



**Count on it.**

**Service Manual**

**GRANDSTAND® Revolution  
Service Manual**



Published: September 2022

# Revision History

# Preface

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

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

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

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

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

# Service Procedure Icons

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



## Critical Process

This icon is used to highlight:

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



## Critical Torque

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



## Fluid Specifications

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

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

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# Safety Instructions



## DANGER



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

---



## WARNING



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

---



## CAUTION



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

---

## Think Safety First

### **Avoid unexpected starting of engine...**

Always turn off the power, engage the parking brake, remove the ignition key and disconnect the battery wire(s) before cleaning, adjusting, or repair.

### **Avoid lacerations and amputations...**

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

### **Avoid burns...**

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

### **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.

# Think Safety First (continued)

## **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 unit is powered on. 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...**

Seek immediate medical attention if fluid is injected into the skin. Injected fluid must be surgically removed within a few hours by a doctor. Use cardboard or paper to find hydraulic leaks.

## **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...**

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

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

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

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

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





# Specifications and Maintenance

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# Specifications

Model	18560	18562	18564
<b>Power System</b>			
Battery	Toro HYPERCELL™		
Battery Quantity	8 batteries		
Battery Capacity	18.4 kWh		
Run Time	4 to 7+ hours		
Charge Time	12 hours		
Charge Type	1.2 kW (120V)		
<b>Traction Drive</b>			
Transmission	Planetary Gearset		
Motors	Commercial High Torque		
Traction Unit Speed	10 mph		
Traction Speed Control	7 speed settings		
Drive Tires	7.87 x 4.13–4.72 cm (20 x 10.5–12 inch)		
Front Caster Tires	4.3 x 1.57–1.97 cm (11 x 4–5 inch) semi-pneumatic		
<b>Cutting Deck</b>			
Deck Size	132 cm (52 inch)	122 cm (48 inch)	152 cm (60 inch)
Deck Construction	7 fa TURBO FORCE®		
Spindle Assembly	Die-Cast aluminum 3.5 cm (9 inch) w/ blade retainer		
Blades	0.8 cm (0.315 inch)		
Blade Tip Speed (ft/min)	73.66 88.9 m/s (14,500 - 17,500 ft/min)		

# Torque Specifications

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

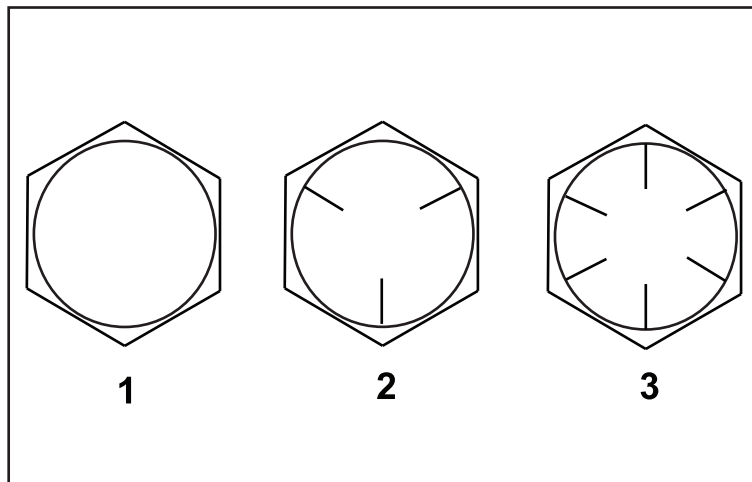
These torque specifications for the installation and tightening of fasteners shall apply for all fasteners which do not have a specific requirement identified in the service manual. The following factors shall be considered when applying torque: cleanliness of the fastener, use of a thread sealant (Loctite),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

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

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

## Fastener Identification

### Inch Series Bolts and Screws

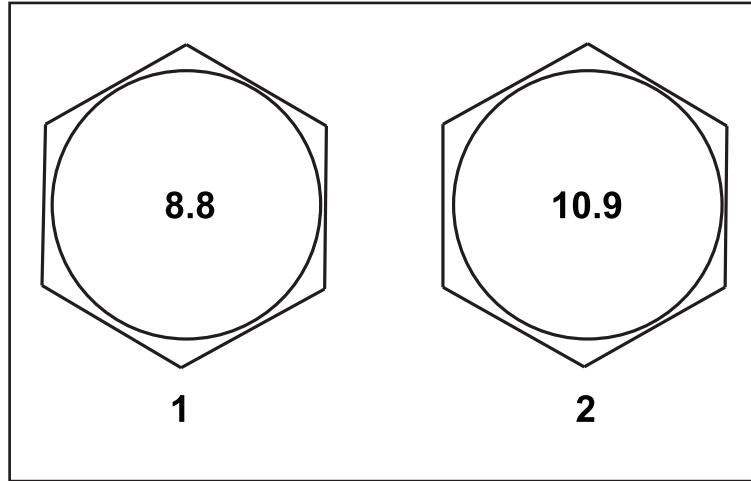


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**Figure 1**

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

Metric Bolts and Screws



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**Figure 2**

1. Class 8.8

2. Class 10.9

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

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

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

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

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

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

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

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

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

The nominal torque values listed above are based on 75% of the minimum proof load specified in SAE J1199. The tolerance is approximately ± 10% of the nominal torque value. Thin height nuts include jam nuts.

## SAE Grade 8 Steel Set Screws

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

## Wheel Bolts and Lug Nuts

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

\*\*For steel wheels and non-lubricated fasteners.

## Thread Cutting Screws (Zinc Plated Steel)

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

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

### Conversion Factors

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

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

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

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

## Thread Cutting Screws (Zinc Plated Steel)

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

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

# Equivalents and Conversions

## Decimal and Millimeter Equivalents

Fractions	Decimals	mm	Fractions	Decimals	mm
1/64	0.015625	0.397	33/64	0.515625	13.097
1/32	0.03125	0.794	16/32	0.53125	13.484
3/64	0.046875	1.191	35/64	0.546875	13.891
1/16	0.0625	1.588	9/16	0.5625	14.288
5/64	0.078125	1.984	37/64	0.578125	14.684
3/32	0.09375	2.381	19/32	0.59375	15.081
1/8	0.1250	3.175	5/8	0.6250	15.875
9/64	0.140625	3.572	41/64	0.640625	16.272
5/32	0.15625	3.969	21/32	0.65625	16.669
11/64	0.171875	4.366	43/64	0.671875	17.066
3/16	0.1875	4.762	11/64	0.6875	17.462
13/64	0.203125	5.159	45/64	0.703125	17.859
7/32	0.21875	5.556	23/32	0.71875	18.256
15/64	0.234375	5.953	47/64	0.734375	18.653
1/4	0.2500	6.350	3/4	0.7500	19.050
17/64	0.265625	6.747	49/64	0.765625	19.447
9/32	0.28125	7.144	25/32	0.78125	19.844
19/64	0.296875	7.541	51/64	0.796875	20.241
5/16	0.3125	7.541	13/16	0.8125	20.638
21/64	0.328125	8.334	53/64	0.828125	21.034
11/32	0.34375	8.731	27/32	0.84375	21.431
23/64	0.359375	9.128	55/64	0.859375	21.828
3/8	0.3750	9.525	7/8	0.8750	22.225
25/64	0.390625	9.922	57/64	0.890625	22.622
13/32	0.40625	10.319	29/32	0.90625	23.019
27/64	0.421875	10.716	59/64	0.921875	23.416
7/16	0.4375	11.112	15/16	0.9375	23.812
29/64	0.453125	11.509	61/64	0.953125	24.209
15/32	0.46875	11.906	31/32	0.96875	24.606
31/64	0.484375	12.303	63/64	0.984375	25.003
1/2	0.5000	12.700	1	1.000	25.400
<b>1 mm = 0.03937 in.</b>			<b>0.001 in. = 0.0254 mm</b>		

# U.S. to Metric Conversions

	To Convert	Into	Multiply By
<b>Linear Measurement</b>	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
<b>Area</b>	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
<b>Volume</b>	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
<b>Weight</b>	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces	Grams	28.3495
<b>Pressure</b>	Pounds/Square Inch	Kilopascal	6.895
<b>Work</b>	Foot-Pounds	Newton-Meters	1.356
	Foot-Pounds	Kilogram-Meters	0.1383
	Inch-Pounds	Kilogram-Centimeters	1.152144
<b>Liquid Volume</b>	Quarts	Liters	0.9463
	Gallons	Liters	3.785
<b>Liquid Flows</b>	Gallons/Minute	Liters/Minute	3.785
<b>Temperature</b>	Fahrenheit	Celsius	1. Subtract by 32°
			2. Multiply by 5/9





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## 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

Refer to the universal and HYPERCELL™ fault code and troubleshooting documents.





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# General Information

# Service and Repairs

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
T1	P0225	<b>Traction Pedal 1 Analog Sensor 1 - Open Circuit</b>	Traction Pedal Analog Sensor 1 is reading a voltage outside the range it was designed to operate, indicating an open circuit	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P0226	<b>Traction Pedal 1 Analog Sensor 1 - Out of Range</b>	Traction Pedal Analog Sensor 1 is reading a voltage outside the range it was designed to operate.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P0227	Traction Pedal Analog Sensor 1 - Short to Ground	Traction Pedal Analog Sensor 1 is reading a voltage outside the range it was designed to operate, indicating a short to ground.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
TBX	P058E	<b>Battery - High Temp Shutdown</b>	A battery cell temperature was measured to be greater than the allowed threshold.	Key On or Charger Connected	Battery contactor is opened	Let the machine cool before operating.
TBX	P058F	<b>Battery - Low Temp Shutdown</b>	A battery cell temperature was measured to be less than the allowed threshold.	Key On or Charger Connected	Battery contactor is opened	Let the machine warm up before operating.
SC1, SC2, SC3, SC4, SC5	P062F	EEPROM Failure	Failure to write to EEPROM memory. Differs from an internal board fault in that it has the potential for recovery through reprogramming.	Key ON	Application specific	<ol style="list-style-type: none"> <li>1. Reprogram controller.</li> <li>2. Reset to defaults, if applicable.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
TBX	P0A80	Battery - Internal Hardware Failure	A hardware component internal to the battery has failed.	Key On or Charger Connected	Battery contactor is opened	<ol style="list-style-type: none"> <li>1. Attempt to cycle power on the machine.</li> <li>2. For HyperCell, if still present, identify which battery is causing the fault.</li> <li>3. For HyperCell, if still present, check that software is up to date.</li> <li>4. If still present, then battery is likely damaged. For Samsung batteries, send Samsung fault file to Toro Service.</li> </ol>
TBX	P0AA1	Battery Contactor - Stuck Closed	The Contactor is measured to be Closed when it should be Open.	Key On or Charger Connected	Battery contactor is opened.  <b>Note:</b> If it's truly welded shut, it won't open.	<ol style="list-style-type: none"> <li>1. Attempt to cycle power on the machine.</li> <li>2. For HyperCell, if still present, identify which battery is causing the fault.</li> <li>3. For HyperCell, if still present, check that software is up to date.</li> <li>4. If still present, then battery is likely damaged. For Samsung batteries, send Samsung fault file to Toro Service.</li> </ol>
TBX	P0AA2	Battery Contactor - Stuck Open	The Contactor is measured to be Open when it should be Closed.	Key On or Charger Connected	Battery contactor is opened	BMS is likely damaged. For Samsung BMS, send Samsung fault file to Toro Service.

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
TBX	P0AC2	Battery - Over Current	A battery cell is supplying too much current for too long. This can either be because of too much power draw or a battery cell imbalance.	Key On or Charger Connected	Battery contactor is opened	<ol style="list-style-type: none"> <li>1. Reduce Power draw.</li> <li>2. For HyperCell, check that all batteries are recognized by the machine.</li> <li>3. Identify which battery has thrown the fault.</li> <li>4. Check battery and machine harness for damaged wires.</li> <li>5. Cycle Power on the machine.</li> <li>6. If faults persists, battery is likely damaged. If Samsung, send Samsung fault file to Toro Service.</li> </ol>
TBX	P0AFA	Battery - Low Voltage	A battery cell voltage was measured to be lower than the allowed threshold but is still recoverable.	Key On or Charger Connected	Battery contactor is opened and BMS is offline	<p>For Samsung, contact Toro Service to recover the battery.</p> <p>For HyperCell,</p> <ol style="list-style-type: none"> <li>1. Charge the battery.</li> <li>2. If no other faults are present and it will not charge after 30 minutes, then battery likely permanently damaged and needs to be replaced.</li> </ol>
TBX	P0AFB	Battery - High Voltage	A battery cell voltage was measured to be higher than the allowed threshold.	Key On or Charger Connected	Battery contactor is opened	<ol style="list-style-type: none"> <li>1. For Samsung, if the fault occurred with a full battery during a regenerative braking, everything is likely fine.</li> <li>2. For Samsung, if the fault occurred when the State of Charge is less than 90% and battery is Samsung, send Samsung fault file to Toro Service.</li> </ol> <p>For HyperCell, battery is permanently disabled and must be replaced.</p>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
SC1, SC2, SC3, SC4, SC5	P0C05	Motor Phase - Open Circuit	An open circuit has been detected on one of the motor phases.	Key On	Application specific	<ol style="list-style-type: none"> <li>1. Verify the motor phases connection on the motor side.</li> <li>2. Verify the motor phases connection on the controller side.</li> <li>3. Check the motor power cables for damage.</li> <li>4. Replace the controller.</li> <li>5. If the fault does not disappear, the problem is in the motor. Replace motor.</li> </ol>
TBX	P0C78	Precharge Failure - Battery	DC Bus precharge timeout.	Key On or Charger Connected		<ol style="list-style-type: none"> <li>1. Check for loose battery connections.</li> <li>2. Check for batteries connected in reverse.</li> <li>3. Check for unintended short placed on + and - terminals.</li> <li>4. Check that software is up to date.</li> <li>5. If fault persists, then battery or machine controller may be damaged. Contact Toro Service.</li> </ol>
TBX	P0DAB	Battery Series Cell Imbalance	The voltage difference between the lowest and highest series cells in the battery have exceeded an acceptable threshold.	Key On or Charger Connected		<ol style="list-style-type: none"> <li>1. Cycle Power.</li> <li>2. If at low state of charge, charging may resolve fault..</li> <li>3. If fault is persistent through several charge cycles, then battery is likely in need of replacement. Contact Toro Service.</li> </ol>
TBX	P1A01	Battery Charging - High Temp Shutdown	A battery cell temperature was measured to be greater than the allowed threshold and will not charge.	Key On or Charger Connected	For Samsung, battery contactor is opened. For HyperCell, only discharging will be allowed until the release threshold is met (40°C).	<ol style="list-style-type: none"> <li>1. Let the machine cool before charging.</li> <li>2. Charge the machine in the shade or in a cooler environment.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
TBX	P1A02	Battery Charging- Low Temp Shutdown	A battery cell temperature was measured to be less than the allowed threshold and will not charge.	Key On or Charger Connected	For Samsung, Battery contactor is opened. For HyperCell, only discharging will be allowed until the release threshold is met (3°C).	Let the machine warm up before operating.
TBX	P1A11	Battery Charging Voltage - High	A battery cell voltage was measured to be higher than the allowed threshold while the battery charger was connected.	Key On or Charger Connected	For Samsung, battery contactor is opened. For HyperCell, only discharging will be allowed until the release threshold is met (4.0V/cell).	<ol style="list-style-type: none"> <li>1. Make sure the customer is using the correct charger.</li> <li>2. Check the charger for faults.</li> <li>3. Replace Charger.</li> </ol>
TBX	P1A21	Battery Charging - Over Current	A battery cell charging current was measured to be greater than the allowed threshold. This is likely due to cell imbalance in the battery pack.	Key On or Charger Connected	Battery contactor is opened	<ol style="list-style-type: none"> <li>1. Make sure the customer is using the correct charger.</li> <li>2. Replace the charger.</li> <li>3. Check battery and charger harness for damaged wires. .</li> <li>4. If Samsung, send Samsung fault file to Toro Service.</li> </ol>
TB1	P1A55	Battery ID Pin - Open Circuit	Open circuit detected on battery ID pin.	Key On or Charger Connected		<ol style="list-style-type: none"> <li>1. Cycle power on the machine.</li> <li>2. Check for loose wire or connector– and replace as needed.</li> <li>3. If problem persists, then swap which battery receives the leader jumper harness.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
T1	P210E	Traction Pedal 1 Sensor/Switch Analog vs Analog conflict	The Traction Pedal 1 Analog Sensor has dual analog signals. The analog signals independently indicate a pedal position relative to neutral. The two signals are reporting differing positions outside of an expected variance	Key is in the run position	TP is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2120	Traction Pedal 2 Analog Sensor 1 - Open Circuit	Traction Pedal 2 Analog Sensor 1 is reading a voltage outside the range it was designed to operate, indicating an open circuit	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2122	Traction Pedal 2 Analog Sensor 1 - Short To Ground	Traction Pedal 2 Analog Sensor 1 is reading a voltage outside the range it was designed to operate, indicating a short to ground.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2125	Traction Pedal 2 Analog Sensor 2 - Open Circuit	Traction Pedal 2 Analog Sensor 2 is reading a voltage outside the range it was designed to operate, indicating an open circuit.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2127	Traction Pedal 2 Analog Sensor 2 - Short To Ground	Traction Pedal 2 Analog Sensor 2 is reading a voltage outside the range it was designed to operate, indicating a short to ground.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
T1	P2130	Traction Pedal Analog Sensor 2 - Short To Ground	Traction Pedal Analog Sensor 2 is reading a voltage outside the range it was designed to operate, indicating a short to ground.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2132	Traction Pedal Analog Sensor 2 - Open Circuit	Traction Pedal Analog Sensor 2 is reading a voltage outside the range it was designed to operate, indicating an open circuit	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2138	Traction Pedal 2 Sensor/Switch Analog vs Analog conflict	The Traction Pedal 2 Analog Sensor has dual analog signals. The analog signals independently indicate a pedal position relative to neutral. The two signals are reporting differing positions outside of an expected variance	Key is in the run position	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the sensor.</li> <li>2. Make sure the position of the sensor is correct.</li> <li>3. Check the sensor wiring to the TEC controller.</li> <li>4. Replace the sensor.</li> </ol>
T1	P2530	Key Start/Run Correlation Fault	Key start input is active but the key run input is off.	Key is in the run or the start position	Machine will be shutdown since key run input is inactive.	<ol style="list-style-type: none"> <li>1. Check for loose wire or connector.</li> <li>2. Check for corrosion due to water.</li> <li>3. Check the TEC harness/connector for loose wires.</li> <li>4. Check the key switch.</li> <li>5. Replace key switch.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1023	Park Brake Disengage - Short to Battery	Low current detected on Park Brake Disengage output. Indicates a short to battery.	Park Brake disengage output is OFF.		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to Vs.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
SC1, SC2, SC3, SC4, SC5	C1024	Park Brake Disengage - Short to Ground/Overcurrent	Overcurrent detected on Park Brake Disengage output. Indicates short to ground.	Park Brake disengage is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted.</li> <li>2. 1Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1314	Proportional Solenoid Valve 1 - Short to Ground/Overcurrent	Overcurrent detected on SP 1 output. Indicates short to ground.	SP1 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted.</li> <li>2. 1Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1413	Solenoid 1 - Short to Battery	Low current detected on Solenoid 1 (S1) output. Indicates a short to battery.	S1 output is OFF		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to Vs.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1414	Solenoid 1 - Short to Ground/Overcurrent	Overcurrent detected on Solenoid 1 (S1) output. Indicates short to ground.	S1 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to ground.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1415	Solenoid 1 - Open Circuit	Open Circuit detected on Solenoid 1 (S1) output.	S1 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not open.</li> <li>2. Test the component connected to the output for proper resistance..</li> <li>3. Replace TEC.</li> </ol>
T1	C1423	Solenoid 2 - Short to Battery	Low current detected on Solenoid 2 output. Indicates a short to battery.	S2 output is OFF		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to Vs.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
T1	C1424	Solenoid 2 - Short to Ground/Overcurrent	Overcurrent detected on Solenoid 2 (S2) output. Indicates short to ground.	S2 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to ground.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1425	Solenoid 2 - Open Circuit	Open Circuit detected on Solenoid 2 (S2) output.	S2 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not open.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1433	Solenoid 3 - Short to Battery	Low current detected on Solenoid 3 (S3) output. Indicates a short to battery.	S3 output is OFF		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to Vs.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1434	Solenoid 3 - Short to Ground/Overcurrent	Overcurrent detected on Solenoid 3 (S3) output. Indicates short to ground.	S3 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not shorted to ground.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
T1	C1435	Solenoid 3 - Open Circuit	Open Circuit detected on Solenoid 3 (S3) output.	S3 output is ON		<ol style="list-style-type: none"> <li>1. Check the output circuit is not open.</li> <li>2. Test the component connected to the output for proper resistance.</li> <li>3. Replace TEC.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F00	Motor Speed Sensor - Out of Range	Speed sensor reading is outside normal operating range.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the speed sensor.</li> <li>2. Check supply to speed sensor.</li> <li>3. Check ground to the speed sensor.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F01	Motor Speed - High	Motor rpm is operating above the allowed max speed which should not be possible.	Motor Running	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check the wiring of the speed sensor.</li> <li>2. Check supply voltage to speed sensor.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
SC1, SC2, SC3, SC4, SC5	C1F02	Motor Controller - Stall Detected	Speed Sensor reading indicates a stalled traction motor.	Motor Running	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the speed sensor feedback if available.</li> <li>2. Check supply to speed sensor if available.</li> <li>3. Check ground to the speed sensor if available.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F07	Motor Speed Sensor - Data Invalid	Speed sensor reading is invalid, based on current operating conditions.	Motor Running	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the speed sensor.</li> <li>2. Check supply to speed sensor.</li> <li>3. Check ground to the speed sensor.</li> </ol>
SC1, SC2, SC3, SC4	C1F0C	Motor Controller - Unexpected Movement	Unexpected motor movement detected.	Key On	Motor Disabled	Inspect phase and feedback connections that they are correctly connected to the motor controller.
SC1, SC2, SC3, SC4	C1F0D	Motor Controller - Misalignment Error	Motor is producing torque in an uncommanded direction.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Restart the machine.</li> <li>2. Check wiring to the motor and encoder.</li> <li>3. Replace controller or assign correct parameters.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F19	Motor Controller - Phase PWM Mismatch	The difference between the commanded phase PWM duty cycle and the measured is greater than allowed.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Verify phase wire connections at the motor and controller.</li> <li>2. Check phase wires for damage or corrosion.</li> <li>3. If wiring is ok and fault persists, replace motor.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F21	Motor Controller Bus Voltage - High	The motor controller bus voltage exceeds the high voltage threshold.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Measure the voltage at the motor connector to determine whether the voltage is high or the controller is measuring high.</li> <li>2. Check the battery voltage.</li> <li>3. Ensure the wiring is ok to the motor.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
SC1, SC2, SC3, SC4, SC5	C1F22	Motor Controller Bus Voltage - Low	The motor bus voltage is lower than the low voltage threshold.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check the fuse.</li> <li>2. Measure the voltage at the motor connector to determine whether the voltage is low or the controller is measuring low.</li> <li>3. Check the battery voltage.</li> <li>4. Ensure the wiring is ok to the motor.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F31	Motor Controller - Over Current	The motor is commanding more current than the hardware and software allows.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Cycle keyswitch.</li> <li>2. Report incident to Toro if fault continues. This should not occur under the desired machine design.</li> <li>3. Replace motor</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F4C	Motor Controller - Internal Hardware Failure	A component internal to the controller has failed.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Reset controller. .</li> <li>2. If persistent, relace controller.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F4D	Motor Controller - Internal Software Failure	Program execution within the controller encountered a critical problem and could not recover from this.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Attempt to reprogram controller.</li> <li>2. Replace controller.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F51	Motor Controller Logic Voltage - High	The traction motor logic voltage exceeds the normal operating limit.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Measure the voltage at the motor connector to determine whether the voltage is high or the controller is measuring high.</li> <li>2. Check the battery voltage.</li> <li>3. Ensure the wiring is ok to the motor.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F52	Motor Controller Logic Voltage - Low	The traction motor logic voltage is lower than the normal operating limit.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Measure the voltage at the motor connector to determine whether the voltage is low or the controller is measuring low.</li> <li>2. Check the battery voltage.</li> <li>3. Ensure the wiring is ok to the motor.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
SC1, SC2, SC3, SC4, SC5	C1F61	Motor Controller - High Temp Shutdown	The controller temperature was greater than the allowed threshold.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Reduce motor load.</li> <li>2. Check for mechanical resistance that would make the motor work harder than necessary.</li> <li>3. Allow the machine to cool.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F62	Motor Controller - Low Temp Shutdown	The controller temperature was lower than the allowed threshold.	Key On	Motor Disabled	Warm the machine.
SC1, SC2, SC3, SC4, SC5	C1F70	Motor Controller - Motor Braking Impaired	Motor braking was impaired.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. If another fault is active, diagnose and resolve that fault.</li> <li>2. Cycle keyswitch.</li> <li>3. Report incident to Toro if fault continues. This should not occur under the desired machine design.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F80	Motor - Temperature Sensor Failure	The motor temperature sensor is out of the normal operating range.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check the wiring to the motor temperature sensor if the wiring is external to the controller.</li> <li>2. Replace temperature sensor.</li> </ol>
SC1, SC2, SC3, SC4, SC5	C1F81	Motor - High Temp Shutdown	The motor temperature was measured to be greater than the Temperature Shutdown Threshold.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check for mechanical resistance that would make the motor work harder than necessary.</li> <li>2. Verify that phase connections are securely fastened to the motor and the motor controller.</li> <li>3. Allow the machine to cool.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
SC1, SC2, SC3, SC4, SC5	C1F9C	Motor Controller - Precharge Failed	The precharge failed to charge the capacitor bank.	Key On	Motor Disabled	<ol style="list-style-type: none"> <li>1. Check if an external load is installed on the high voltage bus.</li> <li>2. Inspect motor controller wiring to ensure that the pins are securely seated in the connector.</li> <li>3. Check contactor wiring connections.</li> <li>4. Replace the controller</li> </ol>
T1, SC1, SC2, SC3, SC4, SC5	B1107	Transmission Lever Switch Broken	Both TRANSMISSION_FWD and TRANSMISSION_REV inputs are active at the same time	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the switch. There could be a short in the switch.</li> <li>2. Check the harness/connector for a loose wire or corrosion.</li> </ol>
T1	B1197	Mode Switch Broken	Two or more of the Neutral, Mow, Transport inputs are active at the same time.	Key On	Traction is disabled	<ol style="list-style-type: none"> <li>1. Check the switch. There could be a short in the switch.</li> <li>2. Check the harness/connector for a loose wire or corrosion.</li> </ol>
T1	U0110	CAN Bus Communication Fault - Traction Motor 1	Lost communication with Traction Motor 1 controller.	Key On	Disable Traction	<ol style="list-style-type: none"> <li>1. Check CAN connection.</li> <li>2. Verify power to controller.</li> </ol>
T1 TB1	U0111	CAN Bus Communication Fault - Battery	Lost communication with Battery controller.	Key On	Limit performance	<ol style="list-style-type: none"> <li>1. Check CAN connection.</li> <li>2. Verify power to controller.</li> </ol>
T1	U0156	CAN Bus Communication Fault - IC	Lost communication with the InfoCenter	Key On		<ol style="list-style-type: none"> <li>1. Check if InfoCenter is powered.</li> <li>2. Check resistance of CAN network.</li> </ol>
T1	U0292	CAN Bus Communication Fault - Traction Motor 2	Lost communication with Traction Motor 2 controller.	Key On	Disable Traction	<ol style="list-style-type: none"> <li>1. Check CAN connection.</li> <li>2. Verify power to controller.</li> </ol>
T1	U1011	Controller Logic Voltage - High	The logic voltage has determined to be out of range on the high side.	Key On		Check the power supply to the controller whether that's a battery or DC-DC Converter
T1	U1012	Controller Logic Voltage - Low	The logic voltage has determined to be out of range on the low side.	Key On	Disable PTO	Check the power supply to the controller whether that's a battery or DC-DC Converter

