



Count on it.

Service Manual

Pro Force® Debris Blower

Models 44552, 44552TE, 44553 & 44554

Reader Comments

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

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Preface

This service manual was written expressly for service technicians. Basic shop safety knowledge and mechanical/electrical skills are assumed. The Toro Company has made every effort to make the information in this manual complete and correct.

The purpose of this publication is to provide the service technician with information about troubleshooting, testing, and repairing major systems and components. This manual may also be specified for use on numerous products. Refer to the Table of Contents for a list of the systems and the related topics covered in this manual.

Refer to the machine *Operator's Manual* for additional information about operating, maintaining, and adjusting the machine. Keep a copy of the *Operator's Manuals*, *Installation Instructions*, and *Parts Catalog* for your machine and its accessories with this *Service Manual* for reference. Additional copies of the *Operator's Manuals*, *Installation Instructions* and *Parts Catalogs* are available at www.toro.com.

The Toro Company reserves the right to change the product specifications or this publication 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; refer to [Standard Torque for Dry, Zinc Plated, and Steel Fasteners \(Inch Series\) \(page 2–7\)](#) or [Standard Torque for Dry, Zinc Plated, and Steel Fasteners \(Metric Fasteners\) \(page 2–8\)](#).



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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KOHLER Command Pro CH740 Service Manual



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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 kill or cause serious permanent injury or disability.



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.

IMPORTANT

The *Important* notice will give the important instructions which you must follow to prevent damage to the systems or components on the machine.

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

Think Safety First

Toro Products are tested and certified for compliance with existing safety standards and specifications. Although hazard control and accident prevention are partially dependent upon the design and configuration of the machine, hazard control and accident prevention are also dependent upon the awareness, concern and proper training of the personnel involved in the operation, transport, maintenance, and storage of the machine. Improper use or maintenance of the machine can result in injury or death.



WARNING



To reduce the potential of injury or death, comply with the safety instructions in this manual, as well as information found in the *Operator's Manuals* and the *Operator and Safety Training Videos* found on www.toro.com.

- **Avoid unexpected starting of the engine...**

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

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

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

Use extreme care in handling fuel. Fuel is flammable and its vapors are explosive.

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

Do not operate an engine in a confined area without proper ventilation.
- **Avoid injury from batteries...**
 - Battery acid is poisonous and can cause burns. Avoid contact with skin, eyes and clothing.
 - Battery gases can explode. Keep cigarettes, sparks and flames away from the battery.
- **Avoid injury due to inferior parts...**

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

Think Safety First (continued)

- **Avoid injury to bystanders...**
 - Always clear the area of bystanders before starting or testing powered equipment.
- **Avoid injury due to projectiles...**
 - Always clear the area of sticks, rocks or any other debris that could be picked up and thrown by the powered equipment.
- **Avoid modifications...**
 - Never alter or modify any part unless it is a factory approved procedure.
- **Avoid unsafe operation...**
 - Always test the safety interlock system after making adjustments or repairs on the machine. Refer to the Electrical section in this manual for more information.
- **Avoid electrical shock...**
 - Never touch electrical wires or components while the engine is running. They can be sources of shock.
 - De-energize the system if you are having to do repairs.
 - If testing electrical components ensure you are working in a dry environment.
- **Hydraulic System precautions...**
 - Release all pressure in the hydraulic system before performing any work on the system.
 - Keep your body and hands away from pin-hole leaks or nozzles that eject hydraulic fluid under high pressure. Do not use your hands to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and cause serious injury.
 - Seek medical attention right away if hydraulic fluid gets in the skin.
- **Use personal protective equipment...**
 - 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.
- **Using 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.
- **Using 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 over load 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 unfamiliar with any lifts, hoists or jacks, do not use them until you know how to operate them correctly.
- **Using fire extinguishers...**

Think Safety First (continued)

Use the proper class of fire extinguisher in case of fire.

Ensure fire extinguishers are serviced regularly, and replace any fire extinguishers that are discharged or in use beyond their expiration dates.

- **Class A** fire 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** fire extinguishers are for fires that 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** fire extinguishers are for fires that 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).
- **Class ABC** fire extinguishers are a dry chemical type used for multiple purposes. See above descriptions for additional information.

Jacking Instructions



CAUTION

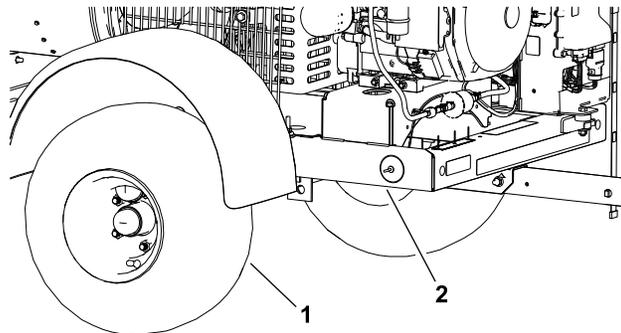


Failing to properly support the machine with appropriate jack stands can cause the machine to move or fall and can result in personal injury.

When changing the attachments, tires, or performing other services, do the following steps:

- Use correct blocks, hoists, and jacks to raise and support the machine.
- Park the machine on a solid level surface, such as a concrete floor.
- Before you lift the machine, remove all the attachments that may interfere with the safe and correct lift of the machine.
- Always block the wheels with chocks.
- Use appropriate jack stands to support the raised machine.
- Do not use the axle as a jacking point.

1. Position the machine on a level surface. Ensure that the blower engine is shut off and remove the key from the key switch. Block the blower wheels with chocks to prevent the machine from moving, or leave the blower attached to a tow vehicle if possible. Engage the tow vehicle parking brake, shut off the tow vehicle engine, and remove the key from the tow vehicle key switch if applicable.



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Figure 1

1. Wheel
2. Frame jacking point

2. Position the jack securely under the main frame of the blower. Do not use the axle as a jacking point.
3. Carefully raise the machine off the ground.
4. Position jack stands under the main frame to support the machine.

Safety and Instructional Decals

Safety decals and instructions are easily visible to the operator and are located near any area of potential danger. If any decal becomes illegible or damaged, install a new decal. Decal part numbers are listed in your *Parts Catalog*, *Operator's Manual*, and accessory *Installation Instructions*. Order replacement decals from Authorized Toro Distributor.



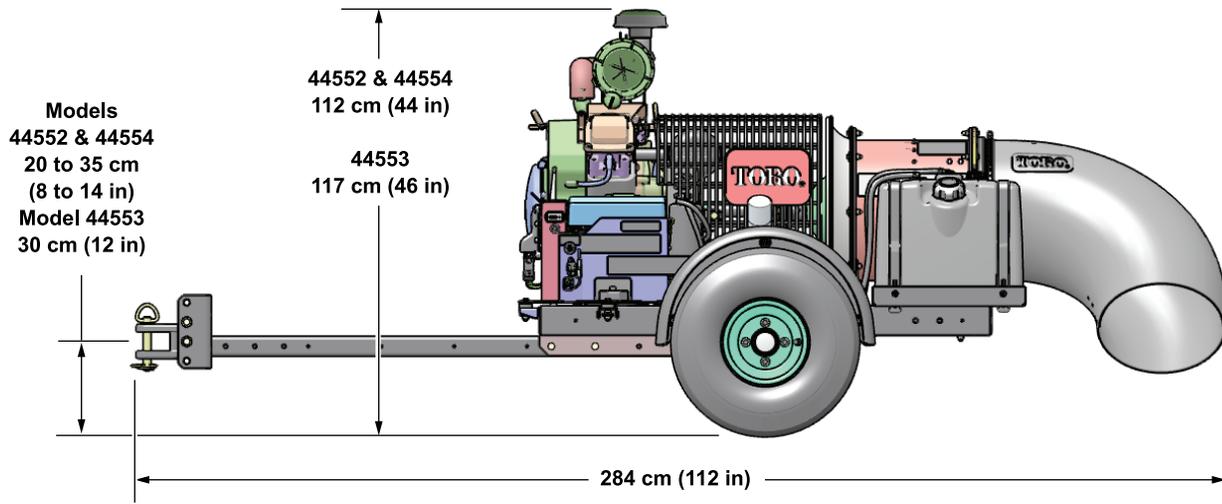
Specifications and Maintenance

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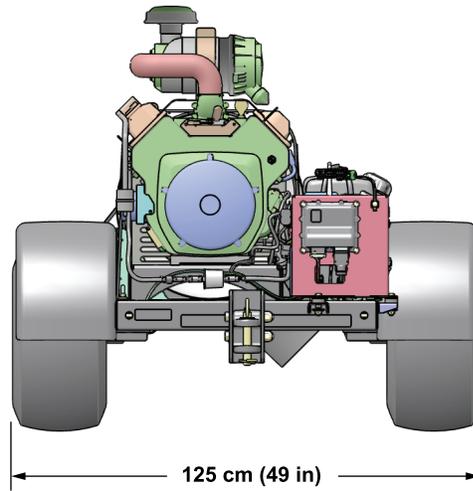
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Specifications

Overall Dimensions



Model 44552 & 44554 = 215 kg (475 lbs)
Model 44553 = 225 kg (495 lbs)



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Figure 2

Engine

Item	Description
Make/Designation	Kohler CH740S, 2-cylinder, air cooled, OHV gasoline engine
Bore x Stroke	83 x 67 mm (3.27 x 2.64 inches)
Total displacement	725 cm ³ (44 in ³)
Compression ratio	9.0:1
Governor	Electronic
Low idle speed	1,750 to 1,850 rpm
High idle speed	3,550 to 3,650 rpm (with no nozzle back pressure)
Carburetor	Float feed, fixed main jet, and solenoid fuel shut-off
Fuel	unleaded gasoline fuel with an octane rating of 87 or higher
Fuel pump	Pulse type
Fuel tank capacity	18.9 L (5 US gallons)
Air cleaner	Dual element
Lubrication system	Pressure lubrication with oil cooler
Crankcase-oil capacity	2.0 L (67 fl oz)
Engine oil	Refer to the <i>Operator's Manual</i>
Ignition system	Flywheel magneto, twin electronic armatures with ignition advance
Spark plug	Champion® RC12YC, Champion® Platinum 3071 or equivalent
Spark plug gap	0.76 mm (0.030 inch)
Starter	12 VDC, solenoid shift
Alternator	12 VDC, 15 A
Engine weight (dry)	53 kg (116 lb)

Chassis

Item	Description
Tires pressure (20×10-8, 4 ply, tubeless)	96.5 kPa (14 psi)
Wheel lug nut torque	95 to 122 N·m (70 to 90 ft-lb)

Torque Specifications

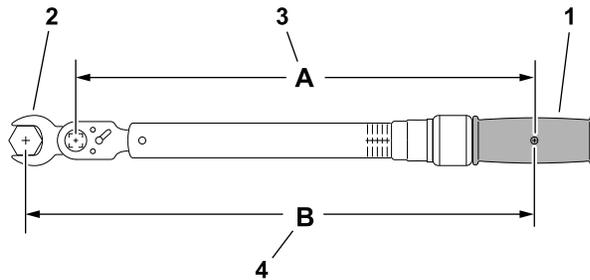
The recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in this Service Manual.

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

As noted in the following tables, the torque values should be **reduced by 25% for lubricated fasteners or fasteners with a wet thread locking compound applied** to achieve the similar stress as a dry fastener. The torque values must be reduced when the fastener is threaded into the 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 checking the torque can be performed by marking a line on the fastener (head or nut) and mating part, then back off the fastener 1/4 of a turn. Measure the torque necessary to tighten the fastener until the lines match up.

Calculating the Torque Values When Using a Drive-Adapter Wrench



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Figure 3

Torque Conversion Factor = A / B

1. Torque wrench
2. Drive-adapter wrench (crowsfoot)
3. A (effective length of torque wrench)
4. B (effective length of torque wrench and drive-adapter wrench)

Using a drive-adapter wrench (e.g., crowfoot wrench) in any position other than 90° and 270° to the frame of the torque wrench will affect the torque value measured by the torque wrench because of the effective length (lever) of the torque wrench changes. When using a torque wrench with a drive-adapter wrench, multiply the listed torque recommendation by the calculated torque conversion factor (Figure 3) to determine proper tightening torque. When using a torque wrench with a drive-adapter wrench, the calculated torque will be lower than the listed torque recommendation.

Example: The measured effective length of the torque wrench (distance from the center of the handle to the center of the square drive) is 457 mm (18 inches).

The measured effective length of the torque wrench with the drive-adapter wrench installed (distance from the center of the handle to the center of the drive-adapter wrench) is 483 mm (19 inches).

The calculated torque conversion factor for this torque wrench with this drive-adapter wrench would be $18/19 = 0.947$.

If the listed torque recommendation for a fastener is **103 to 127 N·m (76 to 94 ft-lb)**, the proper torque when using this torque wrench with a drive-adapter wrench would be **98 to 121 N·m (72 to 89 ft-lb)**.

Identifying the Fastener

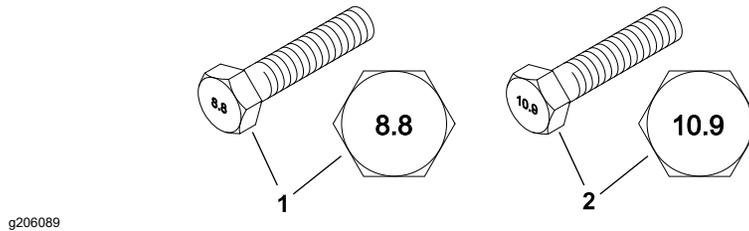


Figure 4
Metric Bolts and Screws

1. Class 8.8

2. Class 10.9

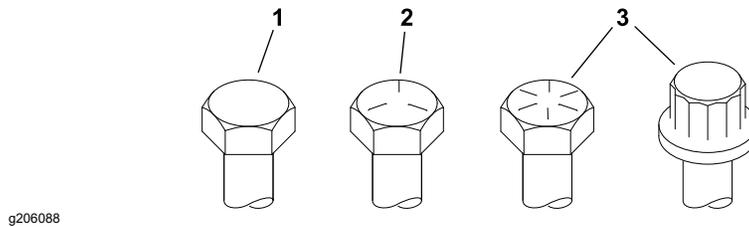


Figure 5
Inch Series Bolts and Screws

1. Grade 1

2. Grade 5

3. Grade 8

Fasteners with a Locking Feature

IMPORTANT

If a fastener with a locking feature or previously applied thread locking compound is reused, clean the fastener threads and apply new thread locker to the fastener during installation.

Locking features are designed to create friction and prevent a fastener from loosening. Locking features can be found on externally or internally threaded fasteners. Common examples are plastic inserts incorporated into the fastener and pre-applied “dry” thread locking compound. Keep in mind, a fastener with a locking feature usually means there will be friction during initial installation and during removal.

Toro recommends replacing fasteners with a locking feature once they have been removed because the effectiveness of the locking feature diminishes with each reuse. If it is necessary to reuse a fastener with a locking feature; apply a thread locking compound (Loctite for example) to the fastener during installation. Use the appropriate strength and type of thread locking compound based on application, fastener size or information found in the product *Operators Manual*, *Service Manual* or *Installation Instructions*.

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

Thread Size	Grade 1, 5 and 8 with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 5 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs, and Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)	
	in-lb	in-lb	N-cm	in-lb	N-cm	in-lb	N-cm
# 6 - 32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	169 ± 23	23 ± 3	262 ± 34
# 6 - 40 UNF				17 ± 2	192 ± 23	25 ± 3	282 ± 34
# 8 - 32 UNC	13 ± 2	25 ± 5	282 ± 56	29 ± 3	328 ± 34	41 ± 5	463 ± 56
# 8 - 36 UNF				31 ± 4	350 ± 45	43 ± 5	486 ± 56
# 10 - 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 5	475 ± 56	60 ± 6	678 ± 68
# 10 - 32 UNF				48 ± 5	542 ± 56	68 ± 7	768 ± 79
1/4 - 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1130 ± 113	140 ± 15	1582 ± 169
1/4 - 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 12	1299 ± 136	160 ± 17	1808 ± 192
5/16 - 18 UNC	115 ± 15	105 ± 15	1186 ± 169	200 ± 25	2260 ± 282	300 ± 30	3390 ± 339
5/16 - 24 UNF	138 ± 17	128 ± 17	1146 ± 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 the torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant, such as engine oil, or a thread locking compound such as Loctite.

Note: The torque values must be reduced when installing the fasteners into threaded aluminum or brass. The specified torque value should be determined based on the aluminum or base material strength, fastener size, length of thread engagement, etc.

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

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

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

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

Note: The torque values must be reduced when installing the fasteners into threaded aluminum or brass. The specified torque value should be determined based on the aluminum or base material strength, fastener size, length of thread engagement, etc.

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

Other Torque Specifications

SAE Grade 8 Steel Set Screws

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

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

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)

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

**The hole size, material strength, material thickness, and material finish must be considered when determining the specified torque values. All the torque values are based on the non-lubricated fasteners.

Conversion Factors

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

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

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

$$\text{N}\cdot\text{m} \times 0.7376 = \text{ft-lb}$$

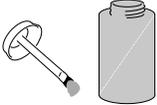
Shop Supplies

The procedures found in this *Service Manual* may recommend the use of commonly used shop supplies (lubricants, sealants, and adhesives). A symbol denoting the use of a shop supply may appear in figures that support a procedure. Always refer to the written procedure for specific information regarding the type and the application of a shop supply.

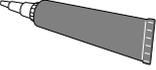
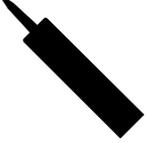
IMPORTANT

Always follow manufacturers instructions when using or storing shop supplies.

Shop Supplies

<p>ANTI-SEIZE LUBRICANT</p> <p>Used to prevent corrosion, galling, and seizure between metal parts. Most often applied to shafts and bores during assembly. Unless otherwise specified, high viscosity regular grade lithium-graphite based anti-seize lubricant should be used.</p>	
<p>GREASE</p> <p>Can be used to pre-fill (pack) bearings, boots, and seals before assembly, ease installation of components during assembly, or fill cavities between moving parts through grease fittings after assembly. Unless otherwise noted, refer to the machine <i>Operator's Manual</i> or <i>Installation Instructions</i> for grease specifications.</p>	
<p>THREAD LOCKING COMPOUND (thread locker)</p> <p>Used to lock threaded fasteners in position. Available in low, medium and high strength for various size fasteners and applications. Most thread locking compounds are applied immediately prior to fastener installation. Some thread locking compounds use a "Wicking" feature, and can be applied after fastener installation. Most thread locking compounds allow the fastener to be removed with standard tools once cured. High strength thread locking compounds may require applying heat to the fastener and the surrounding area to allow fastener removal.</p> <p>Note: Some fasteners have a dry thread locking compound pre-applied (Patch-Loc) so no additional thread locking compound is necessary when installing a "new" fastener. These fasteners are designed to be removed and re-installed only once before applying additional thread locking compound is necessary.</p>	
<p>RETAINING COMPOUND (bearings and sleeves)</p> <p>An adhesive used to secure bearings, bushings, and cylindrical parts into housings or onto shafts. When cured, bearing and sleeve retaining compound fills the gap between mating parts with a hard resin that increases load distribution and protects against corrosion.</p>	
<p>ADHESIVE</p> <p>Used to secure a variety of components immediately prior to assembly. May be recommended for installing new components or when reusing a component that had a pre-applied adhesive such as hood seals, mouldings, and weather-stripping.</p>	
<p>THREAD SEALANT</p> <p>Used to seal threaded fittings and sensors from air, fuel, and oil pressure leaks and prevent galling and seizure between threaded parts. A thread sealant in paste form is preferred over sealant tape. The sealant should remain semi-pliable to allow for component removal with standard tools. Some thread sealants may require the use of a cleaner or primer prior to use.</p>	

Shop Supplies (continued)

<p>GASKET COMPOUND</p> <p>Used to create a seal between mating parts. Gasket compounds may be used with or without the presence of a pre-formed gasket. Gasket compounds may be solvent or silicone based, and cure when exposed to air or designed to cure in an air-less environment (anaerobic). Most gasket compounds are designed to be applied to clean surfaces free of oil, chemical residue and previously used gaskets or gasket compounds.</p>	
<p>SILICONE SEALANT</p> <p>Designed for a broad variety of sealing and bonding requirements, silicone sealants are usually room temperature vulcanizing (RTV) which form a flexible silicone rubber that bonds to a wide variety of smooth or porous materials when cured. Standard silicone sealants are designed to perform in temperatures from -51°F to 232°C (-60°F to 400°F), while high temperature variants can perform in temperatures up to 343°C (650°F).</p>	

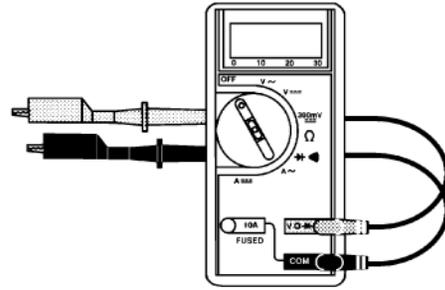
Special Tools

Multimeter

Obtain this tool locally

The meter can test the electrical components and circuits for current, resistance, or voltage.

Note: Use a digital multimeter when testing the electrical circuits. The high impedance (internal resistance) of a digital meter in the voltage mode ensures that the excess current is not allowed through the meter. This excess current can damage the circuits that are not designed to carry it.



Battery Terminal Protector

Toro Part No. 107-0392

Use this aerosol spray on the battery terminals, ring terminals, and fork terminals to reduce corrosion problems. Apply the terminal protector to the connection after you secure the battery cable, ring terminal, or fork terminal.



Dielectric Gel

Toro Part No. 107-0342

Use the dielectric gel to prevent corrosion of unsealed connection terminals. To ensure complete coating of the terminals, liberally apply the gel to the component and wire harness connector, plug the connector into the component, disconnect the connector, apply the gel to both surfaces again, and connect the harness connector to the component again. The connectors must be fully packed with gel for effective results.

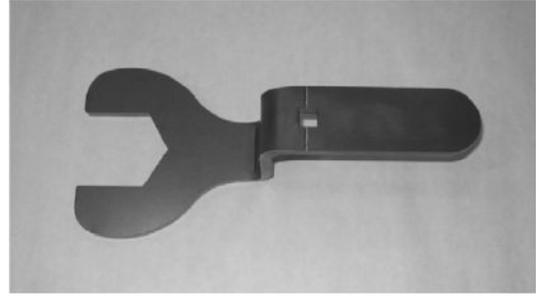


Note: Do not use the dielectric gel on the sealed connection terminals as the gel can unseat the connector seals during assembly.

Offset Wrench

Toro Part No. TOR6006

The offset wrench is used to tighten the nut that secures the blower rotor assembly to the fan shaft. Use with 1/2 inch torque wrench at right angle to the offset wrench handle to ensure that proper torque is applied to the nut.



Shaft Alignment Tool

Toro Part No. 137-6616

The shaft alignment tool is used to align the engine output shaft with the blower shaft if the engine, blower drive shaft, or blower assembly is removed. The tool also sets the proper distance between the engine and blower assembly.

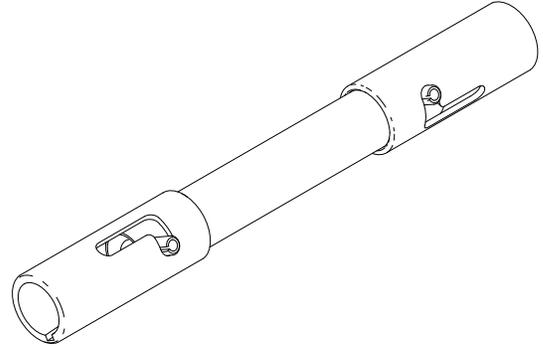




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The information In this chapter is intended to help troubleshoot machine operation issues. Keep in mind there can be more than one cause for a machine malfunction.

GEARS – The Systematic Approach to Defining, Diagnosing and Solving Problems

Gather Information

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

Evaluate Potential Causes

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

Assess Performance

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

Repair

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

Solution Confirmation

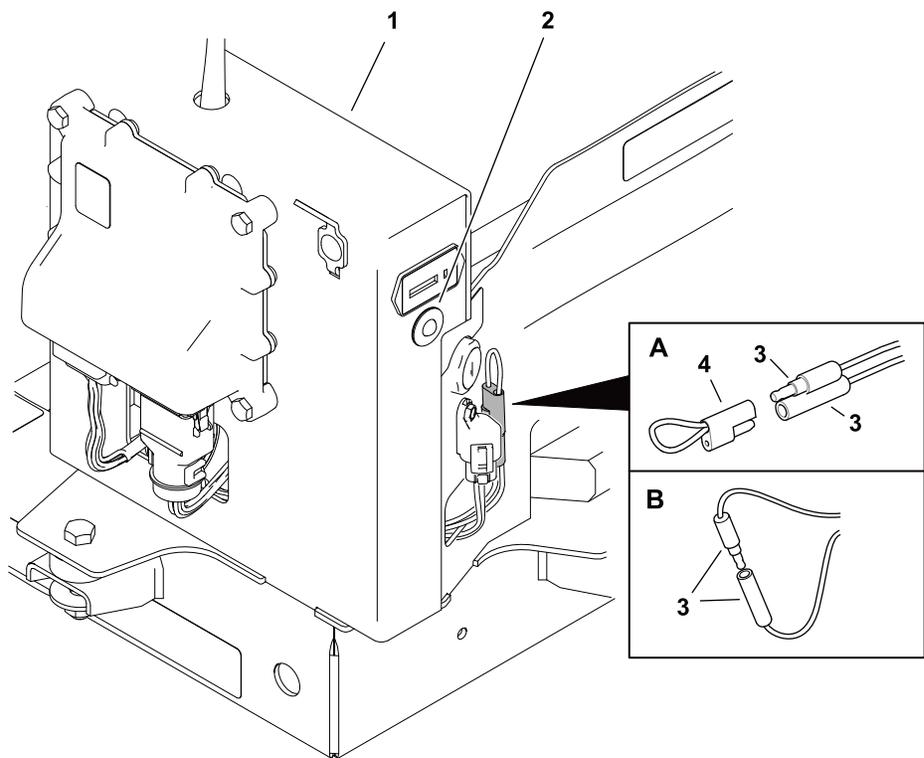
- Did the issue go away
- Was the root cause of the issue correctly repaired
- Are there any other new symptoms

Using the Onboard Diagnostic Lamp

Machines with wireless hand held remote control (Models 44552, 44552TE, and 44553) have a diagnostic light located on the control tower below the hour meter. The diagnostic light is an output of the Toro Electronic Controller (TEC) that indicates normal machine operation or the presence of active machine faults. After you turn the key to the RUN position, the diagnostic light illuminates for 5 seconds, turns off for 5 seconds, and then flashes until you start the engine with the key switch or push a button on the handheld remote.

The diagnostic light will flash rapidly if no signal from the hand held remote has been received within 10 seconds of setting the key switch to the RUN position, if the hand held remote is out of range, has low batteries, or is not associated to the RF2CAN module. The diagnostic light should illuminate while a button on the hand held remote is pressed.

If the key switch is set to the RUN position and the diagnostic light turns on for 5 seconds then starts flashing rapidly (with or without a pause) an active machine fault exists.



g279310

Figure 6

1. Control tower
2. Diagnostic light
3. Shunt connectors
4. Tethered cap

Entering Diagnostic Mode

1. Set the key switch to the OFF position.
2. Locate the diagnostic shunt connectors, remove the tethered cap and connect the shunt connectors together.
3. Set the key switch to the RUN position.
4. Count and record the flash pattern of the diagnostic light.

Entering Diagnostic Mode (continued)

Note: If there are multiple machine faults active, each fault will flash followed by a long pause. After each active faults has been displayed, the fault sequence will repeat. If no active faults exist, the diagnostic light will flash continuously once per second.

Fault Code	Diagnostic Lamp Flash Pattern	Fault Description	Corrective Action
11	Flash once – pause – flash once, long pause then repeat or display next fault	Communication between the TEC and RF2CAN module has been lost	The wire harness connector at the TEC or at the RF2CAN module is loose, corroded, or damaged The RF2CAN module circuit wiring is damaged; refer to Appendix A (page A-1) RF2CAN module may be damaged, contact your authorized Toro Distributor
12	Flash once – pause – flash twice, long pause then repeat or display next fault	Incompatible software exists on one or more of the control system nodes (TEC, RF2CAN module, and hand held remote)	Associate the hand held remote; refer to the machine Operator's Manual Reload the machine software, contact your authorized Toro Distributor
13	Flash once – pause – flash three times, long pause then repeat or display next fault	Wrong product hand held remote being associated	Although the Pro Sweep hand held remote may look similar, it cannot be associated to the Pro Force Debris Blower RF2CAN module. Use a Pro Force hand held remote for association
14	Flash once – pause – flash four times, long pause then repeat or display next fault	Energize to Run (ETR) circuit was interrupted due to a low oil pressure condition for 10 seconds	Check and adjust the oil level as necessary Test the engine oil pressure switch and replace if necessary
15	Flash once – pause – flash five times, long pause then repeat or display next fault	Energize to Run (ETR) circuit was interrupted due to low voltage (less than 5.5 V)	Test the battery condition, Charge the battery and replace if necessary Test the engine voltage regulator/rectifier and replace if necessary Test the engine alternator and replace if necessary

- Set the key switch to the OFF position.

Clearing Active Machine Faults

1. Resolve the active fault(s).
2. While in diagnostic mode (shunt connectors together), set the key switch to the RUN position.
3. Disconnect the diagnostic shunt connectors, then reconnect them. The diagnostic light will flash continuously once per second if all the active faults have been cleared.
4. Set the key switch to the OFF position.

Exiting Diagnostic Mode

1. Set the key switch to the OFF position.
2. Disconnect the diagnostic shunt connectors and install the tethered cap.
3. Store the diagnostic connector assembly in the control tower.

Starting Problems

Problem	Possible Cause	Corrective Action
The starter solenoid clicks, but the starter does not crank	The battery charge is low	Charge the battery
	The battery is discharged or damaged	Charge and test the battery
		Replace the battery if necessary
	The battery cables are loose or corroded	Clean and secure the battery cables
	The ground connection is loose or corroded	Clean and secure the ground connections at the engine block
	The wiring at the starter motor is damaged	Repair or replace starter wiring
	The starter solenoid or starter motor is damaged	Refer to the Kohler Command Pro CH740 Service Manual for starter solenoid and starter motor information.
Nothing happens when you attempt to start the engine using the key switch	The battery is discharged or damaged	Charge and test the battery
		Replace the battery if necessary
	The battery cables are loose or corroded	Clean and secure the battery cables
	The ground connection is loose or corroded	Clean and secure the ground connections at the engine block
	A fuse is damaged	Test the fuse and replace it if necessary F-1 (7.5 A), F-2 (7.5 A), F-3 (15 A), and/or F-4 (2 A) if necessary; refer to Fuses in Chapter 5 – Electrical System
	A relay is damaged	Test the start relay and main power relay and replace them if necessary; refer to Component Testing in Chapter 5 – Electrical System
	The key switch is damaged	Test the key switch and replace it if necessary; refer to Component Testing in Chapter 5 – Electrical System
	The wiring to the start circuit components is corroded, loose, or damaged	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	The wiring at the starter motor is damaged	Test the circuit wiring and replace it as necessary
	The starter solenoid or starter motor is damaged	Refer to the Kohler Command Pro CH740 Service Manual for starter solenoid and starter motor information.

