



Count on it.

Service Manual

2000 Series Z MASTER® Service Manual



Published: November 2020

Revision History

Preface

This service manual was written expressly for Toro service technicians. The Toro Company has made every effort to make the information in this manual complete and correct.

Basic shop safety knowledge and mechanical/electrical skills are assumed. The Table of Contents lists the systems and the related topics covered in this manual.

We are hopeful that you will find this manual a valuable addition to your service shop. If you have any questions or comments regarding this manual, please contact us at the following address:

The Toro Company
RLC/SWS Customer Care Department
8111 Lyndale Avenue South
Bloomington, MN 55420

The Toro Company reserves the right to change product specifications or make changes to this manual without notice.

Service Procedure Icons

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



Critical Process

This icon is used to highlight:

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



Critical Torque

This icon is used to highlight an assembly torque requirement that is different than what is recommended in the Standard Torque Tables.



Fluid Specifications

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

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

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Safety Instructions



DANGER



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



WARNING



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



CAUTION



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

Think Safety First

Avoid unexpected starting of engine...

Always turn off the engine, remove the ignition key and disconnect the spark plug wire(s) before cleaning, adjusting, or repair.

Avoid lacerations and amputations...

Stay clear of all moving parts whenever the engine is running. Treat all normally moving parts as if they were moving whenever the engine is running or has the potential to start.

Avoid burns...

Do not touch the engine, muffler, or other components, which may be hot during operation, while the unit is running or shortly after it has been running.

Avoid fires and explosions...

Use extreme care in handling fuel. It is flammable and its vapors are explosive. Extinguish all cigarettes, cigars, pipes, and other sources of ignition. Avoid spilling fuel and never smoke while working with any type of fuel or lubricant. Wipe up any spilled fuel or oil immediately. Never remove the fuel cap or add fuel when the engine is running. Always use approved, labeled containers for storing or transporting fuel and lubricants. Do not add or drain fuel in an enclosed space. Do not store the machine or fuel container where there is an open flame, spark, or pilot light, such as on a water heater or other appliance.

Avoid asphyxiation...

Do not operate an engine in a confined area without proper ventilation.

Avoid injury from batteries...

Think Safety First (continued)

Battery acid is poisonous and can cause burns. Avoid contact with skin, eyes and clothing. Battery gases can explode. Keep cigarettes, sparks and flames away from the battery.

Avoid injury due to inferior parts...

Use only original equipment parts to ensure that important safety criteria are met.

Avoid injury to bystanders...

Always clear the area of bystanders before starting or testing powered equipment.

Avoid injury due to projectiles...

Always clear the area of sticks, rocks or any other debris that could be picked up and thrown by the powered equipment.

Avoid modifications...

Never alter or modify any part unless it is a factory approved procedure.

Avoid unsafe operation...

Always test the safety interlock system after making adjustments or repairs on the machine. Refer to the Electrical section in this manual for more information.

Avoid electrical shock...

Never touch electrical wires or components while the engine is running. They can be sources of shock. De-energize the system if you are having to do repairs. If testing electrical components ensure you are working in a dry environment.

Hydraulic System...

Release all pressure in the hydraulic system before performing any work on the system. Keep your body and hands away from pin-hole leaks or nozzles that eject hydraulic fluid under high pressure. Do not use your hands to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate under the skin and cause serious injury. Seek medical attention right away if hydraulic fluid gets in the skin.

Personal Protective Equipment...

Tie back long hair, and do not wear loose clothing or jewelry. Use appropriate personal protective equipment (PPE) for protecting yourself from potential hazards in the environment in which you will work. Each process outlined in this manual may need different PPE to protect the service person. Use the proper PPE for the task at hand.

Tools...

All tools should be in proper working order. Do not use tools that are broken or in disrepair. Use the proper tool for the proper application.

Lifts, Hoists, and Jacks...

All lifts, hoists, and jacks should be used in accordance with the manufacturer information. Inspect lifts, hoists, and jacks prior to use. Do not overload lifts, hoists, and jacks. Do not work under a suspended load. Ensure chock blocks are used on equipment that can move. Use lifts or jacks and jack stands that are rated to support the total weight of the machine and any attachments. Do not rely on jacks to support the machine. If you are unsure of the operation of any lifts, hoists, and jacks do not use.

Fire Extinguishers...

Think Safety First (continued)

The proper class of fire extinguisher should be used in case of fire.

Class A extinguishers are for ordinary combustible materials such as paper, wood, cardboard, and most plastics. The numerical rating on these types of extinguishers indicates the amount of water it holds and the amount of fire it can extinguish. Geometric symbol (green triangle).

Class B fires involve flammable or combustible liquids such as gasoline, kerosene, grease and oil. The numerical rating for class B extinguishers indicates the approximate number of square feet of fire it can extinguish. Geometric symbol (red square).

Class C fires involve electrical equipment, such as appliances, wiring, circuit breakers and outlets. Never use water to extinguish class C fires - the risk of electrical shock is far too great! Class C extinguishers do not have a numerical rating. The C classification means the extinguishing agent is non-conductive. Geometric symbol (blue circle).

ABC fire extinguishers are a dry chemical type used for multiple purposes. See above information for description. Ensure fire extinguishers are serviceable and replace any that are discharged or out of inspection dates



Specifications and Maintenance

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Specifications

Configuration	2000 Series		
Model	74490	74491	74492
Engine	Toro		
Engine Type	Toro V-Twin 708CC		
Engine Model	LCP77F		
High Idle	3600 ± 100 RPM		
Low Idle	1800 ± 150 RPM (Governor Set)		
Spark Plug	Champion: RN9YC/NGK: BPR6ES		
Oil Capacity	2.4 L (80 oz.) with filter change		
CARB	No		
EPA	Yes		
Fuel Capacity	26.5 L (7 gallons)		
Battery	12 volt - 300 CCA		
Hydraulic Drive System			
Transmission	ZT3400		
Transmission Lubricant	4.45 L (150 oz.) Toro® HYPR-OIL™ 500 hydraulic fluid or Mobil 1 15W-50 oil		
Max Ground Speed (FWD)	Up to 10 mph		
Rear Tires	24 x 9.5 - 12		
Rear Tire Pressure	13 psi		
Front Caster Tires	13 x 6.5 - 6, Cage Bearing		
Front Tire Pressure	13 psi		
Mower Deck			
Deck Width	121.9 cm (48 inches)	132.1 cm (52 inches)	152.4 cm (60 inches)
Deck Configuration	5.0 inch Deep Turbo Force Deck, Side Discharge		
Deck Spindles	8 inch Aluminum with Sealed Ball Bearings, 1 inch Shaft		
Blade Tip Speed	18,500 FPS	15,500 FPS	
Cutting Height	3.81-12.7 cm; 0.63 cm increments (1.5 - 5 inches; 0.25 inch increments)		

Configuration	2000 Series	
Model	74493	74494
Engine	Toro	
Engine Type	Toro V-Twin 708CC	
Engine Model	LCP77F	
High Idle	3600 ± 100 RPM	
Low Idle	1800 ± 150 RPM (Governor Set)	
Spark Plug	Champion: RN9YC/NGK: BPR6ES	
Oil Capacity	2.4 L (80 oz.) with filter change	
CARB	No	
EPA	Yes	
Fuel Capacity	26.5 L (7 gallons)	
Battery	12 volt - 300 CCA	
Hydraulic Drive System		
Transmission	ZT3800	
Transmission Lubricant	4.45 L (150 oz.) Toro® HYPR-OIL™ 500 hydraulic fluid or Mobil 1 15W-50 oil	
Max Ground Speed (FWD)	Up to 11 mph	
Rear Tires	24 x 9.5 – 12	24 x 12 – 12
Rear Tire Pressure	13 psi	
Front Caster Tires	13 x 6.5 - 6, Cage Bearing	
Front Tire Pressure	13 psi	
Mower Deck		
Deck Width	132.1 cm (52 inches)	152.4 cm (60 inches)
Deck Configuration	5.0 inch Deep Turbo Force Deck, Side Discharge	
Deck Spindles	8 inch Aluminum with Sealed Ball Bearings, 1 inch Shaft	
Blade Tip Speed	18,500 FPS	
Cutting Height	3.81-12.7 cm; 0.63 cm increments (1.5 - 5 inches; 0.25 inch increments)	

Configuration	2000 Series		
Model	74495	74496	74497
Engine	Kawasaki		
Engine Type	Kawasaki FX 726CC		
Engine Model	FX730V		
High Idle	3750 ± 50 RPM		
Low Idle	1550 (Governor Set)		
Spark Plug	NGK: BPR6ES		
Oil Capacity	2.1 L (71 oz.) with filter change		
CARB	Yes		
EPA	Yes		
Fuel Capacity	26.5 L (7 gallons)		
Battery	12 volt - 300 CCA		
Hydraulic Drive System			
Transmission	ZT3400		ZT3800
Transmission Lubricant	4.45 L (150 oz.) Toro® HYPR-OIL™ 500 hydraulic fluid or Mobil 1 15W-50 oil		
Max Ground Speed (FWD)	Up to 10 mph		
Rear Tires	24 x 9.5 - 12		24 x 24 - 12
Rear Tire Pressure	13 psi		semi-pneumatic caster tires
Front Caster Tires	13 x 6.5 - 6, Cage Bearing		
Front Tire Pressure	13 psi		
Mower Deck			
Deck Width	121.9 cm (48 inches)		152.4 (60 inches)
Deck Configuration	5.0 inch Deep Turbo Force Deck, Side Discharge		
Deck Spindles	8 inch Aluminum with Sealed Ball Bearings, 1 inch Shaft		
Blade Tip Speed	18,500 FPS		
Cutting Height	3.81-12.7 cm; 0.63 cm increments (1.5 - 5.5 inches; 0.25 inch increments)		

Torque Specifications

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

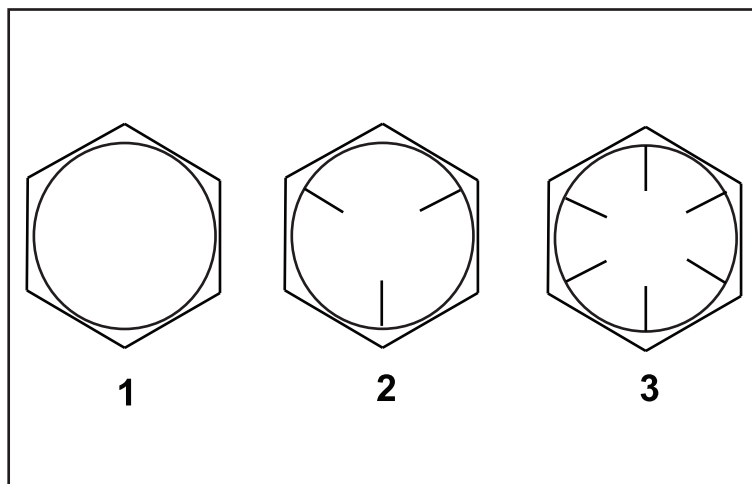
These torque specifications for the installation and tightening of fasteners shall apply for all fasteners which do not have a specific requirement identified in the service manual. The following factors shall be considered when applying torque: cleanliness of the fastener, use of a thread sealant (Loctite),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

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

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

Fastener Identification

Inch Series Bolts and Screws

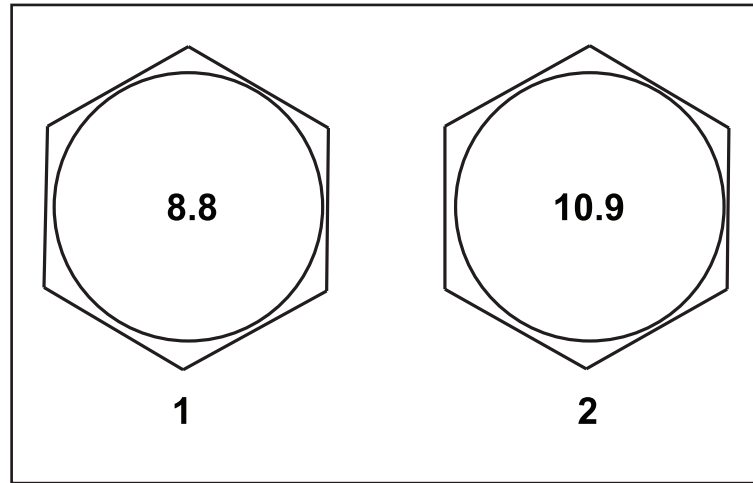


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Figure 1

- | | |
|------------|------------|
| 1. Grade 1 | 3. Grade 8 |
| 2. Grade 5 | |

Metric Bolts and Screws



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Figure 2

1. Class 8.8

2. Class 10.9

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

Thread Size	Grade 1, 5, & 8 Fasteners with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE Grade 2 or Better Nut)		SAE Grade 5 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE Grade 5 or Better Nut)		SAE Grade 8 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE Grade 8 or Better Nut)	
		in-lb	in-lb	N • cm	in-lb	N • cm	in-lb
#6-32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	169 ± 23	23 ± 3	260 ± 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 oil, graphite, or thread sealant such as Loctite.

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.

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 nuts include jam nuts.

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

Thread Size	Class 8.8 Bolts, Screws, Studs with Regular Height Nuts (Class 8 or Stronger Nuts)		Class 10.9 Bolts, Screws, Studs with Regular Height Nuts (Class 10 or stronger Nuts)	
	in-lb	N • cm	in-lb	N • cm
M5 X 0.8	57 ± 6	644 ± 68	78 ± 8	881 ± 90
M6 X 1.0	96 ± 10	1085 ± 113	133 ± 14	1503 ± 158
	ft-lb	N • m	ft-lb	N • m
M8 X 1.25	19 ± 2	26 ± 3	28 ± 3	38 ± 4
M10 X 1.5	38 ± 4	52 ± 5	54 ± 6	73 ± 8
M12 X 1.75	66 ± 7	90 ± 10	93 ± 10	126 ± 14
M16 X 2.0	166 ± 17	255 ± 23	229 ± 23	310 ± 31
M20 X 2.5	325 ± 33	440 ± 45	450 ± 46	610 ± 62

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 oil, graphite, or thread sealant such as Loctite.

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.

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. Thin height nuts include jam nuts.

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
1/2 - 13 UNC	75 ± 15 ft-lb	50 ± 10 ft-lb
3/8 - 16 UNC	35 ± 10 ft-lb	18 ± 3 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

*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

$$\text{in-lb} \times 11.2985 = \text{N} \cdot \text{cm}$$

$$\text{ft-lb} \times 1.3558 = \text{N} \cdot \text{m}$$

$$\text{N} \cdot \text{cm} \times 0.08851 = \text{in-lb}$$

$$\text{N} \cdot \text{cm} \times 0.73776 = \text{ft-lb}$$

Thread Cutting Screws (Zinc Plated Steel)

Threads 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.

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	16/32	0.53125	13.484
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
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	11/64	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	7.541	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	Grams	28.3495
Pressure	Pounds/Square Inch	Kilopascal	6.895
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 Flows	Gallons/Minute	Liters/Minute	3.785
Temperature	Fahrenheit	Celsius	1. Subtract by 32°
			2. Multiply by 5/9



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General Troubleshooting 3-3

GEARS

The Systematic approach to defining, diagnosing and solving problems.



G

Gather Information

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



E

Evaluate Potential Causes

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



A

Assess Performance

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



R

Repair

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



S

Solution Confirmation

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

General Troubleshooting

Problem	Possible Cause	Corrective Action
The starter does not crank	The blade control switch (PTO) is engaged.	Move the blade-control switch (PTO) to the disengaged position.
	The parking brake is not engaged.	Set the parking brake.
	The motion-control levers are not in the Neutral-Lock position.	Ensure that the motion-control levers are in the Neutral-Lock position.
	The operator is not seated.	Sit on the seat.
	The battery is dead.	Charge the battery.
	The electrical connections are corroded or loose.	Check the electrical connects for good contact.
	The fuse is blown.	Replace the fuse.
	The relay or switch is worn or damaged.	Test and replace faulty relay or switch.
The engine does not start, starts hard, or fails to keep running	The fuel tank is empty.	Fill the fuel tank.
	The fuel shut-off valve is closed.	Open the fuel shut-off valve.
	The oil level in the crankcase is low.	Add oil to the crankcase.
	The throttle is not in the correct position.	Be sure that the throttle control is midway between the slow and fast positions.
	There is dirt in the fuel filter.	Replace the fuel filter.
	There is dirt, water, or stale fuel in the fuel system.	Clean and flush the fuel system.
	The air cleaner is dirty.	Clean or replace the air cleaner element.
	The seat switch is not functioning properly.	Check the seat-switch indicator. Replace the seat if necessary.
	The electrical connections are corroded, loose, or damaged.	Check the electrical connections for good contact. Clean the connector terminals thoroughly with electrical-contact cleaner, apply dielectric grease, and make the appropriate connections.
	The relay or switch is worn or damaged.	Test and replace faulty relay or switch.
	The spark plug is fouled or improperly gapped.	Adjust or replace the spark plug.
The spark plug wire is not connected.	Check the spark plug wire connection.	
Engine loses power	The engine load is excessive.	Reduce the ground speed.
	The air cleaner is dirty.	Clean the air cleaner element.
	The oil level in the crankcase is low.	Add oil to the crankcase.
	The cooling fins and air passages above the engine are plugged.	Remove the obstruction and thoroughly clean cooling fins and the air passages.
	The vent hole in the fuel cap is plugged.	Clean or replace the fuel cap.
	There is dirt in the fuel filter.	Replace the fuel filter.
	There is dirt, water, or stale fuel in the fuel system.	Clean and flush the fuel system.

General Troubleshooting (continued)

Problem	Possible Cause	Corrective Action
The engine overheats	The engine load is excessive.	Reduce the ground speed.
	The oil level in the crankcase is low.	Add oil to the crankcase.
	The cooling fins and the air passages above the engine are plugged.	Remove the obstruction and thoroughly clean cooling fins and the air passages.
The mower pulls to the left or right (with levers fully forward)	The tracking needs adjustment.	Adjust the tracking.
	The tire pressure in the drive tires is not correct.	Adjust the tire pressure in the drive tires.
The machine does not drive	The bypass valves are not closed tight.	Tighten the bypass valves.
	The pump belt is worn, loose or broken.	Change the belt.
	The pump belt is off a pulley.	Change the belt.
	The idler spring is broken or missing.	Replace the spring.
	The hydraulic oil level is low or too hot.	Add hydraulic oil to the reservoirs or let it cool down.
The machine vibrates abnormally	The cutting blade(s) is/are bent or unbalanced.	Install new cutting blade(s).
	The blade mounting bolt is loose.	Tighten the blade mounting bolt.
	The engine mounting bolts are loose.	Tighten the engine mounting bolts.
	The engine pulley, idler pulley, or blade pulley is loose.	Tighten the appropriate pulley, check to make sure idler springs are not over stretched.
	The engine pulley is damaged.	Replace the engine pulley.
	The blade spindle is bent.	Replace the spindle.
	The motor mount is loose or worn.	Check the mounting bolts.
The machine produces an uneven cutting height	The blade(s) is/are not sharp.	Sharpen the blade(s).
	The cutting blade(s) is/are bent.	Install new cutting blade(s).
	The mower deck is not level.	Level the mower deck from side-to-side and front-to-rear.
	The underside of mower is dirty.	Clean the underside of the mower.
	The tire pressure is not correct.	Adjust the tire pressure.
	The blade spindle is bent.	Replace the spindle.
The blades do not rotate	The mower deck belt is damaged, worn, loose, or broken.	Install a new deck belt.
	The mower deck belt is off the pulley.	Install the mower belt on the deck pulley and check the idler pulley, idler arm, and spring for correct position and function.
	The pump drive belt is worn, loose or broken.	Check the belt tension or install a new belt.
	The idler spring is broken or missing.	Replace the spring.

General Troubleshooting (continued)

Problem	Possible Cause	Corrective Action
The clutch does not engage	The fuse is blown.	Replace the fuse. Check the coil resistance, battery charge, charging system, and wiring connections, and replace components if necessary.
	There is a low voltage supply at the clutch.	Check the coil resistance, battery charge, charging system, and wiring connections and replace parts if necessary.
	The coil is damaged.	Replace the clutch.
	There is inadequate current supply.	Repair or replace the clutch lead wire or electrical system. Clean the connector contacts.
	The rotor/armature air gap is too large.	Remove the shim or replace the clutch.



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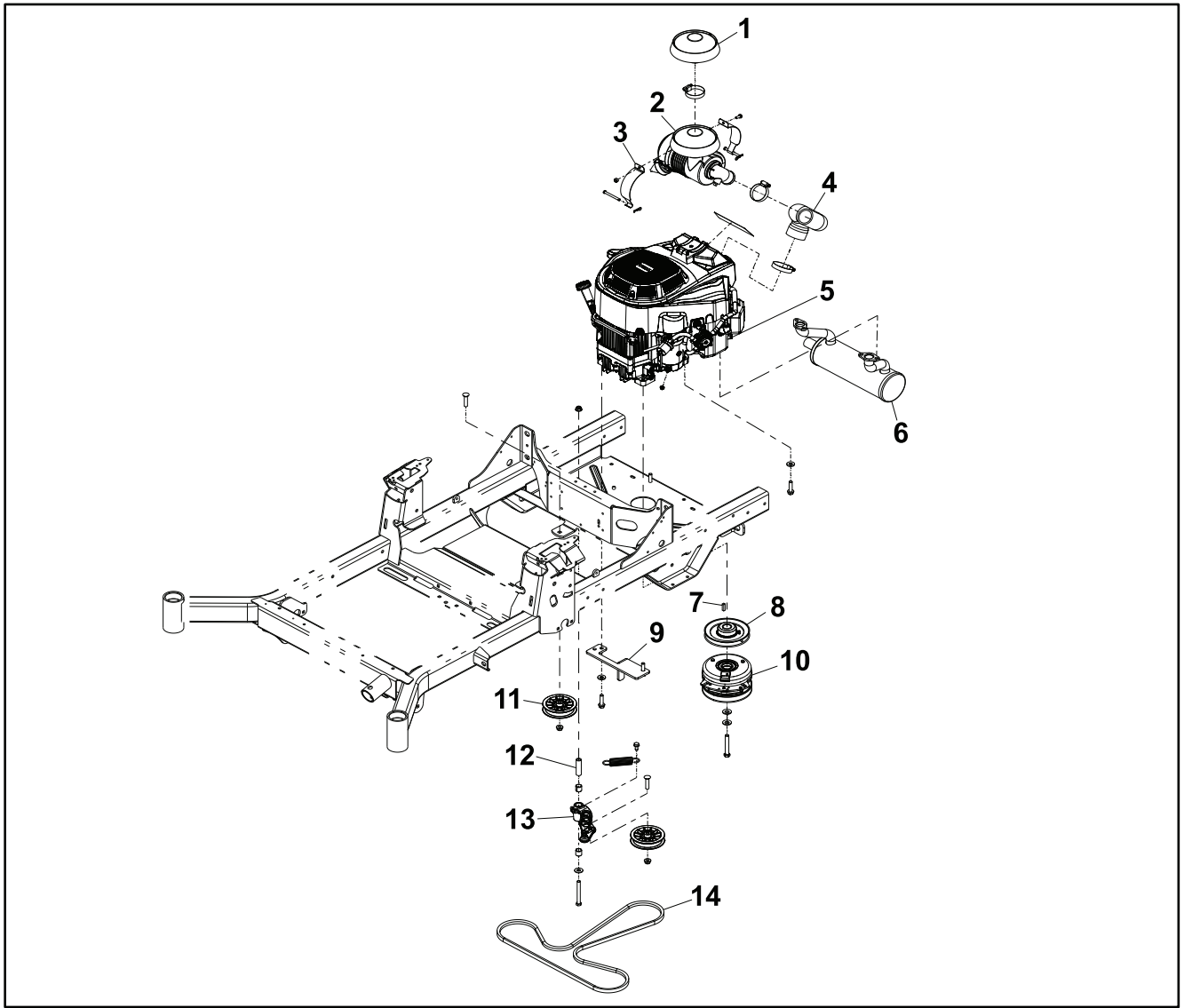
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Kawasaki Engine Replacement	4-9

General Information

The 2000 Z MASTER® series of mowers use the 708cc V-Twin as well as the 726cc Kawasaki V-Twin. Either selection is a 4 Cycle, OHV 90° carburetor engine. All engine selections utilize a heavy duty air cleaner.