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
T1	U1022	TEC Fuse 2 Failure	Fuse is blown on a PWR output group of the TEC. Source Address to indicate which controller reported this fault.	Key On		Check 7.5 Amp fuses protecting TEC outputs.
SC1, SC2, SC3, SC4, SC5	U1030	5V Supply - Out of Range	5 Volt Supply voltage has been determined to be out of range either on the high or low side.	Key ON	Disable the controller functionality.	<ol style="list-style-type: none"> <li>1. Check 5V.</li> <li>2. Disconnect Sensors one by one to make sure one of them is not pulling too heavy of a load.</li> <li>3. Replace the controller.</li> </ol>
T1, SC1, SC2, SC3, SC4, SC5	U110C	Model Number Unknown	Model number not recognized	Key ON	Disable Engine	Update machine firmware using ToroDIAG.
T1	U1117	Source Address Contention Fault	Controller received a message from another controller on the CAN bus using the same Source Address.	Key ON	Disable the machine	<ol style="list-style-type: none"> <li>1. Inspect machine to ensure that two controllers installed on the machine are not both programmed the same.</li> <li>2. Reprogram the machine using ToroDIAG.</li> </ol>
T1	U111F	Source ID - CU Motor ID Out of Range	At least one of the Cutting Unit Motor node addresses is outside of the standard range of 0x81- 0x85. There was either contention on the CAN bus for the same node ID or the ID circuit internal to the node is not functioning properly.	Key ON	Disable Mow	<ol style="list-style-type: none"> <li>1. Check for loose wire or connector.</li> <li>2. Check the internal resistance of the motor ID PIN. It should be 18.9kohm +/- 1 ohm.</li> <li>3. Check the resistance of the ID Module</li> </ol>
SC1, SC2, SC3, SC4, SC5	U1120	CAN Bus Lost Communication Fault - All	Controller lost communication with one or all of the nodes.	Key is in the run position		<ol style="list-style-type: none"> <li>1. Check if all the nodes are powered up.</li> <li>2. Check resistance of CAN network.</li> </ol>
T1	U1122	CAN Bus Communication Fault - CU Motor 1	Controller has lost communication with CU Motor Controller 1	Key On	Disable PTO	<ol style="list-style-type: none"> <li>1. Check CAN connection.</li> <li>2. Verify power to controller.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
T1	U1123	CAN Bus Communication Fault - CU Motor 2	Controller has lost communication with CU Motor Controller 2	Key On	Disable PTO	<ol style="list-style-type: none"> <li>1. Check CAN connection.</li> <li>2. Verify power to controller.</li> </ol>
T1	U1124	CAN Bus Communication Fault - CU Motor 3	Controller has lost communication with CU Motor Controller 3	Key On	Disable PTO	<ol style="list-style-type: none"> <li>1. Check CAN connection.</li> <li>2. Verify power to controller.</li> </ol>
TBX	U1140	Communication Fault - Battery Cell Module	The BMS lost communication with at least one of the battery cell modules	Key On or Charger Connected	Battery contactor is opened	<p>Samsung:</p> <ol style="list-style-type: none"> <li>1. Check the communication cable connection and harness between all batteries and the BMS.</li> <li>2. Battery likely damaged. If Samsung, send Samsung fault file to Toro Service.</li> </ol> <p>HyperCell:</p> <ol style="list-style-type: none"> <li>1. Try restarting the machine.</li> <li>2. Check that software is up to date.</li> <li>3. If persistent, then a support battery, leader battery, their connectors, or the wire harness may be damaged. Contact Toro service.</li> </ol>
T1	U1151	Battery Pack Inactive	Fewer battery packs are active than the machine expects.	Key On	Application specific, see engineering notes	<ol style="list-style-type: none"> <li>1. If another fault is active, diagnose and resolve that fault.</li> <li>2. Charge the machine.</li> <li>3. Check all wiring to the batteries.</li> <li>4. Update machine firmware using ToroDIAG.</li> <li>5. Check the machine fault log for previously logged battery faults. Resolve those faults if applicable.</li> <li>6. Locate and replace the inactive battery pack.</li> </ol>

Supported Controllers	Fault ID	Fault Name	Fault description / Technical description	Fault set preconditions	Controller action	Recommended service actions
TB1	U1170	Host Machine Controller Authentication Failure - Battery	Host machine controller is not authorized to operate battery packs	Key On or Charger Connected	Disable the machine	<ol style="list-style-type: none"> <li>1. Update machine firmware using ToroDIAG.</li> <li>2. If fault persists, contact Toro service.</li> </ol>
T1	U1301	Software Version Incompatibility - CU Motor 1	CU Motor 1 slave controller software is incompatible.	Key On	Disable Engine	Update machine firmware using ToroDIAG.
T1	U1302	Software Version Incompatibility - CU Motor 2	CU Motor 2 slave controller software is incompatible.	Key On	Disable Engine	Update machine firmware using ToroDIAG.
T1	U1303	Software Version Incompatibility - CU Motor 3	CU Motor 2 slave controller software is incompatible.	Key On	Disable Engine	Update machine firmware using ToroDIAG.
T1	U130A	Software Version Incompatibility - InfoCenter	InfoCenter software is incompatible.	Key On	Disable the machine	Update machine firmware using ToroDIAG.
T1	U130B	Software Version Incompatibility - Traction Motor 1	Traction Motor 1 firmware is incompatible.	Key On	Disable the machine	Update machine firmware using ToroDIAG.
T1	U130C	Software Version Incompatibility - Traction Motor 2	Traction Motor 2 firmware is incompatible.	Key On	Disable the machine	Update machine firmware using ToroDIAG.
T1	U130F	Software Version Incompatibility - Unknown	Unknown Software Version Incompatible.	Key On	Disable the machine	Update machine firmware using ToroDIAG.
T1	U1311	Software Version Incompatibility - Battery	Battery firmware is incompatible.		Disable the machine	Update machine firmware using ToroDIAG.
T1	U1701	Board Internal Error - IPE	Inputs or outputs on the controller are not working correctly due to low internal voltage. Inputs can't be trusted.	Key ON	Disable the controller functionality	<ol style="list-style-type: none"> <li>1. Check 12V battery.</li> <li>2. Internal circuit board fault. Replace the controller.</li> </ol>
T1	U1710	Calibration Error	Calibration procedure was not able to be completed successfully.	Key ON		<ol style="list-style-type: none"> <li>1. Verify calibration procedure is performed properly.</li> <li>2. Internal circuit board fault. Replace the controller.</li> </ol>



---

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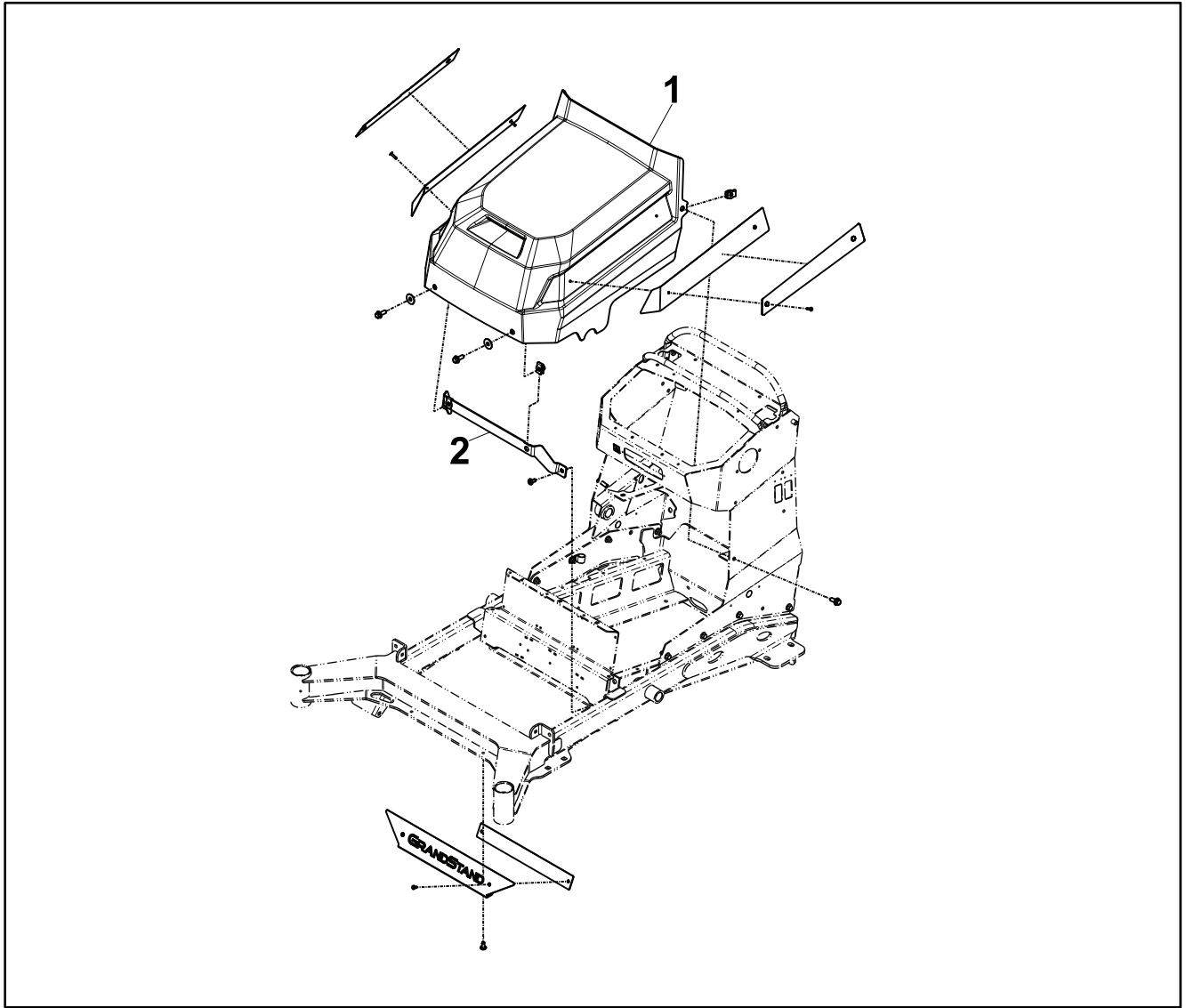
# General Information

The Grandstand chassis is a stand on platform made up of a welded steel frame with a front-end I-beam, folding operator platform, and control tower.

The chassis and HYPERCELL™ fault codes and troubleshooting information will be covered by standalone documents.

# Service and Repairs

## Chassis Assembly 1



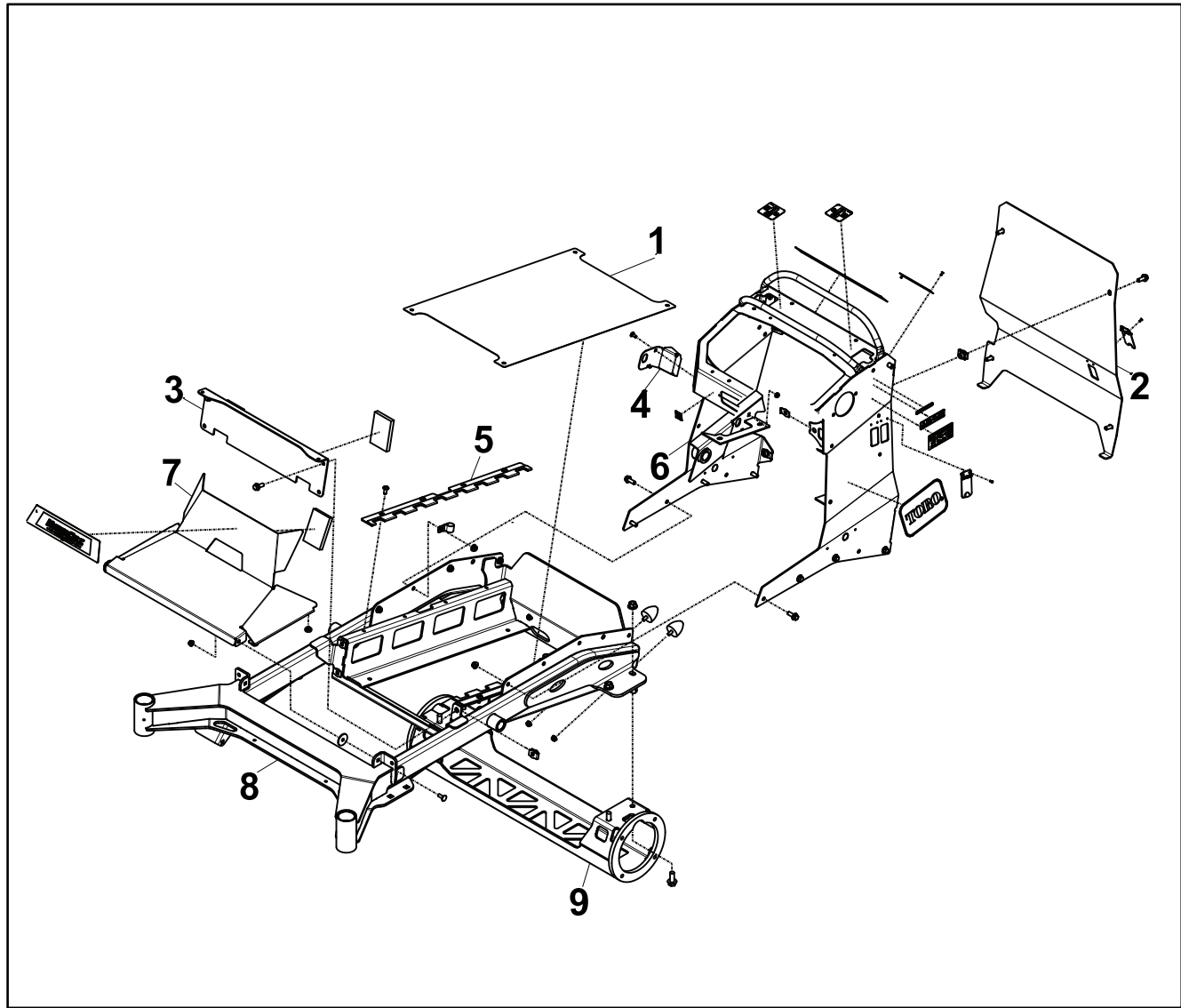
g394586

**Figure 3**

1. Battery Cover Assembly

2. Cover Mount Bracket

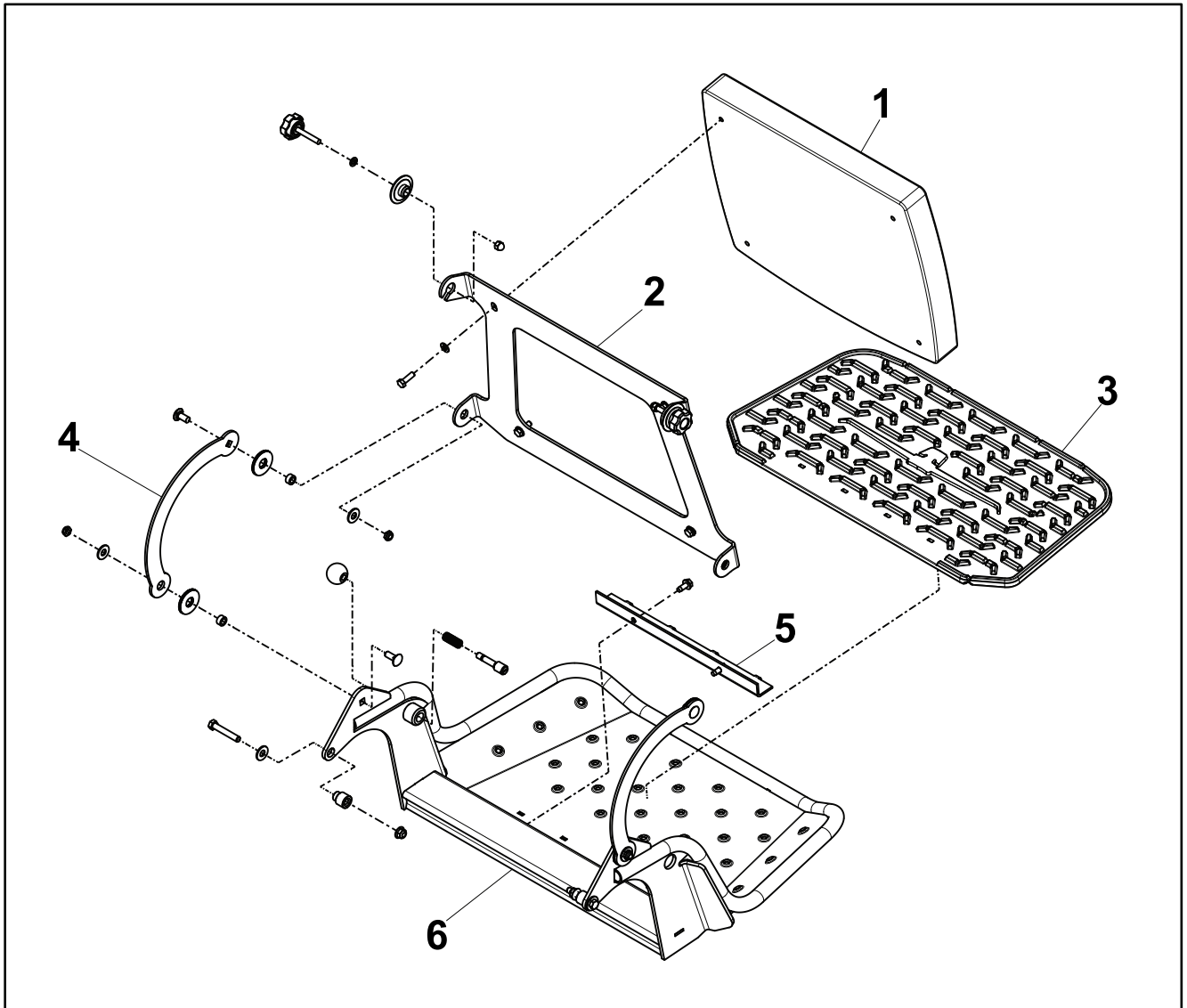
## Chassis Assembly 2



g394588

**Figure 4**

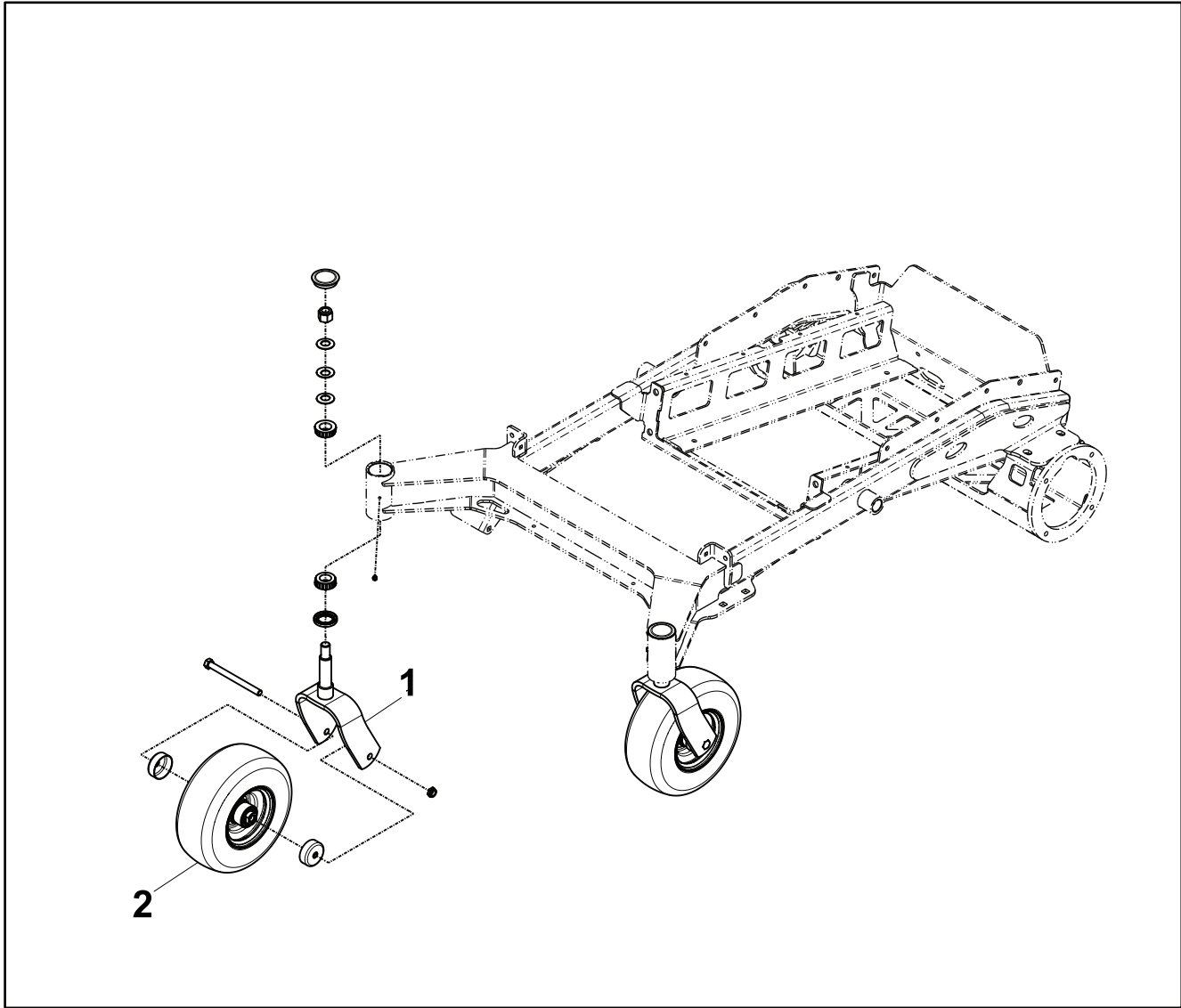
- |                              |                           |
|------------------------------|---------------------------|
| 1. Skid Plate                | 6. Tower Assembly         |
| 2. Cover Plate               | 7. Motor Controller Cover |
| 3. Battery Plate             | 8. Frame Assembly         |
| 4. Latch Plate               | 9. Axle Frame Assembly    |
| 5. Battery Retention Bracket |                           |



