Form No. 13200SL Rev C

TORO®

Count on it.

Service Manual

Workman® MDX-D

Original Instructions (EN)

Revision History

Revision	Date	Description
--	2013	Initial Issue.
A	02/2018	Updated Electrical, Chassis and Electrical Drawings chapters. Added revision history.
B	03/2019	Updated Chassis chapter.
C	04/2020	Updated Electrical, Chassis and Electrical Drawings chapters.

Reader Comments

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or Mail to:

Technical Publication Manager, Commercial
The Toro Company
8111 Lyndale Avenue South
Bloomington, MN 55420-1196
Phone: +1 952-887-8495

NOTES

Part No. 13200SL (Rev. C)

Service Manual

Workman® MDX-D

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 Workman MDX-D.

REFER TO THE OPERATOR'S MANUAL FOR OPERATING, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS. For reference, insert a copy of the Operator's Manual and Parts Catalog for your machine into Chapter 2 of this service manual. Additional copies of the Operator's Manual and Parts Catalog are available on the internet at www.Toro.com.

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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Safety Instructions

Workman MDX-D vehicles are 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.

Read and understand the contents of the Operator's Manual before starting and operating the machine. Become familiar with all controls and know how to stop it quickly. Additional copies of the Operator's Manual are available on the internet at www.Toro.com.

The safety alert symbol means CAUTION, WARNING or DANGER — "personal safety instruction". Read and understand the instruction because it has to do with safety. Failure to comply with the instruction may result in personal injury.

WARNING

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

WARNING

The Workman is an off-highway vehicle only. It is not designed, equipped or manufactured for use on public streets, roads or highways.

Supervisor's Responsibilities

1. Make sure operators are thoroughly trained and familiar with the Operator's Manual and all labels on the vehicle.

2. Be sure to establish your own special procedures and work rules for unusual operating conditions (e.g. slopes too steep for vehicle operation).

Before Operating

1. Read and understand the contents of the Operator's Manual and Operator's DVD before starting and operating the vehicle. Become familiar with the controls and know how to stop the vehicle and engine quickly. Additional copies of the Operator's Manual are available on the internet at www.Toro.com.

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 vehicle. Also, tighten any loose nuts, bolts or screws to ensure vehicle is in safe operating condition.

3. Since diesel fuel used in your Workman MDX-D vehicle is flammable, handle it carefully:

   A. Store fuel in containers specifically designed for this purpose.

   B. Do not remove vehicle fuel tank cap while engine is hot or running.

   C. Do not smoke while handling fuel.

   D. Fill fuel tank outdoors and only to within an inch of the top of the tank, not the filler neck. Do not overfill the fuel tank.

   E. Clean up any spilled fuel.

While Operating

1. Sit on the operator seat when starting and operating the vehicle.

2. Before starting the engine:

   A. Sit on operator's seat and depress the brake pedal. Make sure that the parking brake is released.

   B. Turn ignition switch to the ON position. When the glow plug indicator goes off, the engine is ready to start.

   C. Turn ignition switch to the START position. Release switch to the ON position once the engine starts.

3. Do not run engine in a confined area without adequate ventilation. Exhaust fumes are hazardous and could possibly be deadly.

4. Do not touch engine, radiator, exhaust system or transaxle while engine is running or soon after it is stopped. These areas could be hot enough to cause burns.

5. Before getting off the seat:

   A. Stop movement of the vehicle.

   B. Turn ignition switch to OFF and wait for all movement to stop.

   C. Apply parking brake.

   D. Remove key from ignition switch.

   E. Do not park on slopes unless wheels are chocked or blocked.

Maintenance and Service

1. Before servicing or making adjustments, turn all accessories off, stop the engine, set parking brake and remove key from the ignition switch.

2. Make sure vehicle is in safe operating condition by keeping all nuts, bolts and screws tight.

3. Never work under a raised bed without placing the bed on the fully extended prop rod.

4. Never store the vehicle or fuel container inside where there is an open flame, such as near a water heater or furnace.

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

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

7. Do not overspeed the engine by changing governor setting. To assure safety and accuracy, check maximum engine speed. Maximum engine speed is 3470 RPM.

8. Shut engine off before checking or adding oil to the engine crankcase.

9. Disconnect battery before servicing the vehicle. Disconnect negative (-) battery cable first and positive (+) cable last. If battery voltage is required for troubleshooting or test procedures, temporarily connect the battery. Attach positive (+) cable first and negative (-) cable last.

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

13. To assure optimum performance and continued safety of the vehicle, use genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers may result in nonconformance with safety standards, and the warranty may be voided.

14. When raising the vehicle to change tires or to perform other service, use correct blocks, hoists and jacks. Make sure vehicle is parked on a solid level surface such as a concrete floor. Prior to raising the vehicle, remove any attachments that may interfere with the safe and proper raising of the vehicle. Always chock or block wheels. Use appropriate jack stands to support the raised vehicle. If the vehicle is not properly supported by jack stands, the vehicle may move or fall, which may result in personal injury (see Jack Vehicle in this section).

15. Make sure to dispose of potentially harmful waste (e.g. fuel, oil, engine coolant, filters, battery) in an environmentally safe manner. Follow all local codes and regulations when recycling or disposing of waste.

Jacking and Other Instructions

Jack Vehicle

DANGER

POTENTIAL HAZARD
- **A vehicle that is not properly supported may become unstable.**

WHAT CAN HAPPEN
- **The vehicle may move or fall. Personal injury or damage to the machine may result.**

HOW TO AVOID THE HAZARD
- **Make sure vehicle is parked on a solid level surface, such as a concrete floor.**
- **Make sure engine is off and key is removed from the ignition switch before getting off the vehicle.**
- **Before raising the vehicle, remove any attachments that may interfere with the safe and proper raising of the vehicle.**
- **Always chock or block wheels to prevent the vehicle from rolling.**
- **Do not start vehicle while it is on jack stands without placing transaxle in neutral.**
- **Make sure proper hoists, jacks and jack stands are used to raise and support the vehicle.**

Jacking Locations

1. Jack front of the vehicle on the front of the frame and behind the towing tongue (Fig. 1).

2. Jack rear of the vehicle under each rear axle tube. Do not jack vehicle below the transaxle case (Fig. 2).

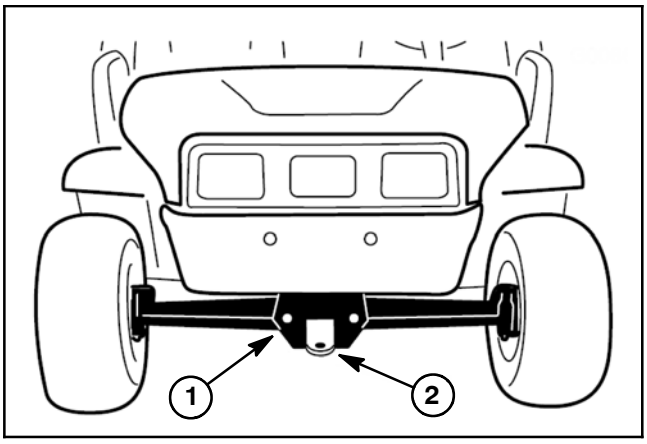

Figure 1

1. Front frame **2. Towing tongue**

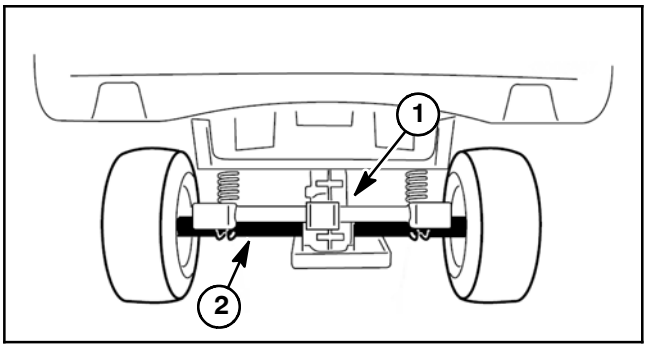

Figure 2

1. Transaxle case **2. Axle tube**

Transport Vehicle

When moving the vehicle long distances, use a trailer or flatbed truck. Make sure vehicle is secured to the trailer properly. Refer to Operator's Manual for transport information.

Tow Vehicle

IMPORTANT: Frequent or long distance towing of the Workman MDX-D is not recommended.

In case of emergency, the vehicle can be towed for a **short** distance. Refer to Operator's Manual for towing information.

IMPORTANT: If vehicle is towed, make sure that ignition switch is in the OFF position and key is removed from switch.

Transaxle Neutral Position

When performing routine maintenance and/or engine testing, the transaxle must be shifted into the neutral position.

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

2. Move shift lever to the neutral position (Fig. 3).

3. Make sure transaxle is in the neutral position by rotating the driven clutch. The tires should not rotate when the transaxle is in the neutral position. If tire rotation does occur, see Adjust Shift Cables in the Adjustments section of Chapter 4 – Drive Train.

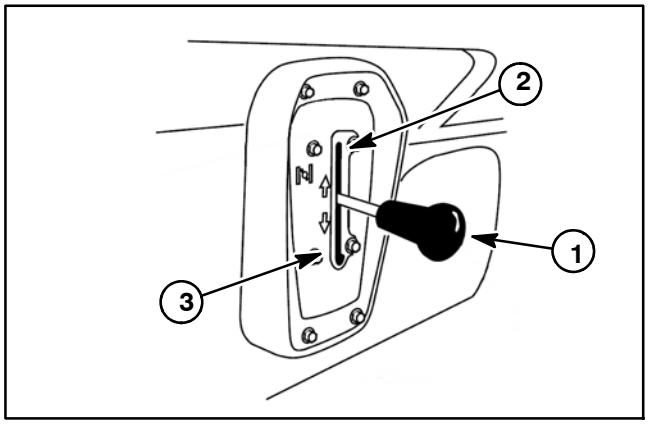

Figure 3

1. **Shift lever (in neutral)**
2. **Forward position**
3. **Reverse position**

Safety and Instruction Decals

Numerous safety and instruction decals are affixed to your Workman. If any decal becomes illegible or damaged, install a new decal. Part numbers are listed in the 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 Workman at the end of this chapter. Additionally, if any optional equipment or accessories have been installed to your machine, 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 your Workman 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

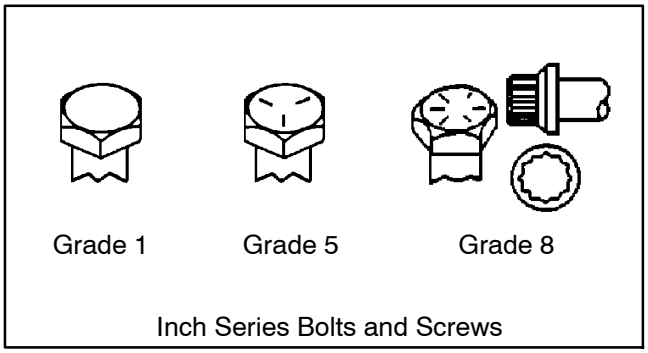

Figure 1

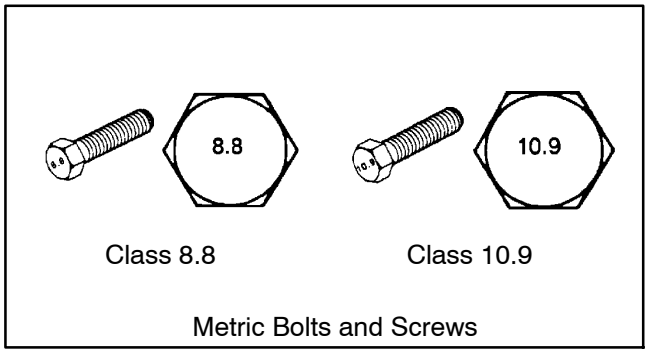

Figure 2

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	169 ± 23	23 ± 3	262 ± 34
# 6 - 40 UNF				17 ± 2	192 ± 23	25 ± 3	282 ± 34
# 8 - 32 UNC	13 ± 2	25 ± 5	282 ± 30	29 ± 3	328 ± 34	41 ± 5	463 ± 56
# 8 - 36 UNF				31 ± 4	350 ± 45	43 ± 5	486 ± 56
# 10 - 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 5	475 ± 56	60 ± 6	678 ± 68
# 10 - 32 UNF				48 ± 5	542 ± 56	68 ± 7	768 ± 79
1/4 - 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1130 ± 113	140 ± 15	1582 ± 169
1/4 - 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 12	1299 ± 136	160 ± 17	1808 ± 192
5/16 - 18 UNC	115 ± 15	105 ± 15	1186 ± 169	200 ± 25	2260 ± 282	300 ± 30	3390 ± 339
5/16 - 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2542 ± 282	325 ± 33	3672 ± 373
	ft-lb	**ft-lb**	**N-m**	**ft-lb**	**N-m**	**ft-lb**	**N-m**
3/8 - 16 UNC	16 ± 2	16 ± 2	22 ± 3	30 ± 3	41 ± 4	43 ± 5	58 ± 7
3/8 - 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 4	47 ± 5	50 ± 6	68 ± 8
7/16 - 14 UNC	27 ± 3	27 ± 3	37 ± 4	50 ± 5	68 ± 7	70 ± 7	95 ± 9
7/16 - 20 UNF	29 ± 3	29 ± 3	39 ± 4	55 ± 6	75 ± 8	77 ± 8	104 ± 11
1/2 - 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 11	142 ± 15
1/2 - 20 UNF	32 ± 4	53 ± 7	72 ± 9	85 ± 9	115 ± 12	120 ± 12	163 ± 16
5/8 - 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 21	285 ± 28
5/8 - 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 18	230 ± 24	240 ± 24	325 ± 33
3/4 - 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 27	359 ± 37	375 ± 38	508 ± 52
3/4 - 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 30	407 ± 41	420 ± 43	569 ± 58
7/8 - 9 UNC	140 ± 20	225 ± 25	305 ± 34	430 ± 45	583 ± 61	600 ± 60	813 ± 81
7/8 - 14 UNF	155 ± 25	260 ± 30	353 ± 41	475 ± 48	644 ± 65	667 ± 66	904 ± 89

NOTE: Reduce torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant such as engine oil 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 Series)

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

NOTE: Reduce torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant such as engine oil or 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 and finish must be considered when determining specific torque values. All torque values are based on non-lubricated fasteners.

Conversion Factors

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

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

Chapter 3

Diesel Engine

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KUBOTA WORKSHOP MANUAL, DIESEL ENGINE, SM-E3B SERIES

Specifications

Item	Description
Make / Designation	Kubota water-cooled, Diesel, Model Z602-E3B
Number of Cylinders	2
Bore x Stroke	2.83” x 2.9” (72mm x 73.6mm)
Total Displacement	36.55 in^3 (599 cc)
Compression Ratio	24.0:1
Firing Order	1 (closest to gear case end) - 2 (closest to flywheel end)
Direction of Rotation	Counterclockwise (viewed from flywheel)
Fuel	Diesel Fuel with Low or Ultra Low Sulfur Content
Fuel Injector Pump	Bosch MD Type Mini
Fuel Injection Nozzle	Bosch Throttle Type
Fuel Capacity	6.5 U.S. gallons (24.6 liters)
Governor	Mechanical
Low Idle (no load)	1300 $\pm$ 70 RPM
High Idle (no load)	3470 $\pm$ 50 RPM
Engine Oil	API CH-4, CI-4, CJ-4 or higher
Engine Oil Viscosity	See Operator’s Manual
Oil Pump	Gear Driven Trochoid Type
Crankcase Oil Capacity	2.6 U.S. quarts (2.5 liters) with filter
Cooling System Capacity (including reserve tank)	3.0 U.S. quarts (2.8 liters)
Starter	12 VDC 0.95 KW
Alternator/Regulator	12 VDC 40 AMP
Dry Weight (approximate)	132 lbs (60 kg)

General Information

This Chapter gives information about specifications, maintenance, troubleshooting, testing and repair of the diesel engine used in the Workman MDX–D.

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the Kubota Workshop Manual, Diesel Engine, SM–E3B Series. 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 the Kubota engine in your Workman are supplied through your local Toro distributor. If no parts list is available, be sure 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 Workman MDX–D vehicle. Refer to the Operator's Manual for additional information when servicing the machine.

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Adjustments

Adjust Throttle Cable

Proper throttle operation is dependent upon proper adjustment of throttle control. Make sure throttle control is operating properly.

NOTE: The shoulder bolt that secures the throttle cable to the engine speed control lever should be positioned in the lowest hole in the lever.

1. Fully depress throttle pedal to position engine speed control lever in the high speed position.

2. Check position of the engine speed control lever on the fuel injection pump (Fig. 1). The speed control lever should contact the high speed screw when the throttle pedal is fully depressed.

3. If necessary, throttle control can be adjusted by loosening cable jam nuts and repositioning throttle cable until speed control lever contacts high speed screw when the throttle pedal is fully depressed (Fig. 2). Tighten cable jam nuts after adjustment has been completed.

4. Release throttle pedal and make sure that cable is loose enough to allow engine speed control lever to return to the idle position.

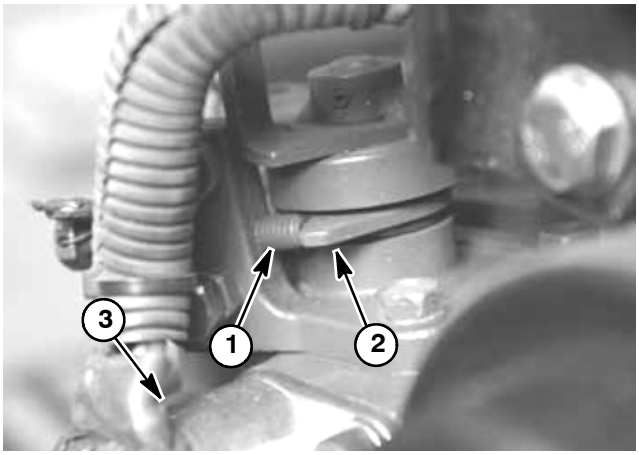

Figure 1

1. **High speed screw**
2. **Speed control lever**
3. **Engine run solenoid**

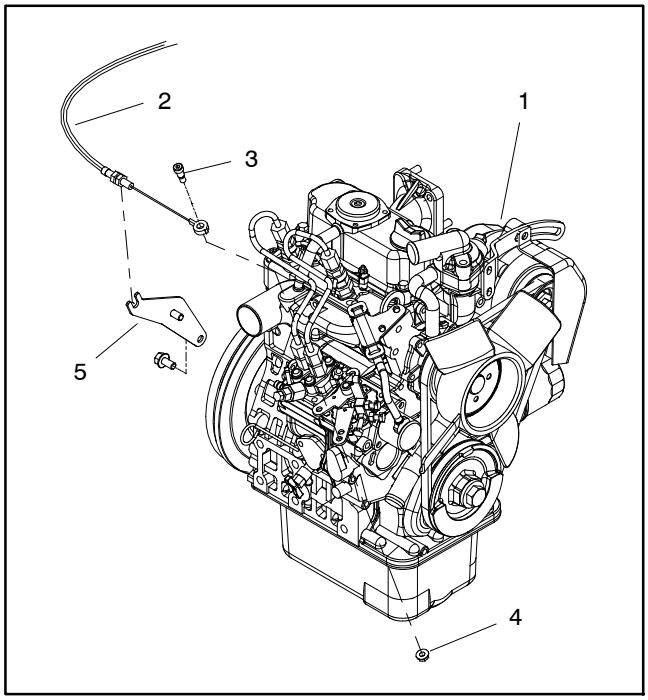

Figure 2

1. **Diesel engine**
2. **Throttle cable**
3. **Shoulder bolt**
4. **Flange nut**
5. **Throttle cable mount**

Air Cleaner

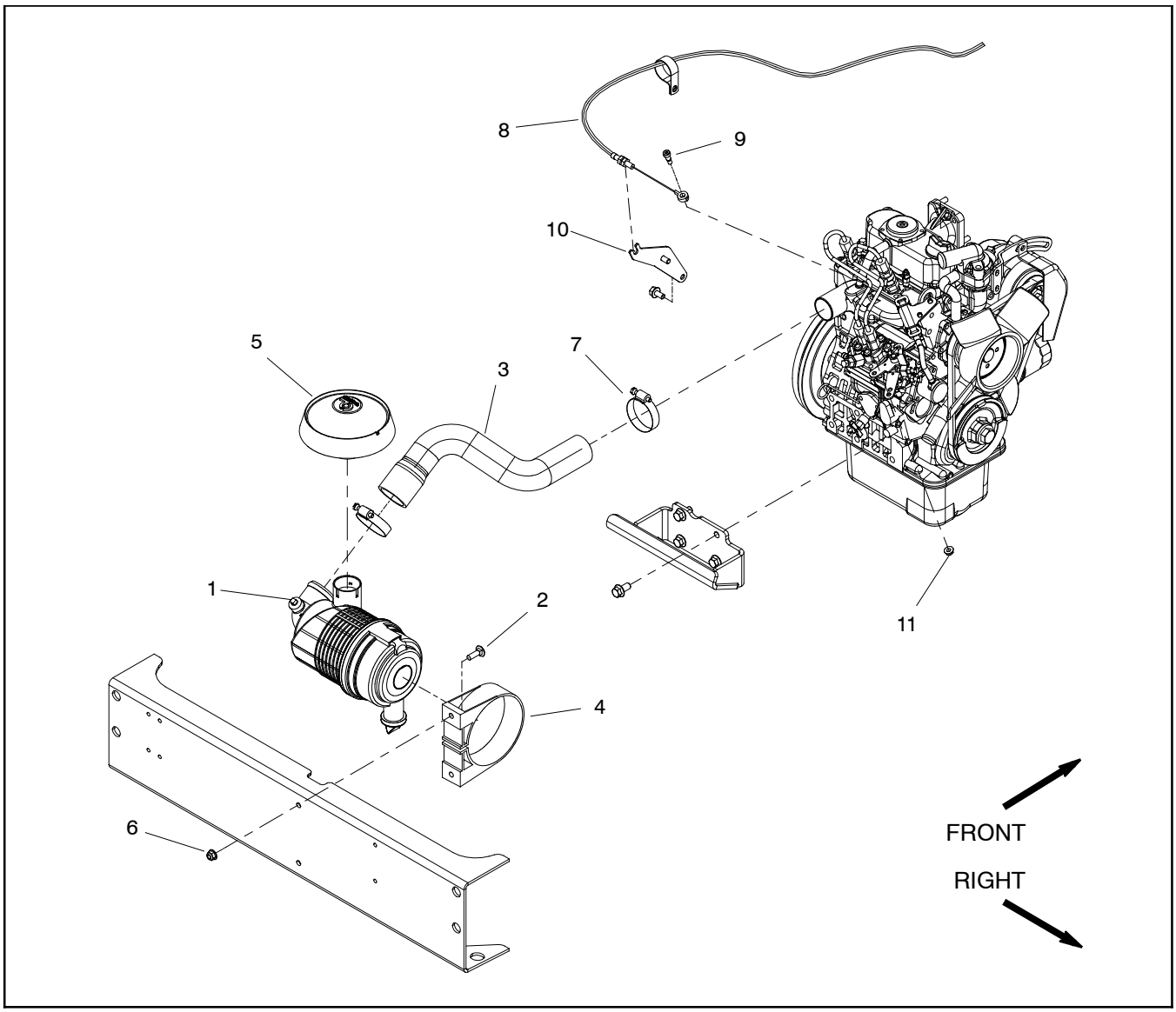

Figure 3

1. Air cleaner assembly
2. Carriage screw (2 used)
3. Air intake hose
4. Air cleaner mounting bracket
5. Air inlet hood
6. Flange nut (2 used)
7. Hose clamp (2 used)
8. Throttle cable
9. Shoulder bolt
10. Throttle cable mount
11. Flange nut

Air Cleaner Removal (Fig. 3)

1. Park machine on a level surface, stop the engine, engage parking brake and remove the key from the ignition switch.

2. Raise and support cargo bed to access air cleaner.

3. Remove air cleaner components as needed using Figure 3 as a guide.

4. Check air cleaner hose (item 3 in Fig. 3) for damage or wear. Replace hose if damage is found.

5. Disassemble air cleaner as necessary (Fig. 4).

6. Check air cleaner housing and cover for damage that could cause possible air leaks.

Air Cleaner Installation (Fig. 3)

IMPORTANT: Any leaks in the air cleaner system will allow dirt into engine and will cause serious engine damage. Make sure that all air cleaner components are in good condition and are properly secured during assembly.

1. Assemble air cleaner system using Figures 3 and 4 as guides.

   A. If plug (item 5 in Fig. 4) was removed from air cleaner housing, apply sealant to threads of plug before assembly. Torque plug to **30 in-lb (3.4 N-m)**.

   B. Make sure that vacuator valve on air cleaner assembly is pointed down after assembly.

   C. Make sure that clearance between air intake hose and air inlet hood is less than **0.180" (4.6 mm)** (Fig. 5). If this clearance is excessive, the intake hose may contact secondary clutch during suspension movement. Rotate intake hose to modify clearance as needed.

2. Lower and secure cargo bed.

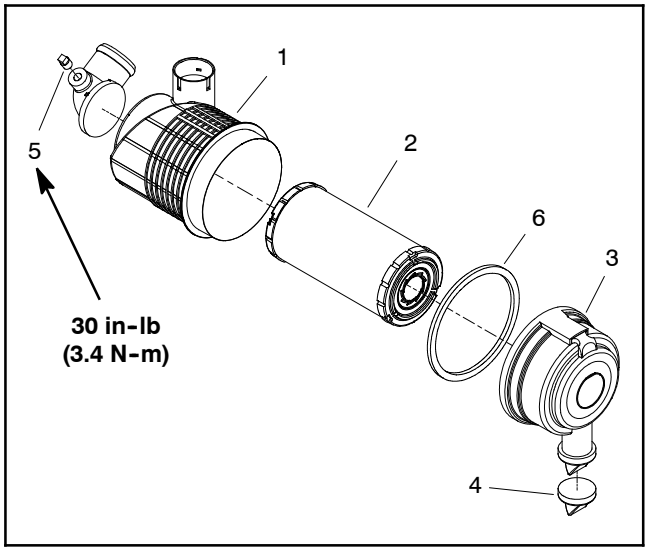

Figure 4

1. **Housing**
2. **Filter element**
3. **Cover**
4. **Vacuator valve**
5. **Plug**
6. **Gasket**

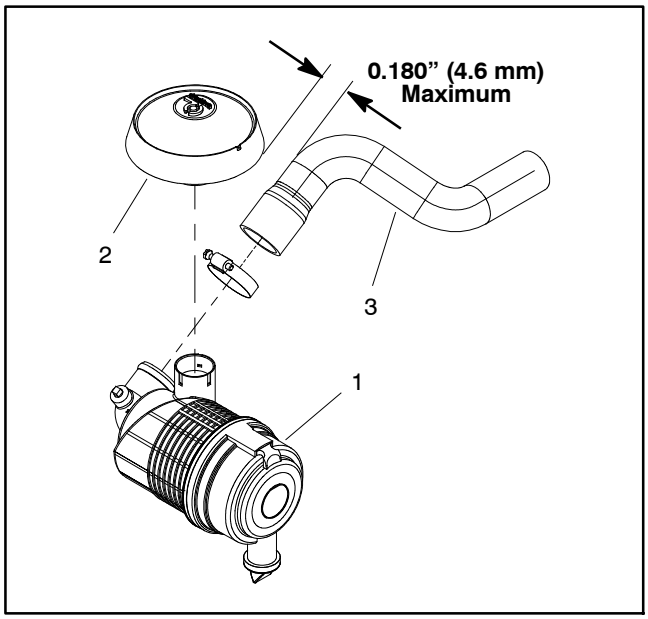

Figure 5

1. **Air cleaner assembly**
2. **Air inlet hood**
3. **Air intake hose**

Exhaust System

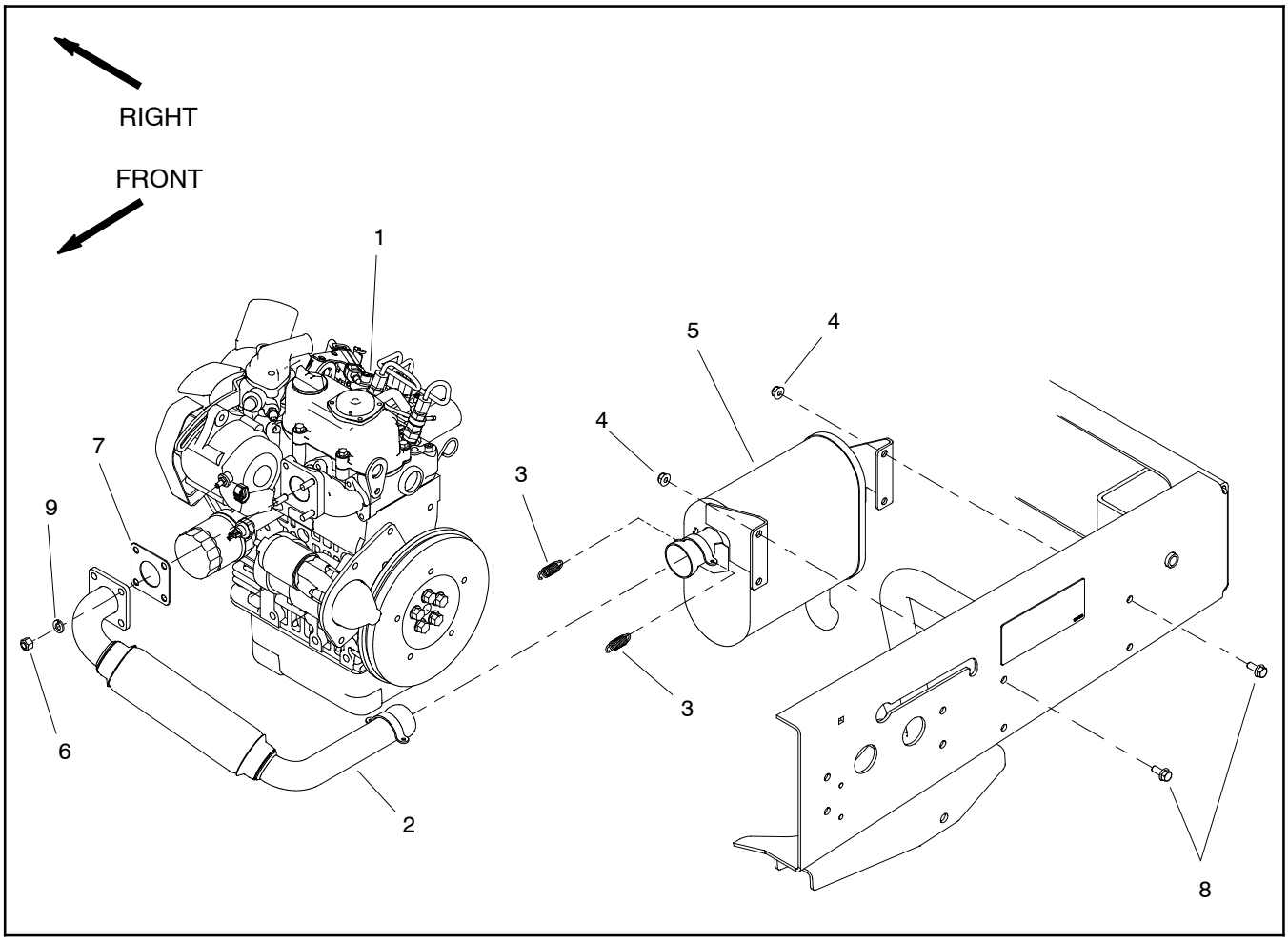

Figure 6

1. **Engine**
2. **Exhaust header**
3. **Coupler spring (2 used)**
4. **Flange nut (4 used)**
5. **Muffler**
6. **Hex nut (4 used)**
7. **Exhaust gasket**
8. **Flange head screw (4 used)**
9. **Lock washer (4 used)**

Exhaust System Removal (Fig. 6)

1. Park machine on a level surface, stop the engine, engage parking brake and remove the key from the ignition switch.

2. Raise and support cargo bed to access exhaust system.

CAUTION

The muffler and exhaust pipe may be hot. To avoid possible burns, allow the engine and exhaust system to cool before working on the muffler.

3. Remove exhaust system components as needed using Figure 6 as a guide.

Exhaust System Installation (Fig. 6)

1. Make sure the engine is off.

IMPORTANT: If exhaust studs were removed from engine cylinder head, thoroughly clean threads in head and apply Loctite #277 (or equivalent) to stud threads before installing studs into head.

NOTE: Make sure exhaust header flange and engine exhaust manifold sealing surfaces are free of debris or damage that may prevent a tight seal.

2. If exhaust gasket (item 7) was removed, place new exhaust gasket on the engine exhaust manifold.

NOTE: To ensure proper exhaust system sealing, mount all exhaust system components loosely before fully tightening any fastener.

3. Assemble all removed exhaust system components using Figure 6 as a guide.

4. After all exhaust components have been assembled, make sure that all fasteners are properly tightened. Also, make sure that all electrical wires and control cables are not contacted by exhaust components.

5. Lower and secure cargo bed.

Fuel Tank

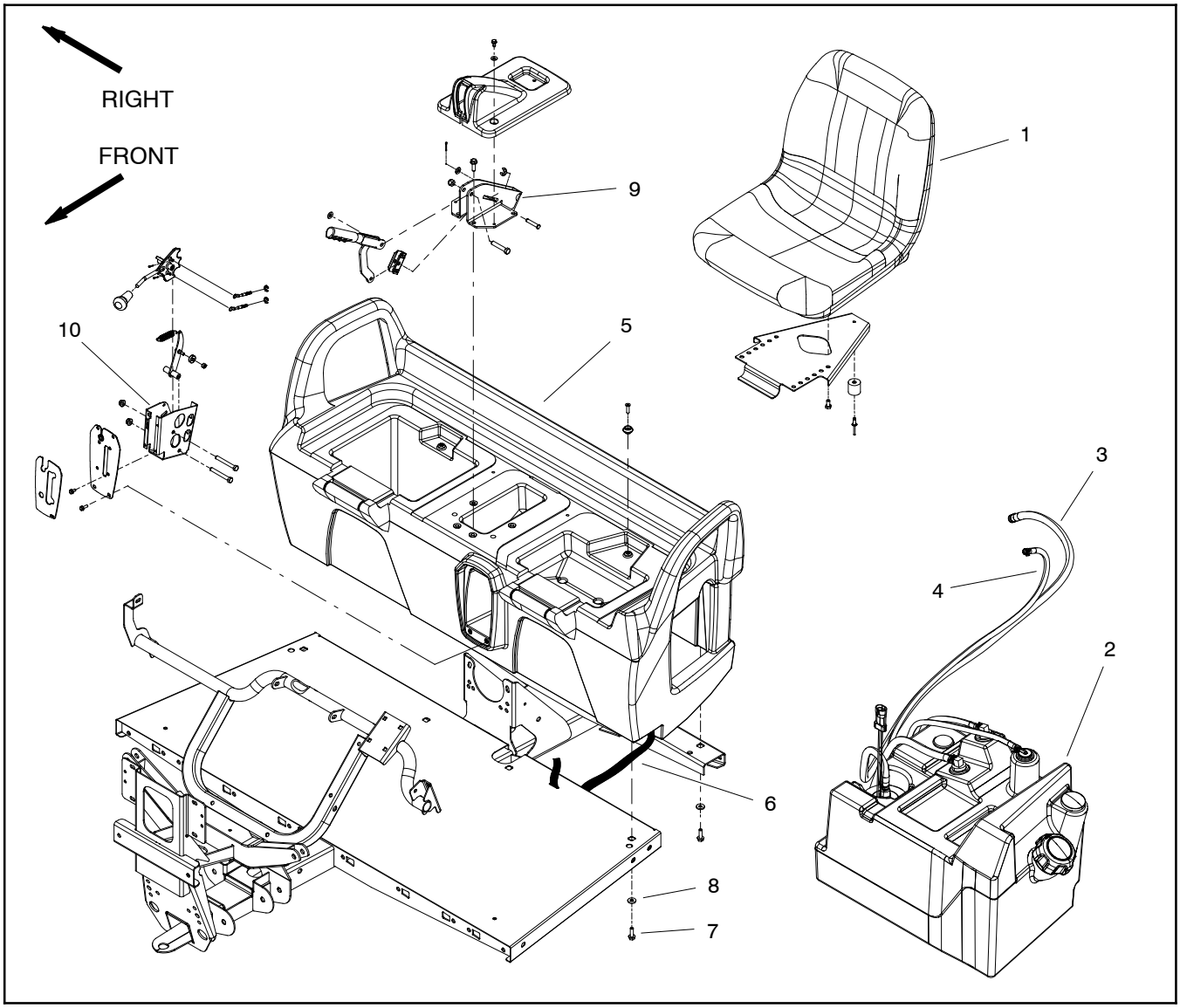

Figure 7

1. **Seat**
2. **Fuel tank**
3. **Fuel hose (to fuel separator)**
4. **Fuel hose (return from engine)**
5. **Seat base**
6. **Web strapping**
7. **Hex head flange screw (8 used)**
8. **Flat washer (8 used)**
9. **Parking brake support**
10. **Shift bracket**

Fuel Tank Removal (Fig. 7)

CAUTION

Read safety precautions for handling fuel before working on the fuel system (see Safety Instructions in Chapter 1 – Safety).

1. Remove seat base from the frame (see Seat Base in the Service and Repairs section of Chapter 6 – Chassis).

2. Use fuel transfer pump to remove fuel from fuel tank.

3. Loosen hose clamp and disconnect fuel return hose (item 13 in Figure 8) from elbow fitting in fuel tank.

4. Loosen hose clamp and disconnect fuel supply hose (item 17 in Figure 8) from the fuel pump.

5. Disconnect fuel pump electrical connector from vehicle wire harness.

6. Release tank strap that secures fuel tank to frame. Do not remove strap from floor plate and frame cross member. Lift fuel tank assembly from frame.

7. Remove fuel tank components as needed using Figure 8 as a guide.

8. Clean fuel tank before installing it back on vehicle.

Fuel Tank Installation (Fig. 7)

1. Install all removed fuel tank components using Figure 8 as a guide.

2. Position fuel tank to frame. Secure tank to frame and cross member with tank strap.

3. Connect fuel supply hose (item 17 in Figure 8) to the fuel pump and fuel return hose (item 13 in Figure 8) to the elbow fitting. Secure hoses with hose clamps.

4. Connect fuel pump electrical connector to vehicle wire harness.

5. Install seat base to the frame (see Seat Base in the Service and Repairs section of Chapter 6 – Chassis).

6. Fill fuel tank.

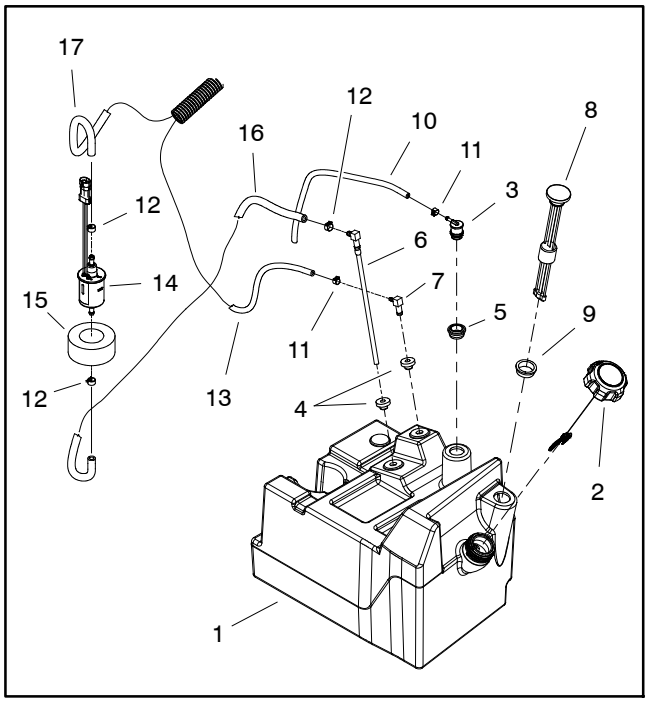

Figure 8

1. **Fuel tank**
2. **Fuel cap**
3. **Rollover valve**
4. **Bushing**
5. **Grommet**
6. **Stand pipe**
7. **Elbow fitting**
8. **Fuel gauge**
9. **Grommet**
10. **Vent hose**
11. **Hose clamp**
12. **Hose clamp**
13. **Fuel return hose**
14. **Fuel pump**
15. **Fuel pump holder**
16. **Fuel supply hose**
17. **Fuel supply hose**

Radiator

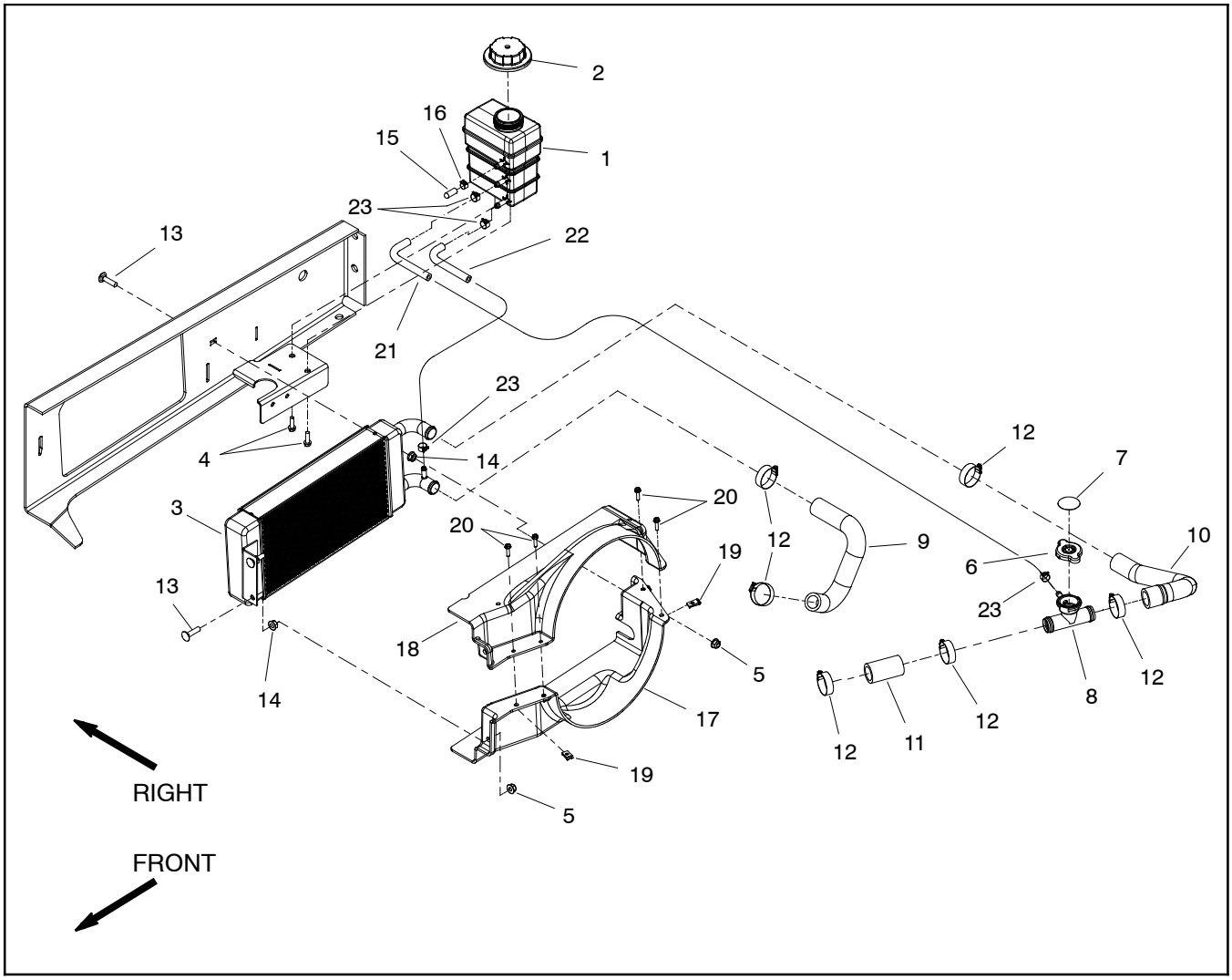

Figure 9

1. Surge tank
2. Tank cap
3. Radiator
4. Washer head screw (2 used)
5. Flange nut (3 used)
6. Cap
7. Cap decal
8. Filler neck
9. Lower radiator hose
10. Upper radiator hose
11. Straight hose
12. Hose clamp (6 used)
13. Carriage screw (3 used)
14. Flange nut (3 used)
15. Cap
16. Hose clamp
17. Lower radiator shroud
18. Upper radiator shroud
19. Speed nut (4 used)
20. Washer head screw (4 used)
21. Coolant hose
22. Coolant hose
23. Hose clamp (4 used)

CAUTION

DO NOT open radiator cap or drain coolant if the engine or radiator is hot. Pressurized hot coolant can escape and cause burns.

Ethylene-glycol antifreeze is poisonous. Dispose of it properly or store it in a properly labeled container away from children and pets.

Radiator Removal (Fig. 9)

1. Park machine on a level surface, stop the engine, engage parking brake and remove the key from the ignition switch.

2. Raise and support cargo bed to access radiator.

3. Remove knob that secures radiator screen to right side of rear frame (Fig. 10). Lift screen to separate tabs on screen from slots in frame and then remove screen from vehicle.

4. Remove caps (items 2 and 6) from surge tank and radiator filler neck to allow complete draining of cooling system.

5. Drain radiator into a suitable container by disconnecting lower radiator hose from the radiator.

6. Disconnect upper radiator hose from the radiator.

7. Disconnect the coolant hose (item 22) from the fitting located on the lower radiator tube.

8. Remove four (4) washer head screws (item 20) and three (3) flange nuts (item 14) that secure the radiator shrouds. Also, disconnect wire harness clips from upper radiator shroud. Carefully remove upper radiator shroud from vehicle.

9. Position lower radiator shroud away from the radiator.

10. Remove three (3) carriage head screws (item 13) and flange nuts (item 14) that secure the radiator to the rear frame.

11. Carefully remove radiator from vehicle.

Radiator Installation (Fig. 9)

1. Make sure that lower radiator shroud is positioned under the engine fan.

2. Carefully position radiator to the rear frame. Secure radiator to frame with three (3) carriage head screws (item 13) and flange nuts (item 14).

3. Position upper and lower radiator shrouds around the fan and to the radiator. Secure shrouds together with four (4) washer head screws (item 20). Then, secure shrouds to frame with three (3) flange nuts (item 14). Make sure that equal clearance exists between shrouds and fan at all points.

4. Connect upper and lower radiator hoses to radiator and secure with hose clamps.

5. Connect coolant hose (item 22) to the fitting located on the lower radiator tube and secure with hose clamp. Make sure that hose is not kinked at any point after installation.

6. Install radiator screen to rear frame and secure with knob (Fig. 10).

IMPORTANT: Use a 50/50 mix of ethylene-glycol and water when filling cooling system.

7. Fill cooling system with coolant as follows (Fig. 11):

   A. Make sure that surge tank cap is installed on surge tank.

   B. Remove cap on radiator filler neck and fill cooling system with coolant.

   C. Install cap into radiator filler neck and tighten.

   D. Remove surge tank cap and fill surge tank to the bottom of the filler neck. Install surge tank cap.

8. Check radiator, surge tank, hoses and all connections for leaks.

9. Lower and secure cargo bed.

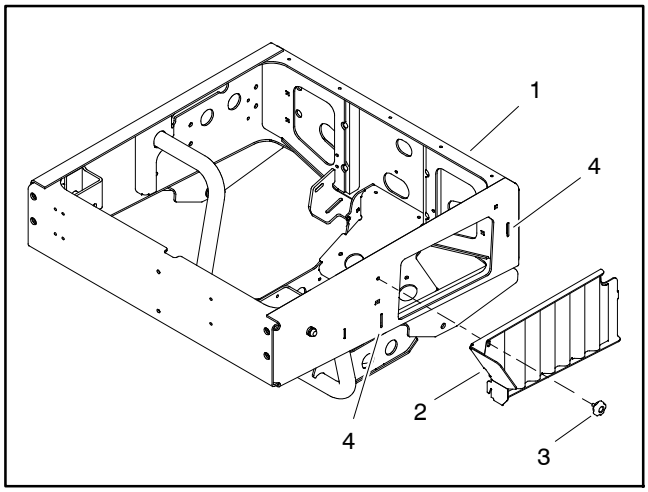

Figure 10

1. **Rear frame**
2. **Radiator screen**
3. **Knob**
4. **Slot**

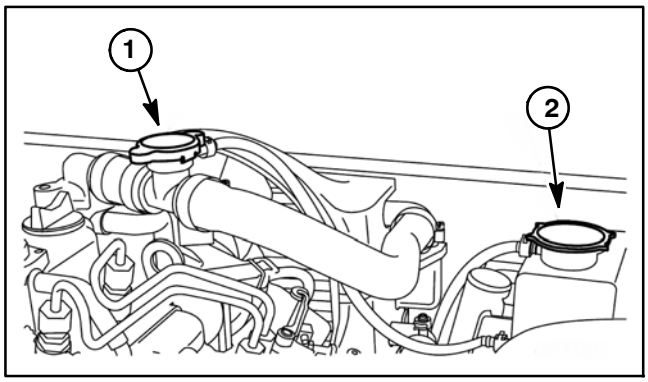

Figure 11

1. **Filler neck cap**
2. **Surge tank cap**

Engine

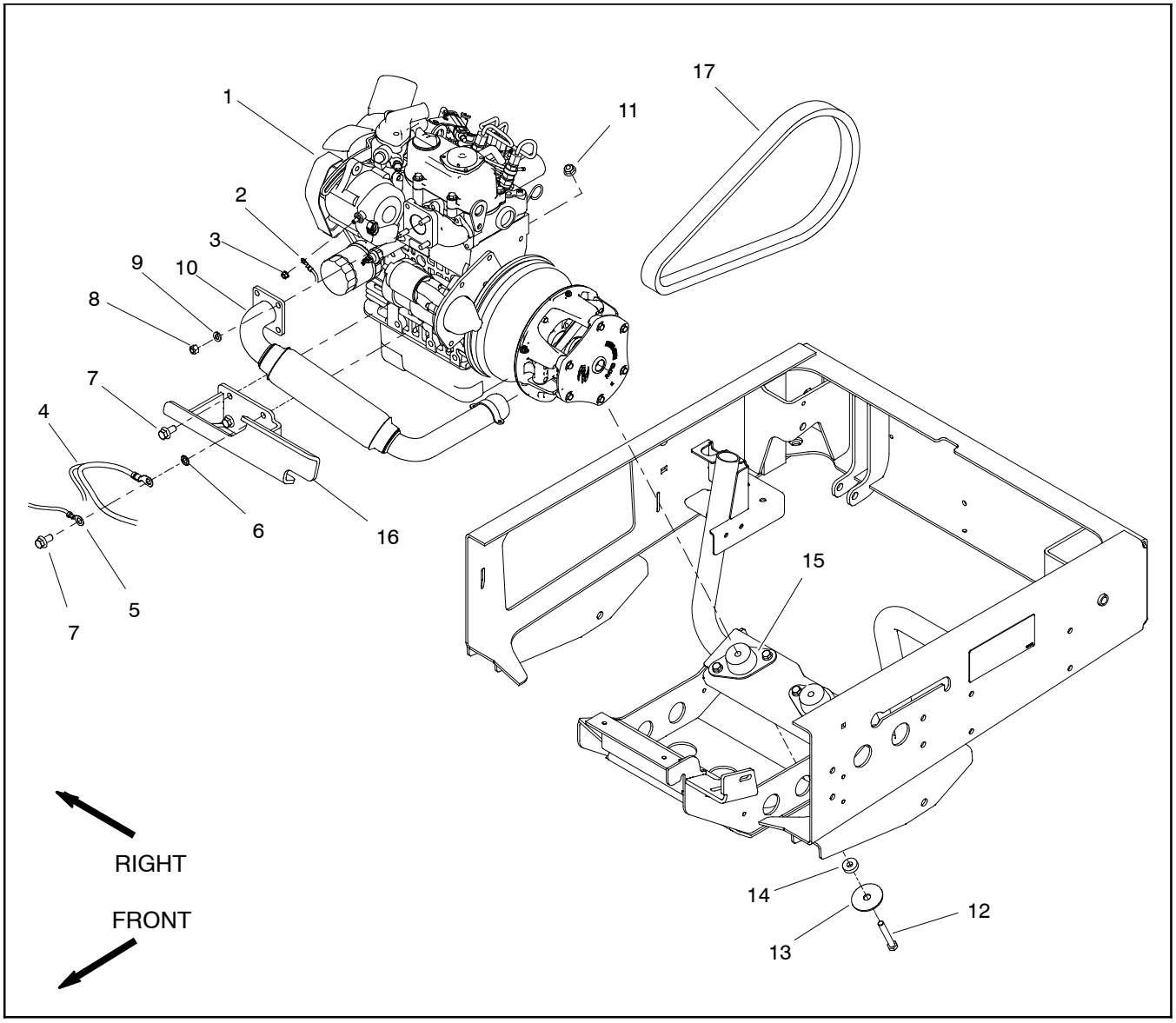

Figure 12

1. **Engine**
2. **Engine wire harness connector**
3. **Hex nut**
4. **Negative battery cable**
5. **Engine wire harness connector**
6. **Lock washer**
7. **Flange head screw (8 used)**
8. **Hex nut (4 used)**
9. **Lock washer (4 used)**
10. **Exhaust header**
11. **Flange nut (4 used)**
12. **Cap screw (4 used)**
13. **Snubbing washer (4 used)**
14. **Spacer (4 used)**
15. **Engine mount (4 used)**
16. **Engine bracket (front shown)**
17. **Drive belt**

Engine Removal (Fig. 12)

1. Park machine on a level surface, stop engine, engage parking brake and remove key from the ignition switch.

CAUTION

The engine, radiator and exhaust system may be hot. To avoid possible injury, allow machine to cool before working on the engine.

2. Disconnect negative (black) cable from the battery. Then, disconnect positive (red) cable from the battery.

3. Remove cargo box to gain access to the engine (see Cargo Box in the Service and Repairs section of Chapter 6 – Chassis).

4. Carefully remove drive belt from drive clutch.

5. Depending on needed engine repairs, it may be easier to drain oil from engine before engine removal.

IMPORTANT: To prevent contaminants from entering the engine and fuel system, make sure all hoses and engine openings are covered or plugged after disconnecting.

6. Drain radiator into a suitable container by disconnecting lower radiator hose from the radiator. Then, remove upper radiator hose from the radiator.

7. Remove air intake hose from the air cleaner and engine intake (see Air Cleaner in this section).

8. Remove muffler and exhaust header from the vehicle (see Exhaust System in this section).

9. Remove shoulder bolt and flange nut that secure the throttle cable end to injector pump speed control lever (Fig. 13). Loosen nuts that secure throttle cable to cable mount. Position throttle cable away from engine.

CAUTION

Read safety precautions for handling fuel before working on the fuel system (see Safety Instructions in Chapter 1 – Safety).

10. Disconnect fuel supply hose from the injector pump and fuel return hose from the #2 injector. Drain any fuel trapped in the hoses into a suitable container. Plug hoses and position them away from engine assembly.

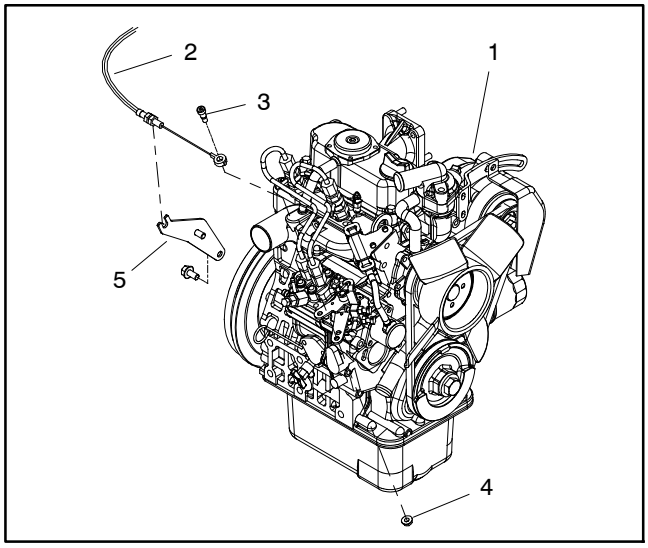

Figure 13

1. **Diesel engine**
2. **Throttle cable**
3. **Shoulder bolt**
4. **Flange nut**
5. **Throttle cable mount**

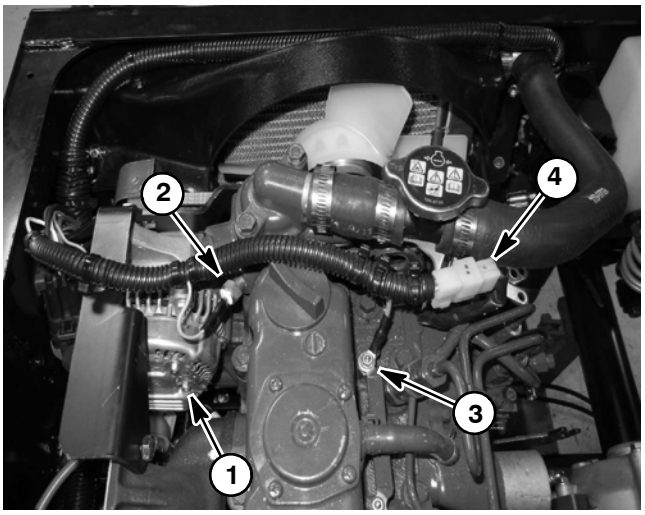

Figure 14

1. **Alternator**
2. **Temperature switch**
3. **Glow plug bus**
4. **Engine run solenoid**

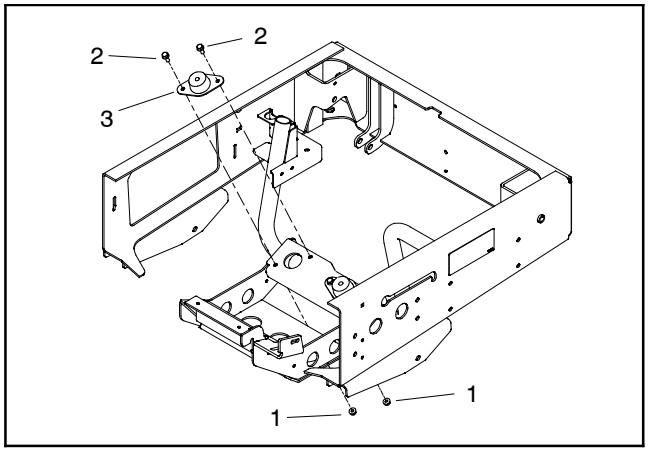

Figure 15

1. **Flange nut (8 used)**
2. **Flange screw (8 used)**
3. **Engine mount (4 used)**

11. Disconnect electrical connections from the following engine components:

A. Disconnect main wire harness connections to glow plug bus, temperature sender and engine run solenoid (Fig. 14).

B. Disconnect main wire harness connection to fusible link harness.

C. Disconnect engine wire harness connector from the main wire harness. The engine wire harness includes connectors for the alternator, oil pressure switch, starter solenoid and engine ground.

D. Remove flange head screw from front engine mount that secures negative battery cable and engine ground connector. Make sure to note location of lock washer when removing screw. Position negative battery cable away from engine.

12. Remove four (4) flange nuts, spacers, snubbing washers and cap screws that secure the engine to the engine mounts.

CAUTION

Make sure that hoist or lift used to remove engine can properly support engine. Engine assembly weighs approximately 170 pounds (77 kg). Also, one person should operate the hoist while a second person guides the engine out of the vehicle.

13. Remove engine from the vehicle.

A. Attach a short section of chain between both engine lift tabs.

B. Connect hoist to center of chain.

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

C. Carefully move the engine assembly away from the radiator and when the engine has cleared the radiator shrouds, carefully raise the engine from the vehicle.

14. Remove engine brackets, components and attachments as necessary to repair the engine.

15. Inspect engine mounts (Fig. 15) and bumper assembly (Fig. 16) for wear or damage and replace components if necessary.

