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TORO

Count on it.

Service Manual

TITAN® Service Manual

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8111 Lyndale Avenue South
Bloomington, MN 55420

Original Instructions (EN)

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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Chapter 1

Safety

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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

Chapter 2

Specifications and Maintenance

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Specifications

Model	75301	75302	75303	75310
Engine Make	Toro			Kawasaki
Engine Model	Toro V-Twin 24.5 HP 708cc			Twin 21.5 HP 726cc
Engine Model	LC2P77F			FR651–S12–R (CARB)
Crankcase Capacity	1.8 L (61 fl oz); without filter; 2.4 L (81 fl oz) with filter 50 deg - 100+ deg SAE 30 32 deg -100+ deg SAE 20W–50 20 deg - 85 deg SAE 10W–30 20 deg -100+deg SAE 10W–40 -20 deg - 40 deg SAE 5W–20			
High Idle	3600 ± 100 rpm			
Low Idle	1750 ± 150 rpm			
Spark Plug	Champion: RN9YC NGK: BPR6ES			
Engine Oil	40 deg-100+deg SAE 30 0 deg -80 deg SAE 5W–30,10W–30 -20 deg - 100+ deg synthetic 5wW–20, 5W–30, 10W–30			
Oil Capacity	2.4 L (81 fl oz) with filter change			
CARB	No			Yes
EPA	Yes			
Air Filter	Canister			Standard
Fuel Capacity	5 gallons			
Display	Hourmeter			
Battery	12 volt – 300 CCA			
Clutch	Warner — 105 ft-lb			
Clutch Adjustment	Non-adjustable			
Hydraulic Drive System				
Transmission	ZT-2800			
Transmission Lubricant	4.45 L (150 oz) Toro HYPR-OIL® 500 hydraulic fluid or Mobil 1 20W-50 oil			
Max Ground Speed (FWD)	Up to 8.5 mph			
Max Ground Speed (REV)	Up to 5 mph			
Rear Tires	22 x 11 x 10			
Rear Tire Pressure	13 psi			

Model	75311	75312	75313
Engine Make	Toro		
Engine Model	Toro V-Twin 24.5 HP 708cc		
Engine Model	LC2P77F		

Model	75311	75312	75313
Crankcase Capacity	1.8 L (61 fl oz); without filter; 2.4 L (81 fl oz) with filter 50 deg - 100+ deg SAE 30 32 deg -100+ deg SAE 20W–50 20 deg - 85 deg SAE 10W–30 20 deg -100+deg SAE 10W–40 -20 deg - 40 deg SAE 5W–20		
High Idle	3600 ± 100 rpm		
Low Idle	1750 ± 150 rpm		
Spark Plug	Champion: RN9YC NGK: BPR6ES		
Engine Oil	40 deg-100+deg SAE 30 0 deg -80 deg SAE 5W–30,10W–30 -20 deg - 100+ deg synthetic 5wW–20, 5W–30, 10W–30		
Oil Capacity	2.4 L (81 fl oz) with filter change		
CARB	No		
EPA	Yes		
Air Filter	Canister		
Fuel Capacity	5 gallons		
Display	Hourmeter		
Battery	12 volt – 300 CCA		
Clutch	Warner — 105 ft-lb		
Clutch Adjustment	Non-adjustable		
Hydraulic Drive System			
Transmission	ZT-2800		
Transmission Lubricant	4.45 L (150 oz) Toro HYPR-OIL® 500 hydraulic fluid or Mobil 1 20W-50 oil		
Max Ground Speed (FWD)	Up to 8.5 mph		
Max Ground Speed (REV)	Up to 5 mph		
Rear Tires	22 x 11 x 10		
Rear Tire Pressure	13 psi		

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

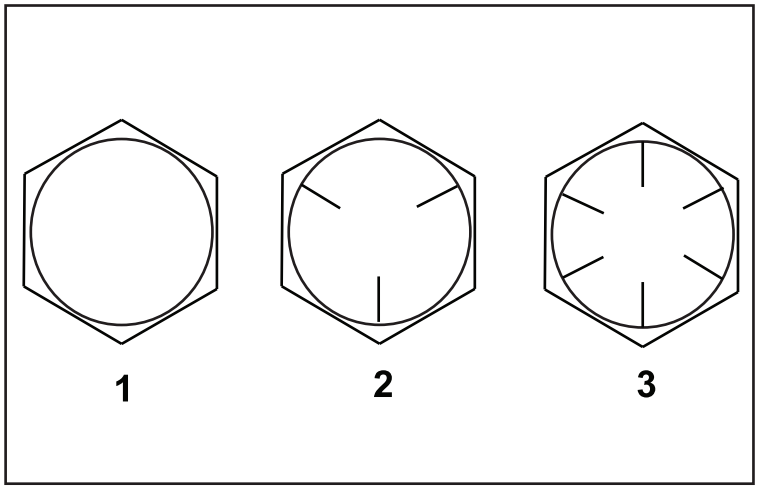

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Figure 1

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

Metric Bolts and Screws

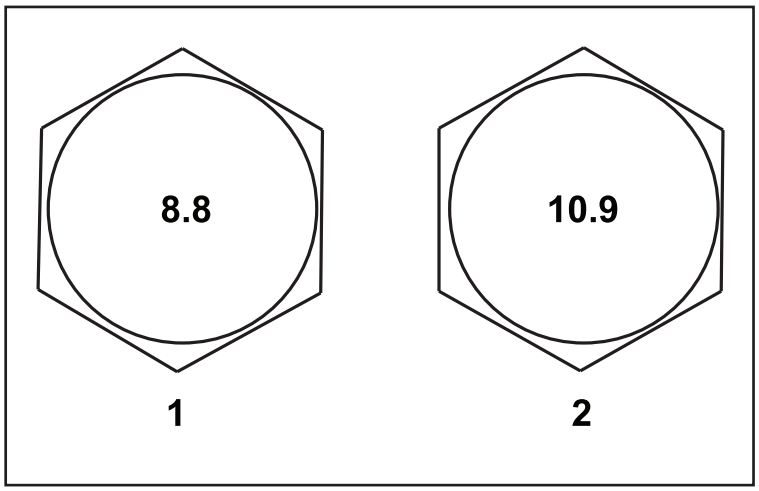

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Figure 2

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, Studes & 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	N • cm
#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 my 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

in-lb X 11.2985 = N • cm

ft-lb X 1.3558 = N • m

N • cm X 0.08851 = in-lb

N • cm X 0.73776 = 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	0.9375	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

Chapter 3

Troubleshooting

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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.	Ensure that the throttle 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 function. 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 cap.
	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 the 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. Replace components if necessary.
	There is a low voltage supply at the clutch.	Check the coil resistance, battery charge, charging system, and wiring connections. Replace components 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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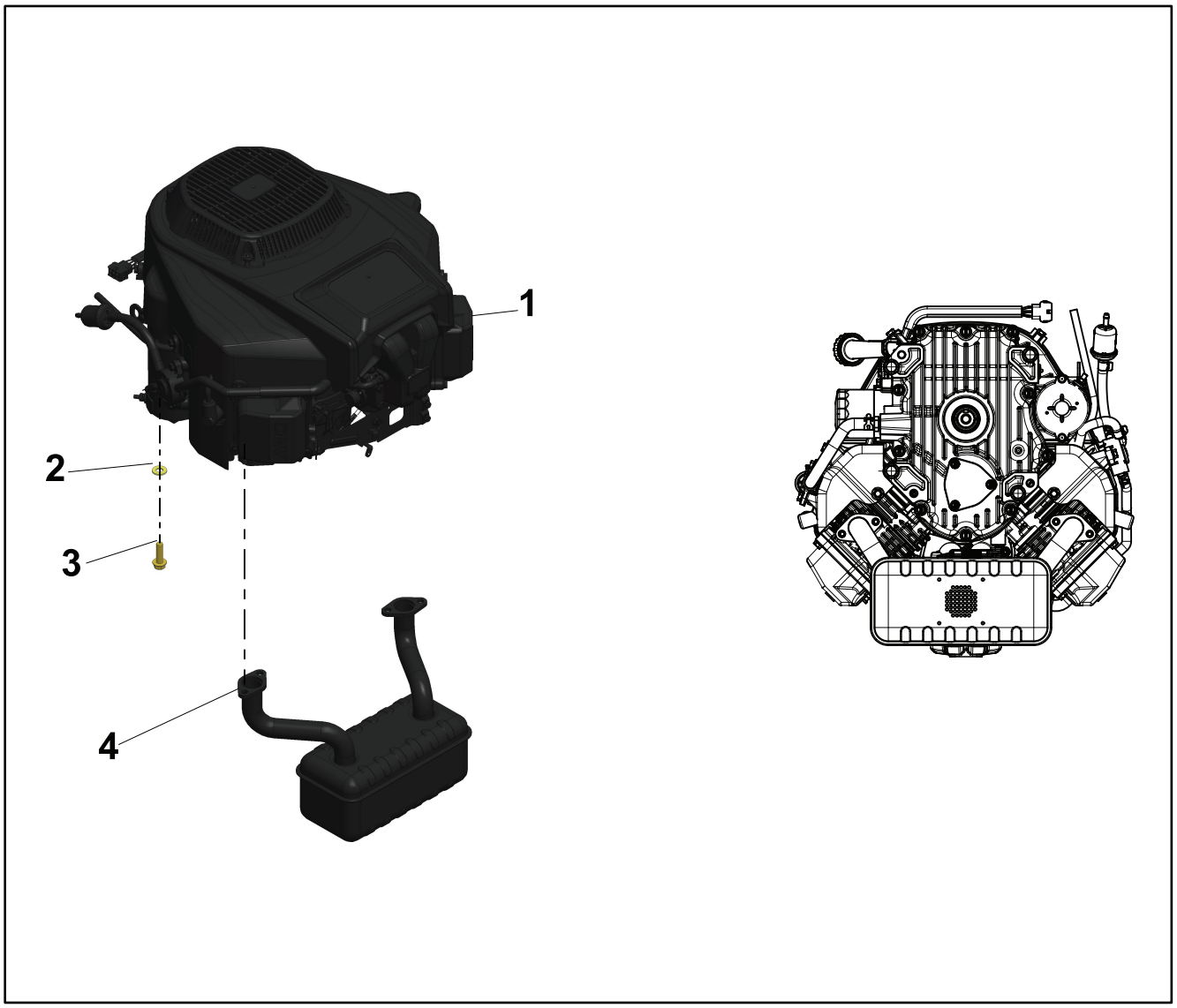
General Information

The TITAN® series of mowers use 2 different engine combinations; 708cc Toro twin cylinder OHV 4 cycle engine (LC2P77F) and 726cc Kawasaki twin cylinder OHV 4 cycle engine (FR651V).

Service and Repairs

Engine Assembly



g322220

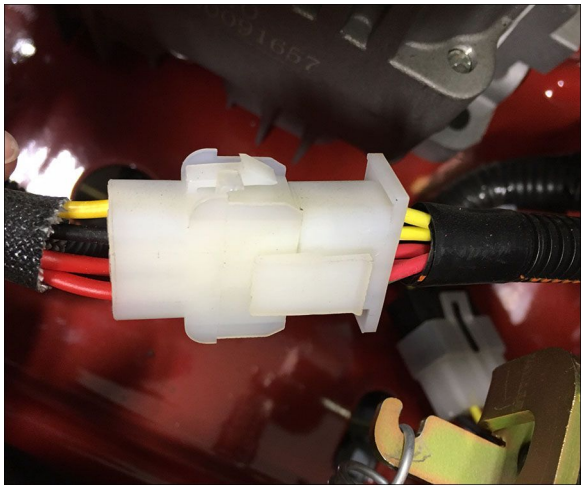
Figure 3

1. Engine
2. Flat Washer
3. Taptite Screw
4. Muffler

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 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 engine guard.
4. Remove the muffler.
5. Remove the mower belt.
6. Remove the hydrostatic drive belt.
7. Disconnect the chassis wire harness from the main engine wire harness.



g321703

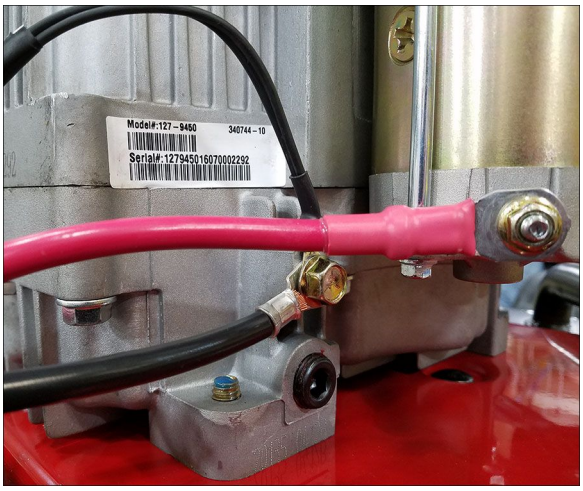
Figure 4

8. Disconnect the red wire from the starter.

g321704

Figure 5

9. Disconnect the black engine ground wire.



g321702

Figure 6

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

g321705

Figure 7

11. Remove vent line at splice with Toro supplied hose.

g321706

Figure 8

12. Disconnect the throttle cable.
13. Disconnect the choke cable.
14. Remove the clutch mounting bolt and washer. Slide the clutch off of the crankshaft.
15. Remove the engine pulley.
16. Remove the engine mounting bolts.
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. Lower the engine onto the frame.

3. Align the four holes of the engine base to the frame and attach the 2 rear mounting bolts and two flat washers loosely.

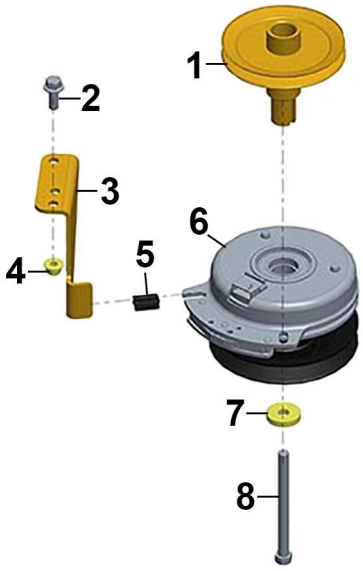
   Note: Apply Loctite 243 to engine mounting bolts.
4. Attach the front bolt through the clutch anchor and into the engine base.

g321707

Figure 9

5. Install the 3 remaining engine bolts.

6. Torque the 4 engine mounting bolts to 52 ± 5.8 N • m (450 ± 50 in-lb).
7. Apply anti-seize to the clutch end of the crankshaft.
8. Install the engine pulley onto the crankshaft.
9. Install the clutch on to the crankshaft ensuring that the slot in the clutch aligns with the tab on the clutch anchor.



g212682

Figure 10

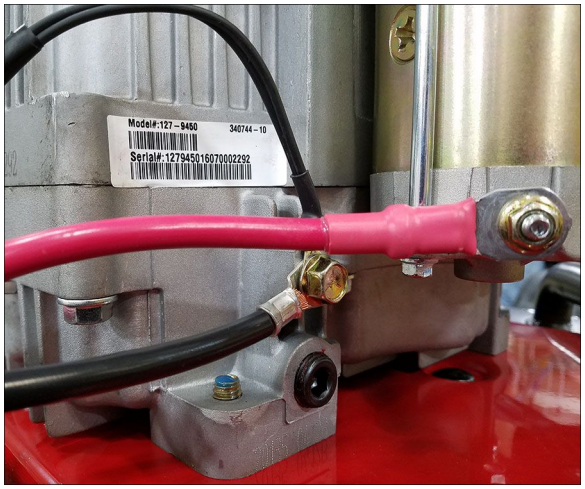
1. Engine Pulley
2. Screw
3. Clutch Stop
4. Flange Nut
5. Clutch Isolator
6. PTO Clutch
7. Washer
8. Clutch Bolt

10. Install the washer and clutch bolt.

    Note: Apply Loctite to the clutch bolt.

11. Torque the clutch bolt to 69-83 N • m (50-60 ft-lb).
12. Connect the choke cable.
13. Connect the throttle cable.
14. Connect the black engine ground wire.

