Part No.

Service Manual

ProForce® Debris Blower

Preface

The purpose of this publication is to provide the service technician with information for troubleshooting, testing and repair of major systems and components on the ProForce Debris Blower.

REFER TO THE OPERATOR'S MANUALS FOR OPERATING, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS. Space is provided in Chapter 2 of this book to insert the Operator's Manuals and Parts Catalogs for your machine. Replacement Operator's Manuals are available on the internet at www.toro.com or by sending complete Model and Serial Number to:

The Toro Company
Attn. Technical Publications
8111 Lyndale Avenue South
Minneapolis, MN 55420

The Toro Company reserves the right to change product specifications or this publication without notice.

This safety symbol means DANGER, WARNING, or CAUTION, PERSONAL SAFETY INSTRUCTION. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions may result in personal injury.

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

IMPORTANT: The IMPORTANT notice will give important instructions which must be followed to prevent damage to systems or components on the machine.

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Chapter 1

Safety

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Safety Instructions

The ProForce Debris Blower is designed and tested to offer safe service when operated and maintained properly. Although hazard control and accident prevention partially are dependent upon the design and configuration of the machine, these factors are also dependent upon the awareness, concern and proper training of the personnel involved in the operation, transport, maintenance and storage of the machine. Improper use or maintenance of the machine can result in injury or death. To reduce the potential for injury or death, comply with the following safety instructions.

WARNING

To reduce the potential for injury or death, comply with the following safety instructions.

Before Operating

1. Read and understand the contents of the Operator's Manual before starting and operating the ProForce Debris Blower. Become familiar with the controls and know how to stop the machine quickly. A replacement Operator's Manual is available on the Internet at www.Toro.com or by sending the complete model and serial number to:

   The Toro Company
   Attn. Technical Publications
   8111 Lyndale Avenue South
   Bloomington, Minnesota 55420–1196

2. Keep all shields, safety devices and decals in place. If a shield, safety device or decal is defective, illegible or damaged, repair or replace it before operating the machine.

3. Make sure that the tow vehicle is carefully selected to assure the best performance and safe operation of the ProForce Debris Blower.

4. Make sure that operator is familiar with safe tow vehicle operation.

5. Tighten any loose nuts, bolts, screws or other fasteners to ensure machine is in safe operating condition.

6. Make sure that the ProForce Debris Blower is properly attached to tow vehicle.

While Operating

1. Operator should be on the tow vehicle when starting the engine and when operating the ProForce Debris Blower. Stay away from the blower when it is engaged.

2. Before starting the engine on the tow vehicle, refer to tow vehicle Operator's Manual for safe starting procedures.

3. Do not run engine of ProForce Debris Blower or tow vehicle in a confined area without adequate ventilation. Exhaust fumes are hazardous and could possibly be deadly.

4. Be aware of the blower nozzle direction and do not point it at anyone. Keep away from the nozzle opening during machine operation.

5. Do not touch engine or exhaust system while the Debris Blower engine is running or soon after it is stopped. These areas could be hot enough to cause burns.

6. If abnormal vibration is detected, shut off blower and stop tow vehicle immediately. Determine source of vibration and correct problem(s) before resuming the use of blower.

7. While operating, the combination of the tow vehicle and the ProForce Debris Blower may exceed noise levels of 85dB(A) at the operator position. Hearing protection is recommended for prolonged exposure to reduce the potential of permanent hearing damage.

8. Before leaving the operator's position of the tow vehicle:

   A. Park on level surface and stop ProForce Debris Blower engine. Make sure that all machine motion has stopped.

   B. Ensure that tow vehicle transmission or traction lever is in neutral, set parking brake, stop engine and remove key from ignition switch.

   C. Wait for all moving parts to stop before leaving the tow vehicle.

   D. If blower use is complete, turn ProForce Debris Blower ignition switch OFF and remove key from switch.

Maintenance and Service

1. Before servicing or making adjustments to ProForce Debris Blower, position ProForce Debris Blower on a level surface and stop blower engine. If blower is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch. Also, turn blower ignition switch OFF and remove key from switch.

2. To prevent unexpected machine operation, disconnect battery before performing any Debris Blower service. Disconnect negative battery cable first and positive cable last. If battery voltage is required for troubleshooting or test procedures, temporarily connect the battery. Reconnect positive battery cable first and negative cable last.

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

4. Use care when checking or servicing the blower: wear gloves and use caution.

5. Before disconnecting ProForce Debris Blower from tow vehicle, park blower on a hard, level surface and chock blower wheels to prevent machine movement.

6. To reduce potential fire hazard, keep engine area free of excessive grease, grass, leaves and dirt.

7. If engine must be running to perform maintenance or to make an adjustment, keep hands, feet, clothing and other parts of the body away from moving parts on the Debris Blower. Keep bystanders away.

8. Do not overspeed the engine by changing governor setting. To assure safety and accuracy, check maximum engine speed with a tachometer.

9. Shut Debris Blower engine off before checking or adding oil to the crankcase.

10. Battery acid is poisonous and can cause burns. Avoid contact with skin, eyes and clothing. Protect your face, eyes and clothing when working with a battery.

11. Battery gases can explode. Keep cigarettes, sparks and flames away from the battery.

12. After servicing the ProForce Debris Blower, be sure that all guards and covers are properly installed.

13. When changing tires or performing other service, use correct supports, hoists and jacks. Make sure machine is parked on a solid level surface such as a concrete floor. Always chock or block wheels. Use suitable jack stands to support the raised machine. If the machine is not properly supported by suitable jack stands, the machine may move or fall, which may result in personal injury (see Jacking Instructions in this chapter).

14. If welding on the machine is necessary, disconnect the negative battery cable to prevent electrical system damage.

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

16. At the time of manufacture, the machine conformed to all applicable safety standards. To assure optimum performance and continued safety certification of the machine, use genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers may result in non-conformance with the safety standards, and the warranty may be voided.

Securing ProForce Debris Blower to Tow Vehicle

While operating or servicing the ProForce Debris Blower, make sure that blower is properly secured to tow vehicle (Fig. 1). Refer to your Operator's Manual for the correct procedure for attaching blower to tow vehicle.

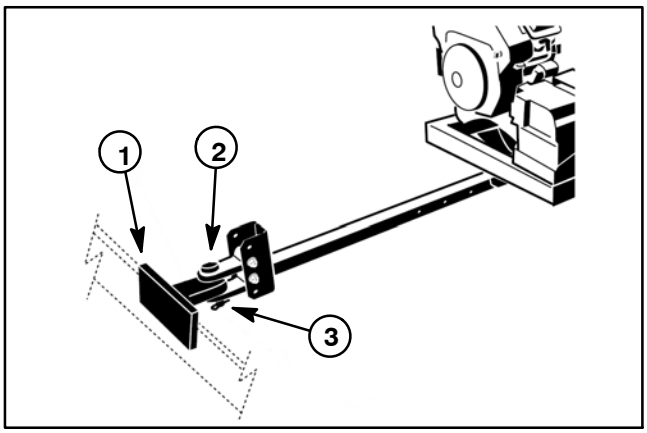

Figure 1

1. **Tow vehicle hitch**
2. **Hitch pin**
3. **Hairpin clip**

Jacking Instructions

CAUTION

When changing tires or performing other service, use suitable hoists and jacks to support the ProForce Debris Blower. Make sure machine is parked on a solid level surface such as a concrete floor. Always chock or block wheels. Use suitable jack stands to support the raised machine. If the machine is not properly supported by jack stands, the machine may move or fall, which may result in personal injury.

1. Position ProForce Debris Blower on a level surface with blower attached to tow vehicle. Engage tow vehicle parking brake, stop engine and remove key from the ignition switch. Make sure that blower engine is off. Chock blower wheels to prevent the machine from moving.

2. Position jack securely under the main frame of the blower (Fig. 2). Do not use the axle as a jacking point.

3. Carefully jack machine off the ground.

4. Position jack stands under the main frame to support the ProForce Debris Blower.

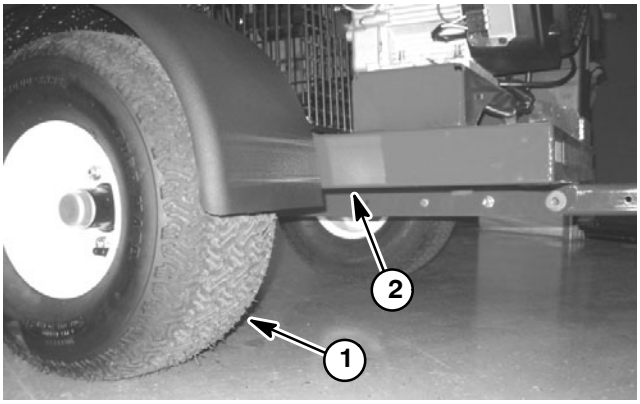

Figure 2

1. **Wheel**
2. **Frame jacking point**

Safety and Instruction Decals

Numerous safety and instruction decals are affixed to the ProForce Debris Blower. If any decal becomes illegible or damaged, install a new decal. Part numbers for replacement decals are listed in your Parts Catalog. Order replacement decals from your Authorized Toro Distributor.

Chapter 2

Product Records and Maintenance

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Product Records

Insert Operator's Manual and Parts Catalog for your ProForce Debris Blower at the end of this chapter. Additionally, if any optional equipment or accessories have been installed to your blower, insert the Installation Instructions, Operator's Manuals and Parts Catalogs for those options at the end of this chapter.

Maintenance

Maintenance procedures and recommended service intervals for the ProForce Debris Blower are covered in the Operator's Manual. Refer to that publication when performing regular equipment maintenance.

Equivalents and Conversions

Decimal and Millimeter Equivalents

Fractions	Decimals	mm	Fractions	Decimals	mm
1/64	0.015625	— 0.397	33/64	0.515625	— 13.097
1/32	0.03125	— 0.794	17/32	0.53125	— 13.494
3/64	0.046875	— 1.191	35/64	0.546875	— 13.891
1/16	0.0625	— 1.588	9/16	0.5625	— 14.288
5/64	0.078125	— 1.984	37/64	0.578125	— 14.684
3/32	0.09375	— 2.381	19/32	0.59375	— 15.081
7/64	0.109275	— 2.778	39/64	0.609375	— 15.478
1/8	0.1250	— 3.175	**5/8**	0.6250	— 15.875
9/64	0.140625	— 3.572	41/64	0.640625	— 16.272
5/32	0.15625	— 3.969	21/32	0.65625	— 16.669
11/64	0.171875	— 4.366	43/64	0.671875	— 17.066
3/16	0.1875	— 4.762	11/16	0.6875	— 17.462
13/64	0.203125	— 5.159	45/64	0.703125	— 17.859
7/32	0.21875	— 5.556	23/32	0.71875	— 18.256
15/64	0.234375	— 5.953	47/64	0.734375	— 18.653
1/4	0.2500	— 6.350	**3/4**	0.7500	— 19.050
17/64	0.265625	— 6.747	49/64	0.765625	— 19.447
9/32	0.28125	— 7.144	25/32	0.78125	— 19.844
19/64	0.296875	— 7.541	51/64	0.796875	— 20.241
5/16	0.3125	— 7.938	13/16	0.8125	— 20.638
21/64	0.328125	— 8.334	53/64	0.828125	— 21.034
11/32	0.34375	— 8.731	27/32	0.84375	— 21.431
23/64	0.359375	— 9.128	55/64	0.859375	— 21.828
3/8	0.3750	— 9.525	**7/8**	0.8750	— 22.225
25/64	0.390625	— 9.922	57/64	0.890625	— 22.622
13/32	0.40625	— 10.319	29/32	0.90625	— 23.019
27/64	0.421875	— 10.716	59/64	0.921875	— 23.416
7/16	0.4375	— 11.112	15/16	0.9375	— 23.812
29/64	0.453125	— 11.509	61/64	0.953125	— 24.209
15/32	0.46875	— 11.906	31/32	0.96875	— 24.606
31/64	0.484375	— 12.303	63/64	0.984375	— 25.003
1/2	0.5000	— 12.700	**1**	1.000	— 25.400

1 mm = 0.03937 in. **0.001 in. = 0.0254 mm**

U.S.to Metric Conversions

	To Convert	Into	Multiply By
Linear Measurement	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
Area	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
Volume	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
Weight	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
Pressure	Pounds/Sq. In.	Kilopascal	6.895
	Pounds/Sq. In.	Bar	0.069
Work	Foot-pounds	Newton-Meters	1.356
	Foot-pounds	Kilogram-Meters	0.1383
	Inch-pounds	Kilogram-Centimeters	1.152144
Liquid Volume	Quarts	Liters	0.9463
	Gallons	Liters	3.785
Liquid Flow	Gallons/Minute	Liters/Minute	3.785
Temperature	Fahrenheit	Celsius	1. Subract 32° 2. Multiply by 5/9

Torque Specifications

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

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

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

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

Fastener Identification

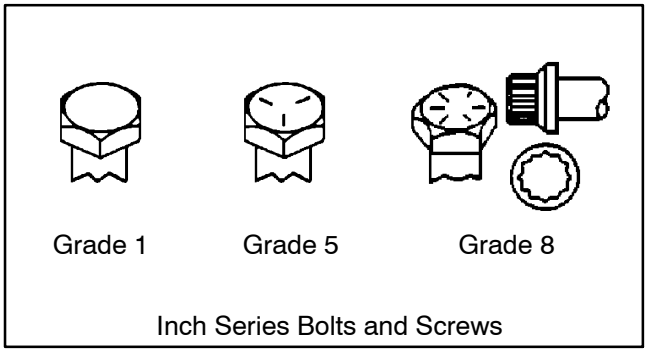

Figure 1

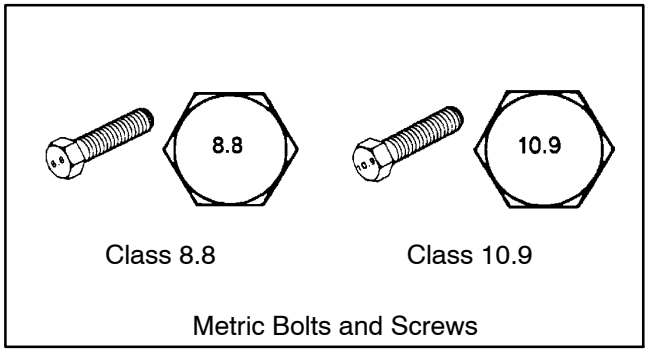

Figure 2

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

Thread Size	Grade 1, 5 & 8 with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 5 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 5 or Stronger Nuts)	
	in–lb	**in–lb**	**N–cm**	**in–lb**	**N–cm**	**in–lb**	**N–cm**
# 6 – 32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	170 ± 20	23 ± 2	260 ± 20
# 6 – 40 UNF				17 ± 2	190 ± 20	25 ± 2	280 ± 20
# 8 – 32 UNC	13 ± 2	25 ± 5	282 ± 30	29 ± 3	330 ± 30	41 ± 4	460 ± 45
# 8 – 36 UNF				31 ± 3	350 ± 30	43 ± 4	485 ± 45
# 10 – 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 4	475 ± 45	60 ± 6	675 ± 70
# 10 – 32 UNF				48 ± 4	540 ± 45	68 ± 6	765 ± 70
1/4 – 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1125 ± 100	140 ± 15	1580 ± 170
1/4 – 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 10	1300 ± 100	160 ± 15	1800 ± 170
5/16 – 18 UNC	115 ± 15	105 ± 17	1186 ± 169	200 ± 25	2250 ± 280	300 ± 30	3390 ± 340
5/16 – 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2540 ± 280	325 ± 30	3670 ± 340
	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 ± 4	58 ± 5
3/8 – 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 3	47 ± 4	50 ± 4	68 ± 5
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 ± 5	75 ± 7	77 ± 7	104 ± 9
1/2 – 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 10	142 ± 14
1/2 – 20 UNF	32 ± 3	53 ± 7	72 ± 9	85 ± 8	115 ± 11	120 ± 10	163 ± 14
5/8 – 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 20	285 ± 27
5/8 – 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 15	230 ± 20	240 ± 20	325 ± 27
3/4 – 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 25	359 ± 34	375 ± 35	508 ± 47
3/4 – 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 25	407 ± 34	420 ± 35	569 ± 47
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 ± 45	644 ± 61	660 ± 60	895 ± 81

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

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

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

Standard Torque for Dry, Zinc Plated and Steel Fasteners (Metric 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 ± 5 in–lb	640 ± 60 N–cm	78 ± 7 in–lb	885 ± 80 N–cm
M6 X 1.0	96 ± 9 in–lb	1018 ± 100 N–cm	133 ± 13 in–lb	1500 ± 150 N–cm
M8 X 1.25	19 ± 2 ft–lb	26 ± 3 N–m	27 ± 2 ft–lb	36 ± 3 N–m
M10 X 1.5	38 ± 4 ft–lb	52 ± 5 N–m	53 ± 5 ft–lb	72 ± 7 N–m
M12 X 1.75	66 ± 7 ft–lb	90 ± 10 N–m	92 ± 9 ft–lb	125 ± 12 N–m
M16 X 2.0	166 ± 15 ft–lb	225 ± 20 N–m	229 ± 22 ft–lb	310 ± 30 N–m
M20 X 2.5	325 ± 33 ft–lb	440 ± 45 N–m	450 ± 37 ft–lb	610 ± 50 N–m

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

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

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

Other Torque Specifications

SAE Grade 8 Steel Set Screws

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

Wheel Bolts and Lug Nuts

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

** For steel wheels and non–lubricated fasteners.

Thread Cutting Screws (Zinc Plated Steel)

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

Thread Cutting Screws (Zinc Plated Steel)

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

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

Conversion Factors

in–lb X 11.2985 = N–cm
ft–lb X 1.3558 = N–m

N–cm X 0.08851 = in–lb
N–m X 0.7376 = ft–lb

Chapter 3

Engine

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Specifications

Item	Description
Make / Designation	Kohler, 4–cycle, V–Twin cylinder, OHV, air cooled, Model CH740S
Bore x Stroke	3.27 in x 2.64 in (83 mm x 67 mm)
Total Displacement	44 in^3 (725 cc)
Compression Ratio	9.0:1
Governor	Electronic
Low Idle Speed (no load)	1800 $\pm$ 100 RPM
High Idle Speed (no load)	3450 $\pm$ 100 RPM
Carburetor	Float feed, fixed main jet, solenoid fuel shut–off
Fuel	Unleaded, regular grade gasoline
Fuel Pump	Mechanical
Fuel Tank Capacity	5 U.S. gal (18.9 l)
Air Cleaner	Dual element
Lubrication System	Pressure lubrication with oil cooler
Crankcase Oil Capacity	2.0 U.S. qt (1.9 l)
Engine Oil	See Operator's Manual
Ignition System	Flywheel magneto, twin electronic armatures with ignition advance
Spark Plug	Champion RC12YC (resister style)
Spark Plug Gap	0.030 in (0.76 mm)
Starter	12 VDC, solenoid shift
Alternator	12 VDC / 15 Amps
Dry Weight	94 lbs (43 kg)

General Information

This Chapter gives information about specifications, maintenance, troubleshooting, testing and repair of the gasoline engine used in the ProForce Debris Blower.