g394589

Figure 5

- |                         |                 |
|-------------------------|-----------------|
| 1. Cushion Pad Assembly | 4. Pad Link     |
| 2. Pad Hinge            | 5. Shield Clamp |
| 3. Platform Mat         | 6. Platform     |



g394590

Figure 6

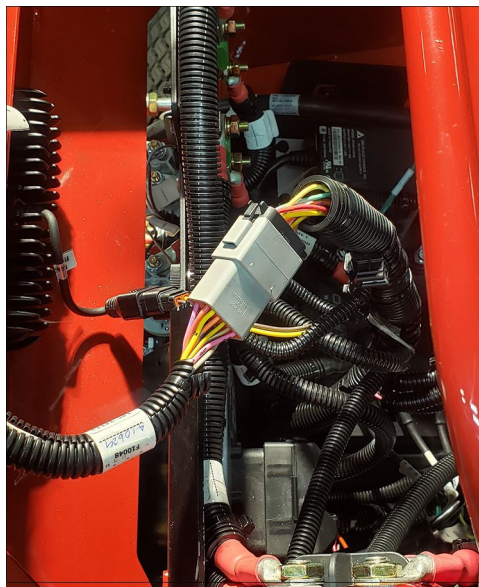
1. Caster Fork

2. Wheel and Tire Bearing Assembly

# Tower Replacement

## Tower Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Open the front motor controller cover.
4. Remove the 4 (3/8-16 x 1 inch) screws securing the hood assembly to the chassis. Remove the hood assembly.
5. Remove the 4 (3/8-16 x 1 inch) screws securing the rear cover plate to the tower. Remove the rear cover plate.
6. Remove the 4 (1/4-20 x 1/2 inch) Torx screws securing the control panel dashboard to the tower.
7. Unplug the gray connector connecting the wiring harness to the control panel dashboard. Remove the control panel dashboard from the unit.

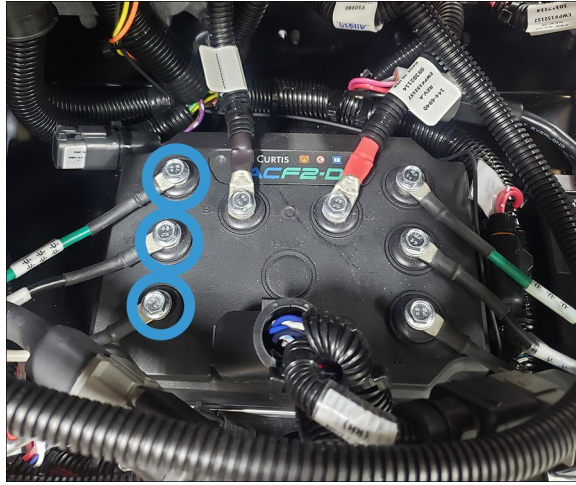


g394597

**Figure 7**

- 
8. Unplug the black connector from the wiring harness to the headlight.
  9. Remove the 3 (M6-1 x 16) screws securing the 3 LH traction motor phase wires (white, black, and green) to the LH traction motor controller. Repeat on the RH traction motor phase wires.

## Tower Removal (continued)



g382187

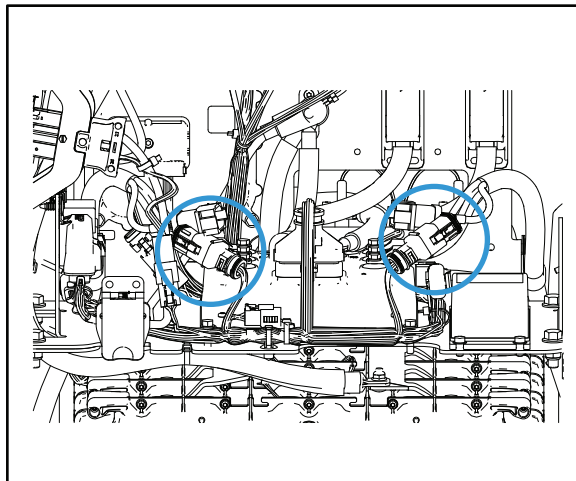
Figure 8



g382188

Figure 9

10. Unplug the 2 gray connectors securing the drive motor harnesses to the drive motor controllers.



g402412

Figure 10

## Tower Removal (continued)

11. Remove the (5/16–18 x 3/4 inch) screw, nut, and cable clamp securing the LH traction motor harness to the LH clamp mounting plate. Repeat on the RH side of the unit.



g382191

**Figure 11**

- 
12. Remove the (3/8-16 x 1 inch) screw, nut, and cable clamp securing the LH traction motor harness to the LH frame. Repeat on the RH side of the unit.

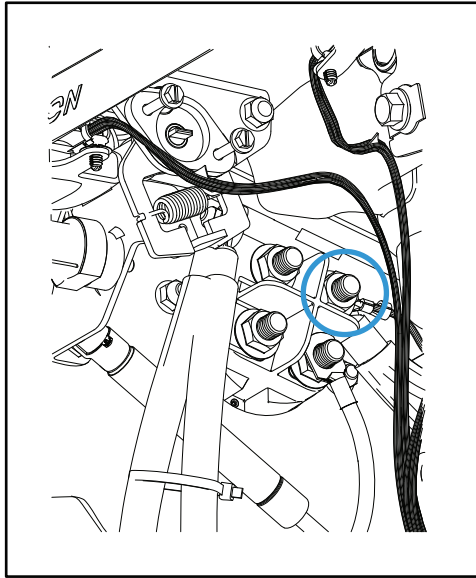


g382192

**Figure 12**

- 
13. Pull the LH motor harness from the LH traction motor controller towards the front of mower. Repeat on the RH side of the unit.
  14. Remove the (M12 x 1.75) flange nut securing the 3 wires to the upper RH terminal on the main switch. Remove the wires from the main switch.

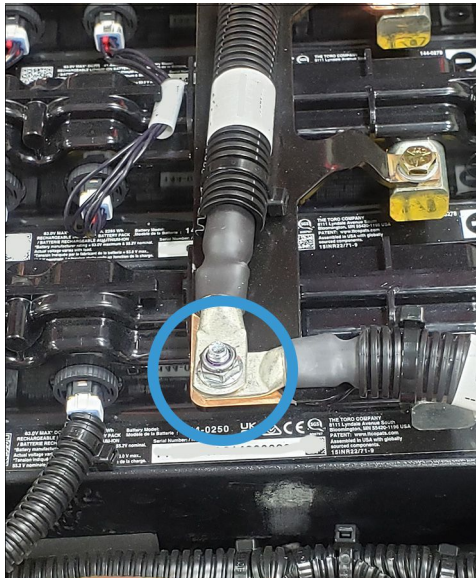
## Tower Removal (continued)



g402417

**Figure 13**

15. Remove the (M12 x 1.75) flange nut securing the wire to the lower LH terminal on the main switch. Remove the wire from the terminal.
16. Remove the (M12 x 1.75) flange nut securing the wire to the lower RH terminal on the main switch. Remove the wire from the terminal.
17. Remove the (M12 x 1.75) flange nut securing the wire to the upper LH terminal on the main switch. Remove the wire from the terminal.
18. Remove the 2 (5/16–18 x 3/4 inch) screws and 2 (5/16 inch) nylock nuts securing the charger bracket to the tower assembly.
19. Remove the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut securing the 2 wires to the negative terminal on the busbar.



g394600

**Figure 14**

20. Unplug the gray connector at the deck motor controller harness.

## Tower Removal (continued)



g394598

**Figure 15**

21. Remove the cable tie securing the cable that routes back to the electrical panel at the third battery handle.
22. From the front of the tower assembly, remove the nut securing the positive battery cable going from the contactor to the RH motor controller. Remove the cable from the threaded stud..
23. Unplug the wiring harness from the plunger switches and handle position sensors on the RH and LH control handles.

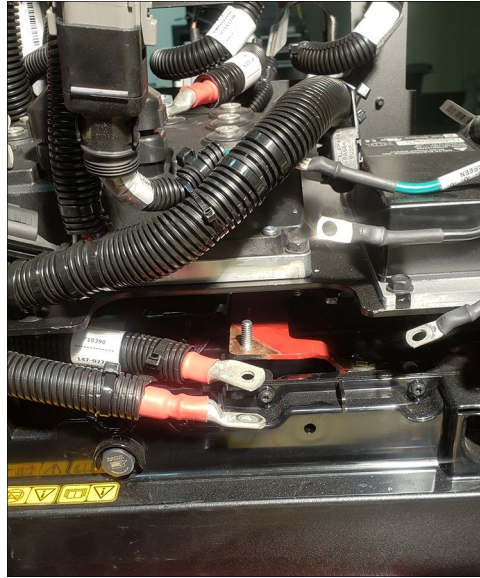


g395880

**Figure 16**

24. Remove the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut securing the 2 red wires to the positive bus bar.

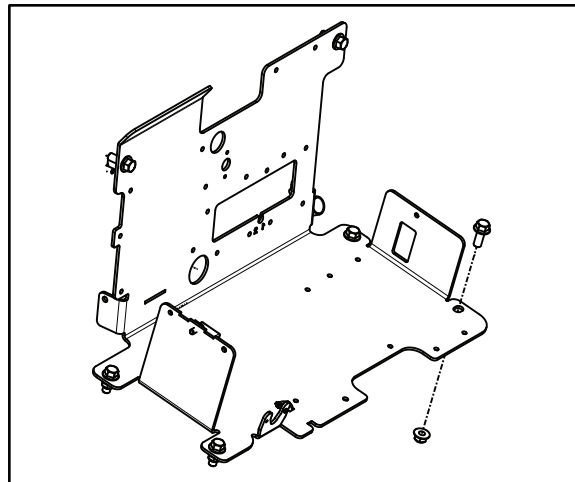
## Tower Removal (continued)



g395881

**Figure 17**

- 
25. Remove the 6 (3/8-16 x 1.0 inch) screws and 4 (3/8 inch) nuts securing the electrical mounting plate to the tower assembly.



g397499

**Figure 18**

- 
26. Remove the LH control handle damper from the lower ball mount by prying on the retaining clip with a screw driver and pulling the damper from the ball mount. Repeat on the RH damper.

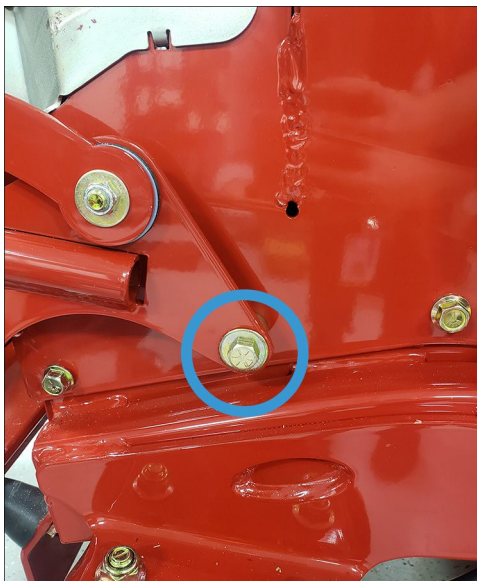
## Tower Removal (continued)



g394596

**Figure 19**

- 
27. Remove any cable ties securing the harness to the chassis.
  28. Slide the electrical mounting plate rearward and remove the electrical mounting plate from the tower assembly.
  29. Remove the 4 (7/16 inch) nuts securing the LH wheel to wheel motor. Remove the wheel from wheel motor. Repeat on the RH side of the unit.
  30. Loosen the 2 operator pad knobs and lower the operator pad so it rests on the operator platform.
  31. Remove the LH (3/8–16 x 2–1/4 inch) screw, washer, flanged bushing, and (3/8 inch) nylock nut securing the operators platform to the frame. Repeat on the RH side of the unit. Remove the operators platform.

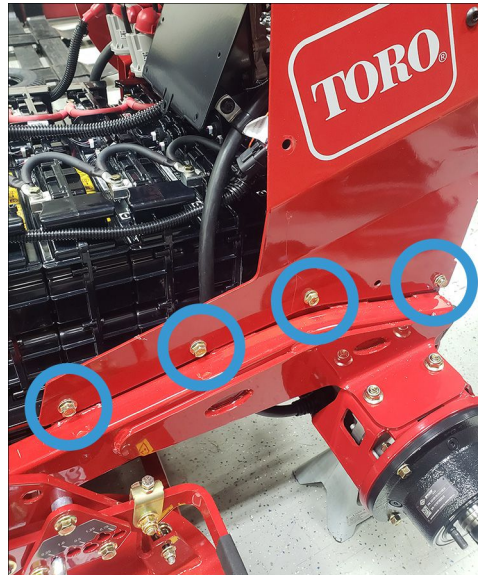


g382194

**Figure 20**

- 
32. Remove the 4 (3/8–16 UNC x 1.00 inch) screws and 4 nylock nuts securing the LH tower to the frame. Repeat on the RH side of the unit.

## Tower Removal (continued)



g397186

**Figure 21**

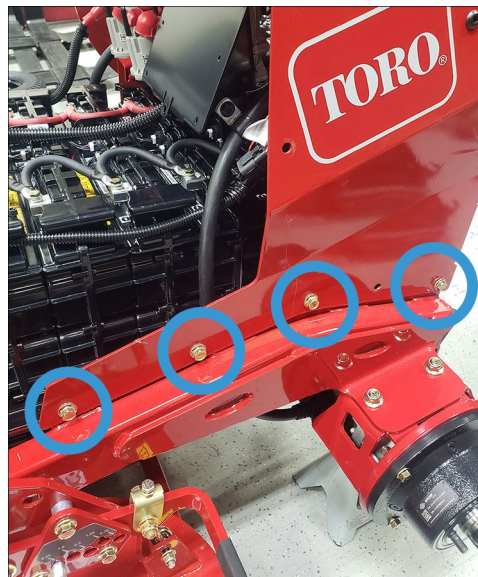
1. Remove
2. Loosen

---

33. Using a proper lifting device, remove the tower from the frame.

## Tower Installation

1. Using a proper lifting device, set the tower on the frame.
2. Install the 4 (3/8–16 UNC x 1.00 inch) screws and 4 nylock nuts securing the LH tower to the frame. Repeat on the RH side of the unit.



g397186

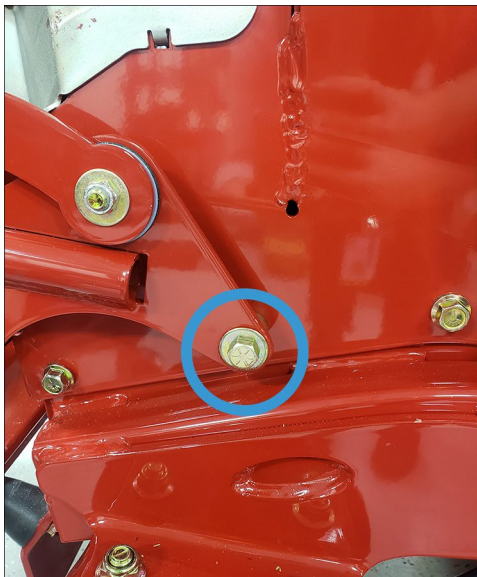
**Figure 22**

1. Install
2. Tighten

---

3. Install the operators platform to the unit, secure with the (3/8–16 x 2–1/4 inch) screw, washer, flanged bushing, and (3/8 inch) nut on the LH side of the unit. Repeat on the RH side of the unit.

## Tower Installation (continued)



g382194

**Figure 23**

4. Raise the cushion pad assembly to the frame and secure with the 2 knobs on the pad hinge.

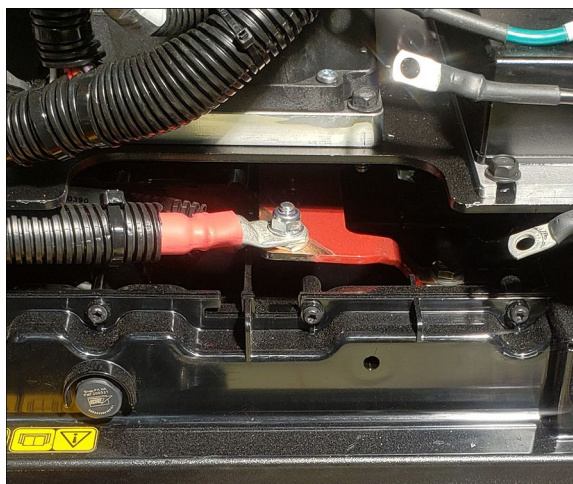


5. Install the LH wheel to the LH wheel motor, secure with the 4 (7/16 inch) nuts. Torque the nuts to  $81.3 \pm 6.78 \text{ N} \cdot \text{m}$  ( $60 \pm 5 \text{ ft-lb}$ ). Repeat on the RH side of the unit.

6. Tighten the 3 (5/16-18 x 3/4 inch) screws securing the LH battery retention bracket to the frame. Repeat on the RH battery retention bracket.



7. Install the 2 red wires to the positive bus bar, secure with the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut. Torque the nut to  $10.7 \pm 1.1 \text{ N} \cdot \text{m}$  ( $95 \pm 10 \text{ in-lb}$ ).

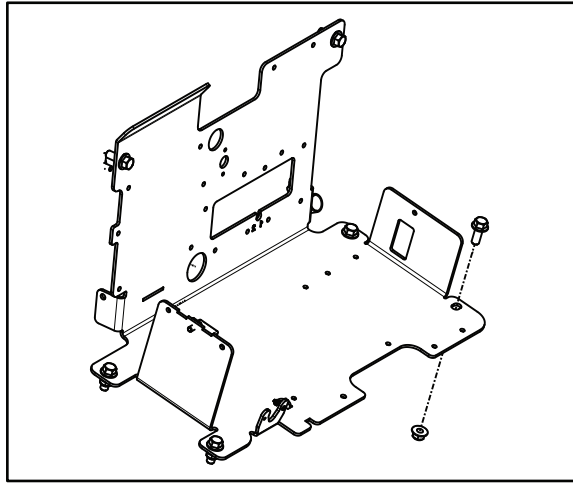


g394603

**Figure 24**

8. From the back side of the unit, slide the electrical mounting plate into the tower. Secure the electrical mounting plate with the 6 (3/8-16 x 1.00 inch) screws and 4 (3/8 inch) nuts.

## Tower Installation (continued)



g397499

Figure 25

9. Route the 2 wires from the positive battery busbar through the frame and towards the master switch busbar.
10. Install one of the positive battery busbar wires to the upper LH terminal on the master switch, and the other to the lower LH terminal.



11. Secure the positive battery busbar wires to the master switch with a (M12 x 1.75) flange nut. Torque the nuts to 18.98 N • m (14 ft-lb).

12. Install LH control damper to the lower ball mount on the tower assembly. Repeat on the RH side of the unit.

13. Install the 2 (5/16–18 x 3/4 inch) screws and 2 (5/16 inch) nylock nuts securing the charger bracket to the tower assembly.



14. Install the wire from the charge port to the lower RH terminal of the master switch, secure with the (M12 x 1.75) flange nut. Torque the nut to 18.98 N • m (14 ft-lb).



15. Install the 3 wires (2 from the mega fuses and one from the wiring harness) to the upper RH terminal on the master switch, secure with the (M12 x 1.75) flange nut. Torque the nut to 18.98 N • m (14 ft-lb).

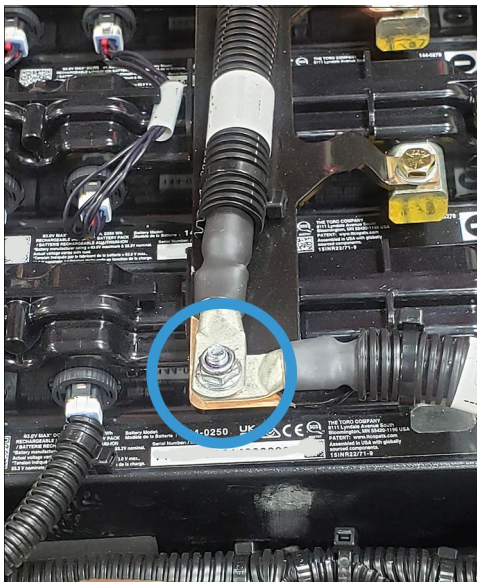


16. Connect the red wire from the deck motor controller on the RH side of the chassis to the RH contactor on the electrical mounting plate. Secure the wire with a washer and (5/16 inch) nut. Torque the nut to 5.08 N • m (45 in-lb).



17. Install the 2 black wires to the negative busbar terminal, secure with the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut. Torque the nut to 10.7 ± 1.1 N • m (95 ± 10 in-lb).

## Tower Installation (continued)



g394600

**Figure 26**

18. Install the cable tie securing the cable that routes back to the electrical panel at the third battery handle.
19. From the front of the unit, connect the gray connector at the deck motor controller harness.

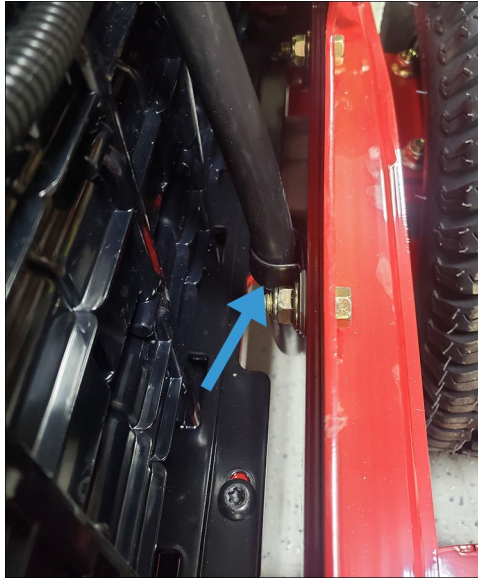


g394598

**Figure 27**

20. Route the cable through the battery handles and install the cable to the third battery handle.
21. Plug-in the LH plunger switch and position the sensor to the wiring harness. Repeat on the RH side of the unit.
22. Route the LH traction motor harness to the traction motor controller.
23. Secure the LH traction motor harness to the frame with the (3/8-16 x 1 inch) screw, nut, and cable clamp. Repeat on the RH side of the unit.