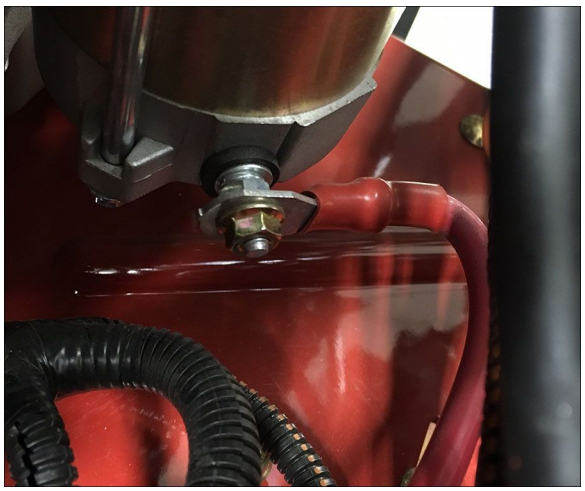
    Note: Apply Loctite to ground bolt.



g321702

Figure 11

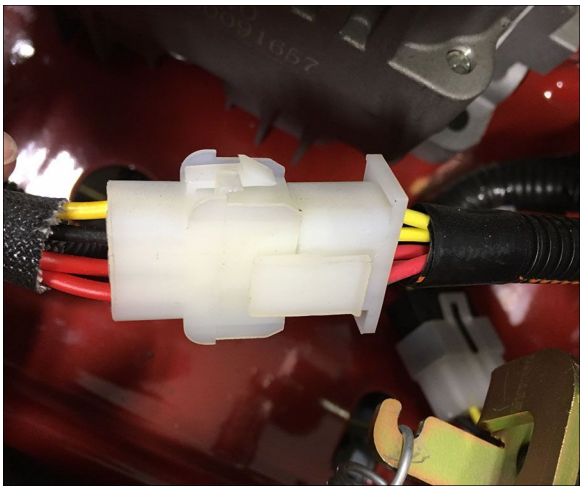
15. Connect the red wire to the starter.



g321704

Figure 12

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



g321703

Figure 13

17. Connect the fuel supply line to the fuel pump.
18. Connect the vent line to barb/splice.

g321706

Figure 14

19. Install the hydrostatic drive belt.
20. Install the mower belt.
21. Install the muffler and new exhaust.

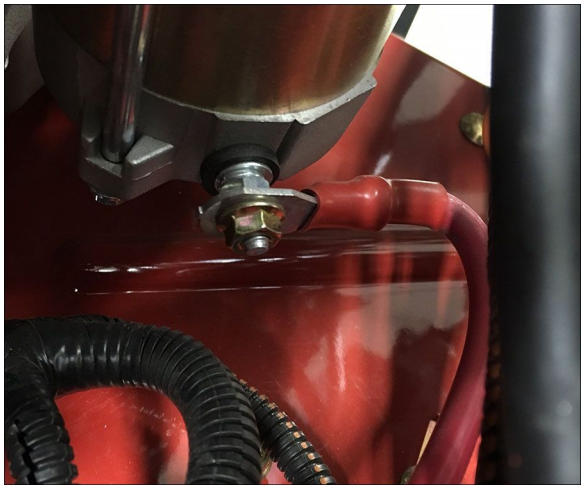
    Note: Torque muffler mounting bolts or nuts to 17-20 N • m (150-170 in-lb).
22. Install the engine guard.
23. Fill crankcase with approved oil and verify proper oil level.
24. Connect the battery by installing the positive cable first, then the negative cable to the battery.
25. Lower the unit and verify proper function.

Note: Verify Engine speed is set to proper RPM specification for the applicable model.

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 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 engine guard.
4. Remove the muffler.
5. Remove the mower belt.
6. Remove the hydrostatic drive belt.
7. Disconnect the chassis wire harness from the main engine wire harness.
8. Disconnect the red wire from the starter.



g321704

Figure 15

9. Disconnect the black engine ground wire.
10. Disconnect the fuel supply line at the fuel filter.
11. Remove vent line at splice with Toro supplied hose.
12. Disconnect the throttle cable.
13. Disconnect the choke cable.
14. Remove the clutch mounting bolt and washer. Slide the clutch off of the crankshaft.
15. Remove the engine pulley.
16. Remove the engine mounting bolts.
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. Lower the engine onto the frame.

3. Align the four holes of the engine base to the frame and attach the two rear mounting bolts and two flat washers loosely.

   Note: Apply Loctite 243 to engine mounting bolts.

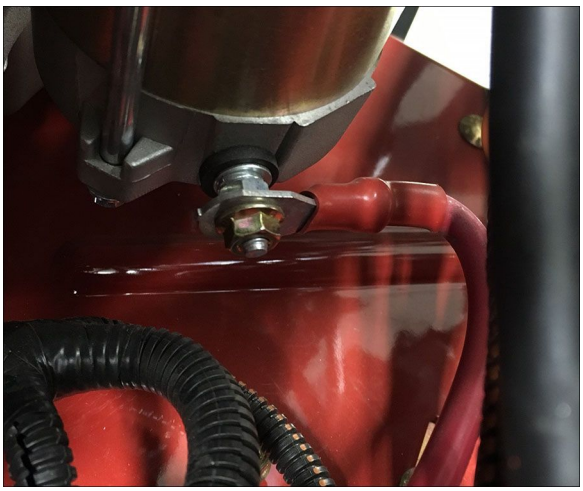
4. Attach the front bolt through the clutch anchor and into the engine base.
5. Install the 3 remaining engine bolts.
6. Torque the 4 engine mounting bolts to 52 ± 5.8 N • m (450 ± 50 in-lb).
7. Apply anti-seize to the clutch end of the crankshaft.
8. Install the engine pulley onto the crankshaft.
9. Install the clutch on to the crankshaft ensuring that the slot in the clutch aligns with the tab on the clutch anchor.
10. Install the washer and clutch bolt.

    Note: Apply Loctite to the clutch bolt.

11. Torque the clutch bolt to 69-83 N • m (50-60 ft-lb).
12. Connect the choke cable.
13. Connect the throttle cable.
14. Connect the black engine ground wire.

    Note: Apply Loctite to ground bolt.

15. Connect the red wire to the starter.



g321704

Figure 16

16. Connect the chassis wire harness to the main engine wire harness.
17. Connect the fuel supply line to the fuel pump.
18. Connect the vent line to barb/splice.
19. Install the hydrostatic drive belt.
20. Install the mower belt.
21. Install the muffler and new exhaust.

    Note: Torque muffler mounting bolts or nuts to 17-20 N • m (150-170 in-lb).

Kawasaki Engine Installation (continued)

22. Install the engine guard.
23. Fill crankcase with approved oil and verify proper oil level.
24. Connect the battery by installing the positive cable first, then the negative cable to the battery.
25. Lower the unit and verify proper function.

    Note: Verify engine speed is set to proper RPM specification for the applicable model.

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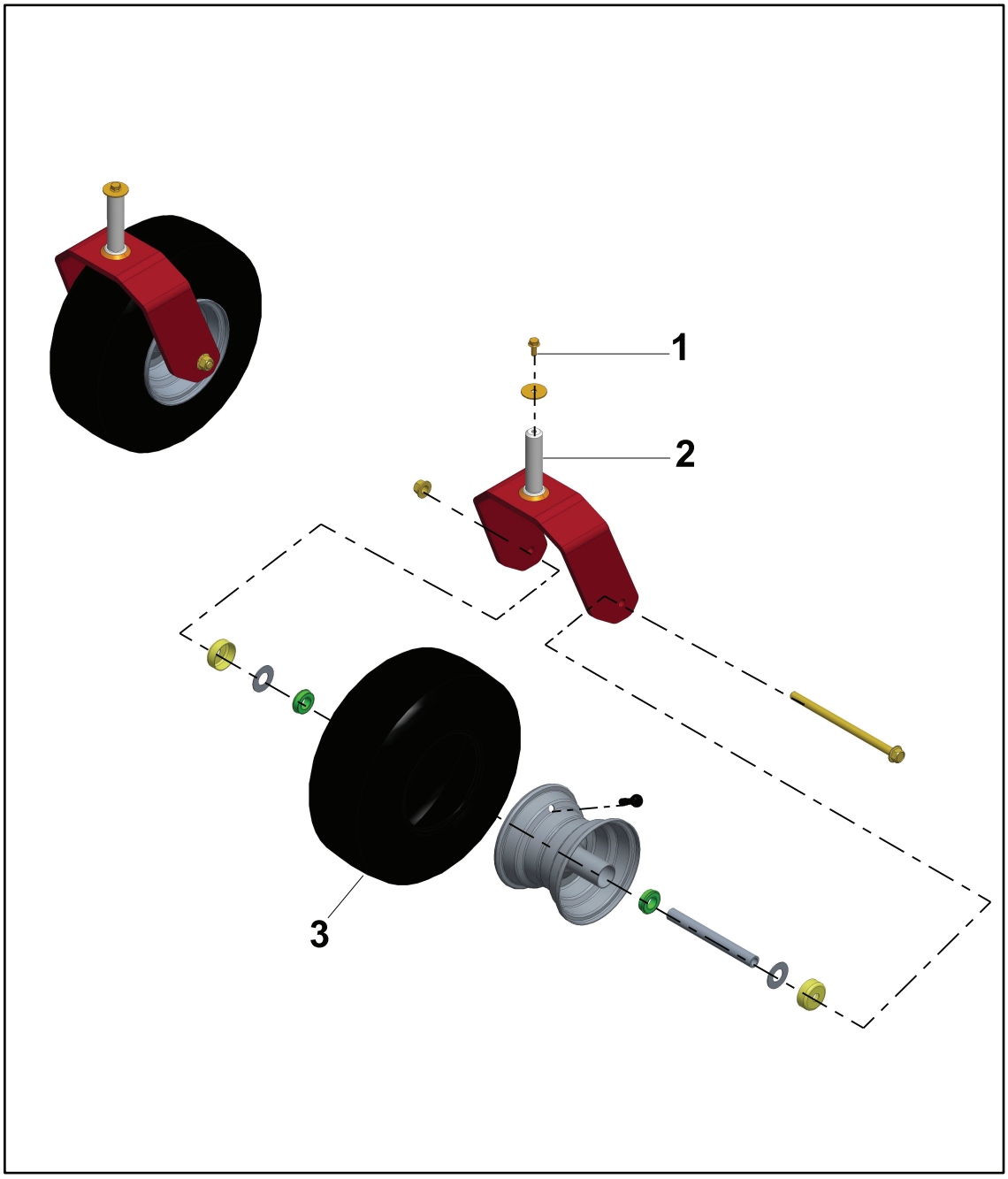
General Information

The TITAN® series uses a common frame with 2 different configurations, a MYRIDE® suspension platform and a conventional solid platform. The frame is constructed from 10 gauge steel.

Caster Tires Assembly

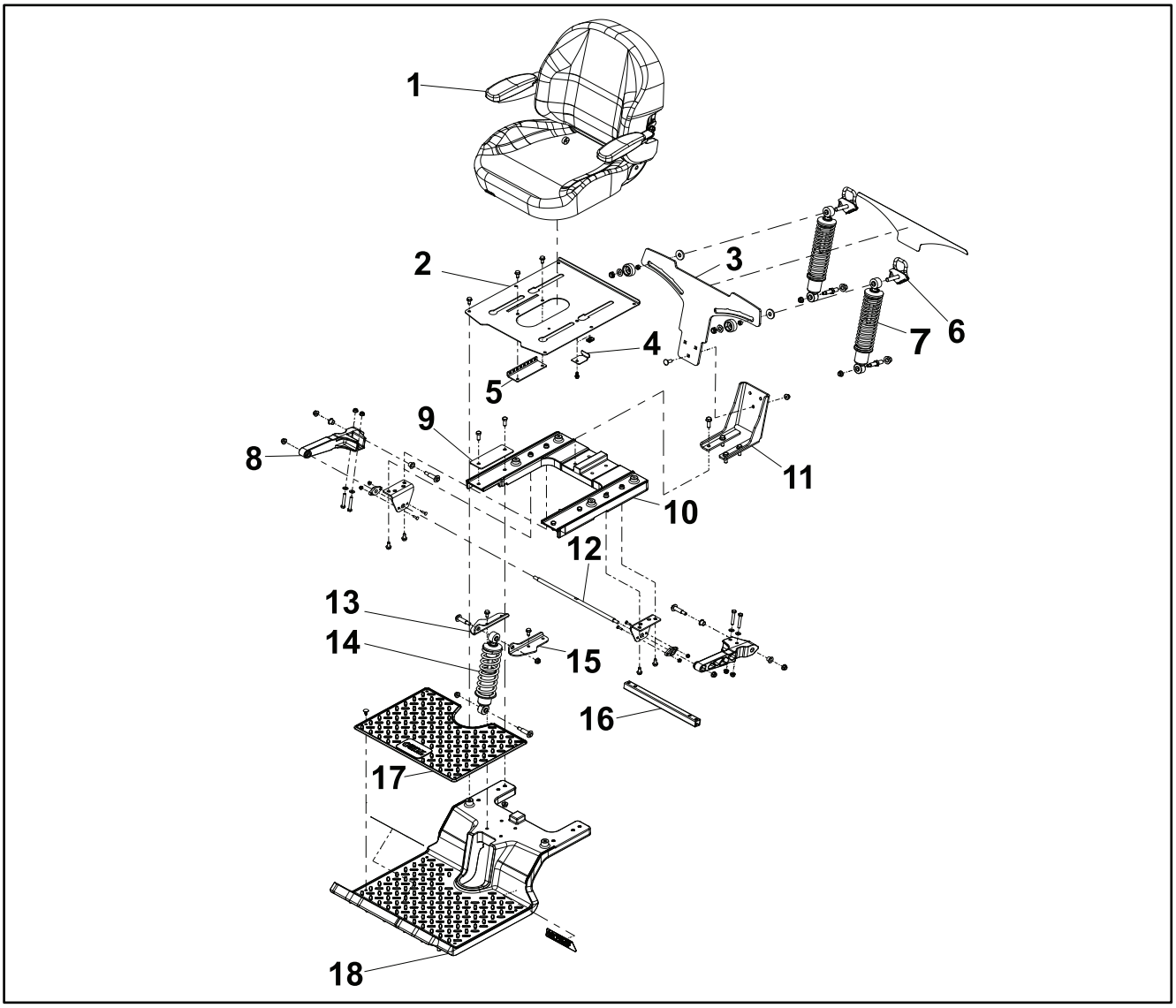


g322218

Figure 17

1. Screw
2. Caster Fork
3. Tire and Wheel Asm

Seat Assembly



g330049

Figure 18

1. Seat Asm
2. Seat Pan
3. Shock Mounting Bracket
4. Seat Stop Bracket
5. Seat Latch Bracket
6. Cam Lock Asm
7. Shock/Spring Asm
8. Trailing Arm
9. Backer Plate
10. Rear Subframe
11. Lower Mount Bracket
12. Pivot Rod
13. Upper Shock Mount Bracket
14. Shock/Spring Asm
15. Upper Shock Mount Bracket
16. Trailing Arm Tube
17. Floormat
18. Front Subframe

Caster Assembly and Bearing Replacement

Caster Assembly 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 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 front wheels are off the ground, block rear wheels.
4. Remove the caster cap.
5. Support the underside of the caster wheel and remove the screw securing the caster bearing assembly.
6. Remove the caster fork from the front axle. Inspect the caster fork shaft for wear or damage.
7. Remove the upper and lower bearings from the axle and inspect the inside of the axle bearing area for damage or excessive wear.

   Note: The bearings are pressed in and cannot be reused.

Caster Assembly and Bearing Installation

1. Clean the surface inside the axle bearing area, keeping surface clean of debris.
2. Using a proper bearing installation tool, install a new lower bearing from the bottom side into the axle, making sure that it is fully seated.
3. Using a proper bearing installation tool, install a new upper bearing from the top side into the axle, making sure that it is fully seated.

   Note: The bearings are sealed and do not require grease/lubrication.
4. Apply anti-seize to fork shaft before installing.
5. Install the caster from the bottom side of the frame and place flat washer on top of the bearing.
6. Install fastener and tighten to the caster shaft.
7. Install the caster cap.
8. Connect the battery by installing the positive cable first, then the negative cable to the battery.
9. Lower the unit and verify proper function.

Caster Wheel Bearing Replacement

Caster Wheel 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 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 front wheels are off the ground, block rear wheels.
4. Remove the bolt and nut securing the caster wheel to the caster fork.
5. Lower the caster wheel away from the caster fork.
6. Remove the dust caps, felt washers, and wheel spanner.
7. Remove the bearings (bearings may have a slight press fit).

Caster Wheel Bearing Installation

1. Install new bearings (bearings may have a slight press fit).

   Note: The bearings are sealed and do not require grease/lubrication. They may also have a slight press fit.

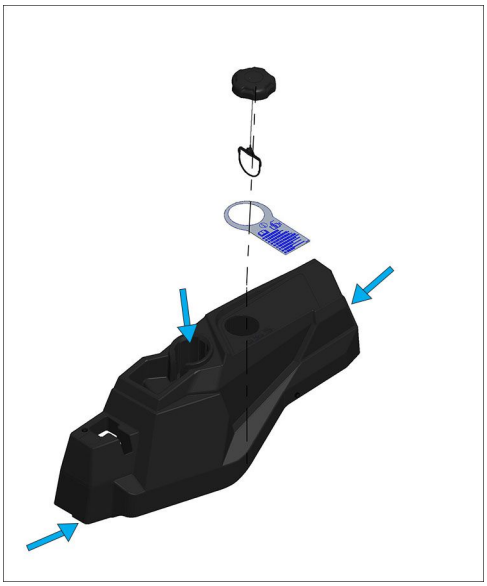
2. Install the spanner into the caster wheel, then install felt washers and dust caps over the caster bearings.
3. Place the caster wheel inside of the caster fork, aligning the spanner with the holes in the caster fork.

4. Install the bolt and nut and torque to 44 ± 7 N• m (32 ± 5 ft-lb).
5. Lower the unit and verify proper function.
6. Install new bearings (bearings may have a slight press fit).
7. Connect the battery by installing the positive cable first, then the negative cable to the battery.

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 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 3 (T30) shoulder screws from the left console.