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the KOHLER ENGINE SERVICE MANUAL that is included at the end of this Chapter. The use of some specialized test equipment is explained. However, the cost of the test equipment and the specialized nature of some repairs may dictate that the work be done at an engine repair facility.

Service and repair parts for Kohler engines are supplied through your local Toro distributor. Be prepared to provide your distributor with the Toro model and serial number.

Operator's Manual

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

Electrical Power

Electrical power to ProForce Debris Blower components is controlled by the Remote Control Module. To make sure that machine operation does not occur unexpectedly, disconnect the negative battery cable from the battery before performing any machine service.

Reattach the disconnected negative battery cable as the last step in any repair. Secure cable with flange nut. Torque nut from from **10 to 15 ft–lb (14 to 20 N–m)**.

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Cooling System

To ensure proper engine cooling, make sure the grass screen, cooling fins and other external surfaces of the engine are kept clean at all times.

IMPORTANT: The engine that powers the ProForce Debris Blower is air–cooled. Operating the engine with dirty or plugged cooling fins or a plugged or dirty blower housing will result in engine overheating and damage.

1. Park machine on a level surface. Make sure engine is OFF. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

IMPORTANT: Never clean engine with pressurized water. Water could enter and contaminate the fuel system.

3. Clean cooling fins on both cylinder heads.

4. Clean grass screen and blower housing of dirt and debris (Fig. 3).

5. If necessary remove blower housing from engine for more thorough engine cleaning.

IMPORTANT: Never operate engine without the blower housing installed. Overheating and engine damage will result.

6. Make sure blower housing and/or engine cylinder shrouds are installed to the engine if removed.

7. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

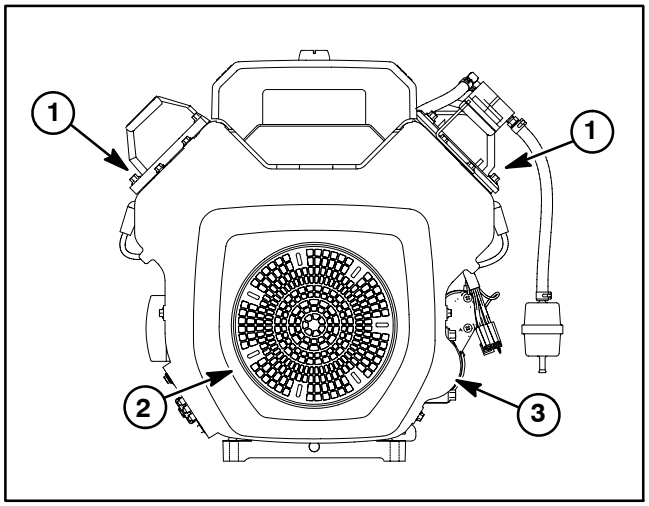

Figure 3

1. **Cylinder head**
2. **Grass screen**
3. **Blower housing**

Fuel Tank

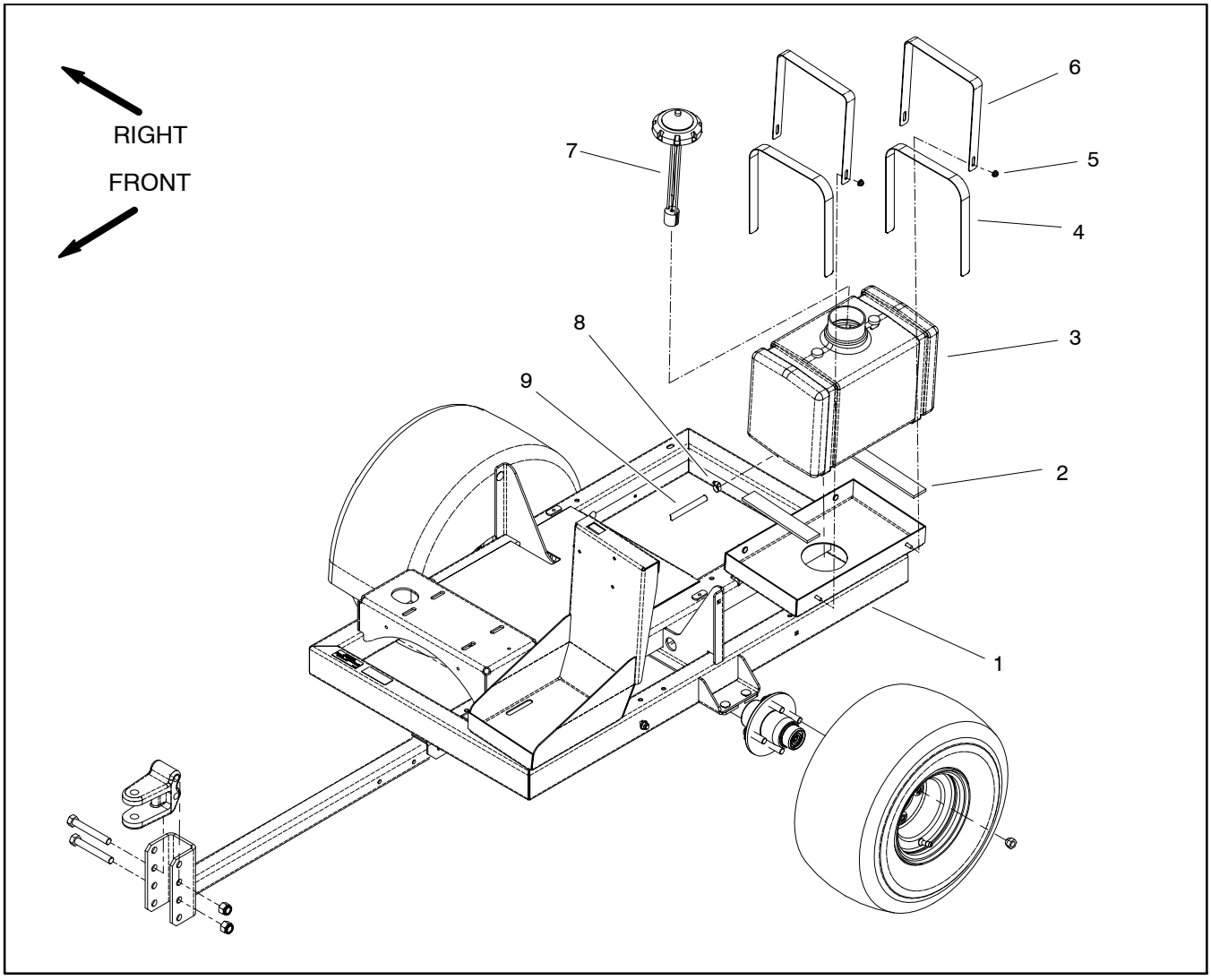

Figure 4

1. **Frame**
2. **Foam strip (2 used)**
3. **Fuel tank**
4. **Felt strip (2 used)**
5. **Flange nut (4 used)**
6. **Tank strap (2 used)**
7. **Fuel cap and gauge**
8. **Worm clamp**
9. **Fuel hose**

DANGER

Because gasoline is highly flammable, use caution when storing or handling it. Do not smoke while filling the fuel tank. Do not fill fuel tank while engine is running, hot, or when machine is in an enclosed area. Always fill fuel tank outside and wipe up any spilled fuel before starting the engine. Store fuel in a clean, safety–approved container and keep cap in place. Use gasoline for the engine only; not for any other purpose.

Check Fuel Lines and Connections

Check fuel lines and connections periodically as recommended in the Operator's Manual. Check fuel lines for deterioration, damage or leaking connections. Replace hoses, clamps and connections as necessary.

Drain and Clean Fuel Tank

Drain and clean the fuel tank periodically as recommended in the Operator's Manual. Also, drain and clean the fuel tank if the fuel system becomes contaminated or if the machine is to be stored for an extended period.

To clean fuel tank, flush tank out with clean solvent. Make sure tank is free of all contaminates and debris.

Fuel Tank Removal (Fig. 4)

1. Park machine on a level surface with the engine OFF. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Disconnect fuel hose from the fuel filter inlet.

4. Lower end of disconnected fuel line into a suitable container and drain fuel tank.

5. After fuel tank is completely empty, remove fuel hose from tank outlet at bottom of tank.

6. Remove four (4) flange nuts that secure tank straps to machine. Remove straps and felt strips.

7. Lift fuel tank from machine.

8. Make sure to clean up any spilled fuel. Also, check that foam strips under fuel tank location are in good condition.

Fuel Tank Installation (Fig. 4)

1. Position foam strips, fuel tank and tank straps to machine frame. Place felt strip between tank and both tank straps.

2. Secure straps and fuel tank to frame with four (4) flange nuts.

3. Connect fuel hose to fuel tank outlet at bottom of tank. Secure hose with clamp.

4. Connect fuel hose to the fuel filter inlet. Secure hose with clamp.

5. Add fuel to tank and check for any fuel leaks.

6. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

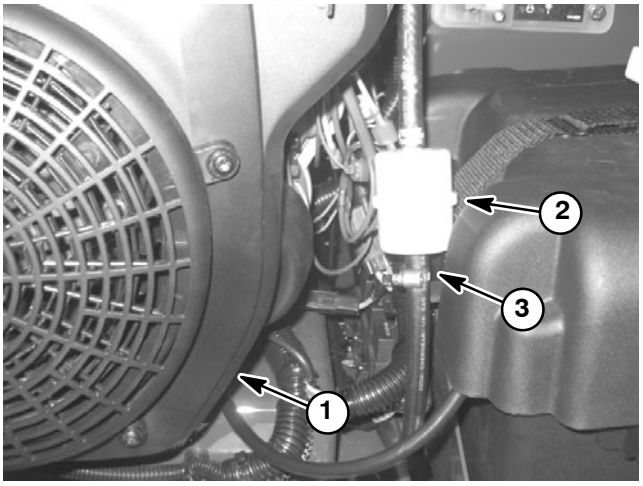

Figure 5

1. **Engine blower housing**
2. **Fuel filter**
3. **Fuel filter inlet**

Engine

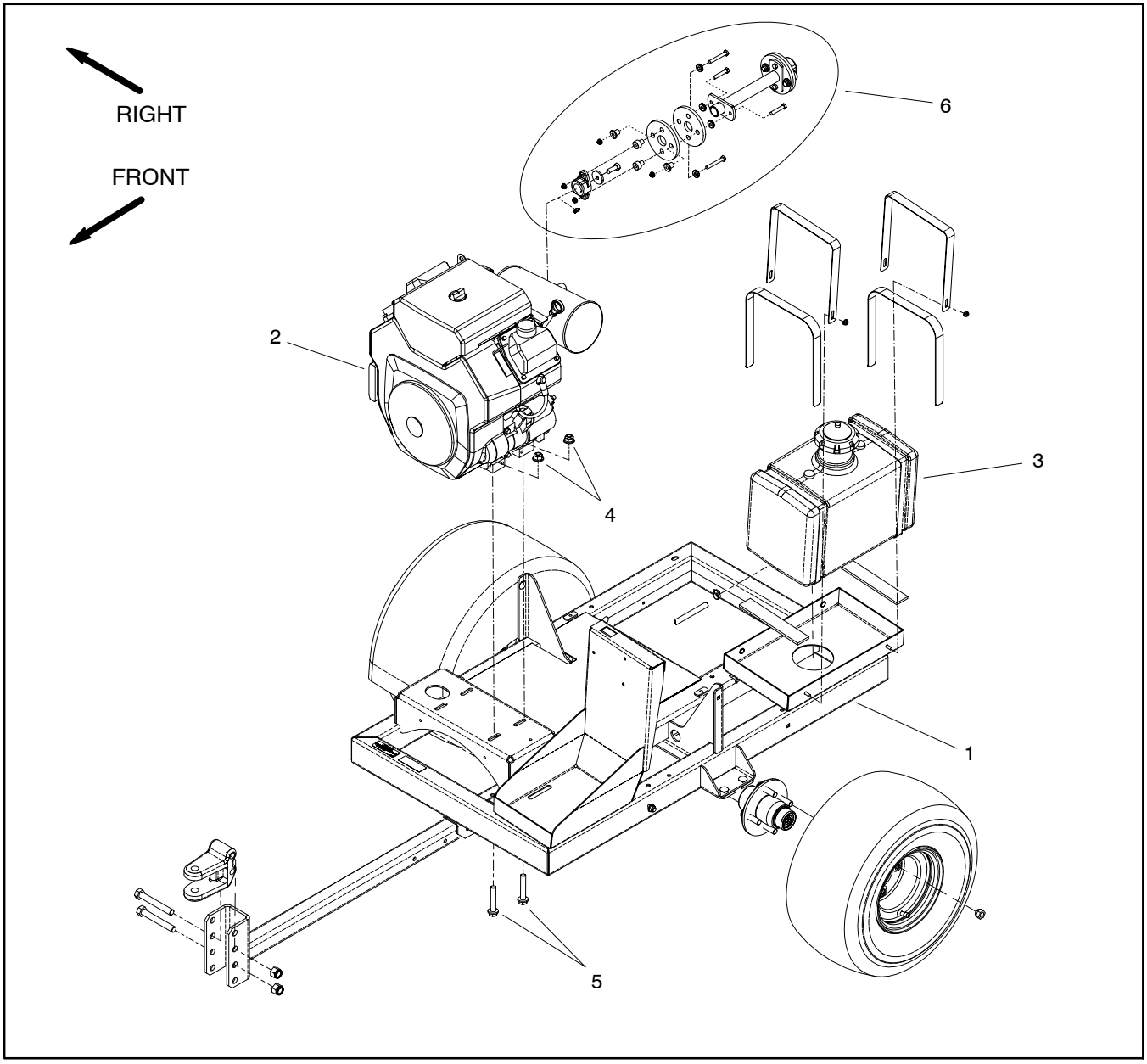

Figure 6

1. **Frame**
2. **Engine**
3. **Fuel tank**
4. **Flange nut (4 used)**
5. **Flange head screw (4 used)**
6. **Blower coupler assembly**

Engine Removal (Fig. 6)

1. Park machine on a level surface with the engine not running and the ignition key removed from the key switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

CAUTION

The exhaust system may be hot. Avoid possible burns, allow exhaust to cool before removing the engine.

3. If engine is to be disassembled, it may be easier to drain oil from engine before removing engine from machine.

4. Label and disconnect wire harness connectors from engine.

   A. Disconnect positive battery cable and fusible link from the starter motor B+ stud.

   B. Disconnect wire harness blue wire from starter motor terminal.

   C. Loosen and remove flange bolts that secure negative battery cable and wire harness ground connector to engine. Note that there is a lock washer on the bolt that secures the negative battery cable.

   D. Disconnect wire harness connectors from remaining engine wires.

5. Loosen hose clamp that secures fuel hose to fuel filter inlet (Fig. 7). Remove fuel hose from fuel filter. Plug fuel hose to prevent leakage and contamination. Make sure to clean up any spilled fuel. Position disconnected fuel hose away from engine.

6. Remove top grill and side grill from machine (Fig. 8).

7. Disconnect blower drive shaft from engine crankshaft (see Drive Shaft Removal in the Service and Repairs section of Chapter 5 – Blower Assembly).

8. Remove four (4) flange head screws and flange nuts that secure engine to machine.

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

CAUTION

To prevent personal injury, make sure that engine is properly supported as it is removed from the machine. Engine weighs approximately 94 pounds (43 kg).

9. Carefully remove the engine from machine.

10. Remove engine parts and attachments as necessary to repair the engine.

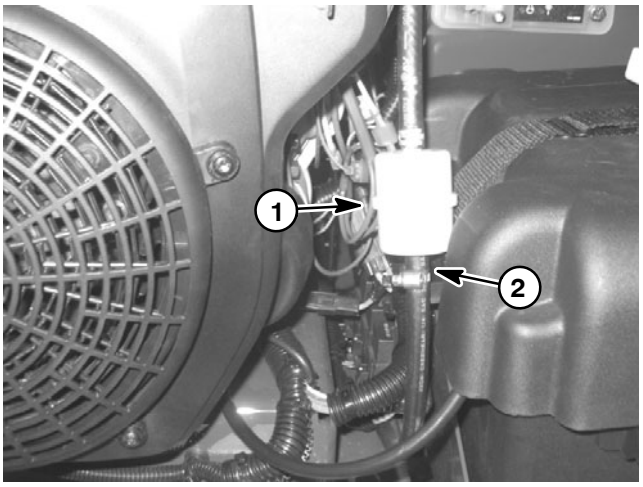

Figure 7

1. **Fuel filter**
2. **Fuel filter inlet**

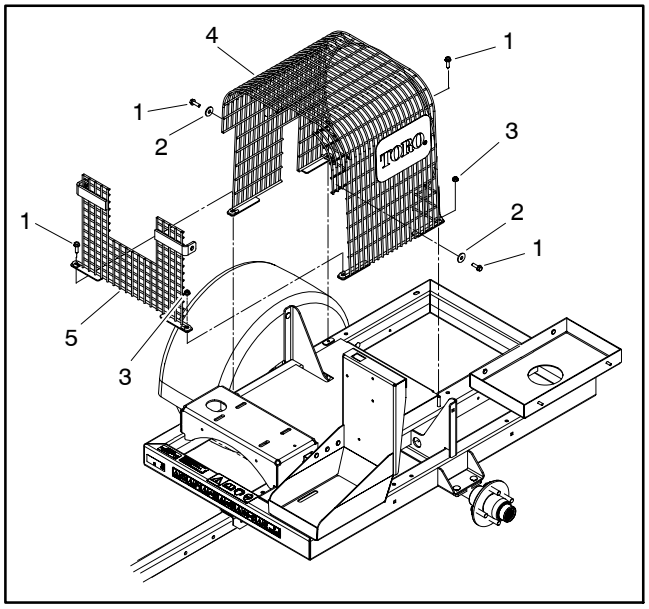

Figure 8

1. **Screw**
2. **Washer**
3. **Flange nut**
4. **Top grill**
5. **Side grill**

Engine Installation (Fig. 6)

1. Position machine on a level surface.

2. Make sure that all parts removed from the engine during maintenance or rebuilding are properly installed to the engine.

IMPORTANT: Take care to not damage the engine, fuel hoses, electrical harness or other parts while installing the engine.

3. Carefully position engine on machine frame.

4. Install four (4) flange head screws up through the frame and engine mounting holes. Install flange nuts on screws. Do not fully tighten nuts at this time.

5. Connect blower drive shaft to engine crankshaft (see Drive Shaft Installation in the Service and Repairs section of Chapter 5 – Blower Assembly).

6. Position engine on frame to align the blower drive shaft assembly between the blower and engine shafts.

7. Fully tighten the engine mounting fasteners. Torque fasteners from **270 to 330 in–lb (31 to 37 N–m)**.

8. Install top grill and side grill (Fig. 8).

9. Connect wire harness connectors to engine.

   A. Connect positive battery cable and fusible link to the starter motor B+ stud.

   B. Connect wire harness blue wire to starter motor terminal.

   C. Secure negative battery cable and wire harness ground connector to engine with flange bolts. Note that there is a lock washer on the bolt that secures the negative battery cable.