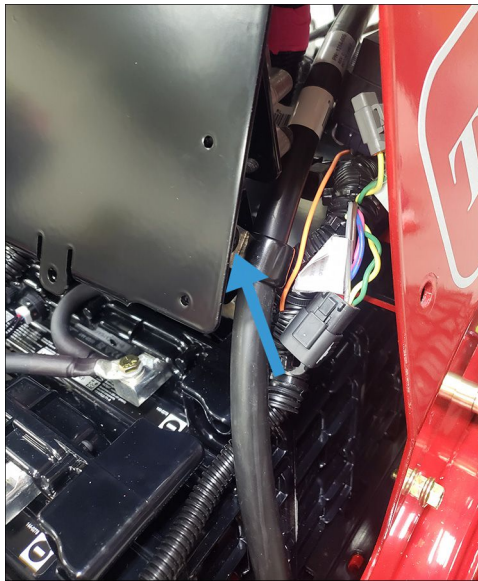
## Tower Installation (continued)



g382192

**Figure 28**

- 
24. Secure the LH traction motor harness to the clamp mounting plate with the (5/16–18 inch) screw, nut, and cable clamp. Repeat on the RH side of the unit.

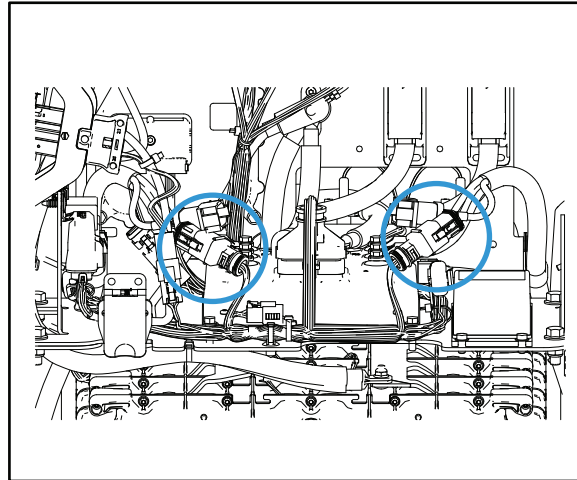


g382191

**Figure 29**

- 
25. Plug-in the 2 gray connectors securing the drive motor harnesses to the drive motor controllers.

## Tower Installation (continued)



g402412

Figure 30



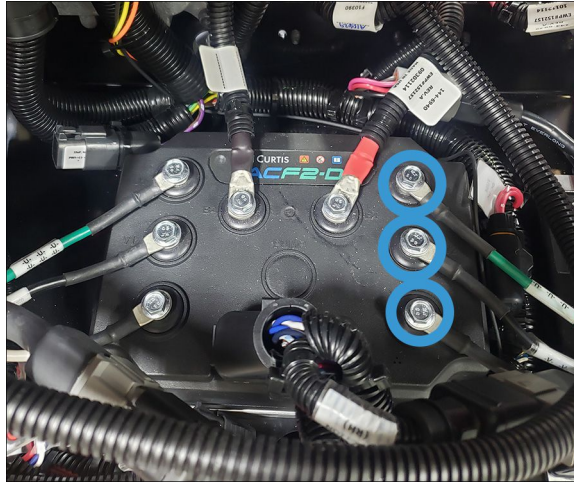
26. Install the 3 traction motor phase wires to the LH side of the traction motor controller, secure with the 3 (M6-1 x 16) screws. Tighten the screws until finger tight and then torque to  $10.2 \pm 1.1 \text{ N} \cdot \text{m}$  ( $90 \pm 10 \text{ in-lb}$ ). Repeat on the RH side of the unit.



g382187

Figure 31

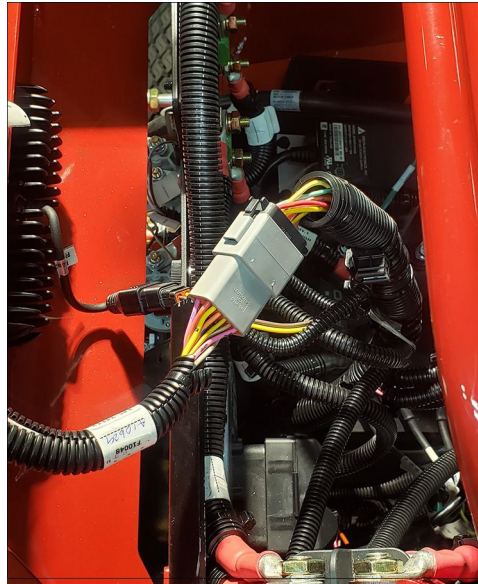
## Tower Installation (continued)



g382188

**Figure 32**

- 
27. Connect the black wiring harness connector to the headlight.
  28. Connect the gray wiring harness connector to the control panel dashboard.



g394597

**Figure 33**

- 
29. Install the control panel dashboard to the tower, secure with the 4 (1/4–20 x 1/2 inch) Torx screws.
  30. Install the rear cover plate to the tower, secure with the 4 (3/8-16 x 1 inch) screws.
  31. Install the hood assembly to the chassis, secure with the 4 (3/8-16 x 1 inch) screws.
  32. Close the front motor controller cover.
  33. Remove the lock out from the master power switch and turn the switch on.

# Caster Wheel Replacement

## Caster Wheel Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Raise and support the unit so that the front wheels are off the ground, block the rear wheels.
4. Remove the grease cap from the top of the caster wheel pivot tube.
5. Remove the nut from the caster fork shaft.



g359178

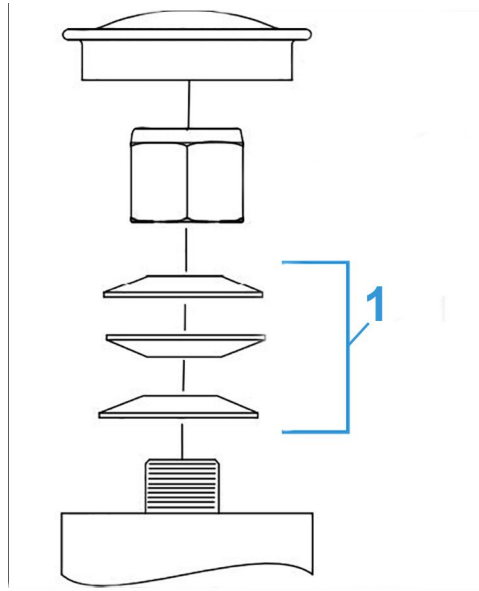
**Figure 34**

- 
6. Remove the caster fork and wheel assembly.
  7. Remove the 3 Belleville washers from the caster wheel pivot tube.
  8. Remove the upper tapered roller bearing from the caster wheel pivot tube.
  9. Remove the grease seal from the bottom of the caster wheel pivot tube. Remove the lower tapered roller bearing.
  10. Using a blunt punch, remove the upper and lower bearing cups from the caster wheel pivot tube.

## Caster Wheel Installation

1. Install the upper and lower tapered roller bearings into the pivot tube.  
**Note:** A socket can be used as a driver. Do not scar the race surface.
2. Pack the pivot tube tapered roller bearings with high temperature grease.
3. Install the lower tapered roller bearing into the pivot tube.
4. Install the grease seal into the base of the pivot tube.
5. Install the upper tapered roller bearing into the pivot tube.
6. Install the 3 Belleville washers into the pivot tube.
  - Bottom washer: crown up
  - Middle washer: crown down
  - Top washer: crown up

## Caster Wheel Installation (continued)



g359179

**Figure 35**

1. Washer Stackup

---

7. Position the caster wheel and fork assembly up through the pivot hub.

8. Secure the caster wheel and fork assembly with a nut.



9. Torque the locknut to 20.3 N • m (15 ft-lb) and then back off a ¼ turn to properly set the preload on the bearings.



g359178

**Figure 36**

---

10. Remove the grease plug from the caster tube.

11. Install a grease zerk into the hole.

12. Fill the caster tube with high temperature grease until the grease is coming through the top bearing.

13. Remove the grease zerk from the hole and install a grease plug.

## Caster Wheel Installation (continued)

14. Install the grease cap onto the top of the pivot hub.
15. Remove the lock out from the master power switch and turn the switch on.

## Caster Wheel Service

### Caster Wheel Disassembly

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Remove the (1/2 inch) nut securing the caster wheel axle (1/2–13 x 6 inch) screw. Remove the axle screw.
4. Remove the caster wheel assembly from the caster fork.
5. Remove the 2 seal guards from both sides of the wheel hub.
6. Remove the spacer nut from the caster axle.

**Note:** The spacer nut is threaded onto the caster axle.

7. Remove the 2 caster seals from both sides of the caster wheel.
8. Remove the 2 cone tapered bearings from both sides of the caster wheel.

### Caster Wheel Assembly

1. Pack the 2 cone tapered bearings with high temperature grease.
2. Install the 2 cone tapered bearings into both sides of the wheel hub.
3. Install the 2 caster seals into both sides of the wheel hub.
4. Fill the center of the wheel hub with a high temperature grease.
5. Position the caster axle through the bearing and seal assembly.
6. Install a spacer nut onto the end of the caster axle.

**Note:** Verify there are approximately 3 internal spacer nut threads visible on both sides, which indicates the axle is centered.

7. Position the 2 seal guards onto both sides of the caster wheel hub.



8. Secure the caster wheel assembly to the caster fork using the (1/2–13 x 6 inch) axle screw and (1/2 inch) nut. Torque the nut to  $44.7 \pm 4.06 \text{ N} \cdot \text{m}$  ( $33 \pm 3 \text{ ft-lb}$ ).
9. Remove the lock out from the master power switch and turn the switch on.





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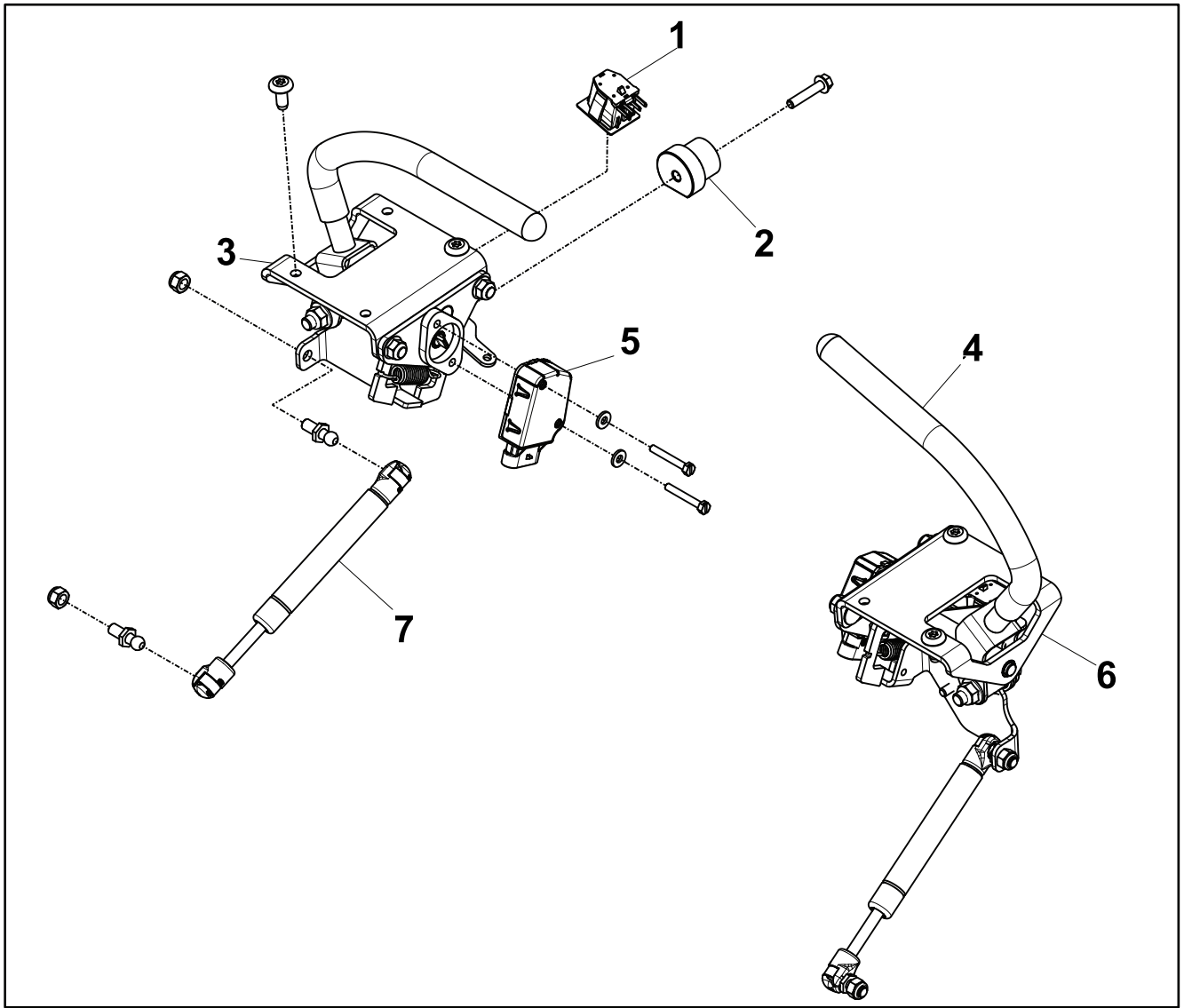
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# General Information

The operator controls the Grandstand by using 2 control handles mounted on the top of the tower assembly. The control input is sent to the motor controllers through the 2 proximity switches. The operator presence input is communicated through a plunger switch on each handle.

# Service and Repairs

## Controls Assembly



g394585

**Figure 37**

- |                               |                               |
|-------------------------------|-------------------------------|
| 1. Plunger Switch             | 5. Grip                       |
| 2. Cam                        | 6. LH Control Handle Assembly |
| 3. RH Control Handle Assembly | 7. Damper                     |
| 4. Position Sensor            |                               |

# Control Handle Replacement

## Control Handle Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Unplug the position sensor and the plunger switch.
4. Remove the 3 (5/16-18 x 3/4 inch) screws securing the control handle assembly to the unit.



g382207

Figure 38

5. Remove the nut and ball stud securing the damper to the control handle assembly. Disconnect the damper.
6. Remove the control handle assembly.

## Control Handle Installation



1. Install the control handle assembly to the unit, secure with the nut and ball stud.
2. Install the 3 (5/16-18 x 3/4 inch) screws securing the control handle assembly to the unit. Torque the screws to  $18.1 \pm 2.26 \text{ N} \cdot \text{m}$  ( $160 \pm 20 \text{ in-lb}$ ).



g382207

Figure 39

## **Control Handle Installation (continued)**

3. Plug-in the position sensor and the plunger switch.
4. Remove the lock out from the master power switch and turn the switch on.





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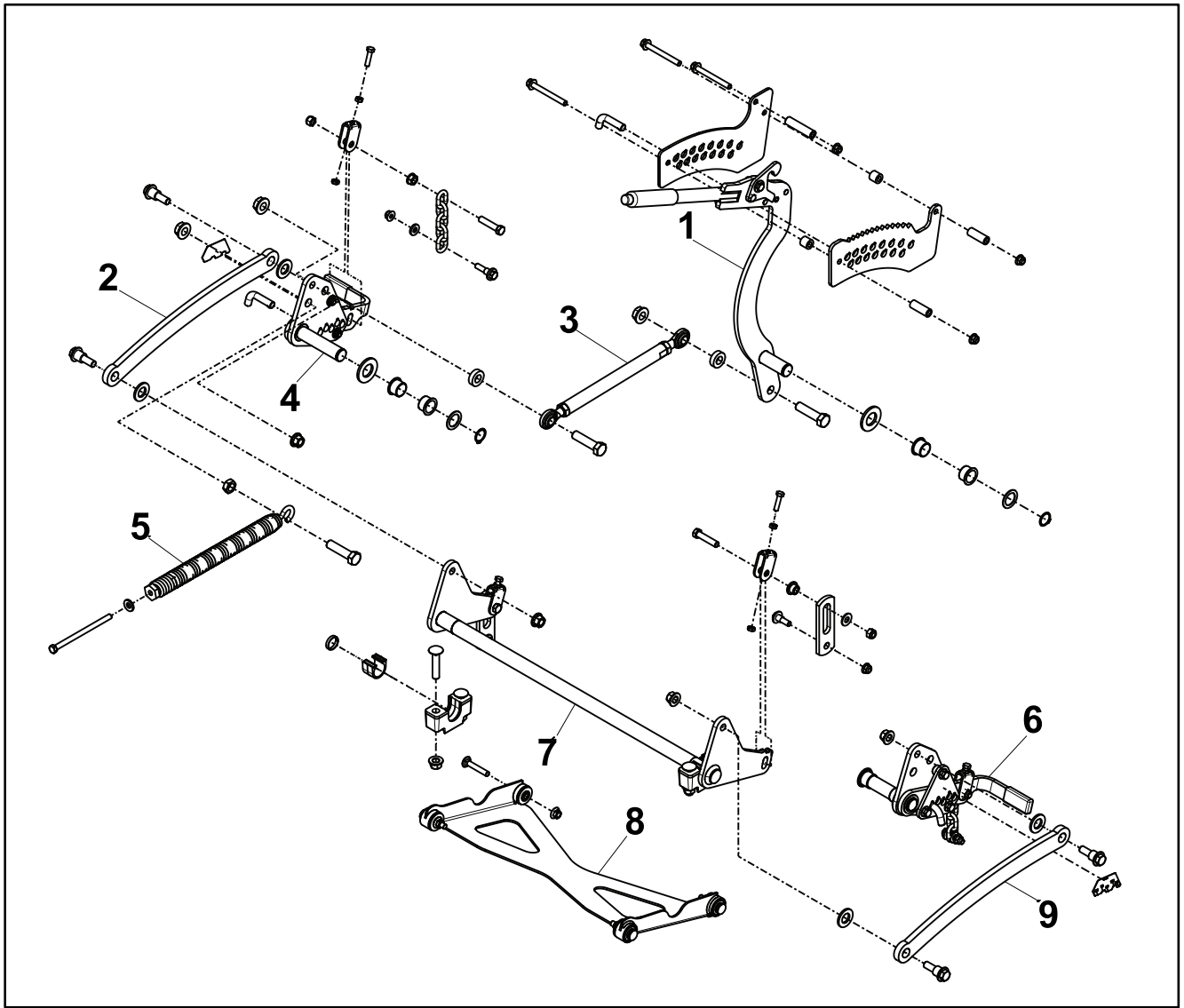
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Deck Replacement.....	7-7
Left Height-of-Cut Replacement.....	7-9
Right Height-of-Cut Replacement .....	7-11
Deck Motor Replacement.....	7-15

# General Information

The Grandstand has a TURBO FORCE® deck equipped with the 3 (48V 3 kW) deck motors. The mowing deck is equipped with the toolless deck rake adjustments.

# Service and Repairs

## Height-of-Cut Assembly

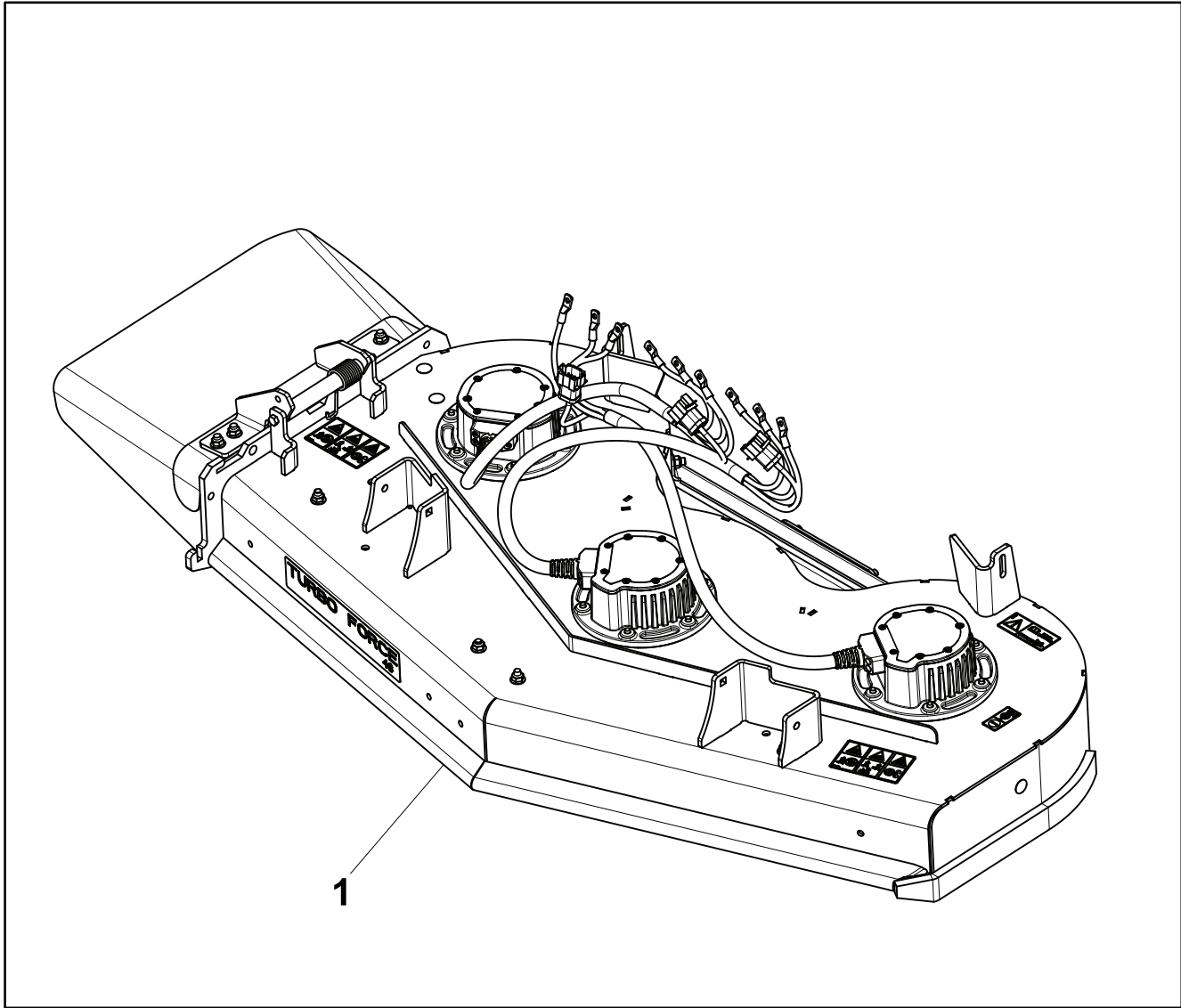


g394587

**Figure 40**

- |                                |                                    |
|--------------------------------|------------------------------------|
| 1. Height-of-Cut Lever         | 6. RH Height-of-Cut Pivot Assembly |
| 2. Lift Link                   | 7. Front Cross Shaft               |
| 3. Height-of-Cut Link Assembly | 8. Deck Strut Assembly             |
| 4. Front Cross Shaft Assembly  | 9. Lift Link                       |
| 5. Extension Spring            |                                    |

