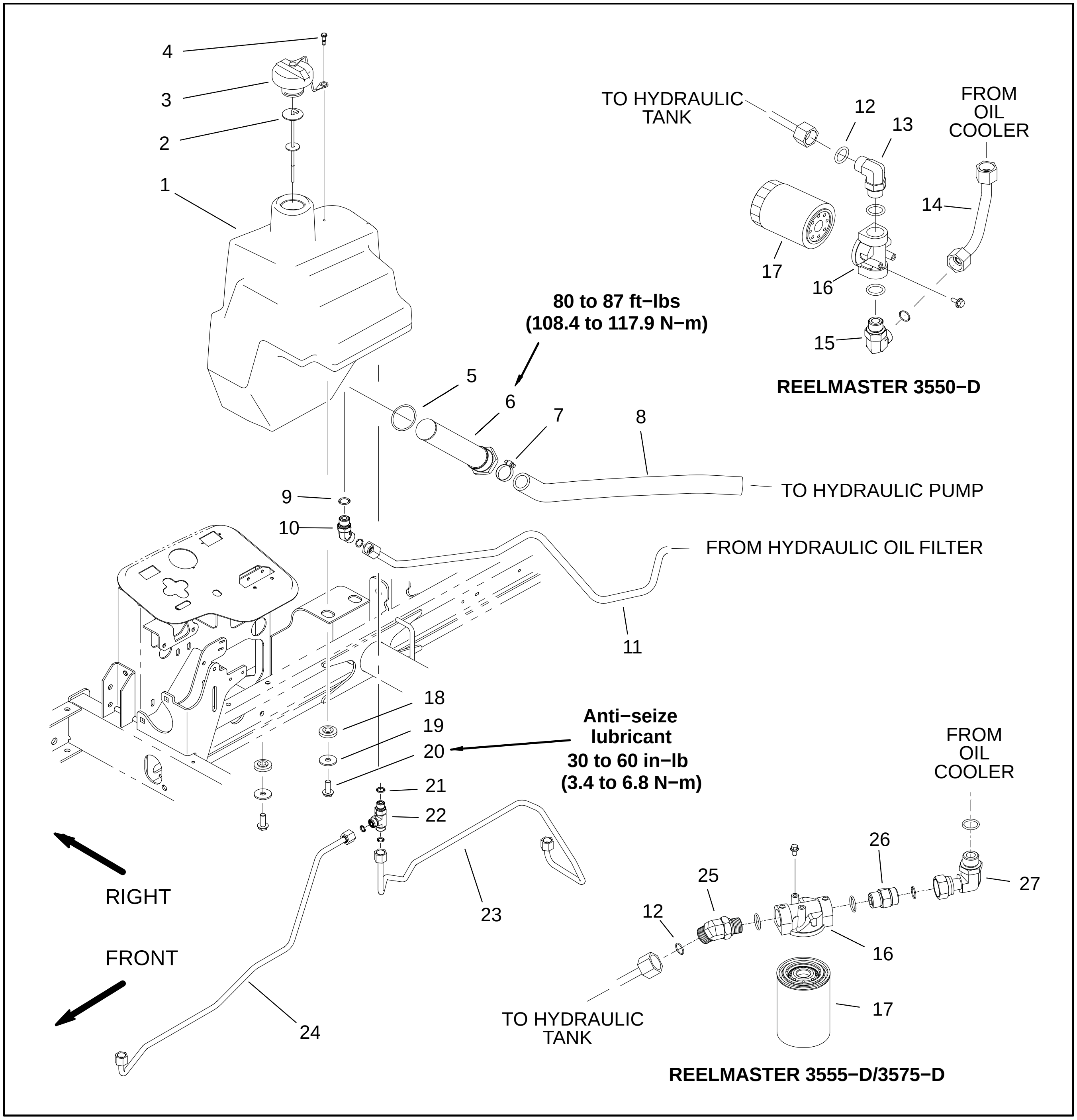


Figure 43

1. **Hydraulic tank**
2. **Dipstick**
3. **Tank cap**
4. **Shoulder screw**
5. **O−ring**
6. **Tank strainer**
7. **Hose clamp (2)**
8. **Suction hose**
9. **O−ring**
10. **Elbow fitting**
11. **Hydraulic tube**
12. **O−ring**
13. **Elbow fitting**
14. **Hydraulic tube**
15. **Elbow fitting**
16. **Filter head**
17. **Filter element**
18. **Grommet (4)**
19. **Flat washer (4)**
20. **Flange head screw (4)**
21. **O−ring**
22. **Tee fitting**
23. **Hydraulic tube**
24. **Hydraulic tube**
25. **Elbow fitting**
26. **Straight fitting**
27. **Elbow fitting**

Hydraulic Tank Removal (Fig. 43)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components at the beginning of this section of this chapter.

3. To prevent contamination of hydraulic system during hydraulic tank removal, thoroughly clean exterior of tank.

4. To allow draining of hydraulic tank, disconnect the suction hose from the tank strainer in the bottom of the tank. Drain tank into a suitable container.

5. Disconnect hydraulic lines from tank and put caps or plugs on open hydraulic lines and fittings. Label disconnected hydraulic lines for proper assembly.

6. Remove tank strainer from hydraulic tank. Discard O−ring from strainer.

7. Remove four (4) flange head screws, flat washers and grommets that secure hydraulic tank to machine. Remove hydraulic tank from machine.

8. If fittings are to be removed from tank, mark fitting orientation to allow correct assembly. Remove fittings from tank and discard O−rings from fittings.

Hydraulic Tank Inspection (Fig. 43)

1. Clean hydraulic tank and suction strainer with solvent.

2. Inspect hydraulic tank for leaks, cracks or other damage.

Hydraulic Tank Installation (Fig. 43)

1. If fittings were removed from hydraulic tank, lubricate and place new O−rings onto fittings. Install fittings into tank openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. Position hydraulic tank to machine. Apply anti−seize lubricant or equivalent to the four (4) flange head screws that secure the hydraulic tank. Secure tank to frame with flange head screws, flat washers and grommets. Torque screws from **30 to 60 in−lb (3.4 to 6.8 N−m)**.

3. Lubricate and install new O−ring on suction strainer.

4. Thread suction strainer into hydraulic tank. Torque strainer into tank port from **80 to 87 ft−lb (109 to 117 N−m)**.

5. Remove caps and plugs from fittings and hydraulic lines. Properly connect hydraulic lines to hydraulic tank (see Hydraulic Hose and Tube Installation in the General Information section of this chapter).

6. Fill hydraulic tank with **new** hydraulic fluid.

7. Operate machine. Check hydraulic oil level and adjust if necessary. Check hydraulic components for leaks. Tighten any loose connections.

Radiator and Oil Cooler Assembly

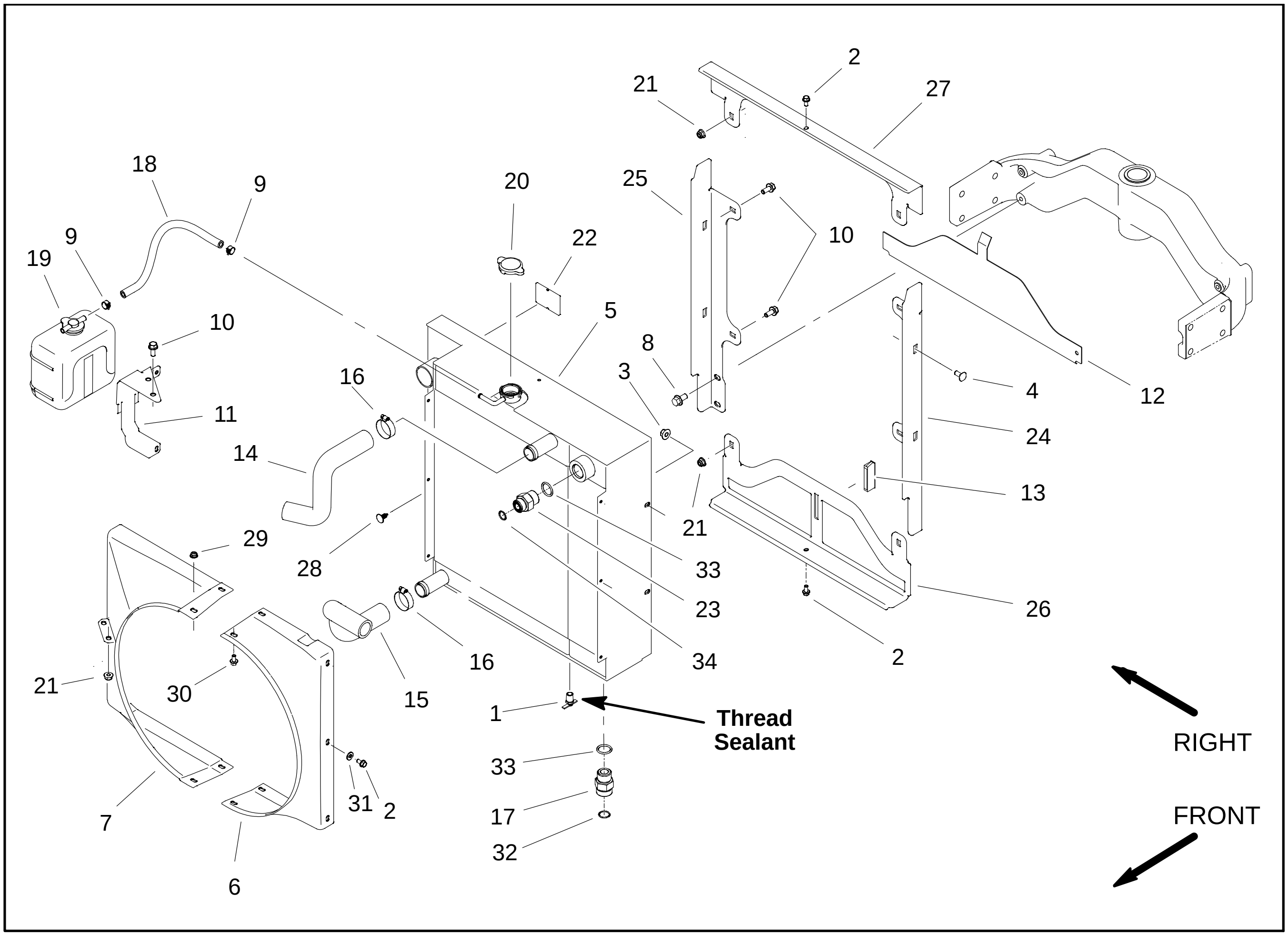


Figure 44

1. Draincock valve
2. Flange head screw (8)
3. Flange nut (4)
4. Carriage bolt (4)
5. Radiator/oil cooler assembly
6. LH fan shroud
7. RH fan shroud
8. Flange head screw (4)
9. Hose clamp (2)
10. Flange head screw (6)
11. Overflow bottle bracket
12. Radiator lower shield
13. Magnet
14. Radiator hose (upper)
15. Radiator hose (lower)
16. Hose clamp (2)
17. Straight hydraulic fitting (RM 3550−D) Elbow hydraulic fitting (RM 3555−D.3575−D)
18. Hose
19. Coolant expansion tank
20. Radiator cap
21. Flange nut (6)
22. Foam seal (2)
23. Straight hydraulic fitting
24. LH radiator bracket
25. RH radiator bracket
26. Bottom radiator bracket
27. Top radiator bracket
28. Plastic plug (2)
29. Flange nut (4)
30. Flange head screw (4)
31. Flat washer (4)
32. O−ring
33. O−ring
34. O−ring

NOTE: The hydraulic oil cooler on your Reelmaster is combined with the radiator. See Radiator and Oil Cooler Assembly in Chapter 3 − Kubota Diesel Engine for information on removal and installation of the radiator/oil cooler assembly.

Hydraulic System

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Hydraulic Pump Assembly

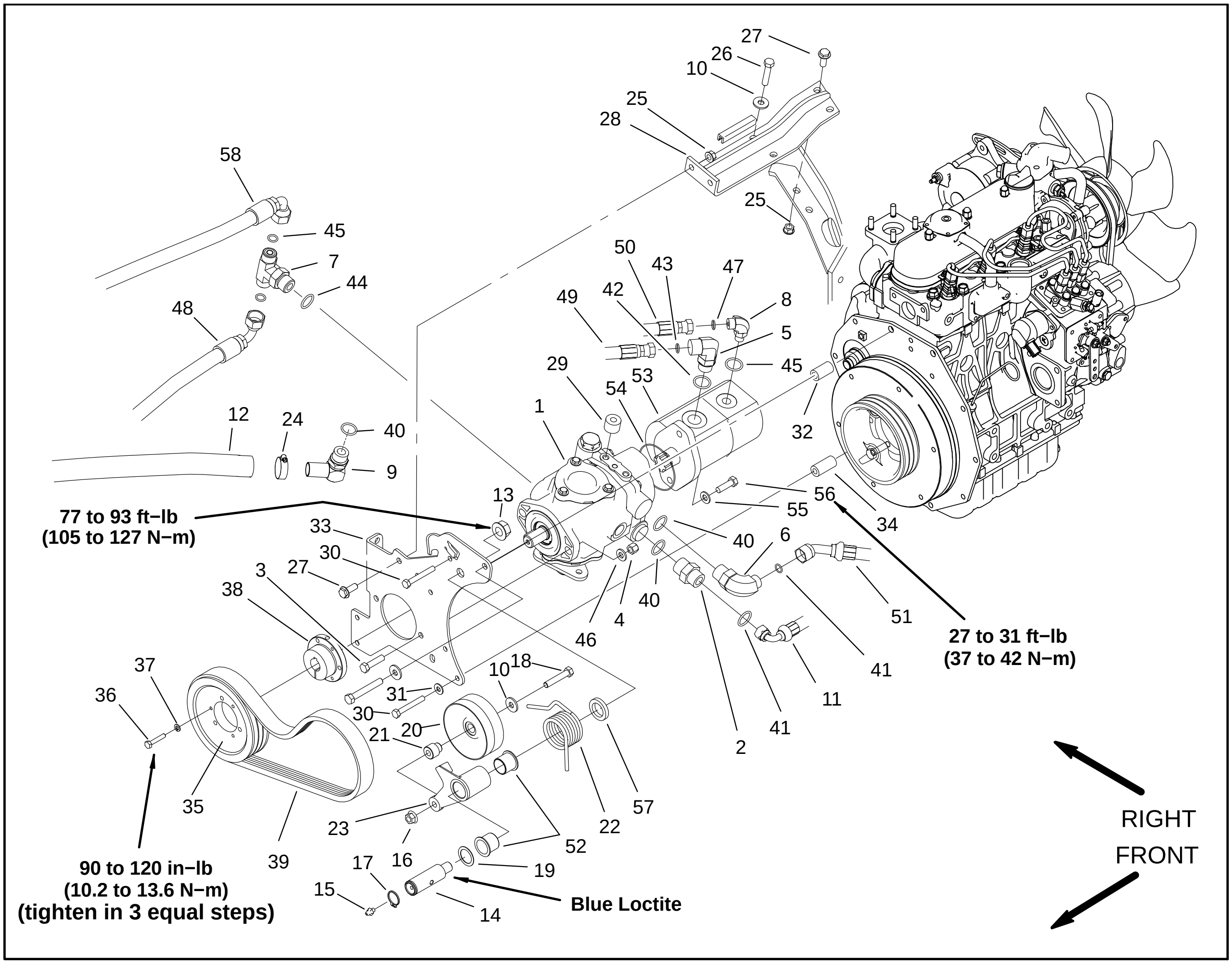

Figure 45

1. Piston pump
2. Straight hydraulic fitting
3. Cap screw
4. Lock nut
5. 90º hydraulic fitting
6. 90º hydraulic fitting
7. Tee fitting
8. 90º hydraulic fitting
9. 90º hydraulic fitting
10. Washer
11. Hydraulic hose
12. Suction hose
13. Flange nut
14. Idler pivot pin
15. Grease fitting
16. Flange nut
17. Retaining ring
18. Cap screw
19. Thrust washer
20. Idler pulley
21. Spacer
22. Torsion spring
23. Idler arm
24. Hose clamp
25. Flange nut
26. Cap screw
27. Flange head screw
28. Pump support
29. Spacer
30. Cap screw
31. Flat washer
32. Spacer
33. Pump mount plate
34. Pump mount spacer
35. Pulley
36. Cap screw
37. Lock washer
38. Taper lock bushing
39. V−belt
40. O−ring
41. O−ring
42. O−ring
43. O−ring
44. O−ring
45. O−ring
46. Flat washer
47. O−ring
48. Hydraulic hose
49. Hydraulic hose
50. Hydraulic hose
51. Hydraulic hose
52. Bushing (2)
53. Gear pump
54. O−ring
55. Flat washer
56. Socket head screw
57. Idler arm spacer
58. Hydraulic hose

Drive Belt Removal (Fig. 45)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Raise and support hood.

CAUTION

The torsion spring that tensions the idler assembly is under tension and may cause personal injury during removal. Use caution when removing spring end from the pump mount plate.

3. Remove pump drive belt tension from torsion spring on idler arm (Fig. 46).

   A. Insert nut driver or small piece of pipe onto the end of the torsion spring that is secured on the pump mount plate tab.

   B. Push down and forward on the spring end to unhook the spring from the tab on the pump mount plate.

4. Rotate idler pulley away from pump drive belt and remove drive belt from pulleys. Make sure that drive belt is in good condition if it is to be re−installed. Replace drive belt if worn or damaged.

5. Remove drive belt idler components as needed.

Drive Belt Installation (Fig. 45)

1. Install all removed drive belt idler components. Make sure that idler pulley and idler arm rotate freely after assembly.

2. Install drive belt onto pulleys. Position idler pulley toward the pump drive belt.

3. Using a straight edge across the lower face of the pump pulley, verify pump drive belt alignment across engine and pump pulleys. If pulleys are not in alignment, adjust location of pump pulley on pump shaft so alignment is correct (see Piston Pump/Hydrostat in this chapter).

CAUTION

Use caution when installing torsion spring end onto the pump mount plate. Applying tension to the spring may cause personal injury during installation.

4. Apply pump drive belt tension with torsion spring on idler arm (Fig. 46).

   A. Insert nut driver or small piece of pipe onto the end of the torsion spring.

   B. Push down on the spring end and then hook the spring under the tab on the pump mount plate.

5. Lubricate grease fitting on end of idler pivot shaft.

6. Lower and secure hood.

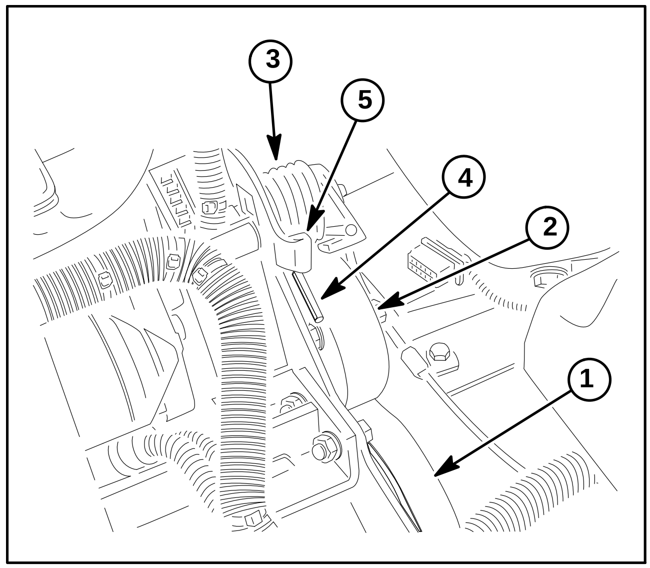

Figure 46

1. Pump drive belt
2. Idler pulley
3. Torsion spring
4. Spring end
5. Pump mount plate tab

Hydraulic System

Neutral Arm Assembly

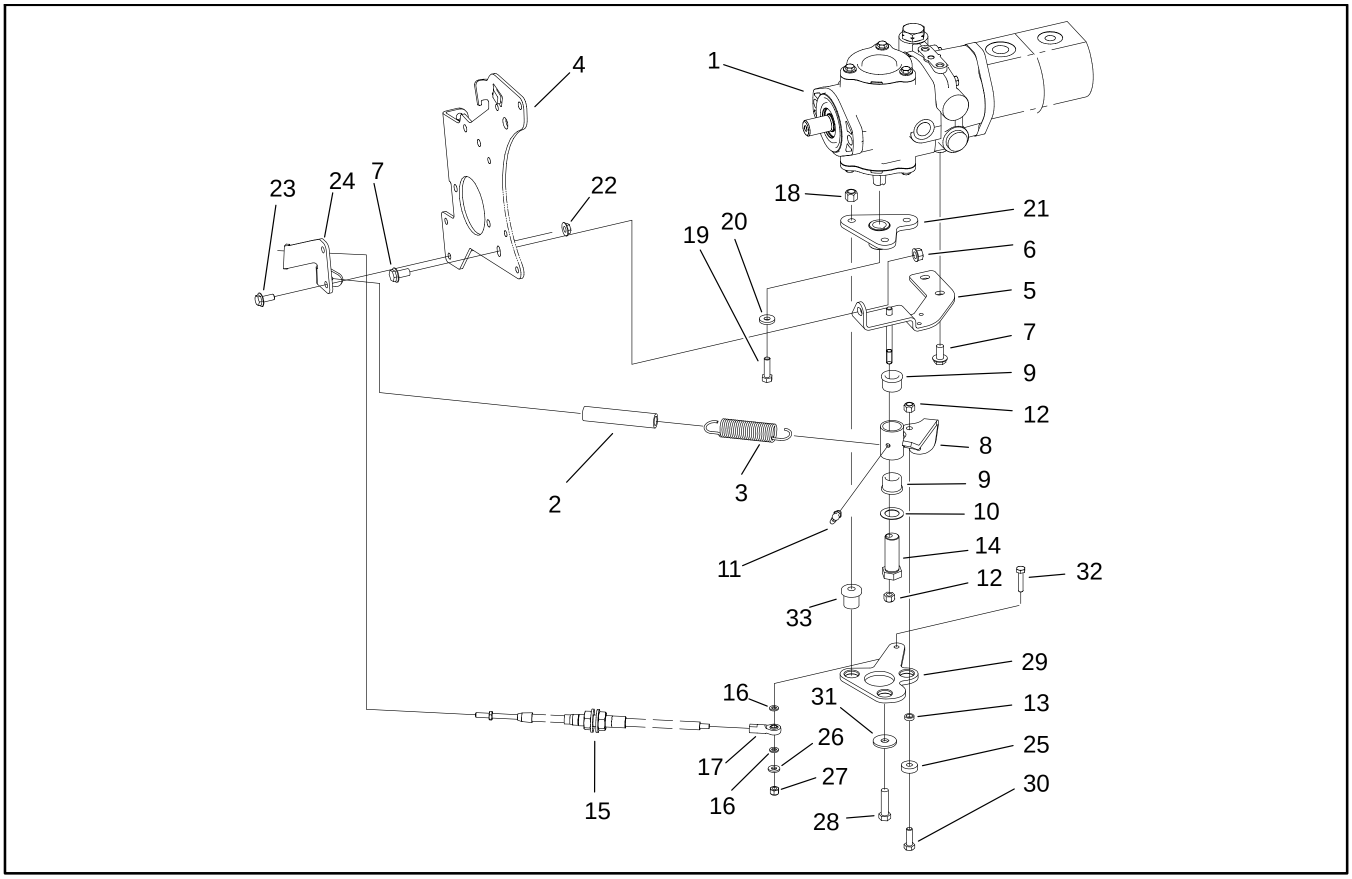

Figure 47

1. **Pump assembly**
2. **Hose**
3. **Extension spring**
4. **Pump mount plate**
5. **Neutral bracket**
6. **Flange nut**
7. **Flange head screw**
8. **Neutral arm**
9. **Flange bushing**
10. **Thrust washer**
11. **90º grease fitting**
12. **Lock nut**
13. **Spacer**
14. **Traction stud**
15. **Traction control cable**
16. **Flat washer**
17. **Ball joint**
18. **Lock nut**
19. **Cap screw**
20. **Flat washer**
21. **Hub assembly**
22. **Flange nut**
23. **Flange head screw**
24. **Cable support bracket**
25. **Ball bearing**
26. **Flat washer**
27. **Lock nut**
28. **Cap screw**
29. **Pump lever**
30. **Cap screw**
31. **Flat washer**
32. **Cap screw**
33. **Mount**

Neutral Arm Removal (Fig. 47)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Raise and support hood.

CAUTION

The extension spring is under tension and may cause personal injury during removal. Use caution when removing spring from the pump lever.

3. Remove extension spring from the cable support bracket and neutral arm.

4. Disconnect traction control cable from the pump lever. Locate and retrieve three (3) flat washers and record their position for assembly purposes.

5. Remove both flange head screws securing the neutral bracket to the piston pump. Remove flange nut and flange head screw securing the neutral bracket to the pump mount plate.

6. Remove cap screw and flat washer that secure the pump lever and hub assembly to the piston pump trunnion.

7. Separate pump lever and hub assembly from pump trunnion and neutral bracket from mount plate. Locate and retrieve key from trunnion.

Neutral Arm Installation (Fig. 47)

1. Install key into trunnion slot. Position neutral bracket to the mount plate and the pump lever and hub assembly to the pump trunnion.

2. Secure pump lever and hub assembly to the piston pump trunnion with flat washer and cap screw.

3. Secure neutral bracket to the pump mount plate with flange head screw and flange nut. Secure neutral bracket to the piston pump with both flange head screws.

4. Position three (3) flat washers to traction control cable end. Secure traction control cable to the pump lever with cap screw and lock nut.

CAUTION

The extension spring is under tension and may cause personal injury during installation. Use caution when installing the spring to the pump lever.

5. Install extension spring to the cable support bracket and neutral arm.

6. Adjust traction drive for neutral.

7. Lower and secure hood.

Piston Pump/Hydrostat

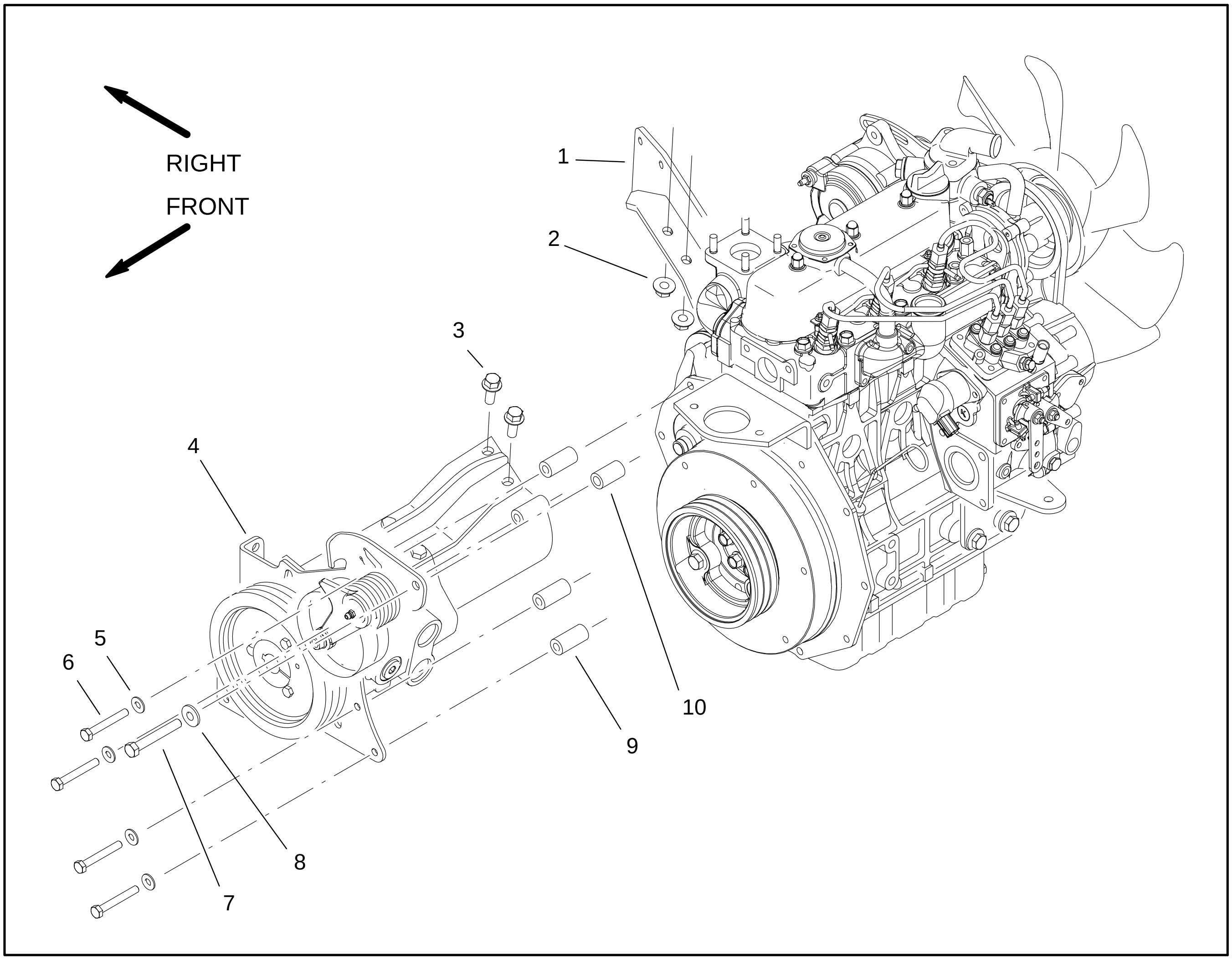

Figure 48

1. **Engine mount bracket**
2. **Flange nut**
3. **Flange screw**
4. **Pump mount plate**
5. **Hardened washer**
6. **10 mm cap screw (4)**
7. **8 mm cap screw (1)**
8. **Hardened washer**
9. **Long spacer (4)**
10. **Short spacer (1)**

Piston Pump/Hydrostat Removal (Fig. 45 and 48)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Raise and support hood.

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.

3. Remove pump drive belt (see Drive Belt Removal in this chapter).

4. Remove neutral arm assembly (see Neutral Arm Removal in this chapter).

5. Thoroughly clean hydraulic hose ends and fittings on piston pump/hydrostat and gear pumps to prevent hydraulic system contamination.

6. Disconnect the suction hose from the barbed fitting on the bottom of the gear pump and drain hydraulic tank into a suitable container.

7. Label all hydraulic hoses and fittings for assembly purposes.

8. Disconnect all hydraulic hoses connected to the hydraulic fittings on the piston pump/hydrostat and gear pump. Allow hoses to drain into a suitable container. Plug hose and fitting openings to prevent contamination.

CAUTION

Support pump assembly during removal to prevent them from falling and causing personal injury or component damage.

9. Support hydraulic pump assembly to prevent it from shifting.

10. Remove both flange head screws and flange nuts that secure pump support to engine mount.

11. Remove fasteners and spacers securing the pump mount plate to the engine (Fig. 48). Record location of cap screws, washers and spacers for assembly purposes.

12. Carefully remove pump mount plate with pumps, pulley, pump support and idler assembly from the machine.

NOTE: A case drain exists in the piston pump/hydrostat and a suction port is near the input shaft of the gear pump (Fig. 49). When the gear pump is removed from the piston pump/hydrostat, plug both case drain holes to prevent draining the pumps.

13. Remove both cap screws and flat washers securing gear pump to the piston pump. Separate gear pump from the piston pump. Locate and retrieve O−ring. Plug openings of gear pump to prevent contamination.

14. Remove pump pulley from the taper lock bushing on the piston pump shaft:

A. Remove three (3) cap screws and lock washers securing pulley to the taper lock bushing.

IMPORTANT: Excessive or unequal pressure on the cap screws can break the bushing flange.

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

15. Loosen set screw that secures taper lock bushing to piston pump shaft. Remove bushing from the pump shaft. Locate and retrieve key from pump shaft.

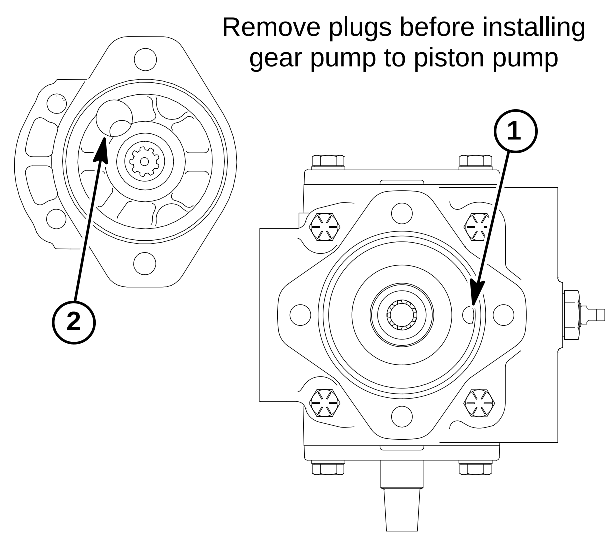

Figure 49

1. **Piston pump/hydrostat case drain**
2. **Gear pump suction port**

16. Remove both cap screws and washers that secure piston pump to pump support. Locate and retrieve spacers.

17. Remove lock nuts, flat washers and cap screws that secure the piston pump to the pump mount plate. Remove pump from plate.

18. If hydraulic fittings are to be removed from piston pump, mark fitting orientation to allow correct assembly. Remove hydraulic fittings and O−rings from the piston pump as needed. Discard removed O−rings.

Piston Pump Installation (Fig. 45 and 48)

1. Position and secure piston pump to the pump mount plate with cap screws, flat washers and lock nuts.

2. Lubricate and place new O−rings onto all removed pump fittings. Install fittings into pump openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in this chapter).

IMPORTANT: A case drain exists in the piston pump/hydrostat and a suction port is near the input shaft of the gear pump (Fig. 49). Before the gear pump is installed to the piston pump, make sure that plugs placed in either of these ports are removed. Failure to remove plugs will cause excessive pressure in the piston pump and damage seals. Also, before installing gear pump to piston pump, fill piston pump housing with clean hydraulic oil through case drain hole.

3. Install and secure gear pump to the piston pump (see Gear Pump in this chapter).

4. Place key into piston pump shaft slot. Slide taper lock bushing onto the piston pump shaft with bushing flange toward pump housing.

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

6. Position pump pulley to taper lock bushing and align non−threaded holes of pulley with threaded holes of bushing. Loosely install three (3) cap screws with lock washers to bushing and pulley.

CAUTION

Support pump assembly during installation to prevent them from falling and causing personal injury or component damage.

7. Position pump assembly to the machine. Install fasteners and spacers securing the pump mount plate to the engine and pump support (Fig. 48). Tighten fasteners securely.

8. Position and secure pump support to pump mount plate, piston pump and engine mount with removed fasteners and spacers.

9. Install pump drive belt (see Drive Belt Installation in this chapter).

10. Using a straight edge across the lower face of the pump pulley, verify pump drive belt alignment across engine and pump pulleys. Slide pulley and taper lock bushing on pump shaft so that drive belt and straight edge are aligned indicating correct position of pump pulley. Secure taper lock bushing in position with set screw.

IMPORTANT: When tightening taper lock bushing cap screws, tighten in three (3) equal steps and in a circular pattern.

11. Secure taper lock bushing and pump pulley by tightening three (3) cap screws to a torque from **90 to 120 in−lb (10.2 to 13.6 N−m)** in three (3) equal steps and in a circular pattern.

12. Check that pump drive belt alignment is still correct. If needed, loosen and re−adjust pulley and taper lock bushing location on pump shaft to allow for correct belt alignment.

13. Remove caps and plugs from all fittings and hydraulic hoses. Using labels placed during pump removal, properly connect hydraulic lines to pump assembly (see Hydraulic Hose and Tube Installation in this chapter).

14. Install neutral arm assembly to the piston pump (see Neutral Arm Installation in this chapter).

15. Fill hydraulic tank with **new** hydraulic fluid.

16. Properly charge hydraulic system (see Charge Hydraulic System in this chapter)

17. Adjust traction drive for neutral (see Traction Unit Operator’s Manual).

18. Lower and secure hood.

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Piston Pump/Hydrostat Service

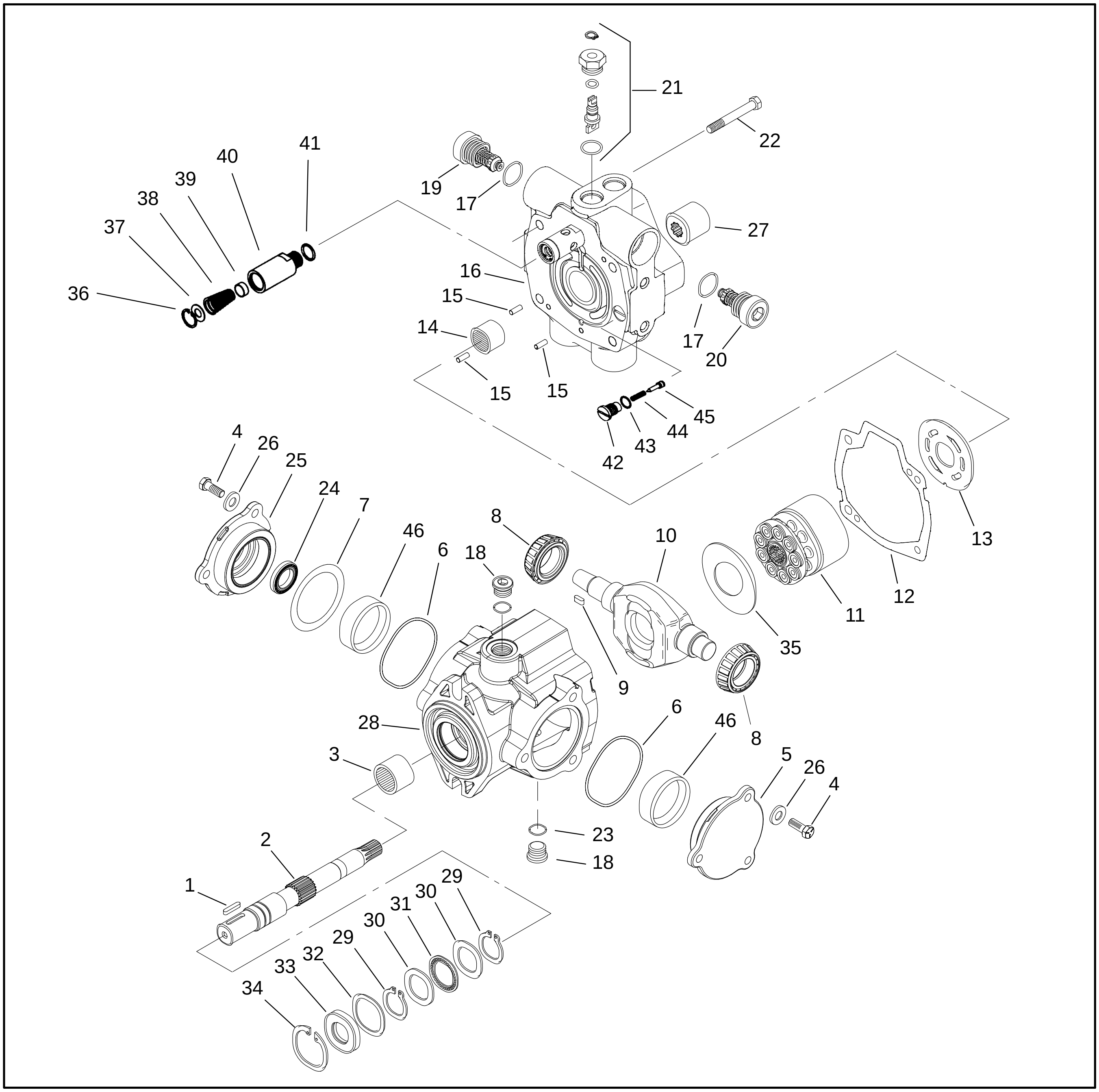

Figure 50

1. Key
2. Drive shaft
3. Bearing
4. Cap screw (3 used per plate)
5. Cover plate
6. O–ring
7. Shim kit
8. Bearing cone
9. Key
10. Swashplate
11. Rotating kit
12. Gasket
13. Valve plate
14. Bearing
15. Dowel pin
16. Back plate
17. O–ring
18. Plug
19. Relief valve asm.
20. Check valve asm.
21. Bypass valve asm.
22. Cap screw
23. O–ring
24. Shaft seal
25. Cover plate
26. Washer (3 per plate)
27. Coupler
28. Housing
29. Retaining ring
30. Thrust washer
31. Thrust bearing
32. Washer
33. Shaft seal
34. Retaining ring
35. Cam plate insert
36. Retaining ring
37. Washer
38. Charge relief spring
39. Charge relief poppet
40. Charge relief housing
41. O–ring
42. Cartridge
43. O–ring
44. Bleed−off spring
45. Bleed−off valve poppet
46. Bearing cup

IMPORTANT: If a piston pump failure occurred, refer to Traction Circuit (Closed Loop) Component Failure in this chapter for information regarding the importance of removing contamination from the traction circuit.

NOTE: The traction circuit charge relief valve and the bleed off valve for traction circuit cooling are attached to the piston pump back plate assembly (Fig. 51). The back plate assembly must be removed from the piston pump/hydrostat to service either the relief valve or the bleed off valve.

IMPORTANT: The shim kit is used to replace the original crush ring (not shown) in the cover plate. If the swash plate, cover plate or housing is replaced during servicing, the old crush ring must be replaced. See Piston Pump Crush Ring Replacement in this chapter in conjunction with the Eaton service manual at the end of this chapter for additional information.

NOTE: For repair of the piston pump, see the Eaton Medium Duty Piston Pump Repair Information Model 70160 Variable Displacement Piston Pump at the end of this chapter.

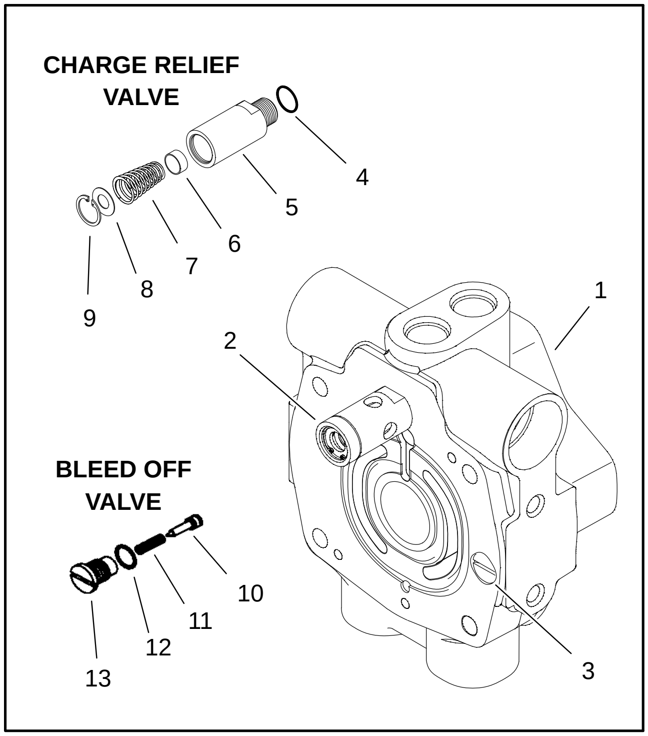

Figure 51

1. **Back plate assembly**
2. **Charge relief valve**
3. **Bleed off valve**
4. **O−ring**
5. **Housing**
6. **Poppet**
7. **Spring**
8. **Washer**
9. **Retaining ring**
10. **Bleed off valve**
11. **Spring**
12. **O−ring**
13. **Cartridge**

Hydraulic System

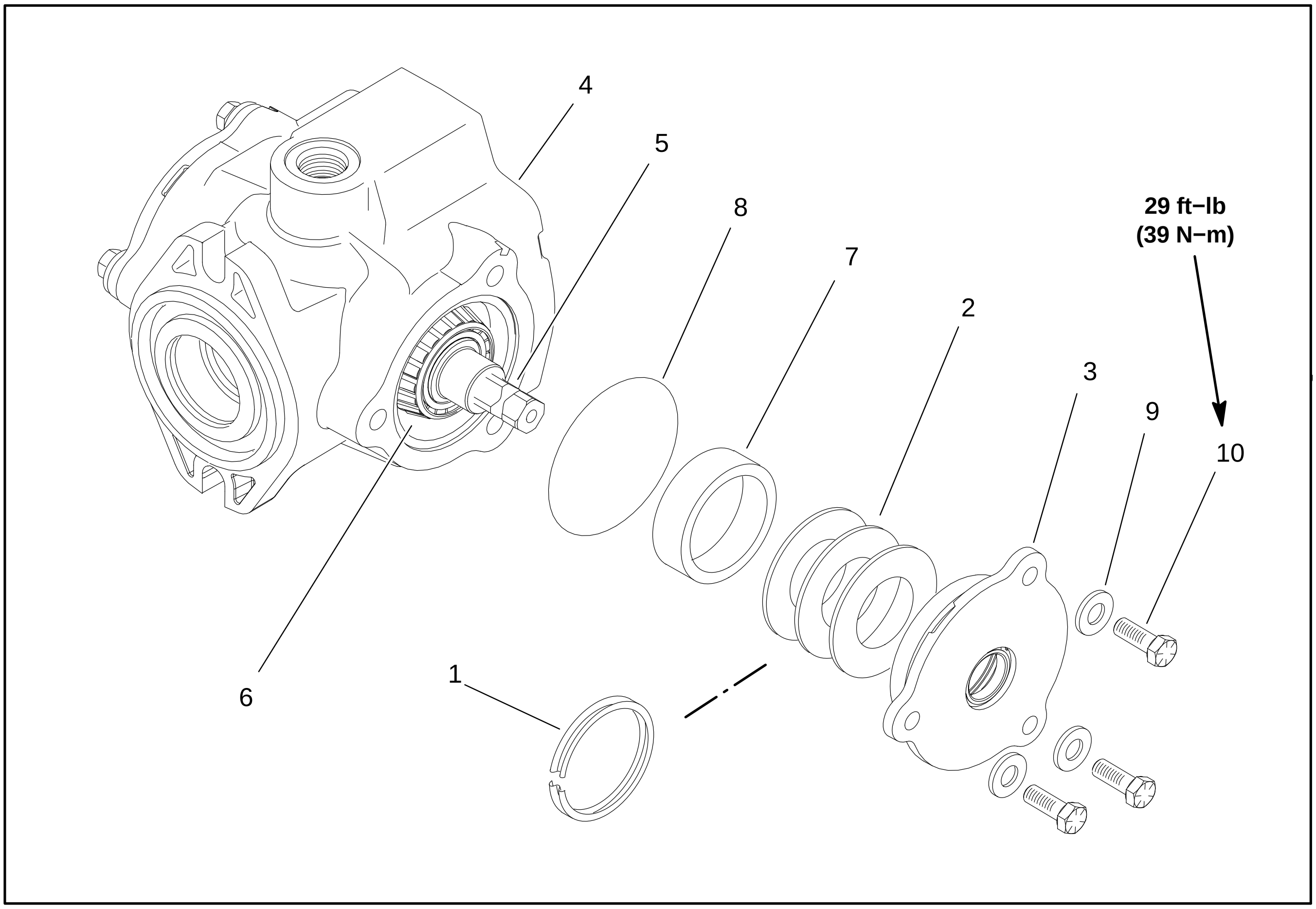

Figure 52

1. **Crush ring**
2. **Shims**
3. **Cover plate**
4. **Housing**
5. **Camplate (control shaft)**
6. **Bearing cone**
7. **Bearing cup**
8. **O−ring**
9. **Washer (3)**
10. **Cap screw (3)**

Piston Pump/Hydrostat Crush Ring Replacement (Fig. 52)

NOTE: The shims replace the crush ring in the cover plate. If the camplate, cover plate or housing is replaced during servicing of the pump, the old crush ring can not be used to make sure of proper preload.

1. Remove crush ring from the cover plate. Measure thickness of crush ring.

2. Stack shims to the thickness of the crush ring.

3. Insert shims into the cover plate in the same location that the crush ring was removed from.

4. Assemble housing sub assembly consisting of the housing, camplate, bearing cone, bearing cup and cover plate (see Eaton, Medium Duty Piston Pump, Repair Information, Model 70160 Variable Displacement Piston Pump at the end of this chapter).

5. Install washers and cap screws to the cover plate and housing. Torque cap screws to **29 ft−lbs (39 N−m)**.

6. Check torque required to rotate control shaft. Torque should be from **15 to 25 in−lbs (1.7 to 2.8 N−m)**.

A. If torque is **too low**, add additional shims and repeat steps 3 through 6 until the specified torque is achieved.

B. If torque is **too high**, remove shims and repeat steps 3 through 6 until the specified torque is achieved.

7. Complete assembly of the pump (see Eaton, Medium Duty Piston Pump, Repair Information, Model 70160 Variable Displacement Piston Pump at the end of this chapter).

Gear Pump

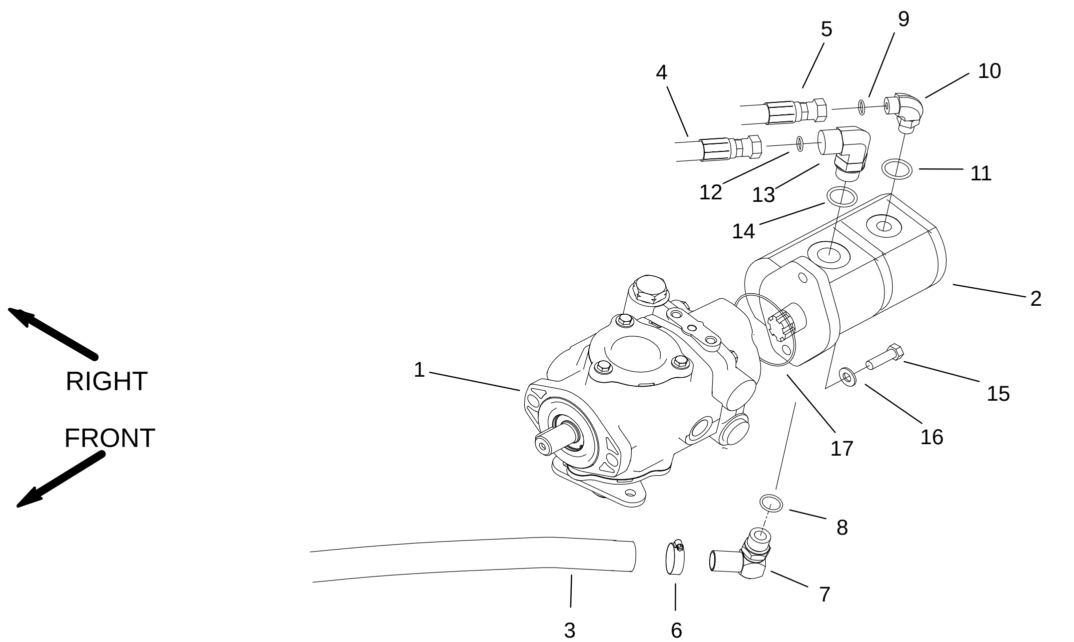

Figure 53

1. **Piston pump**
2. **Gear pump**
3. **Hydraulic hose (tank suction)**
4. **Hydraulic hose (hydraulic manifold)**
5. **Hydraulic hose (steering valve)**
6. **Hose clamp**
7. **Hydraulic barb fitting**
8. **O–ring**
9. **O–ring**
10. **90º hydraulic fitting**
11. **O–ring**
12. **O–ring**
13. **90º hydraulic fitting**
14. **O–ring**
15. **Cap screw**
16. **Flat washer**
17. **O–ring**

Removal (Fig. 53)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch. Raise and support hood.

2. Remove muffler from the engine to gain access to the gear pump (see Exhaust System in Chapter 3 − Kubota Diesel Engine in this manual).

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 this chapter.

3. Thoroughly clean hydraulic hose ends and fittings on gear pump to prevent hydraulic system contamination.

4. Drain hydraulic oil from hydraulic tank by disconnecting the suction hose from the barbed fitting in the bottom of the gear pump. Drain tank into a suitable container.

5. Label hydraulic hoses and fittings on gear pump for assembly purposes.

6. Disconnect hydraulic hoses connected to the hydraulic fittings on the gear pump. Allow hoses to drain into a suitable container. Plug hose openings to prevent contamination.

NOTE: A case drain exists in the piston pump/hydrostat and a suction port is near the input shaft of the gear pump (Fig. 54). When the gear pump is removed from the piston pump, plug piston pump case drain hole to prevent draining the piston pump.

7. Remove both cap screws and flat washers securing gear pump to the piston pump. Separate gear pump from the piston pump. Locate and retrieve O−ring. Plug openings of gear pump to prevent contamination.

8. If hydraulic fittings are to be removed from gear pump, mark fitting orientation to allow correct assembly. Remove hydraulic fittings and O−rings from the gear pump as needed. Discard removed O−rings.

Installation (Fig. 53)

1. If fittings were removed from gear pump, lubricate and place new O−rings onto fittings. Install fittings into pump openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. Make sure mounting and O−ring sealing surfaces on the gear pump and piston pump are clean.

3. Apply clean hydraulic oil to gear pump flange O−ring. Place O−ring on the gear pump.

IMPORTANT: A case drain exists in the piston pump/hydrostat and a suction port is near the input shaft of the gear pump (Fig. 54). Before the gear pump is installed to the piston pump, make sure that plugs placed in either of these ports are removed. Failure to remove plugs will cause excessive pressure in the piston pump and damage seals. Also, before installing gear pump to piston pump, fill piston pump housing with clean hydraulic oil through case drain hole.

4. Remove plugs that were placed in piston pump case drain and gear pump suction port. Fill piston pump housing with clean hydraulic oil through case drain hole.

IMPORTANT: The gear pump suction fitting must be on the same side as the trunnion of the piston pump.

5. Align gear teeth and slide gear pump input shaft into piston pump coupler. Secure gear pump to piston pump with two (2) cap screws and flat washers.

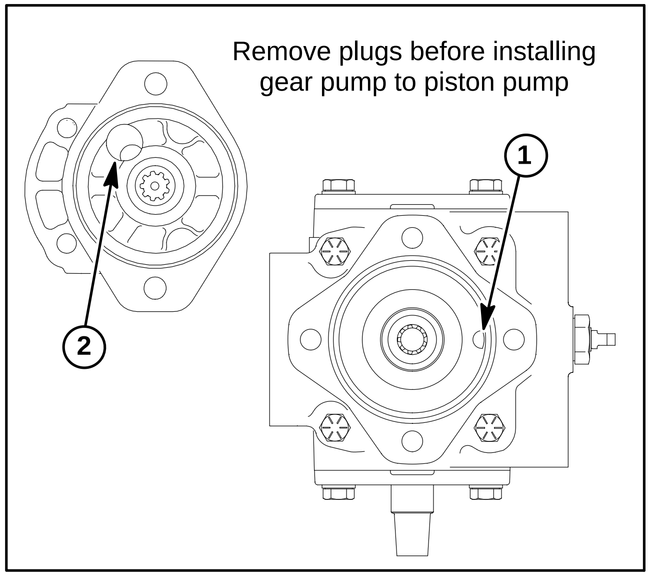

Figure 54

1. **Piston pump/hydrostat case drain**
2. **Gear pump suction port**

6. Remove caps and plugs from gear pump fittings and hoses. Using labels placed during gear pump removal, properly connect hydraulic lines to pump (see Hydraulic Hose and Tube Installation in this chapter).

7. Fill hydraulic tank with **new** hydraulic fluid.

8. Install muffler to the engine (see Exhaust System in Chapter 3 − Kubota Diesel Engine in this manual).

9. Properly fill hydraulic system (see Charge Hydraulic System in this chapter).

10. Lower and secure hood.

Hydraulic System

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Gear Pump Service

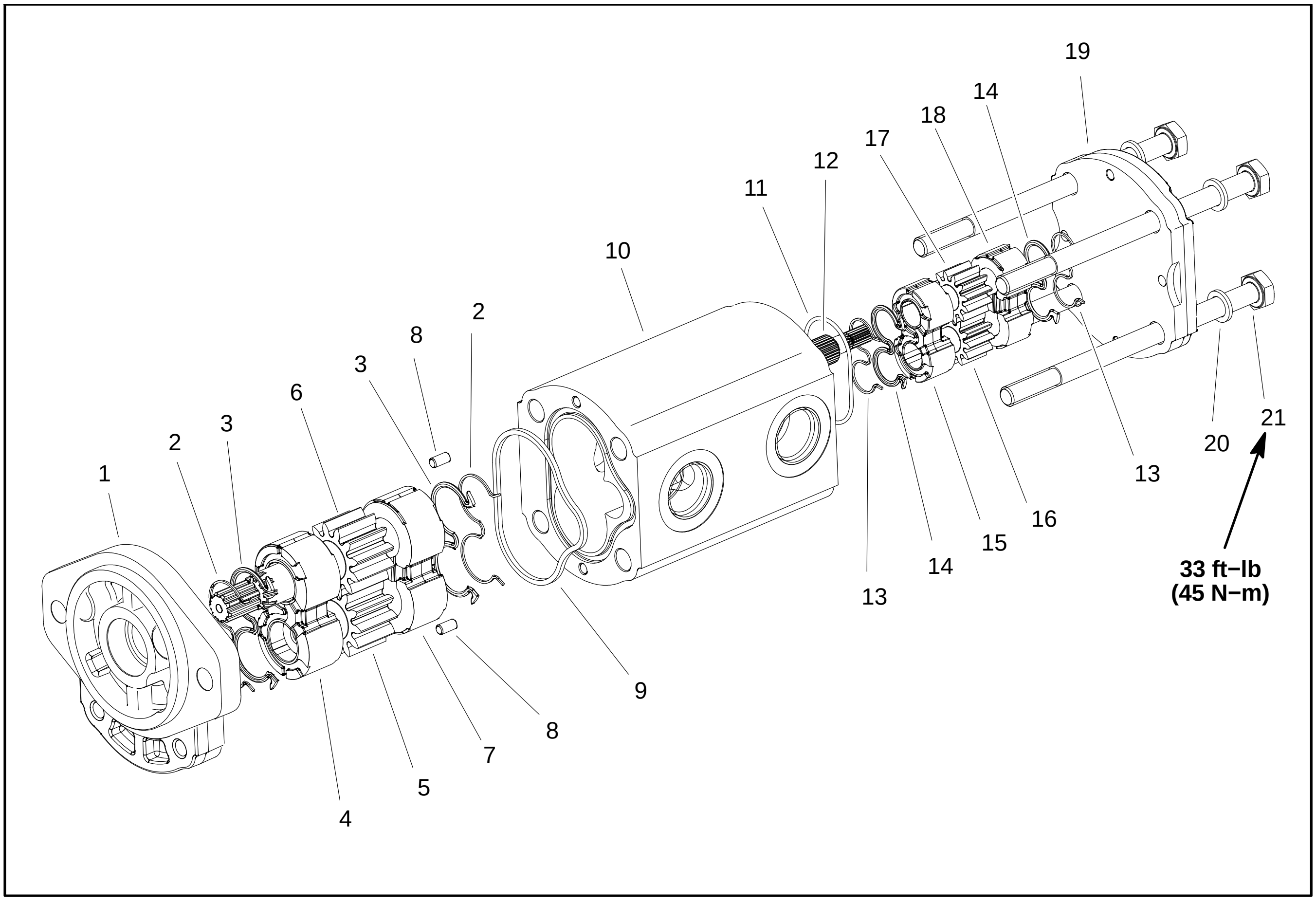

Figure 55

1. Front cover
2. Pressure seal
3. Back−up gasket
4. Front thrust plate
5. Idler gear
6. Drive shaft
7. Rear thrust plate
8. Dowel pin
9. Seal
10. Body
11. Seal
12. Splined connecting shaft
13. Pressure seal
14. Back−up gasket
15. Front thrust plate
16. Idler gear
17. Drive gear
18. Rear thrust plate
19. Rear cover
20. Washer (4 used)
21. Cap screw (4 used)

Disassembly (Fig. 55)

NOTE: The gear pump must be replaced as a complete assembly. Individual gears, housings and thrust plates are not available separately. Disassemble gear pump for cleaning, inspection and seal replacement only.

1. Plug pump ports and thoroughly clean exterior of pump with cleaning solvent. Make sure work area is clean.

2. Use a marker to make a **diagonal** line across the gear pump for assembly purposes (Fig. 56).

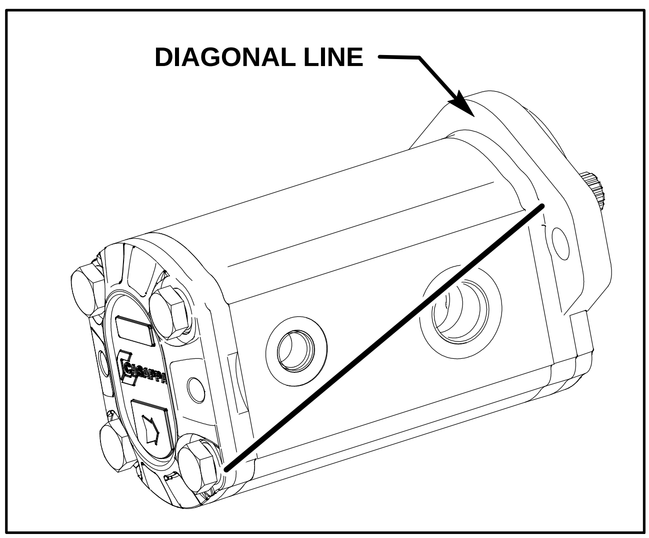

Figure 56

IMPORTANT: Use caution when clamping gear pump in a vise to avoid distorting any pump components.

3. Secure the front cover of the pump in a vise with the drive shaft pointing down.

4. Loosen the four (4) cap screws that secure pump assembly.

5. Remove pump from vise and remove fasteners.

6. Support the pump assembly and gently tap the pump case with a soft face hammer to loosen the pump sections. Be careful to not drop parts or disengage gear mesh.

IMPORTANT: Mark the relative positions of the gear teeth and the thrust plates so they can be reassembled in the same position. Do not touch the gear surfaces as residue on hands may be corrosive to gear finish.

7. Remove the thrust plates and seals from each pump section. Before removing each gear set, apply marking dye to mating teeth to retain ”timing”. Pump efficiency may be affected if the teeth are not installed in the same position during assembly. Keep the parts for each pump section together; do not mix parts between sections.

8. Clean all pump parts. Check all components for burrs, scoring, nicks and other damage.

9. Replace the entire pump assembly if parts are excessively worn or scored.

Assembly (Fig. 55)

1. Apply clean hydraulic fluid to all parts before assembling.

NOTE: Pressure seals and back−up gaskets fit in grooves machined into thrust plates. Body seals fit in grooves machined in body faces.

2. Assemble pump sections starting at front cover end. Apply grease or petroleum jelly to new section seals to hold them in position during gear pump assembly.

3. After pump has been assembled, tighten cap screws by hand. Rotate the drive shaft to check for binding. Protect the shaft if using a pliers to rotate shaft.

4. Tighten the four (4) cap screws evenly in a crossing pattern to a torque of **33 ft−lb (45 N−m)**.

Front Wheel Motors

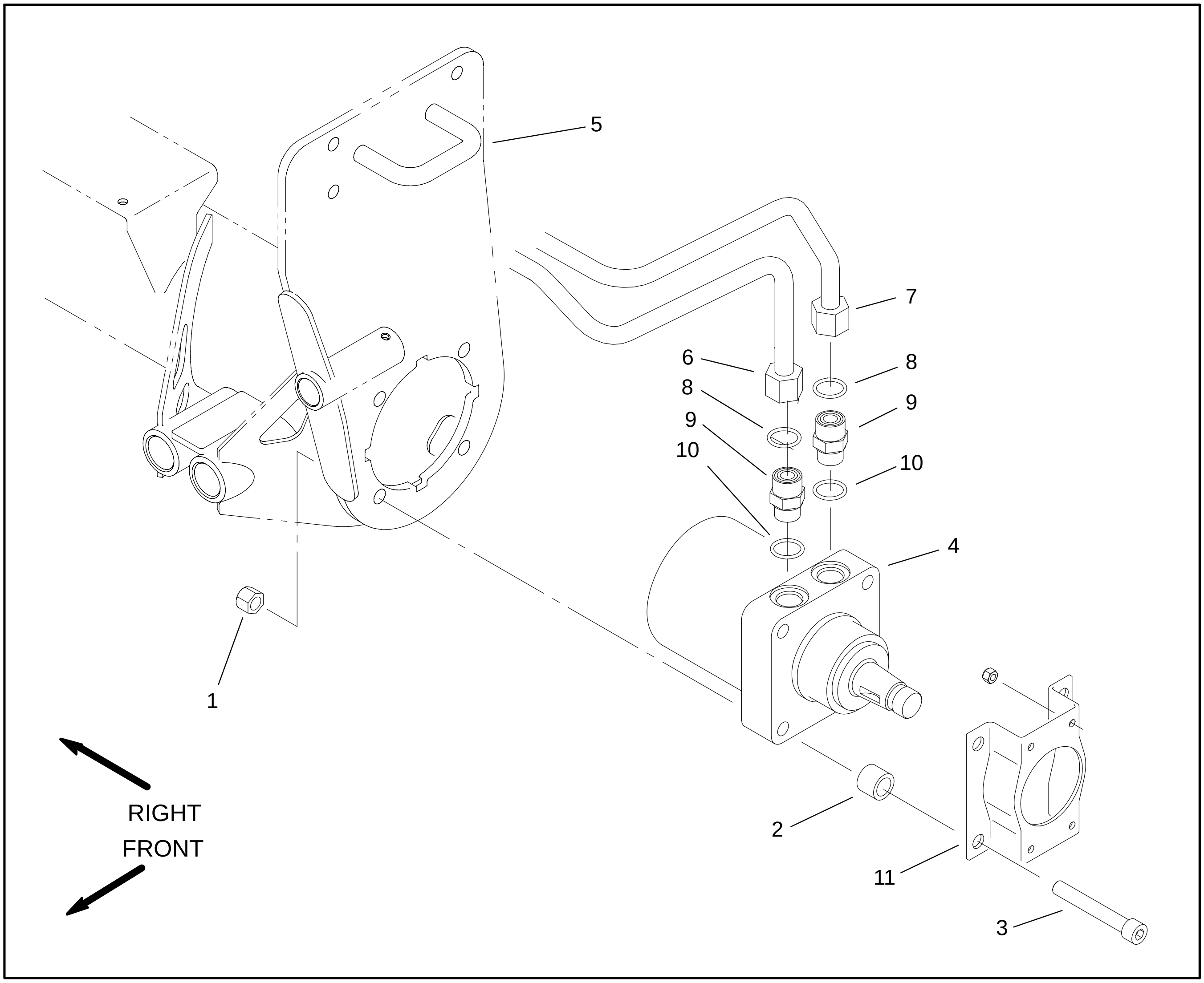

Figure 57

1. **Lock nut**
2. **Spacer**
3. **Socket head screw**
4. **Hydraulic wheel motor**
5. **Frame**
6. **Hydraulic tube**
7. **Hydraulic tube**
8. **O−ring**
9. **Hydraulic fitting (2)**
10. **O−ring**
11. **Brake bracket**

NOTE: The left front wheel motor has a yellow dot on the body to distinguish it from the right front wheel motor.

Removal (Fig. 57)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

2. Jack up front of machine enough to allow the removal of the front wheel. Support machine with appropriate jackstands.

IMPORTANT: DO NOT hit wheel hub, wheel hub puller or wheel motor with a hammer during removal or installation. Hammering may cause damage to the wheel motor.

3. Remove wheel assembly, wheel hub and brake drum from the hydraulic motor. Remove brake assembly from the brake bracket (see Front Wheel and Brake Removal in Chapter 6 − Chassis in this manual).

4. Thoroughly clean hydraulic line ends and wheel motor fittings to prevent hydraulic system contamination.

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.

5. Disconnect hydraulic tubes from adapters on wheel motors. Plug hose openings to prevent contamination.

6. Remove four (4) socket head screws and lock nuts that secure brake bracket and wheel motor to frame. Located and retrieve spacers. Remove brake bracket and wheel motor from machine.

7. If necessary, remove hydraulic adapters and O−rings from the wheel motor. Discard removed O−rings.

Installation (Fig. 57)

1. If adapters were removed from wheel motor, lubricate and place new O−rings onto fittings. Install adapters into motor openings and tighten fittings (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. Install wheel motor and brake bracket to frame using four (4) socket head screws, spacers and lock nuts.

3. Remove caps and plugs from wheel motor fittings and hoses. Using labels placed during motor removal, properly connect hydraulic lines to motor (see Hydraulic Hose and Tube Installation in this chapter).

4. Install brake assembly to the brake bracket. Install brake drum, wheel hub and wheel assembly to the hydraulic motor (see Front Wheel and Brake Installation in the Chapter 6 − Chassis in this manual).

5. Lower the machine to the ground.

6. Make sure that lock nut is torqued from **250 to 275 ft−lb (339 to 372 N−m)**. Also, make sure that wheel lug nuts are torqued from **45 to 65 ft−lb (61 to 88 N−m)**.

7. Make sure hydraulic tank is full. Add correct oil if necessary.

Rear Wheel Motor

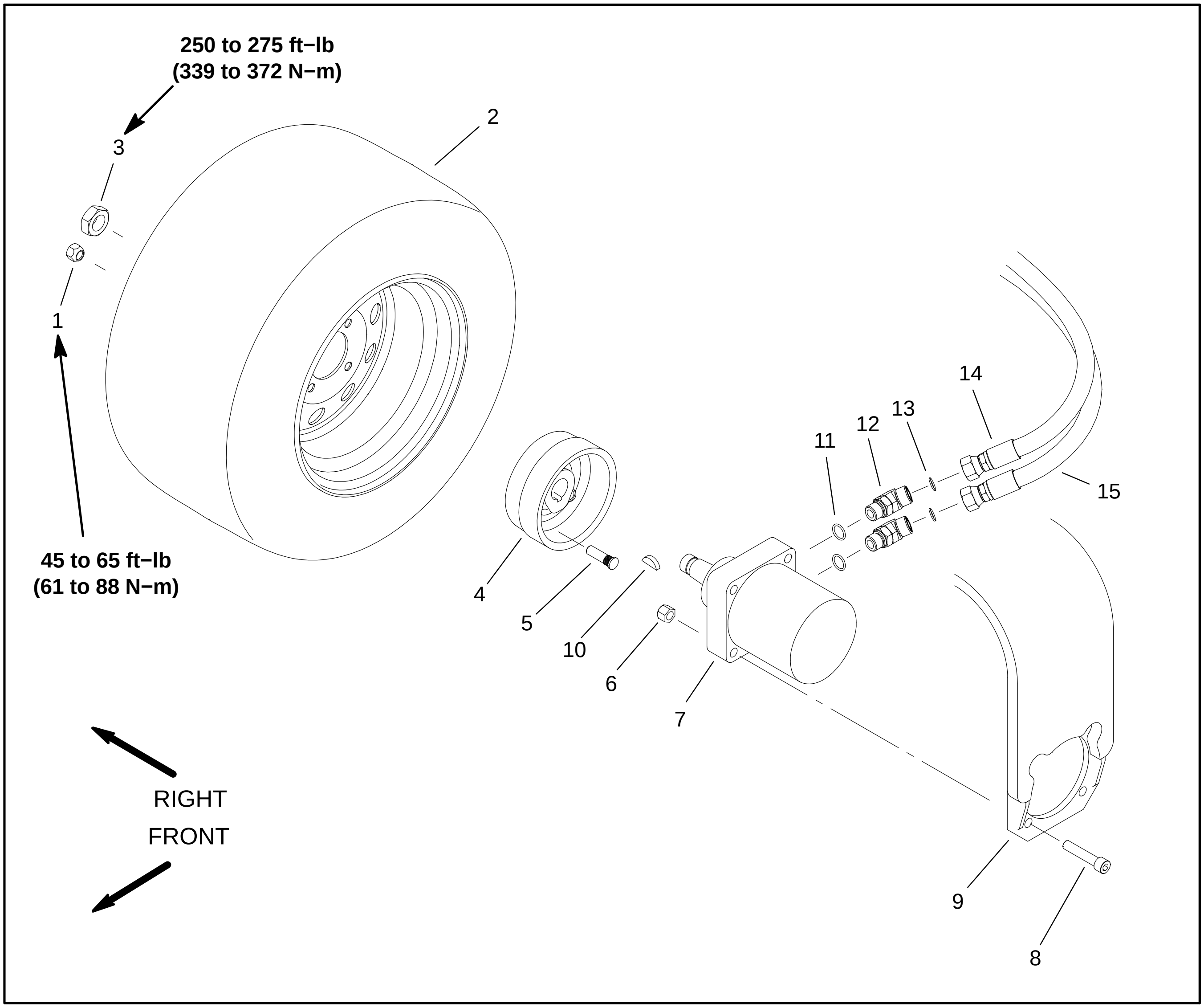

Figure 58

1. **Lug nuts (4)**
2. **Rear wheel assembly**
3. **Lock nut**
4. **Wheel hub**
5. **Wheel stud (4)**
6. **Lock nut (4)**
7. **Rear wheel motor**
8. **Socket head screw (4)**
9. **Rear fork**
10. **Woodruff key**
11. **O−ring (2)**
12. **Elbow fitting (2)**
13. **O−ring (2)**
14. **Hydraulic hose**
15. **Hydraulic hose**

Removal (Fig. 58)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

2. Jack up rear of equipment enough to allow the removal of the rear wheel.

3. Remove rear wheel assembly from machine.

4. Thoroughly clean hydraulic hose ends and rear wheel motor fittings to prevent hydraulic system contamination.

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.

5. Disconnect hydraulic hoses from fittings on wheel motor. Plug hose openings to prevent contamination.

6. Remove four (4) socket head screws and lock nuts that secure rear wheel motor to rear fork. Remove wheel motor with wheel hub attached from the rear fork.

7. Secure wheel hub in a vise. Loosen but do not remove lock nut that secures wheel hub to wheel motor.

IMPORTANT: DO NOT hit wheel hub, wheel hub puller or wheel motor with a hammer during wheel hub removal or installation. Hammering may cause damage to the wheel motor.

8. Using hub puller (see Special Tools in this chapter), loosen wheel hub from wheel motor.

9. Remove wheel hub and motor from vise. Remove lock nut and wheel hub from motor shaft. Locate and retrieve woodruff key.

10. If hydraulic fittings are to be removed from wheel motor, mark fitting orientation to allow correct assembly. Discard O−rings from removed fittings.

Installation (Fig. 58)

1. If fittings were removed from rear wheel motor, lubricate and place new O−rings onto fittings. Install fittings into motor openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in this chapter).

2. Thoroughly clean wheel motor shaft and wheel hub taper.

3. Lock wheel hub in a vise. Install woodruff key into the wheel motor shaft. Slide motor shaft into hub and secure with lock nut. Torque lock nut from **250 to 275 ft−lb (339 to 372 N−m)**. Remove wheel motor and hub from vise.

4. Position wheel motor with wheel hub attached to the rear fork. Secure rear wheel motor to rear fork with four (4) socket head screws and lock nuts.

5. Remove caps and plugs from wheel motor fittings and hoses. Using labels placed during motor removal, properly connect hydraulic lines to motor (see Hydraulic Hose and Tube Installation in this chapter).

6. Install wheel assembly to machine and secure with four (4) lug nuts.

7. Lower the machine to the ground.

8. Make sure that lock nut is torqued from **250 to 275 ft−lb (339 to 372 N−m)**. Also, make sure that wheel lug nuts are torqued from **45 to 65 ft−lb (61 to 88 N−m)**.

9. Make sure hydraulic tank is full. Add correct oil if necessary.

Wheel Motor Service

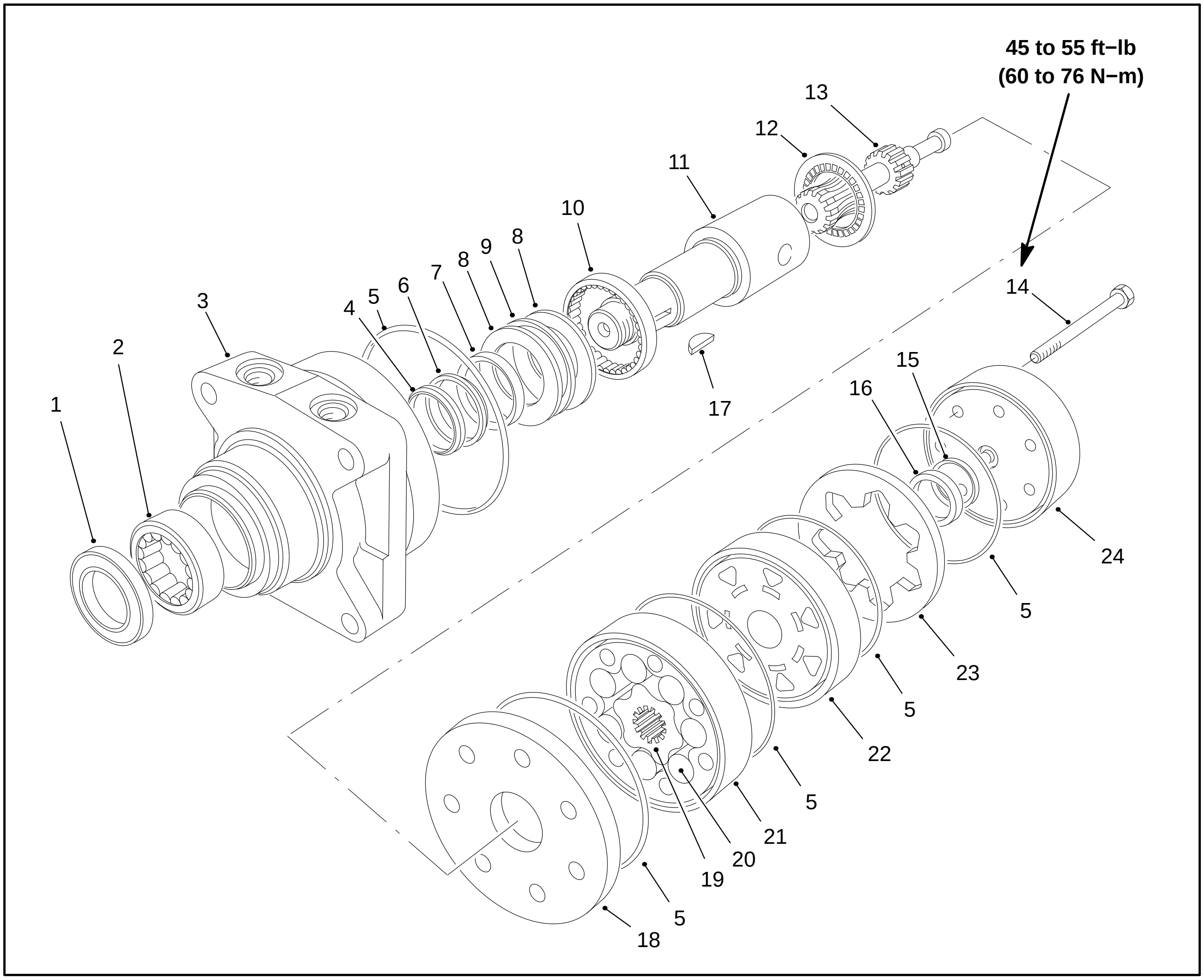

Figure 59

1. **Dirt seal**
2. **Bearing**
3. **Housing**
4. **Back−up washer**
5. **Seal ring**
6. **Back−up washer**
7. **Inner seal**
8. **Thrust washer**
9. **Thrust bearing**
10. **Bearing**
11. **Coupling shaft**
12. **Thrust bearing**
13. **Drive link**
14. **Cap screw**
15. **Commutator seal**
16. **Commutator**
17. **Woodruff key**
18. **Wear plate**
19. **Rotor**
20. **Vane**
21. **Stator**
22. **Manifold**
23. **Commutator ring**
24. **End cover**

NOTE: The wheel motors used on the Reelmaster 3550−D have the same basic construction. The left front wheel motor has a yellow sticker on the motor housing for identification purposes. The right front and rear wheel motors have reverse timed manifolds. The rear wheel motor includes a check valve in the end cover.

IMPORTANT: If a wheel motor failure occurred, refer to Traction Circuit (Closed Loop) Component Failure in the General Information section for information regarding the importance of removing contamination from the traction circuit.

NOTE: For repair of the wheel motors, see the Parker Torqmotor™ Service Procedure (TC, TB, TE, TJ, TF, TG, TH and TL Series) at the end of this chapter.

Hydraulic System

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Cutting Unit Reel Motor

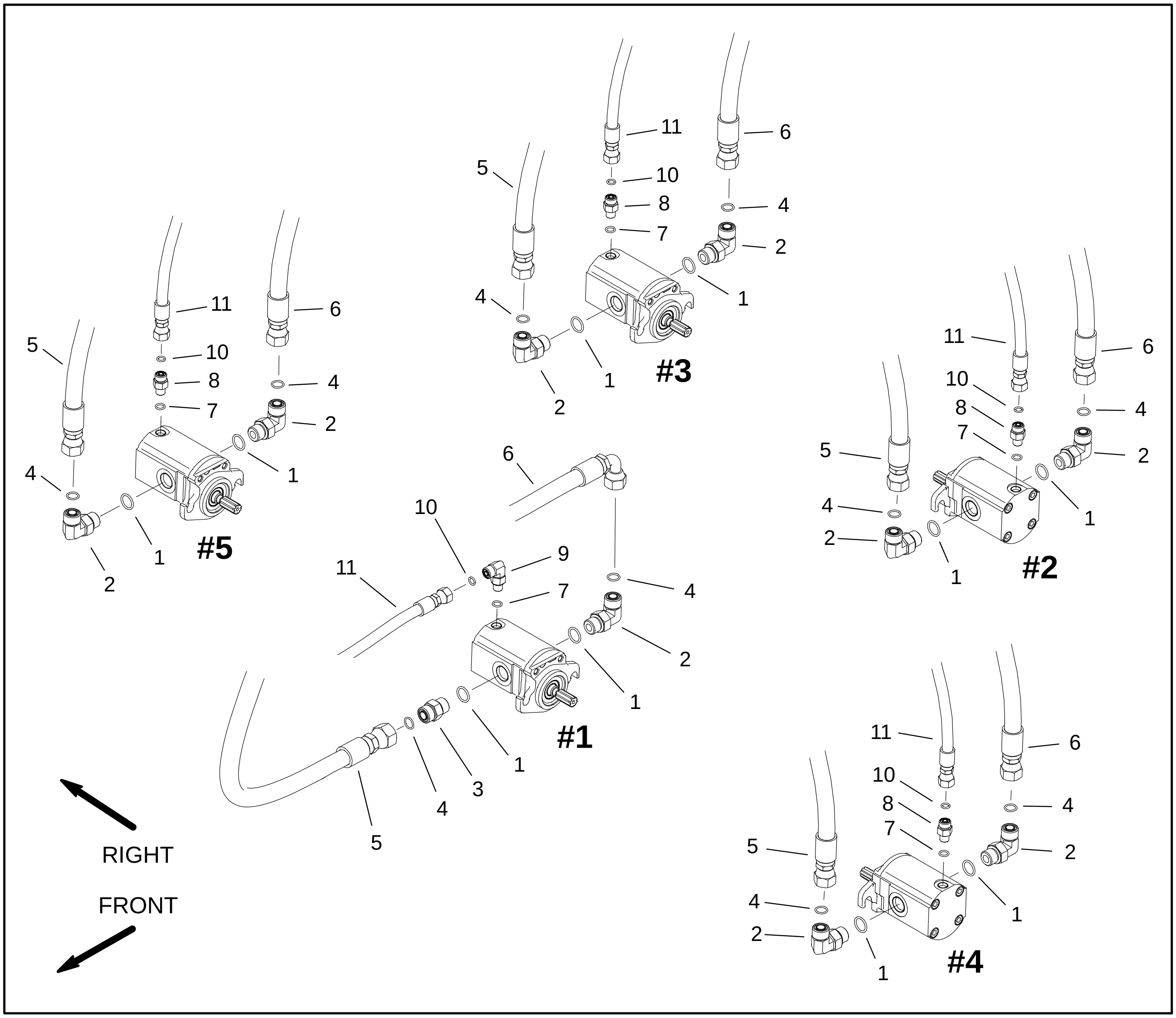

Figure 60

1. **O−ring**
2. **Elbow fitting**
3. **Straight fitting**
4. **O−ring**
5. **Hydraulic hose (Inlet)**
6. **Hydraulic hose (return)**
7. **O−ring**
8. **Straight fitting**
9. **Elbow fitting**
10. **O−ring**
11. **Hydraulic hose (case drain)**

Removal

1. Park the machine on a level surface, engage parking brake, lower cutting units and stop engine. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components in this chapter.

3. Label all hydraulic connections for assembly purposes (Fig. 60). Thoroughly clean hydraulic connections prior to loosening hydraulic lines from reel motor to prevent hydraulic system contamination.

CAUTION

Before opening hydraulic system, operate all hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

4. Disconnect hydraulic hoses from fittings in reel motor. Allow lines to drain into a suitable container. Remove and discard O−rings.

5. Put caps or plugs on disconnected hoses and fittings to prevent contamination.

6. Loosen two (2) flange nuts or flange head screws that secure the hydraulic reel motor to the cutting unit side plate (Fig. 61). Rotate motor clockwise and remove motor from cutting unit.

7. Inspect the O−ring on the reel motor flange and replace O−ring if damaged.

8. If hydraulic fittings are to be removed from motor, mark fitting orientation to allow correct assembly. Remove fittings from motor and discard O−rings.

Installation

1. If hydraulic fittings were removed from motor, lubricate new O−rings, position O−rings to fittings and install fittings into motor ports (see Hydraulic Fitting Installation in this chapter). Make sure that fittings are orientated correctly.

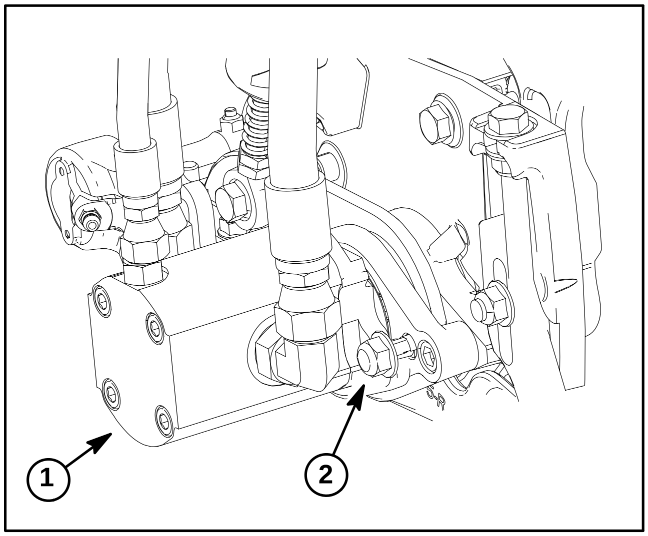

Figure 61

1. **Hydraulic reel motor**
2. **Flange nut or flange head screw (2)**

2. Coat spline shaft of the reel motor with No. 2 multipurpose lithium base grease. Lubricate the O−ring on the motor flange with clean oil.

3. Rotate the motor clockwise so the motor flanges clear the flange nuts in the cutting unit side plates. Align reel motor shaft splines with cutting reel insert splines. Slide motor shaft into reel insert.

4. Rotate the motor counter−clockwise until the motor flanges are encircling the cap screws or studs in the side plates. While holding motor, tighten two (2) flange nuts or flange head screws to secure reel motor to cutting unit (Fig. 61).

5. Remove caps or plugs from fittings and hoses.

IMPORTANT: When installing the hydraulic hoses, make sure that hydraulic hoses are straight (not twisted) before tightening the hoses to the motor fittings.