   D. Connect wire harness connectors to remaining engine wires.

10. Remove plug installed in fuel hose during engine removal process. Connect fuel hose to the fuel filter inlet and secure with hose clamp (Fig. 7).

11. Check and adjust engine oil level as needed.

12. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

Chapter 4

Electrical System

Table of Contents

General Information

This Chapter gives information about troubleshooting, testing and repair of the electrical system used in the ProForce Debris Blower.

Operator's Manual

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

Electrical Power

Electrical power to ProForce Debris Blower components is controlled by the Remote Control Module. To make sure that machine operation does not occur unexpectedly, disconnect the negative battery cable from the battery before performing any machine service.

Reattach the disconnected negative battery cable as the last step in any repair. Secure cable with flange nut. Torque nut from from **10 to 15 ft–lb (14 to 20 N–m)**.

Electrical Diagrams

The electrical schematic and wire harness drawings for the ProForce Debris Blower are located in Chapter 7 – Electrical Diagrams.

Special Tools

Order special tools from your Toro Distributor. Some tools may also be available from a local supplier.

Multimeter

The multimeter can test electrical components and circuits for current (amps), resistance (ohms) or voltage. Obtain this tool locally.

NOTE: Toro recommends the use of a DIGITAL Volt–Ohm–Amp multimeter when testing electrical circuits. The high impedance (internal resistance) of a digital meter in the voltage mode will make sure that excess current is not allowed through the meter. This excess current can cause damage to circuits not designed to carry it.

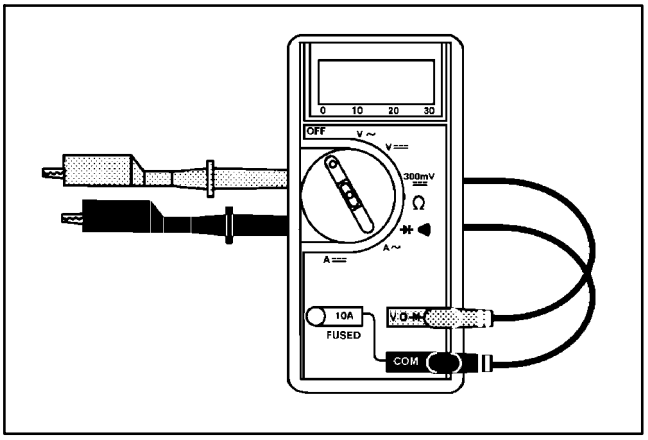

Figure 1

Skin–Over Grease

Special non–conductive grease which forms a light protective skin to help waterproof electrical switches and contacts.

Toro Part Number: **505–165**

Figure 2

Battery Terminal Protector

Aerosol spray that should be used on battery terminals to reduce corrosion problems. Apply terminal protector after the battery cable has been secured to the battery terminal.

Toro Part Number: **107–0392**

Figure 3

Battery Hydrometer

Use the Battery Hydrometer when measuring specific gravity of battery electrolyte. Obtain this tool locally.

Figure 4

Troubleshooting

CAUTION

Remove all jewelry, especially rings and watches, before doing any electrical trouble-shooting or testing. Disconnect the battery cables unless the test requires battery voltage.

For effective troubleshooting and repairs, there must be a good understanding of the electrical circuits (see Chapter 7 – Electrical Diagrams) and components used on this machine.

Starting Problems

Problem	Possible Causes
Starter solenoid clicks, but starter will not crank.	Battery is discharged. Battery cables are loose or corroded. Wire harness ground cable is loose or corroded. Wiring at starter is faulty. Starter solenoid is faulty. Starter is faulty.
Nothing happens when start attempt is made.	Battery is discharged. Wiring to the start circuit components is loose, corroded or damaged (see Electrical Schematic in Chapter 7 – Electrical Diagrams). Battery cables are loose or corroded. Wire harness ground cable is loose or corroded. Main fuse (15 amp) is loose or faulty. Fusible link is faulty. Ignition switch is faulty. Starter solenoid is faulty. Operator remote control or remote control module is faulty.

Starting Problems (Continued)

Problem	Possible Causes
Engine cranks, but does not start.	Ignition switch is faulty. Magneto relay or circuit wiring is faulty. Fuel relay or circuit wiring is faulty. Diode is faulty. Operator remote control or remote control module is faulty. Engine or fuel system is malfunctioning (see Chapter 3 – Engine). Engine and fuel may be too cold.

General Run Problems

Problem	Possible Causes
Battery does not charge.	Wiring to charging circuit components is loose, corroded or damaged (see Electrical Schematic in Chapter 7 – Electrical Diagrams). Voltage regulator is not properly grounded to engine. Voltage regulator is faulty. Ignition switch is faulty. Battery is faulty. Alternator stator or engine flywheel is faulty.
Engine stops during operation.	Operator remote control button was inadvertently pressed. Ignition switch is faulty. Fuse or fusible link is faulty. Fuel, magneto and/or power relay is/are faulty. Wiring to the run circuit components is broken or disconnected (see Electrical Schematic in Chapter 7 – Electrical Diagrams). Operator remote control or remote control module is faulty. Engine or fuel system is malfunctioning (see Chapter 3 – Engine).
Nozzle rotation motor does not operate.	Wiring to the nozzle rotation motor is broken or disconnected (see Electrical Schematic in Chapter 7 – Electrical Diagrams). Nozzle rotation motor is faulty. Operator remote control or remote control module is faulty.

Electrical System Quick Checks

Battery Test (Open Circuit Test)

Use a digital multimeter to measure the battery voltage.

Set the multimeter to the DC volts setting. The battery should be at a temperature of 60º to 100º F (16º to 38º C). The ignition switch should be in the OFF position and all accessories turned off. Connect the positive (+) multimeter lead to the positive battery post and the negative (–) multimeter lead to the negative battery post. Record the battery voltage.

NOTE: This test provides a relative condition of the battery. Load testing of the battery will provide additional and more accurate information (see Battery Service in the Service and Repairs section).

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

Charging System Test

This is a simple test used to determine if a charging system is functioning. It will tell you if the charging system has an output, but not its capacity.

Use a digital multimeter set to DC volts. Connect the positive (+) multimeter lead to the positive battery post and the negative (–) multimeter lead to the negative battery post. Keep the test leads connected to the battery posts and record the battery voltage.

NOTE: Upon starting the engine, the battery voltage will drop and then should increase once the engine is running.

NOTE: Depending upon the condition of the battery charge and battery temperature, the battery voltage will increase at different rates as the battery charges.

Start the engine and run at high idle **(3450 RPM)**. Allow the battery to charge for at least 3 minutes. Record the battery voltage.

After running the engine for at least 3 minutes, battery voltage should be at least 0.50 volt higher than initial battery voltage.

An example of a charging system that is functioning:

At least 0.50 volt over initial battery voltage.	
Initial Battery Voltage	= 12.30 v
Battery Voltage after 3 Minute Charge	= 12.85 v
Difference	= +0.55 v

Component Testing

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

CAUTION

When testing electrical components for continuity with a multimeter (ohms setting), make sure that power to the circuit has been disconnected.

Ignition Switch

The engine mounted ignition (key) switch used on the ProForce Debris Blower has three positions (OFF, RUN and START) (Fig. 5). The switch terminals are positioned as shown in Figure 6.

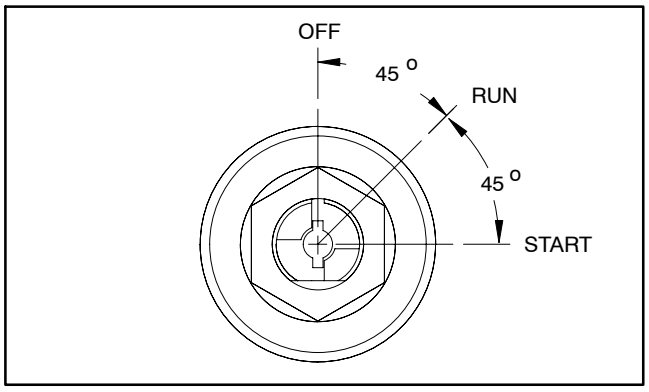

Figure 5

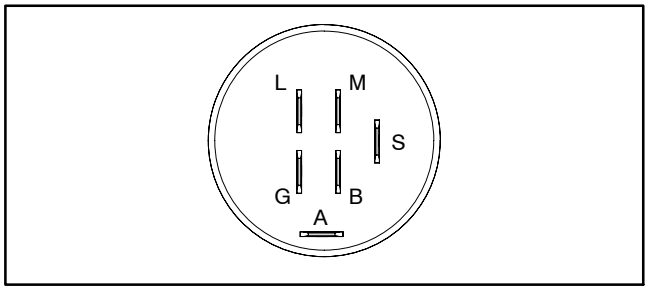

Figure 6

Testing

The circuitry of the ignition switch is shown in the chart below. With the use of a multimeter (ohms setting), the switch functions may be tested to determine whether continuity exists between the various terminals for each switch position.

Testing

1. Make sure that ignition switch is OFF.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Unplug wire harness connectors from switch.

4. The circuitry of the ignition switch is shown in the chart in the right column. With the use of a multimeter (ohms setting), the switch functions may be tested to determine whether continuity exists between the various terminals for each switch position.

5. Connect the harness connectors to the switch after testing.

6. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

POSITION	CIRCUIT
OFF	G + M + A
RUN	B + L + A
START	B + L + S

Hour Meter

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

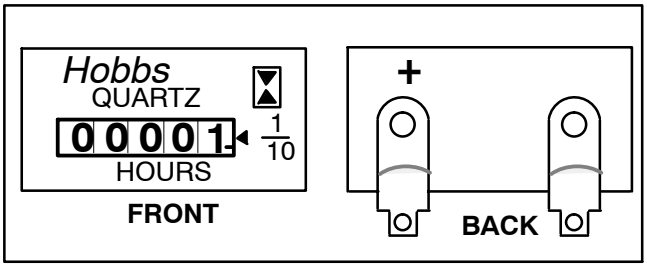

Figure 7

Testing

1. Make sure that ignition switch is OFF.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Locate wire harness connector at rear of hour meter. Unplug harness connector from hour meter.

4. Connect the positive (+) terminal of a 12 VDC source to the positive (+) terminal of the hour meter.

5. Connect the negative (–) terminal of the voltage source to the other terminal of the hour meter.

6. The hour meter should move 1/10 of an hour in six minutes.

7. Disconnect the voltage source from the hour meter.

8. Replace the hour meter if necessary.

9. Connect wire harness connector to hour meter.

10. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

Fuse

The ProForce Debris Blower uses a 15 amp fuse for circuit protection. The fuse holder for this fuse is located next to the engine (Fig. 8).

Testing

1. Make sure that ignition switch is OFF.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Remove fuse from the fuse holder for testing. Fuse should have continuity between fuse terminals.

4. After testing, install fuse into fuse holder.

5. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

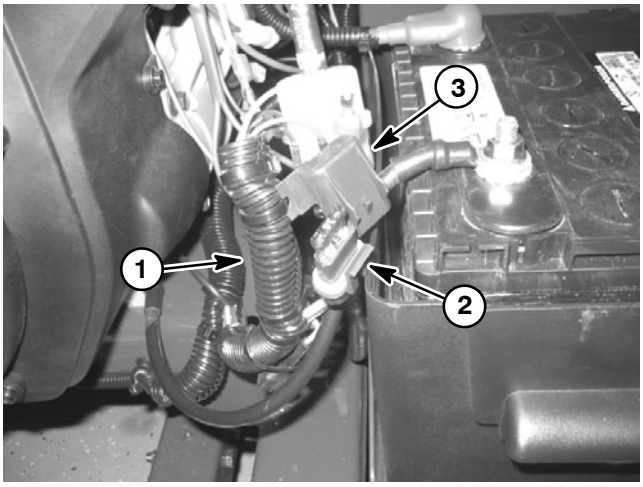

Figure 8

1. **Wire harness**
2. **Fuse**
3. **Fuse cover**

Fusible Link

The ProForce Debris Blower uses a fusible link for circuit protection. This fusible link connects the main wire harness to the starter B+ terminal and positive battery cable (Fig. 9). If the link should fail, current to the machine will cease. Refer to electrical schematic and wire harness drawings in Chapter 7 – Electrical Diagrams for additional fusible link information.

Testing

1. Make sure that ignition switch is OFF.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Locate and unplug fusible link connector from machine wire harness.

4. Use a multimeter to make sure that continuity exists between the disconnected fusible link connector and the link terminal at the starter motor (Fig. 10). If the fusible link is open (no continuity), replace the fusible link harness.

5. After testing is complete, make sure that fusible link connectors are securely attached to starter and machine wire harness.

6. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

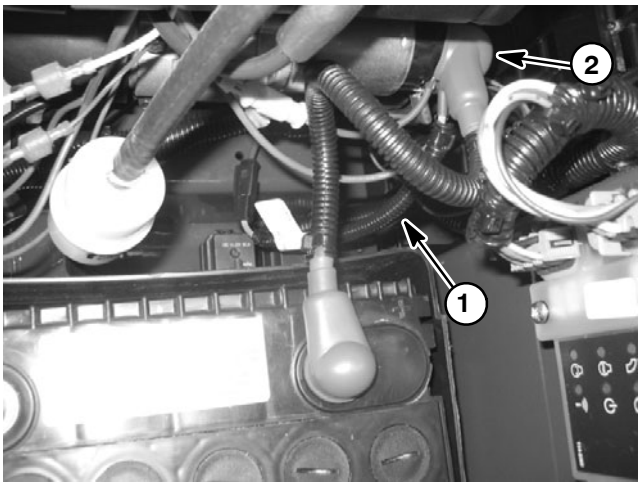

Figure 9

1. Fusible link **2. Starter B+ terminal**

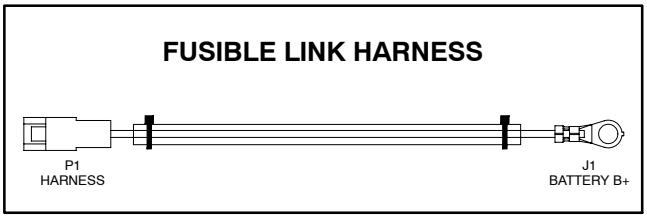

Figure 10

Diode Assembly

A diode assembly (Fig. 11) is used in the ProForce Debris Blower wire harness (see wire harness drawings in Chapter 7 – Electrical Diagrams). The diode provides the initial current flow to energize or “wake up” the remote control module.

Testing

1. Make sure that ignition switch is OFF.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Locate diode assembly and remove cable tie that secures diode to machine wire harness.

4. Unplug the diode from the wire harness for testing.

5. The diode (Fig. 12) can be tested using a digital multimeter (diode test or ohms setting) and the table in the right column.

6. After testing is complete, make sure that diode is fully installed into machine wire harness connector and secured to harness with cable tie.

7. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

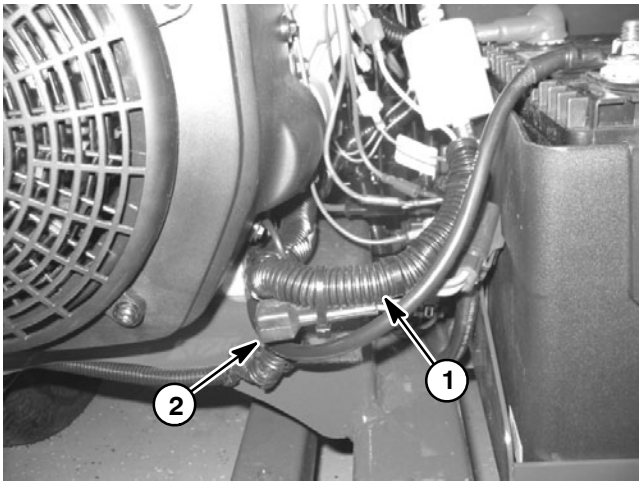

Figure 11

1. Machine wire harness **2. Diode assembly**

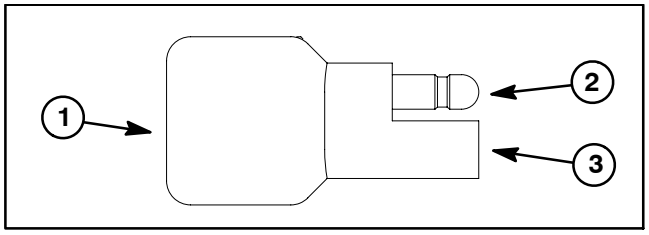

Figure 12

1. Diode **3. Female terminal**
2. Male terminal

Multimeter Red Lead (+) on Terminal	Multimeter Black Lead (–) on Terminal	Continuity
Female	Male	YES
Male	Female	NO

Fuel, Magneto and Power Relays

The ProForce Debris Blower electrical system includes three (3) identical relays. The fuel, magneto and power relays are secured to a frame bracket between the battery and the engine (Fig. 13). All three relays are energized by the Remote Control Module. Relays can be identified by a tag on the wire harness.

The power relay is used to provide power to the machine when energized by the Remote Control Module.

The fuel relay is used to energize the engine carburetor fuel solenoid. When the ignition switch is in the RUN or START position, the fuel relay is energized by the Remote Control Module.

The magneto relay is used to allow ignition operation when the relay is energized by the Remote Control Module. When de−energized, the relay provides a grounding path for the engine ignition armatures to prevent ignition operation.

Testing

1. Make sure that ignition switch is OFF.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Locate relay and disconnect the machine wire harness connector from the relay. Remove relay from machine for easier testing.

NOTE: Prior to taking small resistance readings with a digital multimeter, short the meter test leads together. The meter will display a small resistance value (usually 0.5 ohms or less). This resistance is due to the internal resistance of the meter and test leads. Subtract this value from the measured value of the component you are testing.

4. Using a multimeter (ohms setting), measure coil resistance between terminals 85 and 86 (Fig. 14). Resistance should be between 70 and 90 ohms.

5. Connect multimeter (ohms setting) leads to relay terminals 30 and 87. Ground terminal 86 and apply +12 VDC to terminal 85. The relay should have continuity between terminals 30 and 87 as +12 VDC is applied to terminal 85. The relay should not have continuity between terminals 30 and 87 as +12 VDC is removed from terminal 85.

6. Disconnect voltage from terminal 85 and multimeter lead from terminal 87.

7. Connect multimeter (ohms setting) leads to relay terminals 30 and 87A. Apply +12 VDC to terminal 85. The relay should have continuity between terminals 30 and 87A as +12 VDC is applied to terminal 85. The relay should not have continuity between terminals 30 and 87A as +12 VDC is removed from terminal 85.

8. Disconnect voltage and multimeter leads from the relay terminals.

9. Secure relay to machine and connect machine wire harness connector to relay.

10. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft−lb (14 to 20 N−m)**. Make sure that battery cover is secured.