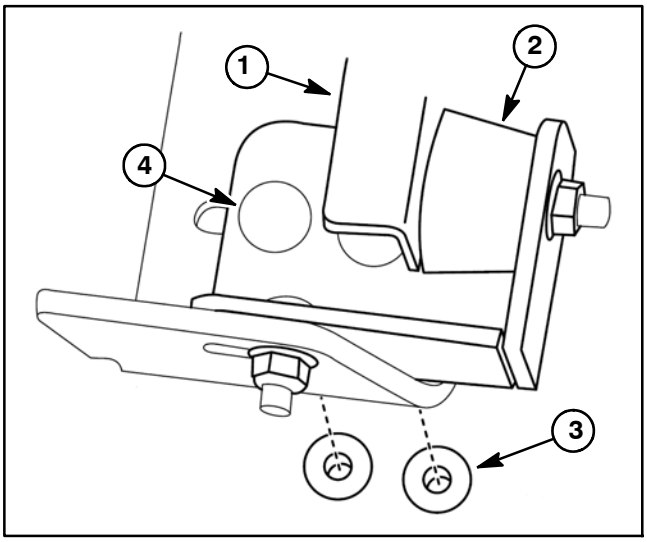

Figure 16

1. **Front engine bracket**
2. **Rubber bumper**
3. **Lock nut (3 used)**
4. **Carriage screw (3 used)**

Engine Installation (Fig. 12)

1. Install all removed mounts, components and attachments to the engine.

CAUTION

Make sure that hoist or lift used to install engine can properly support engine. Engine assembly weighs approximately 170 pounds (77 kg). Also, one person should operate the hoist while a second person guides the engine into the vehicle.

2. Install engine to the vehicle.

A. Attach a short section of chain between both engine lift tabs.

B. Connect a hoist at the center of the short section of chain.

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

C. Carefully lower engine assembly into the engine area of the vehicle. Align holes in engine brackets with engine mounts attached to frame.

3. Secure engine to engine mounts with four (4) cap screws, snubbing washers, spacers and flange nuts.

4. Connect the following electrical components:

   A. Connect main wire harness connections to glow plug bus, temperature sender and engine run solenoid (Fig. 14).

   B. Connect main wire harness connection to fusible link harness.

   C. Connect engine wire harness connector to the main wire harness.

   D. Secure negative battery cable and engine ground connector to front engine mount with flange head screw. The order of assembly should be lock washer, negative battery cable, engine ground connector and then flange head screw. Coat connectors with skin over grease or terminal protector (see Special Tools in Chapter 5 – Electrical System) after assembly.

5. Install drive belt to drive clutch.

IMPORTANT: Make sure to remove all plugs and covers that were placed on hose and engine openings during engine removal.

6. Connect fuel supply hose to the injector pump and fuel return hose to the #2 injector.

7. Position throttle cable to engine. Secure the throttle cable end to injector pump speed control lever with shoulder bolt and flange nut. Tighten cable nuts to secure cable to cable mount (Fig. 13). Check throttle cable adjustment (see Adjust Throttle Cable in the Adjustments section of this chapter).

8. Install exhaust header and muffler to the vehicle (see Exhaust System in this section).

9. Install air intake hose to the air cleaner and engine intake (see Air Cleaner in this section).

10. Connecting lower and upper radiator hoses to the radiator. Fill cooling system with coolant (see Radiator in this section). Check radiator and hoses for leaks.

11. Make sure that alternator belt tension is properly adjusted.

12. Check that the gap between the rubber bumper and front engine bracket is **0.090" (2.2 mm)** (Fig. 16). If gap is incorrect, loosen three (3) lock nuts and adjust bumper to provide correct gap. Tighten lock nuts to secure bumper after adjustment.

13. Make sure engine oil level is correct.

14. Install cargo box to the frame (see Cargo Box in the Service and Repairs section of Chapter 6 – Chassis).

15. Connect positive (red) cable to the battery. Then, connect negative (black) cable to the battery.

Engine Clutch Adapter

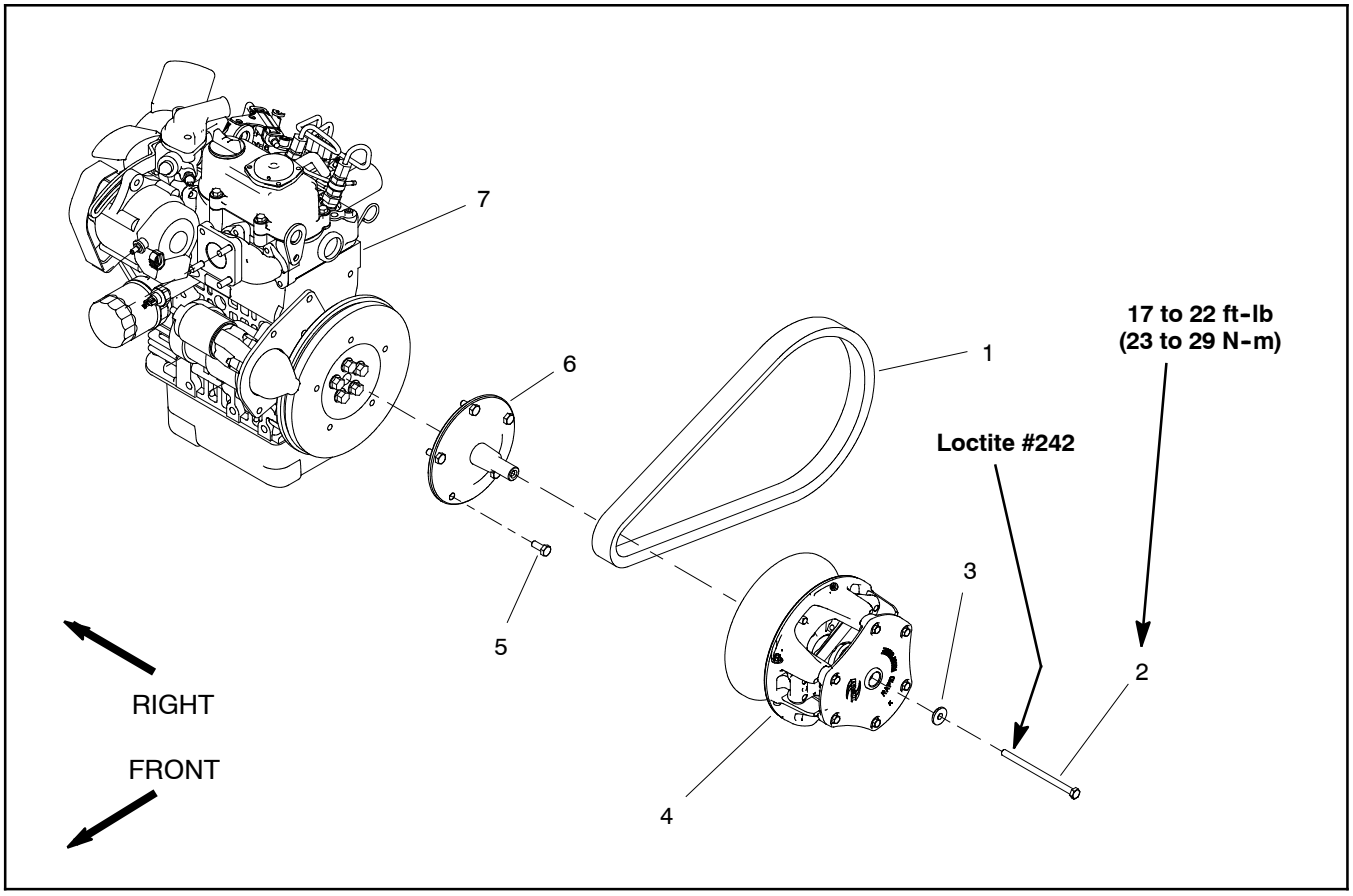

Figure 17

1. **Drive belt**
2. **Cap screw**
3. **Flange washer**
4. **Drive clutch**
5. **Cap screw (5 used)**
6. **Clutch adapter**
7. **Engine assembly**

Removal (Fig. 17)

1. Park machine on a level surface, stop the engine, engage parking brake and remove the key from the ignition switch.

2. Raise and support cargo bed to access engine.

3. Carefully remove drive belt from drive clutch.

4. Remove drive clutch from clutch adapter on engine (see Drive Clutch in the Service and Repairs section of Chapter 4 – Drive Train).

5. Remove five (5) cap screws that secure clutch adapter to engine flywheel. Remove clutch adapter from engine.

Installation (Fig. 17)

1. Position clutch adapter to engine flywheel and secure with five (5) cap screws.

2. Secure drive clutch to clutch adapter on engine (see Drive Clutch in the Service and Repairs section of Chapter 4 – Drive Train).

3. Install drive belt to drive clutch.

4. Lower and secure cargo bed.

Chapter 4

Drive Train

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Specifications

Item	Description
Transaxle	
Transaxle Fluid Capacity	1.5 quarts (1.4 liters)
Transaxle Fluid	SAE 10W–30 Motor Oil
Transaxle Dry Weight	73 pounds (33 kilograms)
Clutch System	Continuously variable transmission type, torque convertor
Drive Clutch	Speed sensing with mechanical fly weights
Driven Clutch	Torque sensing with spring loaded cam

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Workman MDX–D vehicle. Refer to the Operator's Manual for additional information when servicing the machine.

Drive Train Operation

Clutch System Operation

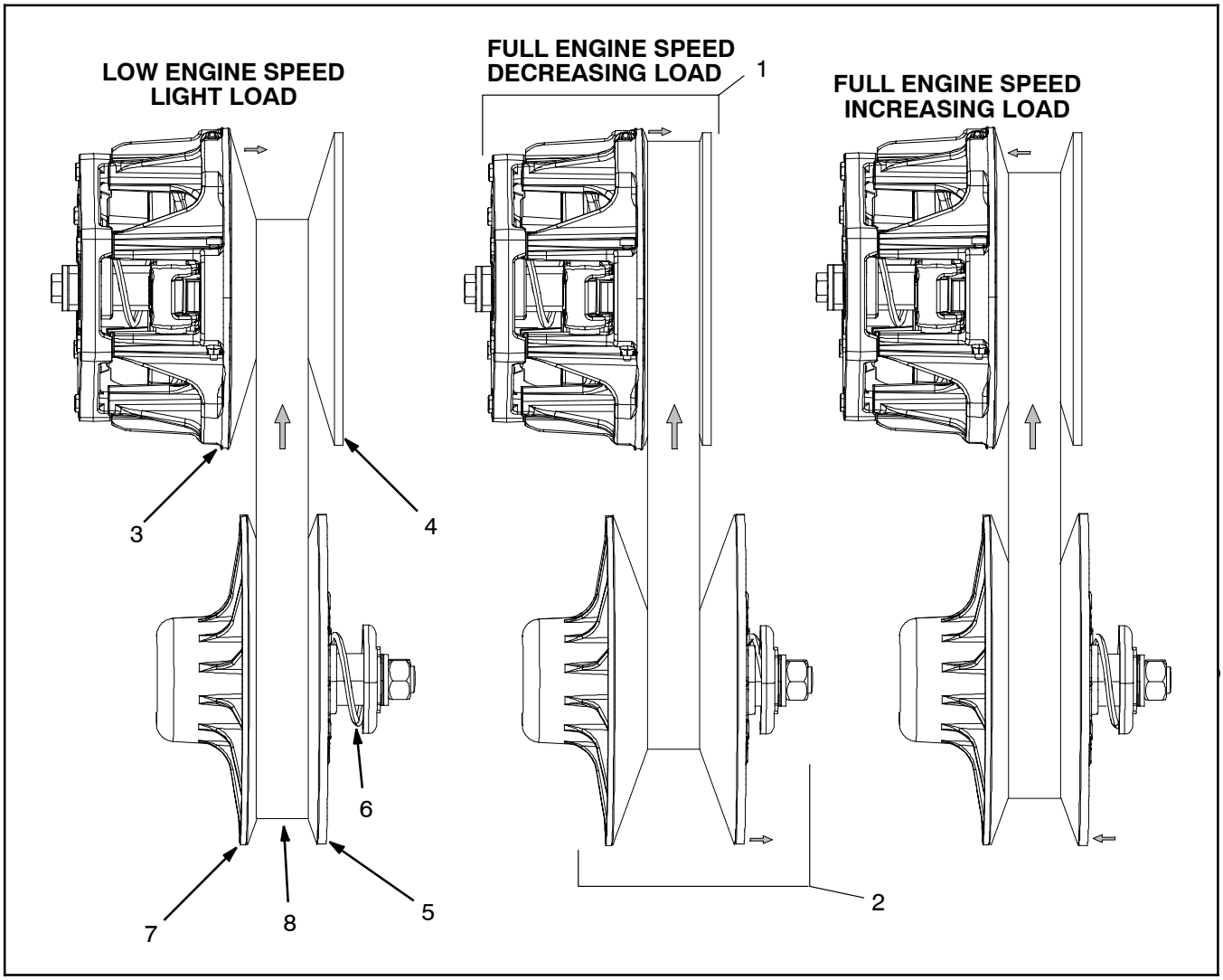

Figure 1

1. **Drive clutch**
2. **Driven clutch**
3. **Moveable sheave (drive clutch)**
4. **Fixed sheave (drive clutch)**
5. **Moveable sheave (driven clutch)**
6. **Spring**
7. **Fixed sheave (driven clutch)**
8. **CVT drive belt**

Power is transferred from the engine to the transaxle by a variable clutch system that consists of two (2) clutches connected by a drive belt. The drive clutch responds to engine speed and is mounted to the engine crankshaft. The driven clutch responds to changes in load to the rear axle and is mounted to the transaxle input shaft.

The two (2) clutches work together to automatically up-shift and back-shift as changes in load and speed occur. This shifting changes the turning ratio between the drive and driven clutches and allows the engine to operate at optimum efficiency.

Drive Clutch Operation

The operation of the drive clutch is affected by engine shaft speed. With the engine not turning, the CVT drive belt rests low within the drive clutch sheaves as the pressure of the spring holds the sheaves apart. As the engine increases in speed, the clutch weights attached to the moveable sheave move outward as they spin about the engine driveshaft. The outward movement of the clutch weights presses against the rollers and overcomes spring pressure through the spider assembly, which forces the moveable sheave closer to the fixed sheave. This inward movement of the sheave engages the drive belt to drive the driven clutch.

With increasing engine speed, the moveable sheave continues to move inward, which forces the drive belt to ride towards the outer diameter of the clutch sheaves.

When engine speed is decreased, the clutch weights exert less force on the rollers and thus the spring. The spring pressure overcomes the force of the clutch weights and shifts the moveable sheave away from the fixed sheave. The drive belt disengages from the clutch sheaves at a point where the force of the spring is greater than that of the clutch weights.

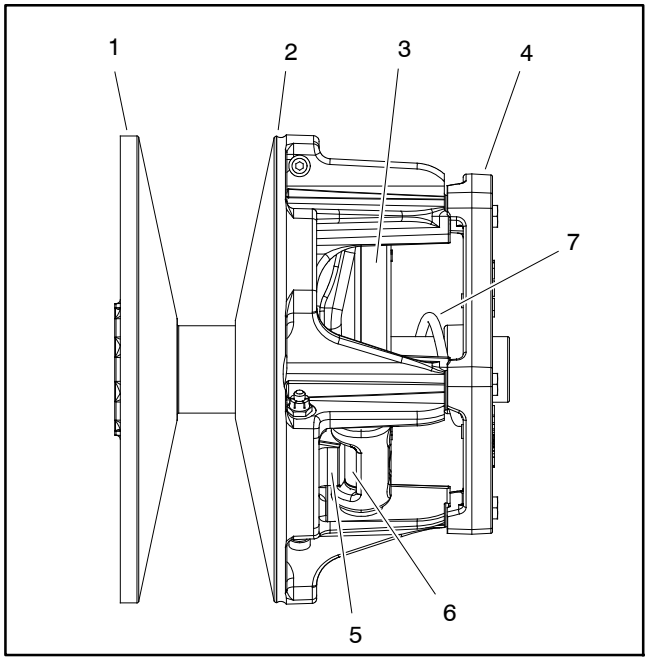

Figure 2

1. **Fixed sheave**
2. **Moveable sheave**
3. **Spider assembly**
4. **Cover**
5. **Clutch weight (3 used)**
6. **Roller (3 used)**
7. **Spring**

Driven Clutch Operation

The operation of the driven clutch is affected by transaxle load. When the vehicle is stopped, the drive belt is held at the outer diameter of the driven clutch sheaves from the pressure of the spring pushing the moveable sheave against the fixed sheave and away from the fixed cam.

Once the drive belt starts rotating, the driven clutch also starts to rotate. With increasing speed of the drive clutch on the engine, the drive belt begins to climb to the outer diameter of the drive clutch sheaves. This increases the tension on the drive belt and forces the moveable sheave of the driven clutch to move away from the fixed sheave against the pressure of the driven clutch spring. As the belt tightens and the driven clutch sheaves open up, the drive belt rides lower in the driven clutch sheaves.

With increased load to the transaxle, the driven clutch fixed cam resists forward movement relative to the moveable sheave and drive belt. Torque from the drive belt along with spring pressure moves the moveable sheave up the ramp of the fixed cam. The drive belt becomes positioned closer to the outer diameter of the driven clutch sheaves.

The fixed cam on the driven clutch moveable sheave rotates on a pair of rollers in the fixed sheave base to allow low friction movement of the moveable sheave (Fig. 3).

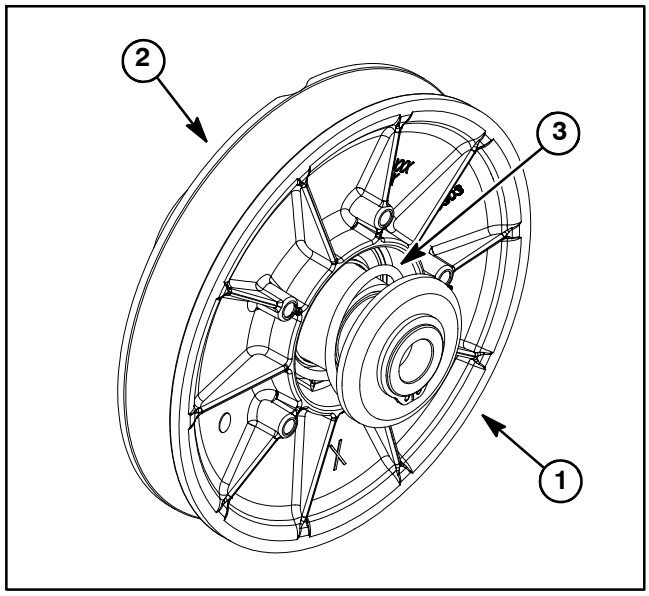

Figure 3

1. **Moveable sheave**
2. **Fixed sheave**
3. **Spring**

Special Tools

Order special tools from your Toro Distributor.

Drive Clutch Removal Tool

This tool is required to remove the drive clutch from the tapered drive shaft of the engine. It is placed in the threaded hole of the fixed clutch sheave after the clutch retaining screw is removed.

Toro Part Number: **TOR6014**

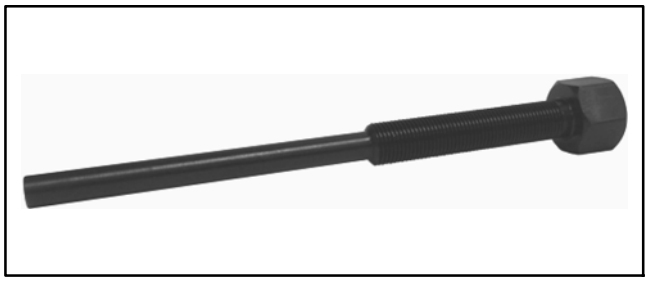

Figure 4

Troubleshooting

Clutch

Problem	Possible Cause
Poor upshifting.	Governed engine speed is adjusted too low. Drive and/or driven clutch assemblies have accumulation of dirt or debris. Drive belt is worn. Clutch sheaves are worn or damaged.
Poor downshifting.	Drive and/or driven clutch assembly has accumulation of dirt or debris. Drive belt is worn. Clutch sheaves are worn or damaged.
Vehicle creeps at idle.	Engine idle speed is too high. Drive clutch has accumulation of dirt or debris preventing full back-shifting. Drive and driven clutches are not aligned.
Rough clutch engagement.	Engine idle speed is too low. Drive clutch assembly has accumulation of dirt or debris. Drive belt is worn. Drive clutch sheaves are worn or damaged.
Noisy clutch operation.	Engine idle speed is too low causing excess shaking. Worn drive clutch roller or weight bushings. Worn drive clutch spider slides (drive clutch replacement necessary if found).

Adjust Shift Cables

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch. Raise and support cargo box.

2. Set the shift lever into the Neutral position. Rotate driven clutch to insure transmission is in neutral.

3. The transaxle select lever assembly should be in a level position and parallel to the cable mounting bracket.

4. While holding the cable below the lever, tighten the lock nut on one of the shift cables to allow **0.030" to 0.060" (0.8 to 1.5 mm)** freeplay in the cable (Fig. 6).

5. Repeat process for other shift cable.

6. Pull up on each shift cable to make sure that freeplay is correct. If necessary, readjust nut (Fig. 6).

7. Start engine and verify transaxle engagement in forward, reverse and neutral as the shift lever is moved.

8. Finally, check vehicle operation in forward, reverse and neutral. Readjust shift cables if needed for correct operation.

9. Lower and secure cargo box.

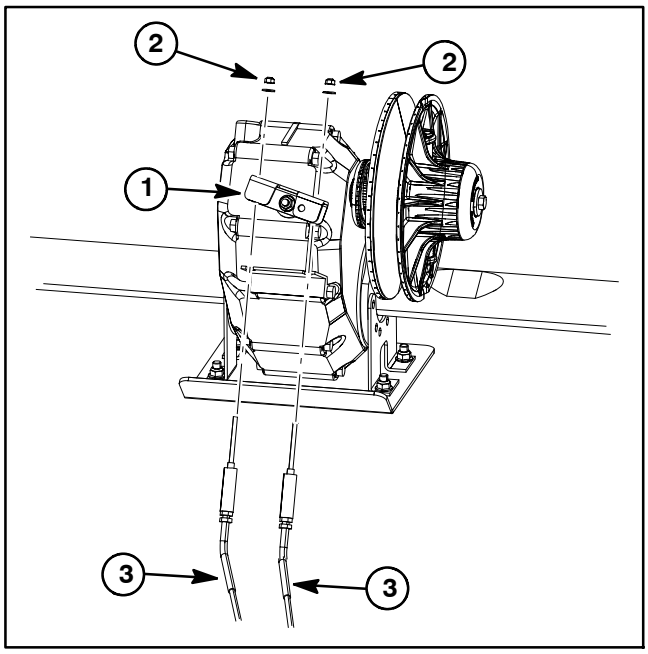

Figure 5

1. **Select lever assembly**
2. **Lock nut location**
3. **Shift cable**

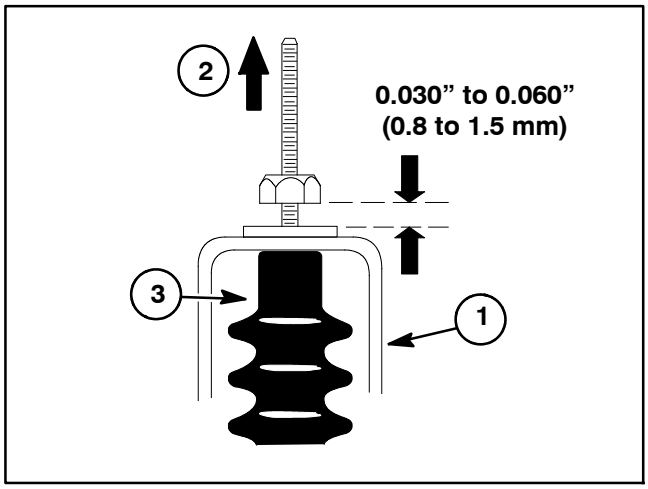

Figure 6

1. **Select lever**
2. **Cable pull direction**
3. **Cable boot**

Drive Clutch

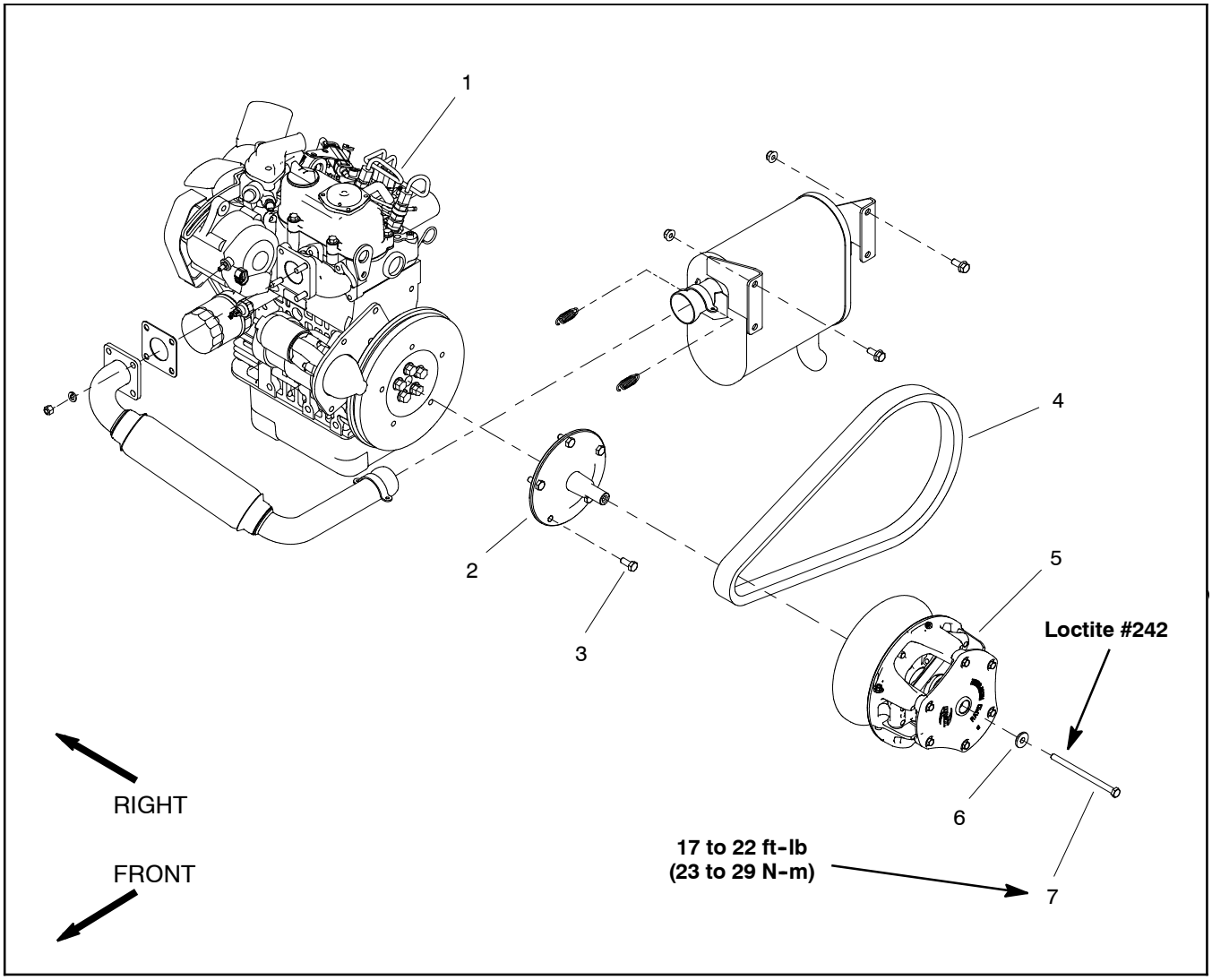

Figure 7

1. **Engine**
2. **Clutch adapter**
3. **Cap screw (5 used)**
4. **Drive belt**
5. **Drive clutch**
6. **Flange washer**
7. **Cap screw**

Drive Clutch Removal (Fig. 7)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch. Raise and support cargo box.

2. Carefully remove drive belt from the drive clutch.

3. Remove cap screw (item 7) and flange washer (item 6) securing the drive clutch to the clutch adapter.

IMPORTANT: Lightly grease end of clutch removal tool to prevent wear or damage to removal tool and clutch adapter. Prevent damage to clutch threads; thread tool into clutch only enough to remove the clutch.

4. Use drive clutch removal tool (see Special Tools in this chapter) to remove drive clutch from the tapered clutch adapter.

5. Inspect the tapered ends of the clutch adapter and fixed sheave of drive clutch. If either is severely damaged, replace component as damage to the taper will allow loosening of the clutch during operation.

Drive Clutch Installation (Fig. 7)

1. Thoroughly clean the tapered surfaces of the clutch adapter and drive clutch.

2. Slide drive clutch onto the clutch adapter.

3. Apply Loctite #242 (or equivalent) to the threads of the cap screw (item 7).

4. Secure clutch to clutch adapter with cap screw (item 7) and flange washer (item 6). Torque cap screw from **17 to 22 ft-lb (23 to 29 N-m)**.

5. Install drive belt to the drive clutch.

6. Lower and secure cargo box.

Drive Clutch Service

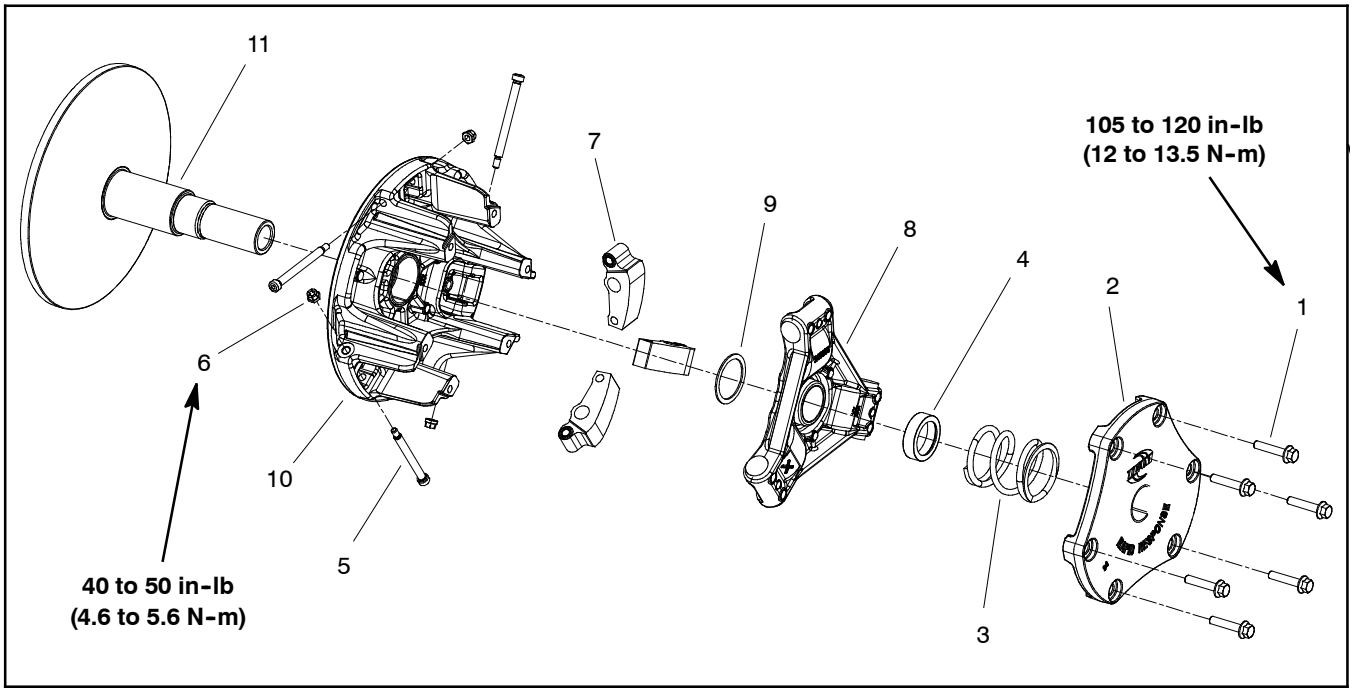

Figure 8

1. Flange head screw (6 used)
2. Cover
3. Compression spring
4. Limiter shim
5. Shoulder screw (3 used)
6. Lock nut (3 used)
7. Clutch weight (3 used)
8. Spider
9. Shim
10. Moveable sheave
11. Fixed sheave

Disassembly (Fig. 8)

IMPORTANT: Make note of the "X" mark cast into the cover and spider before clutch disassembly. These marks must be aligned during assembly for proper clutch operation.

1. Make note of the "X" mark cast into the cover and spider before clutch disassembly (Fig. 9). These marks must be aligned during assembly for proper clutch operation.

CAUTION

Loosen the flange head screws that secure cover slowly. The cover is under pressure from the compression spring.

2. Using a crossing pattern, loosen and remove six (6) flange head screws (item 1) that secure the cover to the movable sheave.

3. Carefully remove cover, compression spring and limiter shim from clutch.

4. Remove lock nut (item 6) from each of the shoulder screws (item 5). Discard lock nuts after removal.

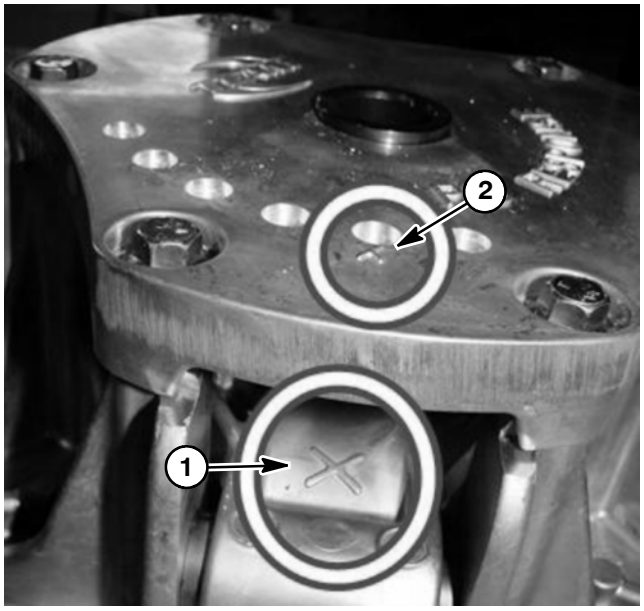

Figure 9

1. Spider
2. Cover

5. Slide shoulder screw from each of the clutch weights (item 7) and then remove weights from clutch.

6. Clean all dust and debris from clutch components with a soft bristle brush. If necessary, use water to remove dirt and dry immediately with compressed air to remove all dirt and water. Remove any remaining debris with a fast drying contact or brake parts cleaner. Focus debris removal on and around moving clutch components.

Inspection

NOTE: If drive clutch wear or damage occurs, clutch replacement may be necessary. Refer to your parts catalog to identify individual drive clutch components that are available.

1. Inspect the tapered ends of the engine crankshaft and fixed sheave of drive clutch. If either is severely damaged, replace component as damage to the taper will allow loosening of the clutch during operation.

2. Inspect the compression spring (item 3) and replace if damaged or fatigued.

3. Clean and inspect shoulder screws (item 5). If the shoulder area of the screws is worn or if the threads are damaged, replace the screws.

4. Check the contact surface of the clutch weights (Fig. 10). If surface is worn or damaged, replace all three (3) clutch weights as a set.

5. Check the rollers in the spider assembly for binding or wear (Fig. 11). If binding or uneven wear is found, replace clutch assembly.

6. Check the belt contact surfaces of the movable and fixed sheaves. Remove any belt material from sheave faces with a fine abrasive pad or fine steel wool. If sheave surfaces are worn, replace clutch assembly.

Assembly (Fig. 8)

IMPORTANT: For proper drive clutch operation, DO NOT lubricate drive clutch components.

IMPORTANT: To maintain the balance of the clutch, all shoulder screws must be installed with their threads pointing in a clockwise direction (Fig. 12).

1. Position clutch weights to moveable sheave and slide shoulder screw into sheave and weight. Make sure that shoulder screw threads are pointing in a clockwise direction.

2. Install new lock nuts on the shoulder screws. DO NOT reuse removed lock nuts. Tighten nuts until they contact screw shoulder and then torque nuts from **40 to 50 in-lb (4.6 to 5.6 N-m)**.

3. Position limiter shim, compression spring and cover to clutch. Make sure that the "X" mark cast into the cover and spider are aligned.

4. Secure cover to the movable sheave with six (6) flange head screws in a crossing pattern and in three (3) steps. Final torque on screws should be from **105 to 120 in-lb (12 to 13.5 N-m)**.

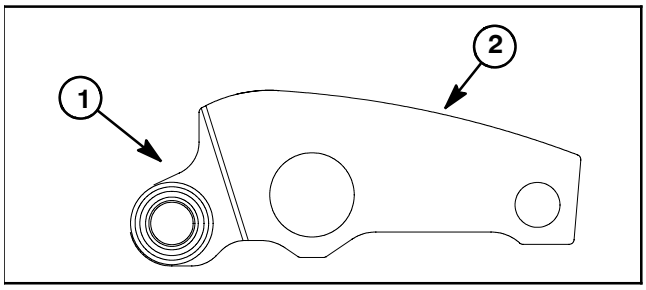

Figure 10

1. **Clutch weight**
2. **Contact surface**

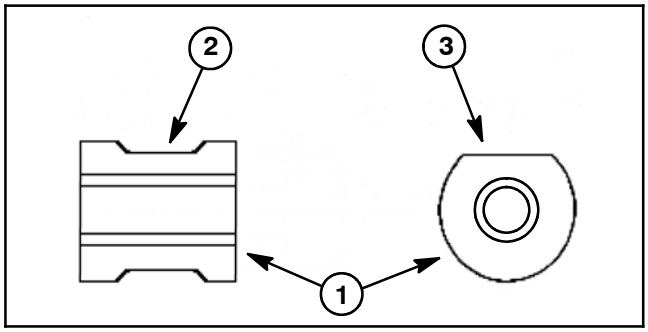

Figure 11

1. **Roller**
2. **Weight contact surface**
3. **Roller uneven wear**

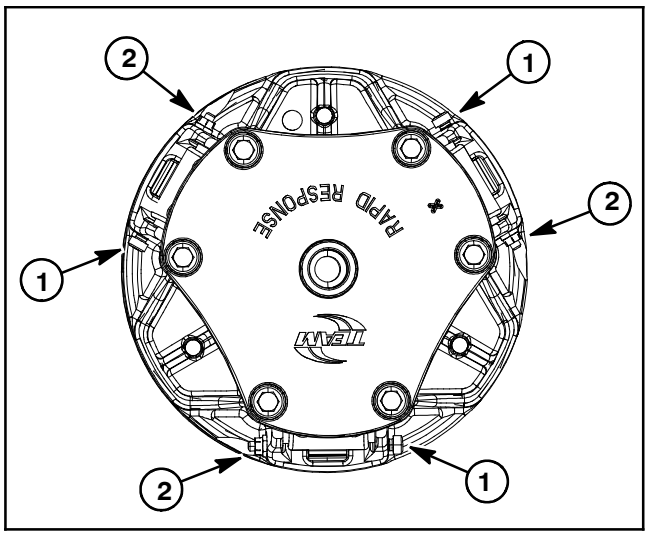

Figure 12

1. **Shoulder screw head**
2. **Lock nut**

Driven Clutch

Driven Clutch Removal (Fig. 13)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch. Raise and support cargo box.

2. Remove muffler from the vehicle (see Exhaust System in the Service and Repairs section of Chapter 3 – Diesel Engine).

3. Carefully remove drive belt from the driven clutch.

4. Remove cap screw and stepped washer securing the driven clutch to the input shaft of the transaxle.

5. Slide driven clutch from the transaxle input shaft.

Driven Clutch Installation (Fig. 13)

1. Coat transaxle input shaft with antiseize lubricant.

2. Position driven clutch to the input shaft. Make sure pulley side of the clutch is next to the transaxle case.

3. Secure driven clutch to the transaxle input shaft with cap screw and stepped washer. Torque cap screw from **39 to 47 ft-lb (53 to 63 N-m)**.

4. Install drive belt to the driven clutch.

5. Install muffler to the vehicle (see Exhaust System in the Service and Repairs section of Chapter 3 – Diesel Engine).

6. Lower and secure cargo box.

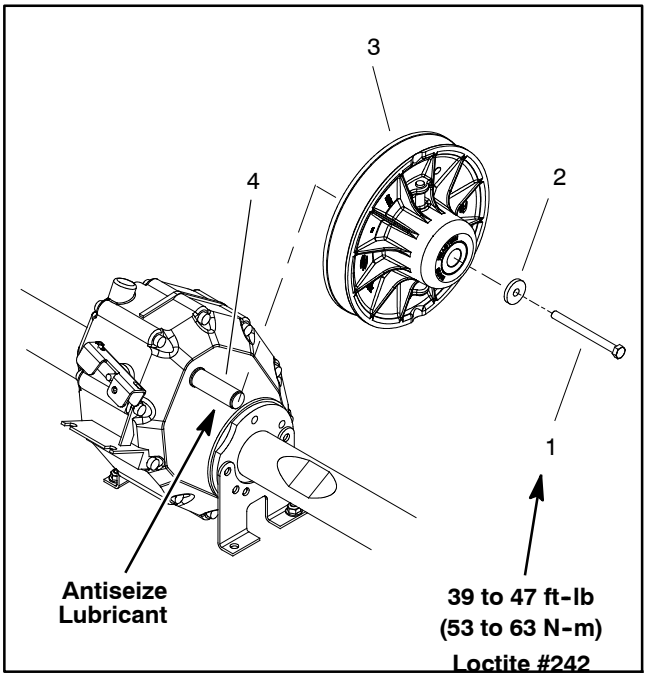

Figure 13

1. **Cap screw**
2. **Stepped washer**
3. **Driven clutch**
4. **Input shaft (transaxle)**

Driven Clutch Service

1. Use a suitable press to compress the clutch spring enough to allow removal of the retaining ring.

2. Remove retaining ring.

3. Carefully, allow the spring to extend fully.

4. Remove outer spring retainer, spring and inner spring retainer from clutch.

5. Make note of the "X" mark cast into the fixed sheave and moveable sheave before removing the moveable sheave. These marks must be aligned during assembly for proper clutch operation.

6. Separate the clutch sheaves. Locate and retrieve thrust washer.

7. Clean and inspect driven clutch components:

   A. Clean all dust and debris from clutch components. If necessary, use contact or brake cleaner to remove any oil or other lubricants from clutch components.

   B. Inspect the spring and replace if damaged or fatigued.

   C. Check the rollers in the fixed sheave for binding or wear. If binding or uneven wear is found, replace driven clutch assembly.

   D. Check the contact surface of the sheaves for wear and/or fraying. If wear or damage is found, replace driven clutch assembly.

8. Assemble the driven clutch in the reverse order of disassembly. Make sure that the "X" mark cast into the fixed and moveable sheaves are aligned. Also, make sure that the retaining ring is fully seated in groove after installation.

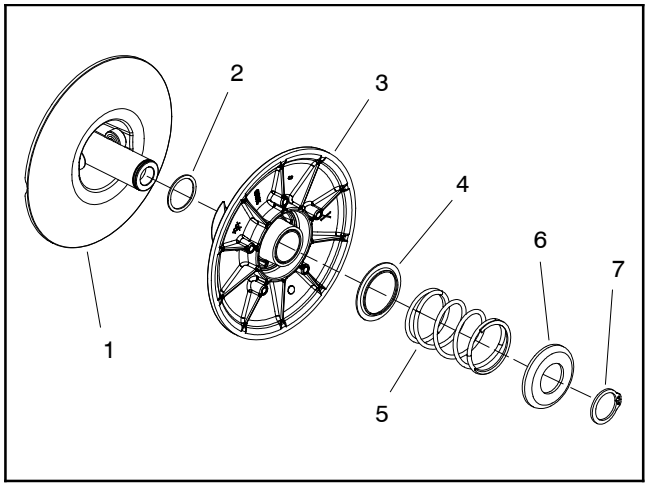

Figure 14

1. **Fixed sheave**
2. **Thrust washer**
3. **Moveable sheave**
4. **Inner spring retainer**
5. **Spring**
6. **Outer spring retainer**
7. **Retaining ring**

Transaxle

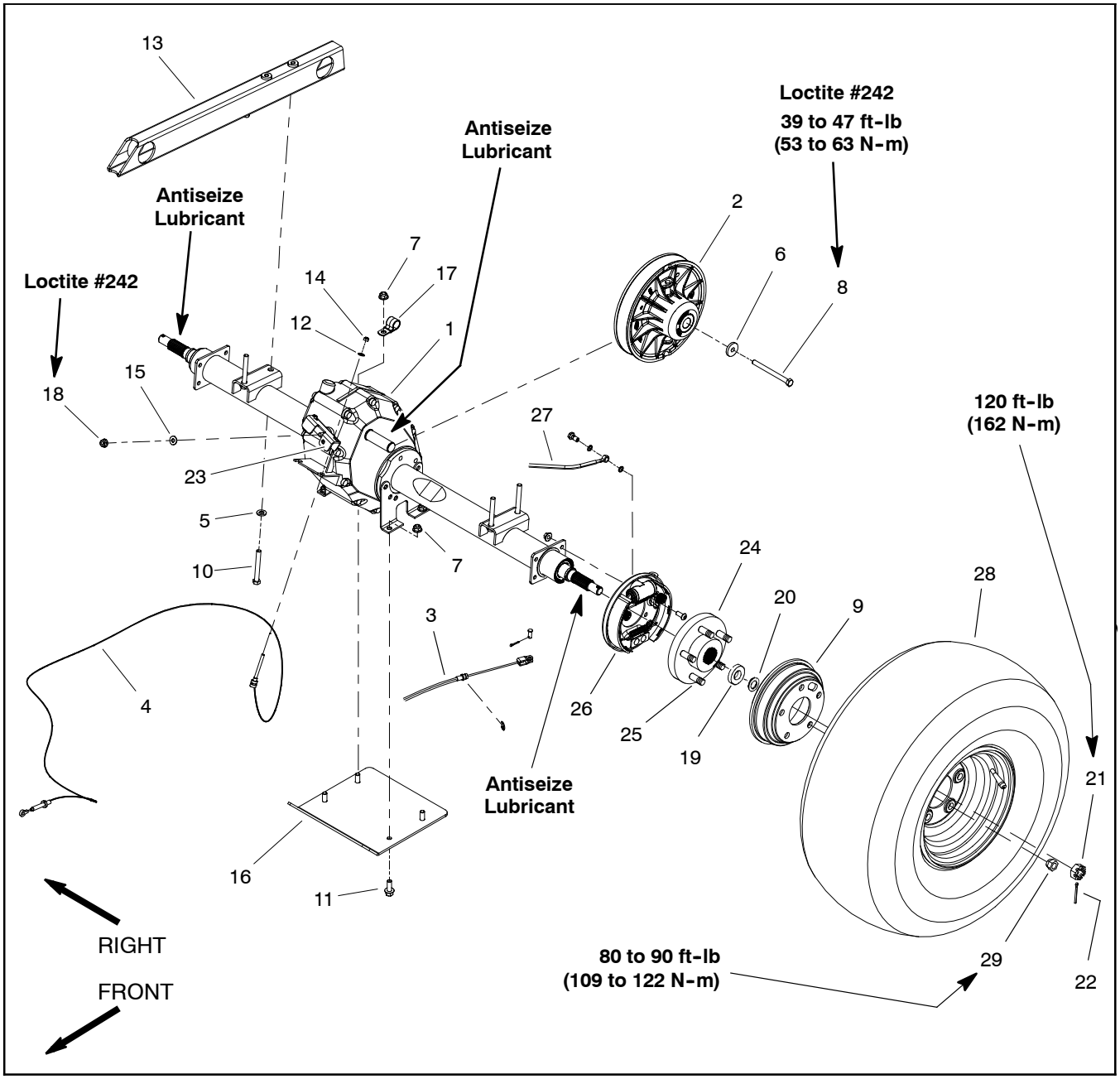

Figure 15

1. Transaxle assembly
2. Driven clutch
3. Parking brake cable (2 used)
4. Shift cable (2 used)
5. Hardened washer (4 used)
6. Stepped washer
7. Flange nut (4 used)
8. Cap screw
9. Brake drum (2 used)
10. Cap screw (4 used)
11. Cap screw (4 used)
12. Flat washer (2 used)
13. Swing arm
14. Lock nut (2 used)
15. Flat washer
16. Skid plate
17. R-clamp
18. Lock nut
19. Washer (2 used)
20. Spring washer (2 used)
21. Slotted hex nut (2 used)
22. Cotter pin (2 used)
23. Select lever
24. Wheel hub (2 used)
25. Wheel stud (5 used per hub)
26. Brake assembly (LH shown)
27. Rear brake line
28. Rear wheel assembly (2 used)
29. Lug nut (5 used per wheel)

Removal (Fig. 15)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

2. Raise and support cargo box.

3. Carefully remove drive belt from the driven clutch on transaxle.

4. Separate shift cables from transaxle:

   A. Loosen jam nuts securing both shift cables to the cable bracket on the transaxle (Fig. 16).

   B. Remove lock nut and flat washer that secures the select lever to the transaxle selector shaft (Fig. 17).

   C. Separate select lever and shift cable assembly from the transaxle.

   D. Remove cap screw (item 11 in Fig. 15) and flange nut (item 7 in Fig. 15) that secure r-clamp (item 17 in Fig. 15) to skid plate.

   E. Note routing of shift cables for assembly purposes. Position select lever with attached shift cables away from transaxle assembly.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 - Safety.

5. Jack up both sides of the frame enough to remove rear wheels.

   A. Chock the front and rear of both front tires to prevent the vehicle from moving.

   B. Support both sides of the frame with appropriate jack stands positioned just in front of the transaxle tubes.

6. Remove both rear wheels and brake assemblies from the transaxle (see Rear Wheels and Brakes in the Service and Repairs section of Chapter 6 - Chassis).

CAUTION

To prevent personal injury, make sure that transaxle is properly supported as it is removed from the machine. Transaxle weighs approximately 73 pounds (33 kg).

7. Support the transaxle to prevent it from shifting.

8. Remove four (4) cap screws (item 10) and flat washers (item 5) that secure the transaxle to the swing arm.

IMPORTANT: Take care to not damage the transaxle, brake hoses, electrical harness, cables or other parts while lowering the transaxle assembly from the vehicle.

9. Carefully lower transaxle assembly and remove it from the rear of the vehicle.

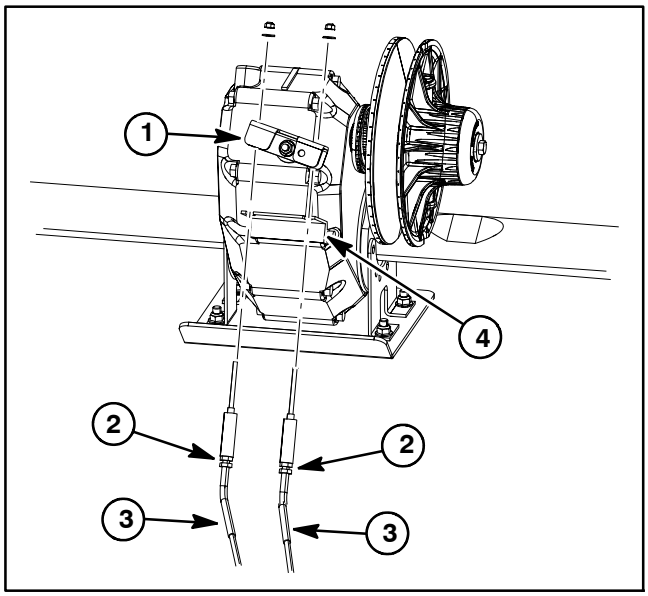

Figure 16

1. Select lever assembly
2. Cable jam nut location
3. Shift cable
4. Cable bracket

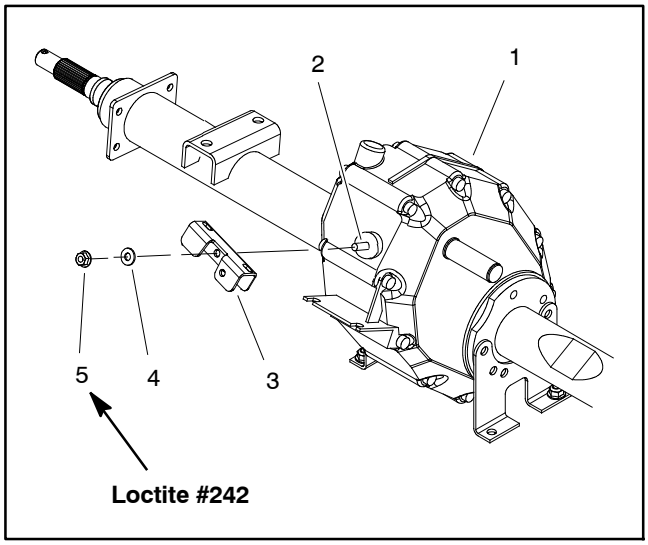

Figure 17

1. Transaxle assembly
2. Selector shaft
3. Select lever
4. Flat washer
5. Lock nut

Installation (Fig. 15)

1. Position transaxle assembly under the vehicle swing arm.

CAUTION

To prevent personal injury, make sure that transaxle is properly supported as it is installed into the machine. Transaxle weighs approximately 73 pounds (33 kg).

IMPORTANT: Take care to not damage the transaxle, brake hoses, electrical harness, cables or other parts while raising the transaxle assembly into the vehicle.

2. Carefully raise transaxle assembly and align it with swing arm mounting points.

3. Secure the transaxle to the swing arm with four (4) cap screws (item 10) and flat washers (item 5).

4. Secure shift cables to transaxle:

   A. Position select lever with attached shift cables to transaxle assembly. Use notes taken before removal to properly route cables around transaxle.

   B. Slide select lever with attached shift cables onto transaxle selector shaft.

   C. Apply Loctite #242 (or equivalent) to threads of lock nut (item 18). Secure select lever assembly to the selector shaft with flat washer (item 15) and lock nut (item 18).

   D. Secure both shift cables to the cable bracket with jam nuts.

   E. Secure r-clamp (item 17) with shift cables to skid plate with cap screw (item 11) and flange nut (item 7).

   F. Check shift cable adjustment and make necessary cable adjustments (see Shift Cable Adjustment in the Adjustments section of this chapter).

5. Install drive belt to the driven clutch.

6. Install both brake assemblies and wheels to the transaxle (see Rear Wheels and Brakes in the Service and Repairs section of Chapter 6 - Chassis). Make sure that brakes are bled and parking brake is adjusted.

7. Lower vehicle to the ground.

8. Make sure transaxle oil level is correct.

9. Lower and secure cargo box.

10. Check brakes for proper operation.

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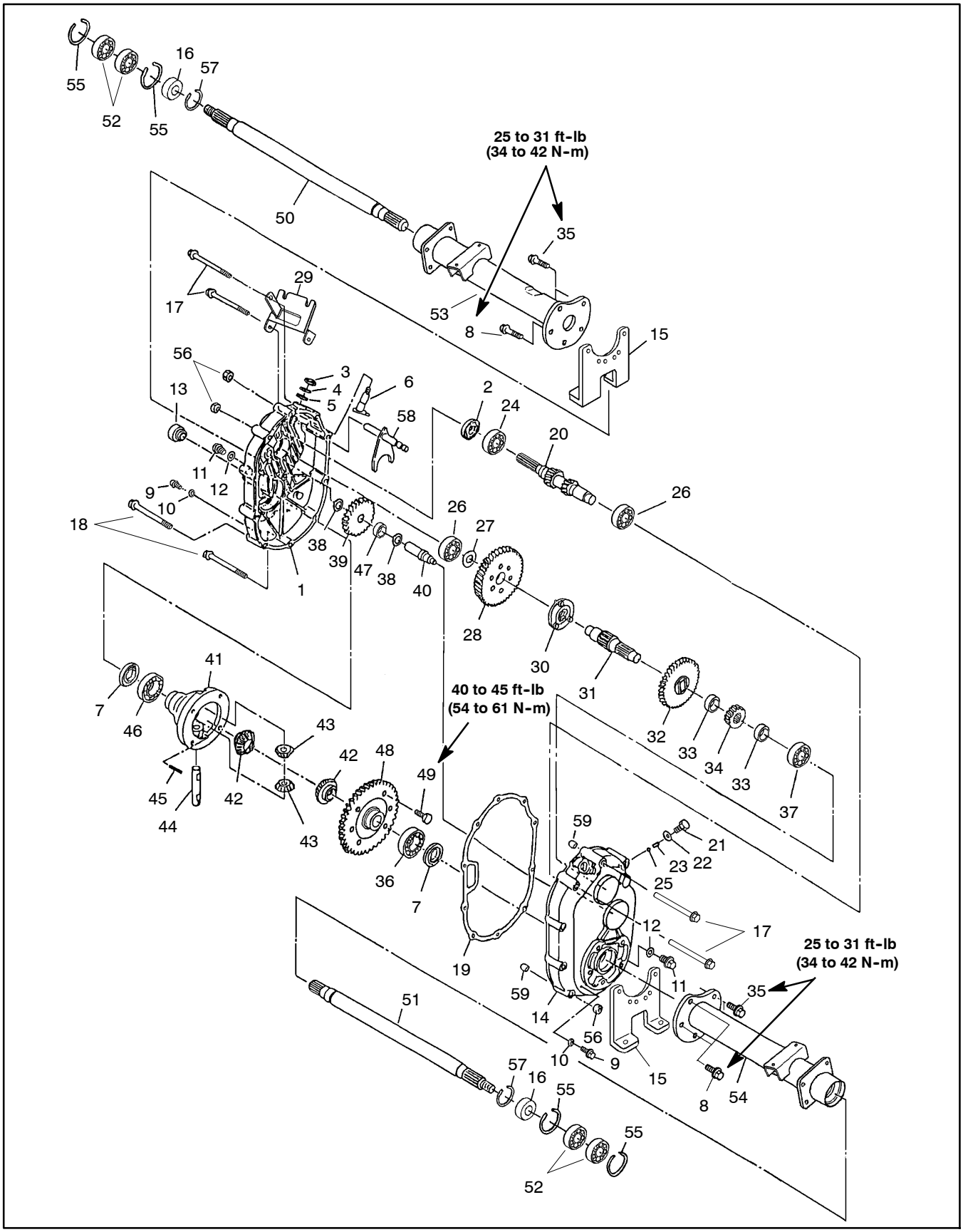
25 to 31 ft-lb
(34 to 42 N-m)
40 to 45 ft-lb
(54 to 61 N-m)
25 to 31 ft-lb
(34 to 42 N-m)

Figure 18

Figure 18 (Continued)

1. Case (LH)
2. Oil seal
3. Oil seal
4. Snap ring
5. Spacer
6. Selector shaft
7. Oil seal (2 used)
8. Flange bolt (4 used)
9. Oil check plug (2 used)
10. Gasket (2 used)
11. Oil drain plug (2 used)
12. Gasket (2 used)
13. Oil filler plug
14. Case (RH)
15. Axle bracket (2 used)
16. Collar (2 used)
17. Flange bolt (4 used)
18. Flange bolt (6 used)
19. Gasket
20. Input shaft
21. Bolt
22. Gasket
23. Spring
24. Ball bearing
25. Steel ball
26. Ball bearing (2 used)
27. Spacer
28. Gear 55
29. Cable bracket
30. Pin clutch
31. Center shaft
32. Gear 47
33. Collar (2 used)
34. Gear
35. Flange bolt (6 used)
36. Ball bearing
37. Ball bearing
38. Spacer (2 used)
39. Gear 34
40. Counter shaft
41. Differential case
42. Side gear (2 used)
43. Pinion gear (2 used)
44. Pinion shaft
45. Spring pin
46. Ball bearing
47. Needle bearing
48. Gear 62
49. Bolt (6 used)
50. Axle shaft (LH)
51. Axle shaft (RH)
52. Ball bearing (4 used)
53. Axle case (LH)
54. Axle case (RH)
55. Snap ring (4 used)
56. Flange nut (10 used)
57. Snap ring (2 used)
58. Shift shaft
59. Pipe knock (2 used)

Transaxle Disassembly and Inspection

1. Disassemble case (LH and RH)

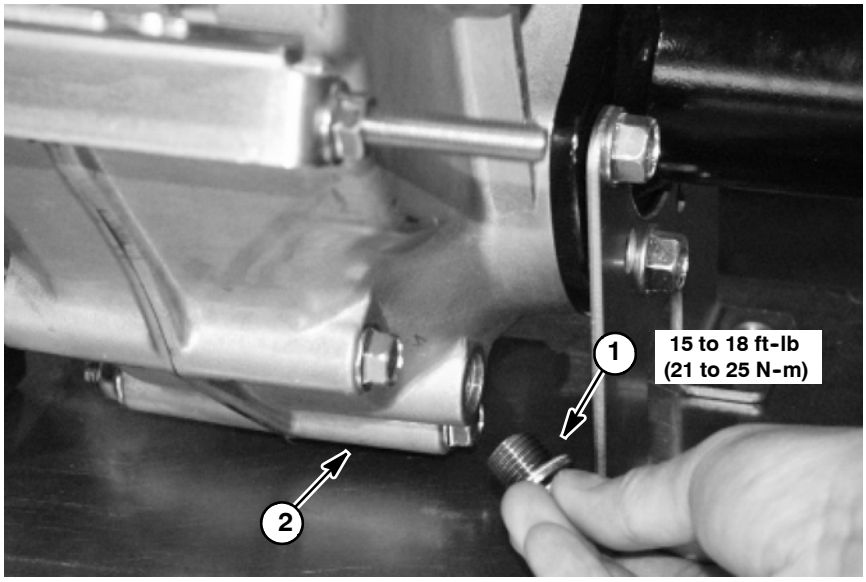

Figure 19

1. Drain plug & gasket
2. Case (LH)

CAUTION

Make sure transaxle case is not hot prior to draining oil to prevent getting burned.