Service and Repairs

Toro Engine Assembly

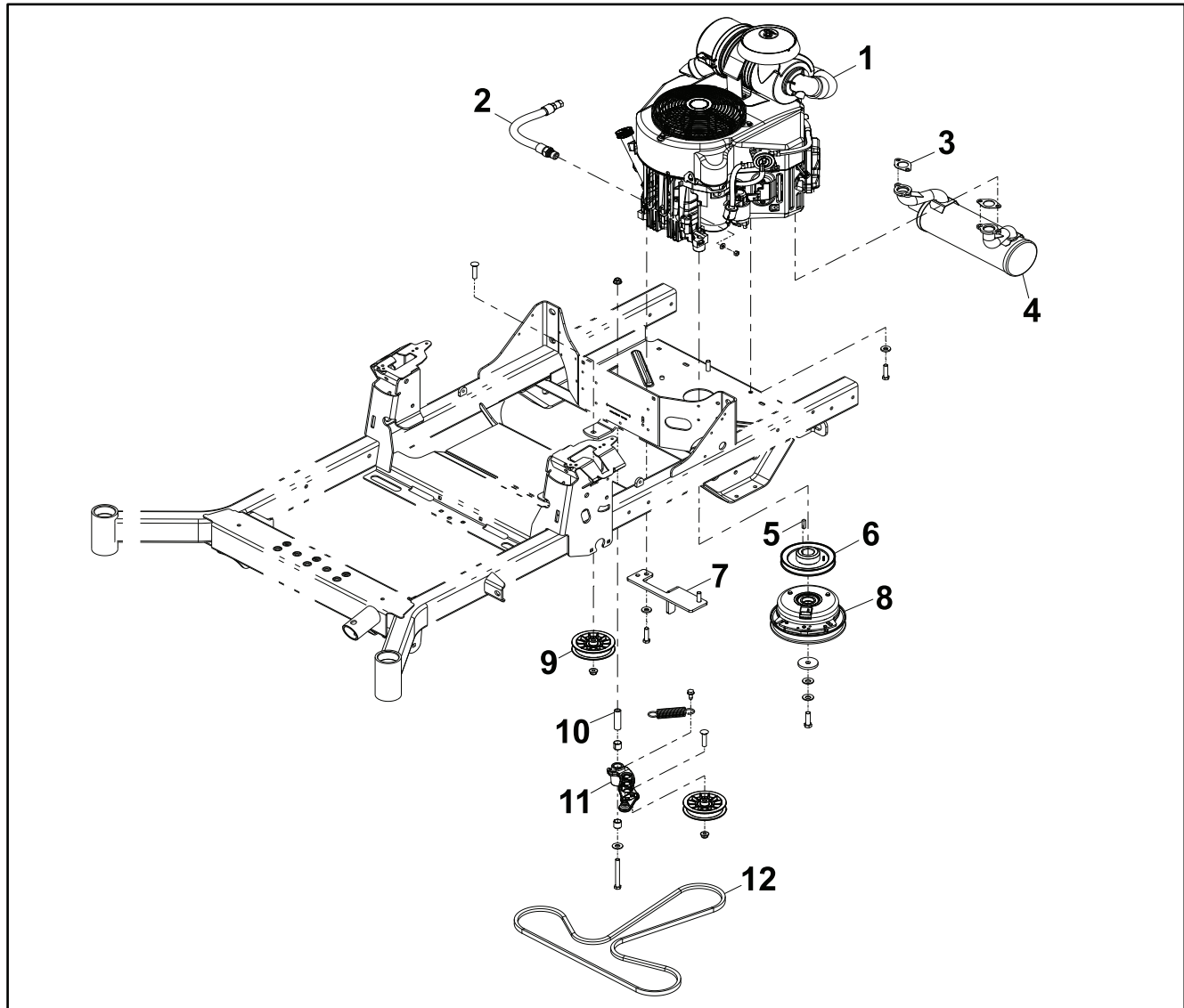


g337394

Figure 3

- | | |
|-----------------------|-------------------------|
| 1. Rain Cap Kit | 8. Engine Sheave |
| 2. Air Cleaner Asm | 9. Clutch Anchor |
| 3. Air Canister Strap | 10. PTO Clutch |
| 4. Intake Hose | 11. Flat Idler Pulley |
| 5. 2P77F—HD Engine | 12. Idler Pivot Bushing |
| 6. Muffler | 13. Idler Arm Asm |
| 7. Key | 14. V-Belt |

Kawasaki Engine Assembly



g337393

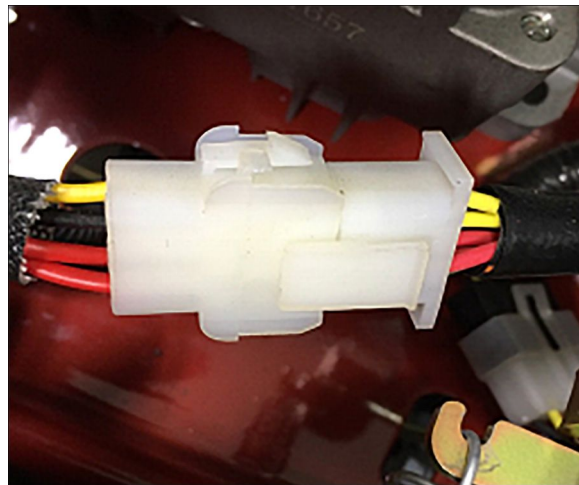
Figure 4

- | | |
|------------------------------|-------------------------|
| 1. Kawasaki Engine | 7. Clutch Anchor |
| 2. Engine Oil Drain Hose Asm | 8. Clutch |
| 3. Exhaust Gasket | 9. Flat Idler Pulley |
| 4. Muffler | 10. Idler Pivot Bushing |
| 5. Key | 11. Idler Arm Asm |
| 6. Sheave | 12. V-Belt |

Toro Twin Cylinder Engine Replacement

Toro Twin Cylinder Engine Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Close the fuel supply valve.
4. Remove the engine guard.
5. Remove the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
6. Remove the hydrostatic drive belt from the engine pulley. [Hydrostatic Drive Belt Replacement \(page 7–8\)](#)
7. Disconnect the chassis wire harness from the main engine wire harness.



g335893

Figure 5

-
8. Disconnect the red (B+) wire from the starter.

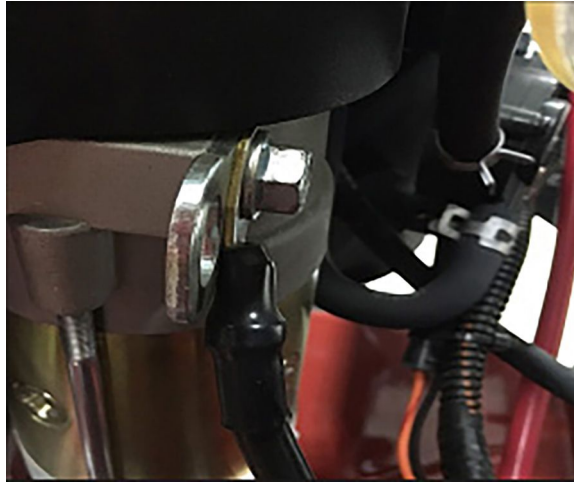


g335895

Figure 6

-
9. Disconnect the black engine ground wire.

Toro Twin Cylinder Engine Removal (continued)



g335899

Figure 7

-
10. Disconnect the fuel supply line at the fuel filter.



g335900

Figure 8

-
11. Disconnect the throttle cable. [Throttle Cable Assembly Replacement \(page 5-20\)](#)
 12. Disconnect the choke cable. [Choke Control Assembly Replacement \(page 5-22\)](#)
 13. Disconnect the clutch wire from the clutch.
 14. Remove the clutch mounting bolt and washers. Slip the clutch off of the crankshaft.
Note: Before removing the clutch, note the orientation of the clutch wire and the clutch.
 15. Remove the engine pulley. Save the square key securing the pulley to the crankshaft.
 16. Remove the 4 engine mounting bolts.
Note: Before removing the engine mounting bolts, note the orientation of the clutch anchor. The clutch wire can remain attached to the clutch anchor.
 17. Lift the engine away from the frame.

Toro Twin Cylinder Engine Installation

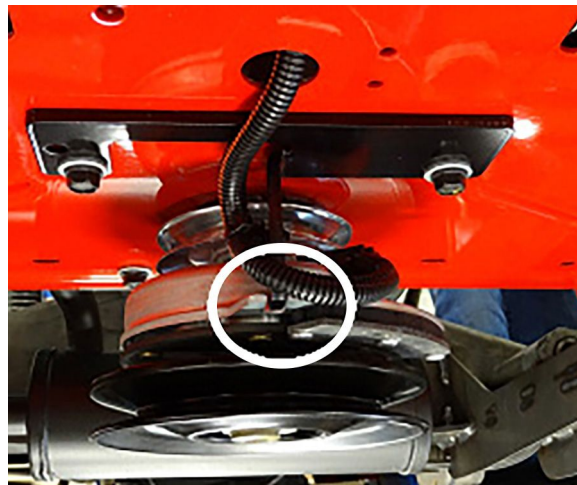
1. Prepare the frame and secure any fuel lines or wire harness components.
2. Install the muffler and 2 new exhaust gaskets.
3. Install the muffler nuts. Torque the muffler nuts to 16–18 N • m (12 ± 14 ft-lb).
4. Lower the engine onto the frame.
5. Align the four holes of the engine base to the frame. Install the rear mounting bolts and Belleville washers loosely.
6. Install the 2 front bolts and Belleville washers through the clutch anchor and into the engine base.



7. Torque the 4 engine mounting bolts to 36-45 N • m (30 ± 3 ft-lb).
8. Install the key and engine pulley onto the crankshaft.

Note: Install the engine pulley with smaller diameter hub toward the engine.

9. Install the clutch onto the crankshaft ensuring that the slot in the clutch aligns with the tab on the clutch anchor.



g337829

Figure 9



10. Install the 2 spring washers and the clutch bolt. Torque the clutch bolt to 66-83 N • m (55 ± 6 ft-lb).
11. Install the hydrostatic drive belt onto the engine pulley. [Hydrostatic Drive Belt Replacement \(page 7–8\)](#)
12. Install the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
13. Connect the clutch wire.
14. Connect the choke cable. [Choke Control Assembly Replacement \(page 5–22\)](#)
15. Connect the throttle cable. [Throttle Cable Assembly Replacement \(page 5–20\)](#)
16. Connect the black engine ground wire.

Toro Twin Cylinder Engine Installation (continued)



g335899

Figure 10

17. Connect the red (B+) wire to the starter.

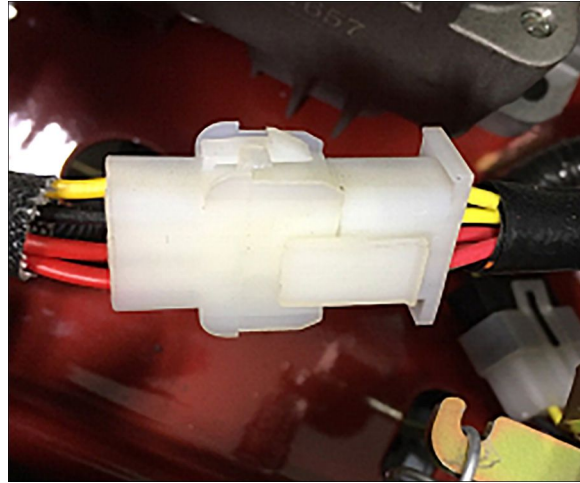


g335895

Figure 11

18. Connect the chassis wire harness to the main engine wire harness.

Toro Twin Cylinder Engine Installation (continued)



g335893

Figure 12

19. Connect the fuel supply line to the fuel filter.
20. Install the engine guard.
21. Open the fuel supply valve.
22. Fill the crankcase with approved oil and verify proper oil level.
23. Connect the battery by installing the positive cable first, then the negative cable to the battery.
24. Verify proper function of the unit.

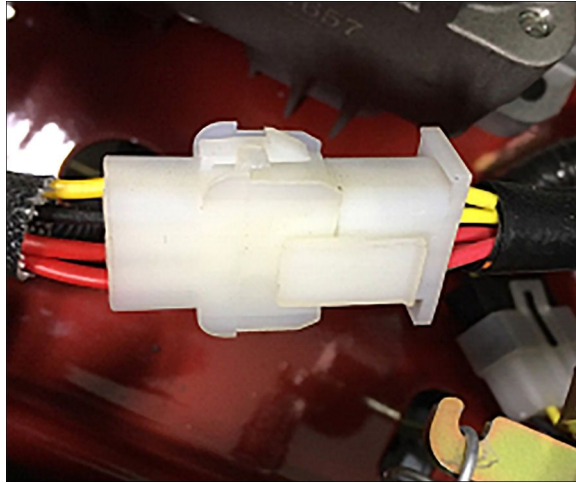
Note: Verify engine speed is set to 3600 ± 50 RPM (or 3000 ± 50 RPM for TE models).

Kawasaki Engine Replacement

Kawasaki Engine Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Close the fuel supply valve.
4. Remove the engine guard.
5. Remove the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
6. Remove the hydrostatic drive belt from the engine pulley. [Hydrostatic Drive Belt Replacement \(page 7–8\)](#)
7. Disconnect the chassis wire harness from the main engine wire harness.

Kawasaki Engine Removal (continued)



g335893

Figure 13

-
8. Disconnect the red (B+) wire from the starter.



g335895

Figure 14

-
9. Disconnect the black engine ground wire.

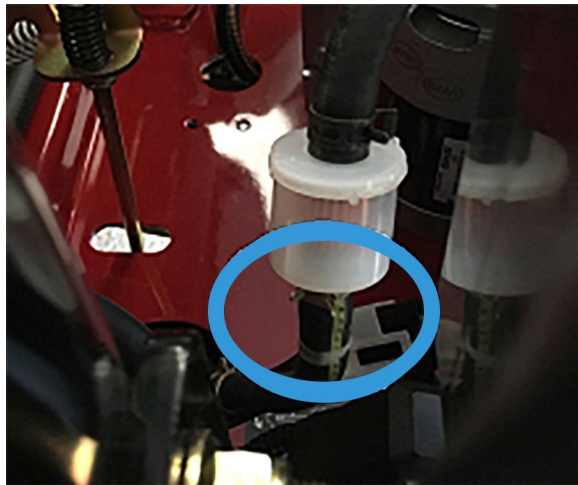
Kawasaki Engine Removal (continued)



g335899

Figure 15

-
10. Disconnect the fuel supply line at the fuel filter.



g337830

Figure 16

-
11. Disconnect the throttle cable. [Throttle Cable Assembly Replacement \(page 5-20\)](#)
 12. Disconnect the choke cable. [Choke Control Assembly Replacement \(page 5-22\)](#)
 13. Disconnect the clutch wire from the clutch.
 14. Remove the clutch mounting bolt and washers. Slip the clutch off of the crankshaft.
Note: Before removing the clutch, note the orientation of the clutch wire and the clutch.
 15. Remove the engine pulley. Save the square key securing the pulley to the crankshaft.
 16. Remove the 4 engine mounting bolts.
Note: Before removing the engine mounting bolts, note the orientation of the clutch anchor. The clutch wire can remain attached to the clutch anchor.
 17. Lift the engine away from the frame.

Kawasaki Engine Installation



1. Prepare the frame and secure any fuel lines or wire harness components.
2. Install the muffler and new exhaust gaskets. Torque the muffler mounting bolts or nuts to 16-19 N • m (13 ft-lb).



3. Install the oil drain hose assembly. Torque oil drain hose (at engine block) to 31-40 N • m (26 ± 3 ft-lb).

4. Lower the engine onto the frame.
5. Align the four holes of the engine base to the frame. Install the 2 rear mounting bolts and Belleville washers loosely.
6. Attach the front 2 bolts and Belleville washers through the clutch anchor and into the engine block.



7. Torque the 4 engine mounting bolts to 36-45 N • m (30 ± 3 ft-lb).

8. Install the key and engine pulley onto the crankshaft.

Note: Install the engine pulley with smaller diameter hub toward the engine.

9. Install the clutch onto the crankshaft ensuring that the slot in the clutch aligns with the tab on the clutch anchor.



10. Install the 2 spring washers and the clutch bolt. Torque the clutch bolt to 66-83 N • m (55 ± 6 ft-lb).

11. Install the hydrostatic drive belt. [Hydrostatic Drive Belt Replacement \(page 7-8\)](#)

12. Install the mower belt. [Mower Belt Replacement \(page 6-6\)](#)

13. Connect the clutch wire to the clutch.

14. Connect the choke cable. [Choke Control Assembly Replacement \(page 5-22\)](#)

15. Connect the throttle cable. [Throttle Cable Assembly Replacement \(page 5-20\)](#)

16. Connect the black engine wire.



17. Connect the red (B+) wire from starter. Torque nut on starter relay to 3-4 N • m (32 ± 3 in-lb).

18. Connect the chassis wire harness to the main engine wire harness.

19. Connect the fuel supply line to the fuel filter.

20. Install the engine guard.

21. Open the fuel supply valve.

22. Fill crankcase with approved oil and verify proper oil level.

23. Connect the battery by installing the positive cable first, then the negative cable to the battery.

24. Verify proper function of the unit. Verify engine RPM is set to 3750 ± 50 RPM.



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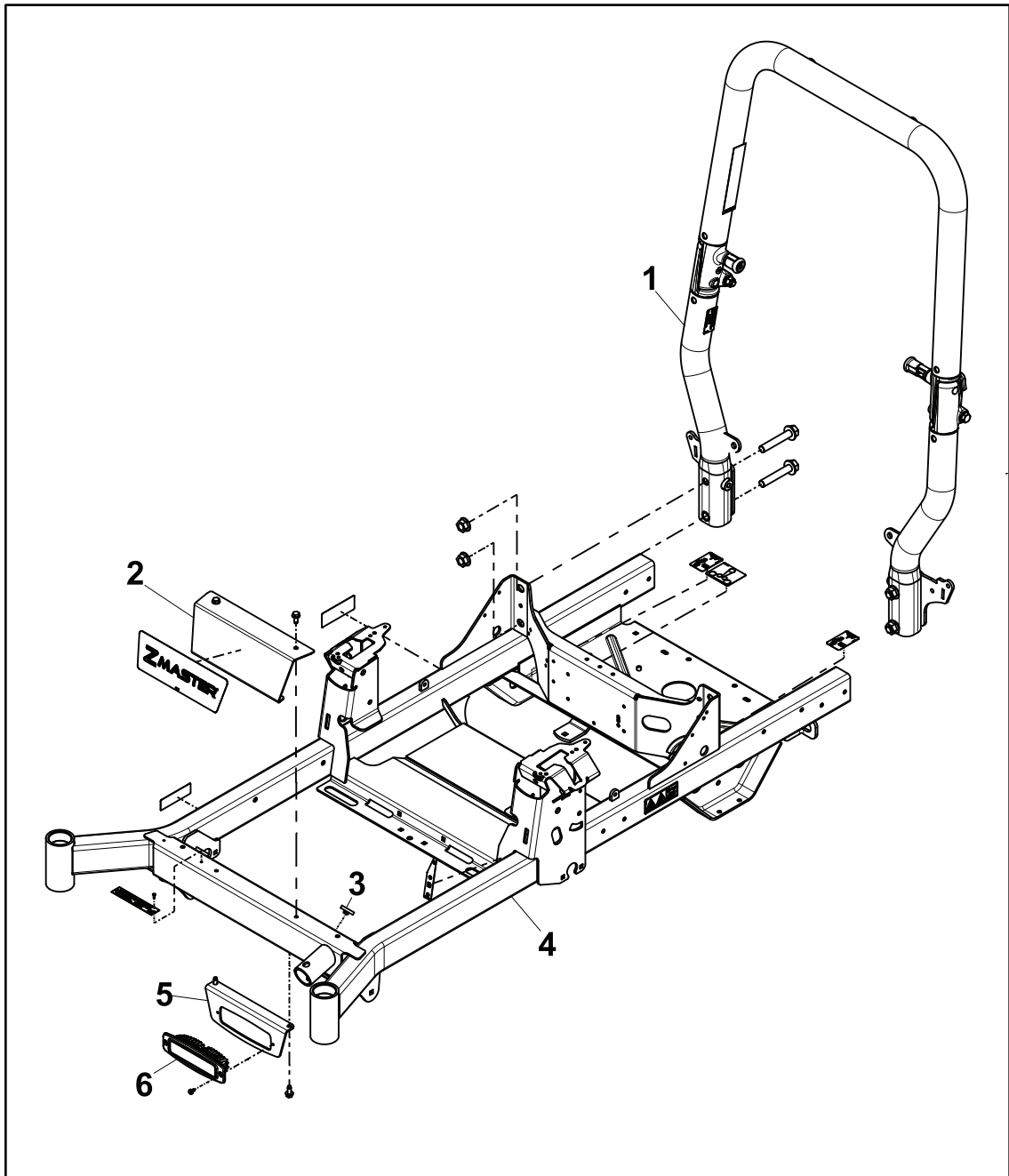
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General Information

The 2000 Z MASTER® series of mowers use a one-piece fully welded frame. All models use a foldable ROPS system.

Service and Repairs

Chassis Assembly 1

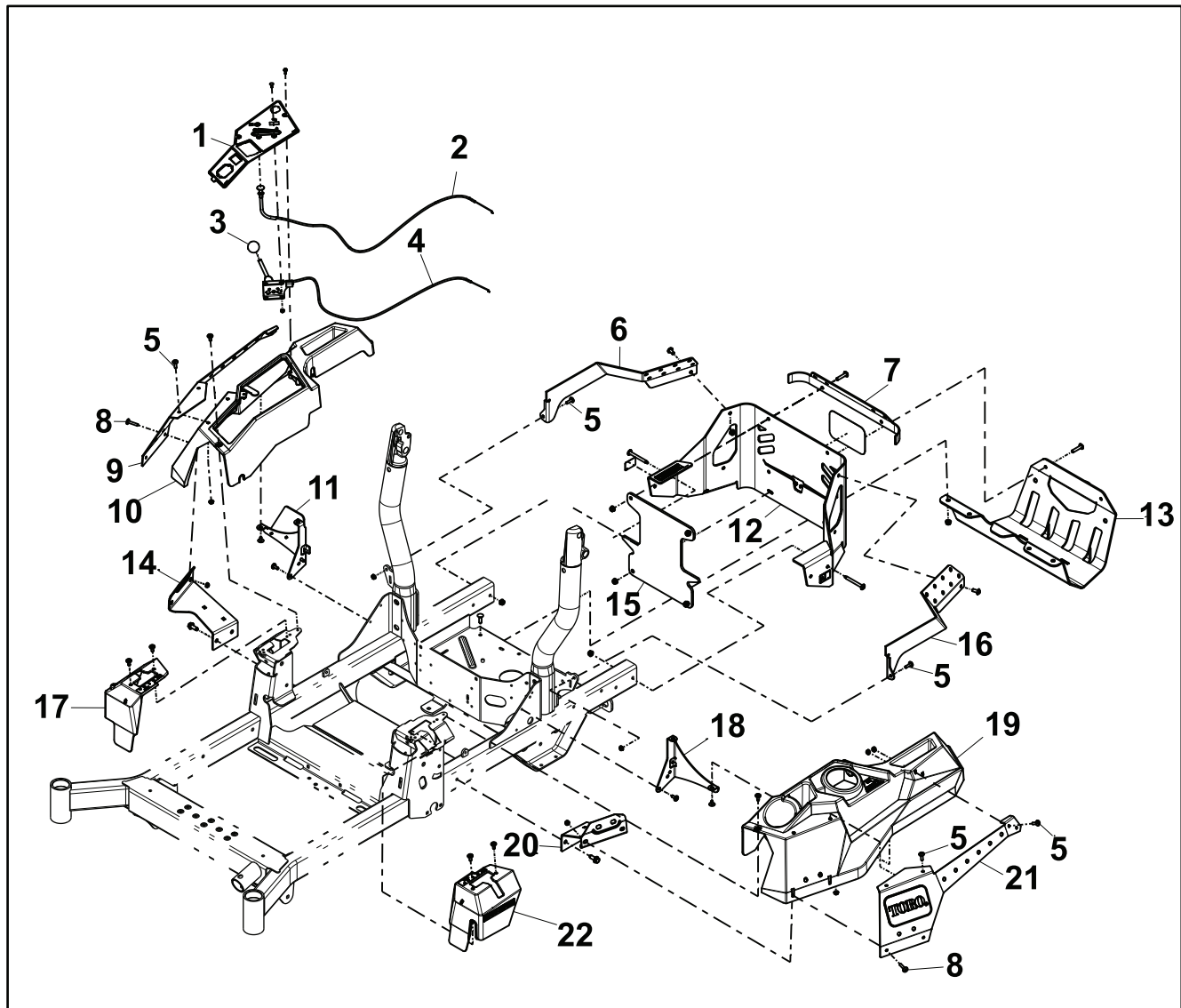


g335781

Figure 17

- | | |
|---------------------|-----------------------------|
| 1. Tapered ROPS Asm | 4. Suspension 60 inch Frame |
| 2. Front Plate | 5. Light Bracket |
| 3. Push-In Bumper | 6. Light Flush Mount |

