Part No. 02110SL (Rev. D)

Service Manual

Workman® 1100/1110/2100/2110

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 1100, 1110, 2100, and 2110.

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

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

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

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

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

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

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Chapter 1

Safety

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Safety Instructions

The Workman 1100/2100/2110 was tested and certified by TORO for compliance with the B71.4–1984 specifications of the American National Standards Institute. 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. A replacement manual is available on the Internet at www.toro.com or by sending complete Model and Serial Number to:

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

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.

Supervisors, operators, and service persons should be familiar with the following standards and publications (The material may be obtained from the addresses shown):

- Flammable and Combustible Liquids Code: ANSI/NFPA 30
- National Fire Protection Association: ANSI/NFPA #505; Powered Industrial Trucks
  ADDRESS:
  National Fire Prevention Association
  Barrymarch Park
  Quincy, Massachusetts 02269 U.S.A.
- ANSI/ASME B56.8; Personal Burden Carriers
  ADDRESS:
  American National Standards Institute, Inc.
  1430 Broadway
  New York, New York 10018 U.S.A.
- ANSI/UL 558; Internal Combustion Engine Powered Industrial Trucks
  ADDRESS:
  American National Standards Institute, Inc.
  1430 Broadway
  New York, New York 10018 U.S.A.
  OR
  Underwriters Laboratories
  333 Pfingsten Road
  Northbrook, Illinois 60062 U.S.A.

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. Operate machine only after reading and understanding the contents of this manual.

2. **Never** allow children to operate the vehicle. **Never** allow adults to operate it without proper instructions. Only trained and authorized persons should operate this vehicle. Make sure all operators are physically and mentally capable of operating the vehicle. Anyone who operates the vehicle should have a motor vehicle license.

3. This vehicle is designed to carry the **operator** and **one passenger** in the seat provided by the manufacturer. **Never** carry more than one passenger on the vehicle.

4. **Never** operate vehicle when under the influence of drugs or alcohol.

5. Become familiar with the controls and know how to stop the engine quickly.

6. Keep all shields, safety devices, and decals in place. Repair or replace any shield, safety device, or decal if it is malfunctioning, illegible, or damaged before operating the machine.

7. Always wear substantial shoes. Do not operate machine while wearing sandals, tennis shoes or sneakers. Do not wear loose fitting clothing or jewelry which could get caught in moving parts and cause personal injury.

8. Wearing safety glasses, safety shoes, long pants and a helmet is advisable, and may be required by some local safety and insurance regulations.

9. Keep everyone, especially children and pets, away from the areas of operation.

10. Before operating the vehicle, always check vehicle and any attachments for damage. If something is wrong, **stop using the vehicle**. Make sure problem is corrected before the vehicle or attachment is operated again.

11. Since gasoline is highly flammable, handle it carefully.

A. Use an approved gasoline container.

B. Do not remove cap from the fuel tank when the engine is hot or running.

C. Do not smoke while handling gasoline.

D. Fill fuel tank outdoors to about one inch below the top of tank (bottom of filler neck). Do not overfill.

E. Wipe up any spilled gasoline.

While Operating

WARNING

POTENTIAL HAZARD
- **Engine exhaust contains carbon monoxide, which is odorless, colorless, poisonous, and deadly.**

WHAT CAN HAPPEN
- **Carbon monoxide can cause death. It is known by the State of California to cause birth defects.**

HOW TO AVOID THE HAZARD
- **Do not run engine indoors or in an en– closed area.**

1. Operator and passenger should remain seated whenever the vehicle is in motion. Operator should keep both hands on the steering wheel. Whenever possible, the passenger should use the hand holds provided. Keep arms and legs within the vehicle body at all times. Never carry passengers in the box or on any attachments. Remember your passenger may not be expecting you to brake or turn.

2. Never overload your vehicle. The name plate (located under the dash and on the center column) shows load limits for the vehicle. The load rating is for level surfaces only. Never overload attachments or exceed the vehicle maximum gross vehicle weight (GVW).

3. Operating the vehicle demands attention. Failure to operate the vehicle safely may result in an accident, tip over of vehicle, and/or serious injury or death. Drive carefully. To prevent tipping or loss of control:

A. Use extreme caution, reduce speed, and maintain a safe distance around sand traps, ditches, creeks, ramps, unfamiliar areas, or any areas that have abrupt changes in ground conditions or elevation.

WARNING

Operating the vehicle on a hill may cause tipping or rolling of the vehicle, or the engine may stall and you could lose headway on a hill. This could result in personal injury.
- **Do not exceed slopes greater than 12 degrees.**
- **If the engine stalls or you lose headway on a hill, never attempt to turn the vehicle around.**
- **Never drive across a steep hill; always drive straight up or down or go around the hill.**
- **Avoid turning on a hill.**
- **Do not accelerate quickly or slam on the brakes.**
- **Reduce your load and the speed of the vehicle.**
- **Avoid stopping on hills, especially with a load.**

B. Use caution when operating vehicle on a slope. Normally travel straight up and down slopes. Reduce speed when making sharp turns or when turning on hillsides. Avoid turning on hillsides whenever possible. If the engine stalls or you begin to lose headway while climbing a hill, gradually apply the brakes and slowly back straight down the hill.

C. Watch for holes or other hidden hazards.

D. Use extra caution when operating the vehicle on wet surfaces, at higher speeds, or with a full load. Stopping distance will increase with a full load. Slow down before starting up or down a hill.