A. Remove drain plug. Drain oil completely from transaxle. Replace drain plug gasket if damaged.

B. Reinstall drain plug to transaxle case. Torque plug from **15 to 18 ft-lb (21 to 25 N-m)**.

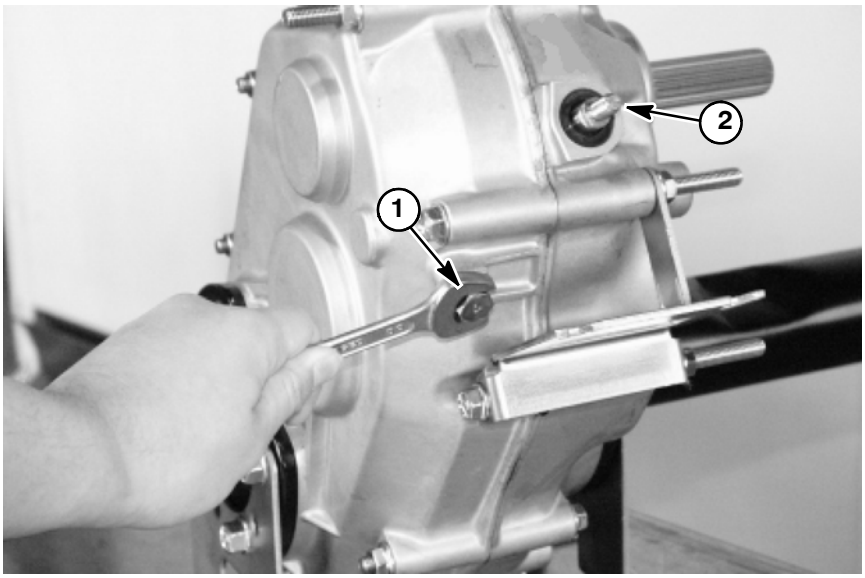

Figure 20

1. **Bolt (steel ball, spring & gasket)**
2. **Selector shaft**

C. Remove bolt near the selector shaft. Remove spring and steel ball. Replace gasket if damaged.

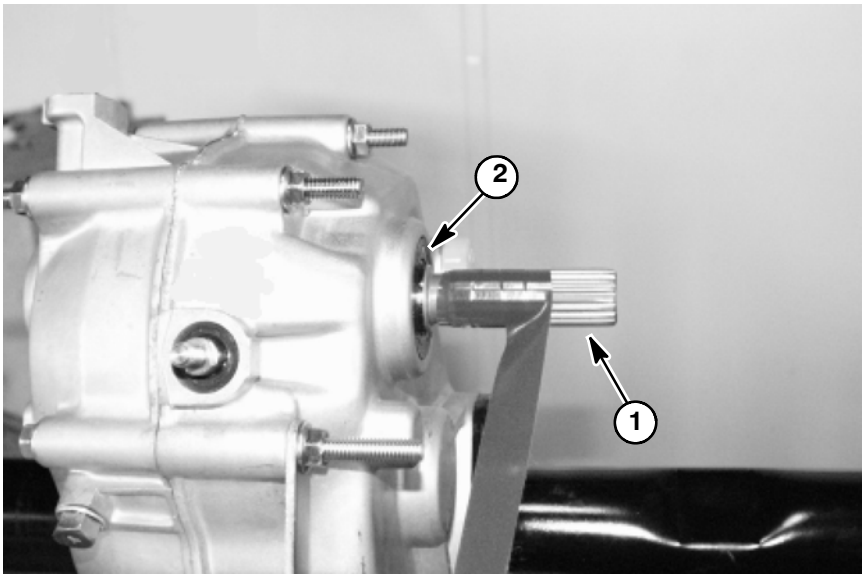

Figure 21

1. **Input shaft**
2. **Oil seal**

D. Wrap vinyl tape around the splined portion of the input shaft. This should protect the oil seal from being damaged.

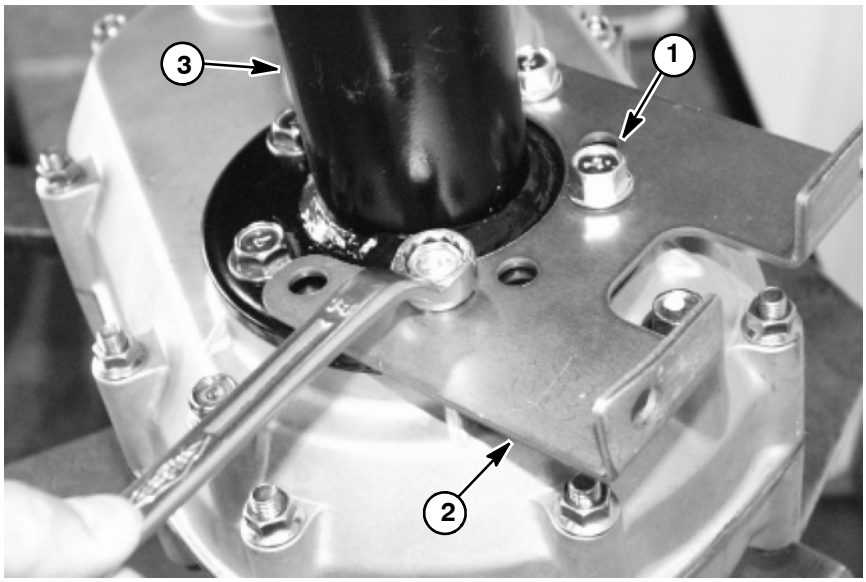

Figure 22

1. **Flange bolts (3 used)**
2. **Axle bracket**
3. **Axle case**

E. Remove three (3) flange bolts securing the axle bracket and axle case to each case. Separate bracket from each axle case.

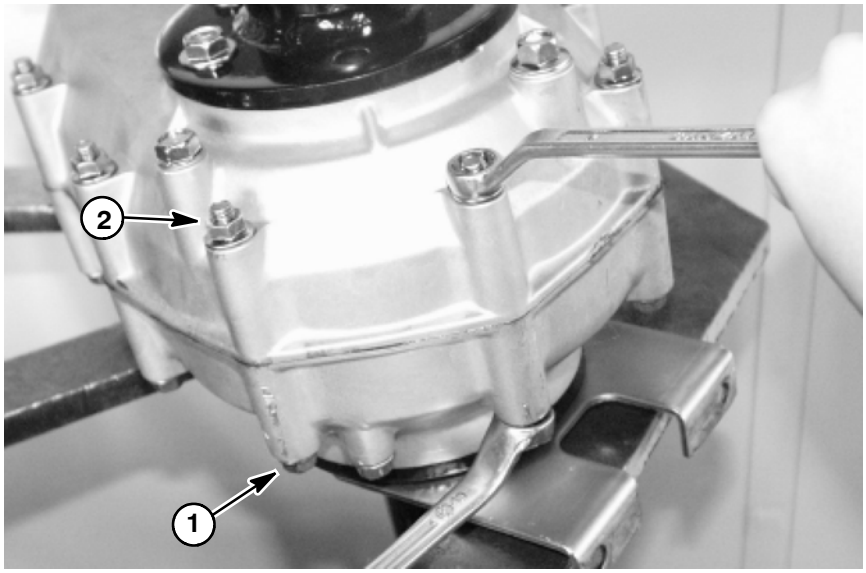

Figure 23

1. **Flange bolt (10 used)**
2. **Flange nut**

F. With the input shaft side down, loosen and remove flange bolts and nuts securing the case (RH) and case (LH) together. Note location of cable bracket for assembly purposes.

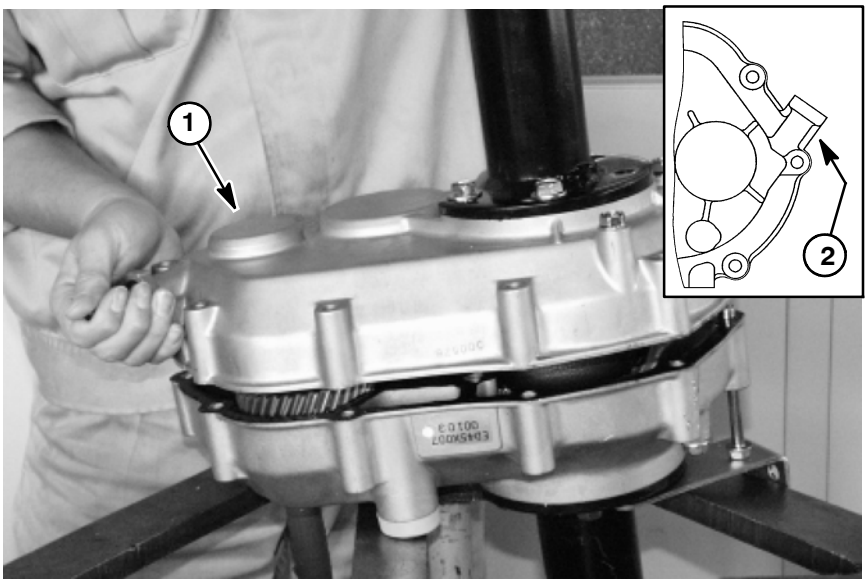

Figure 24

1. **Case (RH)**
2. **Governor boss**

IMPORTANT: Make sure to not hit the governor boss too hard when separating the cases, the boss may get damaged. Do not pry open the two cases with a screw driver, damage may result to the sealing surfaces.

G. Hold the case (RH) and lift up while lightly tapping the governor boss with a plastic hammer.

2. Remove input shaft, center shaft and differential assemblies.

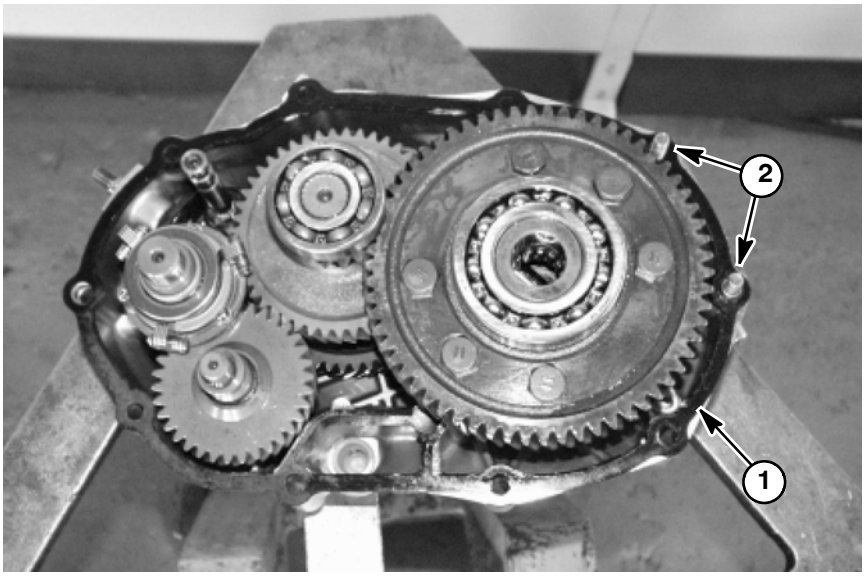

Figure 25

1. **Gasket**
2. **Pipe knock**

A. Remove gasket and pipe knocks.

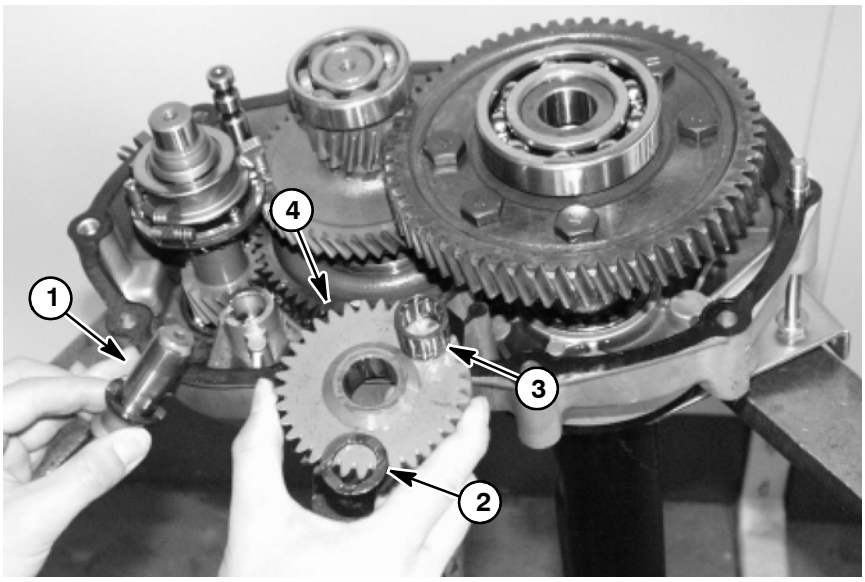

Figure 26

1. **Counter shaft**
2. **Spacer (2 used)**
3. **Needle bearing**
4. **Gear 34**

B. Pull out counter shaft. Remove spacer, needle bearing, gear 34 and spacer.

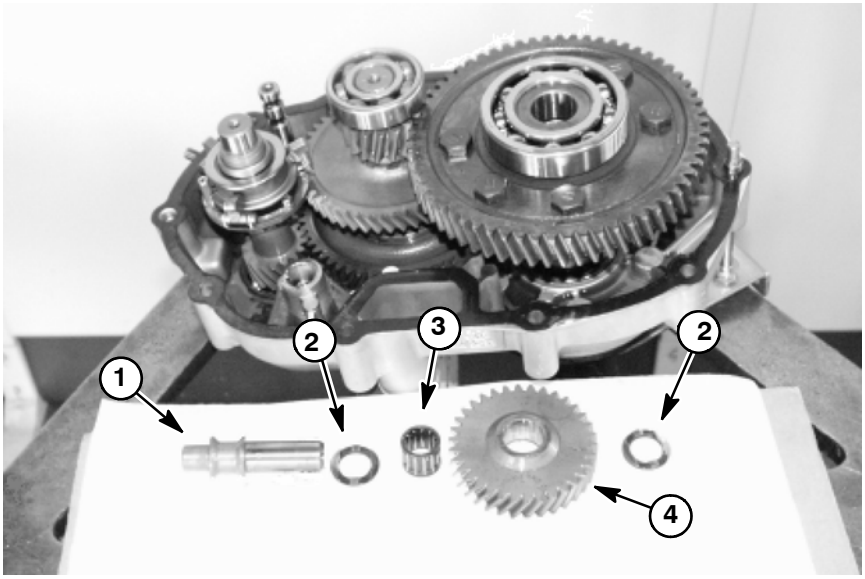

Figure 27

1. **Counter shaft**
2. **Spacer (2 used)**
3. **Needle bearing**
4. **Gear 34**

C. Replace counter shaft if it has abnormal wear, cracks or damage.

D. Replace spacer if either one is cracked or bent.

E. Replace needle bearing if needles are bent, do not rotate freely or do not remain in the bearing cage.

F. Replace gear 34 if worn or damaged. Cracked, broken, missing or chipped gear teeth are not acceptable.

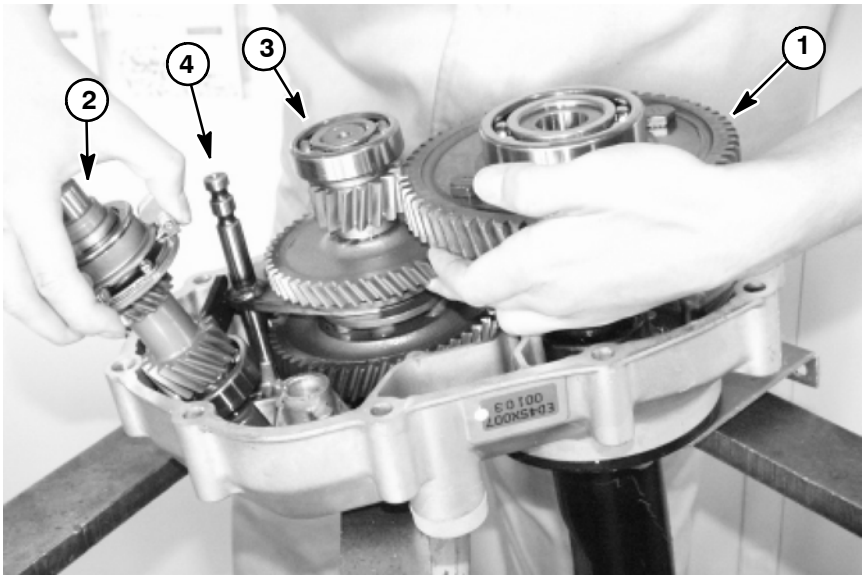

Figure 28

1. **Differential assembly**
2. **Input shaft assembly**
3. **Center shaft assembly**
4. **Shift shaft**

IMPORTANT: Make sure to not damage the oil seal when removing the input shaft.

NOTE: If any of the assemblies can not be pulled out by hand, hold the assembly while gently tapping the case with a plastic hammer. Make sure to tap equally around the case.

3. Remove axle case from case (RH and LH).

G. Lift up differential assembly, center shaft assembly and input shaft assembly at the same time. First, remove input shaft assembly. Then, remove center shaft assembly with the shift shaft and differential assembly.

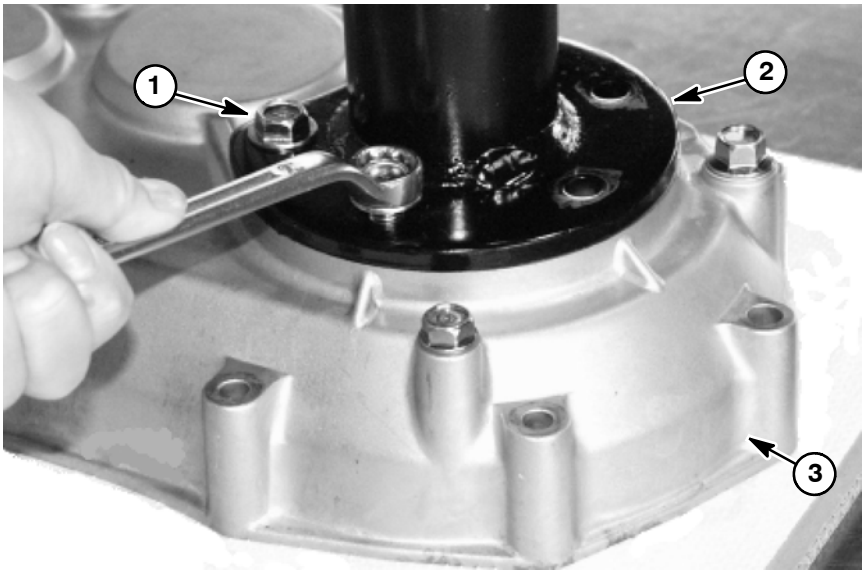

Figure 29

1. **Flange bolt**
2. **Axle case**
3. **Transaxle case**

A. Remove remaining two (2) flange bolts securing each axle case to the case. Remove axle case from the transaxle case.

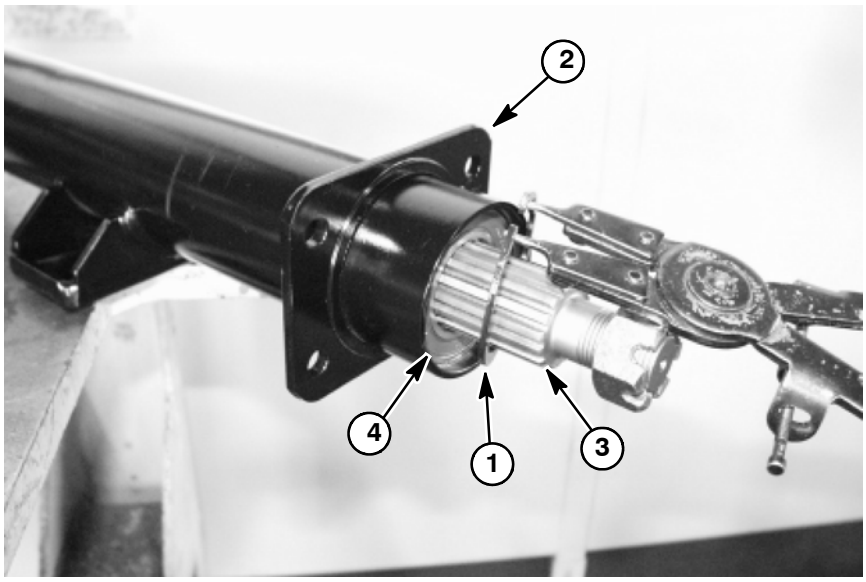

Figure 30

1. Snap ring
2. Axle case
3. Axle shaft
4. Ball bearing

IMPORTANT: Do not reuse snap ring. Discard and replace ring with new one.

B. Remove snap ring from the axle case. Remove axle shaft from case.

IMPORTANT: When replacing ball bearings, both ball bearings must be replaced as a set.

4. Disassemble input shaft assembly.

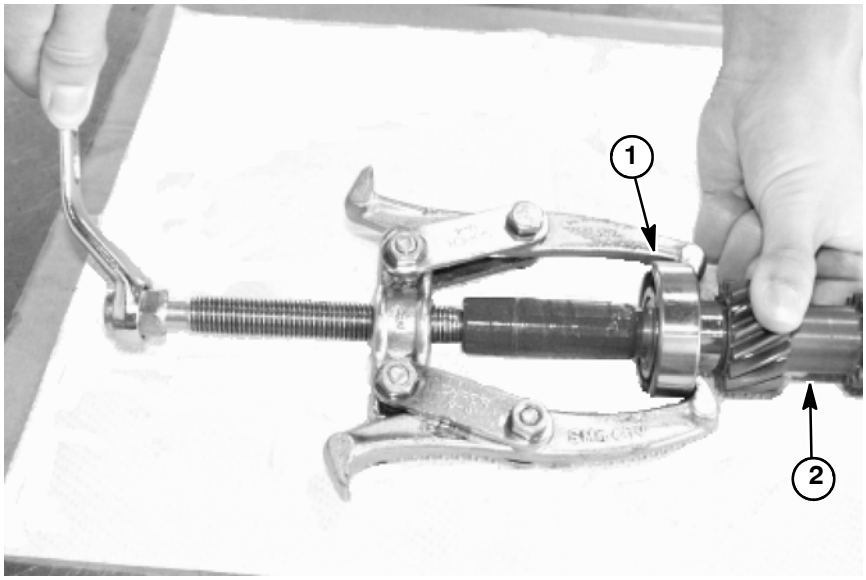

Figure 31

1. Ball bearing
2. Input shaft

IMPORTANT: Do not reuse ball bearings that have been removed.

A. Remove ball bearing from the input shaft with a bearing puller.

C. Ball bearing roller balls must be free of deformation and scoring. Ball bearing must spin freely and have minimum axial play. Replace ball bearing as necessary.

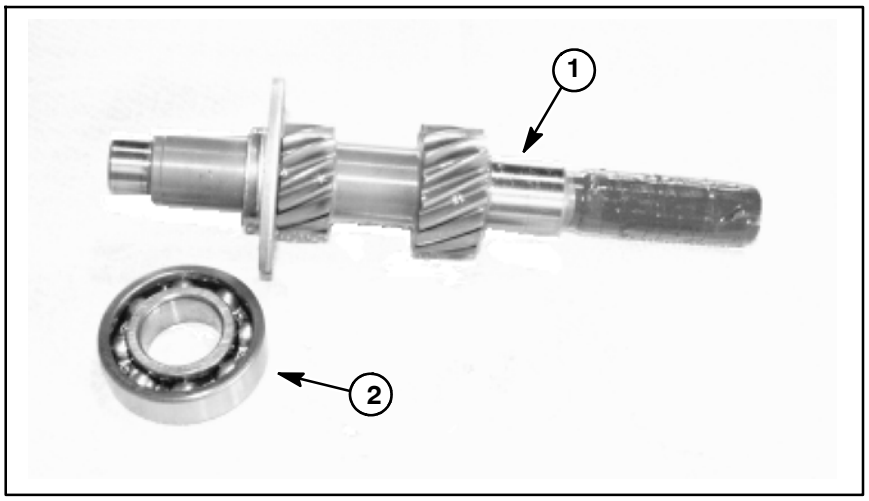

Figure 32

1. **Input shaft**
2. **Ball bearing**

B. Replace input shaft if worn or damaged. Gear teeth that are cracked, broken, chipped or missing are not acceptable.

C. Ball bearing roller balls must be free of deformation and scoring. Ball bearing must spin freely and have minimum axial play. Replace ball bearing as necessary.

5. Disassemble center shaft assembly.

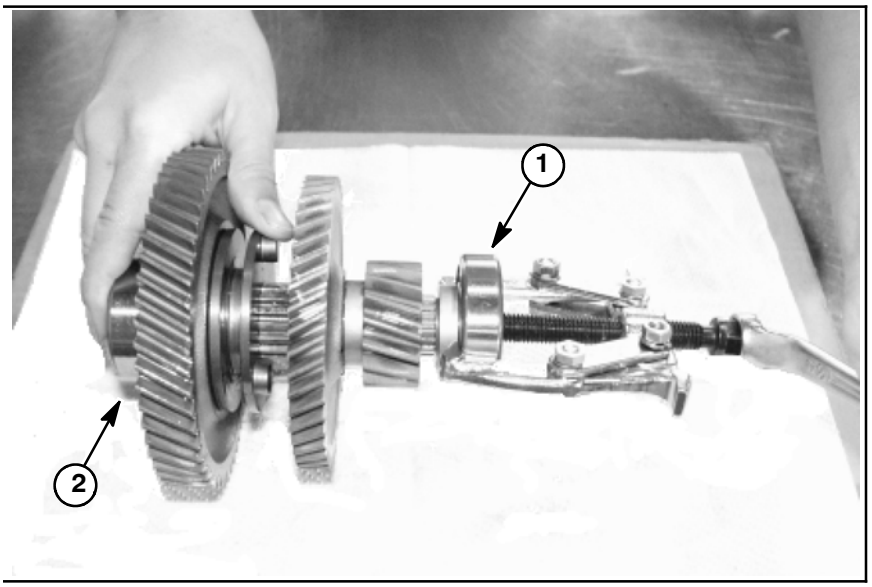

Figure 33

1. **Ball bearing**
2. **Ball bearing**

IMPORTANT: Do not reuse ball bearings that have been removed.

A. Remove ball bearings from the center shaft assembly. Discard removed bearings.

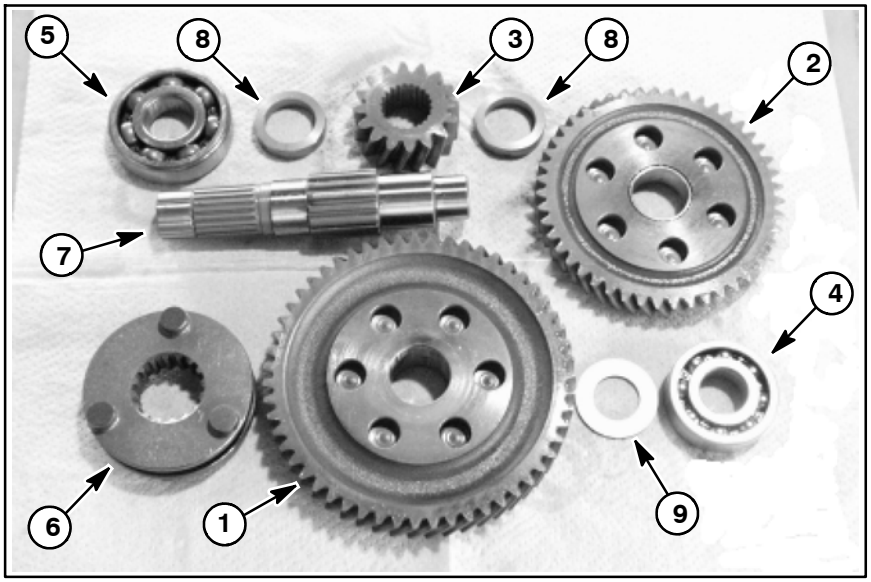

Figure 34

1. **Gear 55**
2. **Gear 47**
3. **Gear (small)**
4. **Ball bearing**
5. **Ball bearing**
6. **Pin clutch**
7. **Center shaft**
8. **Collar (2 used)**
9. **Spacer**

B. Remove gears, pin clutch, collars and spacer from the input shaft.

C. Replace gears if worn or damaged. Cracked, broken, missing or chipped gear teeth are not acceptable.

D. Replace center shaft if worn or damaged. Splines that are cracked, broken, chipped or missing are not acceptable.

E. Replace pin clutch if cracked or bent.

F. Replace collars or spacer if excessively worn or damaged. Replace both collars as a set.

6. Disassemble differential case assembly.

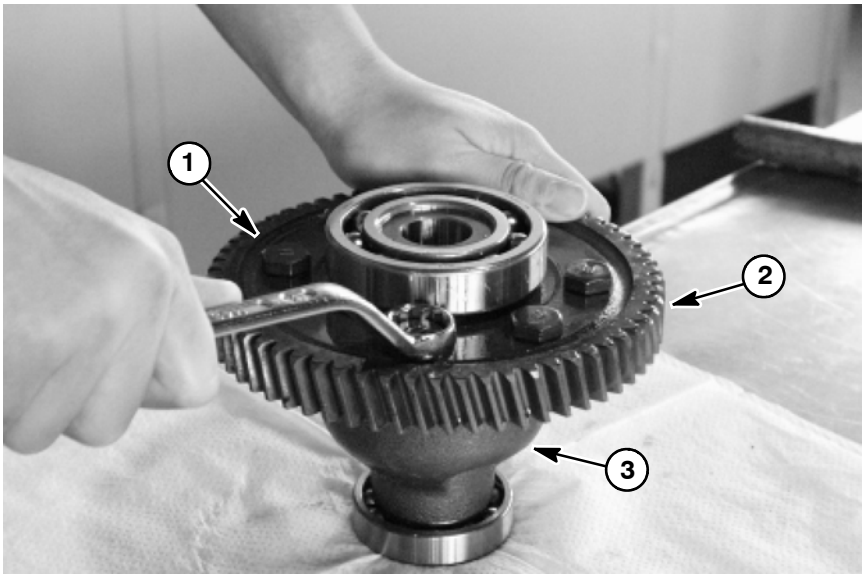

Figure 35

1. **Bolt (6 used)**
2. **Gear 62**
3. **Differential case**

A. Remove six (6) bolts securing gear 62 to the differential case.

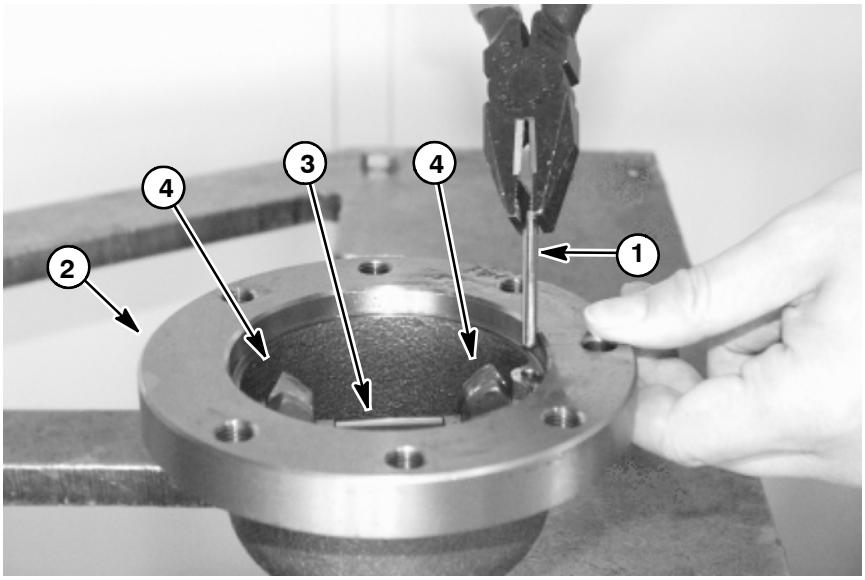

Figure 36

1. **Spring pin**
2. **Differential case**
3. **Pinion shaft**
4. **Pinion gear**

NOTE: The spring pin can be punched out from the hole on the opposite side of gear 62.

B. Remove spring pin from the differential case. Discard pin and replace it with new spring pin.

C. Remove pinion shaft and gears from the case. Separate gears from shaft.

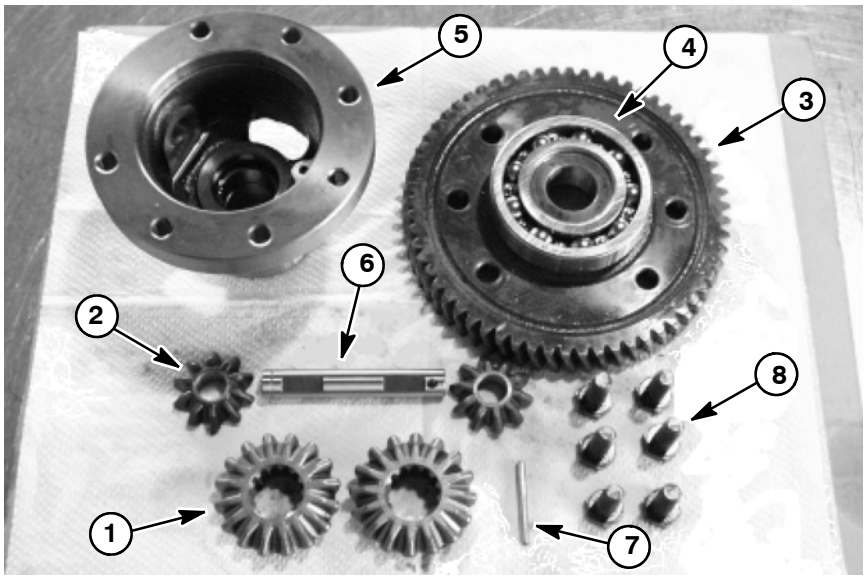

Figure 37

1. **Side gear (2 used)**
2. **Pinion gear (2 used)**
3. **Gear 34**
4. **Ball bearing**
5. **Differential case**
6. **Pinion shaft**
7. **Spring pin**
8. **Bolt (6 used)**

D. Replace gears if worn or damaged. Cracked, broken, missing or chipped gear teeth are not acceptable.

E. Ball bearing roller balls must be free of deformation and scoring. Ball bearing must spin freely and have minimum axial play. Replace ball bearing as necessary.

F. Replace case if machined areas where the side and pinion gears mesh are scored or if the pinion shaft fits loosely in its bore.

G. Replace pinion shaft if cracked or bent.

H. Replace oil seal if cracked, nicked or distorted such that it would not hold a proper seal.

Transaxle Assembly

1. Assemble input shaft assembly.

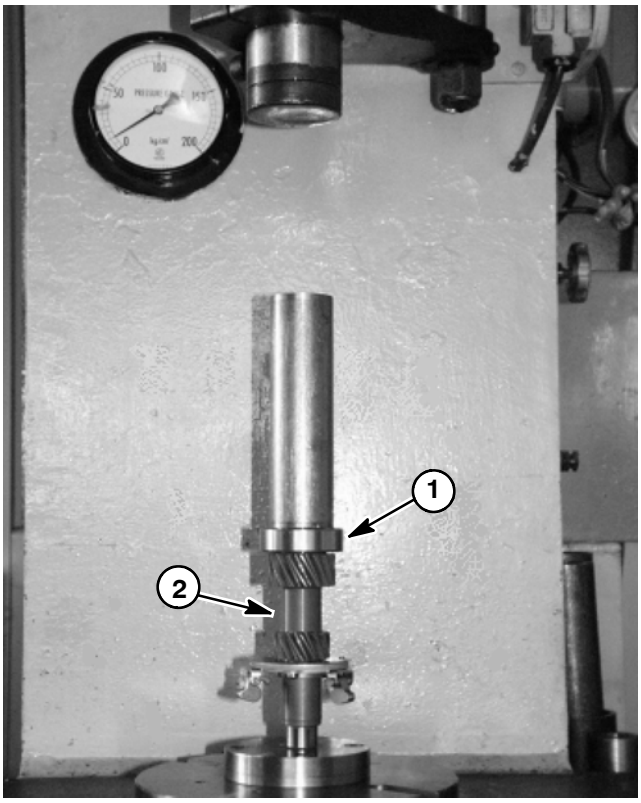

Figure 38

1. **Ball bearing**
2. **Input shaft**

IMPORTANT: Make sure to press ball bearing at the inner race to prevent damaging the ball bearing.

A. Press ball bearing onto the input shaft.

2. Assemble the center shaft assembly.

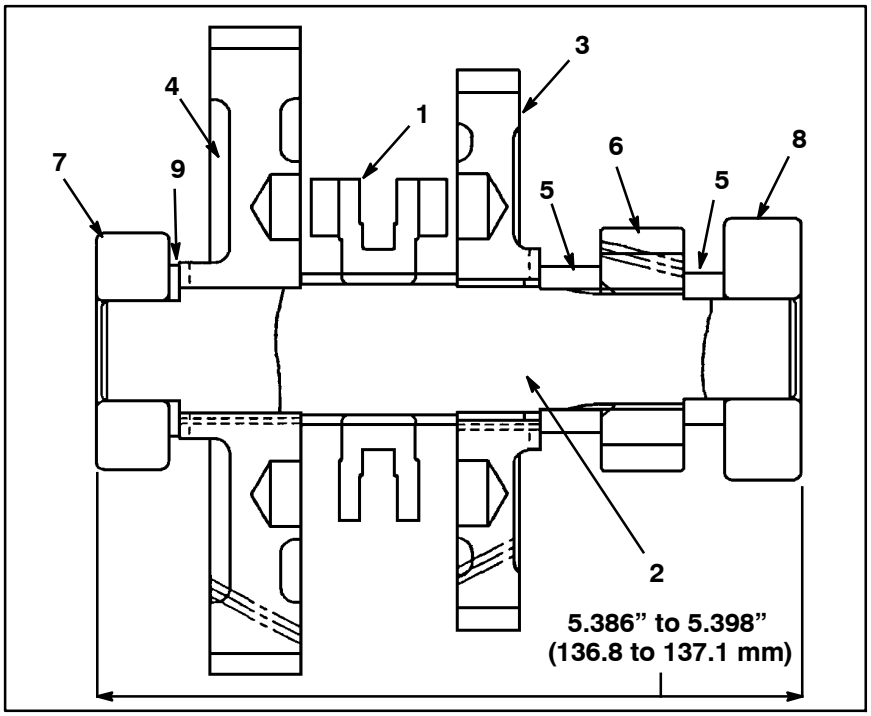

Figure 39

1. **Pin clutch**
2. **Center shaft**
3. **Gear 47**
4. **Gear 55**
5. **Collar**
6. **Gear (small)**
7. **Bearing**
8. **Bearing**
9. **Spacer**

NOTE: Before assembling, apply molybdenum disulfide grease to the inside of gears 47 and 55.

A. Slide pin clutch onto the centershaft. Install gears 47 and 55 onto shaft noting correct orientation of gears. Slide collars, small gear and spacer onto the center shaft.

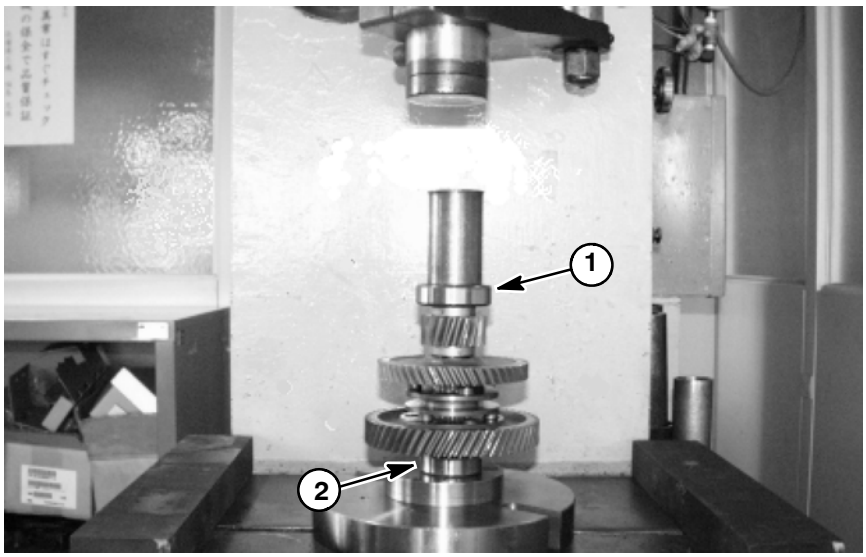

Figure 40

1. **Ball bearing**
2. **Ball bearing**

B. Press ball bearings onto the center shaft using a bearing press.

C. Make sure distance from one ball bearing outer edge to the other ball bearing outer edge is **5.386" to 5.398" (136.8 to 137.1 mm)** (Fig. 39).

Figure 41

D. The center shaft should appear as above when assembled.

3. Assemble differential assembly.

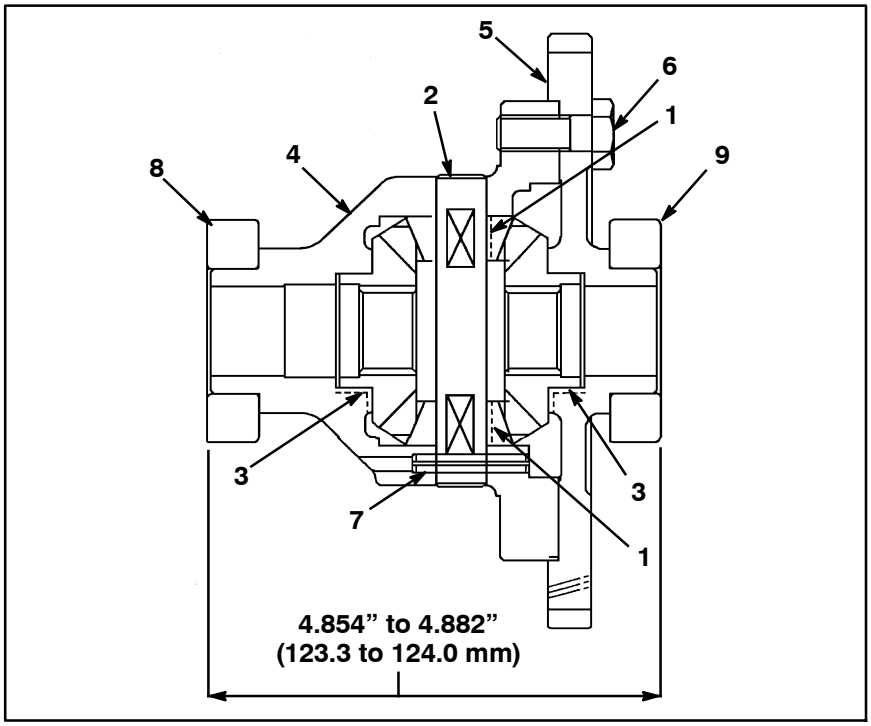

Figure 42

1. **Pinion gear (greased surface)**
2. **Pinion shaft**
3. **Side gear (greased surface)**
4. **Differential case**
5. **Gear 62**
6. **Bolt**
7. **Spring pin**
8. **Ball bearing**
9. **Ball bearing**

A. Apply molybdenum disulfide grease to the inside of both pinion gears where they contact the pinion shaft. Apply molybdenum disulfide grease to the outside of both side gears where they contact the differential case and gear 62.

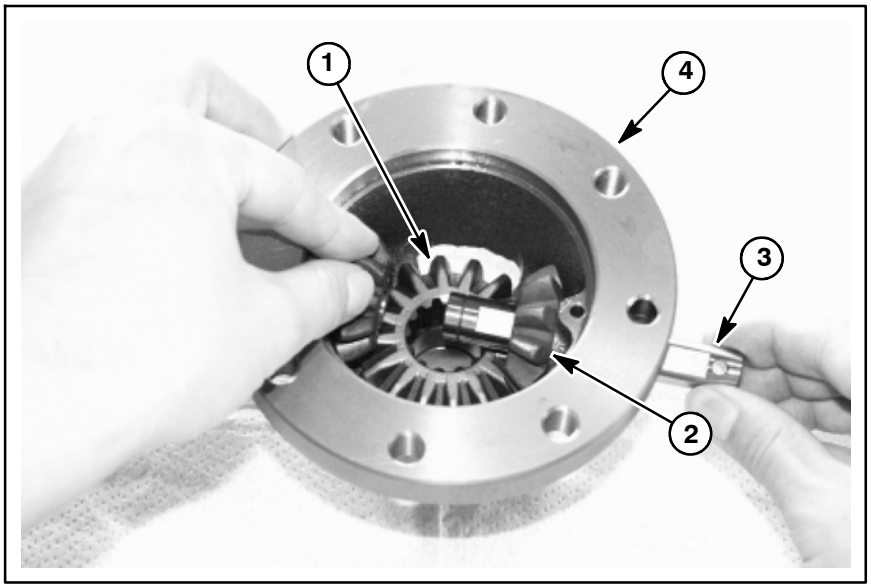

Figure 43

1. Side gear
2. Pinion gear
3. Pinion shaft
4. Differential case

B. Install side gear, both pinion gears and pinion shaft into the differential case.

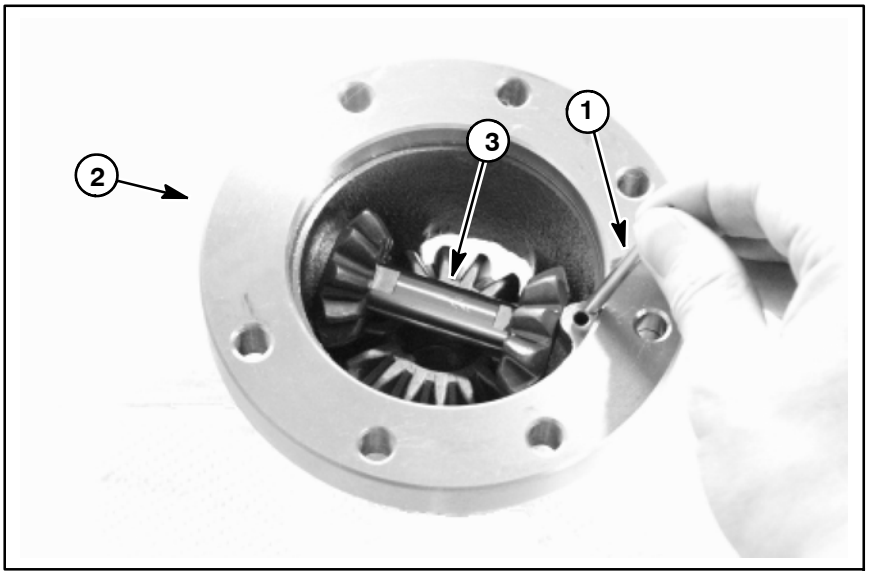

Figure 44

1. Spring pin
2. Differential case
3. Pinion shaft

C. Align pinion shaft hole and install new spring pin through the differential case and pinion shaft.

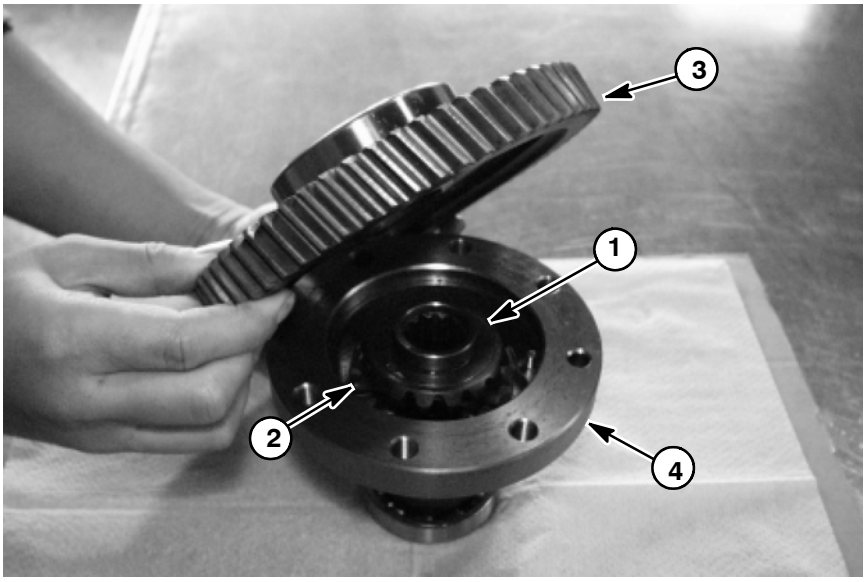

Figure 45

1. **Side gear**
2. **Pinion gear**
3. **Gear 62**
4. **Differential case**

D. Install remaining side gear to the pinion gears.

E. Secure gear 62 to the differential case with six (6) bolts. Torque bolts in a crossing pattern from **40 to 45 ft-lb (54 to 61 N-m)**.

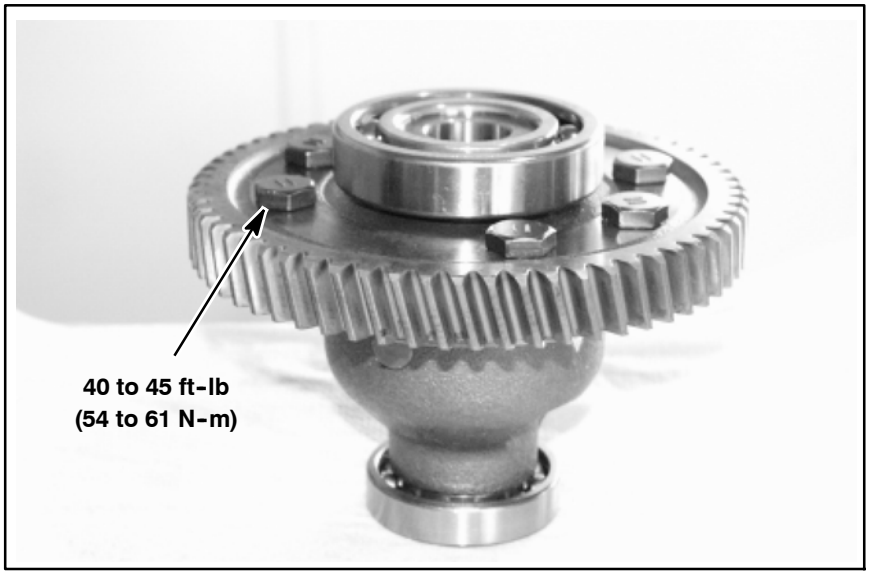

Figure 46

IMPORTANT: The length from the outer most side of each ball bearing must be from 4.854" to 4.882" (123.3 to 124.0 mm) (Fig. 42).

F. If ball bearings were removed, press new ball bearings onto differential case and gear 62.

G. The differential assembly should appear as above when assembled.

4. Install axle case to case (RH and LH).

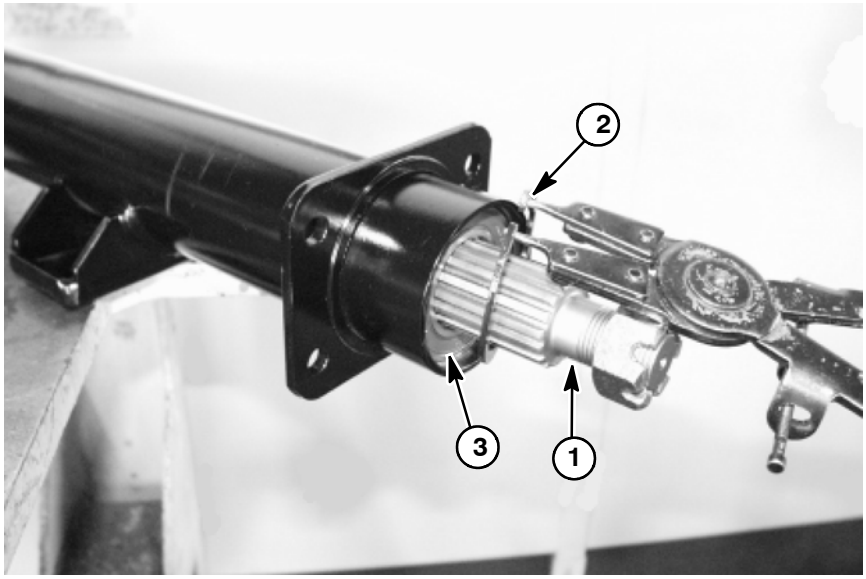

Figure 47

1. **Axle shaft**
2. **Snap ring**
3. **Ball bearing**

IMPORTANT: Do not reuse snap ring. Replace snap ring with new one.

A. Insert axle shaft with snap rings, collar and ball bearings into the axle case. Install snap ring to the axle case.

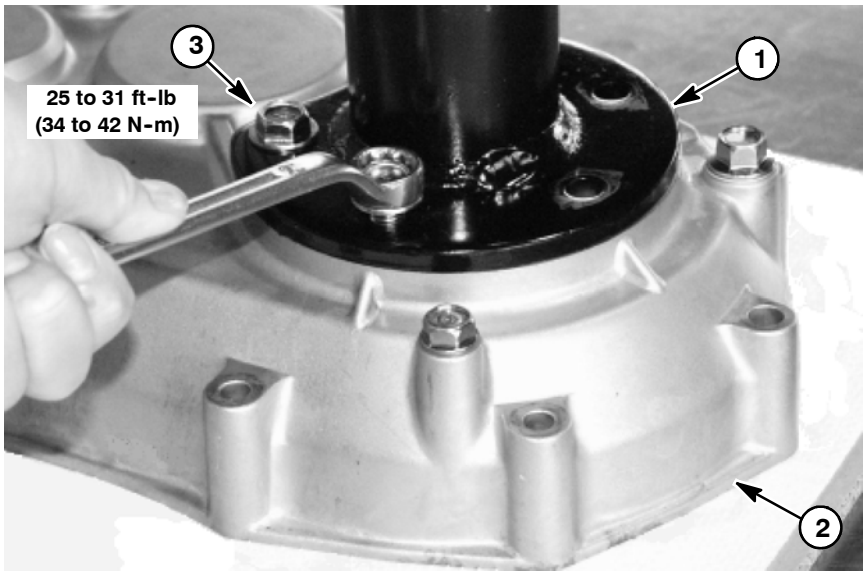

Figure 48

1. **Axle case**
2. **Case**
3. **Flange bolt**

IMPORTANT: Make sure to install the axle case to the proper side of the case. The right side of the case takes the short axle case, and the left side takes the long axle case.

IMPORTANT: Make sure to not damage the oil seal when installing the axle case to the case.

B. Install axle case to the case. Secure each axle case to the case with flange bolts. Torque bolts from **25 to 31 ft-lb (34 to 42 N-m)**.

5. Install input shaft, center shaft and differential assemblies to the case.

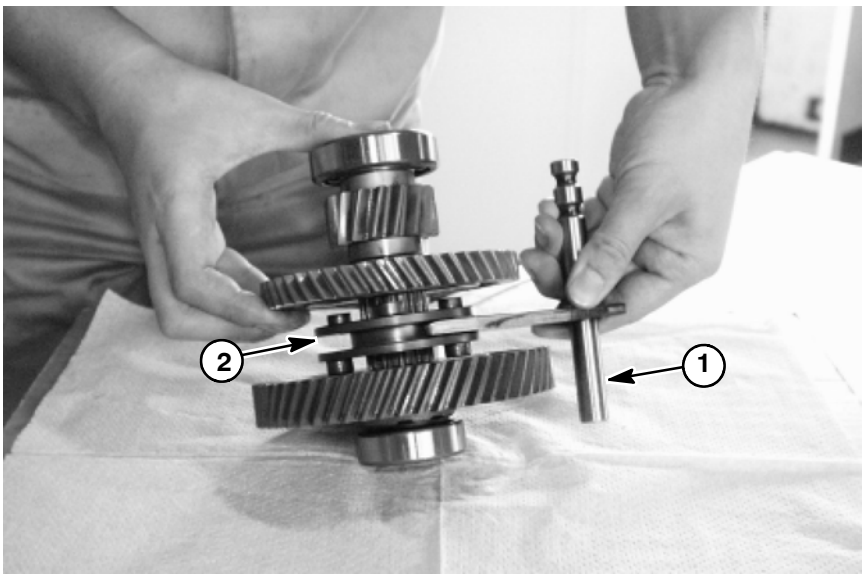

Figure 49

1. **Shift shaft**
2. **Clutch groove**

A. Insert fork of the shift shaft to the clutch groove of the center shaft assembly.

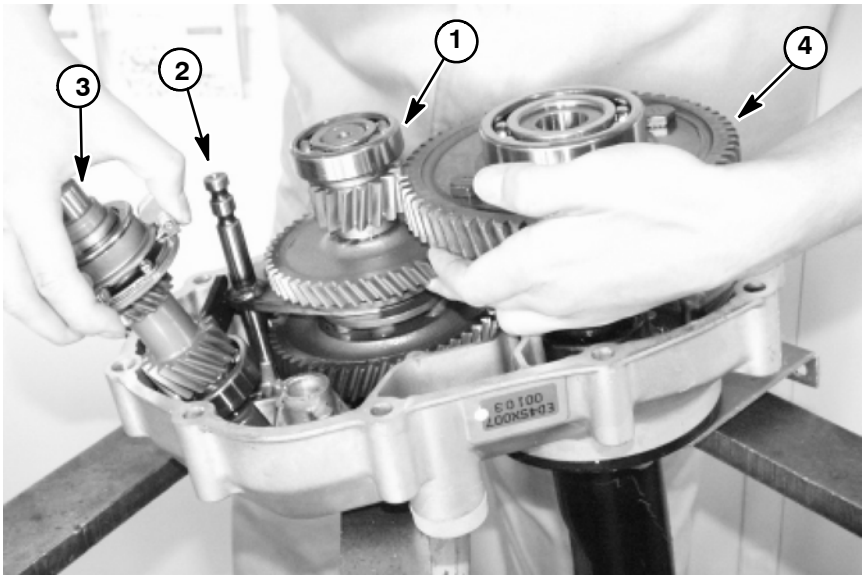

Figure 50

1. **Center shaft assembly**
2. **Shift shaft**
3. **Input shaft**
4. **Differential assembly**

B. Replace oil seals for the input and selector shafts on the case (LH) if cracked, nicked or distorted such that they would not hold a proper seal.

IMPORTANT: Make sure to not damage the oil seal when installing the input shaft.

C. Install center shaft assembly with shift shaft and differential assembly. Then, install input shaft assembly. Lower differential assembly, center shaft assembly and input shaft assembly into the case at the same time.