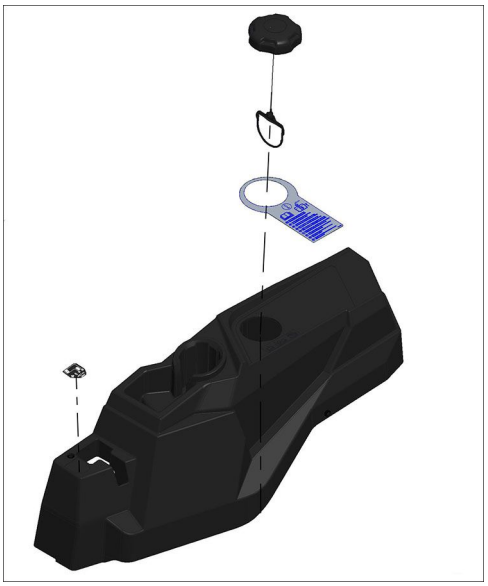


g321205

Figure 19

4. Remove the fuel cap and disconnect the keeper line.

Left Console Removal (continued)



g321206

Figure 20

5. Remove the left side control lever.
6. Lift the console upward off of the machine.
7. Replace the fuel cap.

Left Console Installation

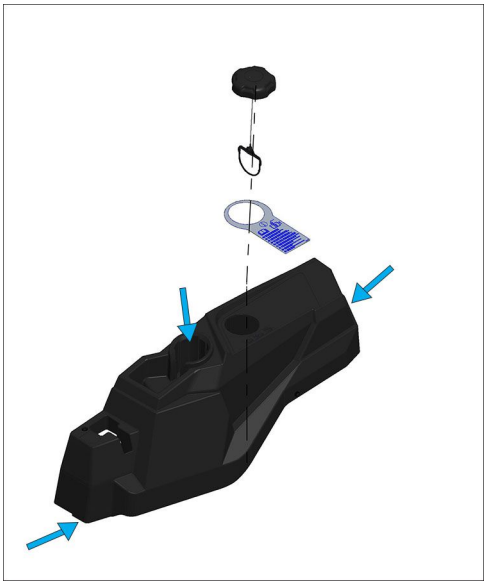
1. Remove the fuel cap from the gas tank.
2. Lower the console into place, ensuring that it seats properly on the supports.

g321204

Figure 21

3. Install the left side control lever.
4. Install the keeper line into the fuel cap, and reinstall the fuel cap.

5. Install the 3 (T30) shoulder screws securing the left console to the machine. Torque screws to 11 N• m (100 in-lb).



g321205

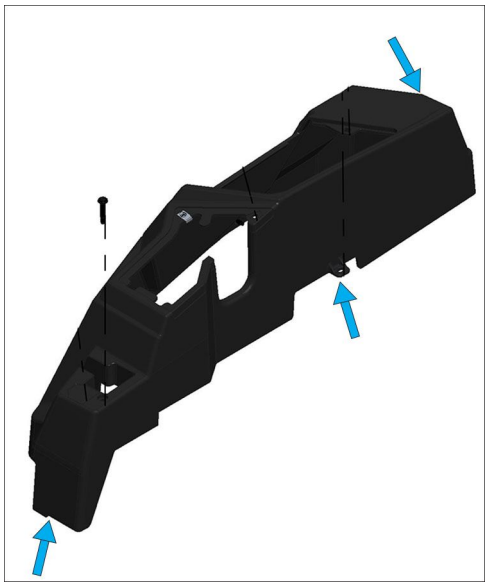
Figure 22

6. Install the battery onto the battery tray and secure with the bungee strap
7. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Right Console Replacement

Right Console Removal

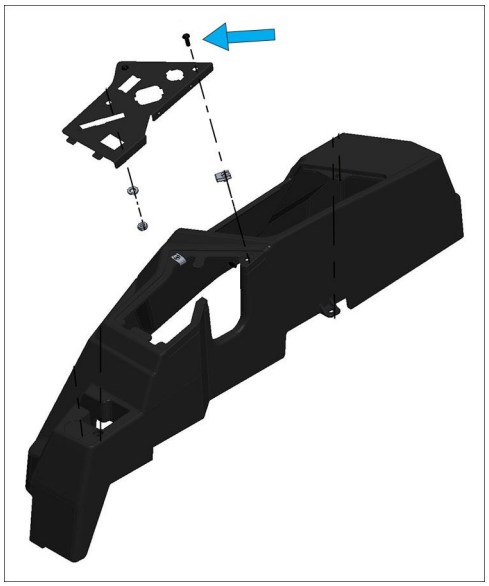
1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the 3 (T30) shoulder screws from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



g321208

Figure 23

4. Remove the screws securing the control panel assembly to the console.



g321207

Figure 24

5. Remove the right side control lever.
6. 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 the cables or wire harness.

Right Console Removal (continued)

g322343

Figure 25

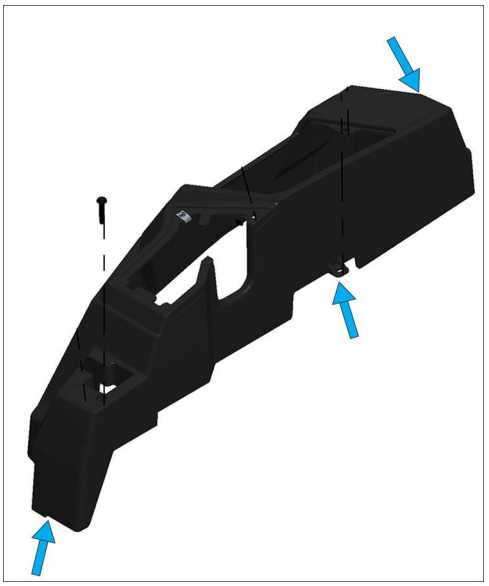
Right Console Installation

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.

2. Secure the control panel assembly to the console.

3. Install the 3 (T30) shoulder screws securing the right console to the machine. Torque screws 11 N • m (100 in-lb).

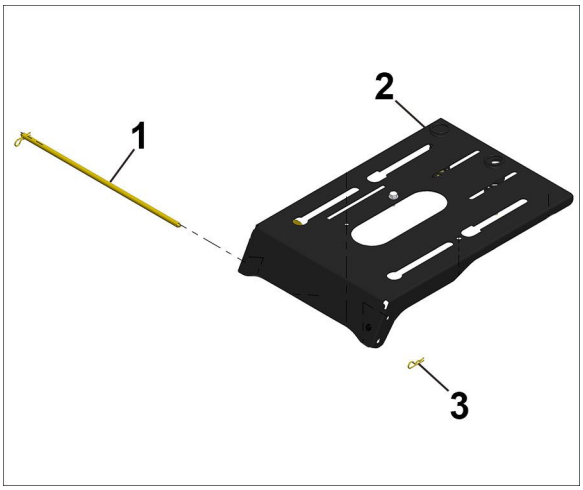


g321208

Figure 26

4. Connect the battery by installing the positive cable first, then the negative cable to the battery.
5. Install the right side control lever.

Seat Replacement (zx Models Only)



g321210

Figure 27

1. Stop Rod
2. Seat Pan
3. Cotter Pin

Seat Removal (ZX Models Only)

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Disconnect the wire harness connector at the operator presence switch.
4. Remove the cotter pins from the stop rod on the left and right sides of the seat.
5. Slide the rod toward the inside of the seat pan to release the seat from the frame, then slide it the opposite way to release it from the other side.
6. Lift the seat assembly off of the machine.

Seat Installation (ZX Models Only)

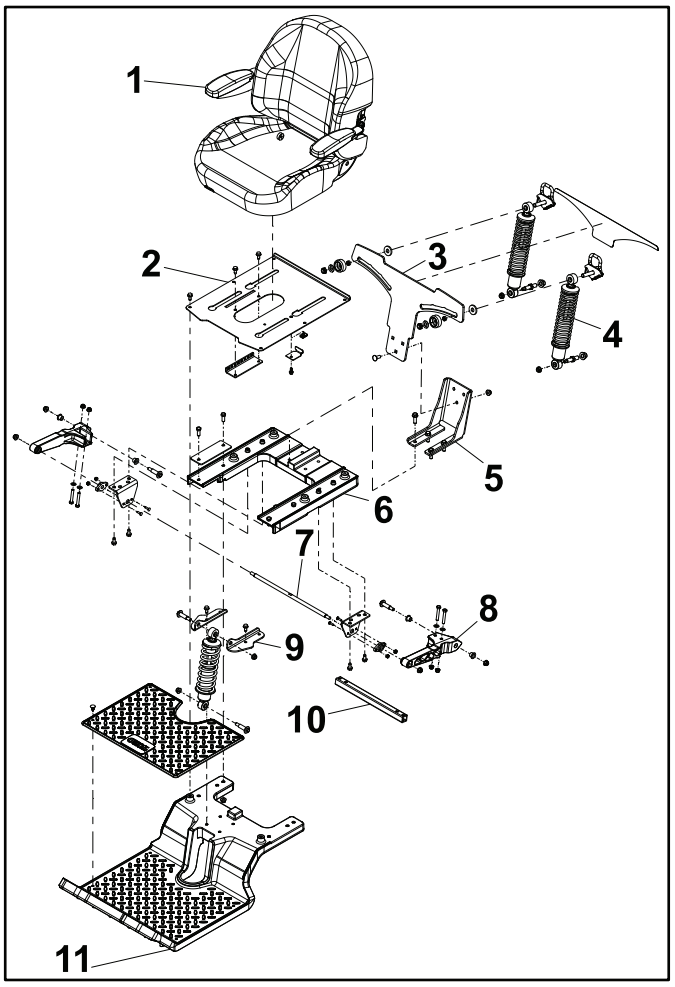
1. Verify that the fuel tank hold down is seated properly in the front and rear of the frame and secured with the hold down bolt.

g321203

Figure 28

2. Place the seat on top of the fuel tank and align the hole in one side of the frame with the hole in the seat plate.
3. Install the stop rod and secure with one cotter pin.
4. Slide the rod toward the outside of the machine while aligning the hole on the opposite side with the hole in the frame.
5. Insert the stop rod to secure the seat in place and install the cotter pin.
6. Raise the seat and connect the wire harness terminal to the operator presence switch.
7. Lift and lower the seat to verify proper function of the seat pivots and the seat latch.
8. Connect the battery by installing the positive cable first, then the negative cable to the battery.
9. Verify proper function of the unit.

Seat and MyRIDE™ Platform Replacement (MR Models Only)



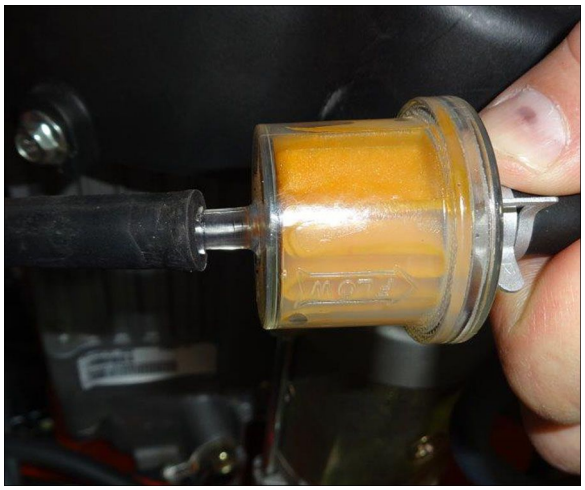
g334845

Figure 29

1. Seat Asm
2. Seat Pan
3. Shock Mounting Bracket
4. Shock/Spring Asm
5. Lower Mount Bracket
6. Rear Subframe
7. Pivot Rod
8. Trailing Arm
9. Upper Shock Mount Bracket
10. Trailing Arm Tube
11. Front Subframe

Seat and MyRIDE™ Platform (MR Models Only) 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 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 right and left side consoles. Left Console Replacement (page 5–6) Right Console Replacement (page 5–8)
4. Disconnect the wire harness connector at the operator presence switch.
5. Remove the relay and bolt attaching relay and fuse to holder on frame.
6. Disconnect the fuel supply line at the fuel filter.



g321211

Figure 30

7. Disconnect the vent line at the splice fitting.

g321202

Figure 31

8. Remove the bolt and nut securing the front shock/spring assembly to the MyRIDE® platform.

g321445

Figure 32

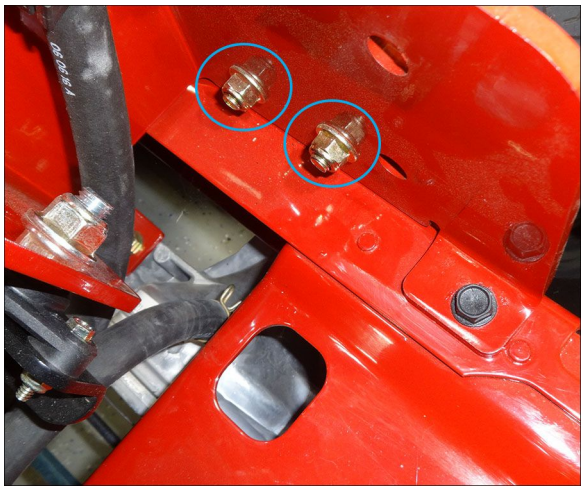
9. Remove the self-tapping screw on the frame brackets on each side of the machine. Release the vent hose keepers.

g321448

Figure 33

10. Remove the 2 bolts and nuts securing the frame brackets to the main frame on each side of the machine.

Seat and MyRIDE™ Platform (MR Models Only) Removal (continued)



g321447

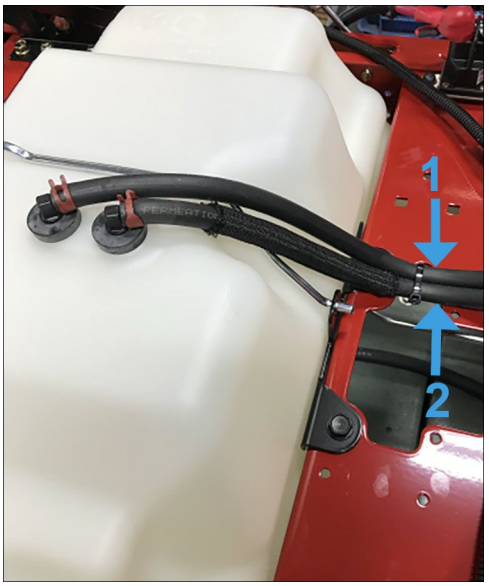
Figure 34

11. Tilt the MyRIDE® assembly one way. Unhook the fuel line keeper from under the seat.
12. Lift the entire MyRIDE® assembly up and away from the main frame. Removing the MyRIDE® assembly will take two or more people.

    Note: Do not remove either of the swing arm rods from the swing arm underneath the machine. This could cause damage or misalignment of the MyRIDE® suspension platform.

Seat and MyRIDE™ Platform (MR Models Only) Installation

1. Verify that the fuel tank hold down is seated properly in the front and rear of the frame and secured with the hold down bolt.



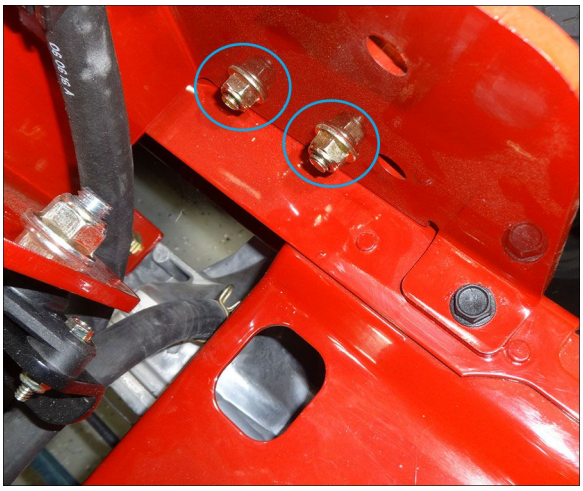
g334861

Figure 35

1. Vent Line
2. Liquid Line

2. Lower the MyRIDE® assembly onto the main frame, aligning the frame brackets on each side with the mating holes in the main frame. Reconnect the fuel line keeper under the seat.

3. Install the 2 bolts and nuts securing the frame brackets to the main frame on each side of the machine.



g321447

Figure 36

4. Install the self-tapping screw on the frame bracket on each side of the machine.

g321446

Figure 37

5. Install the bolt and nut securing the front shock/spring assembly to the MyRIDE™ Platform.

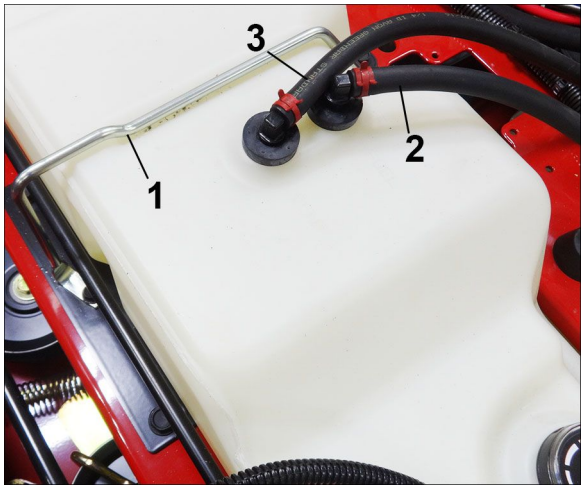
g321445

Figure 38

6. Connect the fuel tank vent line at to the splice fitting.
7. Connect the fuel supply line to the fuel filter.
8. Connect the vent line keepers to the vent lines.
9. Connect the wire harness terminal to the operator presence switch.
10. Install the relay and fuse holder.
11. Install the right and left side consoles. Left Console Replacement (page 5–6) Right Console Replacement (page 5–8)
12. Connect the battery by installing the positive cable first, then the negative cable to the battery.
13. Verify proper function.