Starting Problems (continued)

Problem	Possible Cause	Corrective Action
Models 44552, 44552TE, and 44553 – Nothing happens when you attempt to start the engine using the wireless remote		Attempt to start the engine with the key switch. If the engine starts, troubleshoot the wireless remote as follows:
	The batteries in the wireless remote are discharged or installed improperly	Test the batteries and replace them if necessary
		Make sure the batteries are properly installed; refer to Wireless Remote in Chapter 5 – Electrical System
	The association between the wireless remote and the control module has been lost	Re-establish remote control-to-base unit communication; refer to the machine <i>Operator's Manual</i>
	The wireless remote or control module is damaged	Replace the wireless remote
The engine cranks, but does not start	The fuel tank is empty	Fill the fuel tank
	The engine and/or fuel is too cold	Use the choke to start the engine
		Move the machine to a heated environment prior to starting
	The fuel filter is plugged	Replace the fuel filter
	The fuel pump is damaged	Test the pulse fuel pump and repair/replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for pulse fuel pump information
	Fuse F–2 (7.5 A) is damaged	Test the fuse and replace it if necessary; refer to Fuses in Chapter 5 – Electrical System
	The Governor Control Unit (GCU) has lost power	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	The fuel/carburetor solenoid or its circuit wiring is damaged	Test the carburetor solenoid and replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for fuel shut-off solenoid information
		Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
The engine is malfunctioning	Troubleshoot the engine; refer to the Kohler Command Pro CH740 Service Manual	

General Operation Problems

Problem	Possible Cause	Corrective Action
The battery does not charge	The battery cables are loose or corroded	Clean and secure the battery cables
	The ground connection is loose or corroded	Clean and secure the ground connections at the engine block
	The battery is discharged or damaged	Charge and test the battery
		Replace the battery if necessary
	The in-line charging circuit fuse F-5 (30 A) is damaged	Test the fuse and replace it if necessary; refer to Fuses in Chapter 5 – Electrical System
	The voltage regulator/rectifier is damaged	Test the voltage regulator/rectifier and replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for regulator/rectifier information
	The charging circuit wiring is corroded, loose, or damaged	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A

General Operation Problems (continued)

Problem	Possible Cause	Corrective Action
The engine shuts off during operation	Models 44552, 44552TE, and 44553 – The controller has switched to Power Save Mode after 2.5 hours of no communication from the wireless remote	Cycle the key switch to the OFF position and then turn the key switch to the RUN position
	The engine oil pressure is low	Check and adjust the engine oil level if necessary
	The oil pressure switch has failed	Test the oil pressure switch; refer to the Kohler Command Pro CH740 Service Manual for oil pressure switch information
		Clean, secure or repair/replace the switch circuit wiring; Refer to the Electrical Schematics in Appendix A
	The fuel tank is empty	Fill the fuel tank
	The fuel filter is plugged	Replace the fuel filter
	The fuel pump has failed	Test the pulse fuel pump and repair/replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for pulse fuel pump information
	The fuel/carburetor solenoid or its circuit wiring has failed	Test the carburetor solenoid and replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for fuel shut-off solenoid information
		Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	A component in the engine run circuit (fuses, key switch, main power relay) has failed	Test the engine run circuit components and replace it if necessary; refer to Fuses in Chapter 5 – Electrical System
	The engine run circuit wiring is corroded, loose, or damaged	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	The engine is malfunctioning	Troubleshoot the engine; refer to the Kohler Command Pro CH740 Service Manual

General Operation Problems (continued)

Problem	Possible Cause	Corrective Action
The nozzle does not rotate	The drive belt is loose or damaged	Adjust the drive belt or replace it as necessary; refer to the machine <i>Operator's Manual</i>
	A nozzle relay is damaged	Test nozzle relay 1 and nozzle relay 2 and replace them if necessary; refer to Component Testing in Chapter 5 – Electrical System
	The nozzle rotation motor is damaged	Test the nozzle rotation motor and replace it if necessary; refer to Component Testing in Chapter 5 – Electrical System
	The nozzle rotation circuit wiring is corroded, loose, or damaged	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	Models 44552, 44552TE, and 44553 – The wireless remote is not functioning, (engine speed control is not functioning also)	Test the wireless remote batteries and replace them if necessary
		Make sure the batteries are properly installed; refer to Wireless Remote in Chapter 5 – Electrical System
		Re-establish “associate” remote control-to-base unit communication; refer to the machine <i>Operator's Manual</i>
		Replace the wireless remote as it may be damaged
	Model 44554 – Fuse F-1 (7.5 A) is damaged	Test the fuse and replace it if necessary; refer to Fuses in Chapter 5 – Electrical System
	Model 44554 – The nozzle direction switch or circuit wiring is damaged	Test the nozzle direction switch and replace it if necessary; refer to Component Testing in Chapter 5 – Electrical System
	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A	

General Operation Problems (continued)

Problem	Possible Cause	Corrective Action
The engine speed does not change	Models 44552, 44552TE, and 44553 – The wireless remote is not functioning, (nozzle rotation control is not functioning also)	Test the wireless remote batteries and replace them if necessary
		Make sure the batteries are properly installed; refer to Wireless Remote in Chapter 5 – Electrical System
		Re-establish “associate” remote control-to-base unit communication; refer to the machine <i>Operator’s Manual</i>
		Replace the wireless remote as it may be damaged
	Model 44554 – Fuse F–1 (7.5 A) is damaged	Test the fuse and replace it if necessary; refer to Fuses in Chapter 5 – Electrical System
	Model 44554 – The engine speed control or circuit wiring is damaged	Test the engine speed control and replace it if necessary; refer to Component Testing in Chapter 5 – Electrical System
		Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	The engine speed control circuit wiring is corroded, loose, or damaged	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	The Digital Lineal Actuator (DLA) or its circuit wiring is damaged	Test the DLA and replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for DLA information
		Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A
	The Governor Control Unit (GCU) or its circuit wiring is damaged	Test the GCU and replace it if necessary; refer to the Kohler Command Pro CH740 Service Manual for GCU information
	Clean, secure or repair/replace the circuit wiring; Refer to the Electrical Schematics in Appendix A	
Models 44552, 44552TE, and 44553 – The wireless remote does not function	The batteries in the wireless remote are discharged or installed improperly	Test the batteries and replace them if necessary
		Make sure the batteries are properly installed; refer to Wireless Remote in Chapter 5 – Electrical System
	The association between the wireless remote and the control module has been lost	Re-establish remote control-to-base unit communication; refer to the machine <i>Operator’s Manual</i>
	The wireless remote or control module is damaged	Replace the wireless remote



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Additional Reference Materials

KOHLER Command Pro CH740 Service Manual

General Information

This chapter gives the information about specifications and repair of the Kohler Command Pro CH740 gasoline engine used in the Pro Force debris blower. Described adjustments and repairs require tools that are commonly available in many service shops.

Service and repair parts for the engine in your Pro Force debris blower are supplied through your Authorized Toro Distributor. Be prepared to provide your distributor with the Toro Model and Serial Number of your machine to obtain parts.

When disposing of hazardous waste products (fuel, engine oil, hydraulic fluid, filters, etc.), take them to an authorized disposal site. Waste products must not be allowed to contaminate surface water, drains, or sewer systems.

Operator's Manual

The *Operator's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for your Pro Force Debris Blower. Refer to *Operator's Manual* for additional information when servicing the machine.

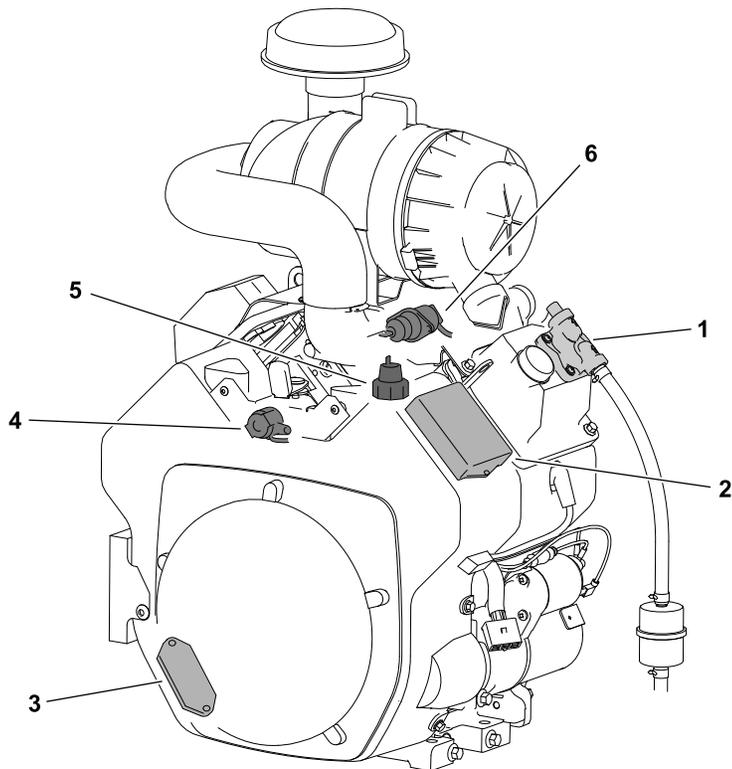
Engine Owner's Manual

The engine *Owner's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for the KOHLER Command Pro CH740 engine used on your Pro Force debris blower. A copy of the engine *Owner's Manual* is supplied with the machine. Contact your local KOHLER Engine Dealer or visit <http://kohlerengines.com> to obtain a copy of the engine *Owner's Manual*. Refer to the engine *Owner's Manual* for additional information when servicing the machine.

Engine Service Manual

Detailed information on engine troubleshooting, testing, disassembly, and assembly is given in the KOHLER Command Pro CH740 *Service Manual*. The use of some specialized tools and test equipment is explained in the KOHLER *Service Manual*. Contact your local KOHLER Engine Dealer or visit <http://kohlerengines.com> to obtain a copy of the engine *Service Manual*. Special tools are described in the KOHLER Service Manuals and the use of some specialized test equipment is explained. The cost of the test equipment and the specialized nature of some repairs may dictate that engine work be done at an engine repair facility.

Kohler Gasoline Engine



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Figure 7

- | | |
|--------------------------------|----------------------------------|
| 1. Pulse style fuel pump | 4. Fuel shut-off solenoid |
| 2. Governor control unit (GCU) | 5. Oil pressure switch |
| 3. Voltage regulator/rectifier | 6. Digital linear actuator (DLA) |

The engine includes an electronic speed control system. In addition to the necessary linkages, the speed control system includes a Governor Control Unit (GCU) and a Digital Linear Actuator (DLA). Electrical power must be available to the GCU for the engine to start and run. Engine speed is adjusted by using either the wireless or tethered remote. Refer to the KOHLER Command Pro CH740 Service Manual for additional information.

The engine includes an oil pressure switch. When oil pressure is being generated (engine is running) the switch is closed. On tethered remote machines, the closed switch provides a path to ground for the hour meter circuit. On wireless remote machines, the closed switch provides a path to ground for the hour meter circuit and is an input for the Toro Electronic Controller (TEC). The TEC begins to monitor the condition of the oil pressure switch 3 minutes after the engine is started. When the oil pressure drops too low (switch circuit opens), the engine is allowed to run for approximately 10 seconds and is then shut down.

The engine includes a pulse style fuel pump and a fuel shut-off solenoid. Oscillating crankcase pressure causes a diaphragm inside the pulse style fuel pump to pull fuel in on the piston down-stroke and to push it into carburetor on the piston up-stroke. Two check valves prevent fuel from going backward through pump. The fuel shut-off solenoid has a spring loaded pin that retracts when 12 volts is applied, allowing fuel flow to the carburetor main jet. When current is removed, the pin extends blocking the fuel flow.

Adjustments

Aligning the Engine and Blower Drive Shafts

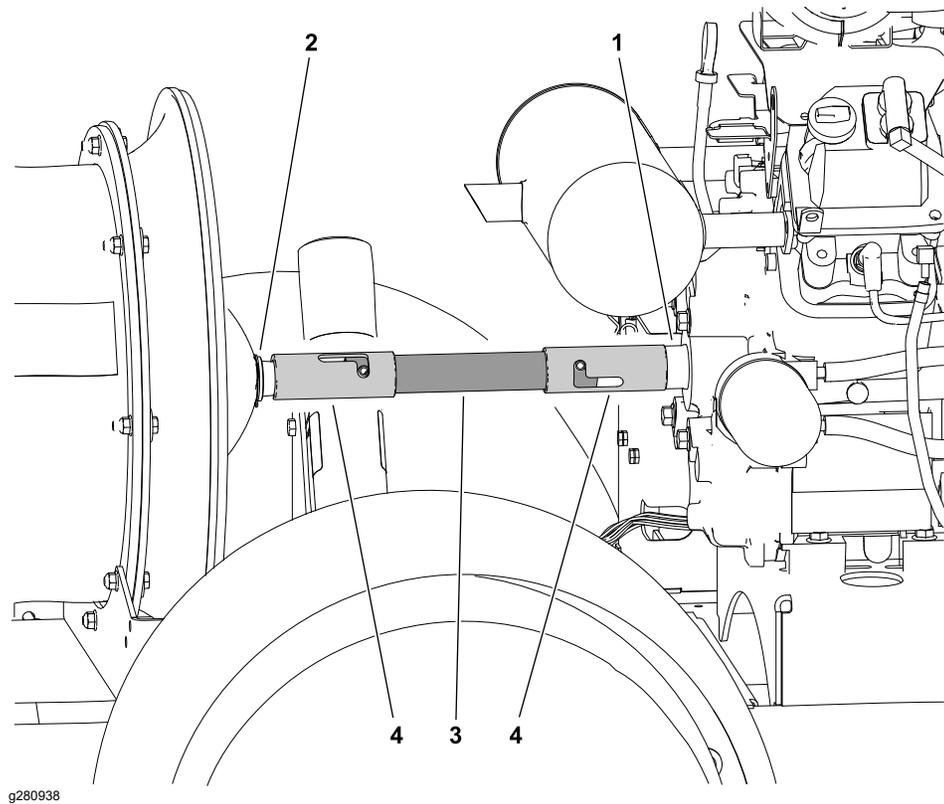


Figure 8

- | | |
|--------------------|-------------------------|
| 1. Engine | 3. Shaft alignment tool |
| 2. Blower assembly | 4. Collar (2 each) |

Align the engine output shaft with the blower shaft if the engine, blower drive shaft, or blower assembly is removed.

1. The fasteners securing the engine to the chassis should be installed finger tight.
2. Ensure a woodruff key is installed in the engine shaft and the blower shaft.
3. Fit one collar of the Shaft Alignment Tool (Toro part number 137-6616) over the blower shaft and key; refer to [Shaft Alignment Tool \(page 2-13\)](#).
4. Move the engine in its mounting slots if necessary and fit the other collar of the tool over the engine shaft and key.
5. Move the engine in its mounting slots if necessary and set the shaft to shaft distance by extending the tool fully. Twist both collars to lock the tool in the extended position.
6. Move the engine in its mounting slots if necessary until each end of the tool fits squarely on the tapered shafts and keys.
7. Tighten the engine mounting fasteners to **37 to 44 N·m (27 to 33 ft-lb)**.
8. Retract both alignment tool collars and remove the alignment tool.

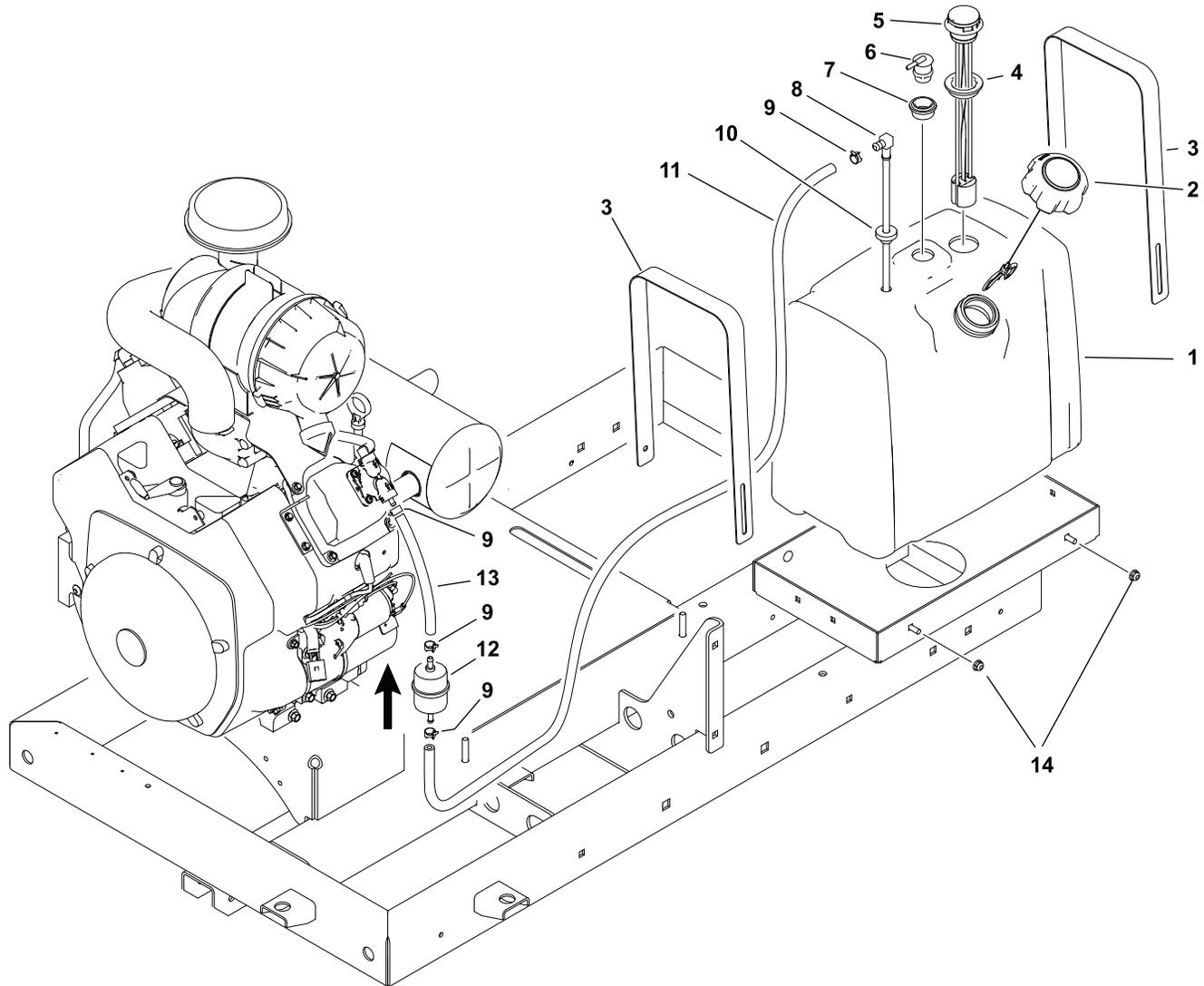


Adjusting the Engine Idle Speed

Refer to the *Kohler Command CH740 Service Manual* for additional information.

Service and Repairs

Fuel Tank



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Figure 9

- | | | |
|------------------------|------------------------|--------------------------------------|
| 1. Fuel tank | 6. Vent/rollover valve | 11. Fuel line – tank to filter |
| 2. Fuel tank cap | 7. Grommet | 12. Fuel filter |
| 3. Tank strap (2 each) | 8. Standpipe | 13. Fuel line – filter to carburetor |
| 4. Seal | 9. Hose clamp (4 each) | 14. Flange nut (4 each) |
| 5. Fuel gauge | 10. Bushing | |



DANGER



Gasoline fuel is highly flammable and explosive. A fire or an explosion from the fuel can burn you, burn other people, and damage property.

- **Use caution whenever you store or handle gasoline fuel.**
- **Do not smoke while filling the fuel tank.**
- **Do not fill the fuel tank while the engine is running, while the engine is hot, or when the machine is in an enclosed area.**
- **Always fill the fuel tank outside and wipe up any spilled gasoline fuel before starting the engine.**
- **Store fuel in a clean, safety-approved container and keep the cap in place.**
- **Use gasoline fuel as an engine fuel only, not for any other purpose.**

Checking the Fuel Lines and Connections

Check the fuel lines and connections at the scheduled maintenance intervals recommended in the *Operator's Manual*. Check the lines for deterioration, damage, leaks, or loose connections. Replace the hoses, clamps, and fittings as necessary.

Draining and Cleaning the Fuel Tank

Drain and clean the fuel tank at the maintenance intervals as recommended in the *Operator's Manual*. If the fuel system becomes contaminated or if the machine is stored for an extended period, drain and clean the fuel tank.

IMPORTANT

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

To drain the fuel tank, suck or siphon the fuel from the tank, or remove the tank from the machine and pour the contents into a suitable container.

To clean the fuel tank, flush the tank out with clean gasoline fuel. Ensure that the fuel tank is free of all contamination and debris.

Removing the Fuel Tank

Refer to [Figure 9](#) for this procedure.

1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch.
2. Record the fuel hose routing for installation purposes. Disconnect the fuel hoses from the fuel tank fittings, then cover or plug the hoses and fittings to prevent contamination from entering the fuel system.
3. Remove the flange nuts and hold down straps from the machine and remove the fuel tank.
4. Disassembly the fuel tank as necessary.

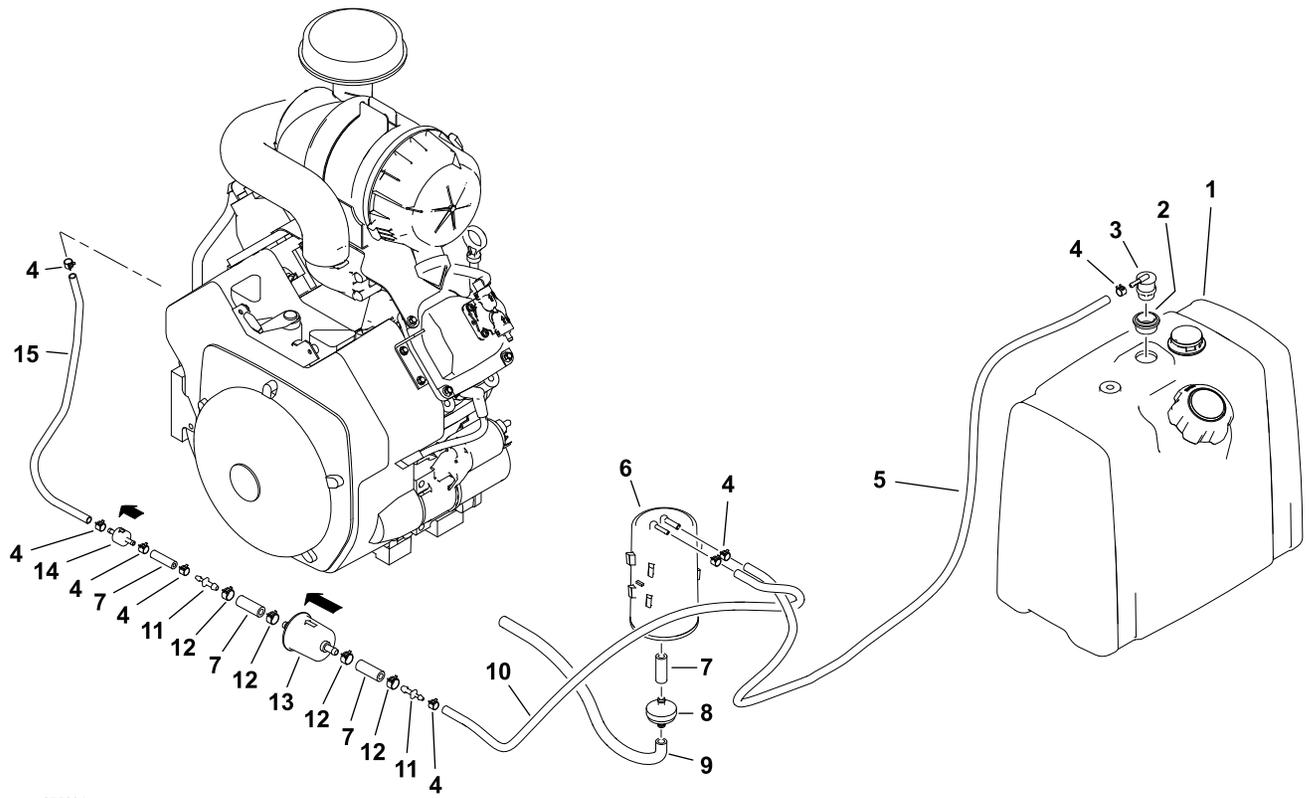
Installing the Fuel Tank

Refer to [Figure 9](#) for this procedure.

Installing the Fuel Tank (continued)

1. Install any previously removed components on the fuel tank.
2. Position the fuel tank on the machine (fuel cap outward) and install the hold down straps and flange nuts.
3. Remove the covers and plugs from the hoses and fittings, then secure the fuel hoses to the tank fittings with the hose clamps.
4. If the fuel filter (item 12) was removed, ensure that the arrow on the filter body points toward the engine.
5. Fill the fuel tank with clean fuel and start the engine. Check the fuel hoses and fittings for leaks and repair any fuel leaks before returning the machine to service.

Fuel Evaporative Control System



g275201

Figure 10

- | | | |
|-----------------------------------|-------------------------------|------------------------------------|
| 1. Fuel tank | 6. Carbon canister | 11. Barb fitting (2 each) |
| 2. Grommet | 7. Hose (3 each) | 12. Hose clamp (4 each) |
| 3. Vent/rollover valve | 8. Fresh air filter | 13. Fuel filter |
| 4. Hose clamp (8 each) | 9. Hose – fresh air | 14. Purge valve |
| 5. Hose – tank to carbon canister | 10. Hose – canister to filter | 15. Hose – purge valve to manifold |

Pro Force debris blowers are equipped with a fuel evaporative control system designed to collect and store evaporative emissions from the fuel tank. The evaporate control system uses a carbon canister and a series of vent hoses to collect these evaporative emissions. The fuel tank uses a non-vented fuel cap. A fuel tank vent/rollover valve is positioned in the top of the tank that allows tank venting through the carbon canister. Fuel vapors from the fuel tank are vented to the canister and consumed by the engine when the engine is running.

Note: If there is restriction in the carbon canister, the fuel tank vent fitting or the vent hose, the fuel tank may distort due to venting issues. If the fuel tank returns to it's normal shape when the fuel cap is removed, restriction in the evaporative control system is likely.

The carbon canister is mounted on the control tower/battery box. The evaporative system connection to the engine passes through a filter and a vacuum check/purge valve before connection to the engine intake manifold. The evaporative control system vent connection passes through a fresh air filter before it reaches the carbon canister.

Disassembling the Fuel Evaporative Control System

Refer to [Figure 10](#) for this procedure.

Disassembling the Fuel Evaporative Control System (continued)



DANGER



Gasoline fuel is highly flammable and explosive. A fire or an explosion from the fuel can burn you, burn other people, and damage property.

- **Use caution whenever you store or handle gasoline fuel.**
 - **Do not smoke while handling gasoline.**
 - **Wipe up any spilled fuel before starting the engine.**
-

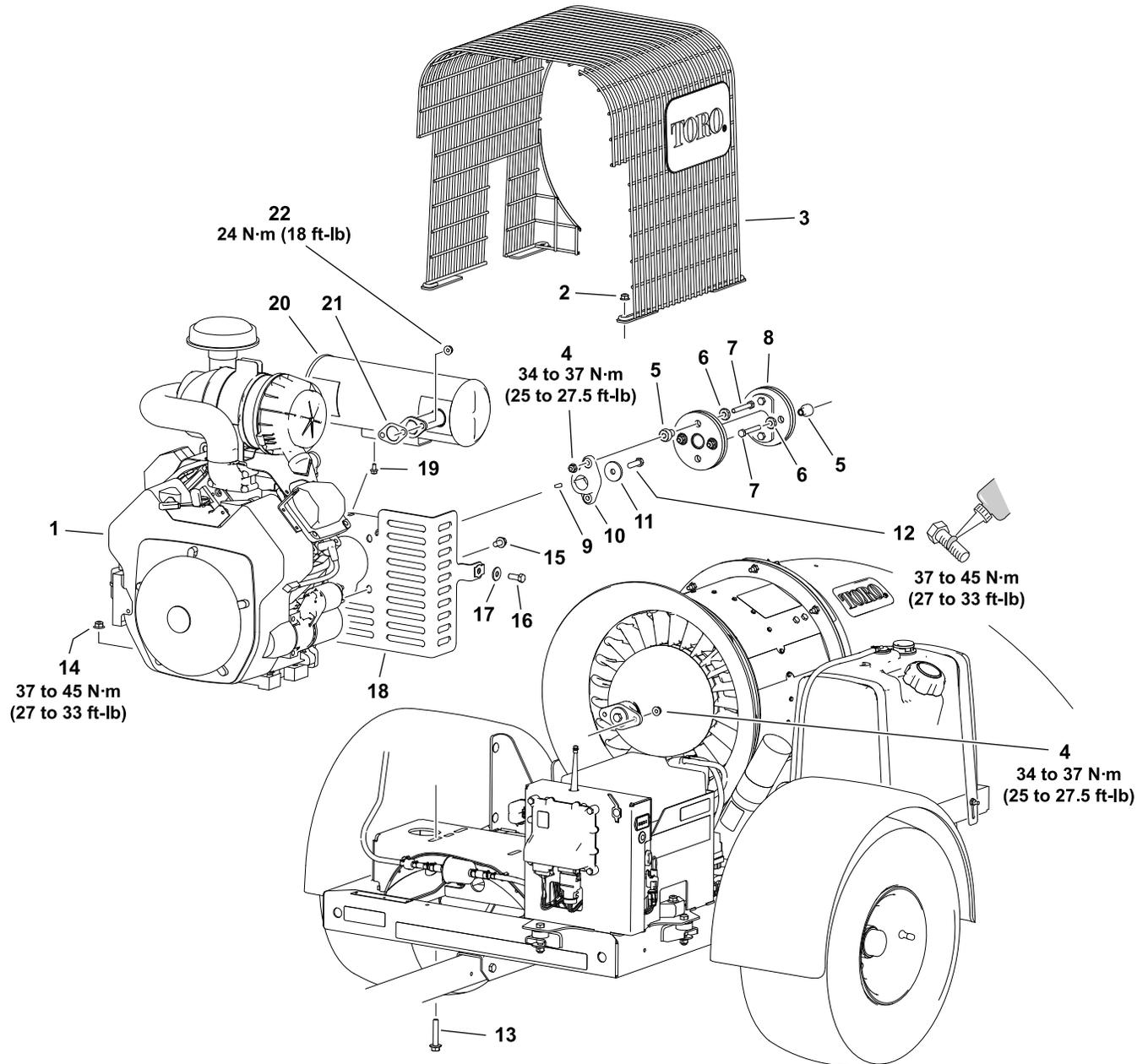
1. Inspect the carbon canister and attached hoses for damage or obvious leaks. A damaged or leaking canister should be replaced.
2. Remove the evaporative control system components as necessary. Record hose routing for assembly purposes.

Assembling the Fuel Evaporative Control System

Refer to [Figure 10](#) for this procedure.

1. If the purge valve (item 14) was removed, ensure that the arrow on the valve body points toward the engine.
2. If the fuel filter (item 3) was removed, ensure that the arrow on the filter body points toward the engine.
3. Ensure that the evaporative system hoses are not kinked after installation. Secure the hoses as recorded during disassembly.

Engine



g277842

Figure 11

- | | | |
|------------------------------------|--------------------------------|--------------------------------|
| 1. Engine | 9. Woodruff key | 17. Hardened washer (2 each) |
| 2. Flange nut (4 each) | 10. Engine shaft hub | 18. Muffler mount |
| 3. Top grill | 11. Washer | 19. Flange-head screw (2 each) |
| 4. Flange nut (4 each) | 12. Cap screw | 20. Muffler |
| 5. Rubber coupling spacer (4 each) | 13. Flange-head screw (4 each) | 21. Gasket (2 each) |
| 6. Washer (4 each) | 14. Flange nut (4 each) | 22. Flange nut (4 each) |
| 7. Cap screw (4 each) | 15. Flange-head screw (4 each) | |
| 8. Drive shaft assembly | 16. Cap screw (2 each) | |

Removing the Engine

Refer to [Figure 11](#) for this procedure.