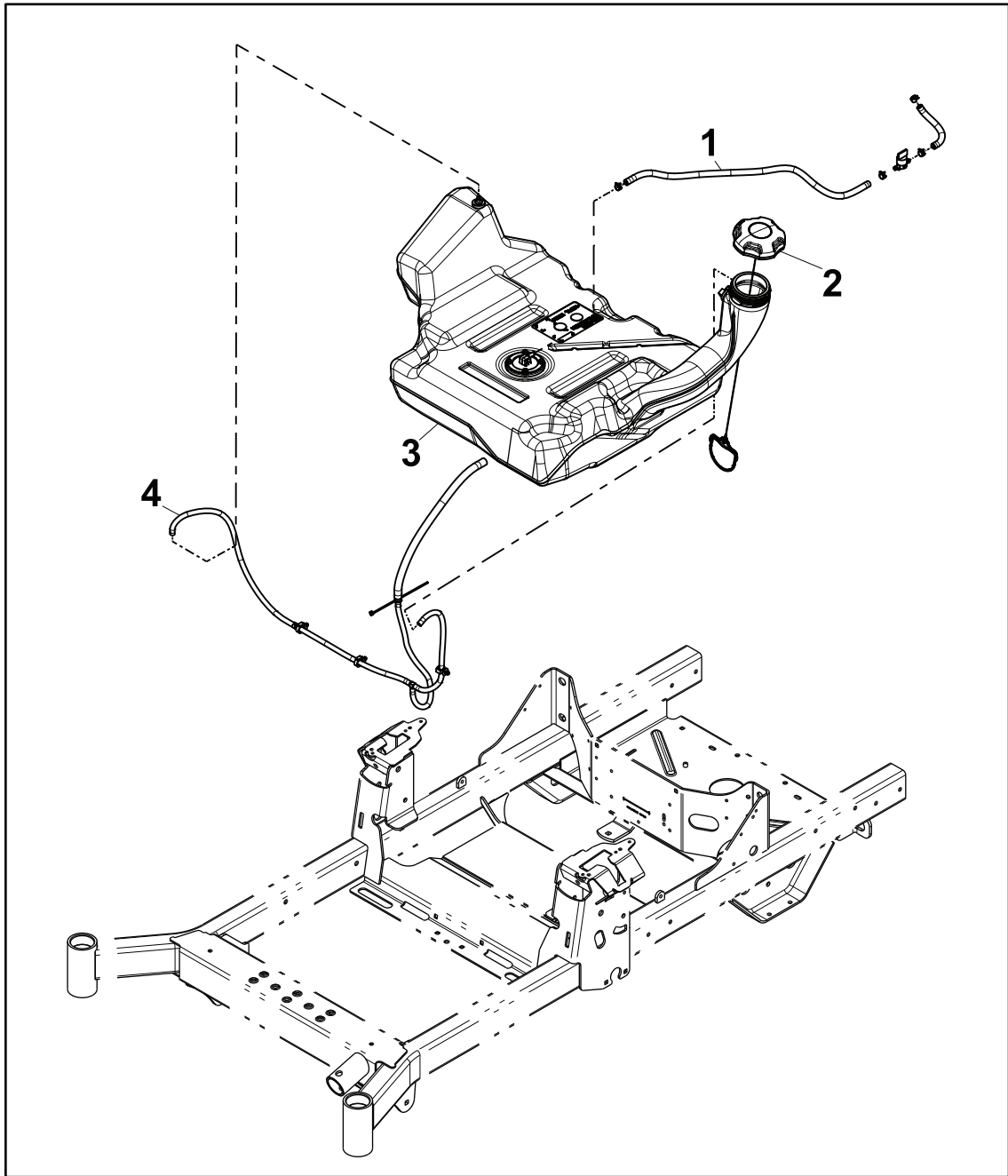
Chassis Assembly 2



g335763

Figure 18

- | | |
|---------------------------|-----------------------------|
| 1. Control Panel Asm | 11. RH Console Support |
| 2. Choke Control Cable | 12. Rear Guard Asm |
| 3. Ball Knob | 13. Muffler Guard |
| 4. Throttle Control Cable | 14. RH Pod Support Bracket |
| 5. Truss Screw | 15. Rear Weight |
| 6. RH Guard Bracket | 16. LH Guard Bracket |
| 7. Rear Upper Trim | 17. RH Motion Control Cover |
| 8. Truss Screw | 18. LH Console Bracket |
| 9. RH Pod Cover | 19. LH Console |
| 10. RH Console | 20. LH Pod Support Bracket |

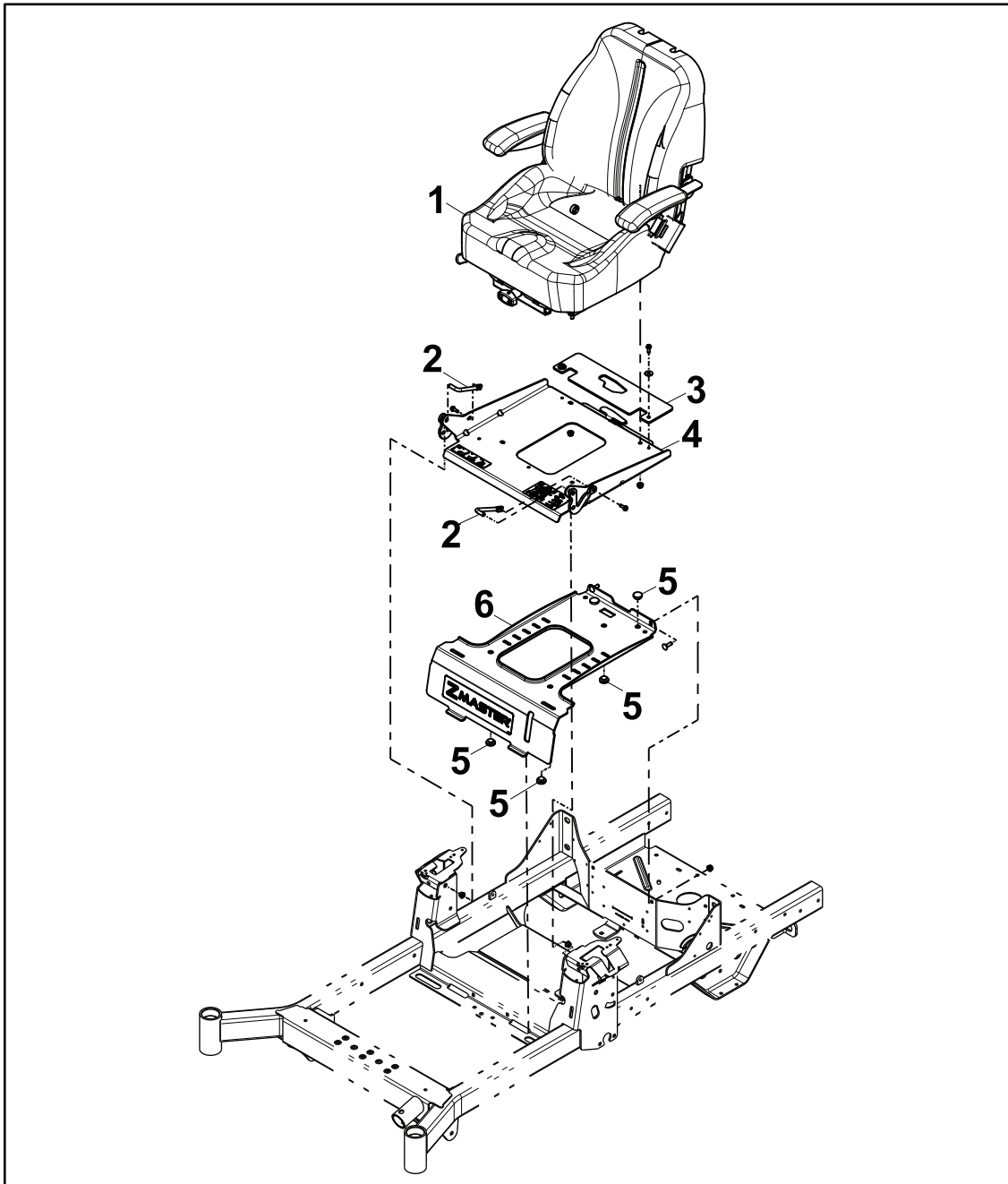


g335767

Figure 19

- 1. Fuel Hose Asm
- 2. Fuel Cap

- 3. Fuel Tank
- 4. Vent Hose Asm

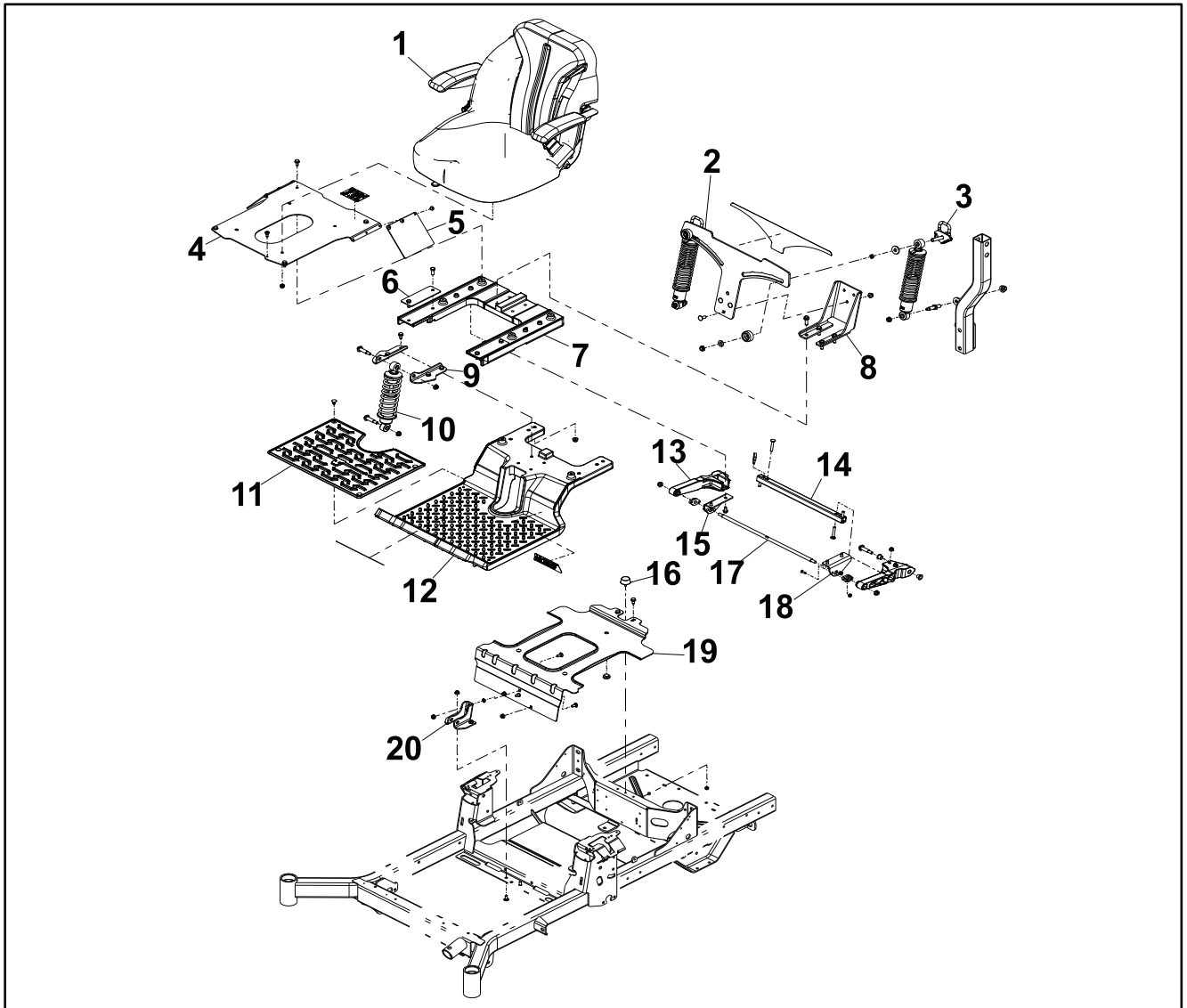


g335769

Figure 20

- | | |
|------------------------|---------------------------|
| 1. Suspension Seat Asm | 4. Seat Pan and Latch Asm |
| 2. Seat Pivot Pin | 5. Seat Bumper |
| 3. Rubber Seat Guard | 6. Tank Retainer Plate |

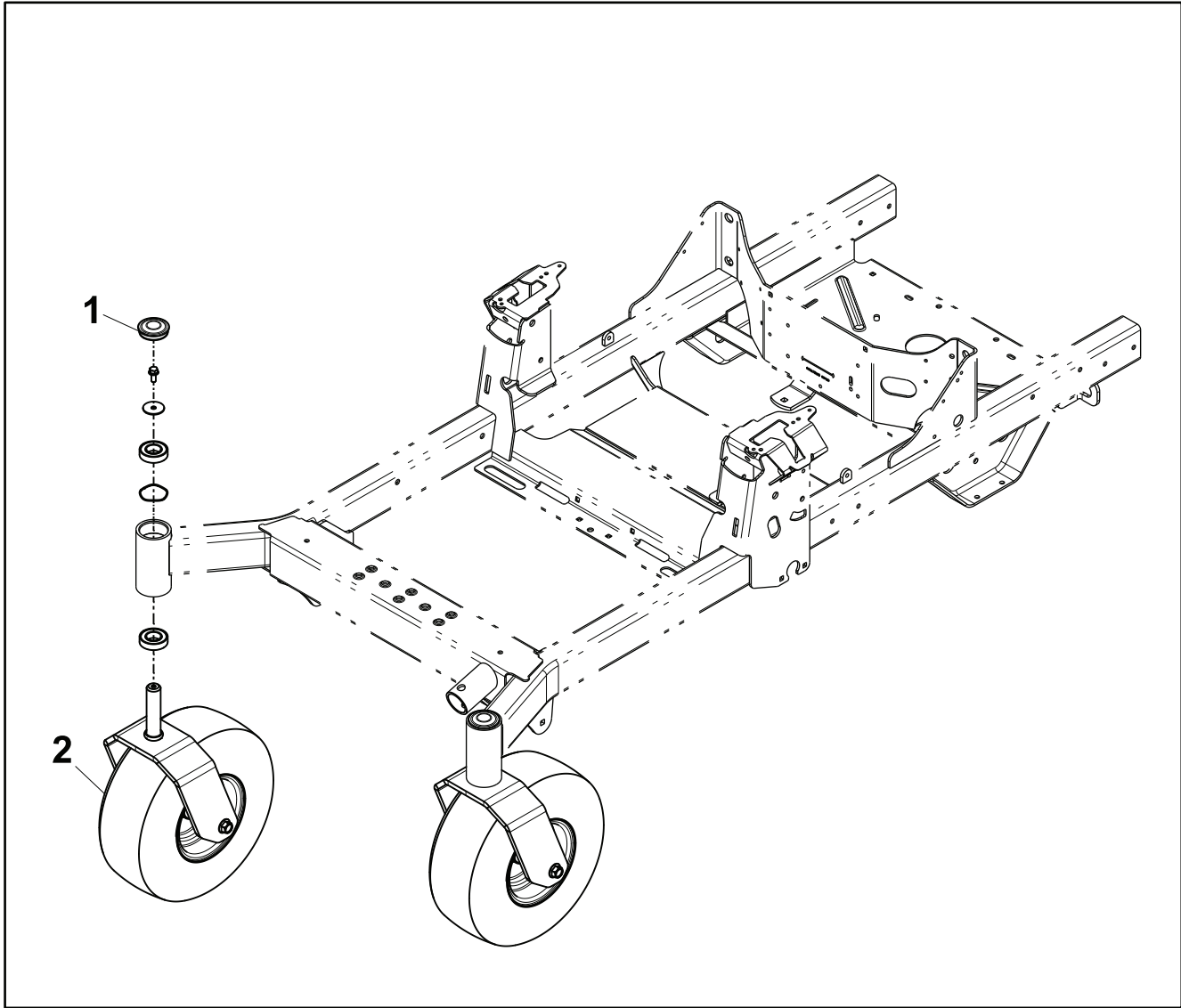
Chassis Assembly 5



g337405

Figure 21

- | | |
|---------------------------------|-------------------------------|
| 1. Fixed Seat | 11. Floor Mat |
| 2. Adj Mounting Platform | 12. Front Subframe |
| 3. Cam Lock Asm | 13. Trailing Arm |
| 4. Seat Plate | 14. Trailing Arm Tube |
| 5. Rubber Flap | 15. RH Trailing Arm Bracket |
| 6. Backer Plate | 16. Bumper |
| 7. Rear Subframe | 17. Pivot Rod |
| 8. Lower Mount Bracket | 18. LH Trailing Arm Bracket |
| 9. LH Upper Shock Mount Bracket | 19. Tank Bracket |
| 10. Shock Spring | 20. Lower Front Shock Bracket |



g335890

Figure 22

1. Grease Cap

2. Front Caster Asm

Caster Fork and Bearing Replacement

Caster Fork and Bearing Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop and remove the key. Engage the parking brake.
2. Raise and support the unit so that the front wheels are off the ground.
3. Remove the caster cap.
4. Support the underside of the caster wheel and remove the fastener screw securing the caster bearing assembly.
5. Remove the caster fork from the front axle. Inspect the caster fork shaft for wear or damage.
6. Remove the upper and lower bearings from the axle and inspect the inside of the axle bearing area for damage and excessive wear.

Caster Fork and Bearing Installation

1. Clean the surface inside the axle bearing area.
2. Install a new lower bearing from the bottom side into the axle, making sure it is fully seated. Press evenly on the inner and outer race to seat the bearing.
3. Install spring washer on the top side of the axle, followed by a new upper bearing, ensuring that the bearing is properly seated (the upper bearing should be floating in the housing and does not need to be pressed in place).

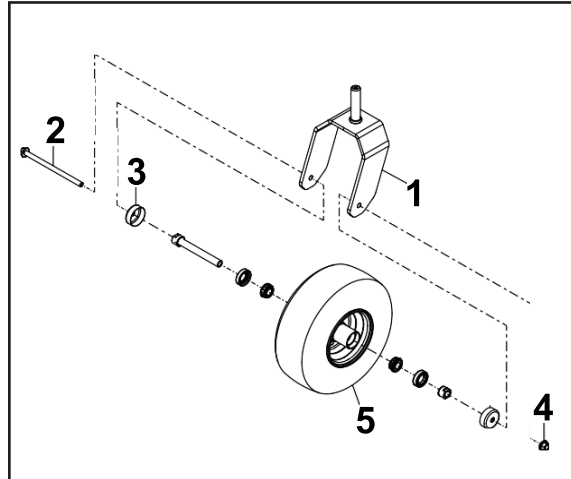
Note: The bearings are sealed and do not require grease/lubrication.

4. Install the flat washer on top of the bearing.
5. Install the fastener screw and tighten to the caster shaft. The spring washers will provide the appropriate preload to the bearings.
6. Lower the unit and verify proper function.

Note: The caster wheel is not serviceable and should be replaced as a complete assembly.

Caster Wheel Replacement

Caster Wheel Disassembly



g336095

Figure 23

- | | |
|----------------|-------------------|
| 1. Caster Fork | 4. Lock Nut |
| 2. Screw | 5. Wheel Assembly |
| 3. Seal Guard | |

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop and remove the key. Engage the parking brake.
2. Raise and support the unit so that the front wheels are off the ground.
3. Remove the caster wheel from the caster fork.
4. Remove the seal guards from the wheel hub.
5. Remove a spacer nut from the axle assembly.

Note: Thread locking adhesive has been applied to lock the spacer nuts to the axle.

6. Remove the axle from the wheel assembly with the second spacer nut still attached.
7. Pry out the seals and remove the bearings.
8. Inspect the bearings for wear or damage and replace if necessary.

Note: Bearing seals must be replaced after removal. Do not reuse bearing seals.

Caster Wheel Assembly

1. Ensure that the wheel is clean and free of debris or excessive wear.
2. Pack the 2 tapered bearings with grease.
3. Insert 1 bearing and seal into the wheel.
4. Insert the assembled spacer nut and axle into the wheel.
5. With the open end of the wheel facing up, fill the area inside the wheel, around the axle, full of grease.
6. Insert the second bearing and seal into the wheel.



Caster Wheel Assembly (continued)

7. Apply thread locker to the second spacer nut and thread onto the axle.



8. Torque nut to 101–110 N•m (78 ± 3 in-lb) to seat the bearings, loosen, then torque to 27–35 N•m (23 ± 3 in-lb).

Note: Make sure that the axle does not extend beyond the nut on either side of the wheel assembly.

9. Install the seal guards onto the wheel hub and assemble the wheel onto the caster fork.



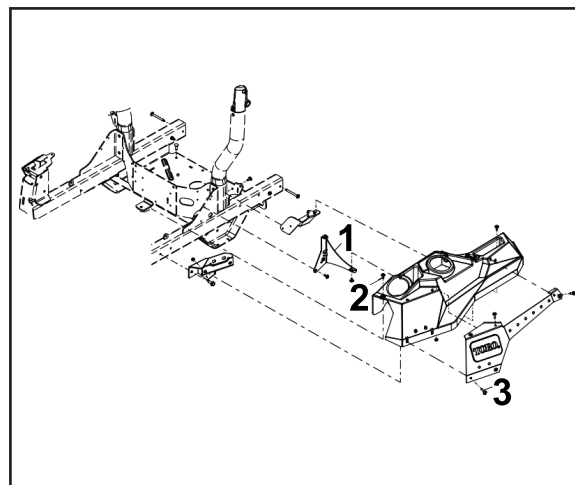
10. Lower the unit and verify proper function.

Note: To prevent seal and bearing damage, check the bearing adjustment often. The tire should not spin freely (more than one or two revolutions) or have any side play. If the wheel spins freely, adjust the torque on the spacer nut until there is a slight amount of drag. Reapply thread locking adhesive to the spacer nut.

Left Console Replacement

Left Console Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the shoulder bolt (T30) at location at the front of the console.



g336092

Figure 24

4. Remove the 2 bolts on the front of the console.
5. Remove the 2 screws (T25) from the console bracket on the underside of the console.

Note: Removing the drive wheel may allow easier access to the torx screws.

6. Remove the 2 bolts from the support bracket.
7. Remove the fuel cap and disconnect the keeper line.

Left Console Removal (continued)



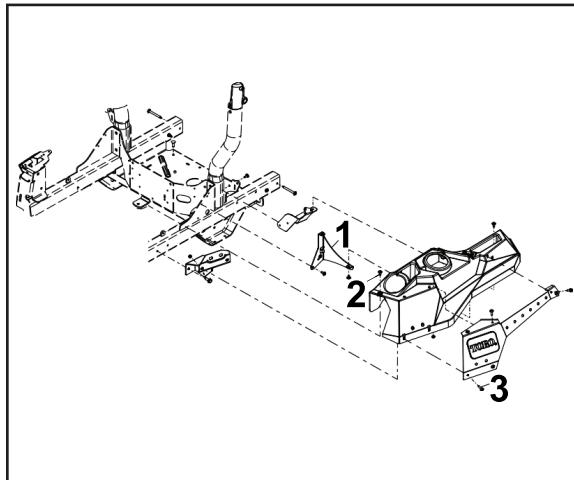
g336093

Figure 25

8. Lift the console upward off of the machine.
9. Install the fuel cap.

Left Console Installation

1. Remove the fuel cap from the gas tank.
2. Lower the console into place, ensuring that it seats properly on the support.
3. Install the keeper line into the fuel cap, and reinstall the fuel cap.
4. Install the 2 bolts and nuts through the support bracket.
5. Install the 2 (T25) screws through the console bracket.



g336092

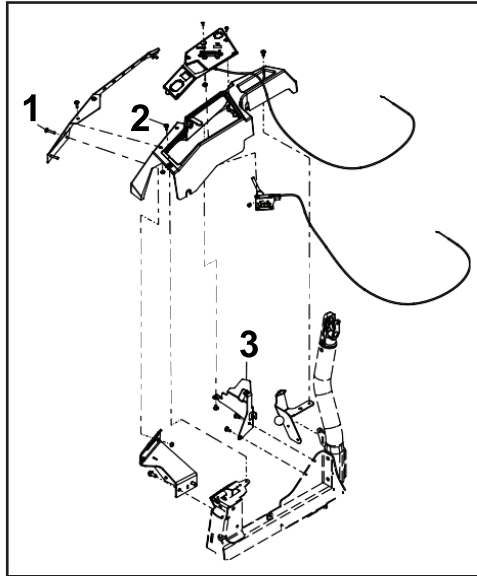
Figure 26

6. Install the 2 bolts and nuts on the front of the console.
7. Install the shoulder bolt (T30) at the front of the console.
8. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Right Console Replacement

Right Console Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the shoulder bolt (T30) at the front of the console.



g336084

Figure 27

4. Remove the 2 bolts on the front of the console.
5. Remove the 2 (T25) screws from the console bracket on the underside of the console.
Note: Removing the drive wheel may allow easier access to the torx screws.
6. Remove the 2 bolts from the support bracket.
7. Remove the hex screw securing the control panel assembly to the console.
8. Lift the console upward off of the machine, while feeding the control panel assembly through the opening in the console.