6. Lubricate and install new O−rings on motor fittings. Correctly connect hydraulic hoses to the motor using labels placed during removal procedure (Fig. 60).

7. Check oil level in hydraulic reservoir and add correct oil if necessary.

8. Follow Hydraulic System Start−up procedures (see Hydraulic System Start−up in this section).

Cutting Unit Reel Motor Service (Reelmaster 3550−D and 3555−D)

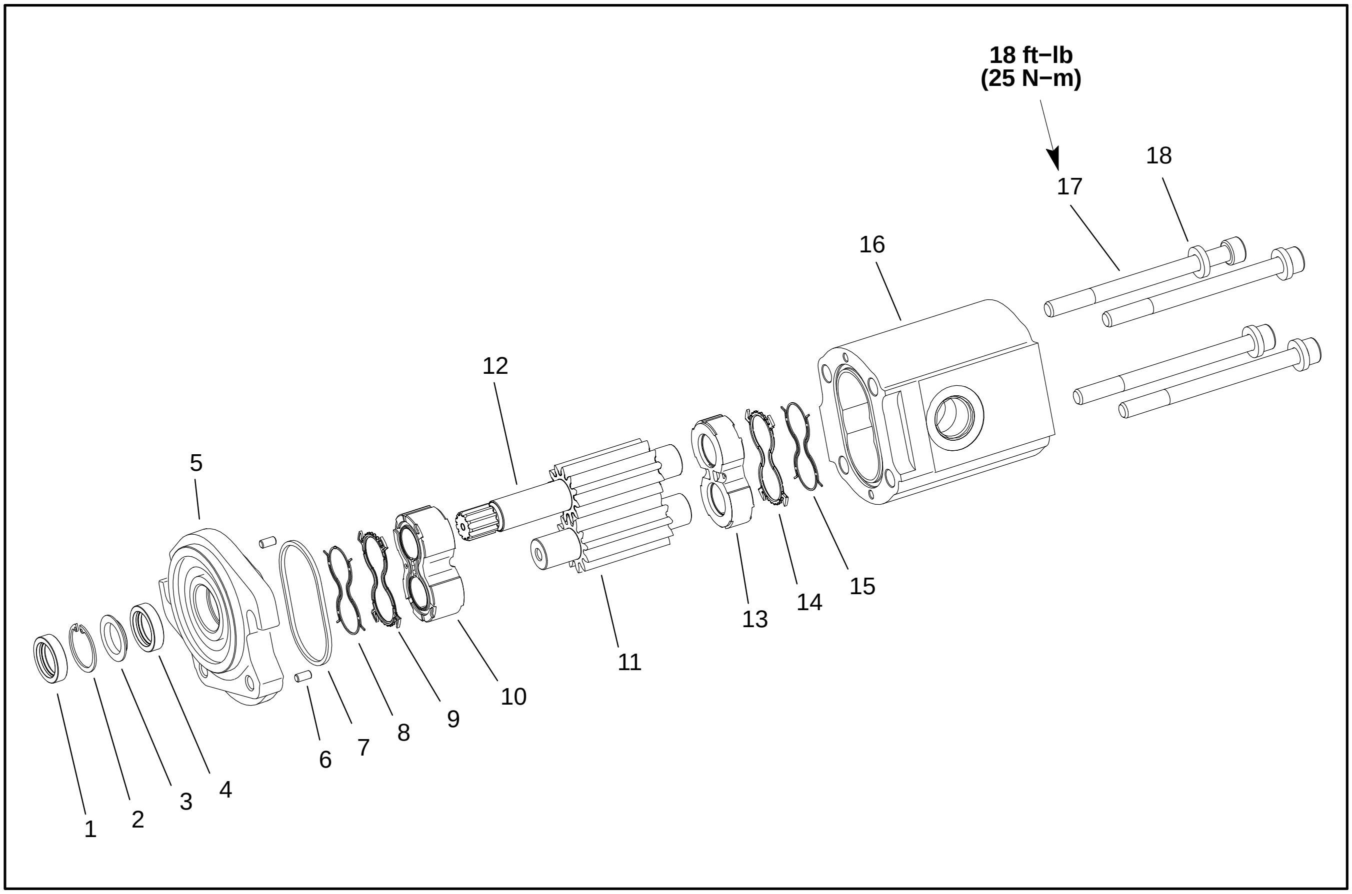

Figure 62

1. Dust seal
2. Retaining ring
3. Backup washer
4. Shaft seal
5. Front flange
6. Dowel pin (2)
7. O–ring
8. Pressure seal (outer)
9. Backup gasket (outer)
10. Wear plate (outer)
11. Idler gear
12. Drive gear
13. Wear plate (inner)
14. Backup gasket (inner)
15. Pressure seal (inner)
16. Body
17. Cap screw (4)
18. Washer (4)

Disassembly (Fig. 62)

1. Plug motor ports and clean the outside of the motor thoroughly. After cleaning, remove plugs and drain any fluid out of the motor.

2. Use a marker to make a **diagonal** line across the front flange and body for assembly purposes (Fig. 63).

IMPORTANT: Prevent damage when clamping the motor into a vise; use a vise with soft jaws and clamp on the front flange only.

3. Clamp front flange of motor in a vise with soft jaws with the shaft end down.

4. Loosen cap screws from the body.

5. Remove motor from the vise. Turn motor so that the shaft end is facing down and remove cap screws.

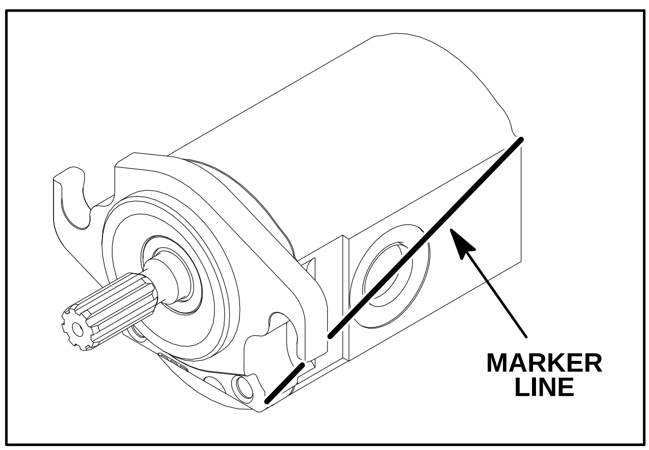

Figure 63

6. Carefully remove body. Lift body straight up to remove. Make sure the rear wear plate remains on the drive and idler gear shafts. Remove and discard O–ring from the body. Locate and retrieve dowel pins.

IMPORTANT: Record position of the open and closed side of the wear plates before removing. Identify wear plates (inner and outer, drive gear and idler gear) with a marker for proper assembly.

IMPORTANT: Mark the relative positions of the gear teeth so they can be reassembled in the same (mated) position. Do not touch the gear surfaces as residue on hands may be corrosive to gear finish.

7. Carefully disassemble the inner wear plate, idler gear, drive gear and outer wear plate.

8. Remove and discard back−up gaskets and pressure seals from wear plates.

9. Turn front flange over, with seal side up.

IMPORTANT: Make sure to not damage the front flange counter bore when removing the seals from the front flange.

10. Carefully remove dust seal, retaining ring, backup washer and shaft seal from the front flange (Fig. 64). Discard removed seals.

Inspection

1. Remove any nicks and burrs from all parts with emery cloth.

CAUTION

Use goggles or other appropriate eye protection when using compressed air for drying parts.

2. Clean all parts with solvent. Dry all parts with compressed air.

3. Inspect drive gears and idler gears for the following (Fig. 65):

A. Gear shafts should be free of rough surfaces and excessive wear at bushing points and sealing areas. Scoring, rough surfaces or wear on gear shafts indicates need for replacement.

B. Gear teeth should be free of excessive scoring and wear. Any broken or nicked gear teeth must be replaced.

C. Inspect gear face edge for sharpness. Sharp edges of gears will damage wear plates and should be replaced.

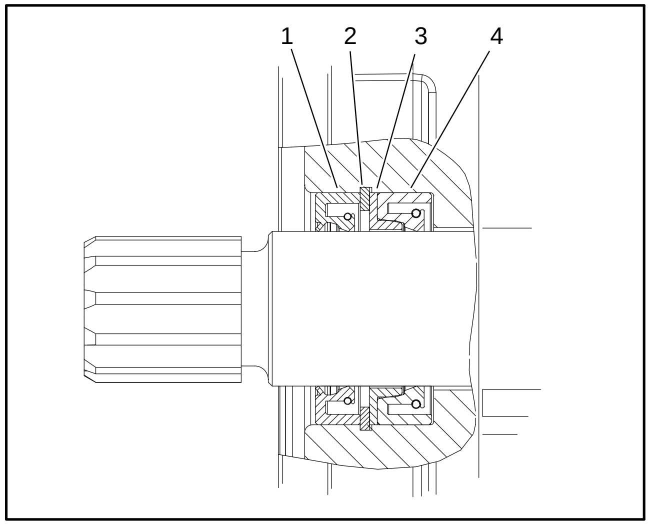

Figure 64

1. **Dust seal**
2. **Retaining ring**
3. **Backup washer**
4. **Shaft seal**

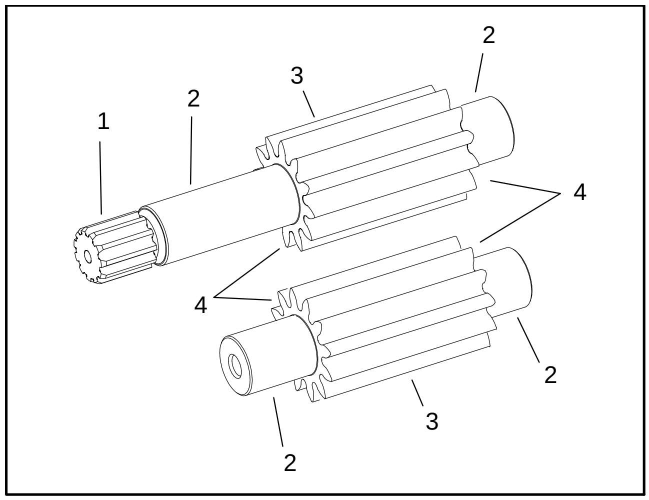

Figure 65

1. **Gear shaft spline**
2. **Gear shaft**
3. **Gear teeth**
4. **Gear face edge**

4. Inspect wear plates for the following:

A. Bearing areas should not have excessive wear or scoring.

B. Face of wear plates that are in contact with gears should be free of wear, roughness or scoring.

C. Thickness of wear plates should be equal.

5. Inspect front flange and rear cover for damage or wear.

6. If internal parts are found to be worn or damaged, reel motor replacement is necessary.

Assembly (Fig. 62)

1. Lubricate O–rings, pressure seals, back−up gaskets and wear plate grooves with a thin coat of petroleum jelly. Lubricate all other internal parts freely with clean hydraulic fluid.

2. Install new seals into front flange (Fig. 64):

   A. Press new shaft seal into front flange until it reaches the bottom of the bore.

   B. Install backup washer into front flange and then install retaining ring into the groove of the front flange. Make sure retaining ring is fully seated in front flange groove.

   C. Install new dust seal into front flange.

3. Place front flange, seal side down, on a flat surface.

4. Install the outer pressure seal, flat side outward, into the grooves in the outer wear plate. Follow by carefully placing the outer backup gasket, flat side outward, between the pressure seal and the grooves in the outer wear plate.

5. Apply a light coating of petroleum jelly to the exposed side of the front flange.

6. Lubricate the drive gear shaft with clean hydraulic fluid. Insert the drive end of the drive shaft through the outer wear plate with the pressure seal side down and the open side of the pressure seal pointing to the inlet side of the motor. Carefully install shaft into front flange.

7. Lubricate the idler gear shaft with clean hydraulic fluid. Install idler gear shaft into the remaining position in the outer wear plate with gear teeth in the mated position recorded during dis−assembly. Apply a light coating of clean hydraulic fluid to gear faces.

8. Install the inner pressure seal, flat side outward, into the grooves in the inner wear plate. Follow by carefully placing the inner backup gasket, flat side outward, between the pressure seal and the grooves in the inner wear plate.

9. Install inner wear plate with pressure seal side up and open side of the pressure seal pointing to the inlet side of the motor.

10. Apply a light coating of petroleum jelly to new O–ring and O–ring grooves in the body. Install new O–ring to the body.

NOTE: When assembling the motor, check the marker line on each part to make sure the parts are properly aligned during assembly.

11. Install locating dowels in body. Align marker line on the body and front flange.

IMPORTANT: Do not dislodge seals during installation.

12. Gently slide the body onto the assembly. Firm hand pressure should be sufficient to engage the dowels.

13. Check to make sure that the surface of the body contacts the front flange. If the body does not contact the front flange, check assembly for a shifted pressure seal, backup gasket or O–ring. Correct before proceeding.

14. Install the four (4) cap screws with washers and hand tighten screws.

IMPORTANT: Prevent damage when clamping the motor into a vise; use a vise with soft jaws and clamp on the front flange only.

15. Place front flange of the motor into a vise with soft jaws and alternately torque the cap screws **18 ft−lb (25 N−m)**.

16. Remove motor from vise.

17. Place a small amount of clean hydraulic fluid in the inlet of the motor and rotate the drive shaft away from the inlet one revolution. If any binding is evident, disassemble the motor and check for assembly problems.

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Cutting Unit Reel Motor Service (Reelmaster 3575−D)

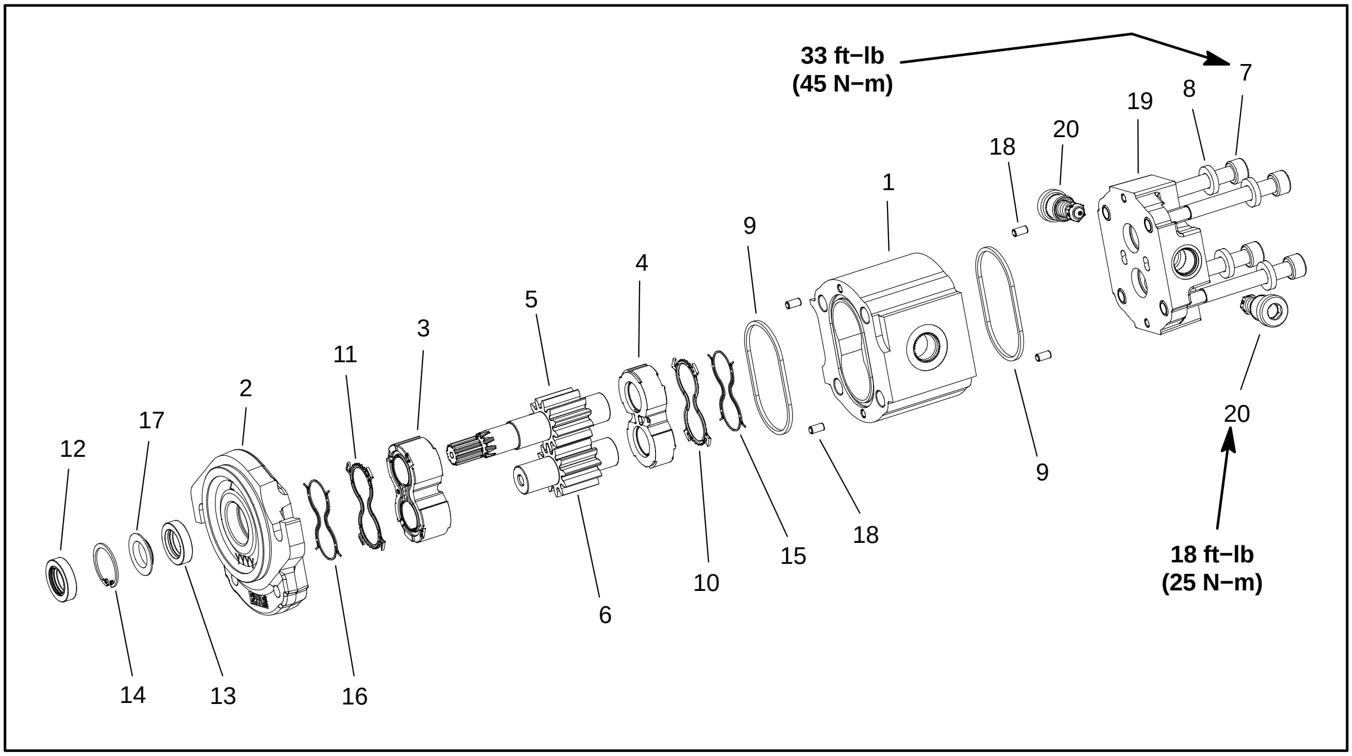

Figure 66

1. **Body**
2. **Front flange**
3. **Front thrust plate**
4. **Rear thrust plate**
5. **Drive gear**
6. **Idler gear**
7. **Socket head screw (4)**
8. **Flat washer (4)**
9. **O−ring (2)**
10. **Pressure seal**
11. **Pressure seal**
12. **Dust seal**
13. **Shaft seal**
14. **Retaining ring**
15. **Back−up seal**
16. **Back−up seal**
17. **Flange washer**
18. **Dowel pin (4)**
19. **Rear cover**
20. **Relief cartridge (2)**

Disassembly (Fig. 66)

1. Plug motor ports and clean the outside of the motor thoroughly. After cleaning, remove plugs and drain any fluid out of the motor.

2. Use a marker to make a **diagonal** line across the front flange, body and rear cover for assembly purposes (Fig. 67).

IMPORTANT: Prevent damage when clamping the motor into a vise; use a vise with soft jaws and clamp on the front flange only.

3. Clamp front flange of motor in a vise with soft jaws with the shaft end down.

4. Loosen cap screws from the rear cover.

5. Remove motor from the vise. Turn motor so that the shaft end is facing down and remove cap screws.

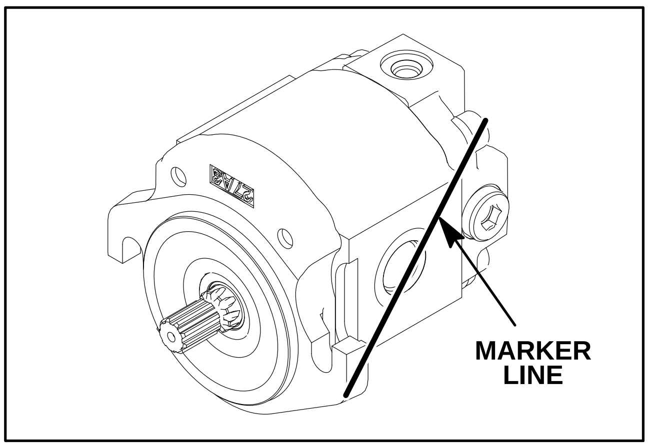

Figure 67

6. Carefully remove rear cover. Remove and discard O–ring from the body. Locate and retrieve dowel pins.

7. Carefully remove body. Lift body straight up to remove. Make sure the rear wear plate remains on the drive and idler gear shafts. Remove and discard O–ring from the body. Locate and retrieve dowel pins.

IMPORTANT: Record position of the open and closed side of the wear plates before removing. Identify wear plates (inner and outer, drive gear and idler gear) with a marker for proper assembly.

IMPORTANT: Mark the relative positions of the gear teeth so they can be reassembled in the same (mated) position. Do not touch the gear surfaces as residue on hands may be corrosive to gear finish.

8. Carefully disassemble the inner wear plate, idler gear, drive gear and outer wear plate.

9. Remove and discard back−up gaskets and pressure seals from wear plates.

10. Turn front flange over, with seal side up.

IMPORTANT: Make sure to not damage the front flange counter bore when removing the seals from the front flange.

11. Carefully remove dust seal, retaining ring, backup washer and shaft seal from the front flange (Fig. 68). Discard removed seals.

12. Remove cross−over relief valves from rear cover if necessary.

Inspection

1. Remove any nicks and burrs from all parts with emery cloth.

CAUTION

Use goggles or other appropriate eye protection when using compressed air for drying parts.

2. Clean all parts with solvent. Dry all parts with compressed air.

3. Inspect drive gears and idler gears for the following (Fig. 69):

A. Gear shafts should be free of rough surfaces and excessive wear at bushing points and sealing areas. Scoring, rough surfaces or wear on gear shafts indicates need for replacement.

B. Gear teeth should be free of excessive scoring and wear. Any broken or nicked gear teeth must be replaced.

C. Inspect gear face edge for sharpness. Sharp edges of gears will damage wear plates and should be replaced.

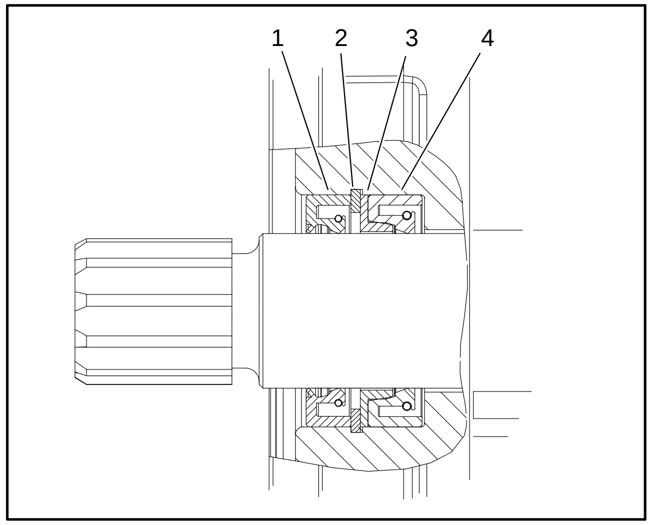

Figure 68

1. **Dust seal**
2. **Retaining ring**
3. **Backup washer**
4. **Shaft seal**

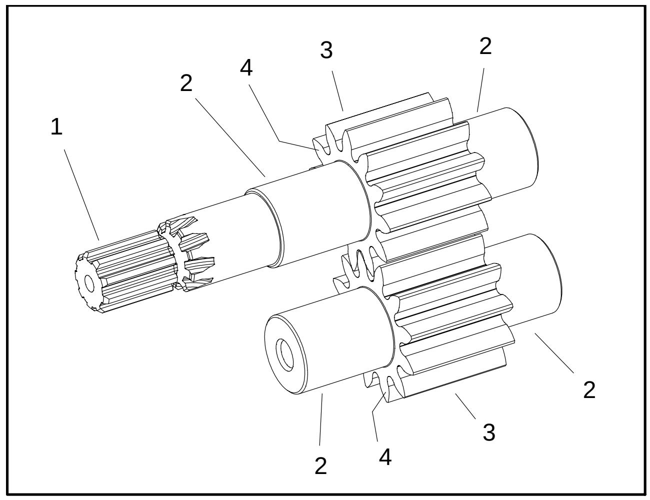

Figure 69

1. **Gear shaft spline**
2. **Gear shaft**
3. **Gear teeth**
4. **Gear face edge**

4. Inspect wear plates for the following:

A. Bearing areas should not have excessive wear or scoring.

B. Face of wear plates that are in contact with gears should be free of wear, roughness or scoring.

C. Thickness of wear plates should be equal.

5. Inspect front flange and rear cover for damage or wear.

6. If internal parts are found to be worn or damaged, reel motor replacement is necessary.

Assembly (Fig. 62)

1. Lubricate O–rings, pressure seals, back−up gaskets and wear plate grooves with a thin coat of petroleum jelly. Lubricate all other internal parts freely with clean hydraulic fluid.

2. Install new seals into front flange (Fig. 68):

   A. Press new shaft seal into front flange until it reaches the bottom of the bore.

   B. Install backup washer into front flange and then install retaining ring into the groove of the front flange. Make sure retaining ring is fully seated in front flange groove.

   C. Install new dust seal into front flange.

3. Place front flange, seal side down, on a flat surface.

4. Install the outer pressure seal, flat side outward, into the grooves in the outer wear plate. Follow by carefully placing the outer backup gasket, flat side outward, between the pressure seal and the grooves in the outer wear plate.

5. Apply a light coating of petroleum jelly to the exposed side of the front flange.

6. Lubricate the drive gear shaft with clean hydraulic fluid. Insert the drive end of the drive shaft through the outer wear plate with the pressure seal side down and the open side of the pressure seal pointing to the inlet side of the motor. Carefully install shaft into front flange.

7. Lubricate the idler gear shaft with clean hydraulic fluid. Install idler gear shaft into the remaining position in the outer wear plate with gear teeth in the mated position recorded during dis−assembly. Apply a light coating of clean hydraulic fluid to gear faces.

8. Install rear wear plate with pressure seal side up and open side of the pressure seal pointing to the inlet side of the motor.

9. Install inner wear plate with pressure seal side up and open side of the pressure seal pointing to the inlet side of the motor.

10. Apply a light coating of petroleum jelly to new O–ring and O–ring grooves in the body. Install new O–ring to the body.

NOTE: When assembling the motor, check the marker line on each part to make sure the parts are properly aligned during assembly.

11. Install locating dowels in body. Align marker line on the body and front flange.

IMPORTANT: Do not dislodge seals during installation.

12. Gently slide the body onto the assembly. Firm hand pressure should be sufficient to engage the dowels.

13. Check to make sure that the surface of the body contacts the front flange. If the body does not contact the front flange, check assembly for a shifted pressure seal, backup gasket or O–ring. Correct before proceeding.

14. Make sure that lubricated O−ring and located dowels are installed in rear of body.

15. Place rear cover onto the assembly. Firm hand pressure should be sufficient to engage the dowels.

16. Install the four (4) cap screws with washers and hand tighten screws.

IMPORTANT: Prevent damage when clamping the motor into a vise; use a vise with soft jaws and clamp on the front flange only.

17. Place front flange of the motor into a vise with soft jaws and alternately torque the cap screws **18 ft−lb (25 N−m)**.

18. Install cross−over relief valves into rear flange if they were removed. Torque relief valves **18 ft−lb (25 N−m)**.

19. Remove motor from vise.

20. Place a small amount of clean hydraulic fluid in the inlet of the motor and rotate the drive shaft away from the inlet one revolution. If any binding is evident, disassemble the motor and check for assembly problems.

Hydraulic System

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Mow Control Manifold

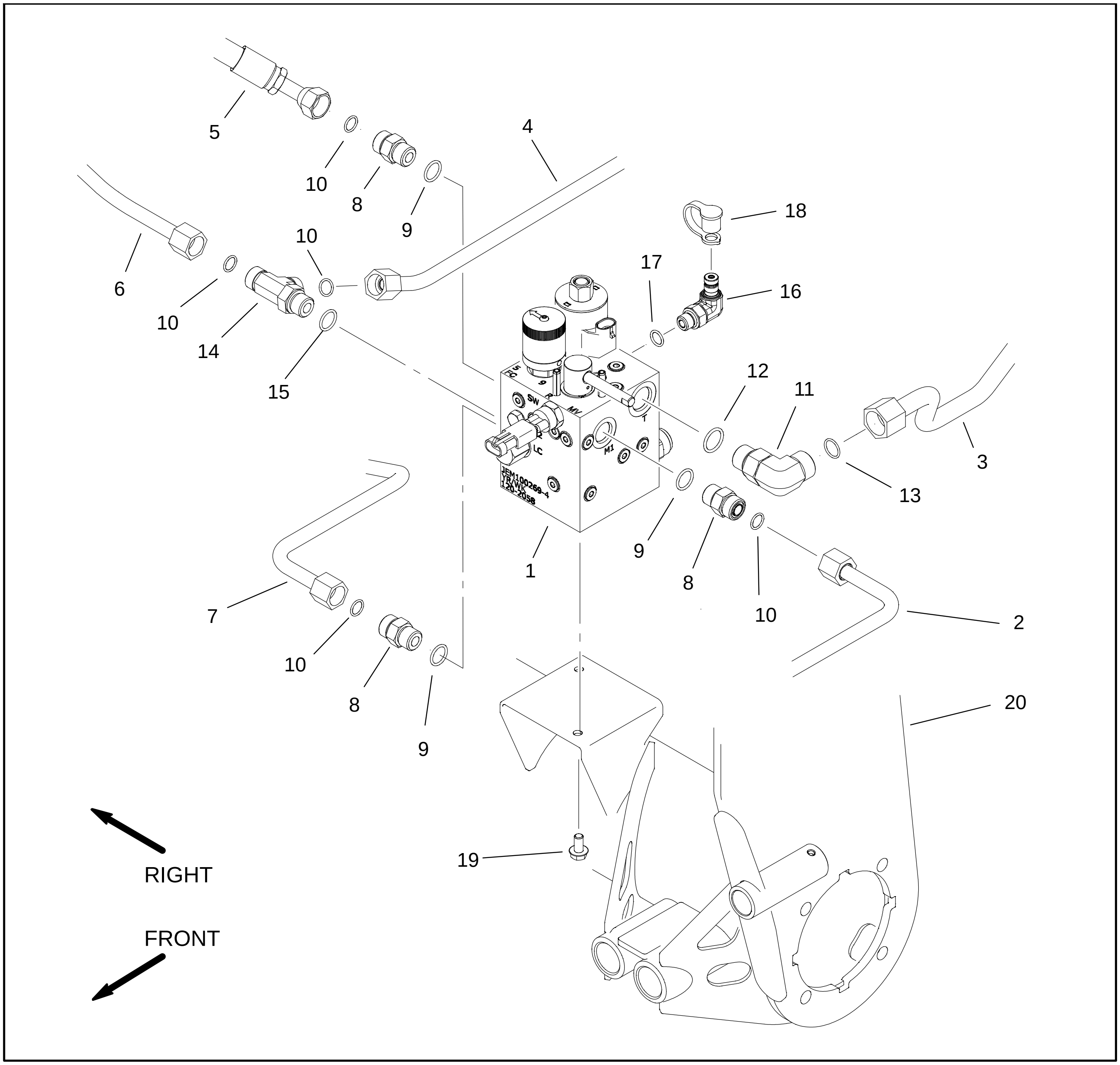

Figure 70

1. Mow control manifold
2. Hydraulic tube
3. Hydraulic tube
4. Hydraulic tube
5. Hydraulic hose
6. Hydraulic tube
7. Hydraulic tube
8. Straight hydraulic fitting (3)
9. O−ring
10. O−ring
11. 90º hydraulic fitting
12. O−ring
13. O−ring
14. Hydraulic tee fitting
15. O−ring
16. Test fitting
17. O−ring
18. Dust cap
19. Flange head screw (2)
20. Front axle

Removal (Fig. 70)

The ports on the mow control manifold are marked for easy identification of components. Example: PRV is the proportional relief valve and P is the supply port (see Hydraulic Schematic to identify the function of the hydraulic lines and cartridge valves at each port location).

The mow control manifold is located on the left side of the traction unit frame. Access the manifold from above through the hinged floor plate in front of the operator's seat, or from behind (below the traction unit frame).

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components at the beginning of the Service and Repairs section of this chapter.

3. To prevent contamination of hydraulic system during manifold removal, thoroughly clean exterior of mow control manifold and fittings.

4. Disconnect wire harness connector from the proportional relief valve coil (PRV) and the backlap switch (SW) on the mow control manifold.

5. Disconnect hydraulic lines from manifold and put caps or plugs on open hydraulic lines and fittings. Label disconnected hydraulic lines for proper installation.

6. Remove the two (2) flange head screws from under the manifold that secure the manifold to the frame.

7. If hydraulic fittings are to be removed from manifold, mark fitting orientation to allow correct assembly. Remove fittings from manifold and discard O−rings.

NOTE: Refer to Mow Control Manifold Service in this chapter for information on cartridge valve removal and installation.

Installation (Fig. 70)

1. If fittings were removed from mow control manifold, lubricate and place new O−rings onto fittings. Install fittings into manifold openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in this chapter).

2. Install mow control manifold to the frame.

3. Remove caps and plugs from fittings and hoses. Using labels placed during manifold removal, properly connect hydraulic lines to manifold (see Hydraulic Hose and Tube Installation in the this chapter).

4. Connect wire harness connector to the proportional relief valve coil (PRV) on the mow control manifold.

5. Make sure hydraulic tank is full. Add correct oil if necessary before returning machine to service.

Mow Control Manifold Service

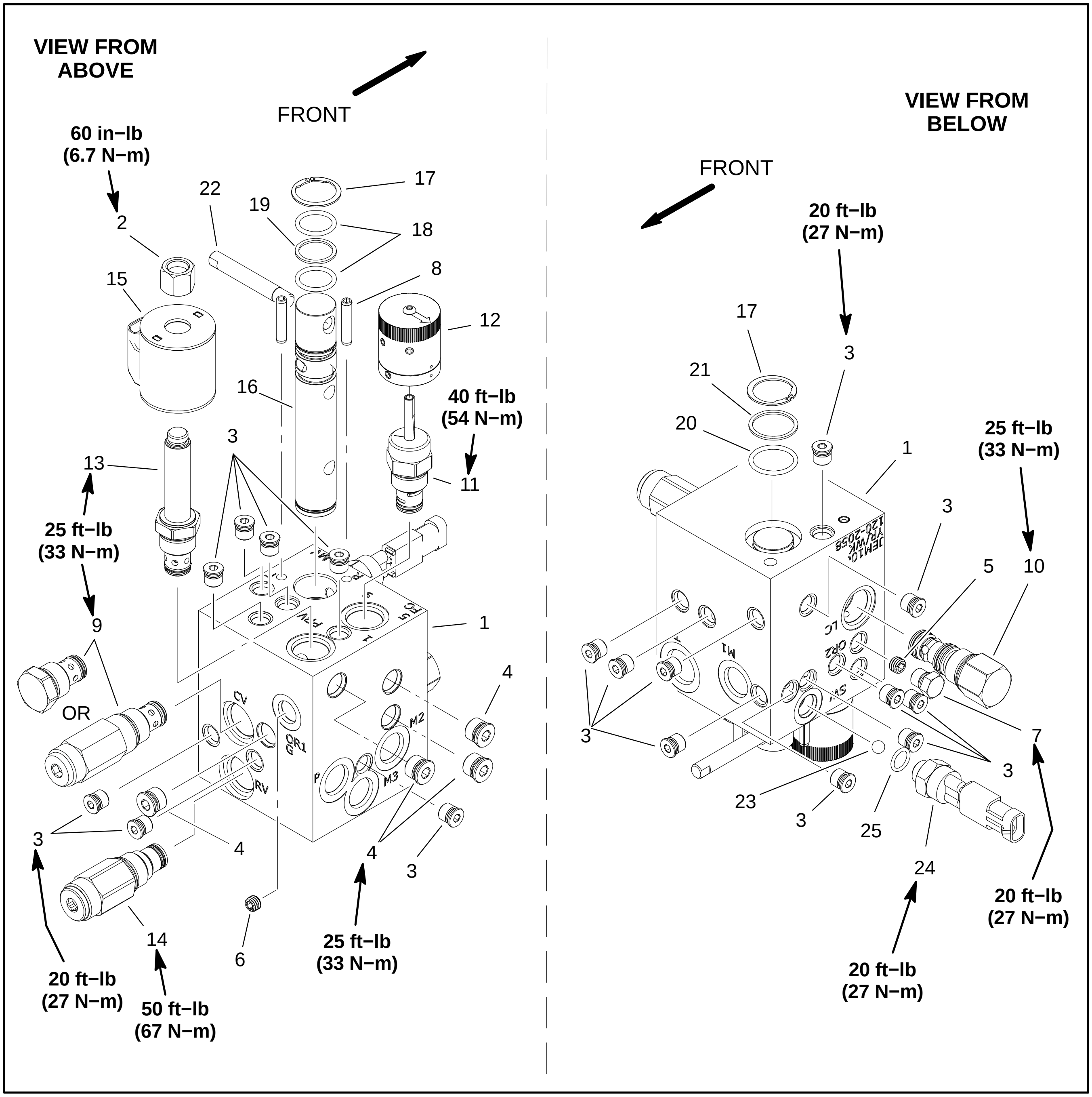

Figure 71

1. Mow control manifold
2. Coil nut
3. SAE #4 plug with O−ring (17)
4. SAE #6 plug with O−ring (4)
5. Orifice plug (0.020) (port OR2)
6. Orifice (0.050) (port OR1)
7. Zero leak #4 plug with O−ring
8. Spring pin (2)
9. Check valve (CV port)
10. Logic spool cartridge (LC port)
11. Flow control valve (FC port)
12. Rotary handle assembly
13. Proportional relief valve (PRV port)
14. Relief valve (RV port)
15. Solenoid coil
16. Backlap spool
17. Retaining ring (2)
18. O−ring (2)
19. Back−up ring
20. O−ring
21. Back−up ring
22. Spool handle
23. Ball
24. Ball switch (normally open)
25. O−ring

NOTE: The ports on the mow control manifold are marked for easy identification of components. Example: PRV is the proportional relief valve and T is the return port (see Hydraulic Schematic to identify the function of the hydraulic lines and cartridge valves at each port location).

NOTE: The hydraulic manifold shown uses several zero leak plugs. These plugs have a tapered sealing surface on the plug head that is designed to resist vibration induced plug loosening. The zero leak plugs also have an O−ring to provide a secondary seal. If zero leak plug removal is necessary, lightly rap the plug head using a punch and hammer before using an allen wrench to remove the plug: the impact will allow plug removal with less chance of damage to the socket head of the plug. When installing plugs into the manifold, torque plugs to the values shown.

NOTE: The mow control manifold includes two (2) orifice fittings. The 0.020” orifice threads into manifold port OR2 under a hex plug. The 0.050” orifice threads into manifold port OR1 under the diagnostic test fitting.

Cartridge Valve Service

The mow control manifold includes an adjustable relief valve (RV). Mow control manifold relief valve (RV) should be set to **1500 PSI (103 Bar)**. Adjust the relief valve to the recommended setting as necessary (see Adjustments in this chapter).

For cartridge valve service procedures, see Cartridge Valve Service in this chapter. When installing cartridge valves into the manifold, torque cartridge valves to the values shown.

Rotary Handle Assembly (Fig. 72)

1. To remove rotary handle from valve:

   A. Loosen two (2) set screws that secure handle cap.

   B. Remove screw and then lift handle cap from valve.

   C. Locate and retrieve detent pin, compression spring, bushing and lip seal. The sleeve bearing should stay in the cap.

   D. Loosen two (2) set screws that secure handle base to flow control valve and remove base.

2. To install rotary handle:

IMPORTANT: Make sure that flow control cartridge valve is properly secured in manifold before installing rotary handle to valve.

   A. Place handle base on flow control valve and position alignment mark on base with number 1 on manifold. Secure base with two (2) set screws. Apply a light coating of grease to chamfer on top of base to ease seal installation.

   B. Make sure that sleeve bearing is in handle cap. If necessary, press sleeve bearing into cap. Install lip seal on cap with seal lip facing down.

   C. While pressing on the cap to keep the lip seal in place, rotate cap in a clockwise direction until the arrow on the cap aligns with number 1 on the manifold. By rotating the cap clockwise, the valve will remain closed. Install screw to retain cap.

   D. Make sure that alignment marks on cap and base are in line and that arrow on cap is pointing to number 1 on manifold. Tighten two (2) set screws to secure handle cap.

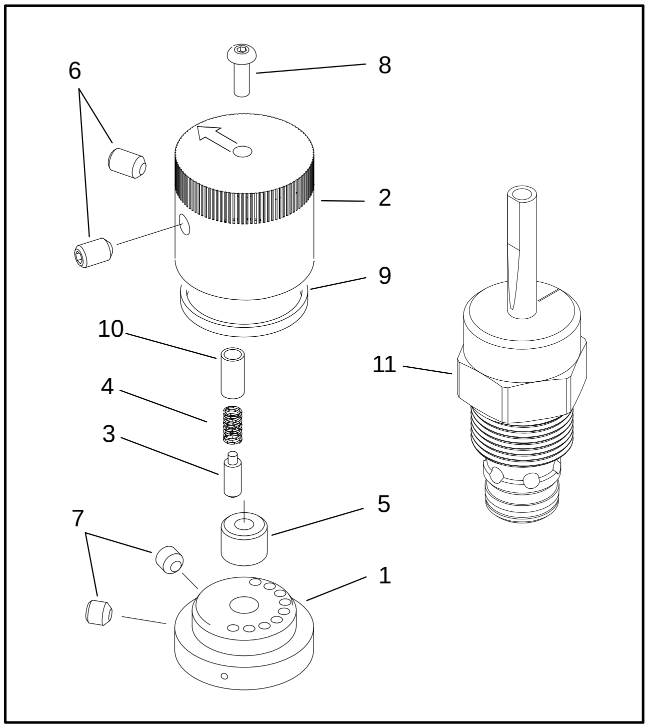

Figure 72

1. Handle base	**7. Set screw (2)**
2. Handle cap	**8. Screw**
3. Detent pin	**9. Lip seal**
4. Compression spring	**10. Sleeve bearing**
5. Bushing	**11. Flow control valve**
6. Set screw (2)	

Hydraulic System

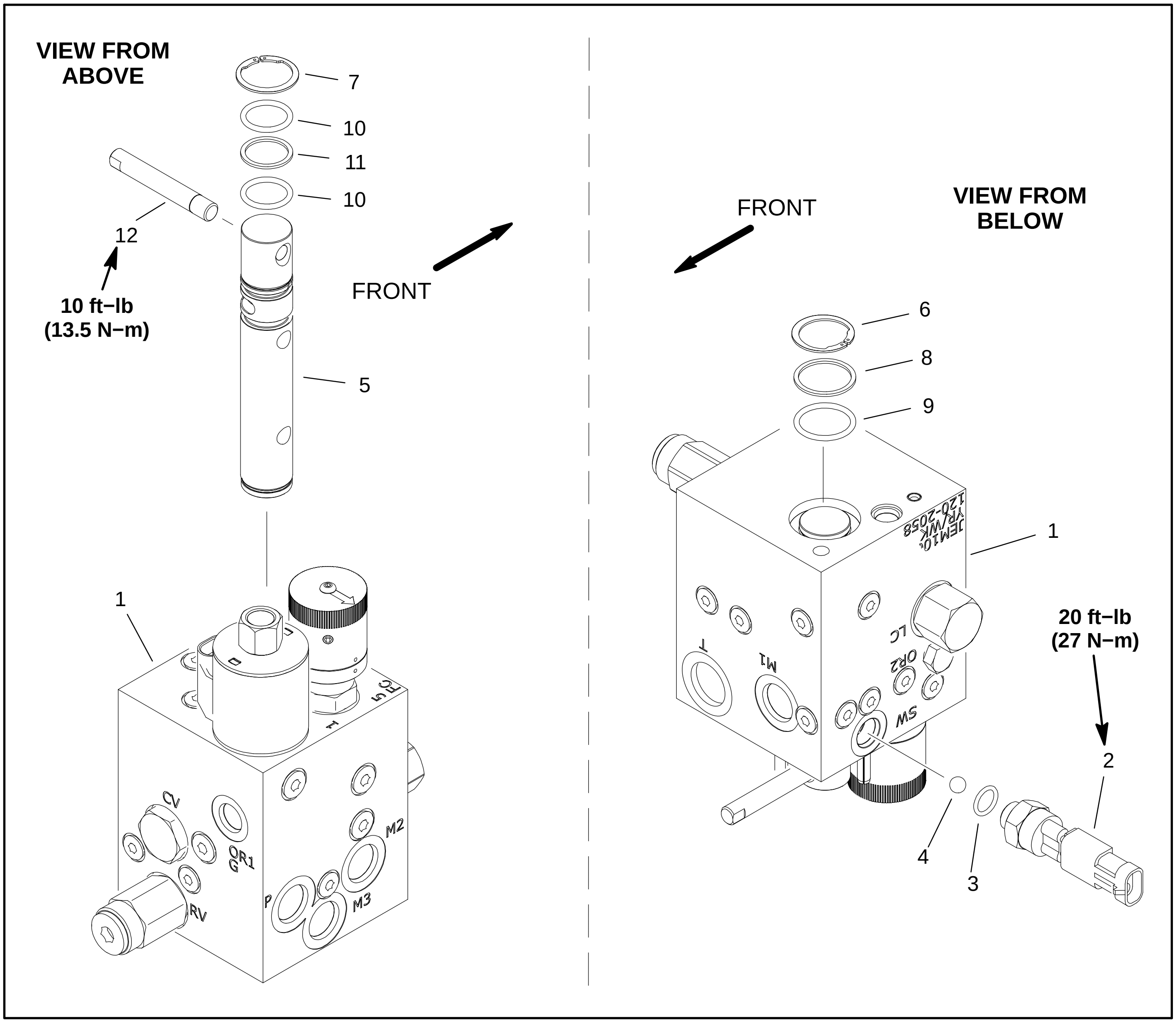

Figure 73

1. **Mow control manifold**
2. **Ball switch (normally open)**
3. **O−ring**
4. **Ball**
5. **Backlap spool**
6. **Retaining ring (lower)**
7. **Retaining ring (upper)**
8. **Back−up ring**
9. **O−ring**
10. **O−ring (2)**
11. **Back−up ring**
12. **Spool handle**

Backlap Spool (Fig. 73)

1. To remove backlap spool from manifold:

   A. Remove backlap switch from manifold before removing backlap spool. Remove ball from manifold port after switch is removed. Remove and discard O−ring from switch.

   B. Remove lower retaining ring from backlap spool. Raise backlap spool to allow access to retaining ring on upper end of spool. Remove upper retaining ring.

   C. Push spool down until lower O−ring and back−up ring are exposed on bottom of manifold. Remove lower O−ring and back−up ring from spool.

   D. Pull spool up and out of manifold. Remove O−rings and back−up ring from spool.

   E. Discard all removed O−rings and back−up rings.

2. Visually inspect the spool and manifold port for damage to the sealing surfaces and contamination.

3. To install backlap spool into manifold:

   A. Install O−rings and back−up ring to upper grooves on spool. Apply a light coating of grease to O−rings.

   B. Carefully push spool down into manifold port until lower O−ring and back−up ring groove is exposed on bottom of manifold. Install lower O−ring and back−up ring to spool. Apply a light coating of grease to O−ring.

   C. Install lower retaining ring to spool.

   D. Carefully raise backlap spool until upper retaining ring groove on spool is exposed on top of manifold. Install upper retaining ring.

   E. If handle was removed from spool, position spool so handle location of spool is between spring pins in manifold. Apply Loctite 603 Retaining Compound (or equivalent) to threads on handle and install handle into spool. Torque handle **10 ft−lb (13.5 N−m)**.

   F. Place ball in manifold port SW (backlap switch). Install new O−ring onto backlap switch. Thread backlap switch into port and torque **20 ft−lb (27 N−m)**.

Lift Control Manifold

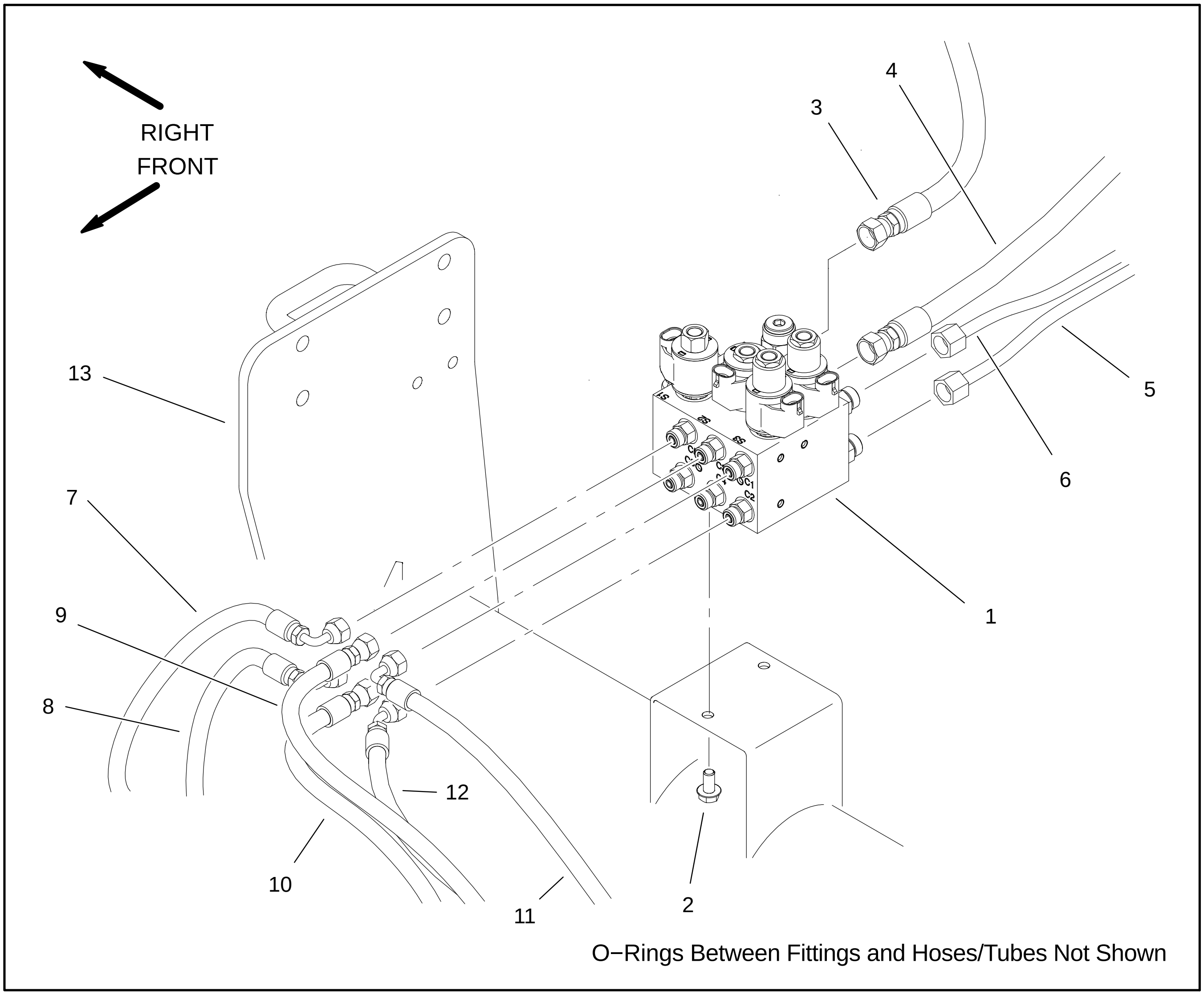

Figure 74

1. **Mow control manifold**
2. **Flange head screw (2 used)**
3. **Hydraulic hose**
4. **Hydraulic hose**
5. **Hydraulic tube (to rear bulkhead)**
6. **Hydraulic tube (to rear bulkhead)**
7. **Hydraulic hose (RH lift cylinder)**
8. **Hydraulic hose (RH lift cylinder)**
9. **Hydraulic hose (center lift cylinder)**
10. **Hydraulic hose (center lift cylinder)**
11. **Hydraulic hose (LH lift cylinder)**
12. **Hydraulic hose (LH lift cylinder)**
13. **Front axle**

Removal (Fig. 74)

The ports on the lift control manifold are marked for easy identification of components. Example: S1 is the solenoid valve and P is the supply port (see Hydraulic Schematic to identify the function of the hydraulic lines and cartridge valves at each port location).

The lift control manifold is located on the right side of the traction unit frame. Access the manifold from above through the hinged floor plate in front of the operator's seat, or from behind the front axle (below the traction unit frame).

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components at the beginning of the Service and Repairs section of this chapter.

3. To prevent contamination of hydraulic system during lift control manifold removal, thoroughly clean exterior of manifold.

WARNING

Make sure that cutting units are fully lowered before loosening hydraulic lines from lift manifold. If cutting units are raised as hydraulic lines are loosened, cutting units may drop unexpectedly.

4. Label wire harness electrical connectors that attach to manifold solenoid coils. Disconnect wire harness electrical connectors from the solenoid valve coils.

5. Disconnect hydraulic lines from lift control manifold and put caps or plugs on open hydraulic lines and fittings. Label disconnected hydraulic lines for proper assembly.

6. Remove the two (2) flange head screws from under the manifold that secure the manifold to the frame.

NOTE: Refer to Lift Control Manifold Service in this chapter for information on hydraulic fitting and cartridge valve removal and installation.

IMPORTANT: A flow control orifice is located beneath many of the fittings in the lift control manifold ports. If any of the fittings is removed from the manifold, make sure to remove orifice and label its position for assembly purposes. When installing the orifice in the manifold, make sure that the orifice is flat in the base of the port. Manifold damage is possible if the orifice is cocked in the port.

Installation (Fig. 74)

1. Install lift control manifold to the frame.

2. Remove caps and plugs from fittings and hoses. Properly connect hydraulic lines to lift control manifold (see Hydraulic Hose and Tube Installation in this chapter).

3. Connect wire harness electrical connectors to the solenoid valve coils on the lift control manifold.

4. Make sure hydraulic tank is full. Add correct oil if necessary before returning machine to service.

Lift Control Manifold Service (Reelmaster 3550−D)

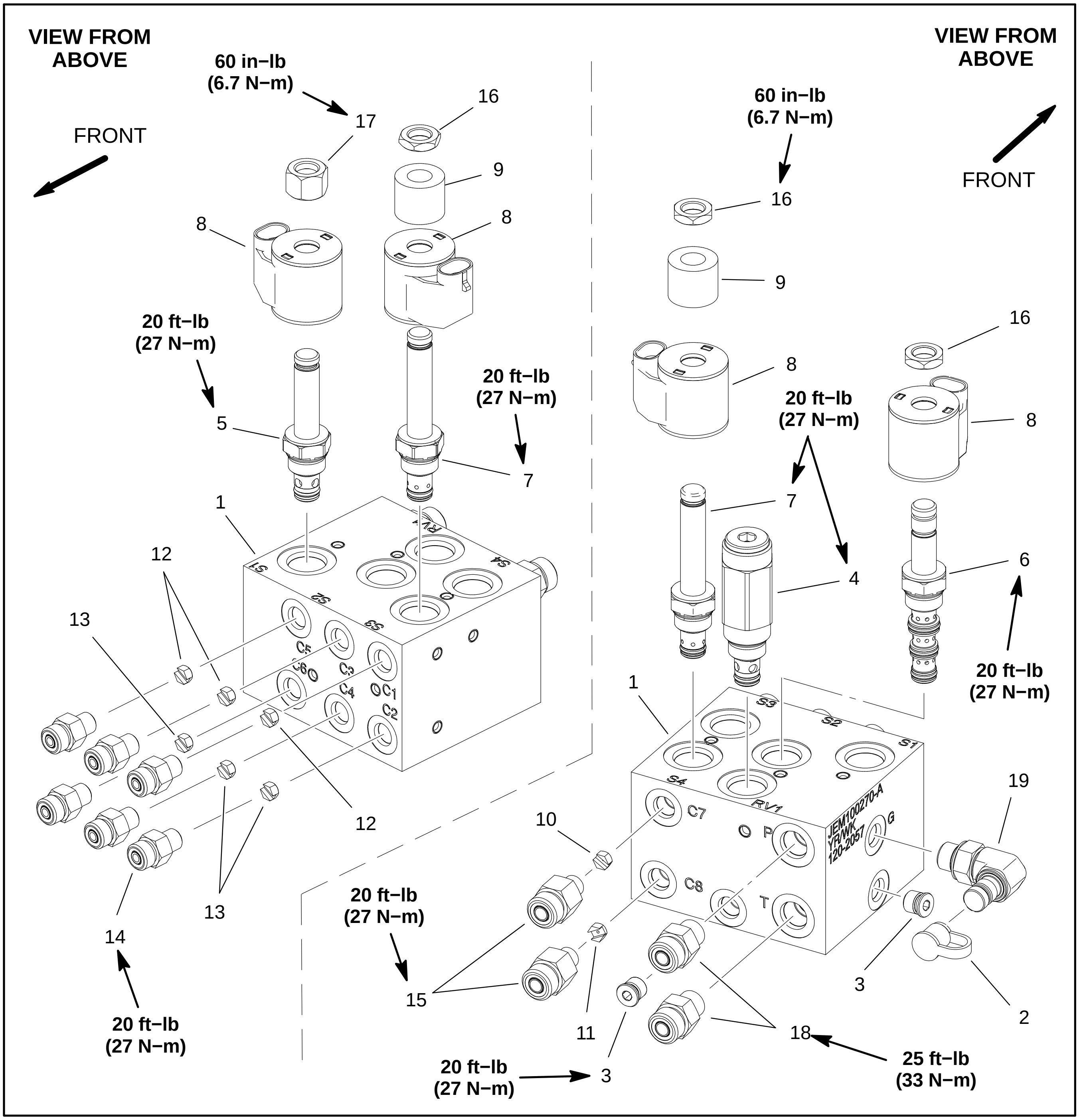

Figure 75

1. **Lift control manifold**
2. **Dust cover**
3. **SAE #4 plug with O−ring (2)**
4. **Relief valve (RV1)**
5. **Solenoid valve (S1)**
6. **Solenoid valve (S2)**
7. **Solenoid valve (S3 and S4)**
8. **Solenoid coil (4)**
9. **Coil spacer (2)**
10. **Orifice (0.035) (port C7)**
11. **Orifice (0.055) (port C8)**
12. **Orifice (0.040) (ports C1, C3 & C5)**
13. **Orifice (0.046) (ports C2, C4 & C6)**
14. **Straight fitting (6)**
15. **Straight fitting (2)**
16. **Coil nut (3)**
17. **Tall coil nut**
18. **Straight fitting (2)**
19. **Diagnostic fitting**

NOTE: The ports on the lift control manifold are marked for easy identification of components. Example: S1 is the solenoid valve and P is the supply port (see Hydraulic Schematic to identify the function of the hydraulic lines and cartridge valves at each port location).

CAUTION

Before continuing further, read and become familiar with General Precautions for Removing and Installing Hydraulic System Components in this section of this chapter.

WARNING

If lift manifold is attached to machine, make sure that cutting units are fully lowered before loosening hydraulic lines or cartridge valves from lift manifold. If cutting units are raised as components are loosened in manifold, cutting units may drop unexpectedly.

IMPORTANT: A flow control orifice is located beneath many of the fittings in the lift control manifold ports. If any of the fittings is removed from the manifold, make sure to remove orifice and label its position for assembly purposes. When installing the orifice in the manifold, make sure that the orifice is flat in the base of the port. Manifold damage is possible if the orifice is cocked in the port.

NOTE: The hydraulic manifold shown uses several zero leak plugs. These plugs have a tapered sealing surface on the plug head that is designed to resist vibration induced plug loosening. The zero leak plugs also have an O−ring to provide a secondary seal. If zero leak plug removal is necessary, lightly rap the plug head using a punch and hammer before using an allen wrench to remove the plug: the impact will allow plug removal with less chance of damage to the socket head of the plug. When installing plugs into the manifold, torque plugs to the values shown.

The lift control manifold includes an adjustable relief valve (RV1). Lift control manifold relief valve (RV1) should be set to **500 PSI (34.5 Bar)**. Adjust the relief valve to the recommended setting as necessary (see Adjustments in this chapter).

For cartridge valve service procedures, see Cartridge Valve Service in this chapter. When installing cartridge valves into the manifold, torque cartridge valves to the values shown.

Lift Control Manifold Service (Reelmaster 3555−D and 3575−D)

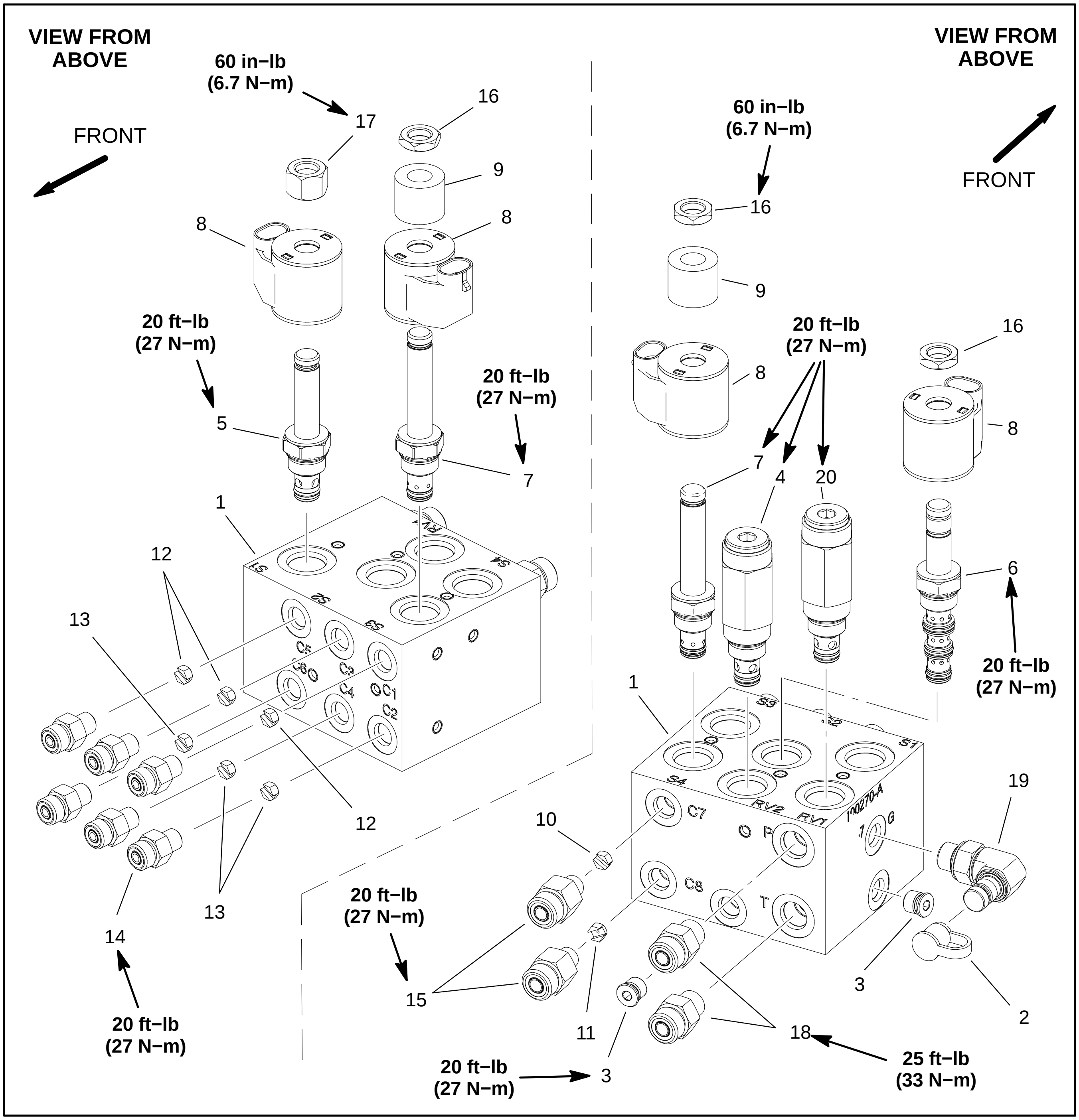

Figure 76

1. **Lift control manifold**
2. **Dust cover**
3. **SAE #4 plug with O−ring (2)**
4. **Relief valve (RV2)**
5. **Solenoid valve (S1)**
6. **Solenoid valve (S2)**
7. **Solenoid valve (S3 and S4)**
8. **Solenoid coil (4)**
9. **Coil spacer (2)**
10. **Orifice (0.035) (port C7)**
11. **Orifice (0.055) (port C8)**
12. **Orifice (0.040) (ports C1, C3 & C5)**
13. **Orifice (0.046) (ports C2, C4 & C6)**
14. **Straight fitting (6)**
15. **Straight fitting (2)**
16. **Coil nut (3)**
17. **Tall coil nut**
18. **Straight fitting (2)**
19. **Diagnostic fitting**
20. **Relief valve (RV1)**

NOTE: The ports on the lift control manifold are marked for easy identification of components. Example: S1 is the solenoid valve and P is the supply port (see Hydraulic Schematic to identify the function of the hydraulic lines and cartridge valves at each port location).

CAUTION

Before continuing further, read and become familiar with General Precautions for Removing and Installing Hydraulic System Components in this section of this chapter.

WARNING

If lift manifold is attached to machine, make sure that cutting units are fully lowered before loosening hydraulic lines or cartridge valves from lift manifold. If cutting units are raised as components are loosened in manifold, cutting units may drop unexpectedly.

IMPORTANT: A flow control orifice is located beneath many of the fittings in the lift control manifold ports. If any of the fittings is removed from the manifold, make sure to remove orifice and label its position for assembly purposes. When installing the orifice in the manifold, make sure that the orifice is flat in the base of the port. Manifold damage is possible if the orifice is cocked in the port.

NOTE: The hydraulic manifold shown uses several zero leak plugs. These plugs have a tapered sealing surface on the plug head that is designed to resist vibration induced plug loosening. The zero leak plugs also have an O−ring to provide a secondary seal. If zero leak plug removal is necessary, lightly rap the plug head using a punch and hammer before using an allen wrench to remove the plug: the impact will allow plug removal with less chance of damage to the socket head of the plug. When installing plugs into the manifold, torque plugs to the values shown.

The lift control manifold includes two (2) adjustable relief valves (RV1) and (RV2). Lift control manifold relief valve (RV1) should be set to **2000 PSI (138 Bar)**. Lift control manifold relief valve (RV2) should be set to **500 PSI (34.5 Bar)**. Adjust the relief valves to the recommended setting as necessary (see Adjustments in this chapter).

For cartridge valve service procedures, see Cartridge Valve Service in this chapter. When installing cartridge valves into the manifold, torque cartridge valves to the values shown.

Control Manifold Cartridge Valve Service

1. Make sure the control manifold is clean before removing the cartridge valve from the control manifold.

2. If cartridge valve is solenoid operated, remove nut securing solenoid coil to the cartridge valve. Carefully slide coil off the valve.

IMPORTANT: Use care when handling the cartridge valve. Slight bending or distortion of the stem tube can cause binding and malfunction. When removing cartridge valve from manifold, make sure that deep well socket fully engages the valve base.

3. Remove cartridge valve from manifold using a deep socket wrench. Record correct location for O−rings, sealing rings and back−up rings. Remove seal kit from cartridge valve and discard removed seals.

4. Visually inspect the port in the manifold for damage to the sealing surfaces, damaged threads and contamination.

5. Visually inspect cartridge valve for damaged sealing surfaces and contamination.

A. Contamination may cause valves to stick or hang up. Contamination can become lodged in small valve orifices or seal areas causing malfunction.

B. If valve sealing surfaces appear pitted or damaged, the hydraulic system may be overheating or there may be water in the system.

CAUTION

Use eye protection such as goggles when using compressed air.

6. Clean cartridge valve using clean mineral spirits. Submerge valve in clean mineral spirits to flush out contamination. Particles as fine as talcum powder can affect the operation of high pressure hydraulic valves. If cartridge design allows, use a wood or plastic probe to push the internal spool in and out 20 to 30 times to flush out contamination. Be extremely careful not to damage cartridge. Use compressed air for cleaning.

7. Install the cartridge valve into the manifold:

A. Lubricate new seal kit components with clean hydraulic oil and install on valve. The O−rings, sealing rings and back−up rings must be arranged properly on the cartridge valve for proper operation and sealing.

B. Dip assembled cartridge into clean hydraulic oil.

IMPORTANT: Use care when handling the valve cartridge. Slight bending or distortion of the stem tube can cause binding and malfunction. When installing cartridge valve into manifold, make sure that deep well socket fully engages the valve base.

C. Thread cartridge valve carefully into manifold port by hand until the top O−ring is met. The valve should go into manifold port easily without binding.

D. Torque cartridge valve using a deep socket wrench to value identified in control manifold illustration.

8. If cartridge valve is solenoid operated, carefully install solenoid coil to the cartridge valve. Secure coil to valve with nut and torque nut to **60 in−lb (6.8 N−m)**.

9. If problems still exist after assembly, remove valve and clean again or replace valve.

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Steering Control Valve

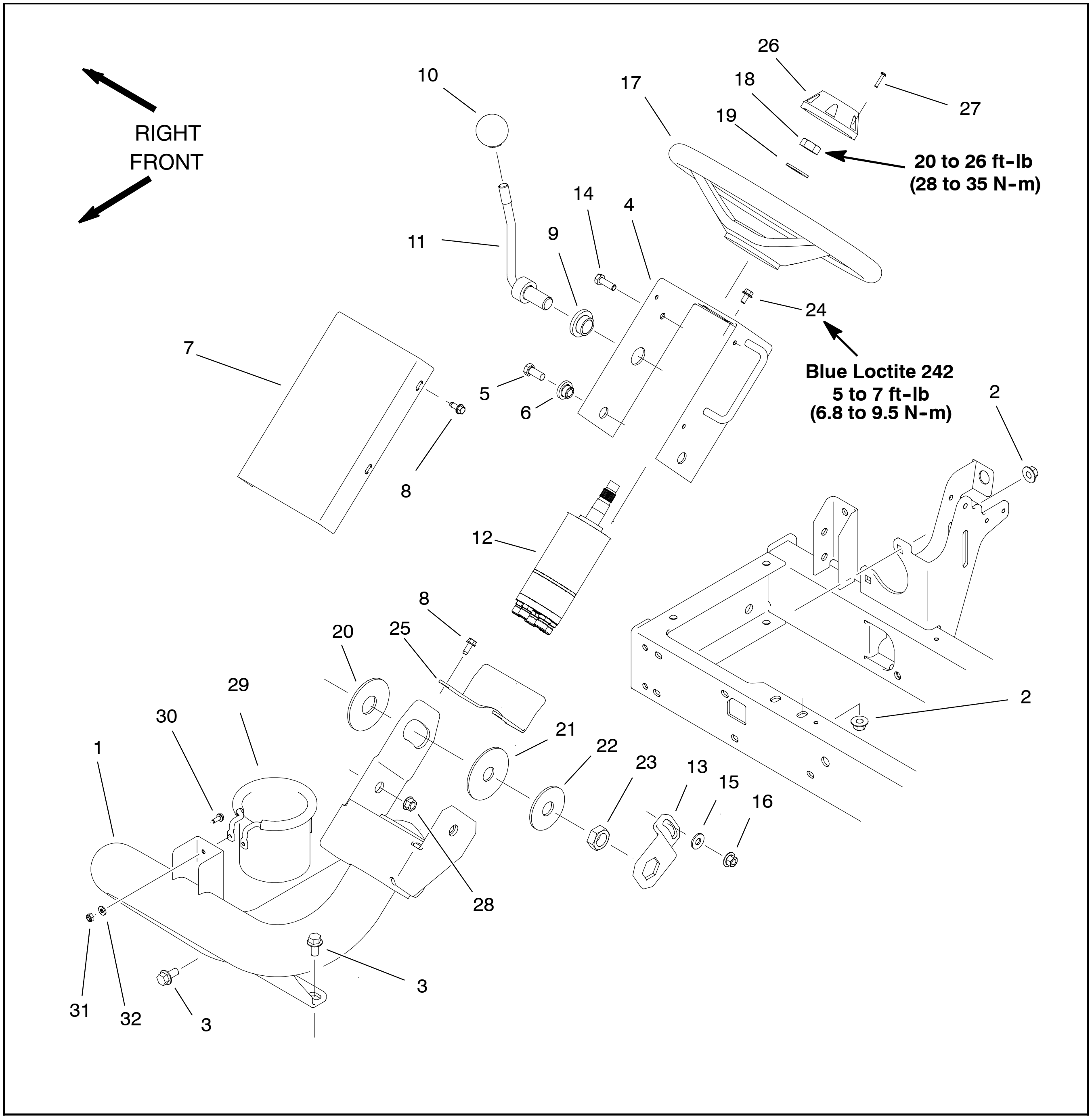

Figure 77

1. Steering arm
2. Flange nut (4)
3. Flange head screw (4)
4. Steering valve bracket
5. Cap screw (2)
6. Pivot hub (2)
7. Steering valve cover
8. Washer head screw (5)
9. Tilt steering boss
10. Ball knob
11. Steering tilt lever
12. Steering control valve
13. Tilt bracket
14. Cap screw
15. Flat washer
16. Flange nut
17. Steering wheel
18. Steering wheel nut
19. Flat washer
20. Friction disc
21. Friction disc
22. Flat washer
23. Jam nut
24. Flange head screw (4)
25. Steering shield
26. Steering wheel cap
27. Screw
28. Flange nut (2)
29. Bag holder
30. Washer head screw (2)
31. Lock nut (2)
32. Flat washer (2)

Removal (Fig. 77)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Thoroughly clean hydraulic hose ends and fittings on steering control valve to prevent hydraulic system contamination.

> **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.**

3. Label all hydraulic hoses and fittings for assembly purposes. Note port identification on steering control valve.

4. Remove steering control valve from the steering column.

Installation (Fig. 77)

1. Install steering control valve to the steering column. Use labels placed during the removal process to properly install hydraulic hoses to control valve.

2. Adjust location of steering shield so that it just contacts hydraulic hoses when the steering wheel is tilted to its lowest position.

3. Make sure hydraulic tank is full. Add correct oil if necessary.

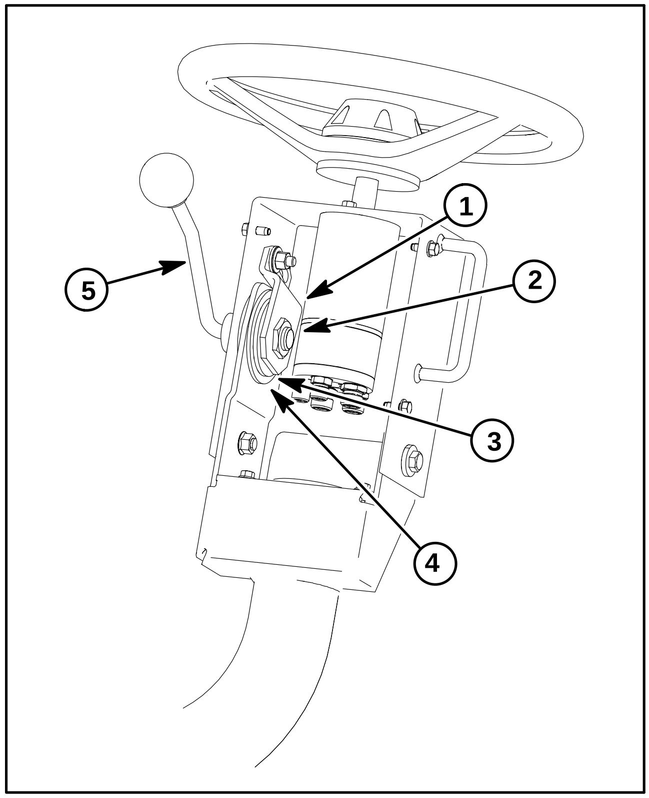

Figure 78

1. **Tilt bracket**
2. **Jam nut**
3. **Flat washer**
4. **Friction disc**
5. **Steering tilt lever**

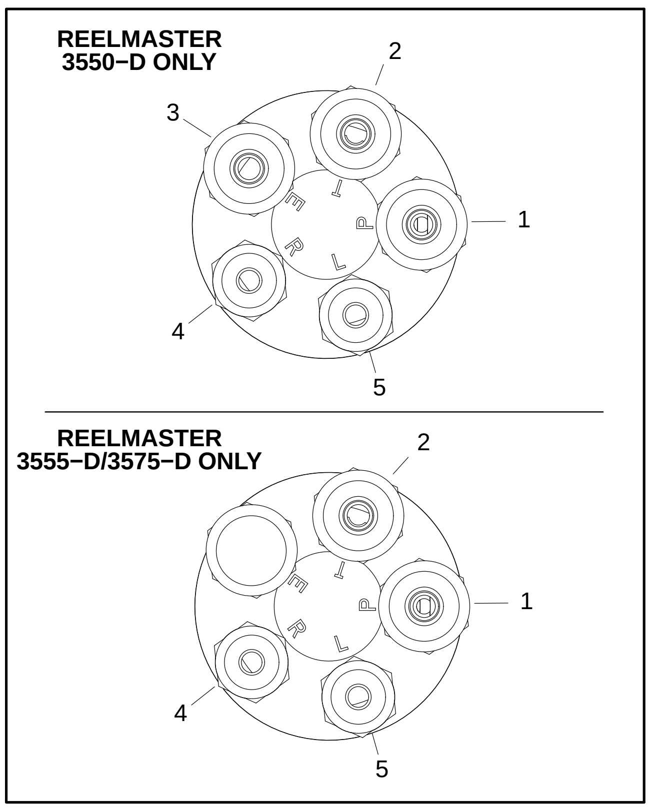

Figure 79

1. **Supply port (pressure)**
2. **Return port (tank)**
3. **Power beyond (E port) (RM 3550−D only)**
4. **To steer cylinder (left)**
5. **To steer cylinder (right)**

Hydraulic System

Steering Control Valve Service

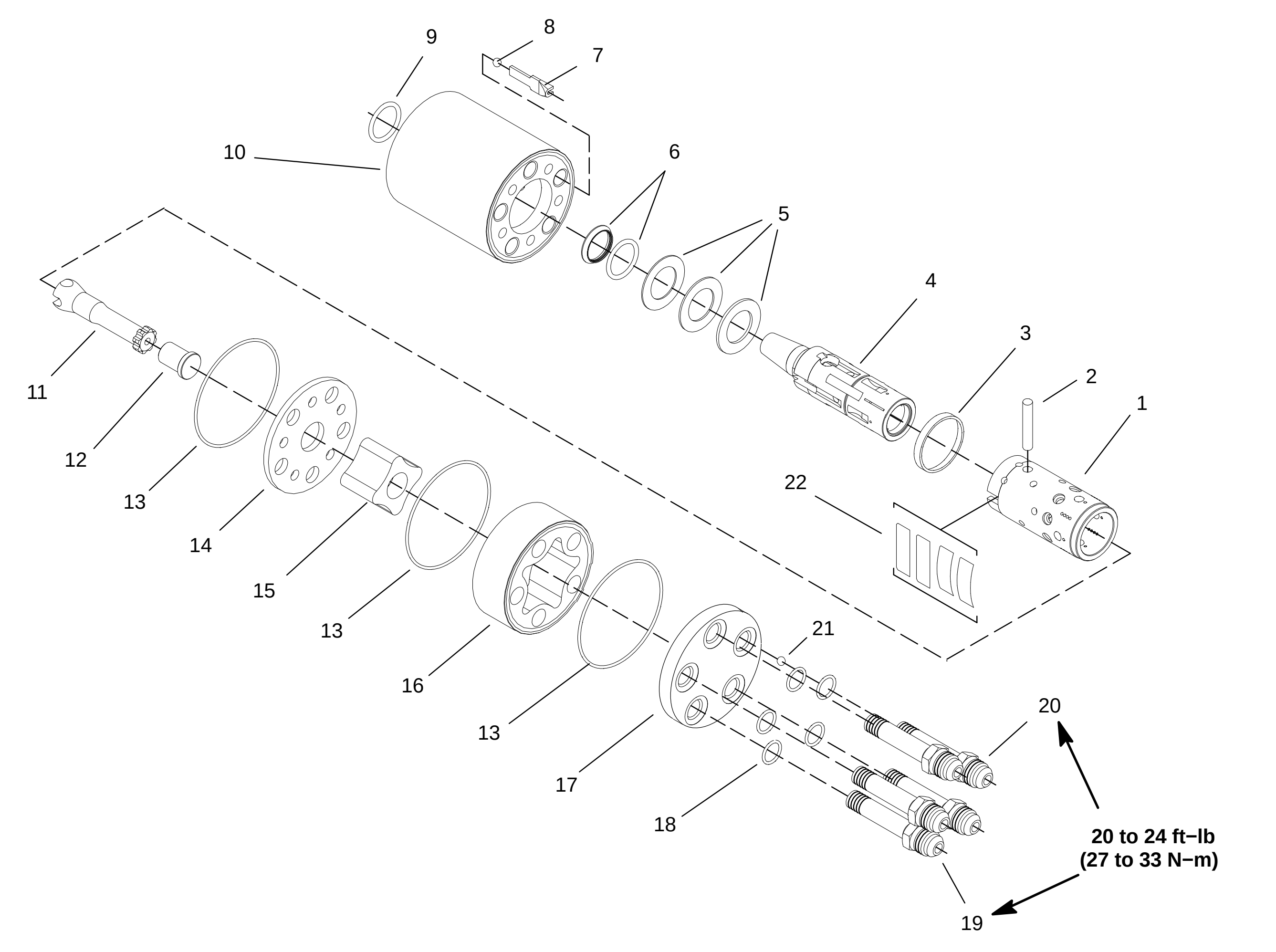

Figure 80

1. **Sleeve**
2. **Cross pin**
3. **Ring**
4. **Spool**
5. **Bearing assembly**
6. **Shaft seal**
7. **Ball stop**
8. **Ball**
9. **Dust seal ring**
10. **Housing**
11. **Cardan shaft**
12. **Spacer**
13. **O–ring**
14. **Distribution plate**
15. **Inner gearwheel**
16. **Outer gearwheel**
17. **End cover**
18. **O–ring (5 used)**
19. **Screw/fitting (ports L and R)**
20. **Screw/fitting (ports P, T and E)**
21. **P port check ball**
22. **Spring set**

NOTE: For service of the steering control valve, see the Sauer/Danfoss Steering Unit Type OSPM Service Manual at the end of this chapter.

Hydraulic System

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Steering Cylinder

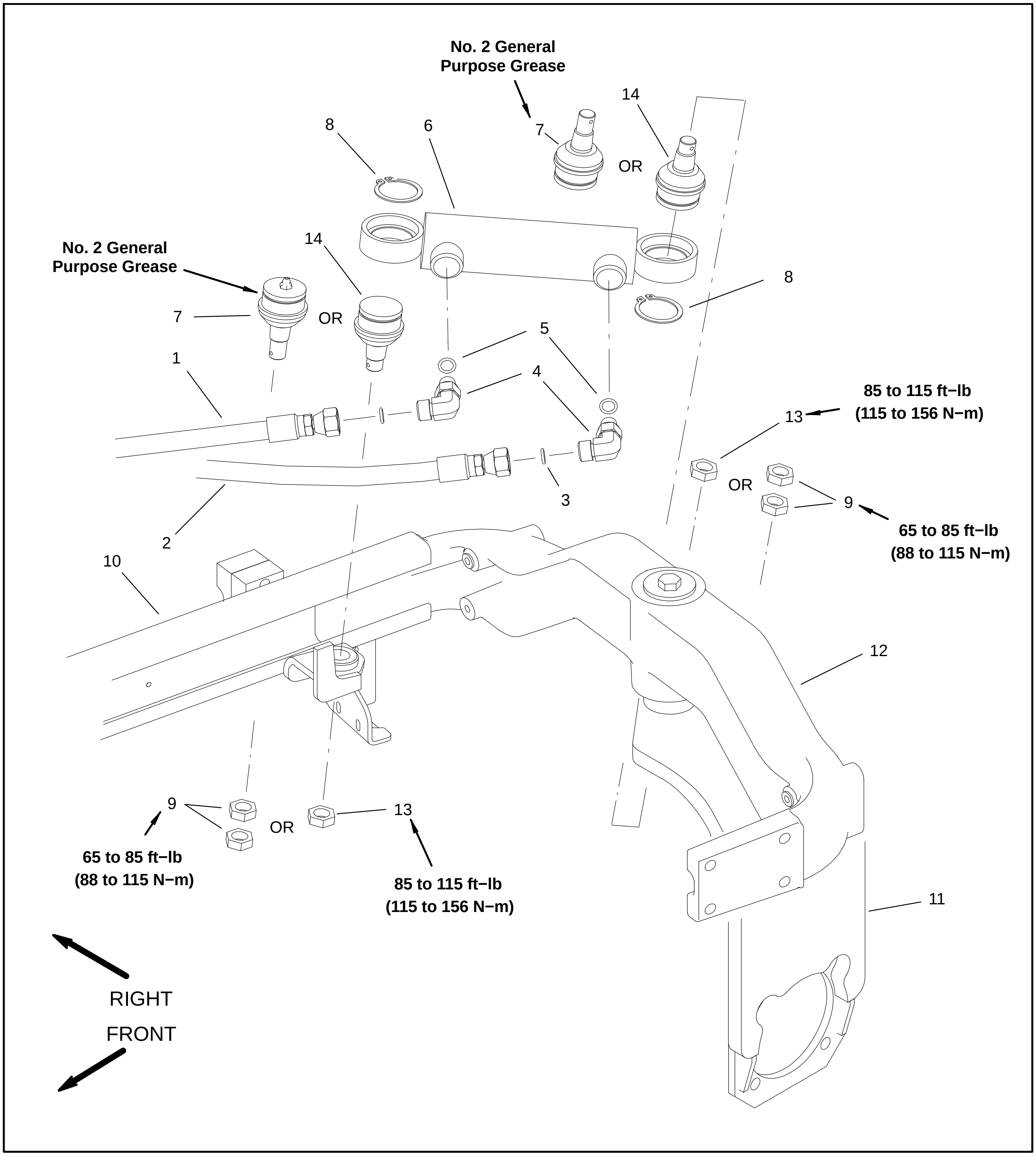

Figure 81

1. **Hydraulic hose**
2. **Hydraulic hose**
3. **O−ring (2)**
4. **Hydraulic fitting (2)**
5. **O−ring (2)**
6. **Steering cylinder**
7. **Ball joint − greasable (2)**
8. **Retaining ring**
9. **Jam nut (4)**
10. **Frame**
11. **Rear fork**
12. **Rear casting**
13. **Flextop lock nut (2)**
14. **Ball joint − non−greasable (2)**

Removal (Fig. 81)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

NOTE: The rear tire must be removed to allow sufficient clearance to remove the steering cylinder from the machine.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

2. Jack or lift rear wheel off the ground.

3. Remove rear wheel from the machine.

4. Thoroughly clean hydraulic hose ends and fittings on steering cylinder to prevent hydraulic system contamination.

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.

5. Label the hydraulic hoses to show their correct position on the steering cylinder. Remove hydraulic hoses from steering cylinder.

6. Remove the two (2) jam nuts or the flextop lock nut from both steering cylinder ball joints.

7. Use a suitable tool (pickle fork) to separate the ball joints from the machine.

8. If hydraulic fittings are to be removed from steering cylinder, mark fitting orientation to allow correct assembly. Discard O−rings from removed fittings.

9. If needed, remove ball joints from steering cylinder.

NOTE: Replace the greasable style ball joints with the non−greasable style. A replacement hydraulic cylinder will come with non−greasable ball joints installed. Use one flextop lock nut to secure non−greasable style ball joints.

Installation (Fig. 81)

1. If removed, install ball joints into steering cylinder.

2. Lubricate and place new O−rings onto removed steering cylinder fittings. Install fittings into cylinder openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in this chapter).

3. Install steering cylinder to machine. When securing cylinder ball joints to machine:

Greasable style ball joints − tighten the first jam nut from **65 to 85 ft−lb (88 to 115 N−m)**, then tighten the second jam nut to the same specification.

Non−greasable style ball joints − tighten the flextop lock nut from **85 to 115 ft−lb (115 to 156 N−m)**.

4. Remove caps and plugs from steering cylinder fittings and hoses. Using labels placed during cylinder removal, properly connect hydraulic lines to steering cylinder (see Hydraulic Hose and Tube Installation in this chapter).

5. Secure rear wheel to the machine with four (4) lug nuts. Lower machine to the ground. Torque wheel lug nuts in a crossing pattern from **45 to 65 ft−lb (61 to 88 N−m)**.

6. Make sure hydraulic tank is full. Add correct oil if necessary.

7. After assembly is completed, operate steering cylinder to verify that hydraulic hoses and fittings are not contacted by anything.