Removing the Engine (continued)

1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch. Block the wheels with chocks to prevent the machine from moving.
2. Remove the top grill.
3. Disconnect the negative battery cable from the battery terminal; refer to [Servicing the Battery \(page 5–37\)](#).

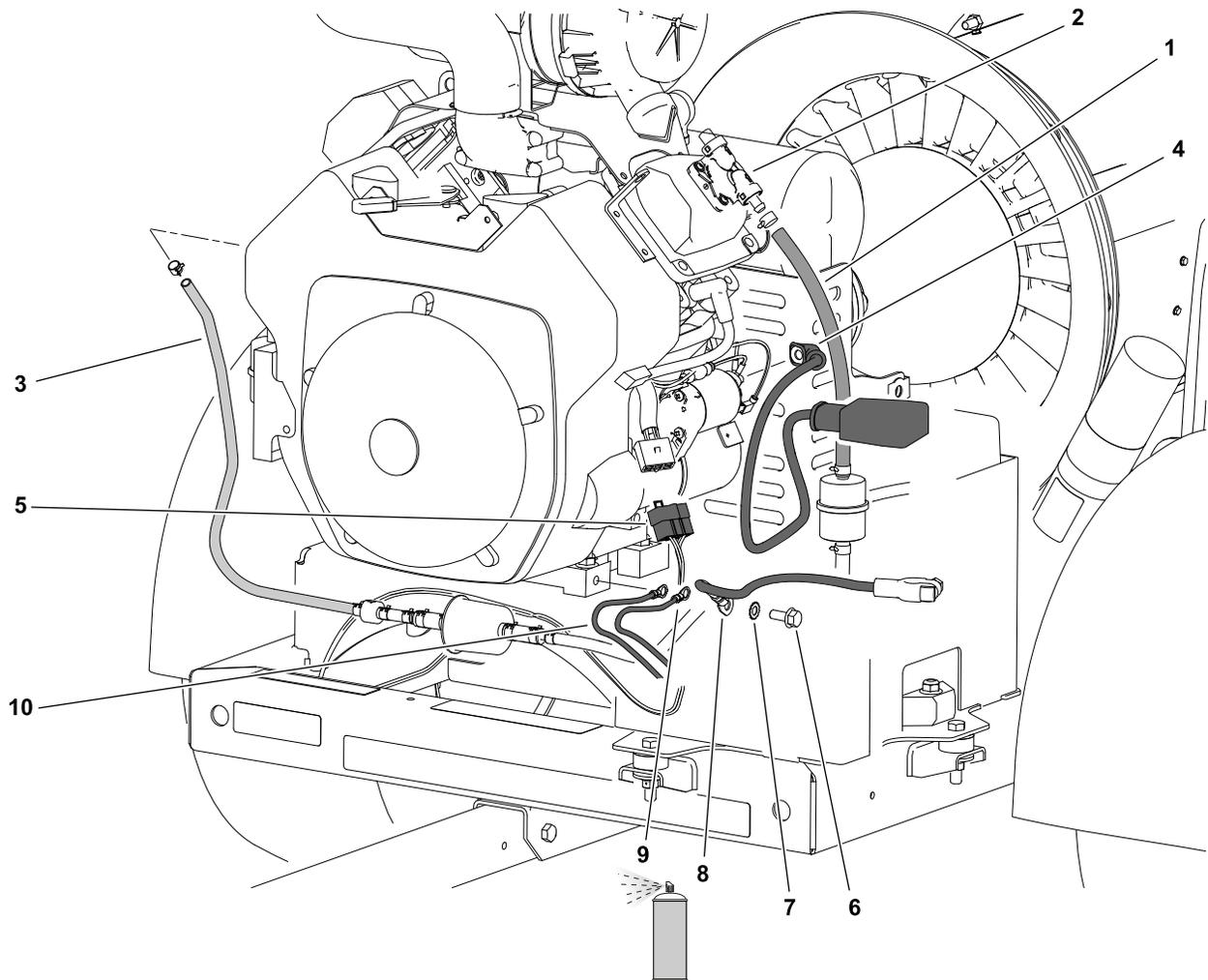


A hot engine and exhaust system can cause burns.

Allow the engine and the exhaust system to cool before removing the engine.

4. Disconnect the fuel supply hose at the fuel pump. Cover or plug the disconnected hose and the fuel pump inlet to prevent fuel system contamination.

Removing the Engine (continued)



g277747

Figure 12

- | | | |
|----------------------------------|-------------------------------------|------------------------|
| 1. Fuel supply hose | 5. Multi-pin wire harness connector | 9. Wire harness ground |
| 2. Fuel pump | 6. Flange-head screw | 10. Engine ground |
| 3. Fuel evaporative control hose | 7. Lock washer | |
| 4. Positive battery cable | 8. Negative battery cable | |

5. Disconnect the fuel evaporative control hose at the intake manifold. Cover or plug the disconnected hose and the intake manifold inlet to prevent fuel evaporative control system contamination.
6. Clean up any spilled fuel and position the disconnected hoses away from the engine.
7. Disconnect the positive battery cable from the starter motor stud.
8. Disconnect the multi-pin wire harness connector from the engine.
9. Remove the screw and lock washer that secure the negative battery cable, wire harness ground, and engine ground connector to the engine..
10. Remove the bolts, washers, and flange nuts that secure the drive shaft assembly to the hubs on the engine shaft and blower shaft.
11. Lift the drive shaft assembly from the machine and retrieve the rubber coupling spacers.
12. Remove the 4 flange-head screws and 4 flange nuts that secure the engine to the chassis.

Removing the Engine (continued)



CAUTION



Use an appropriate lift and the lifting lugs provided to prevent the engine from falling and causing personal injury or product damage. The weight of the engine is approximately 53 kg (116 lb).

13. Carefully remove the engine from the machine.
14. Remove the muffler, muffler mount, and engine shaft hub if necessary.

Installing the Engine

Refer to [Figure 11](#) for this procedure.

1. Ensure that all parts that were removed from the engine are properly installed.
2. If the muffler was removed:
 - A. Remove any remaining gasket material and install new exhaust gaskets.



- B. Tighten the nuts that secure the muffler to the engine to **24 N·m (18 ft-lbs)**.

3. If the engine shaft hub was removed:
 - A. Clean the tapers of the shaft and hub.
 - B. Install a woodruff key in the engine shaft.
 - C. Apply medium strength thread locking compound and install the hub, washer, and hub retaining bolt.



- D. Tighten the hub retaining bolt from **37 to 45 N·m (27 to 33 ft-lb)**.

4. Install the muffler mount if previously removed.



CAUTION



Use an appropriate lift and the lifting lugs provided to prevent the engine from falling and causing personal injury or product damage. The weight of the engine is approximately 53 kg (116 lb).

IMPORTANT

When installing the engine ensure that you do not damage the engine, fuel hoses, electrical harness, or other parts.

5. Carefully position the engine on the chassis.
6. Install the 4 flange-head screws and flange nuts that secure the engine to the chassis finger tight.
7. Use the Shaft Alignment Tool to align the engine output shaft to the blower shaft; refer to [Aligning the Engine and Blower Drive Shafts \(page 4–4\)](#).
8. Fit the rubber coupling spacers into the couplings and position the drive shaft assembly between the engine shaft and blower shaft hubs.

Installing the Engine (continued)



9. Secure the drive shaft to the hubs with the bolts, washers, and flange nuts. Tighten the drive shaft mounting fasteners to **34 to 37 N·m (25 to 27.5 ft-lb)**.
10. Secure the engine ground connector, wire harness ground, and negative battery cable to the engine with the screw and lock washer ([Figure 12](#)). Coat the ring terminals with Battery Terminal Protector; refer to [Special Tools \(page 2–12\)](#).
11. Connect the multi-pin wire harness connector to the engine.
12. Connect the positive battery cable to the starter motor stud.
13. Remove any caps or plugs and connect the fuel evaporative control hose to the intake manifold with a hose clamp.
14. Remove any caps or plugs and connect the fuel supply hose to the fuel pump with a hose clamp.
15. Install the 2 fasteners securing the muffler to the muffler mount.
16. Install the top grill.



17. Connect the negative battery cable to the negative battery terminal. Tighten the nut that secures the battery cable to **14 to 20 N·m (10 to 15 ft-lb)**. Install the battery cover.
18. Check the engine oil level and adjust as necessary.
19. Start and operate the engine controls before returning the machine to service.



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General Information

IMPORTANT

Before performing any welding on the machine, turn the key switch to the OFF position. To prevent damage to the machine electrical system, disconnect the ground (-) cable from the engine when welding on the chassis.

Operator's Manual

The *Operator's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for your Pro Force Debris Blower. Refer to the *Operator's Manual* for additional information when servicing the machine.

Kohler Engine Electrical Components

When servicing or troubleshooting the engine electrical components, use the correct engine service manual and troubleshooting manual. The Kohler engine service and manual is available online, and on the Toro Service Reference flash drive.

Toro Electronic Controller (TEC)

Wireless controlled Pro Force Debris Blowers (Models 44552, 44552TE, and 44553) use a Toro Electronic Controller (TEC) to manage machine electrical functions. The TEC is a 2403 series microcontroller that monitors the condition of various machine switches (inputs) and directs electrical power to control appropriate machine functions (outputs) based on the state of the inputs. The TEC works in conjunction with the Toro Wireless Modules (TWMs) to manage power to the engine start relay and the nozzle control relays. The TEC also manages power to the following Kohler engine components: governor control unit, the fuel shut-off solenoid, and the ignition modules.

The TEC is attached to the machine control tower. Power for the TEC logic and memory is available at all times (unswitched). The logic and memory circuit is protected by a 2 Amp fuse (F-4). Power for the TEC outputs is available when the main power relay is energized (key switch is in the ON or START position). A pair of 7.5 Amp fuses (F-1 and F-2) protect the TEC output circuits.

The Toro Electronic Controller (TEC) and the Toro Wireless Modules (TWMs) communicate with each other on a Controller Area Network (CAN) bus system.

Note: The Toro Electronic Controller (TEC) and the Toro Wireless Modules (TWMs) used on the Pro Force Debris Blower are matched for correct machine operation. If any of these components are replaced for any reason, system software needs to be reloaded (contact an Authorized Toro Distributor for assistance).

Toro Wireless Modules (TWMs)

Wireless controlled Pro Force Debris Blowers (Models 44552, 44552TE, and 44553) use Toro Wireless Modules (TWMs) to allow the operator to control the blower from the tow vehicle without the need for a tethered control box. There are two TWMs used on the machine. The first is a 240005 series RF2CAN (radio frequency to CAN) controller, and the second is a 240006 series wireless handheld remote control.

The RF2CAN controller is attached to the machine control tower. Power for the RF2CAN logic and memory is available at all times (unswitched). The logic and memory circuit is protected by a 2 Amp fuse (F-4). The wireless handheld remote control is powered by 4 size AAA 1.5 volt batteries.

The Toro Electronic Controller (TEC) and the Toro Wireless Modules (TWMs) communicate with each other on a Controller Area Network (CAN) bus system.

Note: The Toro Electronic Controller (TEC) and the Toro Wireless Modules (TWMs) used on the Pro Force Debris Blower are matched for correct machine operation. If any of these components are replaced for any reason, system software needs to be reloaded (contact an Authorized Toro Distributor for assistance).

CAN-bus Communications

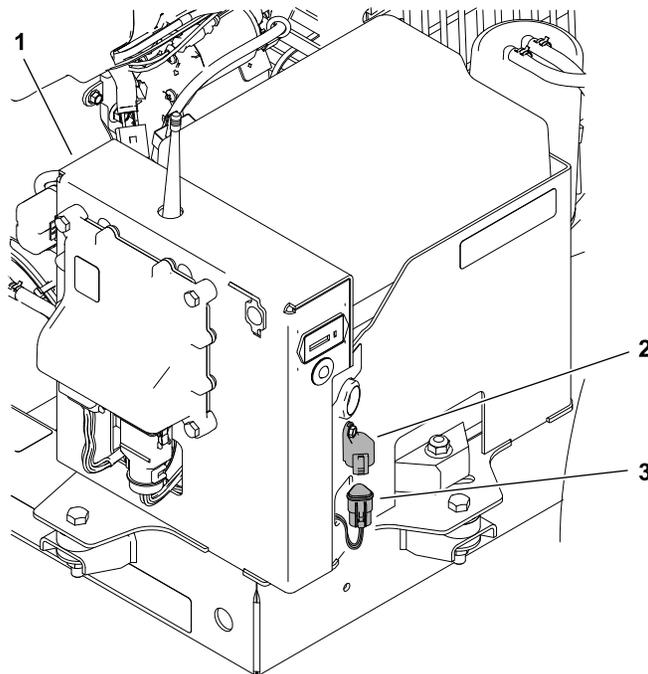
The Toro Electronic Controller (TEC) and the Toro Wireless Modules (TWMs) used on wireless controlled Pro Force Debris Blowers (Models 44552, 44552TE, and 44553) communicate with each other on a Controller Area Network (CAN) bus system. Using this network integrates all the different electrical components of the machine and brings them together as one. The CAN bus system reduces the number of electrical components and connections used on the machine and allows the number of wires in the wire harness to be significantly reduced.

Each of the components that is controlled by the CAN bus network only needs four (4) wires to operate and communicate to the system: CAN High, CAN Low, power and ground. The key switch needs to be in the RUN or START position for the components on the network to be activated.

Two specially designed, twisted wires form the CAN bus. These wires provide the data pathways between the components on the network. The engineering term for these cables are CAN High and CAN Low. The CAN bus wires are either red/white or yellow (CAN-High) and black/white or green (CAN Low). At each end of the twisted pair of bus cables is a 120 ohm termination resistor; refer to [CAN bus Terminator Resistors \(page 5–27\)](#).

The can bus is incorporated into the machine wire harness of all model 44552, 44552TE, 44553, and 44554 machines. Only machines with wireless remote control (model 44552, 44552TE, and 44553) have components that use the CAN bus for communication.

The Toro DIAG electronic control diagnostics service system is available to Authorized Toro Distributors to support machine fault diagnosis and maintenance services of the machine electrical control devices. The Toro DIAG connector is located on the left side of the machine control tower.



g278232

Figure 13

1. Machine control tower
2. Connector cover
3. Toro DIAG connector

Electrical Schematics and Wire Harness Drawings/Diagrams

Refer to the Electrical Schematics and Wire Harness Drawings/Diagrams in [Appendix A \(page A-1\)](#).

Electrical System Quick Checks

Testing the Battery (Open Circuit Test)

Use a multimeter to measure the voltage between the battery terminals; refer to [Battery Test Table \(page 5–6\)](#).

Set the multimeter to the DC volts settings. The battery must be at a temperature of 16°C to 38°C (60°F to 100°F). Ensure that the key is in the OFF position and all the accessories are turned off.

Connect the positive (+) multimeter lead to the positive battery post and negative (-) multimeter lead to the negative battery post.

Measure and record the battery voltage. Use the [Battery Test Table \(page 5–6\)](#) to determine charge level of the battery.

Note: This test provides a relative condition of the battery. The load testing of the battery provides additional and more accurate information; refer to [Servicing the Battery \(page 5–37\)](#).

Battery Test Table

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

Testing the Charging System

This is a simple test that determines if a charging system is functioning. It tells you if the charging system has an output, but not its capacity.

1. Use a digital multimeter to set DC volts and connect the positive (+) multimeter lead to the positive battery post and negative (-) multimeter lead to the negative battery post. Record the battery voltage.
2. Keep the multimeter leads connected to the battery posts and start the engine. The battery voltage while the engine is cranking, then must increase once the engine is running.

Note: Depending upon the condition of the battery charge and battery temperature, the battery voltage increases at different rates as the battery charges.

3. Start the engine and run it at high-idle speed (3,550 to 3,650 rpm). Allow the battery to charge for a minimum time of 3 minutes and record the battery voltage. After running the engine for a minimum time of 3 minutes, the battery voltage must be minimum 0.50 V higher than that of the initial battery voltage.

Refer to the [Battery Voltage Table \(page 5–7\)](#) for an example of a properly functioning charging system.

Testing the Charging System (continued)

Battery Voltage Table

Charging System Performance: at least 0.50 V over the initial battery voltage	
Initial battery voltage	= 12.30 V
Battery voltage after 3 minutes charge	= 12.85 V
Difference	= +0.55 V

Testing the Electrical Components

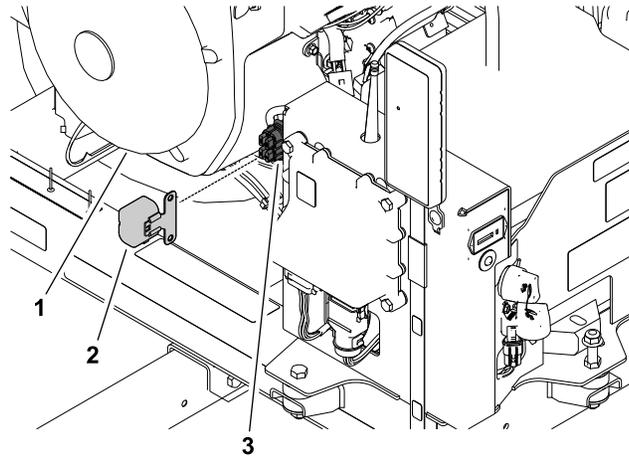
For accurate resistance and/or continuity checks, electrically disconnect the component being tested from the circuit (e.g., disconnect the key switch connector before doing a continuity check of the switch).

IMPORTANT

When testing the electrical components for continuity with a multimeter (ohms setting), ensure that you disconnect the power to the circuit.

Fuses

The individual control circuits are protected by a variety of fuses (F-1 – F-4) found in the fuse block located on the machine control tower next to the engine (Figure 14).

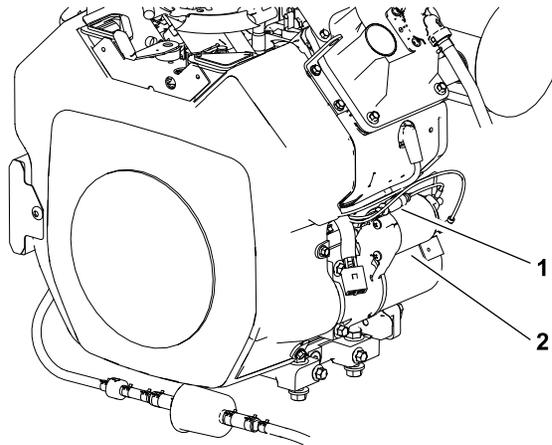


g233941

Figure 14

1. Engine
2. Fuse block cover
3. Fuse block

The engine wire harness includes a 30A in-line fuse (F-5) for charging circuit protection. The engine fuse is located near the starter motor (Figure 15).

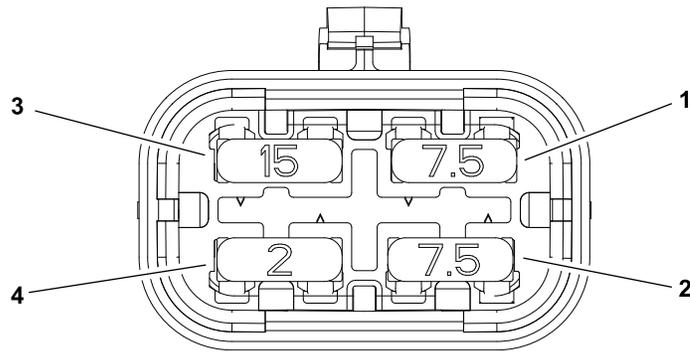


g233945

Figure 15

1. Engine fuse
2. Starter motor

Identification and Function



g234233

Figure 16

- | | |
|---------------------|--------------------|
| 1. Fuse F-1 (7.5 A) | 3. Fuse F-3 (15 A) |
| 2. Fuse F-2 (7.5 A) | 4. Fuse F-4 (2 A) |

Models 44552, 44552TE, and 44553

- Fuse F-1 (7.5 A) protects the power supply to TEC outputs 1-3
- Fuse F-2 (7.5 A) protects the power supply to TEC outputs 4-6
- Fuse F-3 (15 A) protects the unswitched power supply to the key switch, main power relay, and start relay
- Fuse F-4 (2 A) protects the unswitched power to the TEC and TWM (RF2CAN controller)
- Fuse F-5 (30 A) protects the battery charging circuit

Model 44554

- Fuse F-1 (7.5 A) protects the power supply to the engine speed control and the nozzle direction switch
- Fuse F-2 (7.5 A) protects the power supply to the Kohler engine governor control unit, the fuel shut-off solenoid, and the ignition modules
- Fuse F-3 (15 A) protects the unswitched power supply to the key switch (tether control box), main power relay, and start relay
- Fuse F-4 (2 A) not required for this model
- Fuse F-5 (30 A) protects the battery charging circuit

Testing the Fuses

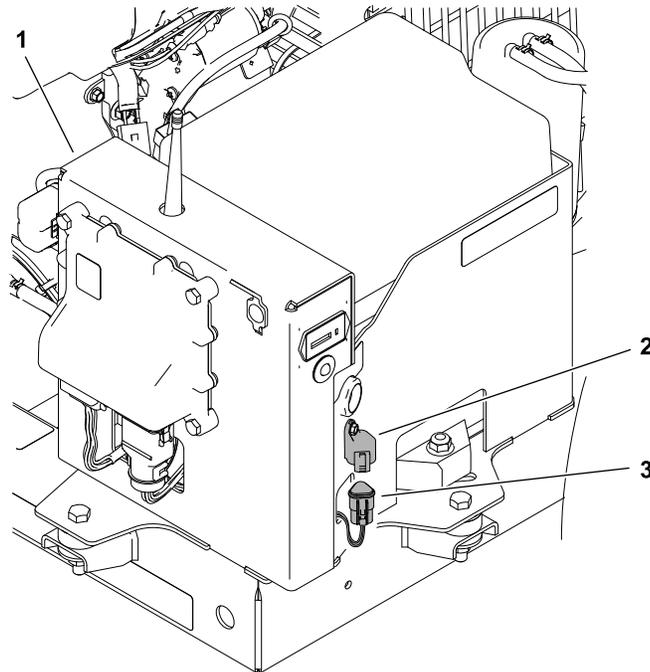
1. Make sure that key switch is in the OFF position and the key is removed from switch.
2. Remove the fuse from the fuse block.
3. Use a digital multimeter (ohms setting) and test the fuse for continuity across the fuse terminals.

Can bus

The machine controllers communicate with each other on a Controller Area Network (CAN) bus system. Using this network allows full integration of all the different electrical components of the machine, allowing them to operate together as one. Two specially designed, twisted wires form the CAN bus. These wires provide the data pathways between the components on the network. The engineering term for these cables are CAN High and CAN Low. The CAN bus wires are either red/white or yellow (CAN-High) and either black/white or green (CAN Low). At each end of the CAN bus is a 120 ohm termination resistor; refer to [CAN bus Terminator Resistors \(page 5–27\)](#).

The can bus is incorporated into the machine wire harness of all model 44552, 44552TE, 44553, and 44554 machines. Only machines with wireless remote control (model 44552, 44552TE, and 44553) have components that use the CAN bus for communication.

Testing the CAN bus



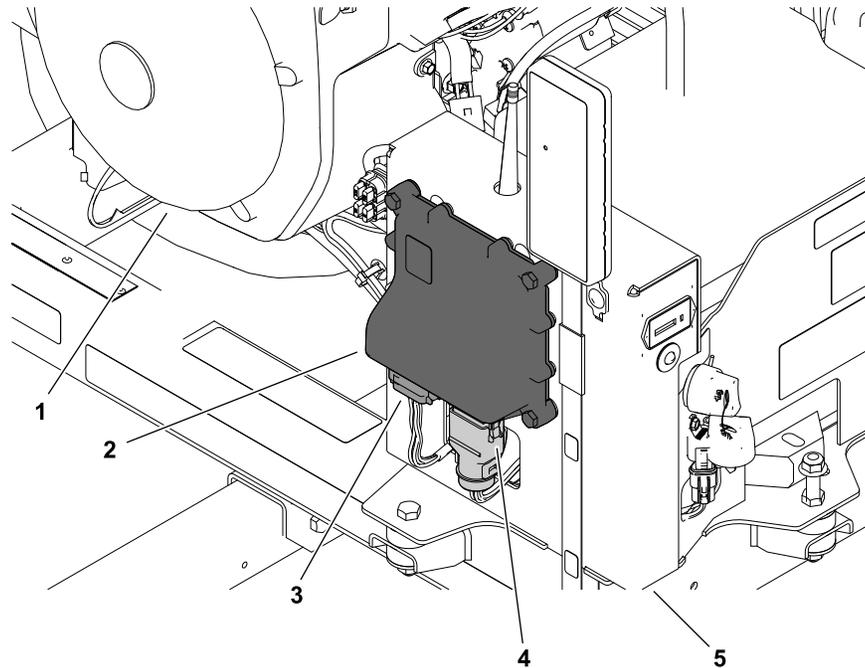
g278232

Figure 17

- | | |
|--------------------------|------------------------|
| 1. Machine control tower | 3. Toro DIAG connector |
| 2. Connector cover | |

1. Make sure that key switch is OFF and key is removed from switch.
2. The Toro DIAG connector is part of the CAN bus and is located on the left side of the machine control tower.
3. Locate the Toro DIAG connector and remove it from the connector cover.
4. Use a multimeter (ohms setting) to measure the resistance across terminals A and B.
 - A reading of 54 to 66 ohms indicates the CAN bus is intact.
 - A reading of 120 ohms indicates one of the CAN bus terminator resistors is not connected, damaged, or the CAN bus wiring is damaged; refer to [CAN bus Terminator Resistors \(page 5–27\)](#) and/or [Appendix A \(page A–1\)](#).
5. Install the Toro DIAG connector after testing.

Toro Electronic Controller (TEC) (Models 44552, 44552TE, and 44553)



g233944

Figure 18

- | | |
|-------------------------------------|-------------------|
| 1. Engine | 4. Gray connector |
| 2. TEC (Toro Electronic Controller) | 5. Control tower |
| 3. Green connector | |

Wireless controlled Pro Force Debris Blowers (Models 44552, 44552TE, and 44553) use a Toro Electronic Controller (TEC) to manage machine electrical functions. The TEC is a 2403 series microcontroller that monitors the condition of various machine switches (inputs) and directs electrical power to control appropriate machine functions (outputs) based on the state of the inputs. The TEC works in conjunction with the Toro Wireless Modules (TWMs) to manage power to the engine start relay and the nozzle control relays. The TEC also manages power to the following Kohler engine components: governor control unit, the fuel shut-off solenoid, and the ignition modules.

The TEC is attached to the machine control tower. Power for the TEC logic and memory is available at all times (unswitched). The logic and memory circuit is protected by a 2 Amp fuse (F-4). Power for the TEC outputs is available when the main power relay is energized (key switch is in the ON or START position). A pair of 7.5 Amp fuses (F-1 and F-2) protect the TEC output circuits.

Toro Electronic Controller (TEC) (Models 44552, 44552TE, and 44553) (continued)

TEC Digital Inputs

INPUT NUMBER	DESCRIPTION
DIN 1	Hour Meter and Engine Oil Pressure Switch
DIN 2	Not Used
DIN 3	Not Used
DIN 4	Not Used
DIN 5	Not Used

INPUT NUMBER	DESCRIPTION
DIN 6	Not Used
DIN 7	Not Used
DIN 8	Not Used
KEY RUN	Key Switch (RUN position)
KEY START	Key Switch (START position)

TEC Outputs

OUTPUT NUMBER	DESCRIPTION
THROTTLE CONTROL (PWM)	Engine Governor Control Unit (GCU)
OUT 1	Start Relay
OUT 2	Nozzle Relay 1
OUT 3	Nozzle Relay 2

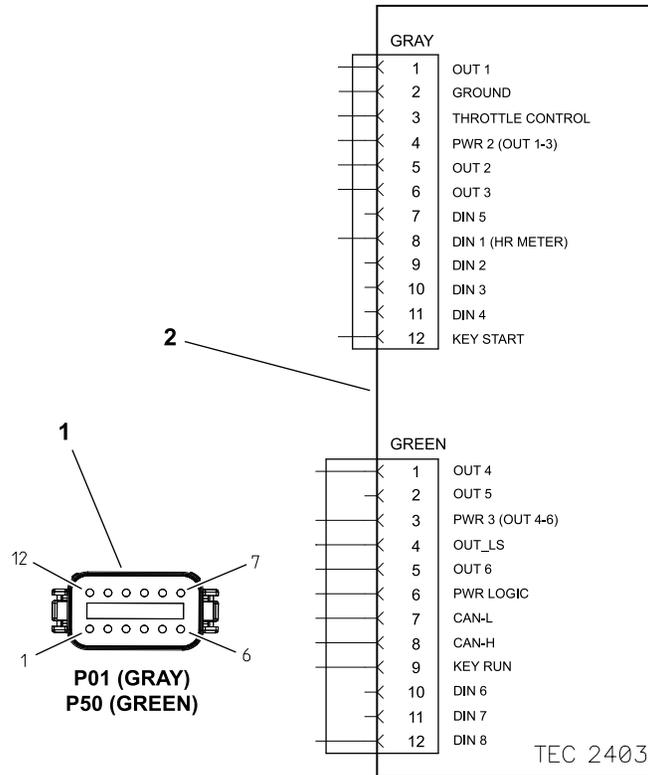
OUTPUT NUMBER	DESCRIPTION
OUT 4	Engine: Fuel Shut Off and Ignition Coils
OUT 5	Not Used
OUT 6	Diagnostic LED
OUT_LS (-)	Main Power Relay

The machine electrical schematic and wire harness drawings in [Electrical Drawing Designations \(page A-2\)](#) can be used to identify possible circuit problems between the controller and the input or output devices (e.g. switches and relays).

IMPORTANT

When testing for wire harness continuity at the connector for the controller, take care to not damage the connector pins with multimeter test leads. If connector pins are enlarged or damaged during testing, connector repair may be necessary for proper machine operation.

Toro Electronic Controller (TEC) (Models 44552, 44552TE, and 44553) (continued)



g234237

Figure 19

1. Wire harness connectors P01 (gray) and P50 (green)
2. Toro Electronic Controller (TEC)

Two color coded 12 pin wire harness connectors are attached to the controller. The connection terminal function for the controller and the wire harness connector pins are shown above.

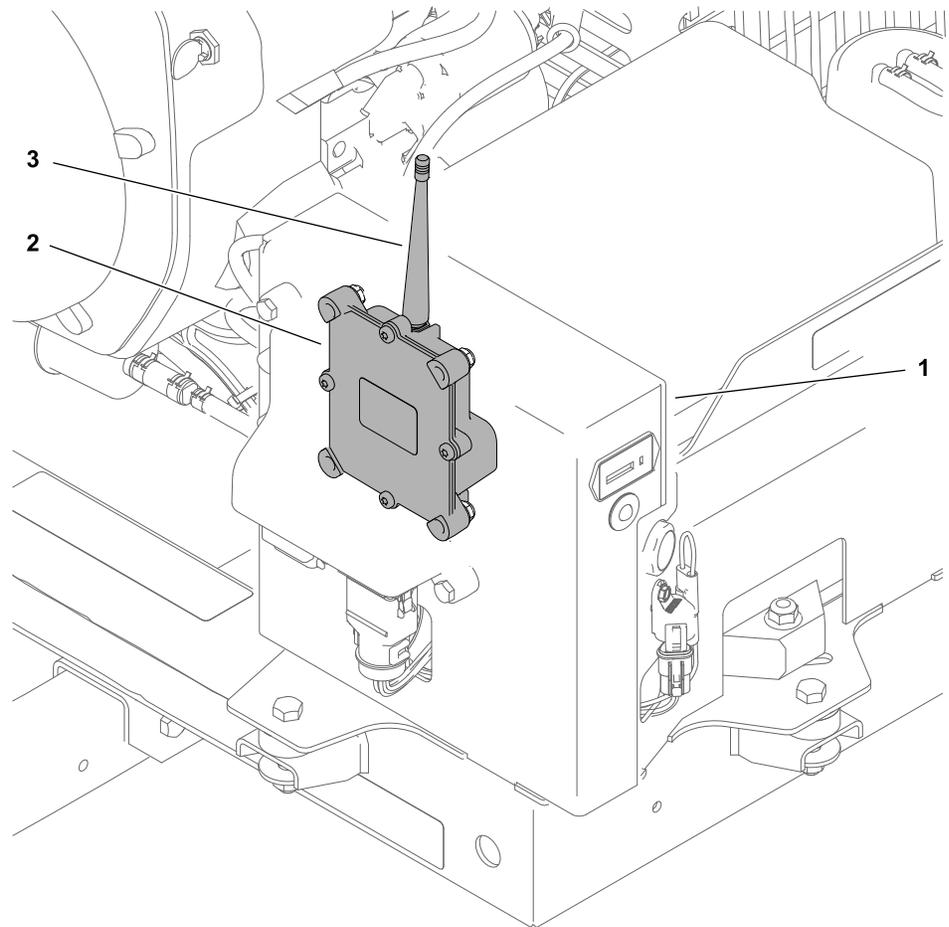
IMPORTANT

The TEC wire harness connections are color coded. Make sure the gray harness connector is installed in the gray port, and the green harness connector is installed in the green port.