## 123 cm (42 inch) Deck Assembly

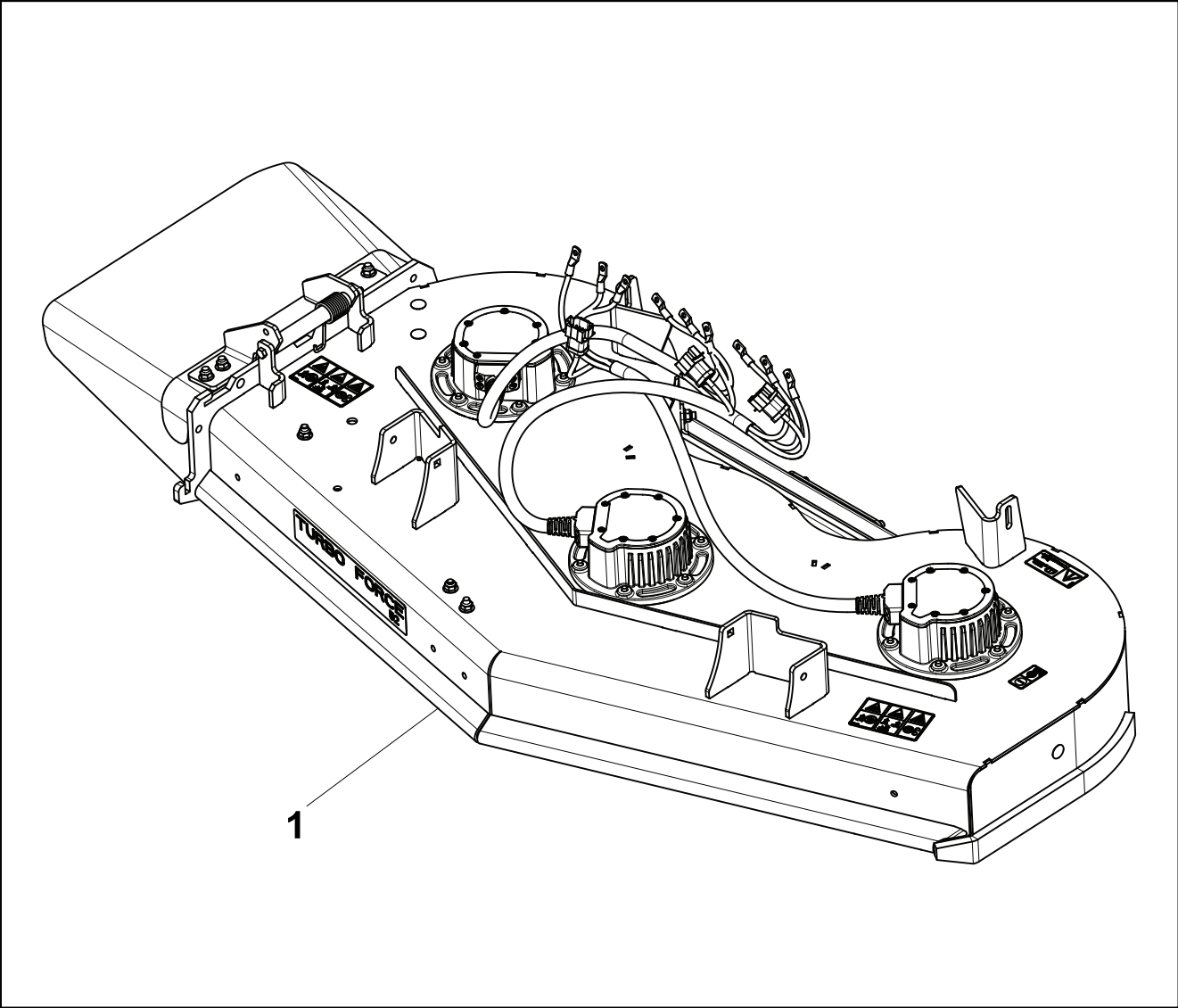


g394581

**Figure 41**

1. 123 cm (48 Inch) Deck

132 cm (52 Inch) Deck Assembly

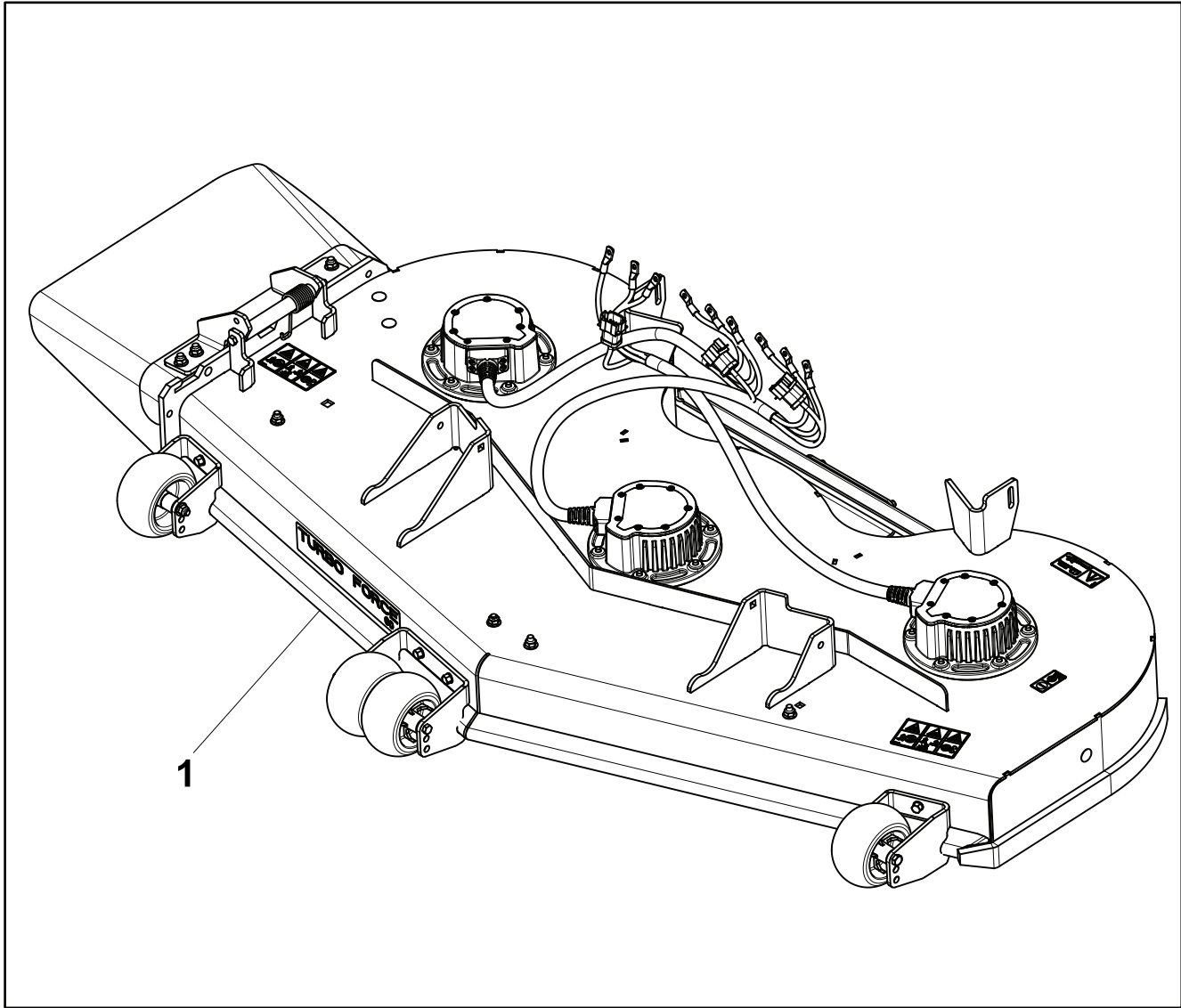


g394582

Figure 42

- 1. 132 cm (52 Inch) Deck

## 152.4 cm (60 Inch) Deck Assembly



g394583

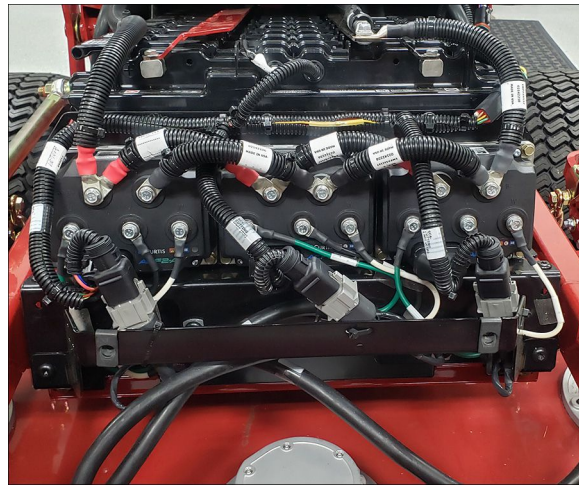
**Figure 43**

1. 152.4 cm (60 Inch) Deck Assembly

# Deck Replacement

## Deck Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Lock the deck in the transport height position.
4. Place the wood blocks under the deck.
5. Use the deck height-of-cut lever to set the deck down on the wood blocks.
6. Open the front motor controller cover.
7. Remove the 4 (3/8-16 x 1 inch) screws securing hood assembly to the chassis. Remove the hood assembly.
8. Unplug the 3 connectors from the wire harnesses and the deck motor cables.

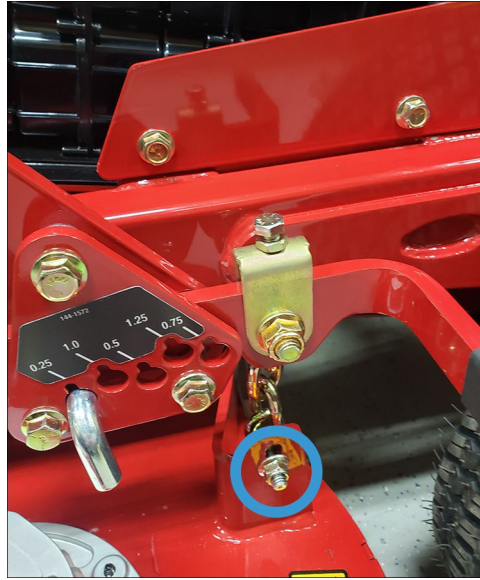


g397175

**Figure 44**

- 
9. Remove the 9 (M6-1 x 16) screws securing deck motor phase wires to deck motor controllers.
  10. Remove the 4 (1/4 inch) screws and 4 cable clamps from the deck motor wires to the motor control mount plate.
  11. Remove the (3/8-16 x 2.250 inch) carriage screw and flanged nylock nut securing the LH deck strut to the LH deck. Repeat on the RH side of the unit.
  12. Remove the (7/16-14 x 2 inch) screw, flanged bushing, washer, and nylock nut securing the front LH lift links to the LH deck. Repeat on the RH side of the unit.
  13. Remove the (3/8 inch) screw, spacer, and nut securing the LH rear deck lift chain to the LH deck lift pivot assembly. Repeat on the RH side of the unit.

## Deck Removal (continued)



g382203

Figure 45

14. Slide and remove the deck from the RH side of the unit.

## Deck Installation

1. Support the deck on wood blocks.
2. From the RH side of the unit, slide the deck under the unit.
3. Install the LH rear deck lift chain to the LH deck lift pivot assembly, secure with the (3/8 inch) screw, spacer, and nut. Repeat on the RH side of the unit.



g382203

Figure 46



4. Install the LH front lift link to the LH deck, secure with (7/16-14 x 2 inch) screw, flanged bushing, washer, and nylock nut. Repeat on the RH side of the unit. Torque the nut to  $67.79 \pm 6.779 \text{ N} \cdot \text{m}$  ( $50 \pm 5 \text{ ft-lb}$ ).

## Deck Installation (continued)



5. Install the LH deck strut to the LH deck, secure with the (3/8-16 x 2.25 inch) carriage screw and flanged nylock nut. Repeat on the RH side of the unit. Torque the nut to  $43.386 \pm 5.4 \text{ N} \cdot \text{m}$  ( $32 \pm 4 \text{ ft-lb}$ ).

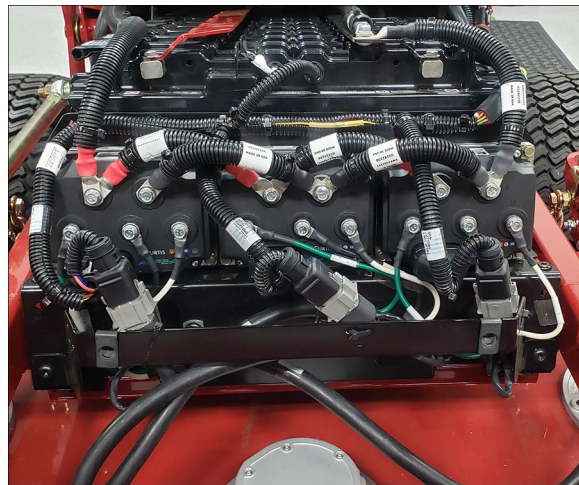
6. Using the deck lift handle, lift the deck to the transport height and remove the wood blocks.

7. Install the deck motor wires to the motor control mount plate, secure with the 4 (1/4 inch) screws and 4 cable clamps.



8. Install the deck motor phase wires to the deck motor controllers, secure with the 9 (M6-1 x 16) screws. Tighten the screws finger tight and then torque to  $10.2 \pm 1.1 \text{ N} \cdot \text{m}$  ( $90 \pm 10 \text{ in-lb}$ ).

9. Plug-in the 3 connectors to the wire harnesses and the deck motor cables.



g397175

Figure 47

10. Install the hood assembly to the chassis, secure with the 4 (3/8-16 x 1 inch) screws.

11. Close the front motor controller cover.

12. Remove the lock out from the master power switch and turn the switch on.

## Left Height-of-Cut Replacement

### Left Height-of-Cut Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Lock the deck in the transport height position.
4. Place the wood blocks under the deck.
5. Use the deck height-of-cut lever to set the deck on the wood blocks.
6. Set the LH height-of-cut pivot assembly to 1.9 cm (0.75 inch).
7. Remove the (3/8-16 x 1 inch) shoulder screw, spacer, and (3/8-16 inch) nut securing the LH deck lift chain to the LH height-of-cut pivot assembly.

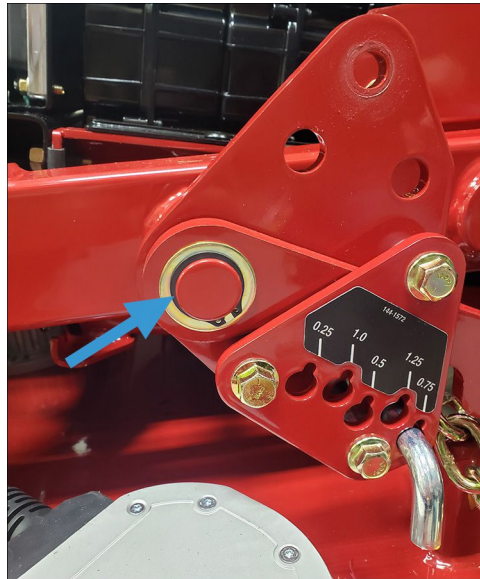
## Left Height-of-Cut Removal (continued)



g382203

**Figure 48**

8. Remove the (3/8 inch) nylock nut, washer, and (3/8-16 x 0.80 inch) shoulder screw securing the LH lift link to the LH height-of-cut pivot assembly.
9. Using a 90° circlip tool, remove the inside retaining ring and washer.



g382204

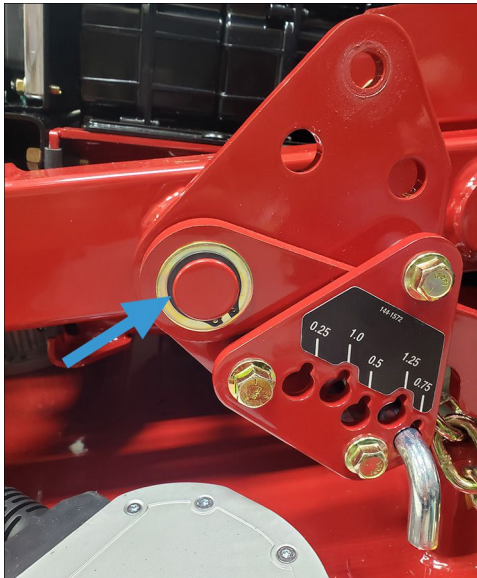
**Figure 49**

10. Remove the LH height-of-cut pivot assembly from the deck.

## Left Height-of-Cut Installation

1. Place the LH height-of-cut pivot assembly to the deck and use a 90° circlip tool to install the inside retaining ring and washer.

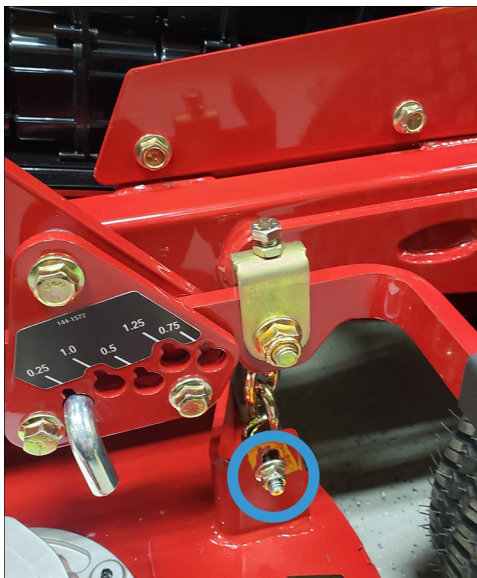
## Left Height-of-Cut Installation (continued)



g382204

**Figure 50**

2. Install the LH lift link to the LH height-of-cut pivot assembly, secure with the (3/8 inch) nylock nut, washer, and (3/8-16 x 0.80 inch) shoulder screw.
3. Install the LH deck lift chain to the LH height-of-cut pivot assembly, secure with the (3/8-16 x 1 inch) shoulder screw, spacer, and (3/8 inch) nylock nut.



g382203

**Figure 51**

4. Remove the wood blocks from under the deck.
5. Remove the lock out from the master power switch and turn the switch on.

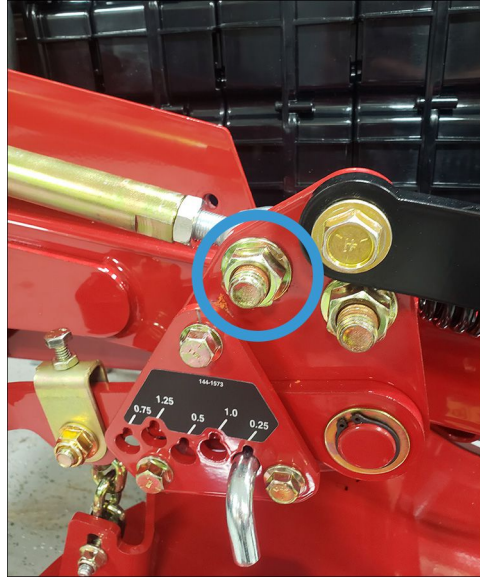
## Right Height-of-Cut Replacement

### Right Height-of-Cut Removal

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

## Right Height-of-Cut Removal (continued)

2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Lock the deck in the transport height position.
4. Place the wood blocks under the deck.
5. Use the deck height-of-cut lever to set the deck on the wood blocks.
6. Set the height-of-cut pivot assembly to 1.9 cm (0.75 inch).
7. Remove the (3/8–16 x 6 inch) tap bolt and Belleville washer securing the RH extension spring.
8. Remove the (1/2–13 x 1.12 inch) lock screw, washer, and (1/2 inch) flanged nut securing the height-of-cut link assembly to the height-of-cut pivot assembly.



g382196

**Figure 52**

- 
9. Remove the (3/8–16 x 1 inch) shoulder screw, spacer, and (3/8 inch) nylock nut securing the RH deck lift chain to the RH height-of-cut pivot assembly.

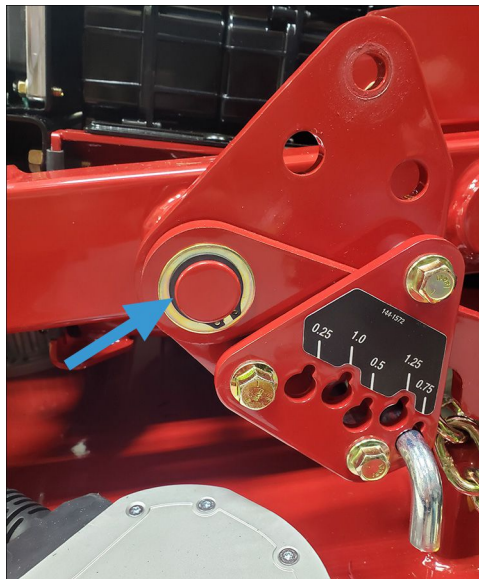
## Right Height-of-Cut Removal (continued)



g382203

**Figure 53**

10. Remove the (3/8 inch) nylock nut, washer, and (3/8-16 x 0.80 inch) shoulder screw securing the RH lift link to the RH height-of-cut pivot assembly.
11. Using a 90° circlip tool, remove the inside retaining ring and washer.



g382204

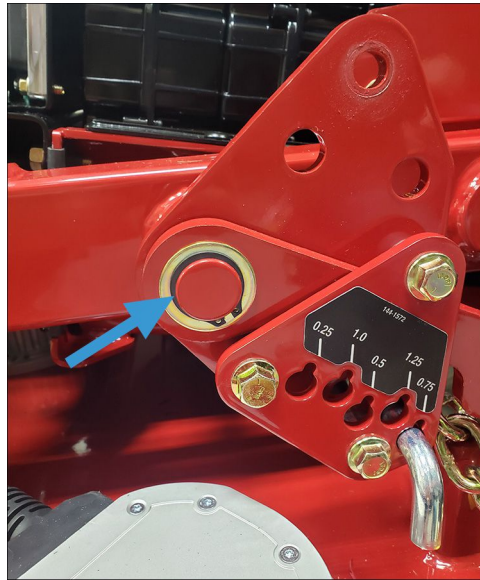
**Figure 54**

12. Remove the RH height-of-cut pivot assembly from the unit.

## Right Height-of-Cut Installation

1. Place the RH height-of-cut pivot assembly to the deck and use a 90° circlip tool to install the inside retaining ring and washer.

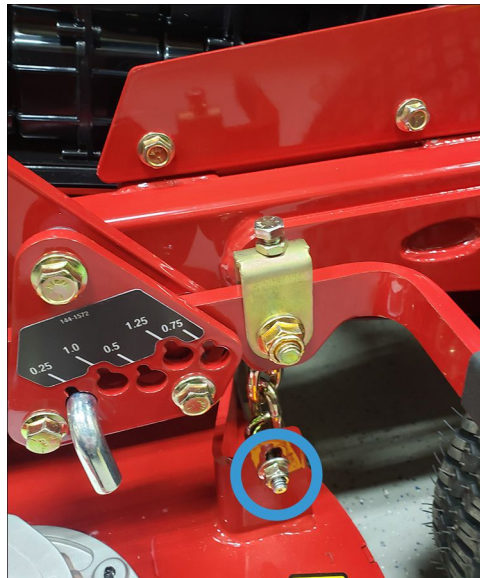
## Right Height-of-Cut Installation (continued)



g382204

**Figure 55**

2. Install the RH lift link to the RH height-of-cut pivot assembly, secure with the (3/8 inch) nylock nut, washer, and (3/8-16 x 0.80 inch) shoulder screw.
3. Install the RH deck lift chain to the RH height-of-cut pivot assembly, secure with the (3/8-16 inch) shoulder screw, spacer, and (3/8 inch) nylock nut.



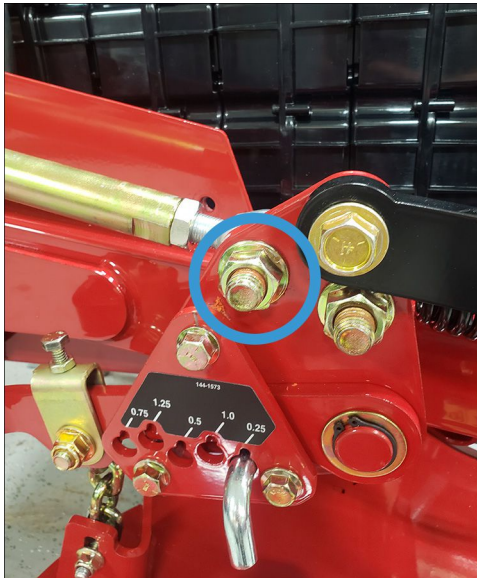
g382203

**Figure 56**



4. Install the RH height-of-cut link assembly to the RH height-of-cut pivot assembly, secure with the (1/2-13 x 1.12 inch) lock screw, washer, and (1/2 inch) locknut. Torque the nut to  $90.84 \pm 13.56 \text{ N} \cdot \text{m}$  ( $67 \pm 10 \text{ ft} \cdot \text{lb}$ ).