Steering Cylinder Service

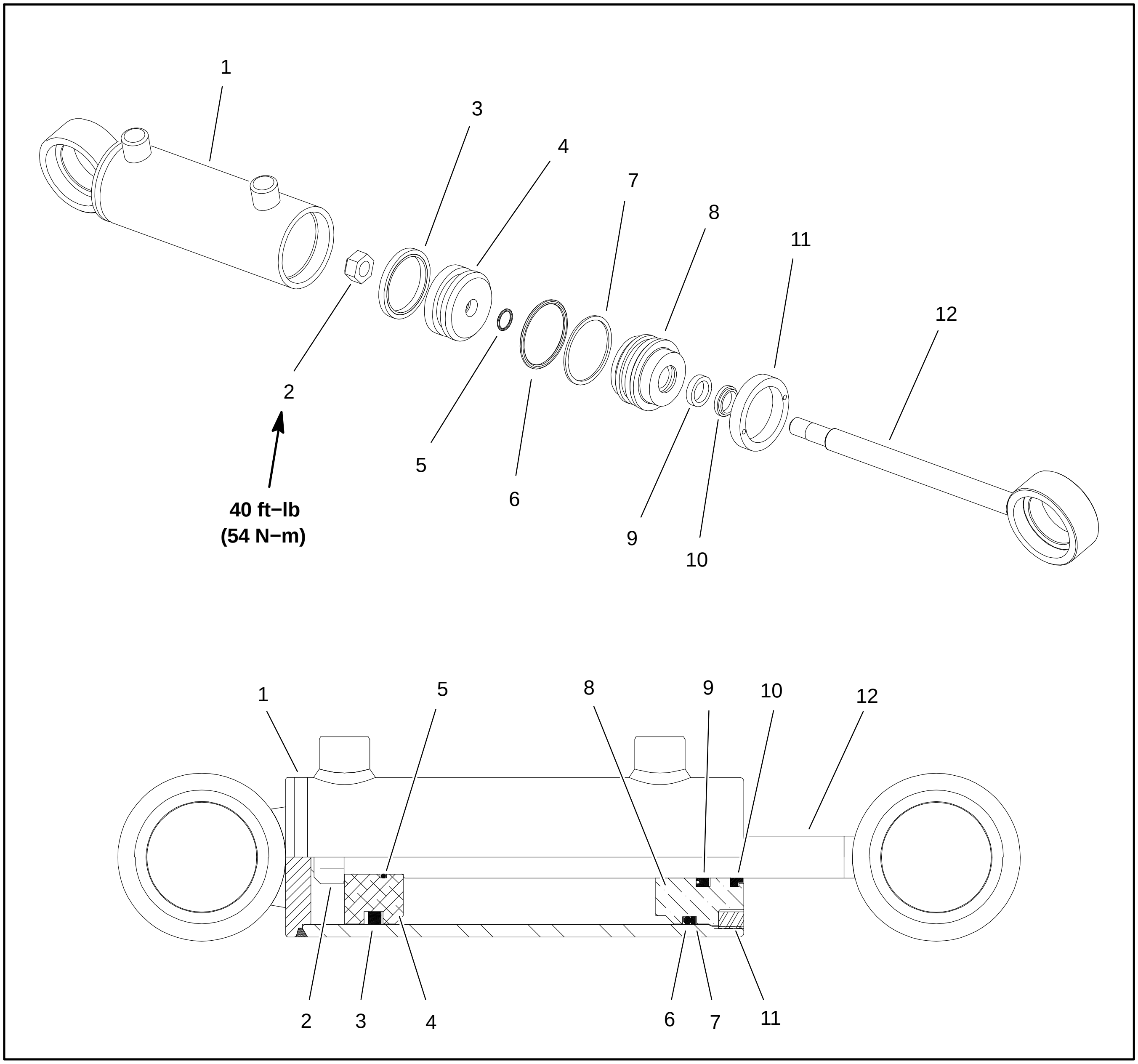

Figure 82

1. **Barrel with clevis**
2. **Lock nut**
3. **Piston seal**
4. **Piston**
5. **O−ring**
6. **O−ring**
7. **Back−up ring**
8. **Head**
9. **Head seal**
10. **Dust seal**
11. **Internal collar**
12. **Rod**

Disassembly (Fig. 82)

1. Remove oil from the steering cylinder into a drain pan by slowly pumping the cylinder rod. Plug both ports and clean the outside of the cylinder.

IMPORTANT: Prevent damage when clamping the steering cylinder into a vise; clamp on the clevis ONLY.

2. Mount barrel end of steering cylinder in a vise. Use a spanner wrench to remove internal collar from barrel.

3. Remove plugs from ports. Extract rod, head and piston assembly from barrel by carefully twisting and pulling on the rod.

IMPORTANT: Do not clamp vise jaws against the rod surface. Clamp on the clevis ONLY.

4. Mount rod securely in a vise by clamping on the clevis of the rod. Remove lock nut from the rod. Slide piston and head off the rod.

5. Remove seals, back−up rings and O−rings from the piston and head. Discard removed seals.

Assembly (Fig. 82)

1. Make sure all steering cylinder components are clean before assembly.

2. Coat new O−rings, seals and back−up ring with clean hydraulic oil.

   A. Install piston seal and O−ring to the piston.

   B. Install O−ring, back−up ring, head seal and dust seal to the head.

IMPORTANT: Do not clamp vise jaws against the rod surface. Clamp on the clevis ONLY.

3. Mount rod securely in a vise by clamping on the clevis of the rod.

   A. Place internal collar onto rod.

   B. Coat rod with a light coat of clean hydraulic oil.

   C. Carefully slide head assembly and then piston assembly onto the rod. Install lock nut onto the rod and torque nut **40 ft−lb (54 N−m)**.

   D. Remove rod assembly from the vise.

IMPORTANT: Prevent damage when clamping the steering cylinder into a vise; clamp on the barrel clevis ONLY.

4. Mount clevis of the barrel in a vise.

5. Coat all internal cylinder parts with a light coat of clean hydraulic oil. Slide piston, rod and head assembly into the barrel being careful to not damage the seals.

6. Thread the internal collar into the barrel and secure with spanner wrench.

Front Lift Cylinders

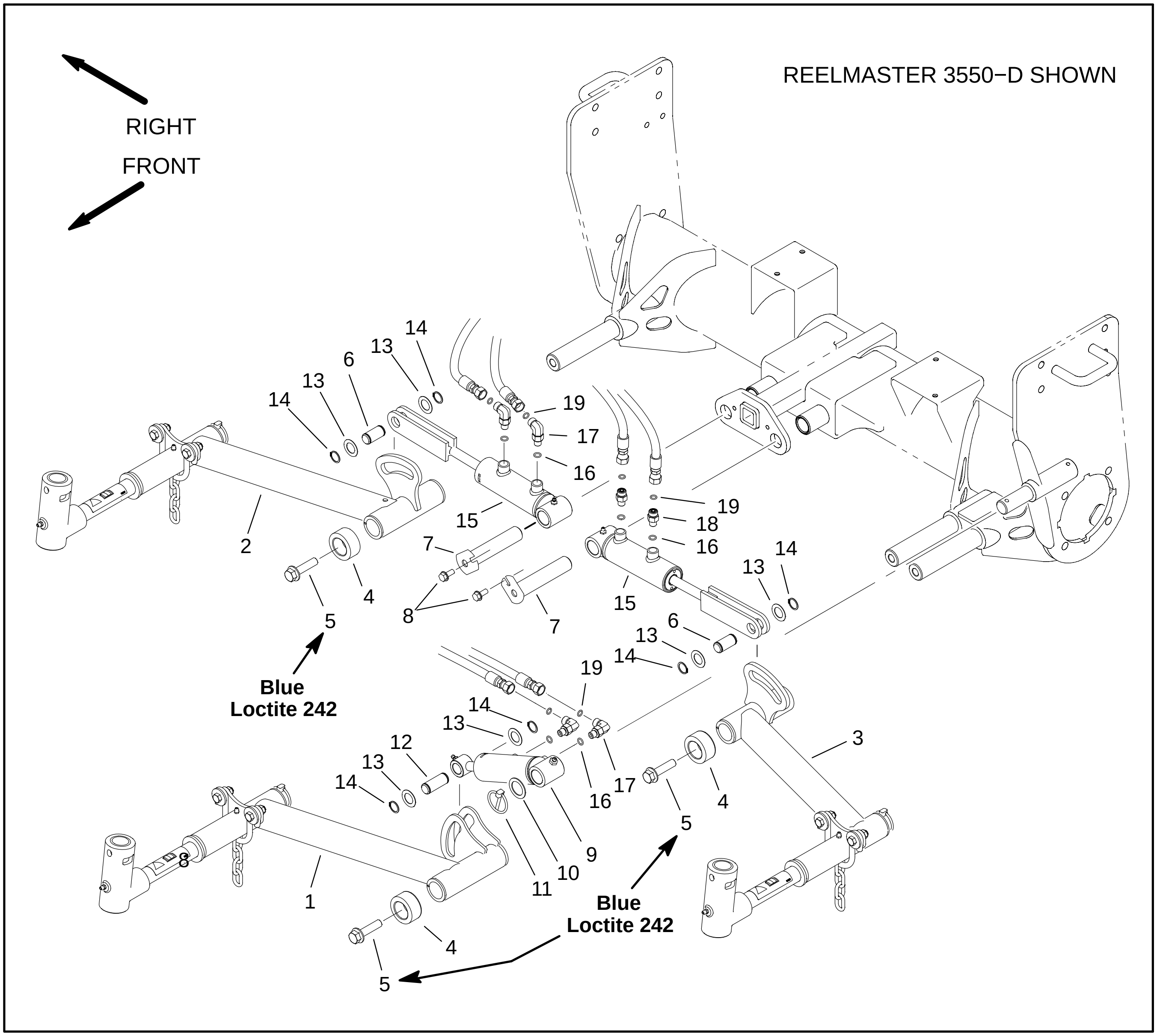

Figure 83

1. #1 lift arm
2. #5 lift arm
3. #4 lift arm
4. Recessed bumper (3)
5. Flange head screws (3)
6. Cylinder pin (2)
7. Pivot pin (2)
8. Washer head screw (2)
9. #1 Lift cylinder
10. Thrust washer
11. Lynch pin
12. Cylinder pin
13. Thrust washer (6)
14. Retaining ring (6)
15. #4 & 5 Lift cylinder (2)
16. O−ring (6)
17. Elbow fitting (4)
18. Straight fitting (2)
19. O−ring (6)

Removal (Fig. 83)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components in this chapter.

3. To prevent contamination of hydraulic system during lift cylinder removal, thoroughly clean exterior of cylinder and fittings.

WARNING

Make sure that the cutting units are fully lowered before loosening hydraulic lines from lift cylinders. If cutting units are not fully lowered as hydraulic lines are loosened, cutting units may drop unexpectedly.

NOTE: To ease installation, label the hydraulic hoses to show their correct position on the lift cylinder.

4. Disconnect hydraulic hoses from lift cylinder being removed and plug hydraulic hoses to prevent contamination.

5. Detach rod end of lift cylinder from lift arm. Remove retaining ring and flat washer from one end of the cylinder pin and slide pin from lift arm and cylinder rod end.

6. Detach barrel end of lift cylinder from frame.

Reelmaster 3550−D (Fig. 83)

For #4 & 5 lift cylinders, remove washer head screw that secures the pivot pin to the frame and slide pivot pin from frame and cylinder.

For #1 lift cylinder, remove lynch pin and thrust washer from pivot pin and slide cylinder off pin.

Reelmaster 3555−D/3575−D (Fig. 84)

Remove washer head screw and flat washer from pivot pin and slide lift cylinder from pin.

7. Remove lift cylinder from machine.

8. If hydraulic fittings are to be removed from lift cylinder, mark fitting orientation to allow correct assembly. Remove fittings from cylinder and discard O−rings.

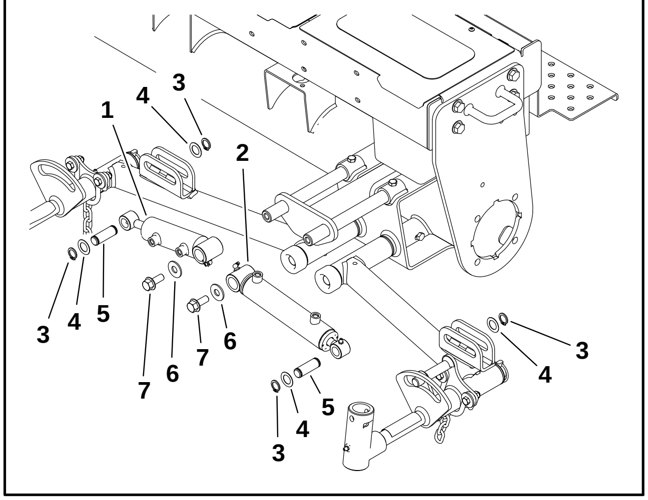

Figure 84

1. #1 lift cylinder
2. #4 & 5 lift cylinder (2)
3. Retaining ring (6)
4. Flat washer (6)
5. Pin (3)
6. Flat washer (3)
7. Washer head screw (3)

Installation (Fig. 83)

1. If fittings were removed from lift cylinder, lubricate and place new O−rings onto fittings. Install fittings into cylinder port openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in this chapter).

2. Secure barrel end of lift cylinder to frame.

Reelmaster 3550−D (Fig. 83)

A. For #1 lift cylinder, slide cylinder over pin and secure with thrust washer and lynch pin.

B. For #4 & 5 lift cylinders, slide pivot pin into frame and cylinder. Secure pivot pin to frame with washer head screw.

Reelmaster 3555−D/3575−D (Fig. 84)

Slide cylinder over pin and secure with flat washer and washer head screw.

3. Make sure that flat washer and retaining ring are installed on one end of the cylinder pin.

4. Position cylinder rod end to lift arm and insert pin through lift arm and cylinder rod end. Secure pin to lift arm with second flat washer and retaining ring.

5. Attach hydraulic hoses to lift cylinder (see Hydraulic Hose and Tube Installation in this chapter).

6. Fill reservoir with hydraulic fluid as required.

7. After installation is completed, operate lift cylinder to verify cylinder, hydraulic hose and fitting clearance.

Rear Lift Cylinders

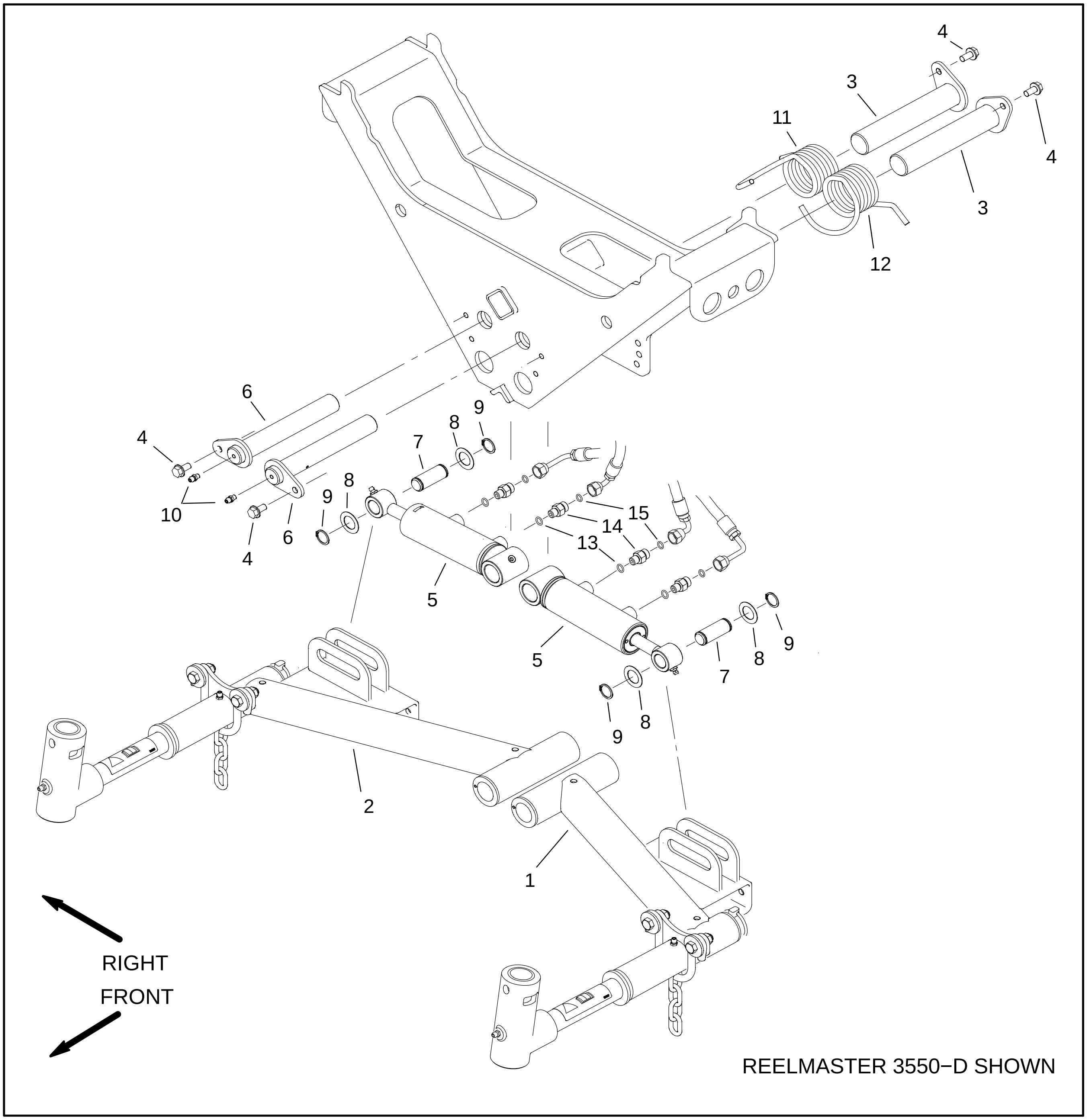

Figure 85

1. **#2 lift arm**
2. **#3 lift arm**
3. **Pin (2)**
4. **Washer head screw (4)**
5. **Rear lift cylinder (2)**
6. **Pin (2)**
7. **Cylinder pin (2)**
8. **Thrust washer (4)**
9. **Retaining ring (4)**
10. **Grease fitting (2)**
11. **RH torsion spring**
12. **LH torsion spring**
13. **O−ring (4)**
14. **Straight fitting (4)**
15. **O−ring (4)**

Removal (Fig. 85)

1. Park machine on a level surface. Lower cutting units, stop engine and engage parking brake. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components in this chapter.

3. To prevent contamination of hydraulic system during lift cylinder removal, thoroughly clean exterior of cylinder and fittings.

WARNING

Make sure that the cutting units are fully lowered before loosening hydraulic lines from lift cylinders. If cutting units are not fully lowered as hydraulic lines are loosened, cutting units may drop unexpectedly.

NOTE: To ease installation, label the hydraulic hoses to show their correct position on the lift cylinder.

4. Disconnect hydraulic hoses from lift cylinder that is to be removed.

5. Detach rod end of lift cylinder from lift arm. Remove retaining ring and flat washer from one end of the cylinder pin and slide pin from lift arm and cylinder rod end.

6. Remove washer head screw that secures the pivot pin to the frame and slide pivot pin from frame and cylinder.

7. Remove lift cylinder from machine.

8. If necessary, remove hydraulic fittings from lift cylinder and discard O−rings.

Installation (Fig. 85)

1. If fittings were removed from lift cylinder, lubricate and place new O−rings onto fittings. Install fittings into cylinder port openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in this chapter).

2. Secure barrel end of cylinder to frame and slide pivot pin into frame and cylinder. Secure pivot pin to frame with washer head screw.

3. Make sure that flat washer and retaining ring are installed on one end of the cylinder pin.

4. Position cylinder rod end to lift arm and insert pin through lift arm and cylinder rod end. Secure pin to lift arm with second flat washer and retaining ring.

5. Attach hydraulic hoses to lift cylinder (see Hydraulic Hose and Tube Installation in this chapter).

6. Fill reservoir with hydraulic fluid as required.

7. After installation is completed, operate lift cylinder to verify cylinder, hydraulic hose and fitting clearance.

Lift Cylinder Service

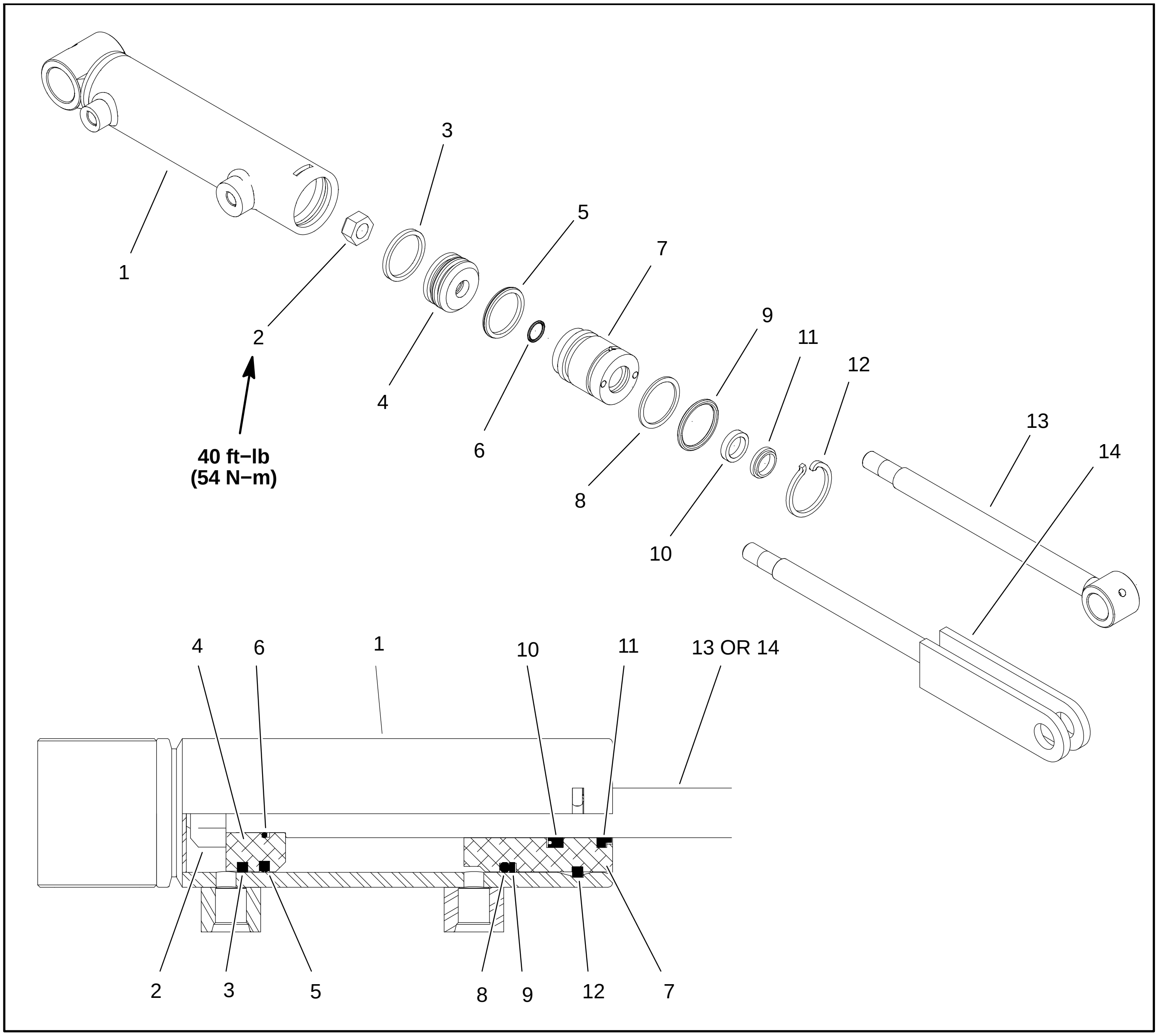

Figure 86

1. **Barrel**
2. **Lock nut**
3. **Wear ring**
4. **Piston**
5. **Seal**
6. **O−ring**
7. **Head**
8. **O−ring**
9. **Back−up ring**
10. **Seal**
11. **Dust seal**
12. **Retaining ring**
13. **Rod (cutting units #1, #2 and #3)**
14. **Rod (cutting units #4 and #5)**

Two different styles of lift cylinders as used on the Reelmaster machines. The most common style uses a thick retaining ring between the cylinder head and barrel to hold the cylinder head in place. The outer front lift cylinders (cutting units #4 and #5) of the Reelmaster 3555−D use a threaded internal collar to hold the cylinder head in place.

All of the lift cylinders used on the Reelmaster 3550−D and 3575−D are the retaining ring style. Only the front center and rear lift cylinders (cutting units #1, #2 and #3) of the Reelmaster 3555−D are the retaining ring style.

Disassembly − Retaining Ring Style (Fig. 86)

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

IMPORTANT: Prevent damage when clamping the cylinder in a vise; clamp on the clevis only.

2. Mount lift cylinder securely in a vise by clamping on the clevis end of the barrel. Use of a vise with soft jaws is recommended.

3. Loosen head from barrel:

   A. Use a spanner wrench to rotate head clockwise until the edge of the retaining ring appears in the barrel opening.

   B. Insert a screwdriver under the beveled edge of the retaining ring to start the retaining ring through the opening.

   C. Rotate the head counter−clockwise to remove retaining ring from barrel and head.

4. Remove plugs from ports. Extract rod, head and piston assembly from barrel by carefully twisting and pulling on the rod.

IMPORTANT: Do not clamp vise jaws against the rod surface. Clamp on the clevis ONLY.

5. Mount rod securely in a vise by clamping on the clevis of the rod. Remove lock nut from the rod. Slide piston and head off the rod.

6. Remove wear ring, seals, back−up ring and O−rings from the piston and head.

Assembly − Retaining Ring Style (Fig. 86)

1. Make sure all lift cylinder components are clean before assembly.

2. Coat new wear ring, O−rings, seals and back−up ring with clean hydraulic oil.

   A. Install wear ring and seal to the outside of the piston.

   B. Install O−ring to inner bore of piston.

   C. Install O−ring, back−up ring and rod seals to the cylinder head.

IMPORTANT: Do not clamp vise jaws against the rod surface. Clamp on the clevis ONLY.

3. Mount rod securely in a vise by clamping on the clevis of the rod.

   A. Coat rod with a light coat of clean hydraulic oil.

   B. Carefully slide head assembly and then piston assembly onto the rod. Install lock nut onto the rod and torque nut **40 ft−lb (54 N−m)**.

   C. Remove rod assembly from the vise.

4. Coat all internal parts with a light coat of clean hydraulic oil. Slide piston, rod and head assembly into the barrel being careful to not damage the seals.

IMPORTANT: Prevent damage when clamping the cylinder's barrel into a vise; clamp on the clevis only.

5. Mount lift cylinder in a vise with soft jaws. Secure head in barrel:

   A. Align retaining ring hole in the head with the access slot in the barrel.

   B. Insert the retaining ring hook into the hole and rotate head clockwise until the retaining ring is completely pulled into the barrel and the ring ends are covered.

   C. Apply silicone sealer to barrel access slot.

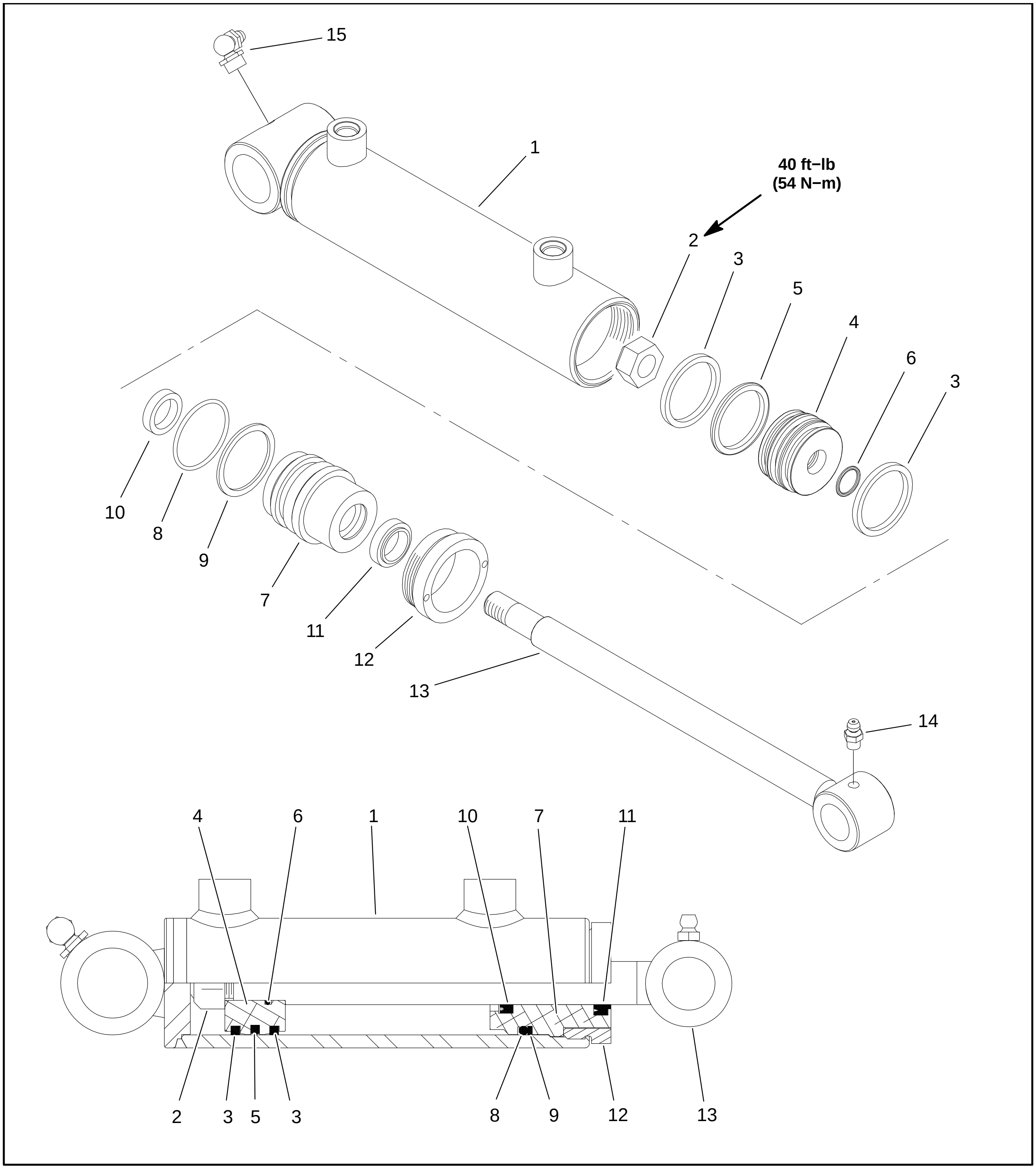

Figure 87

1. **Barrel**
2. **Lock nut**
3. **Wear ring (2)**
4. **Piston**
5. **Seal**
6. **O−ring**
7. **Head**
8. **O−ring**
9. **Back−up ring**
10. **Seal**
11. **Dust seal**
12. **Internal collar**
13. **Rod**
14. **Grease fitting**
15. **Grease fitting**

The threaded collar style lift cylinder uses a threaded internal collar to hold the cylinder head in place. A threaded collar style lift cylinder is used on the outer front lift cylinders (cutting units #4 and #5) of the Reelmaster 3555−D.

Disassembly − Threaded Collar Style (Fig. 86)

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

IMPORTANT: Prevent damage when clamping the cylinder in a vise; clamp on the clevis only.

2. Mount lift cylinder securely in a vise by clamping on the clevis end of the barrel. Use of a vise with soft jaws is recommended.

3. Use a spanner wrench to rotate internal collar counterclockwise until it is free of the cylinder barrel.

4. Remove plugs from ports. Extract rod, head and piston assembly from barrel by carefully twisting and pulling on the rod.

IMPORTANT: Do not clamp vise jaws against the rod surface. Clamp on the clevis ONLY.

5. Mount rod securely in a vise by clamping on the clevis of the rod. Remove lock nut from the rod. Slide piston and head off the rod.

6. Remove wear rings, seals, back−up ring and O−rings from the piston and head.

Assembly − Threaded Collar Style (Fig. 86)

1. Make sure all lift cylinder components are clean before assembly.

2. Coat new wear rings, O−rings, seals and back−up ring with clean hydraulic oil.

A. Install backup rings and seal to outside of piston.

B. Install O−ring to inner bore of piston.

C. Install O−ring, back−up ring and rod seals to the cylinder head.

IMPORTANT: Do not clamp vise jaws against the rod surface. Clamp on the clevis ONLY.

3. Mount rod securely in a vise by clamping on the clevis of the rod.

A. Coat rod with a light coat of clean hydraulic oil.

B. Carefully slide head assembly and then piston assembly onto the rod. Install lock nut onto the rod and torque nut **40 ft−lb (54 N−m)**.

C. Remove rod assembly from the vise.

4. Coat all internal parts with a light coat of clean hydraulic oil. Slide piston, rod and head assembly into the barrel being careful to not damage the seals.

IMPORTANT: Prevent damage when clamping the cylinder's barrel into a vise; clamp on the clevis only.

5. Mount lift cylinder securely in a vise by clamping on the clevis end of the barrel. Use of a vise with soft jaws is recommended.

6. Use a spanner wrench to rotate internal collar clockwise until it is tight against the cylinder barrel.

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TORO

Chapter 5

Electrical System

Table of Contents

Electrical System

General Information

Operator's Manual

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

Toro Electronic Controller (TEC)

The Reelmaster machines use a single Toro Electronic Controller (TEC) to manage machine electrical functions. The TEC controller is attached to the control panel.

The controller is a microprocessor that senses the condition of various machine switches (inputs) and directs electrical power to control appropriate machine functions (outputs) based on the state of the inputs. The status of inputs to the controller as well as outputs from the controller can be checked with the Diagnostic Display (see Special Tools in this chapter).

Because of the solid state circuitry built into the Toro Electronic Controller (TEC), there is no method to test it directly. The TEC may be damaged if an attempt is made to test it with an electrical test device, such as a digital multimeter.

IMPORTANT: Before performing any welding on the machine, disconnect the battery cables from the battery, disconnect the wire harness connectors from the Toro Electronic Controller and disconnect the terminal connector from the alternator to prevent damage to the machine electrical system.

CAN−bus Communications

The TEC controller used on the Reelmaster machines can communicate with other electrical components on a CAN−bus communication system. The CAN−bus system reduces the number of electrical components and connections used on the machine and allows the number of wires in the wire harness to be reduced.

CAN identifies the Controller Area Network that is used on the Reelmaster. Two (2) specially designed, twisted cables form the bus. These wires provide the data pathways between machine components. The engineering term for these two (2) cables are CAN−high and CAN−low. At the ends of the twisted pair of bus cables are 120 ohm termination resistors.

Each of the components that is controlled by the CAN−bus link only needs four (4) wires to operate and communicate to the system: CAN−high, CAN−low, B+ (power) and ground.

IMPORTANT: The termination resistors at the ends of the bus cables are required for proper electrical system operation.

Electrical Schematic

The electrical schematic and wiring diagrams for the Reelmaster machines are located in Chapter 10 − Foldout Drawings in this manual.

Special Tools

Order special tools from your Toro distributor. Some tools may also be available from a local supplier.

Multimeter

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

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.

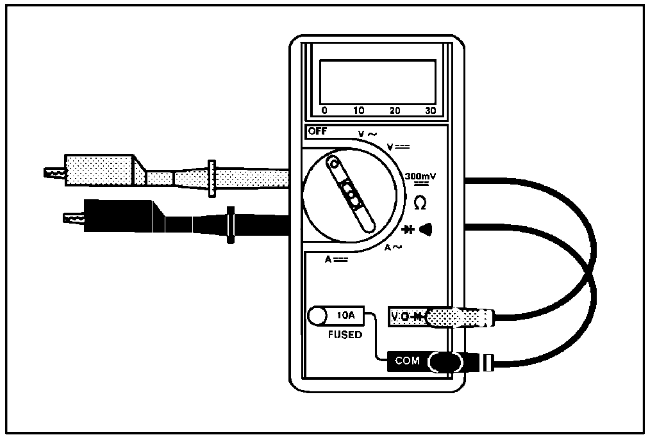

Figure 1

Dielectric Gel

Dielectric gel should be used to prevent corrosion of unsealed connection terminals. To ensure complete coating of terminals, liberally apply gel to both component and wire harness connector, plug connector to component, unplug connector, reapply gel to both surfaces and reconnect harness connector to component. Connectors should be thoroughly packed with gel for effective results.

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

Toro Part Number: **107−0342**

Figure 2

Battery Hydrometer

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

Figure 3

Terminal Protector

Aerosol spray that should be used on battery terminals, ring terminals, and fork terminals to reduce corrosion problems. Apply battery terminal protector to the connection after the battery cable, ring terminal, or fork terminal has been secured.

Toro Part Number: **107−0392**

Figure 4

Diagnostic Display

The Diagnostic Display (Fig. 5) can be connected to the wiring harness connector located under the control panel to verify correct electrical functions of the machine. Toro Electronic Controllers (TEC) inputs and outputs can be checked using the Diagnostic Display.

Diagnostic Display: Part No. **85−4750**

RM 3550−D/3555−D/3575−D Overlay (English):
Part No. **133−4914**

IMPORTANT: The Diagnostic Display must not be left connected to the machine. It is not designed to withstand the environment of the machine's every day use. When use of Diagnostic Display is completed, disconnect it from the machine and reconnect loop−back connector to harness connector. Machine will not operate without loop−back connector installed on harness. Store Diagnostic Display in a dry, secure, indoor location and not on machine.

Figure 5

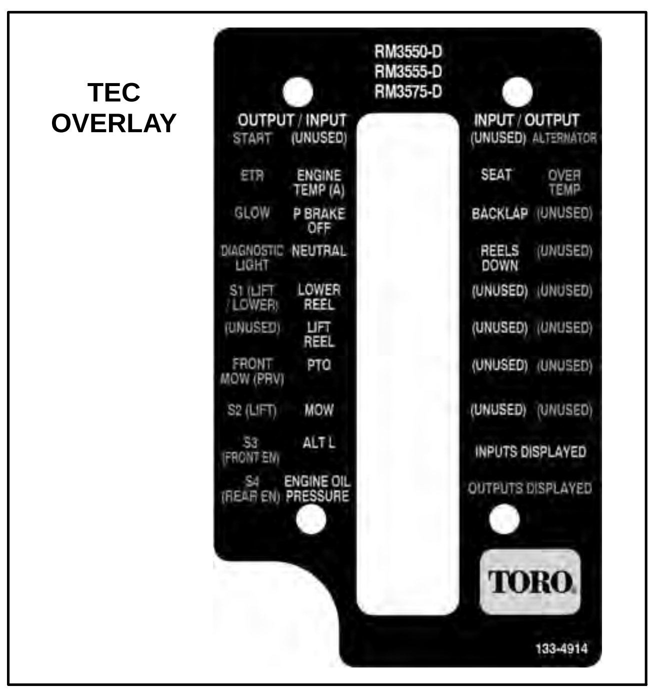

Figure 6

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, there must be a good understanding of the electrical circuits and components used on this machine (see Chapter 10 − Foldout Drawings in this manual).

If the machine has any interlock switches by−passed, reconnect the switches for proper safety and troubleshooting.

NOTE: Use the Diagnostic Display (see Special Tools in this chapter) to test Electronic Control Module inputs and outputs when troubleshooting an electrical problem on your Reelmaster.

Diagnostic Light

Reelmaster machines are equipped with a diagnostic light that indicates if the machine electrical system is functioning correctly. The diagnostic light is located on the control panel (Fig. 7).

When the ignition switch is moved to the RUN position and the machine electrical system is functioning properly, the diagnostic light will be illuminated for approximately three (3) seconds and then will turn off. The light should remain off during normal machine operation.

If the machine TEC controller detects an electrical system malfunction (fault) during machine operation, the diagnostic light will flash rapidly. The light will stop flashing and will automatically reset when the ignition switch is turned to the OFF position. The fault, however, will be retained in controller memory and can be retrieved at a future time (see Retrieving Fault Codes below).

If the diagnostic light does not illuminate when the ignition switch is turned to the RUN position, possible causes are:

D The loopback connector located below the control panel is not connected to the wire harness (Fig. 8).

D The diagnostic light (or circuit wiring) is faulty.

D TEC controller fuses are faulty (see Fuses in this chapter).

D The TEC controller is faulty.

Test electrical connections, controller fuses and the diagnostic light to determine malfunction. Make sure that the loopback connector is secured to the wire harness connector.

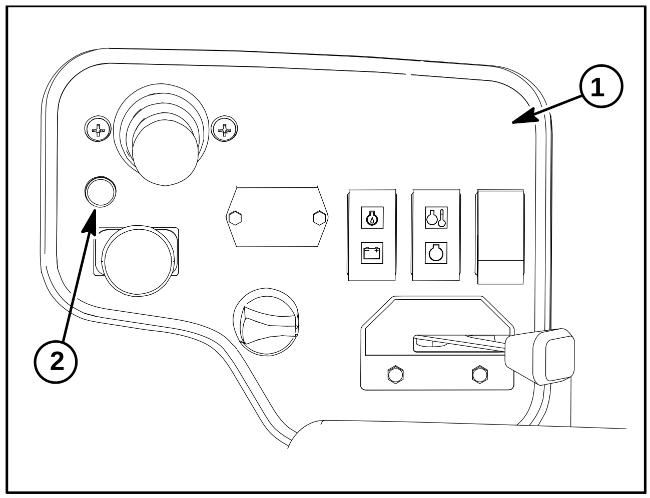

Figure 7

1. **Control panel**
2. **Diagnostic light**

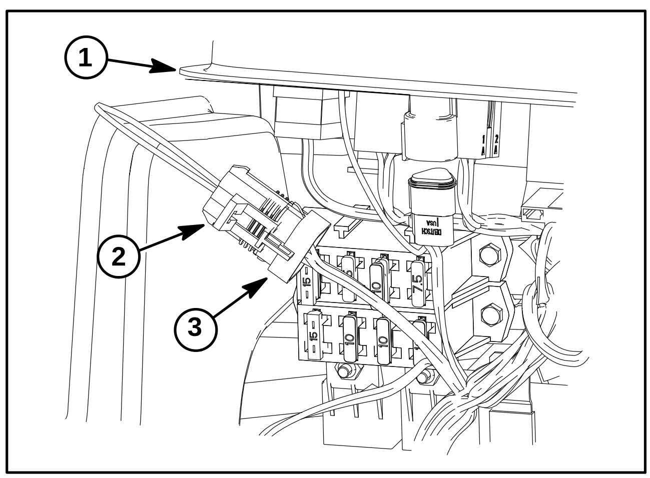

Figure 8

1. **Control panel**
2. **Loopback connector**
3. **Harness connector**

Retrieving Fault Codes

All machine fault codes are retained in the TEC controller memory. The three (3) most recent fault codes that have occurred within the last forty (40) hours of operation can be retrieved using the diagnostic light. To retrieve these fault codes from the controller memory, perform the following switch sequence:

1. Operator seat should be UNOCCUPIED, the traction pedal should be in neutral, the mow/transport slide should be placed in the transport position and the machine should not be in backlap position.

2. Move and hold joystick in the RAISE position.

3. Turn ignition switch to the RUN position.

4. Monitor the diagnostic light for fault code(s).

NOTE: Once the diagnostic light begins to display fault codes, the joystick can be released.

Fault codes are listed in the chart below. There will be a one (1) second pause between the first and second digit of a code. Up to three (3) fault codes retained in controller memory will be displayed by the diagnostic light in order from the most recent fault to the oldest fault. If there are multiple faults in controller memory, there will be a three (3) second pause between codes. The fault codes will continually repeat after a five (5) second pause until the ignition key is turned off.

If there are no faults that have occurred within the last forty (40) hours of operation, the diagnostic light will flash continuously after performing the above switch sequence.

If a fault code is not retrieved from the controller memory within forty (40) hours of machine operating time, the fault cannot be retrieved from controller memory using this procedure. If necessary, contact your Toro distributor to retrieve older fault codes.

Fault Code (Lamp Flashes)	Fault Description
1 − 3	Controller master board is faulty
1 − 5	Circuit current to high temperature warning light is excessive
1 − 6	High engine temp warning occurred (PTO was shutdown by controller)
1 − 7	High engine temp shutdown occurred (engine was shutdown by controller)
1 − 8	Low engine oil pressure occurred
1 − 9	Engine alternator fault occurred
2 − 1	Excessive charging voltage was detected by controller (check charging system)
2 − 2	Low charging voltage was detected by controller (check charging system)
2 − 3	Upper fuse 2 (7.5 amp) is faulty
2 − 4	Upper fuse 3 (7.5 amp) is faulty
2 − 5	Upper fuse 4 (7.5 amp) is faulty
2 − 6	Main power relay fault occurred (check main power relay)
3 − 1	Circuit current to start relay is excessive (check start relay circuit)
3 − 3	Circuit current to fuel stop solenoid is excessive (check solenoid circuit)
3 − 5	Circuit current to glow plug relay is excessive (check glow plug circuit)
4 − 1	Circuit current to energize the lift/lower S1 solenoid is excessive
5 − 1	Circuit current to energize the PRV solenoid (mow) is excessive
5 − 3	Circuit current to energize the lift/lower S2 solenoid is excessive
5 − 5	Circuit current to energize the lift/lower S3 solenoid is excessive
5 − 7	Circuit current to energize the lift/lower S4 solenoid is excessive

Table 1: Diagnostic Fault Codes

Clearing Fault Codes

After fault codes have been retrieved, clearing of those faults can be completed using the following switch sequence:

1. Place machine switches in fault retrieval (see Retrieving Fault Codes in this chapter). The diagnostic light should be displaying the fault codes.

2. Operator seat should remain UNOCCUPIED.

3. Move mow/backlap lever on the hydraulic mow control manifold to the BACKLAP position.

4. Move joystick to the RAISE position.

5. Monitor the diagnostic light for continuous flashing indicating that all faults have been cleared from the controller memory.

Diagnostic Display

Reelmaster machines are equipped with a Toro Electronic Controller (TEC) which controls machine electrical functions. The controller monitors various input switches (e.g. ignition switch, seat switch, neutral switch) and energizes outputs to actuate solenoids or relays for the requested machine function.

For the TEC to control the machine as desired, each of the inputs (switches and sensors) and outputs (solenoids and relays) must be connected and functioning properly.

The Diagnostic Display (see Special Tools in this chapter) is a tool to help the technician verify correct electrical functions of the machine.

IMPORTANT: The Diagnostic Display must not be left connected to the machine. It is not designed to withstand the environment of the machine's every day use. When use of the Diagnostic Display is completed, disconnect it from the machine and reconnect loop−back connector to harness connector. The machine will not operate without the loop−back connector installed on the harness. Store the Diagnostic Display in a dry, secure, indoor location and not on machine.

CAUTION

The interlock switches are for the protection of the operator and bystanders and to ensure correct operation of the machine. Do not bypass or disconnect switches. Check the operation of the interlock switches daily for proper operation. Replace any malfunctioning switches before operating the machine.

Verify Diagnostic Display Input Functions

1. Park machine on a level surface, lower the cutting units, stop the engine and apply the parking brake.

2. Remove cover from control panel to allow access to wire harness loop−back connector. Locate wire harness and loop−back connector (Fig. 9). Carefully unplug loop−back connector from wire harness connector.

3. Connect the Diagnostic Display connector to the wire harness connector. Make sure correct overlay decal is positioned on the Diagnostic Display (Fig. 10).

NOTE: When the ignition switch is in the OFF position, all Diagnostic Display LED's should be OFF.

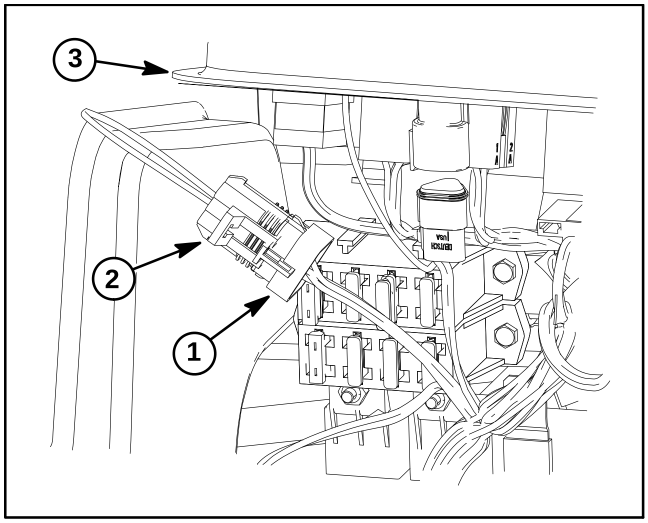

Figure 9

1. **Wire harness connector**
2. **Loop−back connector**
3. **Control panel**

TEC OVERLAY

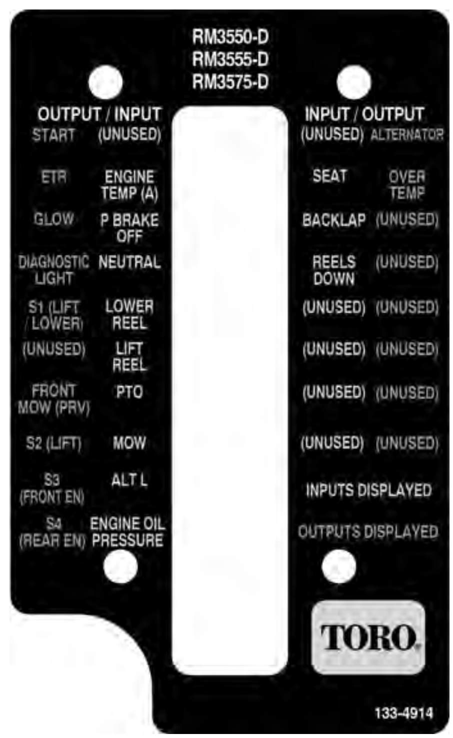

Figure 10

4. Turn the ignition switch to the ON position, but do not start machine.

NOTE: The **red** text on the Diagnostic Display overlay decal refers to TEC inputs and the **green** text refers to TEC outputs.

5. The "inputs displayed" LED, on lower right column of the Diagnostic Display, should be illuminated. If "outputs displayed" LED is illuminated, press the toggle button on the Diagnostic Display to change to "inputs displayed" LED.

6. The Diagnostic Display will illuminate the LED associated with each of the inputs when that input switch is closed. Individually, change each of the switches from open to closed (i.e., sit on seat, press traction pedal, etc.), and note that the appropriate LED on the Diagnostic Display will illuminate when the corresponding switch is closed. Repeat on each switch that is possible to be changed by hand (see Table 2: Diagnostic Display Inputs).

NOTE: When the Diagnostic Display is attached to the wire harness connector and the ignition switch is in the ON position, the input LED for alternator, engine temp and engine oil pressure should be illuminated. To test these inputs, disconnect the wire harness connector from the specific sensor and the appropriate LED should go off after a few second delay. When the harness connector is reattached to the sensor, the input LED should again illuminate after a few seconds.

7. If appropriate LED does not toggle on and off when switch state is changed, check all wiring and connections to that switch and/or test switch (see Component Testing in this chapter). Replace any defective switches and repair any damaged wiring.

8. After input functions testing is complete, disconnect the Diagnostic Display connector from the wire harness connector and plug loop−back connector into wire harness. Install cover onto control panel.

Diagnostic Display Inputs	Diagnostic Display LED Operation
ENGINE TEMP (A)	Engine coolant temperature high, sensor and circuit wiring OK: LED ON Coolant temperature low, sensor or circuit wiring faulty: LED OFF
P BRAKE OFF	Parking brake disengaged: LED ON Parking brake engaged: LED OFF
NEUTRAL	Traction pedal in neutral: LED ON Traction pedal in forward or reverse: LED OFF
LOWER REEL	Lower/raise control lever in LOWER position: LED ON Lower/raise control lever NOT in LOWER position: LED OFF
RAISE REEL	Lower/raise control lever in RAISE position: LED ON Lower/raise control lever NOT in RAISE position: LED OFF
PTO	Enable/disable switch in ON position (pulled out): LED ON Enable/disable switch in OFF position (pushed in): LED OFF
MOW	Mow/transport slide in the MOW position: LED ON Mow/transport slide in the TRANSPORT position: LED OFF
ALT. L	Engine not running OR alternator faulty: LED ON Alternator OK: LED OFF
ENGINE OIL PRESSURE	Engine not running OR low engine oil pressure: LED ON Engine oil pressure OK: LED OFF
SEAT	Operator seat occupied: LED ON Operator seat empty: LED OFF
BACKLAP	Cutting reels in backlap position: LED ON Cutting reels NOT in backlap position: LED OFF
TURN AROUND SWITCH (RM 3555−D/3575−D)	Lift arms at/or below turn around position: LED ON Lift arms above turn around position: LED OFF

Table 2: Diagnostic Display Inputs

Verify Diagnostic Display Output Functions

The Diagnostic Display also has the ability to detect which outputs (solenoids, relays and indicator lights) are energized by the TEC controller. This is a quick way to determine if a machine malfunction is electrical or hydraulic.

NOTE: An open output (e.g. an unplugged connector or a broken wire) cannot be detected with the Diagnostic Display. The diagnostic display confirms the signal is being sent from the TEC controller, not that the solenoid, relay or indicator light is receiving the signal.

1. Park machine on a level surface, lower the cutting units, stop the engine and engage the parking brake.

2. Remove cover from control panel to allow access to wire harness loop−back connector. Locate wire harness and loop−back connector (Fig. 11). Carefully unplug loop−back connector from wire harness connector.

3. Connect the Diagnostic Display connector to the wire harness connector. Make sure correct overlay decal is positioned on the Diagnostic Display (Fig. 12).

NOTE: The red text on the Diagnostic Display overlay decal refers to TEC inputs and the green text refers to TEC outputs.

4. The "outputs displayed" LED, on lower right column of the Diagnostic Display, should be illuminated. If "inputs displayed" LED is illuminated, press the toggle button on the Diagnostic Display to change the LED to "outputs displayed".

NOTE: It may be necessary to toggle between "inputs displayed" and "outputs displayed" several times to perform the following step. To change from inputs to outputs, press toggle button once. This may be done as often as required. **Do not press and hold toggle button.**

5. Attempt to operate the desired function of the machine. Use the following information to position the necessary input(s) and illuminate the desired output LED indicating that the TEC controller is energizing that function.

CAUTION

Keep away from cutting units during test to prevent personal injury from the cutting blades.

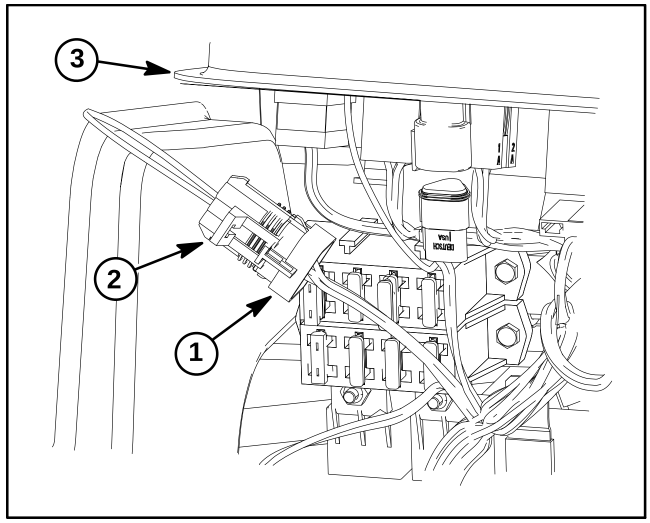

Figure 11

1. **Wire harness connector**
2. **Loop−back connector**
3. **Control panel**

TEC OVERLAY

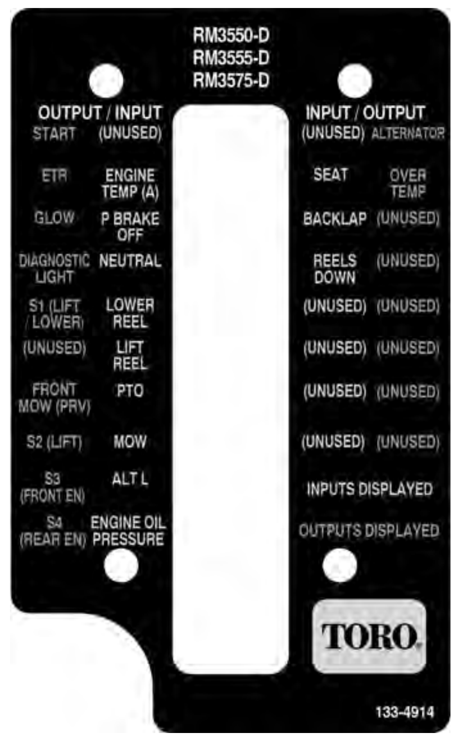

Figure 12

Output No.	Output Name	Input Conditions Required to Illuminate Output LED
1	START	Key Switch − START Traction Pedal − NEUTRAL Seat Switch − OCCUPIED or Parking Brake − ENGAGED Reel Enable/Disable Switch − DISABLE Joystick − NEUTRAL
2	ETR	Key Switch − RUN or START Seat Switch − OCCUPIED Parking Brake − ENGAGED and Traction Pedal − NEUTRAL Engine Coolant Temperature − BELOW 240°F (116°C)
3	GLOW	Key Switch − RUN or START LED illuminates for 6 seconds when key switch is in RUN position. LED illuminates when key switch is in START position.
4	DIAGNOSTIC LIGHT	Key Switch − RUN LED illuminates for 3 seconds when key switch is in RUN position.
5	SV1 (LIFT/ LOWER)	Engine − RUNNING Mow/Transport Switch − MOW Reel Enable/Disable Switch − DISABLE Seat Switch − OCCUPIED Joystick − LOWER or RAISE
6	(unused)	Not used for this product
7	FRONT MOW (PRV)	Engine − RUNNING Engine Coolant Temperature − BELOW 220°F (105°C) Mow/Transport Switch − MOW Reel Enable/Disable Switch − ENABLE Seat Switch − OCCUPIED Cutting Units − FULLY LOWERED (RM 3550−D) or LOWERED BELOW TURN AROUND POSITION (RM 3555−D/3575−D)
8	SV2 (LIFT)	Engine − RUNNING Mow/Transport Switch − MOW Reel Enable/Disable Switch − DISABLE Seat Switch − OCCUPIED Joystick − RAISE Backlap Switch − MOW
9	SV3 (FRONT EN)	Engine − RUNNING Mow/Transport Switch − MOW Reel Enable/Disable Switch − DISABLE Seat Switch − OCCUPIED Joystick − LOWER or RAISE
10	SV4 (REAR EN)	Engine − RUNNING Mow/Transport Switch − MOW Reel Enable/Disable Switch − DISABLE Seat Switch − OCCUPIED Joystick − LOWER or RAISE
11	ALTERNATOR	Key Switch − RUN
12	OVER TEMP	Key Switch − RUN

Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs

6. The automatic cutting unit Lower Sequence or Raise Sequence (programed into the TEC controller) energizes and de−energizes outputs 5 thru 10 in a predetermined order. Operation of the program sequence can be checked using the diagnostic display by meeting the input conditions required for these outputs, setting the reel enable/disable switch to the ENABLE position, and momentarily moving the joystick to RAISE or LOWER. The output LEDs will illuminate during the sequence and extinguish when the sequence is completed, with one exception. The LED for output 7 (Front Mow (SP)) will remain illuminated after the Lower Sequence has completed.

7. If the output LED illuminates as specified, but the machine does not function properly, suspect a failed electrical component, an open condition in the tested circuit or a non-electrical problem (e.g. hydraulic component problem). Repair as necessary.

8. If each input is in the correct position and functioning correctly, and the output LED is not illuminating, a TEC controller problem may exist. If this occurs, contact your Toro Distributor for assistance.

9. After output functions testing is complete, disconnect the Diagnostic Display connector from the wire harness connector and plug loop−back connector into wire harness. Install cover onto control panel.

Output Name	Diagnostic Display LED Operation
START	Start Relay energized: LED ON Start Relay de−energized: LED OFF
ETR	Fuel Pump and Fuel Stop solenoid (HOLD) energized: LED ON Fuel Pump and Fuel Stop solenoid (HOLD) de−energized: LED OFF
GLOW	Glow Relay, Glow Plugs, and Glow Plug Indicator Light energized: LED ON Glow Relay, Glow Plugs, and Glow Plug Indicator Light de−energized: LED OFF
DIAGNOSTIC LIGHT	Diagnostic Light energized: LED ON Diagnostic Light de−energized: LED OFF
SV1 (LIFT/LOWER)	Solenoid S1 energized: LED ON Solenoid S1 de−energized: LED OFF
REAR MOW (SV)	Not used for this product
FRONT MOW (SP)	Proportional Relief Valve (PRV) energized: LED ON Proportional Relief Valve (PRV) de−energized: LED OFF
SV2 (LIFT)	Solenoid S2 energized: LED ON Solenoid S2 de−energized: LED OFF
SV3 (FRONT EN)	Solenoid S3 energized: LED ON Solenoid S3 de−energized: LED OFF
SV4 (REAR EN)	Solenoid S4 energized: LED ON Solenoid S4 de−energized: LED OFF
ALTERNATOR	Charge Indicator Light energized: LED ON Charge Indicator Light de−energized: LED OFF
OVER TEMP	High Temperature Warning Light energized: LED ON High Temperature Warning Light de−energized: LED OFF

Table 4: Diagnostic Display Outputs

Starting Problems

Problem	Possible Causes
Nothing happens when start attempt is made. **NOTE:** If high engine coolant temperature (above 240°F (116°C)) causes the engine to stop, the engine can be restarted for ten (10) seconds to allow the machine to be moved. After ten seconds in this condition, the engine will again shutdown.	The traction pedal is not in the neutral position. The traction neutral sensor is out of adjustment or is faulty. The parking brake is disengaged and the operator seat is unoccupied. The reel enable/disable switch is in the ENABLE (up) position or is faulty. The engine coolant temperature is excessive or the engine high temperature shutdown switch is faulty. The battery is discharged or is faulty. The battery cables are loose or corroded. The ground connection is loose or corroded. Fuse(s) is (are) faulty. The fusible link harness at the engine starter motor is faulty. Wiring in the engine crank circuit is loose, corroded or damaged (see electrical schematic in Chapter 10 − Foldout Drawings in this manual). The ignition switch is faulty. Wiring at the starter solenoid is loose, corroded or damaged. Main power relay or circuit wiring is faulty. The starter solenoid is faulty. The TEC controller is faulty.
Starter solenoid clicks, but starter will not crank. **NOTE:** If the starter solenoid clicks, the problem is not in the interlock system.	The battery is discharged or is faulty. The battery cables are loose or corroded. The ground connection is loose or corroded. The wiring at the starter is faulty. The starter solenoid is faulty. The starter motor is faulty.

Starting Problems (continued)

Problem	Possible Causes
The engine cranks, but does not start.	The fuel tank is empty. Wiring in the engine crank circuit is loose, corroded or damaged (see electrical schematic in Chapter 10 − Foldout Drawings in this manual). The fuel filter is plugged. The engine and/or fuel may be too cold. The fusible link to the engine run solenoid pull coil is faulty. The engine run solenoid or circuit wiring is faulty. The engine fuel pump or circuit wiring is faulty. The engine glow plug circuit does not operate properly (see below). The engine or fuel system is malfunctioning (see Chapter 3 − Kubota Diesel Engine).
The engine glow plug circuit does not operate properly.	Wiring in the engine glow circuit is loose, corroded or damaged (see electrical schematic in Chapter 10 − Foldout Drawings in this manual). One (or more) of the engine glow plugs is faulty. Fuse(s) is (are) faulty. The fusible link harness at the engine starter motor is faulty. The glow relay is faulty. The TEC Controller is faulty.
The engine cranks (but should not):	
with the traction pedal in FORWARD or REVERSE.	The neutral switch is out of adjustment or faulty. The neutral switch circuit wiring is faulty.
with the operator's seat UNOCCUPIED and the parking brake DISENGAGED.	The seat switch or seat switch circuit wiring is faulty. The brake switch is out of adjustment or faulty. The brake switch circuit wiring is faulty.
with the reel enable/disable switch in the ENABLE (up) position.	The reel enable/disable switch or reel enable/disable switch circuit wiring is faulty.
with the joystick in the RAISE or LOWER position.	The joystick raise or lower switch is faulty. The joystick raise or lower switch circuit wiring is faulty. The TEC Controller is faulty.
The engine starts, but stops when the ignition switch is released from the START position.	The engine fuel stop solenoid hold coil circuit wiring is faulty. The ignition switch is faulty.

General Run and Transport Problems

Problem	Possible Causes
Engine stops during operation (operator sitting on seat).	Operator not in center of seat (seat switch is not depressed). Fuel tank is empty. Machine is being operated on a slope with a low fuel level. The parking brake was engaged or the parking brake sensor is faulty. Fuse(s) is (are) faulty (other electrical components most likely affected as well). The engine temperature is high (above 240^{o}F / 115^{o}C). Engine temperature sender or circuit wiring is faulty. The seat switch is faulty. The engine run solenoid or fuel pump failed. Wiring in the run circuit is faulty or disconnected (see electrical schematic in Chapter 10 − Foldout Drawings).
Engine stops when the traction pedal is moved to the FORWARD or REVERSE position with the operator in the seat.	Operator is sitting too far forward on the seat (seat switch not depressed). Seat switch is faulty. Seat switch wiring is loose, corroded or damaged. Parking brake is engaged. Parking brake switch is out of adjustment or is faulty. Parking brake switch wiring is loose, corroded or damaged.
Battery does not charge. **NOTE:** If the alternator warning lamp is faulty, or the alternator warning lamp wiring is loose, corroded or damaged, the alternator warning lamp will not illuminate when a charging system failure occurs.	Wiring to the charge circuit components is loose, corroded or damaged (see electrical schematic in Chapter 10 − Foldout Drawings in this manual). The engine alternator belt is loose or damaged. The fusible link connecting the engine starter motor to the alternator is faulty. The battery is faulty. The alternator/voltage regulator is faulty.

Cutting Unit Operating Problems

Problem	Possible Causes
Cutting units run (but should not) when raised.	The mow control manifold proportional relief valve (PRV) solenoid coil or circuit wiring is faulty. A hydraulic problem exists (see Chapter 5 − Hydraulic System in this manual). Turn around switch or circuit wiring is faulty. (RM 3555−D/3575−D). The TEC Controller is faulty.
Cutting units do not run when lowered with the mow/transport switch in the MOW position.	Fuse(s) is (are) faulty (other electrical components most likely affected as well). Engine temperature is high (above 220°F (105°C) or engine temperature sender or circuit wiring is faulty. The transport/mow switch is out of adjustment or the transport/mow switch or circuit wiring is faulty. The turn around switch is out of adjustment or the turn around switch or circuit wiring is faulty (RM 3555−D/3575−D). The mow control manifold proportional relief valve (PRV) solenoid coil or circuit wiring is faulty. A hydraulic problem exists (see Chapter 5 − Hydraulic System in this manual). The TEC Controller is faulty.
Cutting units will not raise.	Fuse(s) is (are) faulty (other electrical components most likely affected as well). Raise switch in joystick assembly is faulty or raise switch circuit wiring is faulty. Lift control manifold solenoid valve coil(s) (S1, S3 and/or S4) or circuit wiring is faulty. A hydraulic problem exists (see Chapter 5 − Hydraulic System in this manual). The TEC Controller is faulty.
Cutting units will not lower.	Fuse(s) is (are) faulty (other electrical components most likely affected as well). Lower switch in joystick assembly is faulty or lower switch circuit wiring is faulty. Lift control manifold solenoid valve coil(s) (S1, S2, S3 and/or S4) or circuit wiring is faulty. A hydraulic problem exists (see Chapter 5 − Hydraulic System in this manual). The TEC Controller is faulty.

Electrical System Quick Checks

Battery Test (Open Circuit Test)

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

Set multimeter to the DC volts setting. The battery should be at a temperature of 60 to 100F (16 to 38C). The ignition key should be off 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.

NOTE: This test provides a relative condition of the battery. Load testing of the battery will provide additional and more accurate information (see Battery Service in the Service and Repairs section of this chapter).

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 a charging system is functioning. It will tell you if the charging system has an output, but not its capacity.

Use a digital multimeter set to DC volts. Connect the positive (+) multimeter lead to the positive battery post and the negative (−) multimeter lead to the negative battery post. Keep the test leads connected to the battery posts 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 battery voltage will increase at different rates as the battery charges.

Start the engine and run at high idle **(3200 RPM)**. Allow the battery to charge for at least three (3) minutes. Record the battery voltage.

After running the engine for at least three (3) minutes, battery voltage should be at least 0.50 volt higher than initial battery voltage.

Test the battery (see Battery Service in this manual) and/or the alternator/voltage regulator assembly (see Kubota Workshop Manual) if necessary.

An example of a charging system that is functioning:

At least 0.50 volt over initial battery voltage.	
Initial Battery Voltage	= 12.30 v
Battery Voltage after 3 Minute Charge	= 12.85 v
Difference	= +0.55 v

Glow Plug System Test

This is a fast, simple test that can help to determine the integrity and operation of your Reelmaster glow plug system. The test should be run anytime hard starting (cold engine) is encountered on a diesel engine equipped with a glow plug system.

Use a digital multimeter and/or inductive Ammeter (AC/DC Current Transducer). Properly connect the ammeter to the digital multimeter (refer to manufacturers' instructions) and set the multimeter to the correct scale. With the ignition switch in the OFF position, place the ammeter pickup around the main glow plug power supply wire and read the meter prior to activating the glow plug system. Adjust the meter to read zero (if applicable). Activate the glow plug system by turning the ignition switch to ON and record the multimeter results.

The Reelmaster glow plug system should have a reading of approximately nine (9) amps per glow plug (27 amps total). If low current reading is observed, one (or more) of the glow plugs is faulty.

Check Operation of Interlock Switches

CAUTION

Do not disconnect safety switches. They are for the operator's protection. Check the operation of the interlock switches daily for proper operation. Replace any malfunctioning switches before operating the machine.

Interlock switch operation is described in the Traction Unit Operator's Manual. Your Reelmaster is equipped with an Toro Electronic Controller (TEC) which monitors interlock switch operation. Use the Diagnostic Display (see Special Tools in this chapter) to test Toro Electronic Controller inputs and outputs before further troubleshooting of an electrical problem on your Reelmaster (see Diagnostic Display in this chapter).Information for testing individual interlock switches and relays is included in the this Chapter.

Neutral Switch

The neutral switch is a normally open proximity switch that closes when the traction pedal is in the neutral position. The neutral switch is located under the floor plate near the traction pedal.

Adjusting

1. Before adjusting the traction neutral switch, check and adjust traction system neutral position (refer to Traction Unit Operator's Manual).

IMPORTANT: To prevent traction neutral switch damage, make sure that no components contact switch through entire traction pedal movement.

2. Park the machine on a level surface, engage the parking brake, lower the cutting units and stop the engine. Remove the key from the ignition switch.

3. When the traction pedal is in the neutral position, the pin on the traction pedal should be centered with the switch eye. With the traction pushed all the way to the right, the clearance between the pin on the traction pedal and the switch should be no less then **0.07 in (1.8 mm)** (Fig. 14).

4. To adjust the switch, loosen the nut securing the switch to the switch bracket or the nuts securing the switch bracket to the floor plate and adjust the switch position as needed.

5. After adjusting the switch, use the Diagnostic Display (see Diagnostic Display − inputs in the Troubleshooting section of this chapter) to verify that the switch and circuit wiring are functioning correctly. The switch should open when the traction pedal is moved in either direction **0.25" to 1.00" (6.3mm to 25.4mm)** when measured at the top of the traction pedal.

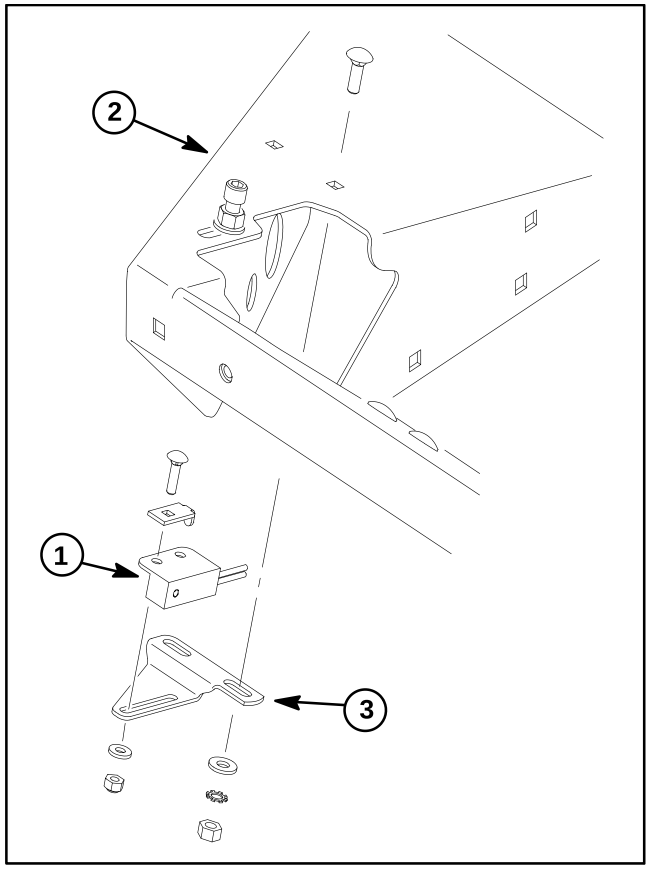

Figure 13

1. **Neutral switch**
2. **Floor plate**
3. **Switch bracket**

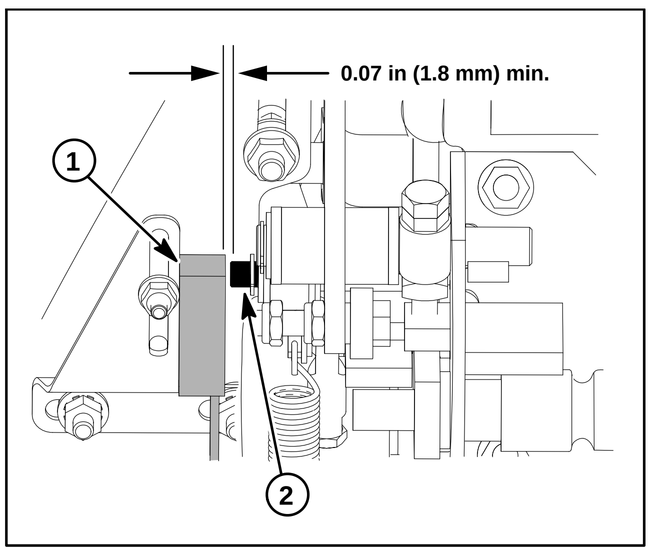

Figure 14

1. **Neutral switch**
2. **Traction pedal pin**

Parking Brake Switch

The parking brake switch is a normally closed proximity switch that is located on the control console (Fig. 32). The sensing plate that opens the switch is the parking brake lever.

When the parking brake is applied, the parking brake lever is positioned near the target end of the parking brake switch so the switch is opened. The parking brake lever is moved away from the switch when the parking brake is released causing the switch to close.

Adjusting

1. Park the machine on a level surface, engage the parking brake, lower the cutting units and stop the engine. Remove the key from the ignition switch.

IMPORTANT: To prevent parking brake switch damage, make sure that no components contact switch through entire brake lever movement.

2. When the parking brake is applied, the clearance between the brake lever and the end of the parking brake switch is **0.250" (6.3 mm)** (Fig. 16).

3. To adjust switch, loosen jam nuts that secure brake switch to bracket and position switch to allow correct clearance between switch and brake lever. Tighten switch jam nuts from **162 to 198 in−lb (18.4 to 22.4 N−m)**. Recheck switch to brake lever clearance.

4. After adjusting the switch, use the Diagnostic Display (see Diagnostic Display − inputs in the Troubleshooting section of this chapter) to verify that the switch and circuit wiring are functioning correctly.

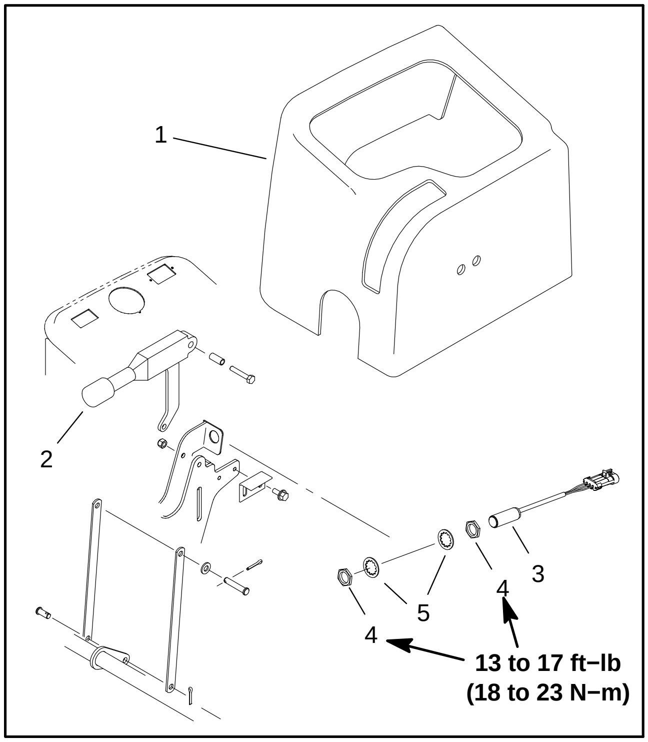

Figure 15

1. **Control panel cover**
2. **Parking brake lever**
3. **Brake switch**
4. **Jam nut (2)**
5. **Lock washer (2)**

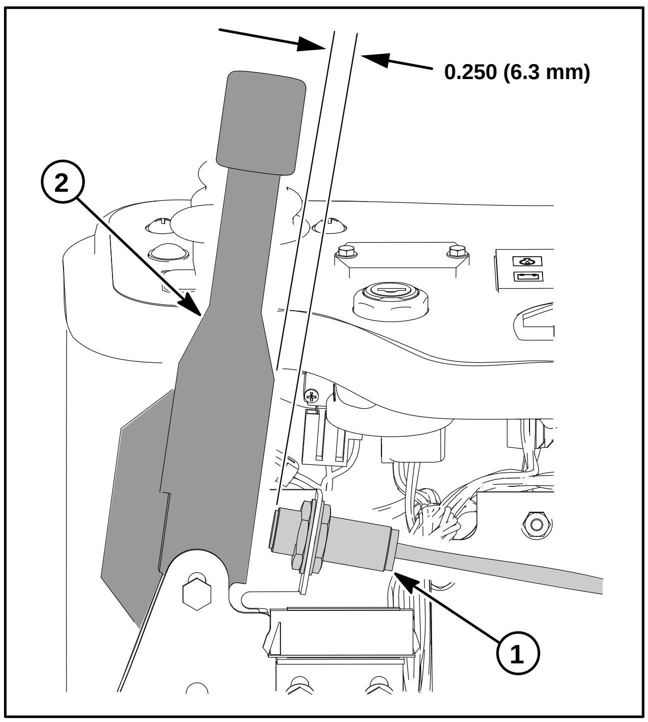

Figure 16

1. **Parking brake switch**
2. **Brake lever**

Electrical System

Turn Around Switch (Reelmaster 3555−D and 3575−D)

The cutting unit turn around switch is a normally open proximity switch that closes when the front right cutting unit (cutting unit #5) is in the turn−around position. The turn around switch is attached to a bracket outside the front right lift arm pivot pin. A plate on the front right lift arm acts as the sensing plate for the turn around switch (Fig. 17).

NOTE: The vertical location of the turn around switch bracket will determine the turn−around height of the cutting units. Raising the switch bracket will allow a higher turn−around height of the cutting units. Lowering the switch bracket will allow a lower turn−around height of the cutting units.

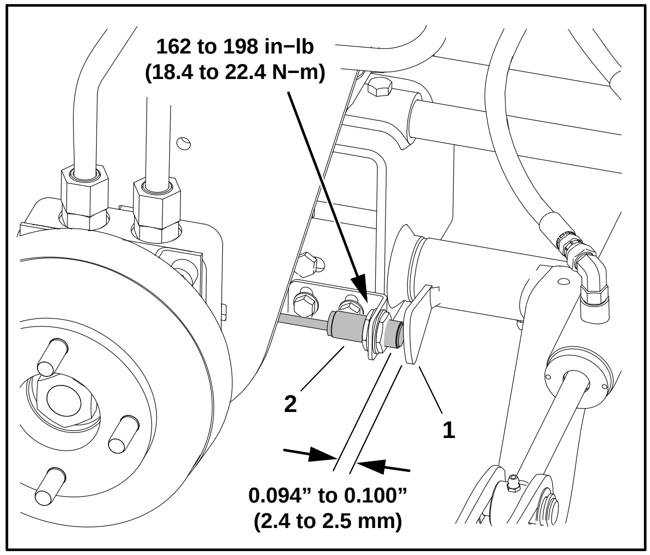

Figure 17

1. Signal plate (on lift arm #5)
2. Turn around switch

Adjusting

1. Park the machine on a level surface, engage the parking brake, lower the cutting units and stop the engine. Remove the key from the ignition switch.

IMPORTANT: To prevent turn around switch damage, make sure that no components contact switch through entire lift arm movement.

2. The distance between the down limit switch and the sensing plate on lift arm should be from **0.094” to 0.100” (2.4 to 2.5 mm)**.

3. If distance is incorrect, loosen jam nuts that secure down limit switch to machine frame. Position switch with jam nuts to allow correct clearance between switch and sensing plate. Tighten switch jam nuts from **162 to 198 in−lb (18.4 to 22.4 N−m)**. After jam nuts are tightened, make sure that clearance has not changed.

4. After adjusting the switch, use the Diagnostic Display (see Diagnostic Display − inputs in the Troubleshooting section of this chapter) to verify that the switch and circuit wiring are functioning correctly.

Mow/Transport Switch

The switch used for the mow/transport slide is a normally closed switch. The switch opens when the mow/transport slide is in the transport position. The switch is located under the floor plate (Fig 18).

Adjusting

1. Park the machine on a level surface, engage the parking brake, lower the cutting units and stop the engine. Remove the key from the ignition switch.

2. When the mow/transport lever is on the transport position, the clearance between the rocker arm and the switch should be **0.025 to 0.045 in (0.6 to 1.1 mm)** at the closest point (Fig. 19).

3. To adjust switch, loosen fasteners that secure switch to bracket and position switch to allow correct clearance between switch and rocker arm. Tighten switch fasteners and recheck switch to rocker arm clearance.

4. After adjusting the switch, use the Diagnostic Display (see Diagnostic Display − inputs in the Troubleshooting section of this chapter) to verify that the switch and circuit wiring are functioning correctly.

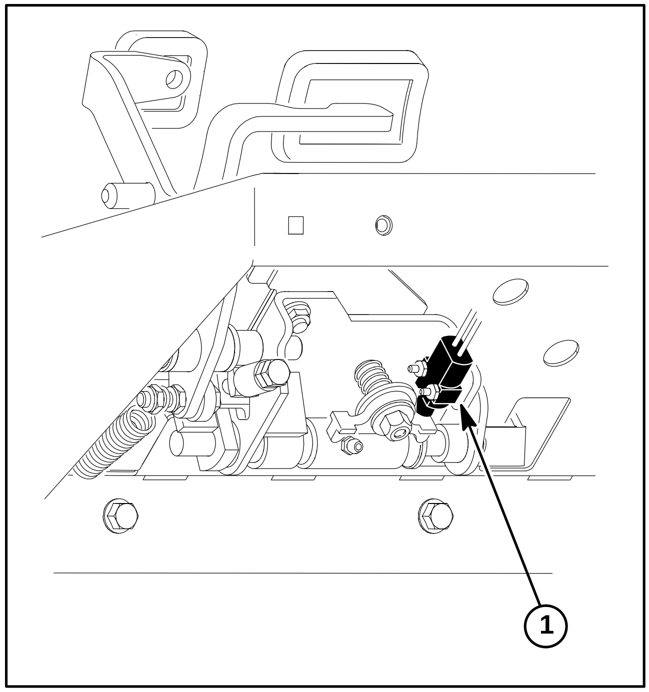

Figure 18
1. Mow/Transport switch

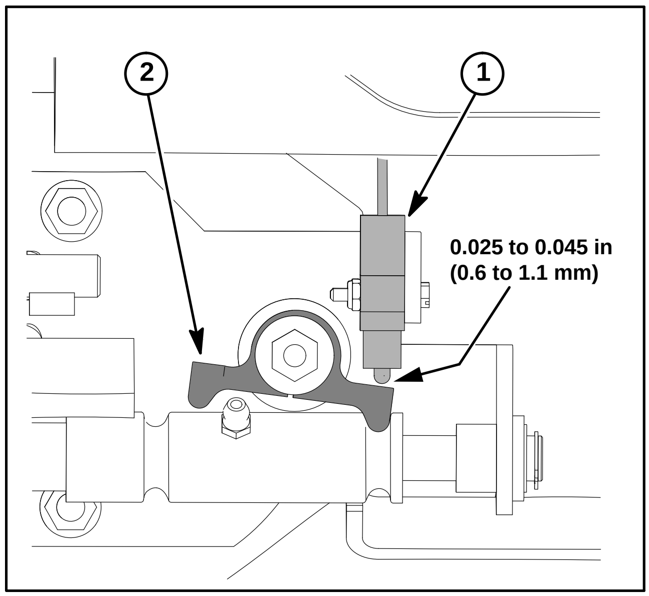

Figure 19
1. Mow/Transport switch **2. Rocker arm**

Electrical System

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 checking continuity on the switch terminals).

NOTE: For engine component testing information (starter solenoid and motor, alternator, glow plugs) see the Kubota Workshop Manual: 05 Series Diesel Engine.

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 is located on the control panel and has three (3) positions: STOP, RUN and START (Fig. 20). The Toro Electronic Controller (TEC) monitors the operation of the ignition switch and reacts to the various ignition switch positions.

Testing

1. Park machine on a level surface, lower cutting units, engage parking brake and stop engine. Remove key from ignition switch.

2. Remove cover from control panel to access ignition switch.

3. Make sure ignition switch is in the OFF position. Disconnect wire harness connector from ignition switch.

4. The ignition switch terminals are identified in Figure 20 and the circuitry of the switch is shown in the chart in Figure 21. With the use of a multimeter (ohms setting), the switch functions can be tested to determine whether continuity exists between the various terminals for each switch position. Verify continuity between switch terminals.

5. Replace ignition switch if testing determines that it is faulty.

6. If the ignition switch tests correctly and a circuit problem still exists, check wire harness.

7. After testing is complete, connect machine wire harness connector to ignition switch. Install cover onto control panel.

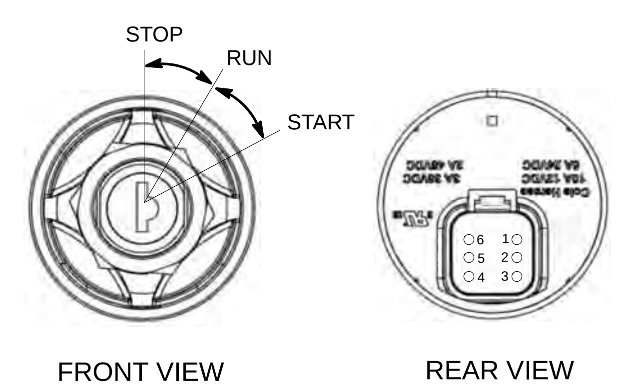

Figure 20

SWITCH POSITION	CIRCUITS
STOP	1 + 6
RUN	1 + 3 + 4 + 5 + 6
START	1 + 2 + 4 + 5 + 6

Figure 21

NOTE: Ignition switch terminals 1 and 6 are connected internally. Terminals 4 and 5 are also connected internally. These terminals should have continuity regardless of switch position.