E. When loading the box, distribute load evenly. Use extra caution if the load exceeds the dimensions of the box. Operate vehicle with extra caution when handling loads that cannot be centered. Keep loads balanced and secure to prevent them from shifting.

F. Avoid sudden stops and starts. Do not go from reverse to forward, or forward to reverse, without first coming to a complete stop.

G. Do not attempt sharp turns, abrupt maneuvers, or other unsafe driving actions that may cause a loss of vehicle control.

WARNING

The weight of the box may be heavy and could crush hands or other body parts.
- **Keep hands and other body parts clear when lowering the box.**
- **Do not dump materials on bystanders.**

H. When dumping, do not let anyone stand behind the vehicle. Do not dump the load on anyone's feet. Release tailgate latches from the side of the box, not from behind the box.

I. Only operate/drive vehicle when the cargo box is down and latched.

J. Before backing up, look to the rear of the vehicle. Make sure no one is behind it. Back up slowly.

K. Watch out for traffic when near or crossing roads. Always yield the right of way to pedestrians and other vehicles. This vehicle is **not** designed for use on streets or highways. Always signal your turns or stop early enough so other persons know what you plan to do. Obey all traffic rules and regulations.

L. Never operate vehicle in or near an area where there is dust or fumes in the air which are explosive. The electrical and exhaust systems of the vehicle can produce sparks capable of igniting explosive materials.

M. Always watch out for and avoid low overhangs such as tree limbs, door jambs, over head walkways, etc. Make sure there is enough room over head to easily clear the vehicle and your head.

N. If ever unsure about safe operation, **stop vehicle** and ask your supervisor.

WARNING

Sudden changes in terrain may cause abrupt steering wheel movement, possibly resulting in hand and arm injuries.
- **Reduce your speed and the load when operating on rough terrain and near curbs.**
- **Grip the steering wheel loosely around the perimeter. Keep your hands clear of the steering wheel spokes.**

O. When operating the vehicle over rough terrain or near curbs, reduce your speed and grip the outside of the steering wheel. Keep your hands and fingers away from the steering wheel spokes.

4. Do not touch engine or muffler while the engine is running or soon after it has stopped. These components may be hot enough to cause burns.

5. If the machine ever vibrates abnormally, stop immediately. Wait for all motion to stop. Inspect vehicle for damage. Repair all damage before commencing operation.

6. Before getting off the seat:

   A. Stop movement of the machine.

   B. Set parking brake.

   C. Turn ignition key to OFF.

   D. Remove key from ignition switch.

CAUTION

If vehicle is parked on an incline, chock wheels after getting off of the vehicle.

Maintenance and Service

1. Only qualified and authorized personnel should maintain, repair, adjust, or inspect the vehicle.

2. Before servicing or making adjustments to the machine, stop engine, set parking brake, and remove key from the ignition switch to prevent someone from accidentally starting the engine.

3. Make sure entire machine is in good condition. Keep all nuts, bolts, and screws properly tightened.

4. Reduce potential fire hazards. Keep engine area free of excessive grease, grass, leaves, and accumulation of dirt.

5. Never use an open flame to check level or leakage of fuel or battery electrolyte.

6. If the engine must be running to perform a maintenance adjustment, keep hands, feet, clothing, and any parts of the body away from the engine and any moving parts. Keep everyone away.

7. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.

8. **Do not adjust** ground speed governor. To assure safety and accuracy, have an Authorized Toro Distributor check the ground speed.

9. If major repairs are needed or assistance is required, contact an Authorized Toro Distributor.

10. Make sure of optimum performance and safety. Always use genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers could cause damage and be dangerous. Altering this vehicle in any manner may affect its operation, performance, and/or durability. Alterations may result in injury or death. Such use could void the product warranty of The Toro Company.

Sound Pressure Level

This unit has an equivalent continuous A–weighted sound pressure at the operator's ear of 80 dB(A), which is based on measurements of identical machines per SAE J1174-MAR 85 procedures.

Vibration Level

This unit does not exceed a vibration level of 2.5 m/s^2 at the hands, which is based on measurements of identical machines per ISO 5349 procedures.

This unit does not exceed a vibration level of 0.5 m/s^2 at the posterior, which is based on measurements of identical machines per ISO 2631 procedures.

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 or blocks without transaxle locked in neutral.**
- **Make sure proper hoists, solid wooden blocks, and jack stands are used to raise and support the vehicle.**

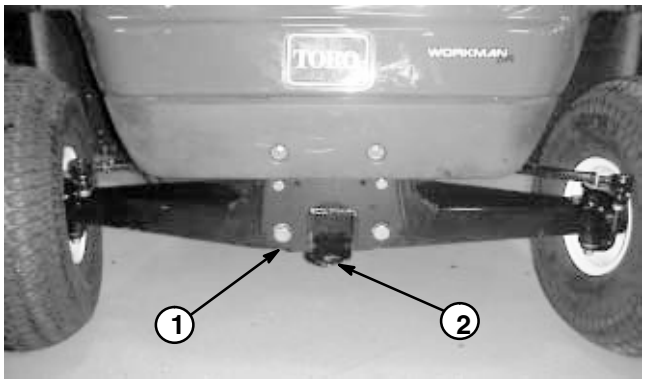

Figure 1

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

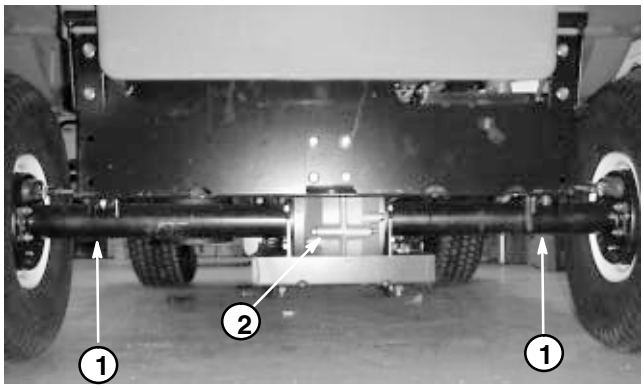

Figure 2

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

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).