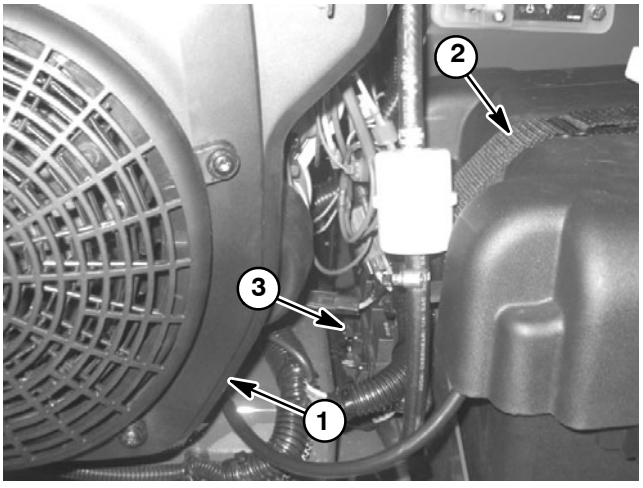

Figure 13

1. **Engine**
2. **Battery**
3. **Relay location**

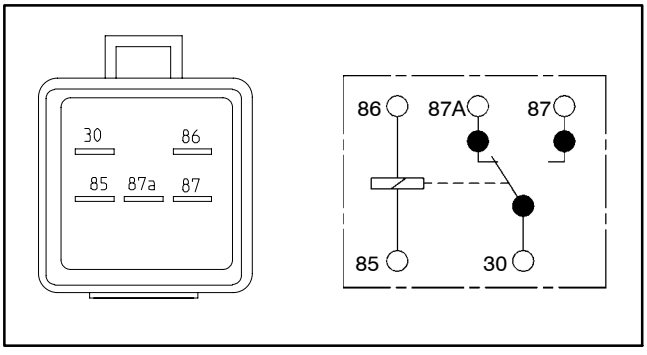

Figure 14

Remote Transmitter

The remote transmitter is a solid state electrical device that sends radio frequency (RF) signal inputs to the machine control module for control of machine electrical operation (Fig. 15). The remote transmitter has sufficient range to send an RF signal to the control module from the tow vehicle operator position.

When a button on the remote transmitter is pressed, the LED on the remote should flicker (Fig. 16). If the machine control module is energized (control module Time Out and Power LED's are both illuminated) and a remote transmitter button is pressed, the corresponding control module LED should illuminate and the control module RF activity LED should flicker.

If the control module is energized (control module Time Out and Power LED's are both illuminated), remote button functions are as follows:

Pressing the Engine Start button initiates a starting sequence to start the engine. This sequence (see Operator's Manual) is necessary to prevent accidental engine starting. After pressing the Engine Start button, the RH Nozzle and LH Nozzle Rotate buttons are inactive for five (5) seconds.

Pressing the Speed Increase (rabbit) button when the engine is running causes the engine speed to increase.

Pressing the Speed Decrease (turtle) button when the engine is running causes the engine speed to decrease.

Pressing the RH Nozzle Rotate button causes the blower nozzle to rotate to the right.

Pressing the LH Nozzle Rotate button causes the blower nozzle to rotate to the left.

Pressing the engine Stop button causes the engine to stop running.

NOTE: When the engine stop button on the remote transmitter is pressed, there will be a one (1) second delay before the engine stop LED on the control module illuminates. Also, for approximately five (5) seconds after the stop button is pressed, the control module engine stop LED will remain illuminated and no other remote transmitter operations can be performed.

The remote transmitter is powered by three (3) AAA alkaline batteries. If the range of the remote transmitter has diminished or the transmitter LED does not flicker when a button is pressed, the batteries should be replaced. To replace the batteries:

1. Remove six (6) screws that secure the rear cover to the remote transmitter.

2. Lift rear cover from remote transmitter.

3. Remove batteries from remote transmitter and replace with three (3) new AAA alkaline batteries.

4. Place rear cover on remote transmitter and secure with six (6) screws.

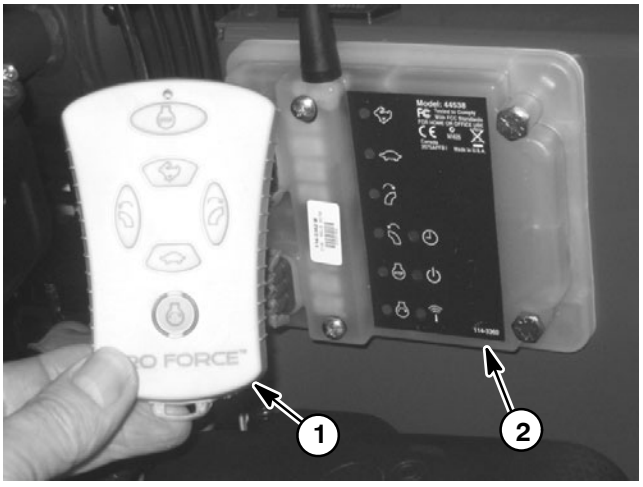

Figure 15

1. **Remote transmitter**
2. **Control module**

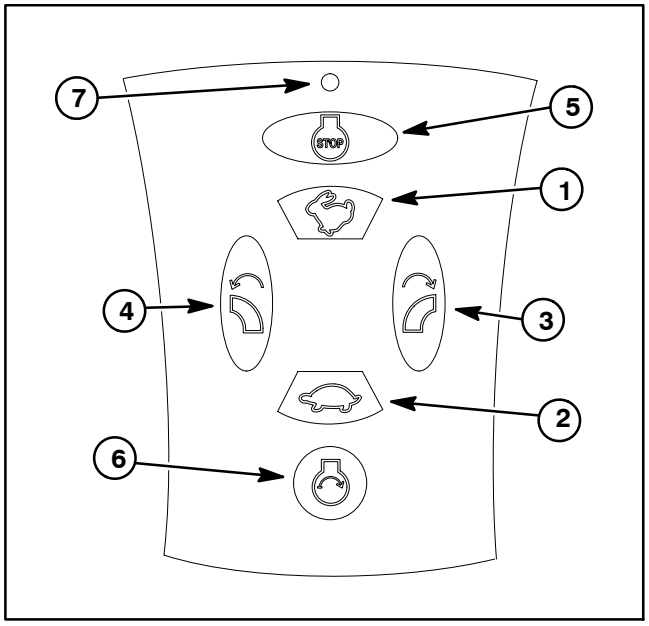

Figure 16

1. **Speed increase**
2. **Speed decrease**
3. **RH nozzle rotate**
4. **LH nozzle rotate**
5. **Engine stop**
6. **Engine start**
7. **Remote control LED**

Control Module

The control module is a solid state electrical device that receives signal inputs from the remote transmitter and uses those inputs to control machine electrical operation. The control module is attached to the frame next to the battery (Fig. 17).

Inputs from the engine mounted ignition switch and the remote transmitter are monitored by the control module. Output to the magneto relay, fuel relay, power relay, engine starter motor solenoid, engine throttle control module and nozzle rotation motor are controlled based on the inputs received by the control module.

To start blower operation, rotation of the ignition switch to the start position is used to turn on or “wake up” the control module. The control module Time Out and Power LED’s should both be illuminated during blower operation (Fig. 18).

When a remote transmitter button is pressed, the corresponding control module LED should illuminate and the control module RF activity LED should flicker (Fig. 18).

NOTE: Because of the normal RF activity in the environment, the control module RF activity LED may flicker or be illuminated at any time during machine operation. Machine operation will only be controlled by the remote transmitter that is recognized by the control module.

NOTE: When the engine stop button on the remote transmitter is pressed, there will be a one (1) second delay before the control module engine stop LED illuminates. Also, the control module engine stop LED will remain illuminated and no other remote transmitter operations can be performed for approximately five (5) seconds.

The control module includes a timer to allow machine operation for 30 minutes after the last control input (e.g. key switch turned off or remote transmitter button pressed). If no inputs are provided to the control module during this time period, the control module will shut off all machine electrical power including turning off the engine, if running. When the engine is turned off with either the key switch or the remote transmitter, the control module Time Out and Power LED’s will both be illuminated for this 30 minute time period.

The control module does not connect to an external computer or hand held device, can not be re–programmed and does not record any fault data. The machine wire harness does include a communication port with loopback connector that should remain connected.

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, such as a digital multimeter.

IMPORTANT: Before performing any welding on the machine, disconnect the negative battery cable from the battery to prevent damage to the electrical system.

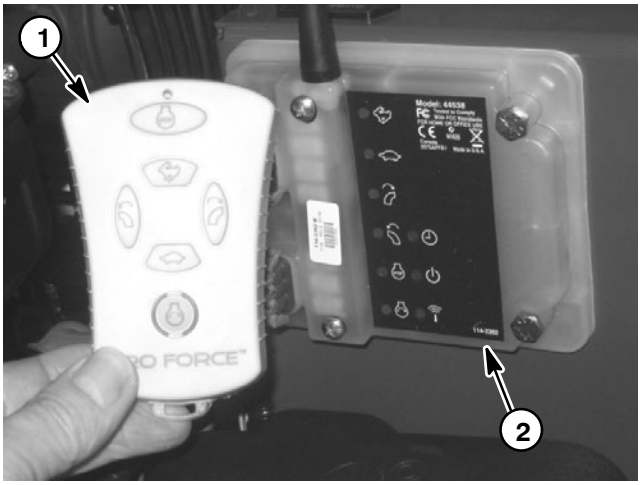

Figure 17

1. **Remote transmitter**
2. **Control module**

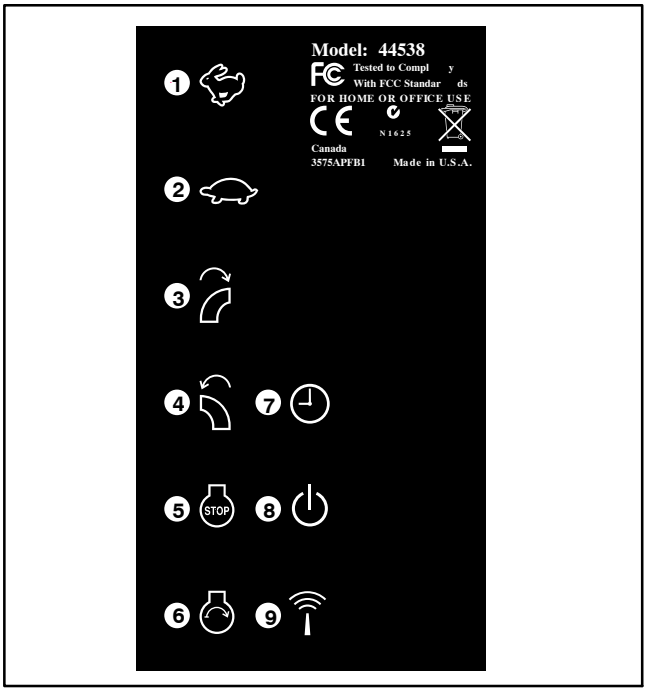

Figure 18

1. **Speed increase LED**
2. **Speed decrease LED**
3. **RH nozzle rotate LED**
4. **LH nozzle rotate LED**
5. **Engine stop LED**
6. **Engine start LED**
7. **Time out LED**
8. **Power LED**
9. **RF activity LED**

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Service and Repairs

NOTE: See the Kohler Engine Service Manual (included at the end of Chapter 3 – Engine) for engine electrical component repair information.

Nozzle Motor

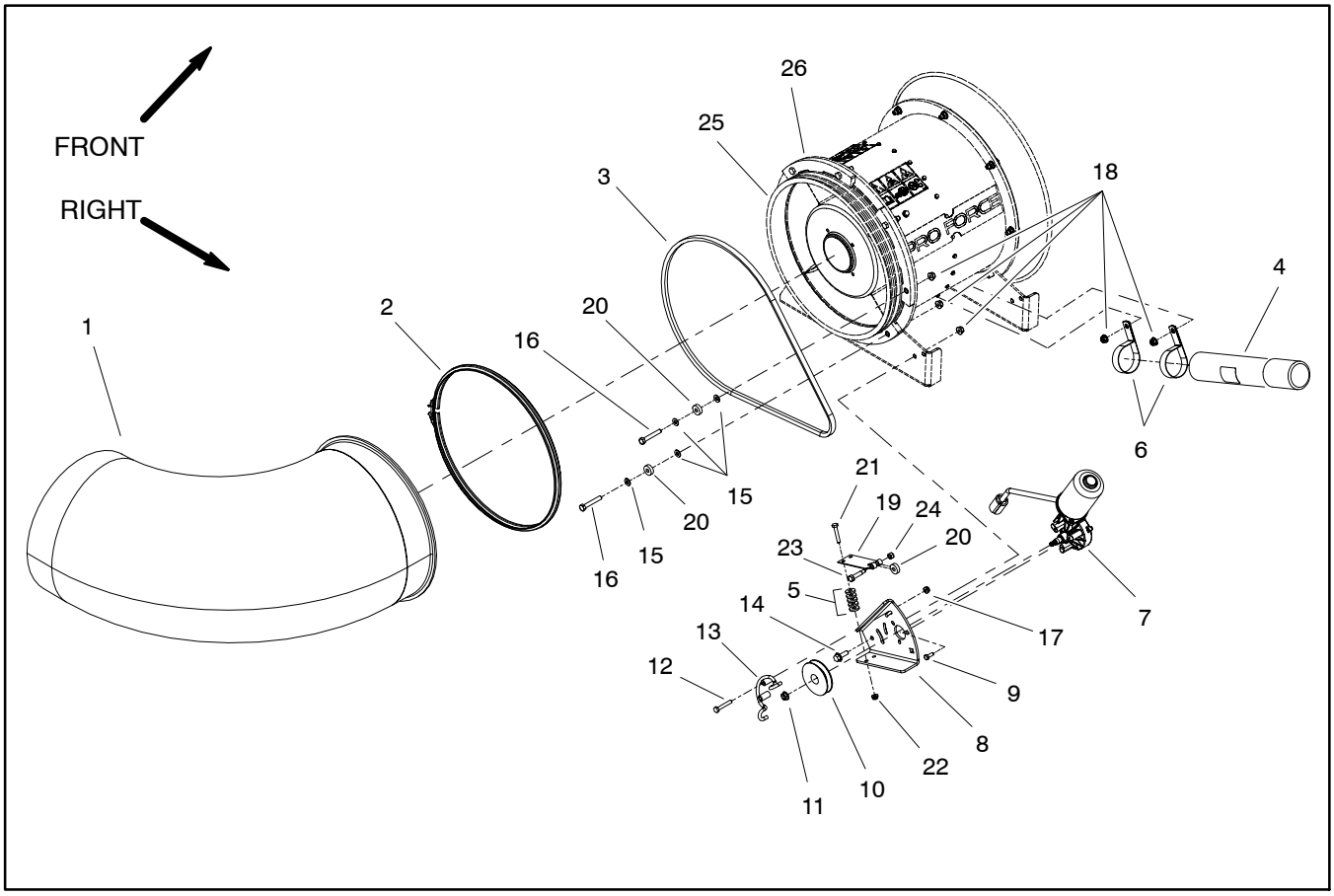

Figure 19

1. **Nozzle**
2. **Nozzle clamp**
3. **V belt**
4. **Housing assembly**
5. **Flat washer (10 used)**
6. **R–clamp**
7. **Nozzle motor**
8. **Motor bracket**
9. **Cap screw (3 used)**
10. **Drive pulley**
11. **Lock nut**
12. **Cap screw (2 used)**
13. **Belt guard**
14. **Flange head screw (2 used)**
15. **Flat washer**
16. **Cap screw**
17. **Flange nut (2 used)**
18. **Flange nut**
19. **Leaf spring**
20. **Bearing**
21. **Cap screw (2 used)**
22. **Flange nut (2 used)**
23. **Shoulder bolt**
24. **Lock nut**
25. **Nozzle pulley**
26. **Nozzle guide**

NOTE: If nozzle motor wear or damage occurs, motor replacement is necessary. Individual components for the nozzle motor are not available.

Removal (Fig. 19)

1. Position machine on a firm, level surface. Make sure engine is stopped and remove key from the ignition switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Unplug wire harness connector from nozzle motor.

4. Loosen, but do not fully remove, flange nut that secures drive pulley to nozzle motor shaft. Loosen flange nut at least two turns.

5. Remove two (2) cap screws (item 21) and flange nuts (item 22) that secure leaf spring to motor bracket. Remove leaf spring with bearing and flat washers (item 5) from bracket.

6. Loosen two (2) flange head screws (item 14) and flange nuts that secure nozzle motor bracket to outer housing. Rotate bracket and nozzle motor to loosen v–belt.

7. Loosen cap screws and flange nuts that secure belt guard (item 13), route v–belt from behind guard and carefully remove belt from machine.

NOTE: The shaft of the nozzle motor is tapered.

8. Use appropriate puller to loosen drive pulley from nozzle motor.

9. Remove flange nut and drive pulley from nozzle motor shaft.

10. Support nozzle motor to prevent it from falling. Remove three (3) cap screws that secure nozzle motor to bracket. Remove nozzle motor from machine.

Installation (Fig. 19)

1. Position nozzle motor to bracket and secure with three (3) cap screws.

2. Thoroughly clean tapered surfaces of motor shaft and drive pulley.

3. Slide drive pulley onto motor shaft and secure with flange nut.

4. Place v–belt in nozzle pulley, route behind belt guard (item 13) and install belt on motor pulley.

5. With a 3/8 in. drive torque wrench, pivot the motor bracket from **200 to 230 in–lb (23 to 25 N–m)** to set v–belt tension (Fig. 20). **Do not over tension belt.** Hold bracket with the torque wrench and tighten two (2) flange head screws and flange nuts to secure belt adjustment and nozzle motor bracket.

6. Center belt guard around v–belt. Tighten cap screws and flange nuts to secure belt guard to machine.

7. Position leaf spring with bearing and flat washers (item 5) to bracket. Make sure that five (5) washers are placed between spring and bracket at each mounting hole. The bearing on the leaf spring should be centered on the outside of the v–belt. Secure leaf spring to motor bracket with two (2) cap screws (item 21) and flange nuts (item 22).

8. Connect wire harness to nozzle motor.

9. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

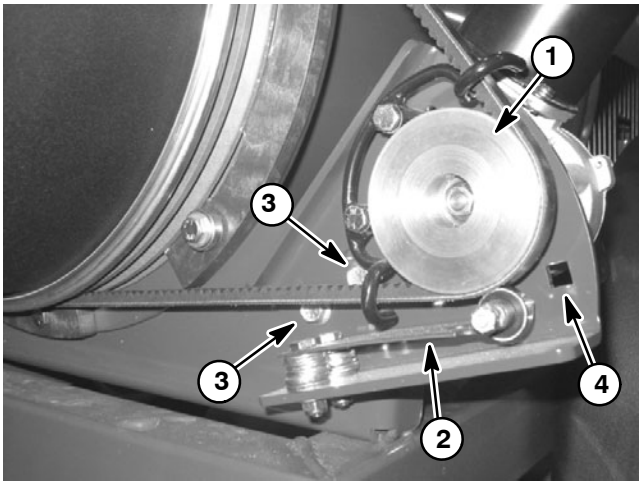

Figure 20

1. **Drive pulley**
2. **Leaf spring**
3. **Flange head screw**
4. **Torque wrench access**

Battery Storage

If the machine will be stored for more than 30 days:

1. Remove the battery from the machine and charge it fully (see Battery Service).

2. Either store battery on a shelf or on the machine.

3. Leave battery cables disconnected if the battery is stored on the machine.

4. Store battery in a cool atmosphere to avoid quick deterioration of the battery charge.

5. To help prevent the battery from freezing, make sure it is fully charged (see Battery Service).

Battery Care

1. 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 temperatures are extremely high, the battery will discharge more rapidly than if the machine is stored in a location where temperatures are cool.