Main Power Relay

The main power relay is secured to the control panel assembly next to the operator seat (Fig. 22). This relay is attached to the wire harness with a four (4) wire connector (Fig. 23). The relay can be accessed by removing the control panel cover.

The main power relay is used to provide current to the TEC controller and most of the fuse protected circuits (worklights, power point, console indicators and other electric equipment). When the ignition switch is in the RUN or START position, the main power relay is energized.

Testing

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. To make sure that machine operation does not occur unexpectedly, disconnect negative (−) cable from battery and then disconnect positive (+) cable from battery (see Battery Service in the Service and Repairs section of this chapter).

3. Remove cover from control panel and locate main power relay (Fig. 22).

4. Disconnect wire harness connector from relay. Remove relay from mounting panel for 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.

5. Using a multimeter, verify that coil resistance between terminals 86 and 85 is approximately 72 ohms.

6. 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.

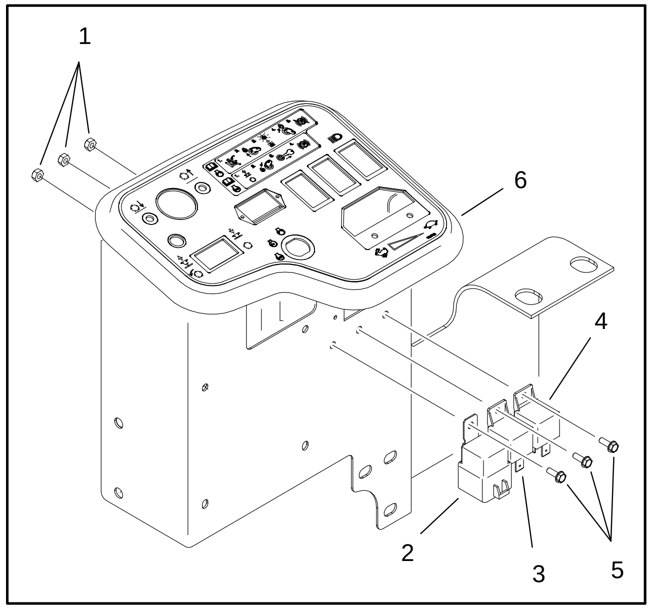

Figure 22

1. **Lock nut**
2. **Start relay**
3. **Main power relay**
4. **Glow relay**
5. **Screw**
6. **Mounting panel**

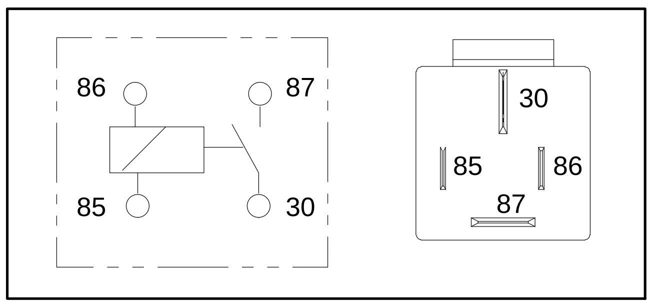

Figure 23

7. Disconnect voltage and test leads from the relay terminals.

8. After testing is completed, secure relay to mounting panel and connect wire harness connector to relay. Install cover to control panel.

9. Connect positive (+) cable to battery and then connect negative (−) cable to battery (see Battery Service in the Service and Repairs section of this chapter).

Fuses

The fuse blocks are located under the control panel cover on the right side of the machine.

Fuse Identification and Function

Use the fuse decal (Fig.24) and fuse block (Fig. 25) to identify each individual fuse and its correct amperage. The fuses have the following function:

F1−1 (2 amp) protects logic power circuit to the TEC controller.

F1−2 (7.5 amp) protects TEC output power supply for start relay, fuel stop solenoid, fuel pump, glow relay, glow plug indicator light and console diagnostic light. If this fuse is faulty, a fault should be displayed by the diagnostic light on the control panel (see Diagnostic Light in this chapter).

F1−3 (7.5 amp) protects TEC output power supply for cutting unit proportional relief valve (PRV), lift/lower enable solenoid (S1) and lift/lower solenoid (S2). If this fuse is faulty, a fault should be displayed by the diagnostic light on the control panel (see Diagnostic Light in this chapter).

F1−4 (7.5 amp) protects TEC output power supply for front cutting unit lift solenoid (S3), rear cutting unit lift solenoid (S4), alternator indicator light and over temperature indicator light. If this fuse is faulty, a fault should be displayed by the diagnostic light on the control panel (see Diagnostic Light in this chapter).

F2−1 (15 amp) protects parking brake switch, hour meter, alternator, low oil pressure light.

F2−2 (10 amp) protects engine starter circuit.

F2−3 (10 amp) protects power point circuit.

F2−4 (10 amp) protects worklight circuit.

Fuse Testing

Remove cover from control panel to access fuse blocks. Turn ignition switch to the ON position (do not start engine). With the fuse installed in the fuse block, use a multimeter to verify that 12 VDC exists at both of the terminal test points on the fuse. If 12 VDC exists at one of the fuse test points but not at the other, the fuse is faulty.

If necessary, make sure that ignition switch is OFF and key is removed from switch. Remove fuse from fuse block and check that fuse has continuity across the fuse terminals.

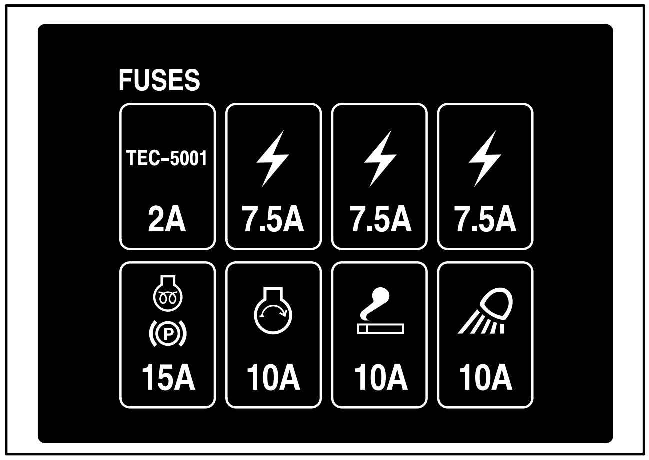

Figure 24

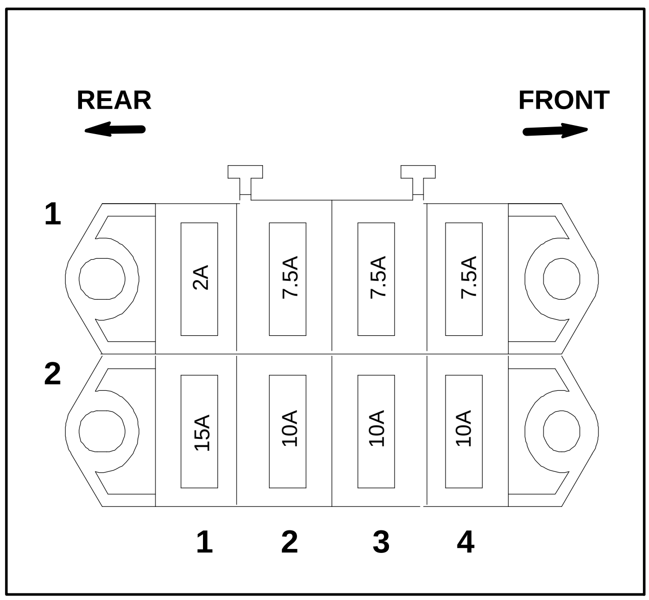

Figure 25

Fusible Links

The Reelmaster machines use four (4) fusible links for circuit protection. Three (3) of the fusible links are located in a single harness that connects the starter B+ terminal to the main wire harness (Fig. 26). The fusible links in this harness protect the glow plug, alternator, and main power relay circuits.

An additional fusible link is integrated into the main wire wire harness between the starter G terminal and the fuel stop solenoid pull coil.

If any of these links should fail, current to the protected circuit will be interrupted. Refer to electrical schematic in Chapter 10 − Foldout Drawings in this manual for additional information.

Testing

1. Park machine on a level surface, lower cutting units, stop engine, and engage parking brake. Unlatch and raise hood.

2. Disconnect negative (−) battery cable from battery terminal and then disconnect positive (+) cable from battery (see Battery Service in the Service and Repairs section of this chapter).

3. For fusible link harness (Fig. 26):

   A. Locate and unplug fusible link connector from machine wire harness.

   B. Use a multimeter to make sure that continuity exists between the fusible link terminal on the starter B+ terminal (terminal J1 on fusible link harness) and each of the terminals in the link harness connector P1. If any of the fusible links are open, replace the fusible link harness.

4. For fusible link integrated into wire harness:

   A. Locate and unplug machine wire harness connector from the fuel stop solenoid (Fig. 27).

   B. Use a multimeter to make sure that continuity exists between the wire harness connector at the starter and the engine fuel stop solenoid connector for the solenoid pull coil (Fig. 28 − yellow wire).

   C. If this fusible link should fail, make sure that the wire harness is repaired with the correct fusible link. Do not replace a failed harness fusible link with a regular section of wire.

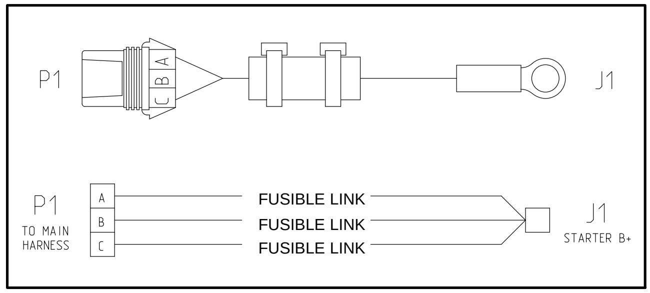

Figure 26

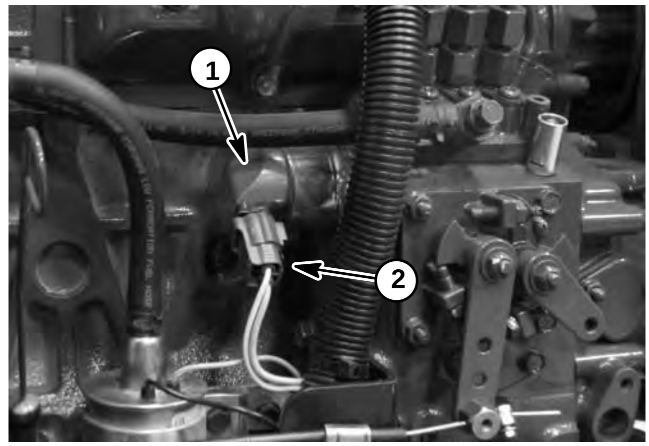

Figure 27

1. Fuel stop solenoid **2. Harness connector**

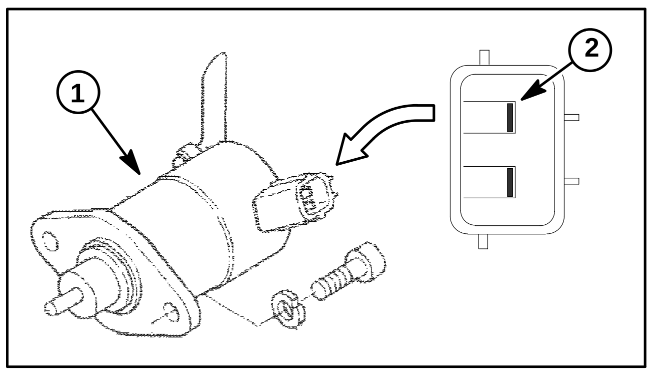

Figure 28

1. Fuel stop solenoid **2. Pull coil terminal**

5. When testing is completed, make sure to connect all disconnected wire harness components. Connect positive (+) battery cable and then negative (−) cable (see Battery Service in the Service and Repairs section of this chapter).

Electrical System

Toro Electronic Controller (TEC)

The Reelmaster machines use a Toro Electronic Controller (TEC) to monitor the condition of various switches (inputs) and directs power to a variety or outputs to control certain machine functions. The controller is located under the control panel (Fig. 29). The handheld Diagnostic Display with the correct overlay should be used to check inputs and outputs of the controller (see Diagnostic Display in this chapter).

Logic power is provided to the controller as long as the battery cables are connected to a charged battery. A two (2) amp fuse (upper, rear fuse 1) provides circuit protection for the logic power to the controller.

The TEC controller monitors the states of the following components as inputs: ignition switch, parking brake switch, neutral switch, reel lower/raise joystick switches, reel enable/disable switch, mow/transport switch, seat switch, backlap switch, engine temperature sender.

Current output to the indicator lights, mow circuit hydraulic solenoid valve coil, lift circuit hydraulic solenoid valve coils and engine components (glow plug relay, start relay, fuel pump and fuel stop solenoid) are controlled based on the inputs received by the controller. Circuit protection for the TEC outputs is provided by three (3) 7.5 Amp fuses (upper, rear fuse 2, 3 and 4).

The machine electrical schematic and wire harness drawings in Chapter 10 − Foldout Drawings can be used to identify possible circuit problems between the controllers and the input or output devices (e.g. switches and solenoid coils).

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

Electrical power for the controller outputs is provided through three (3) connectors (PWR2, PWR3 and PWR4) each protected with a 7.5 amp fuse. A fifty (50) pin wire harness connector attaches to the controller. The layout of the wire harness connector that plugs into the TEC controller is provided (Fig. 30). The TEC controller connection terminal functions and the connector pins are shown for reference (Fig. 31).

IMPORTANT: When testing for wire harness continuity at the connector for the TEC controller, take care to not damage the connector pins with multimeter test leads. If connector pins are enlarged or damaged during testing, connector repair will be necessary for proper machine operation.

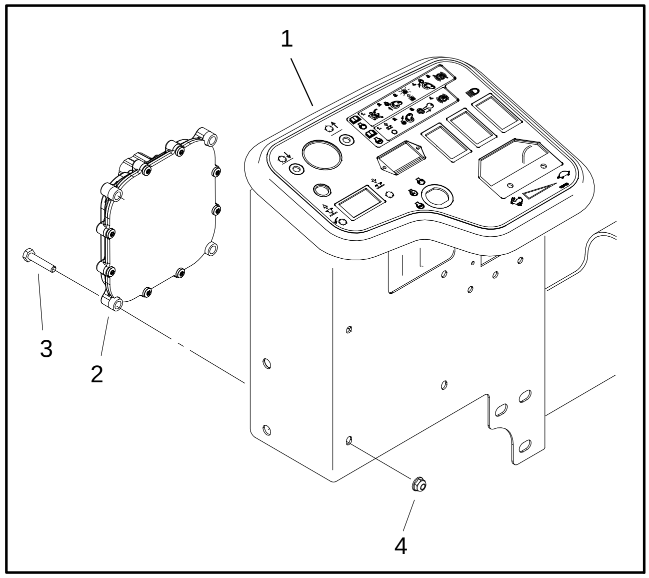

Figure 29

1. **Control panel**
2. **TEC controller**
3. **Cap screw (4)**
4. **Flange nut (4)**

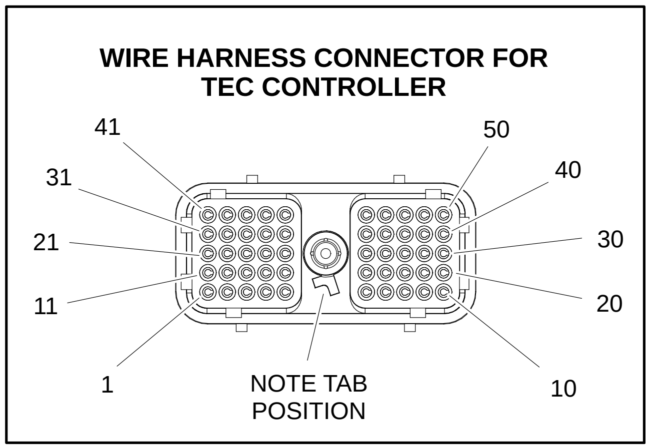

Figure 30

NOTE: The TEC controller used on the Reelmaster machines is specifically programed for correct machine operation. If the controller is replaced for any reason, the controller needs to be reprogrammed by your Toro Distributor.

IMPORTANT: Before performing any welding on the machine, disconnect both positive and negative battery cables from the battery, disconnect the wire harness connector from the TEC controller and disconnect the terminal connector from the alternator. This will prevent damage to the electrical system of your Reelmaster.

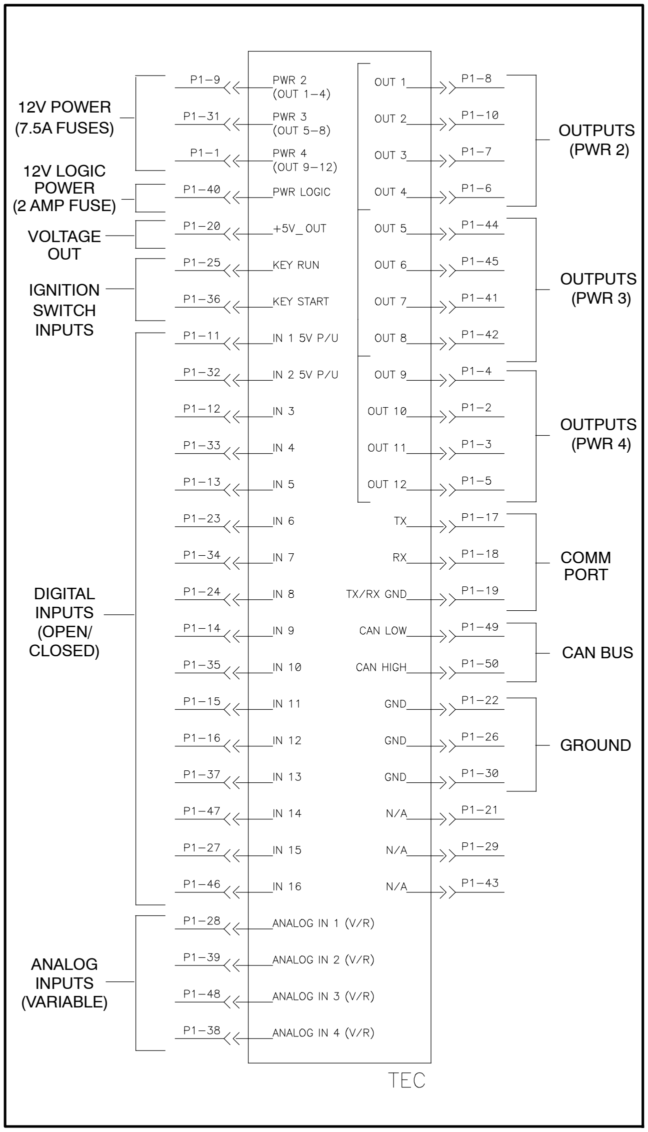

Figure 31

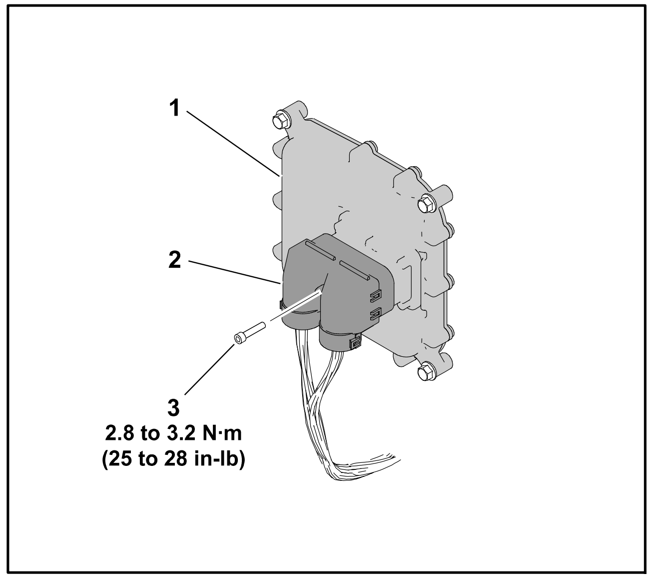

Figure 32

1. **TEC controller**
2. **Harness connector**
3. **Socket head screw**

If the wire harness connector is removed from the TEC controller for any reason, tighten the harness connector screw from **25 to 28 in-lb (2.8 to 3.2 N·m)**.

Parking Brake Switch

The parking brake switch is a normally closed proximity switch that is located on the control console (Fig. 32). The sensing plate that opens the switch is the parking brake lever.

When the parking brake is applied, the parking brake lever is positioned near the target end of the parking brake switch so the switch is opened. The parking brake lever is moved away from the switch when the parking brake is released causing the switch to close.

The TEC controller monitors the position of the parking brake switch (open or closed). Using inputs from the parking brake switch and other switches in the interlock system, the TEC controller controls the energizing of the fuel stop solenoid and fuel pump (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

Testing

1. Park machine on level surface, lower cutting units, stop engine, apply parking brake and remove key from ignition switch.

2. Make sure the parking brake switch is properly adjusted (see Parking Brake Switch in the Adjustments section of this chapter).

3. Before disconnecting the switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

4. Remove cover from control panel to gain access to parking brake switch.

5. Make sure ignition switch is OFF and disconnect the parking brake switch connector from machine wire harness.

6. Verify that the machine wire harness connector terminal for black wire is closed (continuity) to ground.

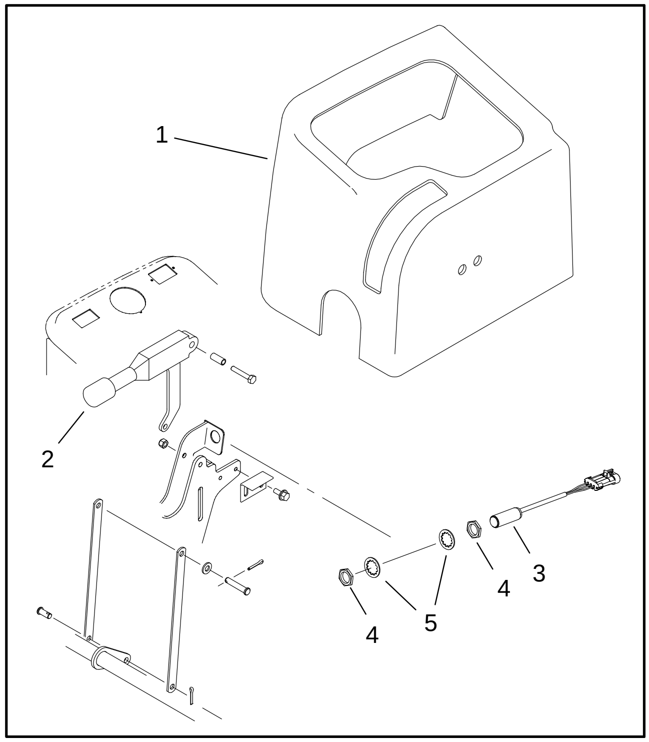

Figure 32

1. **Control panel cover**
2. **Parking brake lever**
3. **Brake switch**
4. **Jam nut (2)**
5. **Lock washer (2)**

7. Turn ignition switch to the ON position (do not start engine) and verify with a multimeter that machine wire harness connector terminal for pink wire has system voltage (12 VDC) present.

8. If black wire is closed to ground, the pink wire has system voltage present and the switch is properly adjusted, replace and adjust the parking brake switch.

9. Reconnect switch after testing.

10. Install cover to control panel.

Neutral Switch

The neutral switch is a normally open proximity switch that closes when the traction pedal is in the neutral position. The neutral switch is located under the floor plate (Fig. 33).

The TEC controller monitors the position of the neutral switch (open or closed). Using inputs from the neutral switch and other switches in the interlock system, the TEC controller controls the energizing of the engine start relay, and the fuel stop solenoid and fuel pump (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

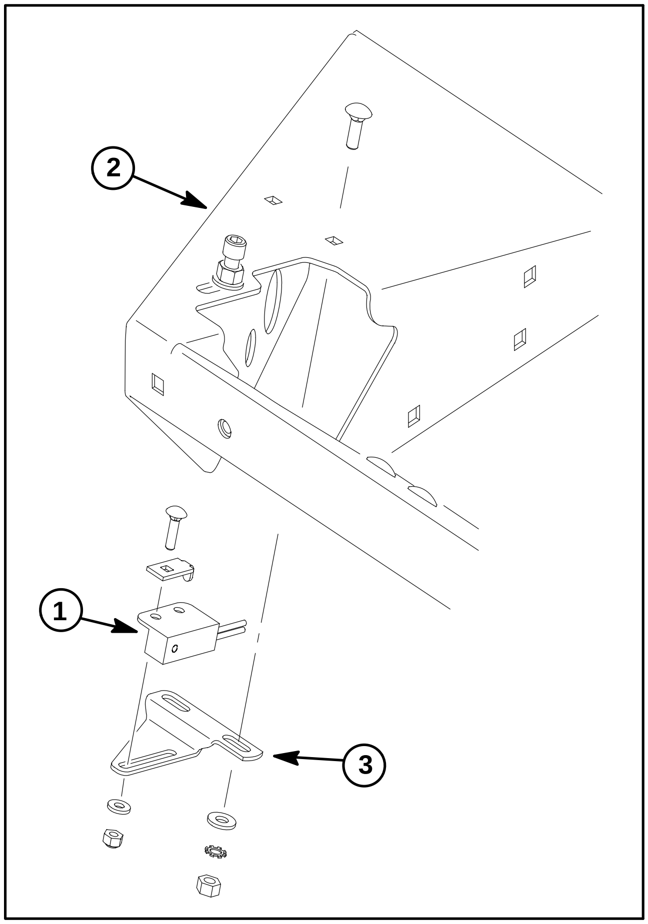

Figure 33

1. Neutral switch
2. Floor plate
3. Switch bracket

Testing

1. Park machine on level surface, lower cutting units, stop engine, apply parking brake and remove key from ignition switch.

2. Make sure the neutral switch is properly adjusted (see Neutral Switch in the Adjustments section of this chapter).

3. Before disconnecting the switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

4. Make sure ignition switch is in the OFF position. Disconnect electrical connector from the neutral switch.

5. Check the continuity of the switch by connecting a multimeter (ohms setting) across the connector terminals.

6. With the traction pedal in the neutral position, there should be continuity between the two (2) switch leads.

7. Slowly depress the traction pedal. The continuity tester should show no continuity as the pedal is moved to the full forward or full reverse direction.

8. Replace and readjust the switch if necessary.

9. Reconnect switch after testing.

Lower/Raise Joystick Switches

The cutting unit raise and lower switches are located on the joystick assembly that is attached to the control panel. The rear switch is used to lower the cutting units and the front switch to raise them (Fig. 34). The switches are identical (Fig. 35).

The TEC controller monitors the position of the lower/raise switches (open or closed). Using inputs from the lower/raise switches and other switches in the interlock system, the TEC controller controls the energizing of the solenoid valves (S1, S2, S3, S4) used to lower and raise the cutting units (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

Testing

1. Park machine on level surface, lower cutting units if possible, stop engine, apply parking brake and remove key from ignition switch.

2. Before disconnecting the raise and lower switches for testing, the switches and their circuit wiring should be tested as TEC electrical inputs using the Diagnostic Display (see Diagnostic Display this chapter). If input testing verifies that the raise and lower switches and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the raise and lower switches and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

3. Remove cover from control panel to gain access to raise and lower switches on joystick assembly.

4. Make sure ignition switch is in the OFF position. Disconnect wire harness connectors from raise and lower switches on joystick assembly.

5. Check the continuity of the raise switch by connecting a multimeter (ohms setting) across the switch connector terminals as follows:

A. With the joystick in the neutral position, continuity should only exist between the common and NC terminals.

B. With the joystick in the raise position, continuity should only exist between the common and NO terminals.

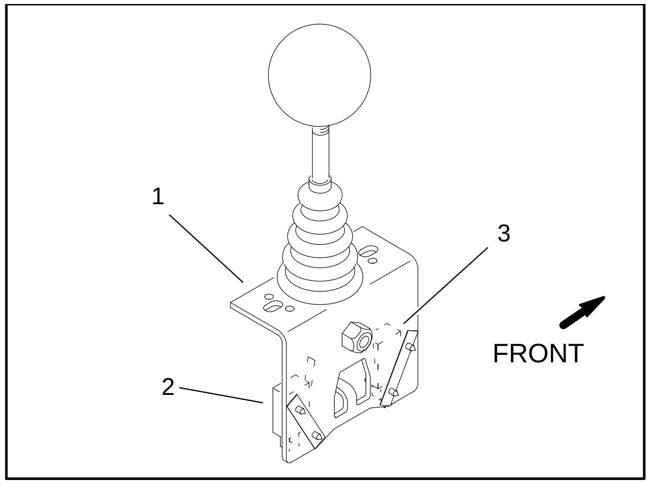

Figure 34

1. Joystick assembly
2. Raise switch
3. Lower switch

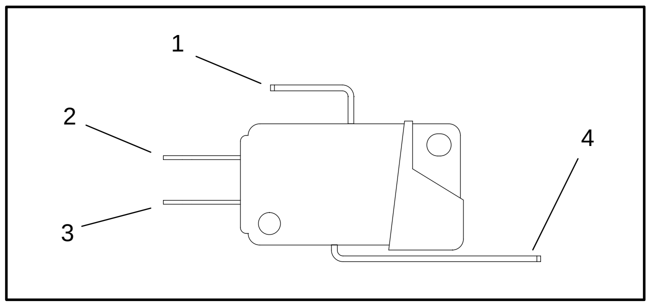

Figure 35

1. Common terminal
2. NO terminal
3. NC terminal
4. Switch lever

6. Check the continuity of the lower switch by connecting a multimeter (ohms setting) across the switch connector terminals as follows:

A. With the joystick in the neutral position, continuity should only exist between the common and NC terminals.

B. With the joystick in the lower position, continuity should only exist between the common and NO terminals.

7. Replace raise and lower switch if testing identifies that switch is faulty.

8. After switch testing is completed, connect the harness connectors to the raise and lower switches on joystick assembly. Install control panel cover.

Reel Enable/Disable Switch

The enable/disable switch is located on the control panel (Fig. 36). This switch is pulled out to engage the cutting units and pushed in to disengage the cutting units.

The TEC controller monitors the position of the enable/disable switch (pulled out or pushed in). Using inputs from the enable/disable switch and other switches in the interlock system, the TEC controller controls the energizing of the proportional relief valve (PRV) used to drive the cutting unit motors (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

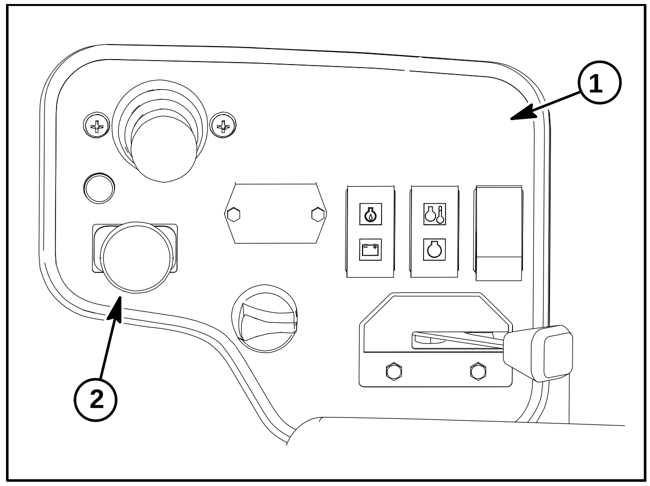

Figure 36

1. **Control panel**
2. **Enable/disable switch**

Testing

1. Park machine on level surface, lower cutting units, stop engine, apply parking brake and remove key from ignition switch.

2. Before disconnecting the enable/disable switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the enable/disable switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the enable/disable switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

3. Remove cover from control panel to gain access to enable/disable switch.

4. Disconnect wire harness electrical connector from the enable/disable switch.

5. The enable/disable switch terminals are marked (Fig. 37). The circuit logic of the enable/disable switch is shown in the chart (Fig. 38). With the use of a multimeter (ohms setting), the switch functions can be tested to determine whether continuity exists between the various terminals for each switch position. Verify continuity between switch terminals. Replace enable/disable switch if testing identifies that switch is faulty.

6. If the enable/disable switch tests correctly and circuit problem still exists, check other circuit components (see Electrical Schematic in Chapter 10 − Foldout Drawings in this manual).

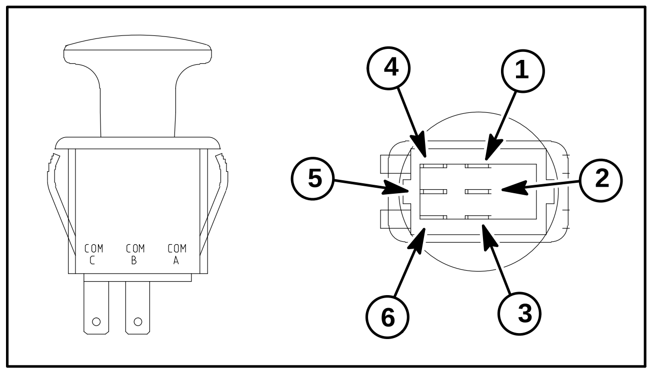

Figure 37

1. **COM B terminal**
2. **NO B terminal**
3. **NC B terminal**
4. **COM C terminal**
5. **NO C terminal**
6. **NC C terminal**

SWITCH POSITION	CLOSED CIRCUITS	OPEN CIRCUITS
OFF (DOWN)	COM B + NC B COM C + NC C	COM B + NO B COM C + NO C
ON (UP)	COM B + NO B COM C + NO C	COM B + NC B COM C + NC C

Figure 38

7. After testing is completed, connect the wire harness connector to the enable/disable switch. Install control panel cover.

Electrical System

Mow/Transport Switch

The switch used for the mow/transport slide is a normally closed switch. The switch opens when the mow/ transport slide is in the transport position. The switch is located under the floor plate (Fig 39).

The TEC controller monitors the position of the mow/ transport switch (open or closed). Using inputs from the mow/transport switch and other switches in the interlock system, the TEC controller controls the energizing of the proportional relief valve (PRV) used to drive the cutting unit motors, and solenoid valves (S1, S2, S3, and S4) used to lower and raise the cutting units (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch.

2. Make sure the mow/transport switch is properly adjusted (see Mow/Transport Switch in the Adjustments section of this chapter).

3. Before disconnecting the switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

4. Locate switch and disconnect electrical connector from the switch.

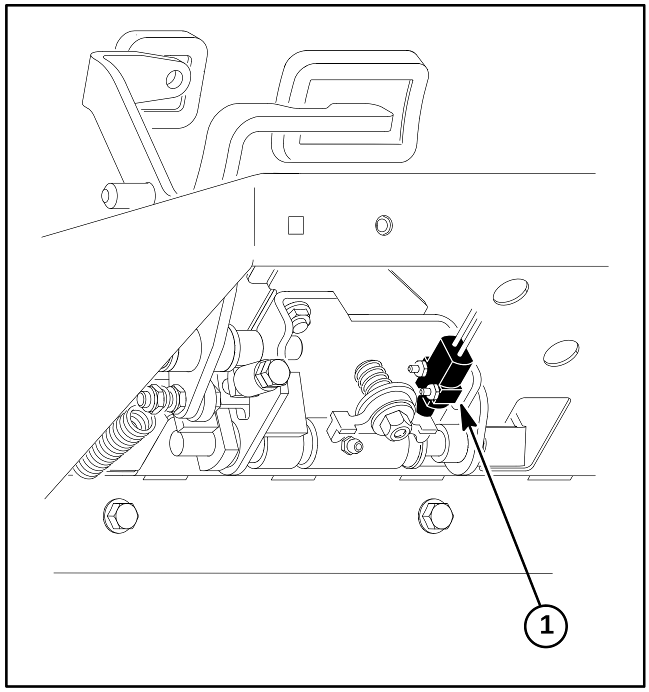

Figure 39
1. Mow/Transport switch

5. Check the continuity of the switch by connecting a multimeter (ohms setting) across the connector terminals.

6. When the switch plunger is extended (mow/transport slide in MOW position) there should be continuity between the switch terminals.

7. When the switch plunger is depressed (mow/transport slide in TRANSPORT position) there should be no continuity between the switch terminals.

8. Replace switch if testing determines that it is faulty.

9. Reconnect switch after testing.

Seat Switch

The seat switch is normally open and closes when the operator seat is occupied. The seat switch is located directly under the seat.

The TEC controller monitors the position of the seat switch (open or closed). Using inputs from the seat switch and other switches in the interlock system, the TEC controller controls the energizing of the engine start relay, the fuel stop solenoid and fuel pump, the proportional relief valve (PRV) used to drive the cutting unit motors,and solenoid valves (S1, S2, S3, and S4) used to lower and raise the cutting units (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch.

2. Before disconnecting the seat switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the seat switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the seat switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

3. A short wire harness is used to connect the seat switch to the main wire harness. Disconnect the seat switch harness from the main wire harness. The seat switch harness connector is located under the seat assembly between the operator's control panel and the seat.

4. Check the continuity of the seat switch by connecting a multimeter (ohms setting) across the seat switch harness connector terminals. With no pressure on the seat, there should be no continuity through the switch.

5. Press directly onto the seat switch through the seat cushion. There should be continuity through the switch as the seat cushion approaches the bottom of its travel.

6. If the continuity test determines that the seat switch is not operating correctly,remove the seat cushion from the seat chassis (Fig. 40):

   A. Remove two (2) flange head screws under the front of the seat cushion.

   B. Lift front of seat cushion up then slide forward and out of seat chassis.

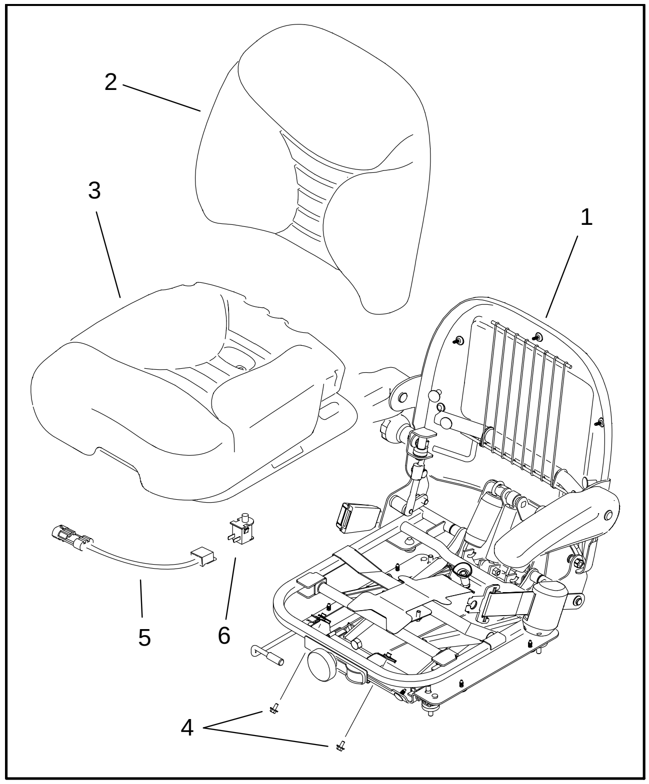

Figure 40

1. **Seat chassis**
2. **Seat back**
3. **Seat cushion**
4. **Flange head screw (2)**
5. **Seat switch harness**
6. **Seat switch**

WARNING

If seat switch service is necessary, remove seat cushion from seat chassis to access switch. DO NOT attempt to reach switch through openings in seat chassis as edges of openings may be sharp.

7. Check seat switch and/or seat switch harness for continuity. Repair or replace components as needed.

8. If the seat switch and seat switch harness tests correctly and a circuit problem still exists, check machine wire harness (see Electrical Schematics and Wire Harness Drawings in Chapter 10 - Foldout Drawings in this manual).

9. After testing is complete, install seat cushion, connect seat switch wire harness to seat switch and install operator seat. Connect seat switch wire harness to main wire harness and check seat switch operation.

Electrical System

Backlap Switch

The backlap switch is a normally open ball switch that is in the normal, open state when the backlap lever is in the mow position. When the backlap lever is in the backlap position, the switch closes. The backlap switch is attached to the hydraulic mow control manifold located on the left side of the machine under the hinged access panel in front of the operator's seat (Fig. 41).

The TEC controller monitors the position of the backlap switch (open or closed). Using inputs from the backlap switch and other switches in the interlock system, the TEC controller controls the energizing of solenoid valve (MV) used to reverse the direction of the cutting unit reel motors (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch.

2. Before disconnecting the seat switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the seat switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the seat switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

3. Raise the hinged access panel and locate the backlap switch on the front of the mow control manifold (left side). Disconnect the harness electrical connector from the backlap switch.

4. Check the continuity of the switch by connecting a multimeter (ohms setting) across the switch connector terminals.

5. With the ignition switch in the OFF position, turn the backlap lever to the backlap position while watching the multimeter. Continuity should be made as the switch closes.

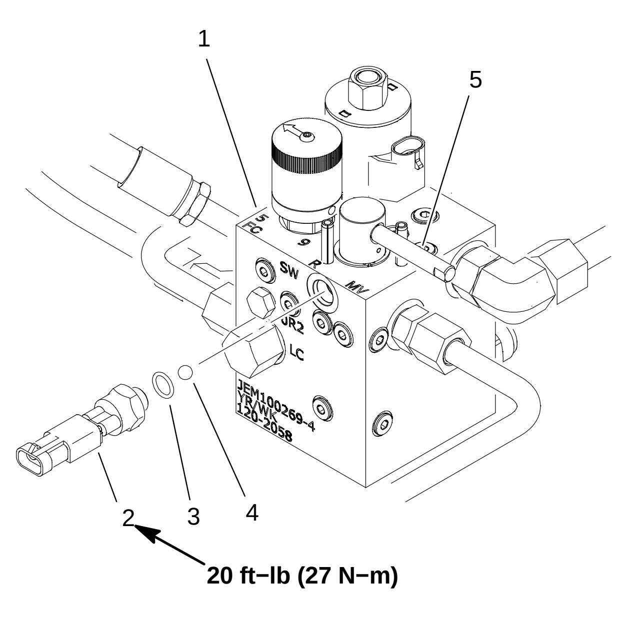

Figure 41

1. **Mow control manifold**
2. **Backlap switch**
3. **O−ring**
4. **Ball**
5. **Backlap lever**

6. Turn the backlap lever to the mow position while watching the multimeter. Continuity should be broken as the switch opens.

7. If backlap switch is faulty, replace switch. Make sure that dowel and ball are placed in the manifold port before installing new switch in manifold. Torque switch to **20 ft-lb (27 N- m)**.

8. If the backlap switch tests correctly and a circuit problem still exists, check wire harness (see Electrical Schematic and Wire Harness Drawings in Chapter 10 - Foldout Drawings in this manual).

9. After testing is completed, connect harness electrical connector to the backlap switch and close access panel.

Turn Around Switch (Reelmaster 3555−D and 3575−D)

The cutting unit turn around switch is a normally open proximity switch that closes when the front right cutting unit (cutting unit #5) is in the turn−around position. The turn around switch is attached to a bracket outside the front right lift arm pivot pin. A plate on the front right lift arm acts as the sensing plate for the turn around switch (Fig. 42).

The TEC controller monitors the position of the turn around switch (open or closed). Using inputs from the turn around switch and other switches in the interlock system, the TEC controller controls the energizing of the proportional relief valve (PRV) used to drive the cutting unit motors, and solenoid valves (S1, S3, and S4) used to raise the cutting units (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

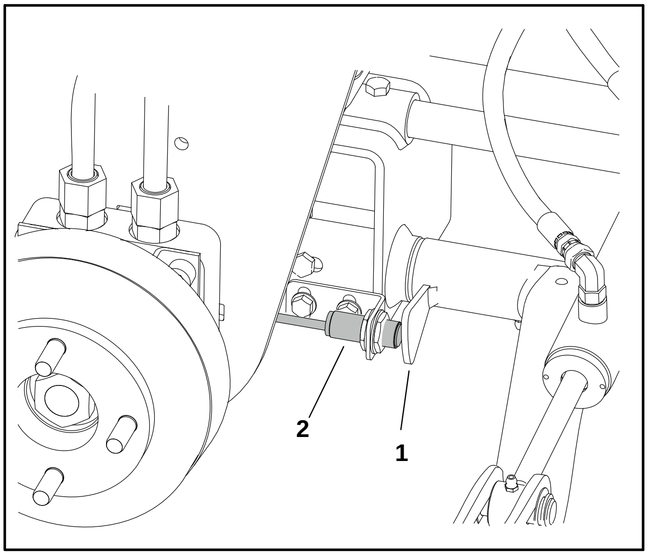

Figure 42

1. **Signal plate (on lift arm #5)**
2. **Turn around switch**

Testing

1. Park machine on level surface, lower cutting units, stop engine, apply parking brake and remove key from ignition switch.

2. Make sure the turn around switch is properly adjusted (see Turn Around Switch in the Adjustments section of this chapter).

3. Before disconnecting the switch for testing, the switch and its circuit wiring should be tested as a TEC electrical input using the Diagnostic Display (see Diagnostic Display in this chapter). If input testing verifies that the switch and circuit wiring are functioning correctly, no further switch testing is necessary. If, however, input testing determines that the switch and circuit wiring are not functioning correctly, proceed with the following switch testing procedure.

4. Make sure ignition switch is OFF and disconnect the turn around switch connector from machine wire harness.

5. Verify that the machine wire harness connector terminal for black wire is closed (continuity) to ground.

6. Turn ignition switch to the ON position (do not start engine) and verify with a multimeter that machine wire harness connector terminal for pink wire has system voltage (12 VDC) present.

7. If the black wire is closed to ground, the pink wire has system voltage present and the switch is properly adjusted, replace and adjust the turn around switch.

8. Reconnect switch after testing.

Electrical System

Engine Temperature Sender

The engine temperature sender is located above the alternator, in the thermostat housing (Fig. 43). The resistance of the temperature sender reduces as the engine coolant temperature increases.

The TEC controller uses input from the temperature sender to control the high temperature warning light on the operator’s control panel (on or off). Using inputs from the temperature sender and other switches in the interlock system, the TEC controller controls the energizing of the engine start relay, the fuel stop solenoid and fuel pump, and the proportional relief valve (PRV) used to drive the cutting unit motors (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

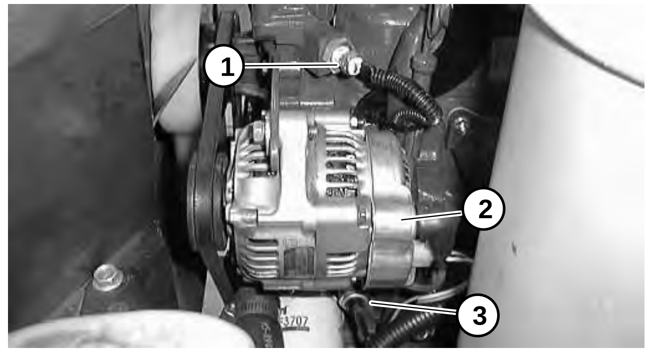

Figure 43

1. **Engine temp. sender**
2. **Alternator**
3. **Oil pressure switch**

Testing

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Locate temperature sender on engine and disconnect wire harness connector from sender.

CAUTION

Make sure engine is cool before removing the temperature sender from engine.

3. Lower coolant level in the engine and remove the temperature sender from the thermostat housing.

4. Put sender in a container of oil with a thermometer and slowly heat the oil (Fig. 44).

CAUTION

Handle the hot oil with extreme care to prevent personal injury or fire.

NOTE: Prior to taking resistance readings with a digital multi meter, short the meter test leads together. The meter will display a small resistance value (usually 0.5 ohms or less) 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.

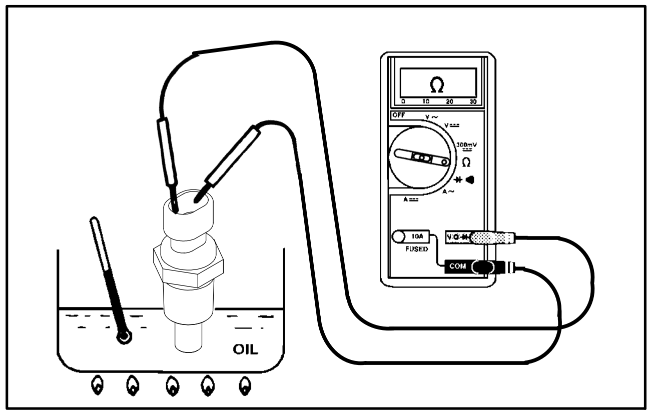

Figure 44

5. Check resistance of the sender with a multimeter (ohms setting) as the oil temperature increases.

   A. The meter should indicate from 11.4 to 13.6 k−ohms at 68F (20C).

   B. The meter should indicate from 2.3 to 2.6 k−ohms at 140F (60C).

   C. The meter should indicate from 640 to 720 ohms at 212F (100C).

6. Replace temperature sender if necessary.

7. Install temperature sender:

   A. Clean threads of water flange and temperature sender thoroughly. Apply thread sealant to the threads of the sender.

   B. Screw sender into the water flange until it is finger tight. Then, tighten sender an additional 2 to 3 full turns.

   C. Connect wire harness connector to sender.

8. Fill engine cooling system.

Start Relay

The start relay is secured to the control panel assembly next to the operator seat (Fig. 45). This relay is attached to the wire harness with a five (5) wire connector (Fig. 46). The relay can be accessed by removing the control panel cover.

The start relay is used to provide current to the engine starter motor. The TEC controller energizes and monitors the operation of the start relay when specific input conditions are met. The start relay should remain energized while the ignition switch is set to the START position for a maximum of thirty (30) seconds.

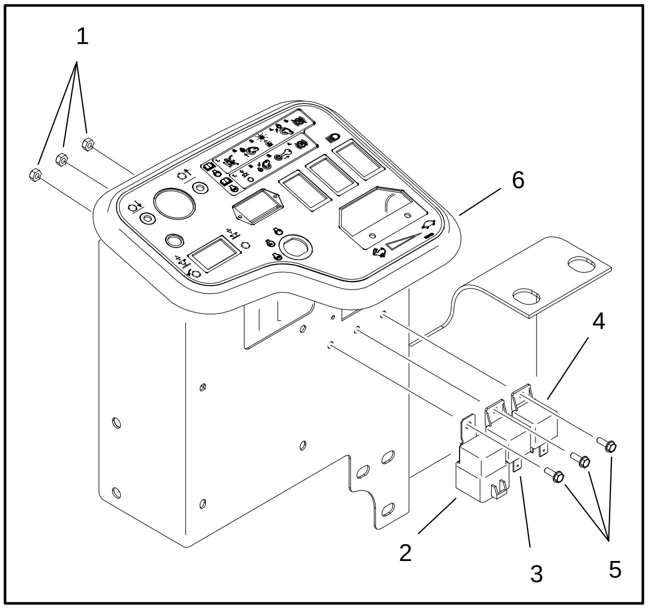

Figure 45

1. **Lock nut**
2. **Start relay**
3. **Main power relay**
4. **Glow relay**
5. **Screw**
6. **Mounting panel**

Testing

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Test the start relay circuit as a TEC electrical output using the Diagnostic Display (see Diagnostic Display in this chapter). If output testing verifies that the TEC is energizing the start relay circuit under the appropriate conditions, leave the diagnostic display connected and test the circuit wiring between the TEC and the start relay.

3. Test the circuit wiring:

   A. Remove cover from control panel and locate relay that is to be tested.

   B. Disconnect wire harness connector from the relay.

   C. Position the necessary input(s) to illuminate the START output LED indicating that the TEC controller is energizing that function (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

   D. Connect multimeter (DC voltage setting) across the terminals of the wire harness connector. 12VDC should be present at the connector when the START LED is illuminated.

   E. Repair damaged wiring as necessary.

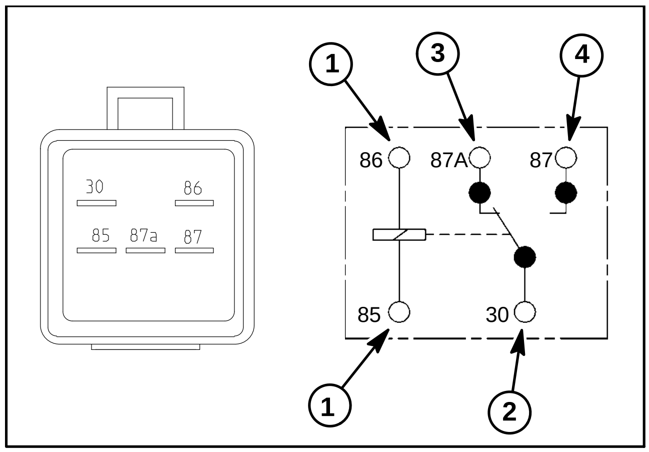

Figure 46

1. **Coil terminal**
2. **Common terminal**
3. **Normally closed term.**
4. **Normally open terminal**

4. If the circuit wiring is functioning correctly, use the following procedure to test the relay.

   A. To make sure that machine operation does not occur unexpectedly, disconnect negative (−) cable from battery and then disconnect positive (+) cable from battery (see Battery Service in the Service and Repairs section of this chapter).

   B. Remove relay from control panel for testing.

Electrical System

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.

C. Using a multimeter, verify that coil resistance between terminals 85 and 86 is from 71 to 88 ohms.

D. 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.

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

F. 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.

G. Disconnect voltage and multimeter test leads from the relay terminals.

5. After testing is completed, secure relay to mounting panel and connect wire harness connector to relay. Install cover to control panel.

6. Connect positive (+) cable to battery and then connect negative (−) cable to battery (see Battery Service in this chapter).

Fuel Stop Solenoid

The fuel stop solenoid must be energized for the diesel engine to run. The solenoid is mounted to the injection pump on the engine (Fig. 47).

The fuel stop solenoid includes two coils for operation: the pull coil and the hold coil. The TEC controller energizes and monitors the operation of the fuel stop solenoid when specific input conditions are met. When the ignition switch is set to RUN or START, the fuel stop solenoid is energized and the pull coil retracts the solenoid plunger. Once the plunger is retracted, the hold coil will keep it retracted for continued engine operation. When the solenoid is de−energized, the plunger extends to shut off fuel supply to the engine causing the engine to stop running. The fuel stop solenoid is grounded through the solenoid housing.

NOTE: The TEC output circuit that controls the fuel stop solenoid also controls the electric fuel pump. This circuit is known as the Energize To Run (ETR) circuit. Refer to the Electrical Schematics and Wire Harness Drawings in Chapter 10 − Foldout Drawings in this manual for additional information.

Testing

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch. Unlatch and raise hood.

2. Test the ETR circuit as a TEC electrical output using the Diagnostic Display (see Diagnostic Display in this chapter). If output testing verifies that the TEC is energizing the ETR circuit under the appropriate conditions, leave the diagnostic display connected and test the circuit wiring.

3. Test the circuit wiring:

   A. Disconnect wire harness connector from the fuel stop solenoid.

   B. Position the necessary input(s) to illuminate the ETR output LED indicating that the TEC controller is energizing that function (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

   C. Connect multimeter (DC voltage setting) across the terminals of the wire harness connector. 12VDC should be present at the connector when the ETR LED is illuminated.

   D. Repair damaged wiring as necessary.

4. If the circuit wiring is functioning correctly, use the following procedure to test the fuel stop solenoid.

   NOTE: Prior to taking small resistance readings with a digital multimeter, short the 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 the measured value of the component you are testing.

   A. Using a digital multimeter, touch one test lead to the pull coil terminal and the other test lead to the fuel stop solenoid frame (ground) (Fig. 48). The resistance of the pull coil should be less than 1 ohm (but not zero).

   B. Using a digital multimeter, touch one test lead to the hold coil terminal and the other test lead to the fuel stop solenoid frame (ground) (Fig. 48). The resistance of the hold coil should be approximately 15 ohms.

5. Replace solenoid if necessary and reconnect the wiring harness.

Electrical System

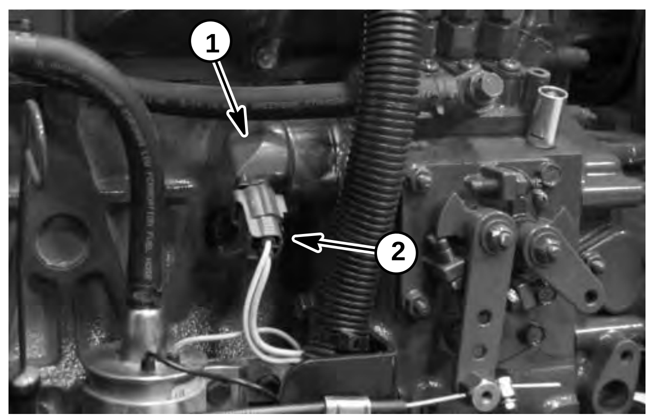

Figure 47

1. **Fuel stop solenoid**
2. **Harness connector**

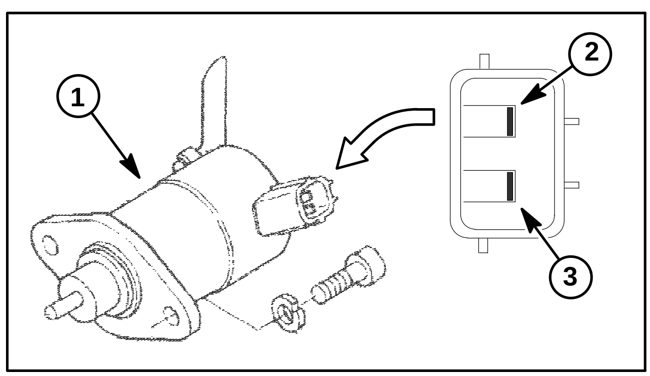

Figure 48

1. **Fuel stop solenoid**
2. **Pull coil terminal**
3. **Hold coil terminal**

Fuel Pump

The fuel pump is attached to the left side of the engine near the fuel/water separator (Fig. 49).

The TEC controller energizes and monitors the operation of the fuel pump when specific input conditions are met. The fuel pump is energized when the ignition switch is set to RUN or START. The fuel pump includes an internal pressure switch that energizes and de−energizes the pump to maintain fuel line pressure.

NOTE: The TEC output circuit that controls the electric fuel pump also controls the fuel stop solenoid. This circuit is known as the Energize To Run (ETR) circuit. Refer to the Electrical Schematics and Wire Harness Drawings in Chapter 10 − Foldout Drawings in this manual for additional information.

Testing

1. Park machine on a level surface, lower cutting units, stop engine, and engage parking brake. Unlatch and raise hood.

2. Test the ETR circuit as a TEC electrical output using the Diagnostic Display (see Diagnostic Display in this chapter). If output testing verifies that the TEC is energizing the ETR circuit under the appropriate conditions, leave the diagnostic display connected test the circuit wiring.

3. Test the circuit wiring:

   A. Disconnect wire harness connector from the fuel pump.

   B. Position the necessary input(s) to illuminate the ETR output LED indicating that the TEC controller is energizing that function (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

   C. Connect multimeter (DC voltage setting) across the terminals of the wire harness connector. 12VDC should be present at the connector when the ETR LED is illuminated.

   D. Repair damaged wiring as necessary.

4. If the circuit wiring is functioning correctly, use the following procedure to test the pump.

   A. Disconnect electrical connector from the fuel stop solenoid to prevent the engine from starting.

   B. Disconnect the fuel hose between the pump and the filter/separator (pump discharge) at the filter separator.

   C. Make sure fuel hoses to and from the fuel pump are not kinked, damaged, and free of obstructions.

   D. Place disconnected fuel hose into a graduated cylinder with at least a 1 quart (0.95 liter) capacity.

   IMPORTANT: When testing the fuel pump, DO NOT turn ignition switch to START.

   E. Collect fuel in the graduated cylinder by turning ignition switch to the RUN position. Allow pump to run for time listed below, then return switch to OFF. The amount of fuel collected in the graduated cylinder should be approximately **21 to 37 fl oz (0.62 to 1.1 Ltr) after thirty (30) seconds**.

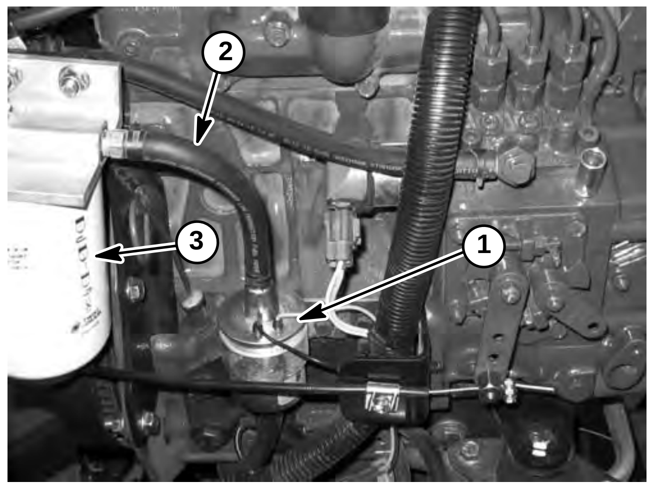

Figure 49

1. **Fuel pump**
2. **Fuel hose (discharge)**
3. **Fuel filter**

5. Replace fuel pump as necessary. Reconnect fuel hose to the fuel filter/separator.

6. Reconnect electrical connector to the fuel stop solenoid.

7. Bleed fuel system.

Fuel Pump Specifications

Pump Capacity	42 to 74 fl oz/min (1.2 to 2.2 Ltr/min)
Pressure	2.3 psi (15.8 kPa)
Max. Current Draw	1.8 amp

Glow Relay

The glow relay is secured to the control panel assembly next to the operator seat (Fig. 50). This relay is attached to the wire harness with a four (4) wire connector (Fig. 51). The relay can be accessed by removing the control panel cover.

The glow relay is used to provide current to the engine glow plugs. The TEC controller energizes and monitors the operation of the glow relay when specific input conditions are met. The glow relay should remain energized for six (6) seconds after the ignition switch is set to the RUN position. The glow relay should also remain energized as long as the ignition switch is in the START position.

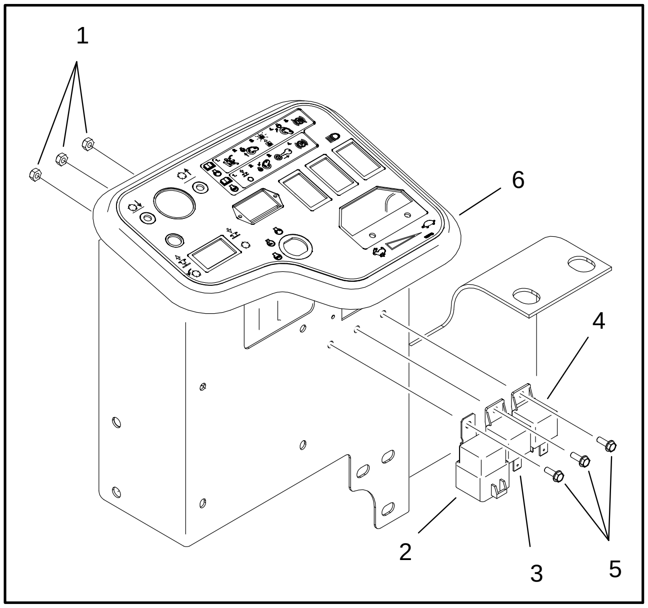

Figure 50

1. **Lock nut**
2. **Start relay**
3. **Main power relay**
4. **Glow relay**
5. **Screw**
6. **Mounting panel**

Testing

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Test the glow relay circuit as a TEC electrical output using the Diagnostic Display (see Diagnostic Display in this chapter). If output testing verifies that the TEC is energizing the glow relay circuit under the appropriate conditions, use the following procedure to test the circuit wiring between the TEC and the glow relay.

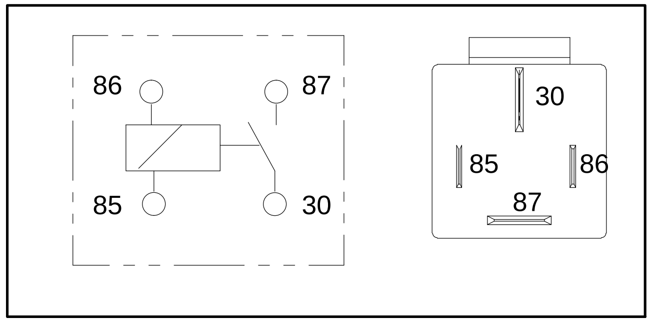

Figure 51

3. Test the circuit wiring:

   A. Remove cover from control panel and locate relay that is to be tested.

   B. Disconnect wire harness connector from the relay.

   C. Position the necessary input(s) to illuminate the GLOW output LED indicating that the TEC controller is energizing that function (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

   D. Connect multimeter (DC voltage setting) across the terminals of the wire harness connector. 12VDC should be present at the connector when the GLOW LED is illuminated.

   E. Repair damaged wiring as necessary.

4. If the circuit wiring is functioning correctly, use the following procedure to test the relay.

   A. To make sure that machine operation does not occur unexpectedly, disconnect negative (−) cable from battery and then disconnect positive (+) cable from battery (see Battery Service in the Service and Repairs section of this chapter).

   B. Remove cover from control panel and locate relay to be tested.

   C. Disconnect wire harness connector from relay. Remove relay from mounting panel for 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.

D. Using a multimeter, verify that coil resistance between terminals 86 and 85 is approximately 72 ohms.

E. 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.

F. Disconnect voltage and test leads from the relay terminals.

5. After testing is completed, secure relay to mounting panel and connect wire harness connector to relay. Install cover to control panel.

6. Connect positive (+) cable to battery and then connect negative (−) cable to battery (see Battery Service in this chapter).

Hydraulic Solenoid Valve Coils

The Reelmaster hydraulic control manifolds use several hydraulic solenoid valve coils for system control. The lift manifold includes four (4) solenoid valves (S1, S2, S3, and S4). The mow manifold includes a single solenoid valve (PRV).

The TEC controller energizes and monitors the operation of the solenoid coils when specific input conditions are met. When the solenoid coils are energized, hydraulic valve shift occurs to control hydraulic circuit flow. Testing of the coils can be done with the coil installed on the hydraulic valve.

Testing

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Before disconnecting and testing solenoid valve coils, test the TEC controller outputs with the Diagnostic Display (see Diagnostic Display in this chapter). If output testing verifies that the TEC is energizing the solenoid coil circuit under the appropriate conditions, leave the diagnostic display connected and test the specific circuit wiring.

3. Test the circuit wiring:

A. Lift hinged access cover in front of operator's seat and locate valve coil that is to be tested.

B. Disconnect wire harness connector from the coil.

C. Position the necessary input(s) to illuminate the appropriate output LED indicating that the TEC controller is energizing that function (see Table 3: Input Conditions Required to Illuminate Diagnostic Display Outputs in this chapter).

D. Connect multimeter (DC voltage setting) across the terminals of the disconnected wire harness connector. 12VDC should be present at the connector when the appropriate LED is illuminated.

E. Repair damaged wiring as necessary.

4. If the circuit wiring is functioning correctly, use the following procedure to test the solenoid coil(s).

A. Determine solenoid coil(s) that is to be tested and locate coil on correct hydraulic manifold. Access the manifolds through the hinged access panel in front of the operator's seat. The lift control manifold is on the right side of the machine and the mow control manifold is on the right side of the machine.

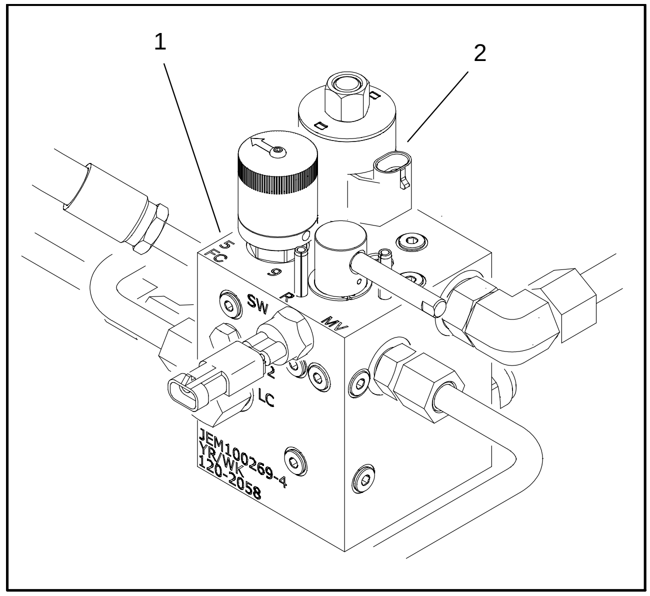

Figure 52

1. **Mow control manifold**
2. **PRV solenoid valve**

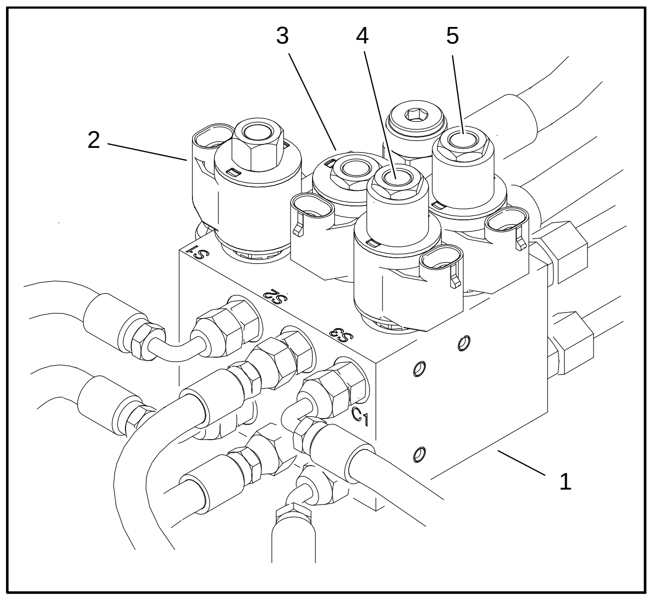

Figure 53

1. **Lift control manifold**
2. **S1 solenoid valve**
3. **S2 solenoid valve**
4. **S3 solenoid valve**
5. **S4 solenoid valve**

B. Disconnect wire harness connector from the hydraulic solenoid valve coil that is to be tested (Figs. 52 or 53).

NOTE: Prior to taking small resistance readings with a digital multimeter, short the meter test leads together. The meter may 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 the measured value of the solenoid coil being testing.

C. Solenoid coil resistance should be measured with solenoid at approximately 68F (20C). Resistance may be slightly different than listed at different temperatures. Typically, a failed solenoid coil will either be shorted (very low or no resistance) or open (infinite resistance). Use a multimeter (ohms setting) and measure resistance between the two (2) connector terminals on the solenoid valve coil. The resistance for the solenoid coils is identified below:

Solenoid Valve Coil	Resistance
PRV (mow)	7.1 ohms
S1, S2, S3 and S4 (lift)	8.8 ohms

NOTE: To assist in troubleshooting, identical solenoid valve coils can be exchanged. If the problem follows the exchanged coil, an electrical problem likely exists with the coil. If the problem remains unchanged, something other than the solenoid coil is the problem source (e.g. switch, circuit wiring, hydraulic problem). The lift manifold S1, S2, S3 and S4 coils are identical.

D. If solenoid coil resistance is incorrect, replace solenoid (see the Service and Repairs section of Chapter 4 − Hydraulic System in this manual).

5. After coil testing is completed, connect wire harness connector to the solenoid valve coil(s).

Indicator Lights

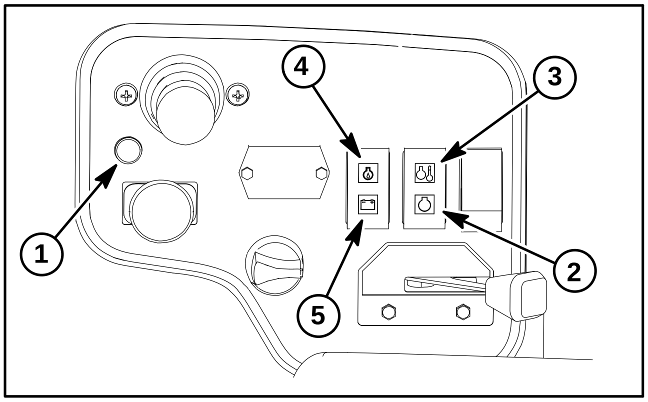

Figure 54

1. **Diagnostic light**
2. **Glow plug indicator**
3. **High temp warning**
4. **Engine oil pressure**
5. **Charge indicator**

Diagnostic Light

When the ignition switch is moved to the RUN position and the machine electrical system is functioning properly, the diagnostic light will be illuminated for approximately three (3) seconds and then will turn off. The light should remain off during normal machine operation.

If the machine TEC controller detects an electrical system malfunction (fault) during machine operation, the diagnostic light will flash rapidly (see Diagnostic Light in the chapter for additional information).

Glow Plug Indicator Light

The glow plug light should come on when the ignition switch is placed in RUN prior to placing the ignition switch in START. The light should stay lit for approximately six (6) seconds while the ignition switch is left in ON.

The glow plug indicator light is controlled by the TEC controller (see Glow Relay in this chapter for additional information).

High Temperature Warning Light

If the engine coolant temperature rises to approximately 220F (105C), the high temperature light should come on and the cutting units will disengage. The high temperature light will remain on and the cutting units will remain inactive until the engine temperature drops below 220F (105C).

If the engine temperature rises above 240F (116C) for more than 10 seconds the engine will shutdown.

To test the high temperature shutdown light and circuit wiring, start the engine and ground the blue wire attached to the temperature sender at the engine thermostat housing. Warning light should illuminate.

The high temperature warning light is controlled by the TEC controller (see Engine Temperature Sensor in this chapter for additional information).

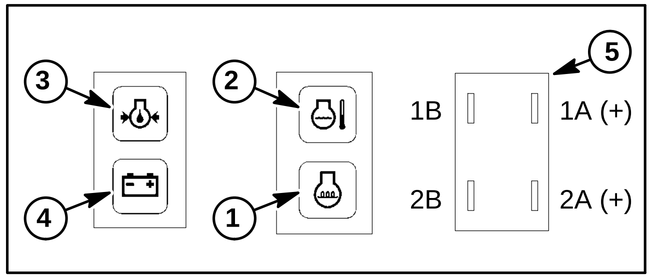

Figure 55

1. **Glow plug indicator**
2. **High temp warning**
3. **Engine oil pressure**
4. **Charge indicator**
5. **Warning light back**

Engine Oil Pressure Light

The oil pressure light should come on when the ignition switch is in the ON position with the engine not running. The oil pressure light should come on with the engine running if the engine oil pressure drops to an unsafe level. The engine oil pressure light is controlled by the oil pressure switch (see Oil Pressure Switch in this chapter for additional information).

IMPORTANT: If the oil pressure indicator light is illuminated with the engine running, shut off the engine immediately.

Charge Indicator Light

The charge indicator light should come on when the ignition switch is in ON with the engine not running or with an improperly operating charging system while the engine is running. The charge indicator light is controlled by the TEC controller. Test the charging system if necessary (see Charging System Test in this chapter).

Testing Indicator Lights

1. Apply 12 VDC to terminals 1A and 2A.
2. Ground terminals 1B and 2B.
3. Both indicator lights should light.

CAN−bus Termination Resistors

System communication between electrical components on Reelmaster machines is accomplished on a CAN−bus communication system. Two (2) specially designed, twisted cables form the bus for the network used on the machine. These wires provide the data pathways between machine components. At the ends of the twisted pair of bus cables are two (2) 120 ohm termination resistors.

The resistors plug into the wire harness under the control panel. The resistors can be accessed by removing the cover from the control panel (see Electrical Schematics and Wire Harness Drawings in Chapter 10 − Foldout Drawings in this manual for additional information). The termination resistor and the wire harness connector have blue inserts to identify the proper location for the termination resistor.

IMPORTANT: The termination resistors are required for proper electrical system operation.

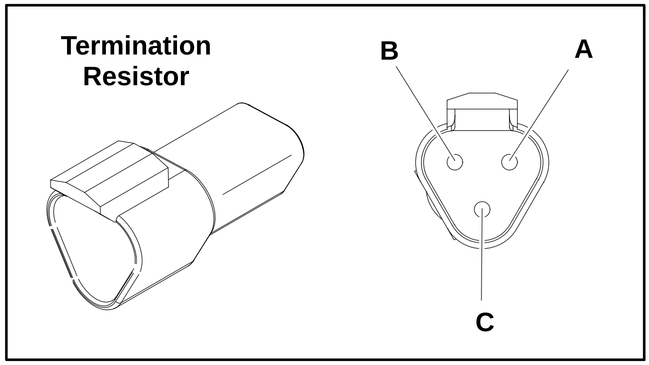

Figure 56

Testing

The termination resistors (Fig. 56) can be tested using a digital multimeter (ohms setting). There should be **120 ohms** resistance between terminals A and B of the termination resistor. Terminal C is not used.

Hour Meter

The hour meter is located on the control panel. The hour meter (Fig. 57) indicates the total hours of machine operation. The hour meter starts to function whenever the key switch is in the ON position.

1. Connect the positive (+) terminal of a 12 VDC source to the positive terminal of the hour meter.

2. Connect the negative (−) terminal of the voltage source to the other terminal of the hour meter.

3. The hour meter should move 1/10 of an hour in six minutes.

4. Disconnect the voltage source from the hour meter.

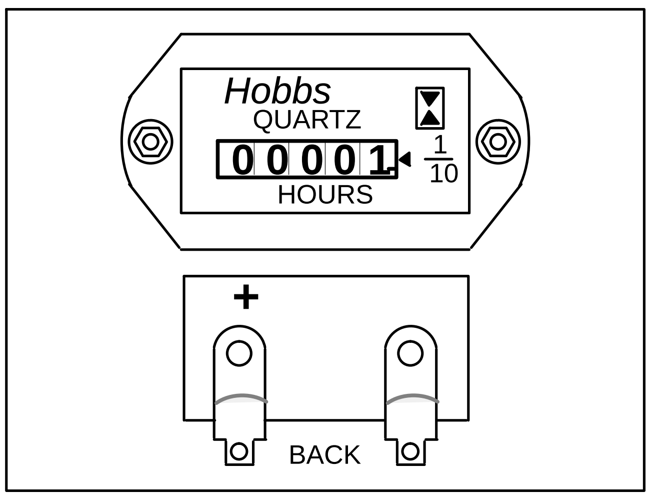

Figure 57

Oil Pressure Switch

The engine oil pressure switch is located on the engine below the alternator (Fig. 58). The oil pressure switch is a normally closed switch that opens with pressure. The oil pressure switch should open at approximately **8 PSI (0.56 kg/cm^2)**.

If low engine oil pressure allows the oil pressure switch to close during engine operation, the engine oil pressure light should illuminate.

Testing

NOTE: Refer to the Kubota Workshop Manual: 05 Series Diesel Engine for information regarding engine lubrication system and testing.

1. Set the ignition switch to the RUN position. The oil pressure indicator light on the control panel should be illuminated.

2. If the indicator light is not illuminated, open hood to gain access to engine.

3. Locate oil pressure switch on engine and disconnect the harness wire from the switch.

4. With the ignition switch in the RUN position, ground the disconnected wire to the engine block.

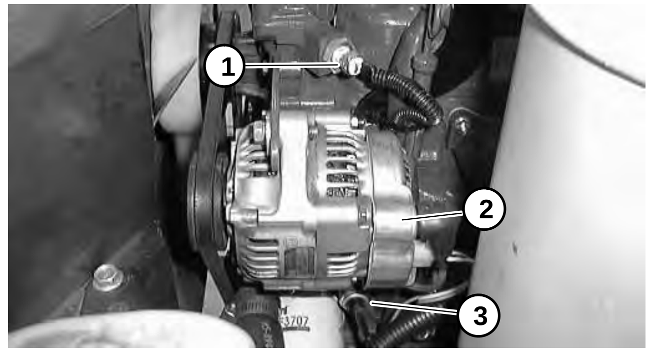

Figure 58

1. **Engine temp. sender**
2. **Alternator**
3. **Oil pressure switch**

5. If the light comes on, the oil pressure switch is faulty.

6. If the light does not come on after step 4, check the oil pressure light circuit wiring and indicator light (see Indicator Lights in this section).

7. After testing is completed, connect the harness wire to the switch. Lower and secure hood.

Electrical System

Worklight Switch

The worklight switch is located on the control panel (Fig. 59). This rocker switch allows the worklights (headlights) to be turned on and off.

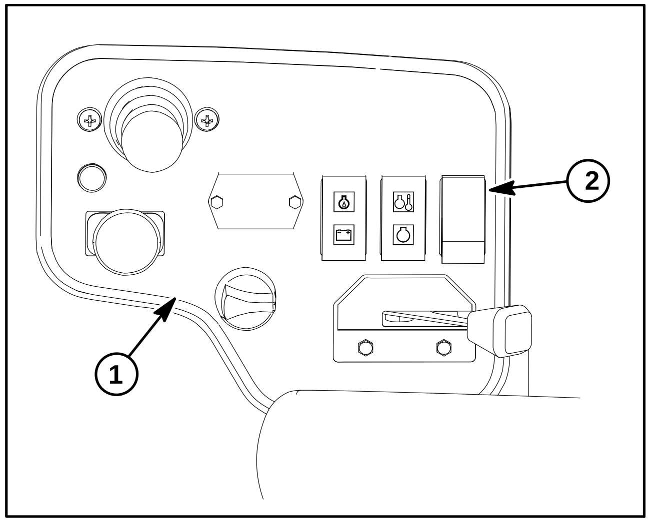

Figure 59

1. **Control panel** 2. **Worklight switch**

Testing

1. Park machine on level surface, lower cutting units, stop engine, apply parking brake and remove key from ignition switch.

2. Remove cover from control panel to gain access to worklight switch.

3. Disconnect wire harness electrical connector from the worklight switch.

4. With the use of a multimeter (ohms setting), the worklight switch functions may be tested to determine whether continuity exists between the various terminals for each position. The switch terminals are marked as shown in Figure 60. The circuitry of the worklight switch is shown in the chart below. Verify continuity between switch terminals.

SWITCH POSITION	NORMAL CIRCUITS	OTHER CIRCUITS
ON	2 + 3	5 + 6
OFF	2 + 1	5 + 4

5. Replace worklight switch if testing identifies that switch is faulty.

6. After testing is completed, connect the wire harness connector to the worklight switch. Install control panel cover.

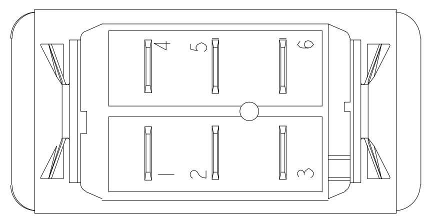

Figure 60

NOTE: Worklight switch terminals 1, 4, 5 and 6 are not used.

Service and Repairs

NOTE: For engine component repair information, see the Kubota Workshop Manual: 05 Series Diesel Engine.

Battery Storage

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

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

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 (see Battery Service in this section).

Battery Care

A maintenance free battery is supplied with the product. Use a maintenance free battery of the same size and capacity for replacement.

1. Keep terminals and entire battery case clean. Dirt and corrosion on the battery terminals may cause the battery to discharge.

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

WARNING

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

NOTE: Disconnect negative (−) cable first. Reconnect positive (+) cable first.

B. If corrosion exists at battery terminals, disconnect cables and clean clamps and terminals separately with baking soda (sodium bicarbonate) and a brush. Reconnect cables.

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

D. Coat battery posts and cable connectors with battery terminal protector (see Special Tools in this chapter) or petroleum jelly to prevent corrosion.

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 (see Battery Storage and Battery Care in this chapter).

Battery Specifications

Maintenance free wet lead acid
BCI Group 26 Battery
525−540 Cold Cranking Amps (CCA) at 0F (−18C)
80 minute Reserve Capacity at 80F (27C)

Battery Removal and Installation (Fig. 61)

1. Remove battery cover from the frame. Loosen battery retainer securing the back of the battery to the battery support.

2. Note battery cable routing and loosen nut on ground cable (−) post and remove cable from battery. This should prevent short circuiting the battery, other components, or the operators hands.

3. Note battery cable routing and loosen nut on positive (+) cable post and remove cable from battery.

4. Carefully remove battery from machine.

5. Install battery in reverse order making sure to connect and tighten positive cable to battery before connecting the negative cable. Route battery cables as noted during removal.

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 for short circuits or faulty components and repaired.

6. Make sure that rubber boot is properly placed over positive cable end and positive battery post.

7. Secure battery cover after installing battery.

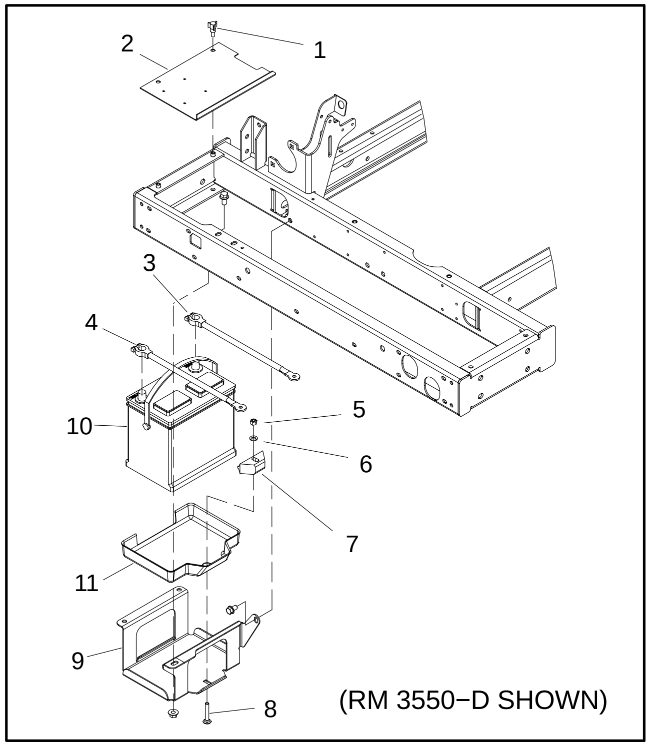

Figure 61

1. Knob (2)
2. Battery cover
3. Negative cable
4. Positive cable
5. Lock nut
6. Flat washer
7. Battery retainer
8. Carriage screw
9. Battery support
10. Battery
11. Battery tray

Battery Inspection and Maintenance

1. Replace battery if case is cracked or leaking.

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

3. Check for signs of wetness or leakage around the top of the battery which might indicate overcharging or a loose terminal post. Check for signs of wetness or leakage around the battery cover seal. Replace the battery if a terminal post is loose or the seal is broken or leaking.

4. Clean the battery with a solution of baking soda and water, then rinse it with clean water.

Battery Testing

1. Perform a high−discharge test with 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 battery load tester manufacturer's instructions when using a 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 fifteen (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. Connect a battery load tester to the battery terminals **following the load tester manufacturer's instructions**. Connect a digital multimeter to the battery terminals.

E. Apply a test load of 285 amps (one half the Cranking Performance rating of the battery) for fifteen (15) seconds.

F. Take a battery voltage reading after the load has been applied to the battery for fifteen (15) seconds, then remove the load. Record the voltage reading.

G. Using the following table, determine the minimum voltage for the cell temperature reading

H. 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.

Minimum Voltage	Battery Temperature	
9.6	70F (and up)	21C (and up)
9.5	60F	16C
9.4	50F	10C
9.3	40F	4C

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.

WARNING

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 charger from electrical outlet before connecting or disconnecting charger leads to or from battery posts.

CAUTION

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

1. Determine the battery charge level from its open circuit voltage.

Battery Charge Level	Open Circuit Voltage
100%	12.68
75%	12.45
50%	12.24
25%	12.06
0%	11.89

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

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

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

5. Occasionally check the temperature of the battery. If the temperature exceeds 125F (52C), the charging rate must be lowered or temporarily stopped.