WARNING

Whenever the engine is run for testing that requires the rear wheels to spin, rear wheels should be at least 1 inch (25 mm) off the ground with the axle supported on jack stands.

Transport Vehicle

When moving the vehicle long distances, use a trailer or flatbed truck. Make sure vehicle is secured to the trailer properly.

1. Secure front of the vehicle to trailer at the towing tongue (Fig. 1).

2. Secure rear of the vehicle to the trailer at each rear axle tube (Fig. 2).

WARNING

POTENTIAL HAZARD
- **Seats may become loose and fall off the vehicle and trailer when transporting.**

WHAT CAN HAPPEN
- **Seats falling off the trailer may hit another vehicle or become a road hazard.**

HOW TO AVOID THE HAZARD
- **Remove or secure seats with cord or strap.**

Tow Vehicle

In case of emergency, the vehicle can be towed for a short distance. However, Toro does not recommend this as a standard procedure.

WARNING

POTENTIAL HAZARD

- **Towing at excessive speeds could cause the vehicle to lose control.**

WHAT CAN HAPPEN

- **Loss of control could result in personnel injury and/or damage to the vehicle.**

HOW TO AVOID THE HAZARD

- **Never tow vehicle more than 5 mph (8 KPH).**

Towing the vehicle is a two person job. If the vehicle must be moved a considerable distance, transport it on a truck or trailer (see Transport Vehicle).

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

2. Remove drive belt from drive and driven clutches (see Service Drive Belt).

3. Secure a chain or tow line to tongue on front frame member (Fig. 1).

4. Put vehicle in neutral (see Set Neutral Lock Assembly) and release parking brake.

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. On vehicles equipped with a neutral position on the shift lever (Fig. 3):

   A. Move shift lever to the neutral position.

   B. Make sure transaxle is locked in neutral by rotating the driven clutch (Fig.4). The tires should not rotate. If tire rotation does occur, see Adjust Shift Cables – Chapter 5, Drive Train.

3. On vehicles without a neutral position on the shift lever (Fig. 3):

   A. Lock transaxle into neutral by rotating the locking pin 180º relative to the shift block (Fig. 4).

   B. Shift gear selector into REVERSE and then into FORWARD. Leave gear shift selector in the FORWARD position.

   C. Make sure transaxle is locked in neutral by rotating the driven clutch (Fig. 4). The tires should not rotate. If tire rotation does occur, repeat steps A & B until the tires no longer rotate.

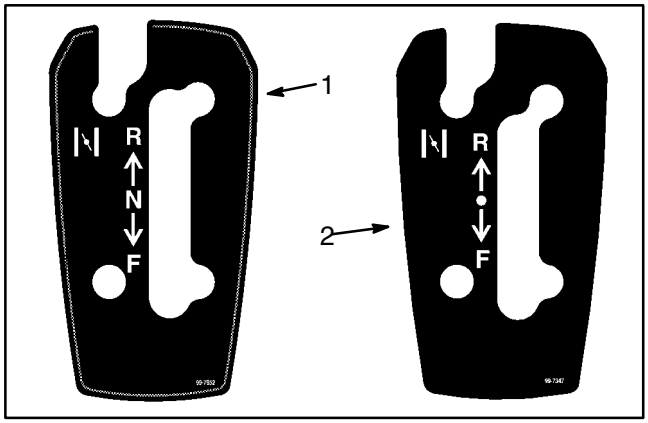

Figure 3

1. Shift lever w/neutral **2. Shift lever w/o neutral**

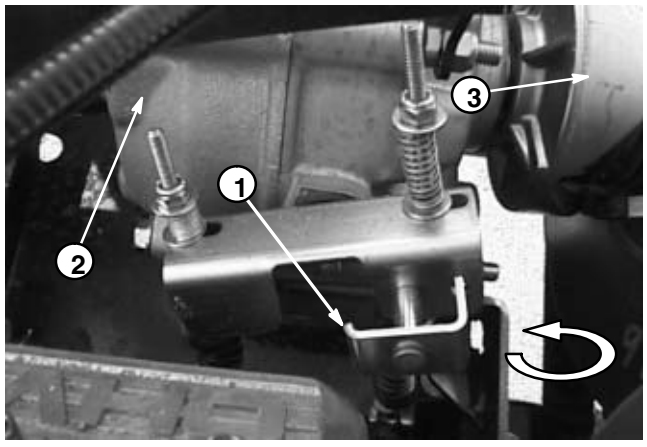

Figure 4

1. Locking pin (if equipped) **3. Driven clutch**
2. Transaxle case

Safety and Instruction Decals

There are several safety and instruction decals attached 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.