CAUTION

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.

IMPORTANT: Do not remove battery fill caps while cleaning.

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.

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 Battery Terminal Protector (Toro Part No. 107−0392) or petroleum jelly to prevent corrosion.

3. Battery cables must be tight on terminals to provide good electrical contact. Tighten nuts that secure battery cables from **10 to 15 ft−lb (14 to 20 N−m)**.

CAUTION

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

4. If corrosion occurs at battery terminals, disconnect cables. Always disconnect negative (−) cable first. Clean clamps and terminals separately. Reconnect cables to battery with positive (+) cable first. Coat battery posts and cable connectors with Battery Terminal Protector (Toro Part No. 107−0392) or petroleum jelly to prevent corrosion.

5. Periodically (at least every 50 operating hours) check battery electrolyte level. Check electrolyte level every 30 days if machine is in storage.

6. Maintain battery cell level with distilled water. Do not fill battery cells above the fill line.

Battery Service

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

CAUTION

When working with batteries, use extreme caution to avoid splashing or spilling electrolyte. Electrolyte can destroy clothing and burn skin and eyes. Always wear safety goggles and a face shield when working with batteries.

Electrolyte Specific Gravity
Fully charged: 1.265 corrected to 80ºF (26.7ºC)
Discharged: less than 1.240

Battery Specifications
BCI Group Size 28
535 CCA at 0º F (–18º C)
Reserve Capacity of 110 minutes at 80ºF (27ºC)

Dimensions (including terminal posts)

Length	10.3 inches (26.2 cm)
Width	6.8 inches (17.3 cm)
Height	9.5 inches (24.1 cm)

Removal and Installation (Fig. 21)

1. Make sure that ignition switch is in the OFF position and that none of the LED's on Remote Control Module are illuminated. Loosen strap and remove battery box cover.

2. Loosen and remove negative cable from battery. After negative cable has been removed, loosen and remove positive cable.

3. Carefully remove battery from machine.

4. Install battery in reverse order making sure to connect and tighten positive cable to battery before connecting negative cable. Tighten nuts that secure battery cables from **10 to 15 ft–lb (14 to 20 N–m)**.

NOTE: Before connecting the negative (ground) cable to the battery, connect a digital multimeter (set to DC Amps) between the negative battery post and the negative (ground) cable connector. The reading should be less than 0.1 amp. If the reading is 0.1 amp or more, the machine's electrical system should be tested for short circuits or faulty components and repaired.

5. Install battery box cover and secure with strap.

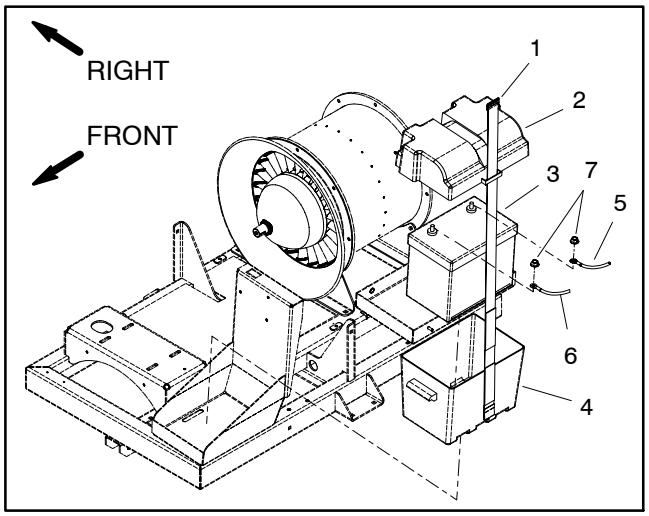

Figure 21

1. **Strap**
2. **Battery box cover**
3. **Battery**
4. **Battery box**
5. **Positive cable**
6. **Negative cable**
7. **Flange nut**

Inspection, Maintenance and Testing

1. Perform the following inspections and maintenance:

   A. Check battery case for cracks. Replace battery if cracked or leaking.

   B. Check battery terminals for corrosion. If corrosion occurs at terminals, disconnect cables. Always disconnect negative (–) cable first. Clean cable clamps and battery terminals separately. Reconnect cables with positive (+) cable first. Coat battery posts and cable connectors with Battery Terminal Protector (Toro Part No. 107–0392) or petroleum jelly to prevent corrosion.

IMPORTANT: Before cleaning the battery, tape or block vent holes to the filler caps and make sure the caps are on tightly.

   C. Check for 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 battery case for dirt and oil. Clean the battery with a solution of baking soda 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.

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

2. Conduct a hydrometer test of the battery electrolyte.

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

A. Measure the specific gravity of each cell with a hydrometer. Draw electrolyte in and out of the hydrometer barrel prior to 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 10ºF (5.5ºC) above 80ºF (26.7ºC) add 0.004 to the specific gravity reading. For each 10ºF (5.5ºC) below 80ºF (26.7ºC) subtract 0.004 from the specific gravity reading.

Example: Cell Temperature	100ºF
Cell Gravity	1.245
100ºF minus 80ºF equals 20ºF	
(37.7ºC minus 26.7ºC equals 11.0ºC)	
20ºF multiply by 0.004/10ºF equals 0.008	
(11ºC multiply by 0.004/5.5ºC equals 0.008)	
ADD (conversion above)	0.008
Correction to 80ºF (26.7ºC)	1.253

C. If the difference between the highest and lowest cell specific gravity is 0.050 or greater or the lowest cell specific gravity is less than 1.225, charge the battery. Charge at the recommended rate and time given in **Charging** or until specific gravity of all cells is 1.225 or greater with the difference in specific gravity between the highest and lowest cell less than 0.050. If these charging conditions can not be met, replace the battery.

3. Perform a high–discharge test with an adjustable load tester.

This is one of the most reliable means of testing a battery as it simulates the cold–cranking test. A commercial battery load tester is **required** to perform this test.

CAUTION

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

A. Check the voltage across the battery terminals prior to testing the battery. If the voltage is less than 12.4 VDC, recharge the battery.

B. If the battery has recently been charged, remove the battery surface charge before performing the load test. Disconnect the engine fuel stop solenoid to prevent the engine from starting. Engage the starter motor for 10 seconds to remove battery surface charge. Reconnect the fuel stop solenoid.

C. Make sure battery terminals are free of corrosion.

D. Measure the temperature of the center battery cell.

E. Connect a battery load tester to the battery terminals **following the load tester manufacturer's instructions**. Connect a digital multimeter to the battery terminals.

F. Apply a test load of 270 amps (one half the Cranking Performance rating of the battery) for 15 seconds.

G. Take a voltage reading after 15 seconds, then remove the load.

H. Using the table below, determine the minimum voltage for the cell temperature reading:

Minimum Voltage	Battery Electrolyte Temperature	
9.6	70ºF (and up)	21.1ºC (and up)
9.5	60ºF	15.6ºC
9.4	50ºF	10.0ºC
9.3	40ºF	4.4ºC
9.1	30ºF	–1.1ºC
8.9	20ºF	–6.7ºC
8.7	10ºF	–12.2ºC
8.5	0ºF	–17.8ºC

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

To minimize possible damage to the battery and allow the battery to be fully charged, the slow charging method is presented here. This charging method can be accomplished with a constant current battery charger which is commonly available.

CAUTION

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

NOTE: Using specific gravity of the battery cells is the most accurate method of determining battery condition.

1. Determine the battery charge level from either its specific gravity or open circuit voltage.

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

2. Determine the charging time and rate **using the battery charger manufacturer's instructions** or the following table:

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

CAUTION

Do not charge a frozen battery because it can explode and cause injury. Let the battery warm to 60° F (15.5° C) before connecting to a charger.

Charge the battery in a well–ventilated place to dissipate gases produced from charging. These gases are explosive; keep open flame and electrical spark away from the battery. Do not smoke. Nausea may result if the gases are inhaled. Unplug the charger from the electrical outlet before connecting or disconnecting the charger leads from the battery posts.

3. **Following the battery charger manufacturer's instructions**, connect the charger cables to the battery. Make sure a good connection is made.

4. Charge the battery **following the battery charger manufacturer's instructions**.

5. Occasionally check the temperature of the battery electrolyte. If the temperature exceeds 125ºF (51.6ºC) or the electrolyte is violently gassing or spewing, the charging rate must be lowered or temporarily stopped.

6. Three hours prior to the end of the charging, measure the specific gravity of a battery cell once per hour. 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 three consecutive readings.

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Chapter 5

Blower Assembly

Table of Contents

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General Information

Operator's Manual

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

Electrical Power

Electrical power to ProForce Debris Blower components is controlled by the Remote Control Module. To make sure that machine operation does not occur unexpectedly, disconnect the negative battery cable from the battery before performing any machine service.

Reattach the disconnected negative battery cable as the last step in any repair. Secure cable with flange nut. Torque nut from from **10 to 15 ft–lb (14 to 20 N–m)**.

Service and Repairs

Blower Drive Shaft

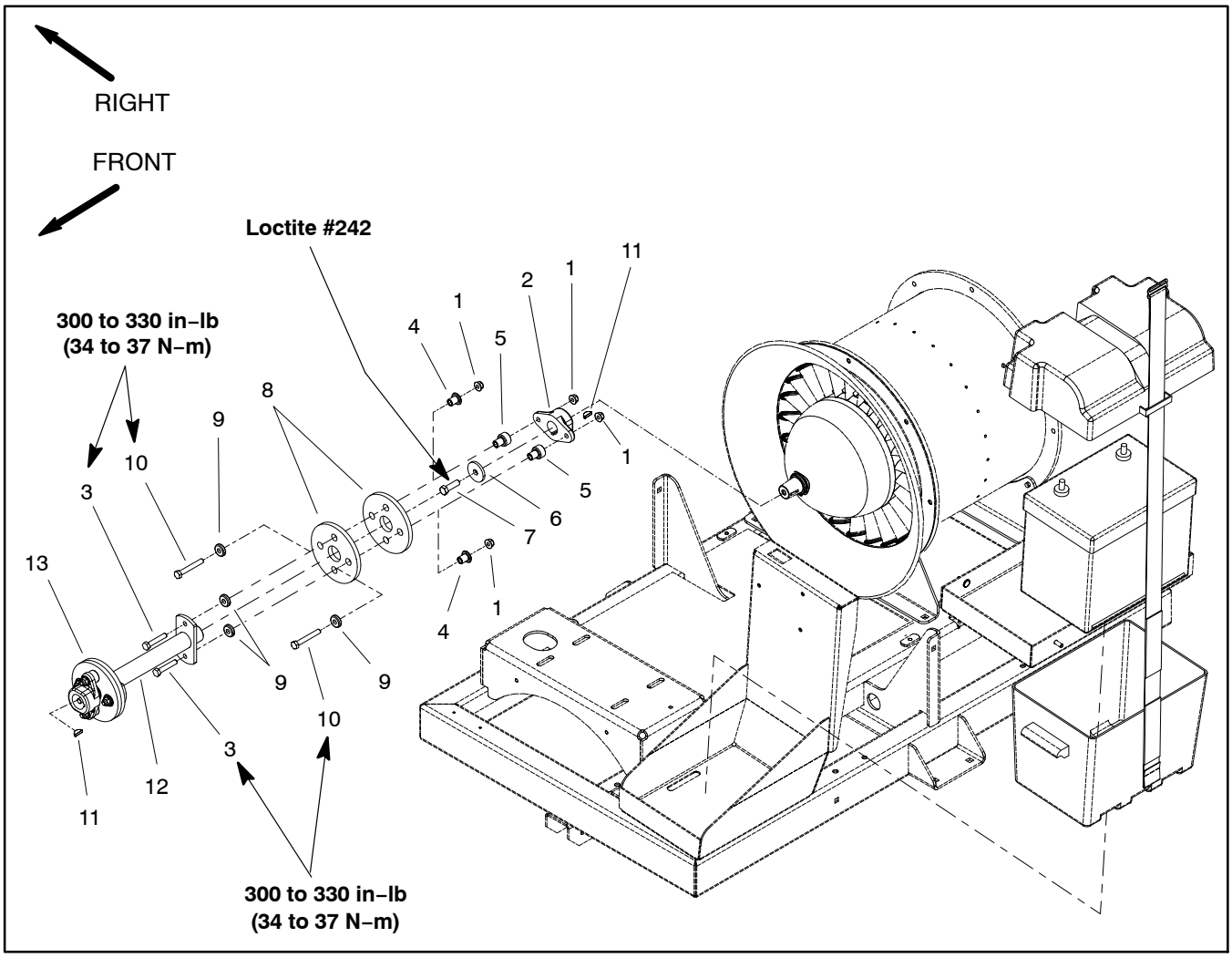

Figure 1

1. **Flange nut**
2. **Fan hub**
3. **Cap screw**
4. **Spacer**
5. **Spacer**
6. **Flat washer**
7. **Cap screw**
8. **Drive coupling**
9. **Flat washer**
10. **Cap screw**
11. **Woodruff key**
12. **Drive shaft**
13. **Engine hub and coupling assembly**

NOTE: The coupling assembly between the blower shaft and drive shaft (item 12) is illustrated in Figure 1. The coupling assembly (item 13) used between the drive shaft (item 12) and engine shaft is composed of the same components (Fig. 2).

Removal (Fig. 1)

1. Position machine on a firm, level surface. Make sure engine is stopped and remove key from the ignition switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Remove top grill to allow access to blower drive shaft (Fig. 3).

4. Remove cap screws, flat washers and lock nuts that secure drive shaft assembly to hubs on engine shaft and blower shaft.

5. Lift drive shaft assembly from machine.

6. Disassemble drive couplings from drive shaft using Figures 1 and 2 as guides. Note differences in coupling spacer flange thickness for assembly purposes.

7. Inspect drive couplings for damage and replace if necessary.

8. If necessary, remove hubs from engine shaft and blower shaft:

   A. Remove cap screw and flat washer that secure hub to shaft.

   NOTE: Hub has a tapered ID and will require a puller to remove it from shaft.

   B. Use appropriate puller to remove hub from shaft.

   C. Remove woodruff key from shaft slot.

Installation (Fig. 1)

1. If hub was removed from engine shaft or blower shaft, thoroughly clean tapers of shaft(s) and hub(s). Fit woodruff key to shaft slot and place hub on shaft. Apply Loctite #242 (or equivalent) to threads of cap screw used to secure hub to shaft. Secure hub to shaft with cap screw and flat washer.

2. Place coupling spacers into rubber coupling.

3. Secure rubber couplings to drive shaft with cap screws and lock nuts using Figures 1 and 2 as guides.

4. Position drive shaft assembly to engine shaft and blower shaft.

5. Secure drive shaft assembly to hubs on engine shaft and blower shaft with cap screws, flat washers and lock nuts.

6. Install top grill to machine (Fig. 3).

7. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

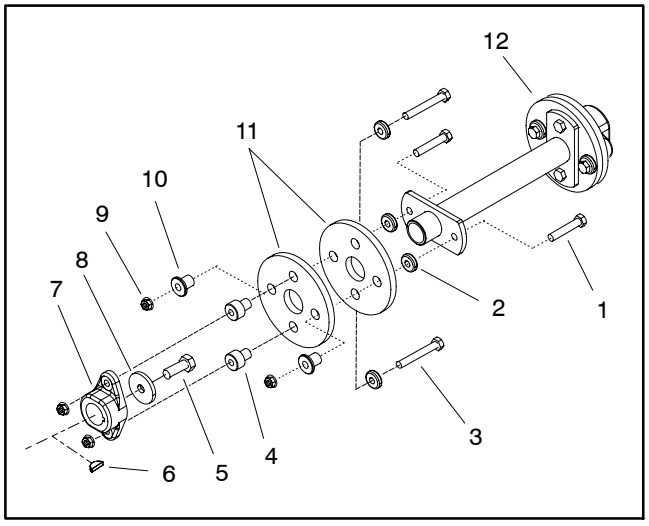

Figure 2

1. **Cap screw**
2. **Flat washer**
3. **Cap screw**
4. **Spacer**
5. **Cap screw**
6. **Woodruff key**
7. **Shaft hub**
8. **Flat washer**
9. **Flange nut**
10. **Spacer**
11. **Rubber coupler**
12. **Fan hub/coupling**