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 60F (16C) 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.

Cartridge Valve Coil Replacement

The solenoid valve coils on the hydraulic control manifolds (Fig. 62) can be replaced without opening the hydraulic system.

Removal

1. Park machine on a level surface, lower cutting decks, engage parking brake, stop engine and remove key from the ignition switch.

2. Disconnect the wire harness electrical connector from the solenoid valve coil.

3. Remove the nut from the spool assembly.

4. Slide the coil assembly from the solenoid valve stem. Discard the coil.

5. Clean any corrosion or dirt from the valve stem.

Installation

1. Slide new coil assembly onto the solenoid valve stem.

2. Install the nut onto the spool assembly and torque nut **60 in−lb (6.8 N−m)** (do not over tighten).

3. Connect the wire harness electrical connector to the solenoid valve coil.

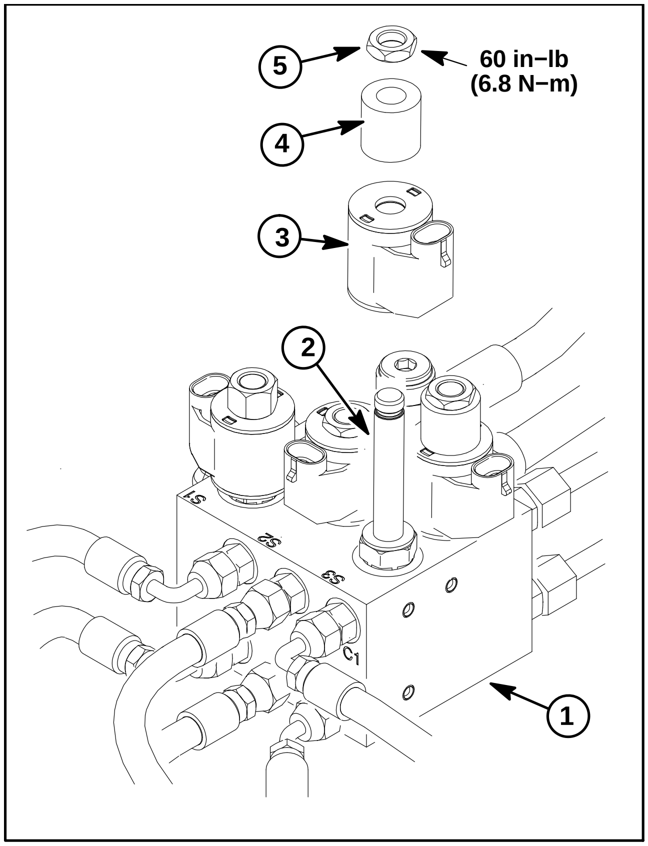

Figure 62

1. Hydraulic control manifold
2. Solenoid valve
3. Solenoid valve coil
4. Spacer
5. Nut

Worklight Bulb Replacement

The worklights are adjustable left and right, and up and down as necessary. The worklights use a replaceable halogen bulb.

CAUTION

The worklights use a halogen bulb that becomes extremely hot when in operation. Handling a hot bulb can cause severe burns and personal injury. Allow enough time for bulb to cool before handling.

Bulb Replacement (Fig. 63)

1. Park machine on a level surface, stop engine, apply parking brake and remove key from ignition switch.

2. Remove screw securing bezel to worklight body and remove bezel.

3. Disconnect worklight from wire harness at bulb and remove worklight.

4. Loosen the bulb from the worklight by rotating it 1/4 turn counter−clockwise. Then, grasp bulb base and remove bulb from the worklight.

CAUTION

Any surface contamination can damage the halogen bulb and lead to its failure or explosion creating a serious safety hazard.

Halogen bulbs should be handled without touching the clear bulb surface. Handle the bulb by holding onto the base.

5. Align tabs on bulb with notches in headlight opening. Insert bulb into back of headlight without touching the glass bulb surface. Secure bulb to worklight by rotating it 1/4 turn clockwise.

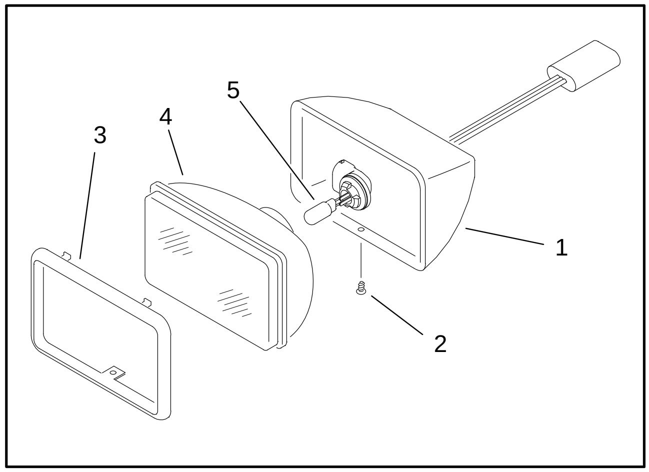

Figure 63

1. Body
2. Screw
3. Bezel
4. Worklight
5. Bulb

6. Connect worklight to wire harness at bulb.

7. Install worklight, bezel, and screw.

8. Adjust/aim worklight as needed.

Chapter 6

Chassis

Table of Contents

Specifications

Item	Description
Tire pressure (22 x 12 − 12 4 ply)	Reelmaster 3550−D = 12 PSI (96 kPa) Reelmaster 3555−D/3575−D = 20 PSI (138 kPa)
Wheel lug nut torque	70 to 90 ft−lb (95 to 122 N−m)

Special Tools

Order special tools from your Toro Distributor.

Wheel Hub Puller

Part Number: **TOR4097**

The wheel hub puller allows safe removal of the wheel hub from the shaft of wheel motors.

Figure 1

Adjustments

Adjust Brakes

CAUTION

Before and after adjusting the brakes, always check the brakes in a wide open area that is flat and free of other persons and obstructions.

1. Check brake adjustment as follows:

    A. Park machine on a level surface, lower cutting units, stop engine and remove key from the ignition switch.

    B. Rotate by−pass valve on the piston pump 90 degrees to allow front wheels to turn freely (Fig. 2).

CAUTION

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

    C. Chock rear wheel. Jack up both front wheels and support the machine with jackstands or hardwood blocks.

    D. Apply the parking brake. The force to actuate the brake lever should be from 30 to 40 lbs (133 to 178 N).

    E. With the parking brake applied, use a torque wrench on the wheel hub lock nut to identify the break away torque at each front wheel. The minimum break away torque with the parking applied should be 300 ft−lb (407 N−m).

2. If adjustment is necessary, adjust brakes as follows:

    A. Remove both front wheel assemblies from the machine (see Front Brake and Wheel Removal in the Service and Repairs section).

    B. Adjust brakes by turning clevis to increase or decrease shoe pressure on the brake drum (Fig. 3). Make sure that brake shoes do not drag against drums with the parking brake lever released.

    C. If brakes can not be adjusted properly, repair or replace brake components as necessary.

    D. After adjustment is complete, install both front wheel assemblies to the machine (see Front Brake and Wheel Installation in the Service and Repairs section).

    E. Lower front wheels to the ground.

    F. Before starting engine, close by−pass valve on pump by rotating it 90 degrees (Fig. 2).

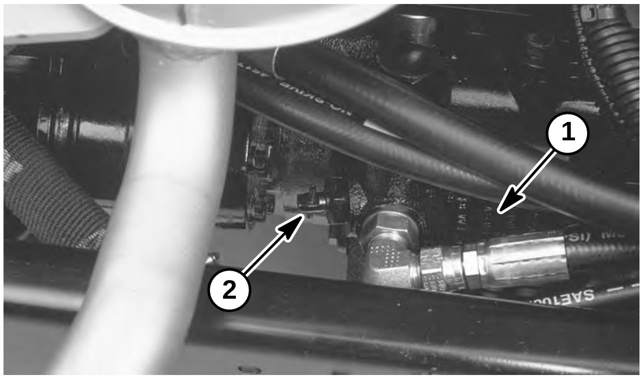

Figure 2

1. Piston pump **2. By−pass valve**

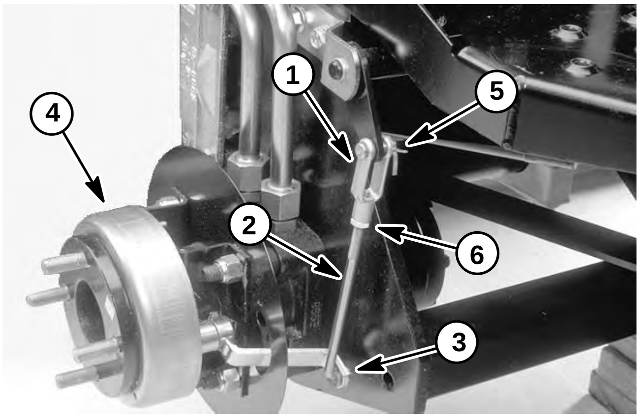

Figure 3

1. Clevis
2. Adjustment rod
3. Brake lever
4. Brake drum
5. Cotter pin
6. Jam nut

Chassis

Operator Seat

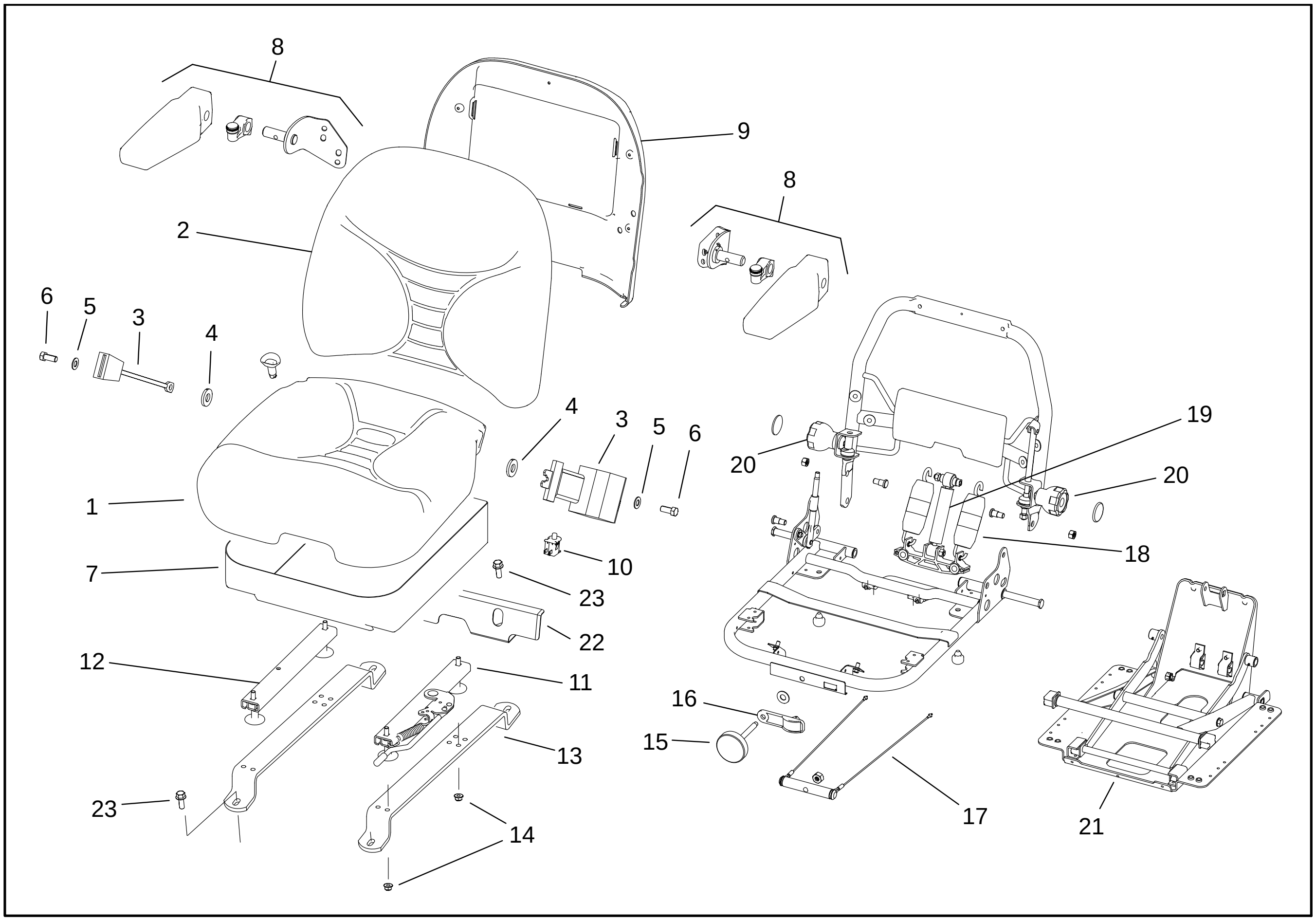

Figure 4

1. Bottom cushion
2. Back cushion
3. Seat belt
4. Flat washer
5. Flat washer
6. Cap screw
7. Bottom cover
8. Armrest kit
9. Back cover
10. Seat switch
11. Adjusting track − LH
12. Track − RH
13. Support strap (2)
14. Flange nut (4)
15. Knob kit
16. Weight indicator
17. Weight adjust kit
18. Spring and saddle kit
19. Shock absorber kit
20. Knob kit
21. Chassis assembly
22. Heat shield
23. Flange head screw (4)

Removal

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove heat shield and seat support straps with seat attached from the frame.

3. Disconnect electrical connector from the seat switch and remove seat assembly.

4. Remove seat parts as necessary to make repairs (Fig. 4).

Installation

1. Install any new seat parts (Fig. 4) as a guide.

2. Position seat with support straps attached to the fuel tank and frame.

3. Attach electrical connector to the seat switch.

4. Secure seat support straps to the frame with four hex flange head screws.

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Front Wheels and Brakes

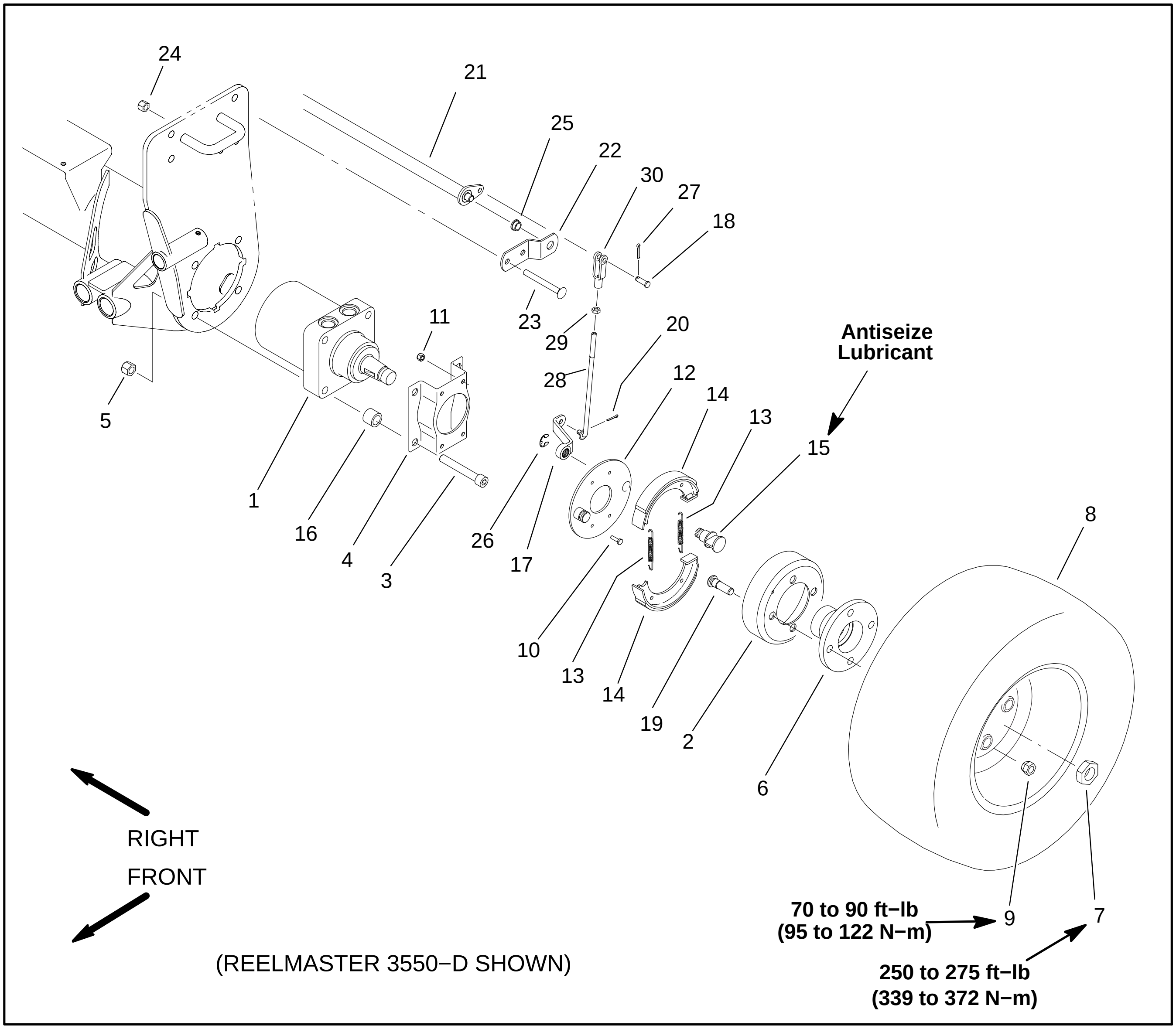

Figure 5

1. **Hydraulic wheel motor (LH shown)**
2. **Brake drum**
3. **Socket head screw (4 per motor)**
4. **Brake bracket**
5. **Lock nut (4 per motor)**
6. **Wheel hub**
7. **Lock nut**
8. **Front wheel assembly**
9. **Lug nut (4 used per wheel)**
10. **Cap screw (4 per brake assembly)**
11. **Lock nut (4 per brake assembly)**
12. **Brake plate**
13. **Spring (2 per wheel)**
14. **Brake shoe (2 per wheel)**
15. **Cam shaft**
16. **Spacer (4 per motor)**
17. **Brake lever**
18. **Clevis pin**
19. **Wheel stud (4 per wheel)**
20. **Cotter pin**
21. **Brake pivot shaft**
22. **Brake pivot bracket**
23. **Flange head screw (2 per bracket)**
24. **Flange nut (2 per bracket)**
25. **Flange bushing**
26. **Retaining ring**
27. **Cotter pin**
28. **Brake rod**
29. **Jam nut**
30. **Yoke**

Removal (Fig. 5)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.

2. Jack up front wheel and use jack stands or blocking to keep the front tire off the floor.

3. Remove lug nuts from drive studs. Pull wheel from drive studs and wheel hub.

NOTE: The installation torque of the lock nut is from **250 to 275 ft–lb (339 to 372 N–m)**. Use impact wrench to remove lock nut from the hydraulic motor shaft.

4. Remove lock nut from the hydraulic motor shaft. Release parking brake.

IMPORTANT: Do not hit wheel hub or puller with a hammer during removal or installation. Hammering may cause damage to the hydraulic wheel motor.

5. Use wheel hub puller to remove wheel hub and brake drum from the hydraulic motor shaft (see Special Tools in this chapter). Remove woodruff key from the shaft.

6. Remove cotter pin that retains adjustment rod to brake lever. Separate adjustment rod from brake lever.

NOTE: The brake lever, backing plate, retainer clip, return springs, brake shoes and cam shaft can be removed as a complete brake assembly.

7. Remove the brake assembly from the brake bracket, remove four cap screws and lock nuts securing the assembly to the bracket.

8. Disassemble brake assembly as follows (Fig. 6):

A. Remove return springs from the brake shoes. Remove brake shoes from the backing plate.

B. Matchmark brake cam and brake lever to assure proper alignment during assembly. Remove E–ring from the brake cam. Pull brake lever from the cam. Remove cam from backing plate.

9. Remove lock nuts, spacers and socket head screws securing the brake bracket and hydraulic motor to the frame if necessary.

Installation (Fig. 5)

1. If removed, insert four socket head screws through the frame, hydraulic motor, spacers, and brake bracket. Secure with lock nuts, but do not fully tighten.

2. Assemble brake assembly as follows (Fig. 6):

A. If removed, secure backing plate to the brake bracket with four cap screws and lock washers.

B. Apply antiseize lubricant to cam shaft splines. Insert cam shaft through the backing plate.

C. Attach brake lever to the cam shaft. Make sure matchmarks are aligned properly. Secure lever to shaft with E–ring.

D. Lubricate brake shoe pivot points with a light coating of grease. Position both brake shoes on the backing plate so that the concave heels attach to the anchor pin.

E. Insert both return springs into the holes of both brake shoes. Make sure shoes fit snuggly against the anchor pin and cam shaft.

3. If the complete brake assembly was removed, secure brake assembly to the brake bracket with four cap screws and lock nuts. Tighten fasteners.

4. Attach adjustment rod to the brake lever and secure with cotter pin.

5. Make sure that wheel hub and hydraulic motor shafts are thoroughly clean. Install key to the slot on the hydraulic motor shaft. Slide wheel hub and brake drum assembly onto the shaft.

6. Secure wheel hub and brake drum to the hydraulic motor shaft with lock nut.

NOTE: For proper brake operation, the brake shoes and backing plate must be concentrically aligned with the brake drum.

7. To align brake shoes and drum, apply parking brake. Then tighten four socket head screws (item 3) and lock nuts that secure the brake bracket and wheel motor to the frame.

WARNING

Failure to maintain proper wheel lug nut and wheel hub lock nut torque could result in failure or loss of wheel and may result in personal injury.

8. Secure wheel to machine with four (4) lug nuts.

9. Lower wheel to ground. Torque wheel lug nuts from **70 to 90 ft-lb (95 to 122 N-m)** in a crossing pattern.

10. Torque lock nut from **250 to 275 ft-lb (339 to 372 N-m)**. Release parking brake.

11. Check brake adjustment and adjust if necessary (see Adjust Brakes in the Adjustments section).

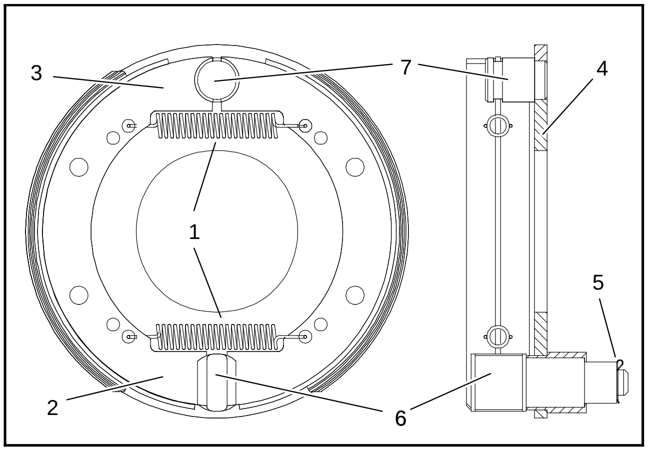

Figure 6

1. **Return spring**
2. **Brake shoe (toe end)**
3. **Brake shoe (heel end)**
4. **Backing plate**
5. **Retaining clip**
6. **Cam shaft**
7. **Anchor pin**

Burnish Brake Pads

After brake pad replacement, burnish (break-in) the brakes before use.

1. Bring the machine to full speed and apply the brakes to rapidly stop the machine without skidding or locking up the wheels.

2. Repeat this procedure 10 times. To avoid overheating the brakes, wait 1 minute between each stop.

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Chassis

Rear Fork and Wheel

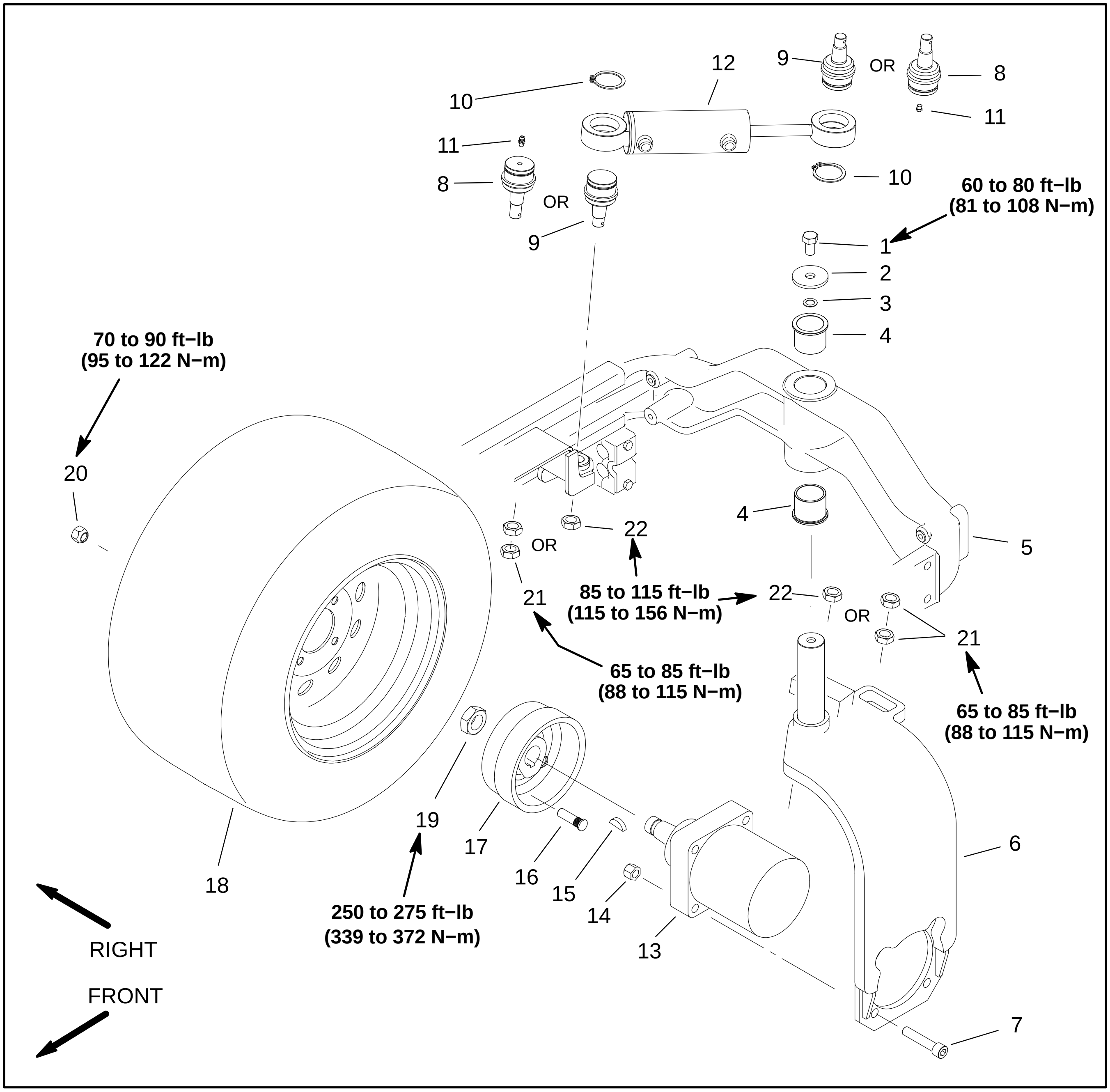

Figure 7

1. Cap screw
2. Thrust washer
3. Lock washer
4. Flange bushing (2)
5. Rear casting
6. Rear fork
7. Socket head screw (4)
8. Ball joint − greasable (2)
9. Ball joint − non−greasable (2)
10. Retaining ring (2)
11. Grease fitting
12. Hydraulic steering cylinder
13. Wheel motor
14. Lock nut (4)
15. Key
16. Drive stud (4)
17. Hub
18. Wheel and tire assembly
19. Lock nut
20. Lug nut (4)
21. Jam nut (4)
22. Flextop lock nut (2)

Removal (Fig. 7)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove hood from the machine.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

3. Raise and safely support rear of machine enough to allow the removal of the rear wheel.

4. Remove lug nuts and remove tire and wheel assembly from hub.

5. Separate hydraulic cylinder from the rear fork as follows:

A. Remove the two (2) jam nuts or the flextop lock nut securing the ball joint to the rear fork.

B. Use a suitable tool (pickle fork) to separate the ball joint from the rear fork.

C. Move cylinder ball joint clear of the rear fork.

6. Remove four lock nuts and hex socket head screws securing the hydraulic motor to the rear fork. Remove motor from the fork and position it away from the fork.

CAUTION

Support rear fork to prevent its falling during removal and installation. Personal injury or damage to the fork may result from improper handling.

7. Remove cap screw, thrust washer, and lock washer from the rear fork shaft.

8. Lower rear fork from machine.

9. Check bushings for wear and damage. Replace if necessary.

Installation (Fig. 7)

1. Position rear fork through the frame.

2. Install lock washer, thrust washer, and cap screw to the rear fork shaft. Torque cap screw from **60 to 80 ft−lb (81 to 108 N−m)**. Make sure fork turns freely.

3. Install hydraulic motor to the rear fork. Secure motor to the fork with four hex socket head screws and lock nuts.

4. Secure hydraulic cylinder to the rear fork as follows:

A. Align cylinder ball joint with the rear fork.

B. Secure ball joint to the rear fork:

Greasable style ball joints − tighten the first jam nut from **65 to 85 ft−lb (88 to 115 N−m)**, then tighten the second jam nut to the same specification.

Non−greasable style ball joints − tighten the flextop lock nut from **85 to 115 ft−lb (115 to 156 N−m)**.

5. Lower wheel to ground. Torque wheel lug nuts from **70 to 90 ft−lb (95 to 122 N−m)** in a crossing pattern.

Brake Lever Linkages

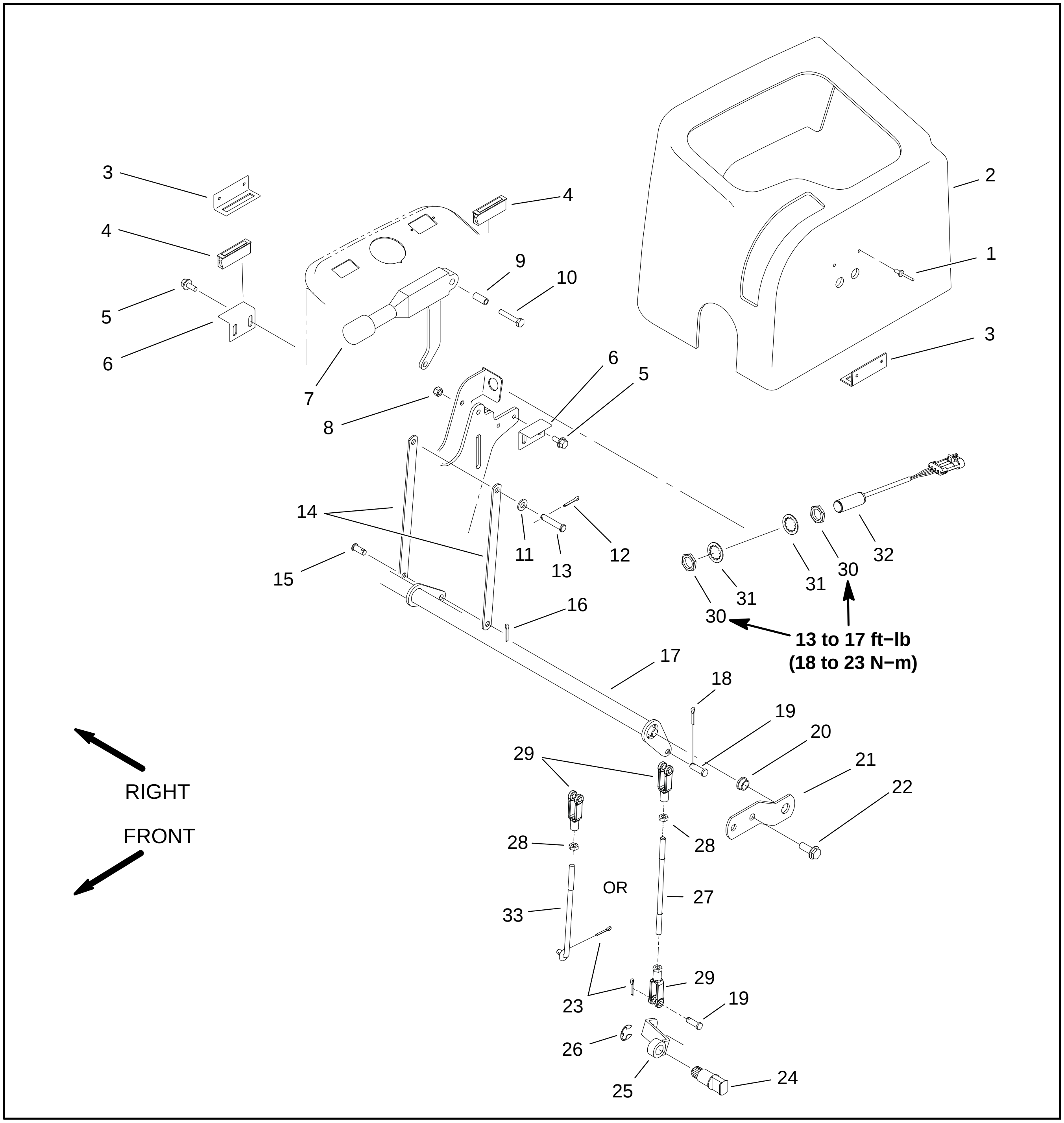

Figure 8

1. **Pop rivet (4)**
2. **Control panel cover**
3. **Cover bracket (2)**
4. **Magnetic catch (2)**
5. **Hex washer head screw (4)**
6. **Strike bracket (2)**
7. **Lever assembly**
8. **Lock nut**
9. **Parking brake spacer**
10. **Cap screw**
11. **Flat washer**
12. **Cotter pin**
13. **Clevis pin**
14. **Parking brake link**
15. **Clevis pin**
16. **Cotter pin**
17. **Brake pivot shaft**
18. **Cotter pin**
19. **Clevis pin**
20. **Flange bushing**
21. **Brake pivot bracket**
22. **Hex flange head screw (2)**
23. **Cotter pin**
24. **Brake cam**
25. **Brake lever**
26. **Retaining ring**
27. **Adjustment rod (RM3555−D/3575−D)**
28. **Jam nut**
29. **Adjustable clevis**
30. **Nut (2)**
31. **Lock washer (2)**
32. **Proximity switch**
33. **Adjustment rod (RM3550−D)**

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove control panel cover from the machine.

IMPORTANT: When removing the adjustable clevis, adjustment rod, or the brake lever, make sure to mark both parts. Marking both parts will make reassembly and brake adjustment easier.

3. Remove and replace parts as necessary to repair brake linkages.

4. Install control panel cover to the machine.

IMPORTANT: Always check and adjust brakes anytime brake linkages are disassembled or repaired.

Steering Column

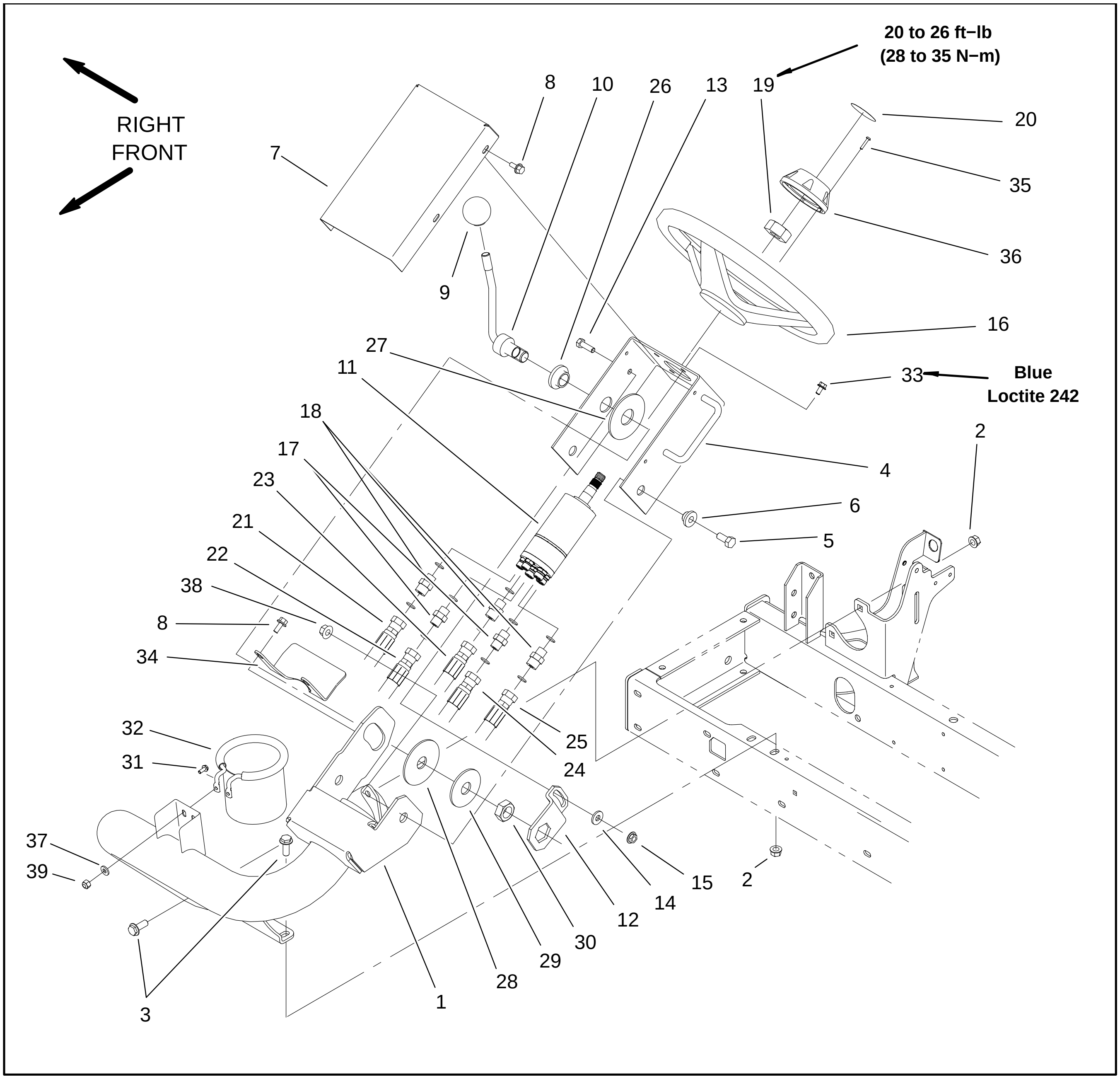

Figure 9

1. **Steering arm**
2. **Flange nut**
3. **Flange head screw (2)**
4. **Steering valve bracket**
5. **Cap screw (2)**
6. **Pivot hub (2)**
7. **Steering cover**
8. **Cap screw (5)**
9. **Ball knob**
10. **Steering tilt lever**
11. **Steering control valve**
12. **Tilt bracket**
13. **Cap screw**
14. **Flat washer**
15. **Flange nut**
16. **Steering wheel**
17. **Hydraulic fitting (2)**
18. **Hydraulic fitting (3)**
19. **Steering wheel nut**
20. **Toro decal**
21. **Hydraulic hose**
22. **Hydraulic hose**
23. **Hydraulic hose**
24. **Hydraulic hose**
25. **Hydraulic hose**
26. **Tilt steering boss**
27. **Friction disc**
28. **Friction disc**
29. **Flat washer**
30. **Jam nut**
31. **Flange screw (2)**
32. **Bag holder**
33. **Flange screw (4)**
34. **Steering shield**
35. **Philips head screw**
36. **Steering wheel cap**
37. **Flat washer (2)**
38. **Flange nut (2)**
39. **Lock nut (2)**

Disassembly

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove philips head screws and steering wheel cap from the steering wheel.

3. Remove steering wheel nut from the steering control valve. Pull steering wheel from the control valve.

4. Remove cover from the steering control valve bracket.

5. Remove four flange screws securing the steering control valve to the steering control valve bracket.

6. Remove both hex flange nuts, cap screws, and pivot hubs securing the steering control valve bracket to the steering arm. Slide bracket from the steering control valve and steering arm.

7. Remove and replace parts as necessary to repair steering column (Fig. 9 and 10).

8. Remove the steering control valve if necessary (see Steering Control Valve in Chapter 4 − Hydraulic System in this manual).

Assembly

1. Make sure lever and friction discs are properly assembled to the steering control valve bracket (Fig. 9 and 10).

2. Position steering control bracket to the steering control valve and steering arm. Secure bracket to the steering arm with pivot hubs, cap screws, and hex flange nuts.

3. Apply blue Loctite 242 to flange hd. screws and install steering control valve to the steering valve bracket

4. Secure cover to the steering control valve bracket with cap screws.

5. Install steering wheel to the steering control valve. Torque steering wheel nut from **20 to 26 ft−lb (28 to 35 N−m)**.

6. Secure steering wheel cap to the steering wheel with six philips head screws.

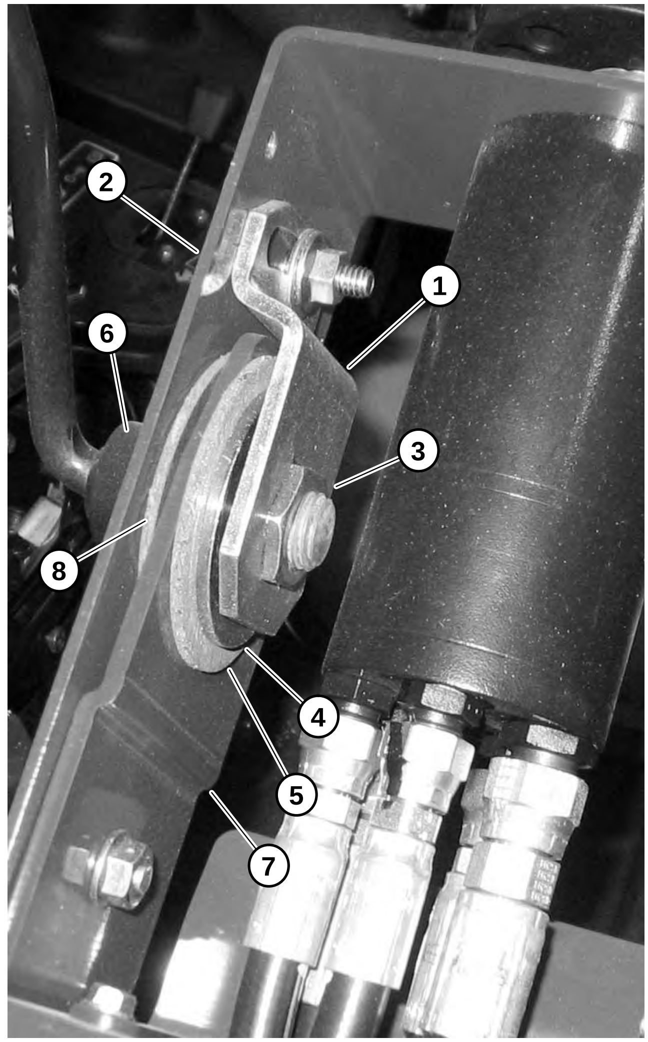

Figure 10

1. **Tilt bracket**
2. **Steering valve bracket**
3. **Jam nut**
4. **Flat washer**
5. **Friction disc**
6. **Tilt steering lever**
7. **Steering arm**
8. **Friction disc**

Chassis

Front Lift Arms (Reelmaster 3550−D and 3555−D)

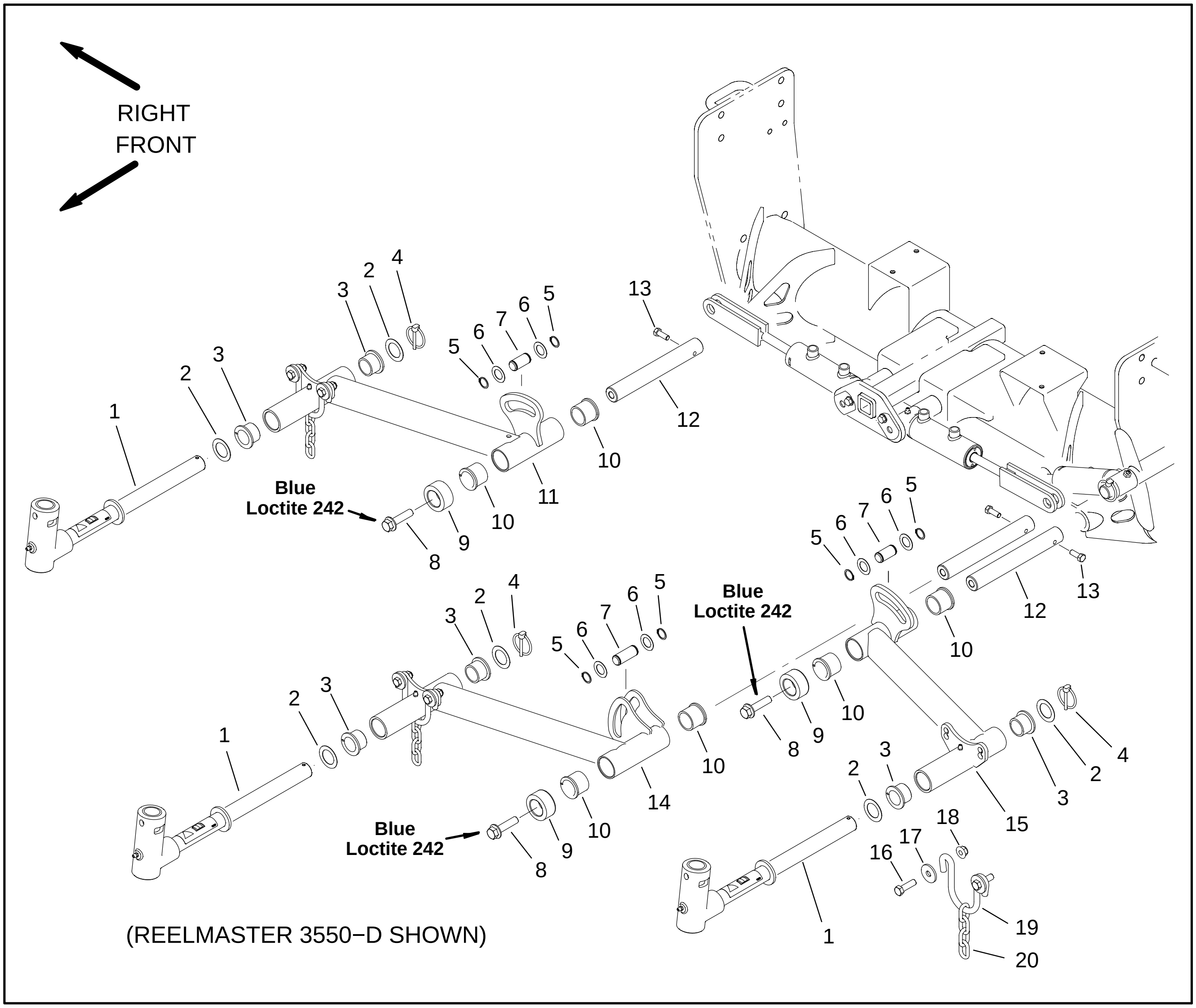

Figure 11

1. **Pivot yoke (3)**
2. **Thrust washer (2 per yoke)**
3. **Flange bushing (2 per lift arm)**
4. **Lynch pin (3)**
5. **Retaining ring (2 per pin)**
6. **Thrust washer (2 per pin)**
7. **Pin (3)**
8. **Flange head screw (3)**
9. **Recessed bumper (3)**
10. **Flange bushing (2 per lift arm)**
11. **Lift arm #5**
12. **Lift arm pin (3)**
13. **Hex head screw**
14. **Lift arm #1**
15. **Lift arm #4**
16. **Cap screw (2 per lift arm)**
17. **Washer (2 per lift arm)**
18. **Flange nut (2 per lift arm**
19. **Chain hoop (3)**
20. **Chain (3)**

Removal (Fig. 11)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove cutting units (see Chapter 7 − Cutting Units in this manual).

3. Remove lynch pin and thrust washer securing pivot yoke to lift arm and remove pivot yoke.

4. Remove retaining ring and flat washer from one end of the cylinder pin that secures rod end of lift cylinder to lift arm. Pull pin from lift arm and cylinder rod. Support lift cylinder away from lift arm. DO NOT allow the lift cylinder to hang by the hydraulic hoses.

5. Remove flange head screw and recessed bumper securing lift arm to lift arm pin. Slide lift arm assembly from pin.

6. Remove hex head screw and drive lift arm pin from frame if necessary.

7. Repair lift arm as necessary.

Installation (Fig. 11)

1. If the lift arm pin was removed from frame, install lift arm pin in frame and secure with cap screw.

2. Slide lift arm onto the lift arm pivot pin.

3. Apply Loctite to flange head screw and secure lift arm and recessed bumper to lift arm pin.

4. Slide pivot yoke into lift arm and secure with thrust washer and lynch pin.

5. Secure hydraulic cylinder to the lift arm with pins, washers, and retaining rings.

6. Install cutting unit to the front lift arm pivot yoke (see Chapter 7 − Cutting Units in this manual).

7. Grease front lift arm and pivot yoke.

Front Lift Arms (Reelmaster 3575−D)

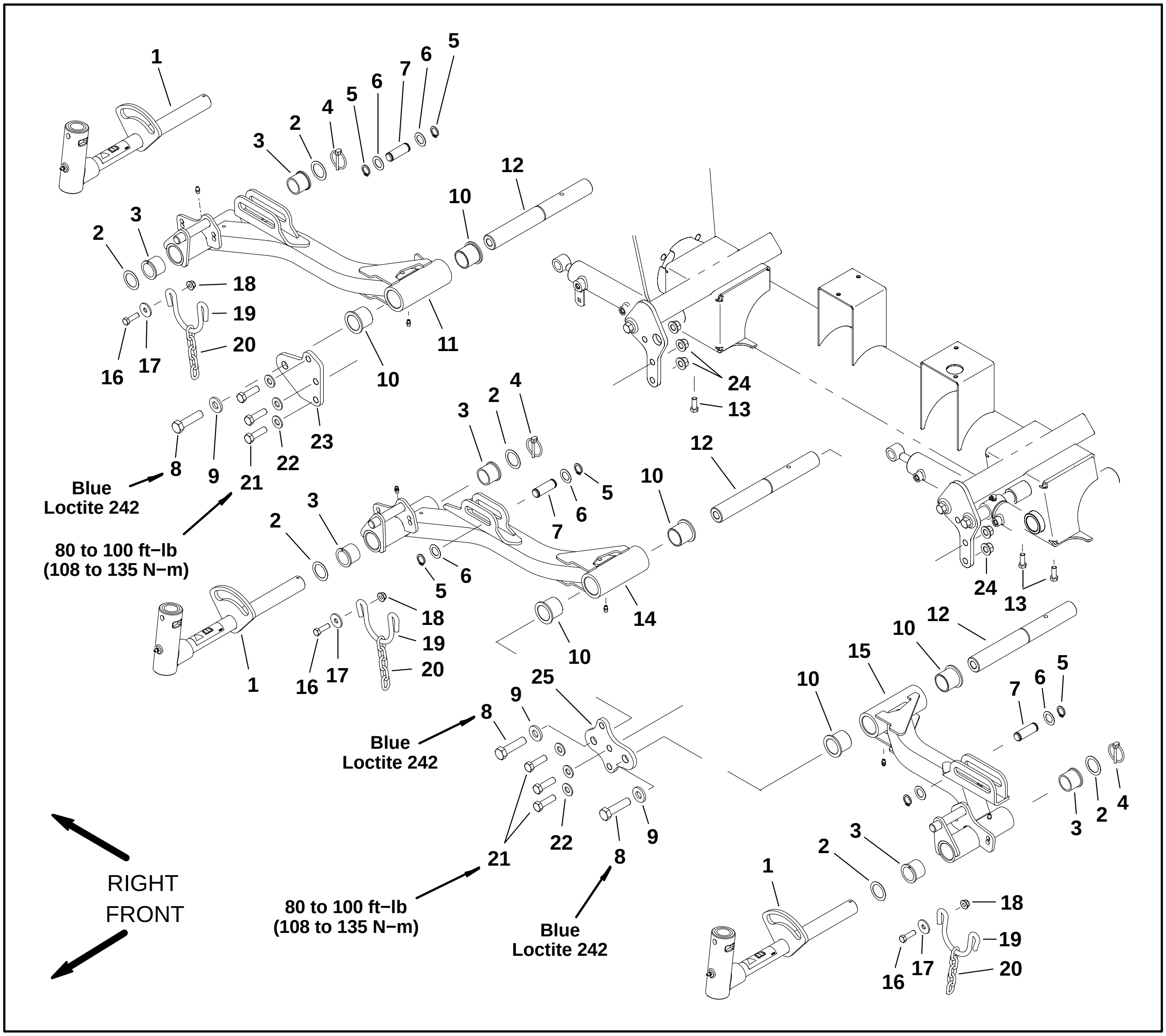

Figure 12

1. Pivot yoke (3)
2. Thrust washer (2 per yoke)
3. Flange bushing (2 per lift arm)
4. Lynch pin (3)
5. Retaining ring (2 per pin)
6. Thrust washer (2 per pin)
7. Pin (3)
8. Flange head screw (3)
9. Flat washer (3)
10. Flange bushing (2 per lift arm)
11. Lift arm #5
12. Lift arm pin (3)
13. Hex head screw (3)
14. Lift arm #1
15. Lift arm #4
16. Cap screw (2 per lift arm)
17. Washer (2 per lift arm)
18. Flange nut (2 per lift arm
19. Chain hoop (3)
20. Chain (3)
21. Cap screw (6)
22. Flat washer (6)
23. Bridge plate #5
24. Flange nut (6)
25. Bridge plate #1 & 4

Removal (Fig. 12)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove cutting units (see Chapter 7 − Cutting Units in this manual).

3. Remove lynch pin and thrust washer securing pivot yoke to lift arm and remove pivot yoke.

4. Remove retaining ring and flat washer from one end of the cylinder pin that secures rod end of lift cylinder to lift arm. Pull pin from lift arm and cylinder rod. Support lift cylinder away from lift arm. DO NOT allow the lift cylinder to hang by the hydraulic hoses.

5. Remove screw(s) and flat washer(s) securing bridge plate (item 23 or 25) to lift arm pin(s).

6. Remove screws, flat washers and flange nuts securing bridge plate to machine frame. Remove bridge plate and slide lift arm assembly from pin.

7. Remove hex head screw and drive lift arm pin from frame if necessary.

8. Repair lift arm as necessary.

Installation (Fig. 12)

1. If the lift arm pin was removed from frame, install lift arm pin in frame and secure with cap screw.

2. Slide lift arm onto the lift arm pivot pin.

3. Apply Loctite to screw(s) securing bridge plate to lift arm pin(s).

4. Align the bridge plate (item 23 or 25) with the machine frame and lift arm pin(s) and loosely install all fasteners.

5. Tighten fasteners securing bridge plate to lift arm pins. Tighten fasteners securing bridge plate to machine frame from **80 to 100 ft−lbs (108 to 135 N−m)**.

6. Slide pivot yoke into lift arm and secure with thrust washer and lynch pin.

7. Secure hydraulic cylinder to the lift arm with pins, washers, and retaining rings.

8. Install cutting unit to the front lift arm pivot yoke (see Chapter 7 − Cutting Units in this manual).

9. Grease front lift arm and pivot yoke.

Rear Lift Arms (Reelmaster 3550−D)

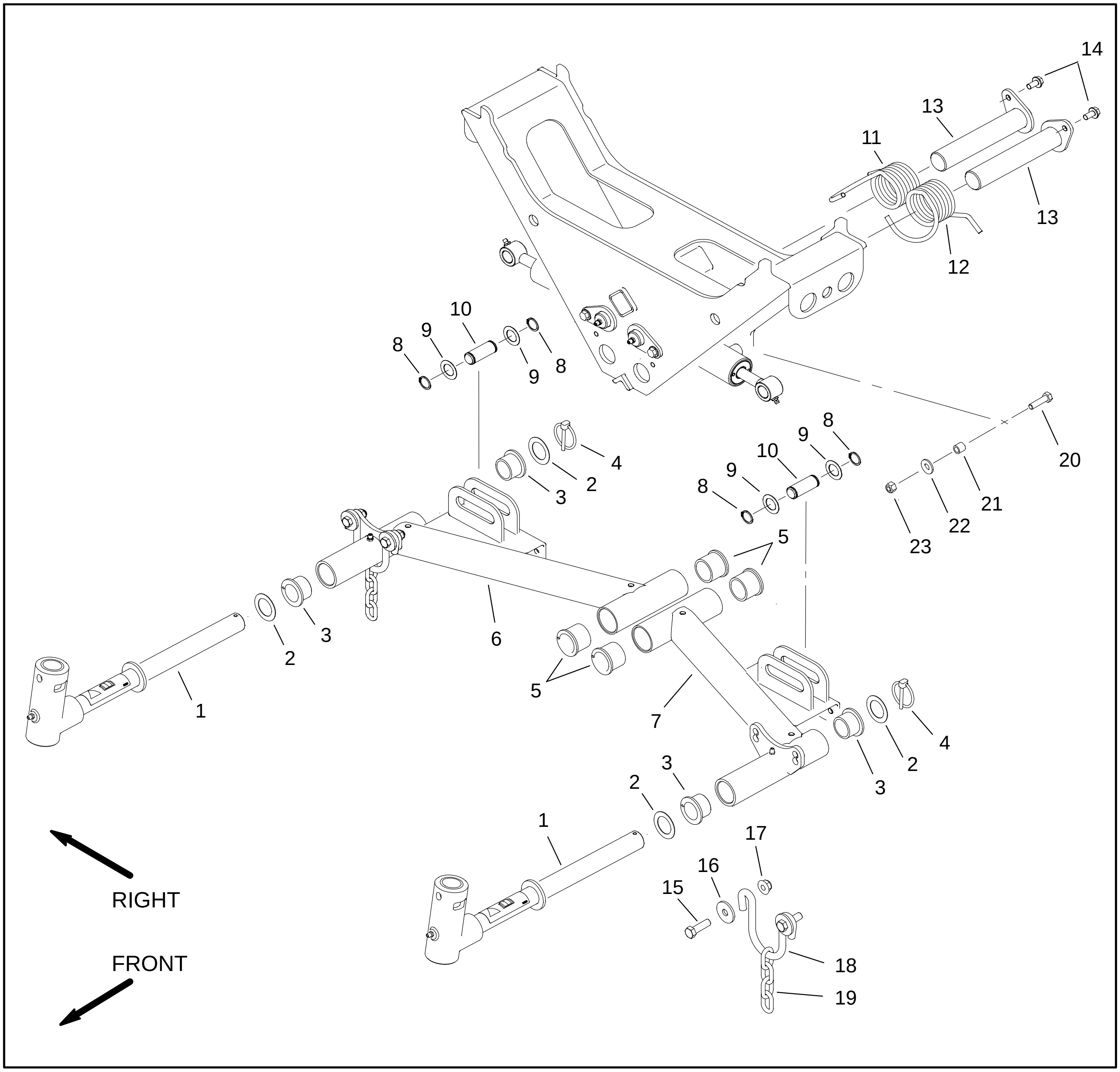

Figure 13

1. **Pivot yoke (2)**
2. **Thrust washer (2 per pivot yoke)**
3. **Flange bushing (2 per lift arm)**
4. **Lynch pin (2)**
5. **Flange bushing (2 per lift arm)**
6. **#3 lift arm**
7. **#2 lift arm**
8. **Retaining ring (2 per pin)**
9. **Thrust washer (2 per pin)**
10. **Pin (2)**
11. **Counterbalance spring (RH)**
12. **Counterbalance spring (LH)**
13. **Lift arm pin (2)**
14. **Flange head screw (2)**
15. **Cap screw (2 per lift arm)**
16. **Washer (2 per lift arm)**
17. **Flange nut (2 per lift arm)**
18. **Chain hoop (2)**
19. **Chain (2)**
20. **Cap screw − spring actuator (2)**
21. **Spacer − spring actuator (2)**
22. **Washer (2)**
23. **Lock nut (2)**

Removal (Fig. 13)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove cutting units (see Chapter 7 − Cutting Units in this manual).

3. Remove lynch pin and thrust washer securing pivot yoke to lift arm and remove pivot yoke.

4. Remove retaining ring and flat washer from one end of the cylinder pin that secures rod end of lift cylinder to lift arm. Pull pin from lift arm and cylinder rod. Support lift cylinder away from lift arm. DO NOT allow the lift cylinder to hang by the hydraulic hoses.

5. Note the position of the spring actuator prior to removal for proper assembly. Insert a tube or similar object onto the straight end of the counterbalance spring. Lift the spring end up and remove the spring actuator (cap screw, spacer, washer, and lock nut) (Fig. 14). Relieve all tension from the counterbalance spring.

6. Remove flange head screw from lift arm pin.

7. Support lift arm assembly and slide lift arm pin from frame. Remove lift arm assembly and counterbalance spring.

8. Repair lift arm as necessary.

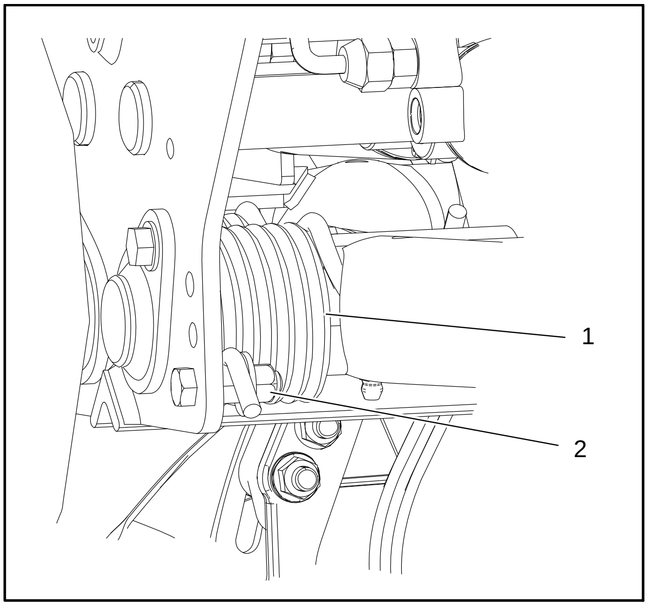

Figure 14

1. Counterbalance spring **2. Spring actuator**

Installation (Fig. 13)

1. Position counterbalance spring over lift arm as shown.

2. Support lift arm and slide lift arm pin into frame. Secure lift arm pin to frame with flange head screw.

3. Insert a tube or similar object onto the straight end of the counterbalance spring. Lift the spring end up and install the spring actuator (cap screw, spacer, washer, and lock nut) (Fig. 14). Rest end of counterbalance spring on spring actuator.

4. Slide pivot yoke into lift arm and secure with thrust washer and lynch pin.

5. Secure hydraulic cylinder to the lift arm with pins, washers, and retaining rings.

6. Install cutting unit to the rear lift arm pivot yoke (see Chapter 7 − Cutting Units in this manual).

7. Grease rear lift arm and pivot yoke.

Chassis

Rear Lift Arms (Reelmaster 3555−D and 3575−D)

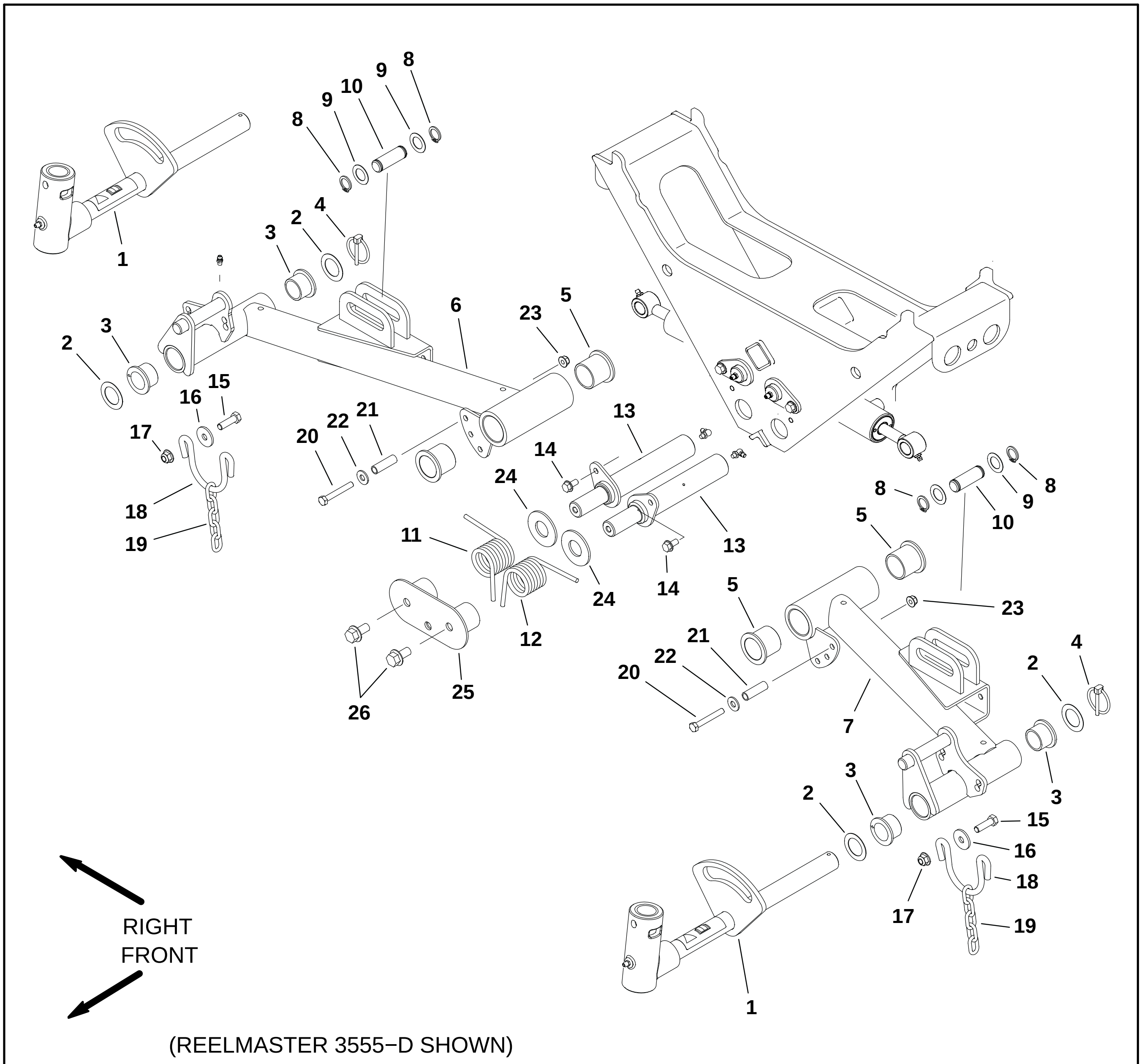

Figure 15

1. **Pivot yoke (2)**
2. **Thrust washer (2 per pivot yoke)**
3. **Flange bushing (2 per lift arm)**
4. **Lynch pin (2)**
5. **Flange bushing (2 per lift arm)**
6. **#3 lift arm**
7. **#2 lift arm**
8. **Retaining ring (2 per pin)**
9. **Thrust washer (2 per pin)**
10. **Pin (2)**
11. **Counterbalance spring (RH)**
12. **Counterbalance spring (LH)**
13. **Lift arm pin (2)**
14. **Flange head screw (2)**
15. **Cap screw (2 per lift arm)**
16. **Washer (2 per lift arm)**
17. **Flange nut (2 per lift arm)**
18. **Chain hoop (2)**
19. **Chain (2)**
20. **Cap screw − spring actuator (2)**
21. **Spacer − spring actuator (2)**
22. **Washer (2)**
23. **Lock nut (2)**
24. **Washer (2)**
25. **Catch**
26. **Flange head screw (2)**

Removal (Fig. 15)

1. Park machine on a level surface, lower cutting units, stop engine, engage parking brake, and remove key from the ignition switch.

2. Remove cutting units (see Chapter 7 − Cutting Units in this manual).

3. Remove lynch pin and thrust washer securing pivot yoke to lift arm and remove pivot yoke.

4. Remove retaining ring and flat washer from one end of the cylinder pin that secures rod end of lift cylinder to lift arm. Pull pin from lift arm and cylinder rod. Support lift cylinder away from lift arm. DO NOT allow the lift cylinder to hang by the hydraulic hoses.

5. Note the position of the spring actuator prior to removal for proper assembly. Insert a tube or similar object onto the straight end of the counterbalance spring. Lift the spring end up and remove the spring actuator (cap screw, spacer, washer, and lock nut) (Fig. 16). Relieve all tension from the counterbalance spring.

6. Remove flange head screw from lift arm pin.

7. Support lift arm assembly and slide lift arm pin from frame. Remove lift arm assembly and counterbalance spring.

8. Repair lift arm as necessary.

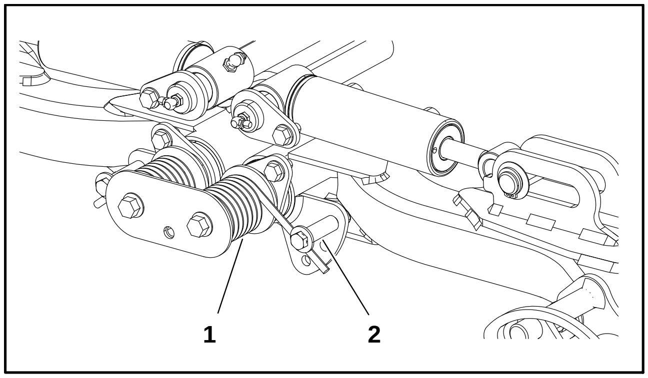

Figure 16

1. **Counterbalance spring** 2. **Spring actuator**

Installation (Fig. 15)

1. Position counterbalance spring over lift arm as shown.

2. Support lift arm and slide lift arm pin into frame. Secure lift arm pin to frame with flange head screw.

3. Insert a tube or similar object onto the straight end of the counterbalance spring. Lift the spring end up and install the spring actuator (cap screw, spacer, washer, and lock nut) (Fig. 16). Rest end of counterbalance spring on spring actuator.

4. Slide pivot yoke into lift arm and secure with thrust washer and lynch pin.

5. Secure hydraulic cylinder to the lift arm with pins, washers, and retaining rings.

6. Install cutting unit to the rear lift arm pivot yoke (see Chapter 7 − Cutting Units in this manual).

7. Grease rear lift arm and pivot yoke.

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Chapter 7

DPA Cutting Units

Table of Contents

Specifications

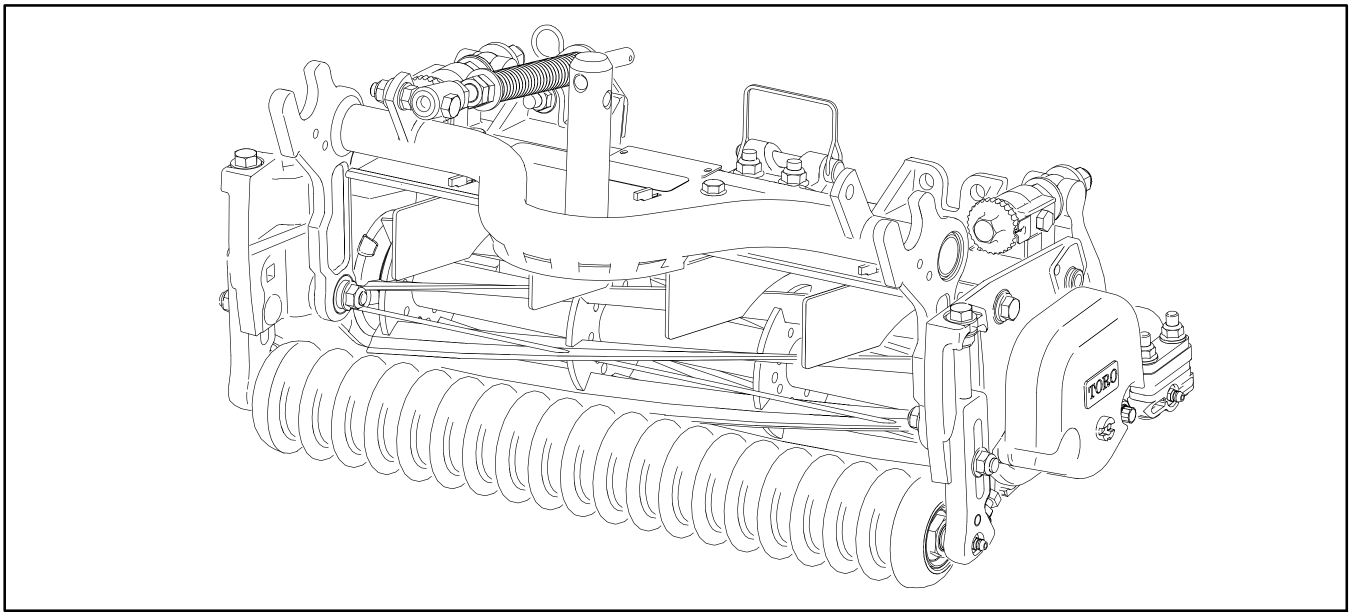


Figure 1

Frame Construction: Precision machined die cast aluminum cross member with two (2) bolt-on cast aluminum side plates.

Cutting Unit/Reel Size

Reelmaster 3550-D: 18 in. (45.7 cm) in length with 5 in. (12.7 cm) diameter 8 or 11 blade reel. Optional 22 in. (55.9 cm) 8 and 11 blade reels are available for the rear cutting unit positions.

Reelmaster 3555-D: 22 in. (55.9 cm) in length with 5 in. (12.7 cm) diameter 8 or 11 blade reel.

Reelmaster 3575-D: 22 in. (55.9 cm) in length with 7 in. (17.8 cm) diameter 8 or 11 blade reel.

Reel Construction: High strength steel blades are thru hardened and impact resistant. Reel blades may have a radial or forward swept design.

Reel Bearings: Two sealed, stainless steel ball bearings support the reel shaft.

Reel Drive: The reel weldment shaft is a 1 5/16 inch (33.3 mm) diameter tube with drive inserts threaded into both ends. The reel drive inserts have an eight (8) tooth internal spline.

Height-of-Cut (HOC): Cutting height is adjusted on the front roller by two (2) vertical screws. Effective HOC may vary depending on turf conditions, type of bedknife, roller type and installed attachments.

Bedknife: A replaceable, single edged bedknife is fastened to a machined cast iron bedbar with screws. A variety of bedknives are available for specific cutting applications.

Bedknife Adjustment: Dual screw adjustment to the reel; detents corresponding to 0.0007 inch (0.018 mm) bedknife movement for each indexed position.

Front and Rear Rollers: Greaseable through-shaft front and rear rollers are used with these cutting units. Both rollers use the same heavy duty ball bearings.

Counterbalance Weight: A cast iron weight mounted opposite to the hydraulic drive motor balances the cutting unit. 5 in diameters reels us a 7 lb. (3.2 kg) weight and 7 in. Diameter reels use a 16 lb (7.4 kg) weight.

Cutting Unit Weight (without counterbalance weight):

18” x 5” dia. Reel, 8 Blade	**79 lb. (35 kg)**
18” x 5” dia. Reel, 11 Blade	**81 lb. (36 kg)**
22” x 5” dia. Reel, 8 Blade	**87 lb. (39 kg)**
22” x 5” dia. Reel, 11 Blade	**91 lb. (41 kg)**
22” x 7” dia. Reel, 8 Blade	**118 lb. (54 kg)**
22” x 7” dia. Reel, 11 Blade	**121 lb. (55 kg)**

Options:
Refer to Cutting Unit Operator’s Manual for available options for your Reelmaster cutting unit.

General Information

Cutting Unit Operator's Manual

The Cutting Unit Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for the cutting units on your Reelmaster machine. Additionally, if optional kits have been installed on the cutting units (e.g. rear roller brush), the installation instructions for the kit includes set-up and operation information. Refer to those publications for additional information when servicing the cutting units.

Cutting Unit Removal and Installation

Removal

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove hydraulic reel motor from cutting unit that is to be removed (see Cutting Unit Reel Motor in this section). Position motor away from cutting unit.

3. For assembly purposes, note location of snapper pin in lift arm chain (Fig. 2). Remove snapper pin from cutting unit chain bracket and lift arm chain.

4. Move hair pin from rear hole of turf compensator rod to the hole closest to the rod bracket (Fig. 3). This will lock the turf compensator spring in position.

5. Remove cutting unit from pivot yoke (Fig. 4):

   A. Remove snapper pin and cap that retain cutting unit carrier frame to pivot yoke in lift arm.

   B. Remove carrier frame shaft from pivot yoke on lift arm.

6. For rear cutting units when the height of cut is above 3/4 inch (1.2 cm) use the following procedure:

   A. Remove the lynch pin and washer securing the lift arm pivot yoke shaft to the rear lift arm (Fig. 5).

   B. Slide the pivot yoke shaft out of the lift arm. Make sure that second thrust washer remains on the pivot yoke shaft.

   C. Move cutting unit away from machine.

   D. Remove the cutting unit from the pivot yoke as described in step 5.

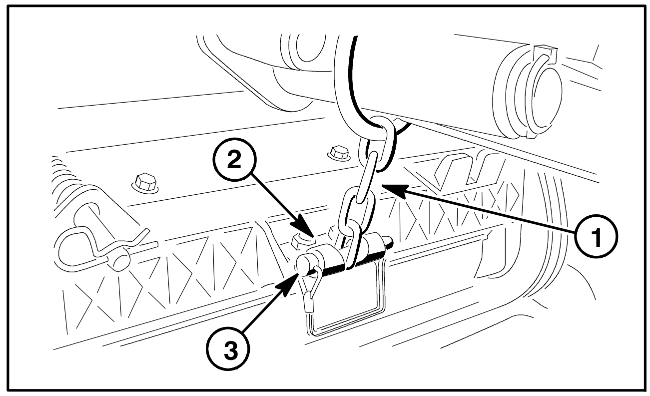


Figure 2

1. Lift arm chain
2. Chain bracket
3. Snapper pin

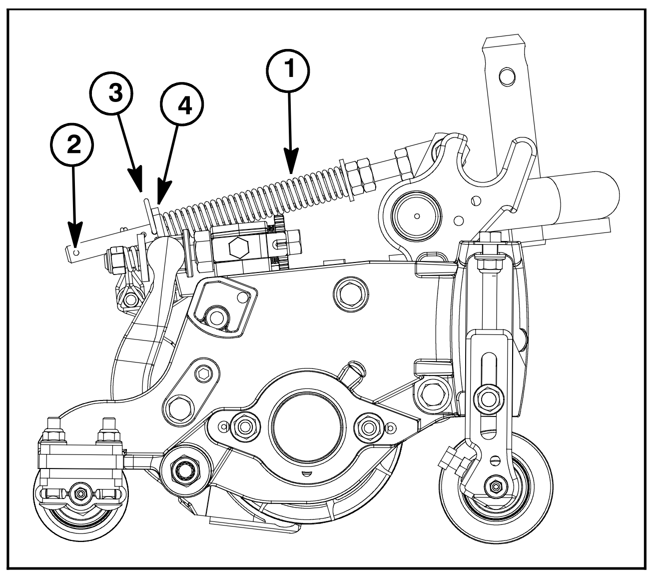


Figure 3

1. Compensator rod assy
2. Unlocked pin position
3. Locked pin position
4. Rod bracket

DPA Cutting Units

Installation

IMPORTANT: When installing cutting unit to machine, make sure that turf compensator spring is mounted on the same side of the cutting unit as the hydraulic reel drive motor. Also, make sure that cutting unit is installed on machine with motor and weight properly orientated to machine (Fig. 6).

1. Lower all the lift arms completely. Make sure the snapper pin and cap are removed from the lift arm pivot yoke (Fig. 4).

2. Position cutting unit to machine. Coat the cutting unit carrier frame shaft with clean grease.

3. Install cutting unit to lift arm pivot yoke:

   A. Slide cutting unit under the lift arm while inserting the carrier frame shaft up into the pivot yoke on lift arm.

   B. Place the cap over the carrier frame shaft and pivot yoke.

   C. Secure the cap and the carrier frame shaft to the pivot yoke with the snapper pin. Use the pivot yoke slot if a steering cutting unit is desired or use the yoke hole if the cutting unit is to be locked in position.

4. For rear cutting units when the height of cut is above 3/4 inch (1.2 cm) use the following procedure:

   A. Slide the pivot yoke onto the cutting unit carrier frame shaft and secure with cap and snapper pin as described in step 3.

   B. Make sure that thrust washer is positioned on the pivot yoke shaft. Insert the yoke arm shaft into the lift arm and secure it with the washer and lynch pin (Fig. 5).

5. Secure the lift arm chain to the cutting unit chain bracket with the snapper pin (Fig. 2). Use the number of chain links described in the cutting unit Operator's Manual.

6. Move hair pin to the rear hole of turf compensator rod to unlock the turf compensator spring (Fig. 3).

7. Install reel motor to cutting unit (see Cutting Unit Reel Motor in this section).

IMPORTANT: After installing cutting reel motor, make sure that the reel motor hoses are not twisted, kinked or in the risk of being pinched.

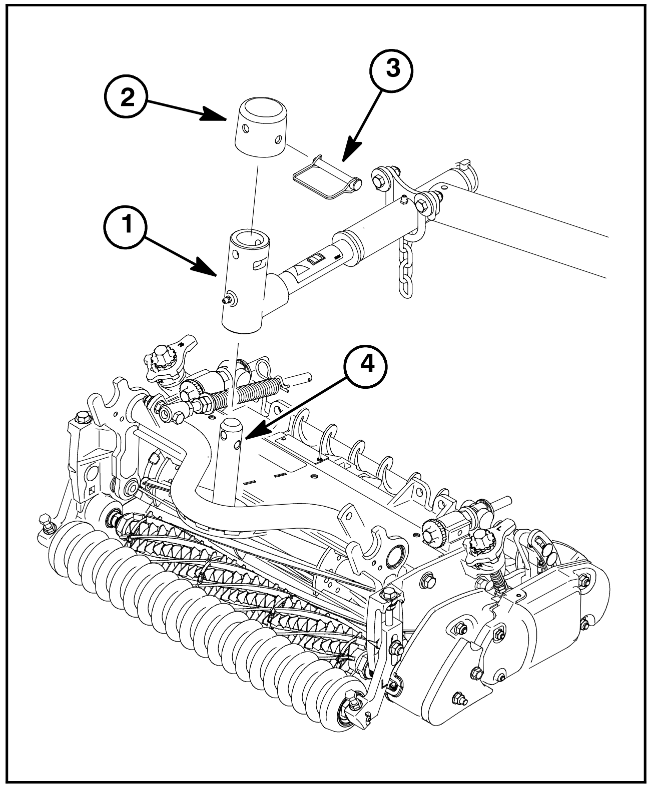


Figure 4

1. **Pivot yoke**
2. **Cap**
3. **Snapper pin**
4. **Carrier frame shaft**

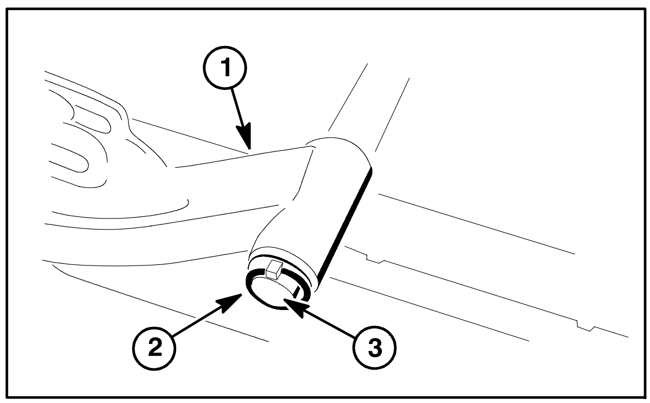


Figure 5

1. **Rear lift arm**
2. **Lynch pin and washer**
3. **Pivot yoke shaft**

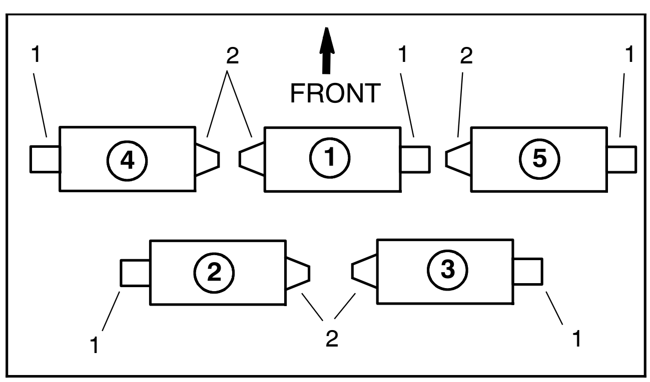


Figure 6

1. **Reel motor location**
2. **Weight location**

Special Tools

Special tools are available from your Toro Distributor. Some tools may have been supplied with your machine or are available as TORO parts.

Gauge Bar Assembly

Toro Part Number: **108-6715**

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

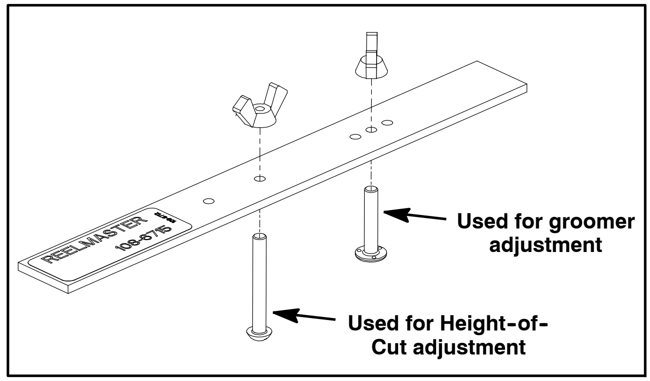


Figure 7

Cutting Reel Shim

Toro Part Number: **125-5611**

The cutting reel shim (0.002”) is used to ensure that the bedknife is parallel to the cutting reel.

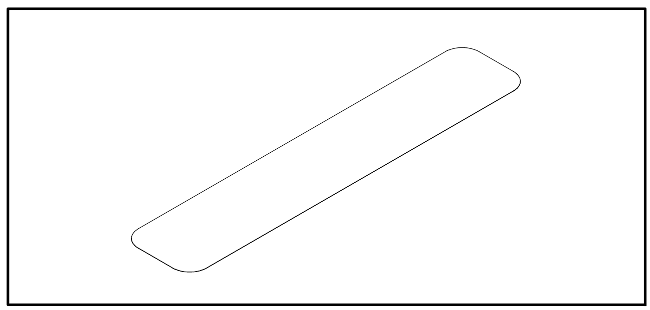


Figure 8

Cutting Performance Paper

Toro Part Number: **125-5610**

Cutting performance paper is used to test the cutting reel performance after adjusting the reel to bedknife clearance. 300 strips of cutting performance paper are included in this part number.