Because of the solid state circuitry built into the controller, there is no method to test it directly. The controller may be damaged if an attempt is made to test it with an electrical test device (e.g., digital multimeter).

Note: The Toro Electronic Controller (TEC) and the Toro Wireless Modules (TWMs) used on the Pro Force Debris Blower are matched for correct machine operation. If any of these components are replaced for any reason, system software needs to be reloaded (contact an Authorized Toro Distributor for assistance).

Toro Wireless Module (TWM) RF2CAN (Models 44552, 44552TE, and 44553)



g278908

Figure 20

- | | |
|------------------|------------|
| 1. Control tower | 3. Antenna |
| 2. RF2CAN module | |

The RF2CAN module is a solid state electrical device used to convert radio frequency signals to and from the wireless handheld remote to CAN signals to and from the TEC. The RF2CAN module is only active when the key switch is in the RUN or START position. The RF2CAN module is mounted inside the machine control tower.

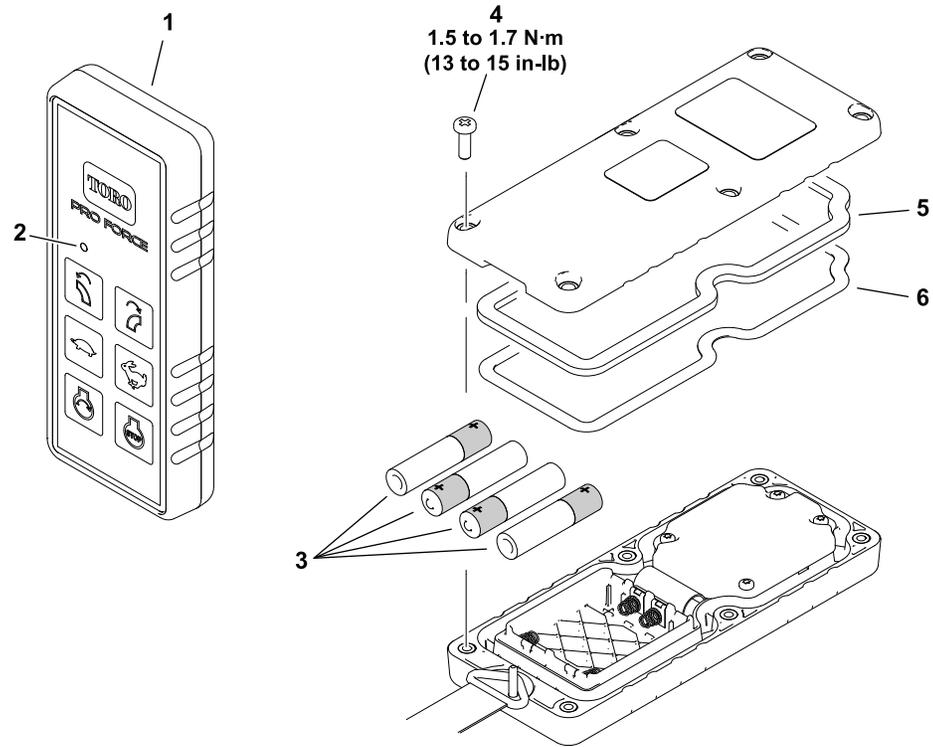
Note: Machine operation will only be controlled by a remote transmitter that is recognized by (associated to) the RF2CAN module; refer to the machine *Operator's Manual* for additional information.

Because of the solid state circuitry built into the control module, there is no reliable method to test it. The module may be damaged if an attempt is made to test it with an electrical test device (e.g., digital multimeter).

IMPORTANT

Before performing any welding on the machine, disconnect the battery ground cable, wire harness ground, and engine harness ground at the base of the engine. This will prevent damage to the electrical system of your Pro Force Debris Blower.

Toro Wireless Module (TWM) Handheld Remote (Models 44552, 44552TE, and 44553)



g278931

Figure 21

- | | |
|---|--------------------|
| 1. Remote transmitter | 4. Screws (6 each) |
| 2. LED | 5. Gasket |
| 3. AAA (1.5V) alkaline battery (4 used) | 6. Steel backer |

The handheld remote is a solid state electrical device that sends and receives radio frequency (RF) signals to and from the RF2CAN module. The handheld remote to RF2CAN module range should be approximately 4.6 m (15 ft). The handheld remote can only be associated to one specific RF2CAN module. Refer to the machine *Operator's Manual* for the handheld remote to RF2CAN (base) association procedure.

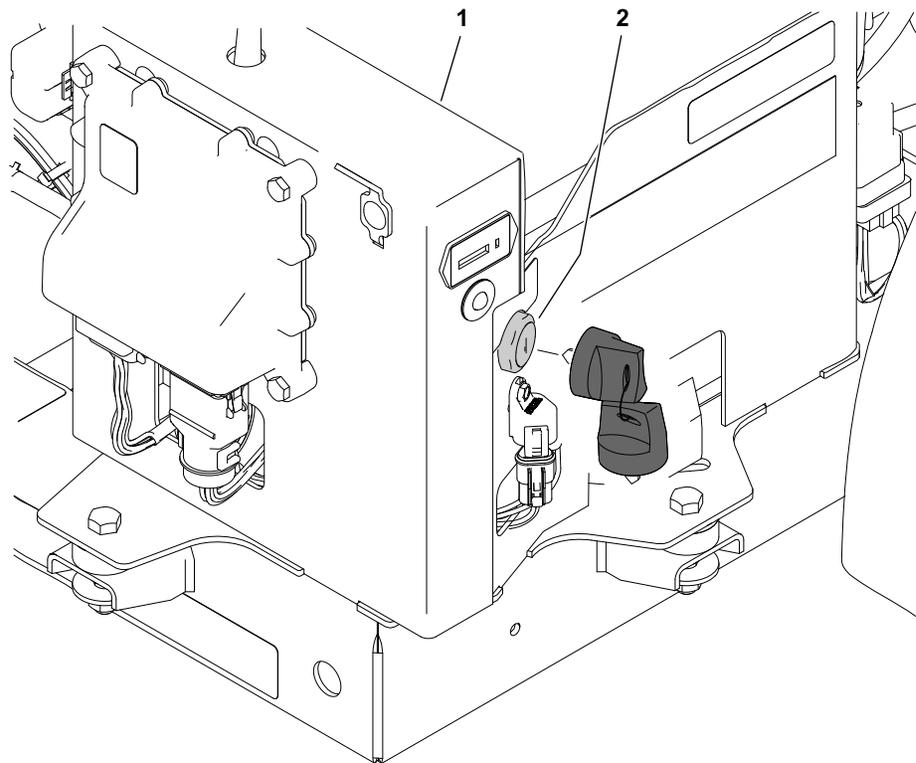
The remote transmitter activates (powers up) when you press any button. Then, when a button on the remote transmitter is pressed, the LED on the remote should illuminate indicating the remote is attempting to transmit a signal. To conserve battery power, the remote transmitter times out and powers down, all remote transmitter LED activity stops until any button on the remote is pressed.

The remote transmitter is powered by 4 AAA (1.5V) alkaline batteries. If the range of the transmitter has diminished or the transmitter LED does not illuminate when a button is pressed, the batteries should be replaced.

The diagnostic light should illuminate while a button on the hand held remote is pressed. This feature can be used to:

- confirm the association between the hand held remote and the RF2CAN module
- check the hand held remote operating range
- check the hand held remote battery condition
- check the hand held remote button operation

Key Switch (for Models 44552, 44552TE, and 44553)



g279128

Figure 22

1. Control tower

2. Key switch

POSITION	CLOSED CIRCUITS	
OFF	1 + 6, 4 + 5	
RUN	1 + 3 + 4 + 5 + 6	
START	1 + 2 + 4 + 5 + 6	

The key switch on the machine control tower has three (3) positions – OFF, RUN and START. The key switch is an input used by the TEC and RF2CAN module to manage various machine functions. The key switch is part of the Energize to Run (ETR) circuit.

Testing the Key Switch

If the ETR circuit (including the key switch) is functioning properly, the diagnostic light on the machine control tower will illuminate when the key switch is set to the RUN position. If testing determines that the switch and circuit wiring are not functioning correctly, proceed with the following test procedure:

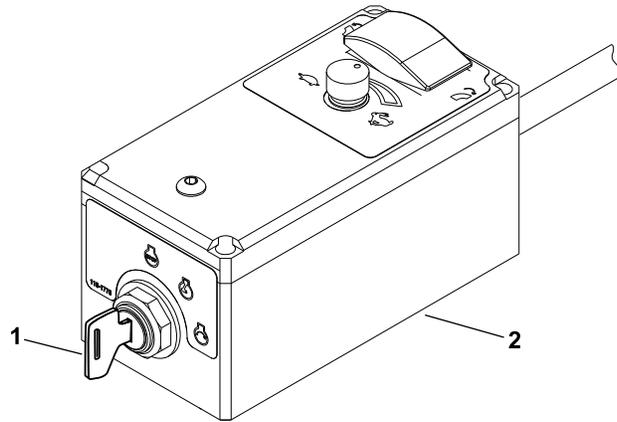
1. Park the machine on a level surface and stop the engine.
2. Disconnect the battery negative (-) cable at the battery.
3. Disconnect the wire harness connector from the switch and remove the switch from the control tower if necessary.

Note: Key switch terminals 1 and 6 are connected internally. Terminals 4 and 5 are also connected internally. These terminals should have continuity regardless of the switch position.

Testing the Key Switch (continued)

4. Use a multimeter (ohms setting) and the preceding table to determine whether continuity exists between the various terminals for each switch position.
5. Replace the switch if necessary.
6. If the switch tests correctly and a circuit problem still exists, check the wire harnesses; refer to [Appendix A \(page A-1\)](#).
7. Install the switch and connect the wire harness after testing.
8. Connect the battery negative (-) cable at the battery.

Key Switch (for Model 44554)



g235608

Figure 23

1. Key switch
2. Tether control box

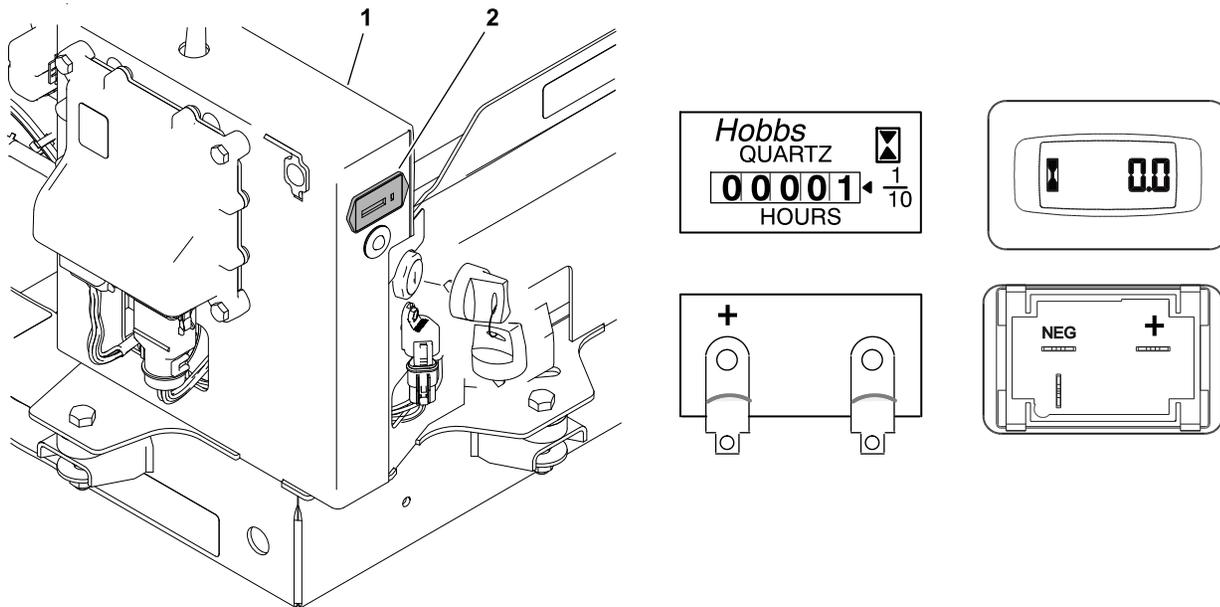
POSITION	CLOSED CIRCUITS			
OFF	NONE			
RUN	B + C + F, D + E			
START	A + B + C			

The key switch on the tether control box has three (3) positions – OFF, RUN and START.

Testing the Key Switch

1. Park the machine on a level surface and stop the engine.
2. Disconnect the battery negative (-) cable at the battery.
3. Remove the tether control box cover and disconnect the wire harness connector from the switch. Remove the switch from the control box if necessary.
4. Use a multimeter (ohms setting) and the preceding table to determine whether continuity exists between the various terminals for each switch position.
5. Replace the switch if necessary.
6. If the switch tests correctly and a circuit problem still exists, check the wire harnesses; refer to [Appendix A \(page A-1\)](#).
7. Install the switch and connect the wire harness after testing.
8. Connect the battery negative (-) cable at the battery.

Hour Meter



g233942

Figure 24

1. Control tower

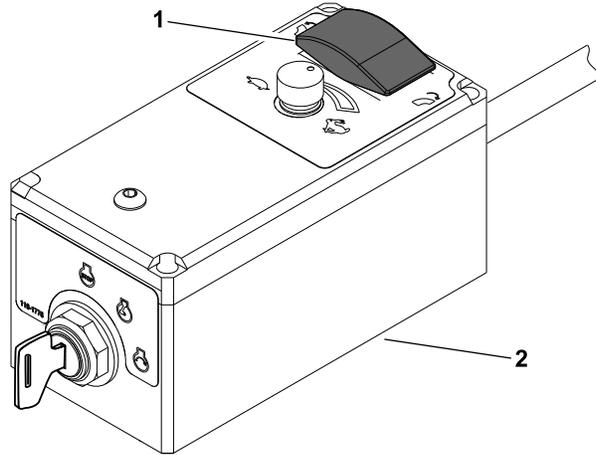
2. Hour meter

The hour meter used on the Pro Force Debris Blower records the amount of time that the engine is running.

Testing the Hour Meter

1. Park the machine on a level surface and stop the engine.
2. Disconnect the battery negative (-) cable at the battery.
3. Disconnect the wire harness connector from the hour meter and remove the hour meter from the control tower if necessary.
4. Connect the positive (+) terminal of the hour meter to the positive (+) terminal of a 12 VDC power source.
5. Connect the negative (-) terminal of the 12 VDC power source to the other terminal of the hour meter.
6. The hour meter should move 1/10 of an hour in 6 minutes.
7. Disconnect the voltage source from the hour meter.
8. Replace the hour meter if necessary.
9. If the hour meter tests correctly and a circuit problem still exists, check the wire harnesses; refer to [Appendix A \(page A-1\)](#).
10. Install the hour meter and connect the wire harness after testing.
11. Connect the battery negative (-) cable at the battery.

Nozzle Direction Switch (for Model 44554)



g235609

Figure 25

1. Nozzle direction switch 2. Tether control box

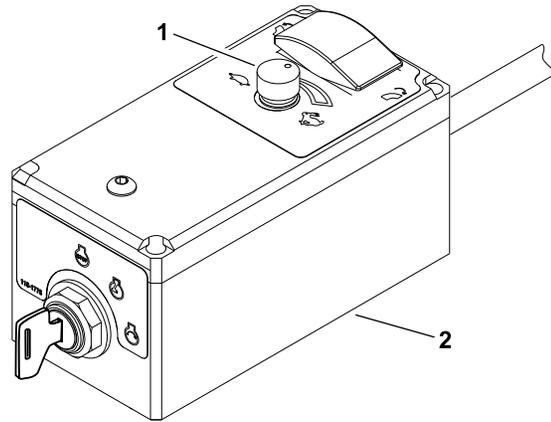
POSITION	CLOSED CIRCUITS	
RAISE or FORWARD	2 + 3, 5 + 6	
OFF	NONE	
LOWER or REVERSE	2 + 1, 5 + 4	

When the left side of the nozzle direction switch is pressed and held, the nozzle rotates in the counterclockwise direction. When the right side of the nozzle direction switch is pressed and held, the nozzle rotates in the clockwise direction. The nozzle direction switch is located on the tether control box.

Testing the Nozzle Direction Switch

1. Park the machine on a level surface and stop the engine.
2. Disconnect the battery negative (-) cable at the battery.
3. Remove the tether control box cover and disconnect the wire harness connector from the switch. Remove the switch from the control box if necessary.
4. Use a multimeter (ohms setting) and the preceding table to determine whether continuity exists between the various terminals for each switch position.
5. Replace the switch if necessary.
6. If the switch tests correctly and a circuit problem still exists, check the wire harness; refer to [Appendix A \(page A-1\)](#).
7. Install the switch and connect the wire harness after testing.
8. Connect the battery negative (-) cable at the battery.

Engine Speed Control (for Model 44554)



g235611

Figure 26

1. Engine speed control
2. Tether control box

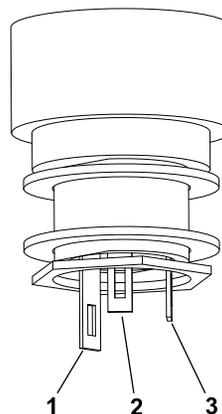
The engine speed control is a potentiometer located in the tether control box, and is used to control the engine speed (RPM).

Testing the Engine Speed Control

1. Park the machine on a level surface and stop the engine.
2. Disconnect the battery negative (-) cable at the battery.
3. Remove the tether control box cover and disconnect the wire harness connector from the switch. Remove the switch from the control box if necessary.

Note: Before taking the small resistance readings with a digital multimeter, short the multimeter test leads together. The meter displays a small resistance value (usually 0.5 ohms or less). This resistance is because of the internal resistance of the multimeter and test leads. Subtract this value from the measured value of the component that you are testing.

4. Use a multimeter to measure the resistance between the speed control terminals as follows:



g235612

Figure 27

1. Terminal A (signal)
2. Terminal B (ground)
3. Terminal C (power)

A. Check that the resistance between the terminals B and C is approximately 10,000 ohms. Record the measured resistance.

Testing the Engine Speed Control (continued)

- B. Measure the resistance between the terminals A and C and then measure the resistance between the terminals A and B. Record these resistances. The total of the 2 measured resistances should be approximately 10,000 ohms.
- C. Rotate the speed control knob and repeat step B
5. Replace the speed control if necessary.
6. If the speed control tests correctly and a circuit problem still exists, check the wire harness; refer to [Appendix A \(page A-1\)](#).
7. Install the speed control and connect the wire harness after testing.
8. Connect the battery negative (-) cable at the battery.

Relays

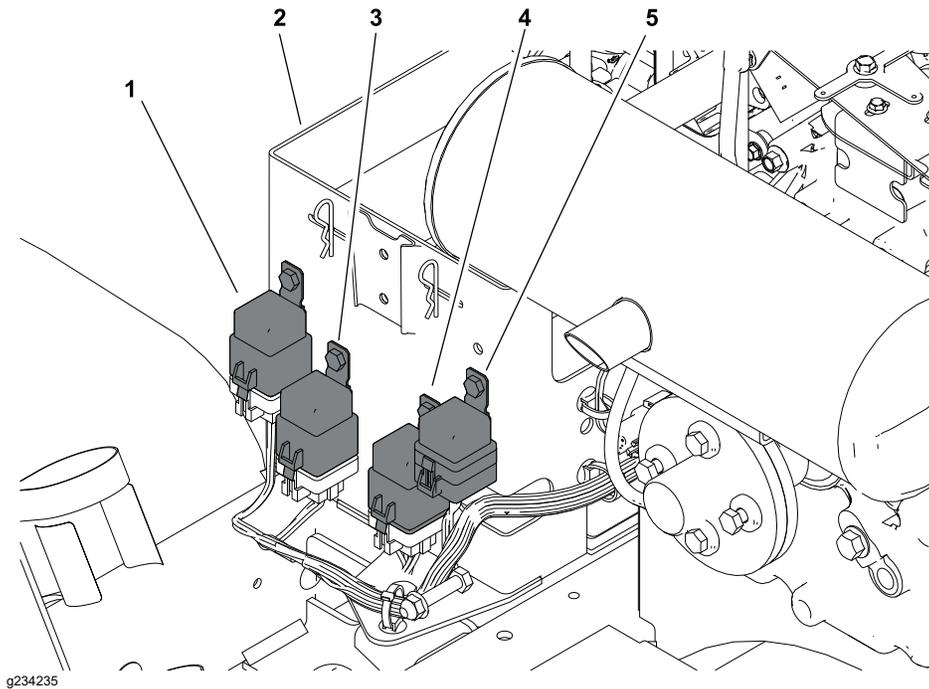


Figure 28

- | | |
|---------------------|-------------------|
| 1. Start relay | 4. Nozzle relay 2 |
| 2. Control tower | 5. Nozzle relay 1 |
| 3. Main power relay | |

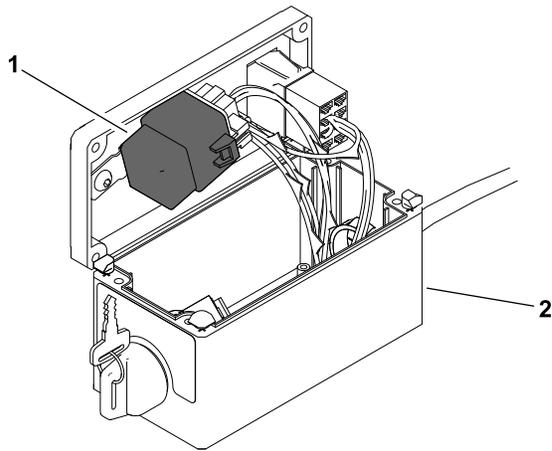
The electrical system of the Pro Force Debris Blower uses 4 identical electrical relays that have 5 terminals. A tag near the relay wire harness connector can be used to identify each relay.

The main power relay is used to provide electrical power to the machine. When the key switch is in the RUN or START position, the main power relay is energized.

The start relay is used in the engine starting circuit to provide a current path to energize the engine starter solenoid. On machines with a wireless remote (model 44552, 44552TE, and 44553) the start relay is energized by the TEC when an engine start signal is received from the handheld remote, or when the key switch is set to the START position. On machines with a tether control box (model No. 44554) the start relay is energized when the key switch is set to the START position.

The 2 nozzle relays are used for energizing the nozzle rotation motor. On machines with a wireless remote (model 44552, 44552TE, and 44553) the relays are energized by the TEC when a nozzle rotation signal is received from the handheld remote. On machines with a tether control box (model No. 44554) the relays are energized when the nozzle direction switch is pressed for nozzle rotation.

The relays are secured to the rear of the machine control tower.



g235610

Figure 29

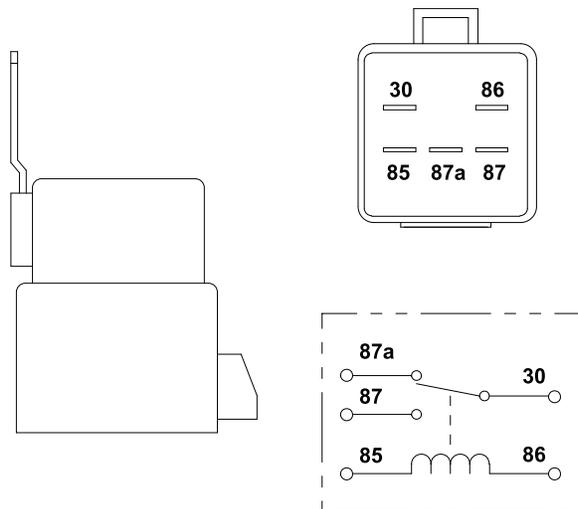
1. Relay
2. Tether control box

Note: Model 44554 machines have an additional 5 terminal relay located in the tethered control box. This relay is not presently being used.

Testing the Relays

1. Park the machine on a level surface and stop the engine.
2. Disconnect the battery negative (-) cable at the battery.
3. Locate the relay to be tested and disconnect the wire harness connector from the relay. Remove the relay from the control tower if necessary.

Note: Before taking the small resistance readings with a digital multimeter, short the multimeter test leads together. The meter displays a small resistance value (usually 0.5 ohms or less). This resistance is because of the internal resistance of the multimeter and test leads. Subtract this value from the measured value of the component that you are testing.



g256780

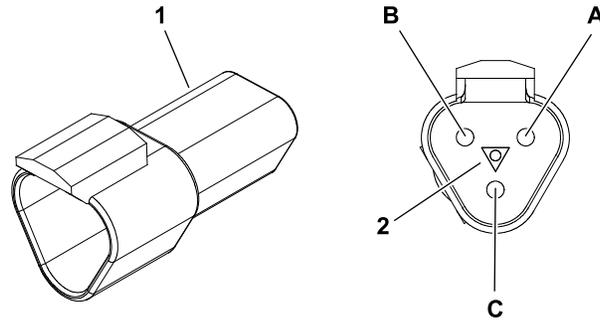
Figure 30

4. Test the relay as follows:

Testing the Relays (continued)

- A. Check the coil resistance between the terminals 85 and 86 with a multimeter (ohms setting). The resistance must be approximately 70 to 90 ohms.
 - B. Connect the multimeter leads to the relay terminals 30 and 87. Then ground terminal 85 and apply +12 VDC to terminal 86. The relay should make and break the continuity between terminals 30 and 87 as +12 VDC is applied and removed from terminal 86.
 - C. Connect the multimeter leads to the relay terminals 30 and 87A. Then ground terminal 85 and apply +12 VDC to terminal 86. The relay should make and break the continuity between terminals 30 and 87A as +12 VDC is applied and removed from terminal 86.
5. After testing, disconnect the voltage and multimeter test leads from the relay terminals.
 6. Replace the relay if necessary.
 7. If the relay tests correctly and a circuit problem still exists, check the wire harness; refer to [Appendix A \(page A-1\)](#).
 8. Install the speed control and connect the wire harness after testing.
 9. Connect the battery negative (-) cable at the battery.

CAN bus Terminator Resistors



g223018

Figure 31

1. CAN-bus terminator resistor
2. Keyway

The system communication between the electrical components on the Pro Force Debris Blower is accomplished on a CAN bus communication system. The 2 specially designed, twisted cables form the bus for the network are used on the machine. These wires provide the data pathways between the machine components. The engineering term for these cables are CAN High and CAN Low. The CAN bus wires are either red/white or yellow (CAN High) and either black/white or green (CAN Low). A 120 ohm termination resistor is located at each end of the CAN-bus.

The can bus is incorporated into the machine wire harness of all model 44552, 44552TE, 44553, and 44554 machines. Only machines with wireless remote control (model 44552, 44552TE, and 44553) have components that use the CAN bus for communication.

One of the resistors is secured to the machine wire harness near the started motor, and one of the resistors is secured to the machine wire harness near the key switch in the control tower (battery removal may be necessary to access the resistor).

Refer to the Electrical Schematics and Wire Harness Drawings/Diagrams in [Appendix A \(page A-1\)](#) for additional information on the location of the terminator resistor and wire connections.

The insulator wedge in the terminator resistor is blue for identification purposes. There is also a center keyway to prevent the terminator resistor from being plugged into the wrong wire harness connector.

IMPORTANT

Both terminator resistors are required for proper electrical system operation.

Testing the CAN bus Terminator Resistor

1. Make sure that key switch is OFF and key is removed from the switch.
2. Unplug the resistor from the wire harness.
3. Use a digital multimeter (ohms setting) to measure the resistance value for the CAN bus terminator resistor. There should be **120 ohms** resistance between the terminals A and B. The terminal C is not used.
4. Replace the resistor if necessary.

Testing the CAN bus Terminator Resistor (continued)

5. If the resistor tests correctly and a circuit problem still exists, check the remainder of the CAN bus; refer to [Appendix A \(page A-1\)](#) or contact an Authorized Toro Distributor for assistance.
6. After testing, ensure that the CAN bus terminator resistor is fully installed into the wire harness connector and secured to the wire harness with cable tie.

Diagnostic Lamp (for Models 44552, 44552TE, and 44553)

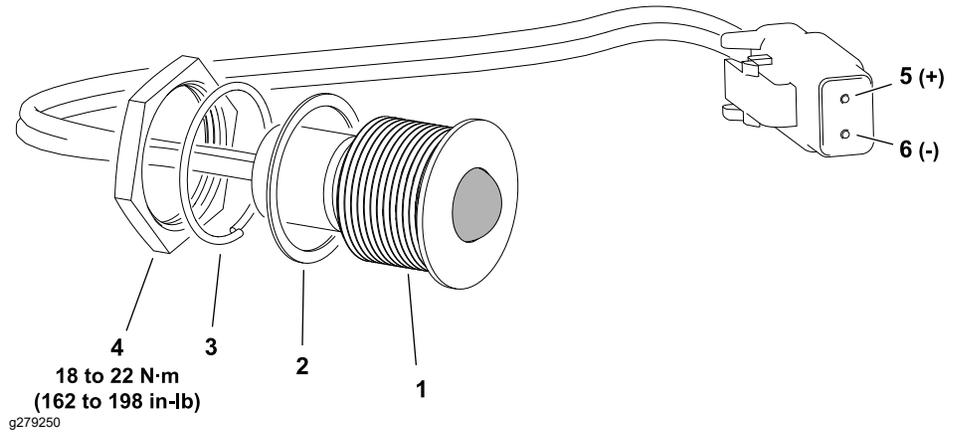


Figure 32

- | | |
|--------------------------|-------------------|
| 1. Diagnostic Lamp (LED) | 4. Hex nut |
| 2. Gasket | 5. Red wire (+) |
| 3. Lock washer | 6. Black wire (-) |

Machines with wireless remote control have an LED diagnostic light located on the machine control tower. The TEC controller uses the diagnostic light (output) to notify the operator or the service technician of an issue that may exist with the machine; refer to [Using the Onboard Diagnostic Lamp \(page 3–3\)](#).