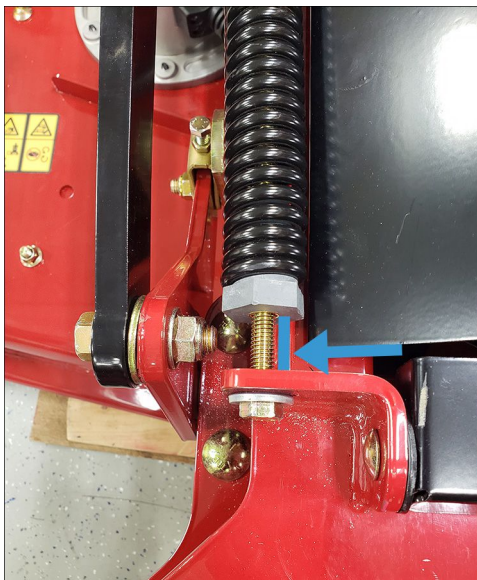
## Right Height-of-Cut Installation (continued)



g382196

**Figure 57**

5. Install the RH extension spring, secure with the (3/8-16 x 6 inch) tap bolt and Belleville washer. Verify a gap of (1.625 inch) exists.



g382206

**Figure 58**

6. Remove the wood blocks from under the deck.
7. Remove the lock out from the master power switch and turn the switch on.

## Deck Motor Replacement

### Deck Motor Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.

## Deck Motor Removal (continued)

3. Remove the (7/16 x 1.5 inch) blade mounting screw, spring washer, blade retainer, and blade from the deck motor.
4. Remove the 6 (5/16-18 x 1.00 inch) motor mount screws.
5. Remove the deck motor from the deck.

## Deck Motor Installation



1. Install the deck motor to the deck, secure with the 6 (5/16-18 x 1.00 inch) motor mount screws. Torque the screws to  $33.9 \pm 4.1 \text{ N} \cdot \text{m}$  ( $25 \pm 3 \text{ ft-lb}$ ).



2. Install the blade (blade sail towards the deck), blade retainer, spring washer (concave surface towards the blade), and (7/16 x 1.5 inch) blade mounting screw to the deck motor shaft. Torque the screw to  $74.57 \pm 6.78 \text{ N} \cdot \text{m}$  ( $55 \pm 5 \text{ ft-lb}$ ).
3. Remove the lock out from the master power switch and turn the switch on.



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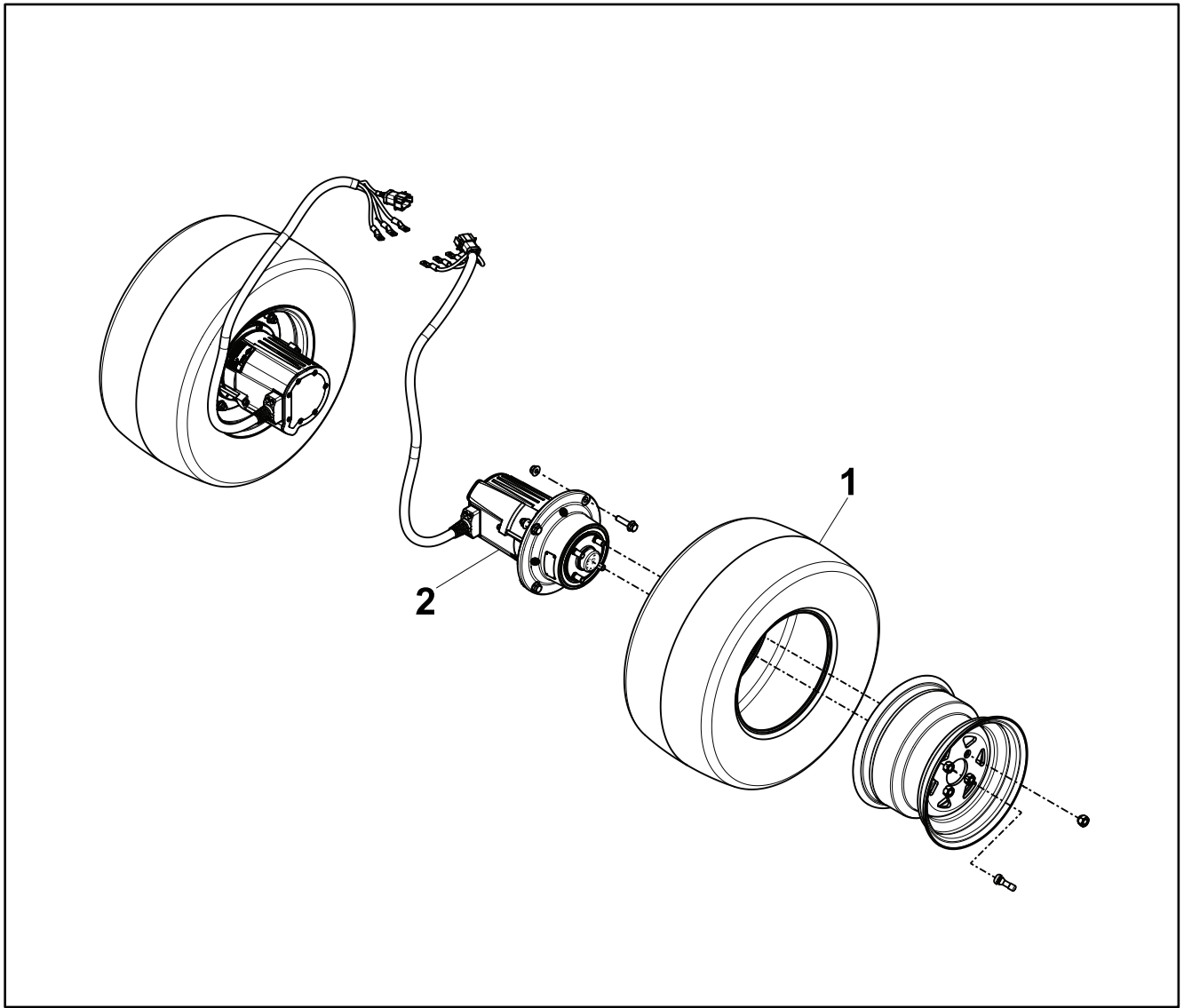
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Wheel Motor Replacement.....	8-4

# General Information

The Granstand is equipped with 2 (48 VDC 3 kW) wheel motors with planetary gear set.

# Service and Repairs

## Drive Assembly



g394584

**Figure 59**

1. Wheel and Tire Assembly

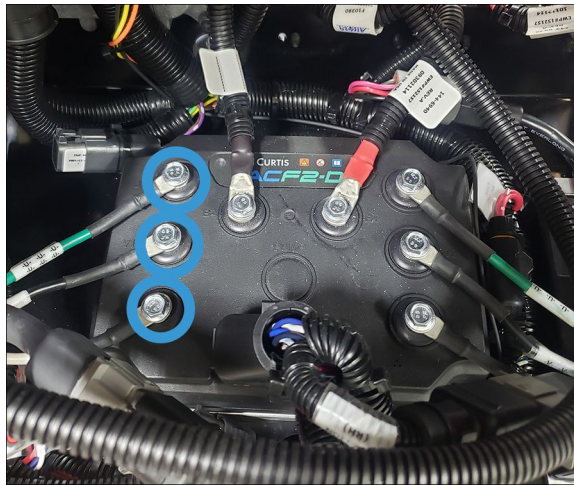
2. Motor Assembly

# Wheel Motor Replacement

This procedure replaces the both LH and RH wheel motors. If replacing 1 of the wheel motors, replace only 1 wheel motor at a time using the same procedure.

## Wheel Motor Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Using a proper lifting device, raise the back side of the unit until the rear wheels are off the ground.
4. Place jack stands under the back side of the unit.
5. Open the front motor controller cover.
6. Remove the 4 (3/8-16 x 1 inch) screws securing the hood assembly to the chassis. Remove the hood assembly.
7. Loosen the 2 operator pad knobs and lower the operator pad so it rests on the operator platform.
8. Remove the 4 (3/8-16 x 1 inch) screws securing the rear cover plate to the tower. Remove the rear cover plate.
9. Remove the 3 (M6-1 x 16) screws securing the 3 LH traction motor phase wires (white, black, and green) to the LH traction motor controller. Repeat on the RH traction motor phase wires.



g382187

Figure 60

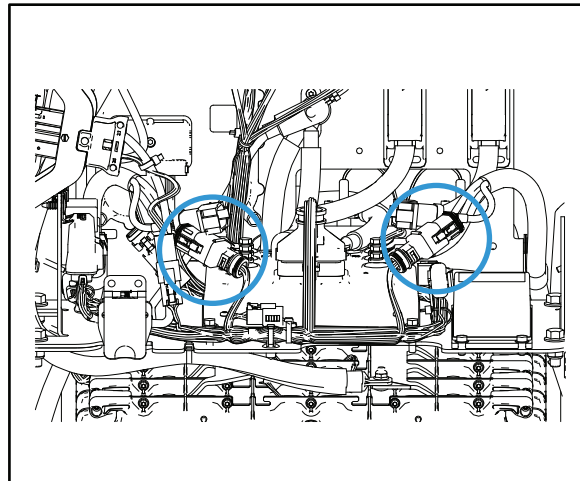
## Wheel Motor Removal (continued)



g382188

**Figure 61**

- 
10. Unplug the LH traction motor harness from the chassis wiring harness. Repeat on the RH harness.



g402412

**Figure 62**

- 
11. Remove the (5/16–18 x 3/4 inch) screw, nut, and cable clamp securing the LH traction motor harness to the LH clamp mounting plate. Repeat on the RH side of the unit.

## Wheel Motor Removal (continued)



g382191

**Figure 63**

- 
12. Remove the (3/8-16 x 1 inch) screw, nut, and cable clamp securing the LH traction motor harness to the LH frame. Repeat on the RH side of the unit.



g382192

**Figure 64**

- 
13. Pull the LH motor harness towards the front of the unit. Repeat on the RH side of the unit.
  14. Remove the 4 (7/16 inch) nuts securing the LH wheel to wheel motor. Remove the wheel from wheel motor. Repeat on the RH side of the unit.
  15. Remove the 4 (3/8-16 x 1.50 inch) wheel motor mounting screws and 4 nuts securing the LH wheel motor to the LH axle frame. Remove the wheel motor from the axle frame. Repeat on the RH side of the unit.

## Wheel Motor Installation

1. Install the LH wheel motor to the LH axle frame, secure with 4 (3/8–16 x 1.50 inch) wheel motor mounting screws and 4 nuts. Tighten the fasteners until finger tight and then fully tighten. Repeat on the RH side of the unit.
2. Route the LH wheel motor harness towards the front of the machine and loop around the rear of the tower. Repeat on the RH side of the unit.
3. Secure the LH wheel motor harness to the LH frame with the (3/8-16 x 1 inch) screw, nut, and cable clamp. Repeat on the RH side of the unit.



g382192

**Figure 65**

- 
4. Secure the LH wheel motor harness to the LH clamp mounting plate with the (5/16–18 x 3/4 inch) screw, nut, and cable clamp. Repeat on the RH side of the unit.

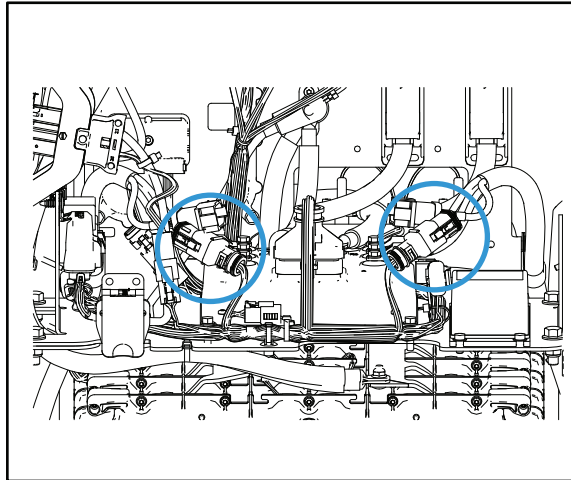


g382191

**Figure 66**

- 
5. Plug—in the traction motor harness to the chassis wiring harness.

## Wheel Motor Installation (continued)



g402412

Figure 67



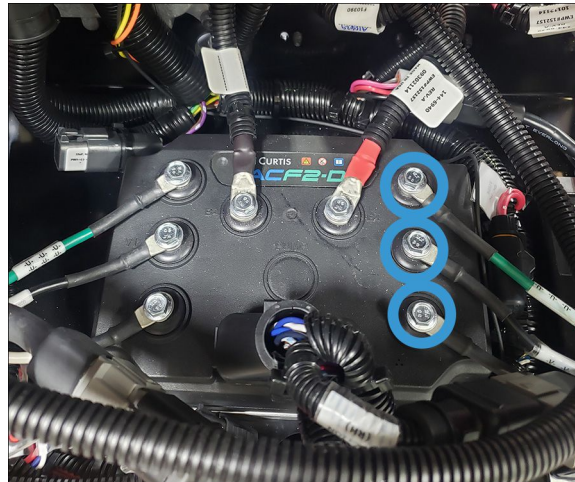
6. Install the 3 LH wheel motor phase wires to the LH controllers, secure with the 3 (M6-1 x 16) screws. Tighten the bolts until finger tight then torque to  $10.2 \pm 1.1 \text{ N} \cdot \text{m}$  ( $90 \pm 10 \text{ in-lb}$ ). Repeat on the RH side of the unit.



g382187

Figure 68

## Wheel Motor Installation (continued)



g382188

Figure 69

7. Install the rear cover plate to the tower, secure with the 4 (3/8-16 x 1 inch) screws.
8. Install the hood assembly to the chassis, secure with the 4 (3/8-16 x 1 inch) screws.
9. Close the front motor controller cover.
10. Remove the lock out from the master power switch and turn the switch on.
11. Turn on the key switch.
12. Test the wheel motor function by moving the control levers forwards and then backwards. Verify the wheel motors turn in the correct direction.

**Note:** If the wheel motors do not turn in the correct direction, verify the green, black, and white motor phase wires are connected to the correct terminals on the motor controller.



13. Install the LH wheel to the LH wheel motor, secure with the 4 (7/16 inch) nuts. Torque the nuts to  $81.3 \pm 6.78 \text{ N} \cdot \text{m}$  ( $60 \pm 5 \text{ ft-lb}$ ). Repeat on the RH side of the unit.
14. Using a proper lifting device, raise the back side of the unit and remove the jack stands.
15. Lower the unit to the ground.





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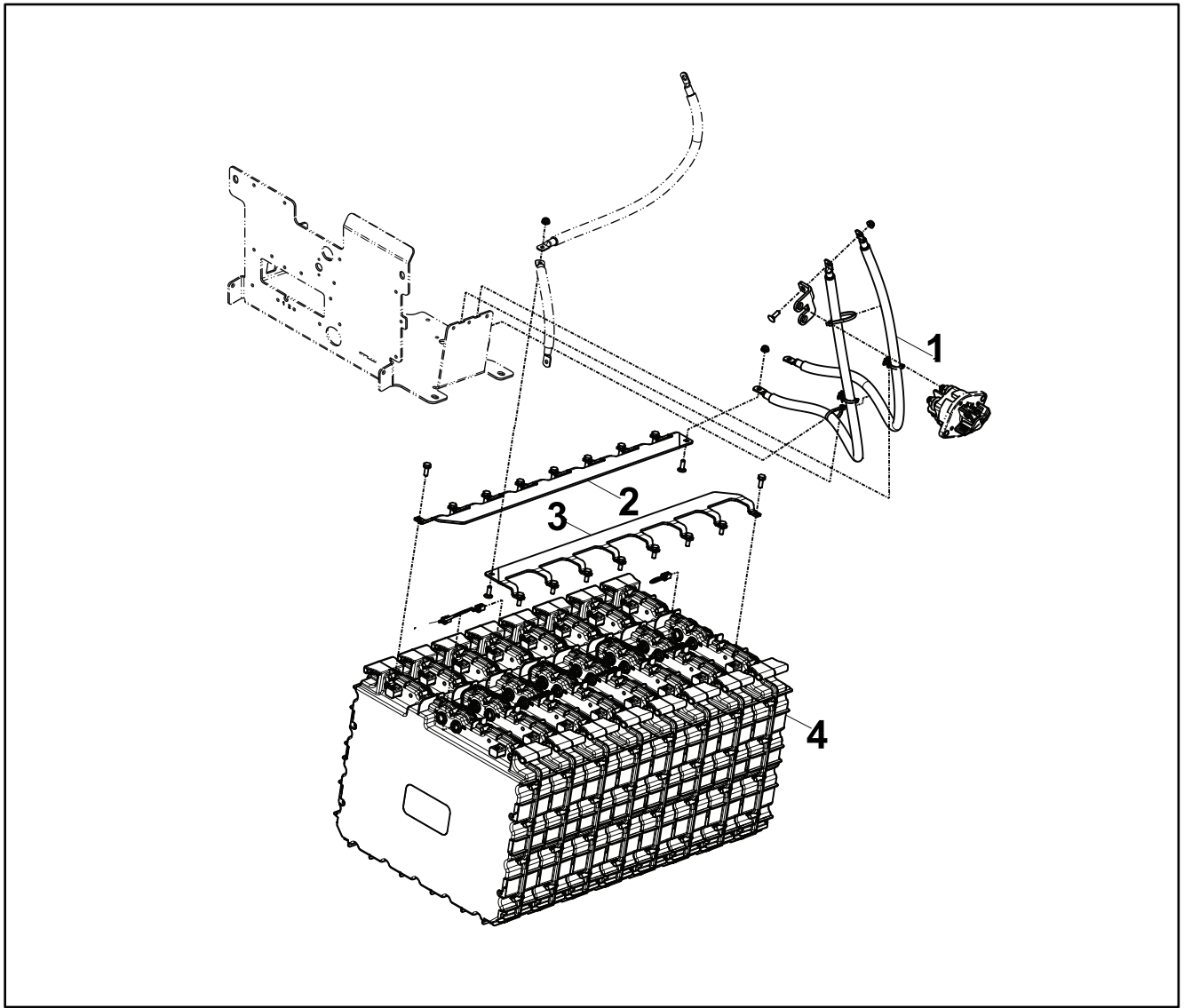
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# General Information

The Grandstand is powered by 8 (2.3 kWh) HYPERCELL™ batteries producing a total 18.4 kWh of energy storage.

# Service and Repairs

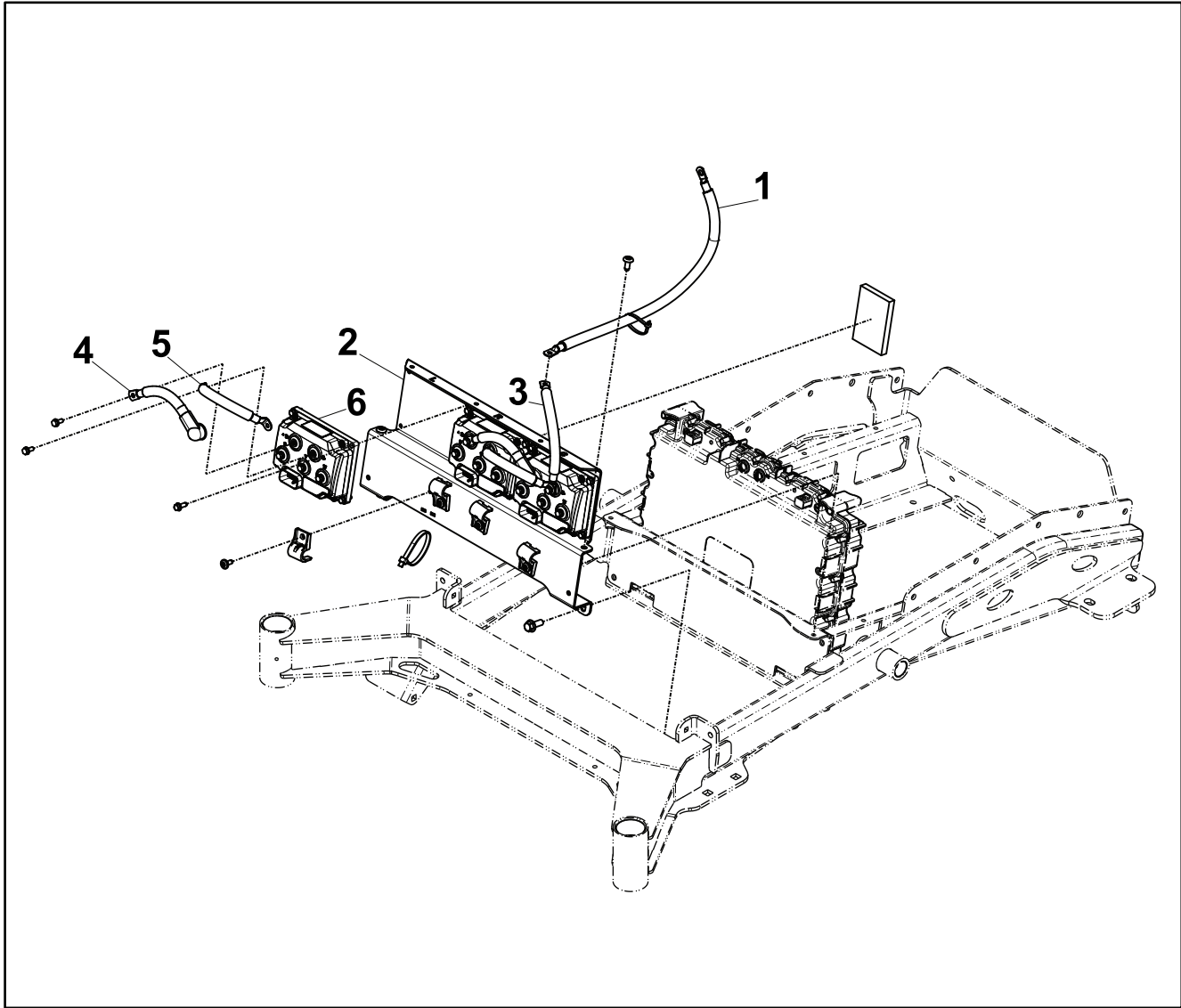
## Battery Assembly



g394591

**Figure 70**

- |                               |                     |
|-------------------------------|---------------------|
| 1. Red Cable Battery Assembly | 3. Black Busbar     |
| 2. Red Busbar                 | 4. Battery Assembly |