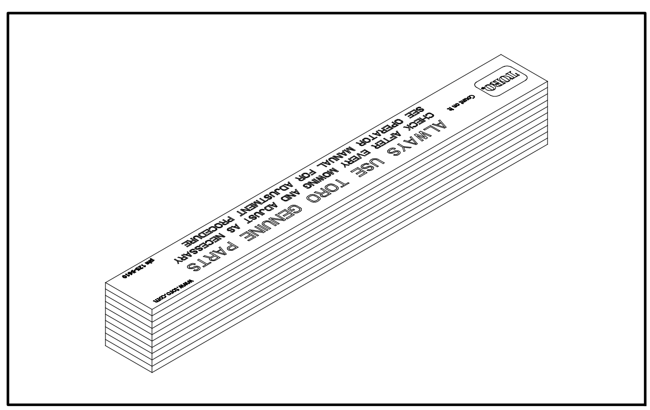


Figure 9

Bedknife Screw Tool

Toro Part Number: **TOR510880**

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

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

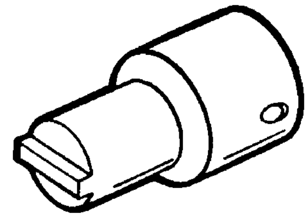


Figure 10

Handle Assembly

Toro Part Number: **29-9100**

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

Components for the handle assembly are available individually as follows:

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

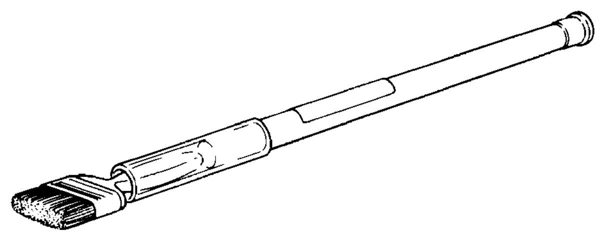


Figure 11

Cutting Unit Kickstand

Toro Part Number: **119-8010-03**

The cutting unit kickstand is used to prop up the rear of the cutting unit during service. Use of this tool prevents the bedbar adjusting screws from resting on the work surface.

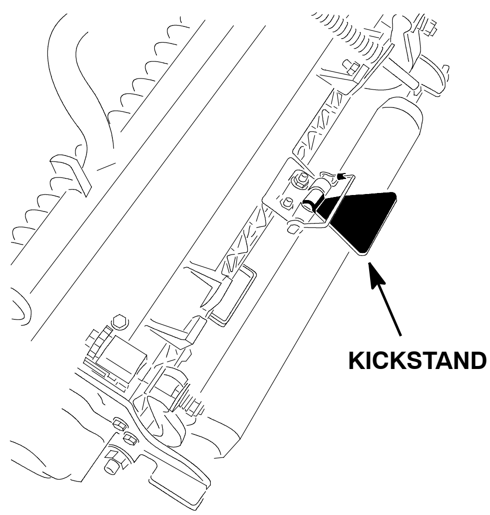


Figure 12

Spline Insert Tool

Toro Part Number: **TOR4112** (8 tooth)

Use the spline insert tool for rotating the cutting reel when hydraulic motor is removed. Also, use this tool for installation of threaded inserts into the cutting reel shaft.

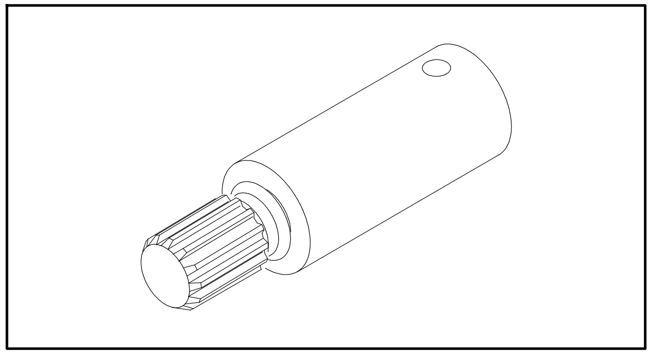


Figure 13

Roller Rebuild Kit

Toro Part Number: **115-0803**

This tool kit is used to assemble the cutting unit rollers. Tools in this kit are also available individually as follows:

115-0852	Inner Seal Tool
115-0853	Bearing/Outer Seal Tool
107-8133	Bearing Installation Washer

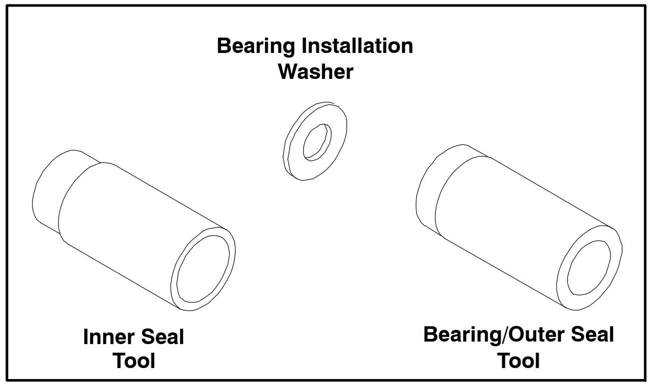


Figure 14

Plastic Plug

Toro Part Number: **2410-30** (for 5 inch reels)
94-2703 (for 7 inch reels)

This cap is used for placement into the cutting unit side plate when the cutting reel motor is removed. It prevents dirt and debris from entering the cutting reel bearing area.

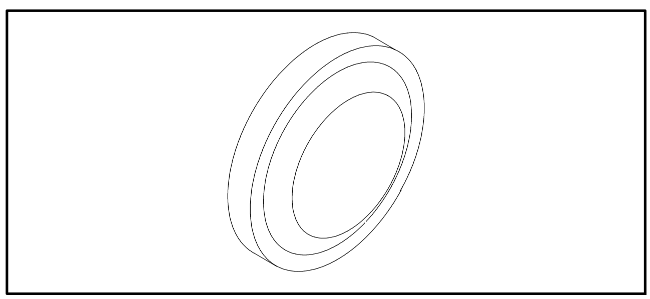


Figure 15

Pulley Alignment Tool

Toro Part Number: **114-5446**

Use pulley alignment tool to verify alignment of groomer and/or rear roller brush drive and driven pulleys.

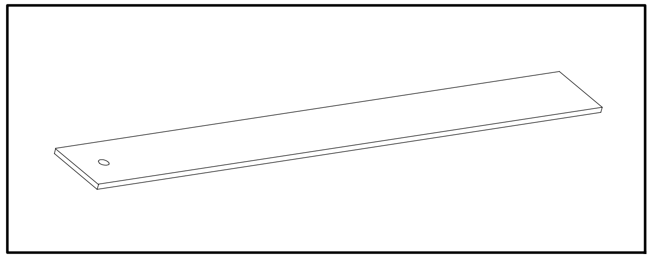


Figure 16

Diameter/Circumference Measuring Tape

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

Toro Part Number: **TOR6023**

Figure 17

Turf Evaluator Tool

Toro Model Number: **04399**

Many turf discrepancies are subtle and require closer examination. In these instances, the Turf Evaluator grass viewing tool is helpful. It can assist turf managers and service technicians in determining causes for poor reel mower performance and in comparing the effective height-of-cut of one mowed surface to another.

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

Figure 18

Bedknife Top Angle Indicator and Mount

Toro Part Numbers: **131-6828** and **131-6829**

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

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

1. Place the angle indicator on the bottom side of the bedknife with the digital display facing you as shown (Fig. 19).

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

3. Remove the angle indicator and place the angle-indicator mount on the edge of the bedknife so the face of the magnet is flat against the top of the bedknife (Fig. 20).

4. Place the angle indicator on the mount with the digital display facing you as shown (Fig. 20). The angle displayed on the indicator is the current bedknife top angle. The angle measured should be between 8° and 12°.

NOTE: Some bedknives were produced with a 5° top angle. Use a 10° top angle when regrinding all bedknives.

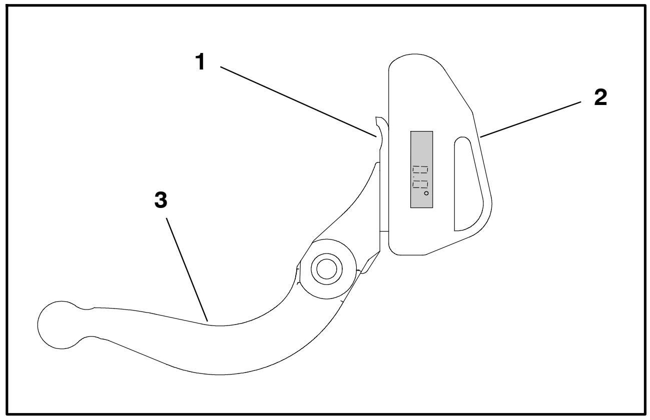


Figure 19

1. **Bedknife**
2. **Angle indicator**
3. **Bedbar**

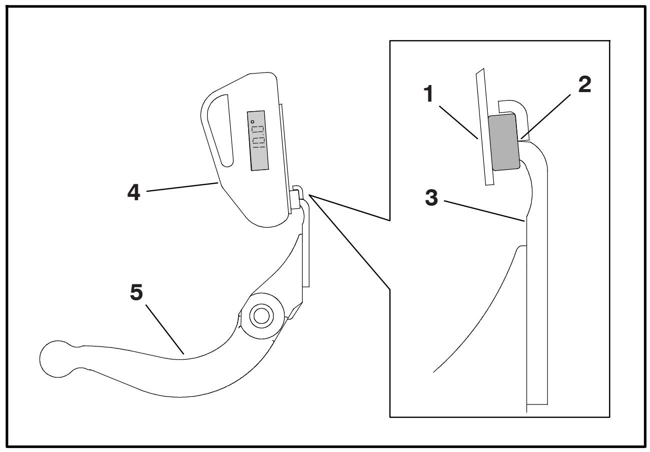


Figure 20

1. **Angle indicator mount**
2. **Magnet**
3. **Bedknife**
4. **Angle indicator**
5. **Bedbar**

DPA Cutting Units

Factors That Can Affect Cutting Performance

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

Refer to the Cutting Unit's Operator's Manual for detailed cutting unit adjustment procedures. For cutting unit repair information, refer to the Service and Repairs section of this chapter.

NOTE: For additional information regarding cutting unit troubleshooting, see **Aftercut Appearance Troubleshooting Aid (Toro part no. 00076SL)**

Factor	**Possible Problem/Correction**
Tire pressure	Check tire pressure of all traction unit tires. Adjust tire pressure as necessary (see Traction Unit Operator's Manual).
Governed engine speed	For best cutting performance and appearance, engine should be run at maximum governed speed during machine operation. Check maximum governed engine speed. Adjust engine to specifications if necessary (see Chapter 3 Kubota Diesel Engine in this manual).
Reel speed	All cutting reels must rotate at the same speed (within 100 rpm). Make sure that reel speed selection is correct (see Clip Chart in Traction Unit Operator's Manual).
Reel bearing condition	Check reel bearings for wear and replace if necessary. See Reel Assembly in the Service and Repairs section of this chapter.
Bedknife to reel adjustment	All cutting units must have equal bedknife to reel and height-of-cut adjustments. Check bedknife to reel contact daily. The bedknife must have light contact across the entire reel. No contact will dull the cutting edges. Excessive contact accelerates wear of both edges. Quality of cut is adversely affected by both conditions (see Bedknife to Reel Adjustment in the Cutting Unit Operator's Manual).

Factor	Possible Problem/Correction
Reel and bedknife sharpness **NOTE:** After grinding the reel and/or bedknife, check the reel to bedknife contact again after cutting two (2) fairways. During this initial use, any burrs will be removed from reel and bedknife which may create improper reel to bedknife clearance and thus accelerate wear. This practice of re-checking the reel to bedknife contact after grinding will extend the longevity of the sharpness of the edge of the reel and the bedknife.	A reel and/or bedknife that has rounded cutting edges or “rifling” (grooved or wavy appearance) **cannot** be corrected by tightening the bedknife to reel contact. Grind cutting reel to remove taper and/or rifling. Grind bedknife to sharpen and/or remove rifling. The most common cause of rifling is bedknife to reel contact that is too tight. Dull cutting edges must be corrected by grinding the bedknife and cutting reel (see Bedknife Replacement and Grinding and Preparing Reel for Grinding in the Service and Repairs section of this chapter). **A new bedknife must be ground flat (within 0.002”) after installation to the bedbar. Backlapping may be required to properly mate the reel and bedknife after installation into the cutting unit.** **NOTE:** On cutting units equipped with optional bedknives, slightly dull cutting edges may be corrected by backlapping (see Backlapping in the Traction Unit Operator’s Manual).
Rear roller adjustment	Adjust the rear roller brackets to correct position depending on the height-of-cut range and aggressiveness of cut that is desired. See Rear Roller Adjustment in the Cutting Unit Operator’s Manual.
Height-of-cut	“Effective” or actual height-of-cut depends on the cutting unit weight and turf conditions. Effective height-of-cut will be different from the bench set height-of-cut. See Height-of-Cut Adjustment in the Cutting Unit Operator’s Manual.
Proper bedknife selection for height-of-cut desired	If the bedknife is incorrect for effective height-of-cut, poor quality of cut will result. See Cutting Unit Operator’s Manual for bedknife options.
Stability of bedbar	Make sure bedbar pivot bolts are seated securely. Check condition of the bushings in the side plates. See Bedbar Removal and Installation in the Cutting Unit Operator’s Manual.
Number of reel blades	Use correct number of reel blades for clip frequency and optimum height-of-cut range. Refer to Clip Chart in Traction Unit Operator’s Manual.

Factor	Possible Problem/Correction
Cutting unit alignment and carrier frame ground following	Check carrier frames and lift arms for damage, binding conditions or bushing wear. Repair if necessary.
Roller condition and roller type	Make sure that front and rear rollers rotate freely. Repair roller bearings as necessary. See Roller Service in the Service and Repairs section of this chapter. Refer to Cutting Unit Operator’s Manual for roller options.
Turf compensation spring adjustment	Refer to Traction Unit Operator’s Manual for adjustment procedures.
Rear lift arm counterbalance spring adjustment	Refer to Traction Unit Operator’s Manual for adjustment procedures.
Cutting unit accessories	A variety of cutting unit accessories are available that can be used to enhance aftercut appearance. Refer to Operator’s Manual for a listing of available accessories.

Set Up and Adjustments

Characteristics

CAUTION

Never install or work on the cutting units or lift arms with the engine running. Always stop engine and remove key first.

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

In addition, the rear roller positioning system allows for various height-of-cut ranges and aggressiveness of cut selections.

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

NOTE: See Cutting Unit Operator's Manual for complete cutting unit adjustment procedures for your Reelmaster.

1. Adjust the bedknife parallel to the reel.

2. Determine desired height-of-cut range and install rear roller mounting shim(s) accordingly.

3. Adjust the height-of-cut.

Leveling Rear Roller

The precision machined components of the cutting unit frame keep the rear roller and cutting reel in alignment (parallel). If the side plates are disassembled or as the cutting reel wears, a limited amount of side plate adjustment is possible to make sure that the cutting unit is properly aligned.

1. Place the assembled cutting unit on a surface plate.

2. Make sure that bedknife is properly adjusted to cutting reel.

3. Check if the rear roller is level to the cutting reel by using a 0.005” (0.13 mm) feeler gauge to determine the clearance between the surface plate and the rear roller at each end of the roller. As the rear roller is rotated one full turn, check if the feeler gauge will consistently pass under the roller at one end but will not pass under the opposite end. Check rear roller with the feeler gauge just inside the machined ends of the roller. A frame adjustment should be made if there is consistently more than 0.005” (0.13 mm) clearance under the roller on one end but not on the other.

NOTE: Cutting units with 5” diameter reel use two (2) shoulder bolts to secure side plates to frame. Cutting units with 7” diameter reel use three (3) shoulder bolts to secure side plates to frame.

4. Loosen, but do not remove, shoulder bolts that secure the side plate to the frame opposite the side that is not level (Fig. 21).

5. Adjust the position of the side plate to parallel the rear roller and cutting reel. Then, tighten the shoulder bolts to a torque from **27 to 33 ft-lb (37 to 44 N-m)**.

6. After tightening the side plate, recheck the rear roller. If necessary, loosen and adjust second side plate.

7. If rear roller is still not level after adjusting both side plates, check to see if cutting reel is tapered (see Preparing Reel for Grinding in this chapter). If cutting reel is not tapered and rear roller is not level, a 0.010” shim (part number 107-4001) is available to allow additional rear roller adjustment. The shim would be used on one side of the rear roller and should be installed between the rear roller bracket and roller shim (Fig. 22). Tighten the flange nuts to a torque from **15 to 19 ft-lb (20 to 26 N-m)**

8. After leveling rear roller, complete cutting unit set-up and adjustment sequence.

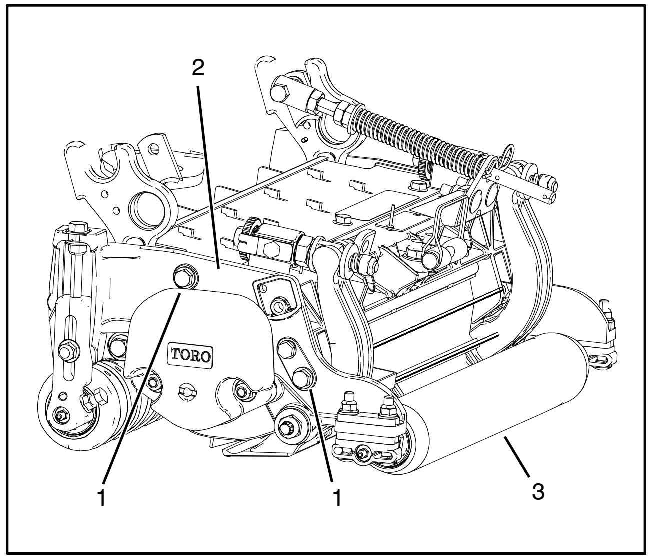


Figure 21

1. **Shoulder bolt**
2. **Side plate**
3. **Rear roller**

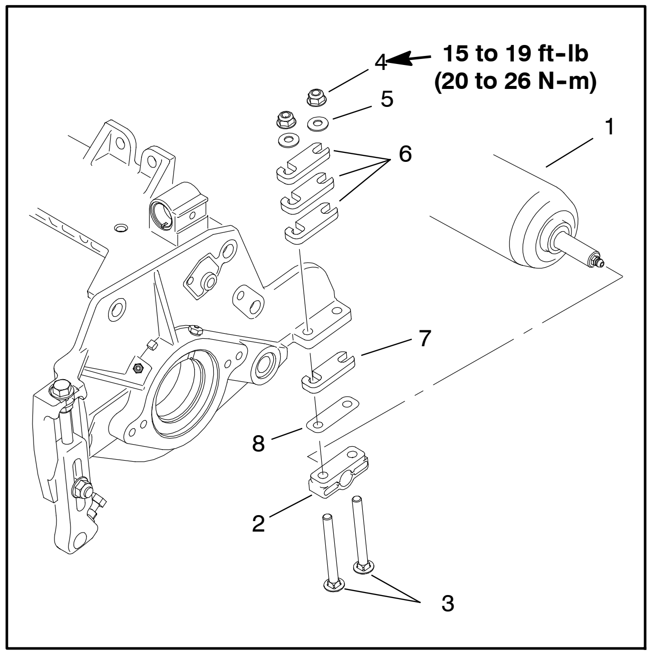


Figure 22

1. **Rear roller assembly**
2. **Rear roller bracket**
3. **Carriage screw (4)**
4. **Flange nut (4)**
5. **Flat washer (4)**
6. **Roller shims (in storage above side plate)**
7. **Roller shims (in use below side plate)**
8. **0.010” shim (if needed)**

Service and Repairs

Cutting Unit Reel Motor

1. Park the machine on a level surface, engage parking brake, lower cutting units and stop engine. Remove key from the ignition switch.

2. Read the General Precautions for Removing and Installing Hydraulic System Components in this chapter.

3. Label all hydraulic connections for assembly purposes. Thoroughly clean hydraulic connections prior to loosening hydraulic lines from reel motor to prevent hydraulic system contamination.

CAUTION

Before opening hydraulic system, operate all hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

4. Disconnect hydraulic hoses from fittings in reel motor. Allow lines to drain into a suitable container. Remove and discard O-rings.

5. Put caps or plugs on disconnected hoses and fittings to prevent contamination.

6. Loosen two (2) flange nuts or flange head screws that secure the hydraulic reel motor to the cutting unit side plate (Fig. 24). Rotate motor clockwise and remove motor from cutting unit.

7. Inspect the O-ring on the reel motor flange and replace O-ring if damaged.

8. If hydraulic fittings are to be removed from motor, mark fitting orientation to allow correct assembly. Remove fittings from motor and discard O-rings.

NOTE: See Cutting Unit Reel Motor Service in Chapter 4 - Hydraulic System in this manual for additional reel motor service information.

Installation

1. If hydraulic fittings were removed from motor, lubricate new O-rings, position O-rings to fittings and install fittings into motor ports (see Hydraulic Fitting Installation in this chapter). Make sure that fittings are orientated correctly.

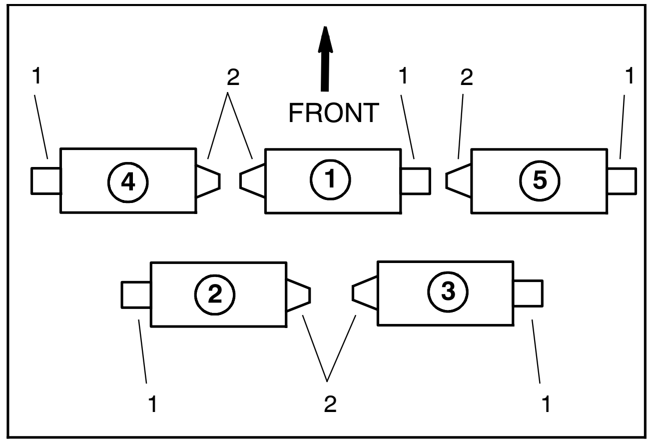


Figure 23

1. Reel motor location
2. Weight location

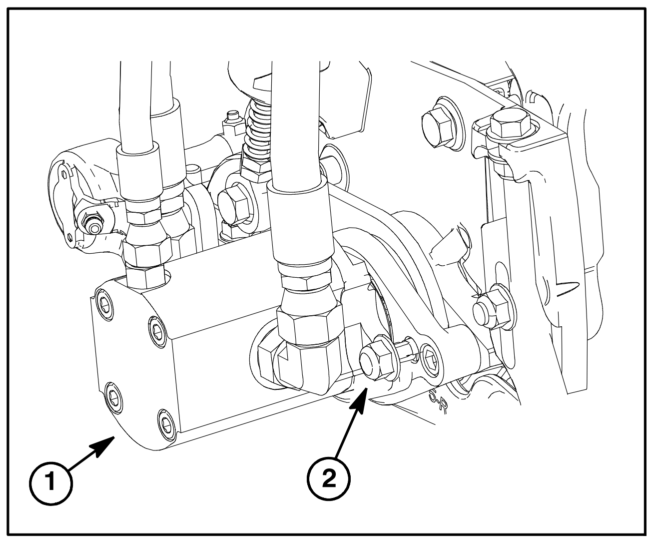


Figure 24

1. Hydraulic reel motor
2. Flange nut or flange head screw (2)

2. Coat spline shaft of the reel motor with No. 2 multipurpose lithium base grease. Lubricate the O-ring on the motor flange with clean oil.

3. Rotate the motor clockwise so the motor flanges clear the flange nuts in the cutting unit side plates. Align reel motor shaft splines with cutting reel insert splines. Slide motor shaft into reel insert.

4. Rotate the motor counter-clockwise until the motor flanges are encircling the cap screws in the side plates. While holding motor, tighten two (2) flange nuts or flange head screws to secure reel motor to cutting unit (Fig. 24).

5. Remove caps or plugs from fittings and hoses.

IMPORTANT: When installing the hydraulic hoses, make sure that hydraulic hoses are straight (not twisted) before tightening the hoses to the motor fittings.

6. Lubricate and install new O-rings on motor fittings. Correctly connect hydraulic hoses to the motor using labels placed during removal procedure.

7. Check oil level in hydraulic reservoir and add correct oil if necessary.

8. Follow Hydraulic System Start-up procedures (see Hydraulic System Start-up in this section).

Backlapping

DANGER

TO AVOID PERSONAL INJURY OR DEATH:
- **Never place hands or feet in the reel area while the engine is running. Stay away from the cutting reels when backlapping.**
- **When backlapping, run engine at idle speed only.**
- **While backlapping, the reels may stall and then restart.**
- **Do not attempt to restart reels by hand or foot.**
- **Do not adjust reels while the engine is running.**
- **If a reel stalls, stop engine before attempting to clear the reel.**
- **Reel motors are connected in series: rotating one motor causes rotation in other motors.**

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. On all cutting units, make initial reel to bedknife adjustments appropriate for backlapping.

IMPORTANT: Do not attempt to rotate the directional valve lever on the hydraulic mow control manifold when the engine or reels are running.

3. Raise seat, locate hydraulic mow control manifold and rotate directional valve lever fully to the R (backlap) position (Fig. 25). Rotate flow control valve knob to position 1.

4. Start engine and run at **low idle speed (1550 RPM)**.

5. With the mow speed limiter in the mow position, move the PTO switch to the ON position. Press the lift switch to start the backlapping operation on the designated reels.

6. Apply lapping compound to cutting reels with a long handle brush (see Special Tools). Never use a short handled brush to apply lapping compound.

CAUTION

Be careful when backlapping the reel because contact with the reel or other moving parts can result in personal injury.

7. To make a cutting unit adjustment while backlapping, turn reels OFF, shut off engine and wait for all machine and cutting unit motion to completely stop. Then, after cutting unit adjustments have been completed, repeat steps 4 through 6.

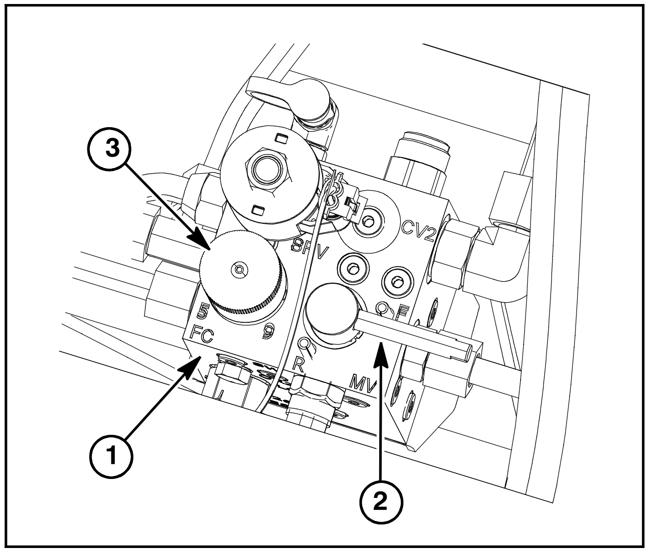


Figure 25

1. **Mow manifold**
2. **Backlap lever**
3. **Reel speed knob**

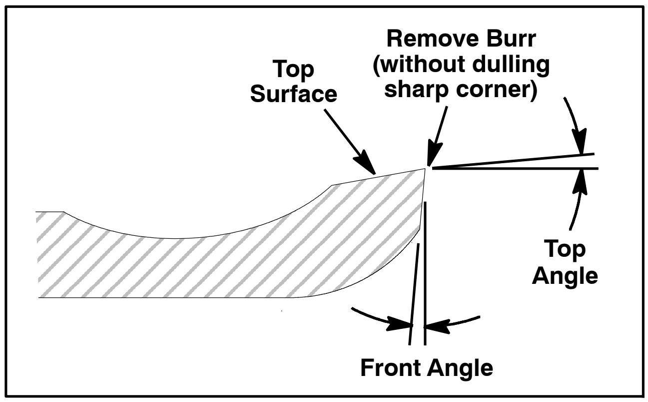


Figure 26

8. When the backlap operation is completed, shut off engine and rotate directional valve lever fully (90º from the backlap position) to the F (forward) position. Also, rotate flow control valve knob to correct mowing position.

9. Wash all lapping compound from the cutting units.

10. For a better cutting edge, run a file across the front face of the bedknife when the lapping operation is completed (Fig. 26). This will remove any burrs or rough edges that may have built up on the cutting edge.

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

Bedbar Assembly

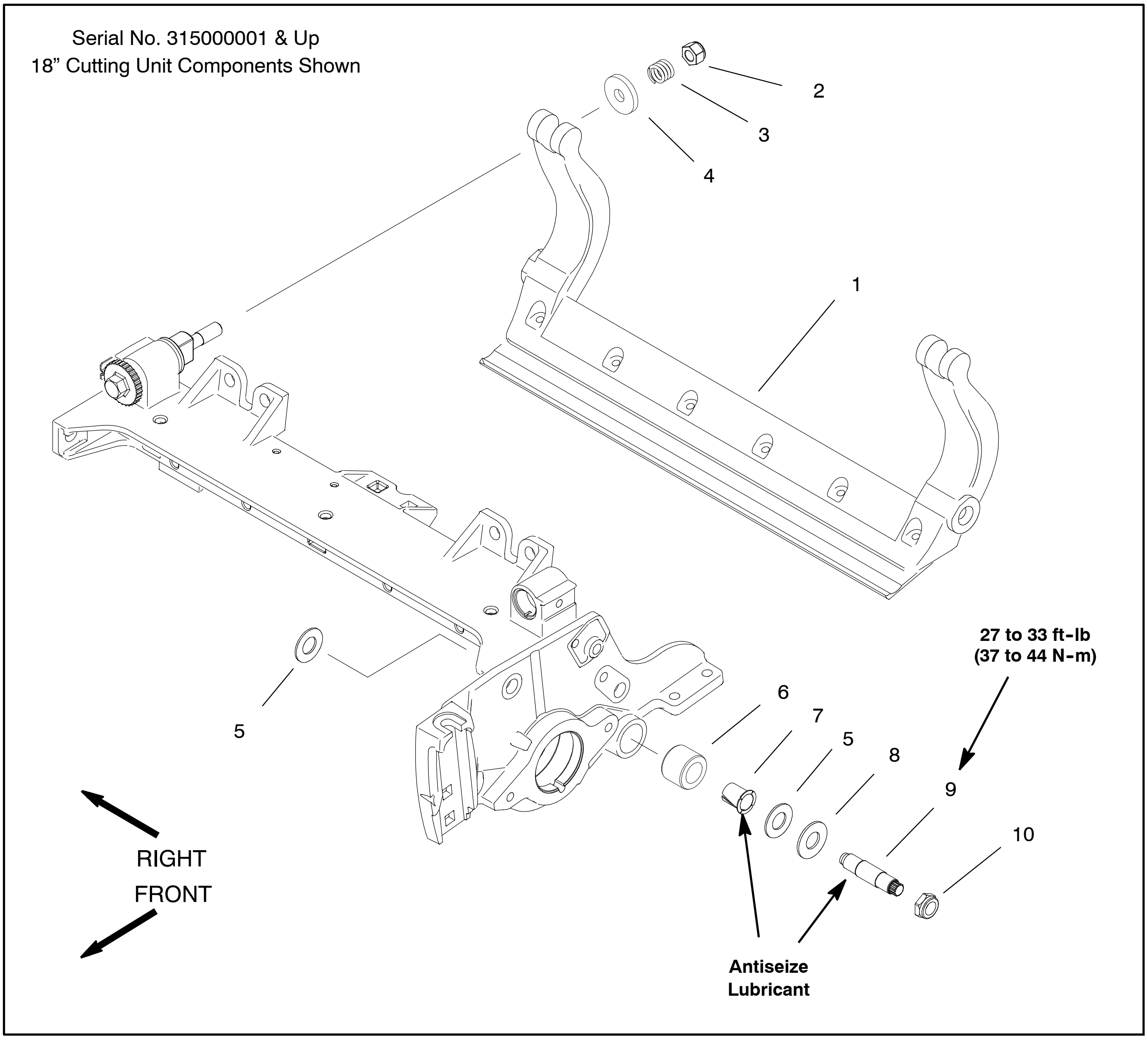


Figure 27

1. **Bedbar assembly**
2. **Lock nut (2 used)**
3. **Compression spring (2 used)**
4. **Washer (2 used)**
5. **Plastic washer (4 used)**
6. **Rubber bushing (2 used)**
7. **Flange bushing (2 used)**
8. **Metal washer (2 used)**
9. **Bedbar pivot bolt (2 used)**
10. **Lock nut (2 used)**

Bedbar Removal (Fig. 27)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove the cutting unit from the machine. Use the cutting unit kickstand to support the cutting unit (see Special Tools).

3. Loosen the lock nuts on the end of each bedbar adjuster assembly until washers are loose.

4. Loosen the lock nuts on each bedbar pivot bolt.

5. Remove two (2) bedbar pivot bolts, two (2) metal washers and four (4) plastic washers from the cutting unit side plates.

CAUTION

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

6. Remove bedbar assembly from cutting unit.

7. Inspect flange bushings and rubber bushings in side plates for wear or damage. Remove bushings and replace if necessary.

Bedbar Installation (Fig. 27)

1. If rubber bushing was removed from either cutting unit side plate, apply antiseize lubricant to the side plate bore and install a new bushing. The bushing should be installed flush with the inside of the side plate.

2. If removed, install the flange bushings with flange facing outward. Apply antiseize lubricant to inside of flange bushing.

3. Apply antiseize lubricant to the bedbar threads and the shoulder area of each bedbar pivot bolt.

4. Slide one metal washer and one plastic washer onto each bedbar pivot bolt.

CAUTION

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

5. Position bedbar into cutting unit. Make sure that the top of each bedbar arm is between washer and adjuster screw flange.

6. Position a plastic washer between bedbar and each cutting unit side plate (Fig. 28).

7. Install the bedbar pivot bolt assemblies. Make sure that plastic washers are not caught on the threads of the pivot bolts. Tighten each bedbar pivot bolt from **27 to 33 ft-lbs (37 to 44 N-m)**.

8. Tighten the pivot bolt lock nuts equally, on each side, until the outer steel washers cannot be rotated by hand. Then, loosen the lock nuts slightly so the outer steel washers just rotate by hand, yet no bedbar end play is present. The plastic washer between the bedbar and side plate may be loose.

9. Tighten the lock nut on each bedbar adjuster assembly until the adjuster spring is fully compressed, then loosen lock nut 1/2 turn.

10. Adjust cutting unit (see Cutting Unit Operator's Manual).

11. Install cutting unit to machine.

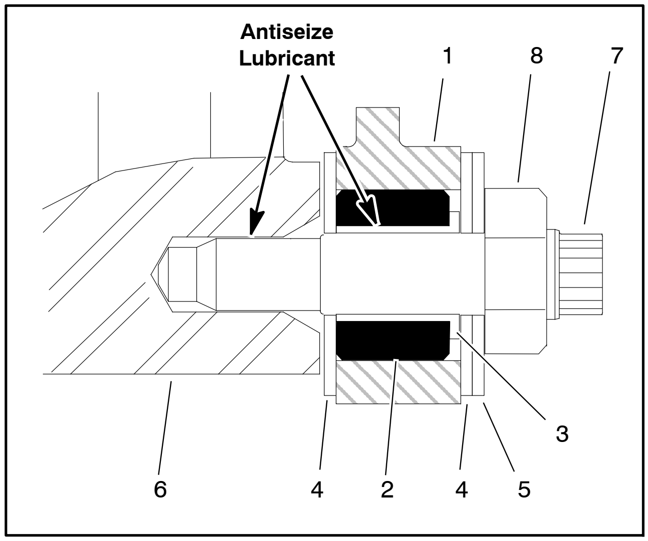


Figure 28

1. **Cutting unit side plate**
2. **Rubber bushing**
3. **Flange bushing**
4. **Washer (plastic)**
5. **Washer (metal)**
6. **Bedbar**
7. **Bedbar pivot bolt**
8. **Lock nut**

Bedknife Replacement and Grinding

Bedknife Removal

1. Remove bedbar from cutting unit (see Bedbar Removal in this chapter).

NOTE: 18” cutting units use 6 screws to secure bedknife to bedbar. 22” cutting units use 8 screws to secure bedknife to bedbar.

2. Remove screws from bedbar using a socket wrench and bedknife screw tool (see Special Tools in this chapter). Discard screws. Remove bedknife from the bedbar (Fig. 29).

3. See bedknife grinding information on the following pages.

Bedknife Installation

1. Use scraper to remove all rust, scale and corrosion from bedbar surface. Lightly oil bedbar surface before installing bedknife.

2. Make sure that screw threads in bedbar (5/16-18UNC-2A) are clean.

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

3. Use new screws to secure bedknife to bedbar. Apply antiseize lubricant to the threads of new screws. Do not apply antiseize lubricant to the taper of the screw heads.

4. Install all screws but do not tighten.

5. Using a torque wrench and bedknife screw tool, tighten the 2 outer screws to **10 in-lb (1 N-m)**.

6. Working from the center of the bedknife toward each end (Fig. 30), tighten screws from **200 to 250 in-lb (23 to 28 N-m)**.

7. After installing bedknife to bedbar, grind bedknife.

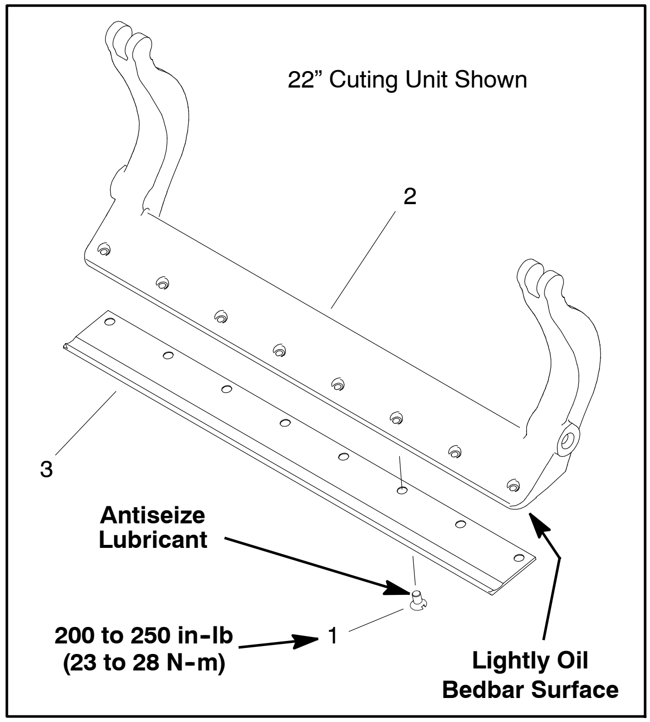


Figure 29

1. **Screw (6 or 8 used)**
2. **Bedbar**
3. **Bedknife**

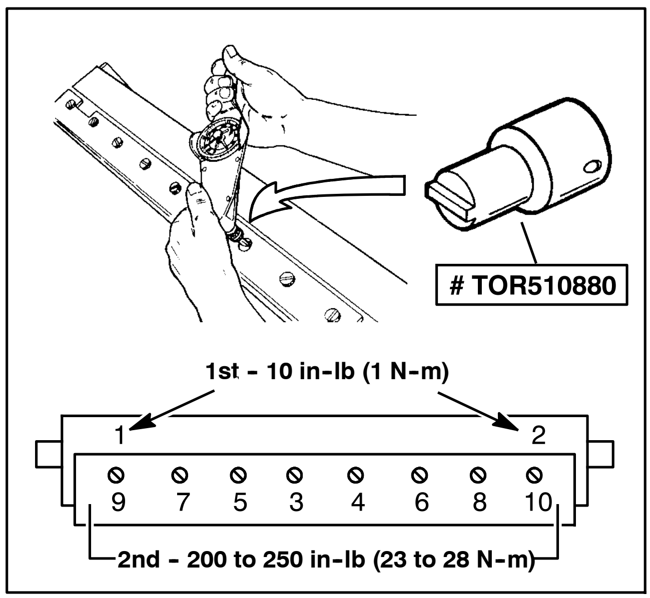


Figure 30

Bedknife Grinding

Since there can be variations in the mounting surface of the bedbar, it is necessary to grind the bedknife after installing it to the bedbar. Follow the bedknife grinding specifications provided and grind only enough to make sure the top surface of the bedknife is true (Fig. 31 and 32).

IMPORTANT: Do Not grind the bedknife below it's service limit (Fig. 31 and 33). Operating the cutting unit with the bedknife below the service limit may result in poor after-cut appearance and reduce the structural integrity of the bedknife for impacts.

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

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

Because the top grind angle on bedknives is critical for edge retention, and therefore after-cut appearance, Toro has developed special service tools for accurately measuring the top grind angle on all bedknives; refer to the Angle Indicator and Magnetic Mount in the Special Tools section of this Chapter.

NOTE: Some bedknives were produced with a 5° top angle. Use a 10° top angle when regrinding all bedknives.

Bedknife Grinding Specifications

Bedknife	Lip Height Service Limit	Top Angle	Front Angle
EdgeMax Low HOC	0.19" (4.8 mm)	10°	5°
Premium Low HOC			
Standard Low HOC			
Extended EdgeMax Low HOC			10°
Extended Low HOC			
EdgeMax Standard HOC			5°
Standard Standard HOC			
Heavy Duty Standard HOC			

Figure 31

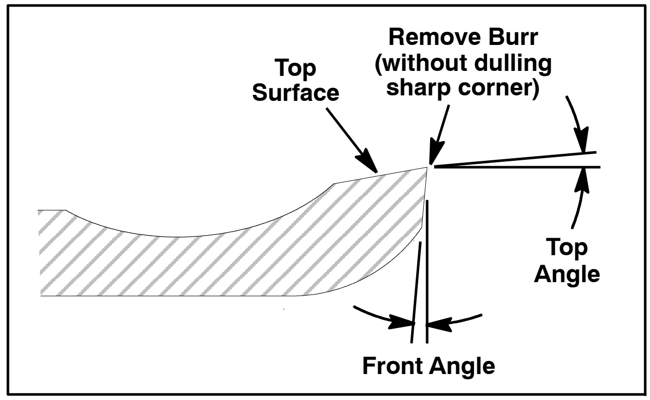


Figure 32

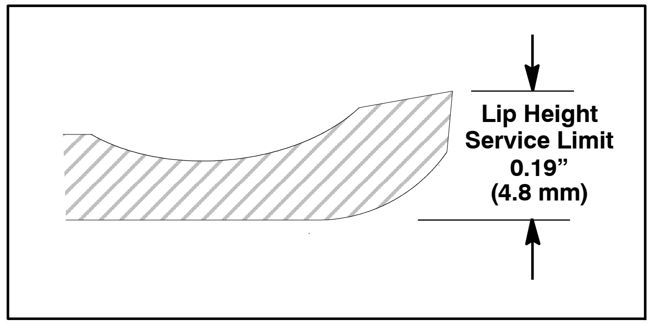


Figure 33

1. **Bedknife**

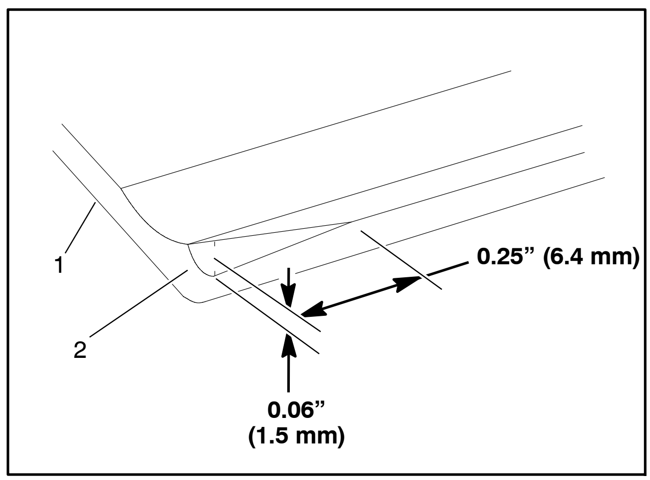


Figure 34

1. **Bedknife** 2. **Lead-in Chamfer**

1. Use Toro General Service Training Book, Reel Mower Basics (part no. 09168SL) and grinder manufacturer's instructions for bedknife grinding information.

2. A lead-in chamfer is ground into all new bedknives (Fig. 34). The original chamfer should last for the first 40% of the bedknife service life. Check and re-grind the lead-in chamfer as necessary.

3. After bedknife grinding is complete, install bedbar to cutting unit (see Bedbar Installation in this section).

Bedbar Adjuster Service

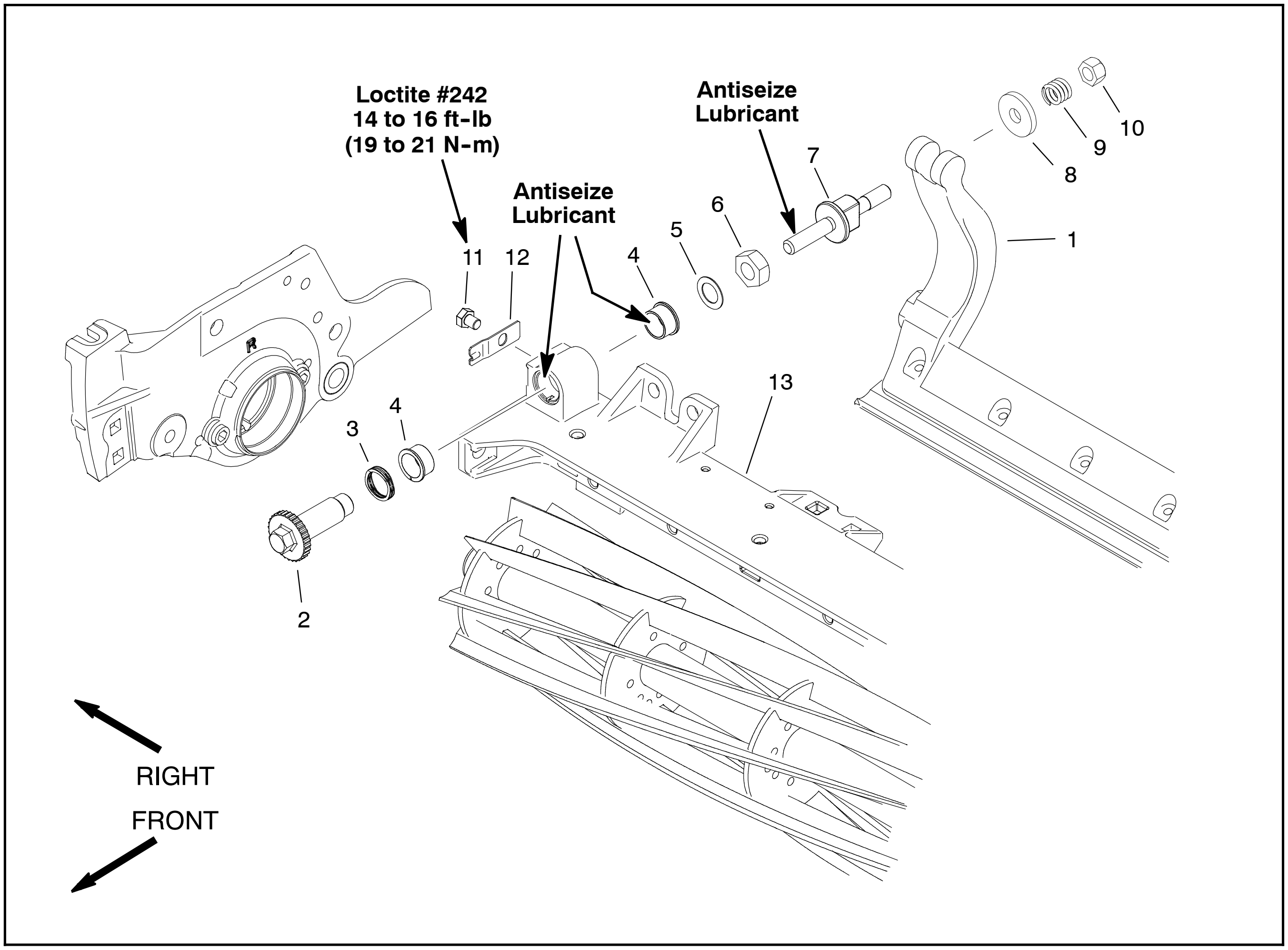


Figure 35

1. **Bedbar assembly**
2. **Bedbar adjuster shaft**
3. **Wave washer**
4. **Flange bushing (2)**
5. **Flat washer**
6. **Lock nut**
7. **Bedbar adjuster screw**
8. **Washer**
9. **Compression spring**
10. **Lock nut**
11. **Cap screw**
12. **Detent**
13. **Frame**

Removal (Fig. 35)

1. Remove lock nut, compression spring and washer from bedbar adjuster screw.

2. Remove bedbar (see Bedbar Removal in this chapter.

NOTE: Bedbar adjuster shaft has left-hand internal threads.

3. Unscrew bedbar adjuster screw from the bedbar adjuster shaft.

4. Remove lock nut and flat washer from adjuster shaft. Slide adjuster shaft and wave washer from cutting unit frame.

5. Inspect flange bushings in cutting unit frame and remove if necessary.

6. If detent is damaged, remove it from cutting unit side plate by removing the cap screw.

Installation (Fig. 35)

1. If detent was removed, apply Loctite #242 (or equivalent) to threads of cap screw and secure detent to cutting unit side plate with cap screw. Torque cap screw from **14 to 16 ft-lb (19 to 21 N-m)**.

2. If flange bushings were removed, apply antiseize lubricant to bore of cutting unit frame. Align key on bushing to slot in frame and install bushings into frame.

3. Slide wave washer onto adjuster shaft and then slide adjuster shaft into flange bushings in cutting unit frame. Secure adjuster shaft with flat washer and lock nut. Tighten lock nut to shoulder of adjuster shaft and then torque lock nut from **15 to 20 ft-lb (21 to 27 N-m)**.

NOTE: Bedbar adjuster shaft has left-hand internal threads.

4. Apply antiseize lubricant to threads of bedbar adjuster screw that fit into adjuster shaft. Thread bedbar adjuster screw into adjuster shaft.

5. Install bedbar (see Bedbar Installation in this chapter).

6. Install washer, compression spring and lock nut onto adjuster screw. Tighten the lock nut on each bedbar adjuster assembly until the compression spring is fully compressed, then loosen lock nut 1/2 turn.

7. Adjust cutting unit (see Cutting Unit Operator's Manual).

Reel Assembly

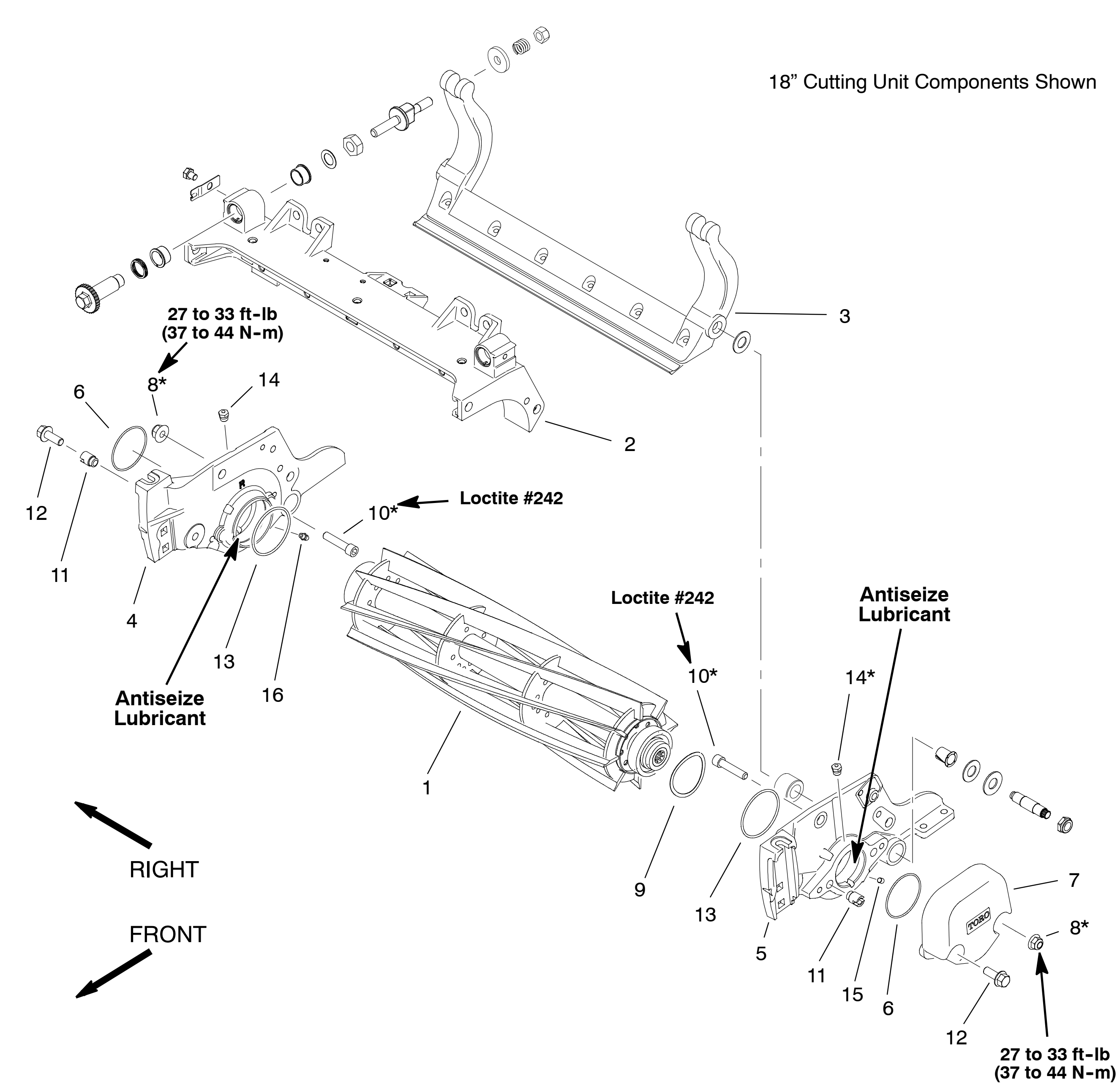


Figure 36

1. **Cutting reel**
2. **Frame**
3. **Bedbar assembly**
4. **RH side plate**
5. **LH side plate**
6. **O-ring (2)**
7. **Weight**
8. **Flange nut (4)***
9. **Wire Spring**
10. **Cap screw (4)***
11. **Threaded insert (4)**
12. **Flange head screw (4)**
13. **O-Ring (2)**
14. **Relief valve (2)**
15. **Plug**
16. **Grease fitting (reel motor side only)**

*Used on cutting units prior to serial no. 315000001.

NOTE: Removal of the cutting reel requires removal of the left side plate from the cutting unit frame. The right side plate does not have to be removed from the frame.

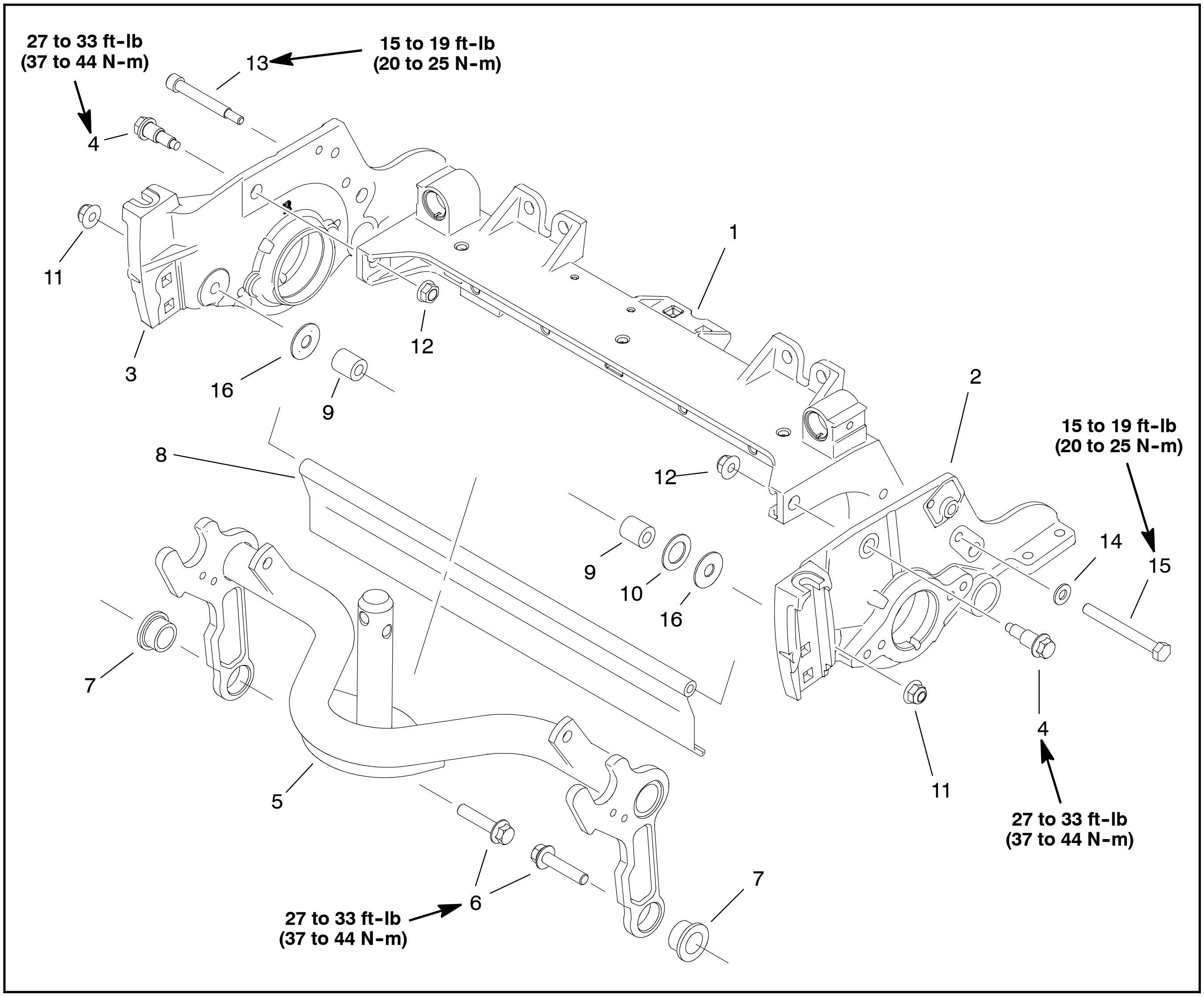


Figure 37

1. Frame
2. LH side plate
3. RH side plate
4. Shoulder bolt (4)
5. Carrier frame
6. Flange head screw (2)
7. Flange bushing (2)
8. Rear grass shield
9. Spacer (2)
10. Shim (as required)*
11. Flange nut (2)
12. Flange nut (4)
13. Special screw
14. Flat washer
15. Cap screw
16. Shim (as required)

*Used on 18" cutting units prior to serial no. 315000001.

DPA Cutting Units

Removal (Fig. 36 & 37)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove the cutting unit from the machine and place on a flat work area.

CAUTION

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

3. If cutting unit is equipped with a counterweight on LH side plate, remove the two (2) flange nuts securing the counter weight to the side plate and remove counter weight from the cutting unit. Remove and discard O-ring from counter weight.

4. If cutting unit is equipped with an optional groomer or rear roller brush, remove components for those options from left hand side plate of cutting unit. See Chapter 8 - Belt Driven Groomer or Chapter 9 - Universal Groomer in this manual for additional Groomer information. See Rear Roller Brush in this chapter for information on rear roller brush.

IMPORTANT: If the reel bearings or seals are being replaced, the reel spline inserts must be removed. Use the following procedure to restrain the reel and loosen the spline insert before removing the rollers.

5. Loosen the spline inserts (Fig. 38):

A. Tip the cutting unit to access the bottom of the reel.

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

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

C. Move the pry bar against the weld side of the reel support plate closest to the spline insert being loosened. Use correct spline insert tool (see Special Tools).

IMPORTANT: The spline insert on the left end of the cutting reel has left hand threads and the spline insert on the right end of the cutting reel has right hand threads.

D. Rest the handle of the pry bar against the front roller and loosen the spline insert closest to the pry bar.

E. Position the pry bar in the same manner on the opposite end of the reel and loosen the remaining spline insert.

F. Tip the cutting unit back onto its rollers.

6. Remove bedbar assembly (see bedbar removal in this chapter).

7. Remove front and rear rollers (see Front Roller Removal and Rear Roller Removal in this chapter).

8. Remove cap screw and flat washer that secure rear grass shield to LH side plate.

9. Remove flange head screw and flange nut that secures frame spacer and carrier frame to LH side plate.

NOTE: The reel bearings and grease seals are press fit on the cutting reel shaft and should remain on the reel when removing the LH side plate.

10. Remove two (2) shoulder bolts and flange nuts that secure the LH side plate to the cutting unit frame. Remove the LH side plate from the reel shaft and cutting unit frame.

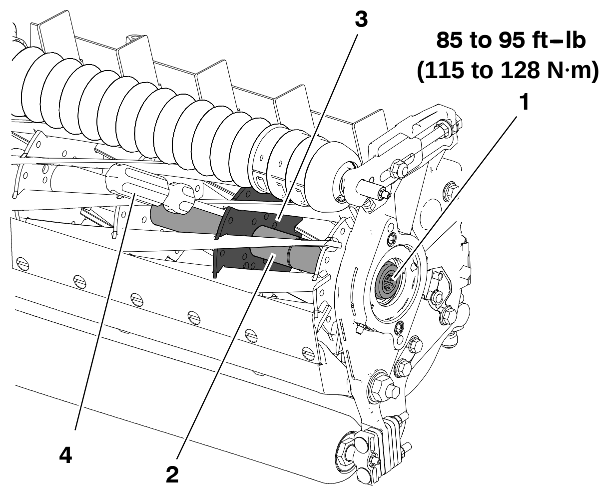


Figure 38

1. **Spline insert (LH)**
2. **Reel shaft**
3. **Reel support plate**
4. **Pry bar**

11. Carefully slide the cutting reel assembly from the RH side plate.

12. Inspect and service cutting reel assembly as required (see Reel Assembly Service in this chapter).

Installation (Fig. 36 & 37)

1. Thoroughly clean side plates and other cutting unit components. Inspect side plates for wear or damage and replace if needed.

2. Make sure that grease seals and bearings are properly installed on cutting reel (see Reel Assembly Service in this Chapter).

3. Cutting unit serial nos. 315000001 & Up have O-rings in the reel bearing bore of each side plate. Make sure the O-rings are in good condition and properly installed in the side plates.

4. Apply a thin coat of antiseize lubricant to the reel bearing bore of each side plate (Fig. 39).

CAUTION

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

5. Carefully slide the RH end of the cutting reel assembly (no groove in reel shaft or on face of threaded insert) into the RH side plate. Make sure that bearing is fully seated into side plate.

6. Slide the LH side plate onto the cutting reel assembly.

7. Install shoulder bolts and flange nuts that secure the LH side plate to the cutting unit frame. Torque the shoulder bolts from **27 to 33 ft-lbs (37 to 44 N-m)**.

8. Apply Loctite #242 (or equivalent) to threads of flange head screw that secures frame spacer and carrier frame to LH side plate. Install screw and torque from **27 to 33 ft-lbs (37 to 44 N-m)**. After tightening screw, check the clearance between the carrier frame and side plate. If clearance is more than **0.065" (1.6 mm)**, remove flange head screw and position shim(s) between carrier frame and side plate so that clearance is less than **0.065" (1.6 mm)**. Make sure that the carrier frame pivots freely after assembly.

9. Install cap screw and flat washer that secure rear grass shield to LH side plate. Torque screw from **15 to 19 ft-lbs (20 to 25 N-m)**.

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

11. Install front and rear rollers (see Front Roller Installation and Rear Roller Installation in this section).

12. Adjust cutting unit (see Cutting Unit Operator's Manual).

NOTE: The parallel position of the rear roller to the cutting reel is controlled by the precision machined frame and side plates of the cutting unit. If necessary, the cutting unit side plates can be loosened and a slight adjustment can be made to parallel the rear roller with the cutting reel (see Leveling Rear Roller in this Chapter).

13. If cutting unit is equipped with optional groomer or rear roller brush, install components for those options to left hand side plate of cutting unit. See Chapter 8 - Belt Driven Groomer or Chapter 9 - Universal Groomer for information on groomer. See Rear Roller Brush in this chapter for information on rear roller brush.

14. Tighten the spline inserts:

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

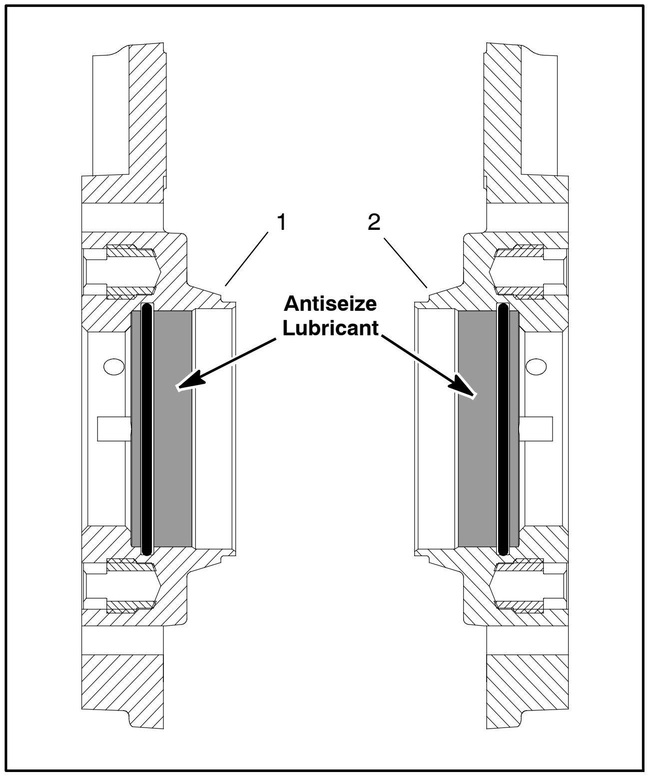


Figure 39

1. **Side plate - RH**
2. **Side plate - LH**

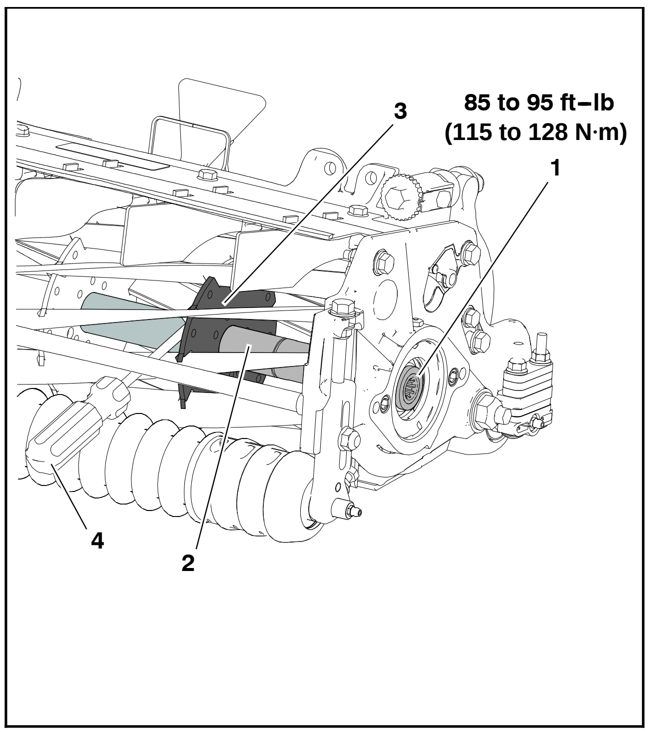


Figure 40

1. **Spline insert (LH)**
2. **Reel shaft**
3. **Reel support plate**
4. **Pry bar**

DPA Cutting Units

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

B. Move the pry bar against the weld side of the reel support plate closest to the spline insert being tightened.

IMPORTANT: The spline insert on the left end of the cutting reel has left hand threads and the spline insert on the right end of the cutting reel has right hand threads.

C. Rest the handle of the pry bar against the front roller and tighten the spline insert closest to the pry bar. The spline inserts are installed with thread locking compound (Loctite #243 or equivalent). Tighten the spline insert from **85 to 95 ft-lb (115 to 128 N·m)**. Use correct spline insert tool (see Special Tools).

D. Position the pry bar in the same manner on the opposite end of the reel and tighten the remaining spline insert.

15. If counterweight was removed from cutting unit, install new O-ring on counter weight. Secure counter weight to cutting unit side plate with two (2) flange nuts. Torque screws from **27 to 33 ft-lbs (37 to 44 N-m)**.

16. Install cutting unit to the machine.

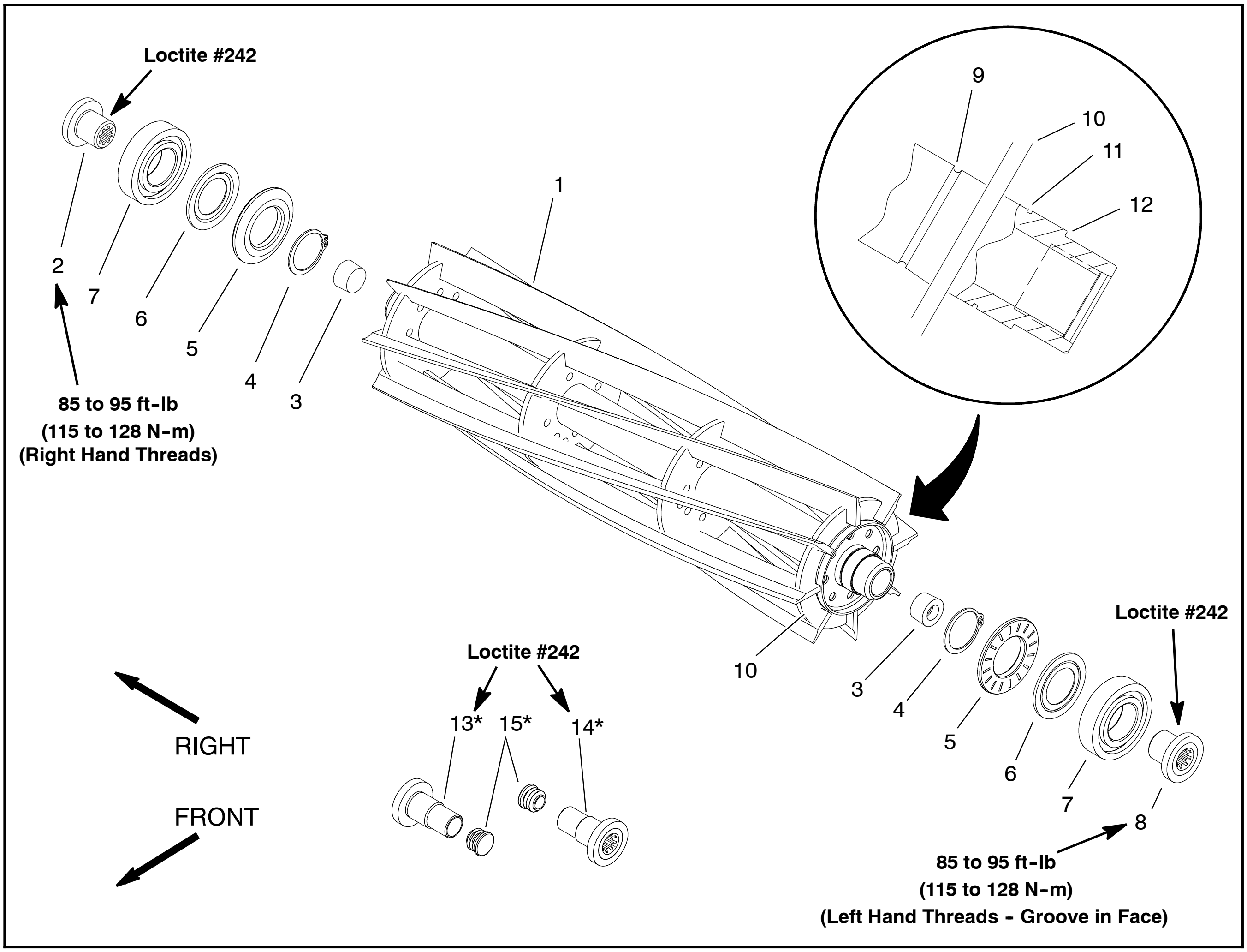


Figure 41

1. **Cutting reel**
2. **Threaded insert (RH thread)**
3. **Plastic plug (2)**
4. **Retaining ring**
5. **Special washer**
6. **Flocked seal**
7. **Sealed bearing**
8. **Threaded insert (LH thread)**
9. **Groove indicating LH threads**
10. **Reel spider**
11. **Retaining ring groove**
12. **Bearing shoulder**
13. **Threaded insert (RH thread)***
14. **Threaded insert (LH thread)***
15. **Plastic plug (2)***

***Used on cutting units prior to serial no. 315000001.

Cutting Reel Inspection

1. Inspect reel bearings to insure that they spin freely and have minimal axial play.

2. Inspect the reel shaft as follows. If reel damage is detected, replace reel.

   A. Check the reel shaft for bending and distortion by placing the shaft ends in V-blocks.

   B. Check the reel blades for bending or cracking.

   C. Check the service limit of the reel diameter (see Preparing a Reel for Grinding in this section).

3. Check the threaded inserts in the reel shaft for excessive wear or distortion. Replace inserts if damage is evident.

   A. One insert has LH threads and the other insert has RH threads. The insert with LH threads has a groove on the insert face. A groove is cut 2.2” (5.6 cm) from the end of the reel shaft to identify the reel end that has LH threads.

   B. Use correct spline insert tool to remove threaded inserts (see Special Tools in this chapter).

Assembly of Cutting Reel (Fig. 41)

1. If flocked seals and/or bearings were removed from reel shaft, discard removed components and replace.

2. Make sure that the retaining ring is fully seated into the groove on the cutting reel shaft.

3. Install special washer with recessed slots toward bearing. Drive special washer onto reel shaft until it squarely contacts retaining ring.

4. Slide flocked seal and bearing onto reel shaft with flocked side of seal against bearing.

5. Install threaded insert.

    A. One insert has LH threads and the other insert has RH threads. The insert with LH threads has a groove on the insert face. A groove is cut 2.2" (5.6 cm) from the end of the reel shaft to identify the reel end that has LH threads.

    B. For cutting unit serial no. prior to 315000001, make sure plastic plug is pressed flush into end of threaded insert. For cutting unit serial no. 315000001 & Up, make sure plastic plug is pressed unto reel shaft **1.63 to 1.37 in. (41 to 35 mm)** below the end of the shaft (Fig. 43).

    C. Use correct spline insert tool to install threaded inserts (see Special Tools in this chapter).

    D. Apply thread locking compound (Loctite #242 or equivalent) to threaded portion of insert. Tighten threaded insert from **85 to 95 ft-lb (115 to 128 N-m)**.

    E. Fill threaded insert splines with high temp Mobil XHP-222 grease or equivalent.

6. Repeat procedure for other end of reel if necessary.

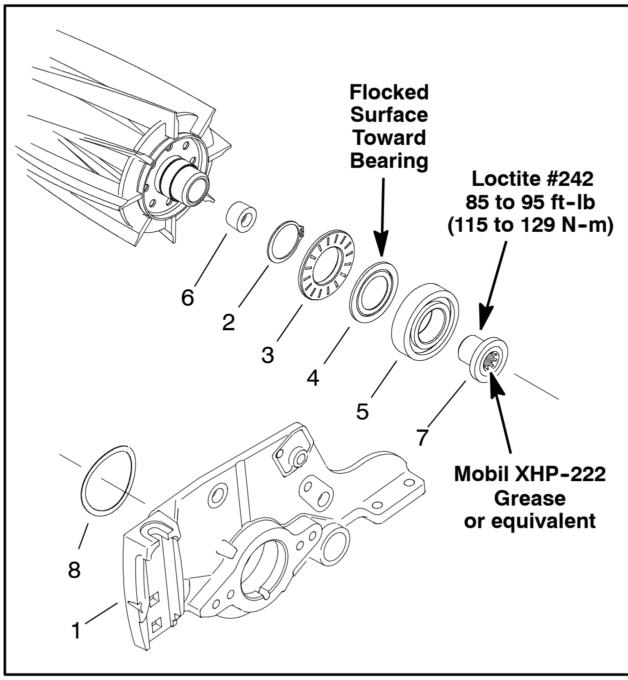


Figure 42

1. **Side plate**
2. **Retaining ring (2)**
3. **Special washer (2)**
4. **Flocked seal (2)**
5. **Bearing (2)**
6. **Plastic plug (2)**
7. **Threaded insert LH**
8. **Wire spring**

Cutting Unit Serial no. 315000001 & Up

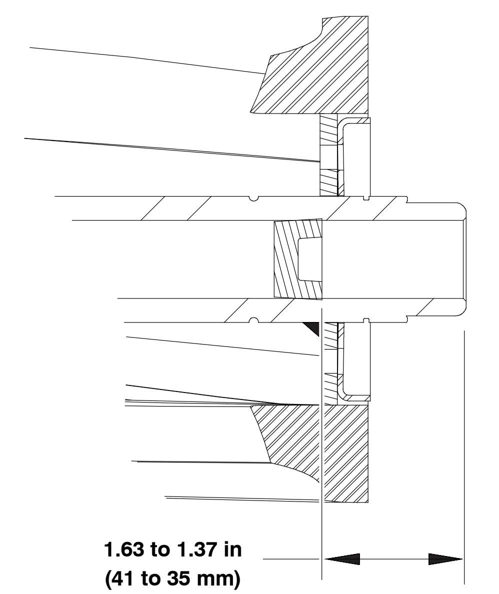


Figure 43

1. **Reel shaft**
2. **Plastic plug (2)**

Preparing Reel for Grinding

Three (3) types of reel designs are used in Reelmaster cutting units: scalloped radial reel, tapered radial reel and tapered forward swept reel (Fig. 44). The radial reel designs have blades that are placed in line with the center of the reel shaft. The rear of the blades either have a scalloped relief or a tapered relief. The forward swept reel have blades that have a slight forward slant. The rear of the forward swept reel blades have a tapered relief. Before grinding a reel, identify the type of reel design to make sure that grinding is correctly done.

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

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

Reel Grinding Specifications		
	5 in. Dia. Reels	7 in. Dia. Reels
Reel Diameter (New)	5.060 in (128.5 mm)	7.060 in (179.3 mm)
Service Limit - Reel Diameter	4.500 in (114 mm)	6.600 in (168 mm)
Reel Shaft Diameter (OD)	1.313 in (33.3 mm)	
Reel Diameter Taper (Fig. 45)	0.001 in (0.025 mm) Service Limit: 0.010 in (0.25 mm)	
Blade Land Width	0.050 to 0.060 in (1.3 to 1.8 mm) Service Limit: .120 in (3.0 mm)	
Blade Relief Angle	30º +/– 5º	

Relief grind the reel blades to the minimum blade land width if the reel blade land width exceeds the service limit. Spin grind the reel to restore its cylindrical shape.

NOTE: Spin grind the reel and establish the specified blade land width after relief grinding.

After grinding the reel and/or bedknife, adjust the cutting unit (see Cutting Unit Operator's Manual). Check the reel to bedknife contact again after cutting two (2) fairways. During this initial use, any burrs will be removed from reel and bedknife which may create improper reel to bedknife clearance and thus accelerate wear. This practice of re-checking the reel to bedknife contact after grinding will extend the longevity of the sharpness of the edge of the reel and the bedknife.

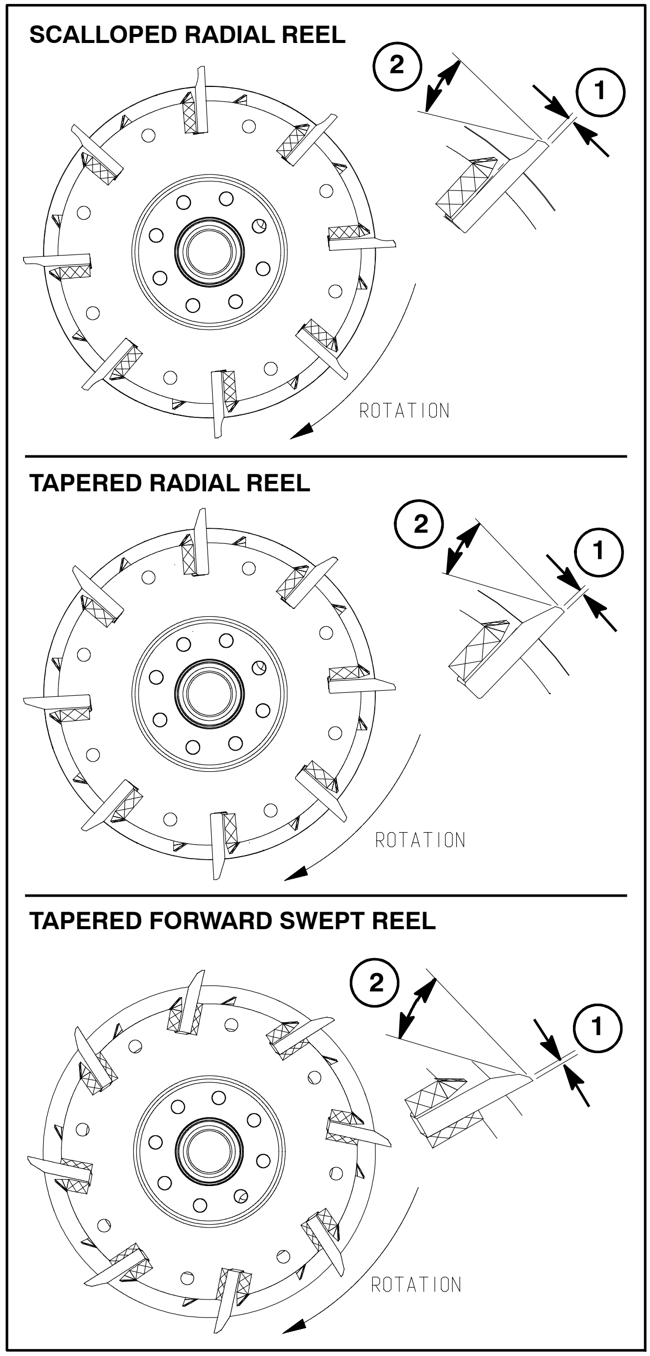


Figure 44

1. **Blade land width**
2. **Blade relief angle**

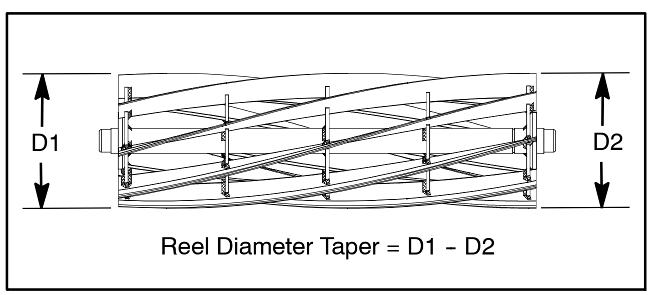


Figure 45

Front Roller

Removal (Fig. 46)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove the cutting unit from the machine and place on a level working surface. Use cutting unit kickstand (see Special Tools) to raise front roller from work surface.

3. Loosen flange nuts and cap screws securing the front roller shaft to each front height-of-cut brackets.

4. Remove flange lock nut and carriage screw that secures one of the height-of-cut brackets to the cutting unit side plate. Remove the height-of-cut bracket from the cutting unit.

5. Slide the front roller assembly from the remaining height-of-cut bracket on the cutting unit.

6. If necessary, remove the second height-of-cut bracket from the cutting unit.

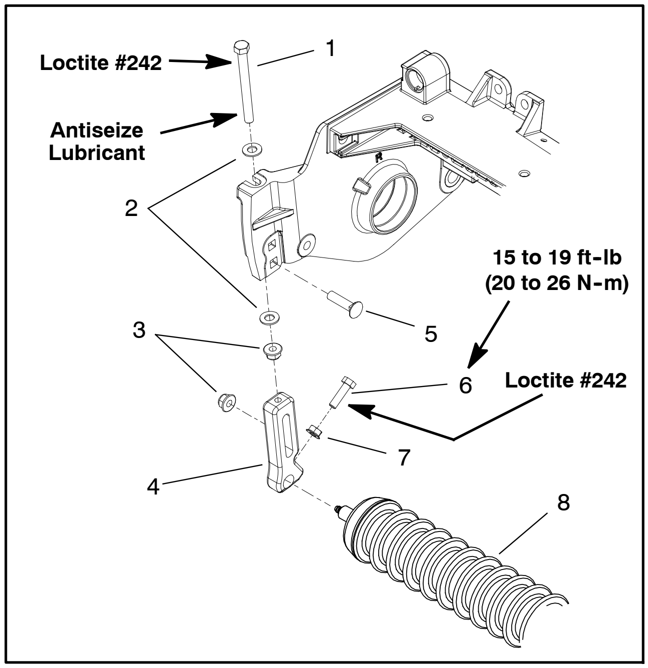


Figure 46

1. **Cap screw**
2. **Flat washer**
3. **Flange lock nut**
4. **Height-of-cut bracket**
5. **Carriage screw**
6. **Cap screw**
7. **Flange nut**
8. **Front roller assembly**

Installation (Fig. 46)

1. Place cutting unit on a level working surface and use cutting unit kickstand (see Special Tools) to support cutting unit.

2. Inspect condition of cap screws in both height-of-cut brackets. Replace cap screw(s) if necessary:

   A. Place two (2) flat washers on cap screw.

   B. Apply Loctite #242 (or equivalent) to threads of cap screw at 0.750” (19 mm) below screw head. Thread flange lock nut (flange toward screw head) onto cap screw over applied Loctite.

   C. Apply antiseize lubricant to cap screw threads that will extend into height-of-cut bracket.

   D. Thread cap screw into bracket.

NOTE: When assembling height-of-cut brackets to side plate, make sure that cap screw head and one flat washer are above adjustment flange on side plate and second flat washer and flange lock nut are below adjustment flange.

3. If both front height-of-cut brackets were removed from cutting unit side plate, position one of the brackets to side plate. Secure bracket to side plate with carriage screw and flange lock nut.

4. Slide front roller shaft into bracket attached to the cutting unit. Slide second height-of-cut bracket onto the other end of roller shaft. Secure second bracket to cutting unit side plate with carriage screw and flange nut.

5. Tighten flange lock nut on cap screw and then loosen nut 1/4 to 1/2 turn. Cap screw should rotate freely with little (if any) end play after lock nut installation.

6. Apply Loctite #242 (or equivalent) to threads of two (2) remaining cap screws. Center front roller to the cutting reel and secure in place with cap screws. Torque cap screws from **15 to 19 ft-lb (20 to 26 N-m)**. Secure cap screws with flange nuts.

7. Lubricate front roller.

8. Adjust cutting unit (see Cutting Unit Operator’s Manual).

Rear Roller

Removal (Fig. 47)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove the cutting unit from the machine and place on a level working surface. Place support blocks under bedbar to raise rear roller from work surface.

3. Loosen flange nuts that secure the rear roller shaft to the rear roller brackets.

4. Remove flange nuts and carriage screws that secure rear roller bracket and roller shims to one of the cutting unit side plates.

NOTE: On cutting units equipped with optional High Height of Cut Kit, there will be additional roller shims installed between rear roller bracket and cutting unit side plate.