Testing the Diagnostic Lamp

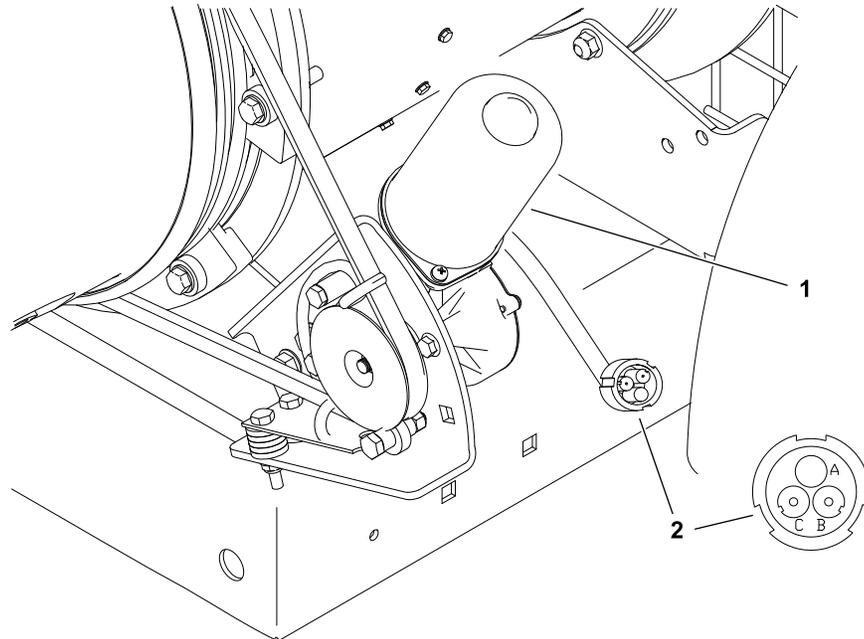
1. Make sure that key switch is OFF and key is removed from the switch.
2. Disconnect the diagnostic light connector from the wire harness.

Note: The diagnostic light is an Light Emitting Diode (LED) and is therefore polarity sensitive.

3. Connect a 12 VDC power source (machine battery) to the diagnostic light terminals. The light should only illuminate when the positive (+) lead of the power supply is connected to the positive (+) red wire, and the negative (-) lead of the power supply is connected to the negative (-) black wire.
4. Replace the diagnostic light if necessary.
5. If the diagnostic light tests correctly and a circuit problem still exists, check the wire harness; refer to [Appendix A \(page A–1\)](#).
6. Install the diagnostic light if necessary and connect the wire harness after testing.

Nozzle Motor

The motor used to rotate the nozzle is a reversible 12 VDC electric motor with an integrated gear box. The assembly components are not serviceable separately.



g279312

Figure 33

1. Nozzle motor assembly
2. Nozzle motor connector

Testing the Nozzle Motor

1. Make sure that key switch is in the OFF position.
2. Disconnect the nozzle motor connector from the wire harness.
3. Connect a 12 VDC power source (machine battery) to the nozzle motor terminals. The motor shaft should rotate clockwise (viewed from the shaft end) smoothly and quietly when the positive (+) lead of the power supply is connected to the (C) terminal of the motor connector, and the negative (-) lead of the power supply is connected to the (B) terminal of the motor connector. The motor shaft should rotate smoothly and quietly in the opposite direction when the power supply wires are reversed.
4. Loosen the nozzle motor bracket and remove the drive belt from the motor pulley.
5. Connect an ammeter or multimeter (DC amps) into the positive (+) lead of the power supply. The motor should draw less than 2 amps under no load.
6. Replace the motor assembly if necessary; refer to [Nozzle Motor \(page 5–32\)](#).
7. If the nozzle motor tests correctly and a circuit problem still exists, check the wire harness; refer to [Appendix A \(page A–1\)](#).
8. Install the nozzle motor assembly and drive belt if necessary and connect the wire harness after testing.

Service and Repairs

Note: Refer to the Kohler Engine Service Manual (included at the end of [Engine \(page 4–11\)](#)) for engine electrical component repair information.

Nozzle Motor

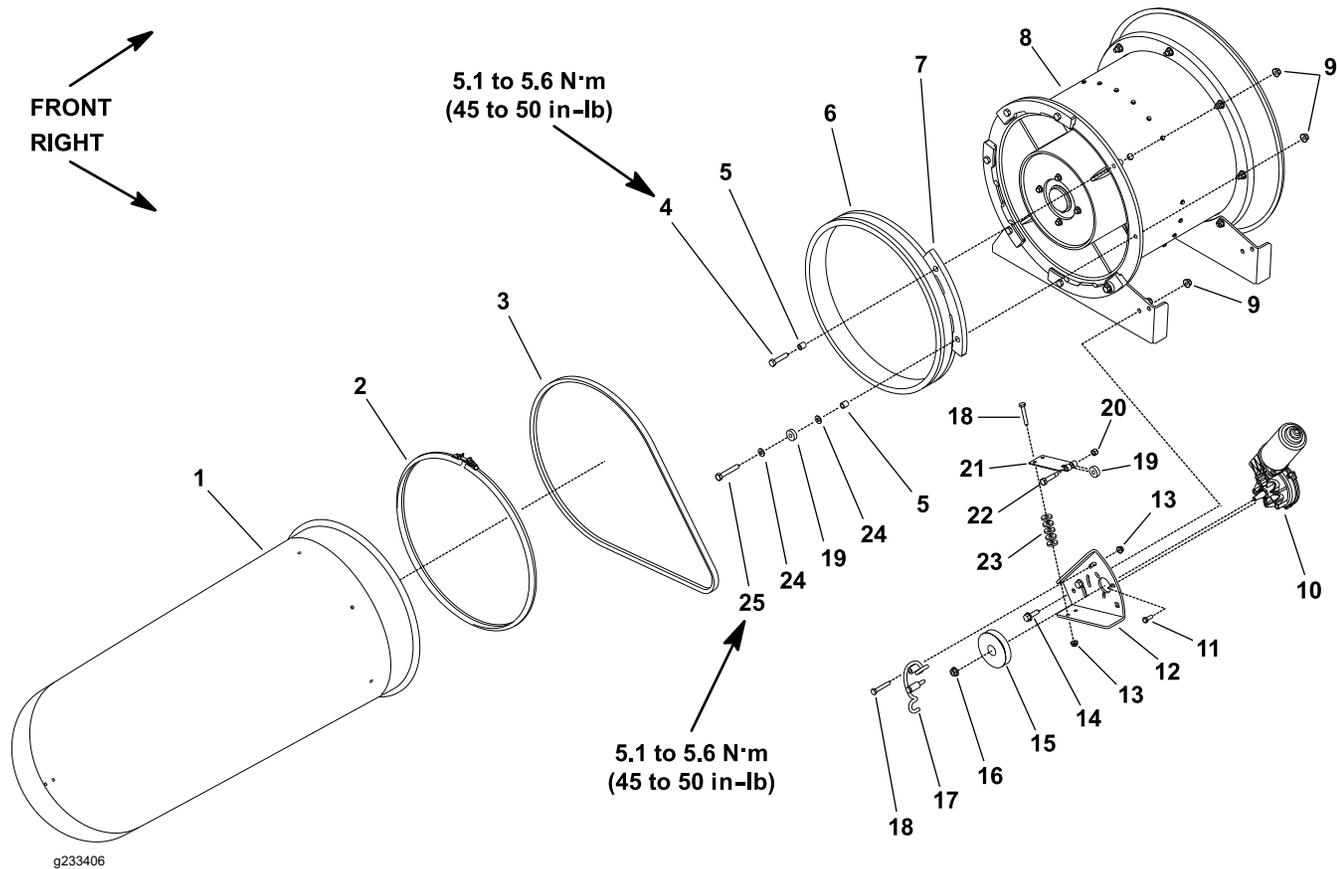


Figure 34

- | | | |
|--------------------------|--------------------------------|---------------------------|
| 1. Nozzle | 10. Nozzle motor | 19. Ball bearing (3 each) |
| 2. Nozzle clamp | 11. Bolt (3 each) | 20. Locknut |
| 3. V-belt | 12. Motor bracket | 21. Leaf spring |
| 4. Bolt (6 each) | 13. Flange nut (4 each) | 22. Shoulder bolt |
| 5. Spacer (8 each) | 14. Flange-head screw (2 each) | 23. Flat washer (10 each) |
| 6. Nozzle pulley | 15. Drive pulley | 24. Flat washer (4 each) |
| 7. Nozzle guide (4 each) | 16. Locknut | 25. Bolt (2 each) |
| 8. Outer housing | 17. Belt guard | |
| 9. Flange nut (10 each) | 18. Bolt (4 each) | |

Removing the Nozzle Motor

Refer to [Figure 34](#) for the following procedure.

1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch. Block the wheels with chocks to prevent the machine from moving.
2. Disconnect the battery negative (-) cable at the battery.
3. Unplug the wire harness connector from the nozzle motor.
4. Loosen, but do not remove the locknut (item 16) that secures the drive pulley to the nozzle motor shaft. Loosen the locknut at least 2 turns.
5. Remove the 2 bolts and 2 flange nuts that secure the leaf spring (item 21) to the motor bracket, and remove the leaf spring with bearing and flat washers from the bracket.

Removing the Nozzle Motor (continued)

- Loosen the 2 flange-head screws (item 14) and 2 flange nuts that secure the nozzle motor bracket to the outer housing. Rotate the bracket and nozzle motor to loosen the V-belt.
- Loosen the 2 bolts and 2 flange nuts that secure the belt guard (item 17), route V-belt from behind guard and carefully remove the belt from the machine.

Note: The nozzle motor shaft is tapered.

- Use appropriate puller to remove the drive pulley from the nozzle motor.
- Remove the 3 bolts that secure the nozzle motor to the bracket, and remove the nozzle motor from the machine.

Installing the Nozzle Motor

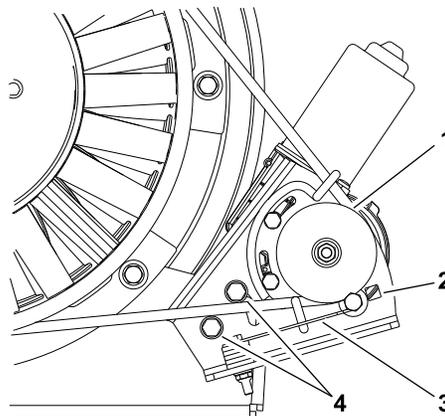
Refer to [Figure 34](#) for the following procedure.

- Position the nozzle motor to the bracket and secure the motor with the 3 bolts.
- Clean the tapered surfaces of the motor shaft and drive pulley.
- Slide the drive pulley onto the motor shaft and secure with the locknut.
- Place the V-belt in the nozzle pulley, route behind the belt guard (item 17) and install the belt on the motor pulley.

Note: Do not over tension the belt.



- With a 3/8 inch drive torque wrench, pivot the motor bracket from **23 to 25 N·m (200 to 230 in-lb)** to set the V-belt tension ([Figure 35](#)). Hold the bracket with the torque wrench and tighten the 2 flange-head screws and 2 flange nuts to secure the bracket.



g233396

Figure 35

- | | |
|-------------------------|-------------------------------|
| 1. Drive pulley | 3. Leaf spring assembly |
| 2. Torque wrench access | 4. Flange-head screw (2 each) |
-
- Center the belt guard around the V-belt. Secure the belt guard to the machine with the 2 bolts and 2 flange nuts.
 - Position the leaf spring with bearing and flat washers to the bracket. Ensure that 5 washers are placed between the spring and the bracket at each mounting hole. The bearing on the leaf spring should be centered on the outside of the V-belt. Secure the leaf spring to the motor bracket with 2 bolts and 2 flange nuts.
 - Connect the wire harness connector to the nozzle motor.

Installing the Nozzle Motor (continued)

9. Connect the battery negative (-) cable at the battery.
10. Test the nozzle rotation before returning the machine to service.

Caring for the Battery

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



WARNING



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

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

IMPORTANT

Do not remove fill caps while cleaning.

- A. Clean battery by washing entire case with a solution of baking soda and water. Rinse with clear water.
- B. Coat battery posts and cable connectors with Toro Part No. 107-0392 battery terminal protector or petroleum jelly to prevent corrosion.



WARNING



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

Ensure that the cables are properly connected to the correct battery posts before operating the machine.

3. Tighten the battery cables on the battery terminals to provide a good electrical contact.
4. If corrosion occurs at the battery terminals, disconnect the battery cables. Always disconnect the negative (-) cable first. Clean the cable clamps and terminals separately. Connect the battery cables. Always connect the positive (+) cable first. Apply a coating of Toro Part No. 107-0392 battery terminal protector or a light coat of petroleum jelly to the terminals to reduce corrosion after you make the connections.
5. Check the battery-electrolyte level every 25 operating hours and every 30 days if machine is in storage.

Note: Do not fill the cells above the fill line.

6. Maintain the cell level with the distilled or demineralized water.

Storing the Battery

If you store the machine for more than 30 days:

1. Remove the battery and charge it fully; refer to [Charging the Battery \(page 5-42\)](#).
2. Store the battery:
 - on a shelf or on the machine
 - with cables disconnected if stored on the machine
 - in a cool atmosphere to avoid quick deterioration of the battery charge
 - in an environment that will not be below freezing for an extended period

Servicing the Battery

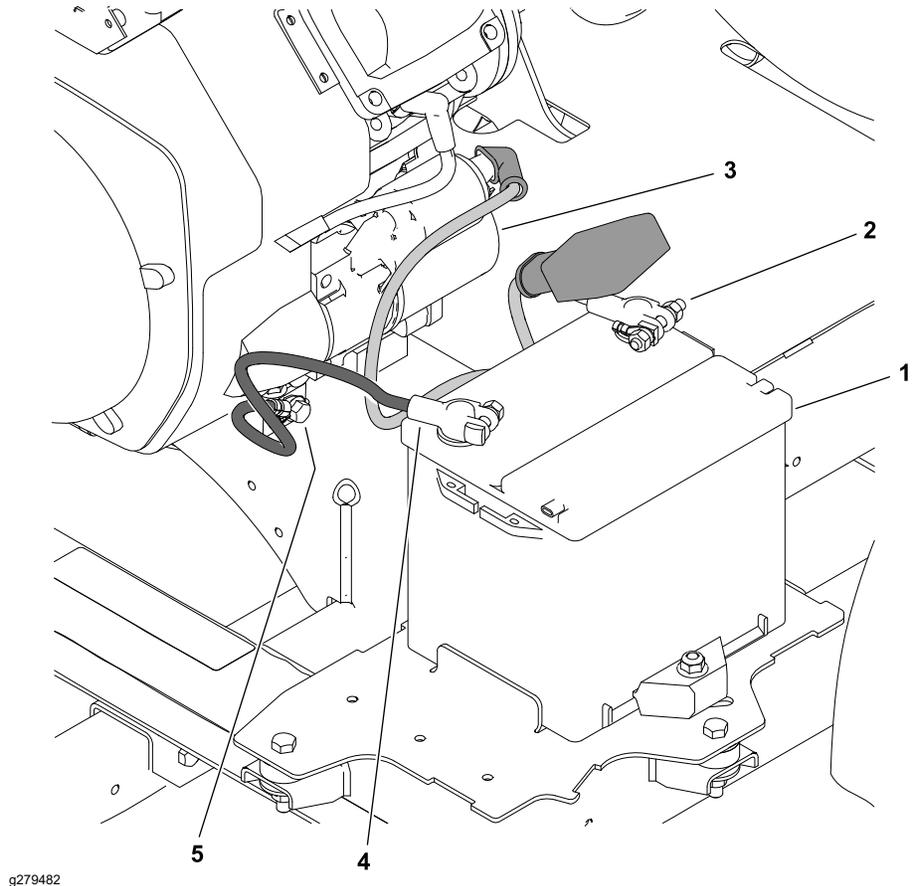


Figure 36

1. Battery
2. Battery positive (+) cable
3. Starter motor
4. Battery negative (-) cable
5. Engine and chassis ground

Battery Specifications

Battery-electrolyte specific gravity	Fully Charged: 1.25 to 1.28 at 27°C (80°F) Discharged: less than 1.24
Battery specifications	BCI Group 26 540 CCA at -18°C (0°F) Reserve Capacity of 80 minutes at 27°C (80°F)
Battery dimensions (including terminal posts and caps)	Length 22.4 cm (8.8 inches) Width 16.8 cm (6.6 inches) Height 18.3 cm (8.0 inches)

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



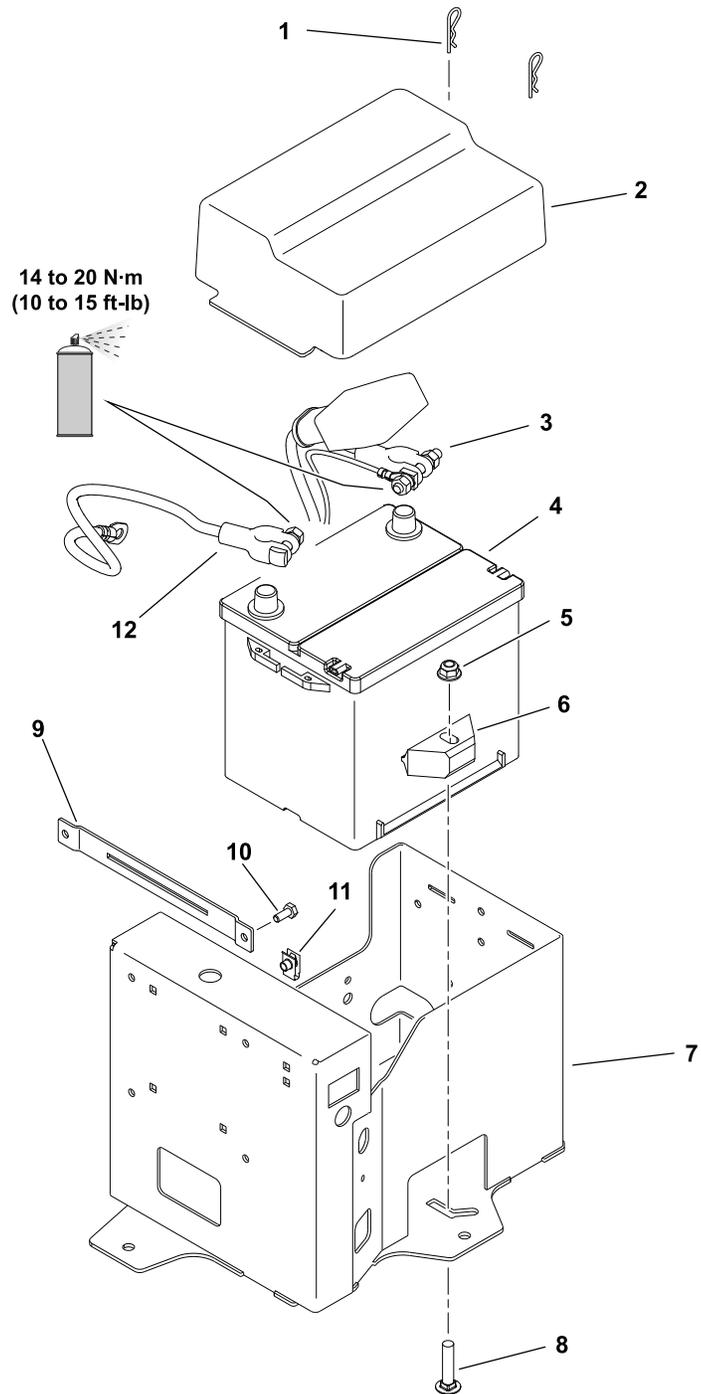
CAUTION



Battery-electrolyte is corrosive and can burn skin and eyes and damage clothing.

While working with the batteries, use extreme caution to avoid splashing or spilling of the electrolyte. Always wear the safety goggles and a face shield while working with batteries.

Removing and Installing the Battery



g234239

Figure 37

- | | |
|-------------------------------|--------------------------------|
| 1. Hairpin cotter (2 each) | 7. Control tower |
| 2. Battery cover | 8. Carriage screw |
| 3. Battery | 9. Battery cover bracket |
| 4. Battery positive (+) cable | 10. Bolt (2 each) |
| 5. Flange nut | 11. Clip (2 each) |
| 6. Battery retainer | 12. Battery negative (-) cable |

Removing and Installing the Battery (continued)

IMPORTANT

Be careful when removing the battery cables and ensure that you do not damage the terminal posts or cable connectors.

1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch. Block the wheels with chocks to prevent the machine from moving.
2. Remove the battery cover.
3. Loosen and remove the negative (-) cable from the battery. Position the disconnected cable away from the battery.
4. Disconnect the positive cable (+) from the battery.
5. Remove the carriage screw and flange nut that secures the battery retainer.
6. Carefully remove the battery from the machine.
7. Install the battery in reverse order.
8. Connect and tighten the positive (+) cable to the battery before connecting negative (-) cable. Tighten the battery terminal nuts from **14 to 20 N·m (10 to 15 ft-lb)**.
9. Apply a thin coating of battery terminal protector to the battery cable terminals; refer to [Battery Terminal Protector \(page 2–12\)](#).
10. Install the battery cover.



Inspecting, Maintaining, and Testing the Battery

Temperature Correcting Specific Gravity

Cell Temperature	100°F
Cell Specific Gravity	1.245
38°C minus 27°C equals 11.0°C (100°F minus 80°F equals 20°F)	
11°C multiply by 0.004/5.5°C equals 0.008 (20°F multiply by 0.004/10°F equals 0.008)	
ADD (conversion above)	0.008
Correction to 27°C (80°F)	1.253

Minimum Voltage

Minimum Voltage	Battery-Electrolyte Temperature	
	70°F (and up)	21°C (and up)
9.6	70°F (and up)	21°C (and up)
9.5	60°F	15°C
9.4	50°F	10°C
9.3	40°F	4°C
9.1	30°F	-1°C
8.9	20°F	-7°C
8.7	10°F	-12°C
8.5	0°F	-18°C

Inspecting, Maintaining, and Testing the Battery (continued)

1. Inspect the battery as follows:
 - A. Check for cracks. Replace the battery if cracked or leaking.
 - B. Check the battery terminals for corrosion. Use the wire brush to clean corrosion from the posts.

IMPORTANT

Before cleaning the battery, tape or block the vent holes of the filler caps and ensure that the caps are secure.

- C. Check for the signs of wetness or leakage on the top of the battery which might indicate a loose or missing filler cap, overcharging, loose terminal post, or overfilling. Also, check the battery case for dirt and oil. Clean the battery with a solution of baking soda (sodium bicarbonate) and water, then rinse it with clean water.
- D. Check that the cover seal is not broken away. Replace the battery if the seal is broken or leaking.

IMPORTANT

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

- E. Check the electrolyte level in each cell. If the level is below the tops of the plates in any cell, fill all the cells with distilled water between the minimum and maximum fill lines. Charge at 15 to 25 A for 15 minutes to allow sufficient mixing of the electrolyte.
2. Perform the hydrometer test of the battery-electrolyte.

IMPORTANT

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

- A. Use a hydrometer to measure the specific gravity of each cell. Pull the electrolyte in and out of the hydrometer barrel before taking a reading to warm-up the hydrometer. At the same time, take the temperature of the cell.
- B. Temperature correct each cell reading. For each 6°C (10°F) above 27°C (80°F) add 0.004 to the specific gravity reading. For each 6°C (10°F) below 27°C (80°F) subtract 0.004 from the specific gravity reading; refer to [Temperature Correcting Specific Gravity \(page 5–40\)](#).
- C. If the difference between the highest and lowest cell specific gravity is 0.050 or more or the lowest cell specific gravity is less than 1.225, charge the battery.
- D. Charge at the rate and time given in [Battery Charge Rate \(page 5–43\)](#) or until all cells specific gravity is 1.225 or greater with the difference in specific gravity between the highest and lowest cell being less than 0.050. If you can not meet these charging conditions, replace the battery.

Inspecting, Maintaining, and Testing the Battery (continued)

3. Do a high-discharge test with an adjustable load tester. This is a very reliable means of testing a battery as it simulates the battery cold-cranking capacity. A commercial battery load tester is required to do this test.



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

- A. Check the voltage across the battery terminals before testing the battery. If the voltage is less than 12.0 VDC, charge the battery before continuing the test.
- B. If you charge the battery, apply a 150 A load for 15 seconds to remove the surface charge. Use a battery load tester following the manufacturer's instructions.
- C. Ensure that the battery terminals are free of corrosion.
- D. Measure the electrolyte temperature of the center cell.
- E. Connect a battery load tester to the battery terminals following the manufacturer's instructions. Connect a digital multimeter to the battery terminals
- F. Apply a test load of 1/2 the cold cranking amperage rating of the battery; refer to [Battery Specifications \(page 5–37\)](#).
- G. Take a test voltage reading while still under load after 15 seconds, then immediately remove the load.
- H. Use [Minimum Voltage \(page 5–40\)](#) to determine the minimum voltage for the center cell electrolyte temperature reading.
- I. If the test voltage is below the minimum, replace the battery. If the test voltage is at or above the minimum, return the battery to service.

Charging the Battery

Battery Charge Level

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

Charging the Battery (continued)

Battery Charge Rate

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

To minimize damage to the battery and allow the battery to charge fully, use the following slow charging procedure. You can accomplish this charging procedure with a constant current battery charger that is available locally.

IMPORTANT

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

Note: Using the specific gravity of the battery cells is the most accurate procedure of determining the battery condition.

1. Use [Battery Charge Level \(page 5–42\)](#) to determine the battery charge level from the specific gravity of the battery cells or open circuit voltage.
2. Use the manufacturer's battery charger instructions or [Battery Charge Rate \(page 5–43\)](#) to determine the charging time and rate.



CAUTION



Charging a frozen battery can cause explosion and can cause personal injury. Let the battery warm to 15°C (60°F) before connecting to a charger.

- Charge the battery in a well-ventilated place to dissipate the gases produced from the charging.
- These gases are explosive; keep open flame and electrical spark away from the battery. Do not smoke.
- Inhaling the battery gases can cause nausea.
- Unplug the charger from the electrical outlet before connecting or disconnecting the charger leads from the battery terminals.

3. Follow the battery charger manufacturer's instructions, connect the charger cables to the battery terminals. Ensure that you make a good connection
4. Charge the battery following the manufacturer's instructions.
5. Occasionally check the temperature of the battery-electrolyte. If the temperature is more than 52°C (125°F) or the electrolyte is violently gassing or spewing, lower the charge rate or temporarily stop charging the battery.
6. Beginning three hours before the end of the scheduled charge, measure the specific gravity of a battery cell once per hour.

Charging the Battery (continued)

Note: The battery is fully charged when the cells are gassing freely at a low charging rate and there is less than a 0.003 change in specific gravity for 3 consecutive readings.



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General Information

The *Operator's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for your Pro Force Debris Blower. Refer to the *Operator's Manual* for additional information when servicing the machine.

Service and Repairs

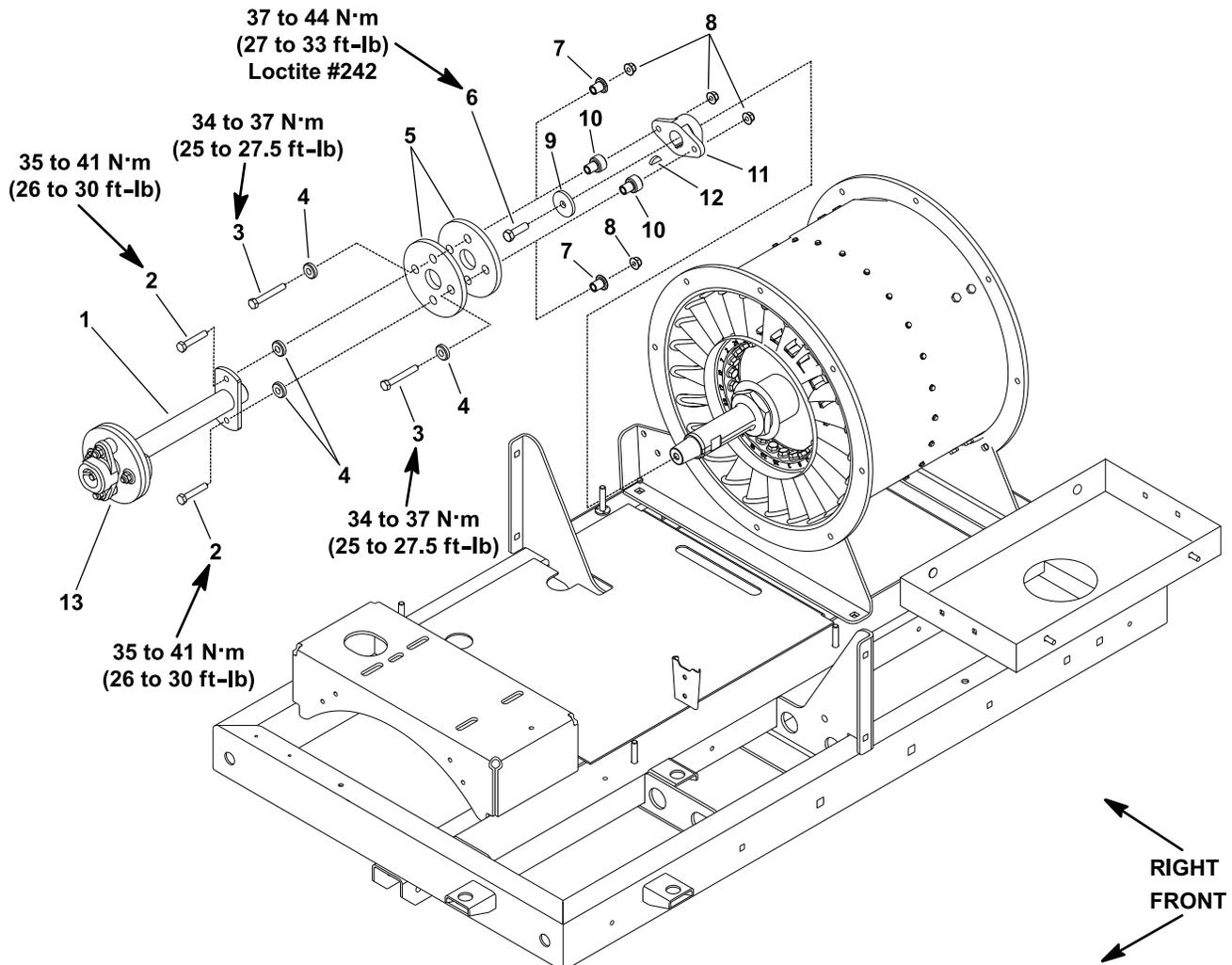


CAUTION



To ensure that the machine operation does not occur unexpectedly, disconnect the negative battery cable from the battery before performing any machine service; refer to [Servicing the Battery \(page 5-37\)](#).

Blower Drive Shaft



g233401

Figure 38

- | | | |
|----------------------------|------------------------------|--------------------------------------|
| 1. Drive Shaft | 6. Bolt | 11. Fan hub |
| 2. Bolt (2 each) | 7. Coupling spacer (2 each) | 12. Woodruff key |
| 3. Bolt (2 each) | 8. Flange nut (4 each) | 13. Engine hub and coupling assembly |
| 4. Washer (4 each) | 9. Washer | |
| 5. Drive coupling (2 each) | 10. Coupling spacer (2 each) | |

Note: The shaft hub and coupling assemblies used between the drive shaft and the engine shaft are comprised of the same components.

Removing the Blower Drive Shaft

Refer to [Figure 38](#) for this procedure.

1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch. Block the wheels with chocks to prevent the machine from moving.
2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal; refer to [Servicing the Battery \(page 5–37\)](#). Position the disconnected negative cable away from the negative battery terminal.
3. Remove the guard to get access to the blower drive shaft; refer to [Removing the Guards \(page 7–7\)](#).

Removing the Blower Drive Shaft (continued)

4. Remove the bolts, washers, and flange nuts that secure the drive shaft assembly to the hubs on the engine shaft and blower shaft.
5. Lift the drive shaft assembly from the machine.
6. Disassemble the drive couplings from the drive shaft. For assembly purposes, note the differences in the coupling spacers.
7. Inspect the drive couplings for damage and replace if necessary.
8. If necessary, remove the hubs from the engine shaft or blower shaft as follows:
 - A. Remove the bolt and washer that secure the hub to the shaft.

Note: The engine and blower shafts are tapered and will require a puller to remove the hub from the shaft.
 - B. Use appropriate puller to remove the hub from the shaft.
 - C. Remove the woodruff key from the shaft slot.

Installing the Blower Drive Shaft

Refer to [Figure 38](#) for this procedure.