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	0.9375	— 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

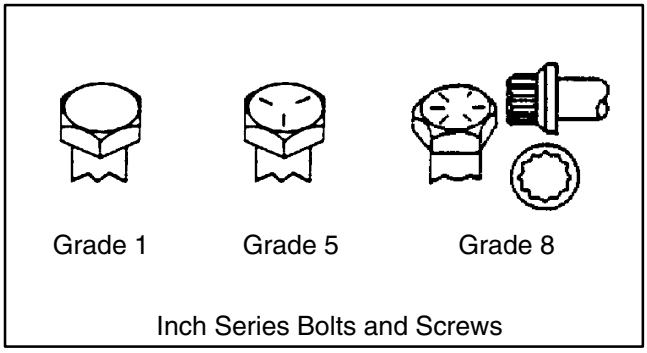
Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in this Service Manual.

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 (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.

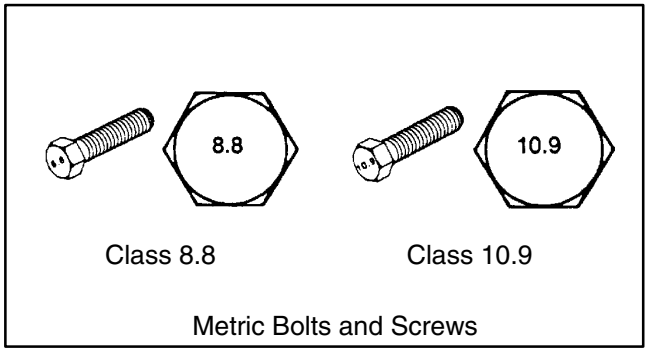
The standard method of verifying torque shall be performed by marking a line on the fastener (head or nut) and mating part, then back off fastener 1/4 of a turn. Measure the torque required to tighten the fastener until the lines match up.

Fastener Identification



Inch Series Bolts and Screws

Figure 1



Metric Bolts and Screws

Figure 2

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

Thread Size	Grade 1, 5, & 8 with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs, & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 5 Bolts, Screws, Studs, & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs, & Sems with Regular Height Nuts (SAE J995 Grade 5 or Stronger Nuts)	
	in–lb	**in–lb**	**N–cm**	**in–lb**	**N–cm**	**in–lb**	**N–cm**
# 6 – 32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	170 ± 20	23 ± 2	260 ± 20
# 6 – 40 UNF				17 ± 2	190 ± 20	25 ± 2	280 ± 20
# 8 – 32 UNC	13 ± 2	25 ± 5	282 ± 30	29 ± 3	330 ± 30	41 ± 4	460 ± 45
# 8 – 36 UNF				31 ± 3	350 ± 30	43 ± 4	485 ± 45
# 10 – 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 4	475 ± 45	60 ± 6	675 ± 70
# 10 – 32 UNF				48 ± 4	540 ± 45	68 ± 6	765 ± 70
1/4 – 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1125 ± 100	140 ± 15	1580 ± 170
1/4 – 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 10	1300 ± 100	160 ± 15	1800 ± 170
5/16 – 18 UNC	115 ± 15	105 ± 17	1186 ± 169	200 ± 25	2250 ± 280	300 ± 30	3390 ± 340
5/16 – 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2540 ± 280	325 ± 30	3670 ± 340
	ft–lb	**ft–lb**	**N–m**	**ft–lb**	**N–m**	**ft–lb**	**N–m**
3/8 – 16 UNC	16 ± 2	16 ± 2	22 ± 3	30 ± 3	41 ± 4	43 ± 4	58 ± 5
3/8 – 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 3	47 ± 4	50 ± 4	68 ± 5
7/16 – 14 UNC	27 ± 3	27 ± 3	37 ± 4	50 ± 5	68 ± 7	70 ± 7	95 ± 9
7/16 – 20 UNF	29 ± 3	29 ± 3	39 ± 4	55 ± 5	75 ± 7	77 ± 7	104 ± 9
1/2 – 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 10	142 ± 14
1/2 – 20 UNF	32 ± 3	53 ± 7	72 ± 9	85 ± 8	115 ± 11	120 ± 10	163 ± 14
5/8 – 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 20	285 ± 27
5/8 – 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 15	230 ± 20	240 ± 20	325 ± 27
3/4 – 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 25	359 ± 34	375 ± 35	508 ± 47
3/4 – 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 25	407 ± 34	420 ± 35	569 ± 47
7/8 – 9 UNC	140 ± 20	225 ± 25	305 ± 34	430 ± 45	583 ± 61	600 ± 60	813 ± 81
7/8 – 14 UNF	155 ± 25	260 ± 30	353 ± 41	475 ± 45	644 ± 61	660 ± 60	895 ± 81

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

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

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

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

Thread Size	Class 8.8 Bolts, Screws, and Studs with Regular Height Nuts (Class 8 or Stronger Nuts)		Class 10.9 Bolts, Screws, and Studs with Regular Height Nuts (Class 10 or Stronger Nuts)	
M5 X 0.8	57 ± 5 in–lb	640 ± 60 N–cm	78 ± 7 in–lb	885 ± 80 N–cm
M6 X 1.0	96 ± 9 in–lb	1018 ± 100 N–cm	133 ± 13 in–lb	1500 ± 150 N–cm
M8 X 1.25	19 ± 2 ft–lb	26 ± 3 N–m	27 ± 2 ft–lb	36 ± 3 N–m
M10 X 1.5	38 ± 4 ft–lb	52 ± 5 N–m	53 ± 5 ft–lb	72 ± 7 N–m
M12 X 1.75	66 ± 7 ft–lb	90 ± 10 N–m	92 ± 9 ft–lb	125 ± 12 N–m
M16 X 2.0	166 ± 15 ft–lb	225 ± 20 N–m	229 ± 22 ft–lb	310 ± 30 N–m
M20 X 2.5	325 ± 33 ft–lb	440 ± 45 N–m	450 ± 37 ft–lb	610 ± 50 N–m