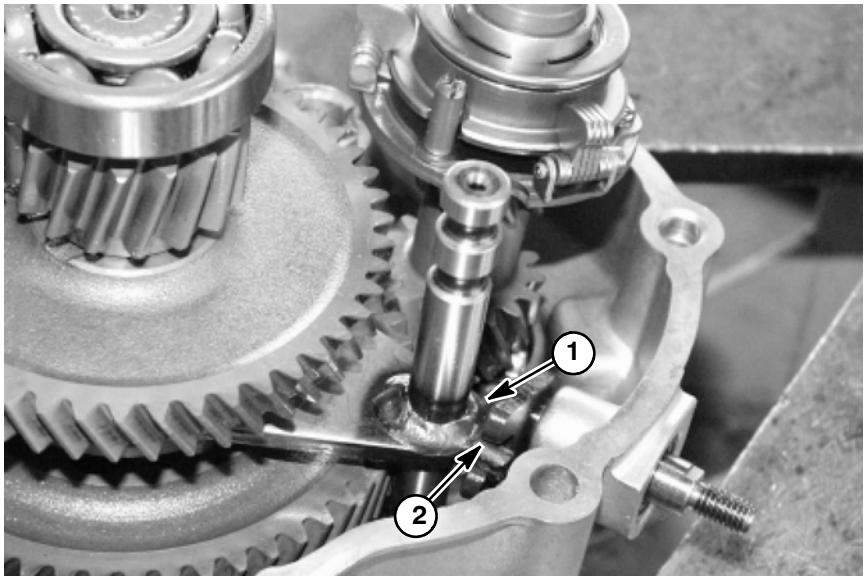

Figure 51

1. **Fork (selector shaft)**
2. **Pin (shift shaft)**

D. Make sure the selector shaft fork is contacting the pin on the shift shaft.

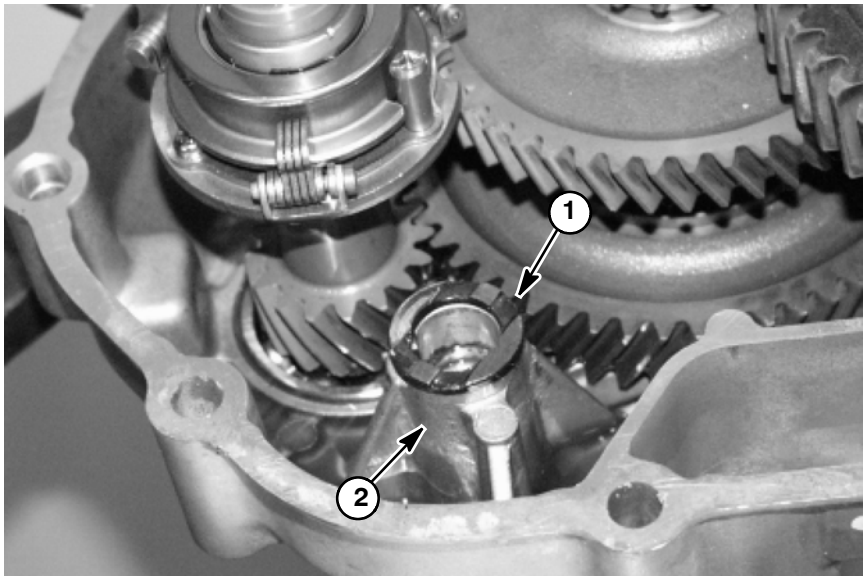

Figure 52

1. **Spacer**
2. **Boss (counter shaft)**

E. Place spacer on the counter shaft boss of the case (LH) so the oil groove faces up.

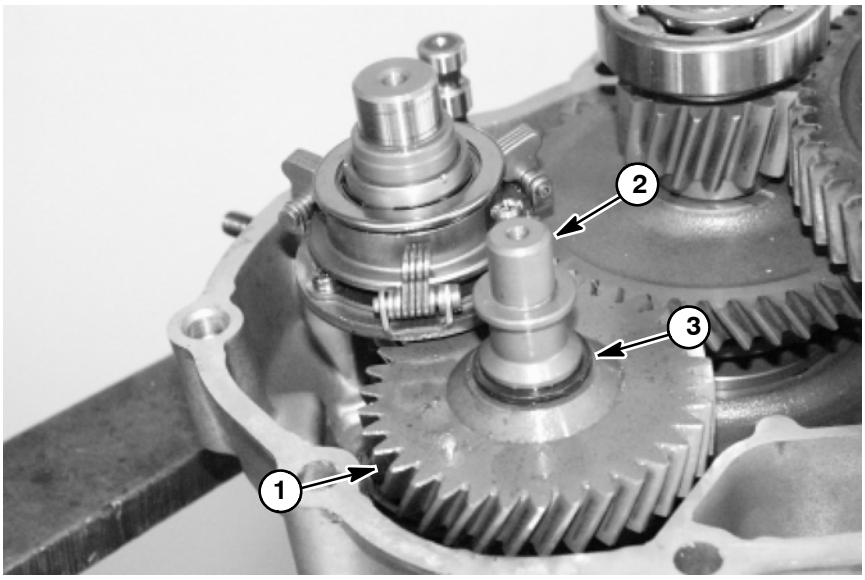

Figure 53

1. **Gear 34**
2. **Counter shaft**
3. **Spacer**

F. Apply molybdenum disulfide grease to the inside of gear 34 and the contact surface between the case and the counter shaft.

G. Place gear 34 onto the spacer. Make sure not to drop the spacer. Insert needle bearing into gear. Insert counter shaft with remaining spacer through the needle bearing, gear 34 and into the spacer and case.

6. Assemble case (LH and RH).

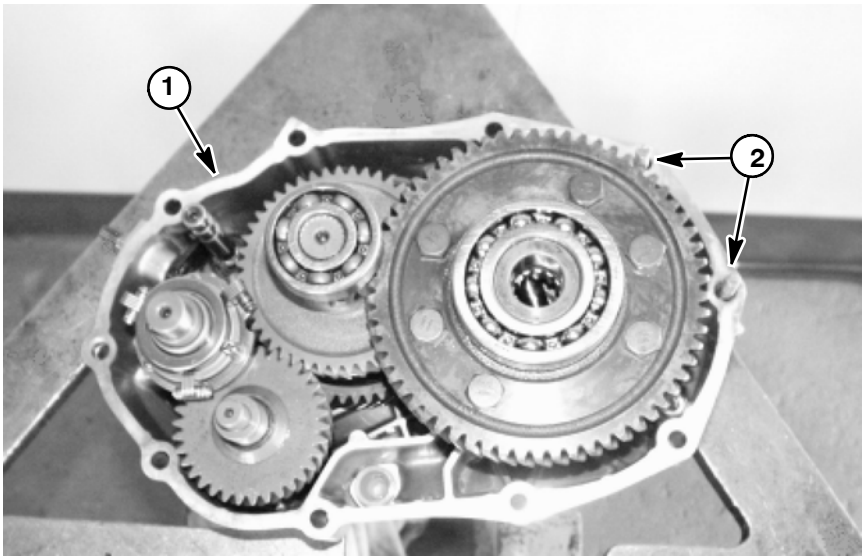

Figure 54

1. **Case (sealing surface)**
2. **Pipe knock**

A. Make sure gasket sealing surfaces of both cases are clean. Install gasket to case.

B. Install both pipe knocks to the case (LH).

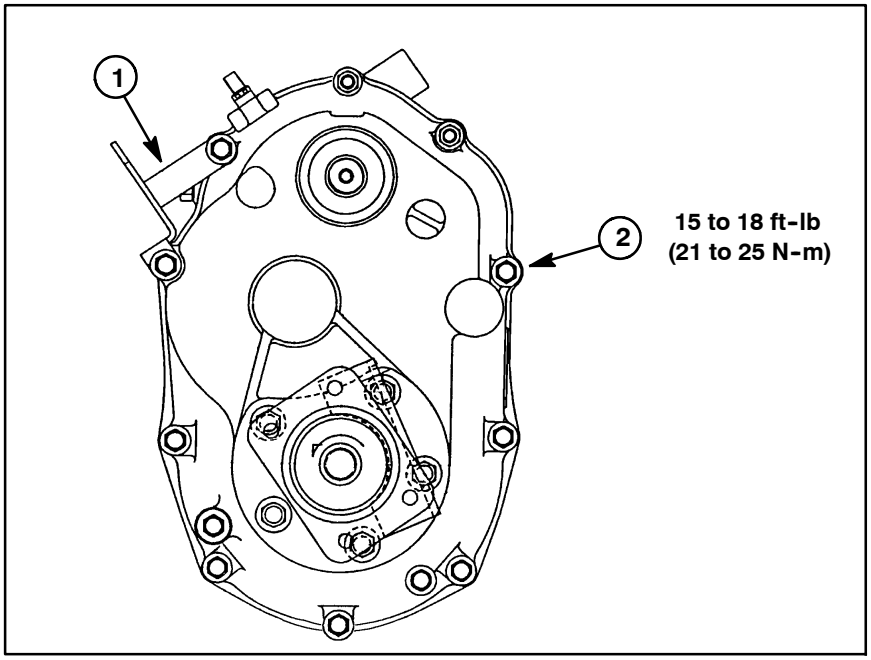

Figure 55

1. **Cable bracket**
2. **Flange bolt**

NOTE: Keep the gasket sealing surfaces of the cases as horizontal to each other as possible. If the sealing surfaces do not join to each other, tap the case lightly with a plastic hammer.

C. Install case (RH) so each shaft fits properly into the case.

D. Position cable bracket to transaxle cases.

E. Secure case (RH) to case (LH) with flange bolts and nuts. Torque bolts from **15 to 18 ft-lb (21 to 25 N-m)**.

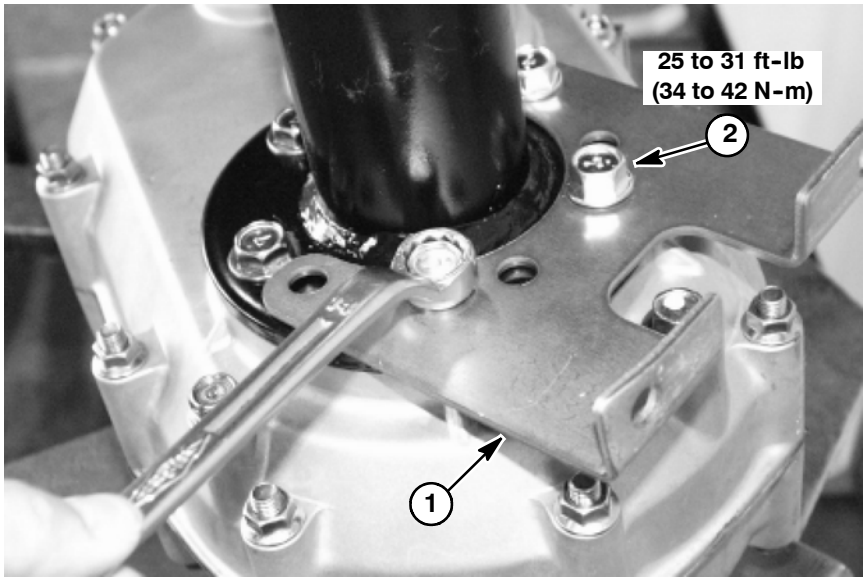

Figure 56

1. **Axle bracket**
2. **Flange bolt**

F. Position axle bracket to each axle case. Secure axle bracket to each axle case with flange bolts. Torque bolts from **25 to 31 ft-lb (34 to 42 N-m)**.

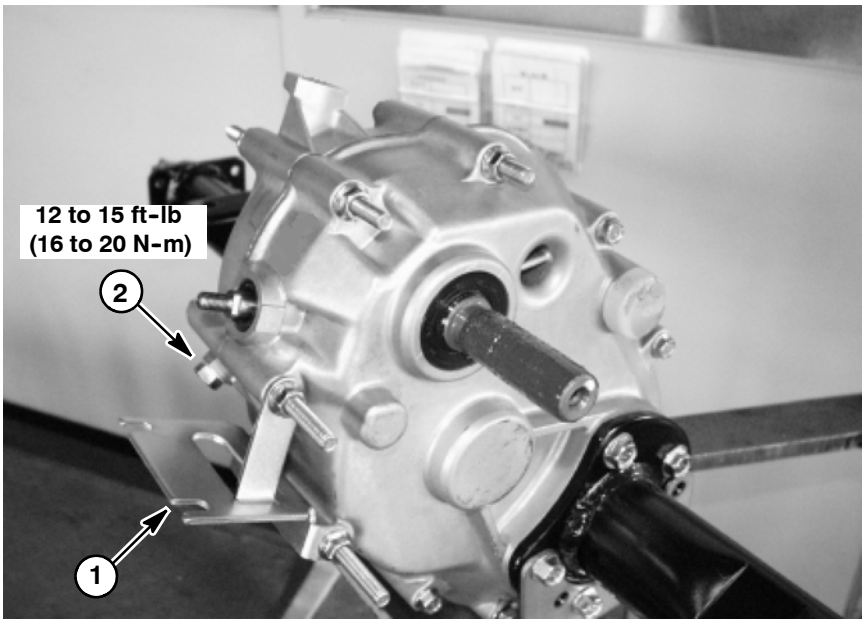

Figure 57

1. **Cable bracket**
2. **Bolt (steel ball, spring & gasket)**

G. Install steel ball, spring, gasket and bolt. Torque bolt from **12 to 15 ft-lb (16 to 20 N-m)**.

H. Fill transaxle with 1.5 quarts (1.4 liters) of new SAE 10W-30 motor oil.

Chapter 5

Electrical System

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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 Workman vehicle. Refer to the Operator's Manual for additional information when servicing the machine.

Electrical Drawings

The electrical schematic and other electrical drawings for the Workman MDX–D are located in Chapter 7 – Electrical Drawings.

Special Tools

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

Multimeter

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

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.

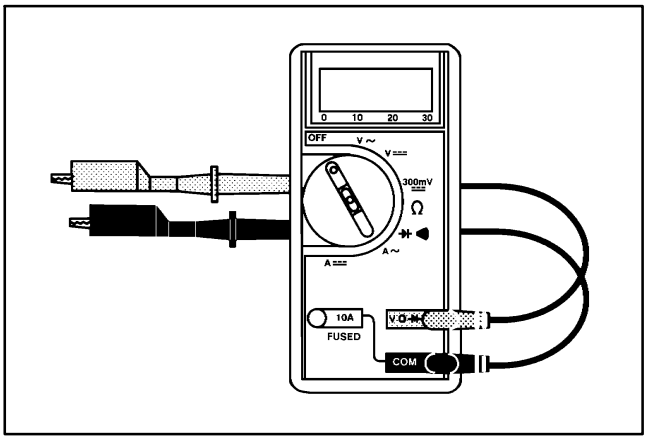

Figure 1

Skin–Over Grease

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

Toro Part Number: **TOR50547**

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

Dielectric Lubricant/Sealant

Dielectric lubricant should be used to prevent corrosion of non−sealed connection terminals. To ensure complete coating of terminals, liberally apply lubricant to both component and wire harness connector, plug connector to component, unplug connector, reapply lubricant to both surfaces and reconnect harness connector to component. Connectors should be thoroughly packed with lubricant for effective results.

Toro Part Number: **107−0342**

Figure 4

Battery Hydrometer

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

Figure 5

Troubleshooting

CAUTION

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

For effective troubleshooting and repairs, you must have a good understanding of the electrical circuits and components used on this vehicle (see electrical drawings in Chapter 7 – Electrical Drawings).

If the vehicle has any interlock switches by–passed, they must be reconnected for proper troubleshooting and safety.

Starting Problems

Problem	Possible Causes
Starter solenoid clicks, but starter will not crank.	Battery is discharged. Battery cables are loose or corroded. Battery ground to frame is loose or corroded. Wiring at starter is faulty. Starter solenoid is faulty. Starter is faulty and causing an incomplete circuit for the starter solenoid.
Nothing happens when start attempt is made.	Brake pedal is not depressed. Battery is discharged. In–line primary fuse (10 ampere) is loose or faulty. Battery cables are loose or corroded. Battery ground to frame is loose or corroded. Wiring to the start circuit components is loose, corroded or damaged (see electrical drawings in Chapter 7 – Electrical Drawings). Brake pedal switch is out of adjustment or faulty. Start relay or circuit wiring is faulty. The ignition switch or circuit wiring is faulty. Fuse block is faulty. Fusible link harness at the engine starter motor has faulty link(s) so battery power is not available to vehicle electrical system. Starter solenoid or circuit wiring is faulty.

Starting Problems (Continued)

Problem	Possible Causes
Engine cranks, but does not start.	Fuel tank is empty. Wiring to start circuits is loose, corroded or damaged (see electrical drawings in Chapter 7 – Electrical Drawings). Engine or fuel system is malfunctioning (see Chapter 3 – Diesel Engine). 15 ampere fuse in fuse block is faulty. Fuel pump or circuit wiring is faulty. Glow plugs, glow relay or glow plug controller are faulty. Wire harness fusible link to run solenoid pull coil is faulty. Engine and fuel may be too cold. Run solenoid is faulty.

General Run Problems

Problem	Possible Causes
Battery does not charge.	Wiring to the charging circuit components is loose, corroded or damaged (see electrical drawings in Chapter 7 – Electrical Drawings). Alternator or circuit wiring is faulty. Battery is faulty.
Engine stops during operation.	Wiring to the run circuit components became broken or disconnected (see electrical drawings in Chapter 7 – Electrical Drawings). Engine or fuel system is malfunctioning (see Chapter 3 – Diesel Engine).

Electrical System Quick Checks

Battery Test

Use a multimeter to measure the voltage between the battery terminals.

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 key should be off and all accessories turned off. Connect the positive (+) meter lead to the positive battery post and the negative (–) meter lead to the negative battery post.

NOTE: This test provides a relative condition of the battery. Load testing of the battery will provide additional and more accurate information.

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

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.

Remove battery cover to gain access to battery. 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: When 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.

Make sure the shift lever is in the neutral position and the parking brake is applied. Start the engine and run engine at high idle **(above 3000 RPM)**. Maintain engine speed to allow the battery to charge for at least three (3) minutes. Record the battery voltage.

After running the engine for at least three (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	= 12.95 v
Difference	= +0.65 v

Glow Plug Test

This is a fast, simple test that can help to determine the integrity and operation of your Workman MDX–D glow plug system. The test should be run anytime hard starting (cold engine) is encountered on a diesel engine equipped with a glow plug system.

Use a digital multimeter and/or inductive Ammeter (AC/DC Current Transducer). Properly connect the ammeter to the digital multimeter (refer to manufacturers' instructions) and set the multimeter to the correct scale. With the ignition switch in the OFF position, place the ammeter pickup around the main glow plug power supply wire and read the meter prior to activating the glow plug system. Adjust the meter to read zero (if applicable). Activate the glow plug system by turning the ignition switch to ON and record the multimeter results.

The Workman MDX–D glow plug system should have a reading of approximately nine (9) amps per glow plug (18 amps total). If low current reading is observed, one (or more) of the glow plugs is faulty.

Component Testing

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

NOTE: See the Kubota Workshop Manual, Diesel Engine, SM–E3B Series for engine component testing information.

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 ignition (key) switch has three positions (OFF, ON and START). The ignition switch is located on the dash panel (Fig. 6).

Testing

The switch terminals are identified as shown in Figure 7. The circuit wiring 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 switch terminals for each switch position. Disconnect wire harness connector from key switch and verify continuity between switch terminals in the different switch positions.

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

After testing is completed, connect wire harness connector to ignition switch.

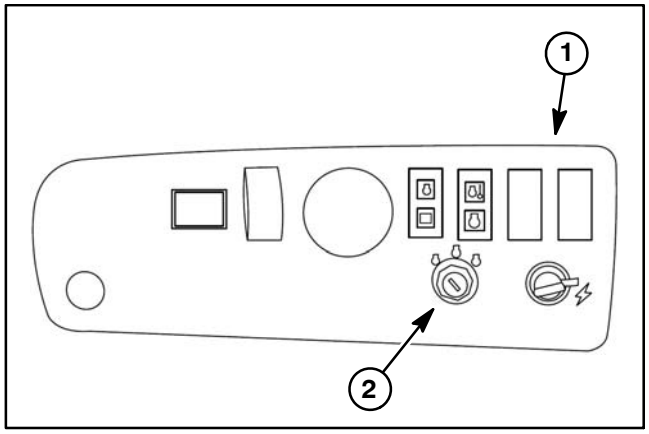

Figure 6

1. Dash panel
2. Ignition switch

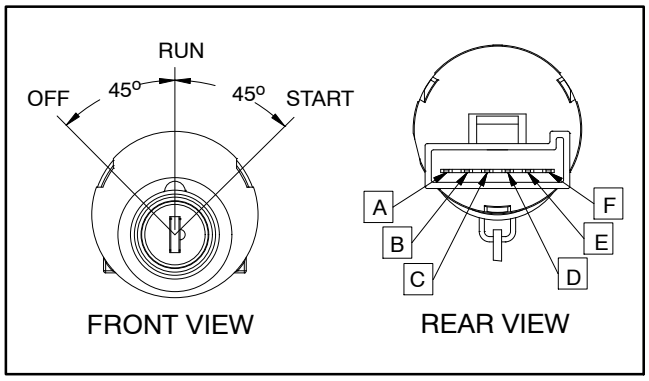

Figure 7

Indicator Lights

Charge Indicator Light

The charge indicator light should come on when the ignition switch is in the ON position with the engine not running. Also, it should illuminate with an improperly operating charging circuit while the engine is running.

Engine Oil Pressure Light

The engine oil pressure light should come on when the ignition switch is in the ON position with the engine not running. Also, it should illuminate with the engine running if the engine oil pressure drops to an unsafe level.

IMPORTANT: If the oil pressure indicator light is illuminated with the engine running, shut off the engine immediately.

To test the oil pressure light and circuit wiring, ground the wire attached to oil pressure switch located on the engine near the oil filter. Turn ignition switch to the ON position; the engine oil pressure light should come on indicating correct operation of the indicator light and circuit wiring.

Engine Temperature Light

If the engine coolant temperature reaches 230ºF (110ºC) (approximate), the engine temperature light will come on.

To test the engine temperature light and circuit wiring, turn ignition switch to the ON position and ground the wire attached to over temperature switch located on the engine water pump housing (see Over Temperature Switch in this section). The engine temperature light should illuminate while the wire is grounded.

Glow Plug Indicator Light

The glow plug light should come on when the ignition switch is placed in the ON position prior to placing the ignition switch in START. The light should stay lit for approximately six (6) seconds while the ignition switch is left in the ON position.

Testing Indicator Lights

1. Apply 12 VDC to indicator light terminals 1A and 2A (Fig. 9).

2. Ground indicator light terminals 1B and 2B (Fig. 9).

3. Both indicator lights should illuminate.

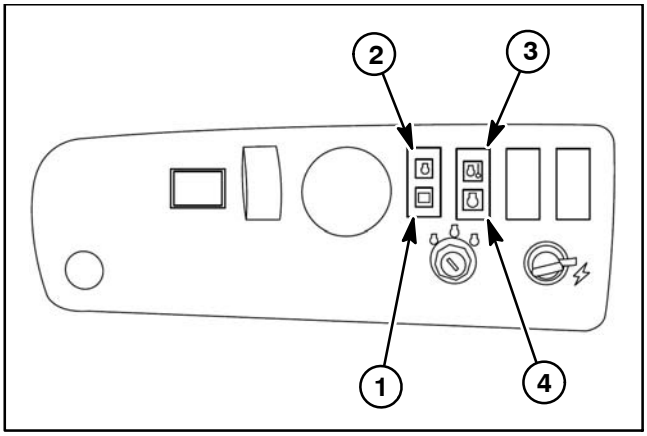

Figure 8

1. Charge Indicator
2. Engine oil pressure
3. Engine temperature
4. Glow plug indicator

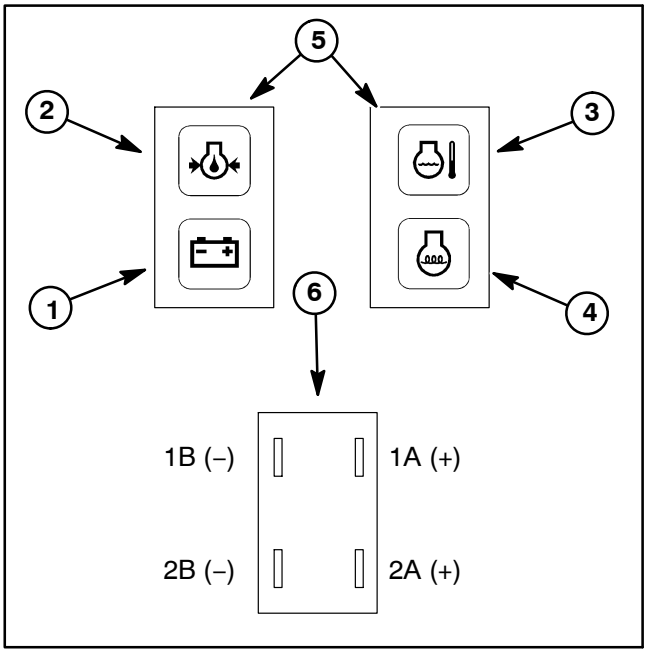

Figure 9

1. Charge indicator
2. Engine oil pressure
3. Engine temperature
4. Glow plug indicator
5. Indicator light front
6. Indicator light back

Fuse Blocks

The fuse block on Workman MDX−D vehicles is located beneath the dash panel.

In addition to the fuses in the fuse block, an in−line 10 amp fuse is included in the wire harness. This fuse protects the ignition switch circuits and also provides protection for the optional brake and signal light kit. The in−line fuse resides in a fuse holder under the dash panel near the fuse blocks (Fig. 11).

Fuse Identification and Function

Use Figure 10 to identify each individual fuse in the fuse block.

The upper row of fuses protect circuits as follows:

1. The extreme left 10 ampere fuse protects the power point circuit. This fuse also protects the circuit for the optional backup alarm (if equipped).

2. The middle left 10 ampere fuse protects the engine start circuit.

3. The middle right 10 ampere fuse protects the light circuit.

4. The extreme right 15 ampere fuse protects the circuits for engine electrical components and also dash indicators (hour meter and indicator lights).

The lower row of fuses protect circuits as follows:

1. The extreme left fuse position is not used.

2. The middle left 15 ampere fuse protects the circuit for the optional cargo box lift.

3. The middle right 15 ampere fuse protects the circuit for the optional rear lift kit.

4. The extreme right 30 ampere fuse protects the circuit for the horn (if equipped).

Fuse Testing

Make sure that ignition switch is OFF and key is removed from switch. Remove fuses from the fuse block for testing. A fuse in usable condition should have continuity between the fuse terminals. A faulty fuse will not have continuity between the fuse terminals.

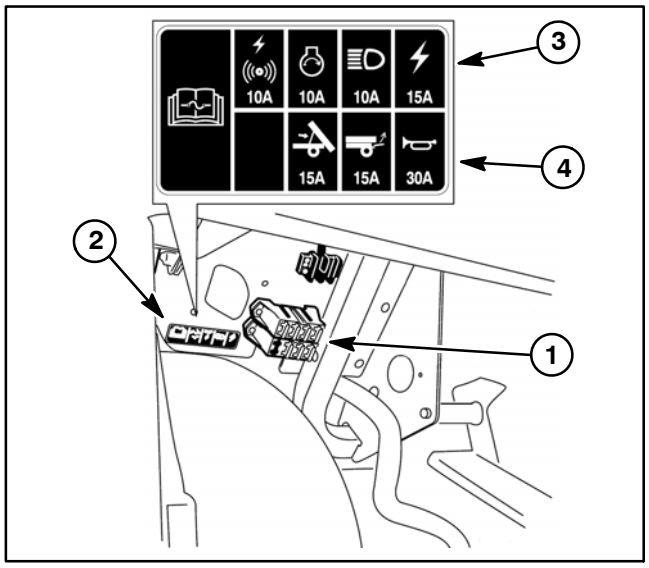

Figure 10

1. **Fuse blocks**
2. **Fuse decal**
3. **Upper fuses**
4. **Lower fuses**

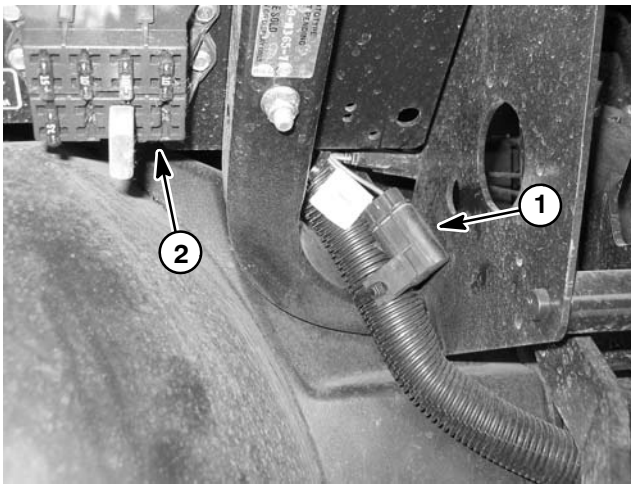

Figure 11

1. **In−line fuse**
2. **Fuse block**

Fusible Links

The Workman MDX–D uses four (4) fusible links for circuit protection. Three (3) of these fusible links are included in a wire harness that connects the starter B+ terminal to the vehicle wire harness (Fig. 12). The remaining fusible link is included in the engine wire harness and connects the starter G terminal to the engine run solenoid pull coil. If any of these links should fail, current to the protected circuit will cease. Refer to the electrical schematic and wire harness drawings in Chapter 7 – Electrical Drawings for additional circuit information.

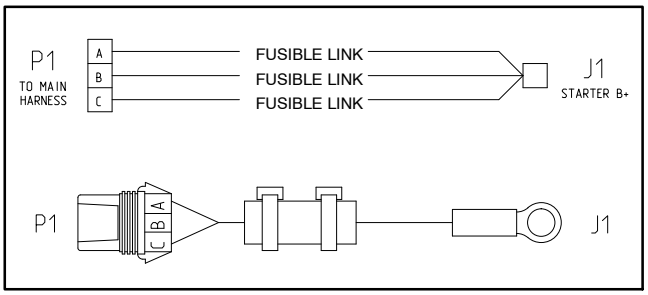

Figure 12

Testing

Make sure that ignition switch is OFF. Disconnect negative battery cable from battery terminal and then disconnect positive cable from battery (see Battery Service in the Service and Repairs section of this chapter). Locate and unplug fusible link connector. Use a multimeter to make sure that continuity exists between the fusible link terminals. If a fusible link is open, replace the link.

After testing is complete, make sure that fusible link is securely attached to engine component and wire harness. Connect positive battery cable to battery terminal first and then connect negative cable to battery.

Hour Meter

Testing

IMPORTANT: Make sure to observe polarity on the hour meter terminals when testing. Damage to the meter may result from an improper connection.

1. Unplug wire harness connector from hour meter.

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

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

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

5. Disconnect voltage source from the hour meter. Reconnect wire harness connector to hour meter.

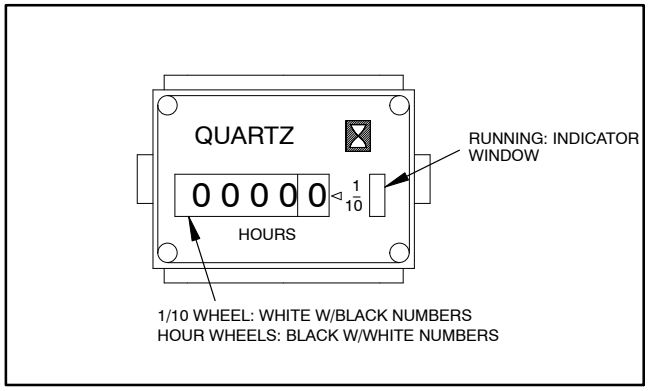

Figure 13

Headlight Switch

The headlight switch is located on the dash panel (Fig. 14). This rocker switch allows the headlights to be turned on and off.

Testing

The switch terminals are marked as shown in Figure 15. The circuitry of the headlight 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 position. Verify continuity between switch terminals.

SWITCH POSITION	NORMAL CIRCUITS	OTHER CIRCUITS
ON	2 + 3	5 + 6
OFF	1 + 2	4 + 5

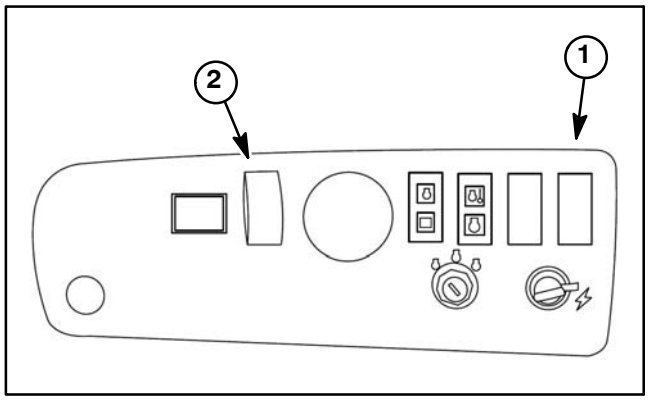

Figure 14

1. Dash panel **2. Headlight switch**

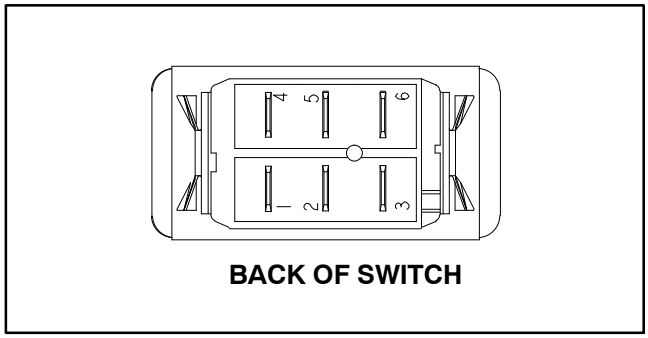

Figure 15

Brake Switch

The brake switch is a normally closed switch that opens when the brake pedal **is not** applied. When the brake pedal **is** applied, the brake pedal moves away from the switch plunger to allow the switch to be in its normally closed state. The brake switch is attached to the pedal support frame under the dash panel (Fig. 16).

Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch.

2. Locate brake switch for testing. Disconnect vehicle wire harness electrical connector from the brake switch.

3. Check the continuity of the switch by connecting a multimeter (ohms setting) across the connector terminals.

4. When the switch plunger is extended (brake pedal **is** applied), there should be continuity (closed) between the switch terminals.

5. When the switch plunger is depressed (brake pedal **is not** applied), there should not be continuity (open) between the switch terminals.

6. Replace brake switch if testing determines that it is faulty. When installing switch, make sure that the brake pedal does not bottom switch when the pedal is released.

7. If the brake switch tests correctly and a circuit problem still exists, check wire harness (see Electrical Schematic and Circuit Drawings in Chapter 7 – Electrical Drawings).

8. When switch testing is completed, connect switch connector to vehicle wire harness.

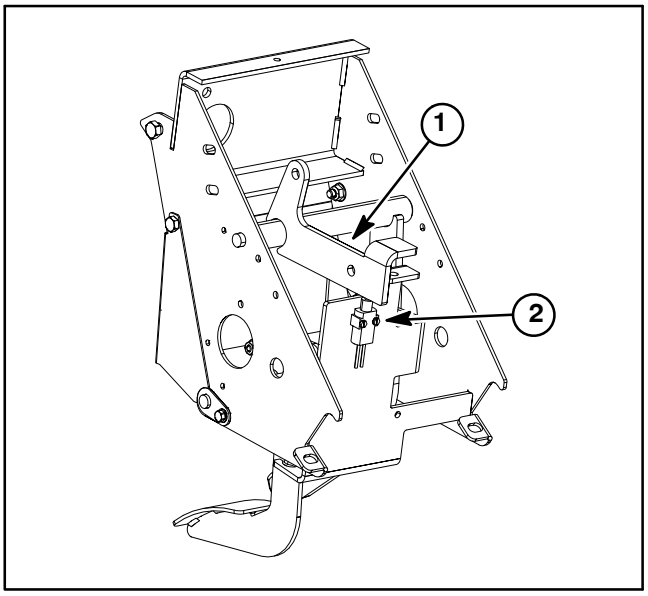

Figure 16

1. **Brake pedal assembly**
2. **Brake switch**

Main Power and Glow Relays

The Workman MDX–D main and glow relays are attached to the front of the dash bracket and can be accessed by raising the hood (Fig. 17). The vehicle wire harness is attached to the main and glow relays with four (4) wire connectors. Relays can be identified by a tag on the wire harness.

The main power relay is used to provide current to the fuse blocks. When the ignition switch is in the ON or START position, the main power relay is energized.

The glow relay is used to provide current to the engine glow plugs when the relay is energized by the glow plug controller.

Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch. Open and support hood to access relays.

2. Make sure ignition switch is in the OFF position. Disconnect wire harness electrical connector from relay that is to be tested. Remove relay from dash bracket 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 relay being testing.

3. Verify coil resistance between terminals 85 and 86 with a multimeter (ohms setting). Resistance should be approximately **72 ohms**.

4. Connect multimeter (ohms setting) leads to relay terminals 30 and 87. Ground terminal 86 and apply +12 VDC to terminal 85. The relay should make and break continuity between terminals 30 and 87 as +12 VDC is applied and removed from terminal 85.

5. Disconnect voltage and leads from the relay terminals. Replace relay if testing determines that it is faulty.

6. Secure relay to dash bracket and connect wire harness electrical connector to relay after testing is completed.

7. Close and secure hood.

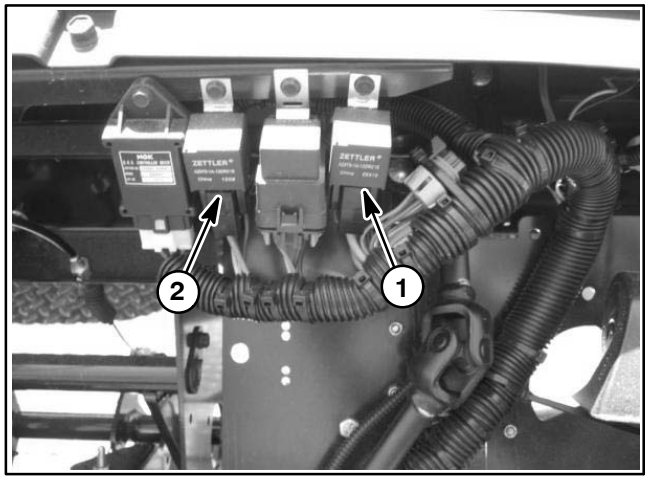

Figure 17

1. **Main power relay** 2. **Glow relay**

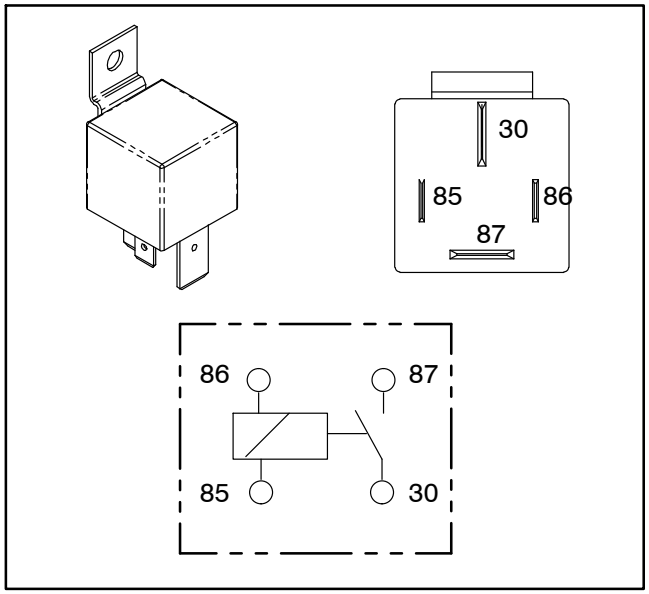

Figure 18

Start Relay

The Workman MDX−D start relay provides electrical current to the engine starter solenoid when energized. The relay is energized when the ignition switch is in the START position and the brake pedal is depressed (brake switch closed). The start relay is attached to the front of the dash bracket and can be accessed by raising the hood (Fig. 19). The vehicle wire harness is attached to the start relay with a five (5) wire connector. The relay can be identified by a tag on the wire harness.

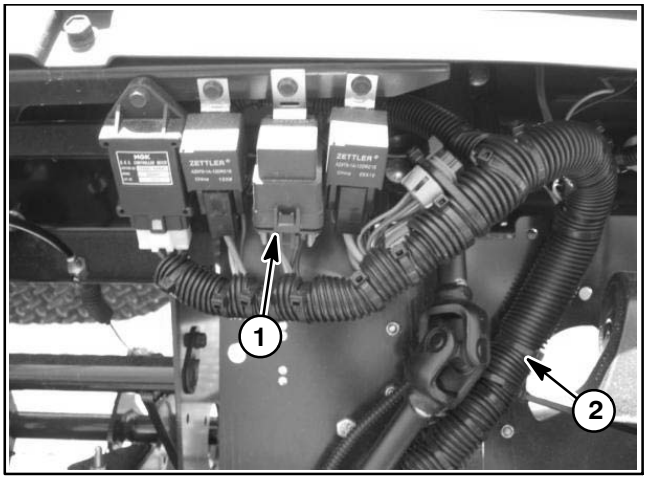

Figure 19

1. Start relay
2. Wire harness

Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch. Open and support hood to access start relay.

2. Locate start relay and disconnect the machine wire harness connector from the relay. Remove relay from from dash bracket 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 relay being testing.

3. Using a multimeter (ohms setting), measure coil resistance between terminals 85 and 86 (Fig. 20). Resistance should be between **70 and 90 ohms**.

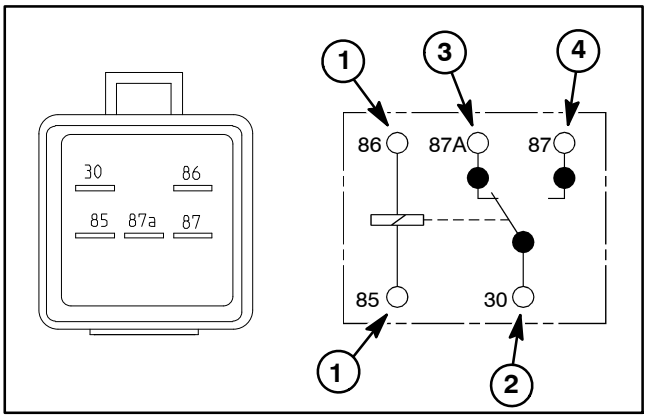

Figure 20

1. Coil terminal
2. Common terminal
3. Normally closed term.
4. Normally open term.

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

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

6. Connect multimeter (ohms setting) leads to relay terminals 30 and 87A. With terminal 86 grounded, apply +12 VDC to terminal 85. The relay terminals 30 and 87A should not have continuity as +12 VDC is applied to terminal 85. The relay terminals 30 and 87A should have continuity as +12 VDC is removed from terminal 85.

7. When relay testing is completed, disconnect voltage and multimeter leads from the relay terminals. Replace relay if testing determines that it is faulty.

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

9. Lower and secure hood.

Glow Plug Controller

The glow plug controller is attached to the front of the dash bracket and can be accessed by raising the hood (Fig. 21).

NOTE: When troubleshooting the glow controller, refer to electrical drawings in Chapter 7 – Electrical Drawings.

Glow Plug Controller Operation

1. When the ignition switch is initially placed in the ON position, the glow plug controller energizes the glow plugs for six (6) seconds. The console glow plug indicator light will also be illuminated for six (6) seconds.

2. When the ignition switch is turned to the START position, the glow plugs will energize as long as the switch is held in START. The console glow plug indicator light will **not** be illuminated.

3. When the ignition switch is released from the START to the ON position, the glow plugs will de–energize and the console glow plug indicator light will remain off.

Glow Plug Controller Checks

1. Make sure there is electrical power from the battery.

2. Disconnect the wire harness electrical connector from the engine run solenoid to prevent the engine from starting (see Engine Run Solenoid in this section).

3. Place ignition switch in the ON position. Verify the following while in the ON position:

   A. Glow plug indicator light is illuminated.

   B. Glow relay is energized.

   C. Glow plugs are energized.

   D. Glow plug indicator light goes out and glow plugs de–energize after approximately six (6) seconds.

4. Place ignition switch in the START position. Verify the following while in the START position:

   A. Glow plug indicator light is not illuminated.

   B. Glow relay is energized.

   C. Glow plugs are energized.

   D. Electrical power exists at terminal 1 of the glow plug controller.

NOTE: If there is no electrical power at terminal 1 of the glow plug controller, verify continuity of the circuitry from the ignition switch to the controller and perform Step 4 again (see Chapter 7 – Electrical Drawings).

5. If any of the conditions in Step 3 are not met or electrical power to controller terminal 1 exists and any of the other conditions in Step 4 are not met:

   A. Verify continuity of the circuitry from the battery to the glow relay and glow plugs (see Chapter 7 – Electrical Drawings).

   B. Verify continuity of the circuitry from the battery to ignition switch, glow plug controller, glow plug indicator light, glow relay and ground (see Chapter 7 – Electrical Drawings).

   C. Repair or replace components as necessary.

6. After testing is completed, connect wire harness electrical connector to the engine run solenoid.

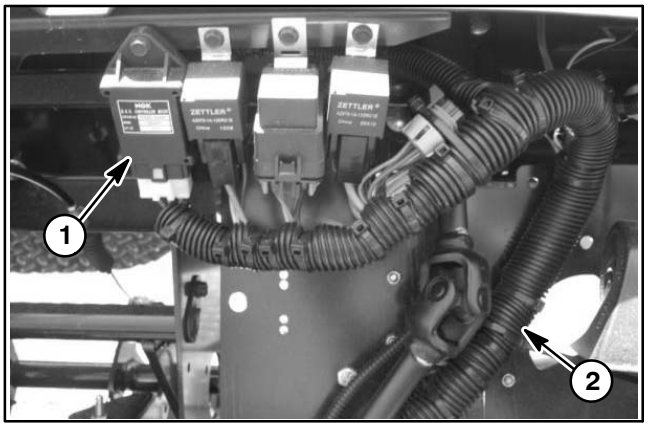

Figure 21

1. Glow plug controller **2. Wire harness**

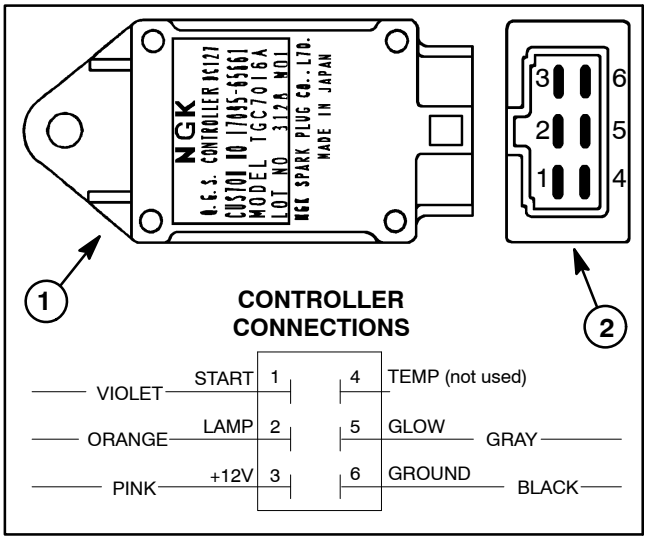

Figure 22

1. Controller top view **2. Controller end view**

Engine Run Solenoid

The engine run solenoid used on Workman MDX−D vehicles must be energized for the diesel engine to run. The run solenoid is mounted to the injection pump on the engine (Fig. 23). The run solenoid is energized when the ignition switch is in either the ON or START position.

The engine run solenoid includes two (2) coils for operation: the pull coil and the hold coil. When the ignition switch is turned to START, the fuel solenoid pull coil is energized and the solenoid plunger retracts. Once the plunger is retracted, the hold coil will keep it retracted for continued engine operation. When the solenoid is de−energized, the plunger extends to shut off fuel supply to the engine causing the engine to stop running.

NOTE: A fusible link in the engine wire harness protects the engine run solenoid pull coil circuit. If this link should fail, the run solenoid will not function and the engine will not run. Refer to electrical drawings in Chapter 7 − Electrical Drawings when troubleshooting the run solenoid.

NOTE: See Kubota Workshop Manual, Diesel Engine, SM−E3B Series for information regarding engine run solenoid testing procedure.

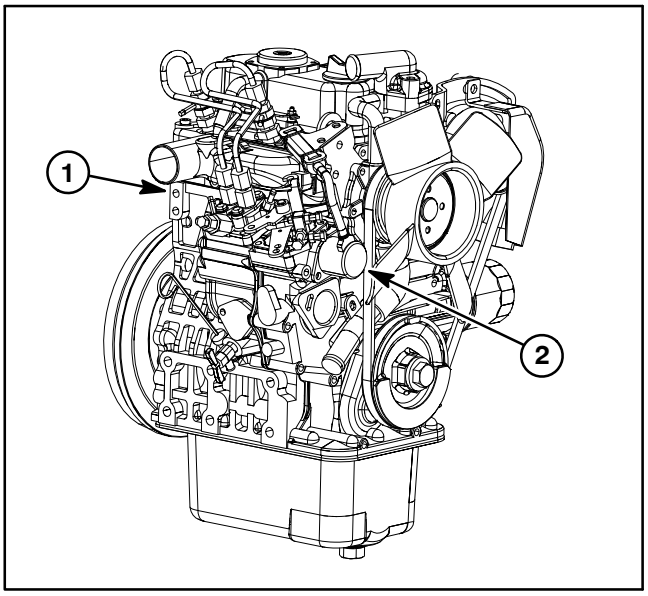

Figure 23

1. **Engine assembly**
2. **Engine run solenoid**

Over Temperature Switch

The over temperature switch is located on the engine thermostat housing near the alternator (Fig. 24). If the engine coolant temperature reaches 230ºF (110ºC) (approximate), the over temperature switch closes which causes the dash panel engine temperature light to come on. The over temperature switch has a gray wire connected to it.

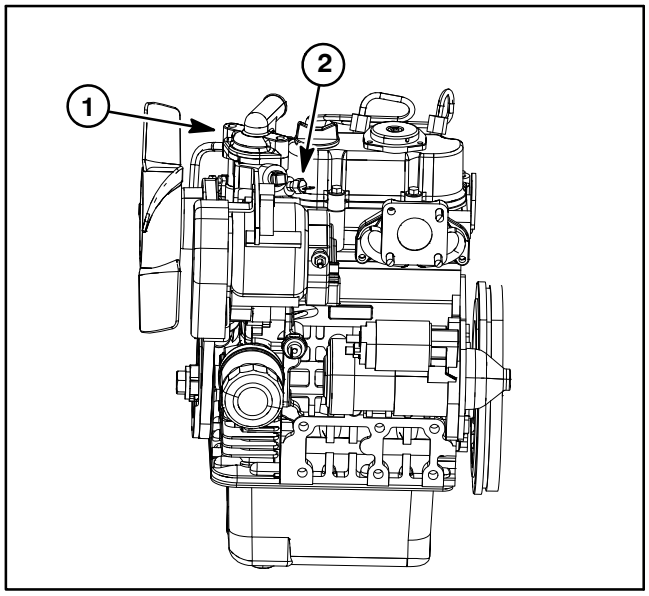

Figure 24

1. **Thermostat housing** 2. **Temperature switch**

Switch Testing

CAUTION

Make sure engine is cool before removing the temperature switch.

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch. Raise and support cargo box to allow access to engine.

2. Lower coolant level in the engine and remove the over temperature switch.

3. Put switch in a container of oil with a thermometer and slowly heat the oil (Fig. 25).

CAUTION

Handle the hot oil with extreme care to prevent personal injury or fire.

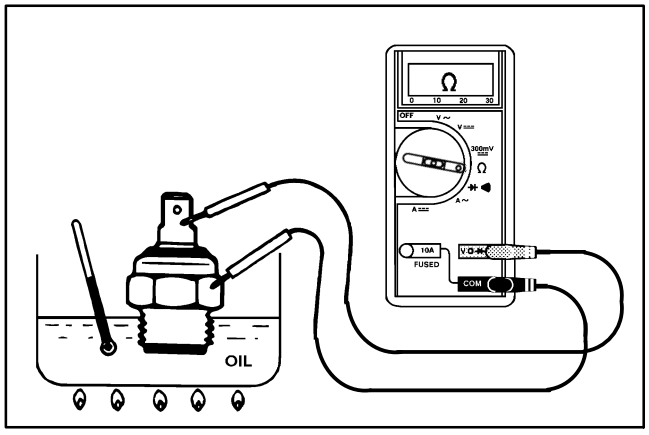

Figure 25

4. Check continuity of the switch with a multimeter (ohms setting). The over temperature switch is normally open and should close between 225º to 235ºF (107º to 113ºC).

5. Replace switch if necessary.

6. After testing, install over temperature switch to the engine housing.

   A. Clean threads of housing and switch thoroughly. Apply thread sealant to the threads of the switch.

   B. Thread temperature switch into the housing and tighten.

   C. Connect wire harness connector to over temperature switch.

7. Fill engine cooling system. Lower and secure cargo bed.

Fuel Pump

The MDX–D fuel pump is secured in a cavity in the top of the fuel tank (Fig. 26). Electrical current is available for the fuel pump when the ignition switch is in either the ON or START position.

IMPORTANT: When testing fuel pump, make sure that pump is not operated without fuel.

DANGER

Because diesel fuel is flammable, use caution when handling it. Do not smoke while testing the fuel pump. Do not test fuel pump while engine is hot. Make sure that there is adequate ventilation when testing. Always wipe up any spilled fuel before starting the engine.

Fuel Pump Capacity Test

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch. Raise and support cargo box.

2. Disconnect wire harness electrical connector from the engine run solenoid to prevent the engine from starting (see Engine Run Solenoid in this section).

3. Disconnect fuel hose (fuel pump discharge) from the fuel/water separator inlet fitting (Fig. 27).

4. Make sure fuel hoses attached to the fuel pump and fuel tank suction tube screen are free of obstructions.

5. Place disconnected fuel hose into a large, graduated cylinder sufficient enough to collect 1 quart (0.95 liter).

IMPORTANT: When testing the fuel pump, DO NOT turn ignition switch to START.

6. Collect fuel in the graduated cylinder by turning ignition switch to the ON position. Allow pump to run for fifteen (15) seconds, then turn ignition switch to OFF.

7. Fuel collected in the graduated cylinder should be approximately 16 fl oz (475 ml) after fifteen (15) seconds.

8. Replace fuel pump if testing determines that it is faulty. Remove seat base to access fuel pump (see Seat Base in the Service and Repairs section of Chapter 6 – Chassis).

9. Install fuel hose to the fuel/water separator. Make sure to secure fuel hose with hose clamp.

10. Connect wire harness electrical connector to the engine run solenoid.

11. Bleed the fuel system.

12. Lower and secure cargo box.

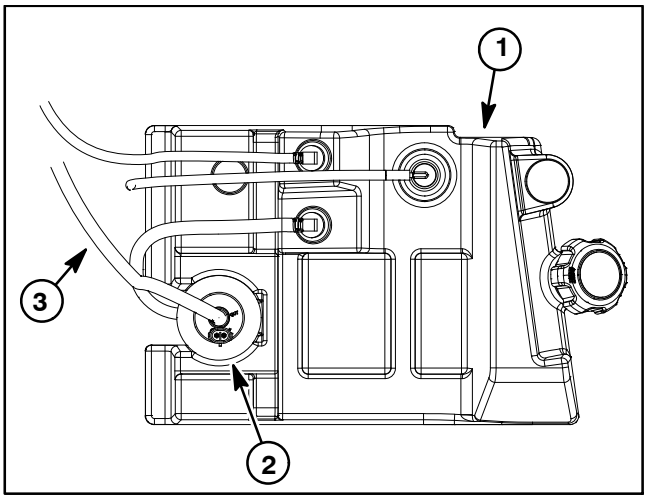

Figure 26

1. **Fuel tank**
2. **Fuel pump**
3. **Fuel hose to filter**

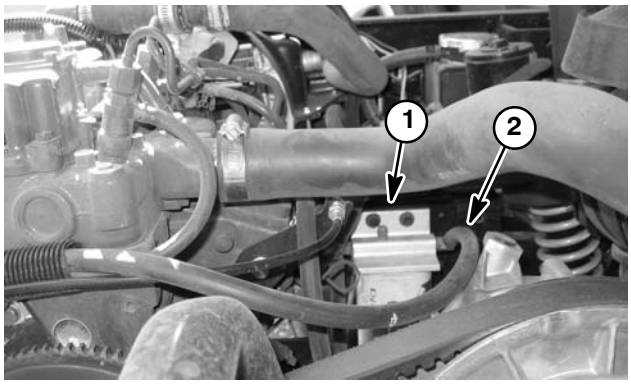

Figure 27

1. **Fuel/water separator**
2. **Pump discharge hose**

Fuel Pump Specifications

Pump Capacity	64 fl oz/min (1.9 l/min)
Pressure	7 PSI (48.3 kPa)
Current Draw	2.0 amp

Oil Pressure Switch

The engine oil pressure switch is located on the engine near the oil filter (Fig. 28). The oil pressure switch is a normally closed switch that opens with pressure.

The oil pressure switch should open at approximately 8 PSI (0.56 kg/cm^2).

Switch Testing

NOTE: Refer to Kubota Workshop Manual, Diesel Engine, SM−E3B Series for information regarding engine lubrication system and testing.

1. Turn the ignition switch to the ON position. The oil pressure indicator light on the dash panel should be illuminated.

2. If the indicator light is not illuminated, raise and support cargo box to gain access to engine.

3. Locate oil pressure switch on engine and disconnect the wire harness connector from the switch.

4. With the ignition switch in the ON position, ground the disconnected wire to the engine block.

5. If the indicator light comes on, the oil pressure switch is faulty. Replace oil pressure switch.

6. If the indicator light does not come on after step 5, check the oil pressure indicator light and circuit wiring (see Indicator Lights in this section).

7. After testing is completed, connect the wire harness connector to the oil pressure switch. Lower and secure cargo box.

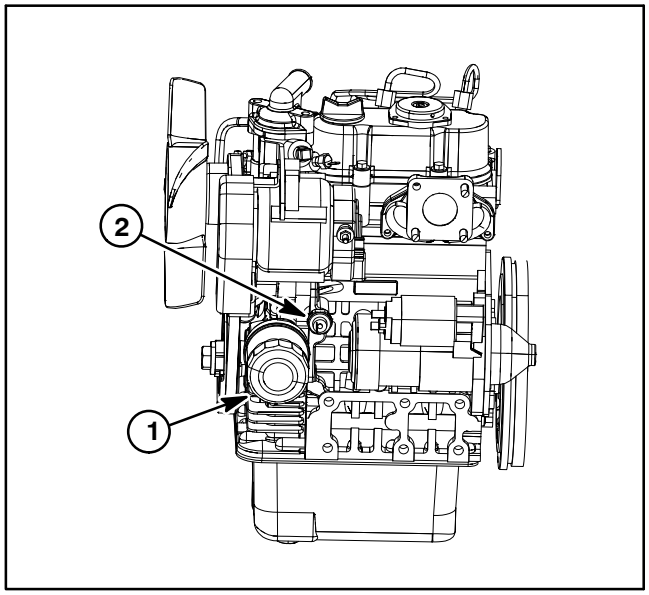

Figure 28

1. **Oil filter**
2. **Oil pressure switch**

Backup Alarm (Optional Kit)

When the shift lever is placed in the reverse position, the backup alarm should sound. The alarm is attached beneath the cargo box to a bracket on the right side of the frame.

Alarm Testing

1. Park vehicle on a level surface, stop engine, apply parking brake and remove key from ignition switch. Make sure that vehicle shift lever is in the NEUTRAL position.

2. Raise and support cargo box to allow access to backup alarm.

IMPORTANT: Make sure to observe polarity on the alarm terminals when testing. Damage to the alarm may result from an improper connection.

3. Disconnect wire harness connector from backup alarm. Correctly connect 12VDC source to the terminals (Fig. 29). Alarm should sound.

4. Remove voltage source from the alarm. Replace alarm if testing determines that it is faulty. Connect wire harness connector to alarm.

5. Lower and secure cargo box.

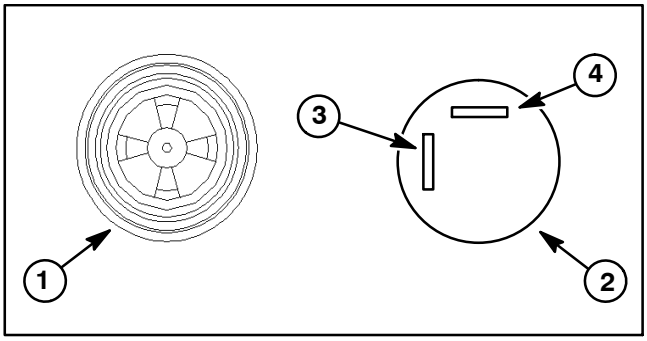

Figure 29

1. Alarm top view
2. Alarm bottom view
3. Positive (+) terminal
4. Negative (–) terminal

Backup Switch (Optional Kit)

The optional backup switch is a four (4) terminal, two (2) circuit switch that is used to energize the backup alarm when the shift lever is in the reverse position. The normally open switch circuit is used while the normally closed switch circuit is not used. If equipped, this switch is attached to the shift bracket in the seat base (Fig. 30).

Switch Testing

1. Position vehicle on a level surface, set parking brake, turn ignition switch OFF and remove key from switch. Make sure that vehicle shift lever is in the NEUTRAL position.