Note: The control panel assembly should be supported while servicing the machine, to avoid damage to cables or the wire harness.

Right Console Removal (continued)



g336085

Figure 28

Right Console Installation

1. Lower the console into place, while moving the control panel assembly through the opening in the console and into position. Ensure that the console seats properly on the supports.

Note: Before securing the control panel to the console, ensure that all cables and electrical connections are seated firmly in place on the underside of the control panel assembly.

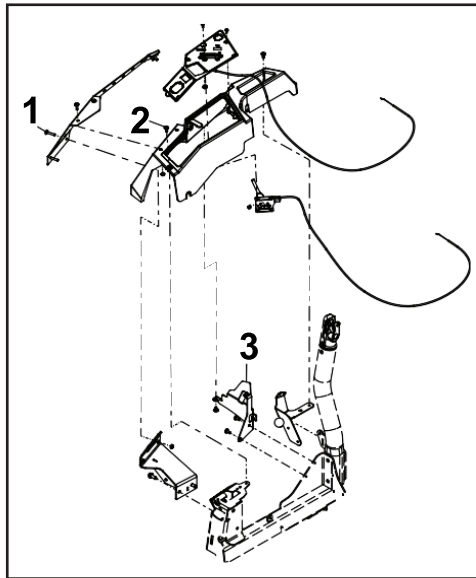


g336086

Figure 29

-
2. Secure the control panel assembly to the console.
 3. Install the 2 bolts and nuts through the support bracket.
 4. Install the 2 (T25) screws through the console bracket.

Right Console Installation (continued)



g336084

Figure 30

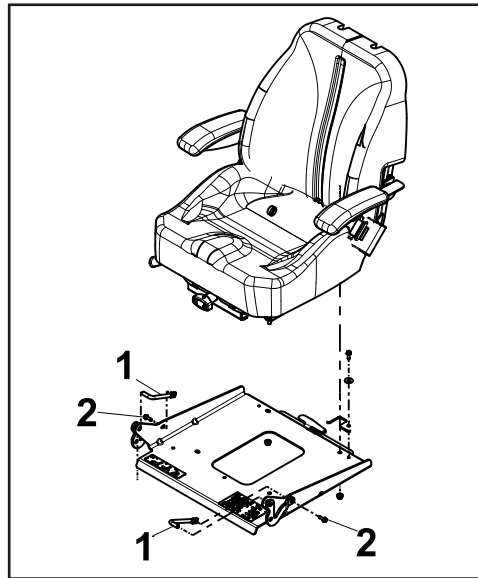
5. Install the 2 bolts and nuts on the front console.
6. Install the shoulder bolt (T30) at the front of the console.
7. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Seat Replacement

Seat Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Unlatch and raise the seat, disconnect the operator presence switch on the underside of the seat assembly.
4. Lower the seat back into the latched position.
5. Remove the bolt and the seat pivot from each side of the seat.

Seat Removal (continued)



g336087

Figure 31

1. Bolt
 2. Seat Pivot
-
6. Unlatch the seat, then move the seat rearward, out of the way of the motion control box. Lift the seat off of the machine.

Seat Installation

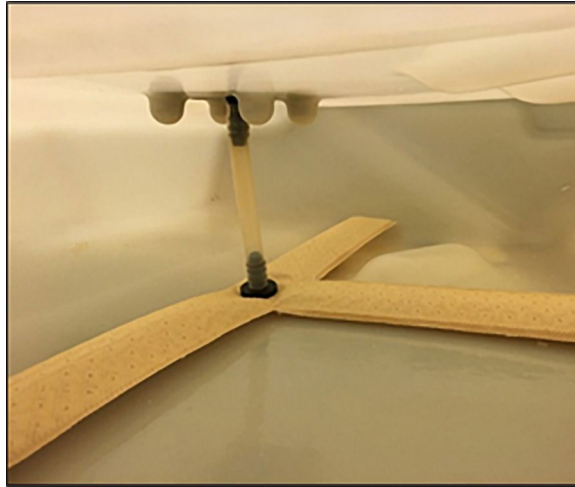
1. Place the seat on top of the fuel tank retainer plate.
2. Move the seat forward, aligning the holes in the seat pan with the holes in the motion control box.
Note: Make sure the flange bushing is present in each side of the seat pan.
3. Install the bolt and seat pivot on each side of the seat.
4. Raise the seat and attach the wire harness to the operator presence switch.
5. Lift and lower the seat to verify proper function of the seat pivots and the seat latch.
6. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Fuel Tank Replacement

Fuel Tank Removal

Note: The fuel pick-up system is designed to pull fuel from any part of the tank in low fuel situations as well as reducing the affect of debris in the tank.

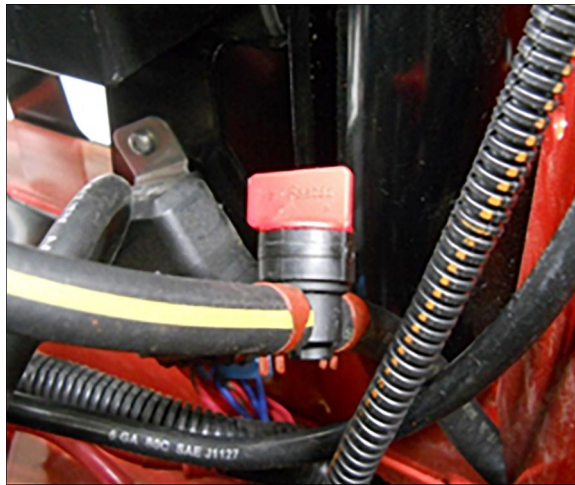
Fuel Tank Removal (continued)



g336089

Figure 32

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Close the fuel supply valve.

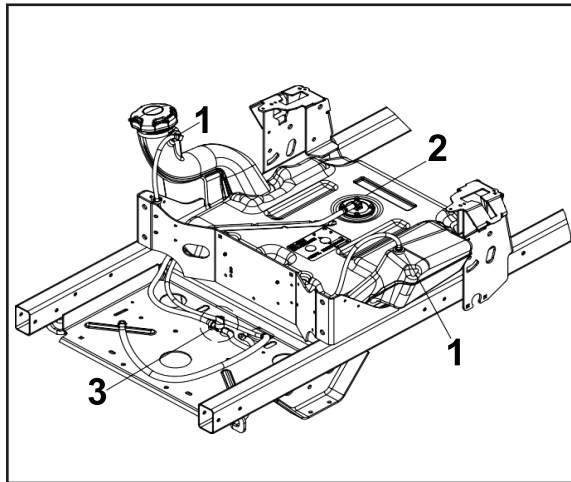


g336090

Figure 33

4. Remove the right and left side consoles. [Right Console Replacement \(page 5–13\)](#) [Left Console Replacement \(page 5–11\)](#)
5. Remove the seat assembly. [Seat Replacement \(page 5–15\)](#)
6. Remove the 2 bolts and nuts securing the fuel tank retainer plate.
7. Remove the fuel tank retainer plate by lifting the rear of the plate toward the front of the machine and sliding the tabs up and out of the frame slots.
8. Disconnect the fuel supply line and the 2 vent lines from the fuel tank.

Fuel Tank Removal (continued)



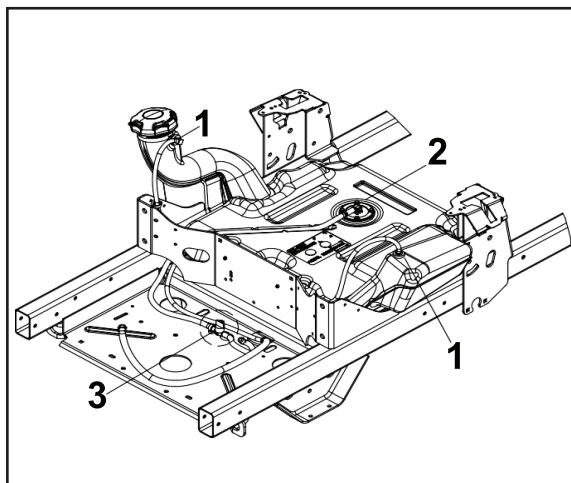
g336088

Figure 34

1. Vent Hose Assembly
 2. Fuel Supply Line
 3. Fuel Shut-Off Valve
-
9. Lift the fuel tank assembly from the machine by sliding the tank rearward and up, away from the frame.

Fuel Tank Installation

1. Position the fuel tank assembly onto the frame with the vent ports toward the rear of the machine.
2. Connect the 2 vent lines to the fuel tank.
3. Connect the fuel supply line to the fuel tank and route the fuel line in the detents molded into the tank.



g336088

Figure 35

1. Vent Hose Assembly
 2. Fuel Supply Line
 3. Fuel Shut-Off Valve
-
4. Install the fuel tank retainer plate.
 5. Install the seat assembly. [Seat Replacement \(page 5-15\)](#)
 6. Install the right and left consoles. [Right Console Replacement \(page 5-13\)](#)
[Left Console Replacement \(page 5-11\)](#)

Fuel Tank Installation (continued)

7. Open the fuel supply valve.



g336052

Figure 36

8. Connect the battery by installing the positive cable first, then the negative cable to the battery.

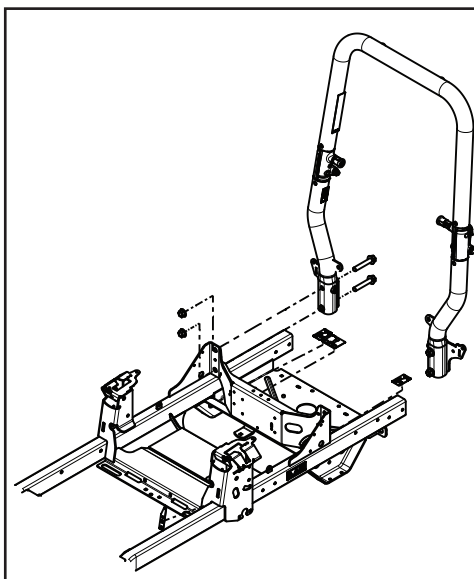
ROPS (Roll Over Protection System) Replacement

ROPS (Roll Over Protection System) Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Fold the ROPS assembly into the upright position and lock in place.

Note: For easier access, remove the right and left side consoles. [Right Console Replacement \(page 5–13\)](#) [Left Console Replacement \(page 5–11\)](#)

3. Support the ROPS assembly and remove the 4 mounting bolts.



g336053

Figure 37

ROPS (Roll Over Protection System) Removal (continued)

4. Lift the ROPS assembly off of the machine.

ROPS (Roll Over Protection System) Installation



1. Lift the ROPS assembly into position on the rear side of the mounting support.
2. Install the 4 mounting bolts.

Note: Orientation of the ROPS hardware is critical. Make sure that the bolts are orientated

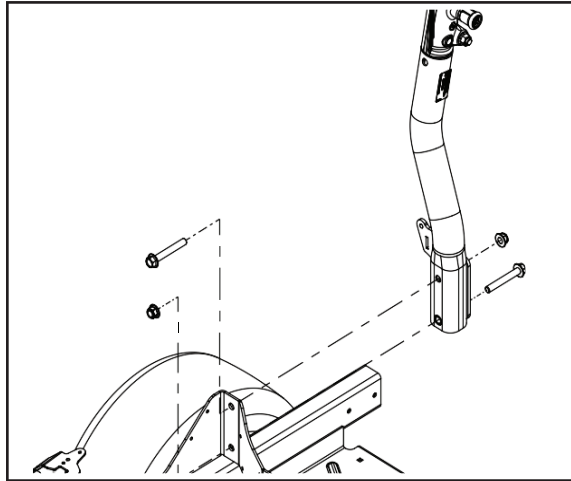


Figure 38



3. Torque the ROPS connecting hardware to 122–135 N •m (95 ± 5 ft-lb).
4. Install the right and left consoles. [Right Console Replacement \(page 5–13\)](#)
[Left Console Replacement \(page 5–11\)](#)

Throttle Cable Assembly Replacement

Throttle Cable Assembly Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the control panel assembly from the right console.
4. Remove the knob from the throttle lever.

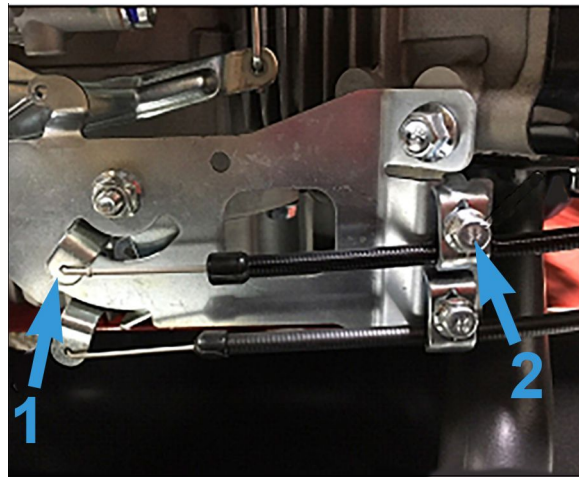
Throttle Cable Assembly Removal (continued)



g336055

Figure 39

5. Remove the 2 bolts and nuts securing the throttle control assembly to the control panel assembly.
6. Loosen the clamp securing the throttle cable to the throttle plate.



g336056

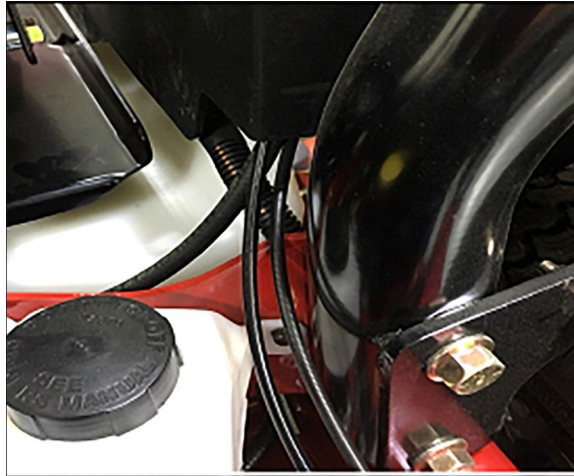
Figure 40

7. Remove the throttle cable from the throttle plate, noting the position of the cable in the plate.
8. Pull the throttle cable assembly through the console and out of the machine.

Throttle Cable Assembly Installation

1. Route the throttle cable through the right console between the ROPS and the hydraulic fluid.

Throttle Cable Assembly Installation (continued)



g336057

Figure 41

2. Attach the throttle cable assembly to the control panel assembly using 2 bolts and nuts.
3. Install the knob on the throttle lever.
4. Install the control panel assembly into the console.
5. Move the throttle control lever to the slow idle position.
6. Place the Z-bend of the throttle cable in the throttle plate on the engine in the position previously noted.
7. Place the cable under the cable clamp.
8. Ensure that the throttle control lever is in the slow idle position and tighten the cable clamp.
9. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Choke Control Assembly Replacement

Choke Control Assembly Removal

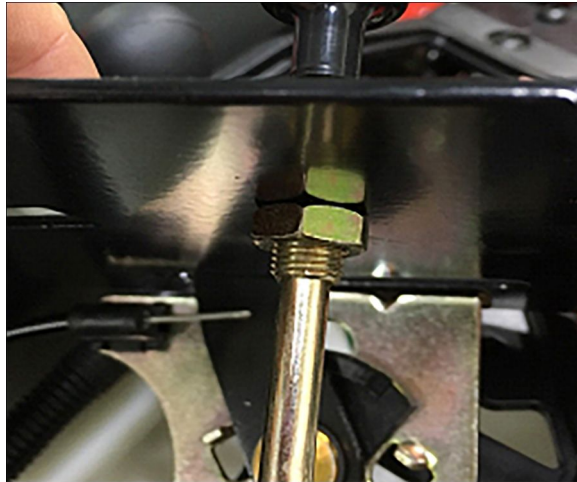
1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Loosen the clamp securing the choke cable to the choke plate on the engine
4. Remove the choke cable from the plate, noting the position of the cable in the plate.
5. Remove the control panel assembly from the right console.
6. On the bottom side of the control panel assembly, loosen the jam nut securing the choke lever in place. Remove the nut from the choke cable.
7. Pull the choke cable assembly through the control panel and out of the machine.

Choke Control Assembly Installation

1. Route the choke cable through the control panel assembly.

Choke Control Assembly Installation (continued)

2. Thread the jam nut over the choke cable up to the control panel assembly.



g336058

Figure 42

3. Attach the choke cable assembly to the control panel with the jam nut.
4. Install the control panel assembly into the console.
5. Move the choke control lever to the open position (down).
6. Place the Z-bend of the choke cable in the choke plate on the engine in the position previously noted.
7. Place the cable under the cable clamp.
8. Ensure that the choke control lever is pressed down fully and tighten the cable clamp.
9. Connect the battery by installing the positive cable first, then the negative cable to the battery.

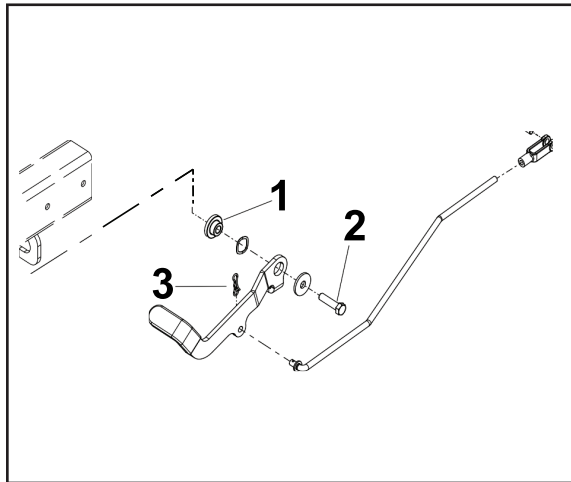
Park Brake Handle Assembly Replacement

Park Brake Handle Assembly Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Release the parking brake (park brake handle down).
4. Remove the left side console. [Left Console Replacement \(page 5–11\)](#)
5. Remove the locking cotter pin securing the upper brake linkage to the park brake lever.

Note: To completely remove the upper brake linkage, remove the locking cotter pin from the brake shaft and remove the clevis pin. The linkage can now be removed from the frame slot for inspection, adjustment, or replacement.

Park Brake Handle Assembly Removal (continued)



g336059

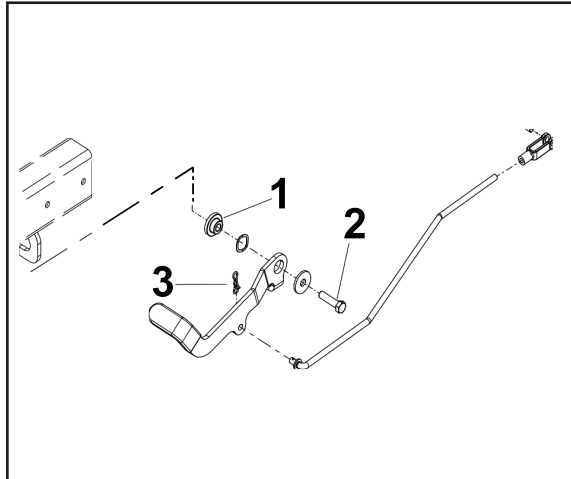
Figure 43

1. Locking Cotter Pin
2. Bolt
3. Flange Nut

-
6. Remove the bolt and flange nut from the park brake lever assembly.

Park Brake Handle Assembly Installation

1. Connect the upper brake linkage to the brake shaft.
2. With the park brake handle hardware orientated as shown, install the bolt and flange nut.



g336059

Figure 44

1. Locking Cotter Pin
2. Bolt
3. Flange Nut

-
3. With the park brake shaft in disengaged position and the park brake lever in the lower position, rotate the upper brake linkage until the end aligns with the hole in the park brake lever.

Park Brake Handle Assembly Installation (continued)



g336060

Figure 45

4. Secure with a locking cotter pin.
5. Cycle the park brake lever to ensure that it locks in the engaged position.
6. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Adjusting the Park Brake

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Raise and support the unit so that the drive wheels are off the ground.
3. Release the drive wheel bypass valves so that the drive wheels are able to spin freely.
4. Engage and disengage the brake and check each drive tire to make sure that the brake engages and disengages.
5. If adjustment is necessary, disengage the park brake. Remove the locking cotter pin from the upper brake linkage.

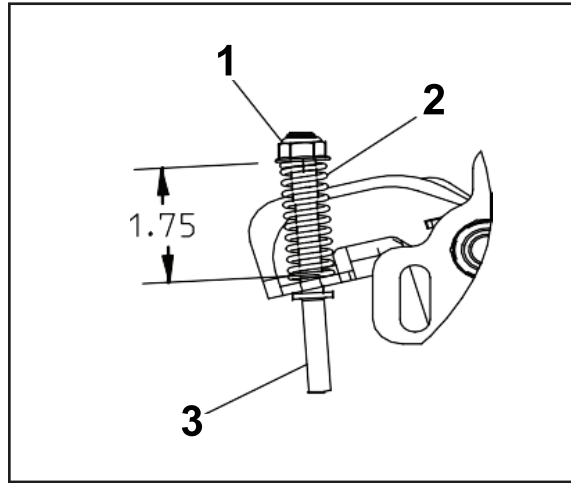


g336038

Figure 46

Adjusting the Park Brake (continued)

6. Check both spring lengths, if adjustment is necessary, turn the top nut clockwise to shorten and counterclockwise to lengthen. The spring length should measure 44 mm (1.75 inch).



g336039

Figure 47

1. Flange Nut
2. Compression Spring
3. Lower Brake Linkage

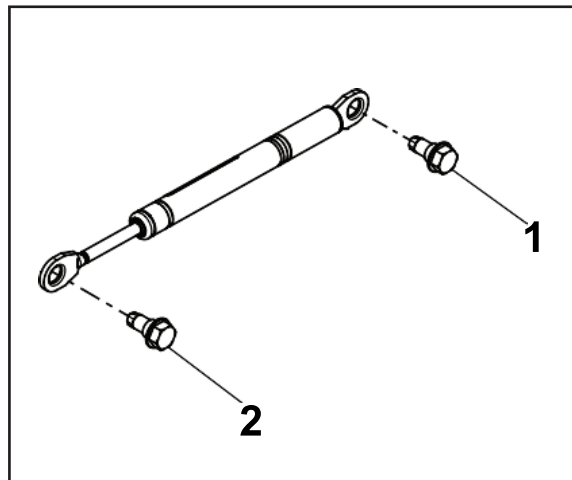
7. Re-check the spring length to ensure both springs are tensioned equally.
8. Disengage the parking brake by pushing the park brake handle all the way forward and down.
9. Rotate the upper brake linkage shaft until the end aligns with the hole in the park brake handle. Shorten the linkage by turning clockwise, lengthen the linkage by turning counterclockwise.
10. Insert the park brake linkage into the upper brake linkage and secure with the locking cotter pin.
11. Repeat step 5, re-adjust if necessary.
12. Move the drive wheel bypass levers back into the operating (forward) position.
13. Lower the unit and verify proper function.

Motion Control Damper

Motion Control Damper Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Remove the 2 bolts securing the motion control damper to the frame and the motion control assembly.

Motion Control Damper Removal (continued)



g336040

Figure 48

1. Bolts
2. Motion Control Damper

-
3. Remove the motion control damper from the machine.

Motion Control Damper Installation

1. Position the motion control damper on the outside of the frame mounting tab.



g336041

Figure 49



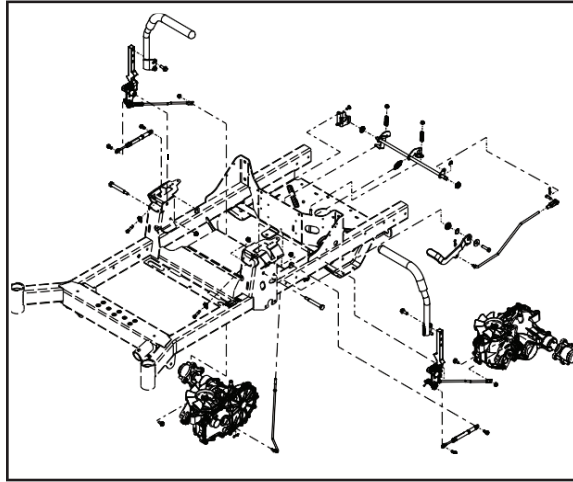
2. Torque the rear mounting bolt to 237-305 N • m (200 ± 25 in-lb).