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

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

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

Other Torque Specifications

SAE Grade 8 Steel Set Screws

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

Wheel Bolts and Lug Nuts

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

** For steel wheels and non–lubricated fasteners.

Thread Cutting Screws (Zinc Plated Steel)

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

Thread Cutting Screws (Zinc Plated Steel)

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

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

Conversion Factors

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

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

Lubrication

Note: Perform this maintenance procedure at the interval specified in the WORKMAN® Maintenance Schedule. Lubricate more frequently when using this vehicle for heavy duty operations and after each washing.

Grease Fitting Locations

1. Each tie rod has a grease fitting on each ball joint, the one that secures the tie rod to the Pitman arm (Fig 3) and the joint that secures the tie rod to the front wheel spindle (Fig 4).

2. The A–arm has a grease fitting for the king pin (Fig 4).

3. The throttle and brake pedal pivots each have one grease fitting. **Note:** These fittings are not greased at the factory. Grease them only when and if the pedals begin to stick (Fig. 5).

Greasing

IMPORTANT: Use No. 2 general purpose lithium base grease.

1. Wipe grease fitting clean so foreign matter cannot be forced into the bearing or bushing.

2. Pump grease into the bearing or bushing.

3. Wipe off excess grease.

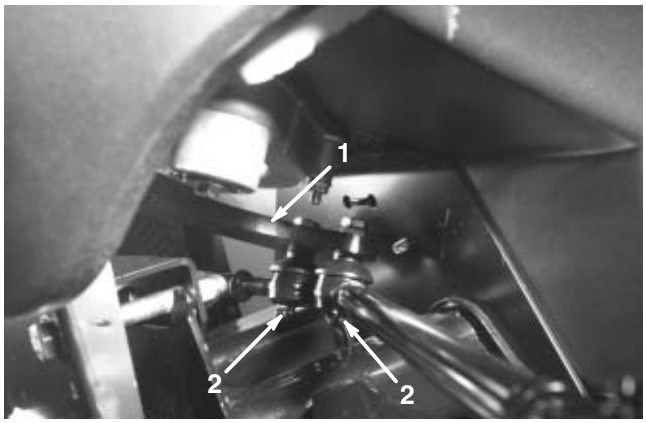


Figure 3

1. Pitman arm **2. Grease fitting**

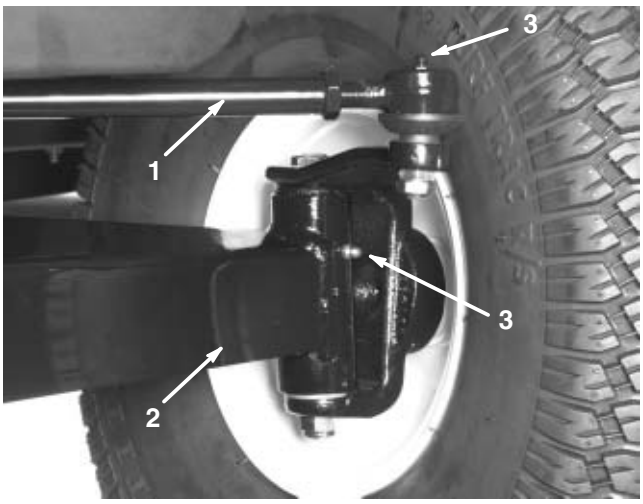


Figure 4

1. Tie rod **3. Grease fitting**
2. A–arm

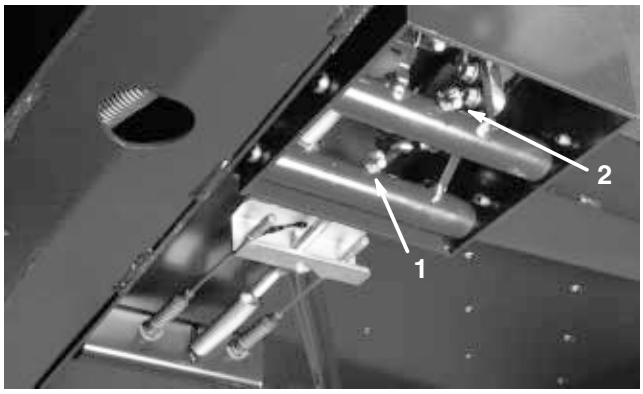


Figure 5

1. Grease fitting (brake) **2. Grease fitting (throttle)**

Drive Clutch Lubrication

Note: After every 400 hours of use, or yearly, cleaning and lubrication of the drive clutch is recommended.

1. Park machine on a level surface, stop engine, and remove key from the ignition switch. Raise and latch cargo bed.

2. Remove the three (3) cap screws that secure the cover to the drive clutch (Fig. 6). Remove the cover from the clutch.

WARNING

When using compressed air for cleaning the clutch, the dust in the clutch will become airborne and could damage your eyes or you could inhale it causing breathing difficulties.

Wear safety goggles and a dust mask or other eye and respiratory protection when performing this procedure.

3. Using compressed air, thoroughly clean the inside of the clutch cover and the clutch components.

4. Lubricate the clutch components as shown in Figure 7 using Toro Dry Lubricant Spray (see Special Tools in Chapter 5 – Drive Train).