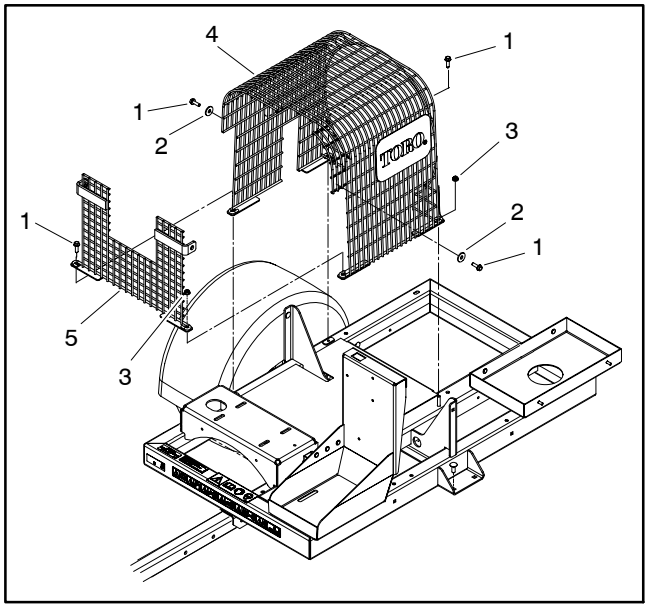

Figure 3

1. **Screw**
2. **Washer**
3. **Flange nut**
4. **Top grill**
5. **Side grill**

Rotor Assembly

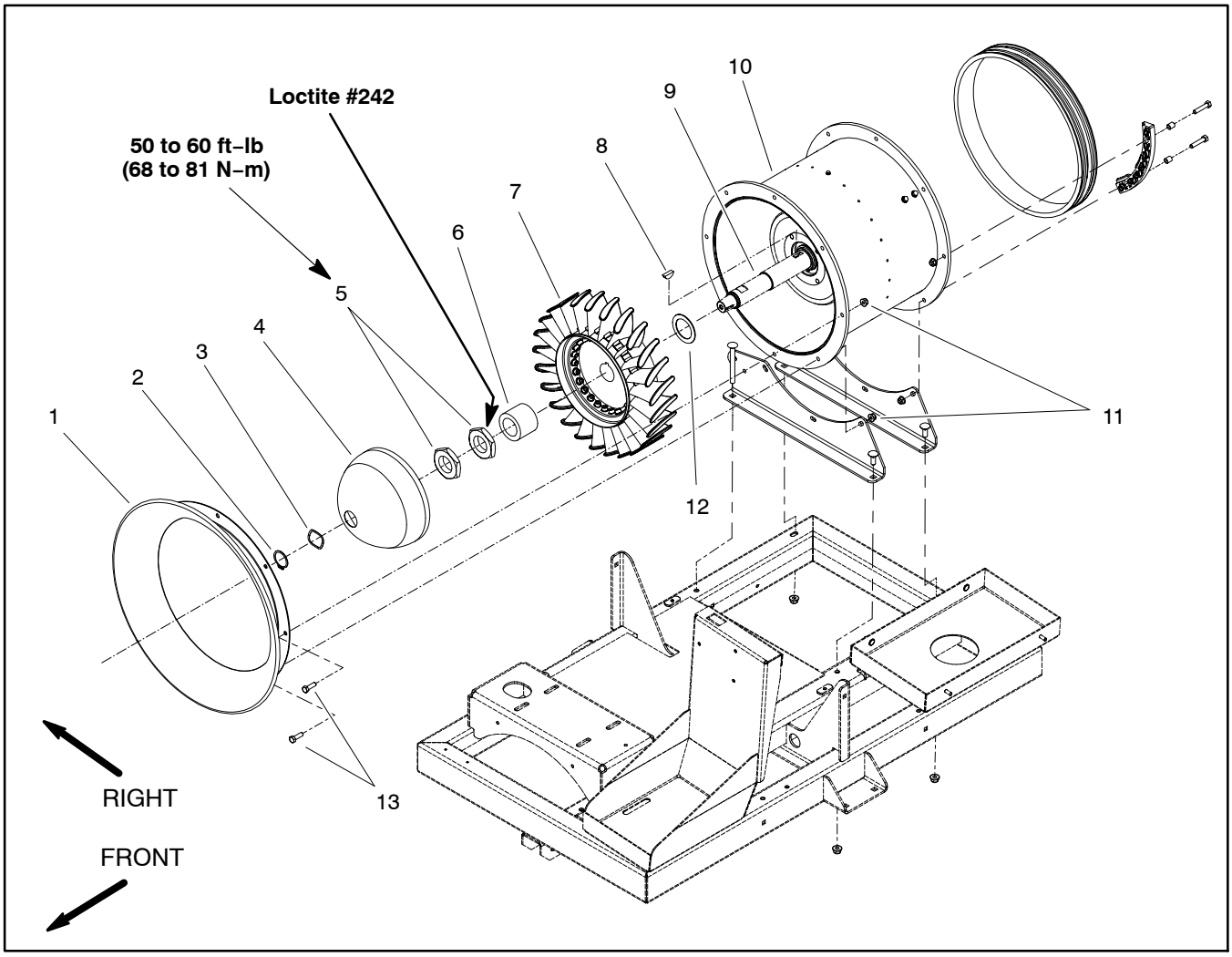

Figure 4

1. **Inlet bell**
2. **Retaining ring**
3. **Wave washer**
4. **Front cap**
5. **Nut (LH threads)**
6. **Spacer**
7. **Rotor assembly**
8. **Woodruff key**
9. **Rotor shaft**
10. **Outer housing**
11. **Flange nut (8 used)**
12. **Washer**
13. **Cap screw (8 used)**

Removal (Fig. 4)

1. Position machine on a firm, level surface. Make sure engine is stopped and remove key from the ignition switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Remove top grill to allow access to blower assembly (Fig. 5).

4. Remove blower drive shaft from machine (see Blower Drive Shaft Removal in this section).

5. Remove retaining ring (item 2), wave washer (item 3) and front cap (item 4) from shaft.

NOTE: When loosening nuts that secure rotor assembly to shaft, use a 1 1/4" wrench in flats on shaft to prevent the shaft from turning.

IMPORTANT: The two (2) nuts (item 5) used to secure the rotor assembly to the rotor shaft have left hand threads. Loosen these nuts by rotating clockwise.

6. Loosen and remove outer nut from rotor shaft by rotating nut in a clockwise direction. Then, remove inner nut by rotating nut clockwise.

7. Slide spacer (item 6), rotor assembly and washer (item 12) from shaft. Locate and retrieve woodruff key.

NOTE: Component parts for the rotor assembly are not available. If rotor damage exists, replace complete rotor assembly.

Installation (Fig. 4)

1. Position woodruff key in slot in rotor shaft. Slide washer (item 12), rotor assembly and then spacer (item 6) onto shaft.

2. Apply Loctite #242 (or equivalent) to threads on rotor shaft.

NOTE: When installing nuts that secure rotor assembly to shaft, use a 1 1/4" wrench in flats on shaft to prevent the shaft from turning.

IMPORTANT: The two (2) nuts (item 5) used to secure the rotor assembly to the rotor shaft have left hand threads.

3. Install inner nut and torque from **50 to 60 ft–lb (68 to 81 N–m)** to secure rotor assembly on shaft. Then, while holding inner nut to prevent it from turning, install and torque outer nut from **50 to 60 ft–lb (68 to 81 N–m)**.

4. Install front cap (item 4), wave washer (item 3) and retaining ring (item 2) onto shaft.

5. Install blower drive shaft (see Blower Drive Shaft Installation in this section).

6. Install top grill to machine (Fig. 5).

7. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

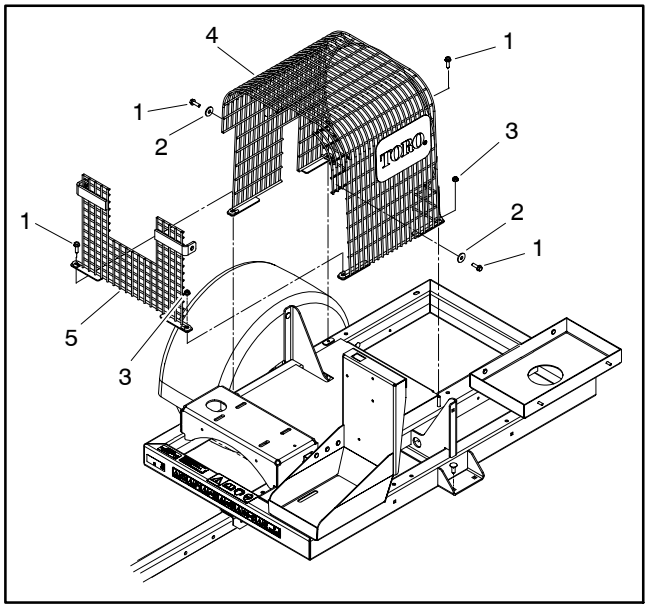

Figure 5

1. **Screw**
2. **Washer**
3. **Flange nut**
4. **Top grill**
5. **Side grill**

Rotor Shaft

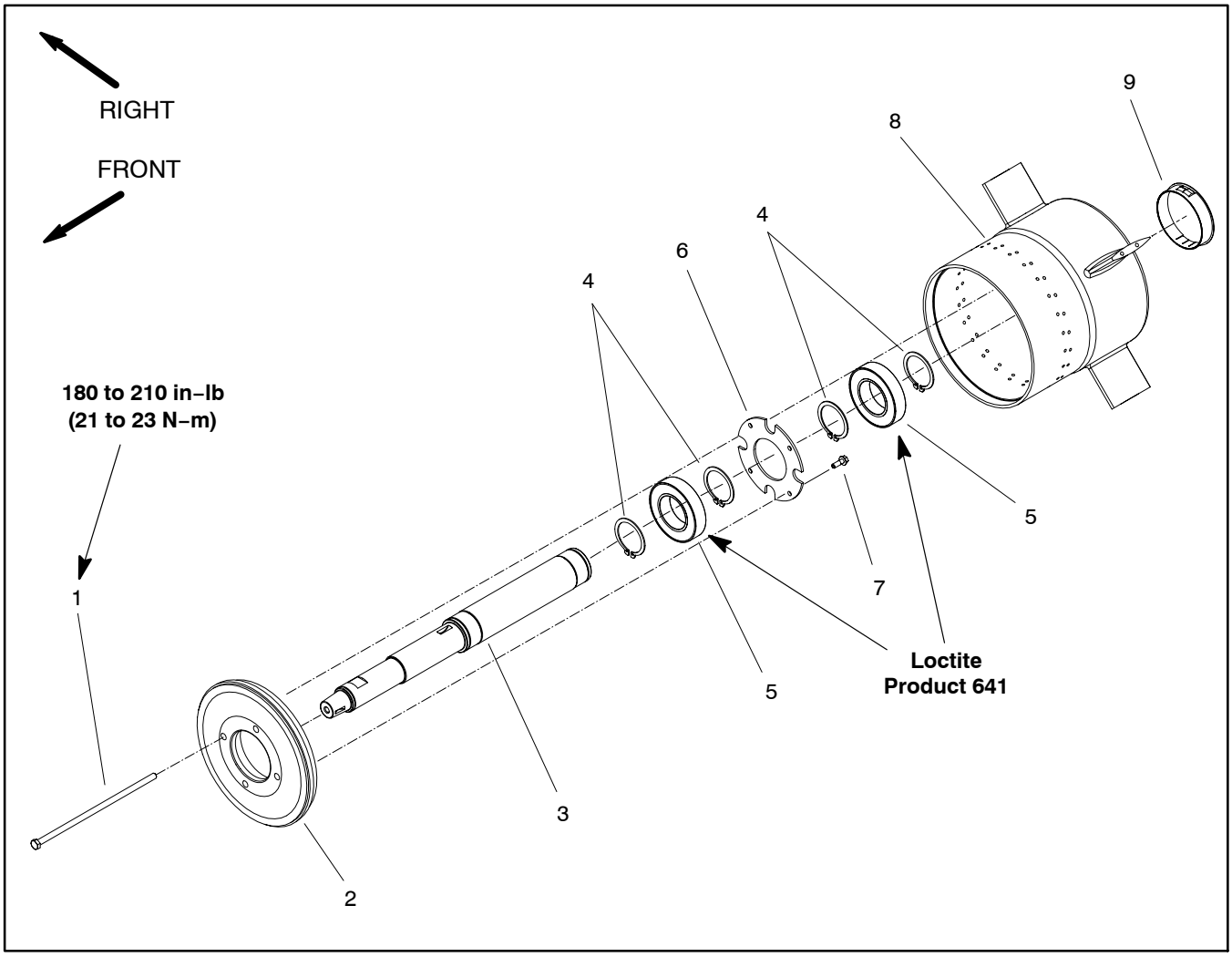

Figure 6

1. **Cap screw (4 used)**
2. **Bearing holder**
3. **Fan shaft**
4. **Retaining ring (4 used)**
5. **Bearing (2 used)**
6. **Front bearing cap**
7. **Flange head screw (4 used)**
8. **Inner housing**
9. **Plug**

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

Removal (Fig. 6)

1. Position machine on a firm, level surface. Make sure engine is stopped and remove key from the ignition switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Remove nozzle and nozzle pulley from rear of outer housing (see Nozzle Assembly Removal in this section).

4. Remove top grill to allow access to blower assembly (Fig. 7).

5. Remove blower drive shaft from machine (see Blower Drive Shaft Removal in this section).

6. Remove rotor assembly (see Rotor Assembly Removal in this section).

7. Remove plug (item 9) from inner housing.

NOTE: Bearings are secured with Loctite Product 641 medium strength bearing mount. Heating of the inner housing and bearing holder in the bearing area may be required during disassembly.

8. Remove four (4) cap screws that secure bearing holder to inner housing.

9. Slide rotor shaft and bearing holder assembly from inner housing.

10. Remove four (4) flange head screws that secure front bearing cap to bearing holder. Remove bearing holder from rotor shaft assembly.

11. Remove bearings from rotor shaft:

A. Remove outer retaining rings from shaft.

B. Press bearings from shaft.

C. Remove front bearing cap and inner retaining rings from shaft if necessary.

12. Inspect rotor shaft and bearing bores of bearing holder and inner housing for wear or damage. Replace parts as necessary.

Installation (Fig. 6)

1. Install bearings onto rotor shaft:

A. Install inner retaining rings into shaft groove if they were removed.

B. Make sure that front bearing cap (item 6) is placed on rotor shaft between bearing locations.

C. Install bearings onto shaft by pressing on inner race. Make sure that bearings are seated against inner retaining ring.

D. Install outer retaining rings to secure bearings on shaft.

2. Clean bearing bores of bearing holder and inner housing with brake parts cleaner or similar non−oily cleaner. After cleaner dries completely, apply Loctite Primer N 7649 (or equivalent) to bearing bores. Allow Primer to dry completely.

3. Thoroughly clean OD of bearings on rotor shaft. Apply Loctite Product 641 (or equivalent) to OD of both bearings.

4. Slide bearing holder onto bearing on rotor shaft. Position front bearing cap (item 6) to bearing holder and secure with four (4) flange head screws.

5. Install rotor shaft assembly into inner housing making sure that bearing is fully seated in housing bearing bore. Make sure that bearing holder slides fully into inner housing and that rotor shaft rotates freely.

6. Install four (4) cap screws to secure bearing holder to inner housing. Tighten screws in three (3) equal steps and in a crossing pattern. Final torque on screws should be from **180 to 210 in−lb (21 to 23 N−m)**.

7. Install plug (item 9) into inner housing.

8. Install rotor assembly (see Rotor Assembly Installation in this section).

9. Install blower drive shaft (see Blower Drive Shaft Installation in this section).

10. Install top grill to machine (Fig. 7).

11. Install nozzle pulley and nozzle to rear of outer housing (see Nozzle Assembly Installation) in this section).

12. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft−lb (14 to 20 N−m)**. Make sure that battery cover is secured.

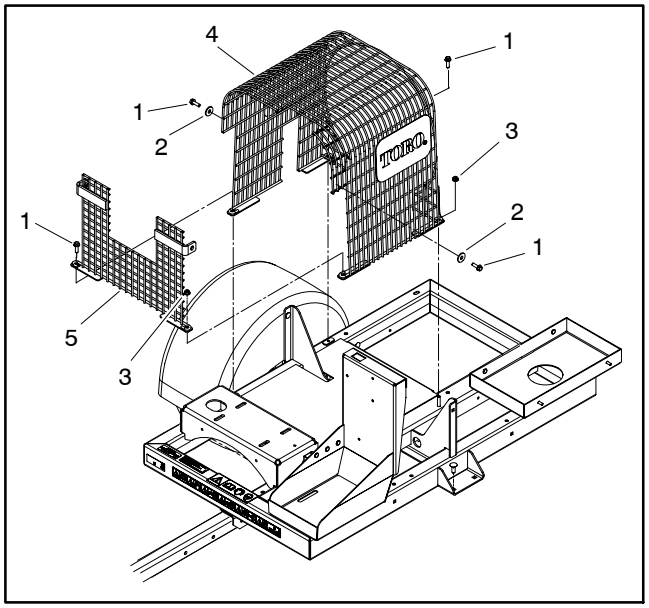

Figure 7

1. **Screw**
2. **Washer**
3. **Flange nut**
4. **Top grill**
5. **Side grill**

Inner Housing Assembly

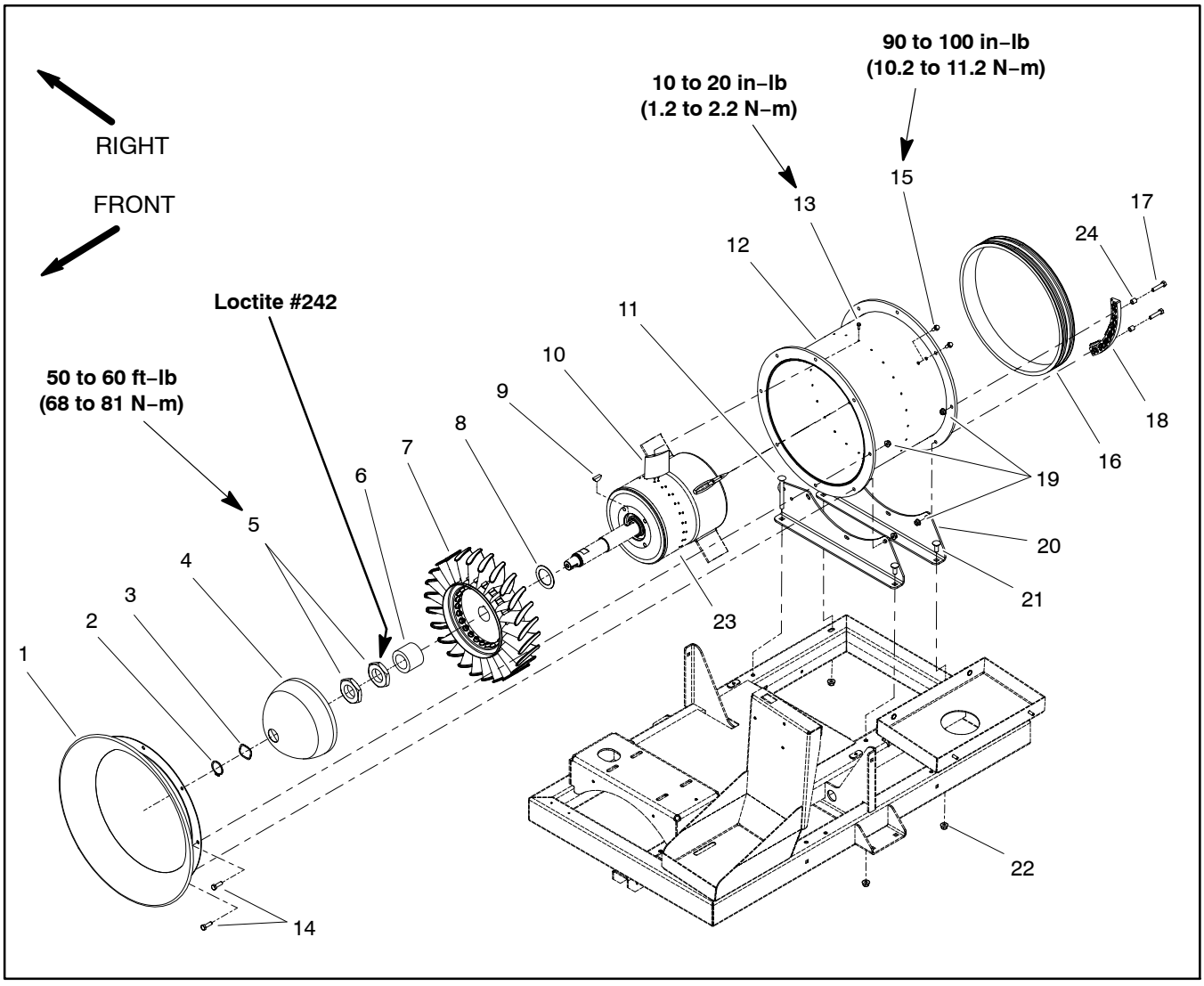

Figure 8

1. **Inlet bell**
2. **Retaining ring**
3. **Wave washer**
4. **Front cap**
5. **Nut (LH thread)**
6. **Spacer**
7. **Rotor assembly**
8. **Washer**
9. **Woodruff key**
10. **Stator vane (24 used)**
11. **Carriage screw (2 used)**
12. **Outer housing**
13. **Flange head screw (24 used)**
14. **Cap screw (8 used)**
15. **Flange head screw (8 used)**
16. **Nozzle pulley**
17. **Cap screw (2 used per guide)**
18. **Nozzle guide (4 used)**
19. **Flange nut (16 used)**
20. **Fan mount (2 used)**
21. **Carriage screw (2 used)**
22. **Flange nut (4 used)**
23. **Inner housing assembly**
24. **Spacer (2 used per guide)**

NOTE: The rotor shaft and bearings can be serviced without removing inner housing from machine (see Rotor Shaft in this section). For replacement of the inner housing, stator vanes (item 10) or outer housing (item 12), the following procedure is necessary.