Motion Control Damper Installation (continued)

3. Torque the front mounting bolt to 108-135 N• m (90 ± 10 in-lb).

Motion Control Assembly Replacement

Motion Control Assembly Removal

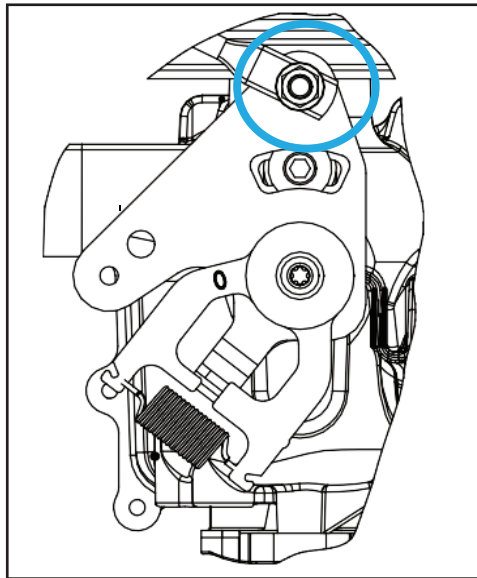


g336042

Figure 50

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Raise and support the unit so that the drive wheels are off the ground.
Note: The console may be removed for easier access. [Left Console Replacement \(page 5–11\)](#) [Right Console Replacement \(page 5–13\)](#)
3. Remove the 2 bolts securing the motion control handle to the motion control assembly.
4. Remove the 2 screws securing the motion control cover to the frame.
5. Disconnect the motion control damper from the motion control assembly.
6. Disconnect the motion control linkage from the transmission.

Motion Control Assembly Removal (continued)



g337843

Figure 51

-
7. Disconnect the motion control assembly from the frame.



g336044

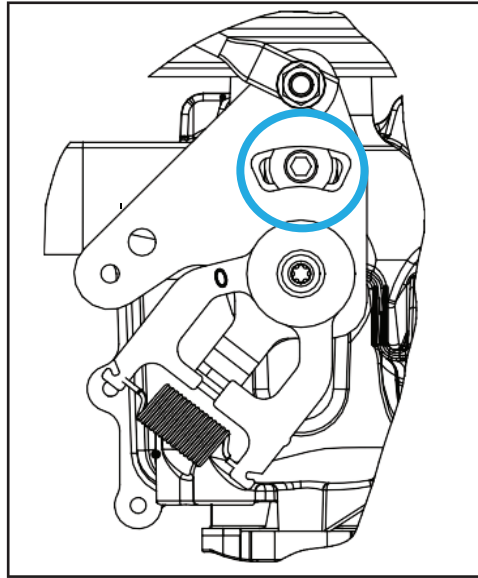
Figure 52

-
8. Lower the motion control assembly through the frame toward the center of the machine, remove the assembly.

Motion Control Assembly Installation

1. Position the motion control assembly in place with the linkage extending toward the transmission.
2. Secure the motion control assembly to the frame.
3. Connect the motion control linkage to the transmission.
4. Adjust the nut on the motion control assembly until the motion control nut is centered in the control plate slots.

Motion Control Assembly Installation (continued)



g337846

Figure 53



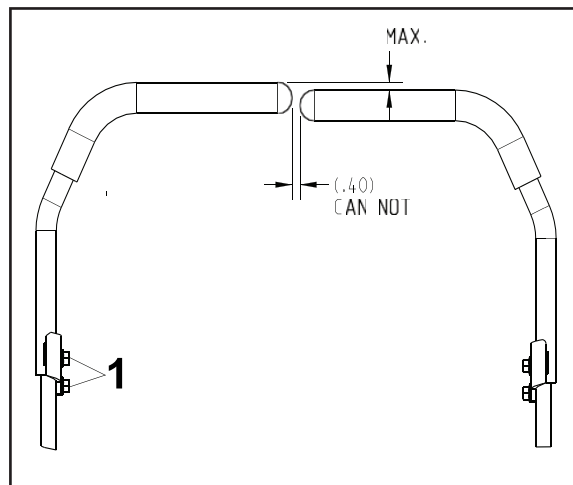
5. Connect the motion control damper to the motion control assembly and torque the bolt to 108-135 N • m (90 ± 10 in-lb).
6. Install the motion control cover to the frame, secure with the 2 screws.
7. Connect the motion control handle to the motion control assembly.
8. Adjust the neutral setting.
9. Lower the unit and verify proper function.
10. Adjust the tracking if necessary. [Tracking Adjustment \(page 7-7\)](#)

Adjusting the Motion Control Handle Position

Note: Ensure proper adjustment of neutral and tracking settings before adjusting the motion control handles. [Tracking Adjustment \(page 7-7\)](#)

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Move the levers into the operating position.
3. Loosen the 2 bolts that secure the motion control handles to the motion control assembly.

Adjusting the Motion Control Handle Position (continued)



g336046

Figure 54

4. Align the levers front to back and secure the bolts.
5. Move the levers into the park position.
6. Verify proper function of the unit.

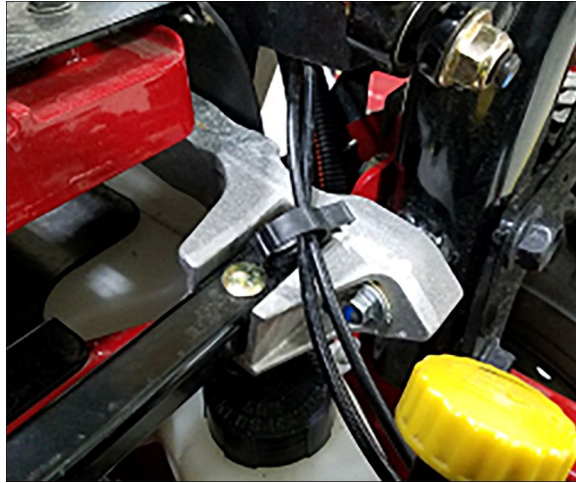
Note: Motion control levers may be adjusted up or down for operator comfort by utilizing the additional mounting holes on the motion control assembly. The motion control levers should always be mounted on the inside of the motion control assembly.

MYRIDE® Replacement

MYRIDE® Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Lower the ROPS.
3. Remove the 2 larger nyloc nuts securing the lower shock mounts to the ROPS. The nyloc nuts can be accessed from the rear of the machine.
4. Open the cable retainer and remove the 2 cables routed across the seat base.

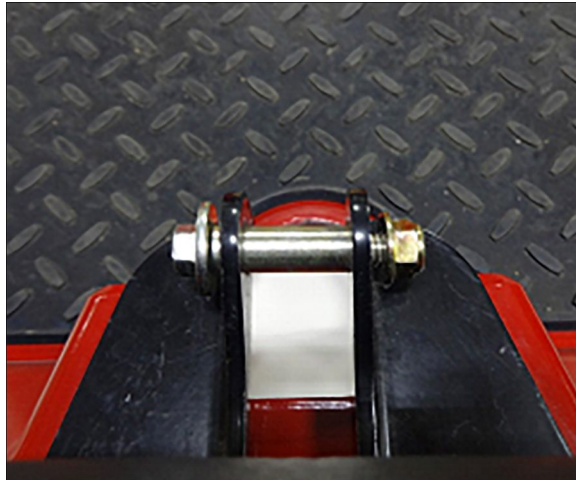
MYRIDE® Removal (continued)



g336047

Figure 55

-
5. Remove the shoulder bolt securing the front shock to the upper shock mount.
 6. Place shoulder bolt back in upper mount and finger tighten with the lock nut.



g336048

Figure 56

-
7. Attach the seat and sub-frame assembly to the overhead lift using three lift points.

MYRIDE® Removal (continued)



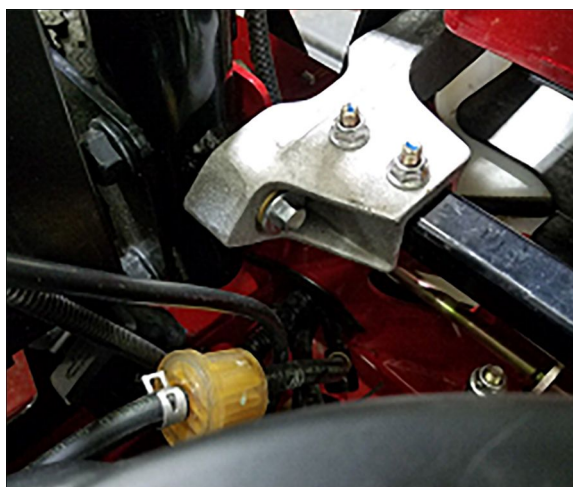
g336049

Figure 57

8. Remove the 2 shoulder bolts securing the trailing arm to the lower ROPS tubes.
9. Using an overhead lift, raise the seat up about 30 cm (12 inches).
10. Disconnect the seat switch.
11. Lift the seat and sub-frame assembly up and away from the machine.

MYRIDE® Installation

1. With the seat and sub-frame assembly attached to the overhead lift, lower the seat into the machine, leaving room under the seat.
2. Connect the seat switch.
3. Lower the seat and sub-frame assembly to align the trailing arm with the mount holes in the ROPS tube.

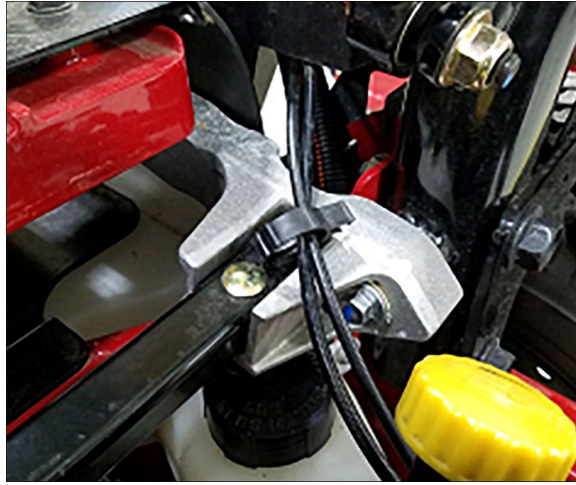


g336050

Figure 58



4. Install the 2 shoulder bolts securing the trailing arm to the lower ROPS tubes. Torque to 50 N • m (37 ± 3 ft-lb).
5. Route the 2 cables back into the cable retainer and fasten.



g336047

Figure 59

-
6. Lower the seat and sub-frame all the way onto the machine.
 7. Disconnect the seat and sub-frame from the overhead lift.
 8. Secure the front shock with a shoulder bolt.

Note: Thread should be on the LH side of the machine (from operator's position).



g336051

Figure 60

-
9. Disconnect the seat and sub-frame from the overhead lift.
 10. Install the 2 nuts securing the lower shock mounts to the ROPS tubes.
Torque to 122 N • m (90 ± 9 ft-lb).
 11. Raise the ROPS back into operating position.





Table of Contents

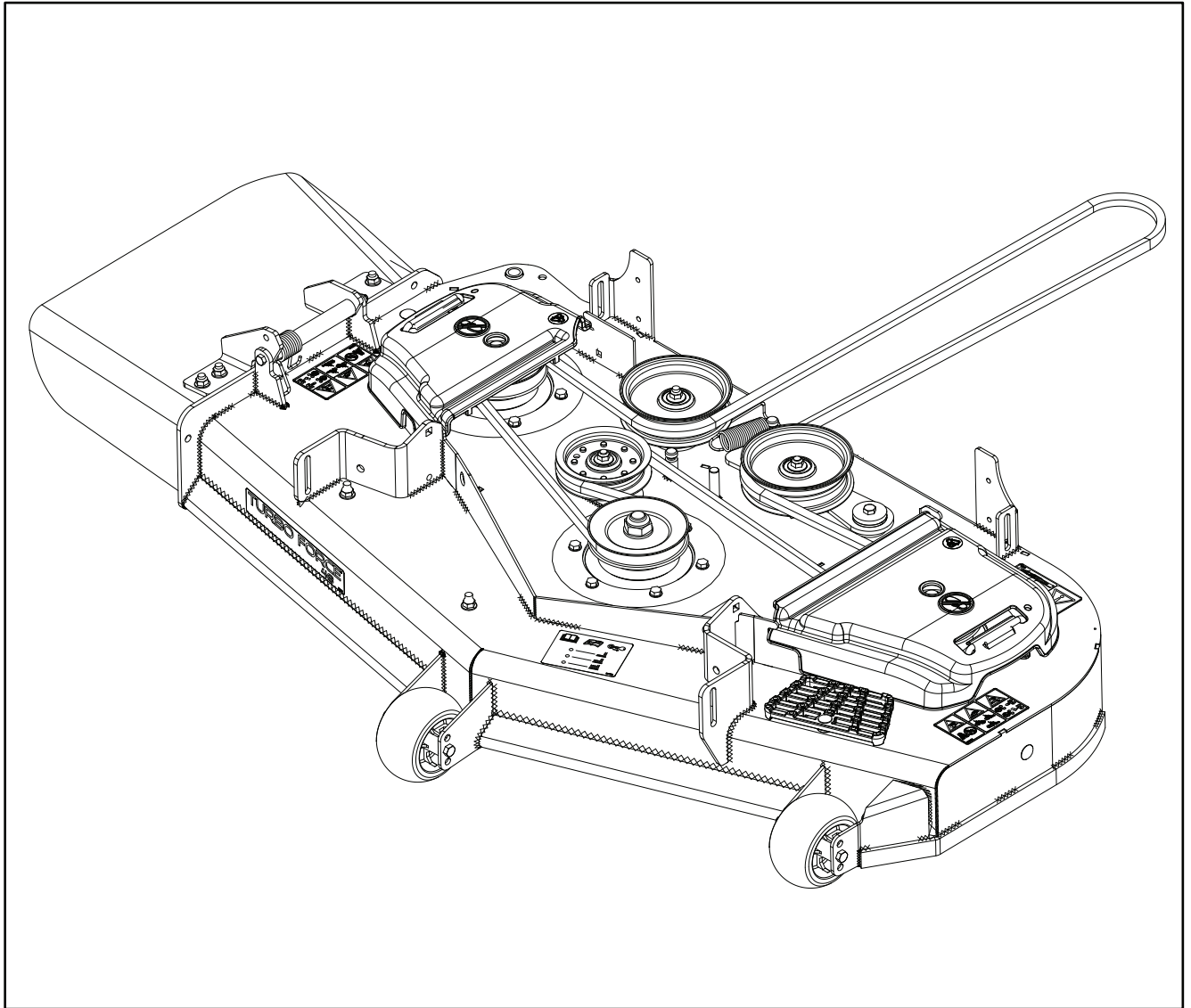
General Information	6-2
Service and Repairs	6-3
Mower Belt Replacement	6-6
Mower Deck Replacement	6-6
Mower Spindle Replacement	6-7
Leveling the Mower Deck	6-9

General Information

The 2000 Z MASTER® series of mowers use a TURBO FORCE® deck platform. All decks are 5 inch deep and constructed of 7ga sides and a 10ga top plate. The spindles are constructed with an 8 inch housing and 1 inch spindle shaft.

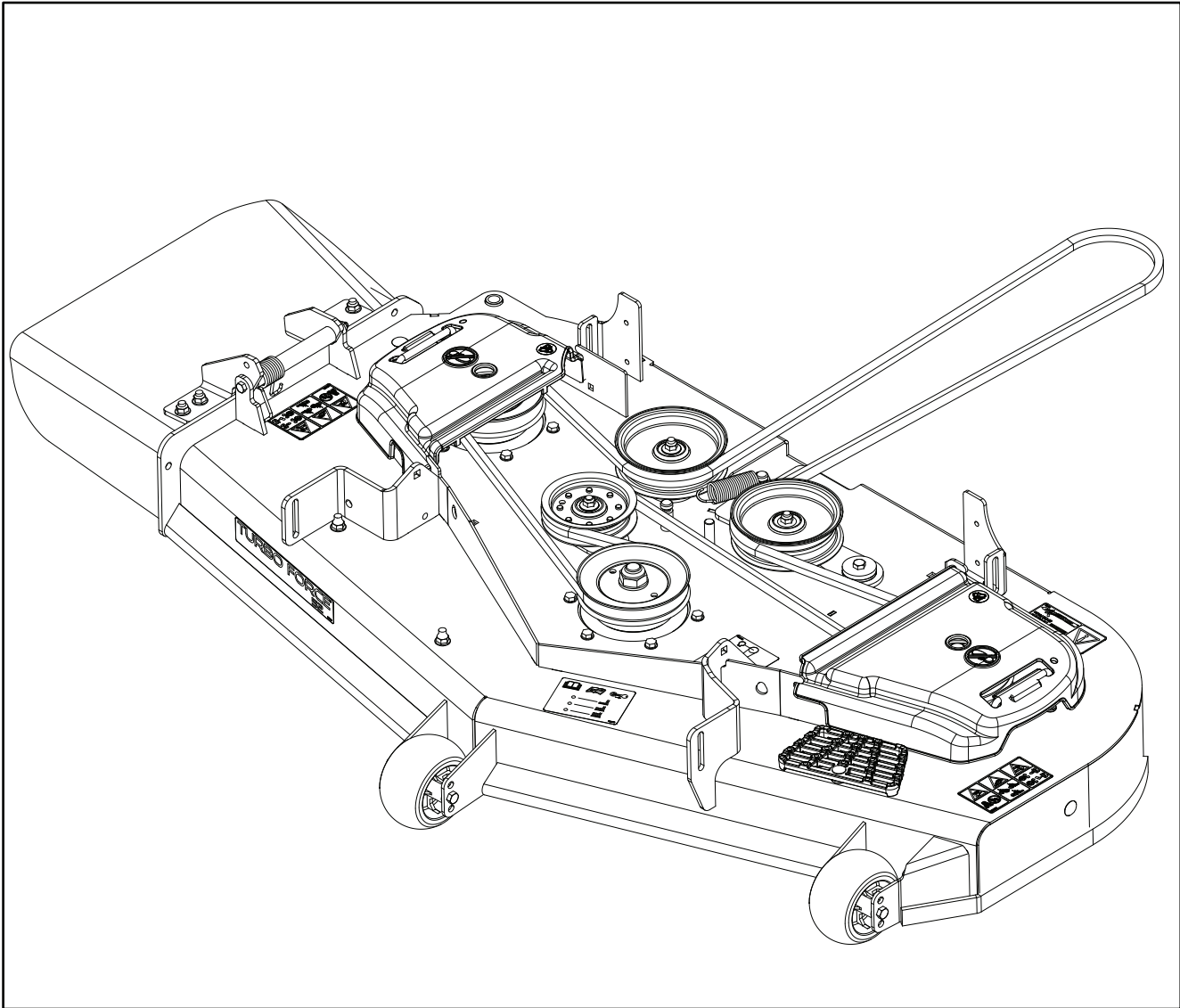
Service and Repairs

48 Inch Deck



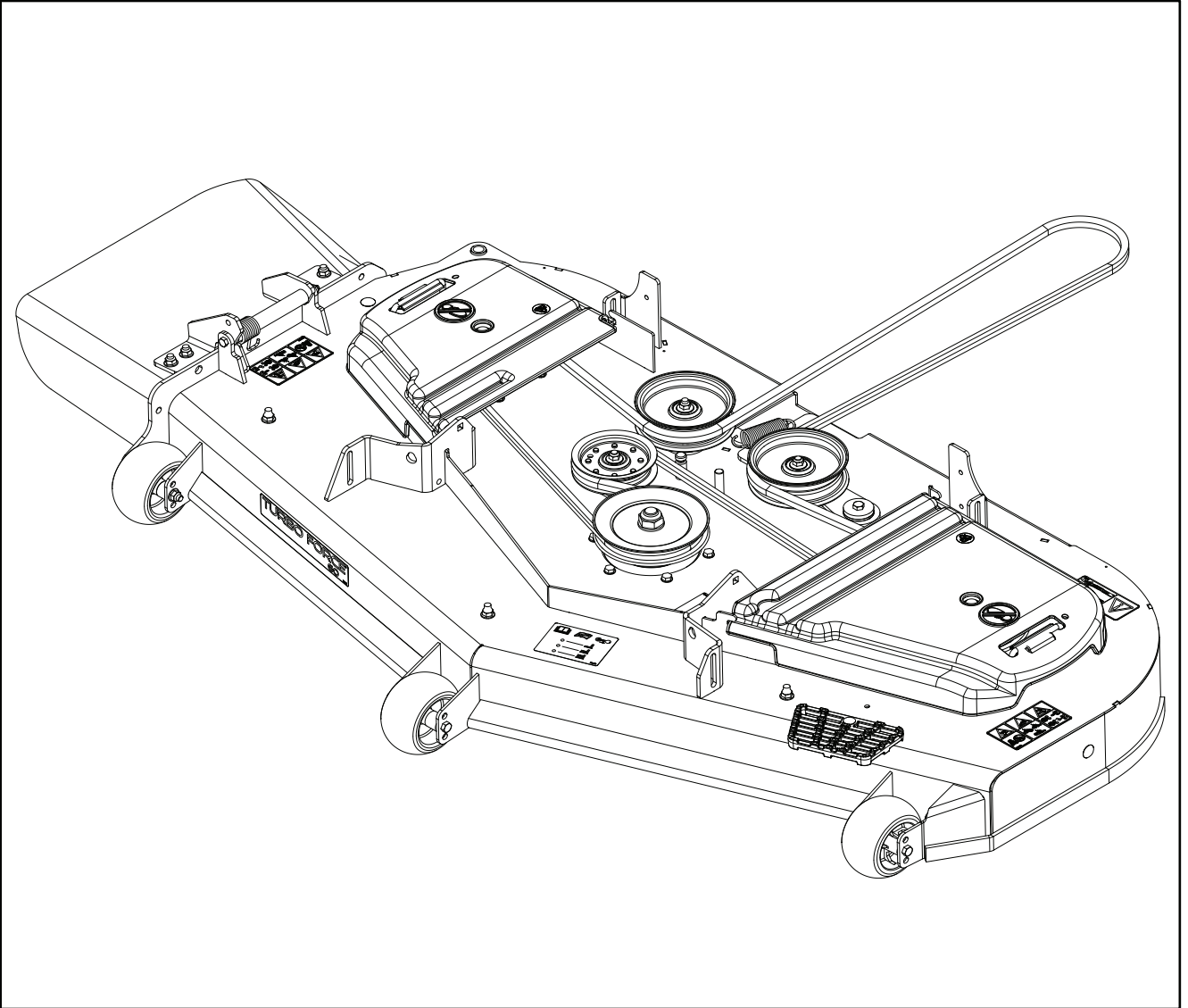
g337546

Figure 61



g337549

Figure 62



g337550

Figure 63

Mower Belt Replacement

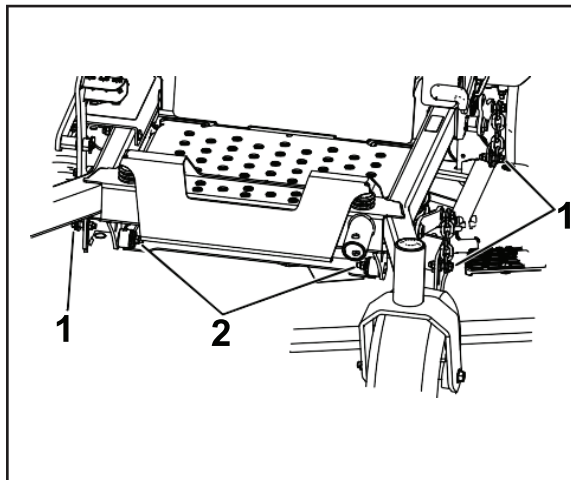
Mower Belt Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Lower the mower deck to the 76 mm (3 inch) height-of-cut position.
4. Remove the mower belt covers.
5. Remove the spring tension from the idler pulley.
6. Remove the belt from the deck pulleys and the clutch pulley.
7. Route the new belt around the clutch pulley and deck pulleys.
8. Install the idler spring (if previously removed).
Note: Make sure to seat the spring ends in the anchor grooves.
9. Make sure to seat the spring ends in the anchor grooves.
10. Connect the battery terminals and verify proper function of the unit.

Mower Deck Replacement

Mower Deck Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the height adjustment pin and lower the deck to the ground.
4. Place the height adjustment pin in the 76 mm (3 inch) height-of-cut position.
5. Remove the mower belt covers.
6. Remove the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
7. Remove the 2 bolts (items 1 and 2) and nuts from the front of the plate under the footrest.



g336155

Figure 64

8. For 60 in. decks only:

Mower Deck Removal (continued)

- Raise the deck to the transport position.
 - Slowly loosen the adjusting screw on the lift assist spring until the screw can be removed. Save the screw for re-installation.
9. Remove the 2 bolts and nuts on each side of the machine.
 10. Slide the deck out toward the right side of the machine.