1. Use the Shaft Alignment Tool to align the engine output shaft to the blower shaft; refer to [Aligning the Engine and Blower Drive Shafts \(page 4–4\)](#).
2. If the hub was removed from the engine shaft or blower shaft:
 - A. Clean the tapers of the shaft and hub.
 - B. Install a woodruff key in the shaft.
 - C. Apply medium strength thread locking compound and install the hub, washer, and hub retaining bolt.



- D. Tighten the hub retaining bolt from **37 to 45 N·m (27 to 33 ft-lb)**.



3. Place the coupling spacers into the drive coupling. The thicker coupling spacers contact the drive hubs.
4. Secure the drive couplings to the drive shaft and tighten the bolts from **35 to 41 N·m (26 to 30 ft-lb)**.



5. Position the drive shaft assembly to the engine shaft and blower shaft.
6. Secure the drive shaft assembly to the hubs on the engine shaft and blower shaft and tighten the bolts from **34 to 37 N·m (25 to 27.5 ft-lb)**.
7. Install the top guard to the machine; refer to [Installing the Guards \(page 7–7\)](#).
8. Connect the negative battery cable to the battery terminal; refer to [Servicing the Battery \(page 5–37\)](#).

Replacement Blower

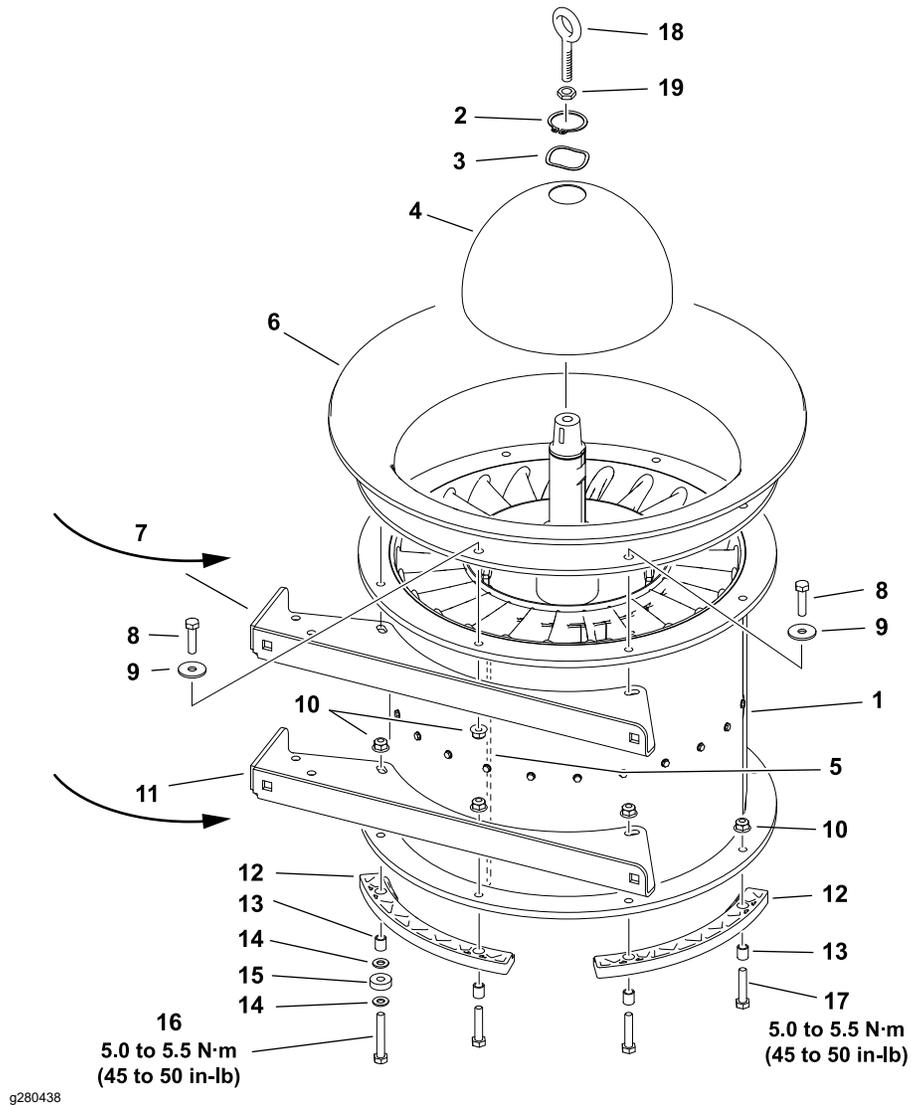


Figure 39

- | | |
|--------------------------------|----------------------------------|
| 1. Replacement blower assembly | 11. Rear fan mount |
| 2. Retaining ring | 12. Nozzle guide (2 each) |
| 3. Wave washer | 13. Spacer (4 each) |
| 4. Front cap | 14. Washer (2 each) |
| 5. Weld seam | 15. Ball bearing |
| 6. Inlet bell | 16. Cap screw |
| 7. Front fan mount | 17. Cap screw (3 each) |
| 8. Cap screw (8 each) | 18. 3/8-16 eye bolt (lift point) |
| 9. Washer (8 each) | 19. Jam nut |
| 10. Flange nut (12 each) | |

A replacement blower requires some assembly before the blower can be installed on the machine.

Note: Align the engine and blower drive shafts once the blower assembly is secured to the chassis; refer to [Aligning the Engine and Blower Drive Shafts \(page 4-4\)](#).

Assembling a Replacement Blower

Refer to [Figure 39](#) for this procedure.



1. Install the front cap, wave washer, and retaining ring.
2. Locate the weld seam on the blower outer housing. Install the inlet bell and the front fan mount so the fan mount is centered over the weld seam. Move the fan mount all the way to the right in its mounting slots (counterclockwise) and secure all of the inlet bell fasteners.



- Note:** A ball bearing is installed on 1 of the nozzle guide fasteners.
3. Install 2 nozzle guides and the rear fan mount so the fan mount is centered over the weld seam (parallel to the front fan mount). Move the fan mount all the way to the right in its mounting slots (the same direction as the front fan mount) and tighten the fasteners from **5.0 to 5.5 N·m (45 to 50 in-lb)**.



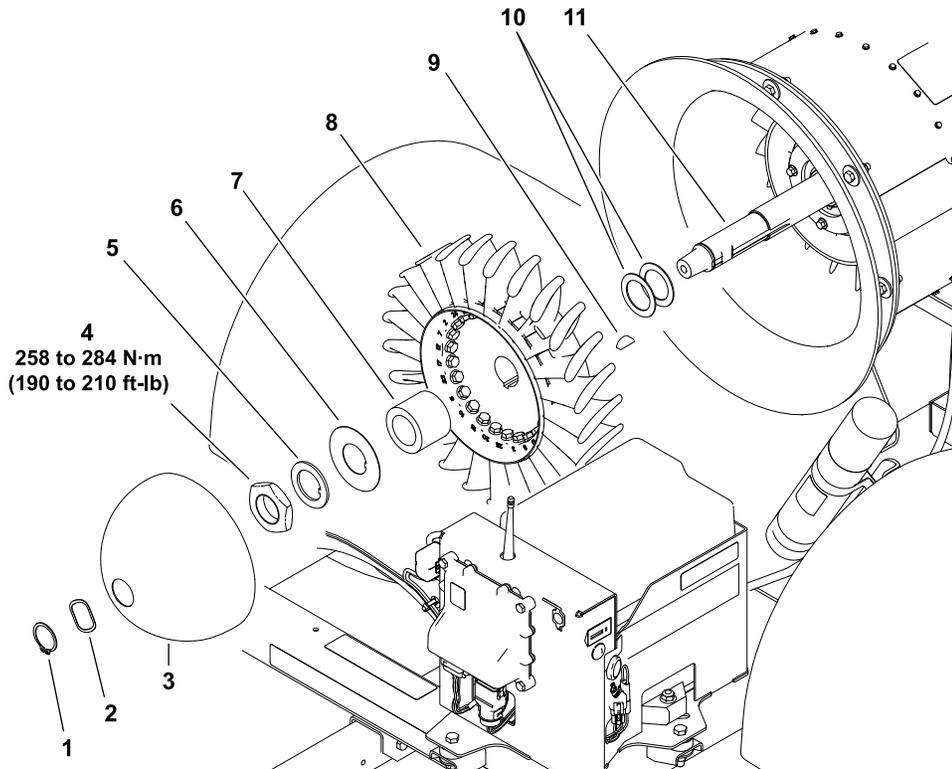
CAUTION



The blower assembly weighs approximately 50 kg (110 lbs). Use an appropriate lifting device when moving the blower assembly.

4. Temporarily install a 3/8–16 eye bolt and jam nut in the blower shaft end for lifting the blower assembly.

Rotor Assembly



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Figure 40

- | | | |
|--------------------------------|---------------------|------------------|
| 1. Retaining ring | 5. Outer tab washer | 9. Woodruff key |
| 2. Wave washer | 6. Inner tab washer | 10. Washer (A/R) |
| 3. Front cap | 7. Spacer | 11. Rotor shaft |
| 4. Hex nut (left-hand threads) | 8. Rotor assembly | |

Removing the Rotor Assembly

Refer to [Figure 40](#) for the for this procedure.

1. Remove the blower drive shaft from the machine; refer to [Removing the Blower Drive Shaft \(page 6–4\)](#).
2. Remove the retaining ring (item 1), wave washer, and front cap from the shaft.
3. Straighten the inner tab washer (item 6) to allow hex nut removal.

IMPORTANT

The nut used to secure the rotor assembly to the rotor shaft has left-hand threads. Loosen the nut by rotating it clockwise.

4. Use the 1-1/4 inch flats provided to hold the rotor shaft and an offset wrench to loosen and remove the hex nut (item 4); refer to [Offset Wrench \(page 2–13\)](#).
5. Remove the inner and outer tab washers from the rotor shaft. Discard the deformed Inner tab washer.
6. Slide the spacer (item 7) and rotor assembly from the shaft. Locate and retrieve the woodruff key.
7. Remove the washers (item 10) from the rotor shaft. Record the number of washers used for proper assembly.

Removing the Rotor Assembly (continued)

Note: The rotor assembly components are not available separately. If rotor damage occurs, replace the complete rotor assembly.

Installing the Rotor Assembly

Refer to [Figure 40](#) for the for this procedure.

Note: Washers (item 10) are used to prevent the rotor from contacting the rotor housing assembly. Typically, 2 washers are necessary.

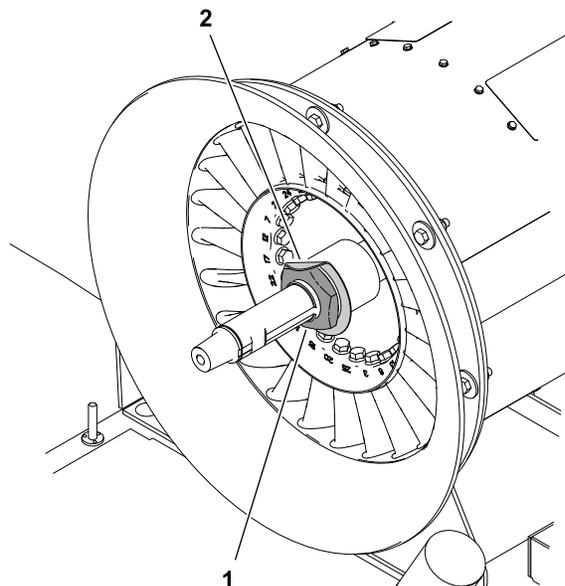
1. Install the same number of washers previously removed from the rotor shaft.
2. Position the woodruff key in the slot in the rotor shaft. Slide the rotor assembly and spacer onto the rotor shaft. Ensure that the rotor does not contact the inner rotor housing. If necessary, add an additional washer to gain clearance.
3. Slide a new inner tab washer (larger outer diameter) and then the outer tab washer onto the rotor shaft.

IMPORTANT

The nut used to secure the rotor assembly to the rotor shaft has left-hand threads. Tighten the nut by rotating it counterclockwise.



4. Use the 1-1/4 inch flats provided to hold the rotor shaft and install the hex nut (item 4). Use an offset wrench to tighten the hex nut from **258 to 284 N·m (190 to 210 ft·lb)**; refer to [Offset Wrench \(page 2–13\)](#).
5. Lock the hex nut in position by bending the inner tab washer over the outer tab washer and one of the hex nut flats.



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Figure 41

1. Hex nut
2. Inner tab washer (fold over)

-
6. Install the front cap (item 3), wave washer, and retaining ring onto the shaft.
 7. Install the blower drive shaft; refer to [Installing the Blower Drive Shaft \(page 6–5\)](#).

Rotor Shaft

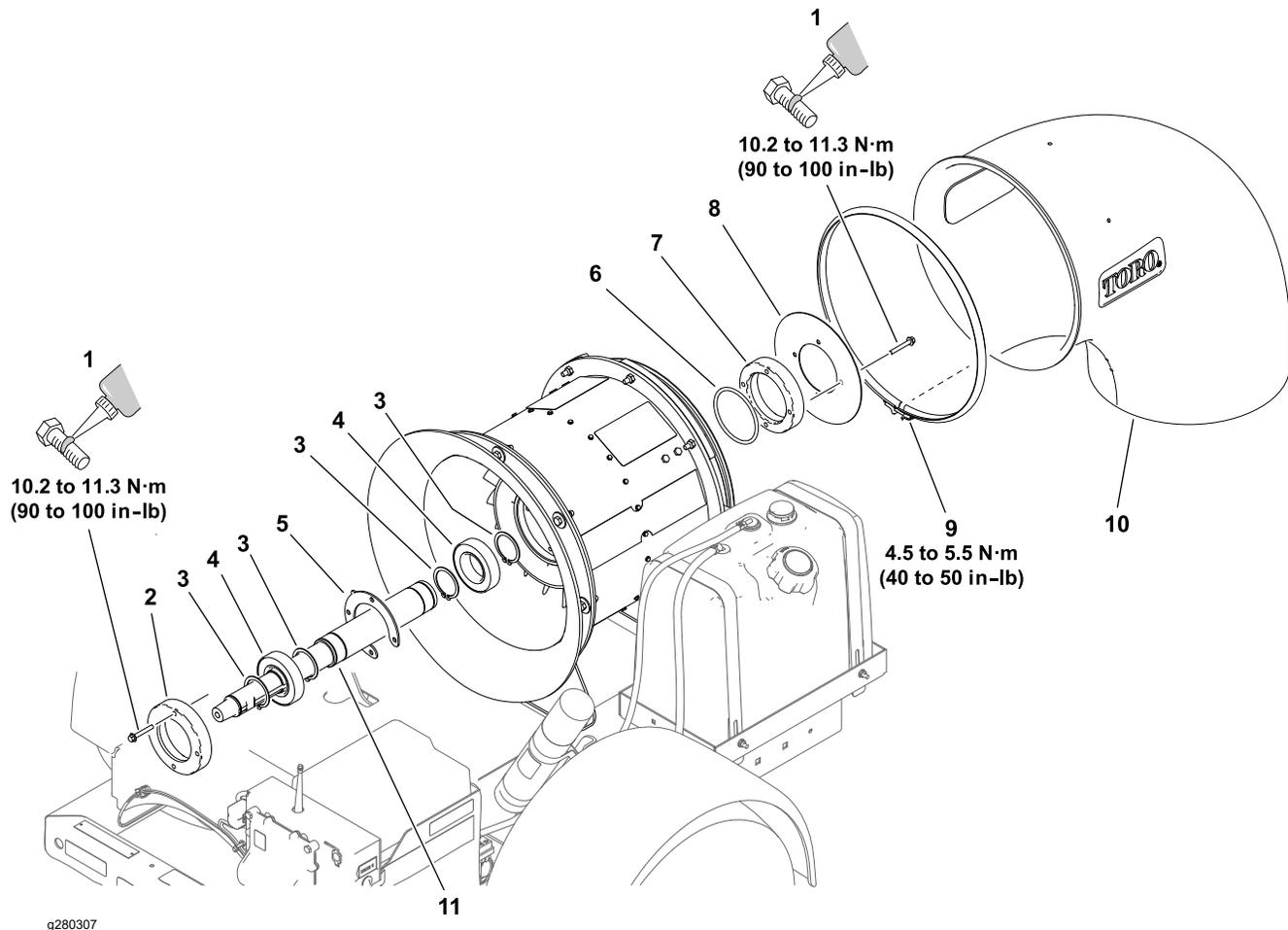


Figure 42

- | | | |
|-------------------------------|---------------------|-----------------|
| 1. Flange-head screw (8 each) | 5. End cap | 9. Nozzle clamp |
| 2. Front bearing cap | 6. O-ring | 10. Nozzle |
| 3. Retaining ring (4 each) | 7. Rear bearing cap | 11. Rotor shaft |
| 4. Bearing (2 each) | 8. Center plate | |

Note: The rotor shaft and bearings can be serviced without removing the inner housing from the machine.

Removing the Rotor Shaft

Refer to [Figure 42](#) for this procedure.

1. Remove the rotor assembly; refer to [Removing the Rotor Assembly \(page 6–8\)](#).
2. Loosen the nozzle clamp fasteners and remove the nozzle clamp and nozzle.
3. Remove the 4 flange-head screws that secure the front bearing cap (item 2) to the inner housing.
4. Carefully pull the rotor shaft assembly from the inner housing. The rear bearing cap will remain in the inner housing. Locate and retrieve the end cap (item 4).
5. Remove the retaining rings and bearings from the rotor shaft.
6. Remove the center plate and rear bearing cap, then remove and discard the O-ring from the rear bearing cap.

Removing the Rotor Shaft (continued)

7. Inspect the rotor shaft, bearing bores of the bearing caps, and bearings for wear or damage, and replace the parts as necessary.

Installing the Rotor Shaft

Refer to [Figure 42](#) for this procedure.

1. Install the inner retaining rings into the rotor shaft grooves if they were removed.
2. Install the bearings onto the rotor shaft by pressing on the inner race of the bearing. Ensure that the bearings are seated against the inner retaining rings.
3. Install the outer retaining rings into the rotor shaft grooves.
4. Install a new O-ring into the rear bearing cap. Apply a thin film of oil to the O-ring.



5. Apply medium strength thread locking compound to 4 of the flange-head screws (item 1) and secure the center plate and rear bearing cap to the inner housing. Tighten the screws from **10.2 to 11.3 N·m (90 to 100 in-lb)**.
6. Position the end cap (item 4) between the bearings of the rotor shaft assembly.
7. Align the tab on the end cap with the slot in the inner housing and install the rotor shaft assembly. Ensure that the bearings are seated in the bearing caps and the front bearing cap is seated in the inner housing.

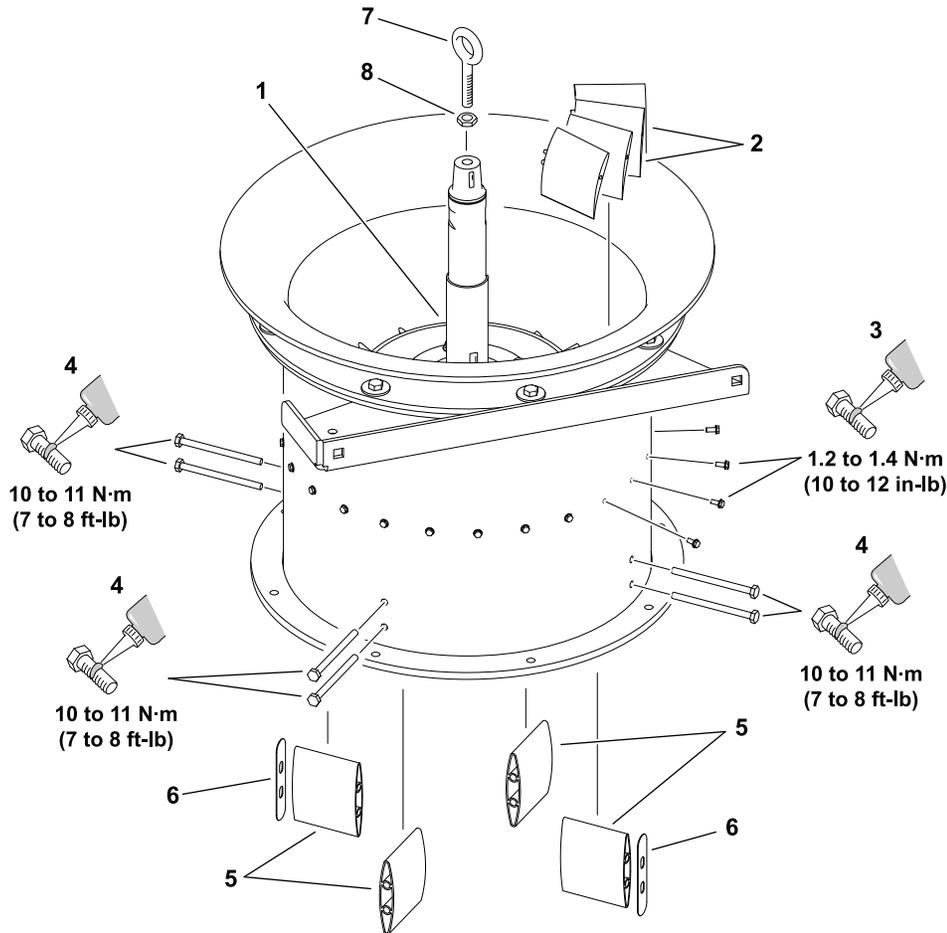


8. Apply medium strength thread locking compound to 4 of the flange-head screws (item 1) and secure the end cap and front bearing cap to the inner housing. Tighten the screws from **10.2 to 11.3 N·m (90 to 100 in-lb)**.
9. Ensure that the rotor shaft rotates freely, and correct any issues before proceeding.



10. Install the nozzle and the nozzle clamp. Position the nozzle clamp fasteners at the seam inside the nozzle and tighten from **4.5 to 5.5 N·m (40 to 50 in-lb)**.
11. Install the rotor assembly; refer to [Installing the Rotor Assembly \(page 6–9\)](#).

Inner Housing Assembly



g280705

Figure 43

- | | | |
|--------------------------------|------------------------------------|---------------------------------|
| 1. Inner housing assembly | 4. Cap screw (8 each) | 7. 3/8–16 eye bolt (lift point) |
| 2. Stator vane (24 each) | 5. Support fin (4 each) | 8. Jam nut |
| 3. Flange-head screw (24 each) | 6. Shim – 0.030 inch (as required) | |

Note: The rotor shaft and bearings can be serviced without removing the inner housing from the blower assembly; refer to [Rotor Shaft \(page 6–10\)](#).

Removing Inner Housing Components

Refer to [Figure 43](#) for this procedure.

1. Remove the rotor from the blower assembly; refer to [Removing the Rotor Assembly \(page 6–8\)](#).
2. Loosen the nozzle clamp fasteners and remove the nozzle clamp and nozzle.

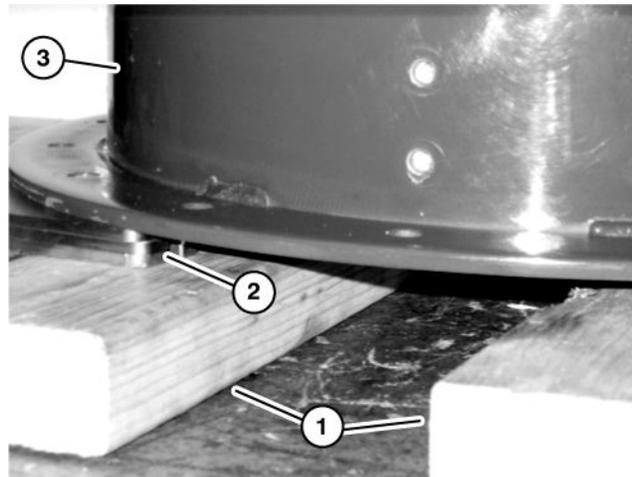


The blower assembly weighs approximately 50 kg (110 lbs). Use an appropriate lifting device when moving the blower assembly.

3. Temporarily install a 3/8–16 eye bolt and jam nut in the blower shaft end for lifting the blower assembly.

Removing Inner Housing Components (continued)

4. Disconnect the nozzle motor from the machine wire harness and remove the fasteners that secure the blower assembly to the machine frame. Remove the blower assembly from the machine.
5. Remove the nozzle motor bracket assembly, nozzle pulley, and rear fan mount from the blower assembly; refer to [Removing the Nozzle Assembly \(page 6–16\)](#).
6. Position the blower assembly on supports with the rotor shaft pointing up. Place **14.3 mm (9/16 inch)** thick spacers between the supports and the outer housing. This arrangement will align and stabilize the inner and outer housing assemblies during the service procedure.



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Figure 44

- | | |
|-------------------------------|------------------|
| 1. Supports (2 x 4 shown) | 3. Outer housing |
| 2. 14.3 mm (9/16 inch) spacer | |

7. Inspect each of the 24 stator vanes to ensure that their mounting lugs are in good condition and their mounting screw is tight. Remove any stator vane that is loose or damaged.
 - A. Remove the flange-head screw (item 18) that secures the stator vane to the outer housing.
 - B. Carefully tilt the vane to free the vane lugs from the inner housing, and remove the stator vane from the assembly.
 - C. Repeat as necessary.
8. Inspect each of the 4 support fins to ensure that their mounting screws are tight. Remove any support fin that is damaged.

Note: If multiple shims were used between a support fin and the outer housing during assembly, center the inner housing in the outer housing by dividing the number of shims evenly on each side of the assembly.
9. Remove all of the stator vanes, support fins, and shims to remove the inner housing.
10. Remove the rotor shaft assembly from the inner housing if necessary; refer to [Removing the Rotor Shaft \(page 6–10\)](#).

Installing Inner Housing Components

Refer to [Figure 43](#) for this procedure.

Installing Inner Housing Components (continued)

1. Assemble the inner housing if it was disassembled; refer to [Installing the Rotor Shaft \(page 6–11\)](#).
2. Position the inner housing assembly on supports with the rotor shaft pointing up. Carefully lower the outer housing around inner housing assembly. Place **14.3 mm (9/16 inch)** thick spacers between the supports and the outer housing. This arrangement will align and stabilize the inner and outer housing assemblies during the service procedure; refer to [Figure 44](#).
3. Install the 4 support fins (item 5) as follows:
 - A. Position the support fins between the inner and outer housing.
 - B. Determine if one or more shims are required to remove any space between a support fin and the outer housing.

Note: If multiple shims were required between a support fin and the outer housing, center the inner housing in the outer housing by dividing the number of shims evenly on each side of the assembly.



- C. Use medium strength thread locking compound and install all 8 cap screws finger tight. Tighten the cap screws from **10 to 11 N·m (7 to 8 ft-lb)**.
4. Install the 24 stator vanes (item 2) as follows:
 - A. Position a vane between the inner and outer housing. The rounded edge of the vane must be upward (toward the front of the blower) and its mounting lugs toward the inner housing.
 - B. Tilt the vane and engage the mounting lugs with the inner housing holes. While keeping the vane lugs in the inner housing holes, rotate the vane to align the threaded hole of the vane with outer housing hole.

IMPORTANT

Be very careful not to cross-thread the stator vane cap screws during assembly.

Note: New stator vane cap screws have a thread locking compound pre-applied. If installing a used stator vane cap screw, apply a medium strength thread locking compound during assembly.

- C. Install a cap screw (item 3) into the threads of the stator vane and tighten the screw finger tight.
- D. Repeat steps A – C for all of the remaining stator vanes.

IMPORTANT

Overtightening the stator vane screws can damage the threads in the stator vanes. Use hand tools only and do not overtighten the stator vane cap screws.



- E. Use a crossing pattern and tighten the stator vane cap screws from **1.2 to 1.4 N·m (10 to 12 in-lb)**.
5. Check each stator vane and support fin for looseness. Correct any loose, improperly installed, or damaged stator vane or support fin before proceeding.

Installing Inner Housing Components (continued)

6. Install the rear fan mount, nozzle pulley, and nozzle motor bracket assembly to the blower assembly; refer to [Installing the Nozzle Assembly \(page 6–17\)](#).



CAUTION



The blower assembly weighs approximately 50 kg (110 lbs). Use an appropriate lifting device when moving the blower assembly.

7. Temporarily install a 3/8–16 eye bolt and jam nut in the blower shaft end for lifting the blower assembly.
8. Install the blower assembly to the machine with the fasteners previously removed. Connect the nozzle motor to the machine wire harness.
9. Use the Shaft Alignment Tool to align the engine output shaft to the blower shaft; refer to [Aligning the Engine and Blower Drive Shafts \(page 4–4\)](#).
10. Install the rotor assembly; refer to [Installing the Rotor Assembly \(page 6–9\)](#).



11. Install the nozzle and the nozzle clamp. Position the nozzle clamp fasteners at the seam inside the nozzle and tighten from **4.5 to 5.5 N·m (40 to 50 in-lb)**.

Nozzle Assembly

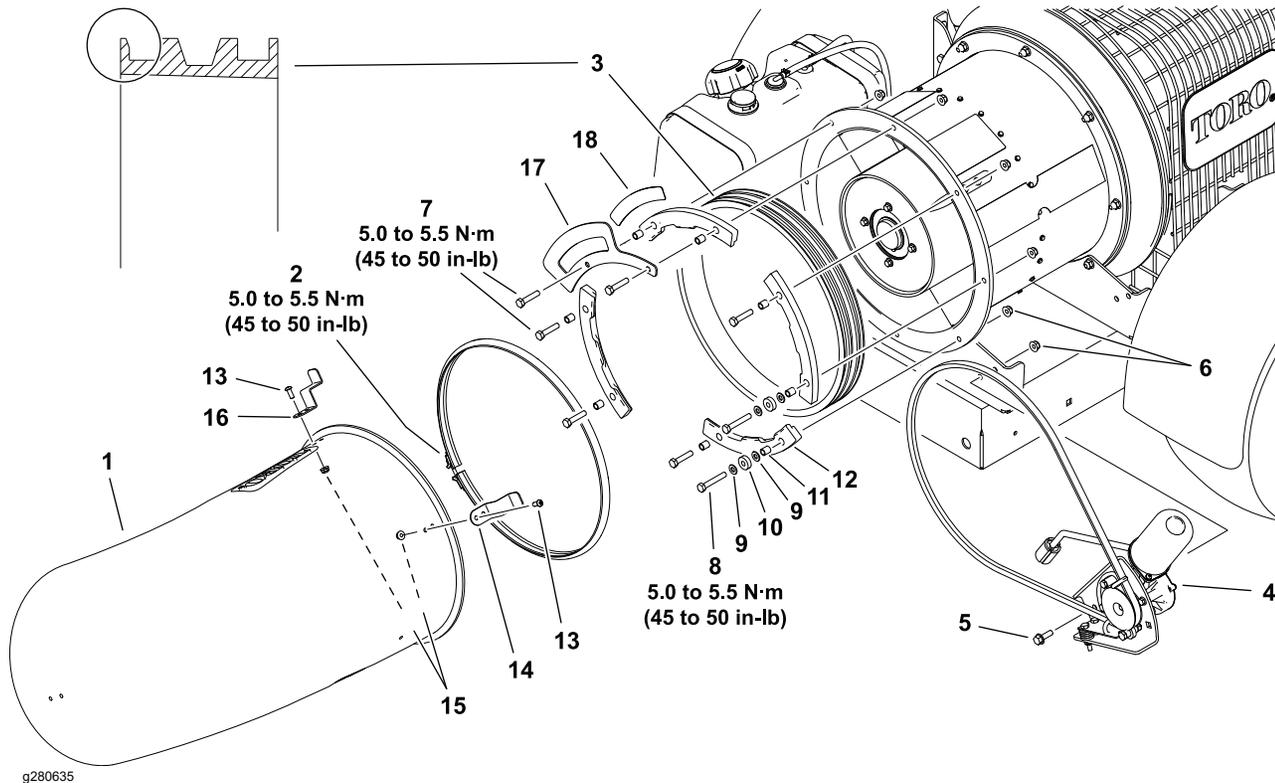


Figure 45

- | | | |
|----------------------------------|---------------------------|--------------------------------|
| 1. Nozzle | 7. Cap screw (6 each) | 13. Button head screw (4 each) |
| 2. Nozzle clamp | 8. Cap screw (2 each) | 14. Indicator – red |
| 3. Nozzle pulley | 9. Flat washer (4 each) | 15. Flange nut (4 each) |
| 4. Nozzle motor bracket assembly | 10. Ball bearing (2 each) | 16. Indicator – green |
| 5. Cap screw (2 each) | 11. Spacer (8 each) | 17. Rotation gauge |
| 6. Flange nut (10 each) | 12. Nozzle guide (4 each) | 18. Decal |

Note: For nozzle motor service information; refer to [Nozzle Motor \(page 5–30\)](#).