2. Remove four (4) screws and carefully slide shift bracket assembly from front of seat base to gain access to backup switch.

3. Unplug vehicle wire harness connector from backup switch.

4. With the use of a multimeter (ohms setting), check that the normally open switch contacts (Fig. 31) do not have continuity when the switch plunger is extended. The contacts should have continuity when the switch plunger is fully depressed.

5. When testing is complete, connect wire harness connector to backup switch. Slide shift bracket into seat base and secure with four (4) screws.

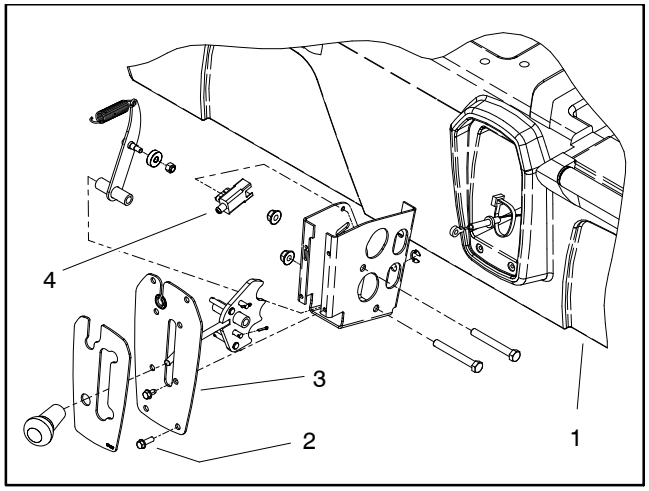

Figure 30

1. **Seat base**
2. **Screw (4 used)**
3. **Shifter plate**
4. **Backup switch**

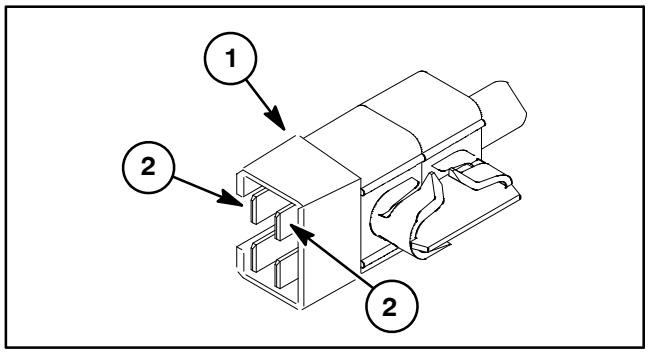

Figure 31

1. **Backup switch**
2. **Normally open contact**

Windshield Washer/Wiper Switch (Machines with Operator Cab)

The windshield washer/wiper switch controls the operation of the windshield wiper and washer pump. The switch is located in the roof console (Fig. 32).

Testing

1. Park the machine on a level surface, lower the cutting deck, set the parking brake, and shut off the engine.

2. To access the switch, do as follows:

   A. Remove the 10 clips, 10 sealing washers, and 10 flange−head screws that secure the roof to the cab frame, and remove the roof.

   B. Remove the console foam.

   C. Remove the console panel from the roof console.

3. Disconnect the wire harness electrical connector from the windshield wiper/washer switch.

4. With the use of a multimeter (ohms setting), test the switch functions to determine if continuity exists between the various terminals for each switch position. Check the continuity between the switch terminals. The windshield wiper/washer switch terminals are identified in Figure 33 and the circuitry of the switch is shown in below table:

SWITCH POSITION	NORMAL CIRCUITS	OTHER CIRCUITS
OFF	2 + 1	None
WIPER ON	2 + 3	None
WASHER ON	2 + 3	5 + 6

5. Replace the windshield wiper/washer switch if testing determines that the switch is damaged.

6. If the windshield wiper/washer switch testing is correct and a circuit problem still exists, check the wire harness; refer to the Chapter 7 − Electrical Drawings.

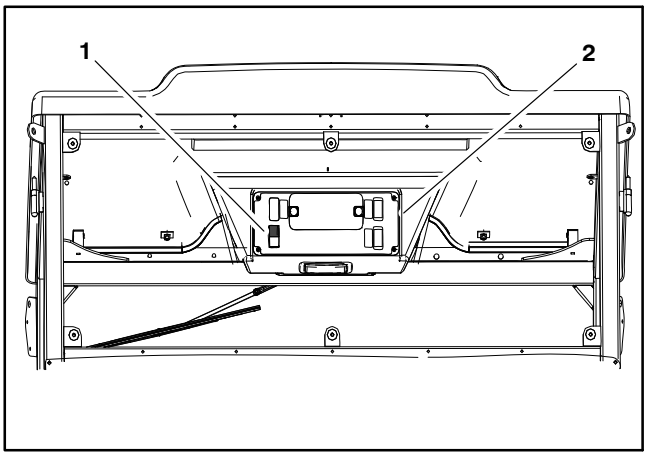

Figure 32

1. Washer/wiper switch **2. Console panel**

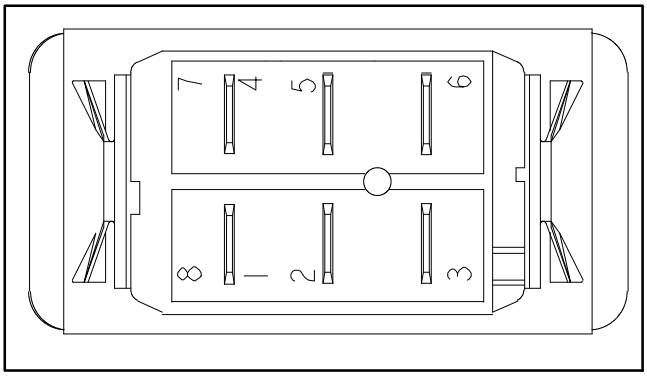

Figure 33

7. After you complete the testing, connect the wire harness connector to the windshield wiper/washer switch.

8. Position the console foam. Secure the roof to the cab frame with the 10 clips, 10 sealing washers, and 10 flange−head screws.

Diode Assembly (Model 07236)

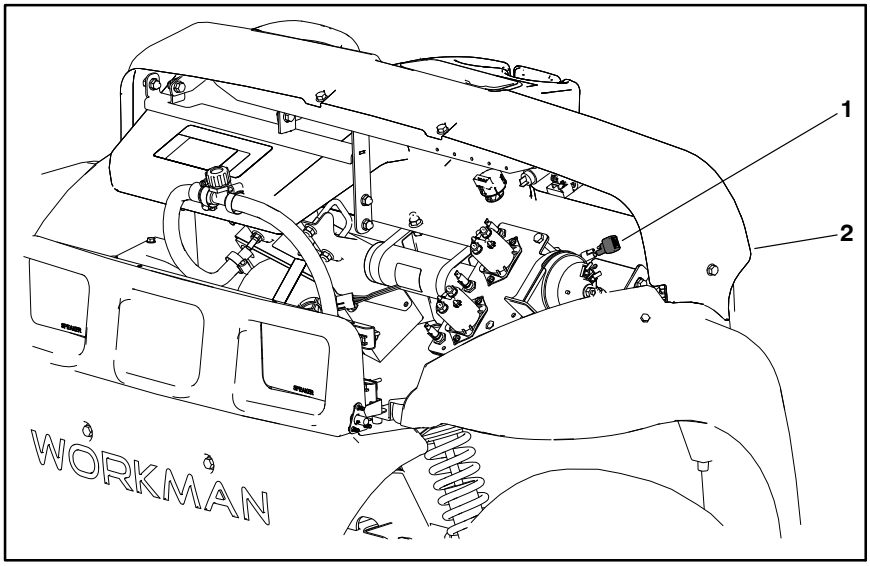

Figure 34

1. Diode
2. Dash panel

The electrical system of the MD Workman (Model 07236) includes a diode. The maximum current allowed through a diode is 6 A. The diode assembly can be identified by a black color, diode symbol, and Toro Part Number on the end of the diode assembly body (Figure 35). The diode plugs into the heater kit wire harness near the dash panel (Figure 34); refer to the Heater Kit Wire Harness Drawing/Diagram in Chapter 7–Electrical Drawings .

A diode assembly is used for circuit protection from the voltage spikes that occur when the speed switch is de–energized.

Testing

1. Park the machine on a level surface, shut off the engine, set the parking brake, and remove the key from the key switch.

2. Remove the hood to get access to the diode assembly.

3. Locate the diode assembly and remove the cable tie that secures the diode to the wire harness. Unplug the diode from the wire harness for testing.

4. The diode (Figure 35) can be tested by using a digital multimeter (diode test or ohms setting) and the Diode Test Table shown below:

Multimeter Red Lead (+) on Terminal	Multimeter Black Lead (–) on Terminal	Continuity
Female	Male	Yes
Male	Female	No

5. Replace the diode assembly if testing determines that the diode is damaged.

6. After you complete the testing, ensure that the diode is fully installed into the wire harness connector and secured to the harness with cable tie. Install the hood.

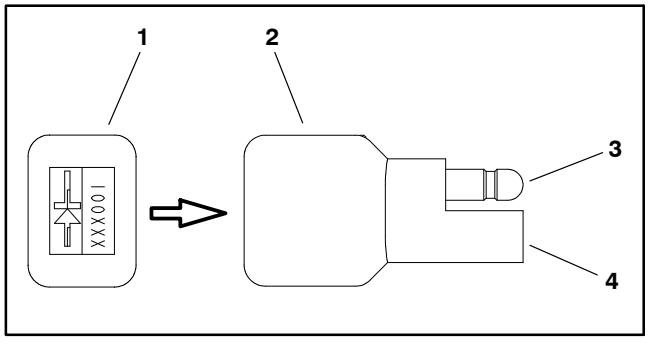

Figure 35

1. End of the diode body
2. Diode assembly
3. Male terminal
4. Female terminal

Service and Repairs

NOTE: For information on engine electrical components, see the Kubota Workshop Manual, Diesel Engine, SM−E3B Series.

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.

WARNING

POTENTIAL HAZARD:
Either the battery terminals or metal tools could short against metal vehicle components.
WHAT CAN HAPPEN:
Sparks can cause the battery gasses to explode.
Damaged cables could short against metal vehicle components and cause sparks.
HOW TO AVOID THE HAZARD:
When removing or installing the battery, do not allow the battery terminals to touch any metal parts of the vehicle.
Always DISCONNECT the negative (black) battery cable before disconnecting the positive (red) cable.
Always CONNECT the positive (red) battery cable before connecting the negative (black) cable.
Do not allow metal tools to short between the battery terminals and metal parts of the vehicle.
Always keep the battery retaining components secure to protect the battery.

Battery Specifications
BCI Group Size 26
540 Amp Cranking Performance at 0º F (−18ºC)
80 Minutes Reserve Capacity at 80ºF (27ºC)

Electrolyte Specific Gravity
Fully charged: 1.265 corrected to 80ºF (27ºC)
Discharged: less than 1.240

Battery Removal (Fig. 36)

IMPORTANT: Be careful to not damage terminal posts or cable connectors when removing the battery cables.

1. Position vehicle on a level surface, set parking brake, turn ignition switch OFF and remove key.

2. Remove battery cover.

3. Disconnect negative (black) cable from battery first to prevent short circuiting the battery, other components or operator's hands. Then disconnect positive (red) cable.

4. Remove battery retainer that secures battery to battery tray.

5. Make sure that battery filler caps are on tightly.

6. Remove battery from chassis to a service area. This will minimize possible battery damage and allow better access for battery inspection and service.

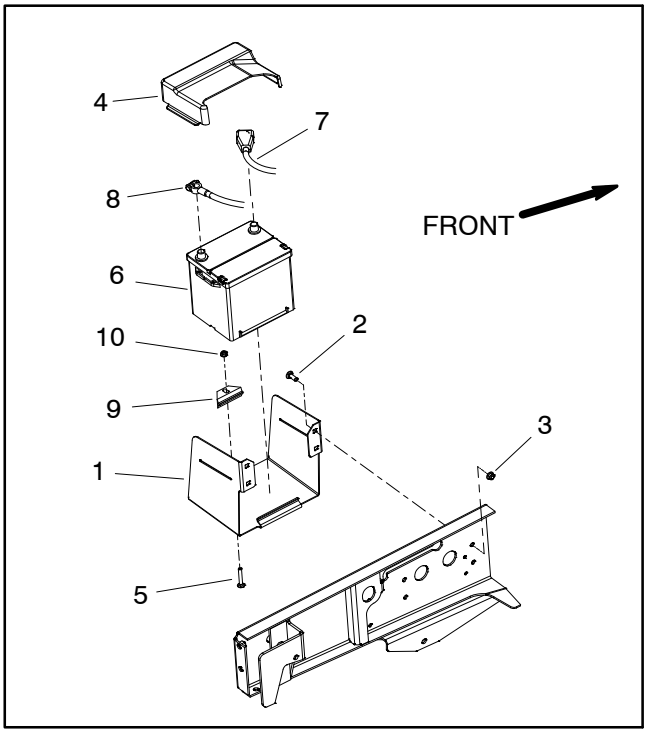

Figure 36

1. **Battery tray**
2. **Carriage screw (4 used)**
3. **Flange nut (4 used)**
4. **Battery cover**
5. **Carriage screw**
6. **Battery**
7. **Positive cable (red)**
8. **Negative cable (black)**
9. **Battery retainer**
10. **Flange nut**

Battery Inspection and Maintenance

WARNING

POTENTIAL HAZARD:

Battery electrolyte contains sulfuric acid which is a deadly poison and it causes severe burns.

WHAT CAN HAPPEN:

If you carelessly drink electrolyte you could die or if it gets onto your skin you will be burned.

HOW TO AVOID THE HAZARD:

Do not drink electrolyte and avoid contact with skin, eyes or clothing. Wear safety glasses to shield your eyes and rubber gloves to protect your hands.

Fill the battery where clean water is always available for flushing the skin. Always RECONNECT the positive (red) battery cable before reconnecting the negative (black) cable.

Follow all instructions and comply with all safety messages on the electrolyte container.

1. Check for cracks caused by overly tight or loose hold down rod. Replace battery if cracked and leaking.

2. Check battery terminal posts for corrosion. Use a terminal brush or steel wool to clean corrosion from the battery terminal posts.

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

3. 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 the battery case for dirt and oil. Clean the battery with a solution of baking soda and water, then rinse it with clean water.

4. Check that the cover seal is not broken away. Replace the battery if the seal is broken or leaking.

5. If battery caps can be removed, 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 to the bottom of the cap tubes (or fill line). Charge at 15 to 25 amps for 15 minutes to allow sufficient mixing of the electrolyte.

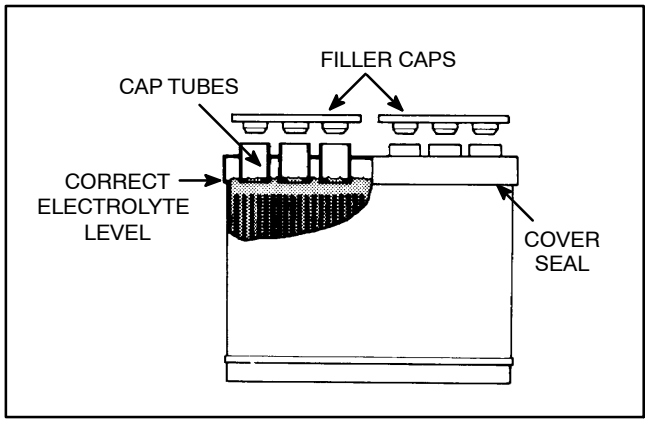

Figure 37

Battery Installation (Fig. 36)

IMPORTANT: To prevent possible electrical problems, install only a fully charged battery.

1. Make sure the ignition switch and all accessories are off.

2. Make sure the battery tray is clean and repainted if necessary.

3. Make sure battery cables, battery connections and the battery hold down components are in good condition.

4. Set battery on the battery base with its posts toward the right side of the vehicle.

5. Secure positive cable (red) to positive battery post.

6. Secure battery with retainer and fasteners.

7. Connect a digital multimeter (set to amps) between the negative battery post and the negative cable (black) connector. The reading should be less than 0.1 amp. If the reading is 0.1 amp or more, the vehicle's electrical system should be tested and repaired.

8. Secure negative cable (black) to negative battery post with flange screw and flange nut.

9. Apply battery terminal protector (see Special Tools in this chapter) on battery posts and cable connectors to reduce corrosion after connections are made.

10. Install battery cover.

Battery Testing

1. If battery caps can be removed, 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 10°F (6°C) above 80°F (27°C) add 0.004 to the specific gravity reading. For each 10°F (6°C) below 80°F (27°C) subtract 0.004 from the specific gravity reading.

Example:	Cell Temperature	100°F
	Cell Gravity	1.245
	ADD (20° above 80°F)	0.008
	Correction to 80°F	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 **Battery Charging** or until the 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.

2. 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 load tester.

A. Check the voltage across the battery terminals prior to testing the battery. If the voltage is less than 12.0 VDC, recharge the battery before load testing.

B. Make sure the battery terminals are free of corrosion.

C. If the battery has been charged, apply a 270 amp load for fifteen (15) seconds to remove the surface charge. Use a battery load tester following the manufacturer's instructions.

D. Measure the temperature of the electrolyte in the center cell.

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

F. Apply a test load of 270 amps (one half the battery CCA performance) for fifteen (15) seconds.

G. Take a battery voltage reading after fifteen (15) seconds, then remove the load. Record this test voltage reading.

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

Minimum Test Voltage	Battery Electrolyte Temperature	
9.6	70°F (and up)	21°C (and up)
9.5	60°F	16°C
9.4	50°F	10°C
9.3	40°F	4°C
9.1	30°F	–1°C
8.9	20°F	–7°C
8.7	10°F	–12°C
8.5	0°F	–18°C

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.

Battery 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 available in most service shops.

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 open specific gravity or 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 (16°C) before connecting to a charger.

Charge 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. Unplug the charger from the electrical outlet before connecting or disconnecting the charger leads from the battery posts.

Nausea may result if the gases are inhaled.

3. **Follow the battery charger manufacturer's instructions.** Connect 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 125°F (52°C) or the electrolyte is violently gassing or spewing, the charging rate must be lowered or temporarily stopped.

6. Three (3) 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 (3) consecutive readings.

Battery Storage

If the vehicle will be stored for more than thirty (30) days, remove the battery and charge it fully. Either store it on the shelf or on the vehicle. Leave the cables disconnected if it is stored on the vehicle. Store the battery in a cool atmosphere to avoid quick deterioration of the charge in the battery. To prevent the battery from freezing, make sure it is fully charged.

Chapter 6

Chassis

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Brake Master Cylinder Service 46
Bleed Brake System 47
Seat Base 49
Front Hood 50
Cargo Box 52
Windshield Wiper Assembly (Machines with Operator Cab) 54

Specifications

Item	Description
Front Tire Pressure Range	(22 x 9.5 – 10, 4 ply) 8 to 22 PSI (55 to 151 kPa)
Rear Tire Pressure Range	(24 x 12 – 10, 2 ply) 8 to 22 PSI (55 to 151 kPa)
Wheel Lug Nut Torque	80 to 90 ft–lb (109 to 122 N–m)
Brake Fluid	DOT 3

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Workman MDX–D vehicle. Refer to the Operator's Manual for additional information when servicing the machine.

Special Tools

Order special tools from your Toro Distributor.

Spanner Wrench

Use spanner wrench to rotate front shock absorber collar which changes the length of the shock spring to affect front wheel camber. Make sure that vehicle is jacked up off the ground to allow shock spring to be at full extension before using spanner wrench.

Toro Part Number: **TOR6010**

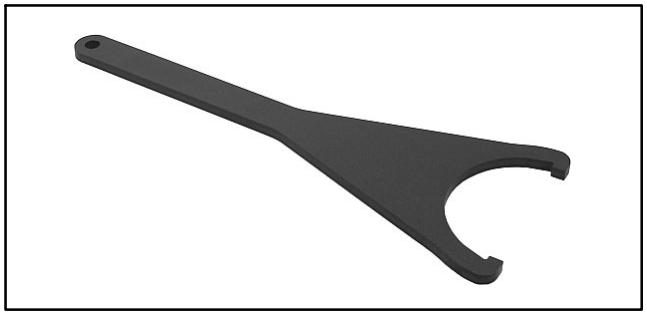

Figure 1

Shock Spring Compressor

Use shock spring compressor to remove spring from front shock absorber.

Toro Part Number: **TOR6015**

Figure 2

Troubleshooting

Suspension and Steering

Problem	Possible Cause
Front end is noisy.	Front wheel lug nuts are loose. Front wheel bearings are loose or worn. Front shocks are loose or worn. Front end components (e.g. tie−rod, spindle, A−arm) are loose or worn. Steering gearbox is damaged or worn.
Rear end is noisy.	Rear wheel lug nuts are loose. Rear shocks are loose or worn. Rear swing arm is loose. Clutch or transaxle problem (see Chapter 4 − Drive Train).
Excessive steering play.	Front wheel lug nuts are loose. Front wheel bearings are loose or worn. Steering linkage is loose or worn. Tie rod ends are worn. Steering gearbox is damaged or worn. Spindle bushings in A−arm are loose or worn.
Vehicle is unstable or wanders.	Tire pressure is low or uneven between tires. Wheel lug nuts are loose. Front wheel bearings are loose or worn. Steering column bushings are worn. Steering gearbox is damaged or worn. Front wheel alignment (toe−in) is incorrect. Rubber shock insert or spindle bushings in A−arm are loose or worn.

Suspension and Steering (continued)

Problem	Possible Cause
Front end shimmies.	Front wheel lug nuts are loose. Front wheel bearings are loose or worn. Steering linkage is loose or worn. Tie rod ends are loose or worn. Front wheel alignment (toe−in) is incorrect. Rubber shock insert or spindle bushings in A−arm are loose or worn.
Steering is hard.	Tire pressure is low or uneven between tires. Steering linkage is binding or damaged. Front wheel alignment (toe−in) is incorrect. Steering gearbox is damaged or worn.
Vehicle pulls to one side when not braking.	Tire pressure is low or uneven between tires. Front wheel alignment (toe−in) is incorrect. Steering or suspension component may be damaged.

Brakes

Problem	Possible Cause
Brake pedal goes to the floor.	Rear brake shoes are excessively worn. Front brake pads are excessively worn. Brake fluid level in master cylinder is low. Brake fluid leak exists at hose, caliper or wheel cylinder. Brake master cylinder is faulty.
Brake pedal is spongy.	Rear brake shoes or front brake pads are not burnished. Air is trapped in brake lines. Ground speed is too fast (see Chapter 4 − Drive Train).

Brakes (continued)

Problem	Possible Cause
Brakes pull to either side.	Tire pressure is incorrect or uneven between tires. Rear brake linings or front brake pads are contaminated. Front wheel alignment (toe–in) is incorrect. Rear brake shoes are distorted. Tires on same axle are unmatched.
Brakes squeal.	Rear brake linings or front brake pads is glazed or saturated. Rear brake shoe–to–shoe spring(s) is (are) weak or broken. Rear brake shoes are distorted. Anchor plate is bent. Rear brake drums and shoes are dusty. Small rock or other debris is caught in brakes. Rear brake drums are scored or out–of–round. Front brake rotors are scored or damaged.
Brakes drag.	Parking brake is applied or incorrectly adjusted. Rear brake shoe–to–shoe spring(s) is (are) weak or broken. Brake pedal is binding. Parking brake cable is binding. Rear brake linings or front brake pads are saturated. Rear brake drums or front brake rotors are bent or out–of–round.
Brake pedal is hard to push.	Incorrect brake lining material. Brake pedal linkage is binding.
Wheels lock–up when braking.	Rear brake linings or front brake pads are contaminated. Rear brake linings or front brake pads are damaged. Wheel or transaxle bearings are damaged. Rear brake shoe–to–shoe springs are weak. Brake drums are grooved in the brake shoe contact area.
Brakes fade.	Rear brake drums or front brake rotors are overheated and warped. Rear brake linings or front brake pads are saturated.
Vehicle surges at slow speeds and chatters at fast speeds.	Rear brake drums or front brake rotors are bent or out–of–round.

Adjustments

Adjust Parking Brake

1. Pry the rubber cover off of the parking brake.

2. Loosen the set screw securing the knob to the parking brake lever (Fig. 3).

3. Rotate the knob until a force from 30 to 35 lb. (133 to 156 N) is required to actuate the lever.

4. Tighten the set screw and install the rubber cover.

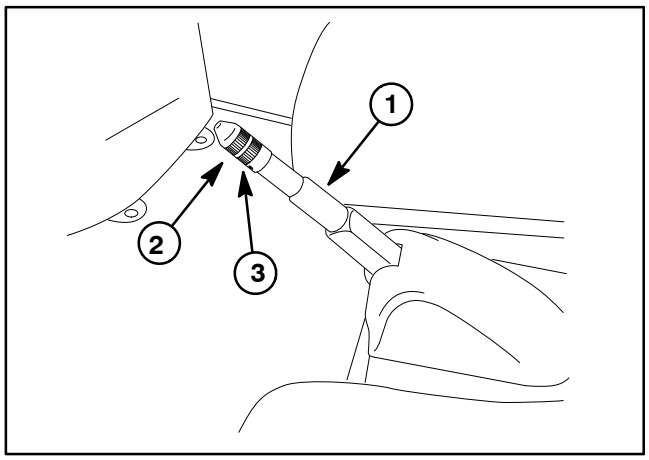

Figure 3

1. **Parking brake lever**
2. **Brake knob**
3. **Set screw**

Adjust Front Wheel Camber

1. Adjust front tire pressures to 12 PSI (82 kPa) before checking front wheel camber.

2. Either add weight to the driver's seat equal to the average operator who will run the machine or have an operator on the vehicle operator's seat. The weight or operator must remain on the seat for the duration of this front wheel camber procedure.

3. On a level surface, roll the vehicle straight back from 6 to 10 feet (2 to 3 meters) and then straight forward to the original starting position. This will allow the suspension to settle into the normal operating position.

4. Make sure that the front wheels are facing straight ahead.

5. Measure the front wheel camber on both front wheels:

A. Place a 90º square on the ground with the vertical edge touching the face of the tire (Fig. 4).

B. From the same part of the rim, measure the distance from the top and bottom of the rim to the square. Record the two (2) measurements.

C. The measurement at the bottom of the rim should be 0.090" (2.3 mm) larger than the top measurement. This measurement allows for a camber of 0+1/2 degree.

D. Repeat measurement procedure for other front wheel.

6. If camber measurement for either wheel is incorrect, adjust shock absorber spring to correct camber for that wheel:

A. Chock wheels to prevent the vehicle from moving. Use a jack to raise vehicle and allow shock absorber to extend. This will allow easier shock spring adjustment.

B. Use spanner wrench TOR6010 (see Special Tools in this chapter) to rotate shock absorber collar which changes the length of the shock spring (Fig. 5). If the bottom camber measurement was too short, rotate the collar to reduce the length of the shock spring. If the bottom camber measurement was too long, rotate the collar to increase the length of the shock spring.

C. Lower vehicle to level surface.

7. Repeat steps 2 through 6 until front wheel camber on both wheels is correct.

8. After camber adjustment, check front wheel toe–in (see Adjust Front Wheel Toe–in in this section).

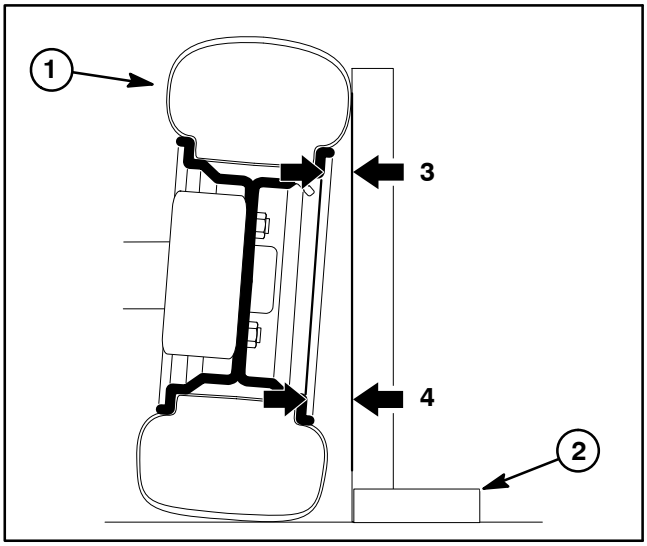

Figure 4

1. **Front wheel**
2. **90º square**
3. **Top measurement**
4. **Bottom measurement**

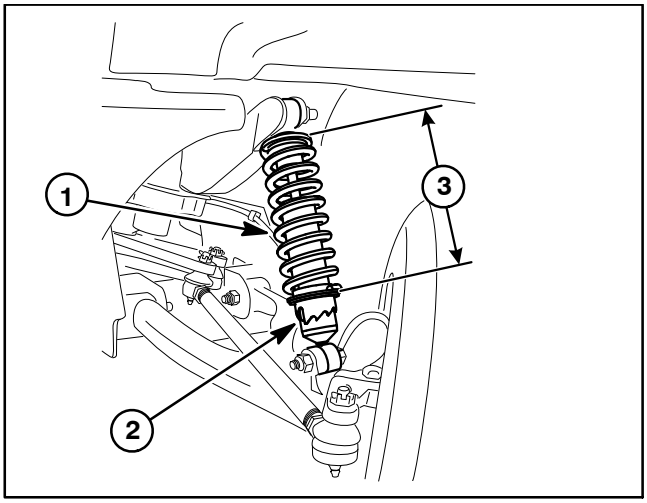

Figure 5

1. **Shock absorber spring**
2. **Collar**
3. **Spring length**

Adjust Front Wheel Toe−in

NOTE: Before adjusting front wheel toe−in, make sure that front wheel camber is correctly adjusted (see Adjust Front Wheel Camber in this section).

1. Adjust front tire pressures to 12 PSI (82 kPa) before checking front wheel toe−in.

2. Either add weight to the driver's seat equal to the average operator who will run the machine or have an operator on the vehicle operator's seat. The weight or operator must remain on the seat for the duration of this front wheel toe−in procedure.

3. On a level surface, roll the vehicle straight back from 6 to 10 feet (2 to 3 meters) and then straight forward to the original starting position. This will allow the suspension to settle into the normal operating position.

4. Make sure that the front wheels are facing straight ahead.

5. Measure distance between the front tires at axle height at both the front and rear of the tires (Fig. 6). Front wheel toe−in should be from 0 to 1/4 inch (0 to 6 mm).

6. If the front wheel toe−in is incorrect, adjust as follows:

   A. Loosen jam nuts at both ends of tie rods (Fig. 7).

   B. Rotate both tie rods to move front of tire inward or outward.

   C. Tighten tie rod jam nuts when toe−in adjustment is correct.

7. Ensure that there is full steering travel in both directions.

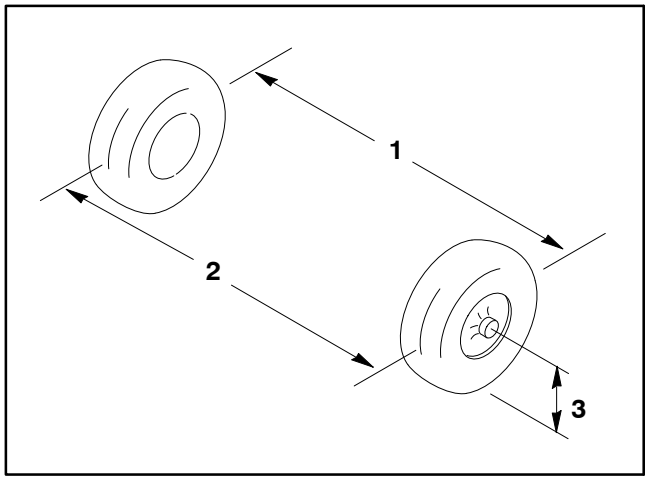

Figure 6

1. **Tire center line (back)**
2. **Tire center line (front)**
3. **Axle center line**

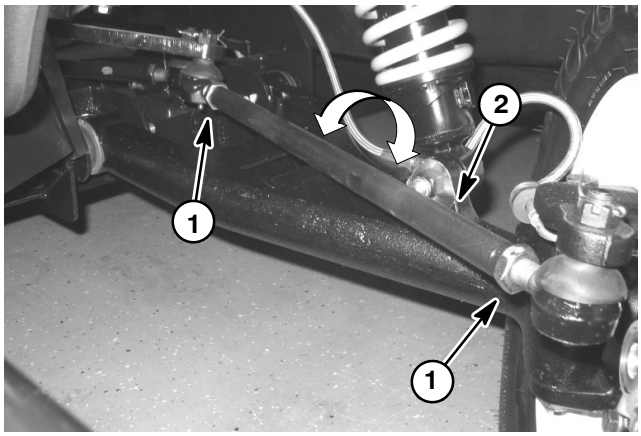

Figure 7

1. **Jam nut**
2. **Tie rod**

Check Tire Pressure

See Specifications for tire pressure range for front and rear tires.

The air pressure needed is determined by the payload carried. **Lower** air pressure will provide less compaction, a smoother ride and fewer tire marks. Lower pressure should not be used for heavy payloads at higher speeds.

Higher pressures should be used for heavier payloads at higher speeds. Do not exceed the maximum tire pressure.

Inspect Tires and Wheels

Operating accidents, such as hitting curbs, can damage a tire or rim and also disrupt wheel alignment. Inspect tire and rim condition after any accident.

Check wheels to ensure they are mounted securely. Torque wheel lug nuts in a crossing pattern from **80 to 90 ft-lb (109 to 122 N–m)**.

Upper Steering (Serial Numbers Below: 316000001)

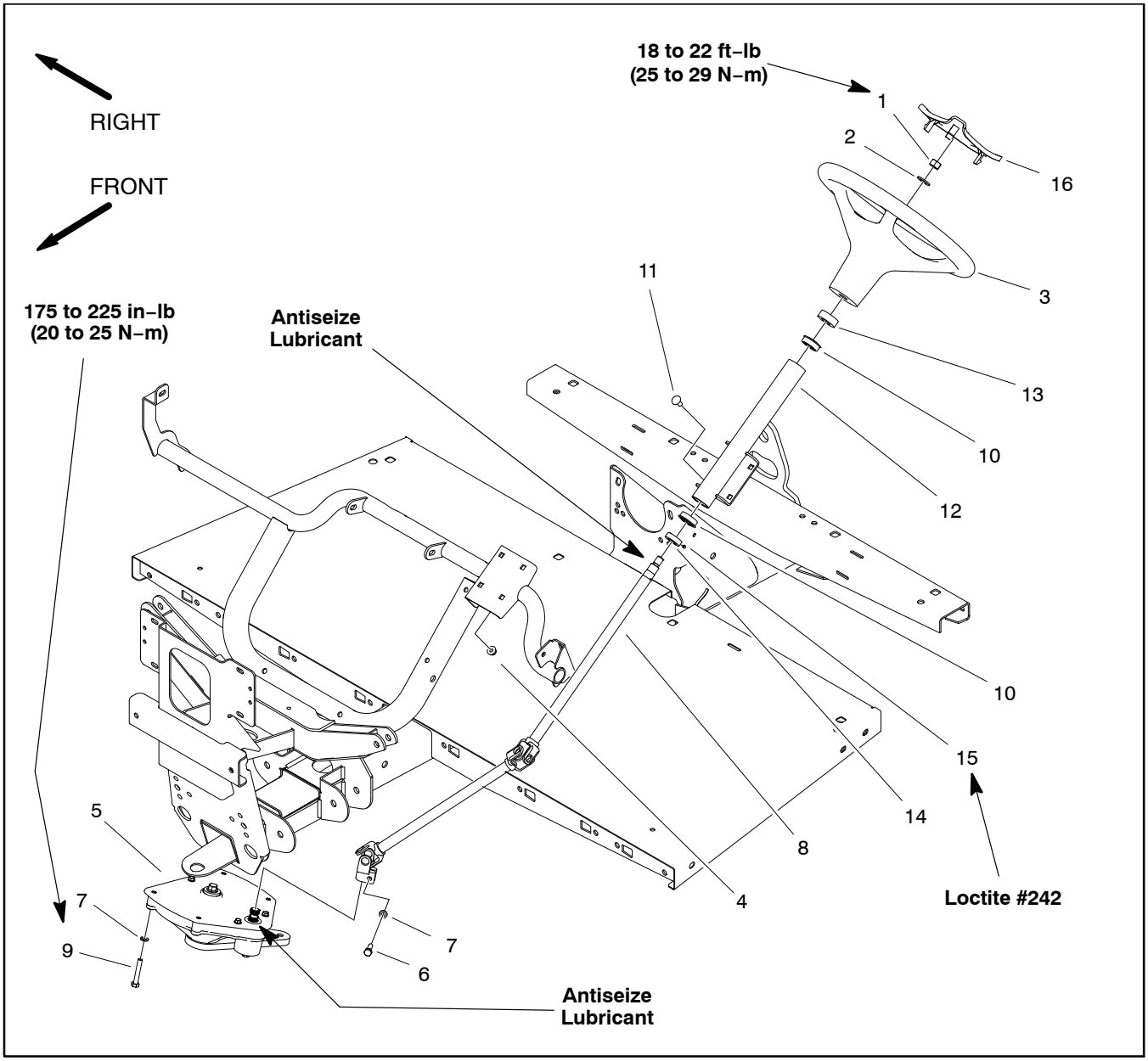

Figure 8

1. Hex nut
2. Flat washer
3. Steering wheel
4. Flange nut (4 used)
5. Steering box assembly
6. Cap screw
7. Lock washer (6 used)
8. Steering shaft
9. Cap screw (4 used)
10. Bearing (2 used)
11. Carriage bolt (4 used)
12. Steering column
13. Dust cover
14. Collar
15. Set screw
16. Steering wheel cover

Disassembly (Fig. 8)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

2. Raise front hood to gain access to the steering components.

3. Carefully remove steering wheel cover from the steering wheel. Remove nut and flat washer securing the steering wheel to the steering shaft. Pull steering wheel from the shaft.

4. Remove cap screw and lock washer securing the lower steering shaft knuckle to the steering gearbox input shaft. Pull knuckle from the gearbox shaft.

5. Support steering column to prevent it from falling. Remove four (4) flange nuts and carriage screws securing the steering column to the mounting plate on the frame.

6. Remove dust cover (item 13) from the steering shaft. Replace cover if damaged. Slide steering shaft out of the steering column.

7. Disconnect both tie rods from the Pitman arm on the steering gearbox (see Lower Steering and Front Wheel Removal in this section).

8. Remove four (4) cap screws and lock washers that secure the steering gearbox to the tower plate on the front frame. Remove gearbox from the tower plate.

9. Inspect the cover above the location of the gearbox Pitman arm (Fig. 9). Make sure that the cover is secure to the frame. If necessary, remove cover, thoroughly clean frame and secure cover with new adhesive gasket.

Assembly (Fig. 8)

1. Position steering gearbox to the tower plate of the front frame with the Pitman arm facing down and to the rear. The gearbox shaft must be to the left side of the tower.

2. Secure steering gearbox to the tower plate with four (4) cap screws and lock washers. Torque screws from **175 to 225 in−lb (20 to 25 N−m)**.

3. Make sure that collar (item 14) is positioned on steering shaft. Insert steering shaft up through the steering column.

4. Secure steering column to the mounting plate on the frame with four (4) carriage screws and flange nuts.

NOTE: Apply antiseize lubricant to the steering gearbox input shaft before installing to steering shaft knuckle.

5. Position knuckle of the lower steering shaft onto the gearbox input shaft. Secure knuckle to the steering gearbox shaft with cap screw and lock washer.

6. Make sure that collar (item 14) is just below steering column. If necessary, re−position collar on steering shaft. Apply Loctite #242 (or equivalent) to collar set screw and secure collar with set screw.

7. Place dust cover onto the steering shaft.

8. Connect both tie rods to the Pitman arm on the steering gearbox (see Lower Steering and Front Wheel Installation in this section).

NOTE: Apply antiseize lubricant to the steering shaft taper before installing the steering wheel.

9. Position front tires straight ahead. Slide steering wheel onto the steering shaft so that the leg of the “Y” formed by the wheel struts is directed towards the operator platform.

10. Secure steering wheel to shaft with flat washer and nut. Torque nut from **18 to 22 ft−lb (25 to 29 N−m)**. Install steering wheel cover to wheel.

11. Lower and secure front hood.

12. Check front wheel alignment (see Adjust Front Wheel Toe−in in the Adjustments section of this chapter).

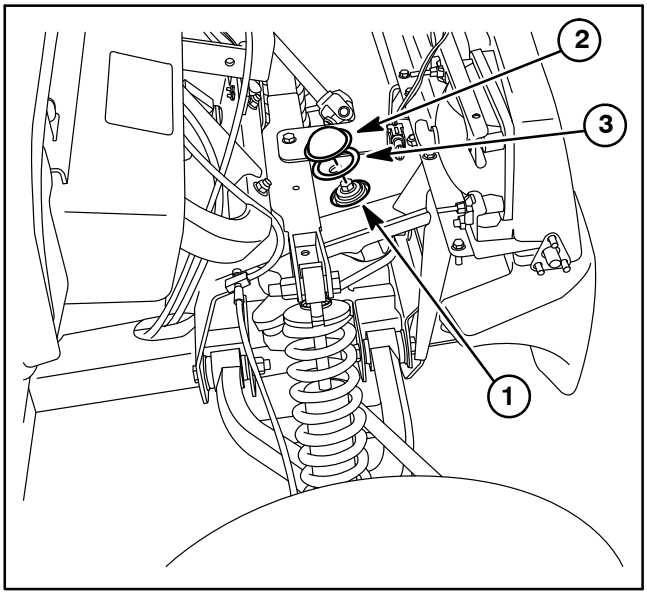

Figure 9

1. **Top of Pitman arm**
2. **Cover**
3. **Adhesive gasket**

Steering Gearbox (Serial Numbers Below: 316000001)

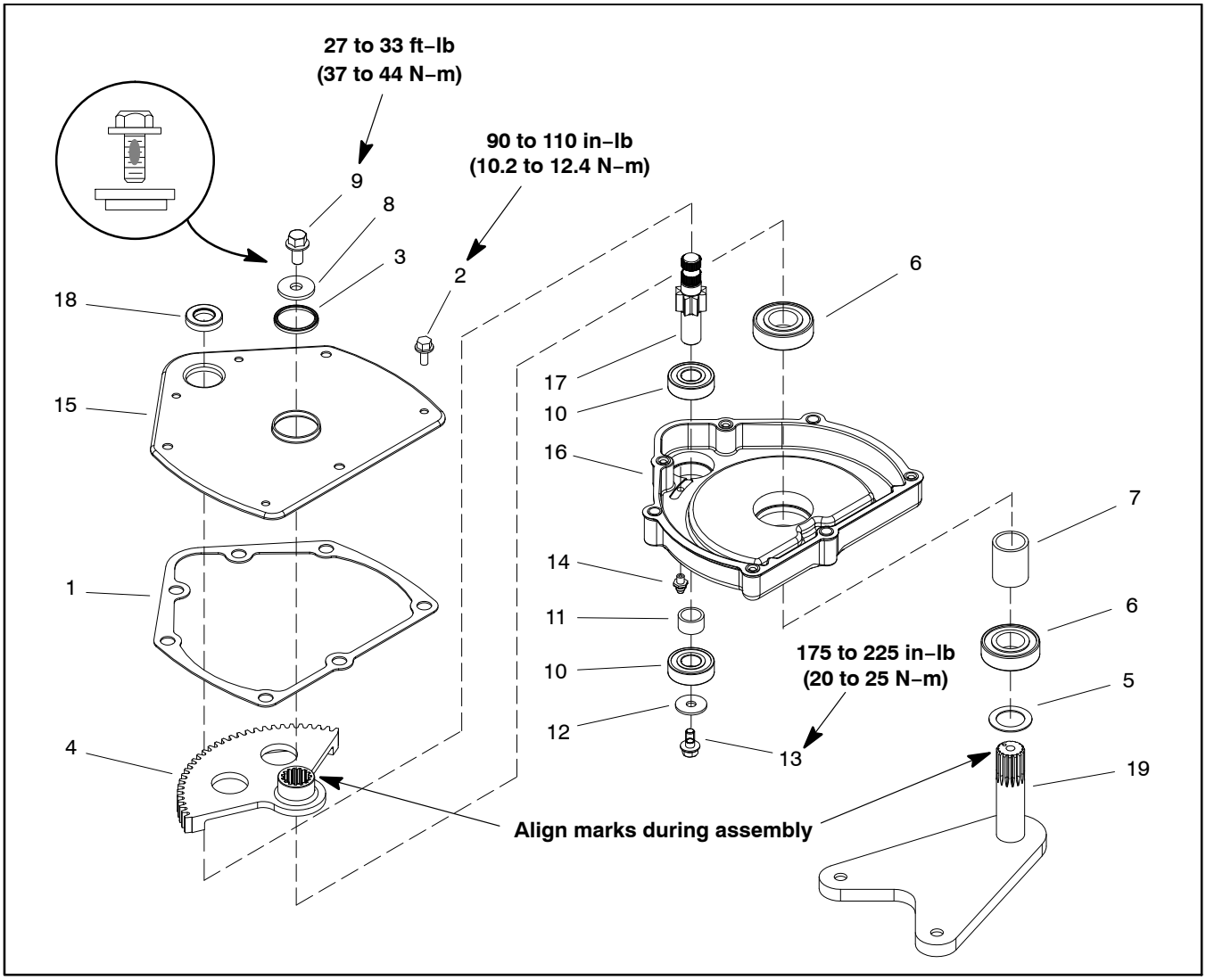

Figure 10

1. Gasket
2. Hex washer head screw (3 used)
3. Seal
4. Sector gear
5. Flat washer
6. Ball bearing
7. Output shaft spacer
8. Stepped washer
9. Flange head screw with patch lock
10. Ball bearing
11. Input shaft spacer
12. Flat washer
13. Flange head screw with patch lock
14. Lube fitting
15. Steering housing cover
16. Steering housing
17. Pinion gear
18. Oil seal
19. Pitman arm

Disassembly (Fig. 10)

IMPORTANT: Do not reuse flange head screws with patch lock (items 9 and 13) after they have been removed.

1. Remove flange head screw with patch lock (item 9) and stepped washer (item 8) from Pitman arm. Discard flange head screw.

2. Remove flange head screw with patch lock (item 13) and flat washer (item 12) from pinion gear shaft. Discard flange head screw.

3. Remove three (3) hex washer head screws (item 2) securing the housing cover and gasket to the steering housing. Remove cover and gasket from the housing. Replace gasket if damaged.

4. Inspect gears. Sector and pinion gear teeth must be free of damage that prevents them of free movement.

5. Remove pinion gear (item 17) from the housing.

IMPORTANT: Note that mark on Pitman arm shaft and sector gear are aligned. Their position is critical during assembly.

6. Separate Pitman arm (item 19) from the sector gear (item 4) and steering housing and remove from the housing.

7. Inspect bearings. Bearings must spin smoothly and be free of damage. Press bearings and spacer out of housing if necessary.

8. Inspect seals. Seals must be free of rips and tears. Replace seals if necessary.

Assembly (Fig. 10)

IMPORTANT: Always replace ball bearings as a set.

1. If ball bearings were removed:

   A. Press new bearing into housing from the inside first.

   B. Turn housing over. Insert spacer and press new bearing into housing.

2. If seals were removed, press new seals into housing. Seal lips should be facing up.

3. Place flat washer (item 5) onto shaft of the Pitman arm (item 19). Insert shaft into steering housing.

IMPORTANT: The position of the Pitman arm and sector gear is critical during assembly. Make sure that the marks on these components are aligned during assembly.

4. Position sector gear (item 4) onto the spline of the Pitman arm shaft.

IMPORTANT: Make sure sector gear is centered to the pinion gear.

5. Insert pinion gear (item 17) into the small bearing in the steering housing.

6. Fill steering housing with Mobil High Temperature XHP−222 grease (or equivalent). Make sure all gear teeth on the sector and pinion gears are covered with grease.

7. Place gasket and steering housing cover onto the housing. Secure cover to housing with three (3) hex washer head screws (item 2). Torque screws from **90 to 110 in−lb (10.2 to 12.4 N−m)**.

IMPORTANT: Flange head screws with patch lock (items 9 and 13) should be replaced whenever they are removed.

8. Secure stepped washer and flange head screw with patch lock (item 9) to the Pitman arm (item 8). Make sure to position stepped washer as shown in Figure 10. Torque screw from **27 to 33 ft−lb (37 to 44 N−m)**.

9. Secure flat washer (item 12) and flange head screw with patch lock (item 13) to the pinion gear shaft. Torque screw from **175 to 225 in−lb (20 to 25 N−m)**.

10. After assembly is completed, make sure that pitman arm rotates freely from stop to stop without binding.

Lower Steering and Front Wheels (Serial Numbers Below: 316000001)

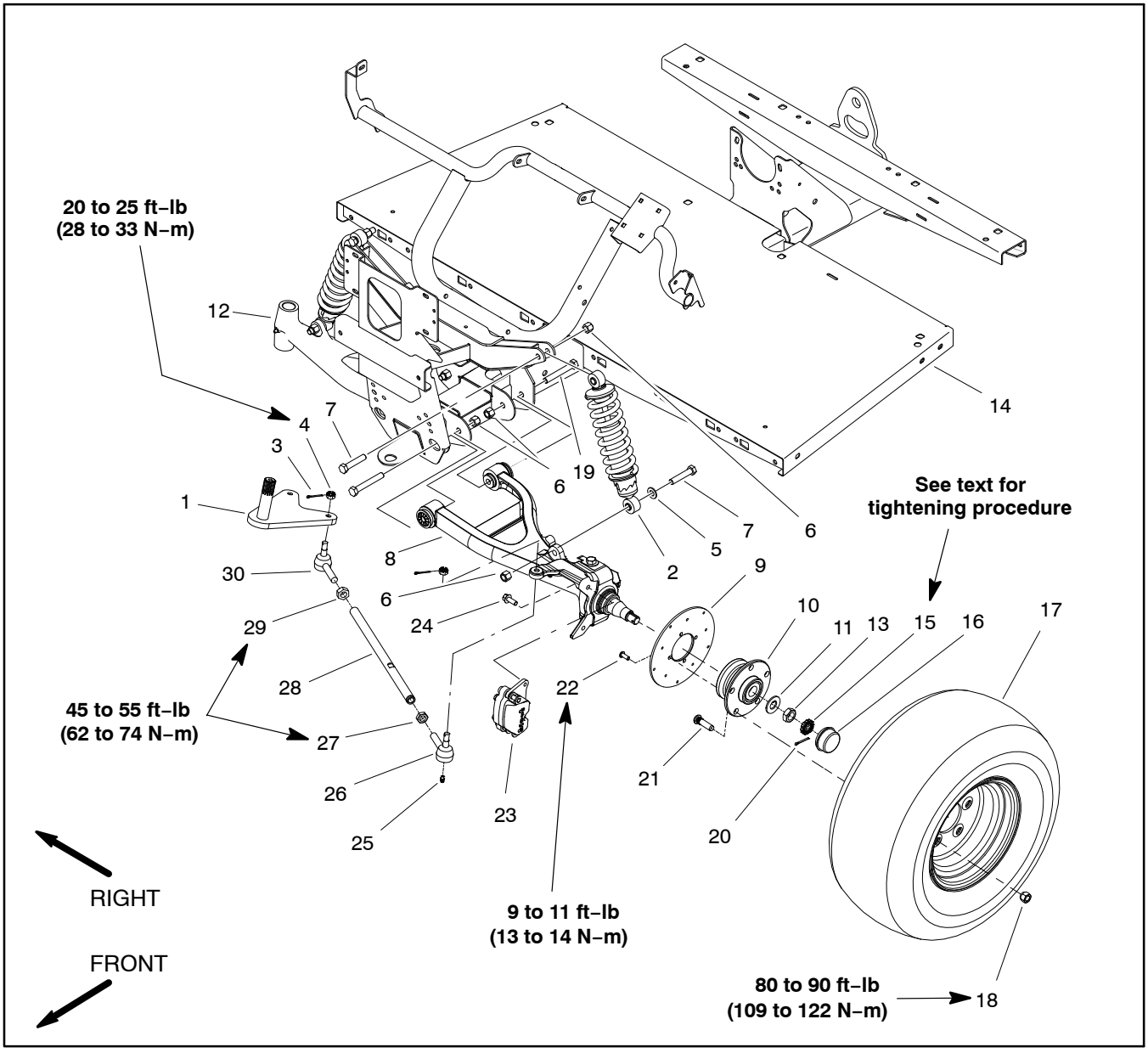

Figure 11

1. Steering gearbox pitman arm
2. Shock absorber (2 used)
3. Cotter pin
4. Slotted hex nut
5. Flat washer
6. Lock nut (3 used per side)
7. Cap screw (2 used per shock)
8. LH A–arm
9. Brake rotor
10. Wheel hub assembly
11. Tab washer
12. RH A–arm
13. Jam nut
14. Front frame
15. Nut retainer
16. Dust cap
17. Wheel assembly
18. Lug nut (5 used per wheel)
19. Cap screw (2 used per A–arm)
20. Cotter pin
21. Wheel stud (5 used per hub)
22. Socket head screw (4 used per rotor)
23. Brake caliper (LH shown)
24. Flange screw (2 used per caliper)
25. Grease fitting
26. Ball joint (LH threads)
27. Jam nut (LH threads
28. Tie rod
29. Jam nut (RH threads)
30. Ball joint (RH threads)

Disassembly (Fig. 11)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.

2. Chock wheels not being jacked up. Jack front wheel off the ground and support vehicle with appropriate jack stand beneath the frame.

3. Remove lug nuts and pull wheel assembly from machine.

4. Remove brake caliper from spindle (see Front Brake Caliper in this section). Position caliper away from wheel hub and spindle.

5. Carefully pry dust cap from wheel hub.

6. Remove cotter pin and nut retainer from spindle.

7. Remove jam nut that secures wheel hub to spindle. Slide wheel hub with bearings and brake rotor from spindle.

8. Disassemble the wheel hub (Fig. 12):

   A. Pull the seal out of the wheel hub.

   B. Remove bearings from both sides of the wheel hub. Clean bearings in solvent. Make sure bearings are in good operating condition. Clean the inside of the wheel hub. Check the bearing cups for wear, pitting or other noticeable damage. Replace worn or damaged parts.

   C. If necessary, remove wheel studs and brake rotor from wheel hub.

9. Remove spindle (Fig. 13):

   A. Remove cotter pin and castle nut securing tie rod ball joint to the spindle. Separate ball joint from the spindle. Remove tie rod from steering gearbox pitman arm if necessary.

   B. Remove lock nut and cap screw securing the spindle to the A–arm. Separate spindle from A–arm.

   C. Locate and remove thrust washer from bottom of kingpin sleeve in A–arm and brake hose clip from top of A–arm. Remove kingpin sleeve from A–arm if necessary.

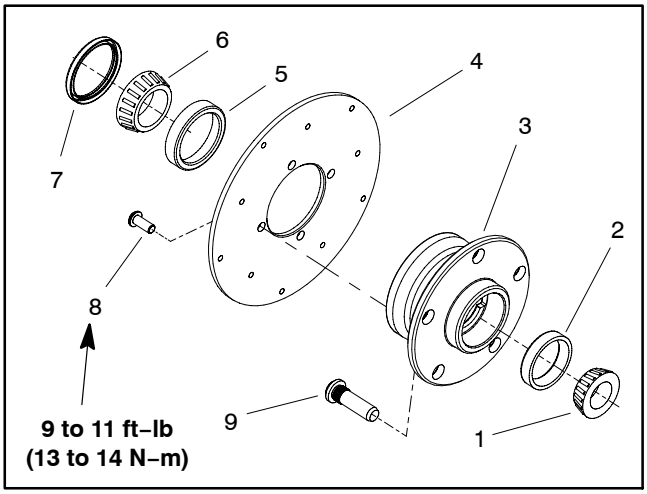

Figure 12

1. Outer bearing cone
2. Outer bearing cup
3. Wheel hub
4. Brake rotor
5. Inner bearing cup
6. Inner bearing cone
7. Seal
8. Socket screw (4 used)
9. Wheel stud (5 used)

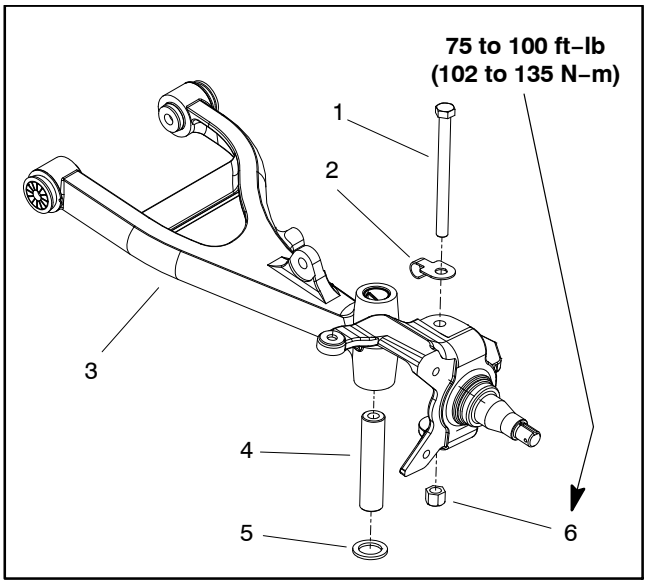

Figure 13

1. Cap screw
2. Brake hose clip
3. A–arm (LH shown)
4. Kingpin sleeve
5. Thrust washer
6. Lock nut

Assembly (Fig. 11)

1. Install spindle as follows (Fig. 13):

   A. Make sure king pin sleeve is positioned into the pivot hub of the A–arm. Sleeve must extend through the bottom of the hub.

   B. Place thrust washer onto the bottom of the king pin sleeve. Then place spindle over the A–arm hub, king pin sleeve and thrust washer.

   NOTE: Make sure cap screw is inserted down through the spindle and A–arm hub.

C. Install brake hose clip onto cap screw. Secure spindle to A−arm hub with cap screw and lock nut. Torque fasteners from **75 to 100 ft−lb (102 to 135 N−m)**.

2. Install tie rod:

   A. Insert tie rod ball joints down through the spindle and up through the Pitman arm. Secure with castle nuts.

   B. Torque castle nuts from **20 to 25 ft−lb (28 to 33 N−m)** to secure ball joint while aligning castle nut slot with hole in ball joint stud. If necessary to align holes, castle nut torque may be slightly more than specification. Install cotter pin.

3. Assemble wheel hub (Fig. 12):

   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. Pack both bearings with grease. Install inner bearing into the cup on inboard side of the wheel hub.

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

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

   D. If brake rotor was removed, position rotor to hub with chamfered edge toward hub. Secure rotor to hub with four (4) socket head screws. Torque screws from **9 to 11 ft−lb (13 to 14 N−m)**.

4. Slide wheel hub assembly onto spindle. Install outer bearing, tab washer and jam nut onto spindle.

5. Rotate the wheel by hand and tighten the jam nut from **75 to 100 in-lb (8.5 to 11.3 N−m)** to set the bearings. Then, loosen the nut until the hub has end play.