5. Install cover to clutch and secure with three (3) cap screws. Torque cap screws from 75 to 100 in–lb (8.5 to 11.3 N–m).

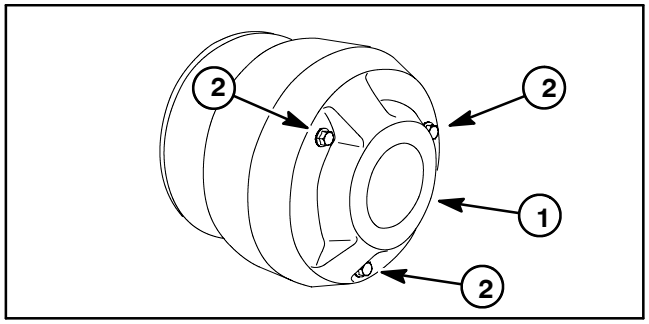


Figure 6

1. **Clutch cover** 2. **Cap screw**

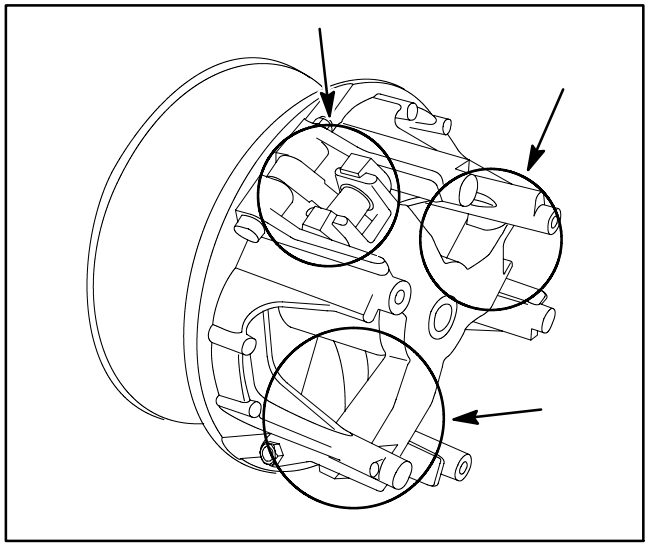


Figure 7

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.

Chapter 3

Briggs & Stratton Gasoline Engine

Table of Contents

Introduction

This Chapter gives information about specifications, maintenance, troubleshooting, testing, and repair of the V–twin cylinder, gasoline engine used in the Workman 2100 and 2110.

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the Briggs & Stratton Repair Manual for 4–Cycle, V–Twin Cylinder, OHV Head Engines. 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 Briggs & Stratton engines are supplied through your local Briggs and Stratton dealer or distributor. If no parts list is available, be sure to provide your distributor with the Toro model and serial number.

Specifications

Item	Description
Make / Designation	Briggs and Stratton, 4–cycle, V–Twin Cylinder, OHV, Air Cooled, Gasoline Engine – Model 303440
Horsepower	16 HP @ 3600 RPM
Torque kg–m (ft–lb)	4.76 (34.5) @ 2300 RPM
Bore x Stroke mm (in.)	68 x 66 (2.68 x 2.60)
Total Displacement cc (cu. in.)	480 (29.3)
Dry Weight (approximate) kg (lb.)	32.4 (72)
Fuel	Unleaded regular grade gasoline
Fuel Capacity liters (gallons)	26.5 (7.0)
Fuel Pump	Pulsating Crankcase Vacuum
Carburetor	Float Feed, Single Barrel
Governor Serial Number Below 240000000 Serial Number Above 240000000	 Transaxle, Ground Speed Governing Mechanical Governor
Engine Oil	See Check Engine Oil in General Information section
Oil Pump	Gear Driven Geroter Type
Crankcase Oil Capacity liters (U.S. qt.)	1.66 (1.75) with new filter
Spark Plugs	Champion RC 12YC (or equivalent)
Spark Plug Gap mm (inch)	0.76 (0.030)
Starter/Generator	10.5 VDC 100 Amps/14 VDC and 23 Amps

Fill Fuel Tank and Fuel Safety Precautions

The Toro Company strongly recommends the use of fresh, clean, UNLEADED regular grade gasoline in Toro gasoline powered products. Unleaded gasoline burns cleaner, extends engine life, and promotes good starting by reducing the build-up of combustion chamber deposits. Minimum Octane rating of 85.

IMPORTANT: Never use gasoline containing METHANOL, gasoline containing more than 10% ethanol, gasoline additives, or white gas. Damage could result to the engine fuel system.

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

2. Clean area around fuel tank cap.

3. Remove fuel tank cap.

4. Fill tank to about one inch below the top of tank, (bottom of filler neck). This space in the tank allows gasoline to expand. **Do not overfill.**