Removing the Nozzle Assembly

Refer to [Figure 45](#) for this procedure.

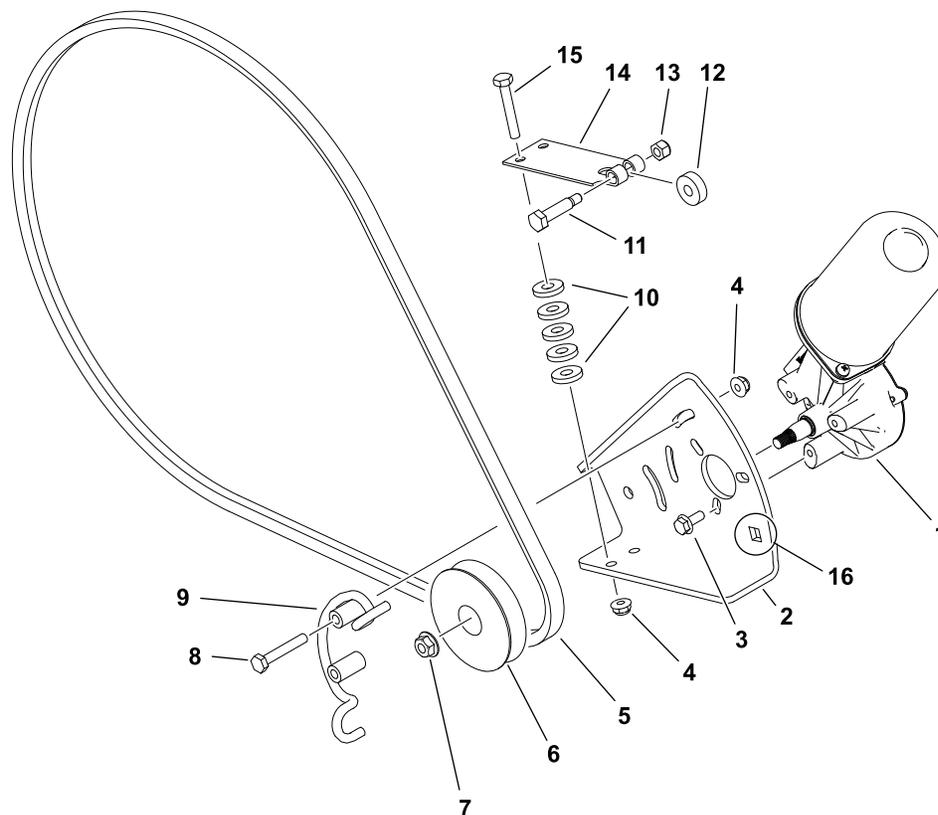
1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch. Block the wheels with chocks to prevent the machine from moving.
2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal; refer to [Servicing the Battery \(page 5–37\)](#). Position the disconnected negative cable away from the negative battery terminal.
3. Loosen the nozzle clamp fasteners and remove the nozzle clamp (item 2) and nozzle.
4. Loosen the 2 flange-head screws and 2 flange nuts that secure the nozzle motor bracket to the rear fan bracket, then remove the V-belt and motor bracket assembly from the machine. Disconnect the nozzle motor from the machine wire harness if necessary.
5. Remove the rotation gauge, nozzle guides and spacers, pulley bearings, and nozzle pulley from the outer housing.
6. Disassemble the nozzle motor bracket assembly if necessary.

Installing the Nozzle Assembly

Refer to [Figure 45](#) for this procedure.

1. Assemble the nozzle motor bracket assembly if necessary.

Note: When installing the leaf spring assembly, the flat side of the leaf spring should be downward. The bearing on the leaf spring assembly should be centered on the outside of the V-belt.



g280657

Figure 46

- | | |
|-------------------------------|---------------------------|
| 1. Nozzle motor | 9. Belt guard |
| 2. Motor bracket | 10. Flat washer (10 each) |
| 3. Flange-head screw (3 each) | 11. Shoulder bolt |
| 4. Flange nut (4 each) | 12. Ball bearing |
| 5. V-belt | 13. Locknut |
| 6. Drive pulley | 14. Leaf spring |
| 7. Flange nut | 15. Cap screw (2 each) |
| 8. Cap screw (2 each) | 16. Torque wrench access |



2. If removed, install the nozzle pulley, pulley bearings, and nozzle guides and spacers, and rotation gauge. Ensure the beveled flange of the nozzle pulley is installed toward the rear (nozzle side) of the machine.



3. Tighten the nozzle guide fasteners from **5.0 to 5.5 N·m (45 to 50 in-lb)**.
4. Place the V-belt in the nozzle pulley and secure the nozzle motor bracket assembly to the rear fan bracket. Tighten the bracket mounting fasteners finger tight.

Note: Do not over tension the belt.

Installing the Nozzle Assembly (continued)



5. Use the square hole provided and a 3/8 inch drive torque wrench to pivot the motor bracket assembly to **23 to 25 N·m (200 to 230 in-lb)**. Hold the motor bracket in position and tighten the 2 flange-head screws and flange nuts to secure the nozzle motor bracket assembly. Refer to the machine *Operator's Manual* for additional information.

6. Check and adjust the belt guard around the V-belt as necessary.



7. Install the nozzle and the nozzle clamp. Position the nozzle clamp fasteners at the seam inside the nozzle and tighten from **5.0 to 5.5 N·m (45 to 50 in-lb)**.



8. Connect the negative battery cable to the negative battery terminal. Tighten the nut that secures the battery cable to **14 to 20 N·m (10 to 15 ft-lb)**. Ensure that the battery cover is secured.



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General Information

The *Operator's Manual* provides information regarding the operation, general maintenance, and maintenance intervals for your Pro Force Debris Blower. Refer to the *Operator's Manual* for additional information when servicing the machine.

Service and Repairs

Wheels

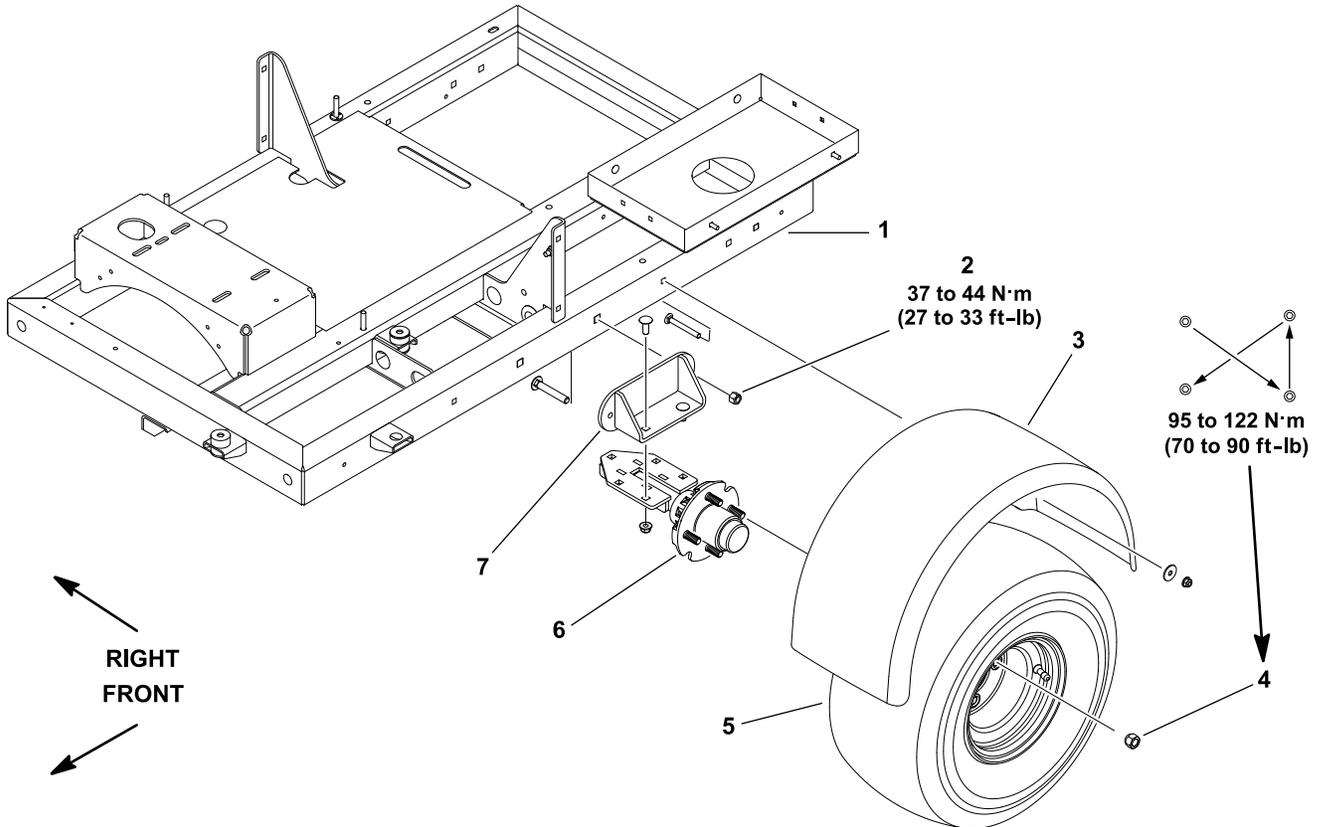


Figure 47
Models 44552, 44552TE, and 44554 shown

- | | | |
|---------------|---------------------------------|-----------------------|
| 1. Main frame | 3. Wheel-lug nut (4 each wheel) | 5. Wheel hub assembly |
| 2. Fender | 4. Wheel and tire assembly | 6. Axle mount |

Removing the Wheel

1. Have the Pro Force Blower attached to a tow vehicle and park the machines on a level surface. Engage the vehicle parking brake, shut off the engine, and remove the key from the key switch. Ensure that the blower engine is shut off. Block the wheels with chocks to prevent movement of either machine.
2. Loosen, but do not remove the wheel-lug nuts that secure the wheel to be removed.
3. Raise the Pro Force Blower from the ground and support the machine with jack stands; refer to [Jacking Instructions \(page 1–6\)](#).
4. Remove the wheel-lug nuts and pull the wheel from the machine wheel hub.

Installing the Wheel

1. Position the wheel to the wheel hub on raised machine.
2. Secure the wheel to the Pro Force Debris Blower with the wheel-lug nuts.

Installing the Wheel (continued)



WARNING



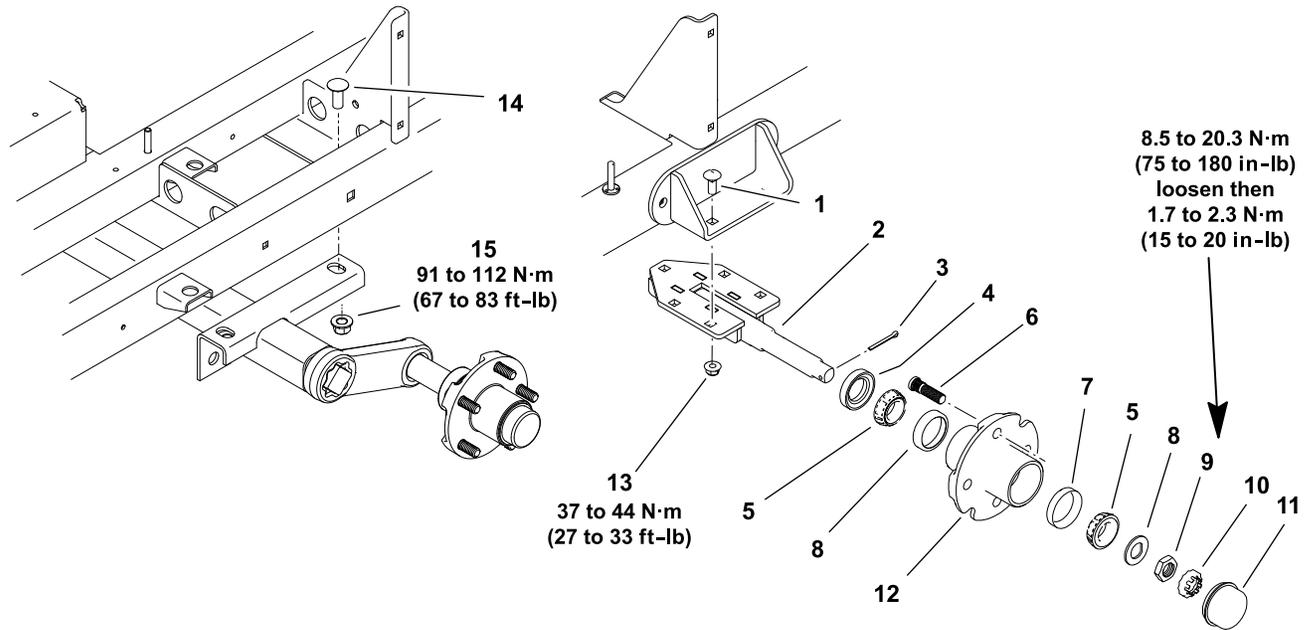
Failure to maintain proper torque could result in failure or loss of wheel and may result in personal injury.

Maintain the proper torque of the wheel-lug nuts.



3. Lower the machine to the ground and tighten the lug nuts to **95 to 122 N·m (70 to 90 ft-lb)** in a crossing pattern.

Wheel Hubs and Bearings



g233391

Figure 48

- | | | |
|------------------------------------|----------------------------------|----------------------------------|
| 1. Carriage bolt (3 each per axle) | 6. Lug screw (4 each per hub) | 11. Dust cap |
| 2. Axle | 7. Bearing cup (2 each per axle) | 12. Wheel hub |
| 3. Cotter pin | 8. Spindle washer | 13. Flange nut (3 each per axle) |
| 4. Oil seal | 9. Nut | 14. Carriage bolt (4 each) |
| 5. Bearing cone (2 each per axle) | 10. Nut retainer | 15. Flange nut (4 each) |

Note: Machines with Models 44552, 44552TE, and 44554 use an axle mount that is fastened to the frame. Machines with Model No. 44553 have a suspension axle for road ready machines. Wheel hub and bearing service is the same for all axle types.

Disassembling the Wheel Hubs and Bearings

Refer to [Figure 48](#) for the following procedure.

1. Remove the wheel assembly; refer to [Removing the Wheel \(page 7–3\)](#).
2. Carefully remove the dust cap from the wheel hub.
3. Remove and discard the cotter pin from the axle spindle.
4. Remove the nut retainer, nut, and spindle washer that secure the wheel hub to the spindle. Slide the wheel hub with the bearings from the spindle.
5. Disassemble the wheel hub as follows:

Note: Ensure that you do not damage the hub bore.

- A. Remove and discard the oil seal from the wheel hub.
 - B. Remove the bearing cones from both sides of the wheel hub. Clean the inner surface of the wheel hub.
 - C. Clean and inspect the wheel bearing cups and cones. Check the bearing cones and cups for wear, pitting, or other damage. Replace the parts that are worn or damaged.
 - D. If necessary, press the lug screws from the wheel hub.
6. Clean and inspect the axle spindle for wear or damage. Replace the axle if necessary.

Assembling the Wheel Hubs and Bearings

Refer to [Figure 48](#) for the following procedure.

1. Assemble the wheel hub as follows:
 - A. If the lug screws were removed from the wheel hub, press the lug screws fully into the hub. Ensure that the lug screw flange is pressed fully to the hub surface.
 - B. If the bearing cups were removed from the wheel hub, press the inner and outer cups into the wheel hub until they seat against the wheel hub shoulder.
 - C. Fill the wheel hub approximately 50% full of grease.
 - D. Pack both bearing cones with grease. Install greased inner bearing cone into the cup on inboard side of the wheel hub.

IMPORTANT

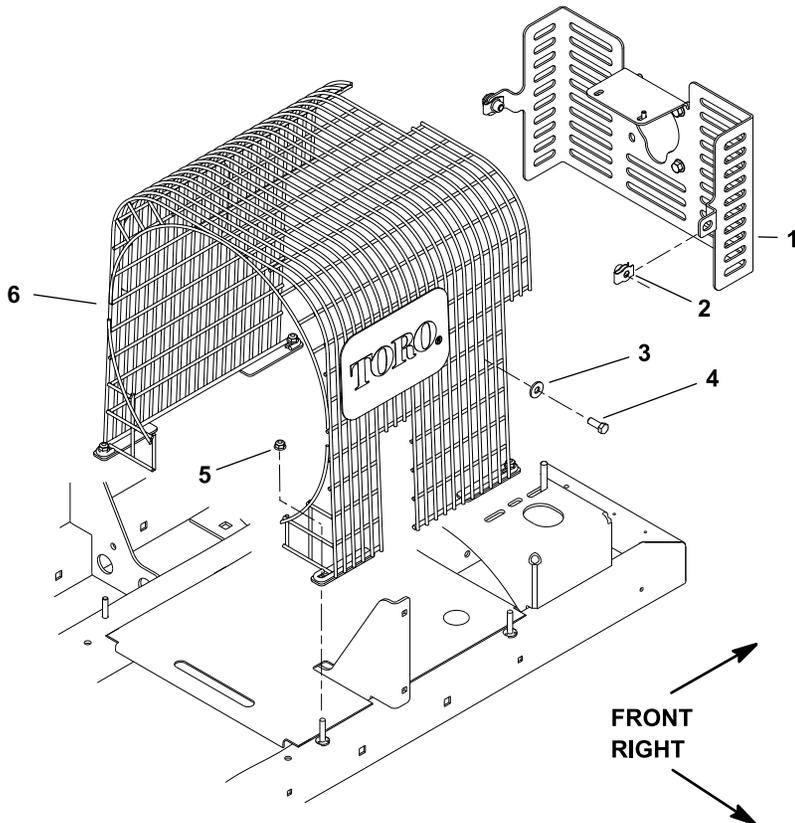
The oil seal should be pressed in so that it is flush with the end of the wheel hub. The lip of the oil seal must be toward the inner bearing.

- E. Lubricate the inside of new oil seal and press it into the wheel hub.

Note: Ensure that you do not damage the oil seal in the wheel hub.

2. Install the wheel hub onto the axle spindle.
3. Install greased outer bearing cone, spindle washer, and nut onto the spindle shaft.
-  4. While rotating the wheel hub by hand, torque the nut to **8.5 to 20.3 N·m (75 to 180 in-lb)** to seat bearings. Loosen the nut until it is away from the spindle washer and the wheel hub has end-play. Finally, while rotating the wheel hub, tighten the nut to **1.7 to 2.3 N·m (15 to 20 in-lb)**.
5. Install the nut retainer and a new cotter pin to secure the nut. Install the dust cap.
6. Install the wheel assembly; refer to [Installing the Wheel \(page 7-3\)](#).

Guards



g233393

Figure 49

- | | |
|-----------------------------|------------------------|
| 1. Muffler mount | 4. Bolt (2 each) |
| 2. Tinnerman nut (2 each) | 5. Flange nut (4 each) |
| 3. Hardened washer (2 each) | 6. Top grill |

Removing the Guards

1. Park the machine on a level surface, shut off the engine, and remove the key from the key switch. Block the wheels with chocks to prevent the machine from moving.
2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal; refer to [Servicing the Battery \(page 5-37\)](#). Position the disconnected negative cable away from the negative battery terminal.



The hot engine can cause burns.

Allow the engine to cool before removing the guards from the machine.

3. Remove the guards from the machine as necessary ([Figure 49](#)).

Note: Removal of the muffler mount (item 1) requires removal of the blower drive shaft or engine.

Installing the Guards

1. Install the guards that were removed from the machine.

Installing the Guards (continued)



2. Connect the negative battery cable to the negative battery terminal. Tighten the nut that secures the battery cable to **14 to 20 N·m (10 to 15 ft-lb)**. Ensure that the battery cover is secured.



Foldout Drawings

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Electrical Drawing Designations

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).

Wire Color

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

ABBREVIATION	COLOR
BK	BLACK
BR or BN	BROWN
BU	BLUE
GN	GREEN
GY	GRAY
OR	ORANGE
PK	PINK
R or RD	RED
T	TAN
VIO	VIOLET
W or WH	WHITE
Y or YE	YELLOW

Numerous harness wires used on the Toro machines include a line with an alternate color. These wires are identified with the wire color and line color with either a / or _ separating the color abbreviations listed above (e.g., R/BK is a red wire with a black line, OR_BK is an orange wire with a black line).

Wire Size

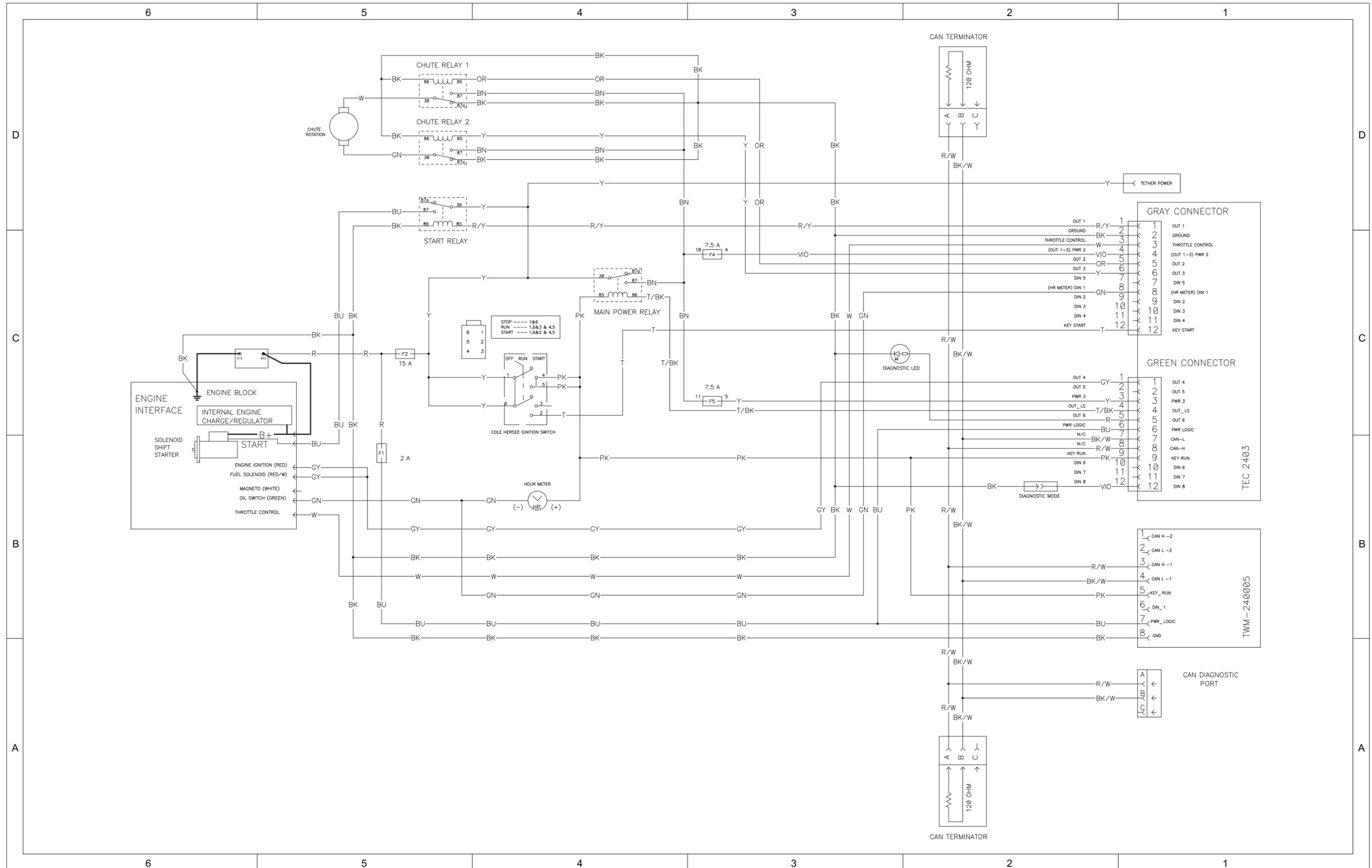
The individual wires of the electrical harness diagrams in this chapter identify both the wire color and the wire size.

Examples:

- 16 BK = 16 AWG (American Wire Gauge) wire that has a black insulator
- 050 R = 0.5 mm metric wire that has a red insulator (AWG equivalents for metric wire appear in the following table)

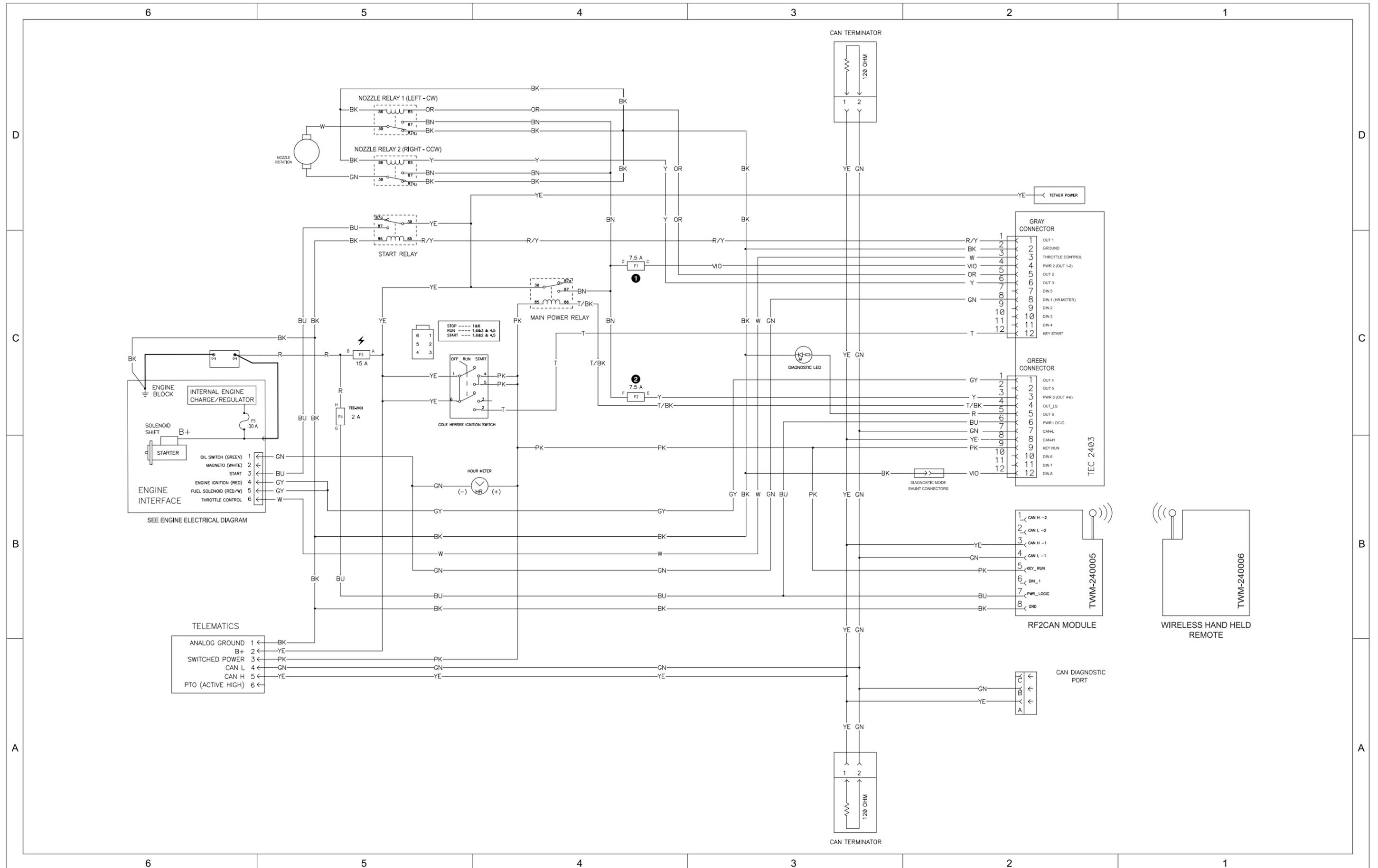
AWG Equivalents for Metric Wire		
Diagram Label	Metric Size	AWG Equivalent
050	0.5 mm	20 GA
175	0.75 mm	18 GA
100	1.0 mm	16 GA
150	1.5 mm	14 GA

Electrical Schematic – Models 44552, 44552TE, and 44553 (serial numbers below 403421000)