Mower Deck Installation

1. Place the deck on the ground on the right side of the machine.
2. Slide the deck into position under the machine.
3. Connect the 2 bolts and nuts on each side of the machine.
4. Connect the 2 bolts and nuts on the front of the plate under the footrest.
5. Install the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
6. Install the mower belt covers.
7. Raise the deck to the 76 mm (3 inch) height-of-cut position and check the deck level. [Leveling the Mower Deck \(page 6–9\)](#)
8. Connect the battery by installing the positive cable first, then the negative cable to the battery.
9. For 60 inch decks only:
 - Raise the deck to the transport position 127 mm (5 inches).
 - Install the lift assist spring adjusting screw previously removed.
 - Slowly adjust the screw on the lift assist spring until a gap of 22–29 mm (7/8–1-1/8 inches) is achieved.

Mower Spindle Replacement

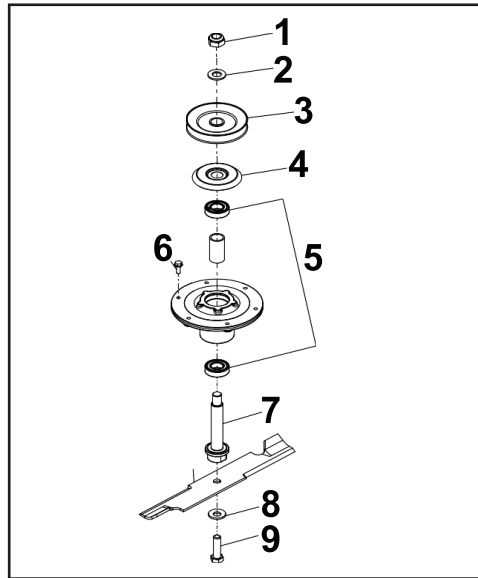
Mower Spindle Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the mower belt covers.
4. Remove the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
5. Remove the cutting blade.
6. Remove the 6 self-tapping bolts that secure the spindle to the deck.
7. Pull the spindle assembly downward, through the deck.

Mower Spindle Disassembly

1. Clamp the spindle for service by placing the spindle shaft in a vise.
2. Remove the nut and washer from the top of the pulley.

Mower Spindle Disassembly (continued)



g336156

Figure 65

- | | |
|--------------------------------|----------------------|
| 1. Bearing and Spacer Assembly | 6. Belleville Washer |
| 2. Taptite Screw | 7. Blade Bolt |
| 3. Bearing Shield | 8. Washer |
| 4. Spindle Shaft | 9. Locknut |
| 5. Pulley | |

3. Remove the pulley.
4. Remove the shaft from the spindle housing.
5. Remove the bearing shield .
6. Remove the bearing and the bearing spacer from the top of the spindle housing.
7. Flip over the spindle housing and remove the lower bearing.
8. Inspect the inside of the spindle housing for wear or damage.

Mower Spindle Assembly

1. Inspect the inside of the spindle housing for wear or damage.
2. Press the top bearing into the spindle housing by pressing equally on the inner and outer race.
Note: Verify that the bearing seats against the shoulder in the spindle housing.
3. Flip the spindle housing over and install the bearing spacer.
4. Press the lower bearing into the spindle housing by pressing equally on the inner and outer race.
Note: The inner and outer race on the upper bearing must be supported while installing the lower bearing.
5. Apply grease to the spindle shaft and install the spindle shaft.
Note: Brush grease completely around the outer seal of the bearing before installing the spindle shaft.
6. Flip the spindle over while supporting the shaft through the spindle housing.
7. Install the bearing shield.

Mower Spindle Assembly (continued)

Note: Brush grease completely around the outer seal of the bearing before installing the bearing seal.

8. Install the pulley to the spindle shaft.



9. Install the washer and nut. Torque the top nut to 136-149 N • m (105 ± 5 ft-lb).

Mower Spindle Installation

Note: Verify that the underside of the deck is clean before proceeding with the spindle installation.

1. Position the spindle against the deck and align the mounting holes.



2. Install 6 spindle mounting screws. Torque to 14-19 N • m (12 ± 2 ft-lb).

Note: Spindle mounting screws are thread forming. Do not reuse spindle mounting screws.



3. Install the Belleville washer with the concave side facing the cutting blade, install the blade bolt. Torque the blade bolt to 136-149 N • m (105 ± 5 ft-lb).

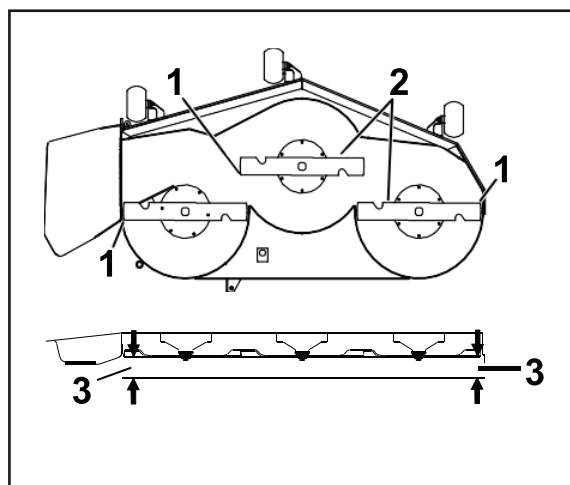
4. Install the mower belt. [Mower Belt Replacement \(page 6–6\)](#)

5. Install the mower belt covers.

6. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Leveling the Mower Deck

1. Park the machine on a flat level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Check to ensure that all tires are properly inflated and adjust as necessary.
4. Position the mower deck in the transport position.
5. Rotate the blades so that they are parallel to the rear of the deck.



g336157

Figure 66

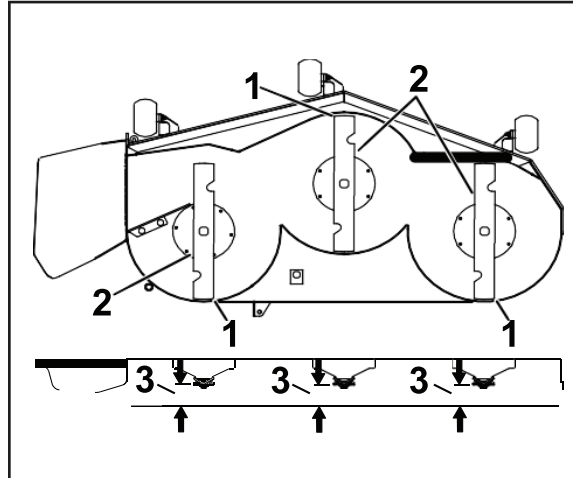
1. Blades Side-to-Side

3. Measure from the Tip of the Blade to the Flat Surface

2. Blade Tip

Leveling the Mower Deck (continued)

6. Measure between the outside cutting edges (blade tips) and the flat surface. If all measurements are not within 5 mm (3/16 inch), an adjustment is required and this procedure should be continued.
7. Rotate the blades so that they are perpendicular to the rear of the deck. Ensure the front blade tip is lower than the rear blade tip as indicated in the Block Height and Rake Table (step 12).

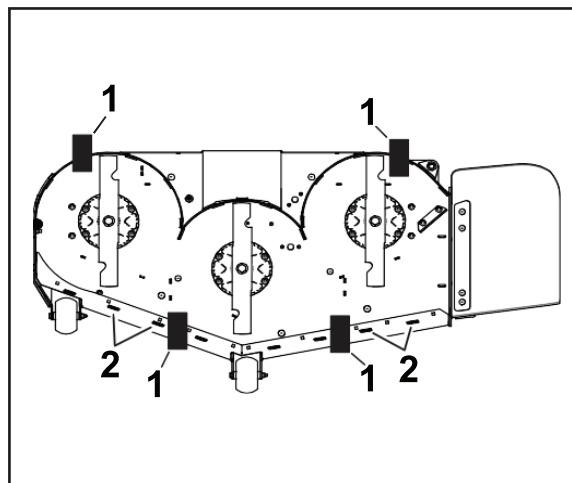


g336158

Figure 67

1. Blades Front to Rear
 2. Blade Tip
 3. Measure from the Tip of the Blade to the Flat Surface
-
8. Set the anti-scalp rollers to the top position or remove completely for this procedure.
 9. For 60 inch deck only:
 - Raise the deck to the transport position.
 - Slowly loosen the adjusting screw on the lift assist spring until the screw can be removed. Save the screw for installation.
 10. Place 2 blocks (see Block Height and Rake table step 12) under the rear edge of the cutting deck skirt, one on each side of the cutting deck.
 11. Set the height-of-cut lever to the 76 mm (3 inch) position.
 12. Place 2 blocks under each side of the front edge of the deck, but not under the anti-scalp roller brackets or welds.

Leveling the Mower Deck (continued)



g336159

Figure 68

1. Block 7.3 cm (2.87 inch)
2. Welds

Block Height and Rake Table

Deck Size	Block Height	Rake
All Mower Deck	7.3 cm (2.87 inch)	4.8 - 6.4 mm (3/16 - 1/4 inch)

13. Rotate the blades side-to-side so that they are parallel to the rear of the deck.
14. Loosen the leveling adjustment lock nuts on all 4 corners so that the deck is sitting squarely on the blocks.
15. Remove any slack from the deck hangers and make sure the deck lift foot lever is pushed back against the stop.
16. Tighten the 4 leveling adjustment lock nuts.
17. Verify that the blocks fit snugly under the deck skirt and that all attachment bolts are tight.
18. Continue leveling the deck by checking the front to rear blade slope.
19. Recheck the level of the blades and repeat deck leveling procedure if necessary.
20. For 60 inch decks only:
 - Raise the deck to the transport position.
 - Install the lift assist spring adjusting screw (removed in step 7 above).
 - Set the gap between the spring and the bracket to 22–29 mm (7/8 - 1-1/8 inches).
21. Connect the battery by installing the positive cable first, then the negative cable to the battery.



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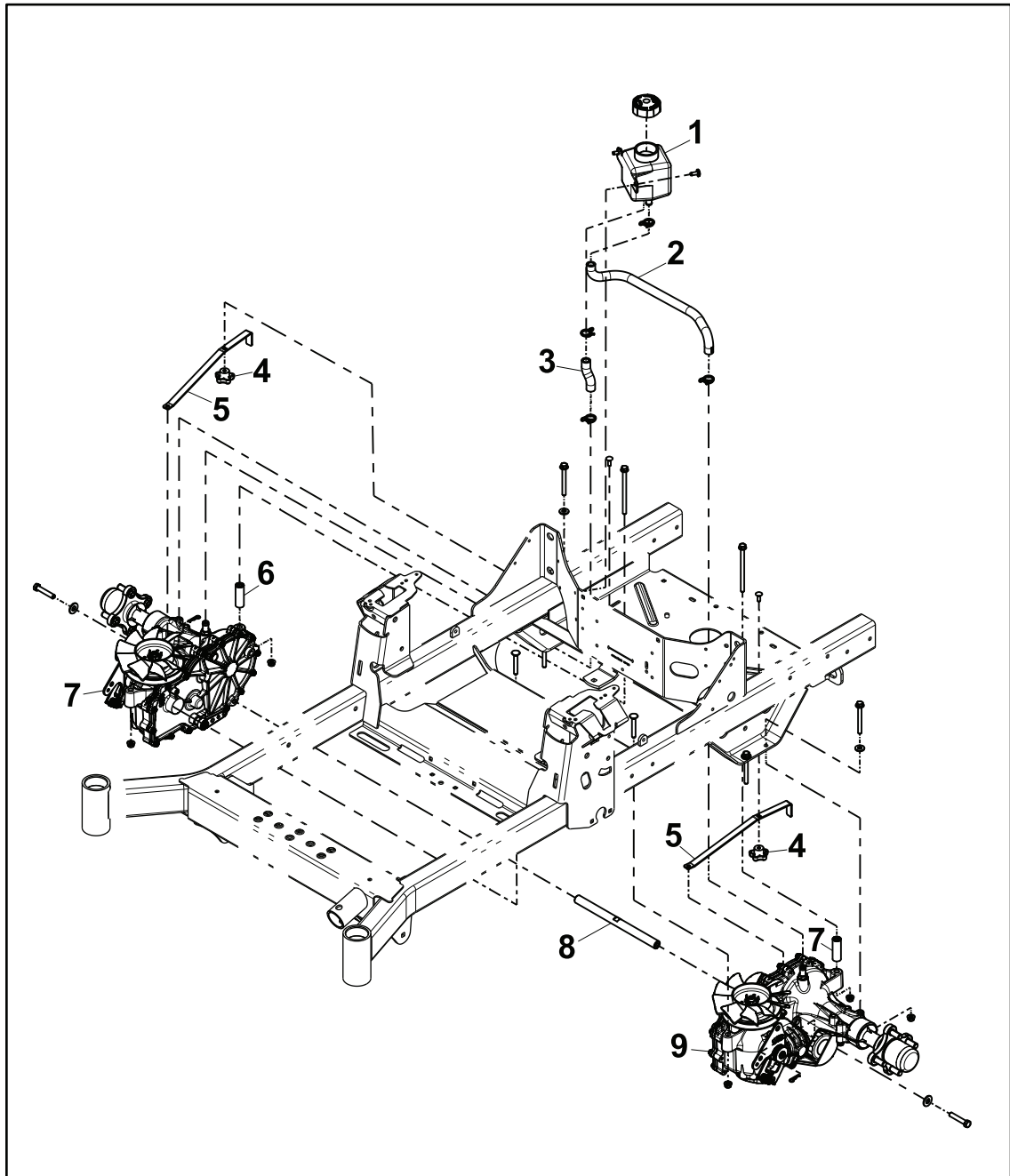
General Information	7-2
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General Information

The 2000 Z MASTER® series of mowers use ZT3400 and ZT3800 transaxles. Either transaxle is fully serviceable via spin on filter and remote reservoir.

Service and Repairs

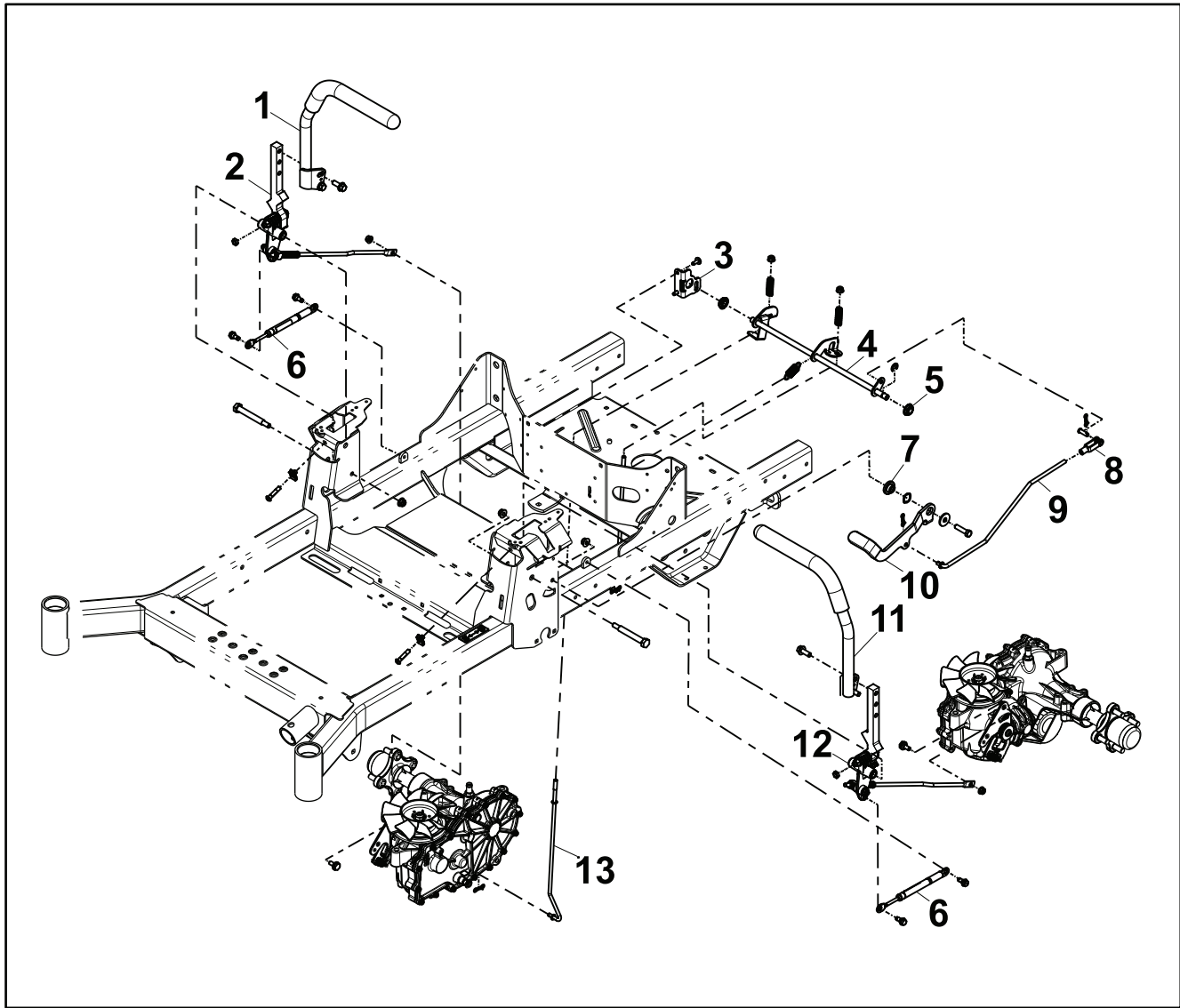
Drive System Assembly 1



g335888

Figure 69

- | | |
|---------------------|---------------------|
| 1. Hydraulic Tank | 6. Hydro Spacer |
| 2. Hydraulic Hose | 7. RH Transaxle Asm |
| 3. Hydraulic Hose | 8. Spacer Shaft |
| 4. Handle Knob | 9. LH Transaxle Asm |
| 5. Hydro Bypass Arm | |



g335889

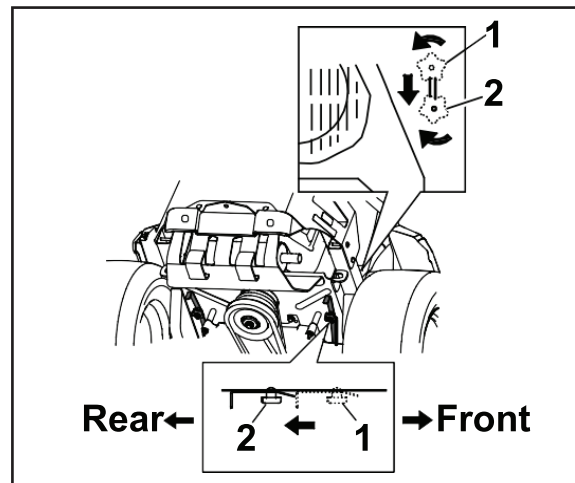
Figure 70

- | | |
|--------------------------|---------------------------|
| 1. RH Control Handle Asm | 8. Adjustable Yoke |
| 2. RH Motion Control Asm | 9. Upper Brake Linkage |
| 3. Brake Bracket | 10. Brake Lever |
| 4. Brake Shaft | 11. LH Control Handle Asm |
| 5. Spherical Bearing | 12. LH Motion Control Asm |
| 6. Damper | 13. Lower Brake Linkage |
| 7. Flange Pivot | |

Using the Drive Wheel Release Valves (Bypass Valves)

The drive wheel release valves are located on the left and right sides underneath the engine block.

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the park brake.
2. Locate the bypass levers behind the seat near the drive wheels, on the left and right side of the frame.
3. To push the machine, loosen the hand screws, move both bypass levers rearward, and tighten the hand screws to lock into place.
4. Disengage the park brake before pushing the machine.



g336200

Figure 71

1. Run Position
 2. Push Position (Disengage Park Brake)
-
5. To run the machine, move the bypass knobs to the forward position and lock them into place.

Adjusting the Motion Control Linkage (Neutral Setting)

Located on either side of the machine, below the seat are the pump control linkages. Rotating the end nut with 1/2 inch deep socket wrench allows fine tuning adjustments so that the machine does not move in neutral. Any adjustments should be made for neutral positioning only.

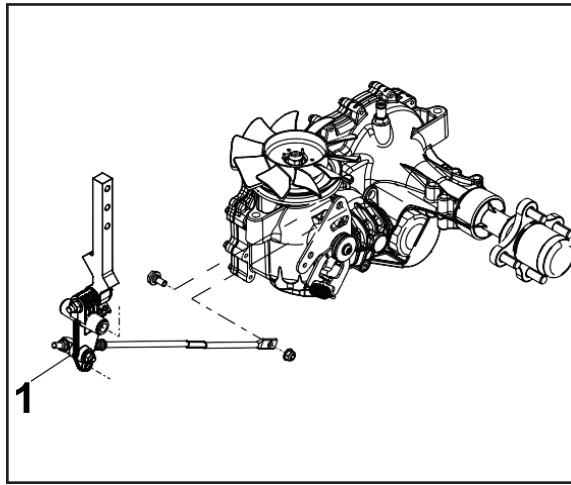


WARNING



Engine must be running and drive wheels must be turning so adjustments can be performed. Contact with moving parts or hot surfaces may cause personal injury. Keep fingers, hands, and clothing clear of rotating components and hot surfaces.

Adjusting the Motion Control Linkage (Neutral Setting) (continued)



g336201

Figure 72

1. Nut

1. Prior to starting the engine, push the deck lift pedal and remove the height-of-cut pin. Lower the deck to the ground.
2. Raise the rear of the machine up and support with jack stands (or equivalent support) just high enough to allow drive wheels to turn freely.
3. Remove the electrical connection from the seat safety switch, located under the bottom cushion of the seat.
Note: The seat safety switch is a part of the seat assembly.
4. Temporarily install a jumper wire across the terminals in the connector of the main harness.
5. Start the engine. Run the engine at full throttle and release the parking brake.
Note: Ensure that the parking brake is engaged and that the motion control levers are in neutral (out) to start the engine, the operator does not have to be present in the seat.
6. Run the machine for 5 minutes with the drive levers in the full forward speed to bring hydraulic fluid up to operating temperature.
7. Bring the motion control levers into the neutral position.
Note: The motion control levers must be in neutral while making any necessary adjustments.
8. Check and ensure that the control plate tabs touch the return-to-neutral plates on the hydraulic units.
9. Adjust the pump control rod lengths by turning the nut (A) in the appropriate direction until the wheels slightly creep in reverse.
10. Move the motion control levers to the reverse position while applying slight pressure to the lever. Allow the neutral return springs to bring the levers back to neutral.
Note: The wheels must stop turning or slightly creep in reverse.
11. Shut off the machine.
12. Remove the jumper wire from the wire harness and plug the connector into the seat switch.
13. Lower the unit.

Adjusting the Motion Control Linkage (Neutral Setting) (continued)

14. Raise the mower deck and install the height-of-cut pin.
15. Check for proper operation and ensure that the machine does not creep in neutral with the park brake disengaged.

Tracking Adjustment

1. Disengage the PTO switch.
2. Drive to an open, flat area and move the motion control levers to the neutral-lock position.
3. Move the throttle midway between the FAST and SLOW positions.
4. Move both motion control levers fully forward until they both hit the stops in the T-slot.
5. Observe which direction the machine tracks.
6. If the machine tracks to the right, insert a 3/16 inch hex wrench through the access hole in the right front cover panel and rotate the tracking screw clockwise or counterclockwise to adjust the travel of the lever.
7. If the machine tracks to the left, insert a 3/16 inch hex wrench through the access hole in the left front cover panel and rotate the tracking screw clockwise or counterclockwise to adjust the travel of the lever.
8. Drive the machine, check the full forward tracking.
9. Repeat the adjustment until the desired tracking is obtained.

Purging Procedure

Due to the effects air has on efficiency in hydrostatic drive applications, it is critical that it be purged from the system. This purge procedure should be implemented any time a hydrostatic system has been opened to facilitate maintenance, any additional oil has been added to the system, or a replacement transaxle has been installed. Air creates inefficiency because its compression and expansion rate is higher than that of the oil in hydrostatic drive systems.

The resulting symptoms in the hydrostatic system may be:

- noisy operation
- lack of power or drive after a short period of operation
- high operating temperature and excessive expansion of oil, in the latter case, oil level may be high in the expansion tank or overflow

The following procedure should be performed with the wheels off the ground and then repeated under operating conditions.

1. With the bypass valve open (push position) and the engine running, slowly move the directional controls (forward/reverse levers) in both forward and reverse directions 5-6 times, as air is purged from the transaxles, the oil level will drop.
2. With the bypass valves in the closed position (run position) and the engine running, slowly move the directional control levers in both forward and reverse directions 5-6 times.
3. It may be necessary to repeat steps 1 and 2 until all air is completely purged from the transaxles. When the transaxles move forward at normal speed, purging is complete.