Removal (Fig. 8)

1. Position machine on a firm, level surface. Make sure engine is stopped and remove key from the ignition switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Remove nozzle and nozzle pulley from rear of outer housing (see Nozzle Assembly Removal in this section).

4. Remove top grill to allow access to blower assembly (Fig. 9).

5. Remove blower drive shaft from machine (see Blower Drive Shaft Removal in this section).

6. Remove rotor assembly (see Rotor Assembly Removal in this section).

7. Remove cap screws and flange nuts that secure outer housing to fan mounts.

CAUTION

To prevent personal injury, make sure that outer housing assembly is properly supported as it is removed from the machine. Assembly weighs approximately 70 pounds (31.8 kg).

8. Lift outer housing assembly from machine. Set assembly on workbench with fan shaft pointing straight up (Fig. 10). Support inner housing so it does not shift during disassembly.

9. Loosen, but do not remove, eight (8) flange head screws (item 14) that secure inner housing flanges to outer housing.

10. Remove flange head screw (item 12) that secures each stator vane (item 9) to outer housing. Tilt vane to free vane lugs from inner housing and remove vane. Inspect each vane to make sure that mounting lugs and screw threads are in good condition. Replace any vane that shows signs of damage or wear.

11. Fully remove flange head screws (item 14) that secure inner housing flanges to outer housing. Remove inner housing assembly from the outer housing.

12. If necessary, disassemble inner housing (see Rotor Shaft Removal in this section).

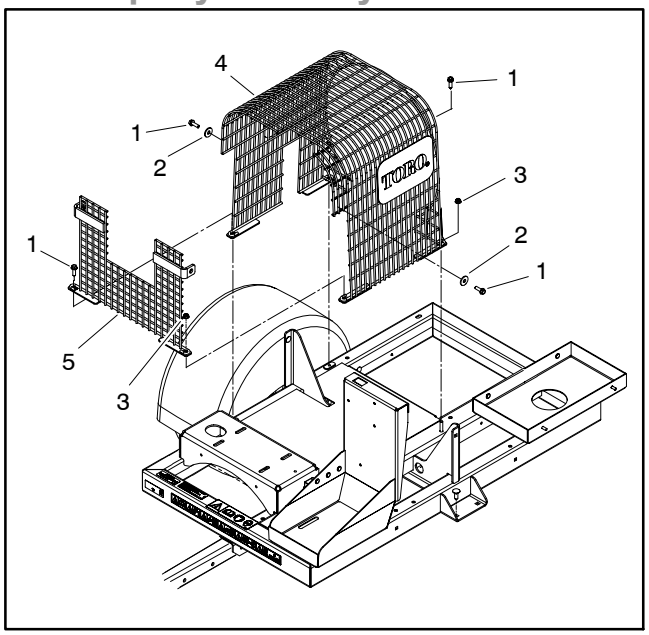

Figure 9

1. **Screw**
2. **Washer**
3. **Flange nut**
4. **Top grill**
5. **Side grill**

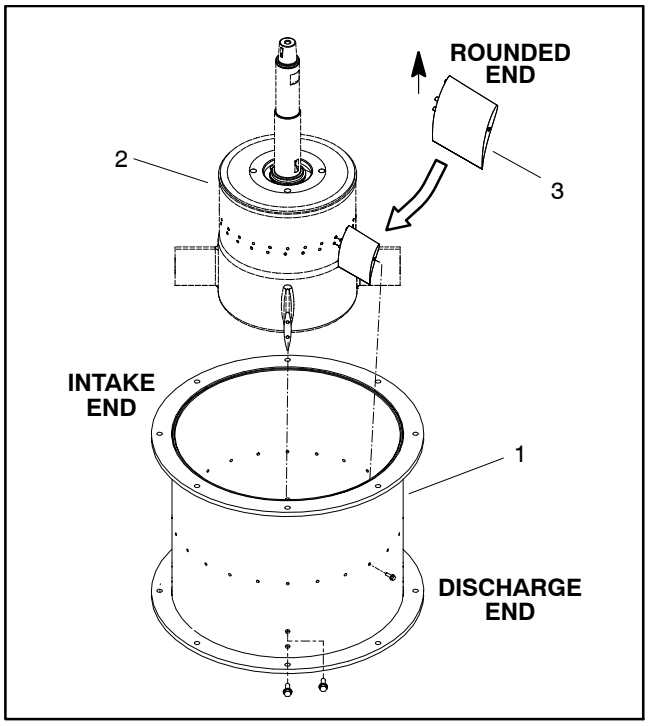

Figure 10

1. **Outer housing**
2. **Inner housing assembly**
3. **Stator vane (24 used)**

Installation (Fig. 8)

1. If rotor shaft was removed from inner housing, assemble inner housing (see Rotor Shaft Installation in this section).

2. Set outer housing on workbench with the intake end up (Fig. 10).

NOTE: When assembling inner and outer housings, do not fully tighten any screws until all screws are installed in inner housing flanges and stator vanes. Also, use hand tools rather than air impact tools during assembly.

3. Install inner housing to outer housing:

   A. Lower inner housing assembly into outer housing with the rotor shaft pointing upwards.

   B. Align holes in inner housing flanges with outer housing holes. Support inner housing so holes remain aligned.

   C. Install and finger tighten eight (8) flange head screws (item 14) into threads of inner housing flanges. Do not fully tighten screws at this time.

4. Install stator vanes to inner and outer housing:

   A. Position vane between inner and outer housing. Make sure that rounded end of vane is orientated toward rotor shaft (Fig. 10).

   B. Tilt vane and engage vane lugs to inner housing holes.

   C. While keeping vane lugs in inner housing holes, rotate vane to align threaded hole of vane with outer housing hole.

   D. Install and finger tighten flange head screw (item 12) into threads of vane. Do not fully tighten screws at this time.

5. Tighten fasteners in the following order to secure assembly:

   A. Use nutdriver to hand tighten the eight (8) flange head screws that secure inner housing flanges to outer housing. Use a crossing pattern while tightening the screws.

   B. Use nutdriver to hand tighten the twenty–four (24) flange head screws that secure the stator vanes to outer housing. Use a crossing pattern while tightening the screws.

   C. Torque flange head screws that secure inner housing flanges to outer housing from **90 to 100 in–lb (10.2 to 11.2 N–m)**. Use a crossing pattern while torquing the screws.

   IMPORTANT: DO NOT overtighten screws that secure stator vanes to outer housing. If screws are overtightened, threads in vanes could be damaged.

   D. Torque screws that secure stator vanes to outer housing from **10 to 20 in–lb (1.2 to 2.2 N–m)**. Use a crossing pattern while torquing the screws.

CAUTION

To prevent personal injury, make sure that outer housing assembly is properly supported as it is positioned to machine. Assembly weighs approximately 70 pounds (31.8 kg).

6. Position outer housing assembly to machine. Secure outer housing to fan mounts with cap screws and flange nuts.

7. Install rotor assembly (see Rotor Assembly Installation in this section).

8. Install blower drive shaft (see Blower Drive Shaft Installation in this section).

9. Install top grill to machine (Fig. 9).

10. Install nozzle pulley and nozzle to rear of outer housing (see Nozzle Assembly Installation in this section).

11. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

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Nozzle Assembly

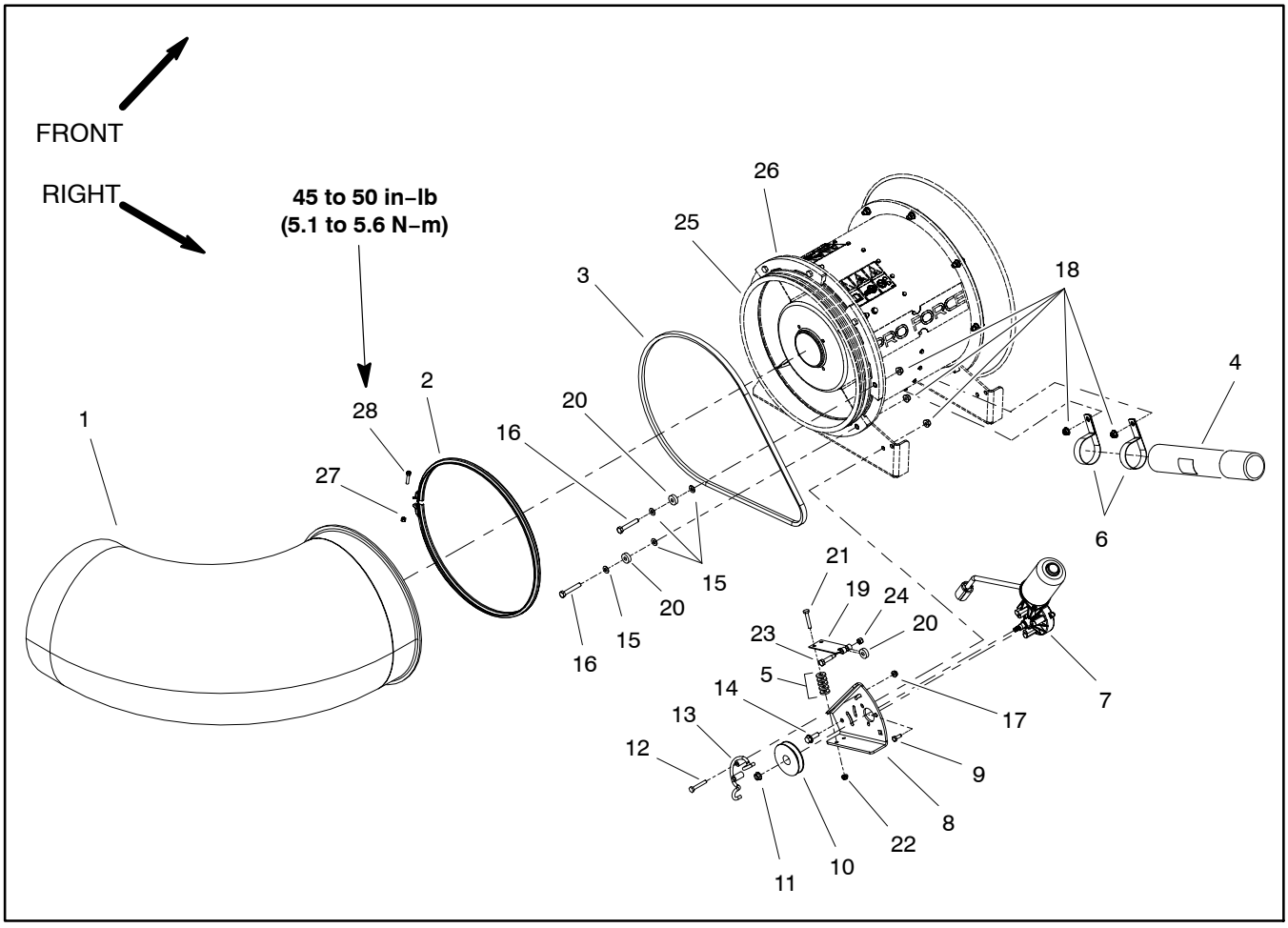

Figure 11

1. Nozzle
2. Nozzle clamp
3. V belt
4. Housing assembly
5. Flat washer (10 used)
6. R–clamp
7. Nozzle motor
8. Motor bracket
9. Cap screw (3 used)
10. Drive pulley
11. Lock nut
12. Cap screw (2 used)
13. Belt guard
14. Flang head screw (2 used)
15. Flat washer (2 used per bearing)
16. Cap screw
17. Flange nut (2 used)
18. Flange nut
19. Leaf spring
20. Bearing
21. Cap screw (2 used)
22. Flange nut (2 used)
23. Shoulder bolt
24. Lock nut
25. Nozzle pulley
26. Nozzle guide (4 used)
27. Lock nut
28. Socket head screw

NOTE: For service information on the nozzle motor (item 7), refer to the Service and Repairs section of Chapter 4 – Electrical System.

Removal (Fig. 11)

1. Position machine on a firm, level surface. Make sure engine is stopped and remove key from the ignition switch. Chock wheels to prevent machine from moving.

2. To prevent unexpected machine operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Loosen socket head screw and lock nut that secures ends of nozzle clamp. Remove clamp from nozzle and nozzle pulley.

4. Remove nozzle from outer housing.

5. Remove two (2) cap screws (item 21) and flange nuts (item 22) that secure leaf spring to motor bracket. Remove leaf spring with bearing and flat washers (item 5) from bracket.

6. Loosen two (2) flange head screws (item 14) and flange nuts that secure nozzle motor bracket to outer housing. Rotate bracket and nozzle motor to loosen v–belt.

7. Loosen cap screws and flange nuts that secure belt guard (item 13), route v–belt from behind guard and carefully remove belt from machine.

8. If necessary, remove nozzle guides, pulley bearings and nozzle pulley from outer housing using Figures 11 and 13 as guides.

Installation (Fig. 11)

1. If removed, install nozzle pulley, pulley bearings and nozzle guides using Figures 11 and 13 as guides.

2. Place v–belt in nozzle pulley, route behind belt guard (item 13) and install belt on motor pulley.

3. With a 3/8 in. drive torque wrench, pivot the motor bracket from **200 to 230 in–lb (23 to 25 N–m)** to set v–belt tension (Fig. 12). **Do not over tension belt.** Hold bracket with the torque wrench and tighten two (2) flange head screws and flange nuts to secure belt adjustment and nozzle motor bracket.

4. Center belt guard around v–belt. Tighten cap screws and flange nuts to secure belt guard to machine.

5. Position leaf spring with bearing and flat washers (item 5) to bracket. Make sure that five (5) washers are placed between spring and bracket at each mounting hole. The bearing on the leaf spring should be centered on the outside of the v–belt. Secure leaf spring to motor bracket with two (2) cap screws (item 21) and flange nuts (item 22).

6. Fit nozzle and nozzle clamp to pulley. Tighten socket head screw and lock nut to secure nozzle to pulley. Torque fasteners from **45 to 50 in–lb (5.1 to 5.6 N–m)**.

7. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

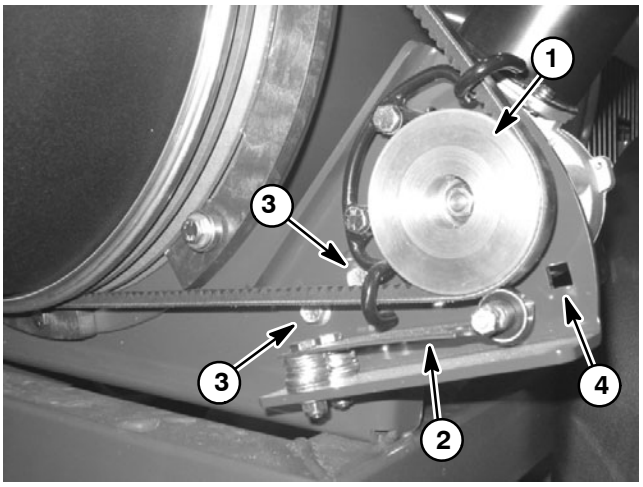

Figure 12

1. **Drive pulley**
2. **Leaf spring**
3. **Flange head screw**
4. **Torque wrench access**

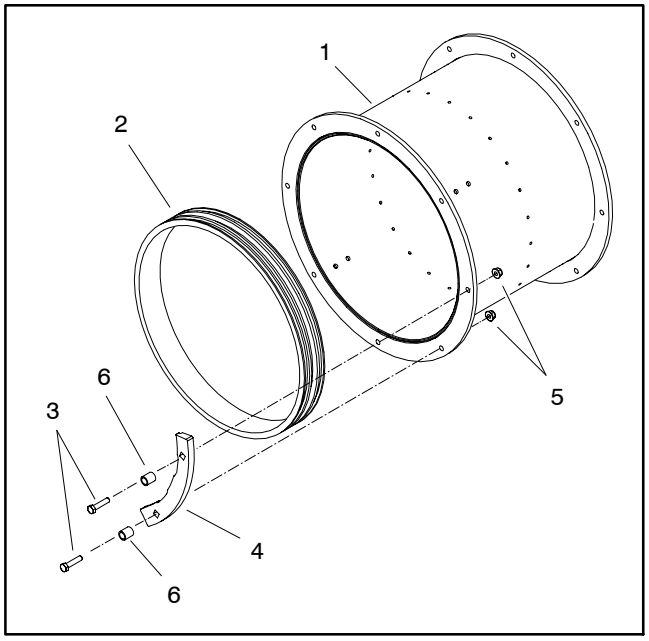

Figure 13

1. **Outer housing**
2. **Nozzle pulley**
3. **Cap screw**
4. **Nozzle guide (4 used)**
5. **Flange nut**
6. **Spacer**

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Chapter 6

Chassis

Table of Contents

Specifications

Item	Description
Tires Size Pressure	 20 x 10 – 8, 4 Ply, Tubeless 14 PSI (0.97 Bar)
Wheel Lug Nut Torque	60 to 65 ft–lb (81 to 88 N–m)

General Information

Operator's Manual

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

Securing ProForce Debris Blower to Tow Vehicle

While operating or servicing the ProForce blower, make sure that hitch pin is properly positioned in tow vehicle hitch and blower tongue. Hitch pin should be secured with hairpin clip (Fig. 1).

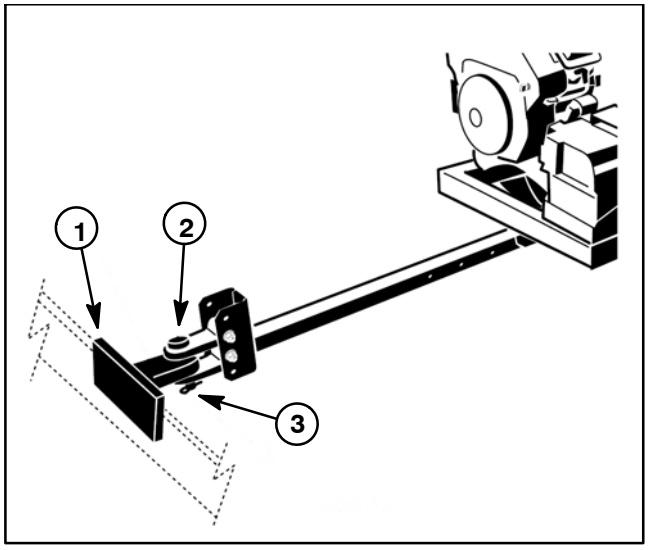

Figure 1

1. **Tow vehicle hitch**
2. **Hitch pin**
3. **Hairpin clip**

Electrical Power

Electrical power to ProForce Debris Blower components is controlled by the Remote Control Module. To make sure that machine operation does not occur unexpectedly, disconnect the negative battery cable from the battery before performing any machine service.