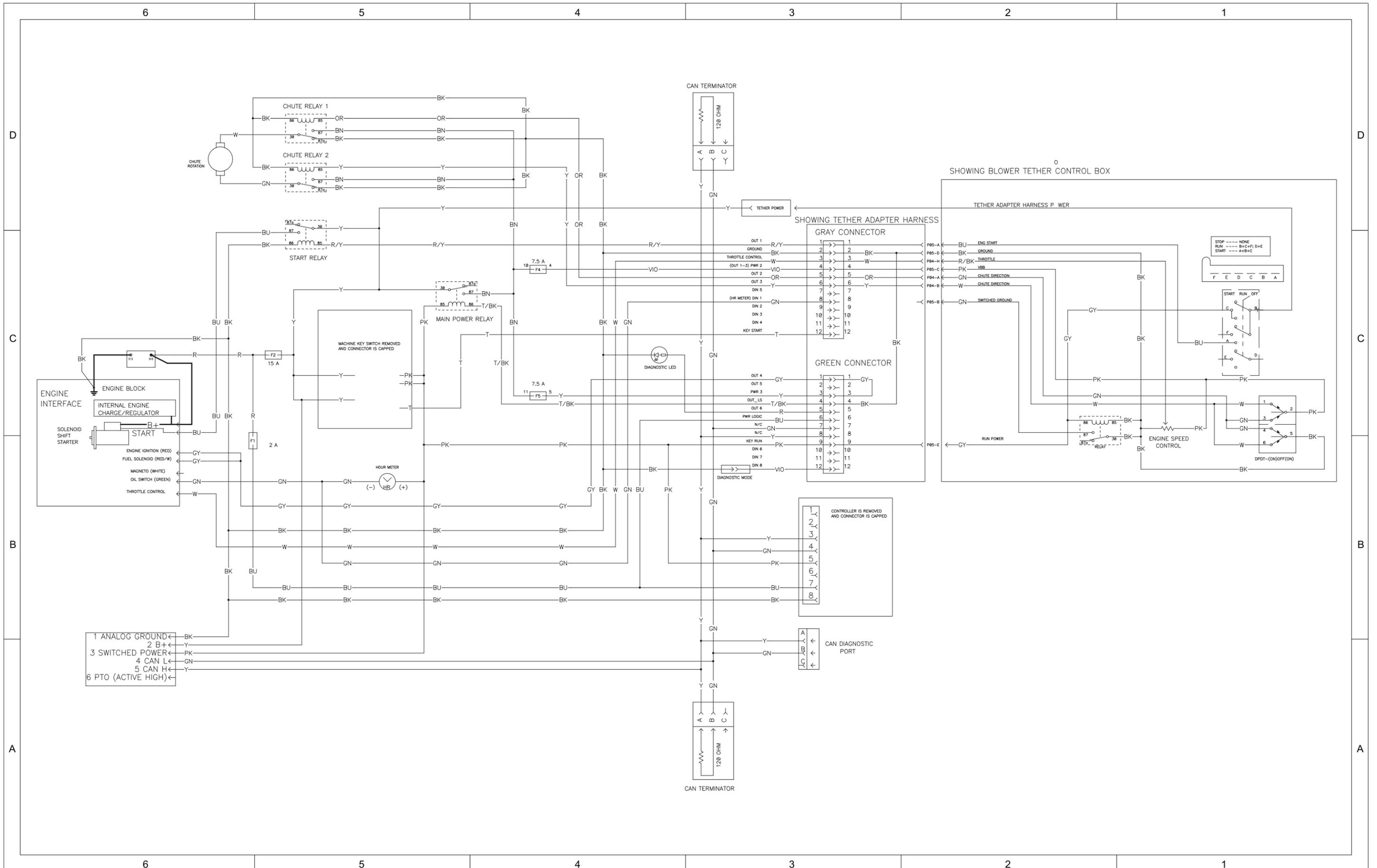


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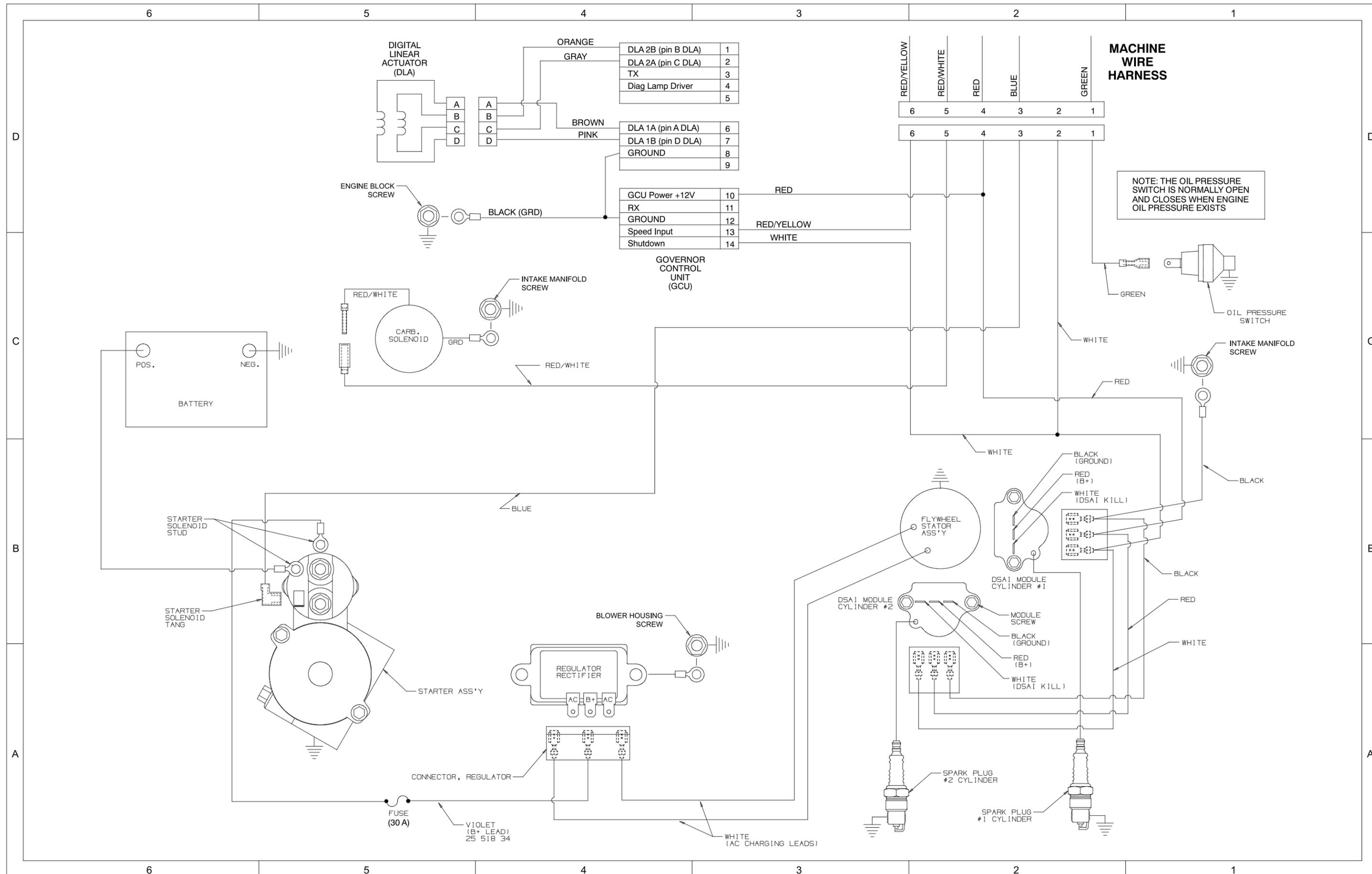
Electrical Schematic – Models 44552, 44552TE, and 44553 (serial numbers above 403421000)



Electrical Schematic – Model No. 44554 (serial numbers above 403421000)

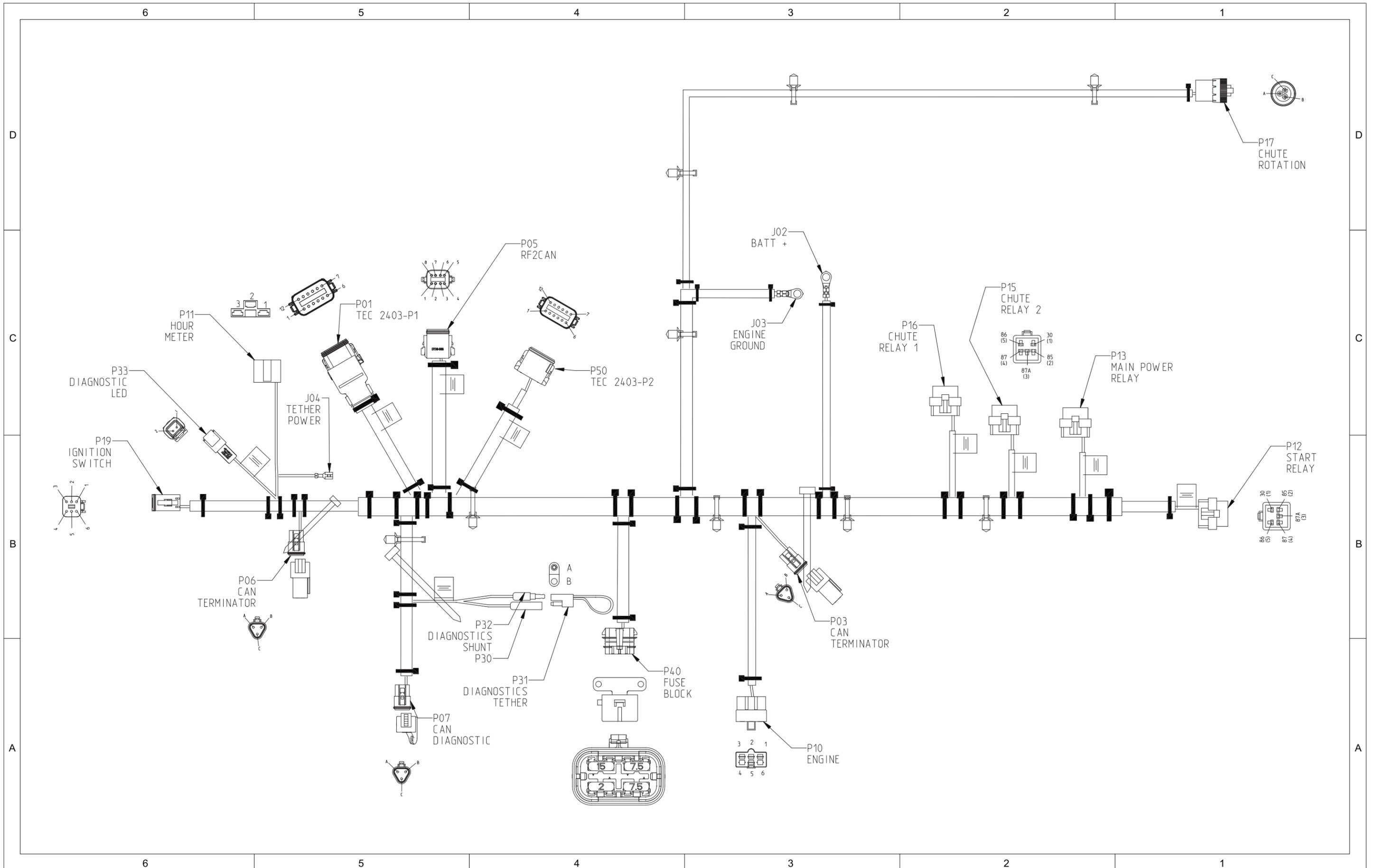


Engine Electrical Diagram

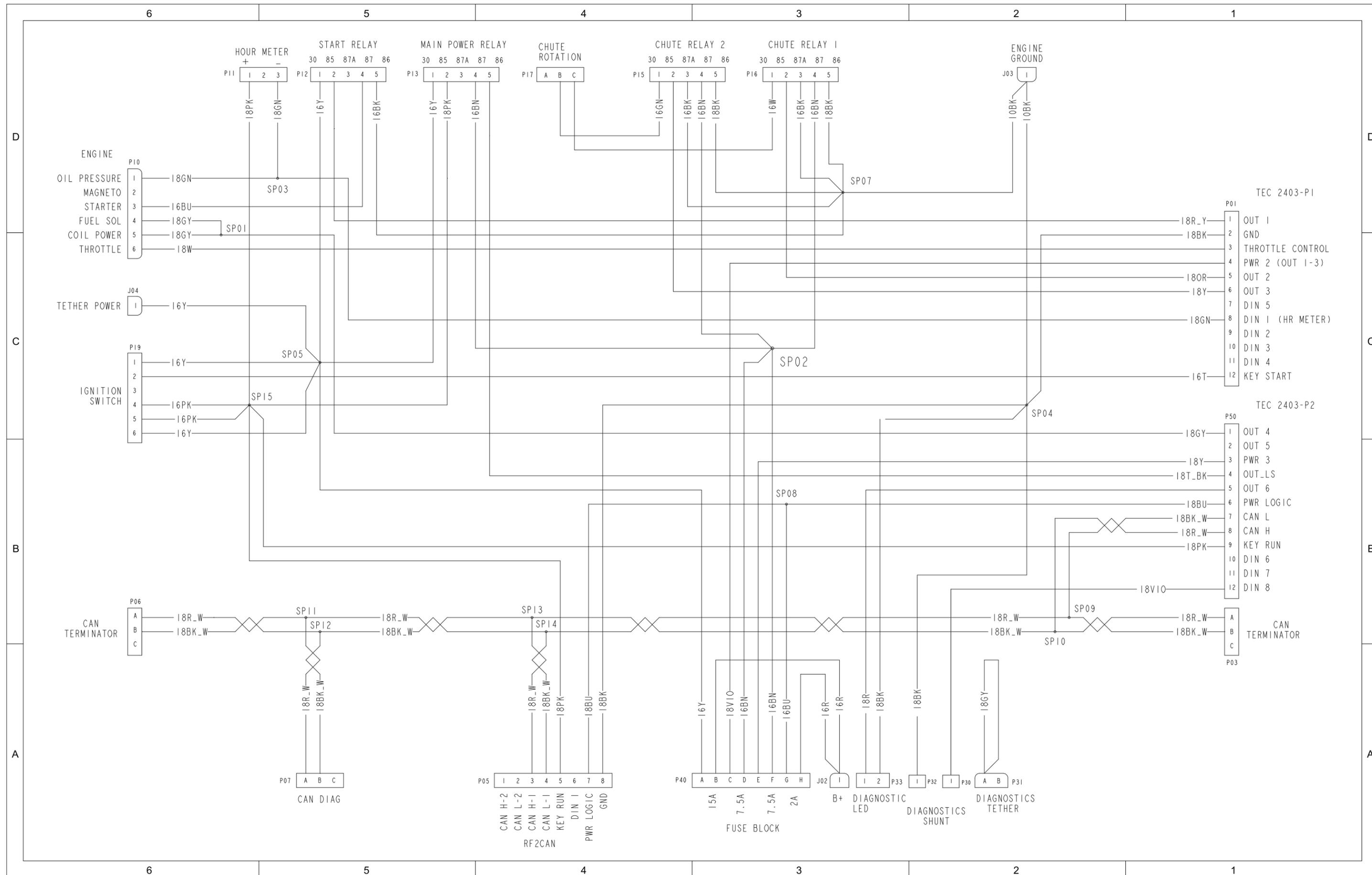


g279585

Wire Harness Drawing – Main (serial numbers below 403421000)

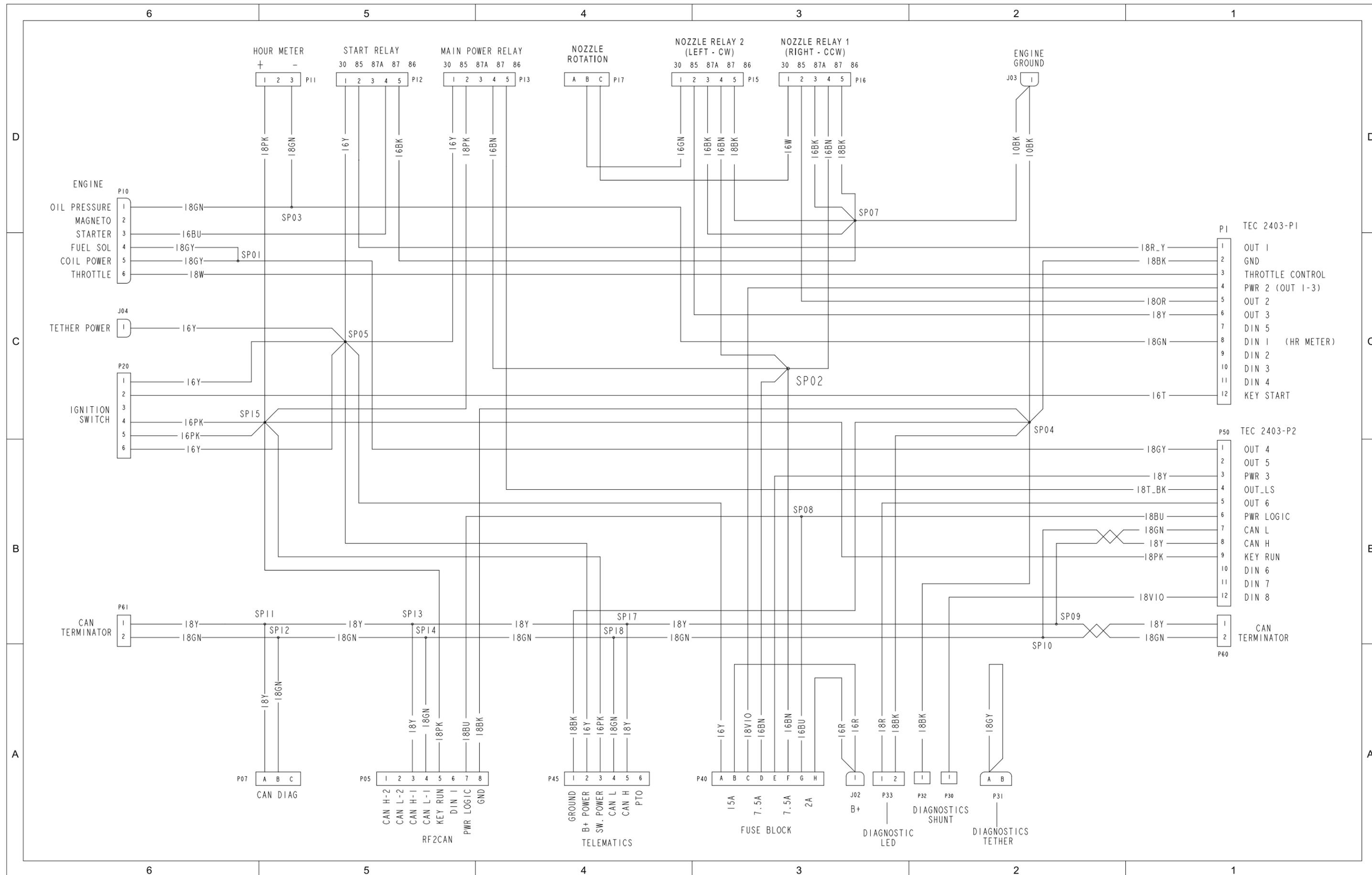


Wire Harness Diagram – Main (serial numbers below 403421000)



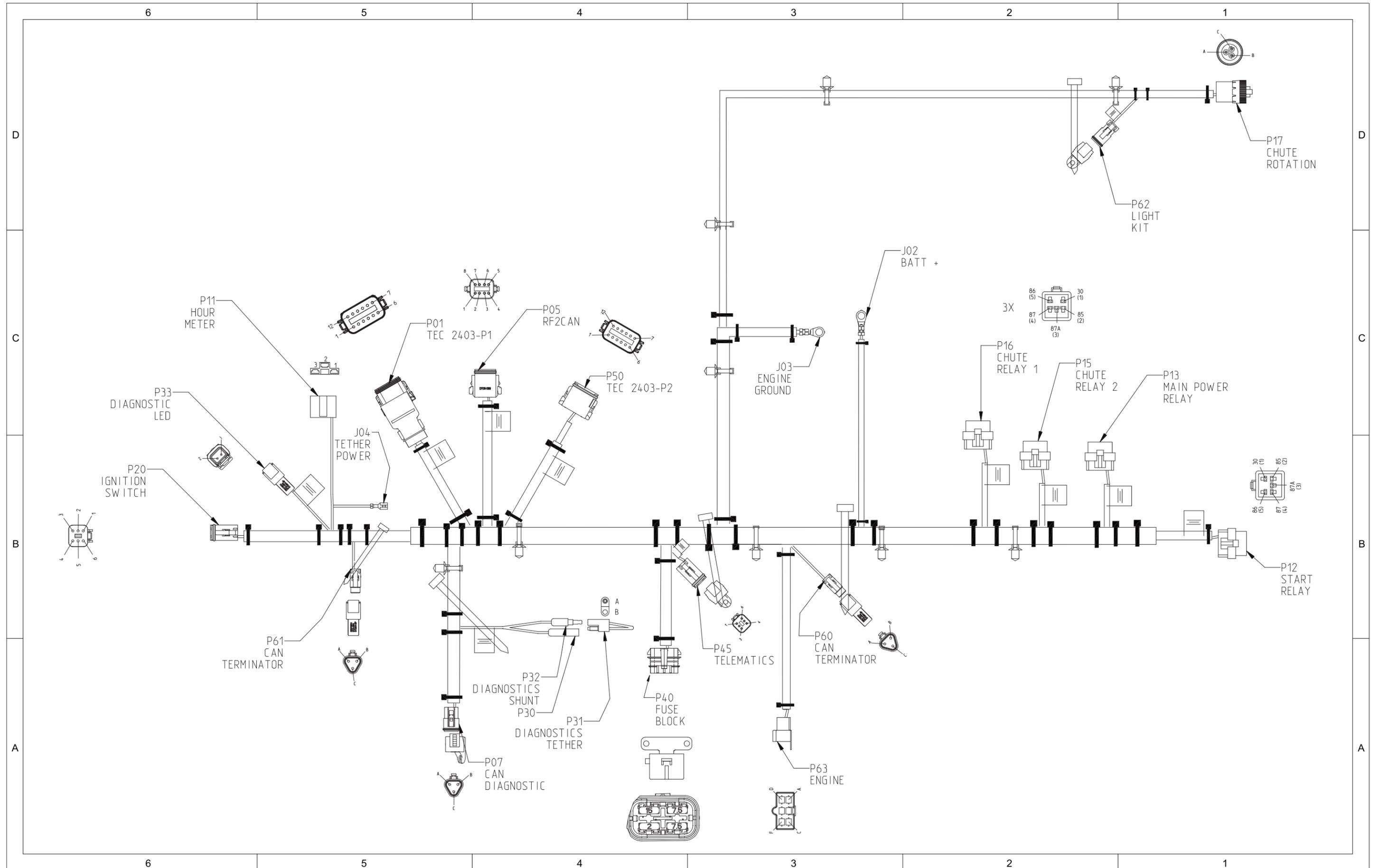
g326211

Wire Harness Diagram – Main (serial numbers 403421000 to 405799999)

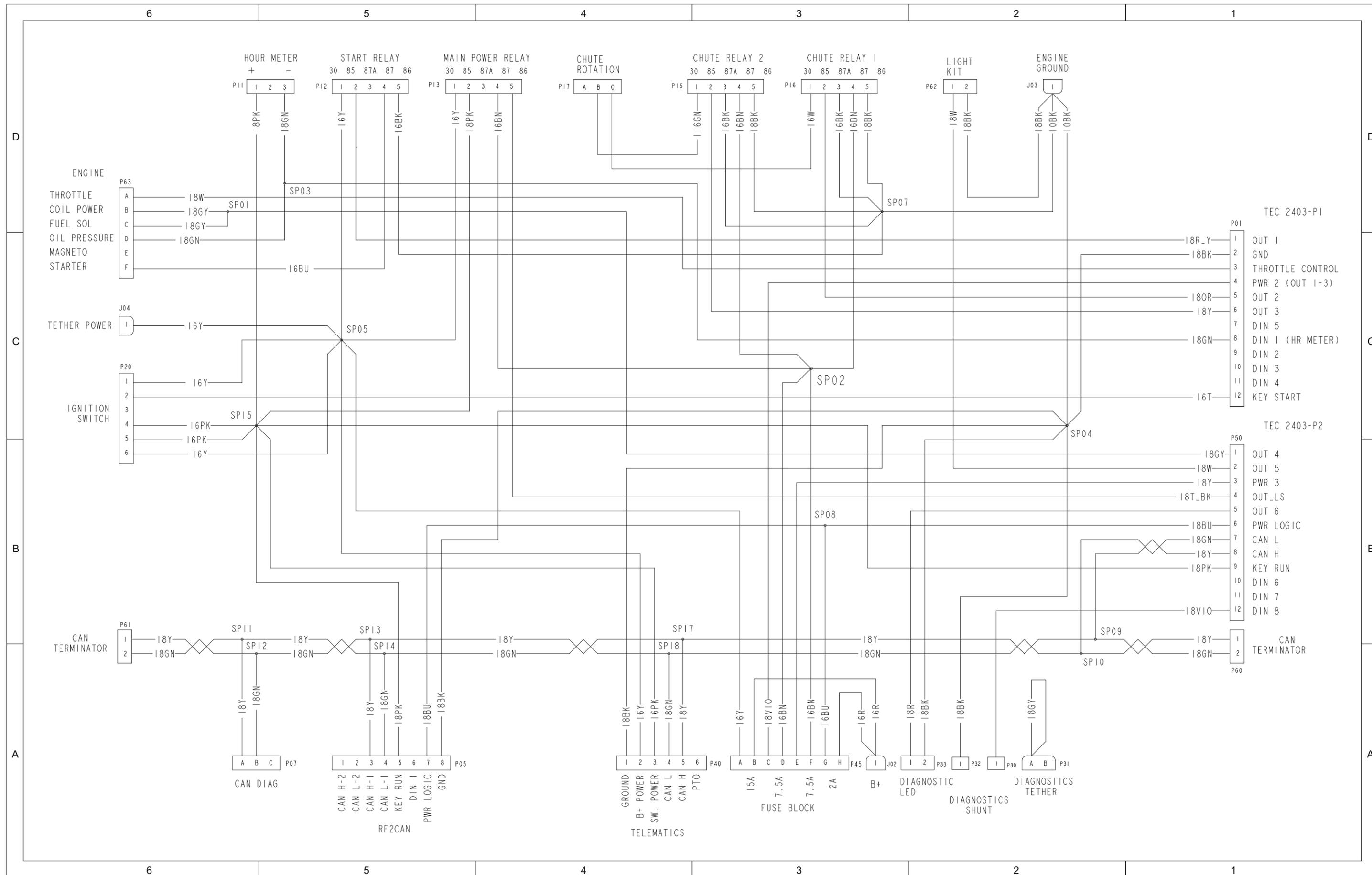


g279709

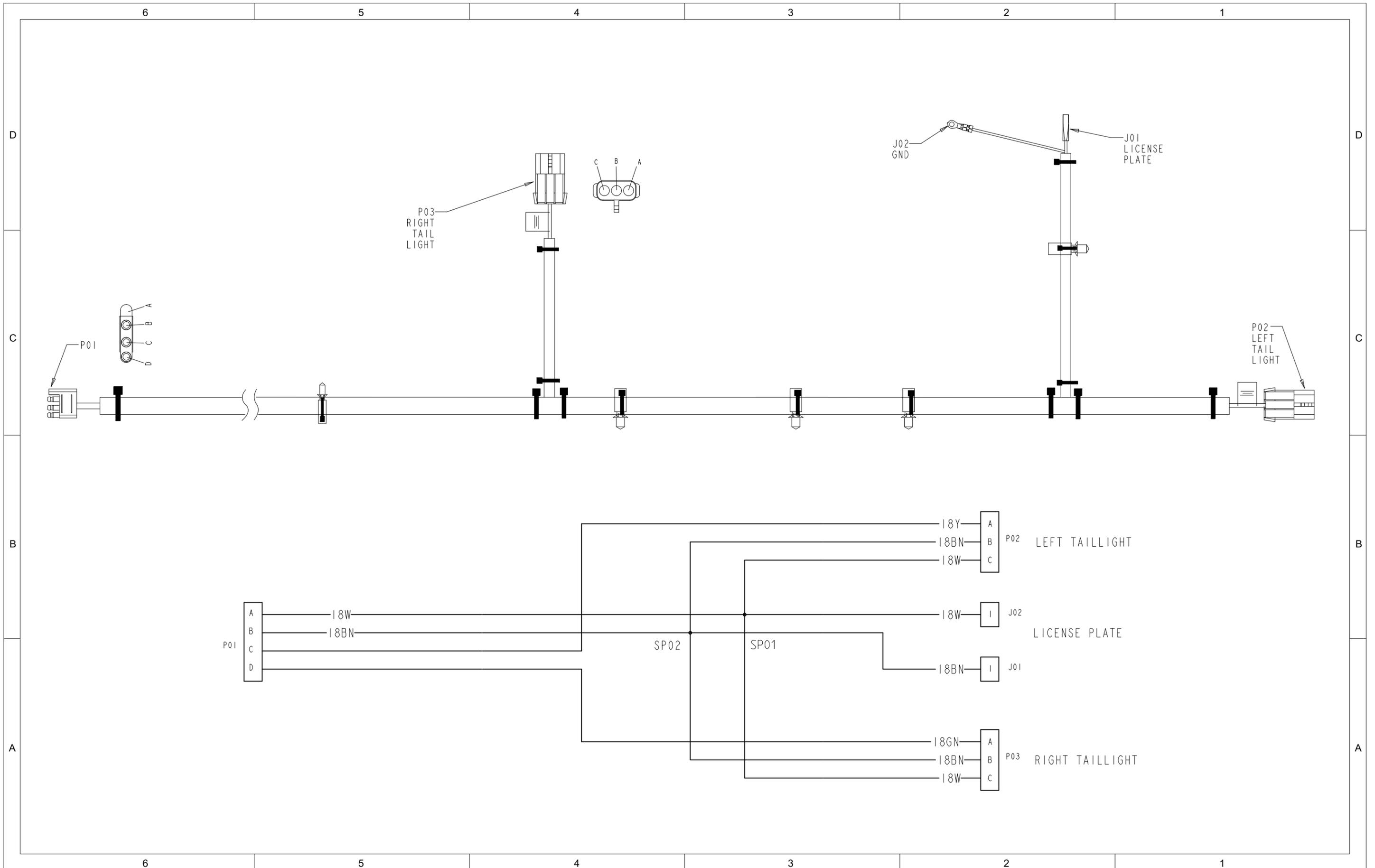
Wire Harness Drawing – Main (serial numbers above 405799999)



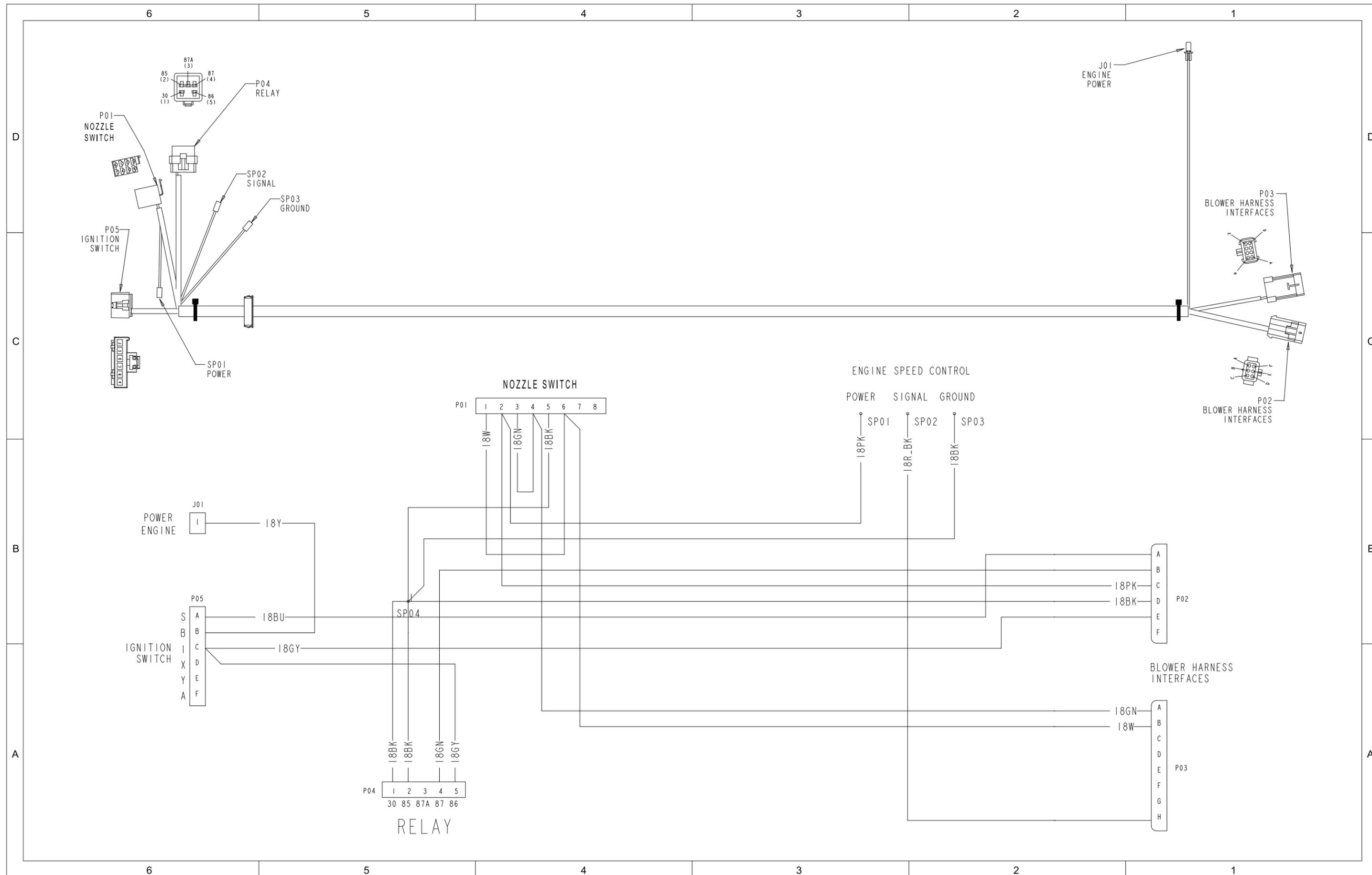
Wire Harness Diagram – Main (serial numbers above 405799999)



g326525



Wire Harness -Tethered Control Box (Model No. 44554)



g235233

Wire Harness-Tether Adapter (Model No. 44554)