6. Again, rotate the wheel by hand and tighten the jam nut from **15 to 20 in-lb (1.7 to 2.3 N−m)**.

7. Position nut retainer over jam nut and install cotter pin through spindle shaft hole. Install dust cap to hub.

8. Install brake caliper to spindle (see Front Brake Caliper in this section).

9. Install wheel assembly with valve stem facing out.

10. Lower machine to ground.

11. Torque wheel lug nuts in a crossing pattern from **80 to 90 ft−lb (109 to 122 N−m)**.

12. Align steering and toe−in (see Adjust Front Wheel Toe−in in the Adjustments section of this chapter).

13. Lubricate tie rod ball joints and king pin.

Steering Assembly (Serial Numbers Above: 316000001)

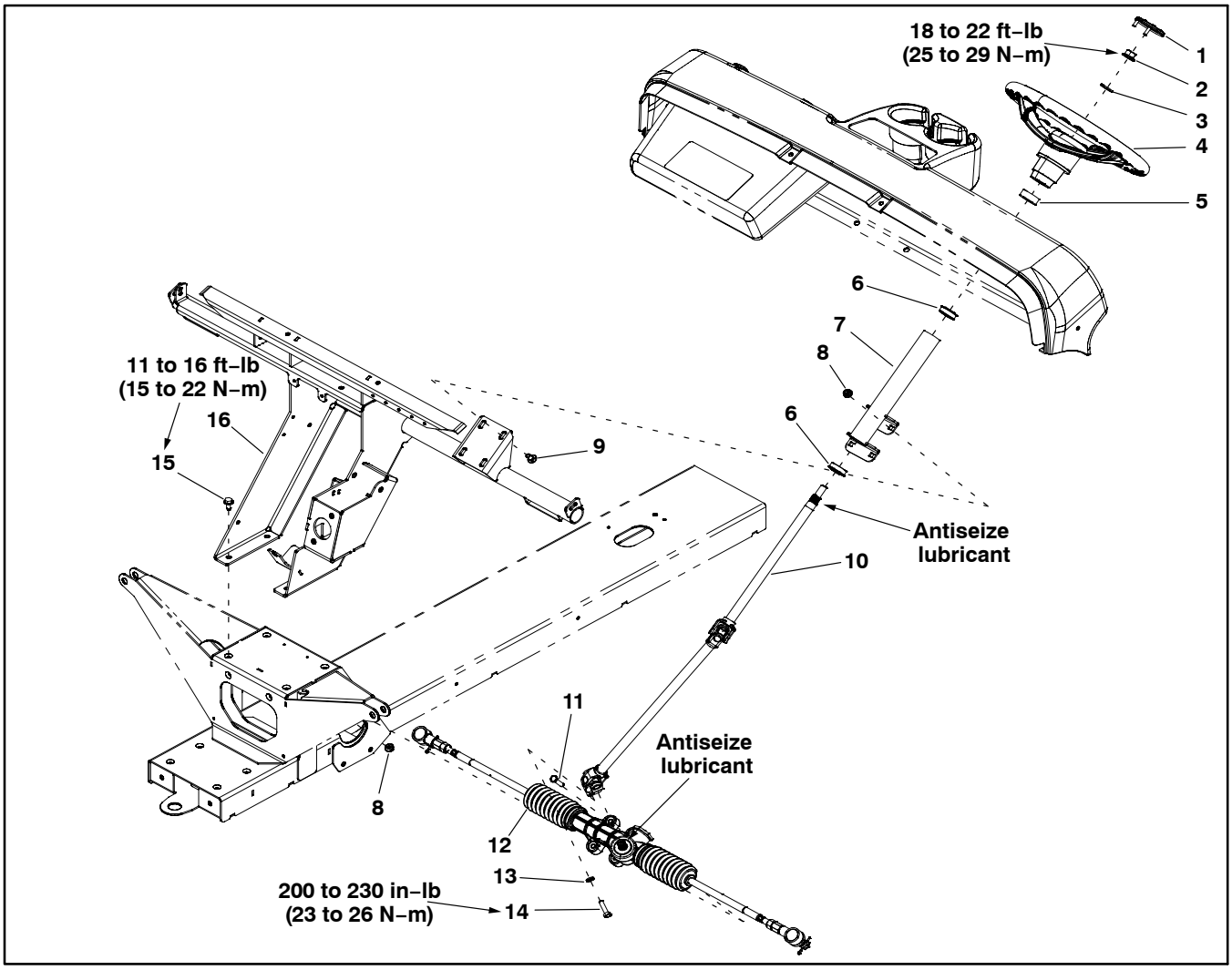

Figure 14

1. Steering wheel cap
2. Lock nut
3. Flat washer
4. Steering wheel
5. Dust cover
6. Bearing (2 used)
7. Steering column
8. Flange nut (8 used)
9. Carriage bolt (4 used)
10. Steering shaft
11. Screws (4 used)
12. Steering rack assembly
13. Lock washer
14. Cap screw
15. Screws (4 used)
16. Dash support

Disassembly (Fig. 14)

1. Park vehicle on a level surface, stop engine, set parking brake and remove key from the key switch.

2. Raise front hood to gain access to the steering components.

3. Carefully remove steering wheel cover from the steering wheel. Remove nut and flat washer securing the steering wheel to the steering shaft.

4. Use suitable puller to remove steering wheel from steering shaft.

5. Remove cap screw and lock washer securing the lower steering shaft joint to the steering rack assembly input shaft.

6. Support steering column to prevent it from falling. Remove four (4) flange nuts and carriage bolts securing the steering column to the mounting plate on the frame.

7. Lift up on steering column assembly, slide lower steering shaft joint from the steering rack assembly input shaft and remove steering column from vehicle.

8. Remove dust cover from the steering shaft. Replace cover if damaged.

9. Slide steering shaft and bearings out of the steering column.

A. Check steering shaft universal joints for roughness that would indicate bearing wear or damage. Replace steering shaft if universal joint bearing damage exists.

B. Check bearings for evidence of wear or damage and replace bearings if necessary.

10. Disconnect both steering rack tie rods from the spindles at the front wheel hubs (see Front Suspension in this section).

11. Remove four (4) washer head screws that secure the steering rack assembly to the front frame. Remove rack assembly from the vehicle.

NOTE: Refer to Steering Rack Assembly Service in this chapter for information on repair of the steering rack assembly.

Assembly (Fig. 14)

1. Position steering rack assembly to the front frame with the input shaft toward the left side of the vehicle.

2. Secure rack assembly to the frame with four (4) washer head screws. Torque screws from **200 to 230 in−lb (23 to 26 N−m)**.

3. Insert steering shaft up through the steering column.

4. Position steering column assembly to vehicle frame and slide lower steering shaft joint onto the steering rack input shaft. Secure steering column to the mounting plate on the frame with four (4) carriage bolts and flange nuts.

5. Secure lower steering shaft joint to the steering rack input shaft with cap screw and lock washer.

6. Place dust cover onto the steering shaft.

7. Connect both steering rack tie rods to the spindles at the front wheel hubs (see Front Suspension in this section).

8. Make sure that front wheels are centered by the steering rack before securing the steering wheel.

A. Install steering wheel onto steering shaft. Leave steering wheel loose on shaft.

B. Rotate the steering wheel until the distance from the steering rack boot to the tie rod is equal on both sides of vehicle indicating that the front wheels are centered.

C. Rotate the steering wheel from lock to lock and check that the front wheel spindles have equal clearances at end of steering rotation. If one spindle contacts a steering component and the other spindle still has clearance, a rotation of the steering shaft is needed to center the wheels.

D. Once wheels are centered, position steering wheel onto steering shaft so that the steering wheel spokes are centered when the front wheels are centered.

9. Secure steering wheel to steering shaft with flat washer and lock nut. Torque nut from **18 to 22 ft−lb (25 to 29 N−m)**. Install steering wheel cover to steering wheel.

10. Carefully position and secure dash to vehicle.

11. Lower and secure front hood.

12. Check front wheel alignment and adjust as necessary (see Adjust Front Wheel Toe−in in the Adjustments section of this chapter).

Steering Rack Assembly Service (Serial Numbers Above: 316000001)

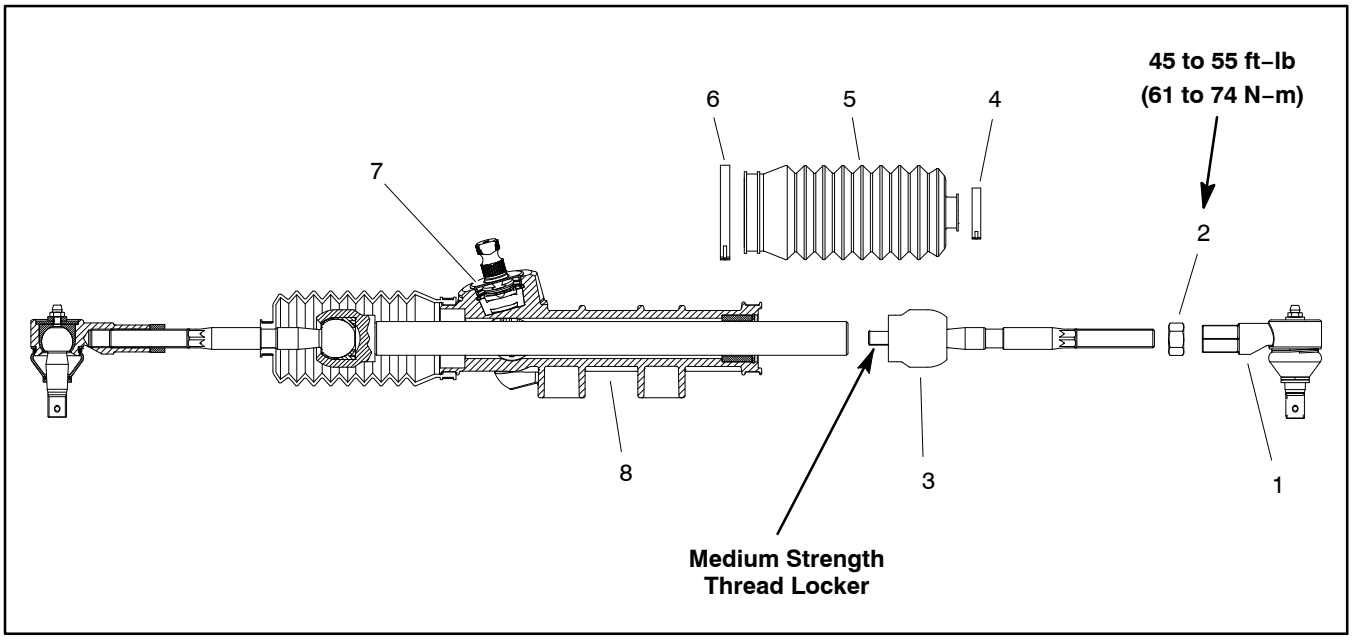

Figure 15

1. Tie rod end (2 used)
2. Jam nut (2 used)
3. Tie rod track (2 used)
4. Bellows clamp (2 used)
5. Bellows (2 used)
6. Bellows clamp (2 used)
7. Input shaft seal
8. Steering rack assembly

NOTE: Check parts catalog to identify individual components that are available for the steering rack assembly on your Workman vehicle. Depending on wear or damage that exists with the steering rack, replacement of the complete steering rack assembly might be necessary.

Disassembly (Fig. 15)

1. For assembly purposes, measure the distance from shoulder on the tie rod track to the location of the tie rod end (Fig. 16). This will help to adjust front wheel toe−in during assembly of steering rack.

2. Loosen jam nut that secures tie rod end to tie rod track. Remove tie rod end and jam nut from end of tie rod track.

3. Remove clamps that secure bellows to the tie rod track and steering rack housing. Remove bellows from steering rack assembly.

4. Secure steering rack assembly in a vise with soft jaws. Clamp on the mounting surfaces of the rack to prevent damage to internal components.

5. Loosen and remove tie rack track from shaft of steering rack.

6. If necessary, remove input shaft seal from steering rack input shaft (Fig. 17):

   A. Mark and drill two (2) holes in the outer face of the seal.

   B. Thread two (2) self-tapping screws into the drilled holes in the face of the seal.

   C. Use the screws in the face of the seal to pull the seal from the steering rack assembly. Discard seal.

7. Clean and inspect all removed steering rack components. Replace parts that are worn or damaged.

8. Check teeth on steering rack shaft by rotating input shaft to extend rack shaft in one direction, inspect exposed rack teeth and then repeat in opposite direction. If any gear teeth are damaged, steering rack assembly replacement is necessary.

Assembly (Fig. 15)

1. If input shaft seal was removed from steering rack, install new seal into rack. Seal should be pressed fully into bore of rack until it contacts retaining ring in bore.

2. Lubricate steering rack shaft by rotating input shaft to extend rack shaft in one direction and apply general purpose grease to exposed teeth on rack. Rotate input shaft to extend rack shaft in opposite direction and apply general purpose grease to exposed teeth on rack.

3. Secure steering rack in a vise with soft jaws. Clamp on the mounting surfaces of the rack to prevent damage to internal components.

4. Apply medium strength thread locker to threads of tie rack track. Install tie rack track into shaft of steering rack.

5. Carefully install bellows onto steering rack assembly. Secure bellows to the tie rod track and steering rack housing with new clamps. To prevent damage to bellows, do not over−tighten clamps.

6. Install jam nut and then tie rod end to tie rod track. Use measured distance made during disassembly to position the tie rod end. Leave jam nut loose to allow easier toe−in adjustment after steering rack assembly installation on vehicle.

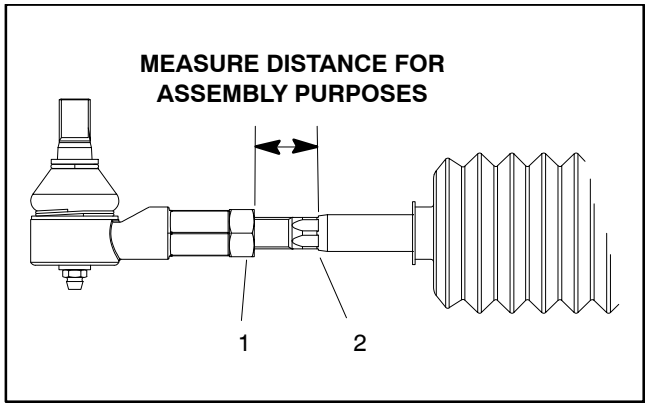

Figure 16

1. Jam nut **2. Track shoulder**

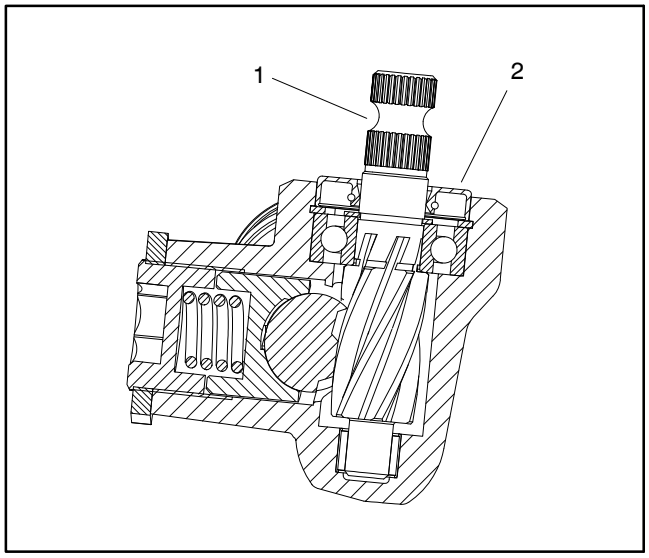

Figure 17

1. Input shaft **2. Input shaft seal**

Front Shock Absorbers

Shock Removal (Fig. 18)

IMPORTANT: Any adjustment to the shock spring preload will affect the front wheel camber (see Adjust Front Wheel Camber in the Adjustments section of this chapter). Do not make shock spring adjustment without checking front wheel camber.

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.

2. Chock wheels not being jacked up. Jack front wheel off the ground and support vehicle with appropriate jack stand beneath the frame.

3. Support a–arm to prevent it from moving after the shock is removed.

4. Remove lock nuts, cap screws and flat washer that secure shock to frame and a–arm. Remove shock absorber from vehicle.

NOTE: Use spanner wrench TOR6010 (see Special Tools in this chapter) if spring preload requires adjustment. If the spring is to be removed from the shock absorber, shock spring compressor tool TOR6015 (see Special Tools in this chapter) can be used.

Shock Installation (Fig. 18)

1. Position shock absorber to frame and a–arm brackets.

2. Secure shock absorber to vehicle.

   A. Slide upper cap screw through frame mounting holes and upper shock eye.

   B. Slide lower cap screw through flat washer, lower shock eye and a–arm mounting hole.

   C. Secure cap screws with lock nuts.

3. Lower vehicle to ground.

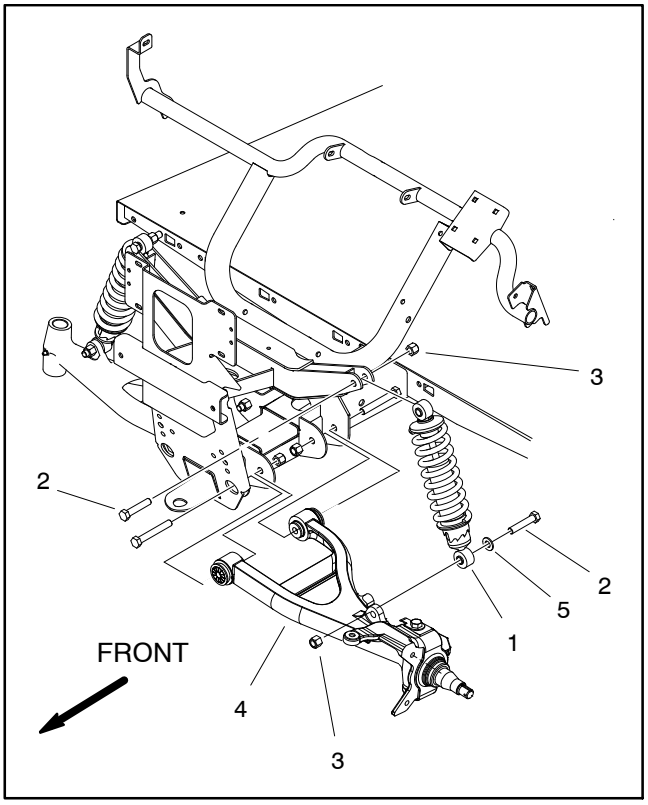

Figure 18

1. **Shock absorber**
2. **Cap screw**
3. **Lock nut**
4. **A–arm (LH shown)**
5. **Flat washer**

A−arms and Front Suspension (Serial Number Below: 316000001)

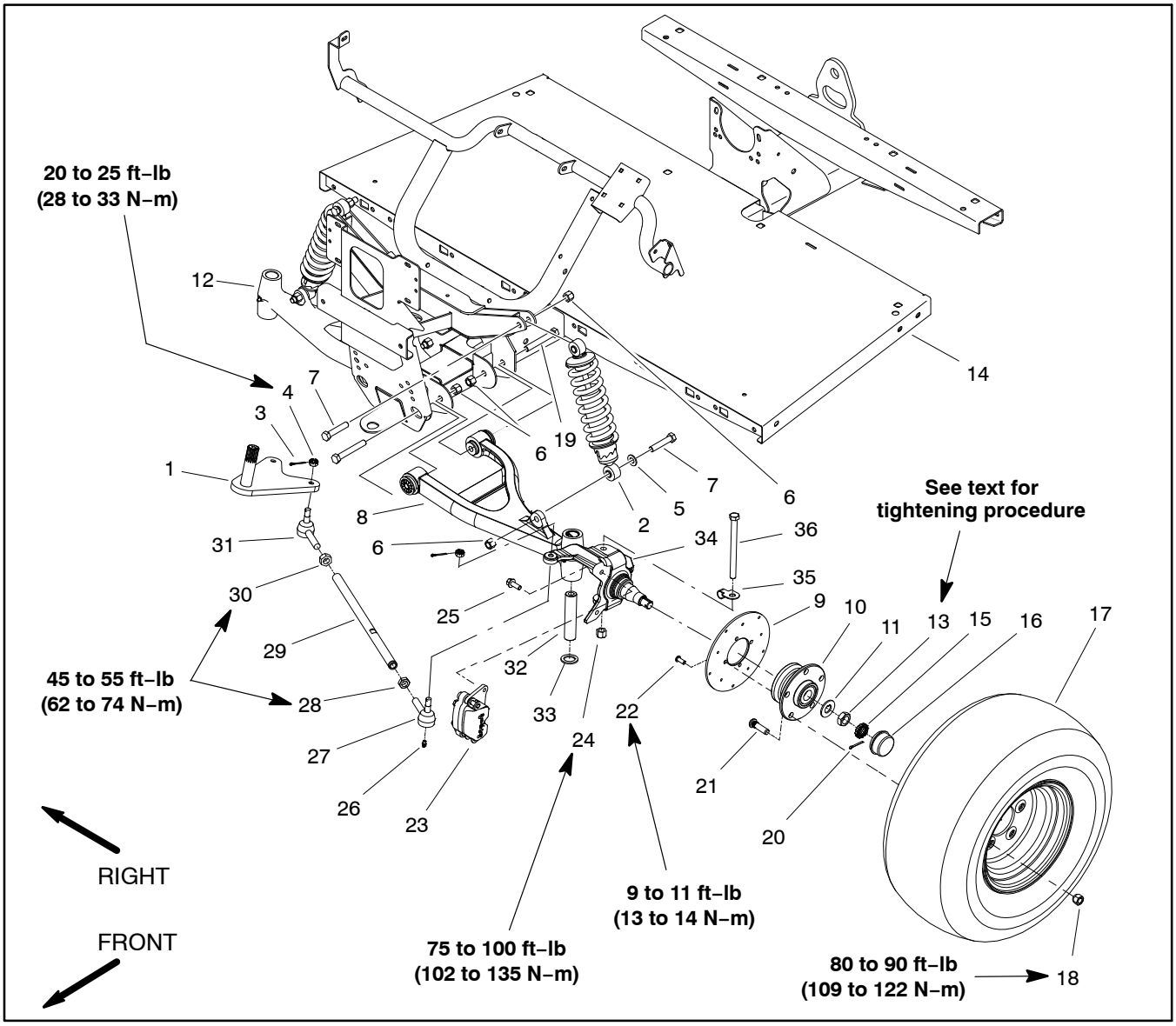

Figure 19

1. Steering gearbox pitman arm
2. Shock absorber (2 used)
3. Cotter pin
4. Slotted hex nut
5. Flat washer
6. Lock nut (3 used per side)
7. Cap screw (2 used per shock)
8. LH A−arm
9. Brake rotor
10. Wheel hub assembly
11. Tab washer
12. RH A−arm
13. Jam nut
14. Front frame
15. Nut retainer
16. Dust cap
17. Wheel assembly
18. Lug nut (5 used per wheel)
19. Cap screw (2 used per A−arm)
20. Cotter pin
21. Wheel stud (5 used per hub)
22. Socket screw (4 used per rotor)
23. Brake caliper (LH shown)
24. Lock nut
25. Flange screw (2 used per caliper)
26. Grease fitting
27. Ball joint (LH threads)
28. Jam nut (LH threads
29. Tie rod
30. Jam nut (RH threads)
31. Ball joint (RH threads)
32. Kingpin sleeve
33. Thrust washer
34. Spindle (LH shown)
35. Brake hose clip
36. Cap screw

A−arm Removal (Fig. 19)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 − Safety.

2. Chock wheels not being jacked up. Jack front wheel off the ground and support vehicle with appropriate jack stand beneath the frame.

3. Remove front wheel and spindle from A−arm (see Lower Steering and Front Wheel Removal in this section).

4. Remove cap screw (item 7), flat washer (item 5) and lock nut (item 6) that secure lower end of shock absorber to A−arm.

5. Support A−arm to prevent it from falling.

6. Remove both cap screws (item 19) and lock nuts (item 6) that secure A−arm to frame. Pull A−arm from frame.

7. If necessary, remove flange bushings and straight bushings from A−arm bores (Fig. 20).

A−arm Installation (Fig. 19)

1. If bushings were removed from A−arm, press new bushings fully into bore of A−arm (Fig. 20).

2. Position A−arm to the frame. Secure A−arm to the frame with cap screws (item 19) and lock nuts (item 6). Insert front screw from front of machine and rear screw from rear of machine. Do not fully tighten nuts.

3. Position lower end of shock absorber to A−arm and insert cap screw (item 7) with flat washer (item 5) from rear of shock. Secure with lock nut (item 6).

4. Fully tighten lock nuts (item 6) to secure A−arm to machine frame.

5. Install spindle and front wheel to the A−arm (see Lower Steering and Front Wheel Installation in this section).

6. Lower machine to ground. Make sure that wheel lug nuts are properly torqued in a crossing pattern from **80 to 90 ft−lb (109 to 122 N−m)**.

7. Align front wheel toe−in (see Adjust Front Wheel Toe−in in the Adjustments section of this chapter).

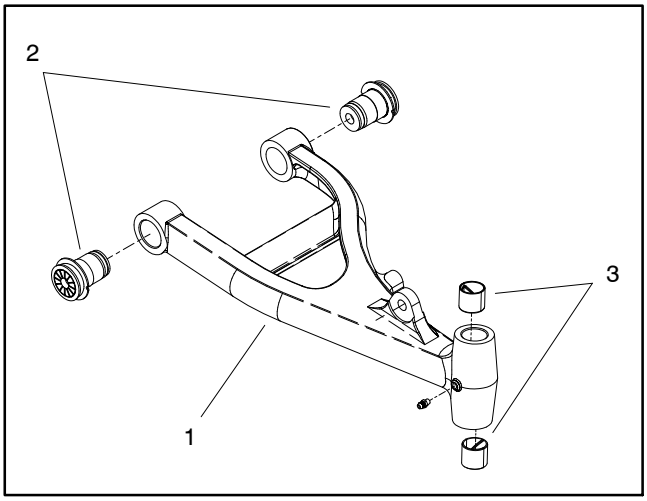

Figure 20

1. **A−arm**
2. **Flange bushing**
3. **Straight bushing**

A−arms and Front Suspension (Serial Number Above: 316000001)

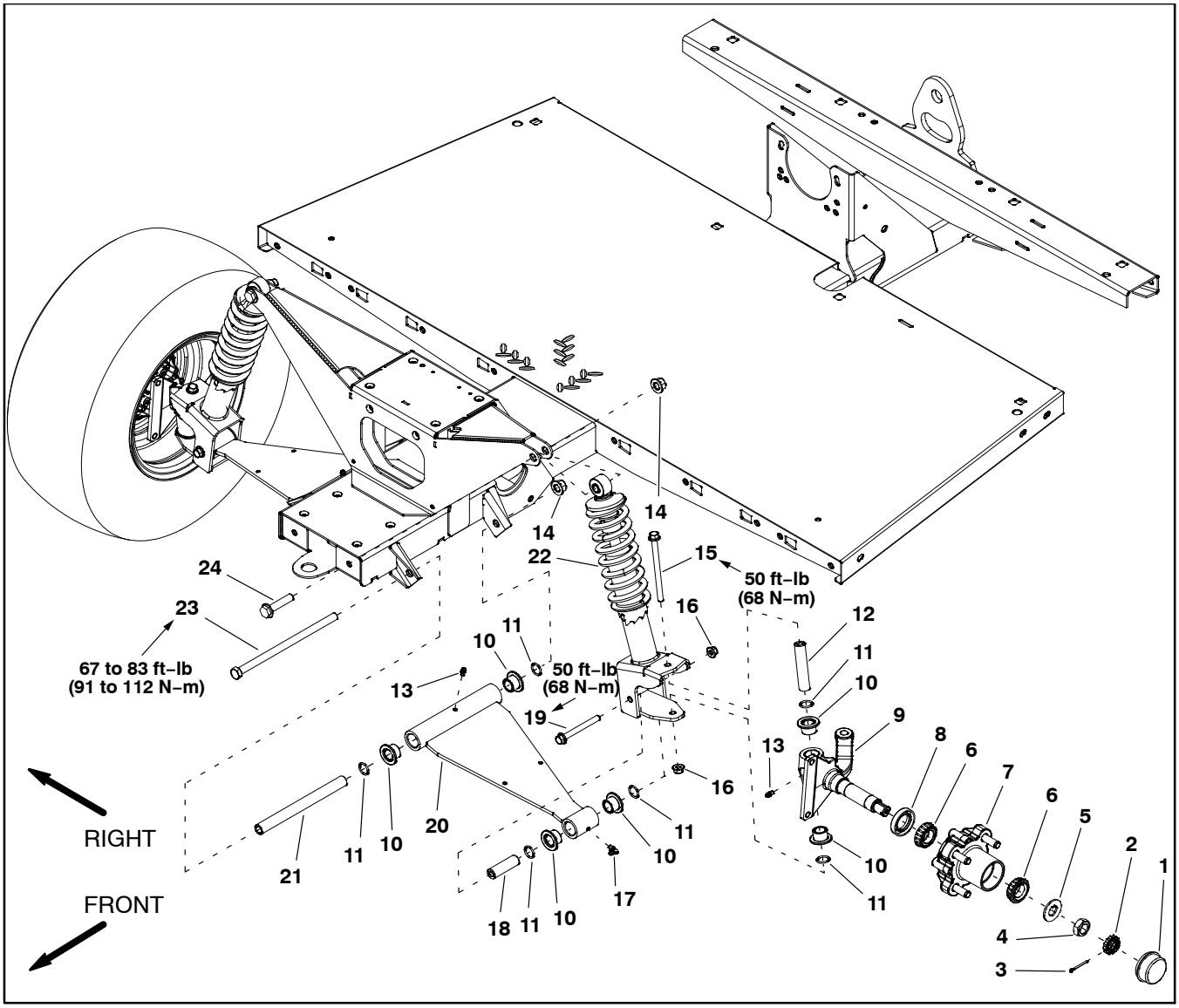

Figure 21

1. Dust cap
2. Retainer
3. Cotter pin
4. Jam nut
5. Tab washer
6. Bearing (2 used)
7. Hub assembly
8. Oil seal
9. Spindle (LH shown)
10. Flange bushing (4 each)
11. O−ring (4 each)
12. Kingpin sleeve
13. Grease fitting (2 each)
14. Flange nut (2 each)
15. Flange head screw
16. Flange nut
17. Grease fitting
18. Control arm sleeve
19. Flange head screw
20. A−arm assembly (2 used)
21. Control arm sleeve
22. Suspension strut assembly
23. Screw
24. Flange head screw

Disassembly (Fig. 19)

1. Park vehicle on a level surface, stop engine, set parking brake and remove key from the key switch.

2. Raise hood to allow access to suspension components from above.

WARNING

Before jacking up the vehicle, review and follow Jacking Instructions in Chapter 1 − Safety.

3. Chock wheels not being removed. Use a jack to raise front wheel that is to be removed off the ground. Support vehicle with appropriate jack stands beneath the frame.

4. Remove front wheel assembly and wheel hub from vehicle (see Front Wheels and Hubs in this section).

5. Remove spindle assembly from vehicle:

A. Remove cotter pin and slotted hex nut securing steering rack tie rod ball joint stud to the spindle. Separate ball joint from the spindle.

B. Remove flange nut and cap screw securing the spindle assembly to the suspension strut assembly. Separate spindle from strut and remove spindle from vehicle.

6. Remove flange head screw and flange nut that secure lower end of suspension strut assembly to A−arm. Pivot strut assembly away from A−arm.

7. If suspension strut assembly removal is necessary, remove flange head screw and lock nut that secure the top of the strut assembly to the front frame. Remove strut assembly from vehicle.

8. Support A−arm to prevent it from falling.

9. Remove cap screw and flange nut that secure A−arm to frame. Remove A−arm assembly from frame.

10. Inspect sleeves and bushings in spindle and A−arm for wear or damage. If necessary, replace sleeves and bushings from spindle or A−arm:

A. Remove sleeves from flange bushings.

B. Remove flange bushings from spindle or A−arm. Take care to not damage bore of component during bushing removal. Clean the inside of the bore to remove all dirt, grease and foreign material.

C. Apply grease to the inside and outside of the new bushings. Use an arbor press to fully install the bushings into the spindle or A−arm.

D. Install sleeves into spindle or A−arm.

Assembly (Fig. 19)

1. Position A−arm to the frame. Secure A−arm to the frame with cap screw and flange nut. Torque screw from **67 to 83 ft−lb (91 to 112 N−m)**.

2. If suspension strut assembly was removed from vehicle, position the top of the strut assembly to the front frame and secure with flange head screw and lock nut.

3. Position lower end of strut assembly to A−arm and secure with flange head screw and flange nut. Torque screw from **50 ft−lb (68 N−m)**.

4. Install spindle assembly to vehicle:

A. Position spindle to suspension strut assembly and secure with cap screw and flange nut. Torque screw from **50 ft−lb (68 N−m)**.

B. Clean tapers of steering rack tie rod ball joint stud and spindle bore.

C. Insert tie rod ball joint stud into spindle and secure with slotted hex nut. Torque slotted hex nut from **26 to 33 ft−lb (35 to 45 N−m)**. If necessary, tighten nut further until slot in nut aligns with hole in tie rod ball joint stud. Install cotter pin.

5. Install front wheel hub and wheel assembly to vehicle (see Front Wheels and Hubs in this section).

6. Lower vehicle to ground. Make sure that wheel lug nuts are properly torqued in a crossing pattern from **80 to 90 ft−lb (108 to 122 N−m)**.

7. Lubricate spindle and A−arm grease fittings with High−Temp Mobil XHP−222 grease (or equivalent).

8. Lower and secure hood.

9. Check front wheel toe−in and adjust if necessary (see Adjust Front Wheel Toe−in in the Adjustments section of this chapter).

Frame Pivot Yoke

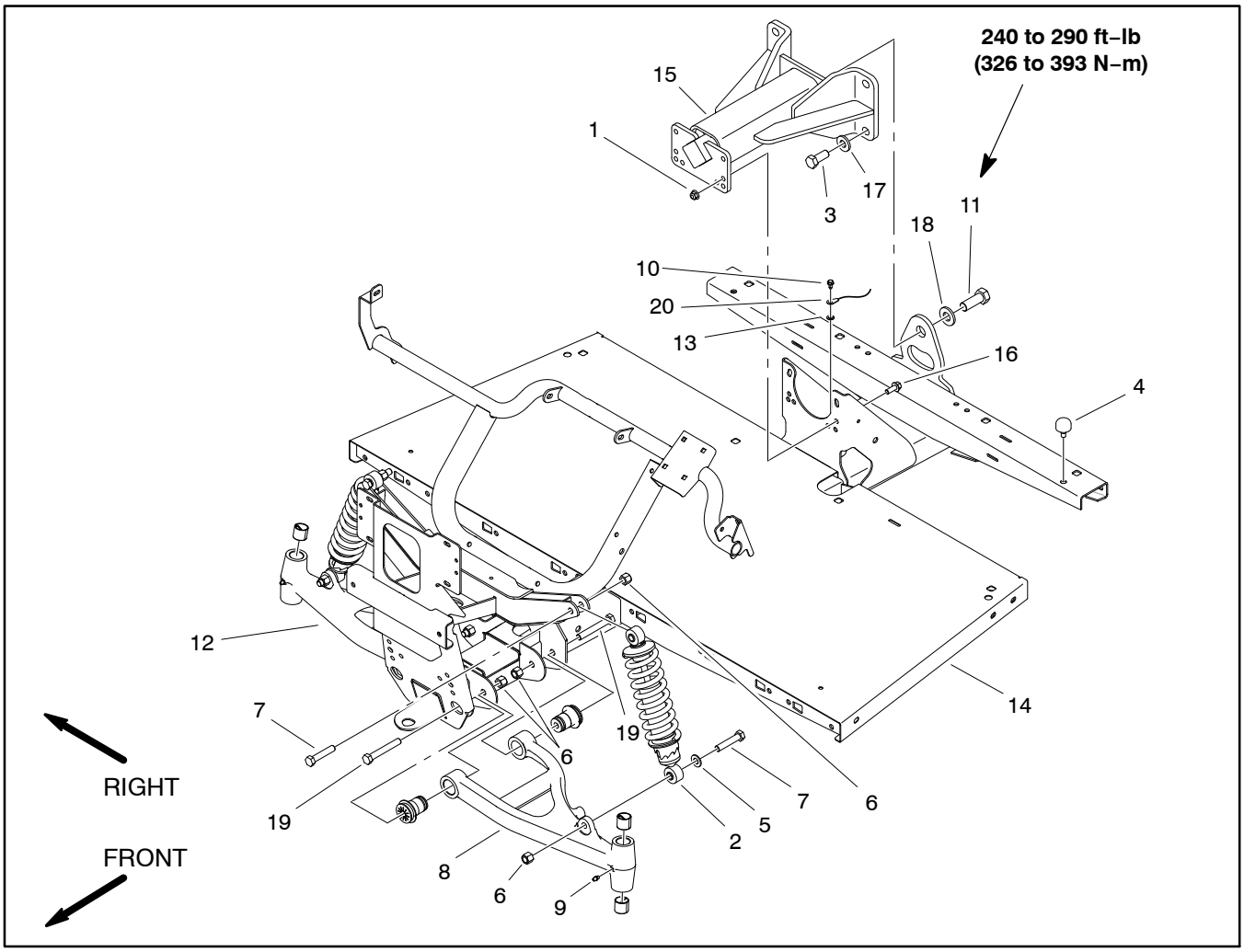

Figure 22

1. Flange nut (4 used)
2. Shock absorber (2 used)
3. Cap screw (4 used)
4. Rubber bumper
5. Flat washer
6. Lock nut (4 used per side)
7. Cap screw (2 used per shock)
8. LH A−arm
9. Grease fitting (1 used per arm)
10. Screw
11. Cap screw
12. RH A−arm
13. Lock washer
14. Front frame
15. Pivot yoke
16. Flange head screw (4 used)
17. Flat washer (4 used)
18. Hardened washer
19. Cap screw (2 used per arm)
20. Ground cable

Pivot Yoke Removal (Fig. 22 and 24)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

2. Remove cargo box from the rear frame (see Cargo Box Removal in this section).

3. Remove seat base from the front frame (see Seat Base Removal in this section).

WARNING

Make sure all tires are chocked to prevent the machine from moving. Before removing the pivot yoke, make sure front and rear frames are supported with jack stands. Support both the front and back of each frame.

4. To prevent vehicle from shifting, use jack stands to support front and back of both front and rear frames.

5. Remove four (4) cap screws and flat washers securing the pivot yoke to the rear frame (Fig. 23).

6. Remove cap screw and hardened washer securing the pivot yoke to the front frame tab.

WARNING

Support pivot yoke while removing it from the front frame to prevent dropping and causing serious injury and damage to the machine.

7. Remove four (4) flange head screws and flanged lock nuts securing the pivot yoke to the front frame. Remove pivot yoke from the machine.

Pivot Yoke Installation (Fig. 22 and 24)

WARNING

Support pivot yoke while installing it to the front frame to prevent dropping and causing serious injury and damage to the machine.

1. Position pivot yoke to the front frame so the diamond pattern faces up. Secure yoke to front frame with four (4) flange head screws and flanged lock nuts. Tighten lower two (2) fasteners first, then tighten upper two (2) fasteners.

2. Secure pivot yoke to the front frame tab with cap screw and hardened washer. Torque cap screw from **240 to 290 ft−lb (326 to 393 N−m)**.

3. Secure pivot yoke to the rear frame with four (4) cap screws and flat washers (Fig. 23).

4. Install seat base to the front frame (see Seat Base Installation in this section).

5. Install cargo box to the rear frame (see Cargo Box Installation in this section).

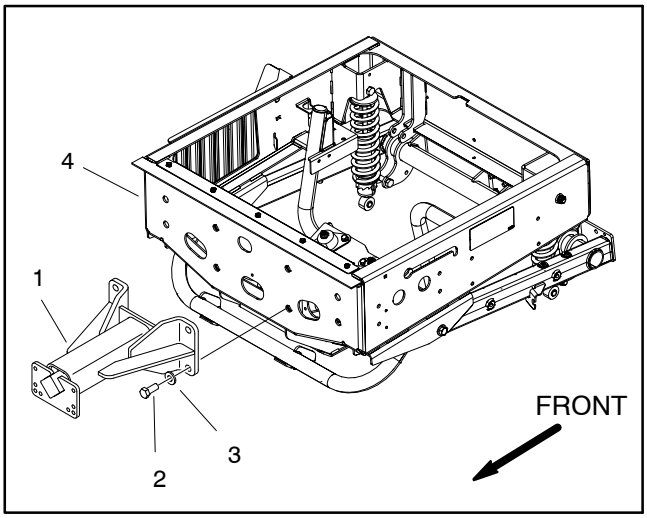

Figure 23

1. **Pivot yoke**
2. **Cap screw (4 used)**
3. **Flat washer (4 used)**
4. **Rear frame**

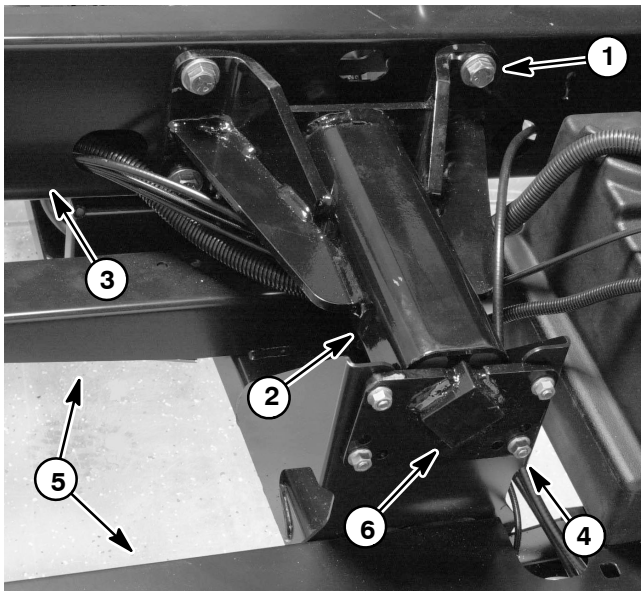

Figure 24

1. **Cap screw & flat washer**
2. **Pivot yoke**
3. **Rear frame**
4. **Flange lock nut**
5. **Front frame**
6. **Diamond pattern**

Swing Arm

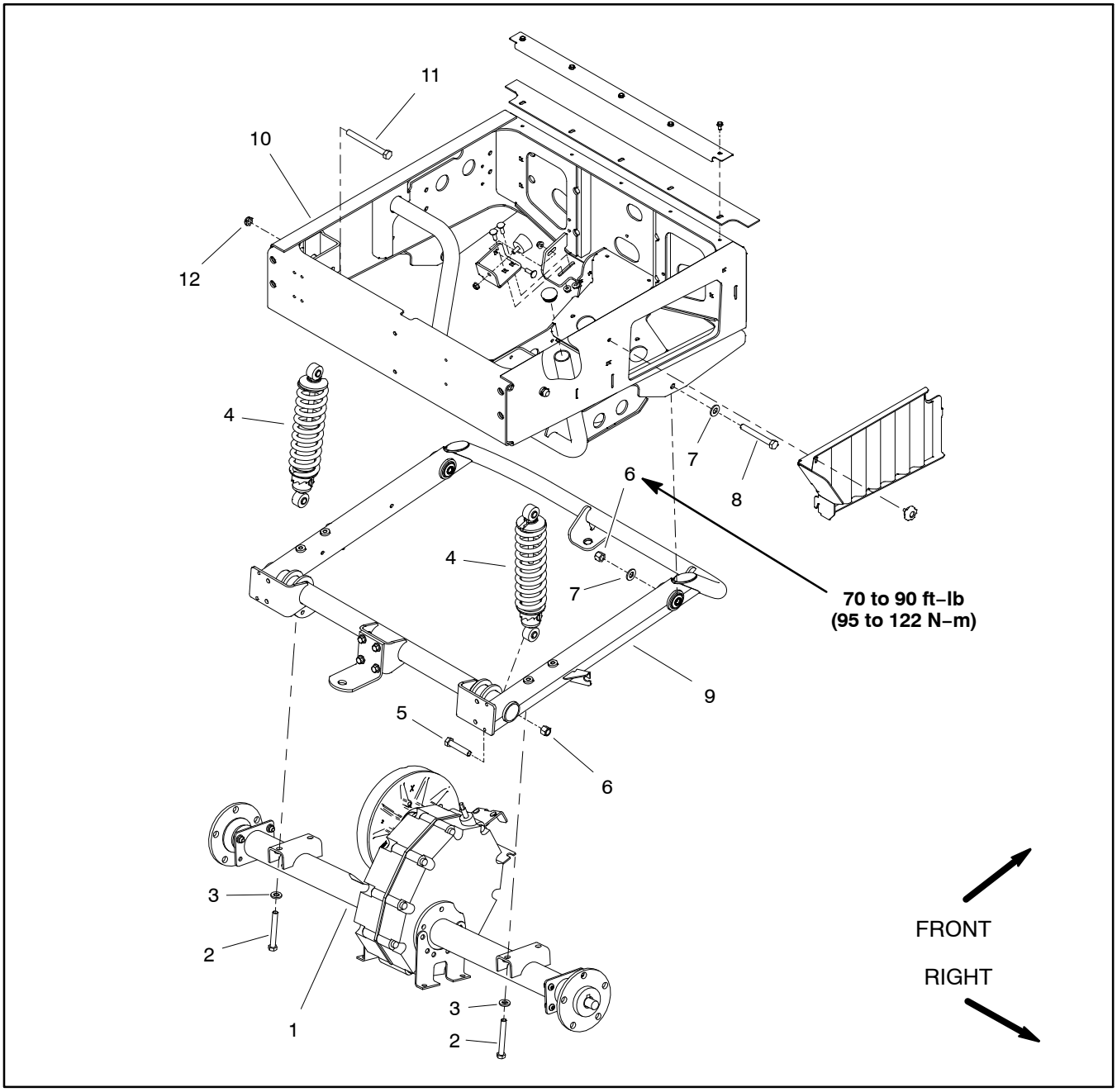

Figure 25

1. **Transaxle assembly**
2. **Cap screw (4 used)**
3. **Hardened washer (4 used)**
4. **Rear shock assembly (2 used)**
5. **Cap screw (2 used)**
6. **Lock nut (4 used)**
7. **Thrust washer (4 used)**
8. **Cap screw (2 used)**
9. **Swing arm**
10. **Rear frame**
11. **Cap screw (2 used)**
12. **Lock nut (2 used)**

Removal (Fig. 25)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

2. Raise and support cargo box with prop rod.

3. Remove muffler from machine (see Exhaust System in the Service and Repairs section of Chapter 3 – Diesel Engine).

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.

4. Jack up and support both sides of the frame:

   A. Chock the front and rear of both front tires to prevent the vehicle from moving.

   B. Use jack or hoist to raise the rear of the vehicle.

   C. After raising the machine, support both sides of the frame with appropriate jack stands positioned just in front of the swing arm pivot area.

5. Remove both rear wheels from transaxle. Also, disconnect parking brake cables and brake lines from both rear wheel brake assemblies on transaxle (see Rear Wheels and Brakes in this section).

6. Remove transaxle from vehicle (see Transaxle in the Service and Repairs section of Chapter 4 – Drive Train). Brake assemblies, brake drums and wheel hubs can remain on the transaxle.

7. Note routing of parking brake cables, rear brake line and shift cables for assembly purposes. Separate cables and brake line from swing arm as needed to allow swing arm removal. Note location of cable ties and clamps for assembly purposes.

8. Remove cap screw and lock nut that secure both shock absorbers to swing arm.

9. Support swing arm to prevent it from falling.

10. Remove cap screws, thrust washers and lock nuts that secure swing arm pivots to machine frame.

IMPORTANT: Take care to not damage the engine, fuel hoses, electrical harness, control cables or other parts while removing the swing arm from the vehicle.

11. Carefully, lower swing arm from rear frame and remove from vehicle.

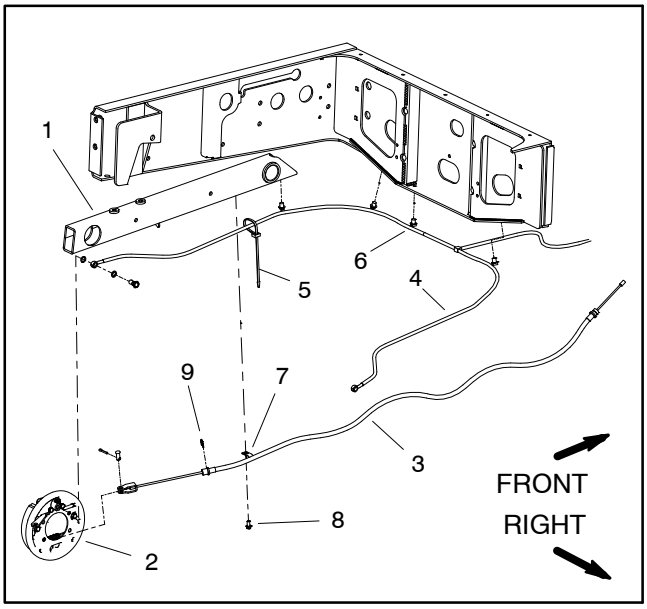

Figure 26

1. **Swing arm**
2. **Rear brake (LH shown)**
3. **Brake cable (2 used)**
4. **Rear brake line**
5. **Cable tie (2 used)**
6. **Clip (6 used)**
7. **R – clamp (2 used)**
8. **Screw (2 used)**
9. **Retaining ring (2 used)**

Installation (Fig. 25)

IMPORTANT: Take care to not damage the engine, fuel hoses, electrical harness, control cables or other parts while raising the swing arm to the rear frame.

1. Position swing arm under vehicle and carefully raise it to rear frame.

2. Align swing arm pivots to frame mounting points. Secure swing arm to machine frame with cap screws, thrust washers and lock nuts. Torque lock nuts from **70 to 90 ft–lb (95 to 122 N–m)**.

3. Secure both shock absorbers to swing arm with cap screw and lock nut. Insert cap screw from the inside of the swing arm brackets.

4. Install transaxle to vehicle (see Transaxle in the Service and Repairs section of Chapter 4 – Drive Train). Make sure that shift cables are correctly adjusted.

5. Use notes taken before removal to properly route and secure parking brake cables and brake lines to rear brake assemblies.

6. Secure parking brake cables to the rear brakes (see Parking Brake in this section).

7. Secure brake lines to the rear brakes (see Rear Wheels and Brakes in this section).

8. Bleed brake system (see Bleed Brake System in this section).

9. Install both wheels to the transaxle (see Rear Wheels and Brakes in this section).

10. Lower machine to ground.

11. Install muffler to machine (see Exhaust System in the Service and Repairs section of Chapter 3 – Diesel Engine).

12. Lower and secure cargo box.

13. Check parking brake operation and adjust if necessary (see Adjust Parking Brake in the Adjustments section of this chapter).

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Parking Brake

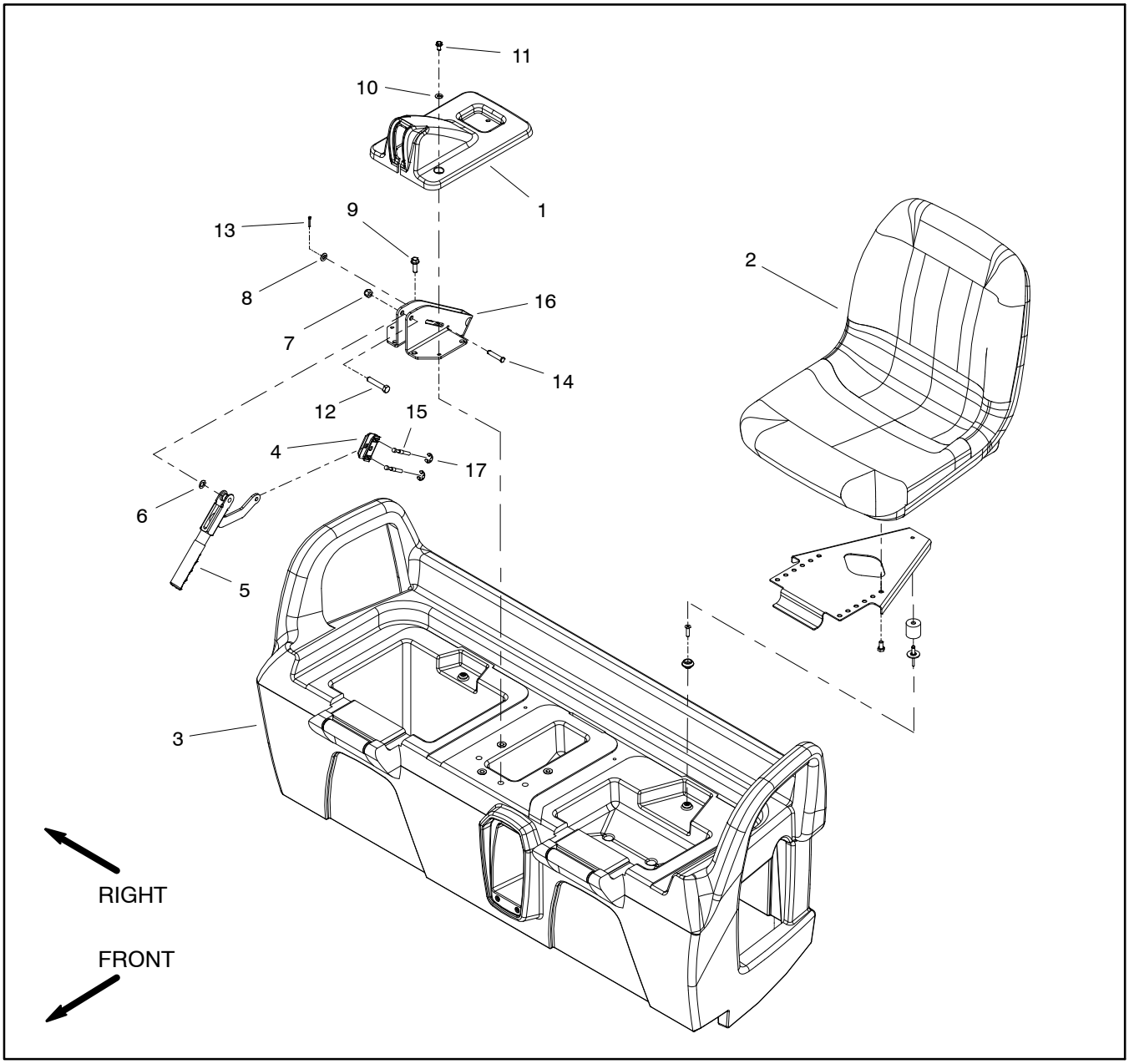

Figure 27

1. Parking brake cover
2. Operator seat (2 used)
3. Seat base
4. Cable equalizer bracket
5. Parking brake lever
6. Curved washer
7. Lock nut
8. Flat washer
9. Flange head screw (4 used)
10. Flat washer (2 used)
11. Screw (2 used)
12. Cap screw
13. Cotter pin
14. Clevis pin
15. Parking brake cable (2 used)
16. Parking brake support
17. Cable retaining ring (2 used)

Disassembly (Fig. 27)

1. Park machine on a level surface, stop engine and remove key from the ignition switch. Chock wheels to prevent the machine from moving.

2. Disconnect both parking brake cables from rear of machine (Fig. 28):

   A. Remove cotter pin and clevis pin that secures each brake cable end to brake lever.

   B. Remove retaining ring that secures each brake cable to swing arm.

   C. Remove washer head screw that secures each R−clamp to rear frame.

   D. For assembly purposes, note location of cable ties that secure each rear brake line to parking brake cables. Remove cable ties.

3. Remove parking brake cover from seat base.

4. Remove four (4) flange head screws that secure parking brake support to seat base.

5. Carefully lift parking brake support with brake cables attached from machine. Take care to not damage brake cables while removing them from seat base opening.

6. Remove brake cables from parking brake support and cable equalizer bracket using Figure 27 as a guide.

7. Note routing of brake cables for assembly purposes.

8. Remove brake cables from machine.

Assembly (Fig. 27)

1. Secure brake cables to parking brake support and cable equalizer bracket using Figure 27 as a guide.

2. Route brake cables through seat base opening taking care to not damage cables. Position parking brake support to seat base.

3. Secure parking brake support to seat base with four (4) flange head screws.

4. Position brake cables to rear brake assemblies using cable routing noted during disassembly.

5. Secure parking brake cables to rear of machine (Fig. 28):

   A. Secure each brake cable to swing arm with retaining ring.

   B. Secure each brake cable end to brake lever with clevis pin and cotter pin.

   C. Secure each R−clamp to rear frame with washer head screw.

   D. Secure each rear brake line to parking brake cable with cable tie.

6. Check parking brake operation and adjust if necessary (see Adjust Parking Brake in the Adjustments section of this chapter).

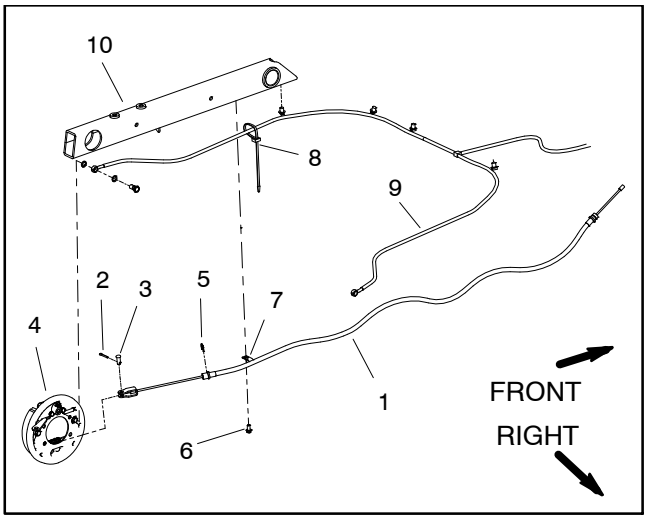

Figure 28

1. **Brake cable**
2. **Cotter pin**
3. **Clevis pin**
4. **Rear brake assembly**
5. **Retaining ring**
6. **Washer head screw**
7. **R−clamp**
8. **Cable tie**
9. **Rear brake line**
10. **Swing arm**

Rear Wheels and Brakes

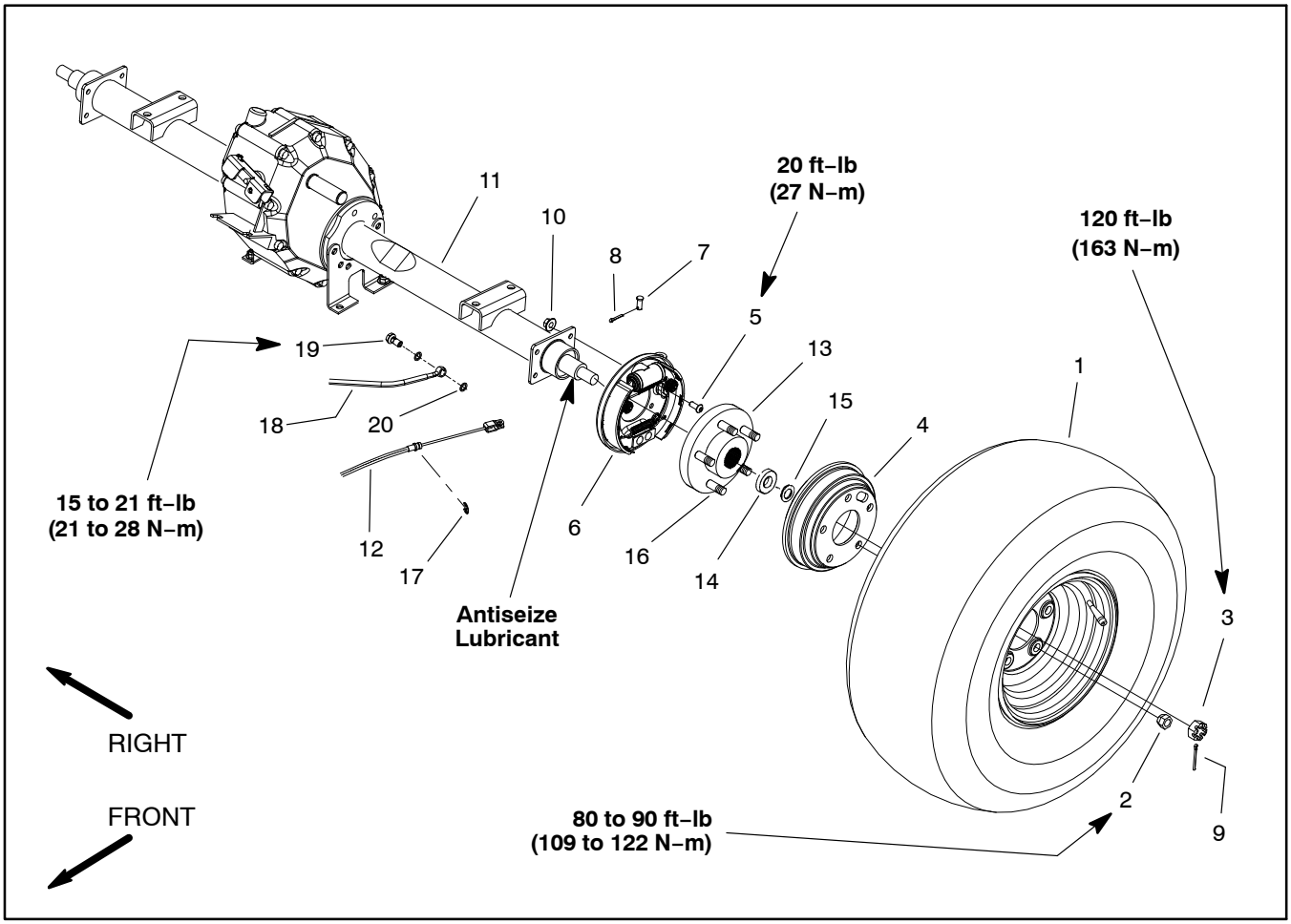

Figure 29

1. Wheel assembly
2. Lug nut (5 used per hub)
3. Castle nut
4. Brake drum
5. Socket head screw (4 used per brake)
6. Brake assembly (LH shown)
7. Clevis pin
8. Cotter pin
9. Cotter pin
10. Flange nut (4 used per brake)
11. Transaxle
12. Parking brake cable (2 used)
13. Wheel hub
14. Washer
15. Spring washer
16. Wheel stud (5 used per hub)
17. Retaining ring
18. Rear brake line
19. Banjo bolt
20. Banjo washer (2 used per brake)

Removal (Fig. 29)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

WARNING

Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.