Fuel Tank Replacement

Fuel Tank Removal



g321450

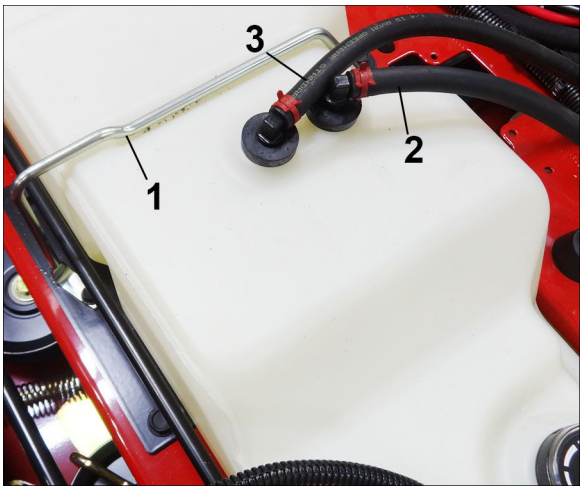
Figure 39

1. Fuel Tank Hold-Down Rod
2. Fuel Supply Line
3. Vent Line

Fuel Tank Removal (continued)

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove 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 right and left consoles. Left Console Replacement (page 5–6)
Right Console Replacement (page 5–8)
4. Reinstall the fuel cap.
5. Remove the seat assembly (ZX models) or the MyRIDE™ Platform Assembly (MR models).
6. Remove the fuel tank hold down rod and bolt.
7. Disconnect the fuel supply line and the bent line from the fuel tank.
8. Rotate and lift the fuel tank assembly from the machine.

Fuel Tank Installation



g321450

Figure 40

1. Fuel Tank Hold-Down Rod
2. Fuel Supply Line
3. Vent Line

---

1. Position the fuel tank assembly and rotate it onto the frame with the vent ports toward the rear of the machine.
2. Connect the vent line to the fuel tank.
3. Connect the fuel supply line to the fuel tank.

   Note: Make sure that the fuel lines are routed towards the hold down rod and in the recess of the fuel tank.
4. Install the fuel tank hold down rod and bolt.
5. Install the seat assembly. Seat Replacement (zx Models Only) (page 5–11)
6. Install the right and left consoles. Left Console Replacement (page 5–6)
Right Console Replacement (page 5–8)
7. Install the fuel cap by sliding the d-ring into the neck of the fuel tank. Secure the fuel cap to the tank.
8. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Throttle Control Assembly Replacement

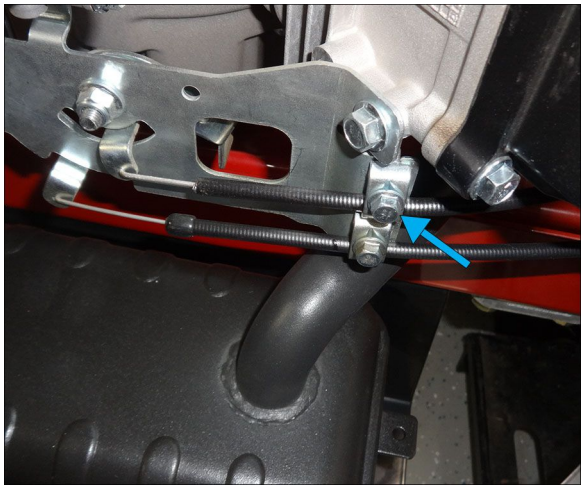
Throttle Control Assembly Removal

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove 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.

g322343

Figure 41

4. Pry the keeper tab on the throttle control assembly and unsnap the control from the console.
5. Loosen the clamp securing the throttle cable to the throttle plate (Figure 28).



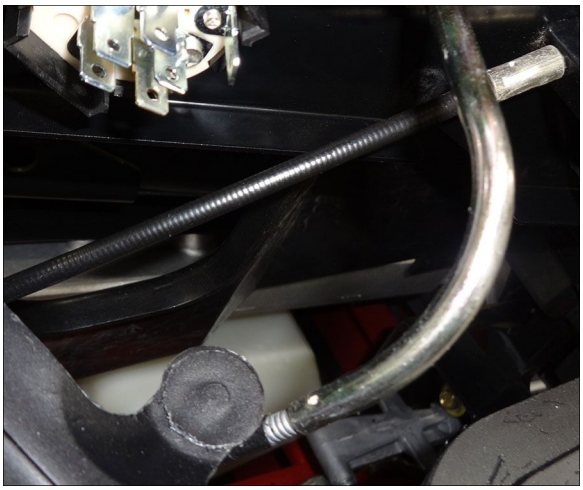
g321451

Figure 42

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

Throttle Control Assembly Installation

1. Route the throttle cable through the right console.



g321452

Figure 43

2. Snap the throttle control assembly into place.
3. Install the control panel assembly into the console.
4. Move the throttle control lever to the full speed position.

g322343

Figure 44

5. Place the z bend of the throttle cable in the throttle plate on the engine in the position previously noted.
6. Place the cable under the cable clamp.
7. Ensure that the throttle control lever is in the fast idle position.

   Note: Pull on the cable and verify the engine is at full throttle, then tighten the clamp.

g321453

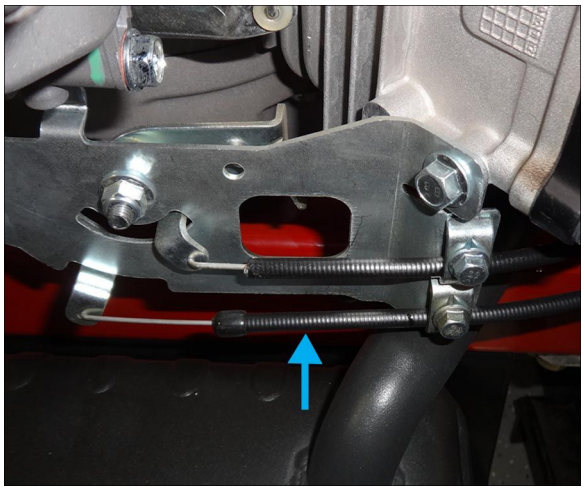
Figure 45

8. 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 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.



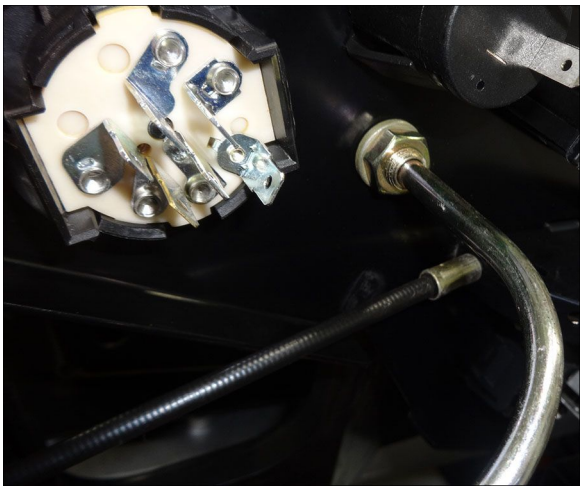
g323084

Figure 46

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 assembly and out of the machine.

Choke Control Assembly Installation

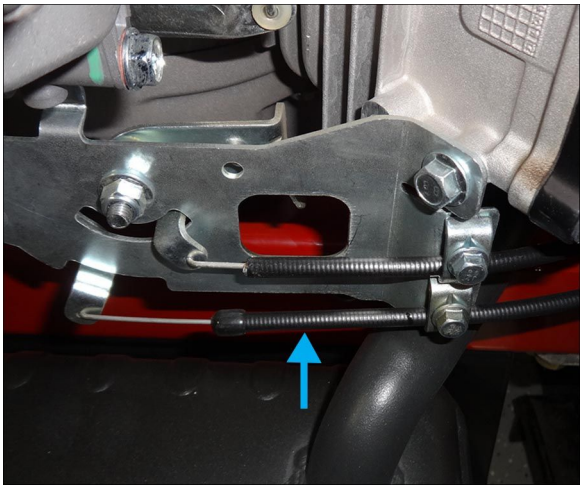
1. Route the choke cable through the control panel assembly
2. Thread the jam nut over the choke cable up to the control panel.



g321454

Figure 47

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 .



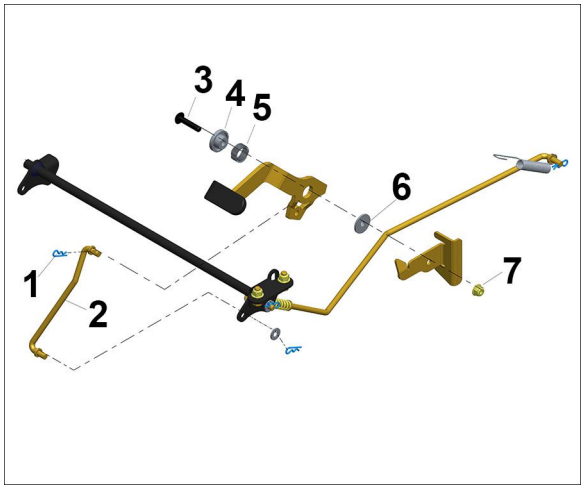
g323084

Figure 48

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



g321540

Figure 49

1. Cotter Pin
2. Intermediate Brake Rod
3. Torx Screw
4. Flange Bushing
5. Wave Spring
6. Brake Flanged Bushing
7. Flange Nut

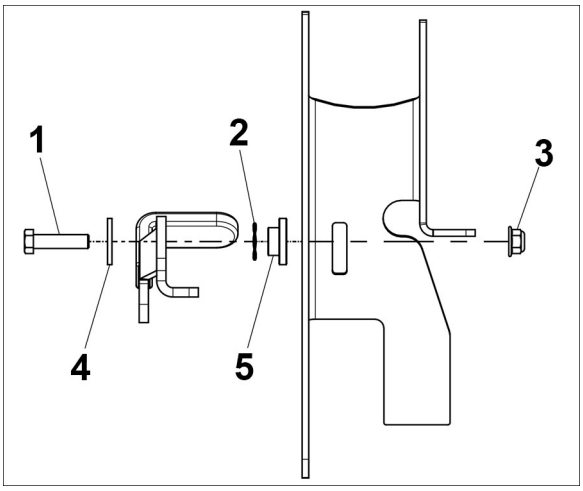
---

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove key.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the left side console.
4. Re-install the fuel cap.
5. Remove the locking cotter pin securing the intermediate brake rod to the park brake lever.
6. Remove the bolt and flange nut from the park brake lever assembly. Retain the bushing and wave spring.

Park Brake Handle Assembly Installation

1. Assemble the bushings and wave spring over the bolt and through the park brake.

   Note: Assemble the bushings and wave spring over the bolt and through the park brake

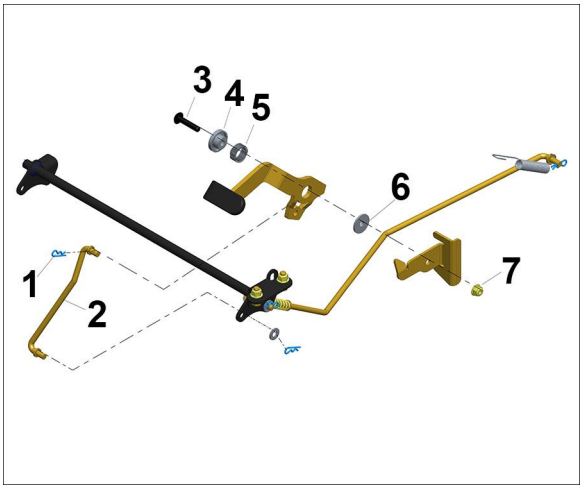


g321541

Figure 50

1. Screw
2. Wave Washer
3. Flange Nut
4. Washer
5. Flange Pivot

2. With the park brake handle hardware oriented as shown, install the bolt through the brake detent and connect the flange nut. Torque to 23 ± 3 N•m (200 ± 25 in-lb).



g321540

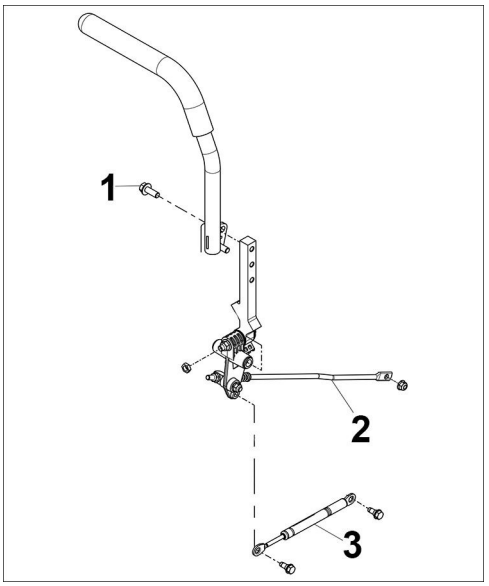
Figure 51

1. Cotter Pin
2. Intermediate Brake Rod
3. Torx Screw
4. Flange Bushing
5. Wave Spring
6. Brake Flanged Bushing
7. Flange Nut

3. Install the intermediate brake rod and secure with locking cotter pin.
4. Cycle the park brake lever to ensure that it locks in the engaged position.
5. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Motion Control Assembly Replacement

Motion Control Assembly Removal



g321537

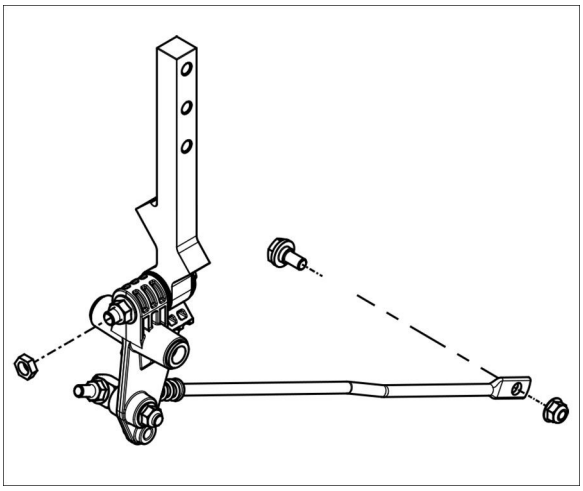
Figure 52

1. Bolt
2. Motion Control Linkage
3. Motion Control Damper

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove 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.

   Note: The console must be removed for access.
4. Remove the 2 bolts securing the motion control handle to the motion control assembly.
5. Disconnect the motion control damper from the motion control assembly.
6. Disconnect the motion control linkage from the motion control assembly.
7. Disconnect the motion control assembly from the frame.

Motion Control Assembly Removal (continued)



g321539

Figure 53

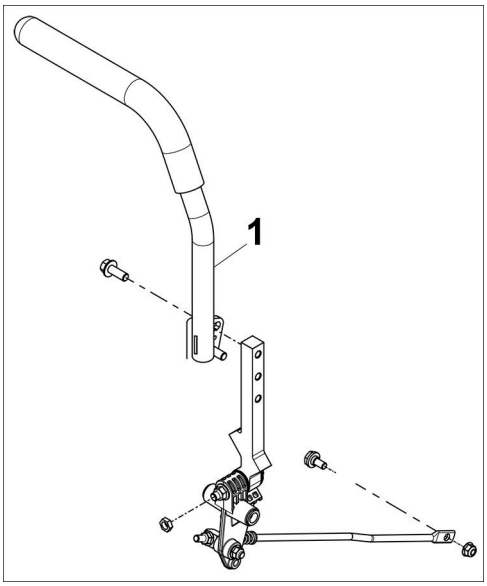
Motion Control Assembly Installation

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 motion control assembly.
4. Connect the motion control damper to the motion control assembly.
5. Connect the motion control handle to the motion control assembly using the two bolts.
6. Adjust the neutral setting. Neutral Adjustment (page 6–4)
7. Connect the battery by installing the positive cable first, then the negative cable to the battery.
8. Lower the unit and verify proper function.
9. Adjust the tracking if necessary. Tracking Adjustment (page 6–5)

Adjust the Motion Control Handle

Note: Ensure proper adjustment of neutral and tracking settings before adjusting the motion control handles.

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove key.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Move the levers into the operating position.
4. Loosen the 2 bolts that secure the motion control handles to the motion control assembly.
5. Align the levers front to back and secure the bolts.



g321538

Figure 54

6. Move the levers into the park position.
7. Connect the battery by installing the positive cable first, then the negative cable to the battery.
8. Verify proper function of the unit.

   Note: Motion control levers may be adjusted up or down as well 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.