Reattach the disconnected negative battery cable as the last step in any repair. Secure cable with flange nut. Torque nut from from **10 to 15 ft–lb (14 to 20 N–m)**.

Service and Repairs

Wheels

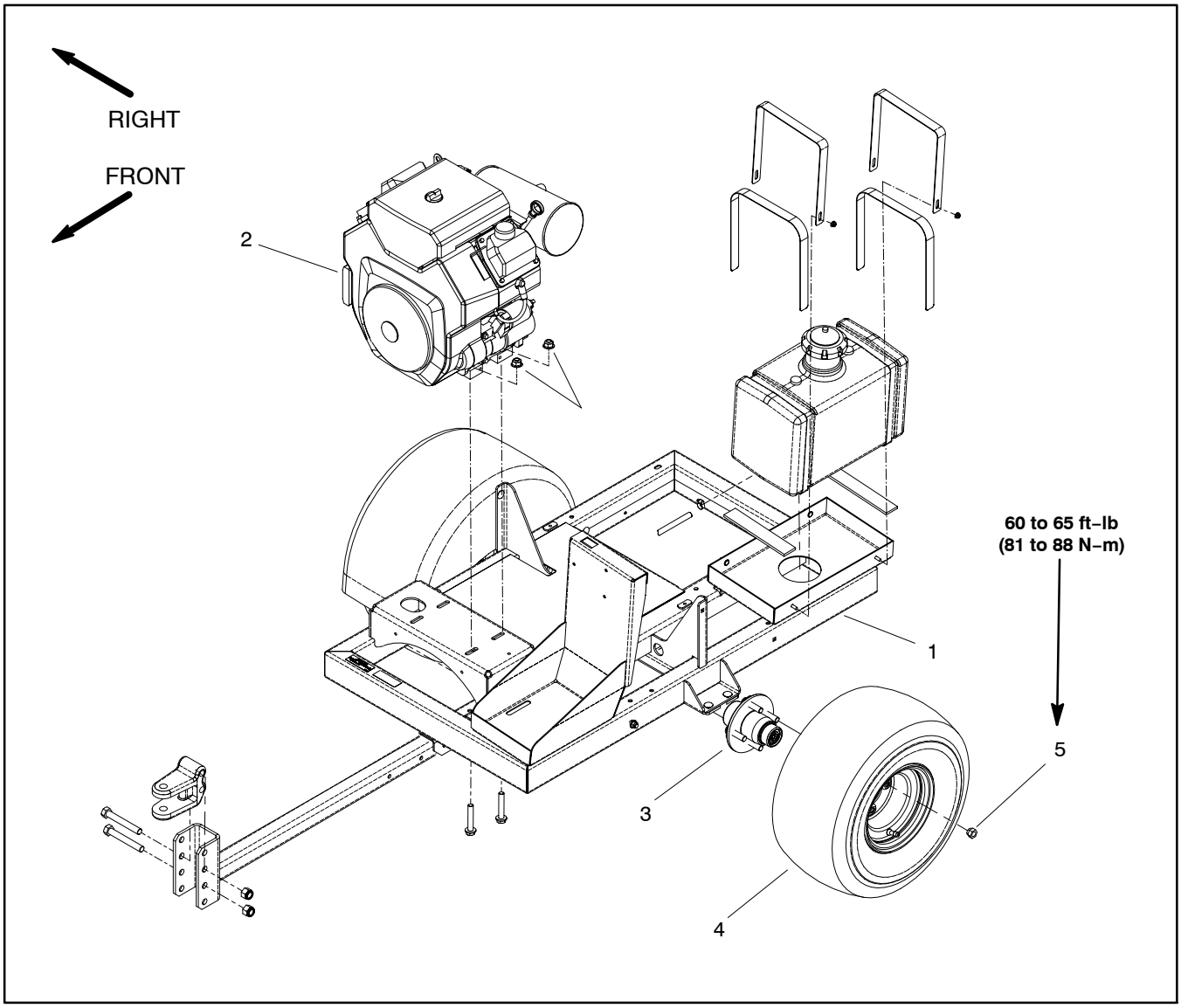

Figure 2

1. **Main frame**
2. **Engine**
3. **Wheel hub assembly**
4. **Wheel and tire assembly**
5. **Lug nut (4 used per wheel)**

Wheel Removal (Fig. 2)

1. Have ProForce Debris Blower attached to tow vehicle and park machines on a level surface. Engage vehicle parking brake, stop engine and remove key from the ignition switch. Make sure that blower engine is off. Chock wheels to prevent movement of either machine.

2. To prevent unexpected blower operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Loosen but do not remove four (4) lug nuts that secure wheel to be removed.

4. Jack or hoist ProForce blower from ground and support raised machine with jack stands (see Operator's Manual and Jacking Instructions in Chapter 1 – Safety).

5. Remove lug nuts and pull wheel from machine wheel hub.

Wheel Installation (Fig. 2)

1. Position wheel to wheel hub on raised machine.

2. Secure wheel to ProForce blower with four (4) lug nuts.

WARNING

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

3. Lower machine to ground. Alternately torque lug nuts from **60 to 65 ft–lb (81 to 88 N–m)**.

4. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

Wheel Hubs and Bearings

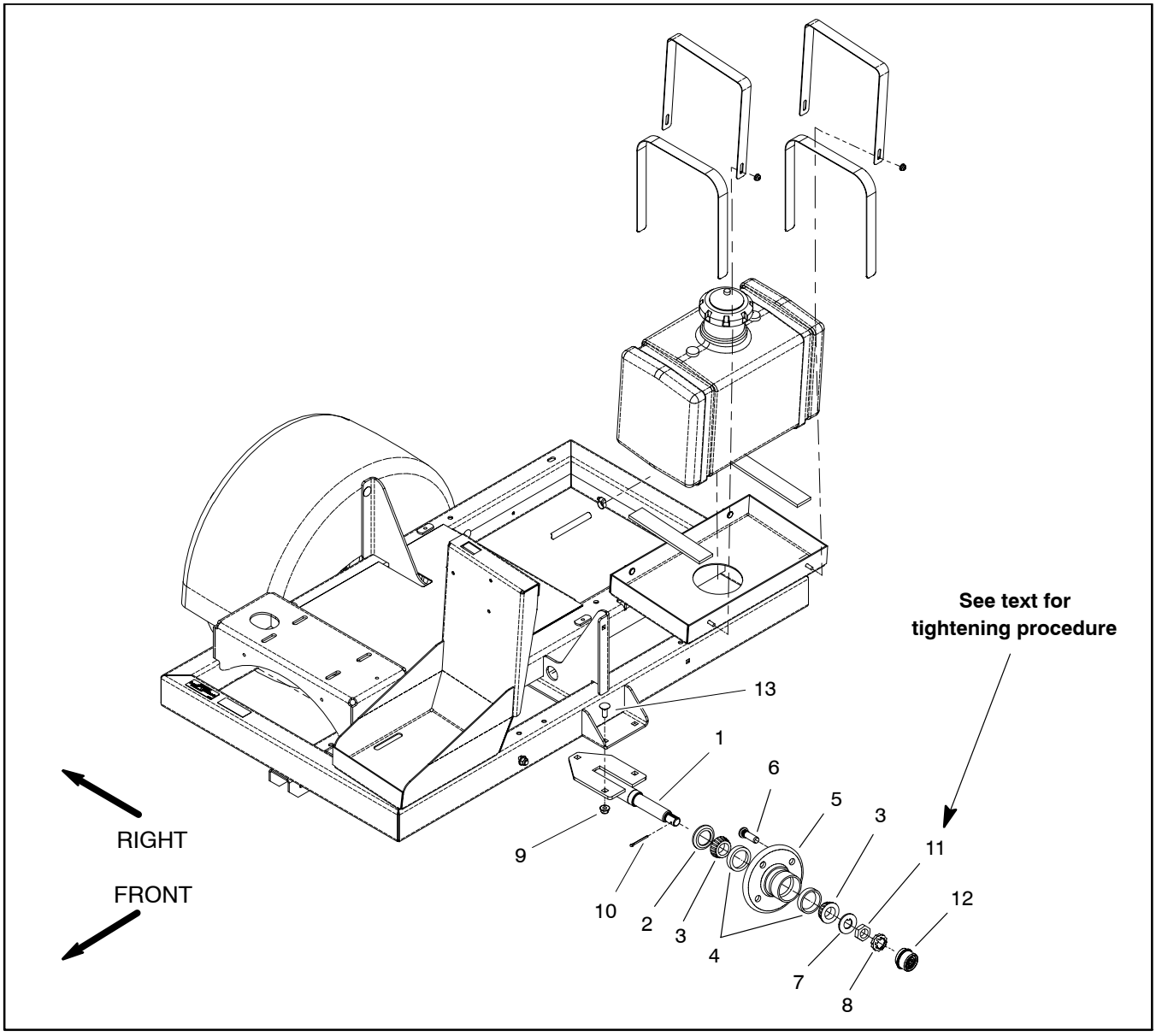

Figure 3

1. Axle (2 used)
2. Grease seal
3. Bearing cone (2 used per axle)
4. Bearing cup (2 used per axle)
5. Wheel hub
6. Lug screw (4 used per hub)
7. Tab washer
8. Nut retainer
9. Flange nut (3 used per axle)
10. Cotter pin
11. Jam nut
12. Dust cap
13. Carriage screw (3 used per axle)

Removal (Fig. 3)

1. Have ProCore Processor attached to tow vehicle and park machines on a level surface. Engage vehicle parking brake, stop engine and remove key from the ignition switch. Make sure that Processor engine is off. Chock wheels to prevent movement of either machine.

2. To prevent unexpected blower operation, disconnect the negative battery cable from the battery terminal. Position disconnected negative cable away from the negative battery terminal.

3. Jack or hoist blower from ground and support with jack stands (see Operator's Manual and Jacking Instructions in Chapter 1 – Safety).

4. Remove wheel assembly (see Wheel Removal in this section).

5. Carefully pry dust cap from wheel hub.

6. Straighten cotter pin and remove from axle spindle.

7. Remove nut retainer, jam nut and tab washer that secure wheel hub to spindle. Slide wheel hub with bearings from spindle.

8. Disassemble wheel hub:

   A. Remove grease seal from the wheel hub taking care to not damage the hub bore. Discard seal.

   B. Remove bearing cones from both sides of wheel hub. Clean bearings in solvent. Clean inside of hub.

   C. If necessary, remove bearing cups from hub.

   D. Inspect wheel bearings. Check the bearing cones and bearing cups for wear, pitting or other damage. Replace worn or damaged parts.

9. Inspect axle for wear or damage. Replace axle if necessary.

Installation (Fig. 3)

1. Thoroughly clean all wheel hub components before assembly.

2. Assemble wheel hub:

   A. If bearing cups were removed from the wheel hub, press inner and outer cups into the hub until they seat against the hub shoulder.

   B. Fill hub approximately 50% full of grease.

   C. Pack both bearing cones with grease. Install greased inner bearing cone into the cup on inboard side of the wheel hub.

   IMPORTANT: The grease seal must be pressed in so it is flush with the end of the hub. The lip of the seal must face the inner bearing.

   D. Lubricate the inside of new grease seal and press it into the wheel hub.

3. Install the wheel hub onto the axle spindle taking care to not damage grease seal in hub.

4. Install greased outer bearing cone, tab washer and jam nut onto spindle shaft.

5. While rotating the wheel hub by hand, torque the jam nut from **75 to 180 in-lb (8.5 to 20.3 N–m)** to seat bearings. Loosen nut until it is away from tab washer and hub has end play. Finally, while rotating hub, tighten jam nut from **15 to 20 in–lbs (1.7 to 2.3 N–m)**.

6. Install nut retainer and cotter pin to secure jam nut. Install dust cap to hub.

WARNING

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

7. Install wheel assembly (see Wheel Installation in this section).

8. Carefully lower machine to ground. Make sure to properly torque wheel lug nuts from **60 to 65 ft–lb (81 to 88 N–m)**.

9. Connect negative battery cable to negative battery terminal. Tighten nut that secures battery cable from **10 to 15 ft–lb (14 to 20 N–m)**. Make sure that battery cover is secured.

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Chapter 7

Electrical Diagrams

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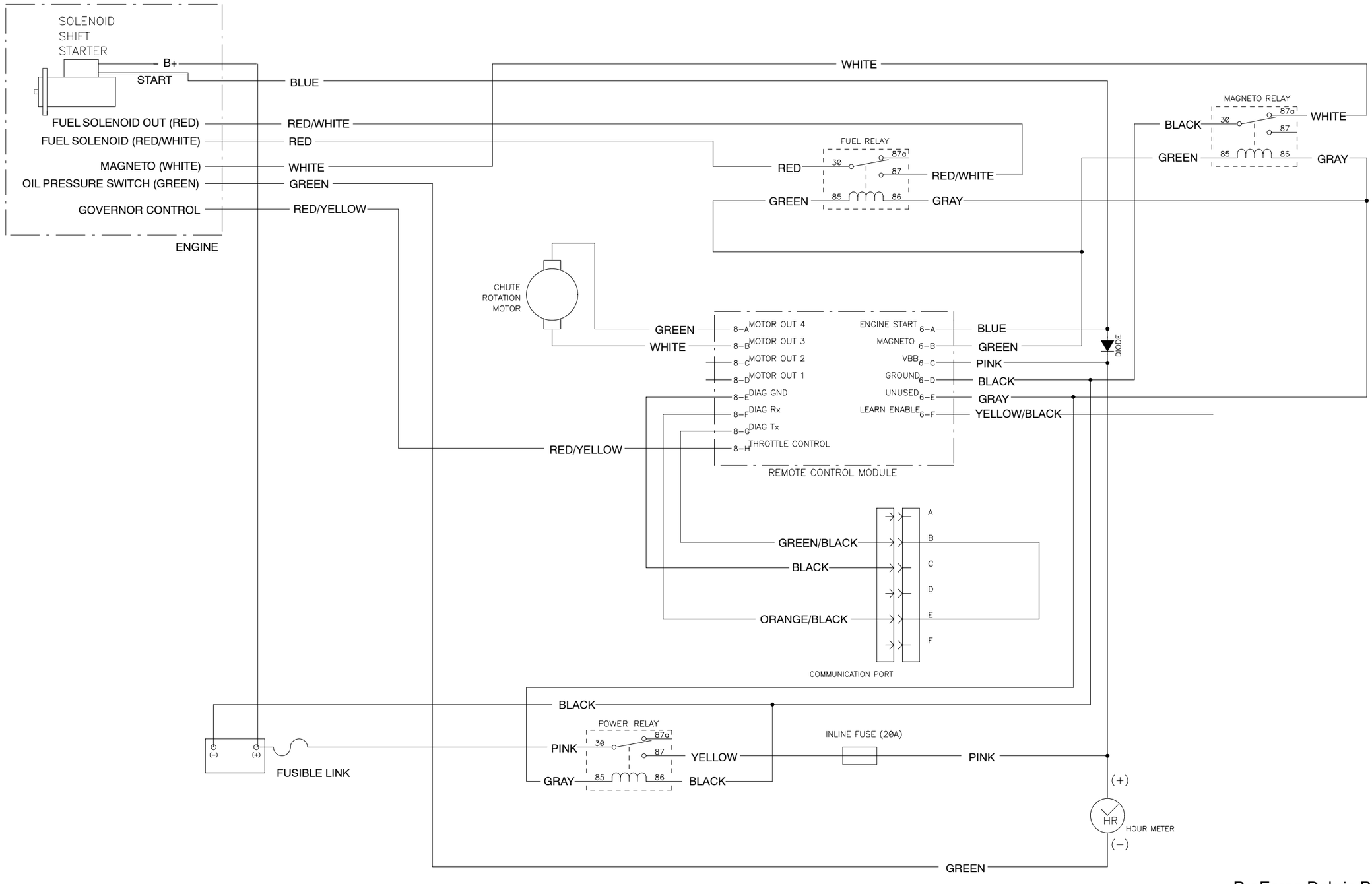
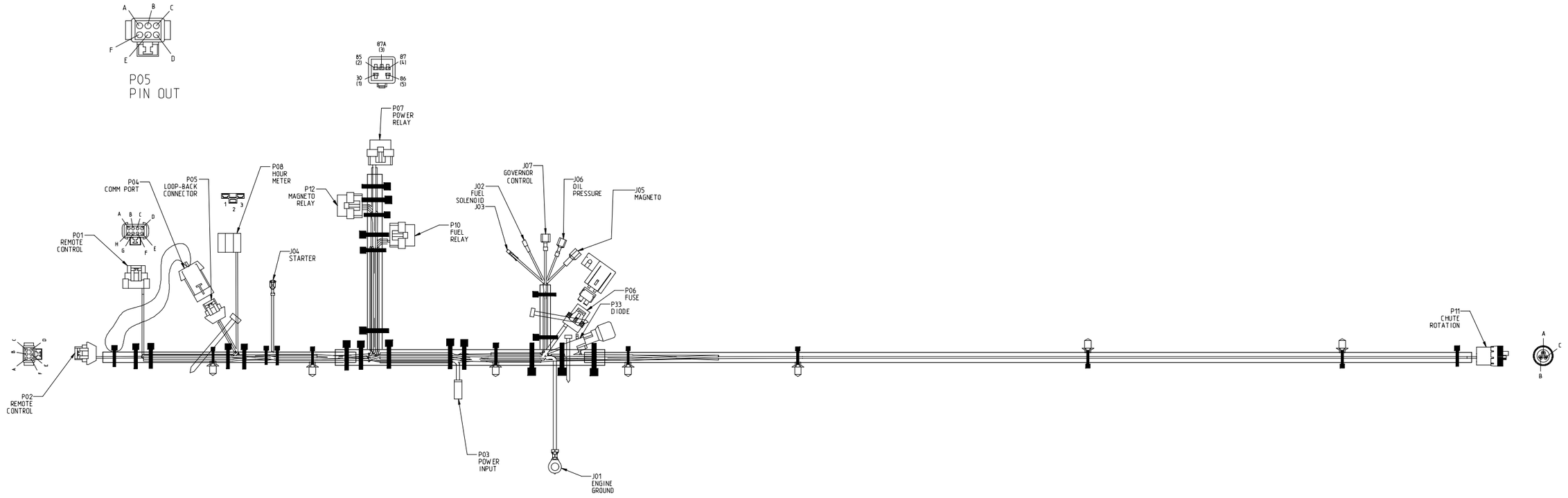


ProForce Debris Blower
Electrical Schematic

All ground wires are black.



ProForce Debris Blower
Wire Harness Drawing