Hydrostatic Drive Belt Replacement

Hydrostatic Drive Belt Removal

1. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Raise and support the unit so that the drive wheels are off the ground.
4. Remove the mower belt from the clutch. [Mower Belt Replacement \(page 6–6\)](#)
5. Using a 9/16 inch socket on the idler pulley, turn the nut clockwise (from the bottom), starting in the 3 O'clock position to remove tension on the belt.

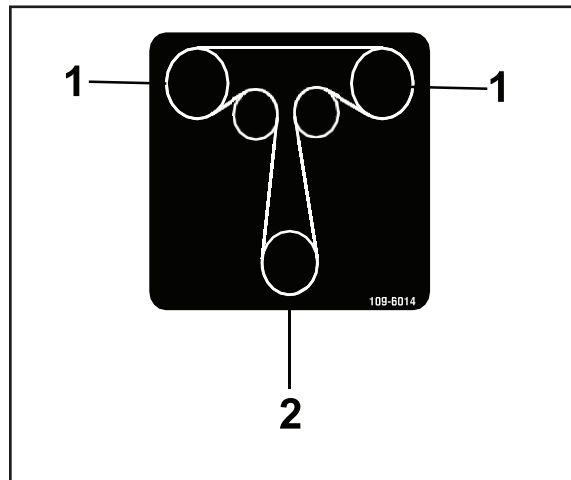
Note: If the drive idler spring is removed, ensure proper spring orientation on installation.

6. Slip the drive belt off of the idler pulleys.
7. Remove the drive belt from the hydrostatic drive pulleys.

Note: Inspect the belt for excessive wear, damage, or cracking, replace if necessary.

Hydrostatic Drive Belt Installation

1. Route the hydrostatic drive belt around the engine pulley.



g336205

Figure 73

1. Engine Pulley
2. Hydrostatic Transmission Pulleys

2. Route the drive belt around the 2 hydrostatic transmission pulleys.
3. Place the drive belt on the inside of the right idler pulley.
4. Place the idler spring through the frame slot and onto the idler pulley stud (if previously removed).

Note: Ensure proper orientation with the hook openings facing away from the idler pivot.

5. Using a 9/16 inch socket on the idler pulley, turn the nut clockwise (from the bottom of the machine), starting in the 3 O'clock position to remove tension on the belt.
6. Slip the belt up and onto the idler pulley.
7. Lower the unit.

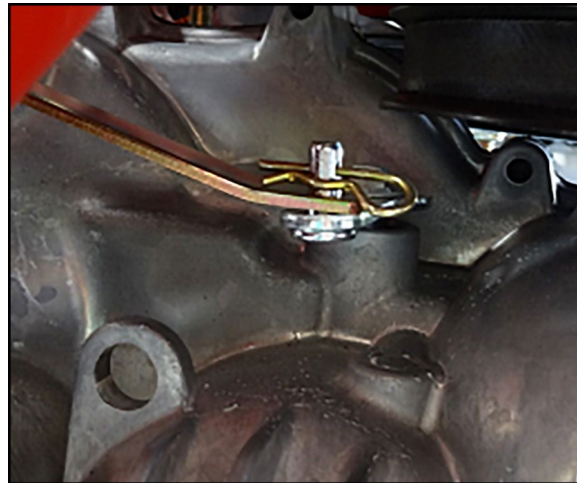
Hydrostatic Drive Belt Installation (continued)

8. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Hydrostatic Drive Transmission Replacement

Hydrostatic Drive Transmission Removal

1. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the left and right consoles. [Left Console Replacement \(page 5–11\)](#)
[Right Console Replacement \(page 5–13\)](#)
4. Remove the seat. [Seat Replacement \(page 5–15\)](#)
5. Remove the fuel tank. [Fuel Tank Replacement \(page 5–16\)](#)
6. Raise and support the unit so that the drive wheels are off the ground.
7. Remove the drive wheel(s).
8. Remove the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
9. Remove the drive belt. [Hydrostatic Drive Belt Replacement \(page 7–8\)](#)
10. Disconnect the motion control linkage from the transmission.
11. Disconnect the bypass arm.

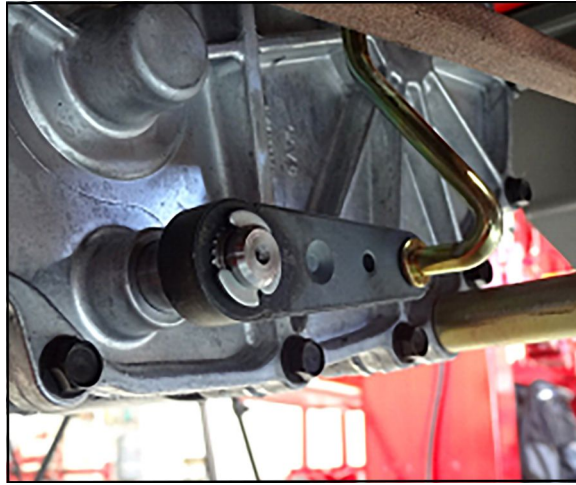


g336196

Figure 74

-
12. Disconnect the lower brake linkage from the transmission.

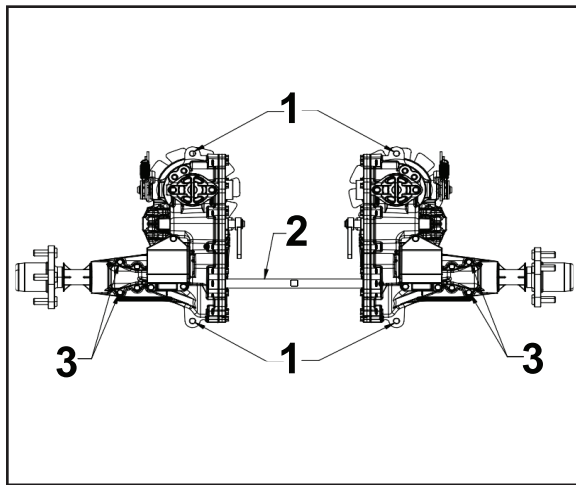
Hydrostatic Drive Transmission Removal (continued)



g336197

Figure 75

13. Disconnect the hydraulic fluid hose from the top of the transmission.
14. Remove the bolt that connects the transmission to the cross shaft.
15. Remove the 2 front and rear hydro mounting bolts.



g336195

Figure 76

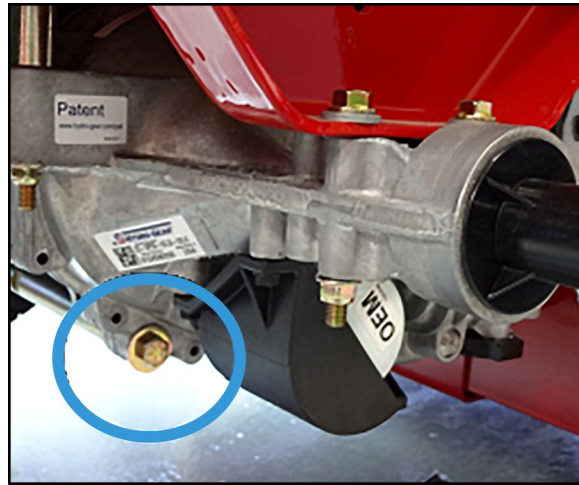
- | | |
|----------------------------------|--------------------|
| 1. Front and Rear Mounting Bolts | 3. Axle Horn Bolts |
| 2. Cross Shaft | |

16. Support the transmission, loosen and remove the two axle horn nuts and bolts. Lower the transmission.

Hydrostatic Drive Transmission Installation

1. Lift and support the transmission, and install the 2 axle horn bolts, washers, and nuts. Do not fully tighten the nuts at this time.
2. Align the cross shaft and install the bolt through the transmission into the cross shaft. Do not tighten at this time.

Hydrostatic Drive Transmission Installation (continued)



g336198

Figure 77

3. Install the front and rear hydro mounting bolts, washers, and nuts. Do not tighten at this time.

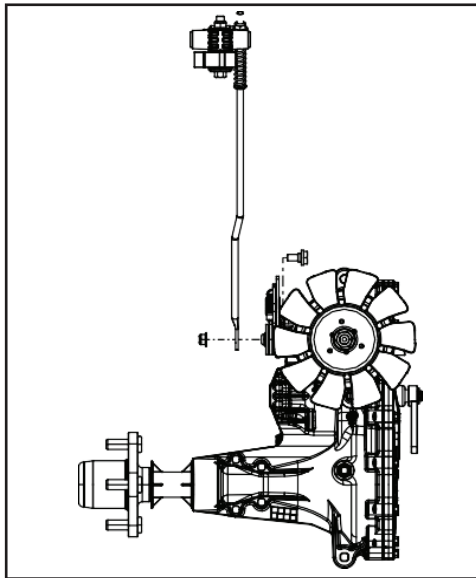
Note: The proper torque sequence, as outlined below, is critical in avoiding damage to the hydrostatic transmission and the frame.



4. Tighten the cross shaft bolt and torque to 52-65 N • m (43 ± 5 ft-lb).
5. Tighten the rear hydro mounting bolt.
6. Tighten the 2 axle horn bolts.
7. Tighten the front hydro mounting bolt.
8. Remove the protective cap from the hydraulic oil nipple (if installing a new hydrostatic drive). Install the hydraulic fluid hose, and move the hose clamp into place.
9. Connect the lower brake linkage to the transmission.
10. Connect the bypass arm.
11. Connect the motion control linkage.

Note: Attach the motion control linkage as shown with the offset toward the outside of the machine.

Hydrostatic Drive Transmission Installation (continued)



g336199

Figure 78


12. Install the drive belt. [Hydrostatic Drive Belt Replacement \(page 7–8\)](#)
 13. Install the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
 -  14. Verify that the wheel hub nut is properly torqued, torque to 325-353 N • m (250 ± 10 ft-lb).
 15. Install the drive wheel and torque the lug nuts, torque to 122-135 N • m (95 ± 5 ft-lb).
 16. Add hydraulic oil to the reservoir to the FULL COLD line.
 17. Connect the battery terminals and verify proper function.
 18. Follow the purging procedure to remove all air from the system. [Purging Procedure \(page 7–7\)](#)
- Note:** Check level of the hydraulic fluid and add if necessary.
19. Adjust the neutral setting if necessary.
 20. Lower the unit.
 21. Adjust the tracking if necessary. [Tracking Adjustment \(page 7–7\)](#)
 22. Connect the battery by installing the positive cable first, then the negative cable to the battery.



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General Information

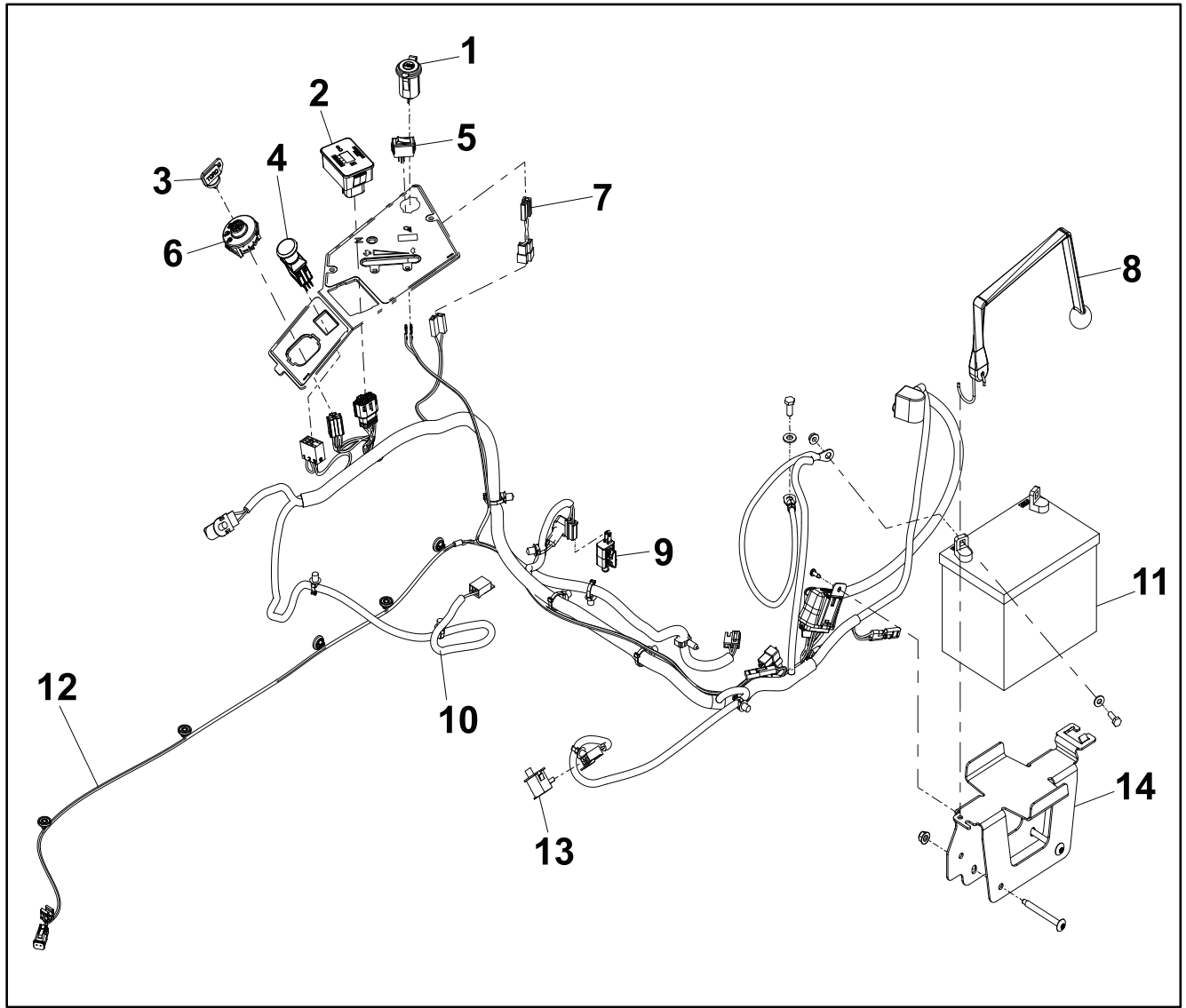
The electrical system operates on 12 VDC. The proper battery size is 300CCA. Before performing any electrical troubleshooting, always:

- Verify proper battery voltage (above 12.4V), batteries reading 12.4v or less are considered discharged.
- Check that all engine and chassis ground wires are securely connected and not damaged.

Use of test lights and continuity testers may result in false readings and lead to an incorrect diagnosis. Use of a digital volt ohm meter is necessary for accurate testing.

Service and Repairs

Electrical Assembly 1

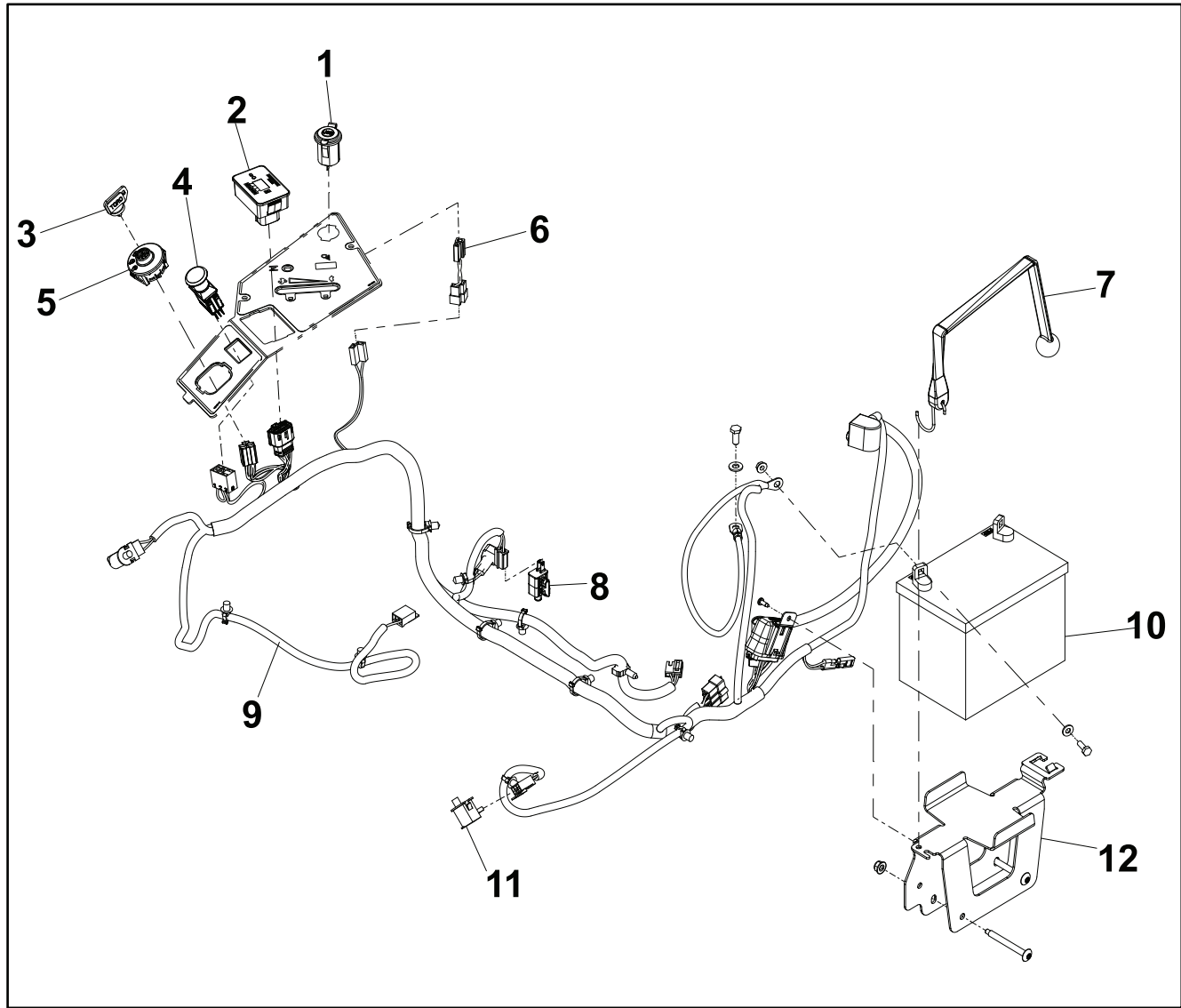


g337720

Figure 79

- | | |
|-------------------------|------------------|
| 1. USB Power Port | 8. Bungee Strap |
| 2. Module Asm | 9. Switch |
| 3. Ignition Key | 10. Wire Harness |
| 4. PTO Switch | 11. Battery |
| 5. Rocker Switch | 12. Wire Harness |
| 6. Ignition Switch | 13. Bail Switch |
| 7. USB Kit Wire Harness | 14. Battery Tray |

Electrical Assembly 2



g337721

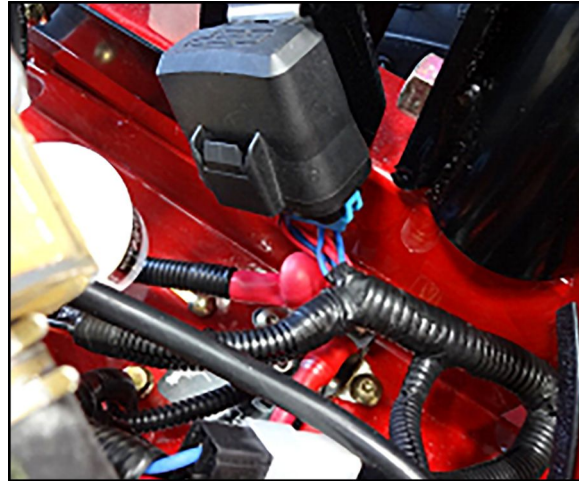
Figure 80

- | | |
|-------------------------|------------------|
| 1. USB Power Port | 7. Bungee Strap |
| 2. Module Asm | 8. Switch |
| 3. Ignition Key | 9. Wire Harness |
| 4. PTO Switch | 10. Battery |
| 5. Ignition Switch | 11. Bail Switch |
| 6. USB Kit Wire Harness | 12. Battery Tray |

Fuse Block and Fuses

The fuse block houses the fuses that protect the electrical system from electrical surges.

Note: Always use Toro fuses when replacing a damaged or blown fuse.

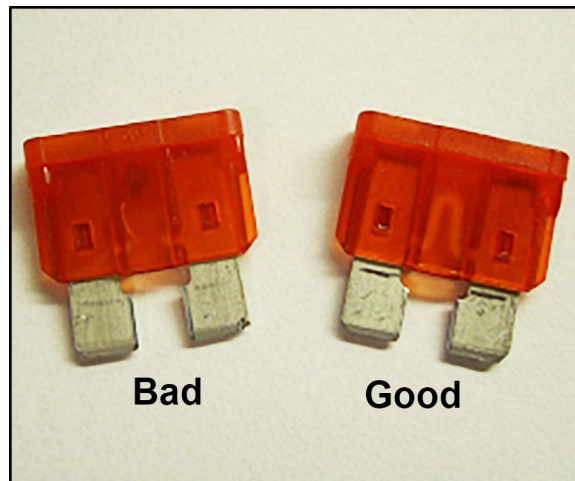


g336412

Figure 81

Fuse Block and Fuses Test

1. Visually inspect the fuses. A failed fuse can be identified by a broken or melted element inside the fuse cover or a damaged spade.



g336414

Figure 82

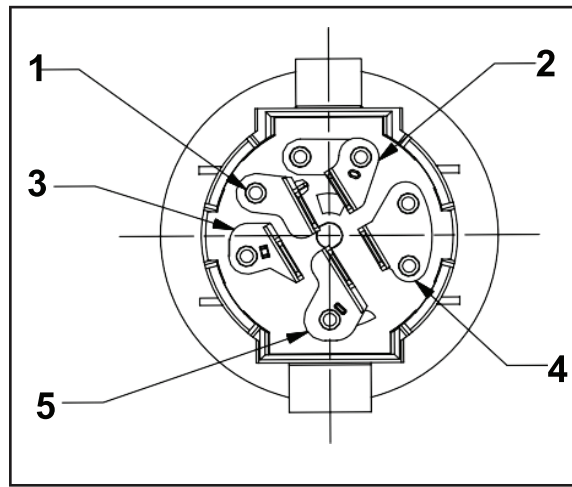
2. Using a digital multi-meter set to the OHM or Continuity setting, check the continuity between the fuse blades. If the fuse is OPEN (no continuity), replace the fuse and test the circuit.

Key/Ignition Switch

The ignition switch makes the proper connections for the starter, safety circuits, and accessories. Detents inside the switch control the three switch positions: OFF, RUN, and START. The START position is spring loaded so that it automatically returns to the RUN position when released.

Ignition Switch Wiring Connections

- 1- PTO Switch
- 2- Operator Presence Switch, Safety Interlock Switches
- 3- Starting Circuit
- 4- Regulator, Charging Circuit
- 5- Battery Voltage In



g336416

Figure 83

Key/Ignition Switch Test

1. Remove the control panel from the right console.
2. Disconnect the ignition switch from the wire harness.
3. Using a digital multi-meter set to the OHM or Continuity setting, verify that continuity exists between the terminals listed for each switch position.
4. Using a digital multi-meter set to the OHM or Continuity setting, verify that NO continuity exists between the terminals not listed for each switch position.

Position	Circuit "Make"
OFF	None
RUN	B + R + I + A
START	B + R + I + S

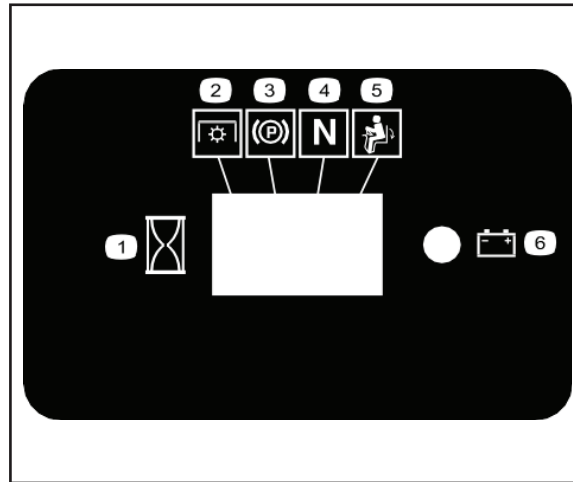
Hourmeter

The hourmeter records hours of operation when the ignition key is ON and the PTO switch is ON.

Hourmeter Test

With the ignition switch in the RUN position and the PTO switch closed (ON), verify battery voltage and ground to the hourmeter.