5. Install fuel tank cap securely. Wipe up any fuel that may have spilled.

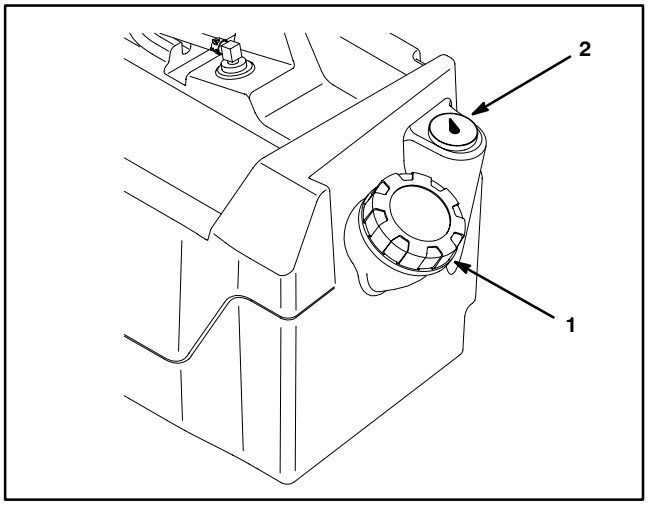


Figure 1

1. **Fuel tank cap**
2. **Fuel gauge**

DANGER

POTENTIAL HAZARD

- **Gasoline is extremely flammable and highly explosive under certain conditions.**

WHAT CAN HAPPEN

- **A fire or explosion from gasoline can burn you, others, and cause property damage.**

HOW TO AVOID THE HAZARD

- **Use a funnel and fill the fuel tank outdoors, in an open area, when the engine is cold. Wipe up any gasoline that spills.**
- **Do not fill the fuel tank completely full. Add gasoline to the fuel tank until the level is no higher than 1 inch (25 mm) below the bottom of the filler neck. This empty space in the tank allows gasoline to expand.**
- **Never smoke when handling gasoline, and stay away from an open flame or where gasoline fumes may be ignited by a spark.**
- **Store gasoline in an approved container and keep it out of the reach of children. Never buy more than a 30-day supply of gasoline.**
- **Always place gasoline containers on the ground away from your vehicle before filling.**
- **Do not fill gasoline containers inside a vehicle or on a truck or trailer bed because interior carpets or plastic truck bed liners may insulate the container and slow the loss of any static charge.**
- **When practical, remove gas–powered equipment from the truck or trailer and refuel the equipment with its wheels on the ground.**
- **If this is not possible, then refuel such equipment on a truck or trailer from a portable container, rather than from a gasoline dispenser nozzle.**
- **If a gasoline dispenser nozzle must be used, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete.**

Check Engine Oil

Procedure (Fig. 2)

The engine is shipped with oil in the crankcase; however, level of oil must be checked before and after the engine is first started.

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

2. Remove dipstick and wipe it with a clean rag. Insert dipstick into tube and make sure it is seated fully. Remove dipstick and check level of oil.

3. If oil level is low, remove filler cap from valve cover. Pour oil with proper type and viscosity into the opening until the oil level is up to the “FULL” mark on the dipstick. Add oil slowly, and check the level often during this process. **Do not overfill.**

4. Install dipstick firmly in place.

Oil Type and Viscosity (Fig. 3)

Oil Type: Detergent oil (API service SF, SG, SH, SJ, or higher).

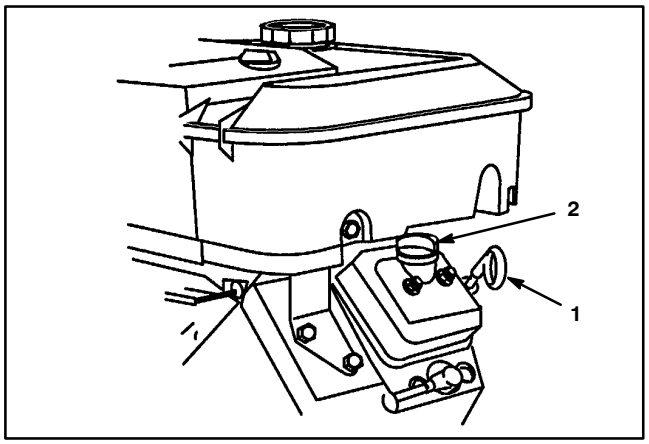


Figure 2

1. Dipstick **2. Filler cap**

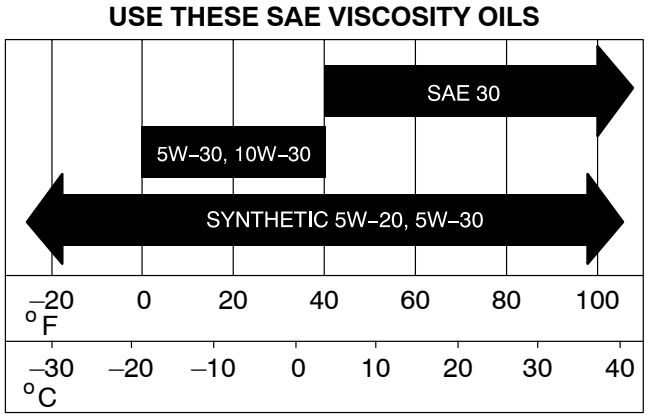


Figure 3

Adjustments

Adjust Starter/Generator Belt

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Loosen starter generator pivot bolt.

3. While pressing the belt at mid–span between the pulleys with 10 lb (44.5 N) of force, adjust jam nut on the starter rod until the belt flexes 1/4 inch (6 mm).