2. Chock wheels not being jacked up. Lift rear wheel off the ground using a jack and support vehicle with appropriate jack stand beneath the frame.

3. Remove five (5) lug nuts, wheel assembly and brake drum from the wheel hub.

4. Remove cotter pin from the castle nut and transaxle shaft. Remove castle nut, spring washer and washer from the shaft. Remove the wheel hub from the shaft.

NOTE: The brake assembly can be removed from the transaxle shaft for disassembly.

5. If required, remove brake assembly as follows:

   A. Remove cotter pin and clevis pin securing the parking brake cable to the parking brake lever on the rear of the brake assembly.

   B. Clean hydraulic brake line area of brake assembly to prevent contamination (Fig. 30). Loosen and disconnect brake line from wheel cylinder. Plug brake line and position it away from brake assembly. Discard two (2) banjo washers.

C. Remove four (4) socket head screws and flange nuts that secure the brake assembly to the transaxle.

D. Remove brake assembly from the transaxle.

Installation (Fig. 29)

IMPORTANT: Parking brake levers must be positioned above the transaxle mount. When positioned correctly, brake lever will point toward the rear of the axle.

1. Position brake assembly to the transaxle. Secure backing plate of the brake assembly to the transaxle with four (4) socket head screws and flanged nuts. Torque screws to **20 ft−lb (27 N−m)**.

2. Position new banjo washer on each side of brake line fitting (Fig. 30). Insert banjo bolt into fitting and thread into wheel cylinder. Torque banjo bolt from **15 to 21 ft−lb (21 to 28 N−m)**.

3. Secure parking brake cable to the brake lever with clevis pin and cotter pin.

IMPORTANT: Do not get antiseize lubricant onto brake shoes.

4. Apply light coat of antiseize lubricant to the transaxle shaft splines.

5. Secure wheel hub to the transaxle shaft with washer, spring washer and castle nut.

6. Torque castle nut **120 ft−lb (163 N−m)**. If slot in nut does not align with hole in transaxle shaft, continue tightening nut to align next slot with hole in shaft. Castle nut torque should not exceed 200 ft−lb (271 N−m).

7. Secure castle nut to transaxle shaft with cotter pin.

8. Slide brake drum onto wheel hub.

9. Position wheel assembly to the machine with valve stem facing out and secure with five (5) lug nuts.

10. Lower machine to ground.

11. Torque lug nuts in a crossing pattern from **80 to 90 ft−lb (109 to 122 N−m)**.

12. Check parking brake operation. Adjust parking brake if necessary (see Parking Brake Adjustment in the Adjustments section of this chapter).

13. Bleed brakes (see Bleed Brake System in this section).

CAUTION

After servicing brake system components, always check the brakes in a wide open, level area that is free of other persons and obstructions.

14. Check brake operation.

Burnish Brake Shoes

After brake shoe replacement, burnish (break−in) the brakes before use.

1. Bring the machine to full speed and apply the brakes to rapidly stop the machine without skidding or locking up the wheels.

2. Repeat this procedure 10 times. To avoid overheating the brakes, wait 1 minute between each stop.

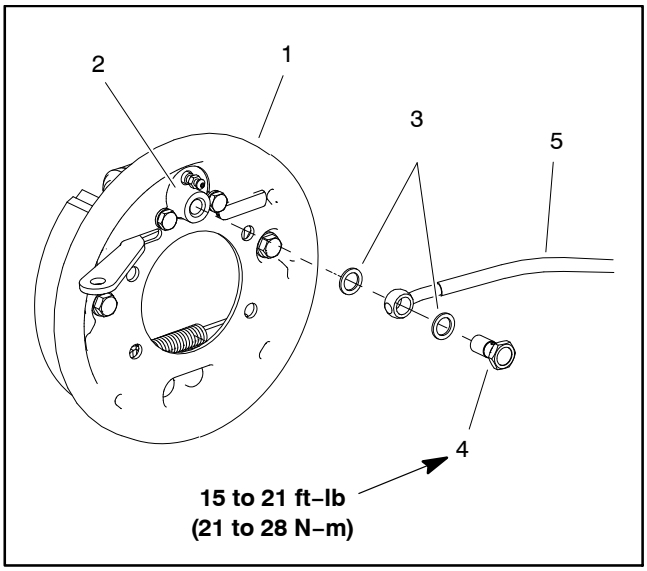

Figure 30

1. **Brake assembly**
2. **Wheel cylinder**
3. **Banjo washer**
4. **Banjo bolt**
5. **Brake line**

Rear Brake Service

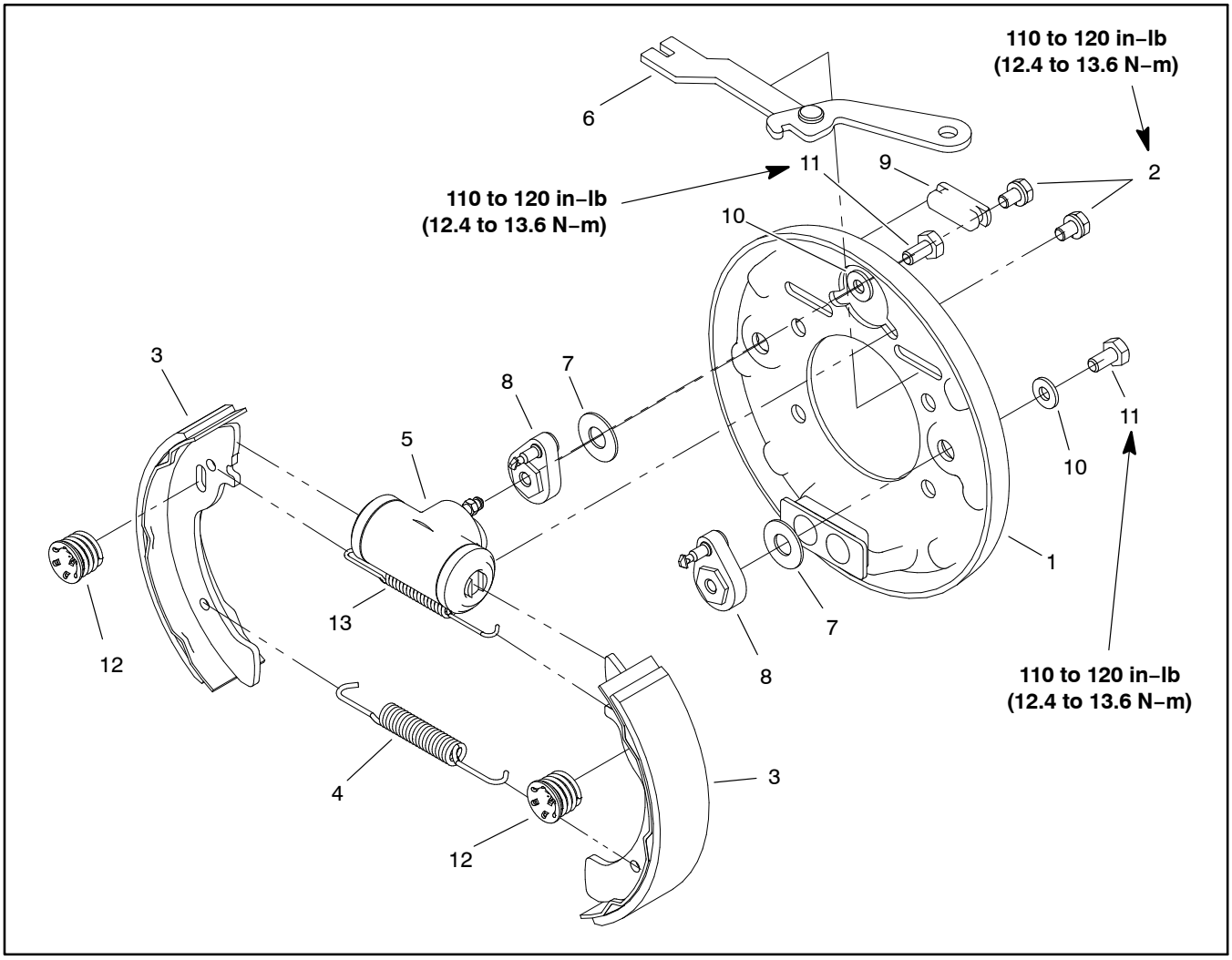

Figure 31

1. Brake backing plate
2. Washer head screw
3. Brake shoe
4. Lower spring
5. Wheel cylinder
6. Parking brake lever (LH shown)
7. Belleville washer
8. Adjuster lever
9. Dust cover
10. Flat washer
11. Bolt
12. Shoe hold down cup and spring
13. Upper spring

Disassembly (Fig. 31)

CAUTION

Be careful when removing springs from brake shoes. The springs are under heavy load and may cause personal injury.

1. Remove upper and lower springs from brake shoes.

2. Remove shoe hold down cups and springs that secure the brake shoes to the backing plate.

3. Remove brake shoes from backing plate.

4. If required, slide parking brake lever from slot and dust cover in backing plate.

5. If necessary, remove two (2) washer head screws that secure wheel cylinder to backing plate. Remove wheel cylinder from backing plate.

6. If necessary, remove bolts and washers to allow adjuster levers to be separated from backing plate. Locate and remove belleville washers from between adjuster levers and backing plate.

Inspection (Fig. 31)

1. Inspect brake drums.

IMPORTANT: Brake drum machining is not recommended. Replace brake drums as a set to maintain equal braking forces.

A. Clean drums with denatured alcohol. Check braking surface diameter in at least three places. If the diameter exceeds 6.320 inches (160.5 mm), replace both brake drums.

B. Replace drums that are cracked, deeply grooved, tapered, significantly out−of−round, scored, heat spotted or excessively rusted.

C. Minor scoring can be removed with sandpaper.

2. Inspect brake shoe linings.

IMPORTANT: Replace brake shoes as a set (all four shoes) to maintain equal braking forces.

A. Replace brake shoes if damaged or if lining is worn to 1/16" (1.6 mm). Replace if lining is contaminated by oil, grease or other fluids.

NOTE: Overheated springs lose their tension, and can cause brake linings to wear out prematurely.

B. Inspect brake shoe webbing, upper and lower springs and shoe hold down springs for overheating. Overheating is indicated by a slight blue color. Inspect brake shoe webbing for deformation. Replace parts as necessary.

C. Inspect hold down pins on adjuster levers for bends, rust and corrosion. Replace as necessary.

3. Inspect backing plate surfaces, which contact with the brake shoes for grooves that may restrict shoe movement. Replace plate if grooves can not be removed by light sanding with emery cloth or other suitable abrasive. Replace plate if cracked, warped or excessively rusted.

4. Inspect adjuster levers for deformation. Replace levers if deformation or excessive rust is found.

5. Replace parking brake cables if frayed, stretched or kinked.

Assembly (Fig. 31)

IMPORTANT: Brake shoe lining surfaces must be free of grease, oil and other foreign matter.

1. Apply a light film of lubricant to the following:

A. Ledges on which the brake shoes rest.

B. Pin surfaces on adjuster levers.

C. Anchor block surface that contacts shoe webs.

D. Both surfaces of belleville washers that are positioned between adjuster levers and backing plate.

2. If removed, position lubricated belleville washer between lever adjuster and backing plate. Secure adjuster to backing plate with washer and bolt. Torque bolt from **110 to 120 in−lb (12.4 to 13.6 N−m)**.

3. If removed, secure wheel cylinder to backing plate with two (2) washer head screws. Torque screws from **110 to 120 in−lb (12.4 to 13.6 N−m)**.

4. If removed from backing plate, slide parking brake lever into slot and dust cover in backing plate.

5. Position brake shoes to backing plate. Make sure that each shoe is properly positioned at anchor block, parking brake lever, wheel cylinder and pin on adjuster lever. Secure shoes to backing plate with shoe hold down cups and springs.

CAUTION

Be careful when installing springs to brake shoes. The springs are under heavy load and may cause personal injury.

6. Secure brake shoes with upper and lower springs.

Front Brake Calipers

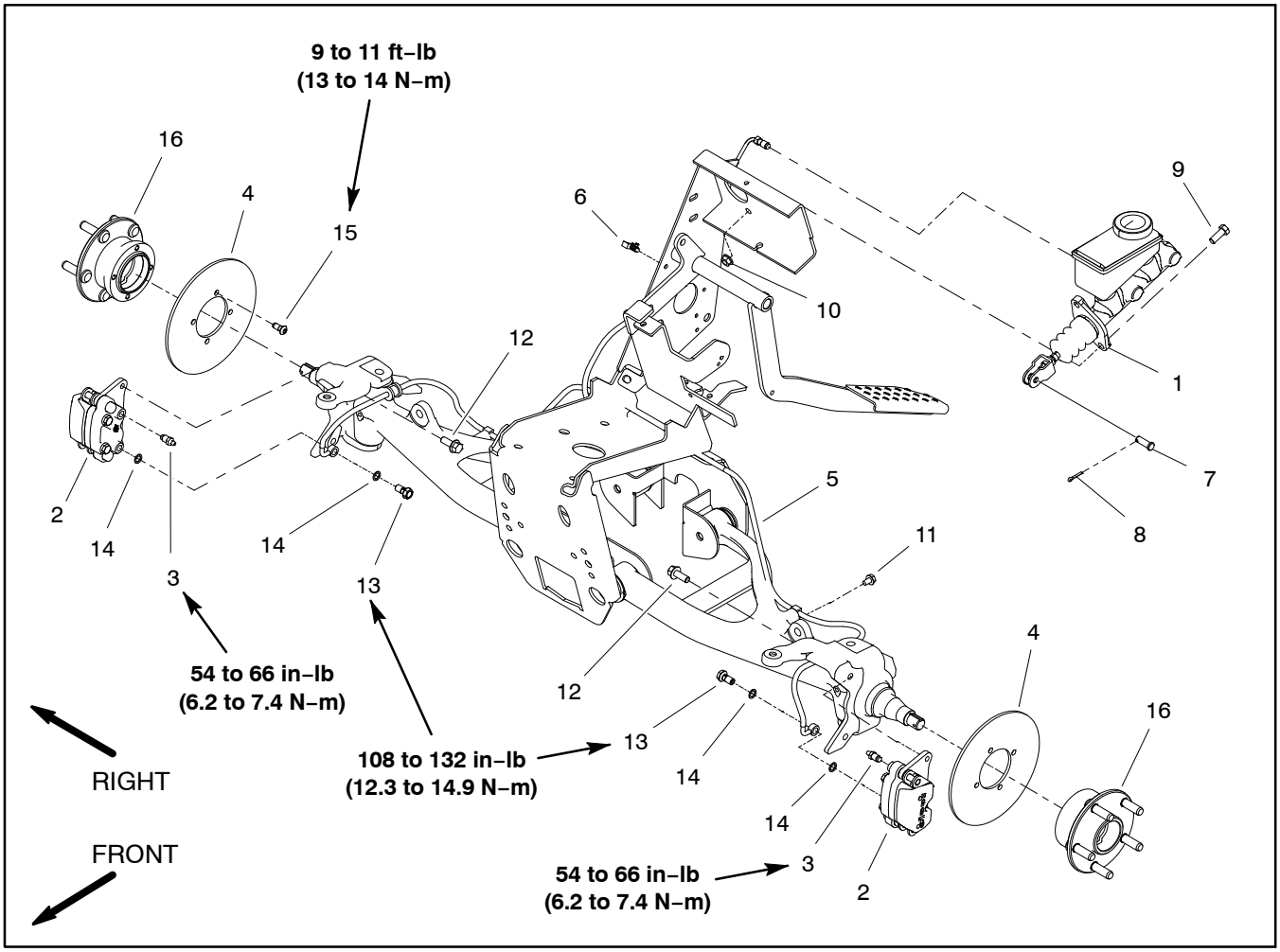

Figure 32

1. Brake master cylinder
2. Brake caliper (2 used)
3. Bleed screw
4. Brake rotor (2 used)
5. Front brake line
6. Brake line clip (4 used)
7. Clevis pin
8. Cotter pin
9. Cap screw (2 used)
10. Flange nut (2 used)
11. Flange screw (2 used)
12. Flange screw (2 per caliper)
13. Banjo bolt (2 used)
14. Banjo washer (4 used)
15. Socket head screw (4 per rotor)
16. Wheel hub assembly

Disassembly (Fig. 32)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

> **WARNING**
>
> **Before jacking up the machine, review and follow Jacking Instructions in Chapter 1 – Safety.**

2. Chock wheels not being jacked up. Jack front wheel off the ground and place appropriate jack stand beneath the frame to support vehicle.

3. Remove front wheel from machine (see Lower Steering and Front Wheel Removal in this section).

4. Disconnect brake line from caliper:

   A. Clean hydraulic brake line area of brake caliper to prevent contamination.

   B. Remove banjo bolt from caliper brake line from caliper.

   C. Carefully separate brake line from caliper. Locate and retrieve two (2) banjo washers from sides of brake line fitting.

   D. Plug brake line and position it away from caliper.

5. Remove two (2) flange head screws that secure the brake caliper to the spindle.

6. Slide brake caliper from brake rotor and remove caliper from machine.

Assembly (Fig. 32)

1. Slide brake caliper onto brake rotor. Make sure that rotor is between brake pads.

2. Align caliper mounting holes with spindle. Secure caliper with two (2) flange head screws.

3. Connect brake line to caliper:

   A. Position brake line to caliper.

   B. Place banjo washer on each side of brake line fitting.

   C. Install banjo bolt through brake line fitting and banjo washers and then thread into caliper. Torque banjo bolt from **108 to 132 in–lb (12.3 to 14.9 N–m)**.

4. Install front wheel assembly (see Lower Steering and Front Wheel Removal in this section).

5. Lower machine to ground.

6. Torque wheel lug nuts in a crossing pattern from **80 to 90 ft–lb (109 to 122 N–m)**.

7. Bleed brakes (see Bleed Brake System in this section).

> **CAUTION**
>
> **After servicing brake system components, always check the brakes in a wide open, level area that is free of other persons and obstructions.**

8. Check brake operation.

Burnish Brake Pads

After brake pad replacement, burnish (break–in) the brakes before use.

1. Bring the machine to full speed and apply the brakes to rapidly stop the machine without skidding or locking up the wheels.

2. Repeat this procedure 10 times. To avoid overheating the brakes, wait 1 minute between each stop.

Front Brake Caliper Service

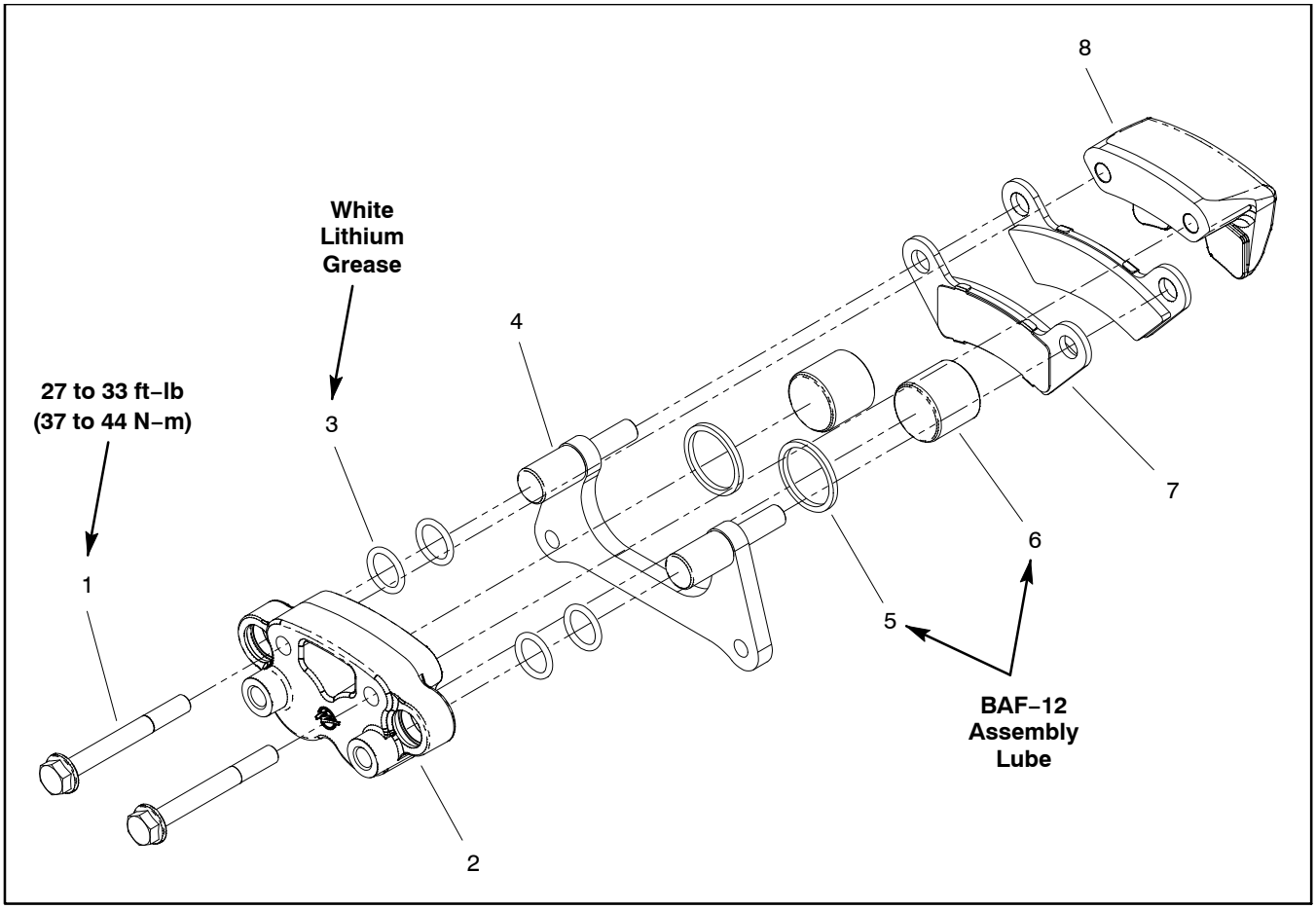

Figure 33

1. Bolt (2 used)
2. Caliper body
3. O−ring (4 used)
4. Caliper bracket
5. Square seal (2 used)
6. Piston (2 used)
7. Brake pad (2 used)
8. Caliper anvil

Disassembly (Fig. 33)

1. Remove two (2) bolts that secure brake caliper assembly.

2. Remove caliper anvil and then slide brake pads from pins on caliper bracket.

3. Slide caliper body assembly from caliper bracket.

4. If necessary, remove remaining components from caliper body:

   A. Carefully remove pistons from caliper body making sure that outer surface of pistons are not damaged during removal.

   B. Carefully, remove and discard O−rings and square seals from caliper body. Make sure that caliper body is not damaged during removal of O−rings and seals.

5. Clean caliper components with brake cleaner.

Inspection

1. Check brake pads for uneven wear that would indicate binding in the caliper assembly. Replace the brake pads if the friction material is worn to less than 1/16" (1.6 mm). Also, if pads are contaminated with grease or oil, they must be replaced.

2. Inspect brake pistons and piston bores in caliper body for damage or wear. Replace brake pistons or complete brake caliper assembly if necessary.

3. Check that pins on caliper bracket are not worn or damaged. Wear on the pins will prevent smooth brake operation.

Assembly (Fig. 33)

1. If caliper body was disassembled, install components in caliper body:

   A. Apply hydraulic brake cylinder assembly lube (BAF−12 or equivalent) to square seals and piston before installation.

   B. Fit lubricated square seals into grooves of caliper body. Make sure that seals are not twisted in groove after installation.

   C. Install lubricated pistons into caliper body bores. Pistons should slide into bores with light resistance.

   D. Lubricate O−rings with white lithium grease and install into grooves in caliper body.

   E. Slide caliper body assembly onto pins on caliper bracket.

NOTE: If brake pads are being replaced, it will be necessary to push caliper pistons back into the caliper bore before installing new pads.

2. Slide brake pads onto pins on caliper bracket. Make sure that friction material on pads is toward brake rotor position.

3. Fit caliper anvil to assembly and secure caliper components with two (2) bolts. Torque bolts from **27 to 33 ft−lb (37 to 44 N−m)**.

Brake Master Cylinder

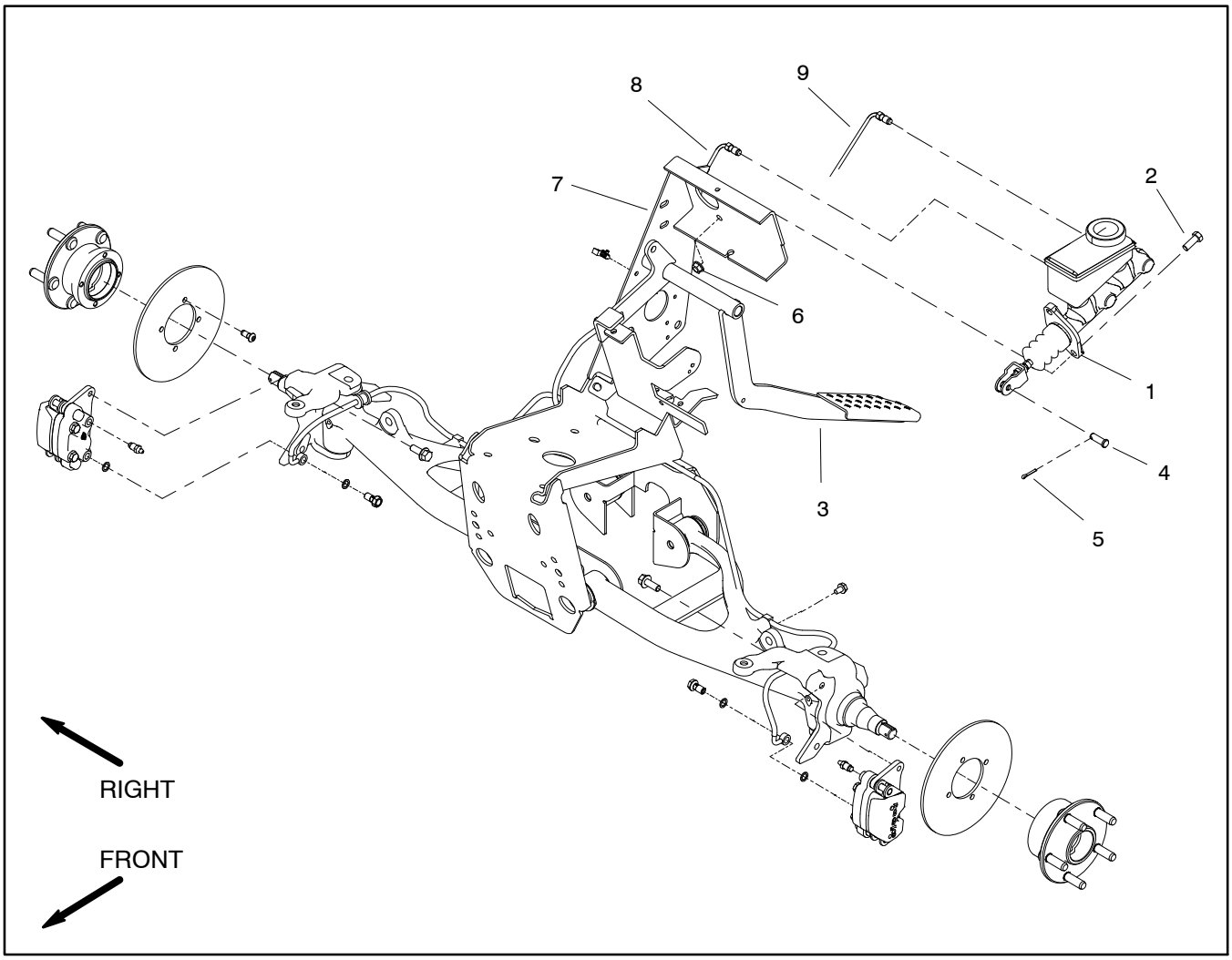

Figure 34

1. **Brake master cylinder**
2. **Cap screw (2 used)**
3. **Brake pedal**
4. **Clevis pin**
5. **Cotter pin**
6. **Flange head nut (2 used)**
7. **Pedal frame**
8. **Front brake line**
9. **Rear brake line**

Removal (Fig. 34)

1. Raise front hood to gain access to brake master cylinder.

2. Remove cotter pin from the clevis pin that connects master cylinder to brake pedal.

IMPORTANT: To prevent contamination of the brake system, make sure to clean components before disassembly.

3. Clean hydraulic brake line area of master cylinder to prevent contamination. Remove both brake lines from master cylinder. Cap ends of brake lines and position them away from master cylinder.

4. Remove two (2) flange head nuts and cap screws that secure master cylinder to pedal frame.

5. Remove master cylinder from machine.

Installation (Fig. 34)

1. Position master cylinder to pedal frame and secure with two (2) cap screws and flange nuts.

2. Remove plugs from brake lines. Install brake lines to master cylinder.

3. Connect master cylinder to brake pedal with clevis pin and cotter pin.

4. Bleed brakes (see Bleed Brake System in this section).

5. Lower and secure front hood.

CAUTION

After servicing brake system components, always check the brakes in a wide open, level area that is free of other persons and obstructions.

6. Check brake operation.

Brake Master Cylinder Service

Disassembly (Fig. 35)

1. Thoroughly clean outside of master cylinder before disassembly.

2. Remove reservoir and flange seal. Push in on the push rod so the stop pin can be removed.

3. Disconnect lower end of the dust cover from the housing.

4. Push in on the push rod and remove circlip, then remove push rod with dust cover and clevis. Remove retainer washer.

5. Remove primary piston assembly and secondary piston assembly from cylinder housing.

Inspection

CAUTION

Use eye protection such as goggles when using compressed air for master cylinder service.

1. Clean all metal parts with isopropyl alcohol, then clean out and dry grooves and passageways with compressed air. Make sure cylinder bore and component pieces are thoroughly clean.

2. Check cylinder bore, pistons and springs for damage or excessive wear. Replace brake cylinder assembly if signs of pitting, scoring or cracks are evident in cylinder bore.

Assembly (Fig. 35)

1. Apply a film of clean brake fluid to cylinder bore and piston assemblies.

2. Install secondary piston assembly and primary piston assembly into cylinder.

3. Install retainer washer.

4. Install push rod and secure in place with circlip. Install lower end of dust cover to housing.

5. Push in on push rod so stop pin can be installed to retain secondary piston assembly, then install flange seal and reservoir.

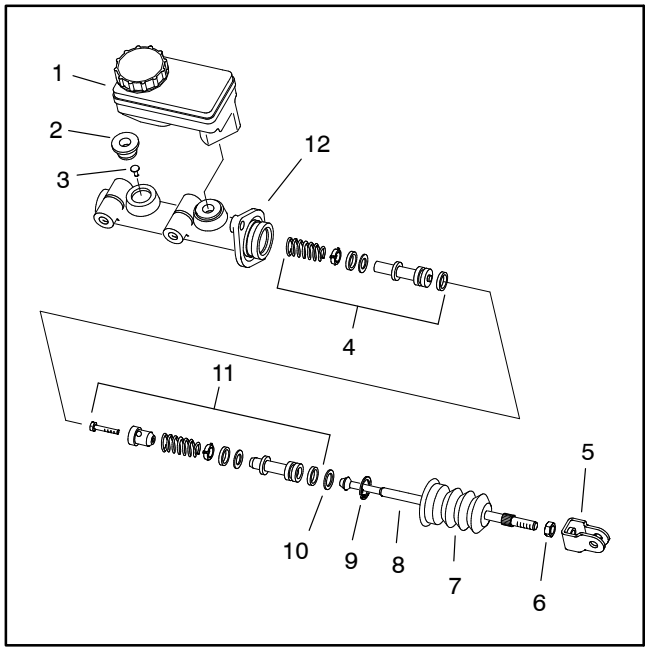

Figure 35

1. **Reservoir**
2. **Flange seal**
3. **Stop pin**
4. **Secondary piston assy**
5. **Clevis**
6. **Jam nut**
7. **Dust cover**
8. **Push rod**
9. **Circlip**
10. **Retainer washer**
11. **Primary piston assy**
12. **Cylinder housing**

Bleed Brake System

IMPORTANT: To prevent contamination of the brake system, make sure to clean components before disassembly.

1. Connect a suitable transparent hose to bleeder valve on front brake caliper (Fig. 36) or rear wheel brake cylinder (Fig. 37). Submerge other end of hose in a glass container partially filled with clean brake fluid.

2. Have a second person pump brake pedal several times, then hold pedal down firmly.

3. With pedal firmly depressed, open bleeder valve of brake until pedal fades to floor. Close bleeder valve before releasing pedal.

4. Repeat procedure until a continuous flow of brake fluid, with no air bubbles, is released from bleeder valve. **Make sure fluid level is maintained in brake fluid reservoir at all times**.

5. When brake bleeding is completed, torque caliper bleed valve as follows:

   A. Torque caliper bleed valve on front brakes from **54 to 66 in−lb (6.2 to 7.4 N−m)**.

   B. Torque caliper bleed valve on rear brakes to **38 in−lb (4.3 N−m)**.

6. Repeat steps 1 to 4 for other front calipers and rear brake cylinders.

CAUTION

After servicing the brakes, always check the brakes in a wide open, level area that is free of other persons and obstructions.

7. After bleeding of brakes is completed, test vehicle to make sure brakes are operating correctly and brake pedal is solid.

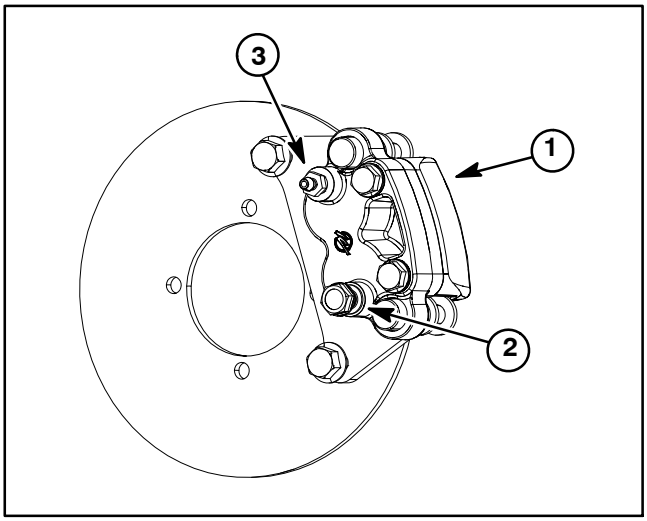

Figure 36

1. **Front caliper (LH shown)**
2. **Banjo bolt**
3. **Bleed valve**

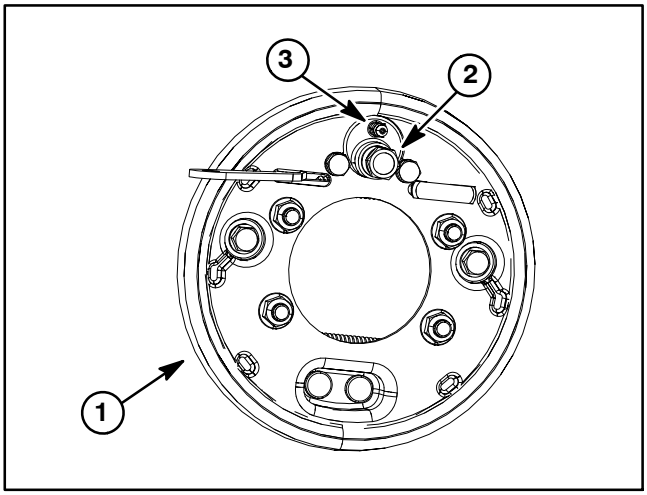

Figure 37

1. **Rear brake (LH shown)**
2. **Banjo bolt**
3. **Bleed valve**

Seat Base

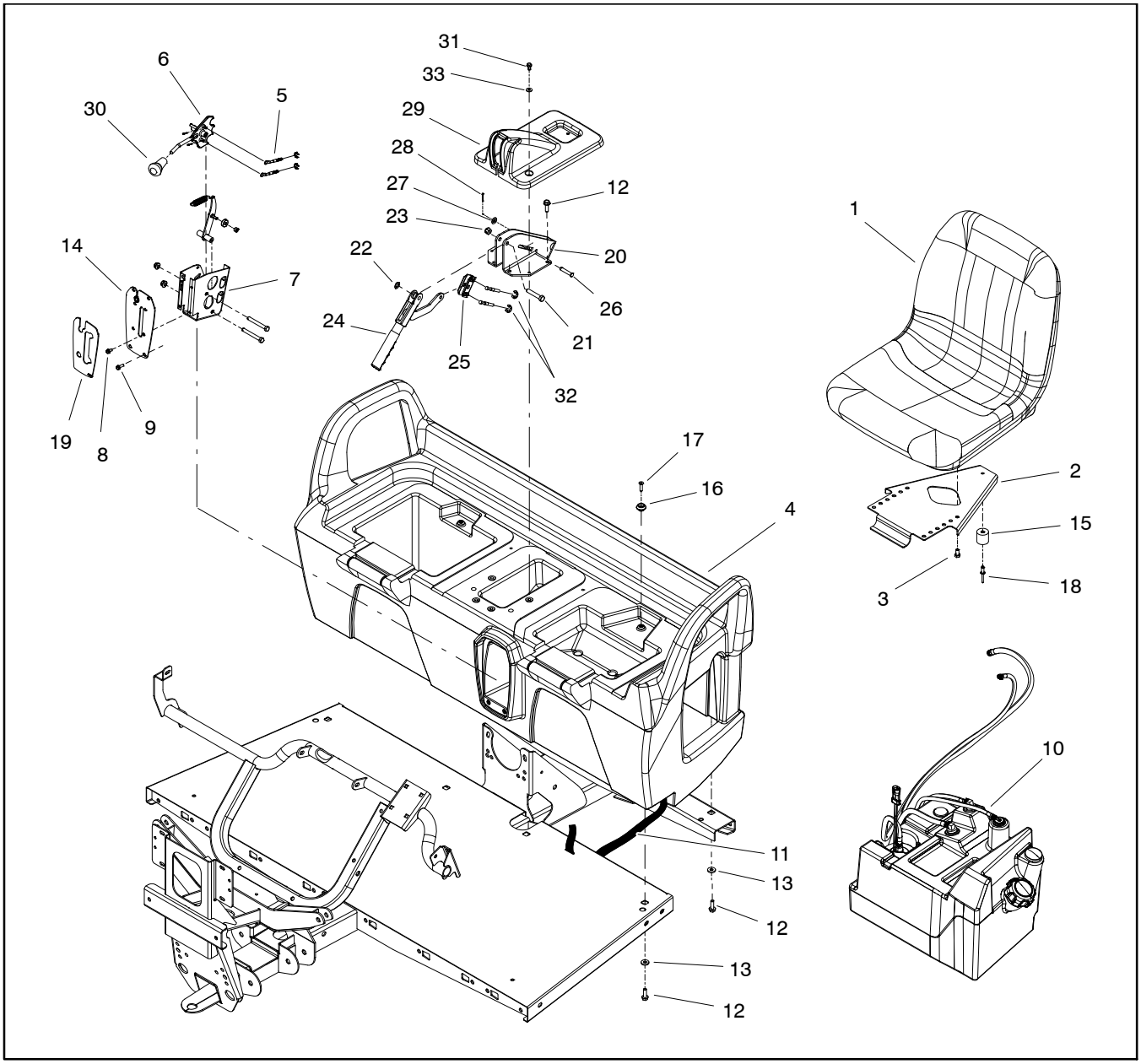

Figure 38

1. Seat (2 used)
2. Seat bracket (2 used)
3. Cap screw (8 used)
4. Seat base
5. Shift cable (2 used)
6. Shift lever
7. Shift bracket
8. Flange screw (1/2” long) (4 used)
9. Flange screw (3/4” long) (4 used)
10. Fuel tank assembly
11. Web strapping
12. Flange head screw (12 used)
13. Flat washer (8 used)
14. Shift plate
15. Rubber receptacle (2 used)
16. Holding post (2 used)
17. Screw (2 used)
18. Rivet (2 used)
19. Shifter decal
20. Parking brake support
21. Cap screw
22. Curved washer
23. Lock nut
24. Parking brake lever
25. Equalizer bracket
26. Clevis pin
27. Flat washer
28. Cotter pin
29. Parking brake cover
30. Knob
31. Screw (2 used)
32. Retaining ring (2 used)
33. Flat washer (2 used)

Seat Base Removal (Fig. 38)

1. Park machine on a level surface, stop engine, engage parking brake and remove key from the ignition switch.

2. Flip both seats forward and remove them from the seat base.

3. Remove parking brake assembly from seat base (see Parking Brake in this section).

4. Unscrew knob from the shift lever. Remove four (4) flange head screws (item 8 in Fig. 38) that secure the shift plate to the shift bracket (Fig. 39).

5. Remove four (4) flange head screws (item 9 in Fig. 38) that secure the shift plate to the seat base (Fig. 39). Separate shift bracket from the seat base.

6. Remove eight (8) flange head screws and flat washers that secure the seat base to the frame.

IMPORTANT: Make sure shift bracket, shift cables and fuel tank do not catch on the seat base during removal.

7. Carefully lift seat base from the machine.

Seat Base Installation (Fig. 38)

IMPORTANT: Make sure shift bracket, shift cables and fuel tank do not catch on the seat base during installation.

1. Carefully lower seat base to the vehicle frame.

NOTE: Do not tighten fasteners securing the seat base to the frame until all of them are installed.

2. Install eight (8) flange head screws and flat washers through the frame and into the seat base. Tighten screws from the middle of the vehicle to the outside.

3. Place shift bracket and shift cables through the opening at the front of the seat base.

4. Position shift plate to shift bracket making sure to capture cable flange. Secure shift plate to shift bracket with four (4) flange head screws (item 8 in Fig. 38). Screw knob onto the shift lever (Fig. 39).

5. Position shift plate with shift bracket to the seat base. Secure shift plate to seat base with four (4) flange head screws (item 9 in Fig. 38) (Fig. 39).

6. Install parking brake assembly to seat base (see Parking Brake in this section).

7. Secure seats to seat base.

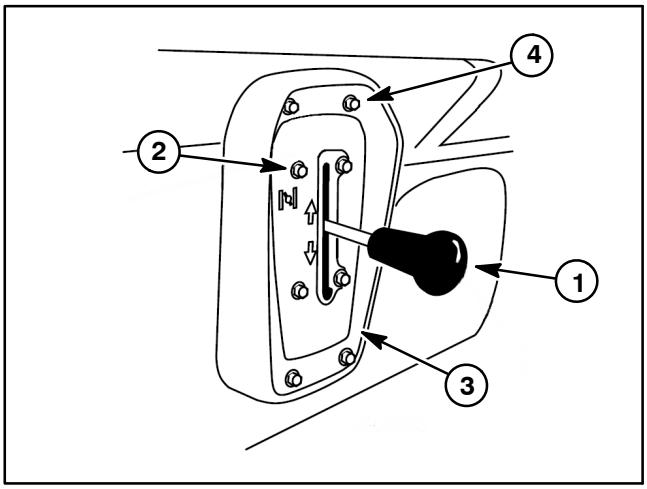

Figure 39

1. **Shift lever**
2. **Cap screw (short)**
3. **Shift plate**
4. **Cap screw (long)**

Front Hood

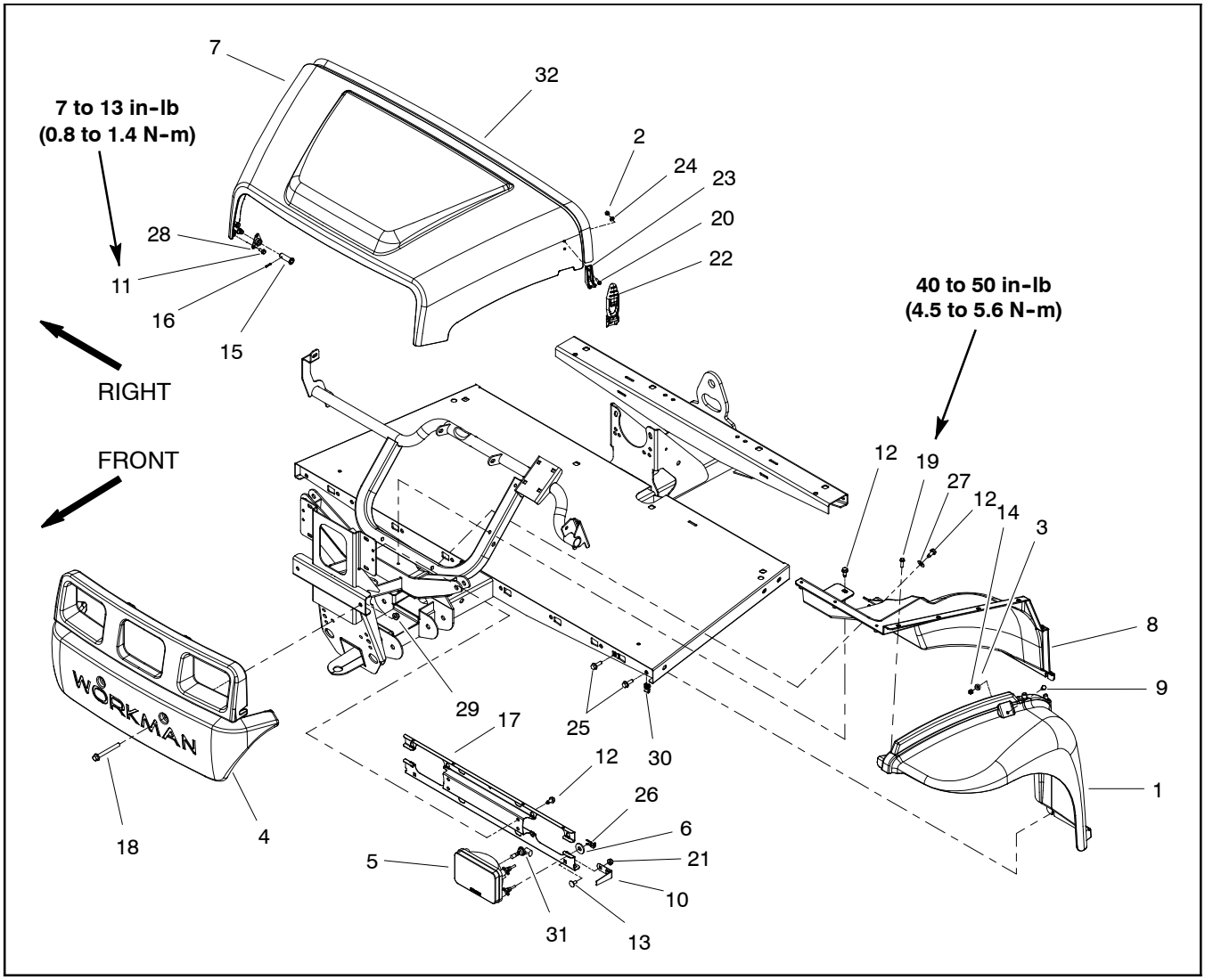

Figure 40

1. Fender (LH shown)
2. Lock nut (4 used)
3. Flat washer (2 used)
4. Front bumper
5. Headlight (2 used)
6. Washer (3 used per headlight)
7. Hood
8. Fender well (LH shown)
9. Cap screw (2 used)
10. Hood pivot keeper (2 used)
11. Screw (6 used)
12. Washer head screw (8 used)
13. Carriage screw (2 used)
14. Lock nut (2 used)
15. Pivot pin (2 used)
16. Spring pin (2 used)
17. Headlight bracket
18. Flange head screw (2 used)
19. Washer head screw (20 used)
20. Washer head screw (4 used)
21. Flange nut (2 used)
22. Rubber latch (2 used)
23. Catch (2 used)
24. Flat washer (4 used)
25. Flange head screw (10 used)
26. Clip (3 used per headlight)
27. Flat washer (2 used)
28. Retainer (2 used)
29. Flange nut (2 used)
30. Tinnerman nut (10 used)
31. Headlight bulb (2 used)
32. Foam seal

Removal (Fig. 40)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition.

2. Remove hood using Figure 40 as a guide.

Installation (Fig. 40)

NOTE: Do not tighten fasteners securing the hood until all fasteners are in place.

1. Install hood using Figure 40 as a guide. During assembly, use fastener torque specifications that are identified in Figure 40.

Cargo Box

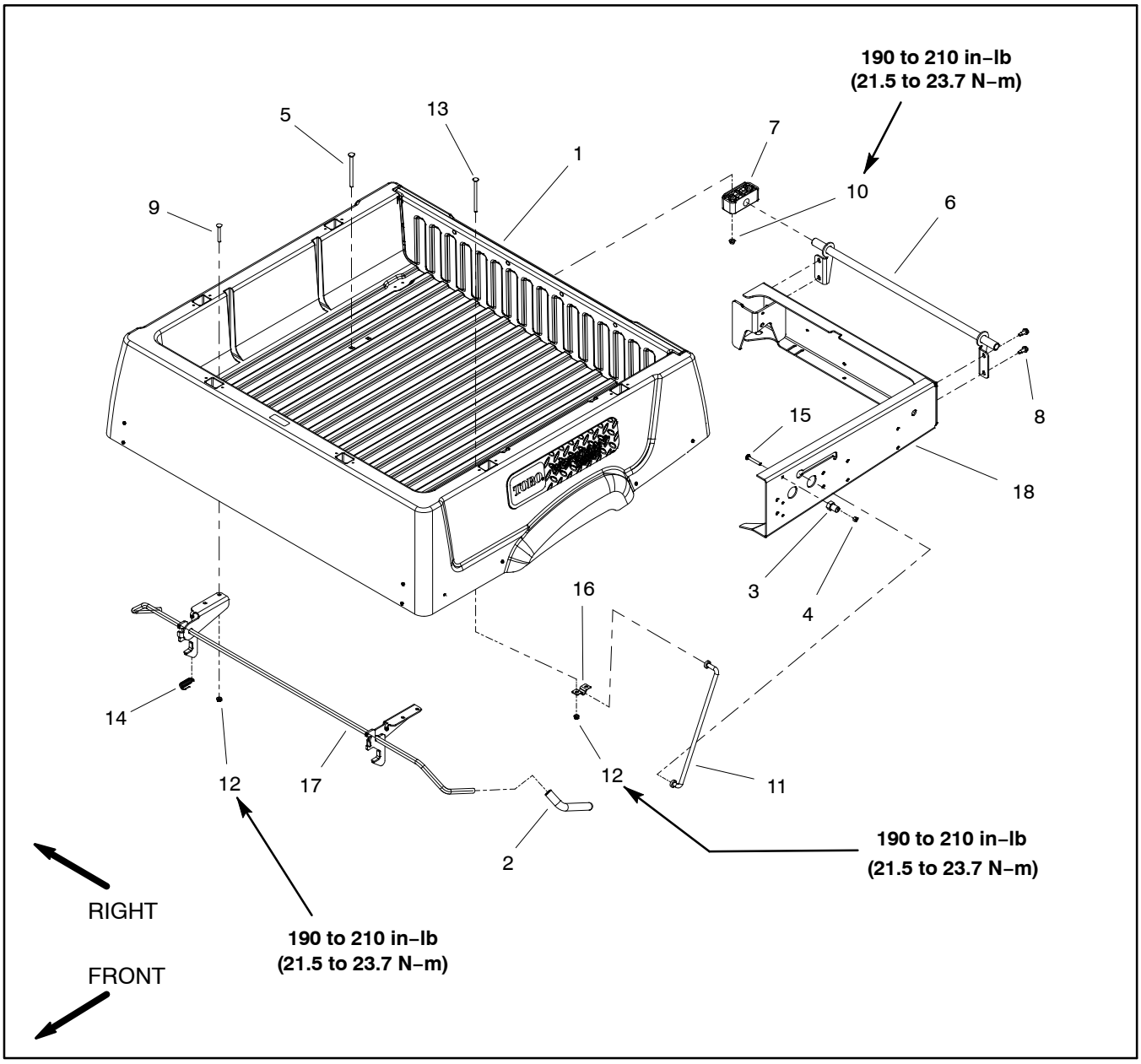

Figure 41

1. Cargo box
2. Handle
3. Latch pin (2 used)
4. Lock nut (2 used)
5. Carriage screw (4 used)
6. Pivot bracket
7. Pivot bushing (2 used)
8. Screw (4 used)
9. Carriage screw (4 used)
10. Flange nut (4 used)
11. Prop rod
12. Flange nut (6 used)
13. Carriage screw (2 used)
14. Tension spring (2 used)
15. Carriage screw (2 used)
16. Prop rod bracket
17. Latch assembly
18. Rear frame

Removal (Fig. 41)

1. Park machine on a level surface, stop engine, set parking brake and remove key from the ignition switch.

2. Disassemble cargo box as necessary using Figures 41 and 42 as guides.

Installation (Fig. 41)

1. Assemble cargo box using Figures 41 and 42 as guides.

A. When installing cargo box, use torque specifications identified in Figure 41.

B. When installing tailgate latches, use torque specifications identified in Figure 42.

C. Adjust latch pin (item 3 in Figure 41) so that cargo box is tight to frame when latched.

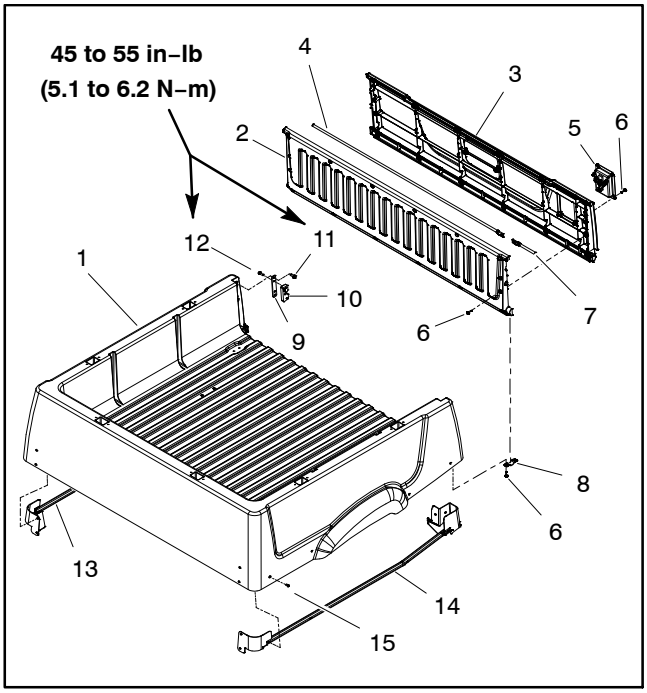

Figure 42

1. **Cargo box**
2. **Inner tailgate**
3. **Outer tailgate**
4. **RH latch rod**
5. **Latch handle**
6. **Screw (24 used)**
7. **LH latch rod**
8. **Retainer (2 used)**
9. **Striker mount (2 used)**
10. **Strike latch (2 used)**
11. **Screw (4 used)**
12. **Screw (4 used)**
13. **RH inside support**
14. **LH inside support**
15. **Pop rivet (18 used)**

Windshield Wiper Assembly (Machines with Operator Cab)

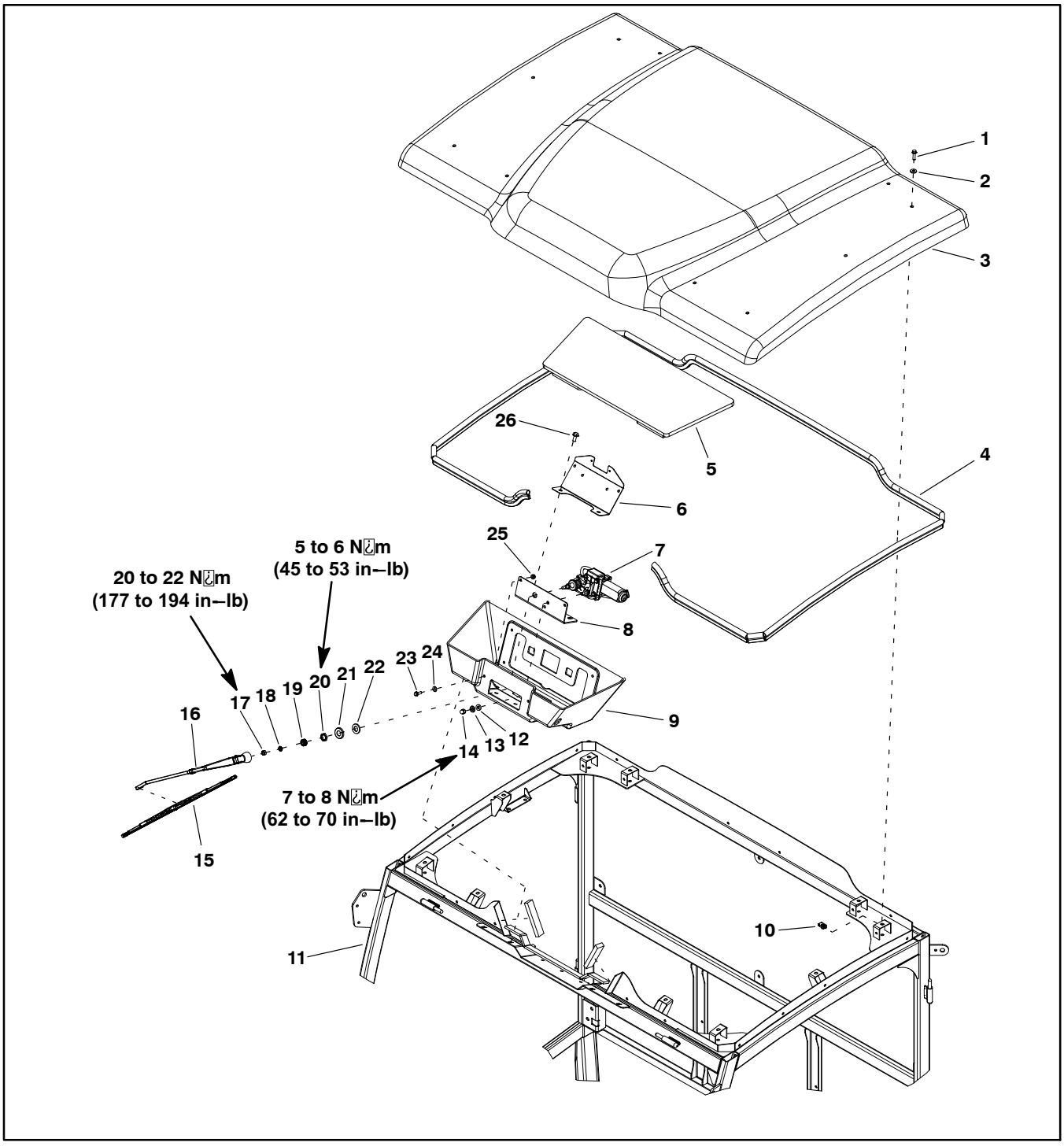

Figure 43

1. Flange–head screw (10 each)
2. Sealing washer (10 each)
3. Cab roof
4. Bulb trim seal
5. Console foam
6. Fuse block mount
7. Wiper motor
8. Wiper motor bracket
9. Roof console
10. Clip (10 each)
11. Cab frame
12. Seal washer (2 each)
13. Cup cover (2 each)
14. Wiper acorn nut
15. Wiper blade
16. Wiper arm
17. Wiper stud nut (2 each)
18. Lock washer
19. Stud cover
20. Wiper nut (2 each)
21. Cup cover (2 each)
22. Seal washer (2 each)
23. Washer–head screw (2 each)
24. Flat washer (2 each)
25. Flange nut (2 each)
26. Washer–head screw (3 each)

Removal (Fig. 43)

1. Park the machine on a level surface, shut off the engine, set the parking brake, and remove the key from the key switch.

2. Remove the wiper blade (item 15 in Fig. 43) from the wiper arm.

3. If necessary, remove the wiper arm as follows:

   A. Disconnect the washer hose from the wiper arm.

   B. Lift the cap at the top of the wiper arm and remove the wiper stud nut that secure the wiper arm to the wiper motor.

   C. Use a suitable puller to remove the tapered wiper arm socket from the wiper motor shaft.

4. If access to the wiper motor is necessary, do as follows:

   A. Remove the 10 clips, 10 sealing washers, and 10 flange−head screws that secure the roof to the cab frame, and remove the roof.