Hourmeter Test (continued)



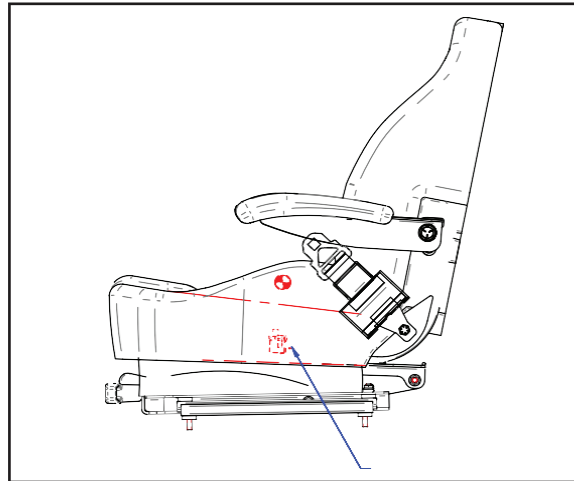
g336418

Figure 84

Operator Presence Switch (Seat Switch)

With the ignition switch in the RUN position, and the operator presence switch closed (operator is in the seat), battery voltage is supplied to the neutral switches.

Note: The operator presence switch is part of the seat assembly.



g336419

Figure 85

Operator Presence Switch (Seat Switch) Test

1. Disconnect the wire harness from the operator presence switch, located on the bottom of the seat assembly.
2. Using a digital multi-meter set to the OHM or continuity setting, test the continuity between the two switch terminals.
 - When the seat is vacated, the switch should NOT have continuity (open).
 - When the operator is present, the switch should have continuity (closed).

Neutral Switch - Left and Right

The neutral switch is a single pole plunger type switch (normally open) with two terminals. When the plunger is depressed, the circuit closes and there is continuity between the terminals.

Motion control levers in neutral position (OUT), the switch will have continuity (closed).

Motion control levers in the operating position (IN), the switch will NOT have continuity (open).



g336403

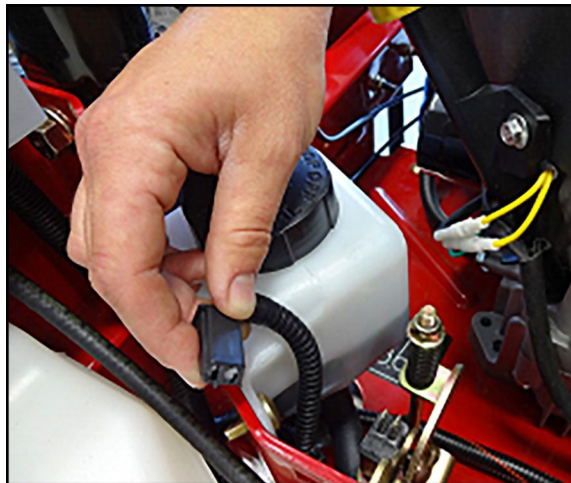
Figure 86

Parking Brake Switch

The parking brake switch is a single pole plunger type switch (normally open) with two terminals. When the plunger is depressed (parking brake ON), the circuit closes and there is continuity between the terminals. This allows battery voltage to flow to the rest of the safety interlock system.

Parking brake ON, the switch should have continuity (closed).

Parking brake OFF, the switch should NOT have continuity (open).

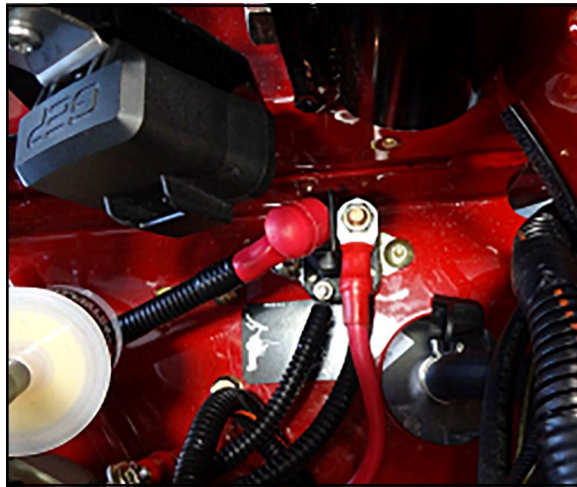


g336405

Figure 87

Starter Solenoid

The solenoid is a remote switch that connects the battery to the starter motor when the ignition switch is turned to START. The solenoid protects the ignition switch from the high current drawn by the starter motor.

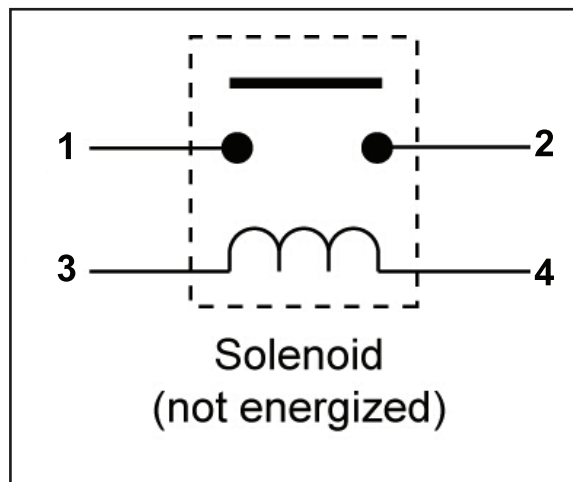


g336406

Figure 88

Starter Solenoid Test

1. Disconnect the solenoid from the wiring harness.
2. With a multi-meter set to the OHM or continuity setting, check to ensure that terminals 1 and 2 are open (no continuity).
3. Apply 12 volts (DC) to terminal 3 and ground terminal 4. Terminals 1 and 2 should now be closed (continuity).



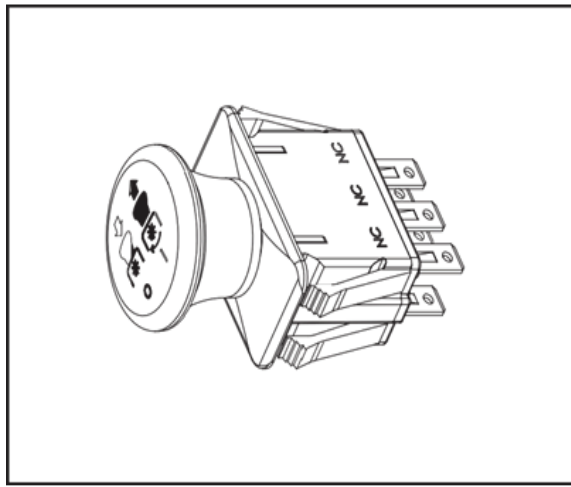
g336407

Figure 89

PTO Switch

The PTO switch provides battery voltage from the ignition switch to the PTO clutch.

As part of the safety interlock system, the PTO switch will prevent the engine from cranking/starting when in the ON position by preventing the starter solenoid from grounding through the engine stop relay.



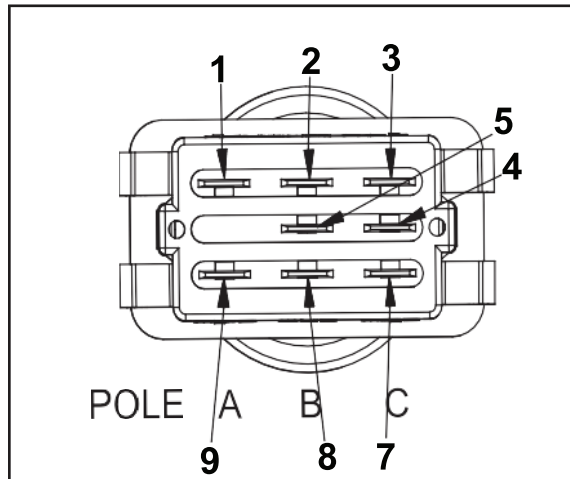
g336408

Figure 90

Note: The engine will not crank over when the PTO switch is in the ON position. The PTO switch provides battery voltage from the ignition switch to the parking brake switch and the neutral switches as part of the safety interlock system.

PTO Switch Test

1. Remove the control panel from the right console.
2. Disconnect the PTO switch from the wire harness.
3. With the switch in the ON position (button pulled OUT).



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Figure 91

4. Using a digital multi-meter set to the OHM or Continuity setting, verify the following:
 - Pin 2 and 5 should have continuity (closed)
 - Pin 1 and 4 should have continuity (closed)
 - Pin 1 and 7 should NOT have continuity (open)
 - Pin 2 and 8 should NOT have continuity (open)
5. With the switch in the OFF position (button pushed IN):
 - Pin 1 and 7 should have continuity (closed)
 - Pin 2 and 8 should have continuity (closed)

PTO Switch Test (continued)

- Pin 1 and 4 should NOT have continuity (open)
- Pin 2 and 5 should NOT have continuity (open)

Electric PTO Clutch

The PTO clutch electronically controls the engagement and disengagement of the PTO pulley (deck belt).

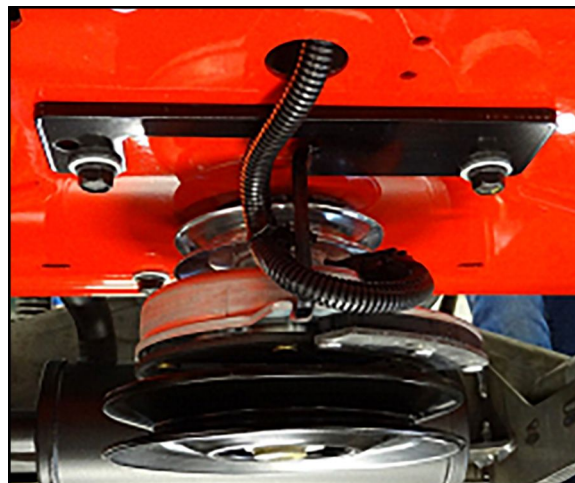
The PTO clutch is composed of three major components:

- Field
- Clutch Plate
- Friction Plate

The clutch plate always turns with the engine (crankshaft). The field is a coil of wire on an iron core which becomes an electromagnet when power is applied. The friction plate is the only piece that moves vertically on the crankshaft. It is normally spring loaded so that it is not in contact with the clutch plate and is pressed against the brake material opposite the clutch plate. When power is applied, the friction plate is pulled toward the clutch plate and the two rotate as one. When the clutch plate and the friction plate rotate at different speeds it is known as clutch slipping.

Electric PTO Clutch Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Raise and support the unit so that the drive wheels are off the ground.
4. Remove the mower belt. [Mower Belt Replacement \(page 6–6\)](#)
5. Disconnect the clutch wire connector from the clutch.



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Figure 92

6. Remove the clutch mounting bolt and washers. Slip the clutch off of the crankshaft.

Electric PTO Clutch Installation

1. Install the clutch onto the crankshaft verifying that the slot in the clutch aligns with the tab on the clutch anchor

Electric PTO Clutch Installation (continued)



2. Install the 2 spring washers and clutch bolt. Torque the clutch bolt to 66-83 N • m (55 ± 6 ft-lb).
3. Connect the clutch power wire to the clutch.

Note: Verify the wire harness is properly routed to avoid contact with the mower belt or drive belt



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Figure 93

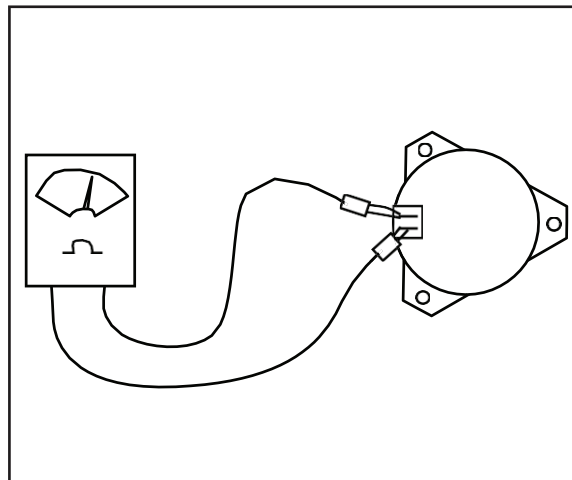
-
4. Connect the battery by installing the positive cable first, then the negative cable to the battery.
 5. Lower the unit and verify proper function.

Electric PTO Clutch-Coil Resistance Measurement Test

If the PTO clutch is not engaging or is suspect as a cause of electrical problems, use the following electrical troubleshooting steps. These procedures will help determine if the clutch has failed as a result of or is the cause of an electrical problem.

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop and remove the key. Engage the parking brake.
2. Disconnect the clutch wire connector.
3. Set the multi-meter to measure resistance (OHMs setting).
4. Connect the meter lead wires to the terminals in the clutch connector.

Electric PTO Clutch-Coil Resistance Measurement Test (continued)



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Figure 94

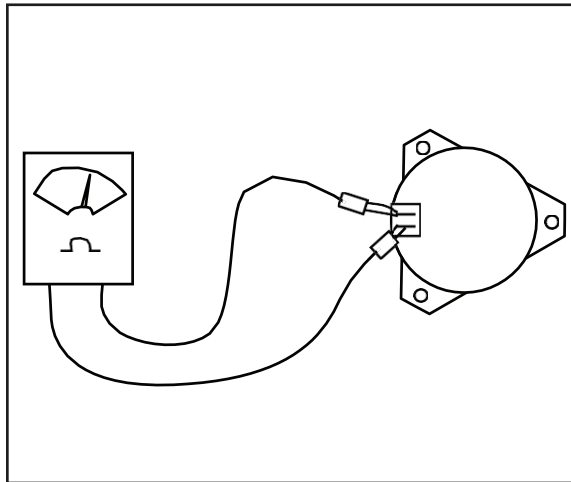
5. See the PTO Clutch Electrical Specifications chart.

Resistance (OHMs)	AMP Draw	Continuity to Ground	Series
2.84	4.23	OPEN	1500 and 2000
3.05 ± 5%	3.93	OPEN	2500

Electric PTO Clutch- PTO Clutch Continuity to Ground Test

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop and remove the key. Engage the parking brake.
2. Disconnect the clutch wire connector.
3. Set the multi-meter to measure resistance (OHM setting).
4. Connect one multi-meter lead to the engine, chassis or battery ground. Connect the other multi-meter lead to each of the clutch connector terminals.
5. The clutch connector terminals should never have continuity to ground and should be OPEN at all times.
6. If continuity is found between the PTO connector and ground, the PTO clutch and the PTO switch must be replaced.

Electric PTO Clutch- PTO Clutch Continuity to Ground Test (continued)

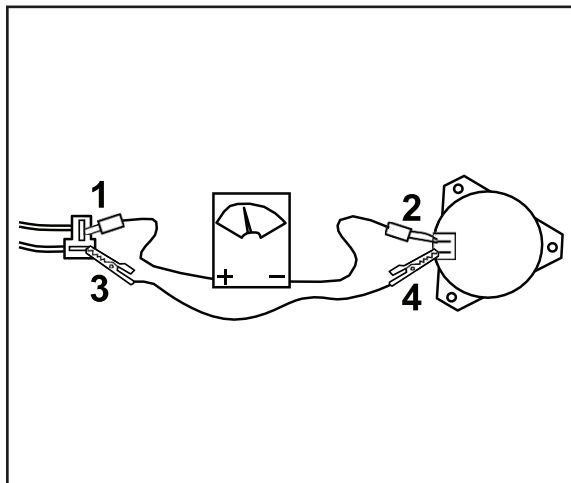


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Figure 95

Electric PTO Clutch- Measuring Clutch Current Draw

Note: Do not measure current draw if the clutch has shorted to ground or if the resistance measurement is out of specification.



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Figure 96

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove the key. Engage the parking brake.
2. Disconnect the clutch wire connector.
3. Set the multi-meter to measure amps (10 amp scale).
4. Connect the positive meter lead to the chassis harness terminal 1.
5. Connect the negative meter lead to the corresponding wire terminal 2.
6. Connect a short jumper lead from terminal 3 to terminal 4.
7. Turn the ignition switch to RUN and the PTO switch to the ON position.
8. Record the amp reading and refer to the PTO Clutch Electrical Specification Chart below.

PTO Clutch Electrical Specification Chart

Electric PTO Clutch- Measuring Clutch Current Draw (continued) PTO Clutch Electrical Specification Chart (continued)

Resistance (OHMs)	AMP Draw	Continuity to Ground	Series
2.84	4.23	OPEN	1500 and 2000
3.05 ± 5%	3.93	OPEN	2500

TVS Diode

The TVS diode protects the electrical system from current surges caused by PTO engagement and disengagement.



g336413

Figure 97



Foldout Drawings

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Electrical Drawing Abbreviations

The following abbreviations are used for wire harness colors on the electrical schematics and wire harness drawings in this chapter.

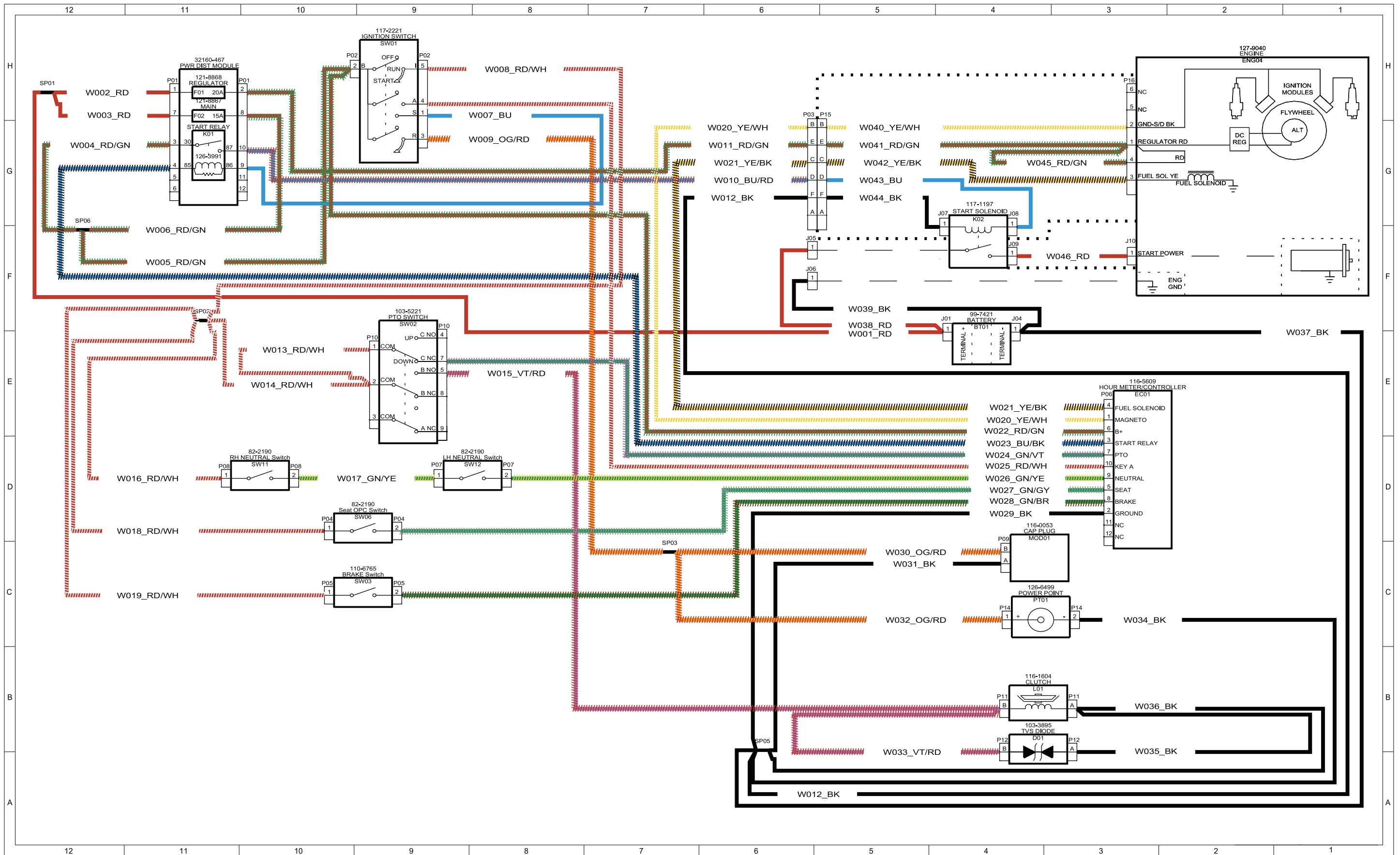
Abbreviation	Color
BK	Black
BR or BN	Brown
BU	Blue
GN	Green
GY	Gray
OR or OG	Orange
PK	Pink
R or RD	Red
T or TN	Tan
VIO or VT	Violet
W or WH	White
Y or YE	Yellow

Numerous harness wires include a line with an alternate color. These wires are identified with the wire color followed by a / or _ and then the line color (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 with black insulation.

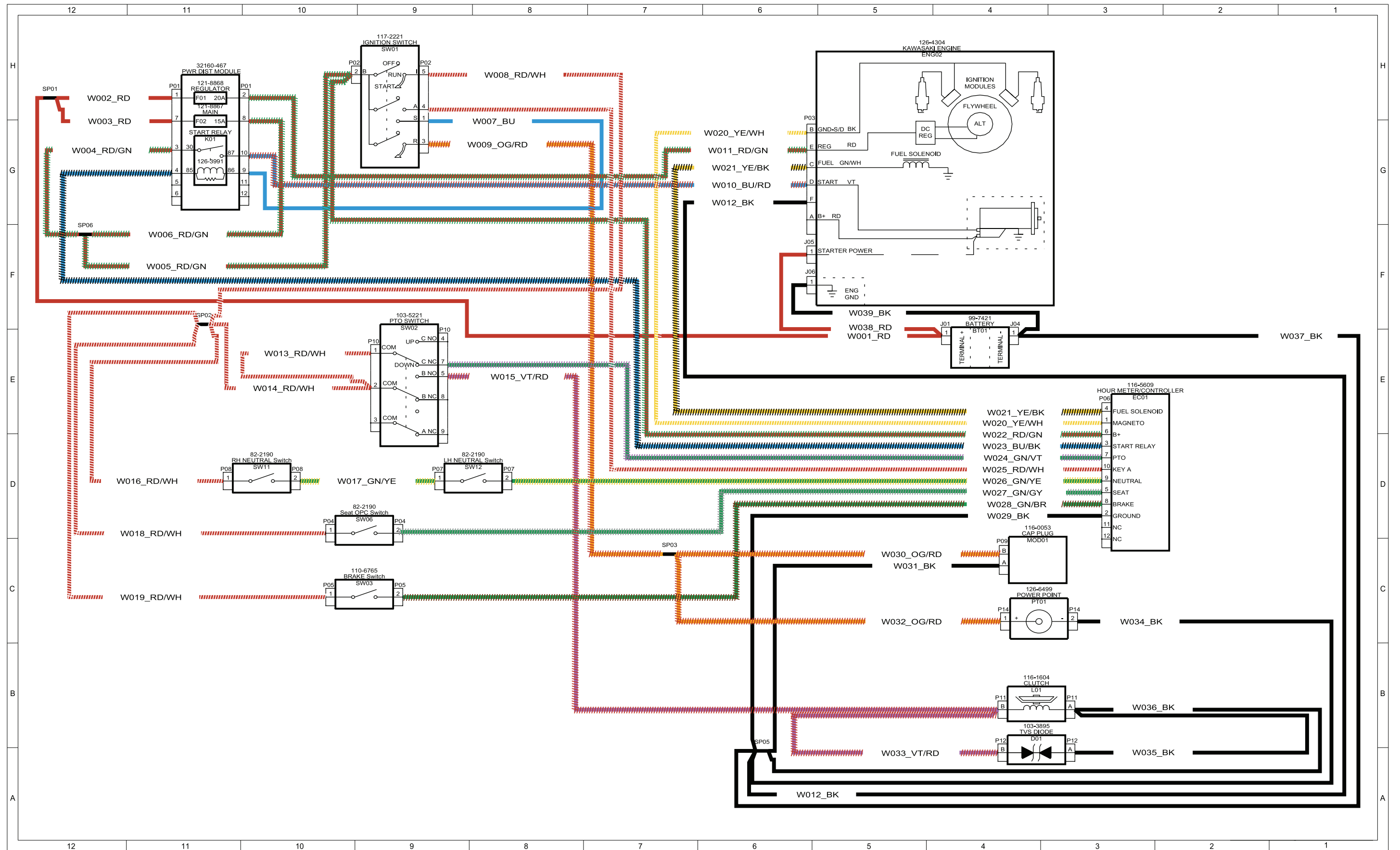
Note: A splice used in a wire harness will be identified on the wire harness diagram by SP. The manufacturing number of the splice is also identified on the wire harness diagram (e.g., SP01 is splice number 1).

Electrical Schematic



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Kawasaki Engine Electrical Schematic



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