Chapter 6

Hydrostatic Drive System

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General Information

The TITAN® series of mowers use Hydro-Gear hydrostatic transaxles model ZT-2800. All drives use the same type of fluid. The oil must have a minimum rating of 9.0 cSt (55 SUS) at 230° F (110° C) with an API classification of SL is recommended. A 20W-50 engine oil has been selected for use by the factory and is recommended for normal operating procedures.

Service and Repairs

Hydrostatic Drive Assembly

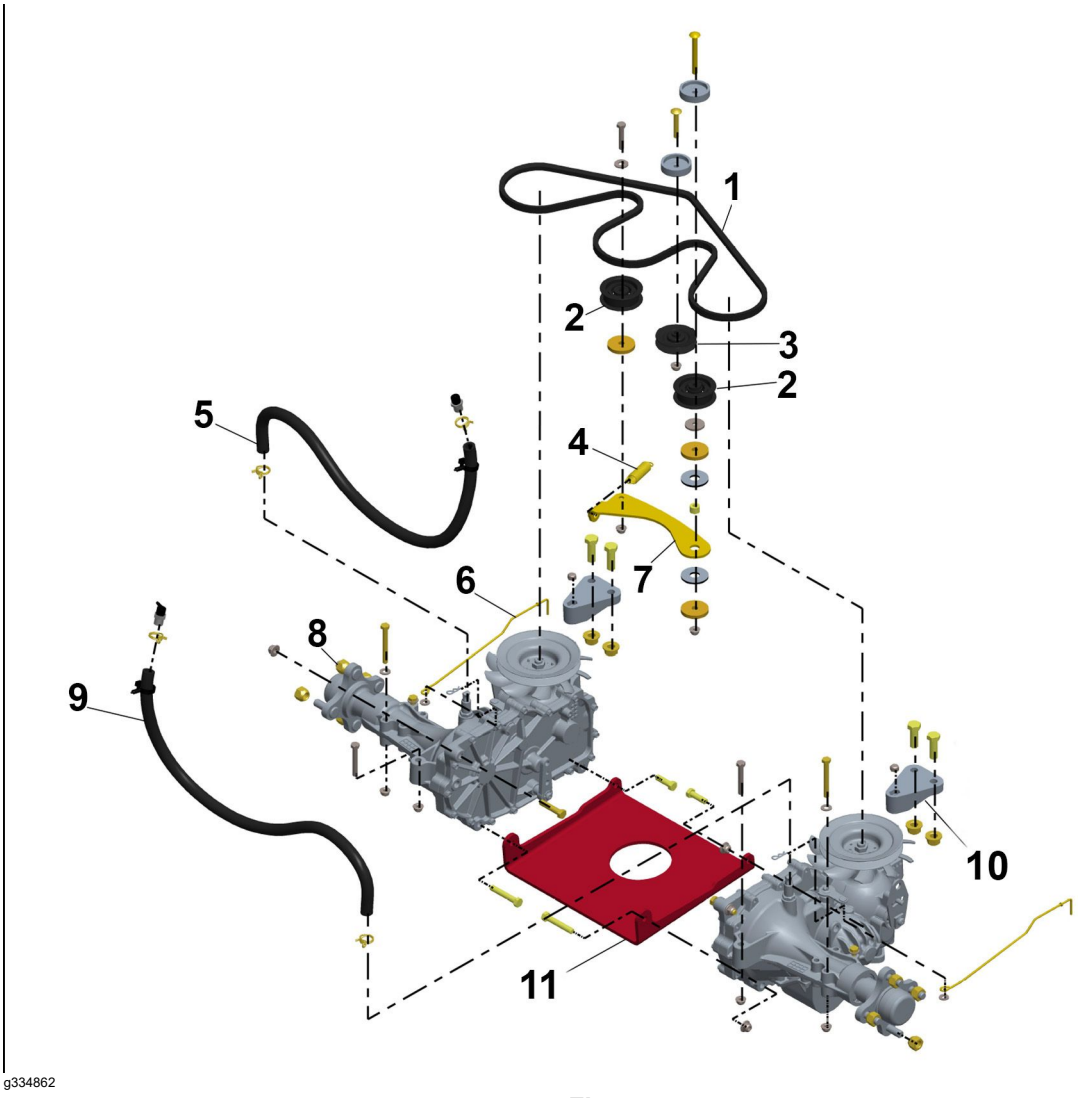


Figure 55

1. Hydrostatic Drive Belt
2. Pulley Idler
3. Pulley Idler
4. Idler Spring
5. Hydro Hose
6. LH Bypass Lever
7. Idler Arm
8. RH Hydro Asm
9. Hydro Hose
10. Rear Hydro Support
11. Hydro Cross Plate

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 parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Locate the bypass levers on the frame on both sides of the engine.
4. Move the bypass lever forward through the key hole and down to lock them in place. Do this for each bypass lever.
5. Disengage the parking brake before pushing the machine. Do not start the machine.
6. To operate the machine normally, move the bypass levers to the rearward position through the keyhole.
7. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Neutral Adjustment

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. Unplug the seat switch on the bottom side of the seat and install a temporary jumper wire across the plug connector (wire harness side).
4. Start the engine and allow the machine to warm-up for 3–5 minutes.
5. Disengage the parking brake.
6. Move the motion control levers into the neutral position.
7. Increase the engine speed to full throttle. Observe the movement of the rear drive wheels. If either drive wheel is moving in forward or reverse, a neutral adjustment is needed.

   Note: A slight creep in reverse is acceptable.
8. Turn the adjustment nut on the motion control rod clockwise or counterclockwise until the drive wheel is slightly rotating in reverse or not rotating at all. Repeat for both drive wheels if necessary.

   Note: When the unit is in neutral, the stud should be roughly centered in the slot of the control plate.

Neutral Adjustment (continued)

g321828

Figure 56

9. Stop the engine and lower the unit.
10. Verify proper neutral setting and tracking.

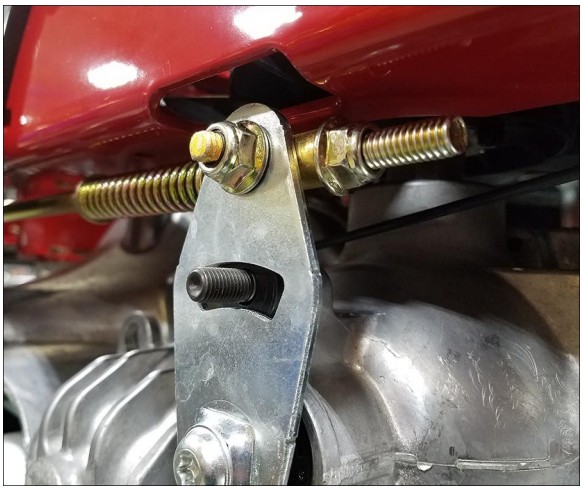
Tracking Adjustment

If the unit tracks or pulls to the RIGHT

Turn the LH adjustment nut 1 full turn clockwise. If more adjustment is needed, turn the adjustment nut 1 full turn at a time.

If the unit tracks or pulls to the LEFT

Turn the RH adjustment nut 1 full turn clockwise. If more adjustment is needed, turn the adjustment nut 1 full turn at a time.



g321828

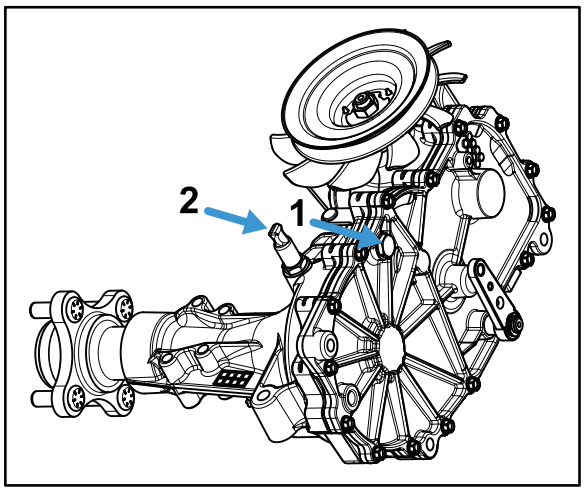
Figure 57

Hydro Change Procedure

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove key. Engage the parking brake

Hydro Change Procedure (continued)

2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Remove the spin on oil filter.
4. Drain the hydraulic oil.
5. Install a new spin on oil filter.
6. Remove the top port plug from the hydro.



g334863

Figure 58

1. Top Port Plug
2. Breather Hole

7. Remove the breather hose and fill vent located on the top of the hydro.
8. Fill approximately 2 quarts of Toro HYPR-OIL® or 20W-50 engine oil to the level of the top port plug hole.
9. Re-install the top port plug.Figure 58
10. Re-install the breather hose.
11. Connect the battery by installing the positive cable first, then the negative cable to the battery.
12. Perform the purging procedure. Purging Procedure (page 6–6)

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 dive systems.

The resulting symptoms in hydrostatic systems may be:

- Noisy operation
- Lack of power or drive after a short period of operation
- High operating temperature and excessive expansion of oil, oil level may be high in the expansion tank or overflow

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

Purging Procedure (continued)

1. With the bypass valve open (push button) and the engine running, slowly move the directional controls (forward/reverse levers) in both forward and reverse directions 5–6 time; as air is purged from the transaxles, the oil level will drop.

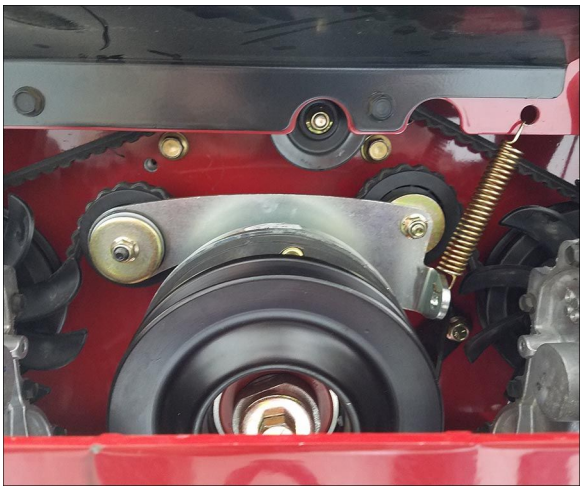
   Note: Seat switch must be bypassed.

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 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. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove 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.
5. Using a spring removal tool, remove the drive idler spring from the slot in the frame. Remove the spring from the drive idler arm and inspect for damage or wear

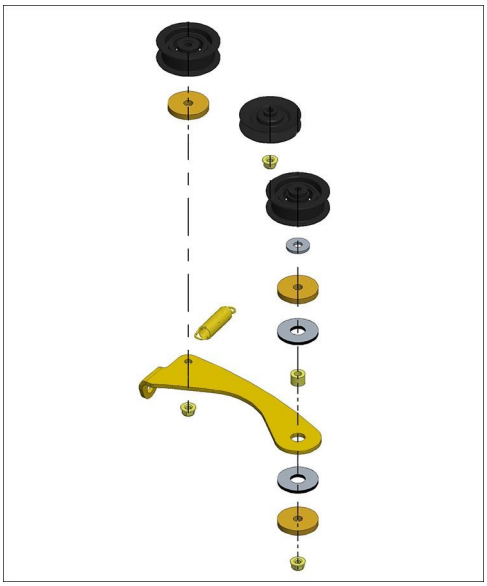


g321832

Figure 59

6. Remove the clutch stop.
7. Remove the rear pulley.
8. Remove the idler arm and pulley.

Hydrostatic Drive Belt Removal (continued)



g321838

Figure 60

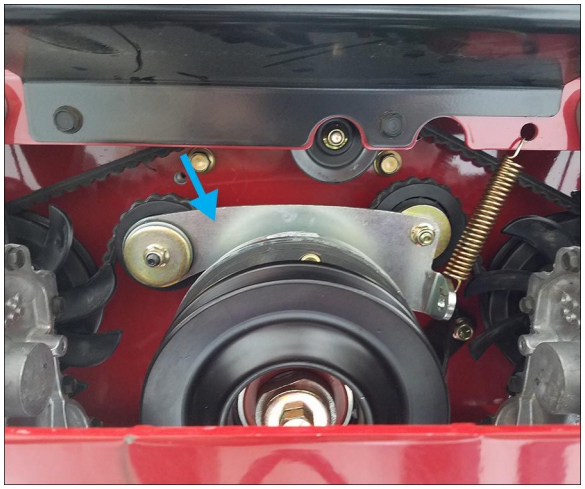
9. Remove the drive belt from the hydrostatic drive pulleys.

   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 two transmission pulleys.
2. Route the drive belt around the engine pulley.
3. Install the idler arm and pulleys.

   Note: Make sure that the belt is properly routed before installation.



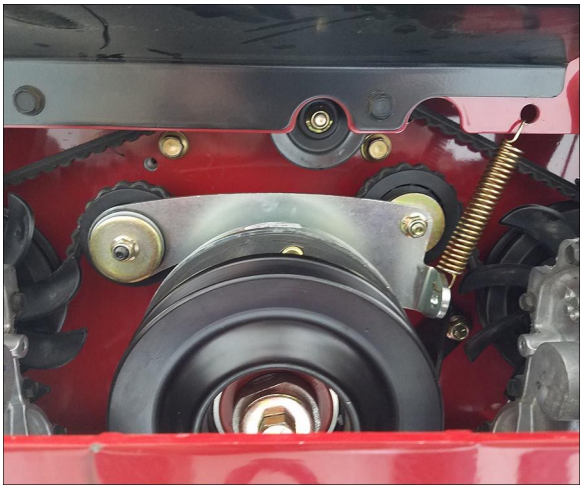
g321833

Figure 61

4. Install the clutch stop.
5. Verify proper routing of the belt.
6. Place the idler spring onto the idler arm loop and use a spring removal tool to secure the spring (A) into the slot on the right rear of the frame.

Hydrostatic Drive Belt Installation (continued)

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



g321832

Figure 62

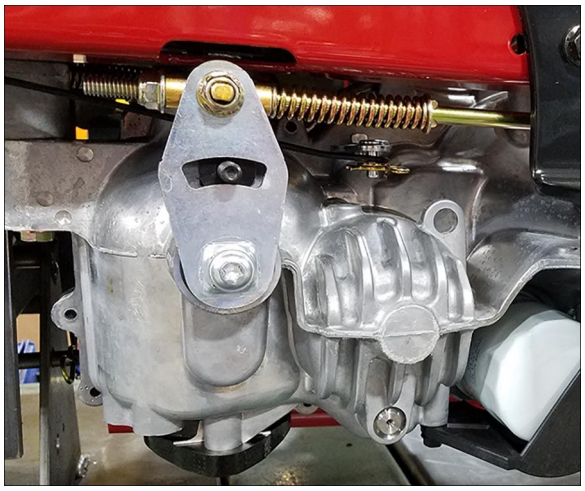
7. Install the mower belt onto the clutch.
8. Lower the unit.
9. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Hydrostatic Drive Transmission Replacement

Hydrostatic Drive Transmission Removal

Note: These steps are shown replacing the right side hydrostatic drive transmission. All of the same steps apply to the left side hydrostatic drive transmission.

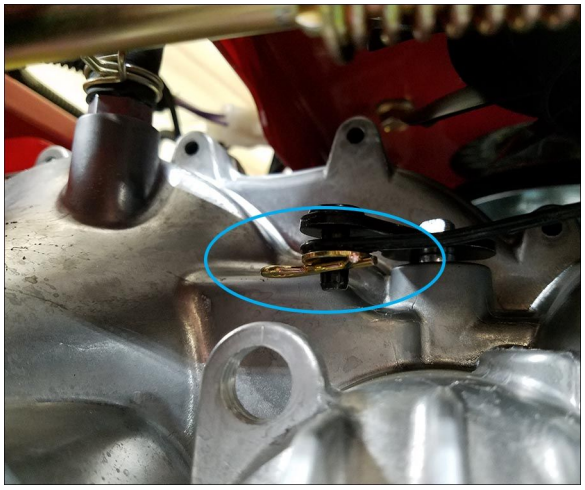
1. Stop the engine, wait for all moving parts to stop, and remove key. Engage the parking brake.
2. Disconnect the battery by removing the negative cable first, then the positive cable from the battery.
3. Raise and support the unit so that the drive wheels are off the ground.
4. Remove the drive wheel(s).
5. Remove the drive belt.
6. Disconnect the motion control linkage from the transmission.



g321830

Figure 63

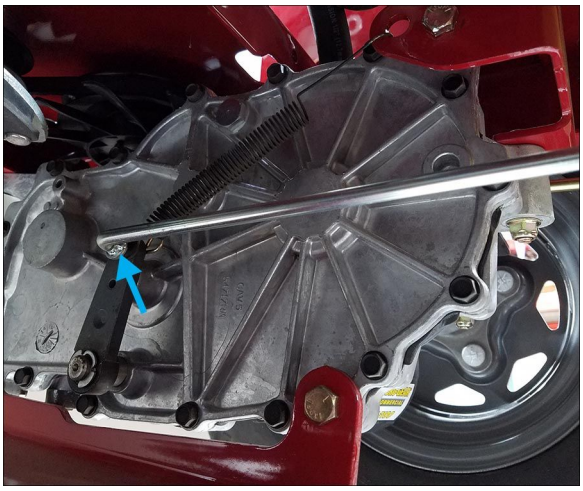
7. Disconnect the bypass arm.



g321835

Figure 64

8. Disconnect the lower brake linkage from the transmission.



g321834

Figure 65

9. Disconnect the connectors securing the overflow tube to the chassis.

   Note: Overflow tubes should stay connected to the top of the transmission. To avoid oil leaking, keep the overflow tubes oriented up.

g321831

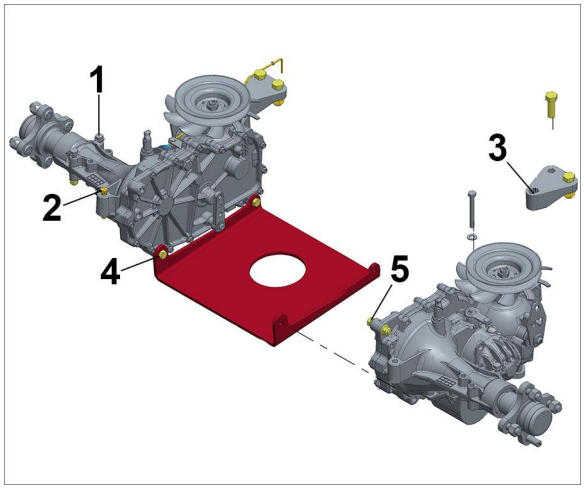
Figure 66

10. Remove the 4 bolts (2 bolts per side) securing the transmission to the hydro cross plate.
11. Loosen the 4 outer frame mounting bolts (2 bolts per side).
12. Loosen the 2 bolts connecting the transmission to the rear cross member.
13. Remove the front mounting bolt.
14. Support the transmission and remove the mounting hardware. Lower the transmission.