   B. Remove the console foam.

5. Remove the wiper motor components as shown in Figure 43.

Installation (Fig. 43)

1. Locate the nuts on the studs at the dimensions shown before assembling the wiper motor into the console (Fig. 44).

2. Install the wiper motor components that were removed (Fig. 43) and do the following:

   A. Ensure that the wiper motor electrical connector is secured to the cab wire harness.

   B. Position the console foam. Secure the roof to the cab frame with the 10 clips, 10 sealing washers, and 10 flange−head screws.

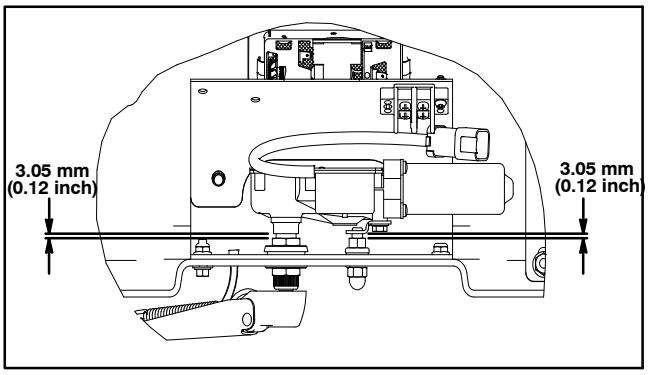

Figure 44

3. If the wiper arm was removed, do the following:

   A. Clean the tapered wiper arm socket and wiper motor shaft.

   B. Slide the wiper arm socket onto the wiper motor shaft and secure the wiper arm socket with the wiper stud nut. Install the wiper arm cap over the wiper stud nut.

4. If the wiper blade was removed, secure the blade to the wiper arm.

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Chapter 7

Electrical Drawings

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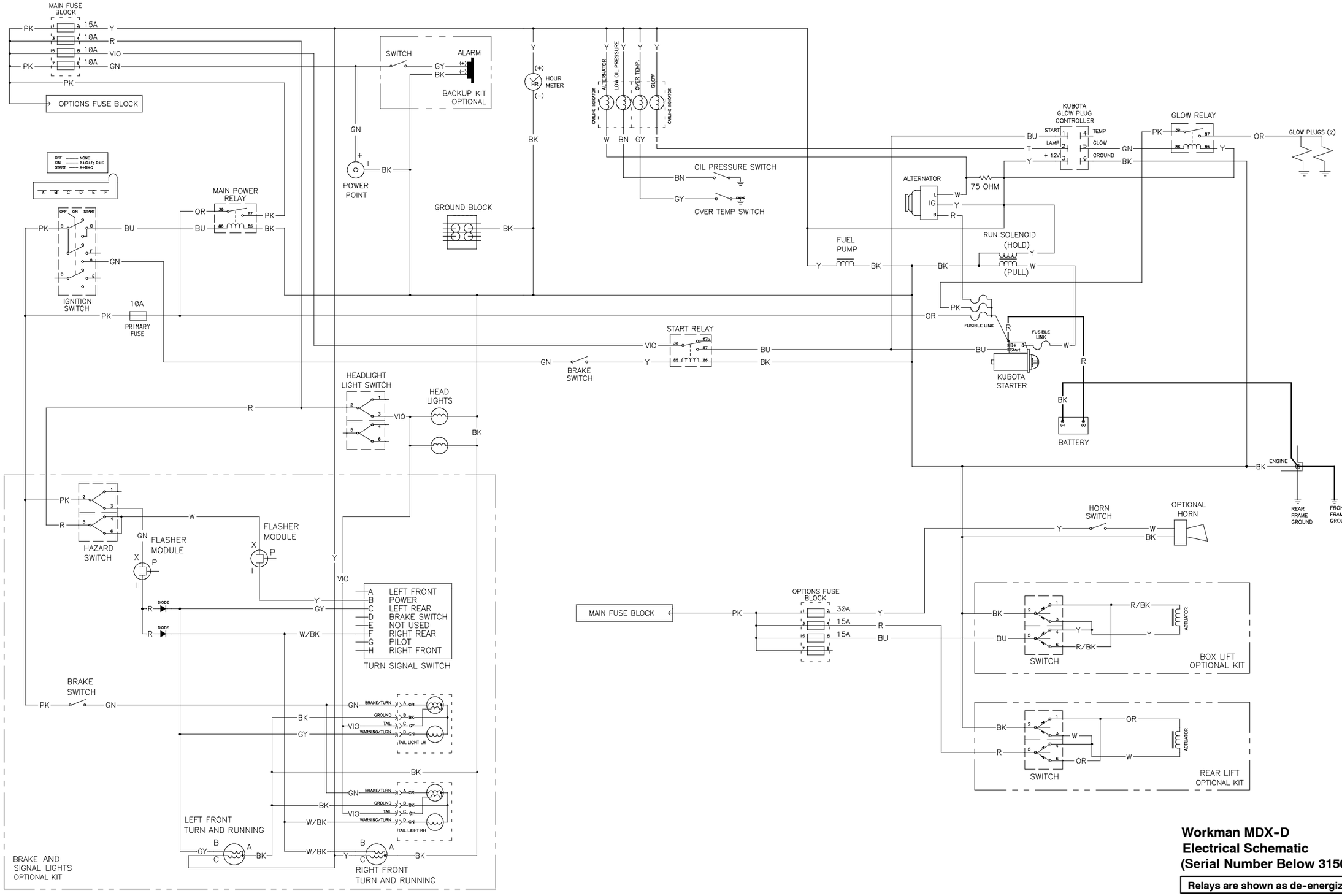
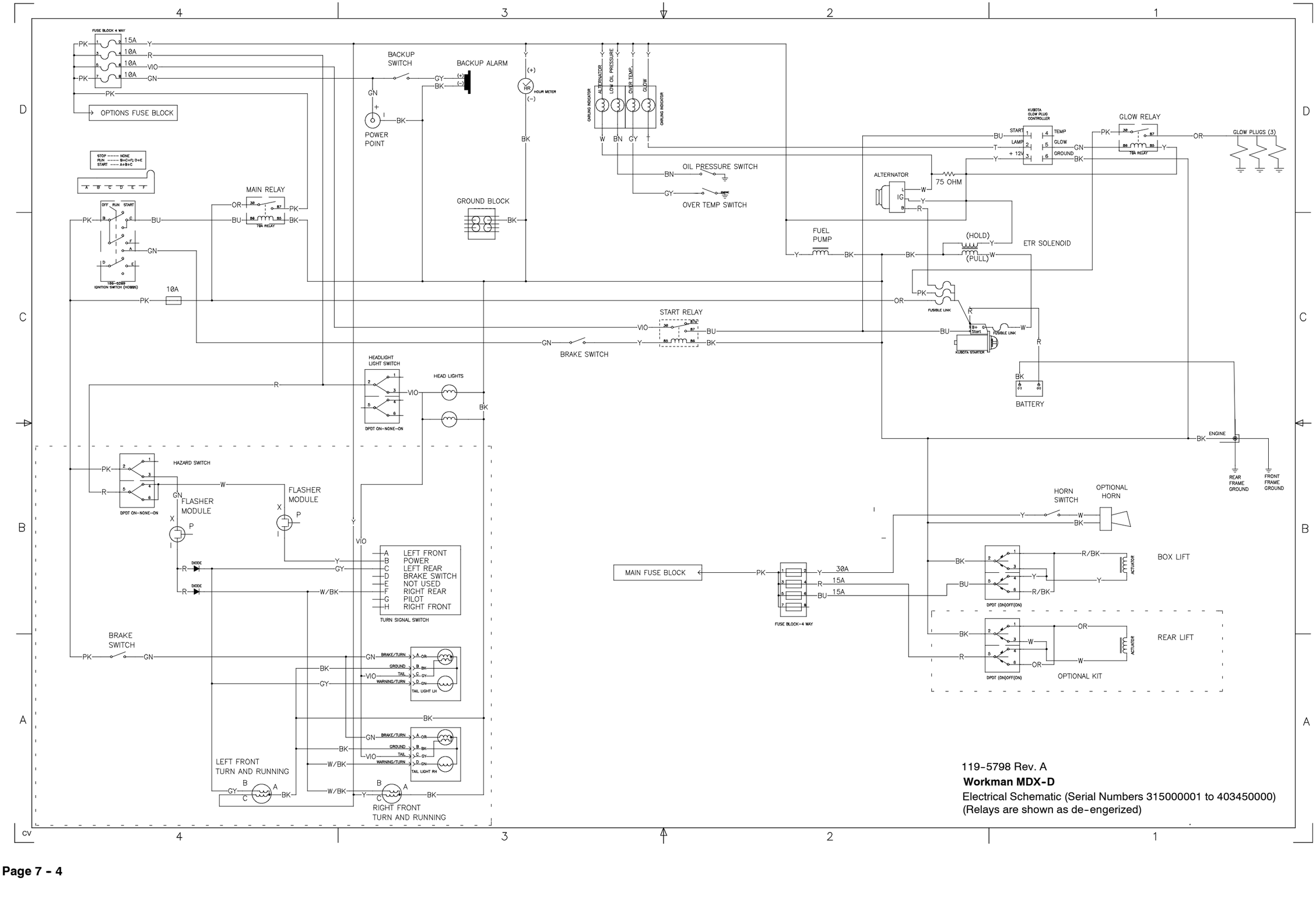


Workman MDX-D
Electrical Schematic
(Serial Number Below 315000000)

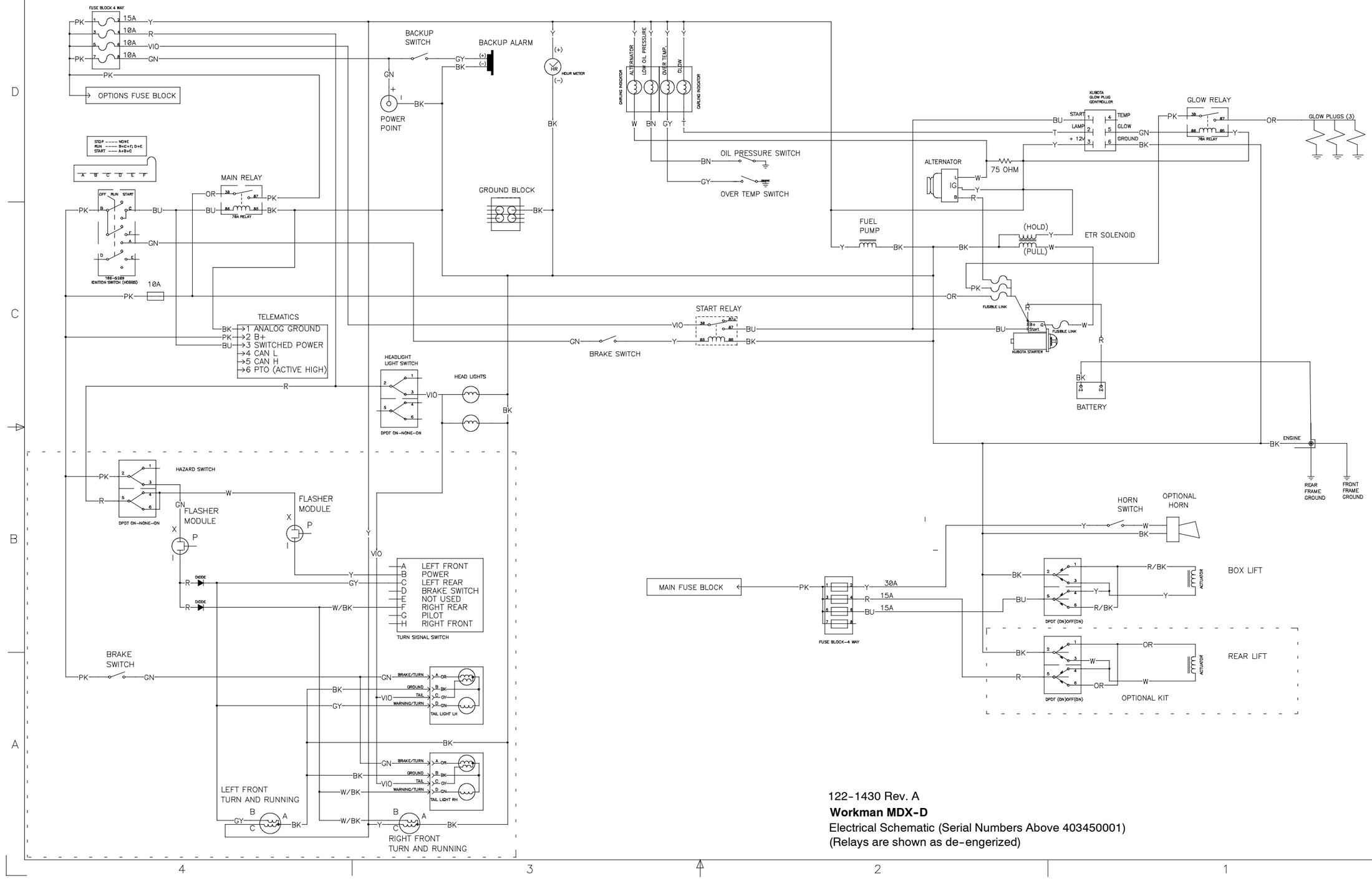
Relays are shown as de-energized



119-5798 Rev. A

Workman MDX-D

Electrical Schematic (Serial Numbers 315000001 to 403450000)
(Relays are shown as de-engerized)

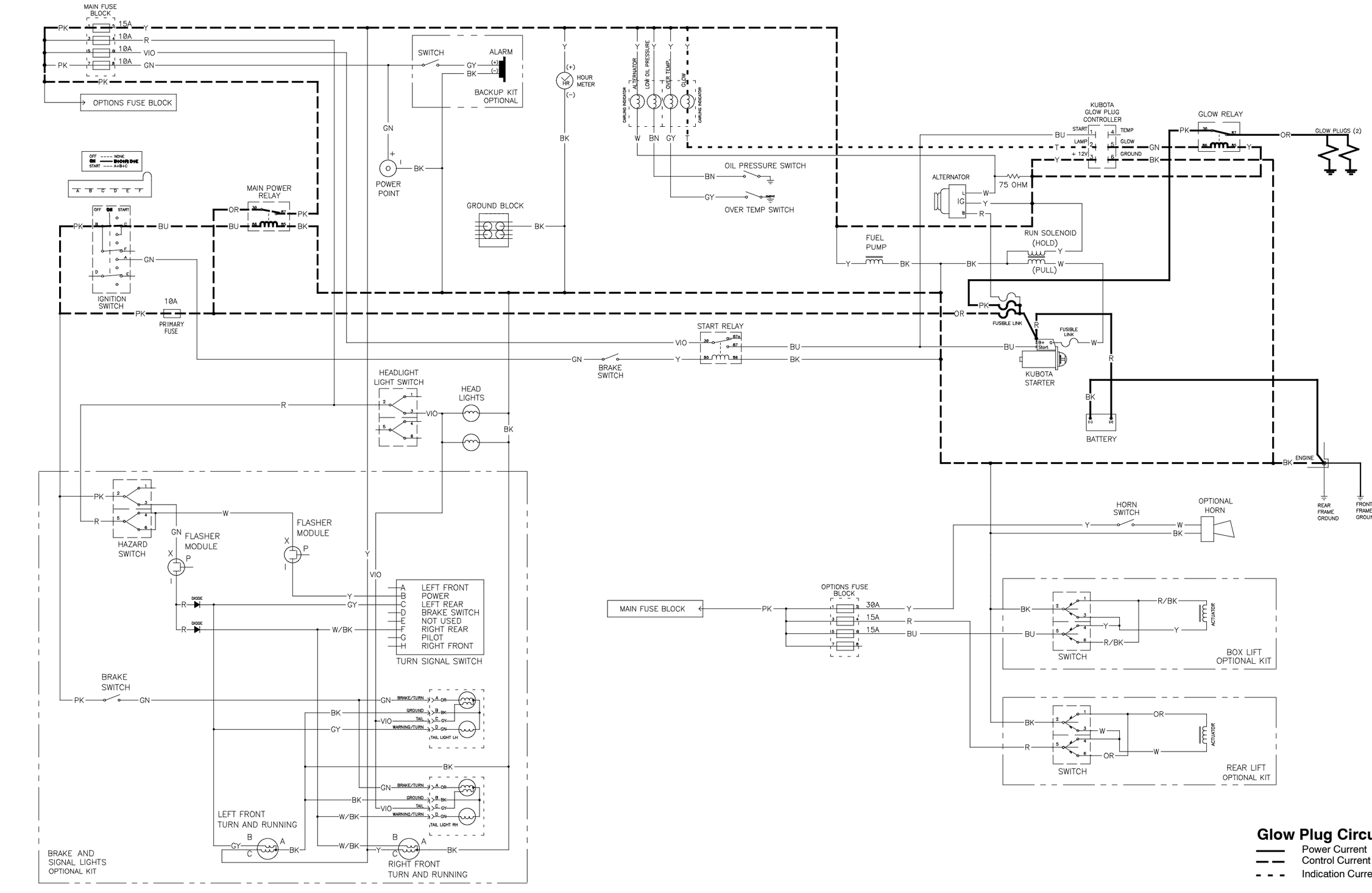


122-1430 Rev. A

Workman MDX-D

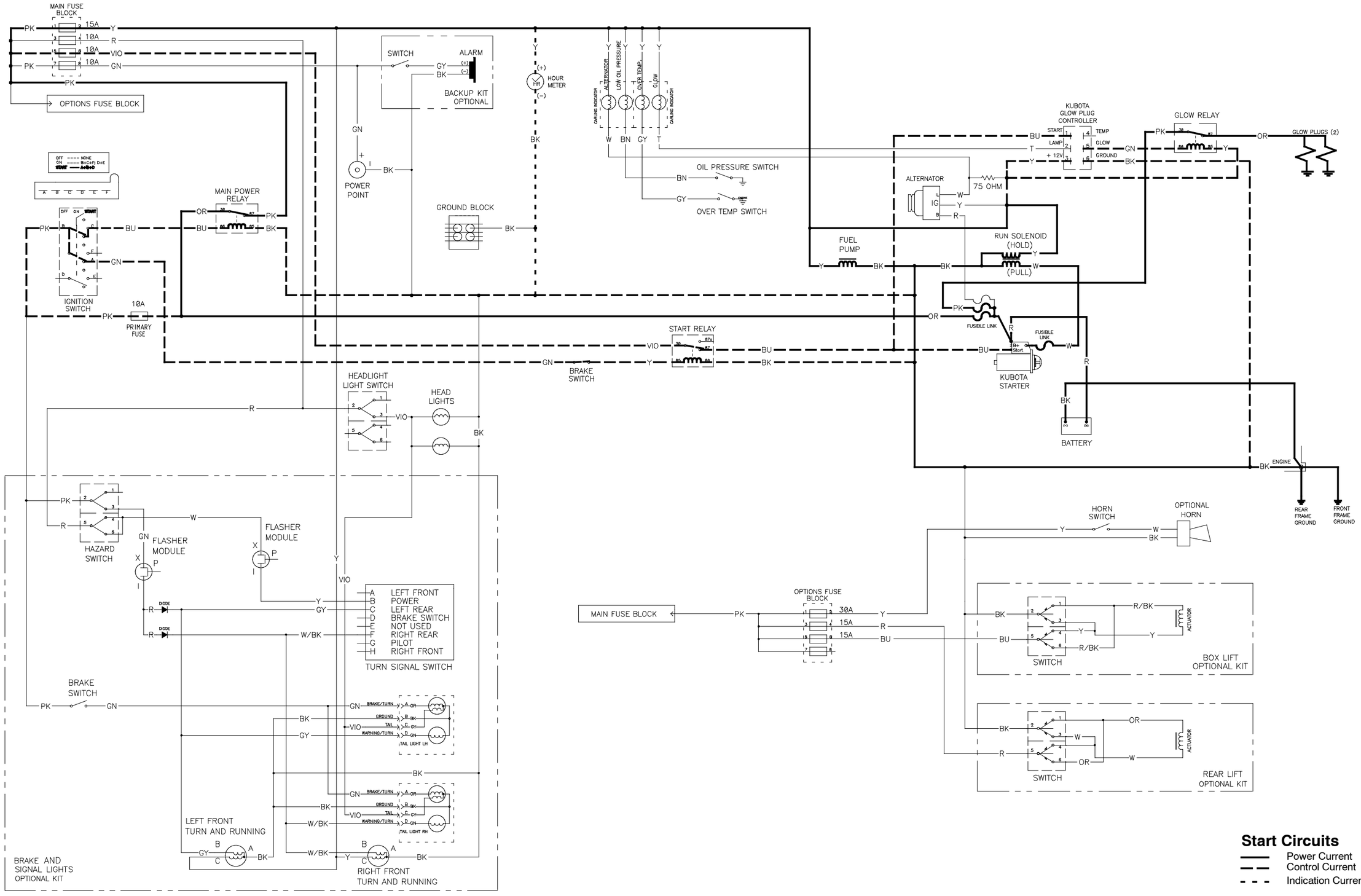
Electrical Schematic (Serial Numbers Above 403450001)

(Relays are shown as de-engerized)



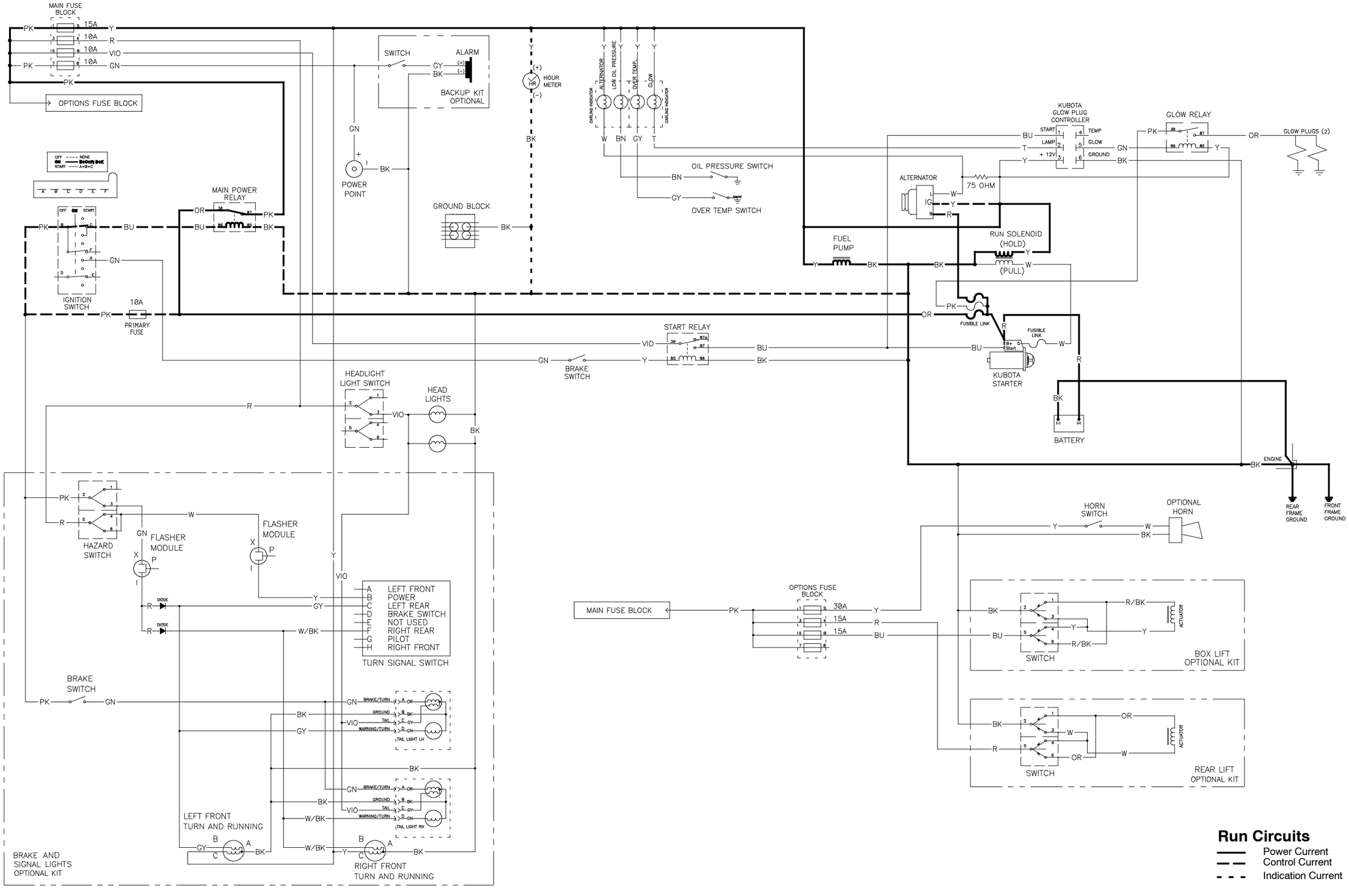
Glow Plug Circuits

- Power Current
- Control Current
- Indication Current



Start Circuits

Power Current
Control Current
Indication Current


MAIN FUSE BLOCK
15A
10A
10A
10A
OPTIONS FUSE BLOCK
SWITCH
ALARM
BACKUP KIT OPTIONAL
HOUR METER
ALTERNATOR
LOW OIL PRESSURE
OVER TEMP
GLOW
CARLING INDICATOR
OIL PRESSURE SWITCH
OVER TEMP SWITCH
POWER POINT
GROUND BLOCK
KUBOTA GLOW PLUG CONTROLLER
START
LAMP
+ 12V
TEMP
GLOW
GROUND
GLOW RELAY
GLOW PLUGS (2)
ALTERNATOR
75 OHM
FUEL PUMP
RUN SOLENOID (HOLD)
(PULL)
IGNITION SWITCH
MAIN POWER RELAY
10A
PRIMARY FUSE
START RELAY
BRAKE SWITCH
FUSIBLE LINK
KUBOTA STARTER
BATTERY
ENGINE
REAR FRAME GROUND
FRONT FRAME GROUND
HEADLIGHT LIGHT SWITCH
HEAD LIGHTS
HAZARD SWITCH
FLASHER MODULE
DIODE
A LEFT FRONT
B POWER
C LEFT REAR
D BRAKE SWITCH
E NOT USED
F RIGHT REAR
G PILOT
H RIGHT FRONT
TURN SIGNAL SWITCH
BRAKE/TURN
GROUND
TAIL
WARNING/TURN
TAIL LIGHT LH
TAIL LIGHT RH
LEFT FRONT TURN AND RUNNING
RIGHT FRONT TURN AND RUNNING
BRAKE AND SIGNAL LIGHTS OPTIONAL KIT
HORN SWITCH
OPTIONAL HORN
MAIN FUSE BLOCK
OPTIONS FUSE BLOCK
30A
15A
15A
ACTUATOR
SWITCH
BOX LIFT OPTIONAL KIT
REAR LIFT OPTIONAL KIT
Run Circuits
Power Current
Control Current
Indication Current

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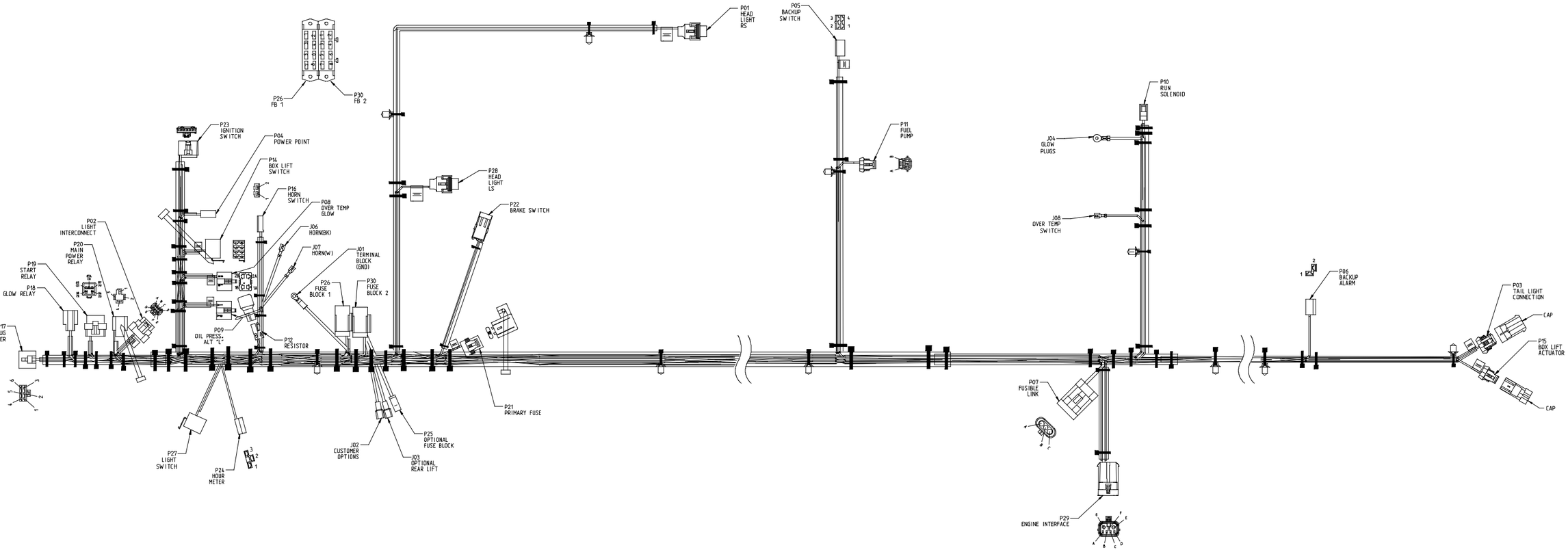
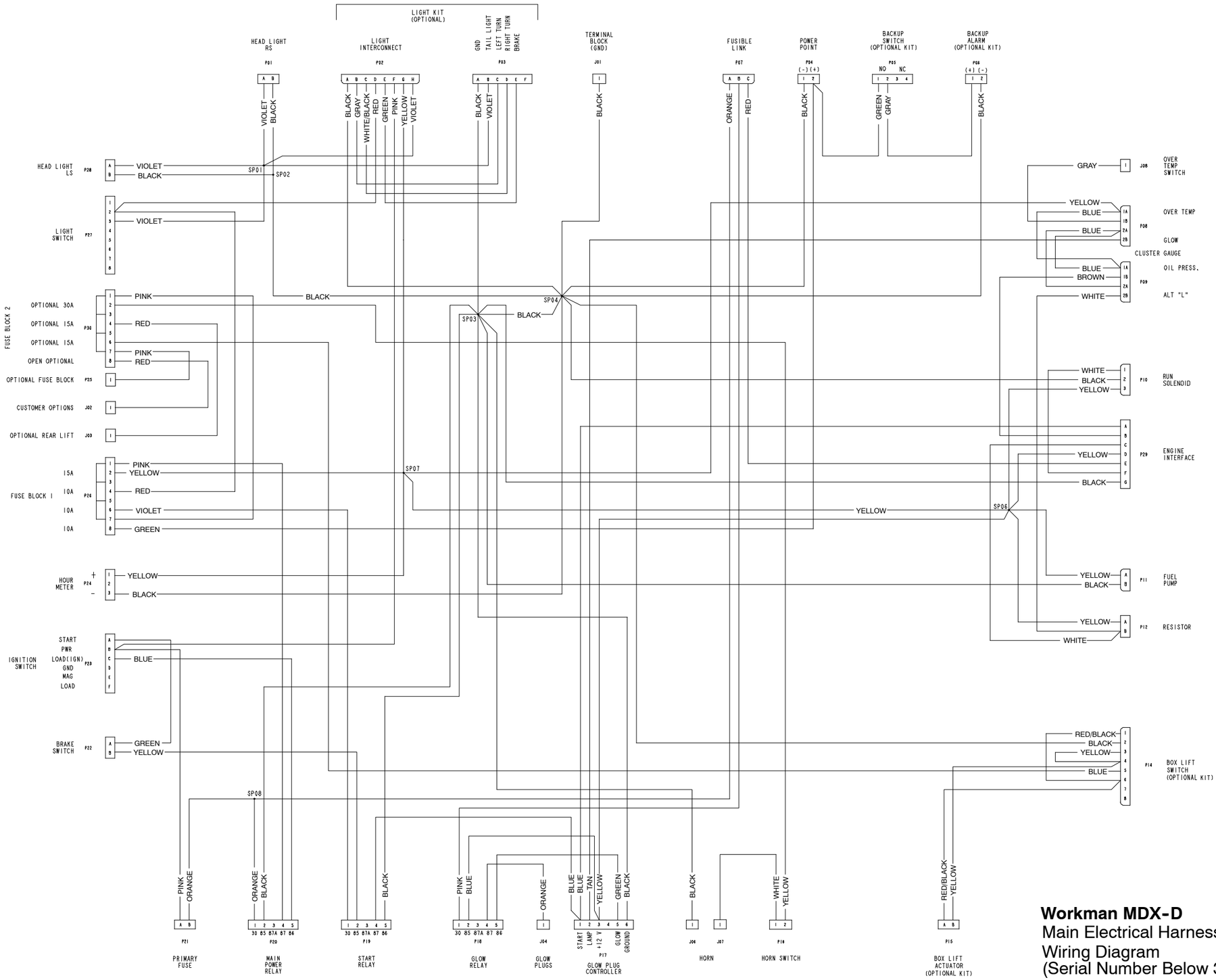
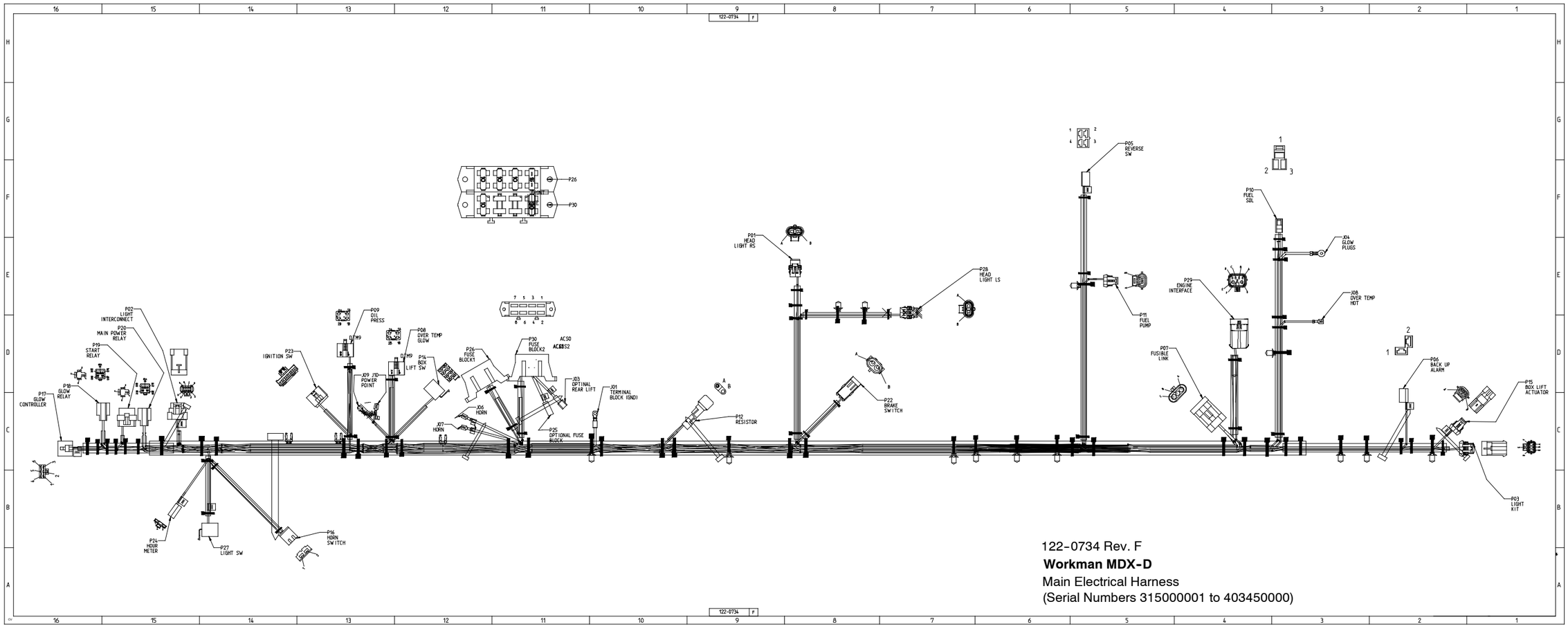


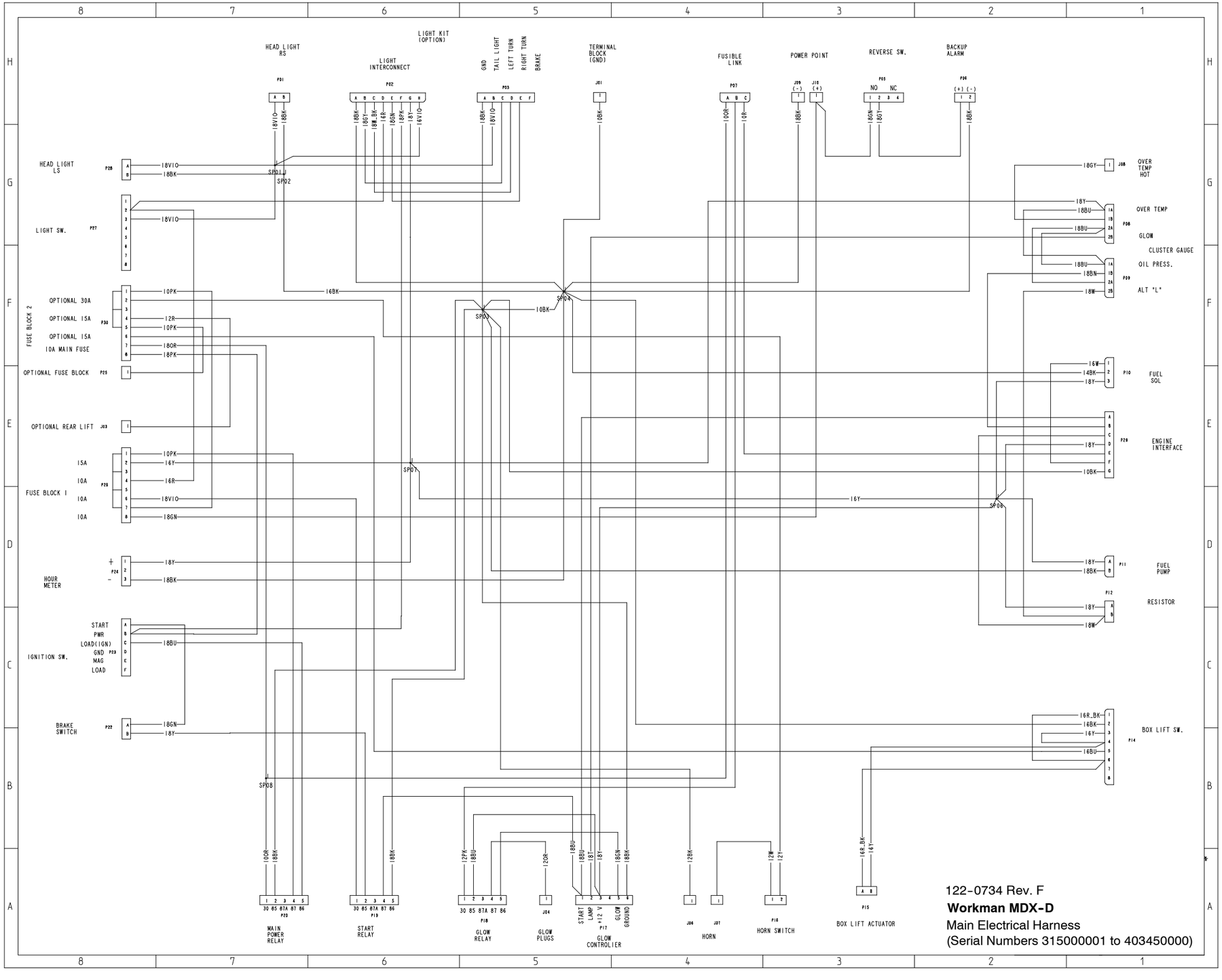
Workman MDX-D
Main Electrical Harness
Wiring Drawing
(Serial Number Below 315000000)



Workman MDX-D
Main Electrical Harness
Wiring Diagram
(Serial Number Below 315000000)



122-0734 Rev. F
Workman MDX-D
Main Electrical Harness
(Serial Numbers 315000001 to 403450000)

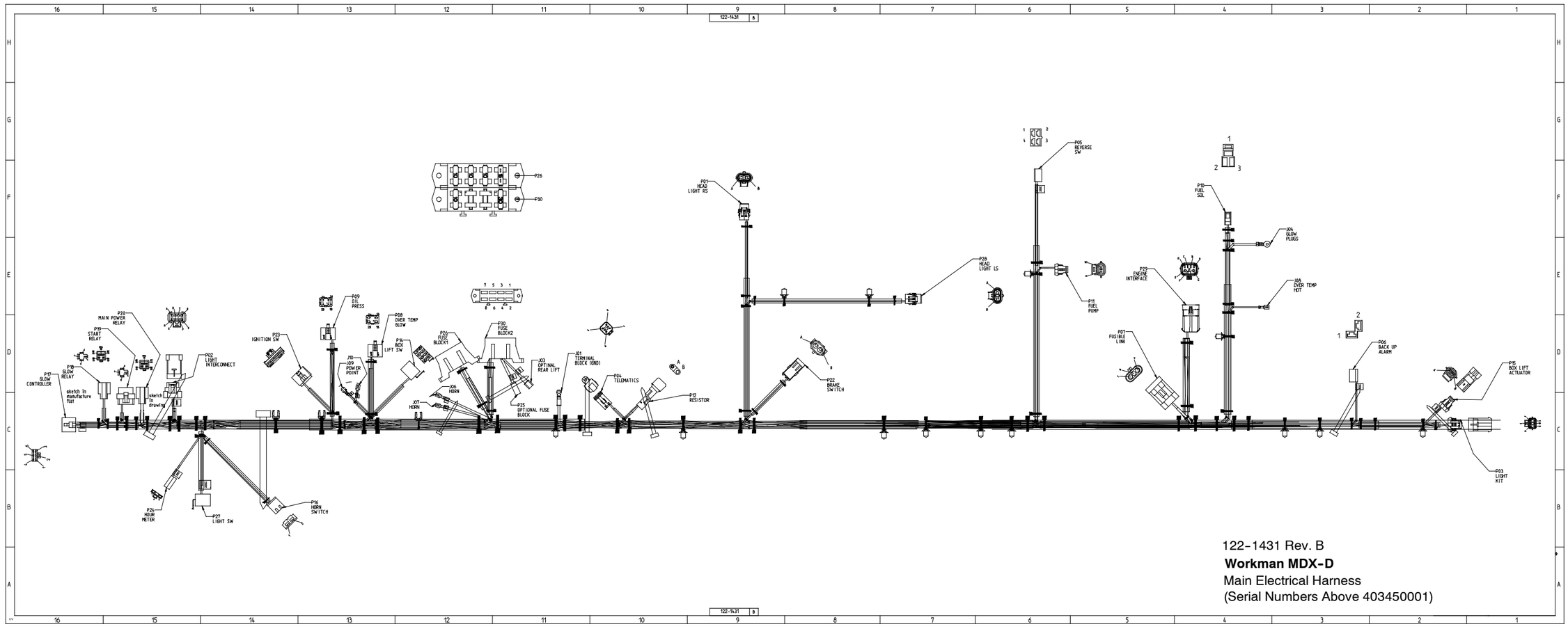


122-0734 Rev. F

Workman MDX-D

Main Electrical Harness

(Serial Numbers 315000001 to 403450000)

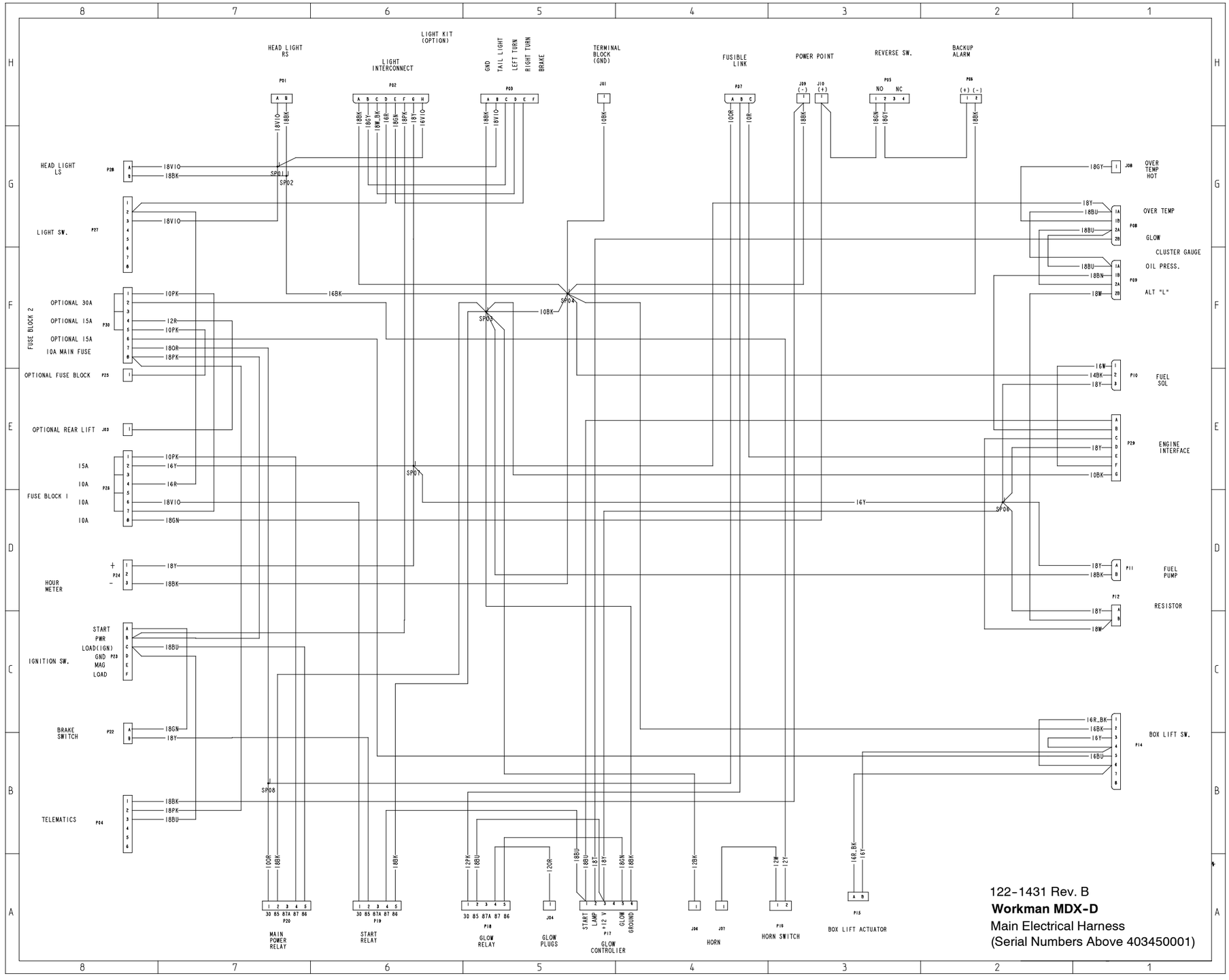


122-1431 Rev. B

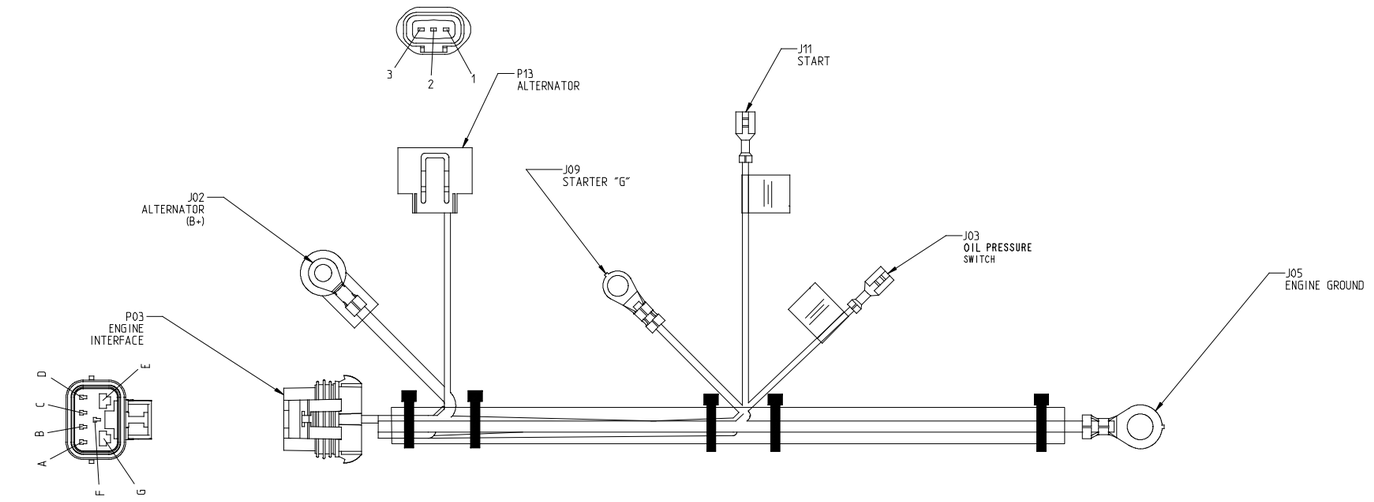
Workman MDX-D

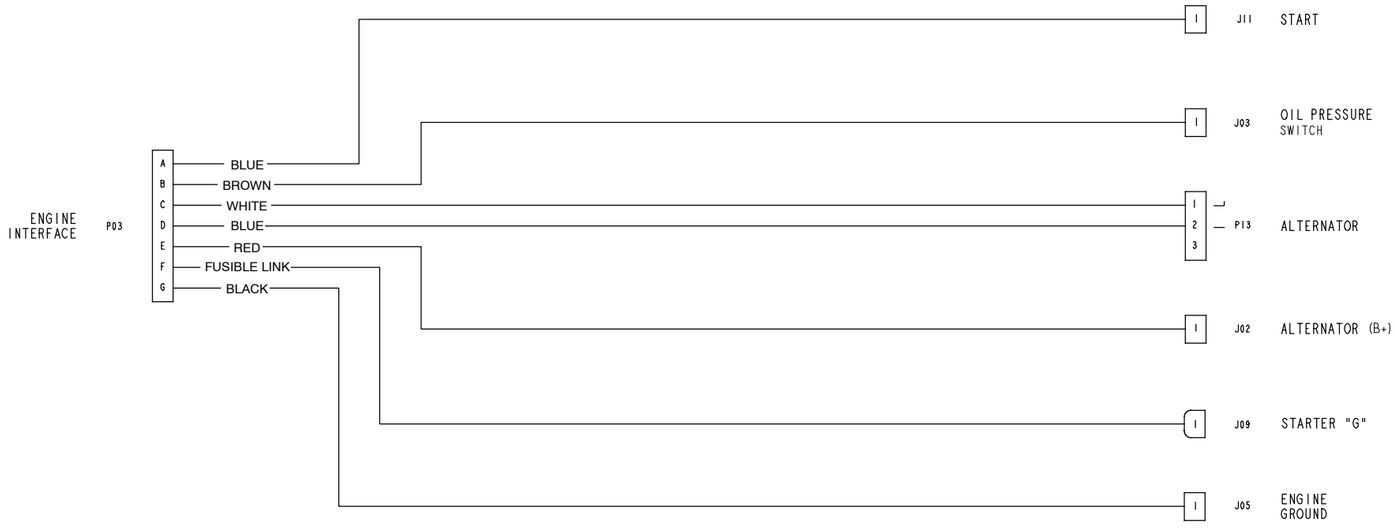
Main Electrical Harness

(Serial Numbers Above 403450001)

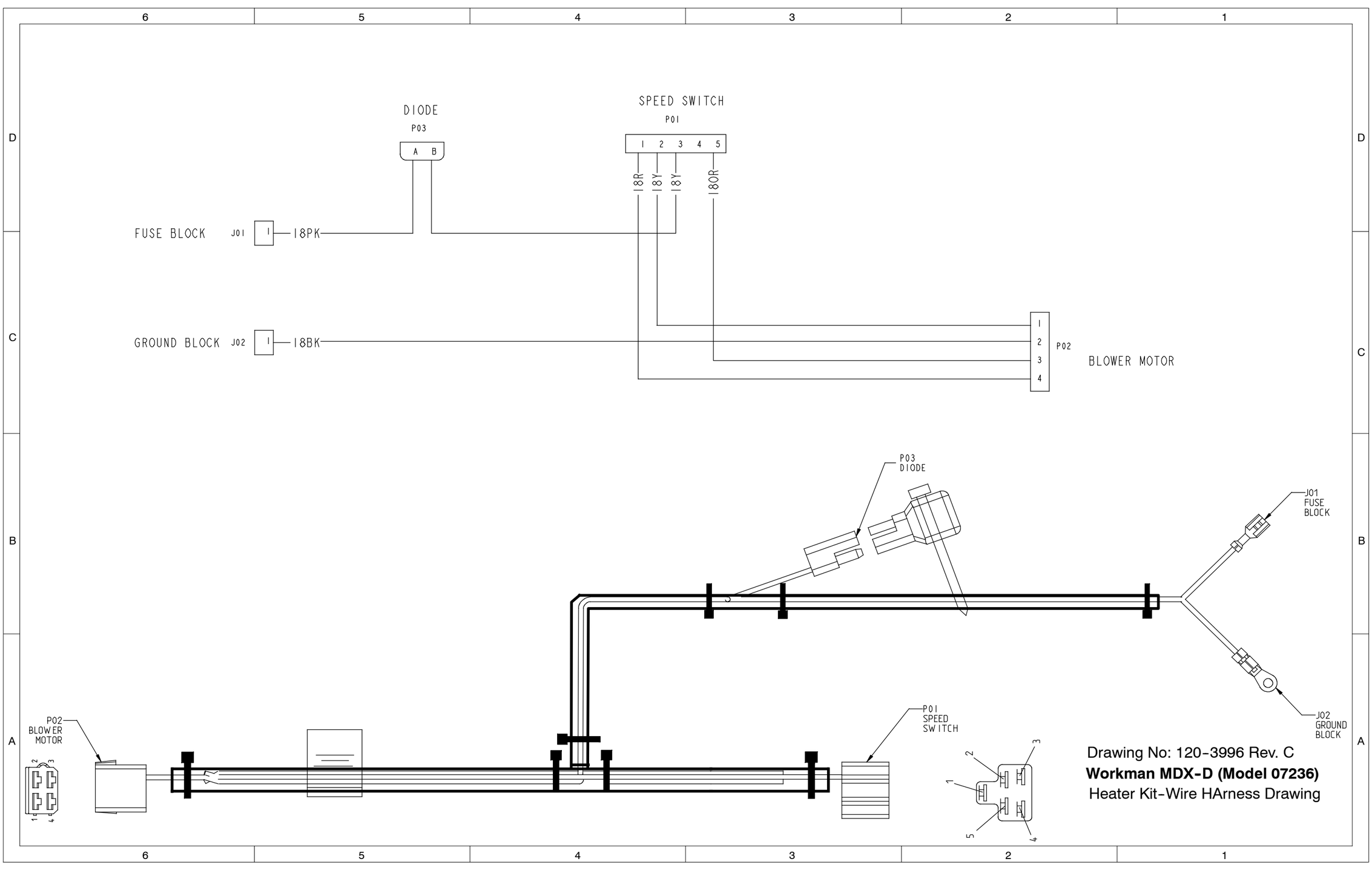


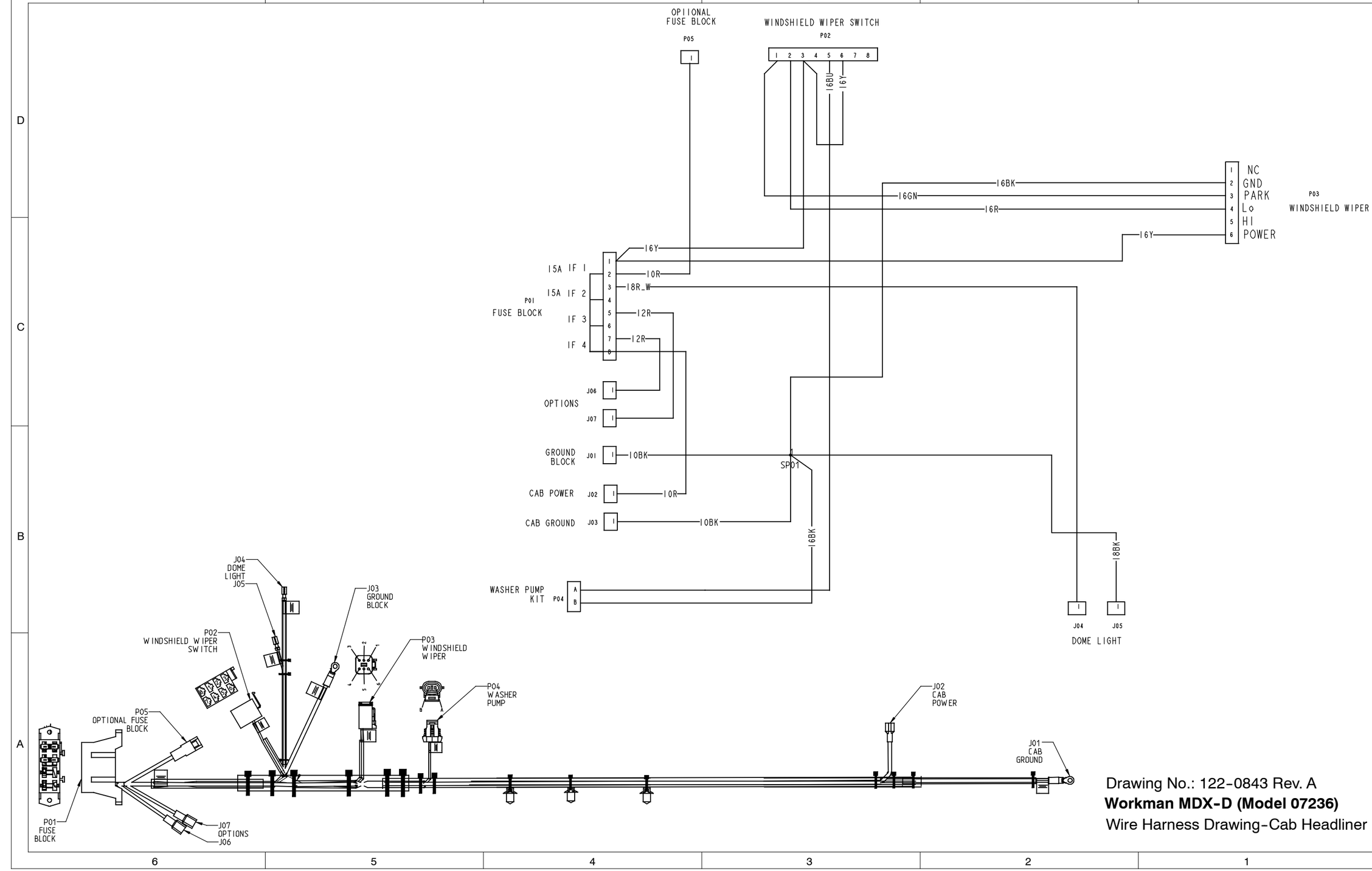
122-1431 Rev. B
Workman MDX-D
Main Electrical Harness
(Serial Numbers Above 403450001)





Workman MDX-D
Engine Electrical Harness


6
5
4
3
2
1
D
C
B
A
DIODE
P03
A B
SPEED SWITCH
P01
1 2 3 4 5
18R
18Y
18Y
18OR
FUSE BLOCK
J01
1
18PK
GROUND BLOCK
J02
1
18BK
1
2
3
4
P02
BLOWER MOTOR
P03
DIODE
J01
FUSE
BLOCK
J02
GROUND
BLOCK
P02
BLOWER
MOTOR
P01
SPEED
SWITCH
1 2 3 4
1 2 3 4 5
Drawing No: 120-3996 Rev. C
Workman MDX-D (Model 07236)
Heater Kit-Wire HArness Drawing



Drawing No.: 122-0843 Rev. A

Workman MDX-D (Model 07236)

Wire Harness Drawing-Cab Headliner