5. Remove the roller bracket and roller shims from the rear roller and cutting unit.

6. Slide the rear roller assembly from the remaining rear roller bracket on the cutting unit.

7. If necessary, remove the second rear roller bracket and roller shims from the cutting unit.

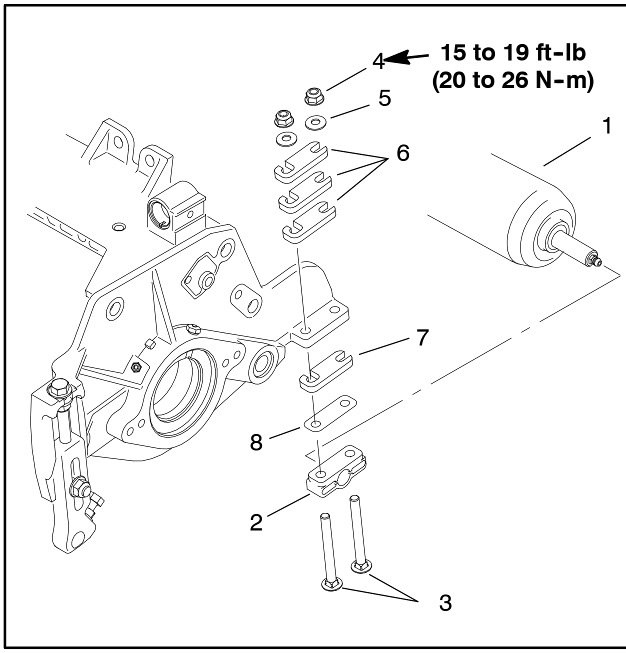


Figure 47

1. **Rear roller assembly**
2. **Rear roller bracket**
3. **Carriage screw (4)**
4. **Flange nut (4)**
5. **Flat washer (4)**
6. **Roller shims (in storage above side plate)**
7. **Roller shims (in use below side plate)**
8. **0.010” shim (if needed)**

Installation (Fig. 47)

1. Place cutting unit on a level working surface.

NOTE: Refer to Cutting Unit Operator’s Manual for number of roller shims required for various height of cut settings.

NOTE: A 0.010” shim (part number 107-4001) is available to allow for leveling of the rear roller (see Leveling Rear Roller in the Set-up and Adjustments section of this chapter). If necessary, this shim would be used on one side of the rear roller and should be installed between the rear roller bracket and roller shim.

2. If both rear roller brackets were removed from cutting unit side plate, position brackets and roller shims to one of the side plates, and install two (2) carriage screws and flange nuts to retain bracket in position. Install slotted roller shims as shown (Fig. 47). Do not fully tighten flange nuts.

3. Slide rear roller shaft into the rear roller bracket attached to the cutting unit.

4. Slide second rear roller bracket onto the other end of roller shaft. Secure second roller bracket and shims to cutting unit side plate with two (2) carriage screws and flange nuts. Install slotted roller shims as shown (Fig. 47). Do not fully tighten flange nuts.

5. Center rear roller to the cutting reel and secure in place by tightening flange nuts. Torque flange nuts from **15 to 19 ft-lb (20 to 26 N-m)**.

6. Lubricate rear roller.

7. Adjust cutting unit (see Cutting Unit Operator’s Manual).

Roller Service

Disassembly (Fig. 48)

1. Remove bearing lock nut from each end of roller shaft.

2. Loosely secure roller assembly in bench vise and lightly tap one end of roller shaft until outer seals and bearing are removed from opposite end of roller tube. Remove second set of outer seals and bearing from roller tube by tapping on opposite end of shaft. Remove shaft from roller tube.

3. Carefully remove inner seal from both ends of roller tube taking care to not damage tube surfaces.

4. Discard removed seals and bearings.

5. Clean roller shaft and all surfaces on the inside of the roller tube. Inspect components for wear or damage. Also, carefully inspect seating surface and threads of bearing lock nuts. Replace all damaged components.

Assembly (Fig. 48)

1. Install both inner seals into roller tube making sure that seal lip (and garter spring) faces end of tube. Use inner seal tool (see Special Tools in this chapter) and soft face hammer to fully seat seals against roller shoulder (Fig. 49). Apply a small amount of grease around the lip of both inner seals after installation.

IMPORTANT: During assembly process, frequently check that bearings rotate freely and do not bind. If any binding is detected, consider component removal and reinstallation.

2. Install new bearing and outer seals into one end of roller tube:

A. Position a new bearing into one end of roller tube. Use bearing/outer seal tool (see Special Tools in this chapter) with a soft face hammer to fully seat bearing against roller shoulder (Fig. 50). After bearing installation, make sure that it rotates freely with no binding.

B. Apply a small amount of grease around the lip of both outer seals.

C. Install first outer seal into roller tube making sure that seal lip (and garter spring) faces end of tube. Use bearing/outer seal tool (see Special Tools in this chapter) and soft face hammer to lightly seat seal against roller shoulder (Fig. 51). Make sure that bearing still freely rotates after seal installation.

D. Using the same process, install second outer seal making sure to not crush the previously installed installed outer seal. Again, make sure that bearing still freely rotates.

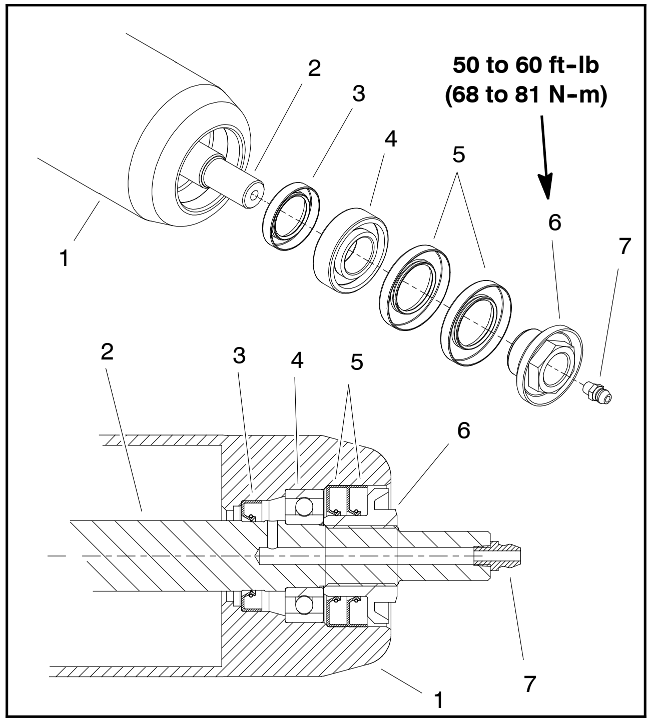


Figure 48

1. Roller tube
2. Roller shaft
3. Inner seal
4. Bearing
5. Outer seal
6. Bearing lock nut
7. Grease fitting

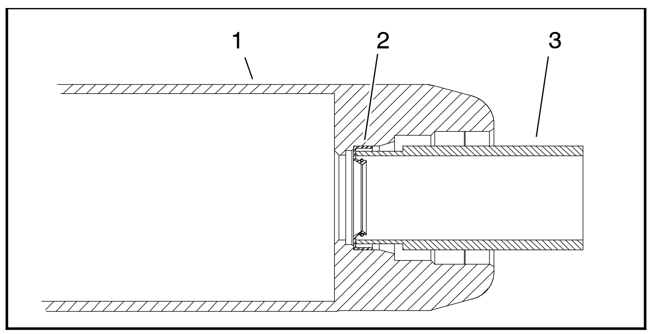


Figure 49

1. Roller tube
2. Inner seal
3. Inner seal tool

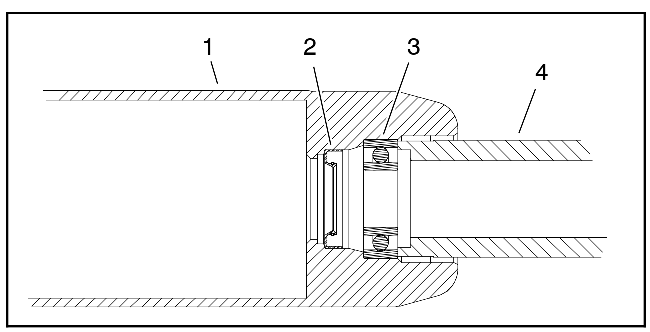


Figure 50

1. Roller tube
2. Inner seal
3. Bearing
4. Bearing/outer seal tool

DPA Cutting Units

3. From the roller tube end with only the inner seal installed, carefully install the roller shaft into the roller tube. Make sure that seals are not damaged as shaft is installed.

4. Install new bearing and outer seals into second end of roller tube:

A. Position a second new bearing to roller shaft and tube. Position washer (see Special Tools in this chapter) on bearing to allow pressing on both inner and outer bearing races simultaneously.

B. Use washer and bearing/outer seal tool (see Special Tools in this chapter) with a soft face hammer to fully seat bearing (Fig. 52). After bearing installation, make sure that shaft freely rotates and that no binding is detected. If necessary, lightly tap bearing and/or shaft ends to align shaft and bearings. Remove washer from roller.

C. Apply a small amount of grease around the lip of both outer seals.

D. Carefully install first outer seal into roller tube making sure that seal lip (and garter spring) faces end of tube. Use bearing/outer seal tool (see Special Tools in this chapter) and soft face hammer to lightly seat seal (Fig. 53). Make sure that shaft and bearings still freely rotate after seal installation.

E. Using the same process, install second outer seal making sure to not crush the previously installed outer seal. Again, make sure that shaft and bearings still freely rotate.

IMPORTANT: Make sure that all grease is removed from shaft threads to prevent bearing lock nut loosening.

5. Thoroughly clean threads on both ends of roller shaft.

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

6. Install bearing lock nut onto each end of the roller shaft. Make sure that outer seals are not damaged during nut installation. Torque bearing lock nuts from **50 to 60 ft-lb (68 to 81 N-m)**.

7. If grease fittings were removed from end of roller shaft, install fittings in shaft.

NOTE: After roller is installed to cutting unit, lubricate roller grease fittings, rotate roller to properly distribute grease in bearings and clean excess grease from roller ends. A properly assembled roller should rotate with less than **5 in-lb (0.68 N-m)** resistance.

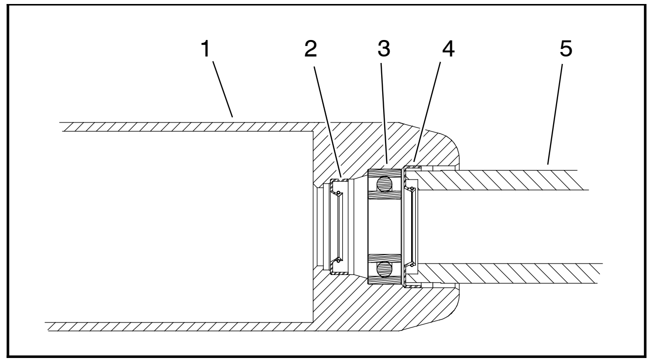


Figure 51

1. **Roller tube**
2. **Inner seal**
3. **Bearing**
4. **Outer seal**
5. **Bearing/outer seal tool**

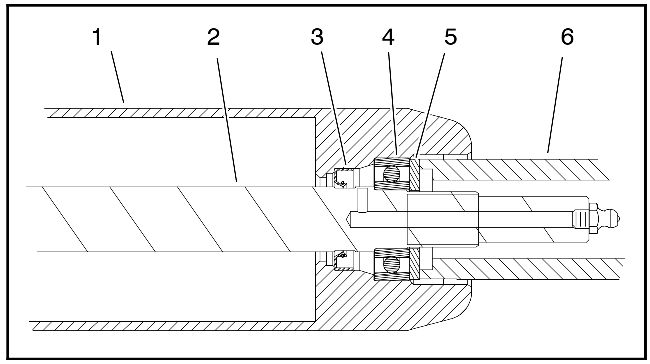


Figure 52

1. **Roller tube**
2. **Roller shaft**
3. **Inner seal**
4. **Bearing**
5. **Washer**
6. **Bearing/outer seal tool**

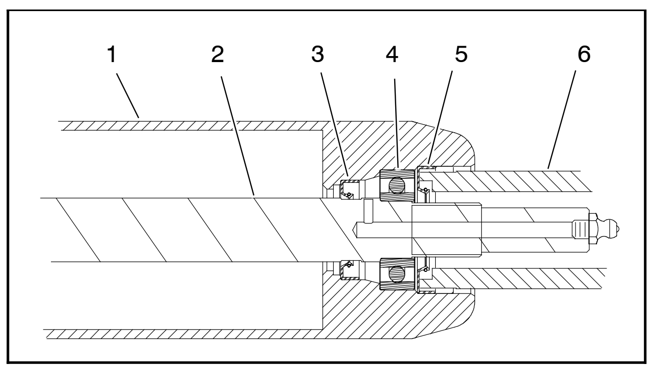


Figure 53

1. **Roller tube**
2. **Roller shaft**
3. **Inner seal**
4. **Bearing**
5. **Outer seal**
6. **Bearing/outer seal tool**

Rear Roller Brush (Optional)

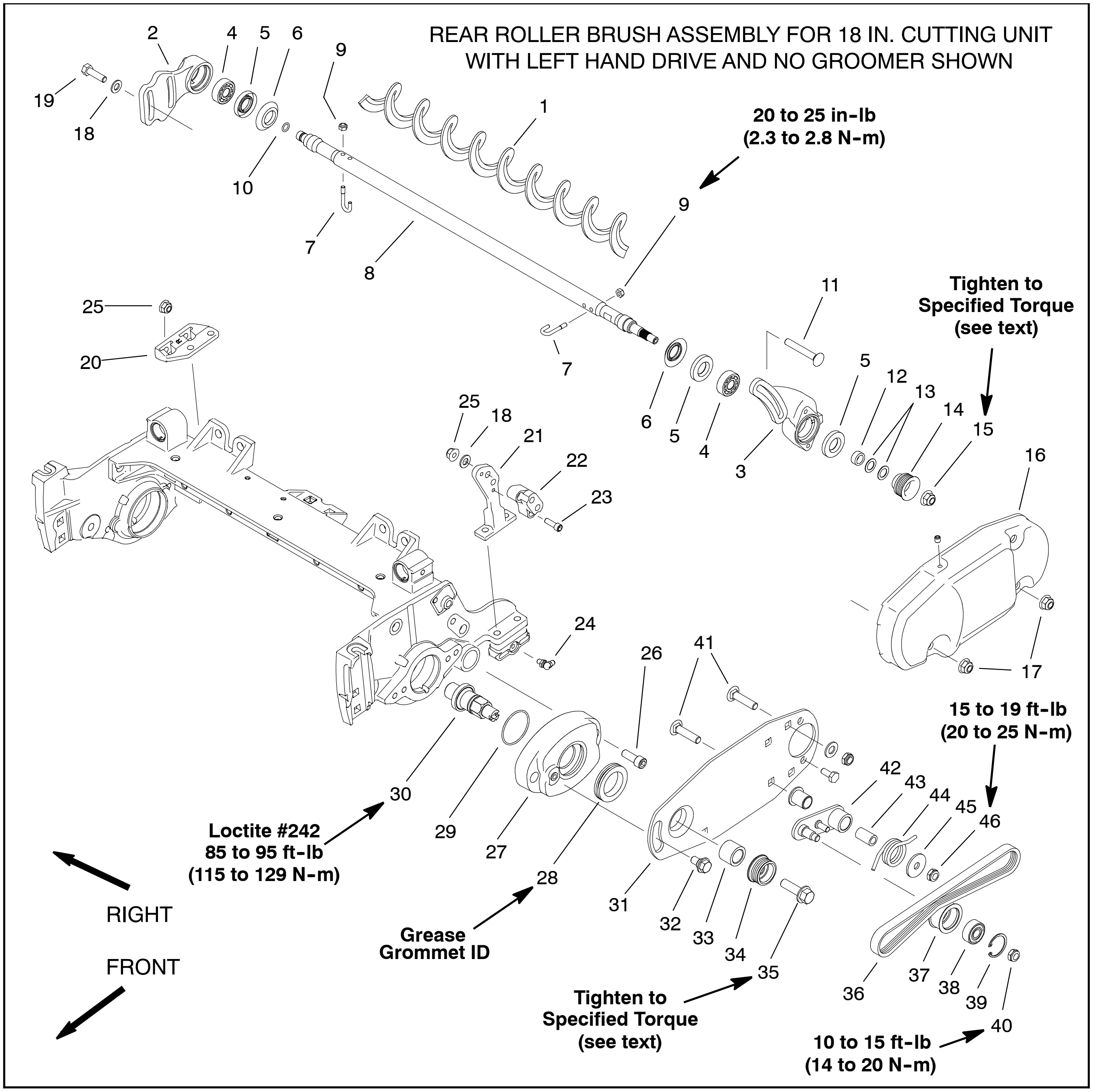


Figure 54

1. **Roller brush**
2. **Bearing housing (non-driven)**
3. **Bearing housing (driven)**
4. **Bearing (2)**
5. **Seal (3)**
6. **Excluder seal (2)**
7. **J-bolt (2)**
8. **Roller brush shaft**
9. **Lock nut (2)**
10. **O-ring**
11. **Carriage bolt (2)**
12. **Spacer**
13. **Hardened washer (as required)**
14. **Driven pulley**
15. **Flange nut**
16. **Cover**
17. **Flange nut (3)**
18. **Flat washer (4)**
19. **Cap screw (2)**
20. **Bracket - RH**
21. **Bracket - LH**
22. **Spacer**
23. **Cap screw (2)**
24. **Grease fitting**
25. **Flange nut (4)**
26. **Cap screw (2)**
27. **Bearing housing**
28. **Grommet**
29. **O-ring**
30. **Drive shaft**
31. **Brush plate**
32. **Flange head screw**
33. **Spacer**
34. **Drive pulley**
35. **Flange head screw**
36. **Drive belt**
37. **Idler pulley**
38. **Bearing**
39. **Retaining ring**
40. **Lock nut**
41. **Carriage bolt (4)**
42. **Idler arm**
43. **Spacer**
44. **Torsion spring**
45. **Washer**
46. **Lock nut**

Rear roller brush drive components are located on the opposite side of the cutting unit from the cutting unit hydraulic motor. Figure 54 shows components used when the brush drive is on the left side of the cutting unit.

The Installation Instructions for the rear roller brush kit has detailed information regarding assembly and adjustment. Use those Instructions along with this Service Manual when servicing the rear roller brush.

Disassembly (Fig. 54)

1. Position machine on a clean and level surface, lower cutting units, stop engine, engage parking brake and remove key from the ignition switch.

2. To remove roller brush from brush shaft:

A. Remove the non-driven brush bearing assembly from cutting unit.

B. Slide excluder seal from roller brush shaft.

C. Remove lock nut and J-bolt from both ends of the brush (Fig. 55).

D. While rotating brush, slide brush from the shaft.

CAUTION

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

3. To remove roller brush drive belt, rotate the cutting reel and carefully pry the belt off the drive pulley.

4. Disassemble roller brush components as necessary.

Assembly (Fig. 54)

1. If brush was removed from shaft, slide brush onto shaft while rotating brush. Secure brush to shaft with two (2) J-bolts and lock nuts. Make sure that the J-bolts are installed with the threaded portion on the outside of the brush (Fig. 55). Torque lock nuts from **20 to 25 in-lb (2.3 to 2.8 N-m)**.

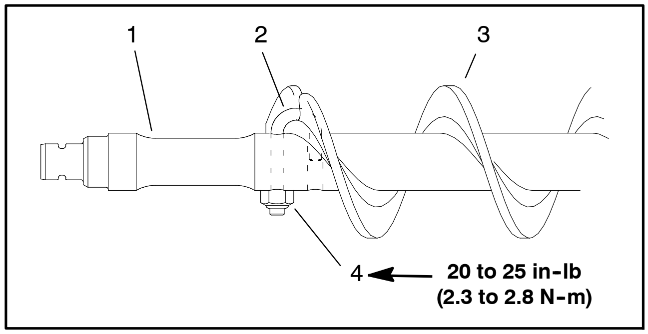


Figure 55

1. **Roller brush shaft**
2. **J-bolt**
3. **Roller brush**
4. **Lock nut**

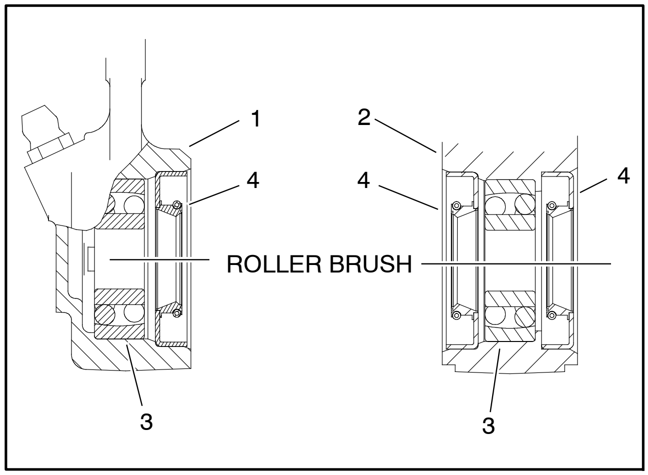


Figure 56

1. **Housing (non-driven)**
2. **Housing (driven)**
3. **Bearing**
4. **Grease seal**

2. If seals or bearings were removed from brush bearing housings, install new components.

A. Pack bearings with grease before installation.

B. Press bearing into bearing housing so that bearing contacts shoulder in housing bore.

C. Install grease seals as shown (Fig 56). Press seals into housing so that seals contact bore shoulders.

3. Assemble roller brush components (Fig. 54).

A. Apply a light coating of grease to inner diameter of the grommet in drive bearing housing.

B. For rear roller brush assemblies attached to cutting units without groomer or to cutting units with a belt driven groomer, tighten 3/8 flange head screw that secures drive pulley to drive shaft from **35 to 40 ft-lb (47 to 54 N-m)**.

For rear roller brush assemblies attached to cutting units with gear driven groomer, tighten 5/16 button head screw that secures drive pulley to drive shaft from **15 to 19 ft-lb (20 to 26 N-m)**.

C. Apply a light coating of grease to inner diameter of the seals in roller brush bearing housings.

D. Inspect O-ring on non-driven end of roller brush shaft and replace if necessary.

E. Apply antiseize lubricant to splines of roller brush shaft before sliding hardened washer(s) and driven pulley onto shaft. For rear roller brush assemblies attached to cutting units without groomer or to cutting units with a belt driven groomer, tighten flange nut that secures driven pulley to roller brush shaft from **27 to 33 ft-lb (36 to 45 N-m)**.

For rear roller brush assemblies attached to cutting units with gear driven groomer, tighten jam nut that secures driven pulley to roller brush shaft from **15 to 20 ft-lb (20 to 27 N-m)**.

F. Position excluder seals on brush shaft so that seals just touch bearing housings.

CAUTION

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

G. To install drive belt, loop belt around driven pulley and over the top of the idler pulley. While rotating the cutting reel, carefully guide belt onto drive pulley (Fig. 57). After belt installation, make sure that belt and pulley grooves are aligned and that belt is centered in idler pulley.

4. Check alignment of pulleys with a straight edge placed along the outer face of the driven pulley (Fig. 58). The outer faces of the driven and drive pulleys (not the idler pulley) should be in line within **0.030" (0.76 mm)**. If necessary to align pulleys, remove driven pulley from brush shaft and add or remove hardened washer(s) until drive and driven pulleys are aligned within **0.030" (0.76 mm)**.

5. Check that roller brush is parallel to rear roller with **0.060" (1.5 mm)** clearance to light contact with roller (Fig. 59). If contact is incorrect, brush operation will be adversely affected.

6. Lubricate grease fittings on brush bearing housings until grease purges past inboard seals. Wipe excess grease from seals and fittings.

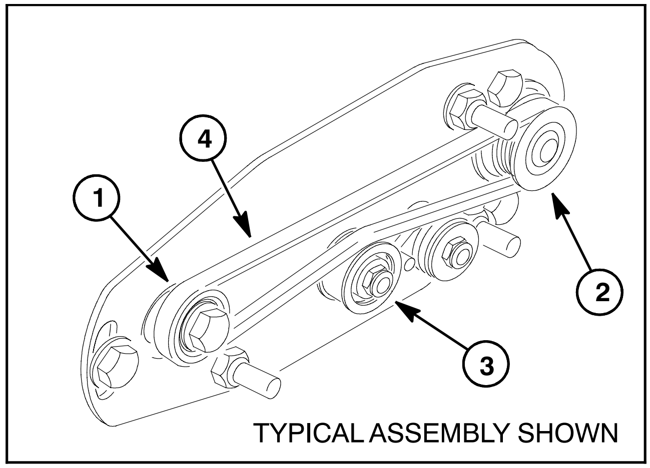


Figure 57

1. **Drive pulley**
2. **Driven pulley**
3. **Idler pulley**
4. **Drive belt**

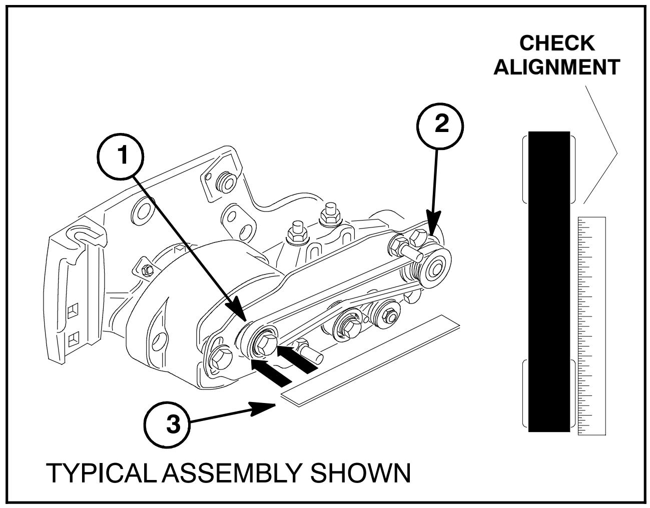


Figure 58

1. **Drive pulley**
2. **Driven pulley**
3. **Straight edge**

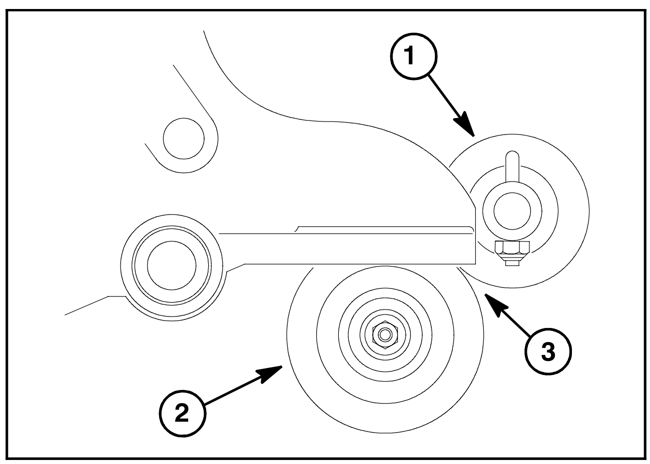


Figure 59

1. **Rear roller brush**
2. **Rear roller**
3. **Light contact**

Chapter 8

Belt Driven Groomer (Optional)

Table of Contents

Grooming Performance

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

IMPORTANT: Improper or overaggressive use of the groomer (e.g. too deep or too frequent grooming) may cause unnecessary stress on the turf leading to severe turf damage. Use the groomer carefully. READ AND UNDERSTAND THE GROOMER OPERATION INSTRUCTIONS BEFORE OPERATING OR TESTING GROOMER PERFORMANCE.

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

Variables That Affect the Use and Performance of Groomers:

1. The growing season and weather conditions.

2. General turf conditions.

3. The frequency of grooming/cutting − number of cuttings per week and how many passes per cutting.

4. The height−of−cut.

5. The grooming depth.

6. The type of grass.

7. The amount of time that a groomer reel has been in use on a particular turf area.

8. The amount of traffic on the turf.

9. The overall turf management program − irrigation, fertilizing, weed control, coring, over−seeding, sand dressing, disease control and pest control.

10. Stress periods for turf − high temperatures, high humidity, unusually high traffic.

Troubleshooting

Groomer Reel Mechanical Problems

Problem	Possible Causes	Correction
No rotation of the groomer reel.	The groomer drive belt needs to be adjusted.	Adjust groomer drive belt.
	Seized groomer reel or idler bearing(s) in groomer side plate(s).	Identify and replace faulty bearing(s).
	Broken or damaged idler spring.	Replace spring.
	The groomer drive belt is worn, broken or damaged.	If the drive belt slips, it probably is out of adjustment or worn.
		Repair or replace drive belt if necessary. A broken or worn belt could be the result of improper belt routing or seized bearings in groomer assembly.
	Grooming depth is too deep.	Change grooming depth.
The turf is damaged or has uneven grooming.	The groomer reel blades are bent, damaged or missing.	Repair or replace blades if necessary.
	The groomer reel shaft is bent or damaged.	Replace groomer reel shaft.
	Grooming depth is not equal on both ends of groomer reel.	Adjust depth if necessary. Check and adjust cutting unit set up (level bedknife to reel, level rear roller to reel, set height−of−cut, etc.).

Service and Repairs

CAUTION

Never work on the groomer with the engine running. Always stop the engine, remove the key from the ignition switch and wait for all machine movement to stop before working on the groomer.

NOTE: The Groomer Operator's Manual provides information regarding the installation, set−up and operation of the optional groomer on your Reelmaster machine. Refer to these instructions for additional information when servicing the groomer.

Groomer Drive Belt Replacement

The groomer drive belt should be inspected/replaced annually or after 750 hours of operation.

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

NOTE: If cutting unit is equipped with powered rear roller brush, removal of roller brush components will be necessary to replace groomer drive belt (see Roller Brush (Optional) in Chapter 7 − Cutting Units in this manual).

NOTE: When removing groomer cover, groomer weights do not have to be removed from cover.

2. Remove the access cover from the groomer cover assembly (Fig. 1).

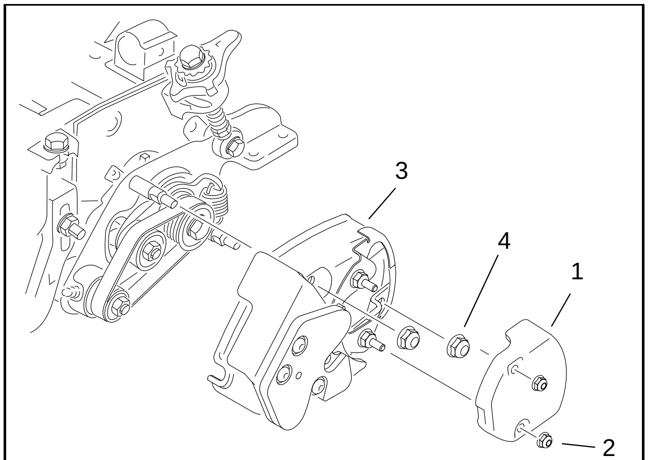
3. Remove two (2) flange nuts that secure groomer cover, then remove cover (Fig. 1).

4. Remove groomer belt tension by pivoting idler plate and pulley using a wrench on pulley nut. Slip groomer drive belt off pulleys (Fig. 2). Carefully release idler plate and pulley.

5. Install new drive belt to drive pulley, idler pulley and driven pulley observing correct belt routing (Fig. 2). Make sure that groomer drive belt is above idler pulley after belt installation.

6. Install groomer cover and secure with two (2) flange nuts.

7. Install access cover to groomer cover assembly.



5 in. dia 18 in. Reel Groomer Shown

Figure 1

1. **Access cover**
2. **Lock nut (2)**
3. **Groomer cover**
4. **Flange nut (2)**

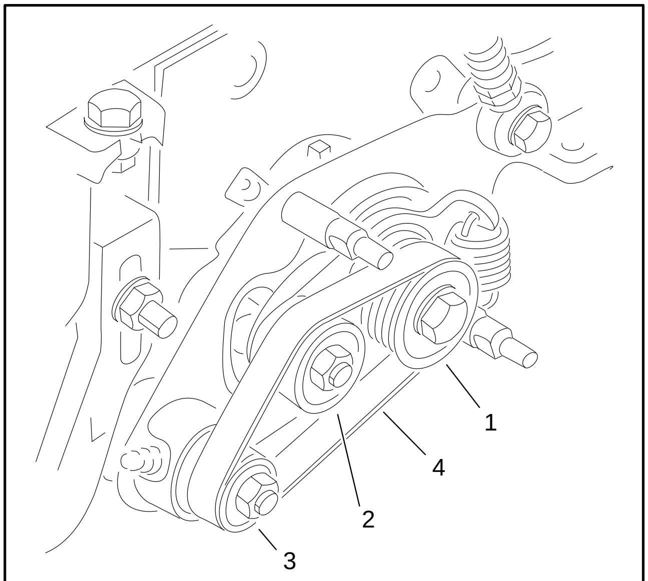


Figure 2

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

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Belt Driven Groomer

Groomer Plate Assembly

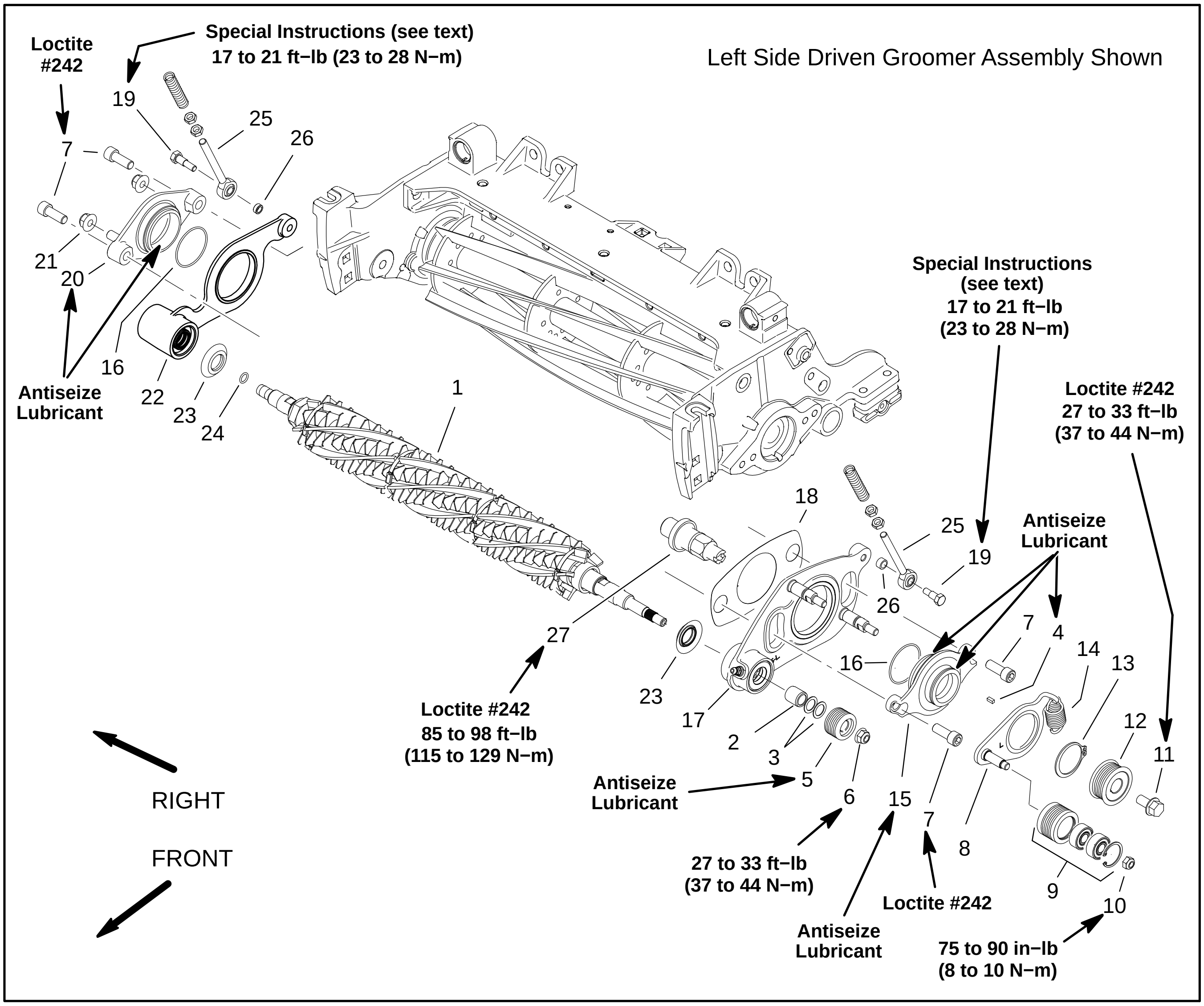

Figure 3

1. **Groomer reel**
2. **Pulley spacer**
3. **Washer (as required)**
4. **Square key**
5. **Driven pulley**
6. **Flange nut**
7. **Socket head screw (4)**
8. **Idler plate**
9. **Idler pulley assembly**
10. **Lock nut**
11. **Flange head screw**
12. **Drive pulley**
13. **Retaining ring**
14. **Extension spring**
15. **Pivot hub (drive)**
16. **O−ring**
17. **Groomer plate assembly (drive)**
18. **Groomer shim**
19. **Shoulder bolt (2)**
20. **Pivot hub assembly (non−drive)**
21. **Flange nut (2)**
22. **Groomer plate assembly (non−drive)**
23. **Excluder seal (2)**
24. **O−ring**
25. **Ball joint rod (2)**
26. **Spacer (2)**
27. **Drive shaft**

NOTE: The groomer reel drive is located on the opposite side of the cutting unit from the cutting unit hydraulic motor.

Removal (Fig. 3)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

NOTE: If cutting unit is equipped with powered rear roller brush, removal of roller brush components will be necessary to service groomer plate assemblies (see Roller Brush (Optional) in Chapter 7 − Cutting Units in this manual).

2. To remove groomer plate assembly from groomer drive side of cutting unit:

A. Remove groomer belt cover and groomer drive belt from groomer drive (see Groomer Belt Replacement in this section).

NOTE: To prevent cutting reel from turning when removing drive pulley, block reel with piece of wood.

B. Remove flange head screw that retains drive pulley. Pull drive pulley from drive shaft. Locate and retrieve square key from drive shaft.

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

C. Remove the flange nut that secures driven pulley to groomer shaft. Remove driven pulley from shaft.

D. Slide washer(s) and pulley spacer from groomer shaft.

E. Remove shoulder bolt and spacer that secures quick−up ball joint rod to groomer plate.

F. Disconnect extension spring from stud on groomer plate.

G. Remove two (2) socket head screws that secure groomer components to cutting unit side plate.

H. Remove pivot hub and idler plate assembly from cutting unit.

I. Support groomer shaft to prevent it from falling. Carefully slide drive side groomer plate from groomer shaft and cutting unit. Remove groomer shim.

3. To remove groomer plate assembly from groomer non−drive side of cutting unit:

A. Remove hydraulic reel motor from cutting unit (see Hydraulic Reel Motor Removal in Chapter 7 − Cutting Units in this manual).

B. Remove shoulder bolt and spacer that secures quick−up ball joint rod to groomer plate.

C. Remove two (2) socket head screws that secure groomer components to cutting unit side plate.

D. Remove pivot hub from cutting unit.

E. Support groomer shaft to prevent it from falling. Carefully slide non−drive side groomer plate from groomer shaft and cutting unit.

4. Inspect seals, bearings and bushing in groomer plates. Remove and discard damaged or worn components.

Installation (Fig. 3)

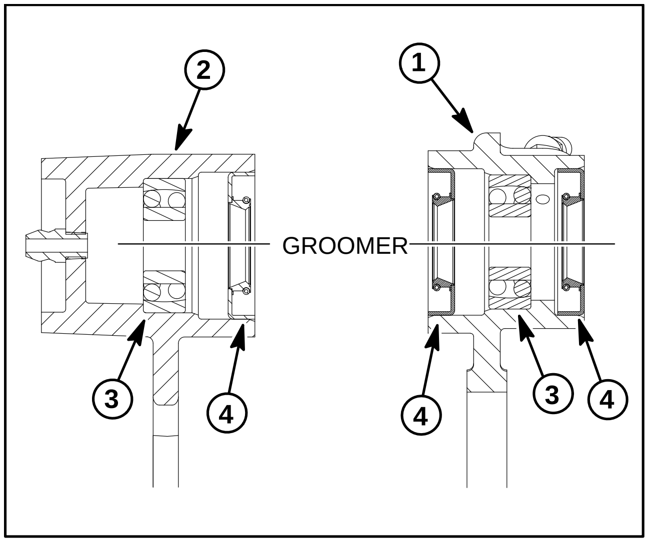

Figure 4

1. **Drive side groomer plate**
2. **Non−drive groomer plate**
3. **Bearing**
4. **Grease seal**

1. If seals, bearings or bushing was removed from groomer plates, install new components noting proper orientation (Fig. 4).

A. Pack bearings with grease before installation.

B. Press bearings into groomer plate so that bearings contact shoulder in groomer plate bore.

C. Install grease seals so that seal lips are positioned toward the groomer blade location. Seals should be flush with surface of groomer plate.

D. Press bushings into groomer plate until the bushing contacts the shoulder in the groomer plate bore.

E. If groomer studs (not shown) were removed from groomer plate, install new studs into groomer plate and torque from **14 to 18 ft−lb (19 to 24 N−m)**.

2. Install groomer plate assembly to groomer non−drive side of cutting unit:

A. Apply a thin layer of grease to inner lip of seal and carefully position non−drive side groomer plate onto groomer shaft and slide to cutting unit.

B. Apply antisieze lubricant to the outside diameter of the pivot hub and position pivot hub to cutting unit (Fig. 6).

C. Apply Loctite to two (2) socket head screws and secure pivot hub to cutting unit side plate.

IMPORTANT: The shoulder bolts that secure the quick−up ball joint rod to the groomer plate have a patch−lock feature. If previously removed shoulder bolts are being re−installed, apply medium strength thread locker to threads before installation.

D. Apply antiseize compound to shoulder area only of shoulder bolt that secures quick−up ball joint rod to groomer plate. Install spacer and shoulder bolt and tighten from **17 to 21 ft−lb (23 to 28 N−m).**

E. Install hydraulic reel motor to cutting unit (see Hydraulic Reel Motor Installation in Chapter 7 − Cutting Units in this manual).

3. Install groomer plate assembly to groomer drive side of cutting unit:

A. Position groomer shim to cutting unit side plate.

B. Apply a thin layer of grease to inner lip of seals and carefully position drive side groomer plate onto groomer shaft and slide to cutting unit.

C. Apply antisieze lubricant to the outside diameter of the pivot hub and position pivot hub to cutting unit (Fig. 6). Apply Loctite to two (2) socket head screws and secure pivot hub to cutting unit side plate.

D. Apply antisieze lubricant to the outside diameter of the pivot hub and position idler plate assembly to pivot hub.

E. Connect extension spring to stud on groomer plate. Make sure that spring is in the stud groove and that spring hook is positioned toward the drive pulley.

IMPORTANT: The shoulder bolts that secure the quick−up ball joint rod to the groomer plate have a patch−lock feature. If previously removed shoulder bolts are being re−installed, apply medium strength thread locker to threads before installation.

F. Apply antiseize compound to shoulder area only of shoulder bolt that secures quick−up ball joint rod to groomer plate. Install spacer and shoulder bolt and tighten from **17 to 21 ft−lb (23 to 28 N−m)**.

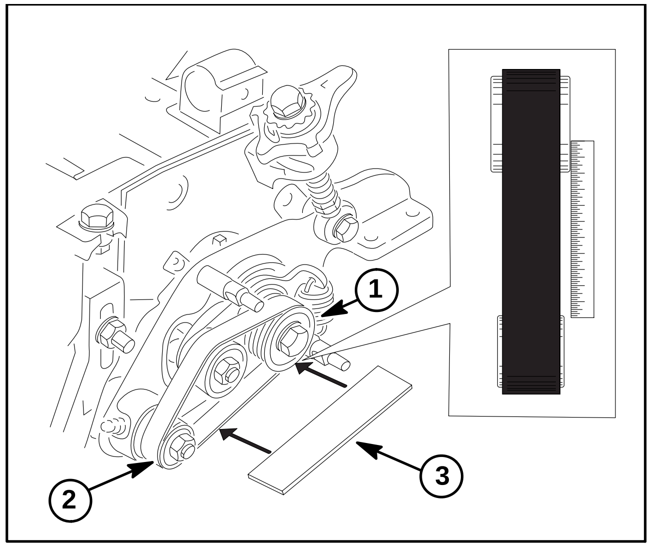

Figure 5

1. **Drive pulley**
2. **Driven pulley**
3. **Straight edge**

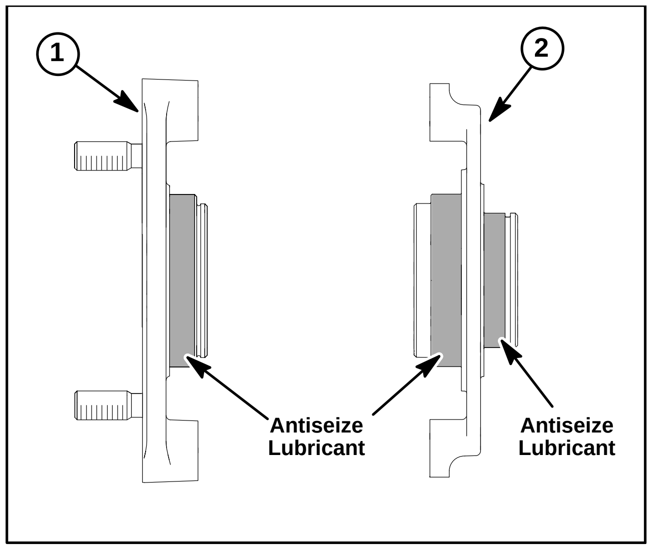

Figure 6

1. **Pivot hub (non−drive side)**
2. **Pivot hub (drive side)**

G. Slide pulley spacer and washer(s) onto groomer shaft.

H. Apply antiseize lubricant to square key that locates drive pulley. Position key into shaft slot.

NOTE: To prevent cutting reel from turning when installing drive pulley, block cutting reel with piece of wood.

I. Apply Loctite #242 to threads of flange head screw that secures drive pulley to pivot hub shaft. Slide drive pulley onto shaft and secure with flange head screw. Torque screw from **27 to 33 ft−lb (37 to 44 N−m)**.

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

J. Apply antiseize lubricant to splines of driven pulley and slide driven pulley onto groomer shaft. Secure driven pulley with flange nut and torque flange nut from **27 to 33 ft−lb (37 to 44 N−m)**.

K. Check pulley alignment by laying a straight edge along the outer face of the drive pulley (Fig. 5). Drive and driven pulleys should be in line within **0.030" (0.70 mm)**. If necessary, align pulleys by removing driven pulley and installing or removing washer(s) between pulley and pulley spacer.

L. After pulleys are aligned, install groomer drive belt and groomer belt cover (see Groomer Belt Replacement in this section).

4. Check that excluder seals just touch groomer plate assembly. Reposition excluder seals on groomer shaft if necessary.

5. Check groomer reel height and mower height−of−cut settings. Adjust as needed.

6. Lubricate groomer bearings.

NOTE: After greasing groomer bearings, operate groomer for 30 seconds, stop machine and wipe excess grease from groomer shaft and seals.

Groomer Reel

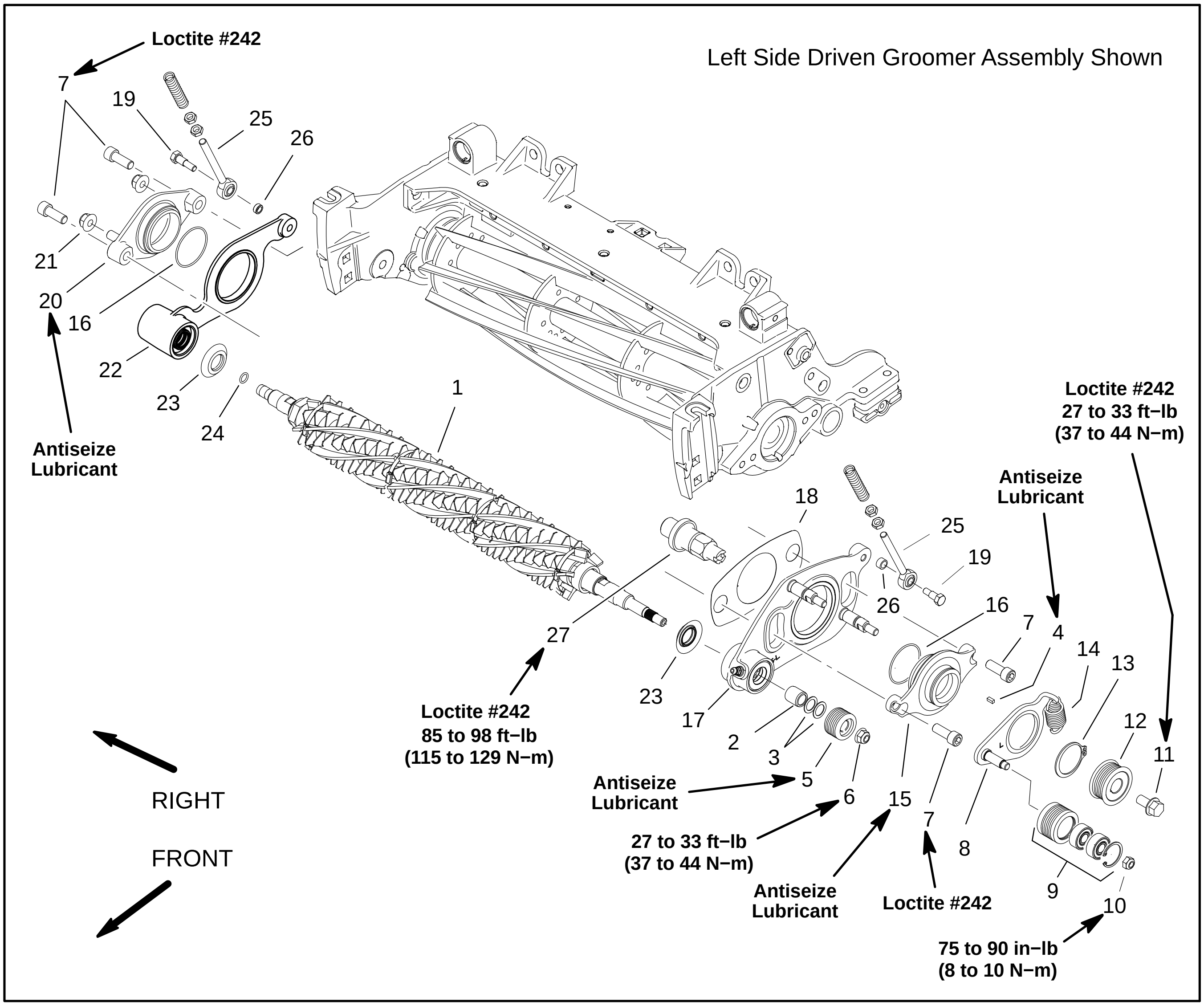

Figure 7

1. **Groomer reel**
2. **Pulley spacer**
3. **Washer (as required)**
4. **Square key**
5. **Driven pulley**
6. **Flange nut**
7. **Socket head screw (4)**
8. **Idler plate**
9. **Idler pulley assembly**
10. **Lock nut**
11. **Flange head screw**
12. **Drive pulley**
13. **Retaining ring**
14. **Extension spring**
15. **Pivot hub (drive)**
16. **O−ring**
17. **Groomer plate assembly (drive)**
18. **Groomer shim**
19. **Shoulder bolt (2)**
20. **Pivot hub assembly (non−drive)**
21. **Flange nut (2)**
22. **Groomer plate assembly (non−drive)**
23. **Excluder seal (2)**
24. **O−ring**
25. **Ball joint rod (2)**
26. **Spacer (2)**
27. **Drive shaft**

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

NOTE: The groomer reel drive is located on the opposite side of the cutting unit from the cutting unit hydraulic motor.

Removal (Fig. 7)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch. If desired, remove cutting unit from machine (see Traction Unit Operator's Manual).

NOTE: If cutting unit is equipped with powered rear roller brush, removal of roller brush components will be necessary to remove groomer reel (see Roller Brush (Optional) in Chapter 7 − Cutting Units in this manual).

2. Remove groomer plate assembly from groomer drive side of cutting unit (see Groomer Plate Assembly Removal in this section).

3. Carefully pull the groomer reel from the non−drive side groomer plate assembly.

4. Inspect all seals, bushings and bearings in groomer plate assemblies for wear or damage. Replace components as needed (see Groomer Plate Assembly in this section).

Installation (Fig. 7)

1. Position cutting unit on a level surface. If cutting unit is attached to traction unit, make sure to stop engine, engage parking brake and remove key from the ignition switch.

2. Apply a light coating of grease to seal lips in groomer plate assemblies.

3. Make sure that O−ring and excluder seals are installed on groomer shaft. The excluder seal outer lips should be toward the groomer plate assemblies. Apply a film of grease on seal outer lip.

4. Carefully slide the groomer reel into the non−drive side groomer plate assembly taking care not to damage seals in groomer plate assembly.

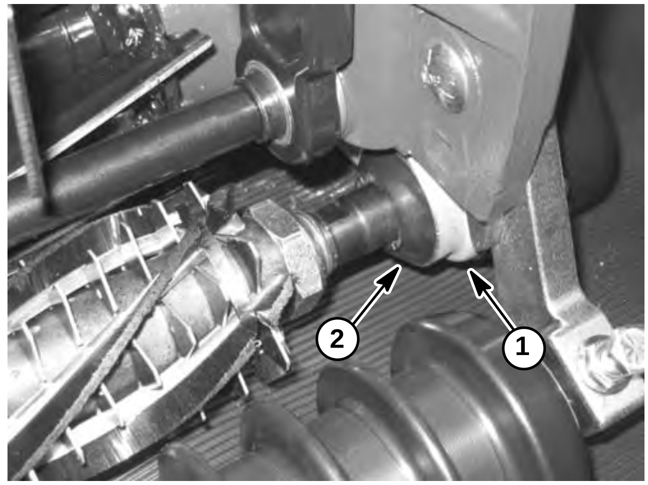

Figure 8

1. **Groomer plate**
2. **Excluder seal**

5. Carefully install groomer plate assembly to groomer reel and groomer drive side of cutting unit (see Groomer Plate Assembly Installation in this section).

6. Check that excluder seals just touch groomer plate assembly (Fig. 8). Reposition excluder seals on groomer shaft if necessary.

7. Check groomer reel height and mower height−of−cut settings. Adjust as needed.

8. Lubricate groomer bearings.

NOTE: After greasing groomer bearings, operate groomer for 30 seconds, stop machine and wipe excess grease from groomer shaft and seals.

Belt Driven Groomer

Groomer Reel Service

Inspect groomer reel blades frequently for damage and wear. Straighten bent blades. Either replace worn blades or reverse the blades to put the sharpest blade edge forward (Fig. 9). Blades that are rounded to the midpoint of the blade tip must be reversed or replaced for best groomer performance.

Disassembly (Fig. 10)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove groomer reel from cutting unit (see Groomer Reel Removal in this section).

3. Remove excluder seals from groomer reel.

4. If groomer reel is equipped with broomer kit (Fig. 11), remove straps and broomer brushes from reel.

5. Remove lock nut from either end of the shaft (Fig. 10).

6. Remove spacers and blades from groomer shaft. If needed, remove second lock nut from shaft.

Assembly (Fig. 10)

1. Install lock nut on drive end of groomer shaft. Place a 1−1/4" (31.7 mm) spacer, a1/4" (6.3 mm) spacer, and then the first blade on the groomer shaft.

2. Alternately install remaining 1−1/4" (31.7 mm) spacers and blades making sure that all blades are separated by a spacer. Additionally, rotate location hole on each installed blade one flat of the shaft, in a counterclockwise direction.

3. When all blades have been installed, place remaining 1/4" (6.3 mm) spacer against blade then final 1−1/4" (31.7 mm) spacer on shaft. Thread second lock nut onto the shaft. Center blades on shaft by adjusting lock nuts.

4. Using wrench on shaft flats to prevent shaft from turning, torque second lock nut from **16 to 21 ft−lb (23 to 28 N−m)**. After torquing lock nut, spacers should not be free to rotate and groomer blades should be centered on shaft.

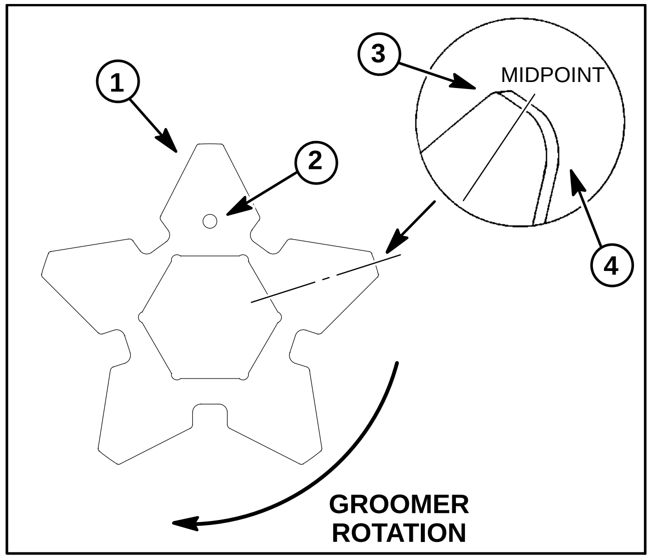

Figure 9

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

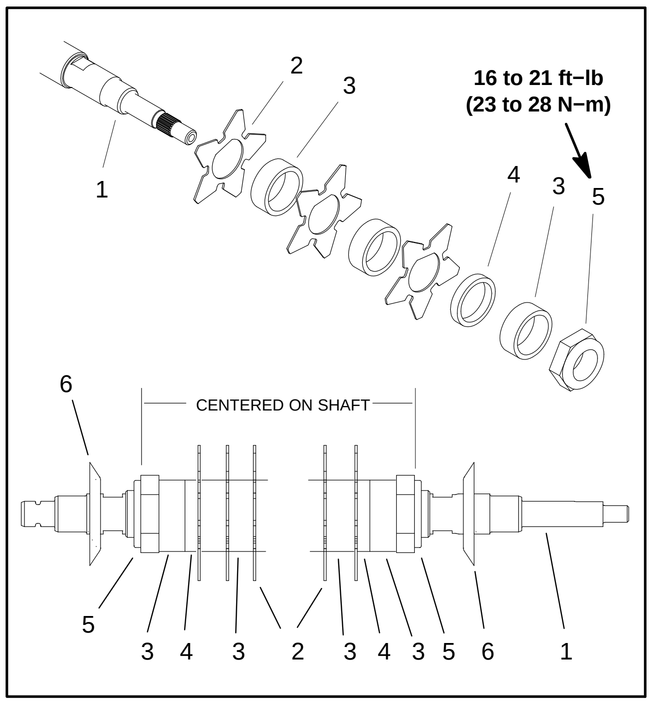

Figure 10

1. **Groomer reel shaft**
2. **Groomer blade (32)**
3. **1−1/4" (31.7 mm) Spacer (33)**
4. **1/4" (6.3 mm) Spacer (2)**
5. **Lock nut (2)**
6. **Excluder seal**

5. If groomer reel is equipped with broomer kit:

A. Loosen the groomer blade retaining nuts on each end of the groomer shaft.

B. Slide a brush into each groove around the full length of the groomer reel (Fig. 11). Make sure brushes are seated in groomer blade slots (Fig. 12)

IMPORTANT: The straps must be wrapped around the groomer blade and brush assembly in the correct direction.

C. Loosely wrap the straps around the groomer reel shaft and brushes as shown (Fig. 11). Straps should be positioned in the pre−cut notches of each brush and at the following locations on the broomer shaft:

18” reels − between blades 1−2, 11−12, 21−22 and 31−32.

22” reels − between blades 1−2, 14−15, 28−29 and 41−42.

Position the broomer brushes properly in the blade slots, and tighten the groomer blade−retaining nuts from **16 to 21 ft−lb (23 to 28 N−m).**

D. While holding strap buckle in place, pull straps tight into the pre−cut notches of each brush.

E. Cut off strap extension approximately 1/4” (6 mm) beyond retainer and fold the excess strap over the buckle (Fig. 13).

6. Place excluder seals on groomer shaft.

7. Install O−ring on non−drive end of groomer shaft.

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

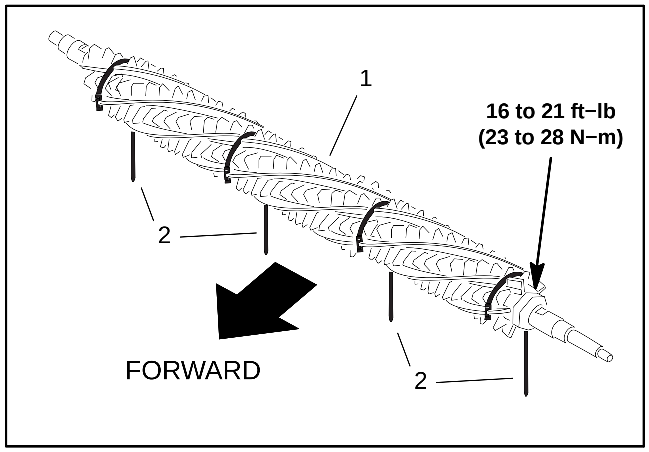

Figure 11

1. **Groomer reel** 2. **Broomer strap (4)**

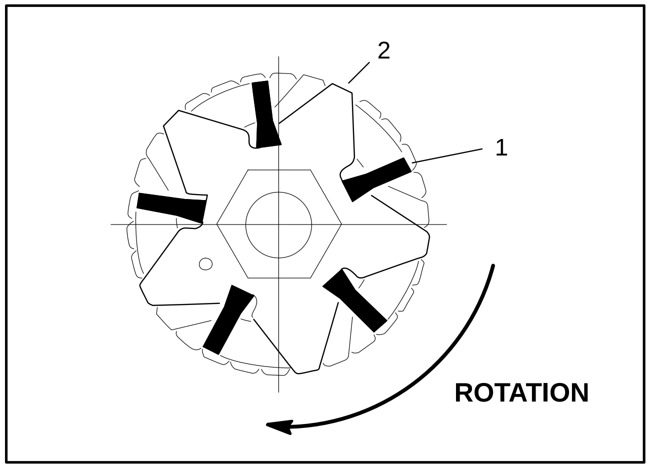

Figure 12

1. **Brush** 2. **Blade**

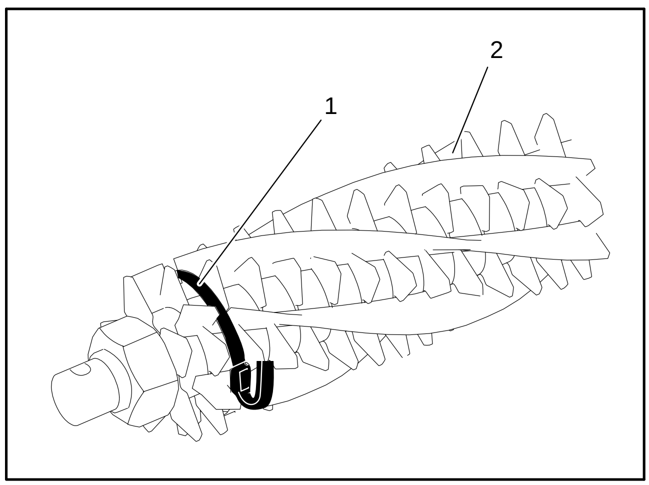

Figure 13

1. **Strap** 2. **Brush**

Belt Driven Groomer

Height Adjuster Assembly

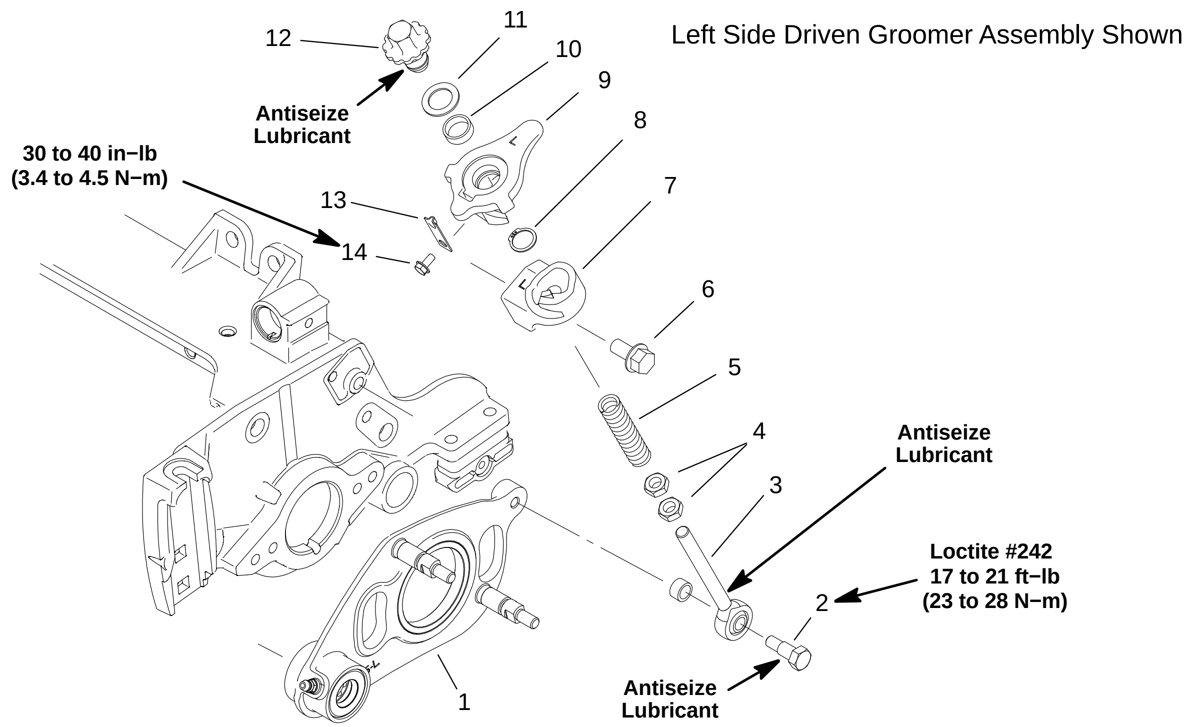

Figure 14

1. **Groomer plate (LH drive shown)**
2. **Shoulder bolt**
3. **Ball joint rod**
4. **Jam nut**
5. **Compression spring**
6. **Flange head screw**
7. **Lower ramp**
8. **External snap ring**
9. **Upper ramp**
10. **Bushing**
11. **Flat washer**
12. **Groomer adjuster**
13. **Detent spring**
14. **Washer head screw**

NOTE: The groomer reel drive is located on the opposite side of the cutting unit from the cutting reel hydraulic motor.

Disassembly (Fig. 14)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Disassemble height adjuster.

3. Clean all components and inspect for wear or damage. Replace all worn or damaged components.

Assembly (Fig. 14)

1. Assemble height adjuster:

A. If bushing was removed from upper ramp, press new bushing into housing fully to the shoulder in the bore.

B. If jam nuts were removed from ball joint rod, apply antiseize lubricant to threads of rod where jam nuts will be positioned (close to rod eye). Install jam nuts and thread all the way to rod eye end of ball joint rod.

C. Apply antiseize lubricant to shoulder of groomer adjuster before installing it on ball joint rod.

D. If detent spring was removed, secure detent spring to upper ramp with washer head screw. Torque screw from **30 to 40 in−lb (3.4 to 4.5 N−m)**.

2. Apply antiseize lubricant to shoulder of shoulder bolt. If reusing a previously installed shoulder bolt, apply Loctite to shoulder bolt threads. Secure ball joint rod to groomer plate with shoulder bolt and tighten shoulder bolt from **17 to 21 ft−lb (23 to 28 N−m)**.

3. Check groomer reel height and adjust as needed.

4. After groomer height has been adjusted, adjust location of jam nuts so compression spring length is **1.38” (3.5 cm)** when the groomer handle is in the disengaged position (handle toward rear of cutting unit).

Chapter 9

Universal Groomer (Optional)

Table of Contents

Universal Groomer

Grooming Performance

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

IMPORTANT: Improper or overaggressive use of the groomer (e.g. too deep or too frequent grooming) may cause unnecessary stress on the turf leading to severe turf damage. Use the groomer carefully. READ AND UNDERSTAND THE GROOMER OPERATION INSTRUCTIONS BEFORE OPERATING OR TESTING GROOMER PERFORMANCE.

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

Variables That Affect the Use and Performance of Groomers:

1. The growing season and weather conditions.

2. General turf conditions.

3. The frequency of grooming/cutting − number of cuttings per week and how many passes per cutting.

4. The height−of−cut.

5. The grooming depth.

6. The type of grass.

7. The amount of time that a groomer reel has been in use on a particular turf area.

8. The amount of traffic on the turf.

9. The overall turf management program − irrigation, fertilizing, weed control, coring, over−seeding, sand dressing, disease control and pest control.

10. Stress periods for turf − high temperatures, high humidity, unusually high traffic.

Troubleshooting

Groomer Reel Mechanical Problems

Problem	Possible Causes	Correction
No rotation of the groomer reel.	The groomer drive is in Neutral.	Engage groomer drive to Forward or Reverse.
	Damaged or seized groomer drive gears.	Repair groomer drive.
The turf is damaged or has uneven grooming.	The groomer reel blades are bent, damaged or missing.	Repair or replace blades if neces-sary.
	The groomer reel shaft is bent or damaged.	Replace groomer reel shaft.
	Grooming depth is not equal on both ends of groomer reel.	Adjust depth if necessary. Check and adjust cutting unit set up (level bedknife to reel, level rear roller to reel, set height−of−cut, etc.).

Service and Repairs

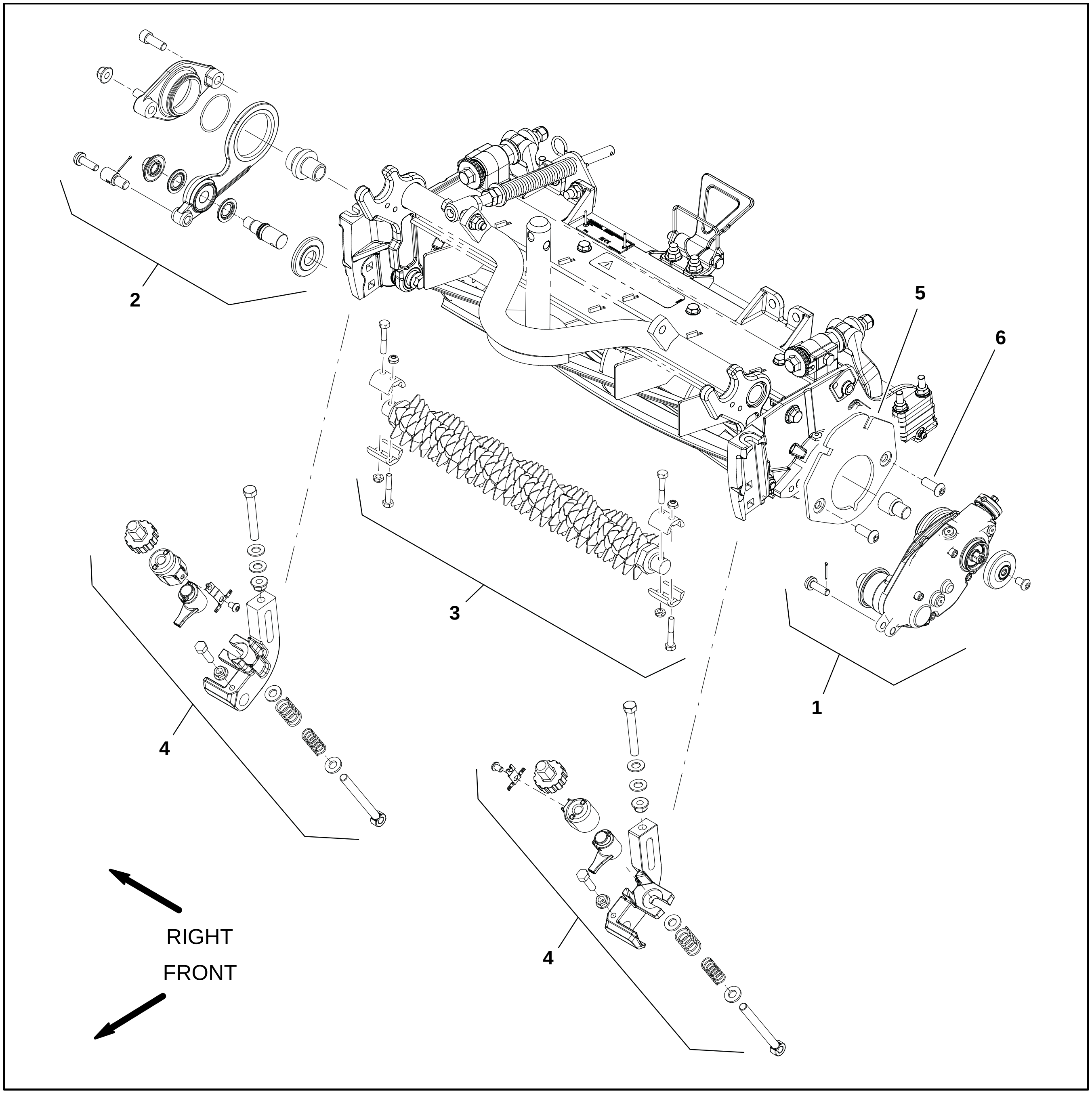

Figure 1

1. **Gear box assembly**
2. **Idler assembly**
3. **Groomer reel**
4. **Height adjuster assembly (2)**
5. **Weight**
6. **Button head screw (2)**

CAUTION

Never work on the groomer with the engine running. Always stop the engine, remove the key from the ignition switch and wait for all machine movement to stop before working on the groomer.

NOTE: The Groomer Operator's Manual provides information regarding the installation, set−up, operation and maintenance of the universal groomer on your Reelmaster machine. Refer to these instructions for additional information when servicing the groomer.

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Universal Groomer

Gear Box Assembly

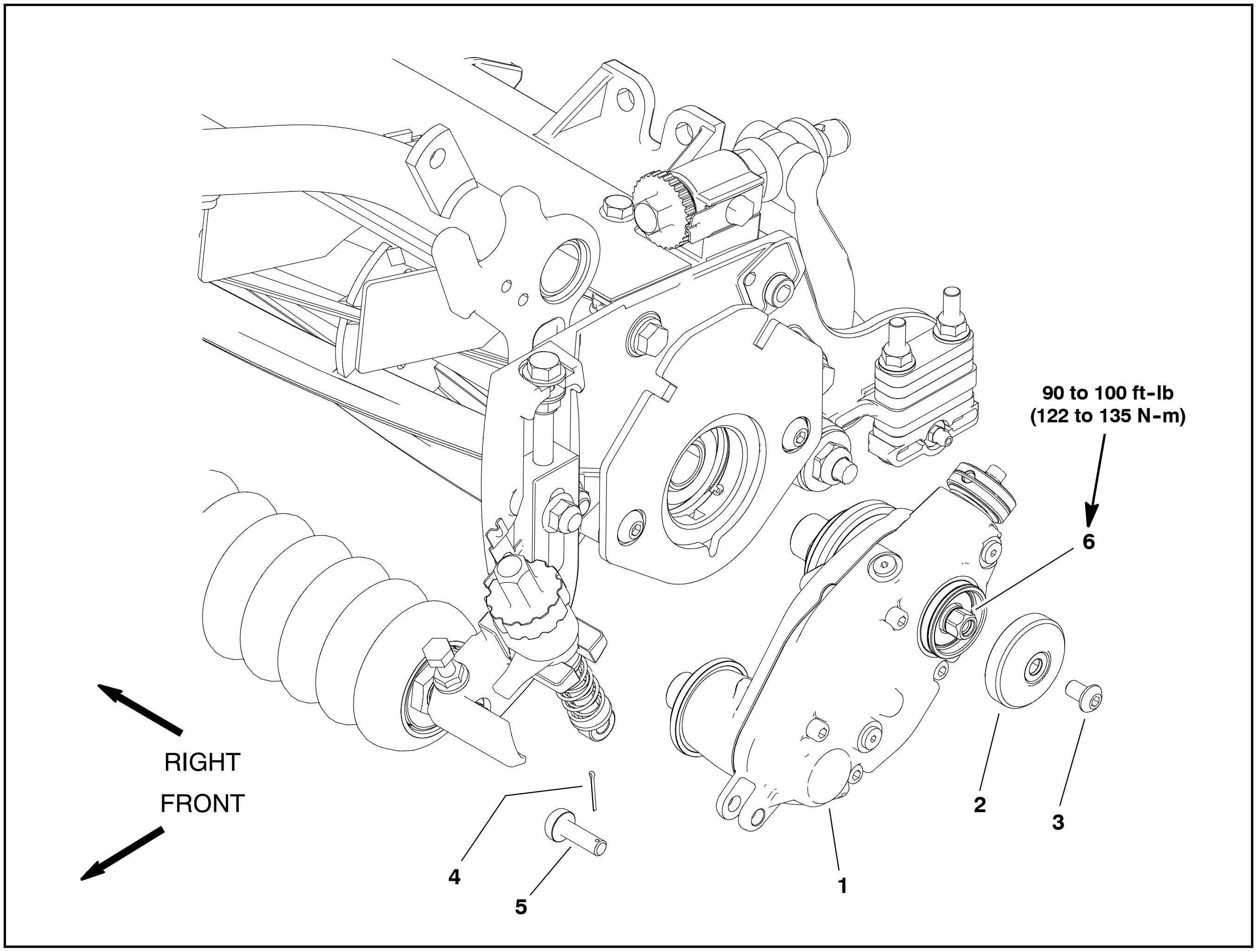

Figure 2

1. **Gear box assembly**
2. **Rear roller brush drive shield**
3. **Button head screw**
4. **Cotter pin**
5. **Clevis pin**
6. **Input shaft**

NOTE: The groomer gear box assembly is located on the opposite side of the cutting unit from the cutting unit hydraulic motor.

Removal (Fig. 2)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove the groomer reel assembly (see Groomer reel in this chapter).

NOTE: If cutting unit is equipped with an optional powered rear roller brush, remove the rear roller brush cover, drive belt and drive housing assembly to service the groomer drive (see Roller Brush (Optional) in Chapter 7 – Cutting Units in this manual for additional information).

CAUTION

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

3. Safely prevent reel from rotating by blocking the cutting reel with piece of wood near one of the reel spiders.

4. If installed, remove the rear roller brush drive shield from the gear box.

IMPORTANT: Groomer gear boxes installed on the left side of the cutting unit use a left hand thread. Turn the input shaft (rear roller brush drive shaft) clockwise to remove the gear box. Groomer gear boxes installed on the right side of the cutting unit use a right hand thread. Turn the input shaft counterclockwise to remove the gear box.

5. Install a 5/16–18 X 5/8 inch square head set screw (Toro p/n 1-803022) in the end of the drive shaft and tighten to 13 N·m (120 in-lb); refer to **Fig. 3**.

6. Remove the cotter pin and clevis pin from the height adjustment rod at the front of the groomer gear box. Discard cotter pin.

7. Tip up the cutting unit to access the bottom of the reel to remove the drive shaft assembly.

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

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

9. Move the pry bar against the weld side of the reel support plate closest to the groomer gear box.

IMPORTANT: You must use a 6-point socket with a heavy wall to remove the gear box from the reel. Do not use an impact wrench. Groomer gear boxes installed on the left side of the cutting unit use a left hand thread; turn the drive shaft in correct direction to remove the gear box.

10. Rest the handle of the pry bar against the front roller and turn the drive shaft in correct direction to loosen it from the reel. Continue to unscrew the drive shaft and remove the gear box from the cutting unit.

11. If the hex head on the end of the drive shaft is damaged during removal:

A. Remove the drain/fill plug and drain the oil from the gear box.

B. Remove the 4 socket-head screws and remove the gear box cover assembly and driven gear. Remove and discard the cover gasket.

C. Slide the thrust washer, ring gear and bushing from the gear box housing.

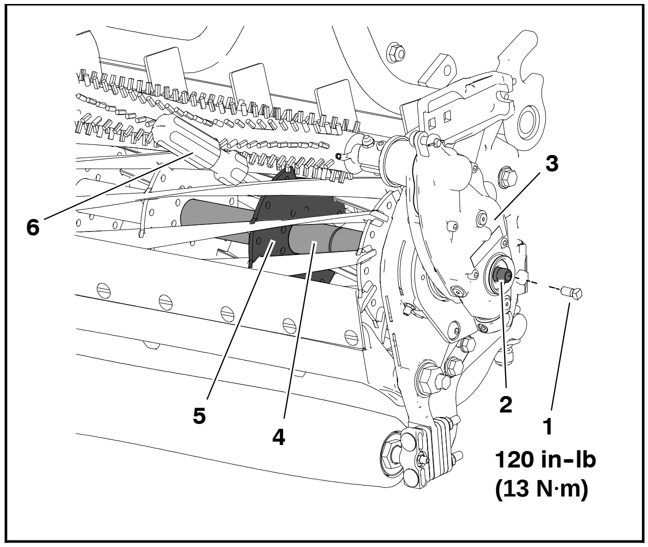

Figure 3

1. **Square head set screw**
2. **Input shaft assembly**
3. **Gear box assembly**
4. **Reel shaft**
5. **Reel support plate**
6. **Pry bar**

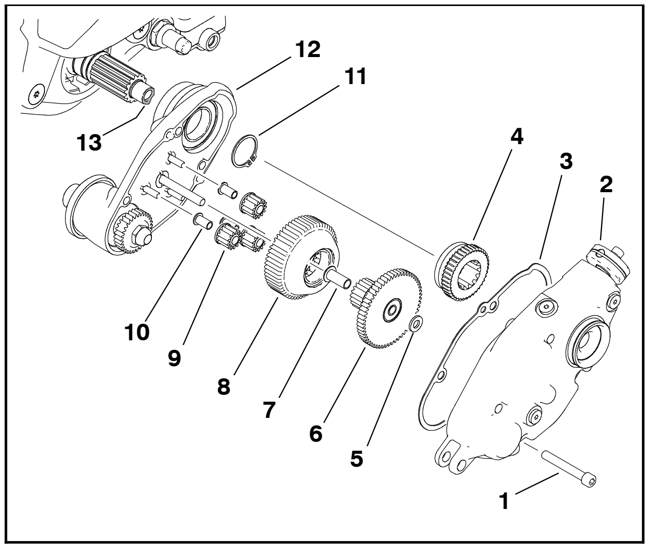

Figure 4

1. **Socket head screw (4)**
2. **Gear box cover assy**
3. **Cover gasket**
4. **Driven gear**
5. **Thrust washer**
6. **Ring gear**
7. **Flange bushing**
8. **Sung gear**
9. **Planet gear (3)**
10. **Flange bushing**
11. **Retaining ring**
12. **Gear box housing**
13. **Damaged drive shaft**

D. Slide the sun gear, and planet gears and bushings from the pins on the gear box housing.

E. Remove the retaining ring from the drive shaft.

F. Slide the groomer housing assembly from the drive shaft.

G. Tip up the cutting unit to access the bottom of the reel to remove the drive shaft assembly.

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

I. Move the pry bar against the weld side of the reel support plate closest to the drive shaft assembly.

J. Use the drive shaft removal tool (Toro p/n 137-0920) on the large flats of the drive shaft assembly; refer to **Fig. 5**.

K. Rest the handle of the pry bar against the front roller and turn the drive shaft in correct direction to loosen it from the reel.

12. Tip the cutting unit back onto its rollers.

13. Clean the threads in the end of the reel shaft. A right–hand thread and left-hand thread tap is available to clean or repair the threads if necessary:

A. 15/16–16 Right-Hand Thread – Toro p/n. 137–0926

B. 15/16–16 Left-Hand Thread – Toro p/n. 137–0927

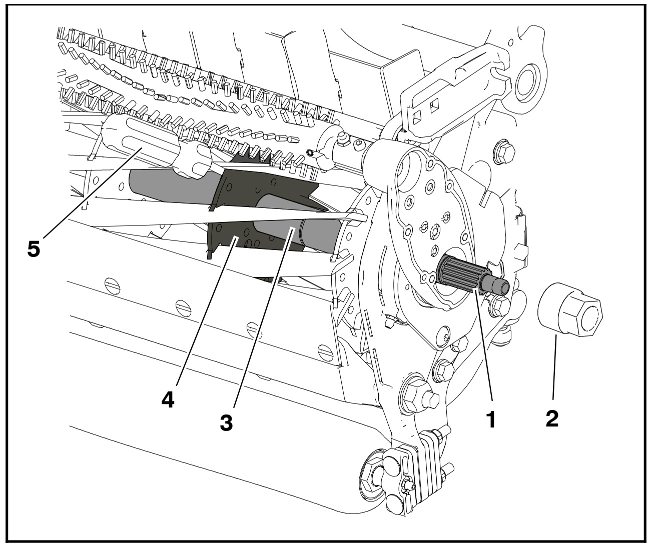

Figure 5

1. Damaged input shaft assembly
2. Drive shaft removal tool
3. Reel shaft
4. Reel support plate
5. Pry bar

Disassembly (Fig. 6)

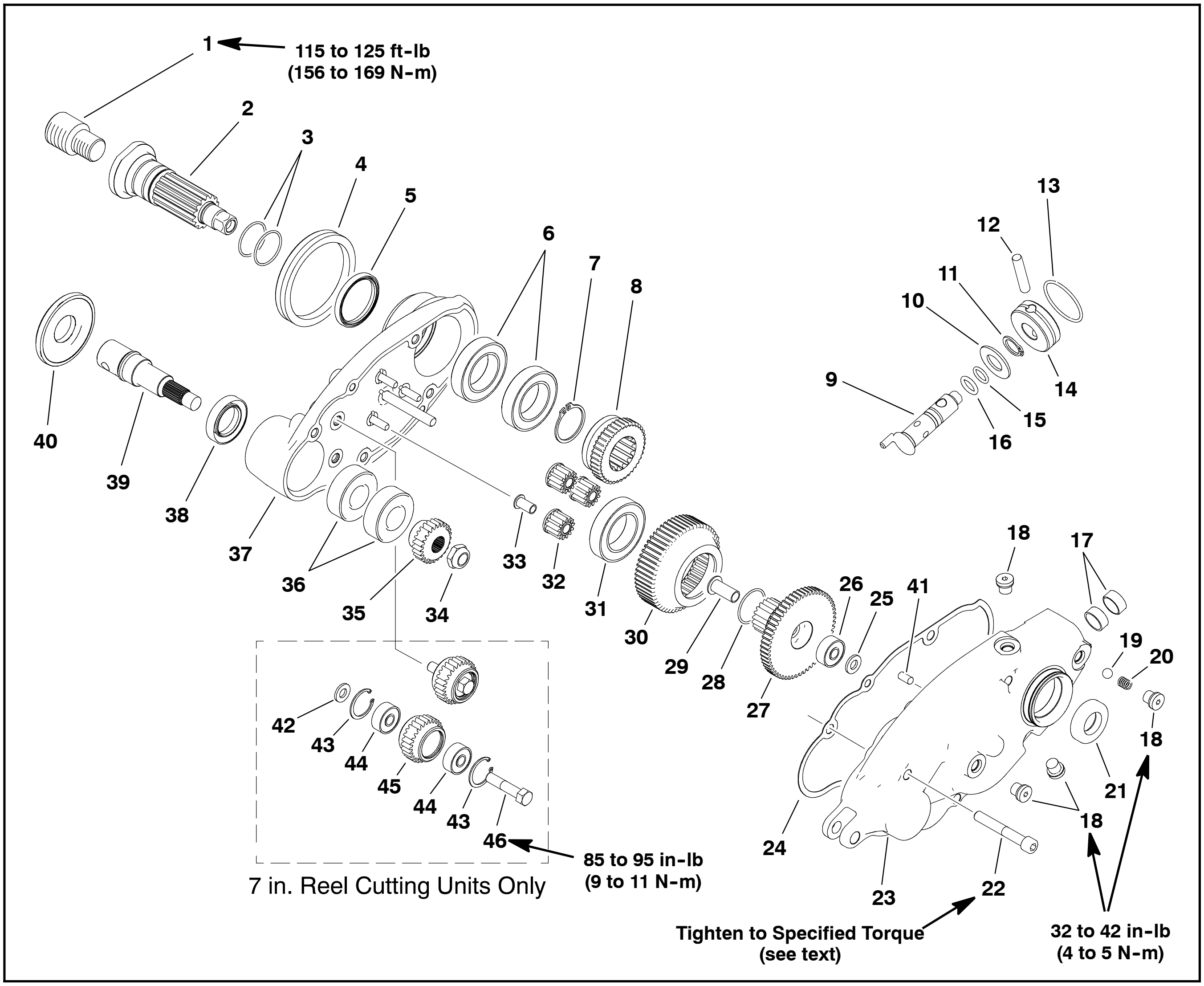

Figure 6

1. Threaded adapter
2. Input shaft
3. O-Ring (2)
4. V-Ring
5. Seal
6. Bearing (2)
7. Retaining ring
8. Slider gear
9. Shifter shaft
10. Thrust washer
11. Retaining ring
12. Dowel pin
13. O-ring
14. Knob
15. O-ring
16. O-ring
17. Bushing (2)
18. Drain/fill plug (4)
19. Ball
20. Detent spring
21. Seal
22. Socket head screw (4)
23. Cover
24. Gasket
25. Thrust washer
26. Bearing
27. Sun gear
28. O-ring
29. Bushing
30. Ring gear
31. Bearing
32. Planet gear (3)
33. Bushing (3)
34. Lock nut
35. Output gear
36. Bearing (2)
37. Housing
38. Seal
39. Output shaft
40. Shield
41. Dowel pin (2)
42. Thrust washer (2)
43. Retaining ring (2)
44. Bearing (4)
45. Idler gear (2)
46. Cap screw (2)

The gear box assemblies for cutting units with 5 in. reels and 7 in. reels are very similar. The gear box for cutting units with 7 in. reels have two (2) additional idler gear assemblies (Fig. 4).