Hydrostatic Drive Transmission Installation

Note: These steps are shown replacing the right side hydrostatic drive transmission. All of the same steps apply to the left side hydrostatic drive transmission.

1. Lift and support the transmission, and install the 2 outer frame mounting bolts and nuts as shown. Do not fully tighten at this time.



g321836

Figure 67

1. Outer mounting bolts to frame bracket
2. Front mid-mounting bolts to frame bracket
3. Rear mid-mounting bolts to cross member rear
4. Bottom mounting bolts to cross plate
5. Front inner mounting bolts to frame bracket

---

2. Align the hydro cross plate and install the 4 bolts (2 bolts per side) through the cross plate and the transmission. Do not tighten at this time.

3. Install the rear and front hydro mounting 4 bolts and nuts per side (3 in the rear, 1 in the front). Do not tighten at this time.

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

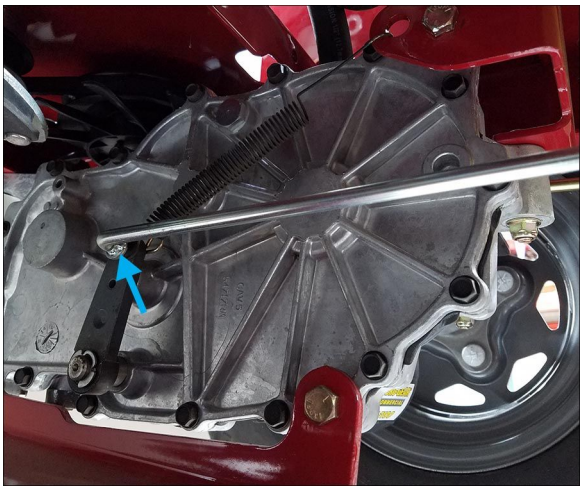
   - Tighten the front mounting bolt through the frame bracket.
   - Tighten the hydro cross plate bolts.
   - Tighten the rear hydro mounting bolts.
   - Tighten the 2 outer mounting bolts.

4. Remove the protective cap from the hydraulic oil nipple, install the overflow tube, and move the hose clamps into place.

g321831

Figure 68

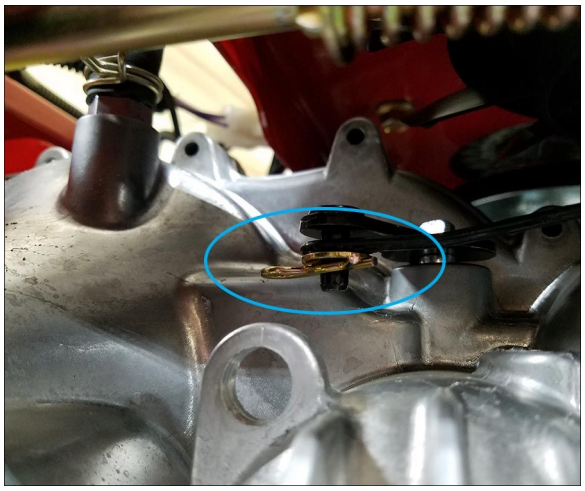
5. Connect the lower brake linkage to the transmission.



g321834

Figure 69

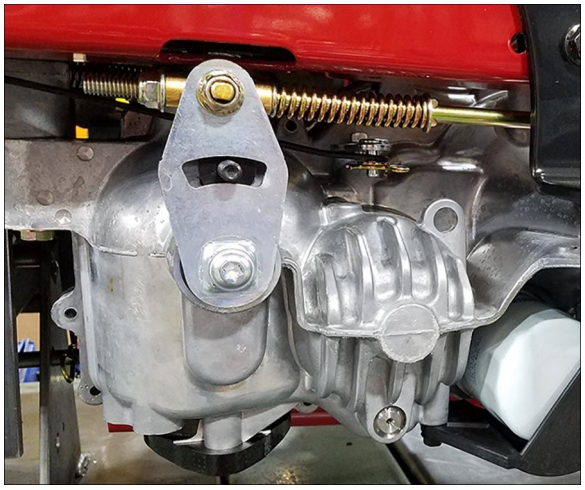
6. Connect the bypass arm.



g321835

Figure 70

7. Connect the motion control linkage.

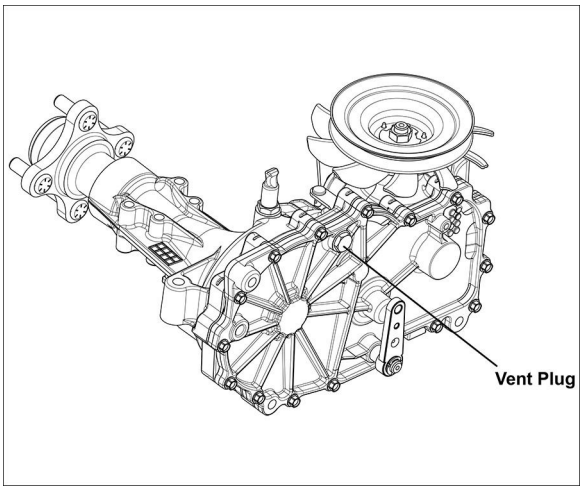


g321830

Figure 71

8. Install the drive belt.

9. Install the drive wheel and torque the lug nuts to 110 ± 14 N•m (80 ± 10 ft-lbs).
10. Add hydraulic oil to the proper level using the vent plugs.



g321839

Figure 72

11. Follow the purging procedure to remove all air from the system.
12. Adjust the neutral setting, if necessary.
13. Lower the unit and verify proper function.
14. Connect the battery by installing the positive cable first, then the negative cable to the battery.

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Mower Belt Replacement 7–6
Mower Deck Replacement 7–7
Mower Spindle 7–8
Electric PTO Clutch Replacement 7–11

General Information

The TITAN® series of mowers uses 3 different deck sizes a 48 inch fabricated, 54 inch fabricated, and a 60 inch fabricated. All the decks use a 4-point lift system. All units have a 1.5-4.5 inch height-of-cut range.

Service and Repairs

Mower Deck Assembly 1

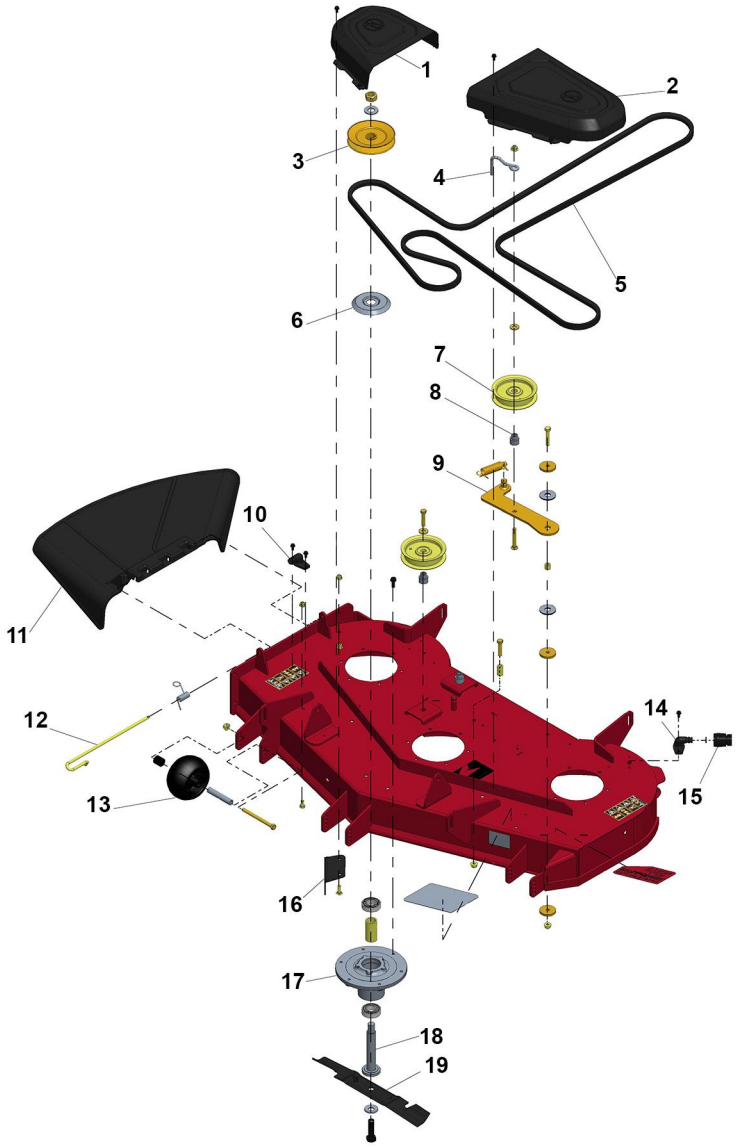
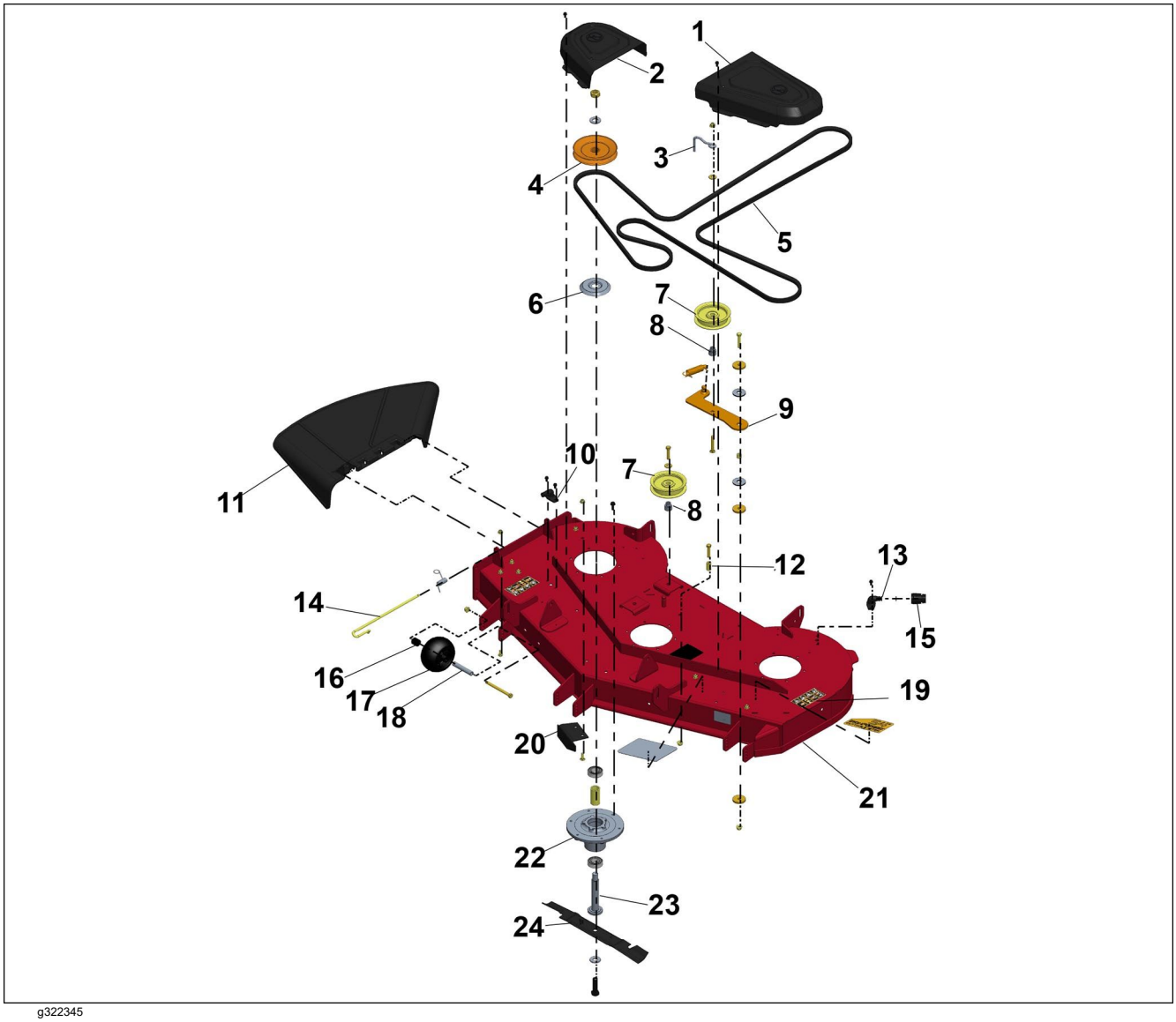


Figure 73

1. RH Belt Cover
2. LH Belt Cover
3. Pulley
4. Idler Belt Guide
5. V-Belt
6. Bearing Shield
7. Flat Idler Pulley
8. Idler Bushing
9. Idler Arm Asm
10. Washout Fitting
11. Discharge Deflector
12. Chute Pin
13. Anti Scalp Roller
14. Washout Fitting
15. Hose Connector
16. Cutoff Baffle
17. Spindle Asm
18. Spindle Shaft
19. Blade

Mower Deck Assembly 2

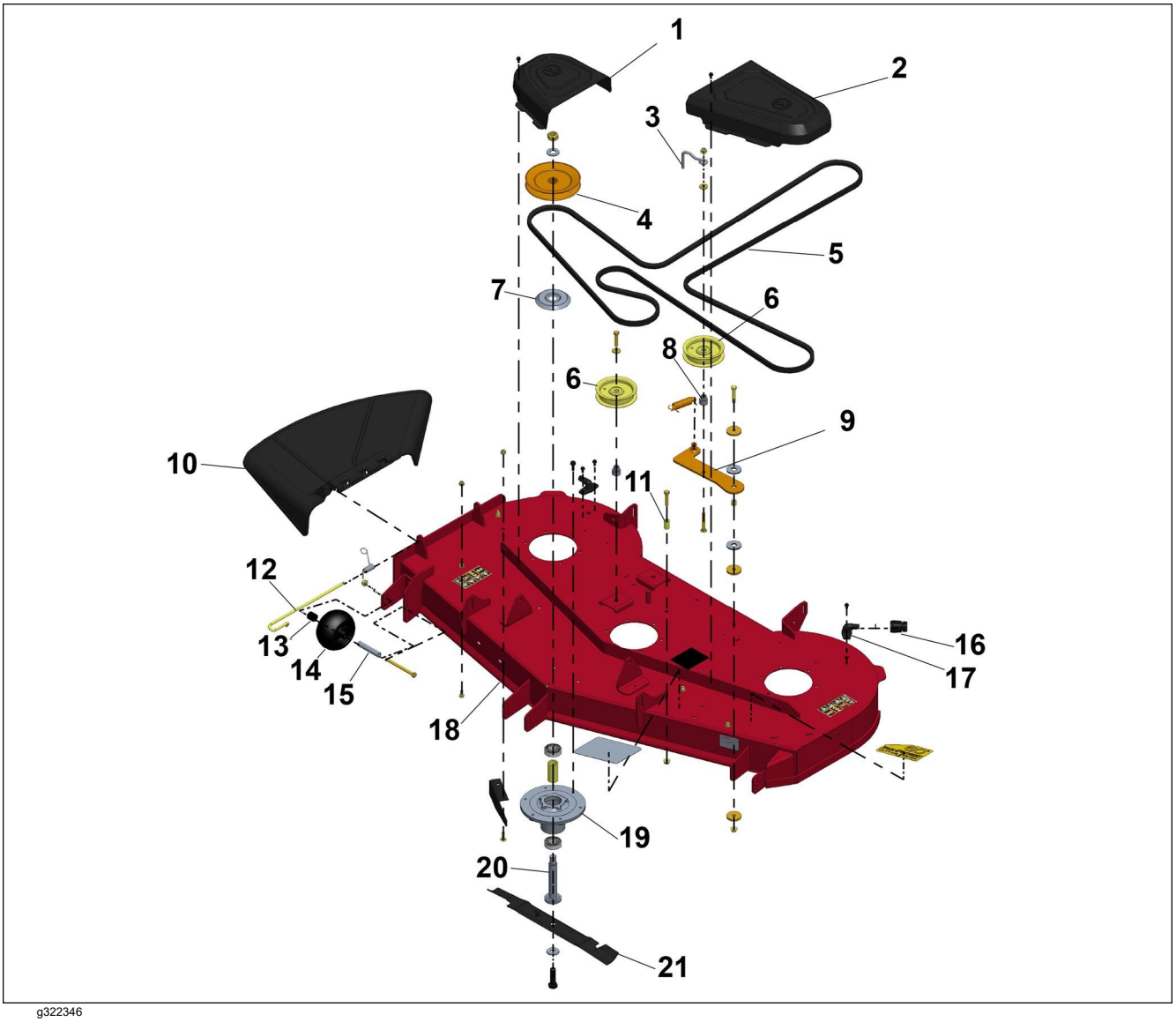


g322345

Figure 74

1. Left Belt Cover
2. Right Belt Cover
3. Idler Belt Guide
4. Pulley
5. V-Belt
6. Bearing Shield
7. Flat Idler Pulley
8. Idler Bushing
9. Idler Arm Asm
10. Washout Fitting
11. Discharge Deflector
12. Spacer Fender
13. Washout Spacer
14. Chute Pin
15. Connector Hose
16. Rear Axle Spacer
17. Anti-Scalp Roller
18. Spanner Tube
19. Deck Asm
20. Cut-off Baffle
21. Deck Asm
22. Spindle Asm
23. Spindle Shaft
24. Mulch Blade