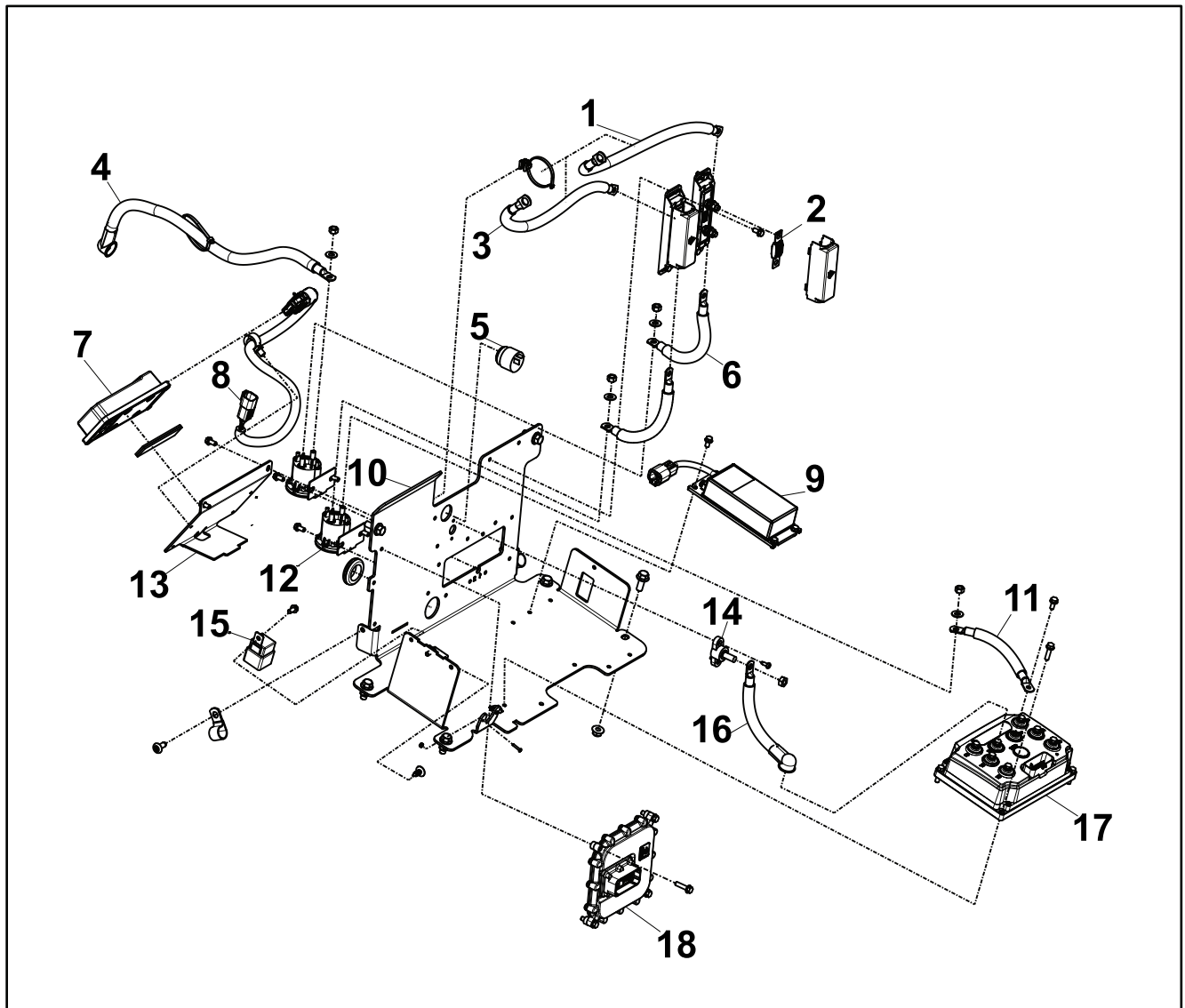


g394592

**Figure 71**

- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. Black Battery Cable Assembly | 4. Red Battery Cable Assembly    |
| 2. Motor Controller Plate       | 5. Battery Cable Assembly 2      |
| 3. Battery Cable Assembly 1     | 6. 48 Volt Deck Motor Controller |

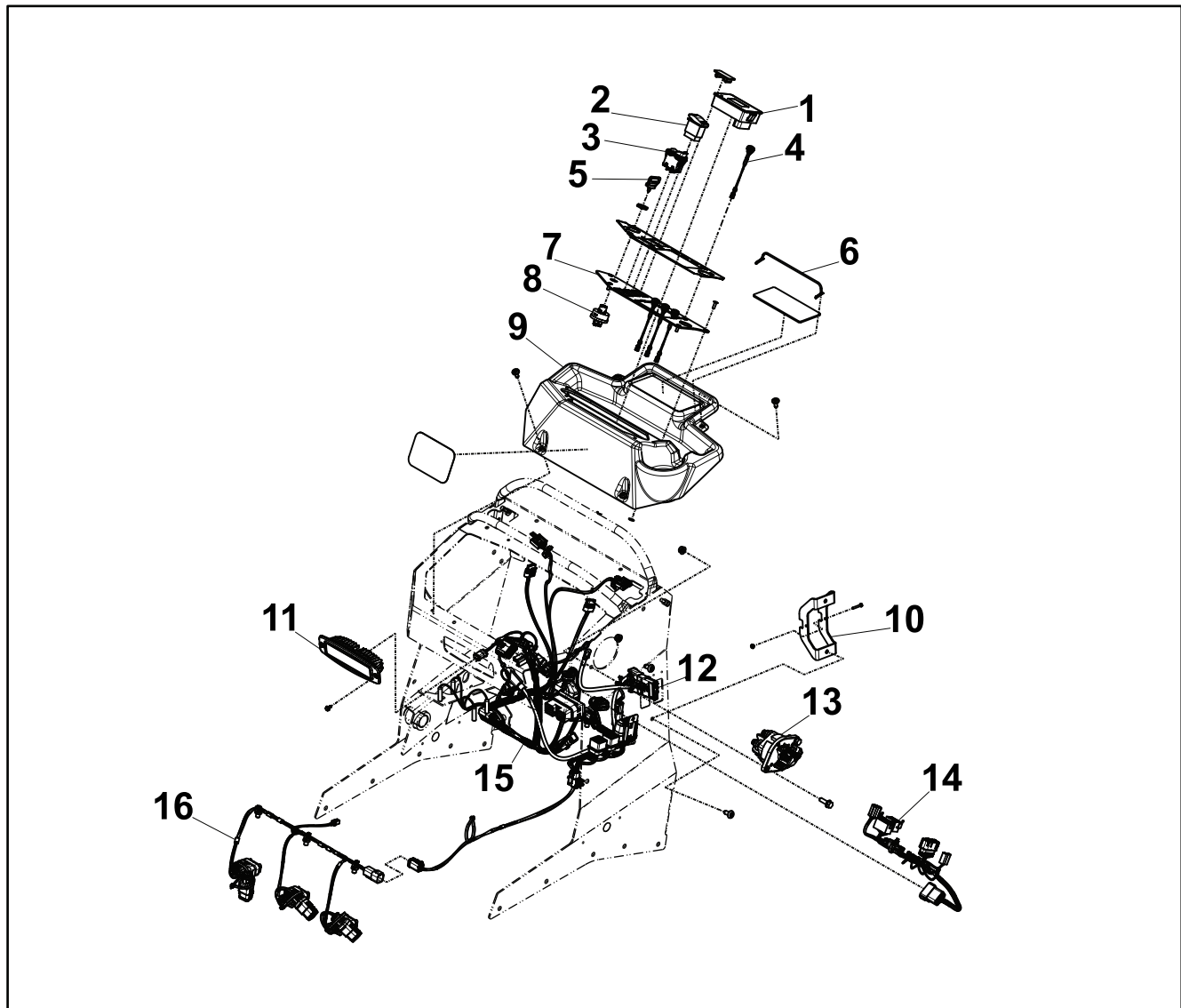
## Electrical Assembly 2



g394593

**Figure 72**

- |                                 |                                  |
|---------------------------------|----------------------------------|
| 1. Red Battery Cable Assembly 1 | 10. Electrical Plate             |
| 2. 70 VDC 200 amp Fuse          | 11. Red Battery Cable Assembly 5 |
| 3. Red Battery Cable Assembly 2 | 12. 12V Contactor                |
| 4. Red Battery Cable Assembly 3 | 13. CALAMP Mount Plate           |
| 5. Audio Alarm Assembly         | 14. Junction Block               |
| 6. Red Battery Cable Assembly 4 | 15. Relay                        |
| 7. CALAMP Controller            | 16. Black Battery Cable Assembly |
| 8. Wire Harness                 | 17. 48V Drive Motor Controller   |
| 9. DC-DC Converter              | 18. TEC 5004 Controller          |



g394594

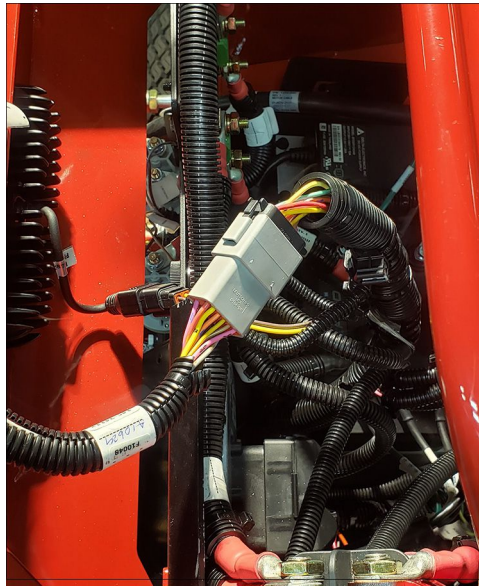
Figure 73

- |                              |  |
|------------------------------|--|
| 1. InfoCenter Display        | 9. Control Panel Dash                  |
| 2. Headlight Switch          | 10. Dual Charger Bracket               |
| 3. PTO Switch                | 11. Headlight                          |
| 4. InfoCenter Control Switch | 12. Charger Port Wire Harness          |
| 5. Ignition Key              | 13. Disconnect Switch                  |
| 6. Elastic Strap             | 14. Control Panel Wire Harness         |
| 7. Control Panel Plate       | 15. Main Wire Harness                  |
| 8. Key Switch                | 16. Deck Motor Controller Wire Harness |

# Battery Replacement

## Battery Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Open the front motor controller cover.
4. Remove the 4 (3/8-16 x 1 inch) screws securing the hood assembly to the chassis. Remove the hood assembly.
5. Loosen the 2 operator pad knobs and lower the operator pad so it rests on the operator platform.
6. Remove the 4 (3/8-16 x 1 inch) screws securing the rear cover plate to the tower. Remove the rear cover plate.
7. Remove the 4 (1/4-20 x 1/2 inch) Torx screws securing the control panel dashboard to the tower.
8. Unplug the gray connector connecting the wiring harness to the control panel dashboard. Remove the control panel dashboard from the unit.



g394597

**Figure 74**

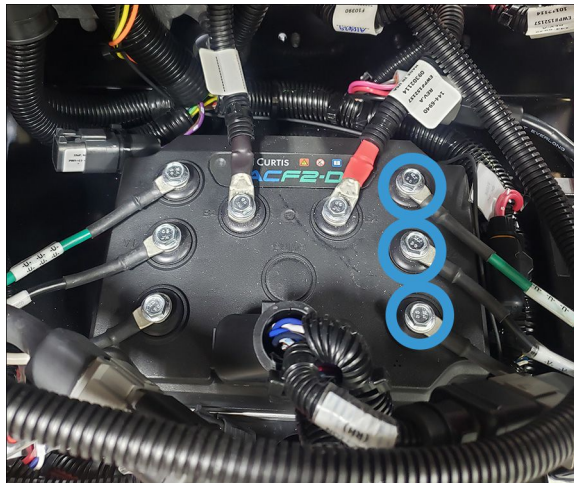
- 
9. Unplug the black connector from the wiring harness to the headlight.
  10. Remove the 3 (M6-1 x 16) screws securing the 3 LH traction motor phase wires (white, black, and green) to the LH traction motor controller. Repeat on the RH traction motor phase wires.

## Battery Removal (continued)



g382187

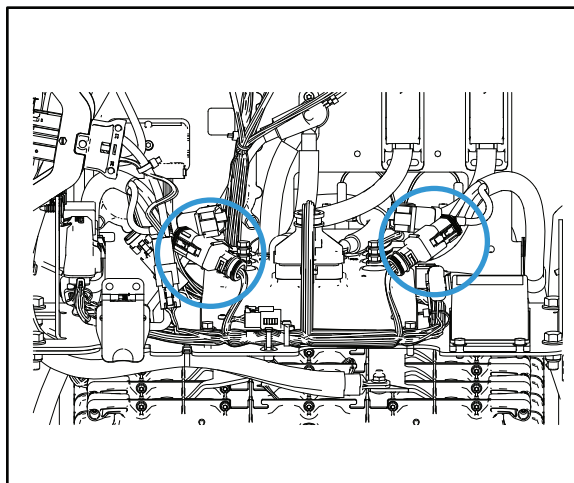
Figure 75



g382188

Figure 76

11. Unplug the 2 gray connectors securing the drive motor harnesses to the drive motor controllers.



g402412

Figure 77

## Battery Removal (continued)

12. Remove the (5/16–18 x 3/4 inch) screw, nut, and cable clamp securing the LH traction motor harness to the LH clamp mounting plate. Repeat on the RH side of the unit.



g382191

**Figure 78**

- 
13. Remove the (3/8-16 x 1 inch) screw, nut, and cable clamp securing the LH traction motor harness to the LH frame. Repeat on the RH side of the unit.

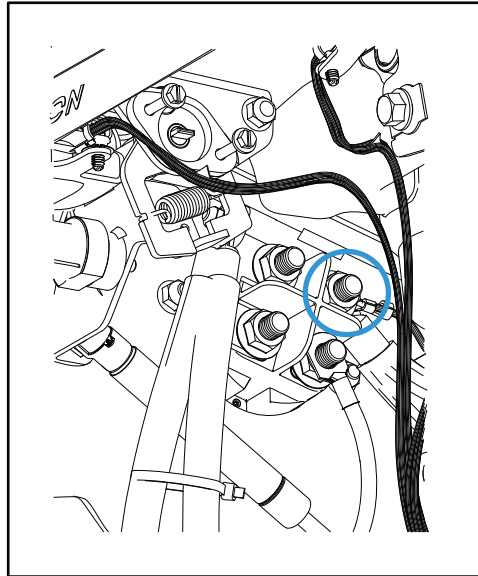


g382192

**Figure 79**

- 
14. Pull the LH motor harness from the LH traction motor controller towards the front of mower. Repeat on the RH side of the unit.
  15. Remove the (M12 x 1.75) flange nut securing the 3 wires to the upper RH terminal on the main switch. Remove the wires from the main switch.

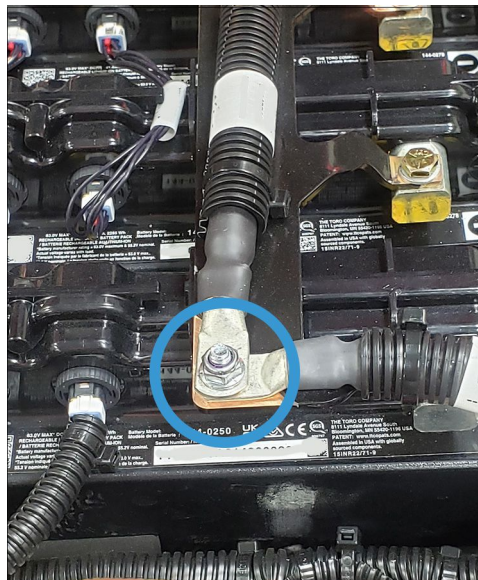
## Battery Removal (continued)



g402417

**Figure 80**

16. Remove the (M12 x 1.75) flange nut securing the wire to the lower LH terminal on the main switch. Remove the wire from the terminal.
17. Remove the (M12 x 1.75) flange nut securing the wire to the lower RH terminal on the main switch. Remove the wire from the terminal.
18. Remove the (M12 x 1.75) flange nut securing the wire to the upper LH terminal on the main switch. Remove the wire from the terminal.
19. Remove the 2 (5/16–18 x 3/4 inch) screws and 2 (5/16 inch) nylock nuts securing the charger bracket to the tower assembly.
20. Remove the (1/4–20 x 3/4 inch) screw and (1/4–20 inch) nylock nut securing the 2 wires to the negative terminal on the busbar.



g394600

**Figure 81**

21. Unplug the gray connector at the deck motor controller harness.

## Battery Removal (continued)



g394598

**Figure 82**

22. Remove the cable tie securing the cable that routes back to the electrical panel at the third battery handle.
23. From the front of the tower assembly, remove the nut securing the positive battery cable going from the contactor to the RH motor controller. Remove the cable from the threaded stud..
24. Unplug the wiring harness from the plunger switches and handle position sensors on the RH and LH control handles.

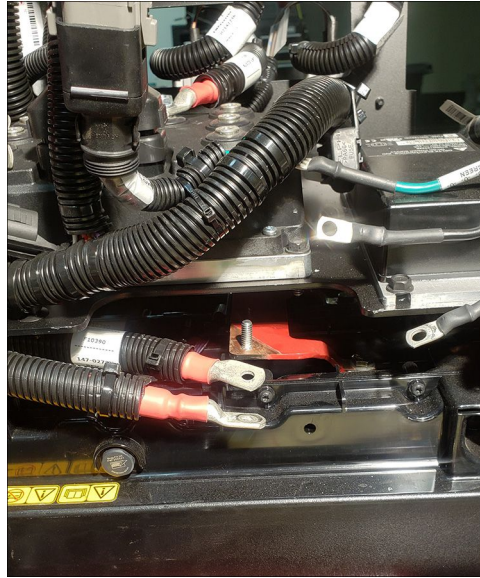


g395880

**Figure 83**

25. Remove the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut securing the 2 red wires to the positive bus bar.

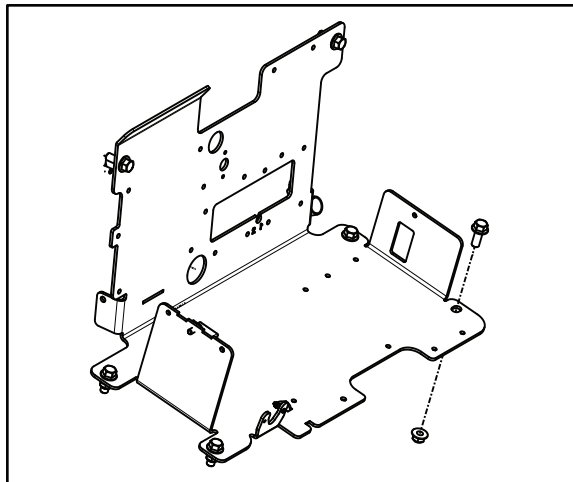
## Battery Removal (continued)



g395881

**Figure 84**

- 
26. Remove the 6 (3/8-16 x 1.0 inch) screws and 4 (3/8 inch) nuts securing the electrical mounting plate to the tower assembly.



g397499

**Figure 85**

- 
27. Remove the LH control handle damper from the lower ball mount by prying on the retaining clip with a screw driver and pulling the damper from the ball mount. Repeat on the RH damper.

## Battery Removal (continued)



g394596

**Figure 86**

- 
28. Remove any cable ties securing the harness to the chassis.
  29. Slide the electrical mounting plate rearward and remove the electrical mounting plate from the tower assembly.
  30. Remove the 8 (1/4–20 x 3/4 inch) screws and 8 washers securing the busbar (black) on the negative side of the batteries. Repeat on the positive busbar (red).

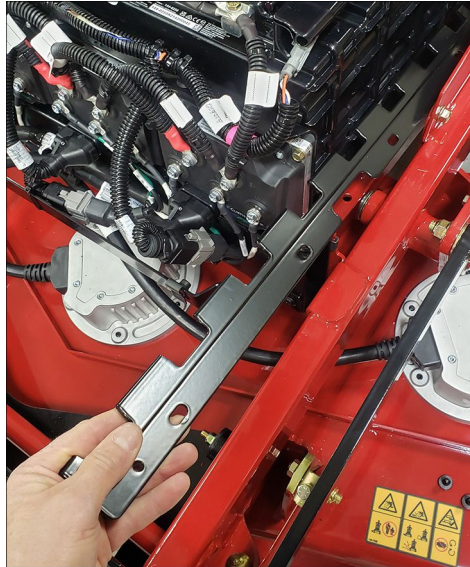


g395879

**Figure 87**

- 
31. Remove the positive and negative busbars.
  32. Remove the 3 (5/16-18 x 3/4 inch) black screws securing the LH battery retention bracket to the frame. Remove the LH battery retention bracket. Repeat on the RH battery retention bracket.

## Battery Removal (continued)

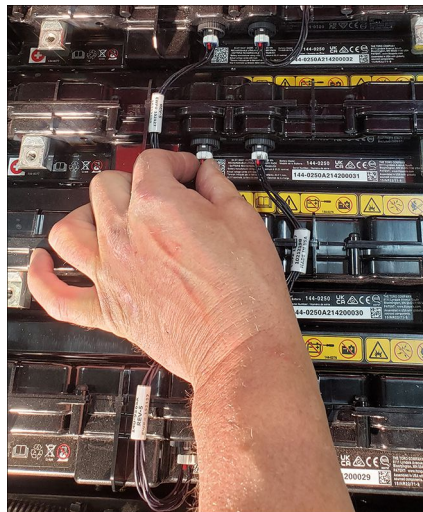


g382208

**Figure 88**

33. Identify the battery to be removed by using the serial number tag on the top of the batteries.
34. Prevent the battery from falling rearward and unplug the 2 communication wires from the battery to be removed.

**Note:** Do not tug on the communication wires.



g395878

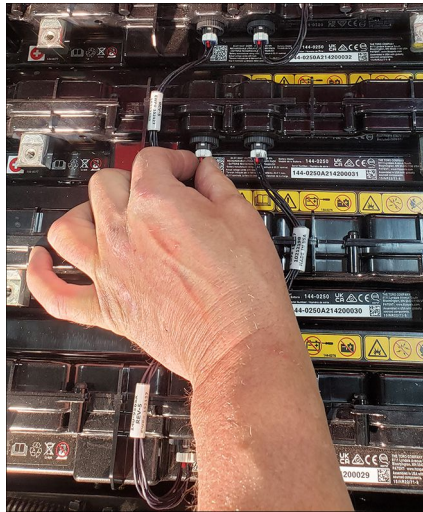
**Figure 89**

35. Using a proper lifting device, lift and remove the battery from the chassis.

## Battery Installation

1. Using a proper lifting device, install the battery in the open battery location.
2. Install the LH battery retention bracket to the frame, loosely secure with the 3 (5/16-18 x 3/4 inch) black screws. Repeat on the RH battery retention bracket.
3. Connect the 2 communication wires to the new battery.

## Battery Installation (continued)



g395878

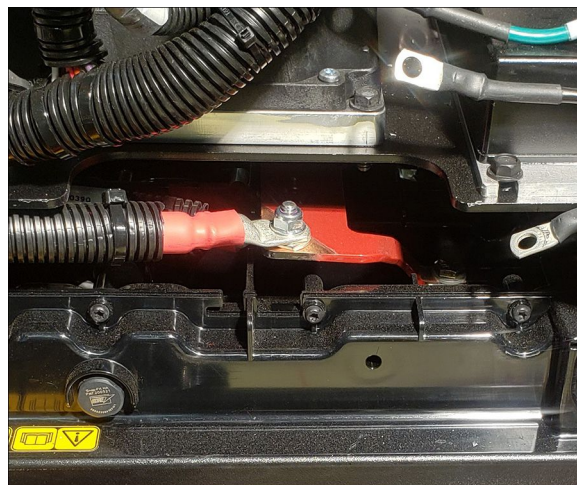
**Figure 90**



4. Install the busbar (black) on the negative side of the batteries, secure with 8 (1/4–20 x 3/4 inch) screws. Torque the screws to  $10.7 \pm 1.1$  N • m (95 ± 10 in-lb). Repeat on the positive battery busbar (red).
5. Tighten the 3 (5/16-18 x 3/4 inch) screws securing the LH battery retention bracket to the frame. Repeat on the RH battery retention bracket.



6. Install the 2 red wires to the positive bus bar, secure with the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut. Torque the nut to  $10.7 \pm 1.1$  N • m (95 ± 10 in-lb).

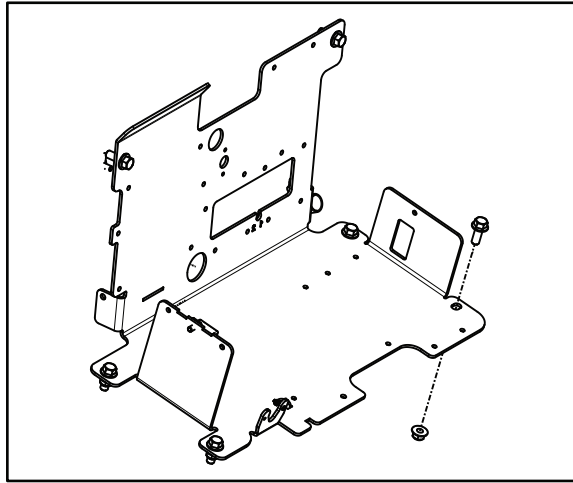


g394603

**Figure 91**

7. From the back side of the unit, slide the electrical mounting plate into the tower. Secure the electrical mounting plate with the 6 (3/8-16 x 1.00 inch) screws and 4 (3/8 inch) nuts.