CAUTION

Use the 1-3/8” flats on the input shaft to prevent the input shaft from rotating during adapter removal. DO NOT use the 1/2” hex on the input shaft to secure the shaft during adapter removal or input shaft damage may occur.

1. Remove input shaft adapter (item 1) if necessary.

2. Remove the drain/fill plug and drain the oil from the gear box.

3. Remove four (4) socket head cap screws (item 22) and separate the gear box cover and housing.

4. Remove and discard the cover gasket.

5. Slide the sun gear, ring gear and planet gears from the pins on the gear box housing.

6. Continue to disassemble the gear box as necessary.

7. Carefully clean any gasket material from gear box housing and cover.

8. Inspect V-ring, seals, bearings, gears and bushings in gear box assembly. Replace damaged or worn components as necessary.

Assembly (Fig. 6)

1. If sun gear, ring gear or gear box housing bearings are replaced, press bearings all the way to shoulder in part.

2. If flange bushings are replaced, ensure bushing flange is fully seated against part.

3. Ensure all retaining rings and O-rings are fully seated in ring groove.

4. Lubricate seal lips and O-rings before installing shafts.

5. If idler gear assemblies were removed (Gear box for 7 in. reel cutting units only) tighten idler gear cap screw from **85 to 95 in-lb (9 to 11 N-m)**.

6. Lubricate planet gear and sun gear pins in gear box housing with gear oil and install planet, ring and sun gears.

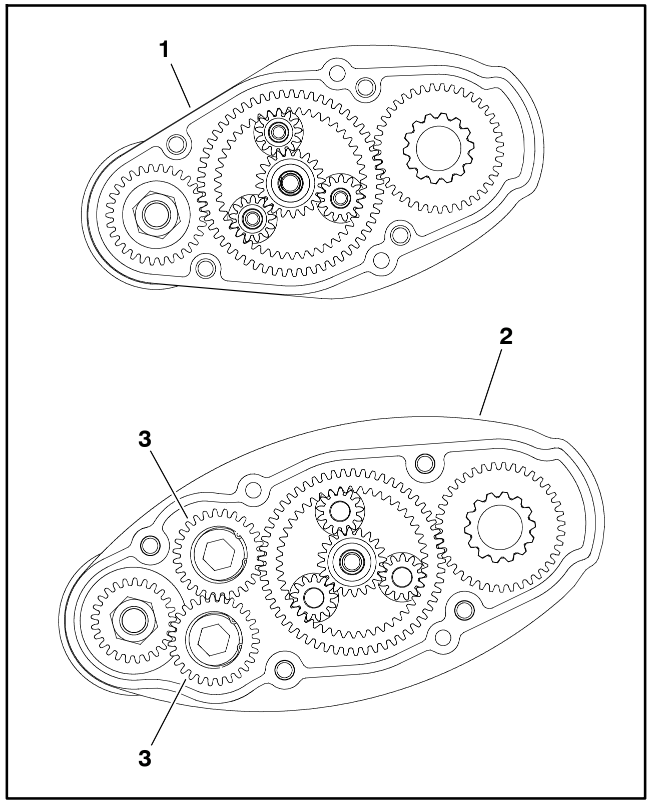

Figure 7

1. **Gear box assembly (5 in. reel cutting units)**
2. **Gear box assembly (7 in. reel cutting units)**
3. **Idler gear (2)**

7. Clean gasket surface on gear box housing and cover with solvent and install new gasket.

8. Fit gear box cover over dowel pins and install four (4) socket head screws. Tighten screws from **15 to 40 in-lb (2 to 4 N-m)**. In an alternating cross pattern, tighten four (4) socket head screws from **75 to 85 in-lb (8 to 9 N-m)**.

9. Fill the gear box with 80W-90 gear oil and tighten drain/fill plug from **32 to 52 in-lb (4 to 5 N-m)**.

Gear box oil capacity for 5 in. reel cutting units = 1.7 oz. (50 cc)

Gear box oil capacity for 7 in. reel cutting units = 3 oz. (90 cc)

CAUTION

Use the 1-3/8” flats on the input shaft to prevent the input shaft from rotating during adapter installation. DO NOT use the 1/2” hex on the input shaft to secure the shaft during adapter installation or input shaft damage may occur.

10. If removed, install the threaded adapter in the input shaft. If reusing a previously installed threaded adapter, apply medium strength thread locker to the smaller (5/8-11) threads only. Tighten threaded adapter from **115-125 ft-lb (156-196 N-m)**.

11. Operate groomer gear box by hand to check for proper operation prior ro installation.

Installation (Fig. 2)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

CAUTION

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

2. Safely prevent reel from rotating by blocking the cutting reel with piece of wood near one of the reel spiders.

IMPORTANT: Groomer gear boxes installed on the left side of the cutting unit use a left hand thread. Turn the input shaft (rear roller brush drive shaft) counterclockwise to install the gear box. Groomer gear boxes installed on the right side of the cutting unit use a right hand thread. Turn the input shaft clockwise to install the gear box.

3. Insert a long-handled pry bar through the front of the cutting unit. The pry bar should pass between the top of the reel shaft and the backs of the reel blades so that the reel will not move.

4. Move the pry bar against the weld side of the reel support plate closest to the gear box assembly and rest the handle of the pry bar against the front roller.

5. Position the gear box assembly against the cutting unit and turn the drive shaft assembly in correct direction until it is seated against the reel.

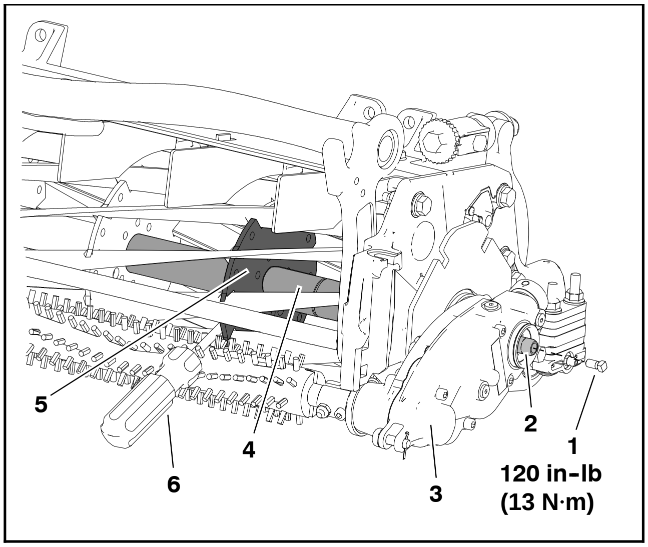

Figure 8

1. Square head set screw
2. Input shaft assembly
3. Gear box assembly
4. Reel shaft
5. Reel support plate
6. Pry bar

IMPORTANT: You must use a 6-point socket with a heavy wall to install the gear box to the reel. Do not use an impact wrench. Groomer gear boxes installed on the left side of the cutting unit use a left hand thread; turn the drive shaft in correct direction to install the gear box.

6. Tighten the input shaft from **90 to 100 ft-lb (122 to 153 N-m)**.

7. Remove the square head set screw from the end of the drive shaft.

8. Use a new cotter pin and install the cotter pin and clevis pin securing the height adjustment rod to the front of the groomer gear box.

9. Install the rear roller brush drive shield if previously removed.

NOTE: If cutting unit is equipped with an optional powered rear roller brush, install the rear roller brush drive housing assembly, drive belt and cover (see Roller Brush (Optional) in Chapter 7 - Cutting Units in this manual for additional information).

10. Install the groomer reel assembly (see Groomer reel in this chapter).

Idler Assembly

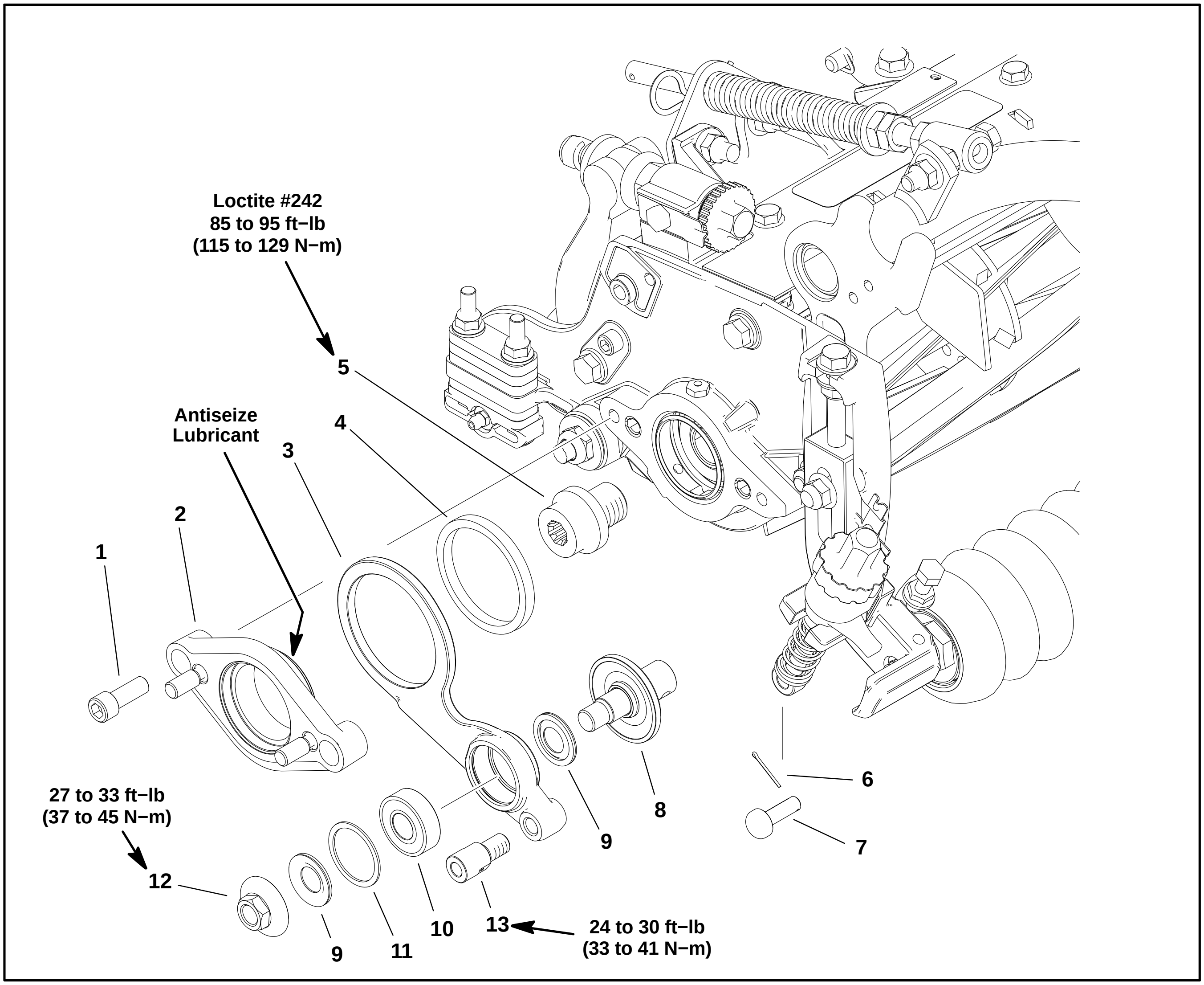

Figure 5

1. **Socket head screw (2)**
2. **Pivot hub**
3. **Idler arm**
4. **Bushing**
5. **Threaded insert**
6. **Cotter pin**
7. **Clevis pin**
8. **Stub shaft and shield**
9. **Bearing shield (2)**
10. **Bearing**
11. **Retaining ring**
12. **Flange nut**
13. **Collar**

NOTE: The groomer idler assembly is located on the same side of the cutting unit as the cutting unit hydraulic motor.

Removal (Fig. 5)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove hydraulic reel motor from cutting unit (see Hydraulic Reel Motor Removal in Chapter 7 − Cutting Units in this manual).

3. Remove the groomer reel assembly (see Groomer reel in this chapter).

4. Remove the cotter pin and clevis pin from the height adjustment rod at the front of the idler arm. Discard cotter pin.

5. Remove the socket head cap screws securing the pivot hub to the cutting unit and remove the pivot hub and idler assembly from the cutting unit.

6. Inspect shields, bearing and bushing in idler assembly. Remove and discard damaged or worn components.

Installation (Fig. 5)

1. If shields, bearing or bushing was removed from idler arm, install new components.

   A. Press bushing into groomer plate until the bushing is centered in the idler arm bore.

   B. Press bearing into idler arm so that bearing contact shoulder in idler arm bore and install bearing retaining ring.

   C. Install bearing shields with flocked side of shield toward bearing.

   D. Verify idler arm orientation (LH or RH cutting unit) and insert stub shaft through shields and bearing. Using through hole in shaft to prevent shaft from rotating, tighten flange nut from **27 to 33 ft−lb (37 to 45 N−m)**.

   E. If collar was removed from idler arm, install collar and tighten from **24 to 30 ft−lb (33 to 41 N−m)**.

2. Apply antisieze lubricant to the outside diameter of the pivot hub (Fig. 6). Position idler arm over pivot hub.

3. Apply Loctite to two (2) socket head screws and secure pivot hub and idler arm to cutting unit side plate.

4. Use a new cotter pin and install the cotter pin and clevis pin securing the height adjustment rod to the front of the idler arm.

5. Install hydraulic reel motor to cutting unit (see Hydraulic Reel Motor Installation in Chapter 7 − Cutting Units in this manual).

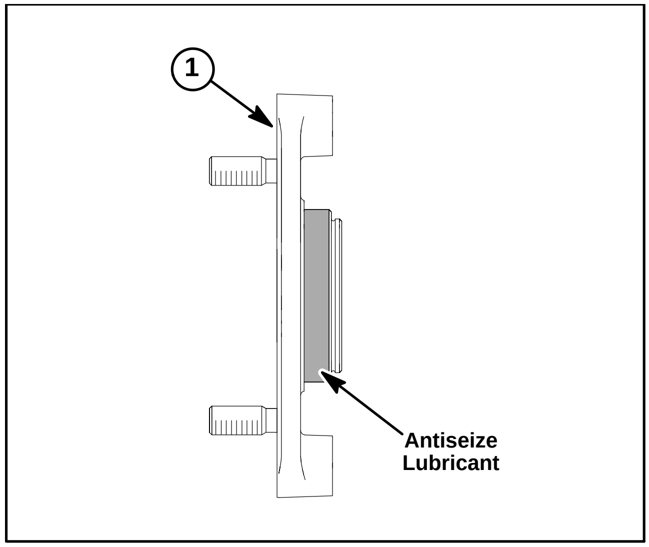

Figure 6

1. **Pivot hub**

Universal Groomer

Groomer Reel

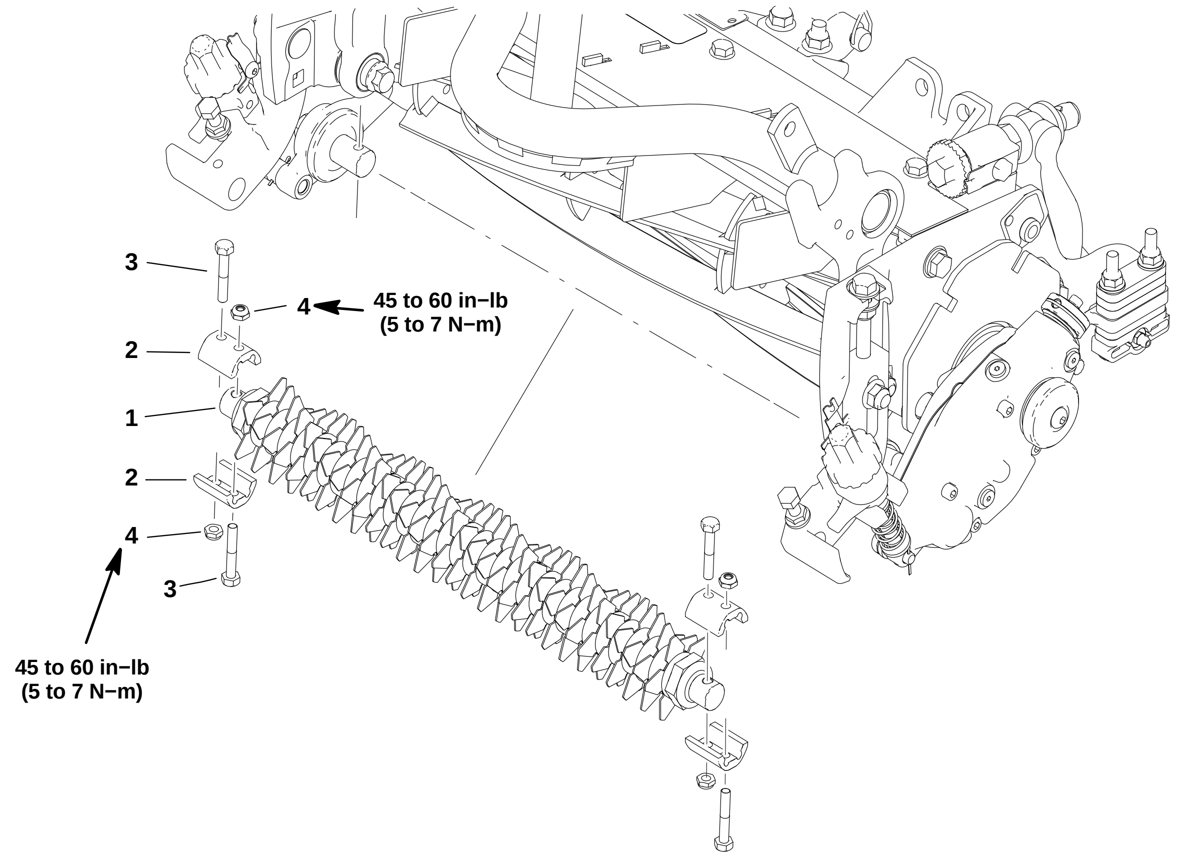

Figure 7

1. **Groomer reel**
2. **Shaft clamp (4)**
3. **Cap screw (4)**
4. **Jam nut (4)**

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

Removal (Fig. 7)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch. If desired, remove cutting unit from machine (see Traction Unit Operator's Manual).

CAUTION

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

2. Carefully remove the four (4) jam nuts, cap screws and shaft clamps securing the groomer reel to the output and stub shafts.

3. Lift the groomer reel from the cutting unit.

4. Inspect seal, shields, bushing and bearings for wear or damage. Replace components as needed (see Gear Box Assembly and Idler Assembly in this section).

Installation (Fig. 7)

1. Position cutting unit on a level surface. If cutting unit is attached to traction unit, make sure to stop engine, engage parking brake and remove key from the ignition switch.

2. Position the groomer reel between the groomer output and stub shafts.

3. Secure the groomer reel to the cutting unit with four (4) jam nuts, cap screws and shaft clamps. Tighten the cap screws to **46 to 60 in−lb (5 to 7 N−m)**.

4. Check groomer reel height and mower height−of−cut settings. Adjust as needed.

Groomer Reel Service

Inspect groomer reel blades frequently for damage and wear. Straighten bent blades. Either replace worn blades or reverse the individual blades to put the sharpest blade edge forward (Fig. 8). Blades that are rounded to the midpoint of the blade tip must be reversed or replaced for best groomer performance.

Disassembly (Fig. 9)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove groomer reel from cutting unit (see Groomer Reel Removal in this section).

3. If groomer reel is equipped with broomer kit, remove straps and broomer brushes from reel (Fig. 12).

4. Remove lock nut from either end of the shaft (Fig. 9).

5. Remove spacers and blades from groomer shaft. If needed, remove second lock nut from shaft.

Assembly (Fig. 9)

1. Install lock nut on drive end of groomer shaft. Place a 1/4" (6.3 mm) spacer on the groomer shaft followed by the first groomer blade.

2. Alternately install 1−1/4" (31.7 mm) spacers and blades making sure that all blades are separated by a spacer.

3. When all blades have been installed, place remaining 1/4" (6.3 mm) on shaft. Thread second lock nut onto the shaft. Center blades on shaft by adjusting lock nuts.

4. Using through holes in shaft to prevent shaft from rotating, tighten second lock nut from **31 to 35 in−lb (42 to 48 N−m)**. After tightening lock nut, spacers should not be free to rotate and groomer blades should be centered on shaft.

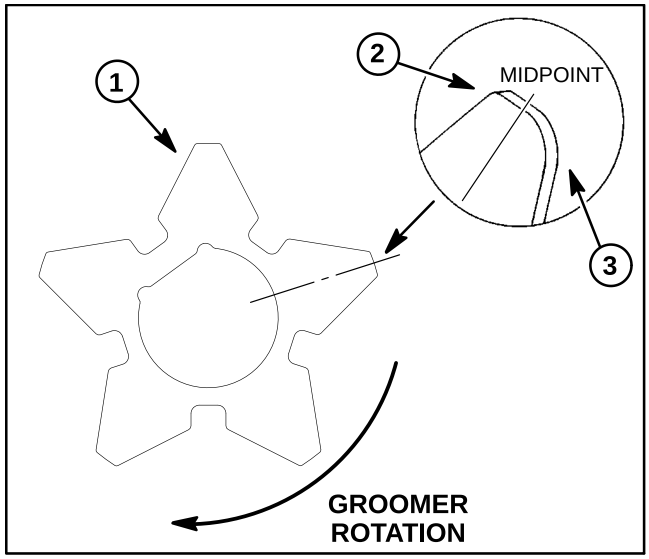

Figure 8

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

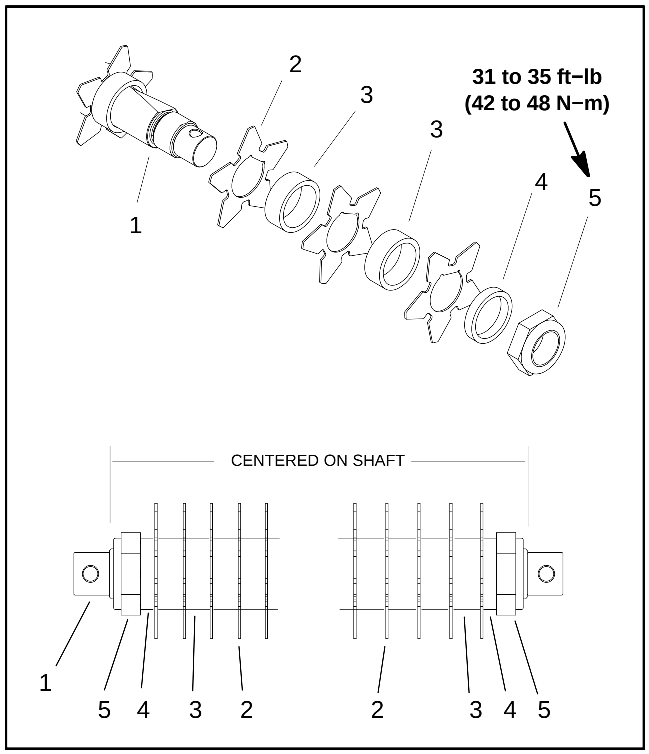

Figure 9

1. **Groomer reel shaft**
2. **Groomer blade (18 in. Reel = 32) (11 in. Reel = 40)**
3. **1−1/4" (31.7 mm) Spacer (18 in. reel = 31) (22 in. Reel = 39)**
4. **1/4" (6.3 mm) Spacer (2)**
5. **Lock nut (2)**

5. If groomer reel is equipped with broomer kit:

A. Loosen the groomer blade retaining nuts on each end of the groomer shaft.

B. Slide a brush into each groove around the full length of the groomer reel (Fig. 10). Make sure brushes are seated in groomer blade slots (Fig. 11)

IMPORTANT: The straps must be wrapped around the groomer blade and brush assembly in the correct direction.

C. Loosely wrap the straps around the groomer reel shaft and brushes as shown (Fig. 10). Straps should be positioned in the pre−cut notches of each brush and at the following locations on the broomer shaft:

18” reels − between blades 2−3, 11−12, 21−22 and 30−31.

22” reels − between blades 2−3, 14−15, 26−27 and 38−39.

Position the broomer brushes properly in the blade slots, and tighten the groomer blade−retaining nuts from **31 to 35 ft−lb (42 to 48 N−m).**

D. While holding strap buckle in place, pull straps tight into the pre−cut notches of each brush.

E. Cut off strap extension approximately 1/4” (6 mm) beyond retainer and fold the excess strap over the buckle (Fig. 12).

6. Install O−ring on non−drive end of groomer shaft.

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

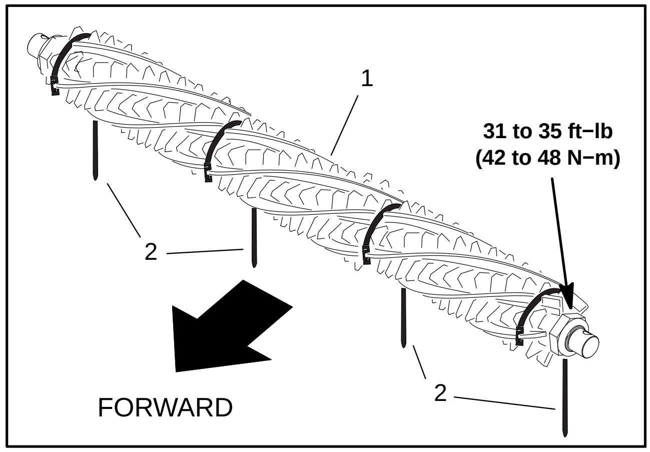

Figure 10

1. **Groomer reel** 2. **Broomer strap (4)**

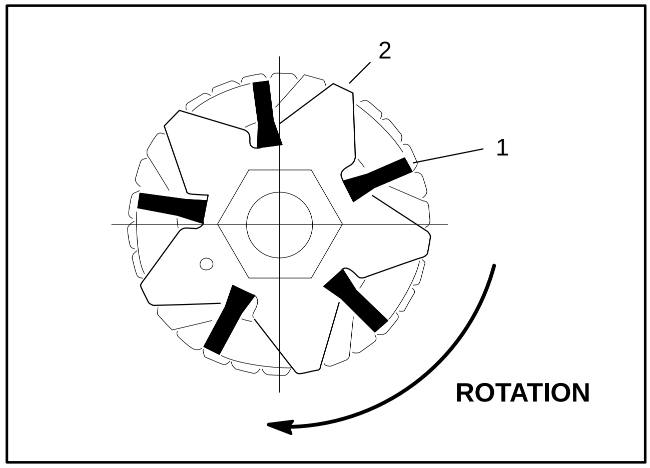

Figure 11

1. **Brush** 2. **Blade**

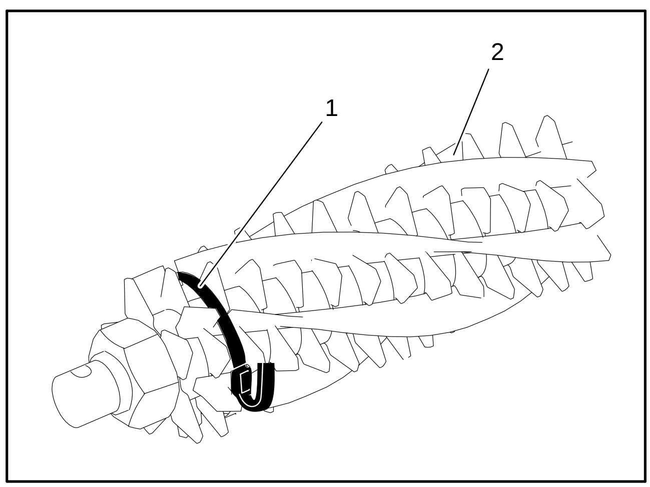

Figure 12

1. **Strap** 2. **Brush**

Grooming Brush (Optional) Service

The optional grooming brush is removed and installed from the groomer in the same manner as the groomer reel (see Groomer Reel in this chapter).

The grooming brush element or shaft can be serviced separately (Fig. 13).

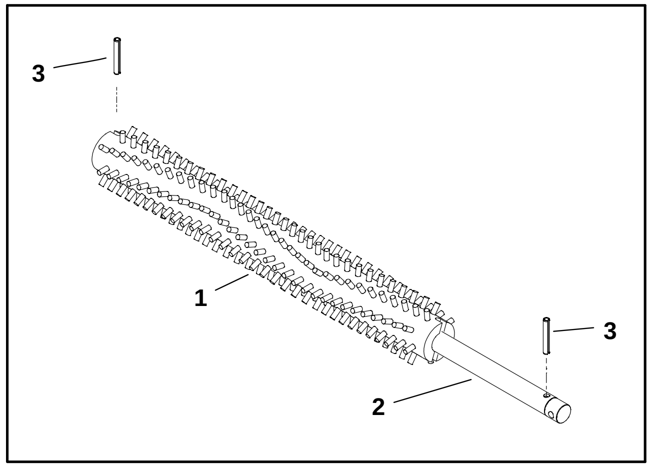

Figure 13

1. **Brush element**
2. **Shaft**
3. **Roll pin (2)**

Height Adjuster Assembly

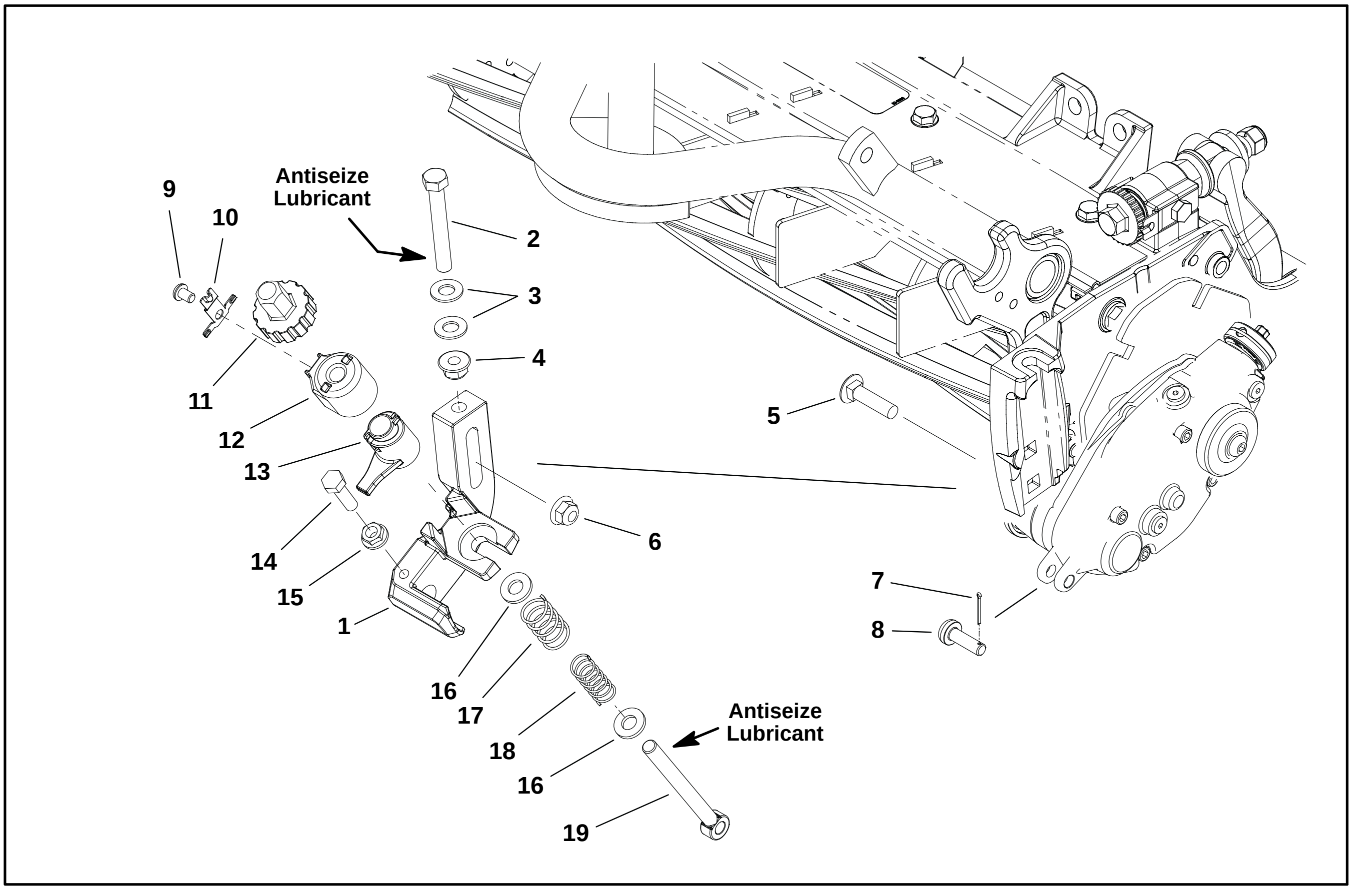

Figure 14

1. Height of cut bracket	8. Clevis pin	14. Pinch bolt (front roller)
2. Height adjustment bolt	9. Button head screw	15. Lock nut
3. Washer (2)	10. Detent spring	16. Washer (2)
4. Lock nut	11. Groomer height adjuster knob	17. Outer spring
5. Carriage bolt	12. Quick up cover	18. Inner spring
6. Flange nut	13. Quick up lever	19. Height adjustment rod
7. Cotter pin		

Disassembly (Fig. 14)

1. Park machine on a clean and level surface, lower cutting units completely to the ground, stop engine, engage parking brake and remove key from the ignition switch.

2. Remove the cotter pins and clevis pins securing the height adjustment rods to the groomer gear box and idler arm. Discard cotter pins.

3. Loosen the two (2) height adjustment bolt lock nuts.

4. Loosen the two (2) front roller pinch bolt lock nuts and cap screws.

5. Remove the flange nut and carriage bolt securing the height adjuster assembly to the cutting unit side plate and remove the front roller and height adjuster from the cutting unit.

6. Disassemble height adjuster assembly.

7. Clean all components and inspect for wear or damage. Replace all worn or damaged components.

Assembly (Fig. 14)

1. Apply antiseize lubricant to upper threads of adjustment rod and lower threads of height adjusters. Assemble height adjuster assembly as shown.

2. If both height adjusters were removed, fit one height adjuster assembly to the cutting unit side plate and secure with carriage bolt and flange nut. Do Not tighten the flange nut at this time. Ensure the height adjustment bolt and one (1) washer is above slot in side plate and one (1) washer and lock nut is below slot in side plate.

3. Position front roller between height adjuster assemblies and secure height adjuster assembly to cutting unit side plate with carriage bolt and flange nut. Do Not tighten the flange nut at this time. Ensure the height adjustment bolt and one (1) washer is above slot in side plate and one (1) washer and lock nut is below slot in side plate.

4. Use new cotter pins and install the cotter pins and clevis pins securing the height adjustment rods to the groomer gear box and idler arm.

5. Adjust the cutting unit height of cut (see Cutting Unit Operators Manual).

6. Check groomer reel height and adjust as needed.

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Chapter 10

Foldout Drawings

Table of Contents

Electrical Drawing Designations

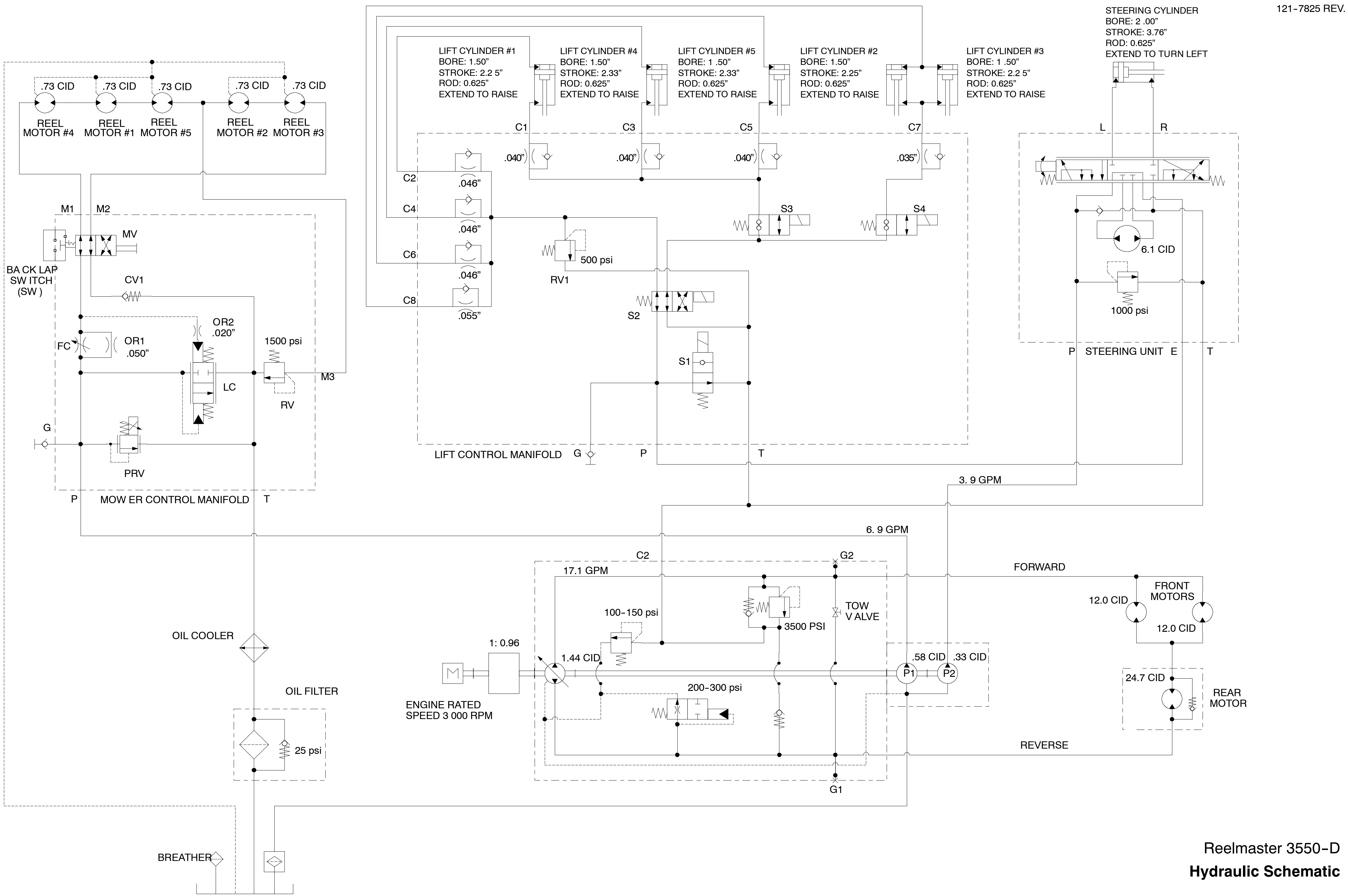
The following abbreviations are used for wire harness colors on the electrical schematics and wire harness drawings in this chapter.

ABBREVIATION	COLOR
BK	BLACK
BR or BN	BROWN
BU	BLUE
GN	GREEN
GY	GRAY
OR	ORANGE
PK	PINK
R or RD	RED
T	TAN
VIO	VIOLET
W or WH	WHITE
Y or YE	YELLOW

Numerous harness wires used on Reelmaster machines include a line with an alternate color. These wires are identified with the wire color and line color with either a / or _ separating the color abbreviations listed above (e.g. R/BK is a red wire with a black line, OR_BK is an orange wire with a black line).

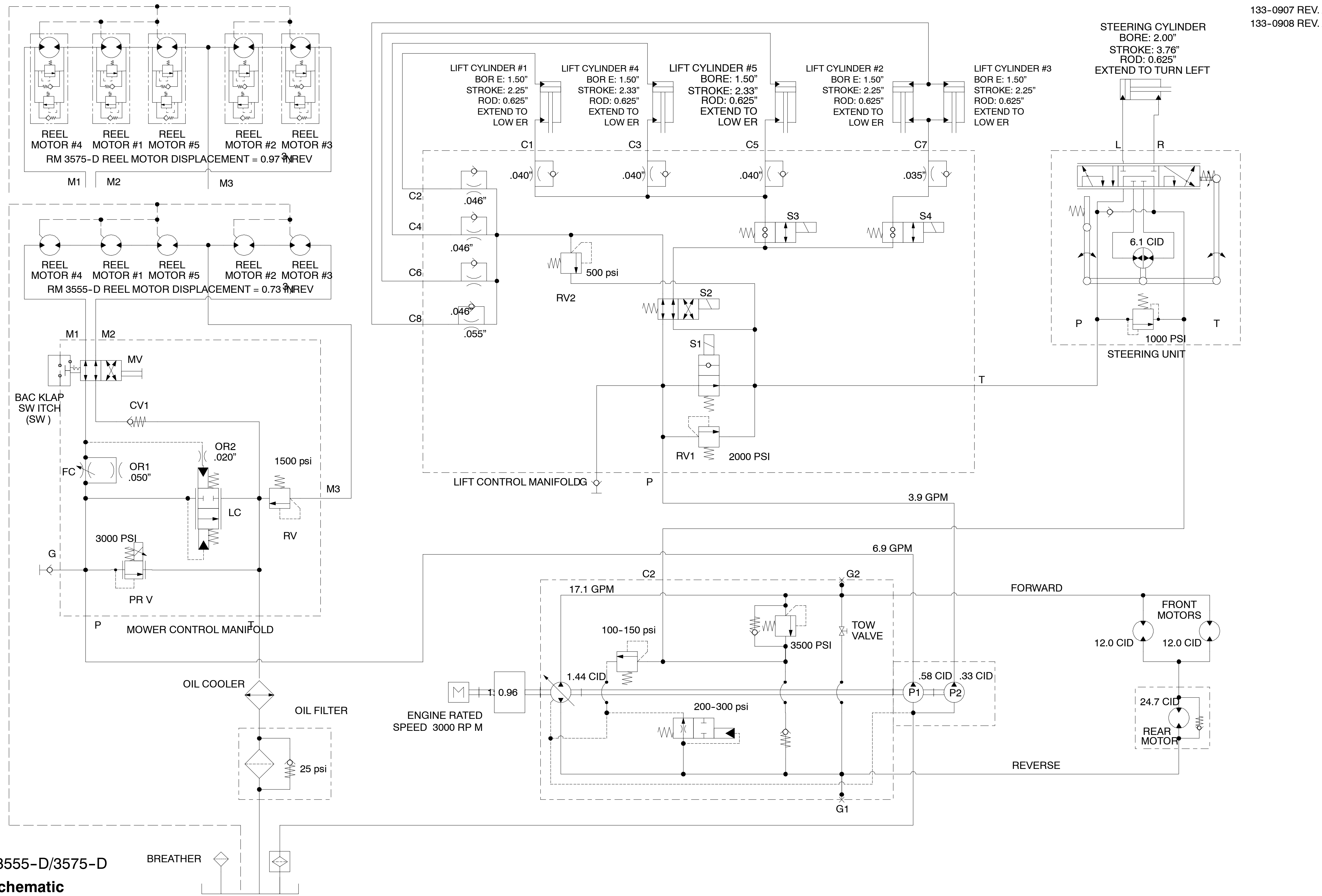
NOTE: The electrical harness drawings in this chapter identify both the wire color and the wire gauge. For example, 16 BK on a harness diagram identifies a 16 gauge wire that has a black insulator.

NOTE: A splice used in a wire harness will be identified on the wire harness diagram by SP. The manufacturing number of the splice is also identified on the wire harness diagram (e.g. SP01 is splice number 1).



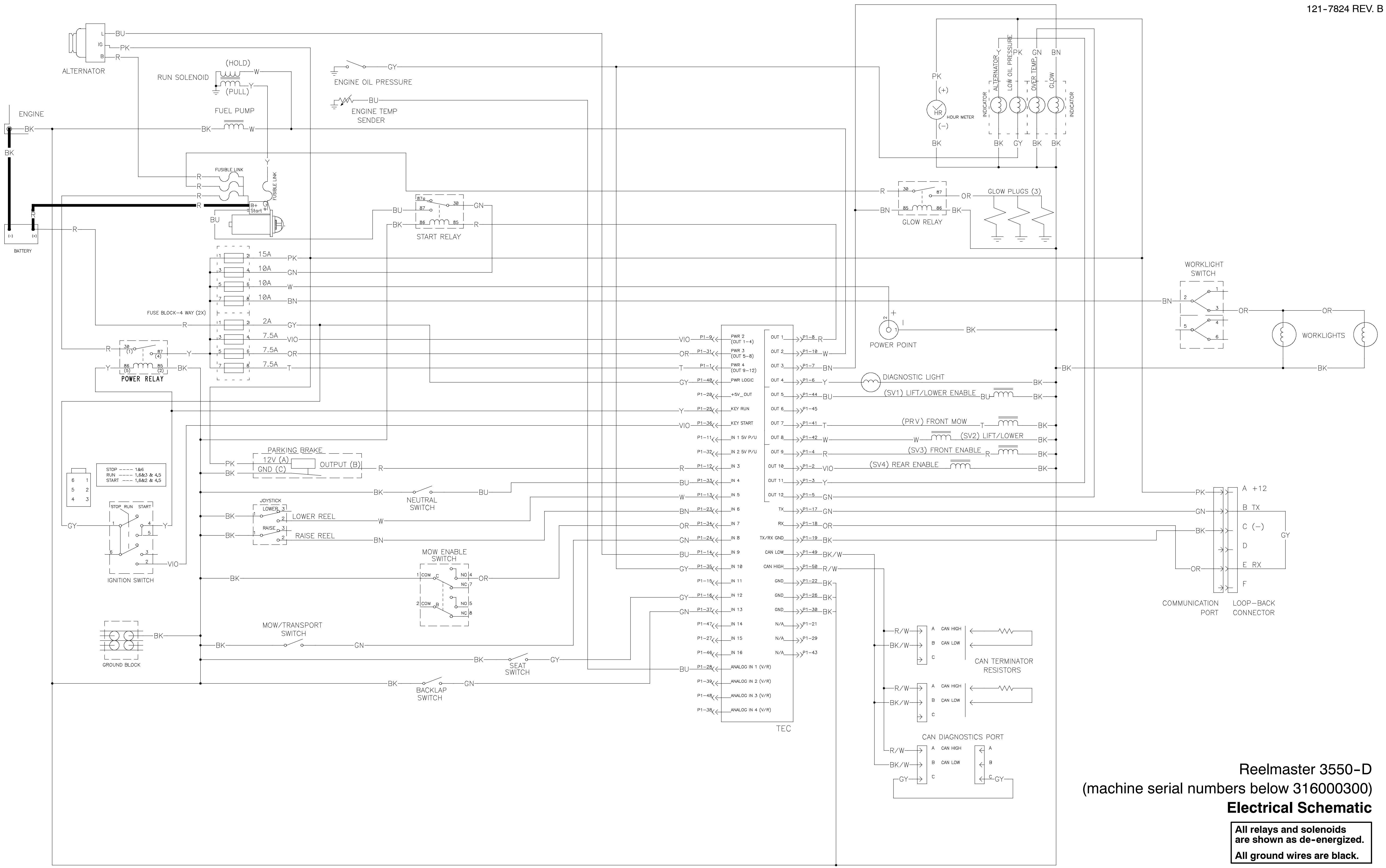
Reelmaster 3550-D

Hydraulic Schematic



Reelmaster 3555-D/3575-D

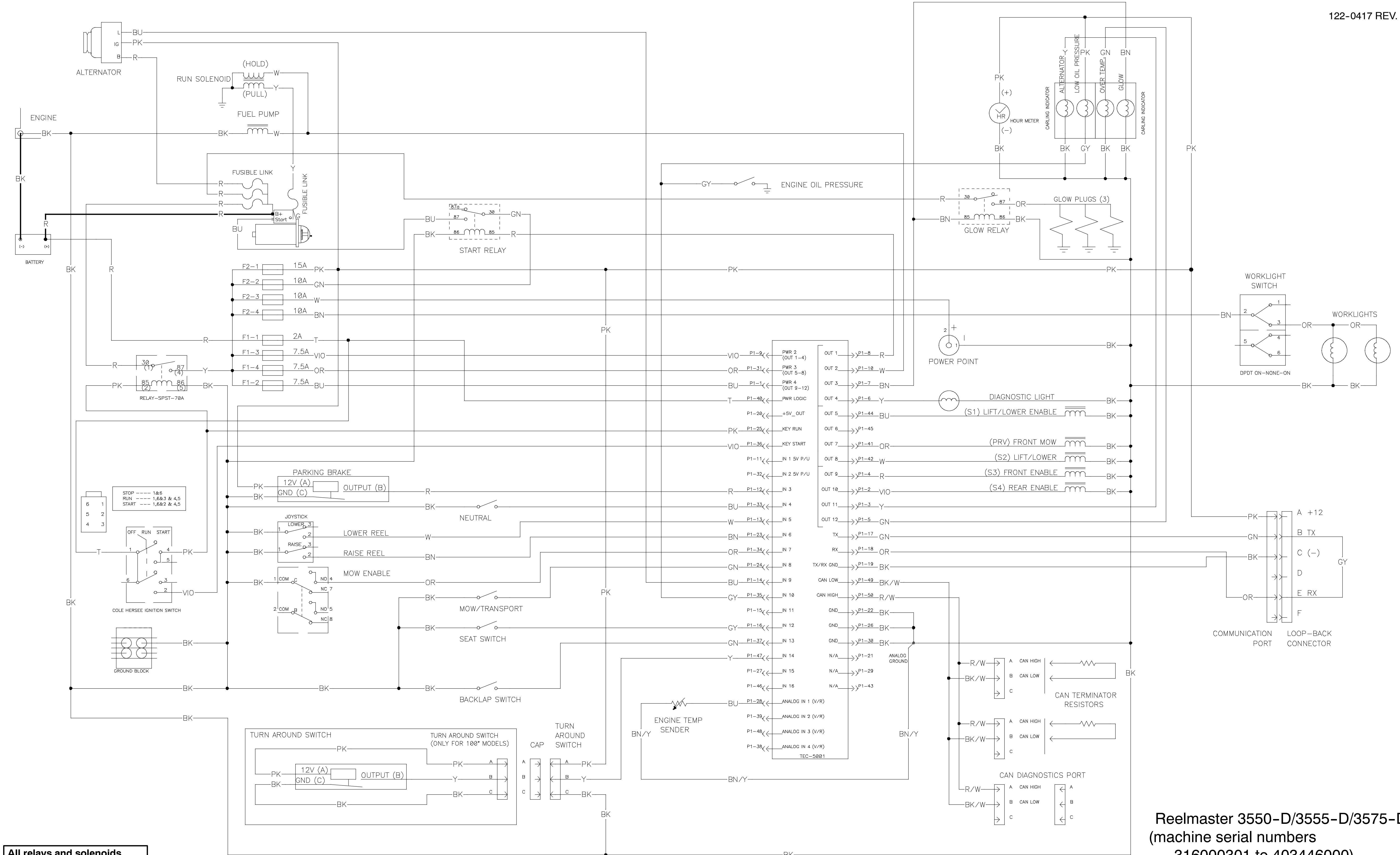
Hydraulic Schematic



Reelmaster 3550-D
(machine serial numbers below 316000300)

Electrical Schematic

All relays and solenoids are shown as de-energized.
All ground wires are black.

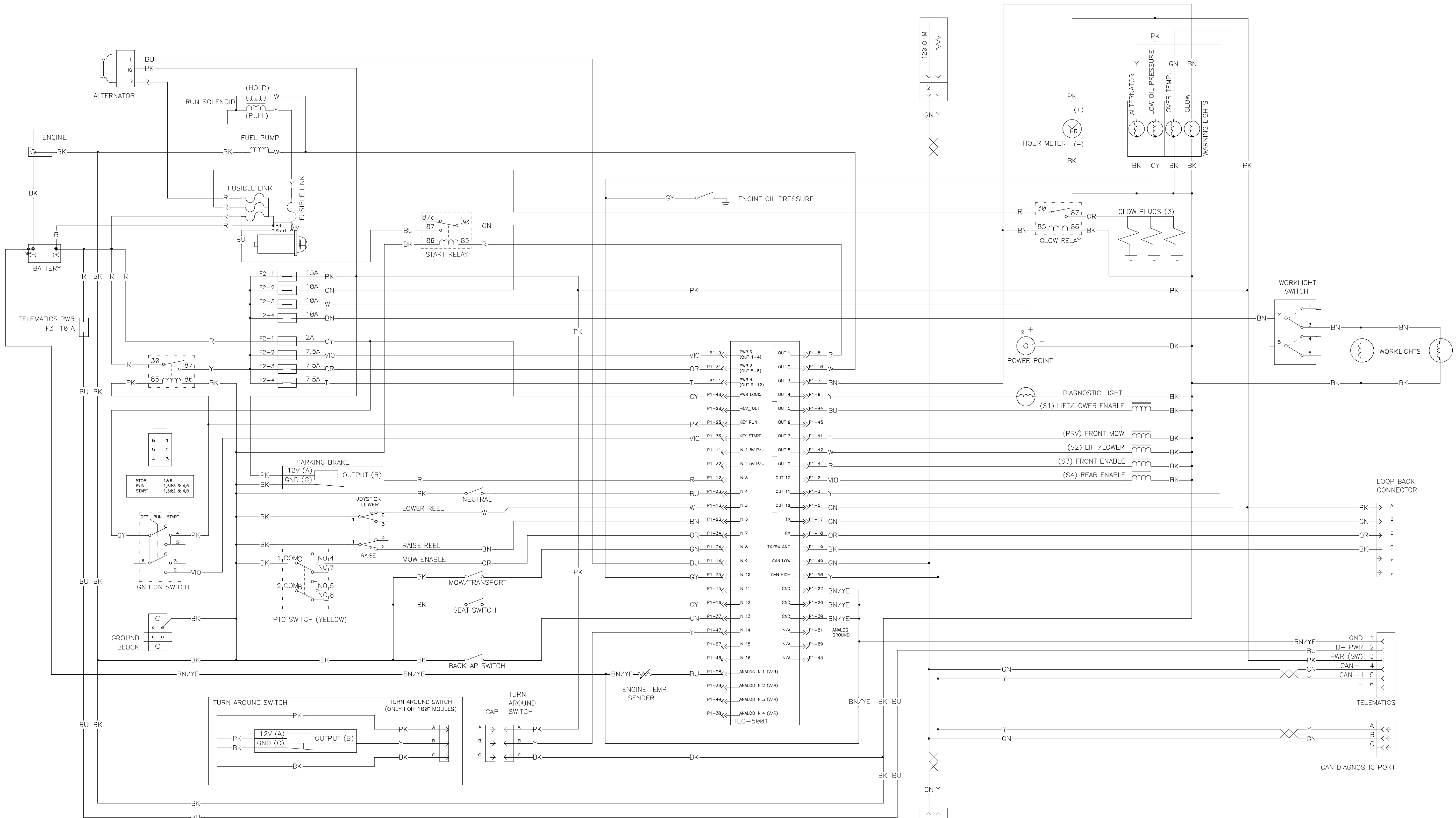


Reelmaster 3550-D/3555-D/3575-D
(machine serial numbers
316000301 to 403446000)

Electrical Schematic

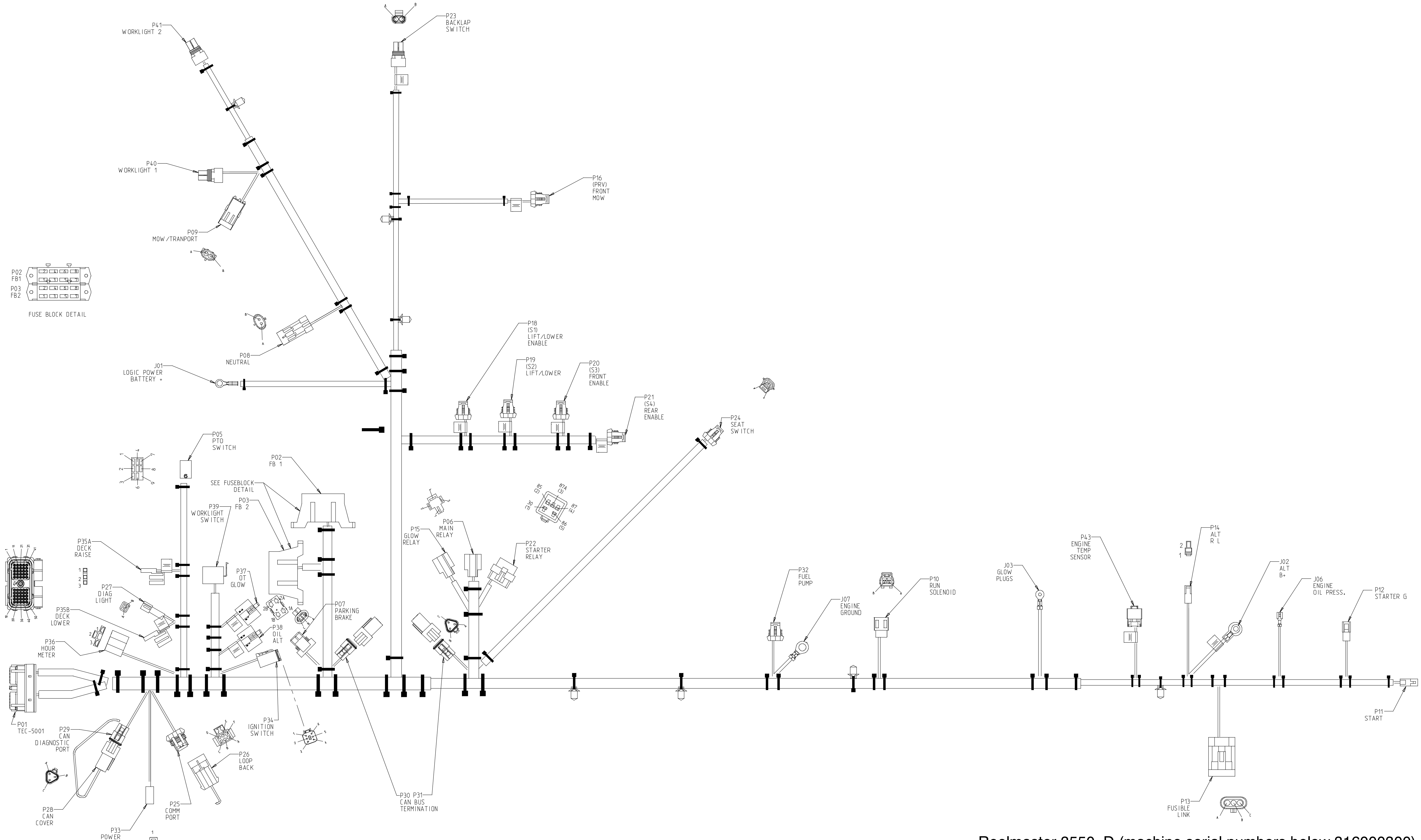
All relays and solenoids are shown as de-energized.

All ground wires are black.



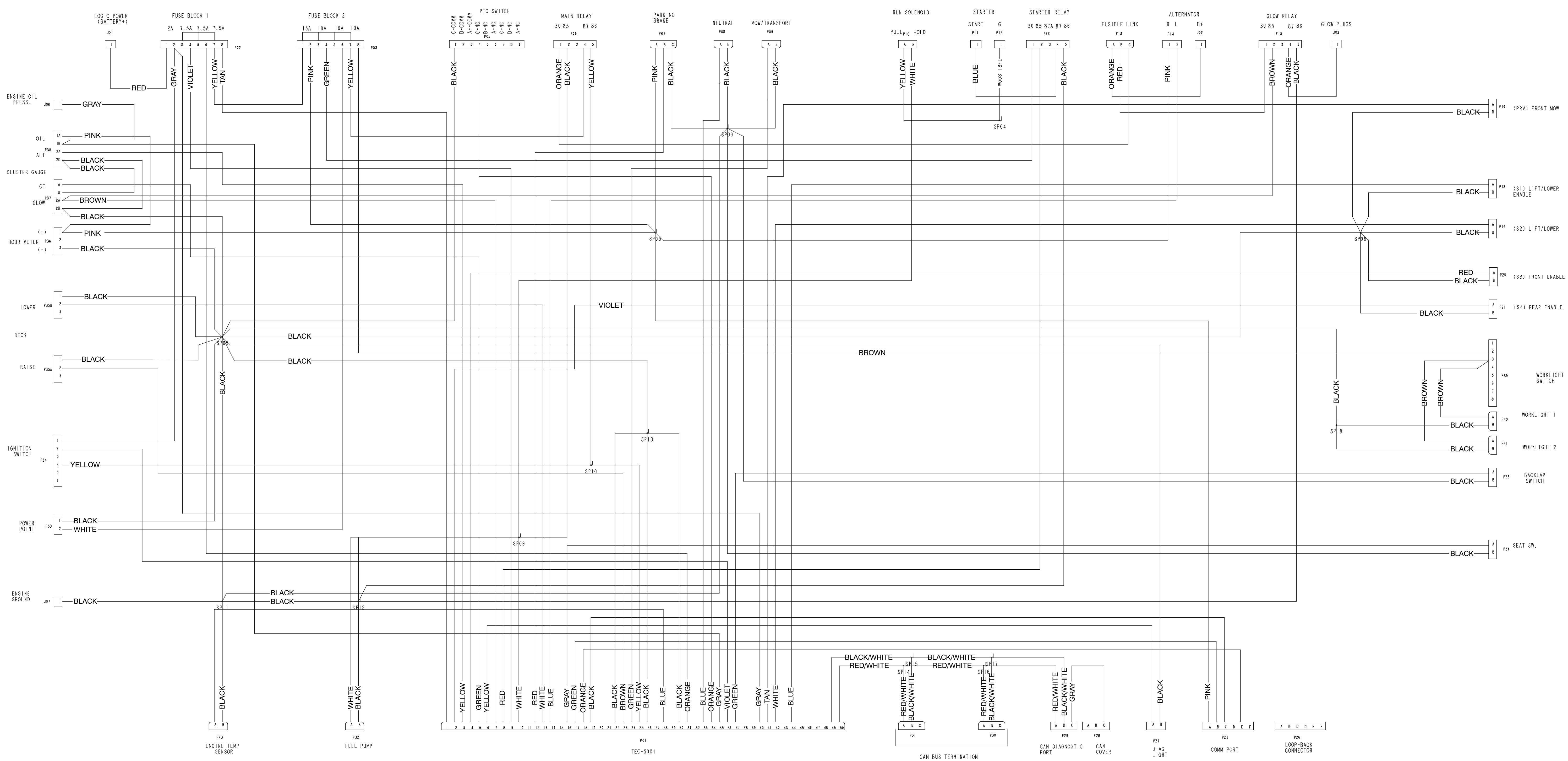
All relays and solenoids
are shown as de energized.
All ground wires are black.

122-1525 Rev A
Reelmaster 3550-D/3555-D/3575-D
Electrical Schematic
(Serial Numbers Above 403446001)



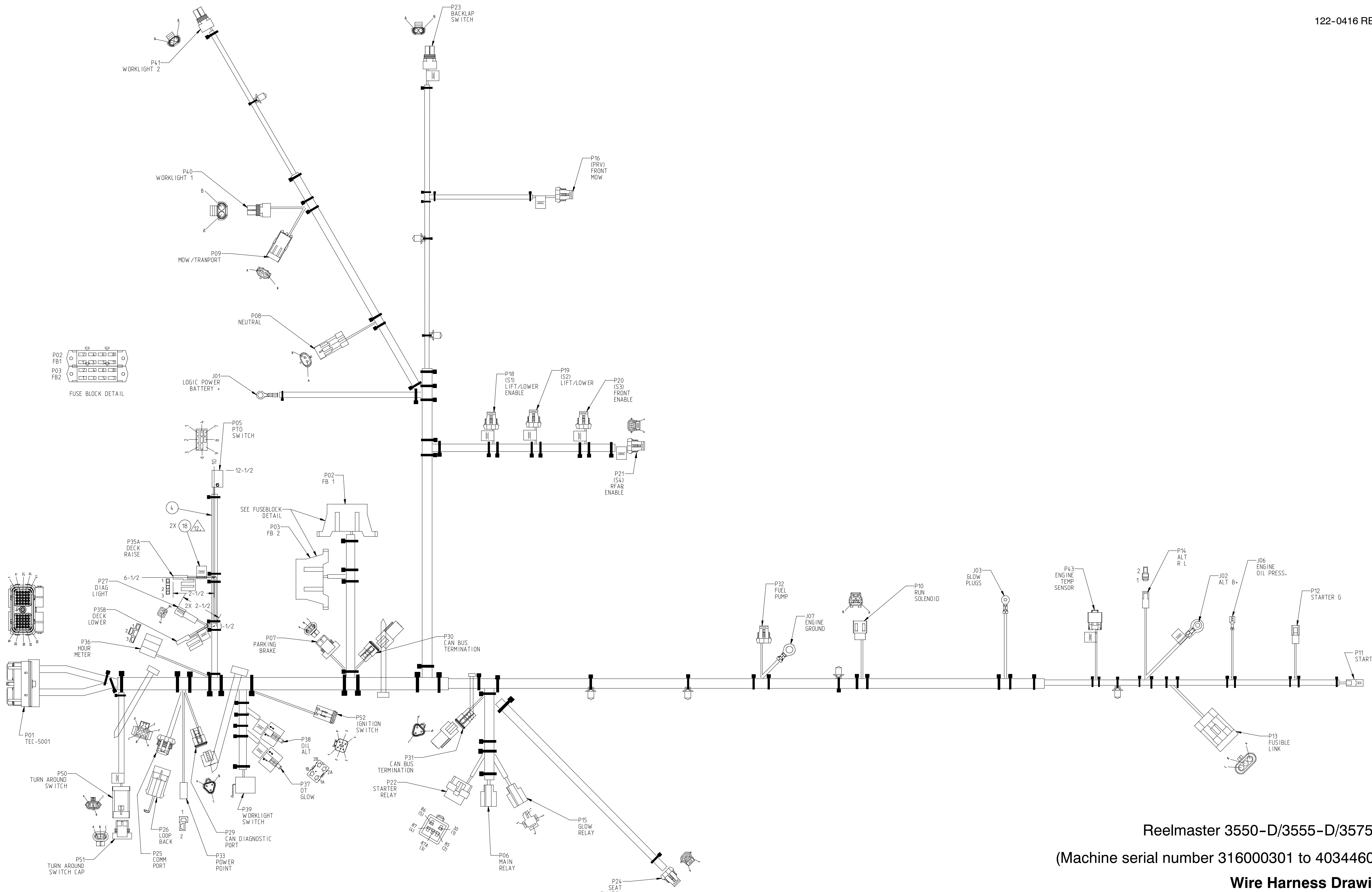
Reelmaster 3550-D (machine serial numbers below 316000300)

Wire Harness Drawing



Reelmaster 3550-D (machine serial numbers below 316000300)

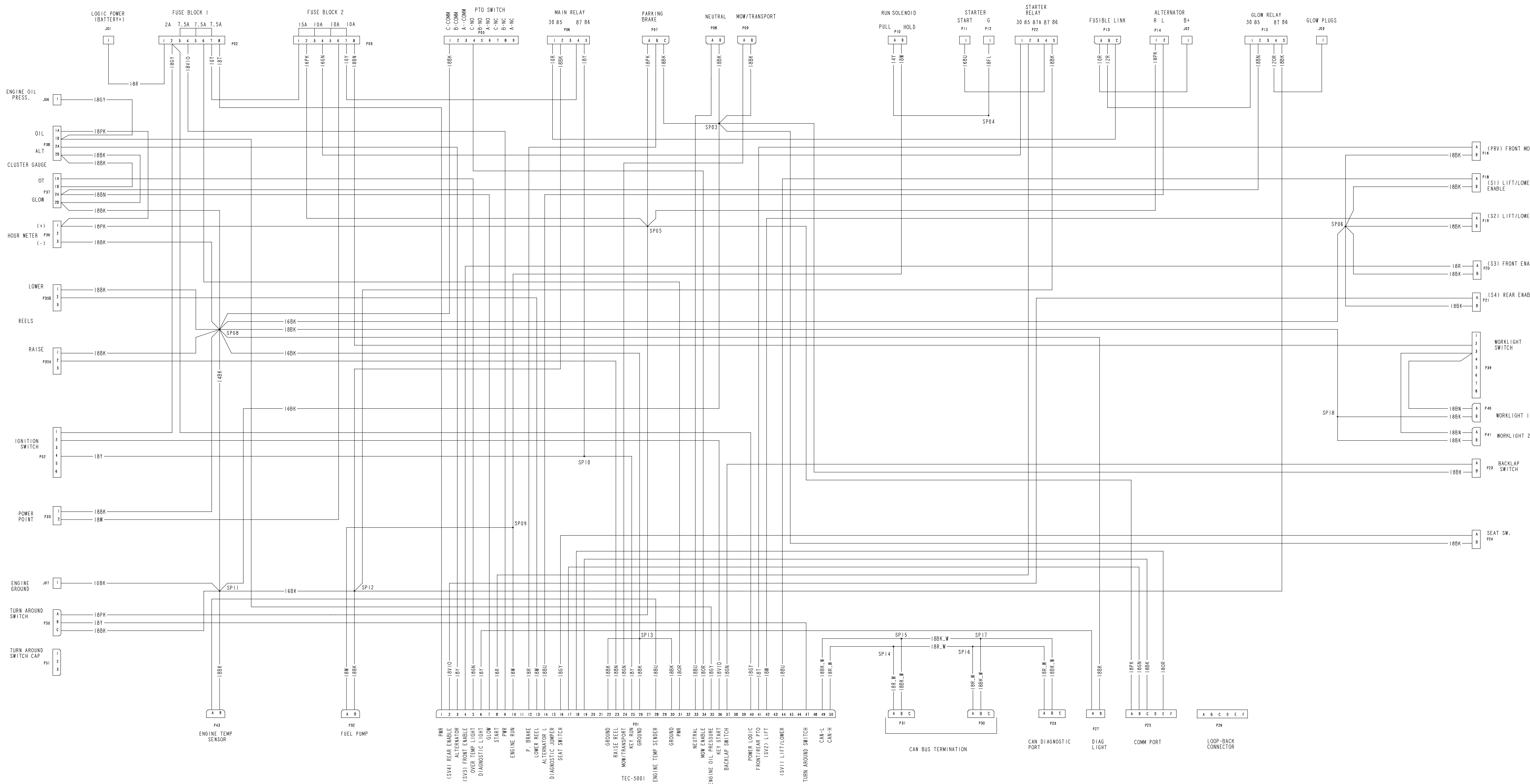
Wire Harness Diagram

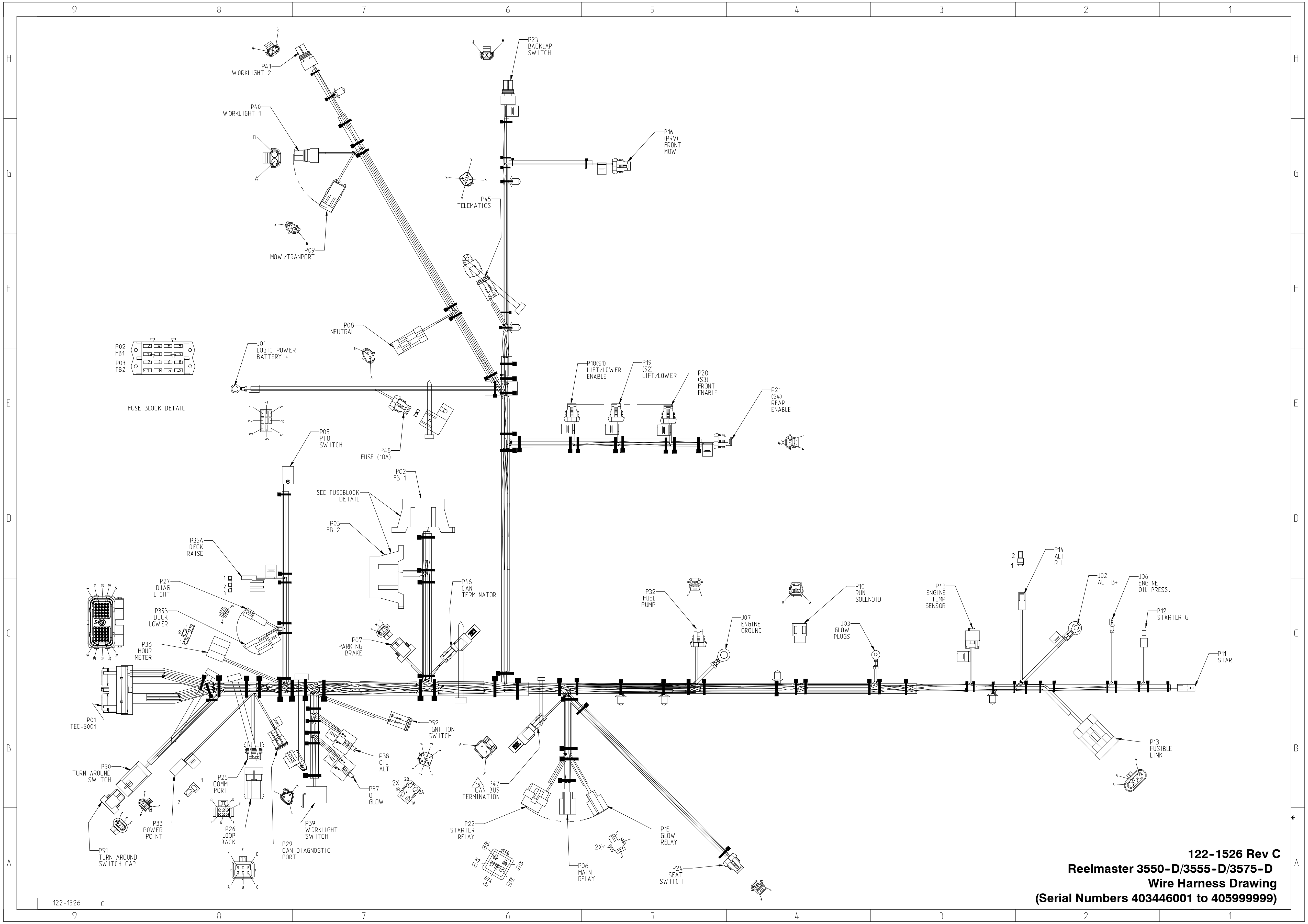


Reelmaster 3550-D/3555-D/3575-D

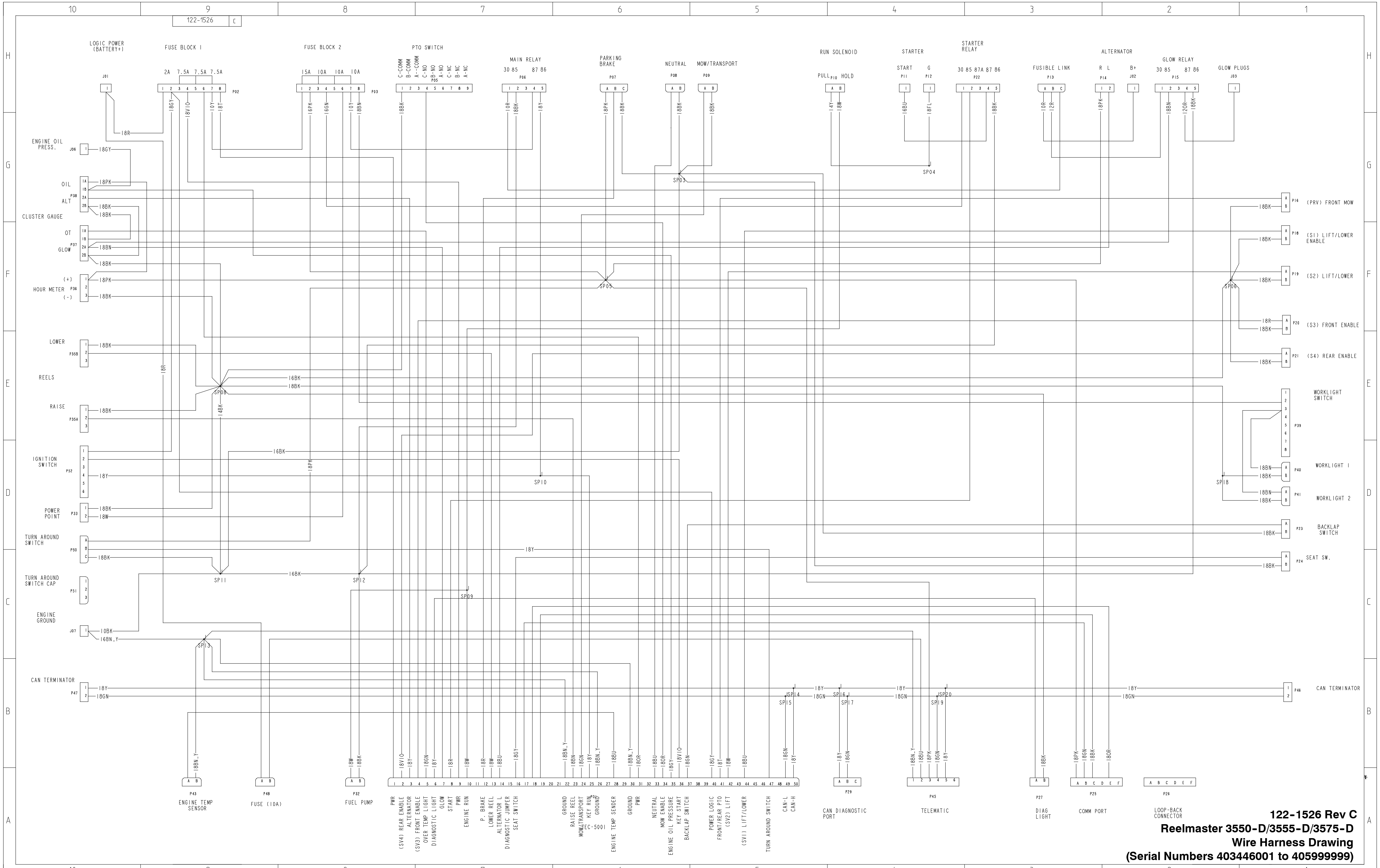
(Machine serial number 316000301 to 403446000)

Wire Harness Drawing

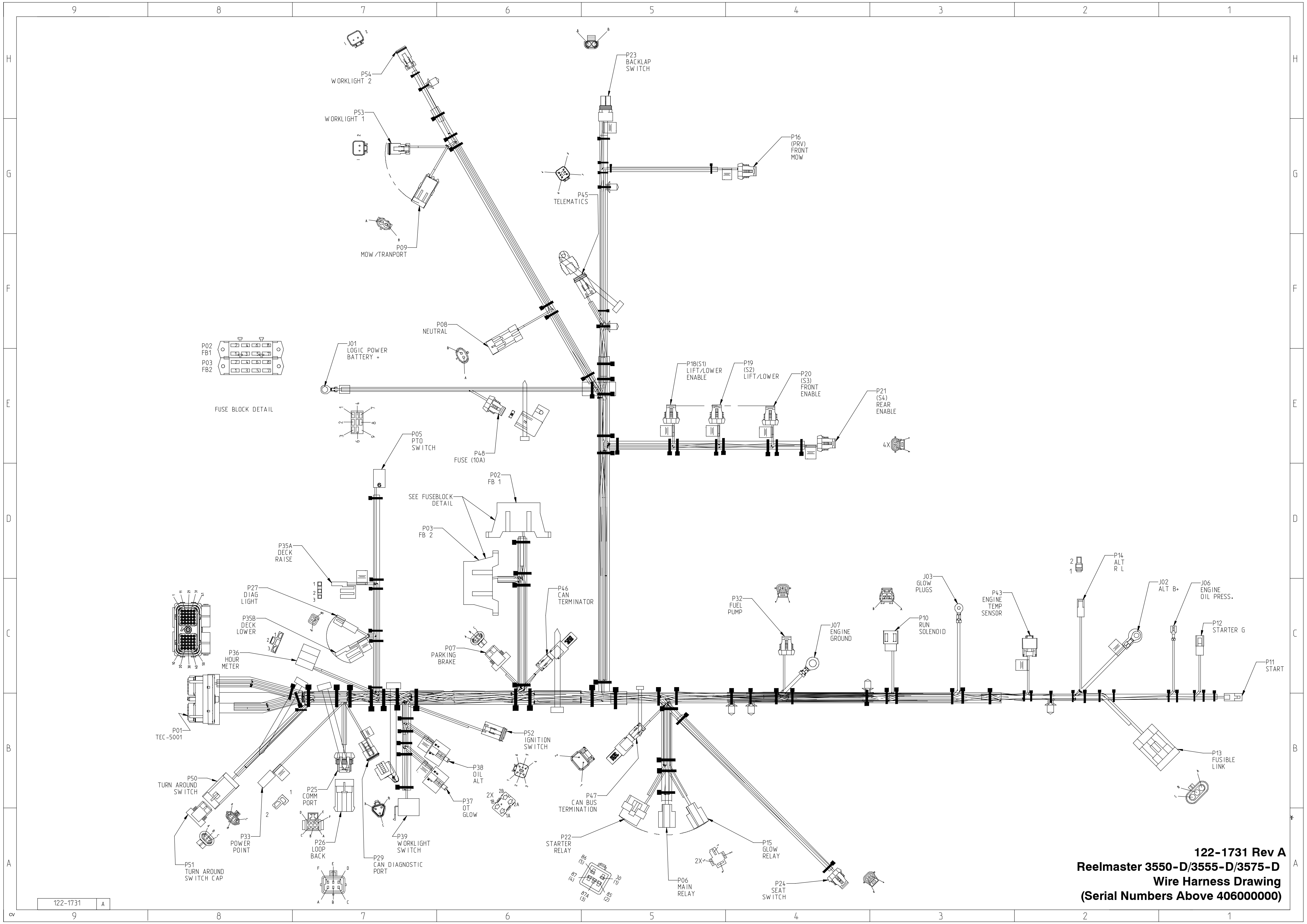




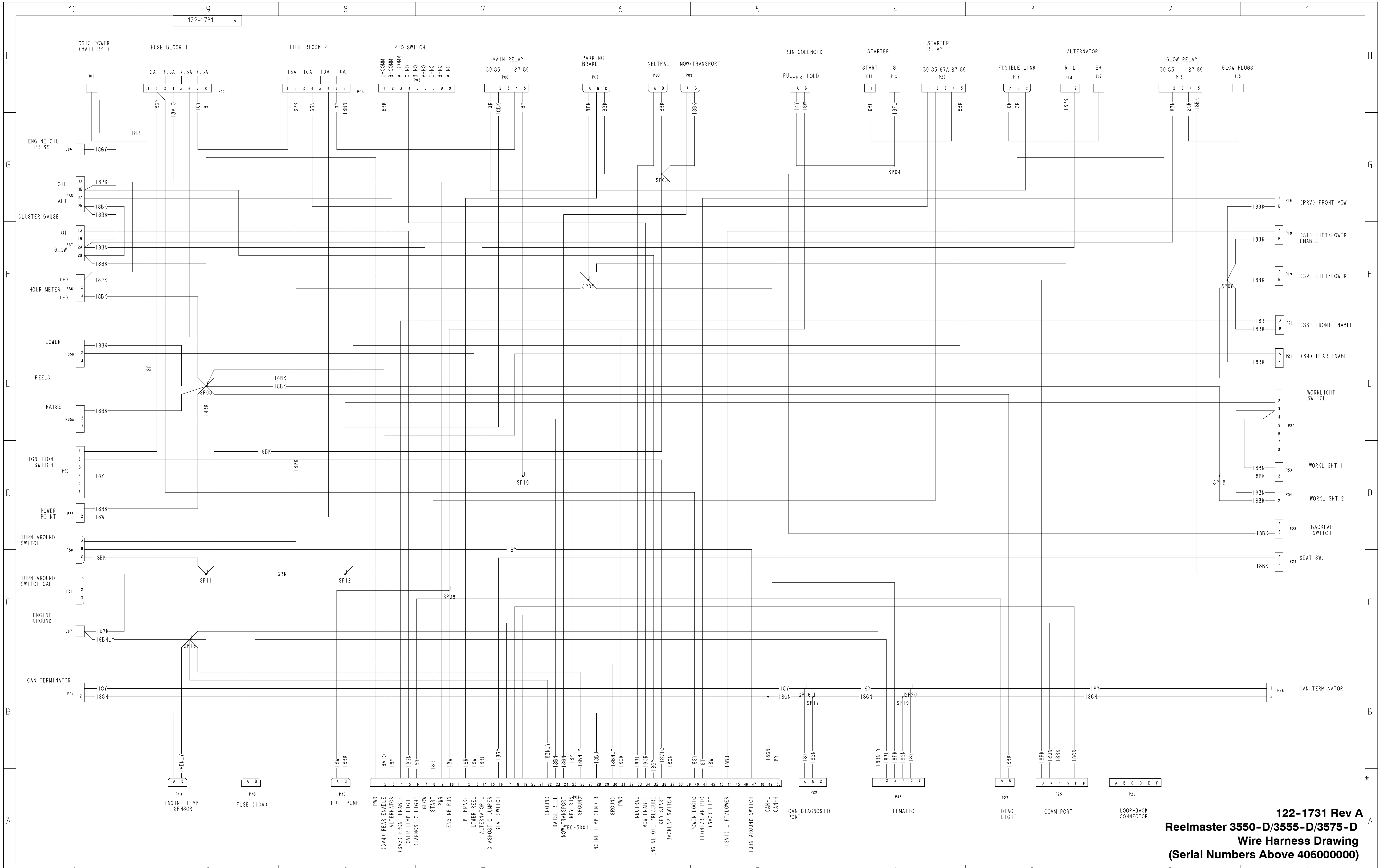
122-1526 Rev C
Reelmaster 3550-D/3555-D/3575-D
Wire Harness Drawing
(Serial Numbers 403446001 to 405999999)



122-1526 Rev C
Reelmaster 3550-D/3555-D/3575-D
Wire Harness Drawing
(Serial Numbers 403446001 to 405999999)



122-1731 Rev A
Reelmaster 3550-D/3555-D/3575-D
Wire Harness Drawing
(Serial Numbers Above 406000000)



122-1731 Rev A
Reelmaster 3550-D/3555-D/3575-D
Wire Harness Drawing
(Serial Numbers Above 406000000)

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