Mower Deck Assembly 3



g322346

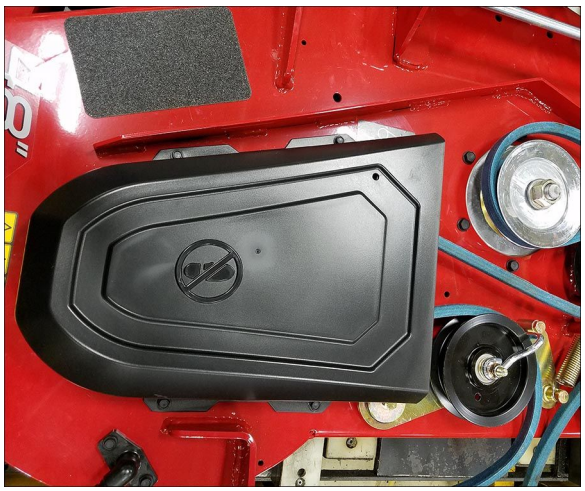
Figure 75

1. Right Belt Cover
2. Left Belt Cover
3. Idler Belt Guide
4. Pulley
5. V-Belt
6. Flat Idler Pulley
7. Bearing Shield
8. Idler Bushing
9. Idler Arm Asm
10. Discharge Deflector
11. Spacer Fender
12. Chute Pin
13. Rear Axle Spacer
14. Anti-Scalp Roller
15. Spanner Tube
16. Washout Fitting
17. Connector Hose
18. Deck Asm
19. Spindle Asm
20. Spindle Shaft
21. Mulch Blade

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 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 inches) height-of-cut position.
4. Remove the bolts from the covers and lift covers off the deck.



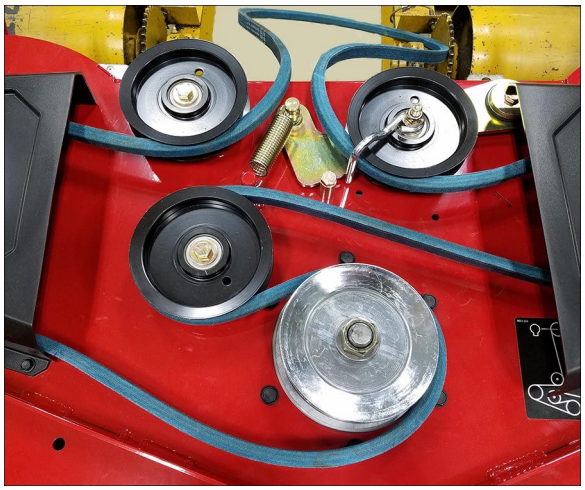
g322061

Figure 76

5. Using a spring removal tool remove the spring tension from the idler pulley.
6. Lower the deck to the lowest height of cut position and secure the pin to lock in position.
7. Remove the belt from the deck pulleys and the clutch pulley.

Mower Belt Installation

1. Route the new belt around the clutch pulley and deck pulleys.



g322062

Figure 77

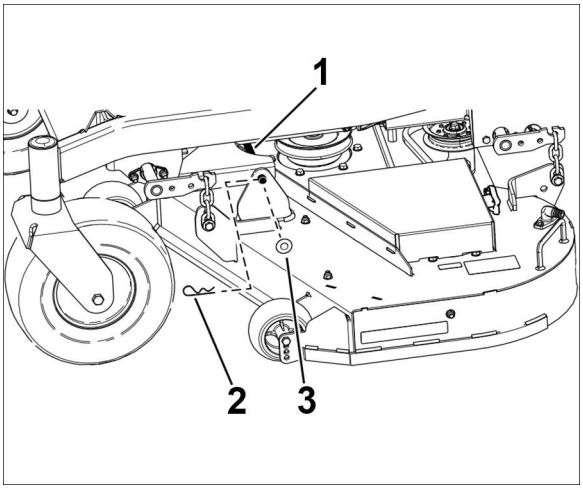
2. Install the idler spring using the spring removal tool.
3. Ensure that the belt is properly seated in all pulleys.

4. Install the belt covers. Torque the belt cover bolts to 6–8 N • m (50–75 in-lb).
5. Tighten the bolts to secure the cover to the deck.
6. Connect the battery by installing the positive cable first, then the negative cable to the battery.

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 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. Remove the mower belt.
5. Remove the 2 hairpins and washers that secure the link pin to the frame and deck, then remove the link pin.



g322064

Figure 78

1. Link Pin
2. Hairpin Cotter
3. Washer

6. Lift the mower deck to remove tension from the chains and unhook the chains from the deck lift arms.
7. Raise the height-of-cut to the transport position.
8. Slide the deck out from underneath the machine.

Mower Deck Installation

1. Place the deck on the ground and slide it into position underneath the machine.
2. Lower the height-of-cut into the lowest position and secure with the height-of-cut pin.
3. Lift the rear of the mower deck and attach the chains to the rear lift arms.
4. Attach the front chains to the front deck lift arms.

Mower Deck Installation (continued)

5. Install the link pin through the frame hanger and the deck. Secure with hairpins and washers that were previously removed.
6. Install the mower belt onto the engine pulley first, then onto the mower deck.

7. Install the mower belt covers. Torque the belt cover bolts to 6–8 N • m (50–75 in-lbs).
8. Raise the deck to the 76 mm (3 inches) height-of-cut position and check for deck level.
9. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Mower Spindle

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 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.
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 Installation

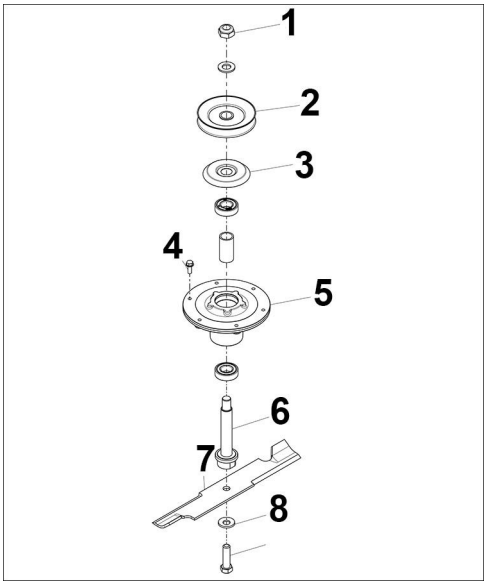
1. Position the spindle against the deck and align the mounting holes.

   Note: Ensure the underside of the deck is clean before proceeding with the spindle installation.
2. Install 6 taptite screws.

   Note: Spindle taptite 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 138–152 N • m (100-110 ft-lb).
4. Install the mower belt.
5. Install the mower belt covers.
6. Connect the battery by installing the positive cable first, then the negative cable to the battery.

Mower Spindle Disassembly



g322066

Figure 79

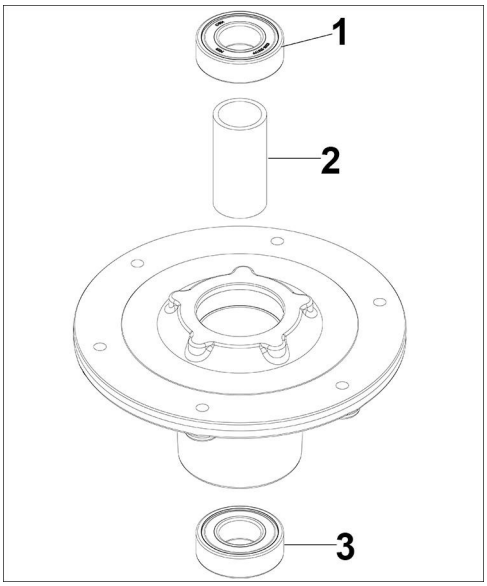
1. Spindle Nut
2. Pulley
3. Bearing Shield
4. Spindle Mounting Screws
5. Spindle Assembly
6. Spindle (Apply Anti-Seize)
7. Blade
8. Belleville Washer
9. Blade Bolt

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.
3. Remove the pulley.
4. Remove spindle housing from the shaft.
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: Ensure that the bearing seats against the shoulder in the spindle housing.



g322065

Figure 80

1. Top Bearing
2. Spacer
3. Lower Bearing

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.

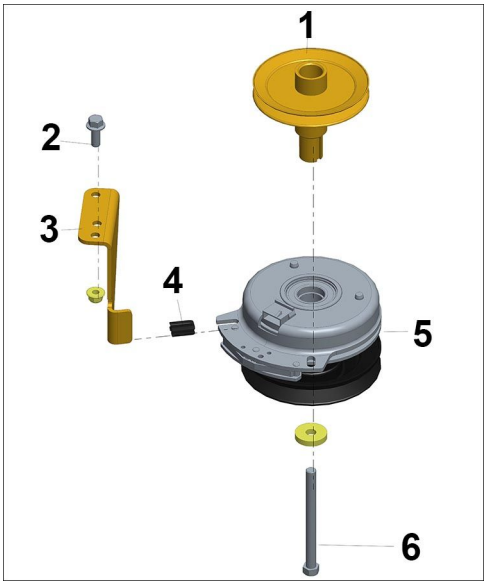
   Note: The inner and outer race on the upper bearing must be supported while installing the lower bearing.

5. Apply anti-seize to the spindle shaft and install the spindle shaft.
6. Flip the spindle over while supporting the shaft through the spindle housing.
7. Install the bearing shield.
8. Install the pulley.

9. Install the washer and nut. Torque the top nut to 138-152 N • m (100-110 ft-lb).

Electric PTO Clutch Replacement

Electric PTO Clutch Removal



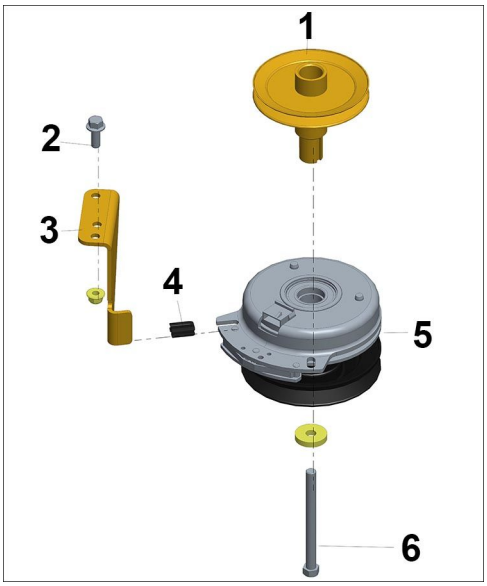
g322063

Figure 81

1. Engine Pulley to Shaft (Apply Anti-Seize)
2. Bolt
3. Clutch Stop Mount
4. Clutch Isolator
5. PTO Clutch
6. Clutch Mounting Bolt (Apply Loctite)

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove 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.
5. Disconnect the clutch wire connector from the clutch.
6. Remove the clutch mounting bolt and washers. Slip the clutch off of the crankshaft.

Electric PTO Clutch Installation



g322063

Figure 82

1. Engine Pulley to Shaft (Apply Anti-Seize)
2. Bolt
3. Clutch Stop Mount
4. Clutch Isolator
5. PTO Clutch
6. Clutch Mounting Bolt (Apply Loctite)

1. Install the clutch on to the crankshaft ensuring that the slot in the clutch aligns with the tab on the clutch anchor and the rubber isolator is in place.

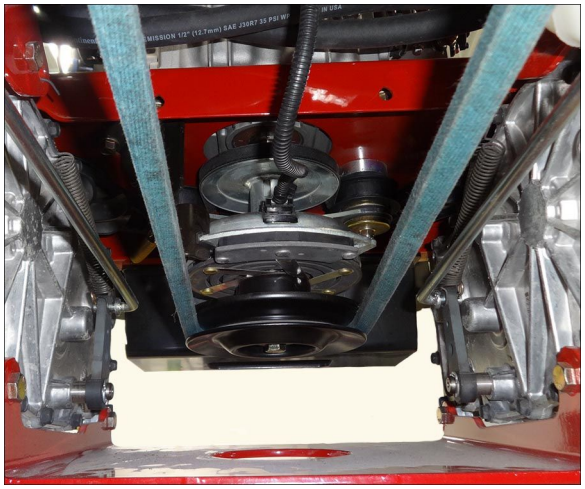
   Note: Apply anti-seize to the end of the pulley shaft.

2. Apply thread lock to the clutch bolt.

3. Install the washer and clutch mounting bolt. Torque the clutch bolt to 76 ± 7 N • m (55 ± 5 ft-lb).

4. Connect the clutch power wire to the clutch.

   Note: Ensure wire harness is properly routed to avoid contact with the mower.



g322060

Figure 83

Electric PTO Clutch Installation (continued)

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

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Parking Brake Switch 8–6
Starter Solenoid 8–7
PTO Switch 8–8
Electric PTO Clutch 8–9
TVS Diode 8–11
Magneto Stop Relay 8–11

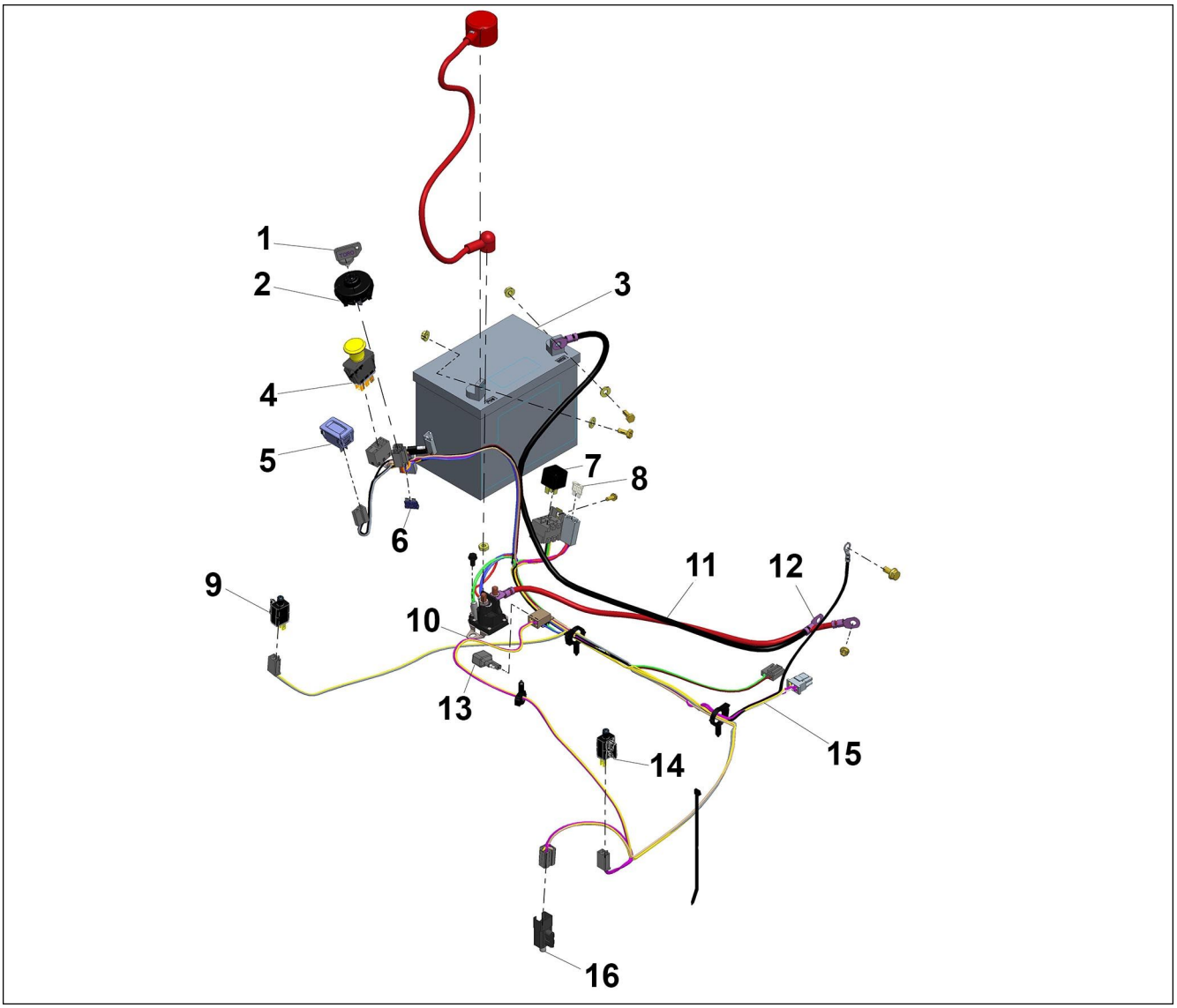
General Information

1. Always use a digital multi-meter for electrical testing procedures and record voltage reading results.
2. Before performing any electrical troubleshooting, always:
   - Verify proper battery voltage (above 12.4 volts) : Batteries reading 12.4 volts or less are considered discharged
   - Check that all engine and chassis ground wires are securely connected and not damaged.
3. Use of test lights and continuity testers may result in false readings and lead to an incorrect diagnosis.
4. Occasionally, electrical testing requires the use of a jumper wire to bypass a safety interlock switch, allowing the technician to continue troubleshooting by taking the switch out of the circuit.