## Battery Installation (continued)



g397499

Figure 92

8. Route the 2 wires from the positive battery busbar through the frame and towards the master switch busbar.
9. Install one of the positive battery busbar wires to upper LH terminal on the master switch, and the other to the lower LH terminal.



10. Secure the positive battery busbar wires to the busbar with a (M12 x 1.75) flange nut. Torque the nuts to 18.98 N • m (14 ft-lb).

11. Install LH control damper to the lower ball mount on the tower assembly. Repeat on the RH side of the unit.

12. Install the 2 (5/16–18 x 3/4 inch) screws and 2 (5/16 inch) nylock nuts securing the charger bracket to the tower assembly.



13. Install the wire from the charge port to the lower RH terminal of the master switch, secure with the (M12 x 1.75) flange nut. Torque the nut to 18.98 N • m (14 ft-lb).



14. Install the 3 wires (2 from the mega fuses one from the wiring harness) to the upper RH terminal on the master switch, secure with the (M12 x 1.75) flange nut. Torque the nut to 18.98 N • m (14 ft-lb).

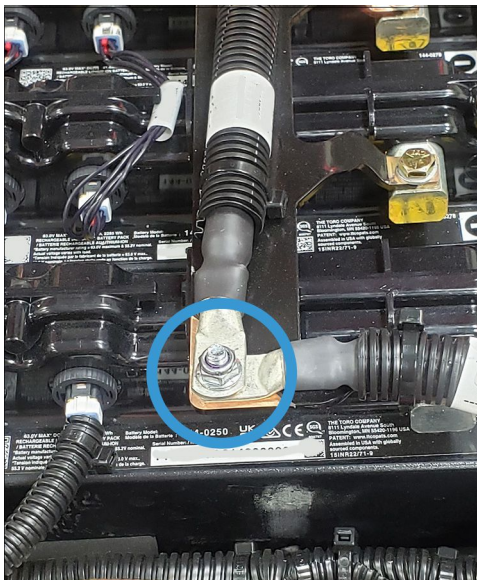


15. Connect the red wire from the deck motor controller on the RH side of the chassis to the RH contactor on the electrical mounting plate. Secure the wire with a washer and (5/16 inch) nut. Torque the nut to 3.39 N • m (30 in-lb).



16. Install the 2 black wires to the negative busbar terminal, secure with the (1/4–20 x 3/4 inch) screw and (1/4 inch) nylock nut. Torque the nut to 10.7 ± 1.1 N • m (95 ± 10 in-lb).

## Battery Installation (continued)



g394600

**Figure 93**

17. Install the cable tie securing the cable that routes back to the electrical panel at the third battery handle.
18. From the front of the unit, connect the gray connector at the deck motor controller harness.



g394598

**Figure 94**

19. Route the cable through the battery handles and install the cable to the third battery handle.
20. Plug-in the LH plunger switch and position the sensor to the wiring harness. Repeat on the RH side of the unit.

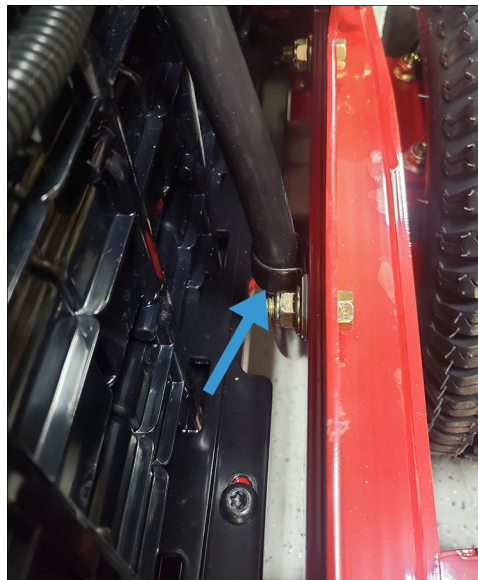
## Battery Installation (continued)



g395880

**Figure 95**

- 
21. Route the LH traction motor harness to the traction motor controller.
  22. Secure the LH traction motor harness to the frame with the (3/8-16 x 1 inch) screw, nut, and cable clamp. Repeat on the RH side of the unit.

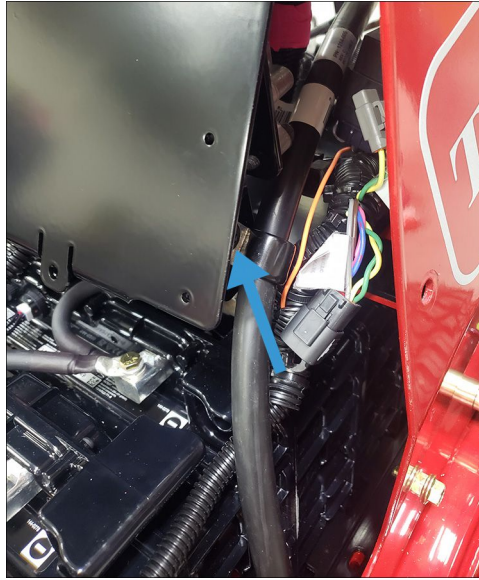


g382192

**Figure 96**

- 
23. Secure the LH traction motor harness to the clamp mounting plate with the (5/16–18 inch) screw, nut, and cable clamp. Repeat on the RH side of the unit.

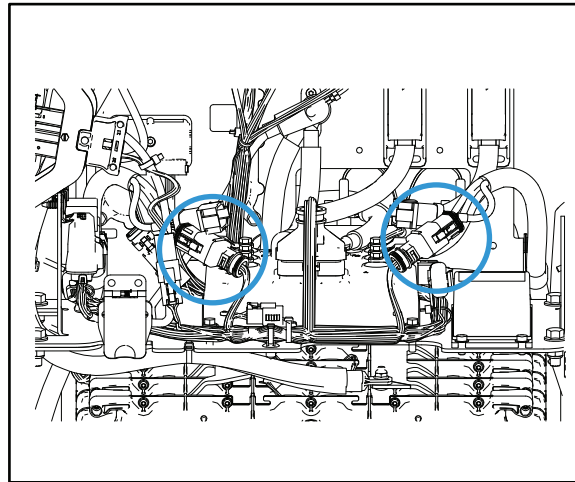
## Battery Installation (continued)



g382191

**Figure 97**

- 
24. Plug-in the 2 gray connectors securing the drive motor harnesses to the drive motor controllers.



g402412

**Figure 98**



25. Install the 3 traction motor phase wires to the LH side of the traction motor controller, secure with the 3 (M6-1 x 16) screws. Tighten the screws until finger tight and then torque to  $10.2 \pm 1.1 \text{ N} \cdot \text{m}$  ( $90 \pm 10 \text{ in-lb}$ ). Repeat on the RH side of the unit.

## Battery Installation (continued)



g382187

**Figure 99**

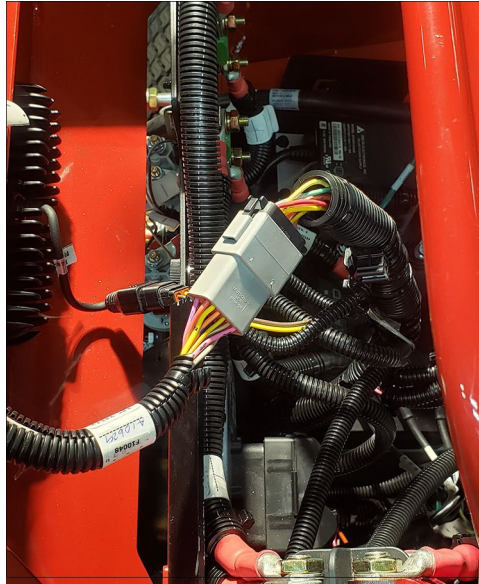


g382188

**Figure 100**

26. Connect the black wiring harness connector to the headlight.
27. Connect the grey wiring harness connector to the control panel dashboard.

## Battery Installation (continued)



g394597

**Figure 101**

28. Install the control panel dashboard to the tower, secure with the 4 (1/4–20 x 1/2 inch) Torx screws.
29. Install the rear cover plate to the tower, secure with the 4 (3/8-16 x 1 inch) screws.
30. Raise the cushion pad assembly to the frame and secure with the 2 knobs on the pad hinge.
31. Install the hood assembly to the chassis, secure with the 4 (3/8-16 x 1 inch) screws.
32. Close the front motor controller cover.
33. Remove the lock out from the master power switch and turn the switch on.

## Deck Motor Controller Replacement

### Deck Motor Controller Removal

1. Park the machine on a clean, dry, and level surface. Stop the engine, wait for all moving parts to stop and remove the key.
2. Turn off the master power switch, secure with a cable tie or pad lock.
3. Open the front motor controller cover.
4. Remove the 4 (3/8-16 x 1 inch) screws securing the hood assembly to the chassis. Remove the hood assembly.
5. Remove the (M6-1 x 16) screw securing the positive battery cable to the motor controller. Repeat on the negative battery cable.
6. Remove the 3 (M6-1 x 16) screws securing the 3 phase wires (white, black, and green) wires to the motor controller.

## Deck Motor Controller Removal (continued)



g395882

**Figure 102**

7. Pull the tab from the connector and unplug the wiring harness from the deck motor controller.
8. Remove the 4 (1/4–20 x 0.75 inch) screws securing the deck motor controller to the motor controller plate. Remove the deck motor controller.

## Deck Motor Controller Installation

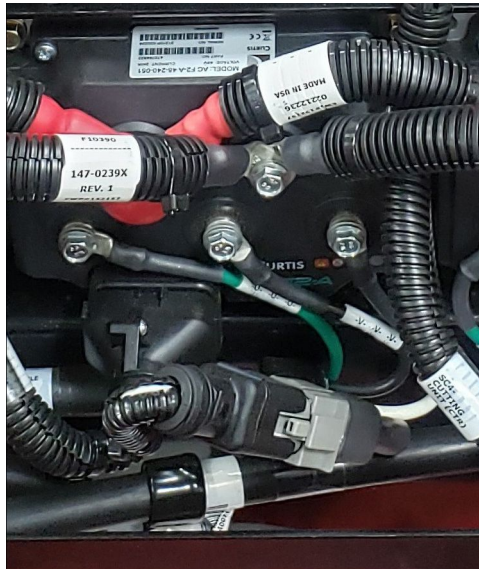


1. Mount the deck motor controller to the motor controller plate and install the 4 (1/4–20 x 0.75 inch) screws by hand. Torque the screws to  $10.2 \pm 1.1$  N • m (90 ± 10 in-lb).



2. Plug-in the deck motor controller into the chassis harness.
3. Install the 3 phase wires (white, black, and green) to the motor controller, secure with the 3 (M6-1 x 16) screws. Torque the screws to  $10.2 \pm 1.1$  N • m (90 ± 10 in-lb).

## Deck Motor Controller Installation (continued)



g395882

**Figure 103**



4. Install the positive battery cable to the motor controller, secure with the (M6-1 x 16) screw. Torque the screw to  $10.2 \pm 1.1 \text{ N} \cdot \text{m}$  ( $90 \pm 10 \text{ in-lb}$ ). Repeat on the negative battery cable.
5. Install the hood assembly to the chassis, secure with the 4 (3/8-16 x 1 inch) screws.
6. Close the front motor controller cover.
7. Remove the lock out from the master power switch and turn the switch on.





# Foldout Drawings

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# Electrical Drawing Abbreviations

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

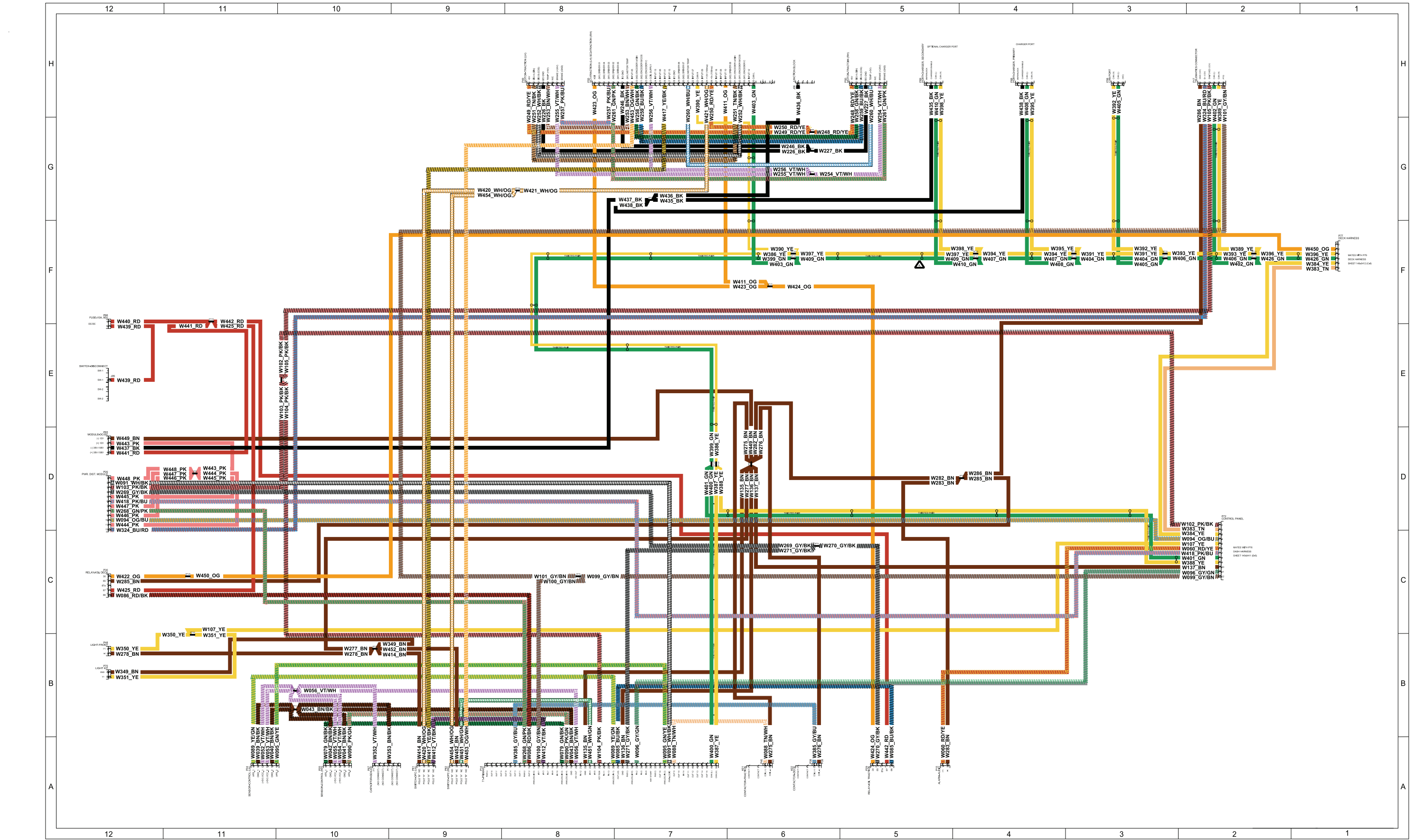
Abbreviation	Color
BK	Black
BR or BN	Brown
BU	Blue
GN	Green
GY	Gray
OR or OG	Orange
PK	Pink
R or RD	Red
T or TN	Tan
VIO or VT	Violet
W or WH	White
Y or YE	Yellow

Numerous harness wires include a line with an alternate color. These wires are identified with the wire color followed by a / or \_ and then the line color (e.g, R/BK is a red wire with a black line; OR\_BK is an orange wire with a black line).

**Note:** The electrical harness drawings in this chapter identify both the wire color and the wire gauge. For example, 16 BK on a harness diagram identifies a 16 gauge wire with black insulation.

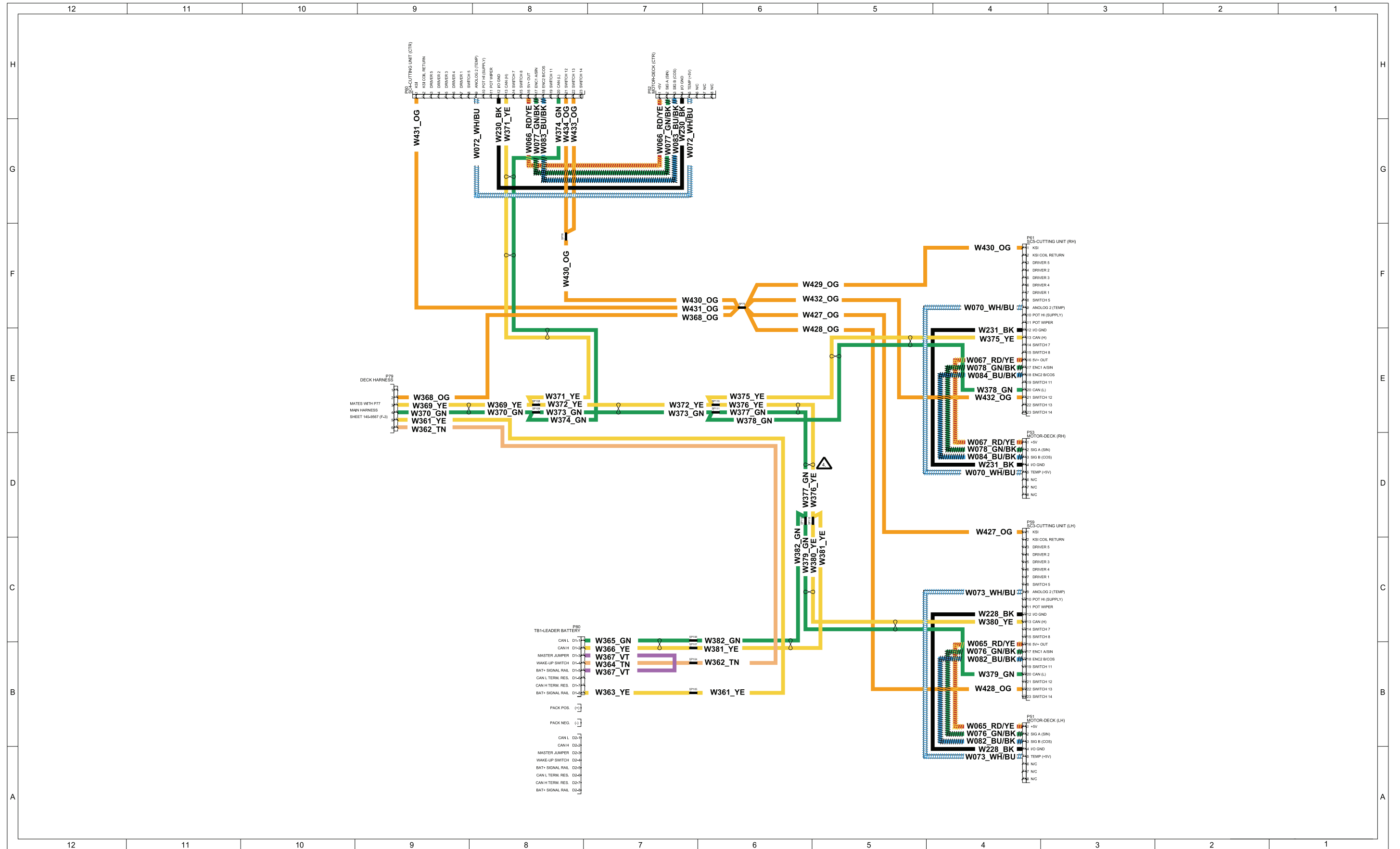
**Note:** A splice used in a wire harness will be identified on the wire harness diagram by SP. The manufacturing number of the splice is also identified on the wire harness diagram (e.g., SP01 is splice number 1).

# Electrical Schematic



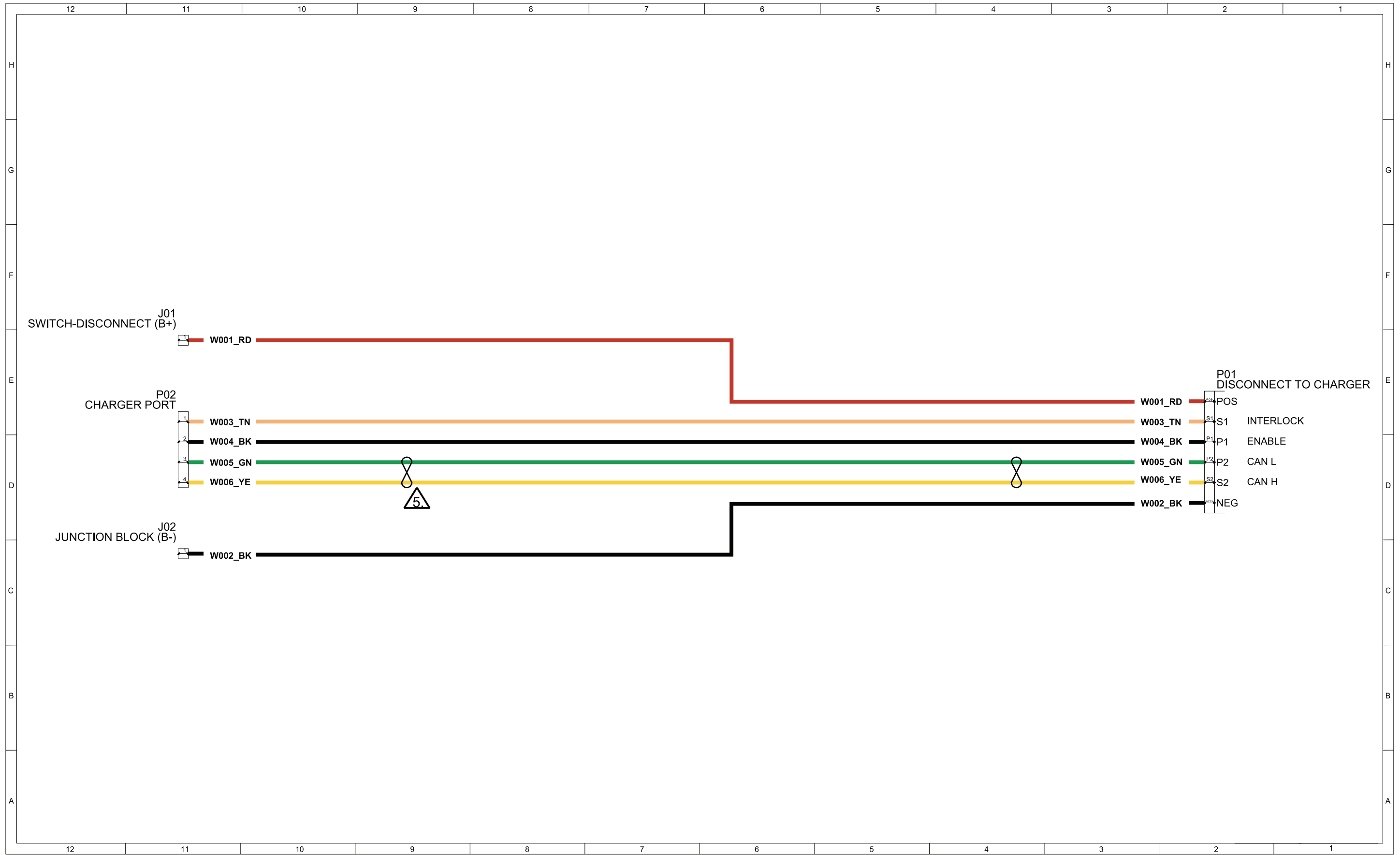
g398173

# Deck Electrical Schematic



g398216

# Charger Port Electrical Schematic



g402201