   Note: Jumper wires should be used for troubleshooting only, NEVER leave a jumper wire in place to bypass a safety circuit.

Service and Repairs

Electrical System Assembly



g322300

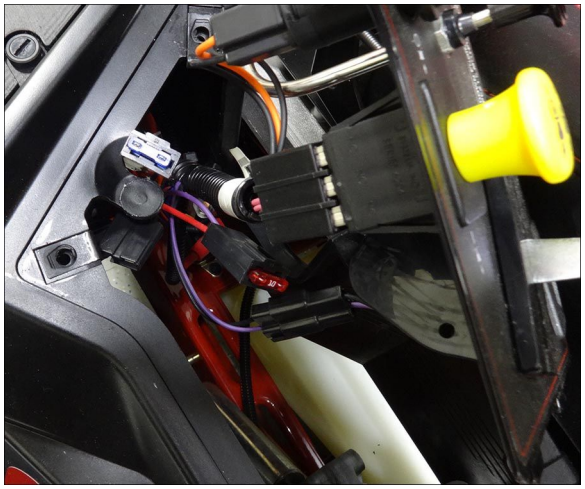
Figure 84

1. Ignition Key
2. Ignition Switch
3. Battery
4. PTO Switch
5. Hourmeter
6. 15A Fuse
7. Magneto Stop Relay
8. 25A Fuse
9. Neutral Switch
10. Solenoid
11. Negative Cable
12. Engine Ground
13. Clutch Diode
14. Neutral Switch
15. Wire Harness
16. Park Brake Switch

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.



g322165

Figure 85

Fuse Block and Fuses Testing

1. Visual Inspection: The fuses used in this application may be visually inspected. A failed fuse can be identified by a broken or melted element inside the fuse cover or a damaged spade.
2. Using a digital multi-meter set to the OHM or Continuity setting, remove the fuse and check the continuity between the fuse blades. If the fuse is OPEN (no continuity), replace the fuse and test the circuit.

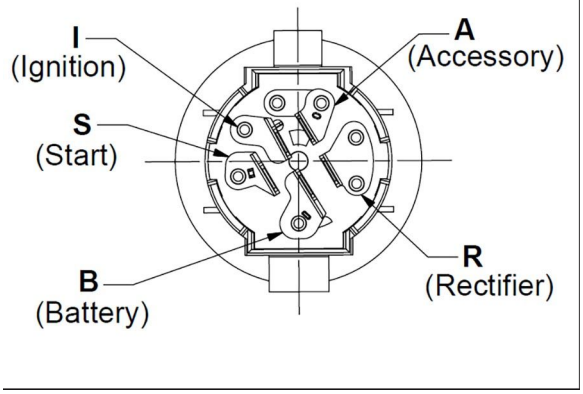
Key/Ignition Switch

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

Key/Ignition Switch Testing

1. Park the machine on a level surface and disengage the PTO. Stop the engine, wait for all moving parts to stop, and remove key. Engage the parking brake
2. Remove the control panel from the right console.
3. Disconnect the harness from the ignition switch. Gently rock the connector back and forth until unplugged.
4. Using a digital multi-meter set to the OHM or Continuity setting, verify that continuity exists between the terminals listed for each switch position.



g331211

Figure 86

5. 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”
1. OFF	None
Run	B + R + I + A
3. Start	B + R + I + S

Hourmeter

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

g322162

Figure 87

Hourmeter Testing

1. Without starting the engine, with the ignition switch in the “RUN” position and the PTO switch closed (ON) verify the battery voltage and ground to the hourmeter.

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 left hand neutral switch.

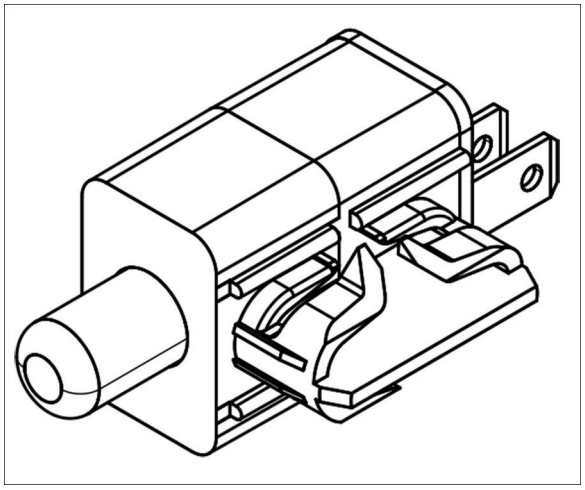
Note: The operator presence switch is part of the seat assembly.

Operator Presence Switch (Seat Switch) Testing

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 2 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 should have continuity (closed).
- Motion control levers in the operating position (IN), the switch should NOT have continuity (open).

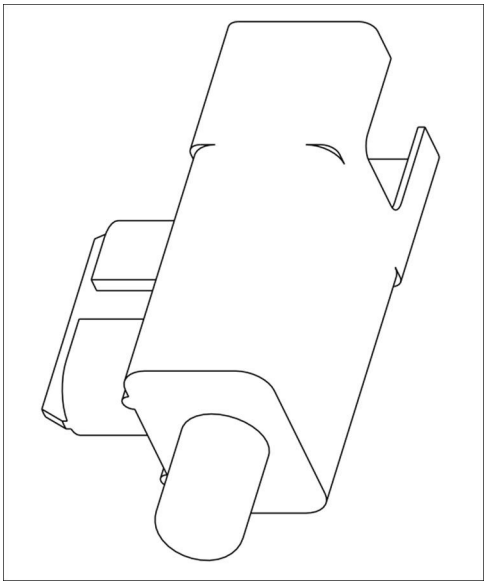


g322163

Figure 88

Parking Brake Switch

- The parking brake switch is a dual pole/four terminal plunger type switch (normally open and normally closed). When the parking brake is set (engaged), the normally closed pole of the switch is open and the normally open pole is closed. This allows proper voltage and ground signal path for the safety interlock and PTO operations.
- Parking Brake ON, the switch should have continuity (closed).
- Parking Brake OFF, the switch should NOT have continuity (open).



g322166

Figure 89

g322160

Figure 90

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.

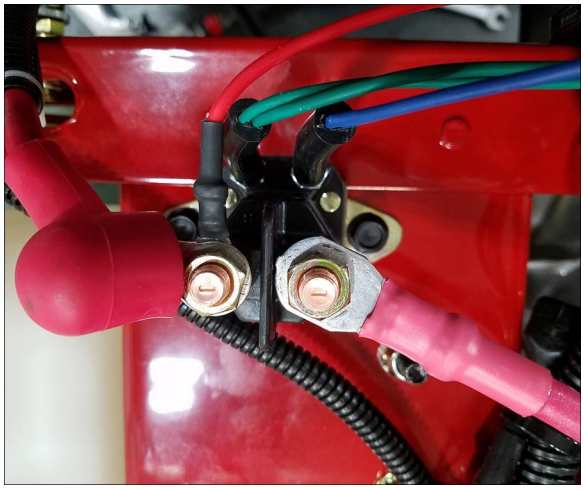


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Figure 91

Starter Solenoid Testing

1. Disconnect the battery cables from the solenoid.
2. With a multi-meter set to the OHM or Continuity setting, check to ensure that terminals C and D are open (no continuity).
   - Green wire is terminal B
   - Blue wire is terminal A
   - Large red wire with red cap and extra red wire is terminal C
   - Large red wire with no cap is terminal D

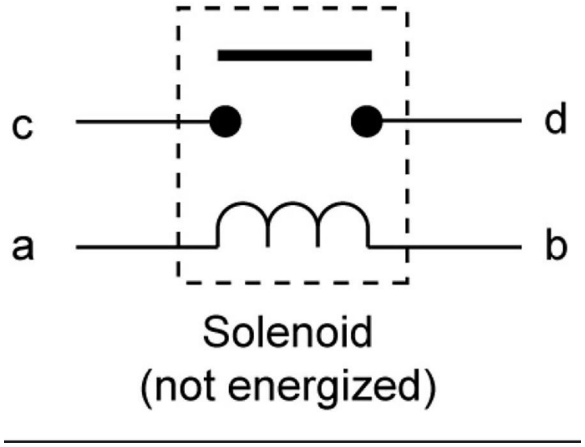

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Figure 92

3. Apply 12 volts (DC) to terminal A and ground terminal B. Terminals C and D should now be closed (continuity).

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 kill relay.

Note: 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 Testing

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).
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)

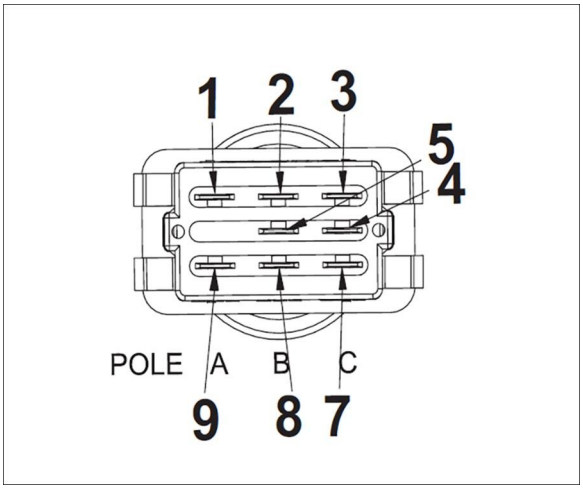

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Figure 93

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)
   - 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:

- Coil
- 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 as different speeds it is known as clutch slipping.

Electric PTO Clutch Testing

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.

Electric PTO Clutch Coil Resistance Measurement

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.

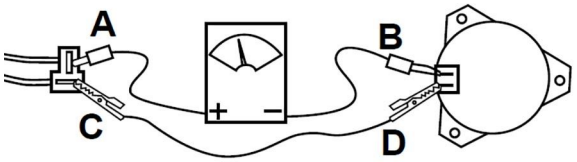

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Figure 94

5. See the PTO Clutch Electrical Specifications chart.

Resistance (OHMs)	AMP Draw	Continuity to Ground
3.05 ± 5%	3.93	OPEN

Electric PTO Clutch Continuity to Ground Check

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 clutch housing. Connect the other multi-meter lead to each of the clutch connector terminals.
5. The 2 clutch connector terminals should never have continuity to ground and should 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.

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.

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 A.
5. Connect the negative meter lead to the corresponding clutch terminal.
6. Connect a short jumper lead from terminal C (large red wire with cap) to terminal D (large red wire with no cap).
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.

Resistance (OHMs)	AMP Draw	Continuity to Ground
3.05 ± 5%	3.93	OPEN

TVS Diode

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

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Figure 95

TVS Diode Testing

No testing procedure available. If the diode is suspected to be faulty, replace the diode. If the system fuse blows each time the clutch is engaged, the TVS diode is more than likely shorting clutch power to ground.

Magneto Stop Relay

The magnento stop relay grounds the magneto when the key is turned to the “OFF” position. When the key is turned to the “RUN” position, the solenoid is

Magneto Stop Relay (continued)

grounded through the stop relay and the magneto is no longer grounded. The magneto stop relay prevents starting in an unsafe position.

Appendix A

Foldout Drawings

Table of Contents

Electrical Drawing Abbreviations.....A–2
Electrical Schematic.....A–3

Electrical Drawing Abbreviations

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

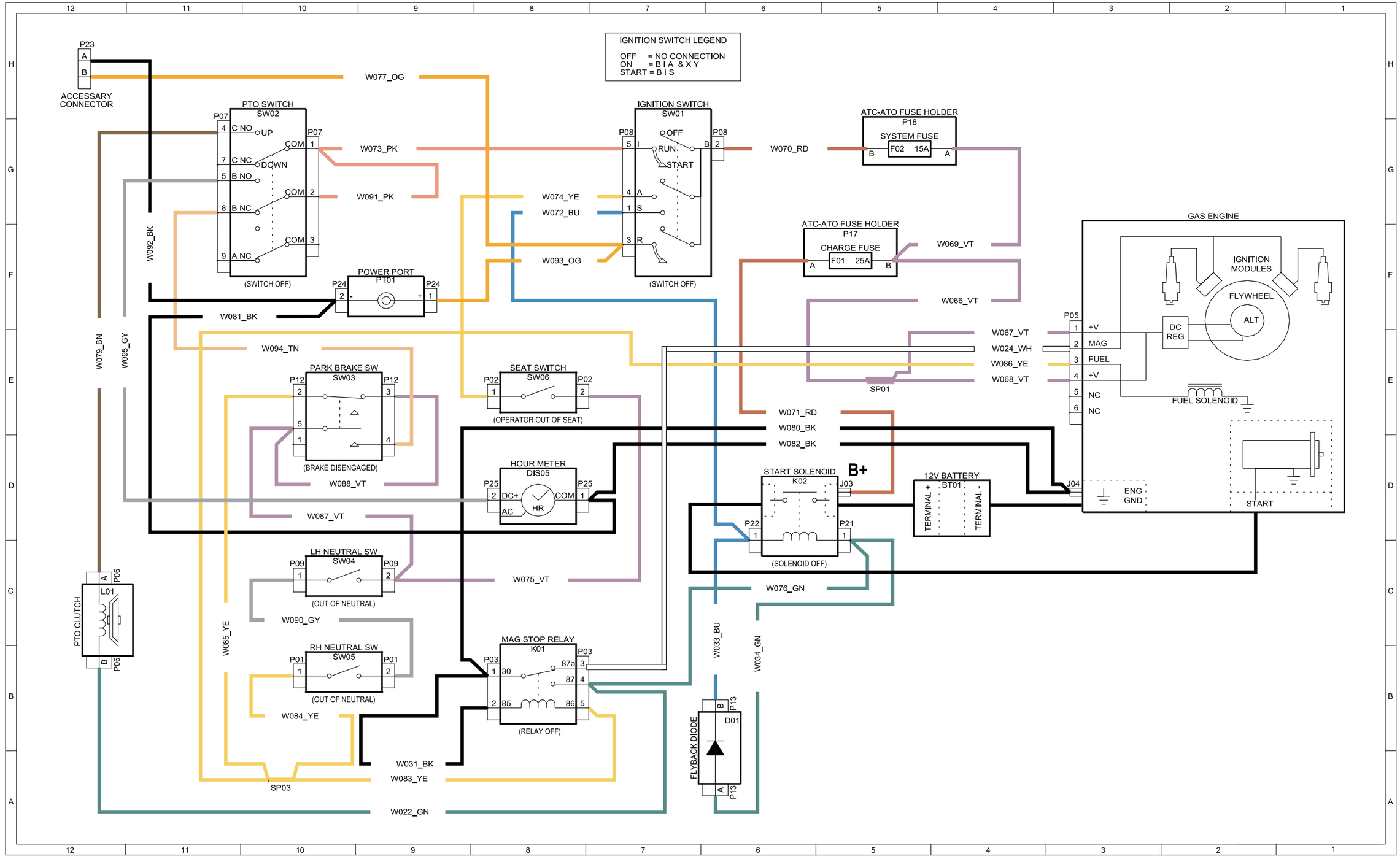
Abbreviation	Color
BK	Black
BR or BN	Brown
BU	Blue
GN	Green
GY	Gray
OR or OG	Orange
PK	Pink
R or RD	Red
T or TN	Tan
VIO or VT	Violet
W or WH	White
Y or YE	Yellow

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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