4. Tighten starter generator pivot bolt.

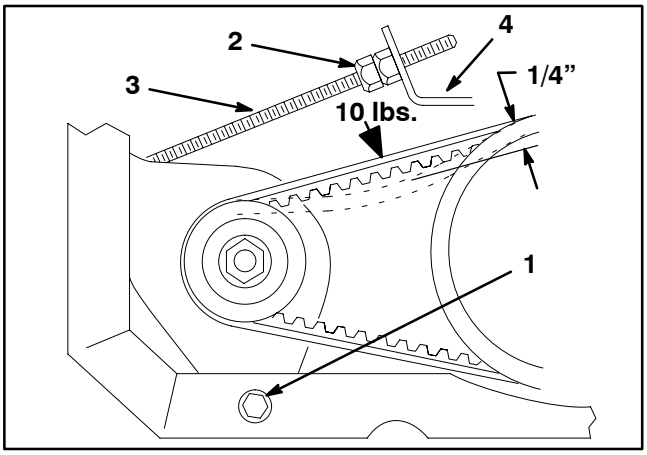


Figure 4

1. **Generator pivot bolt**
2. **Jam nut**
3. **Starter rod**
4. **Torque arm**

Adjust Throttle Cable

Note: Workman 2100 and 2110 machines with Serial Numbers above 240000000 are equipped with an engine governor rather than a transaxle governor. Refer to the Briggs & Stratton Repair Manual at the end of this chapter for governor information on these machines.

Releasing the accelerator pedal should allow the throttle cable to close the carburetor throttle control lever so that the lever touches the adjustment screw. The adjustment screw keeps the throttle valve inside the carburetor open slightly to prevent the valve from binding.

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

2. Lift cargo bed and prop with rod to gain access to the engine.

3. Rotate governor arm on transaxle fully clockwise (Fig. 5).

4. Make sure of the following:

   A. The engine throttle control lever should be to the fully open position (Fig. 6).

   B. Adjust throttle cable at the cable bracket as necessary, so there is no compression of the throttle cable (Fig. 5). This will allow the throttle control lever to fully close when the accelerator pedal is released.

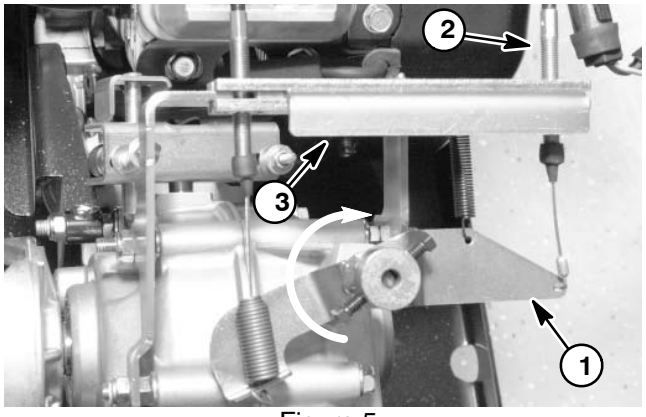


Figure 5

1. **Governor arm**
2. **Throttle cable**
3. **Cable bracket**

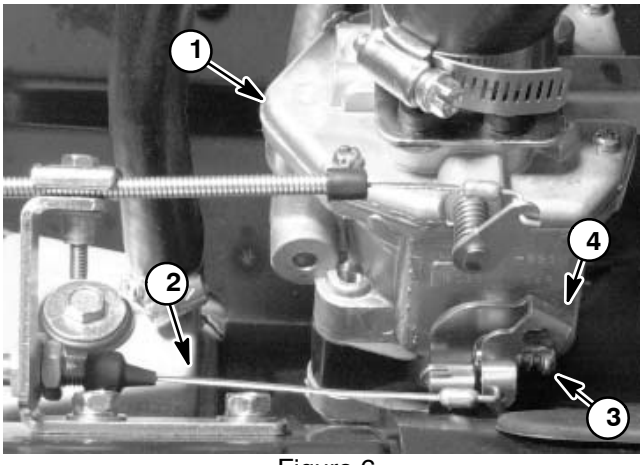


Figure 6

1. **Carburetor**
2. **Throttle cable**
3. **Adjustment screw**
4. **Throttle control lever**

Change Engine Oil

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

1. Start vehicle and let it run for a few minutes to warm the oil.

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

3. Raise bed and support with prop rod (see Operator's Manual).

4. Disconnect spark plug wires.

5. Remove drain plug and let the oil flow into a drain pan. When the oil stops, reinstall the drain plug (Fig.7).

Note: Dispose of the used oil at a certified recycling center.

Note: See Check Engine Oil for the proper type and viscosity of oil to add to the engine.

6. Pour oil into fill opening until the oil level is up to the "**FULL**" mark on the dipstick. Add oil slowly and check level often during this process. **Do not overfill (Fig. 8).**

7. Install filler cap and dipstick firmly in place (Fig. 8).

8. Connect spark plug wires.

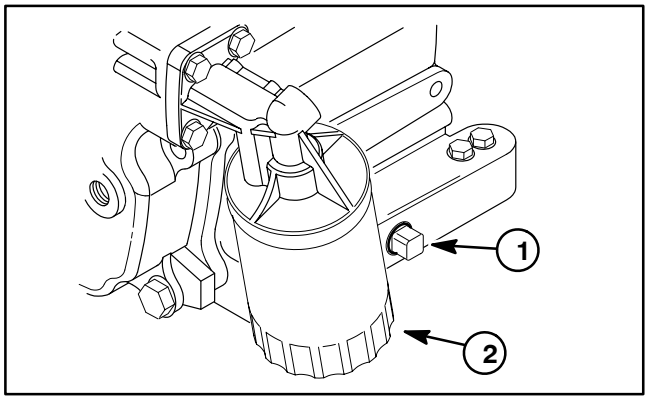


Figure 7

1. Drain plug **2. Oil filter**

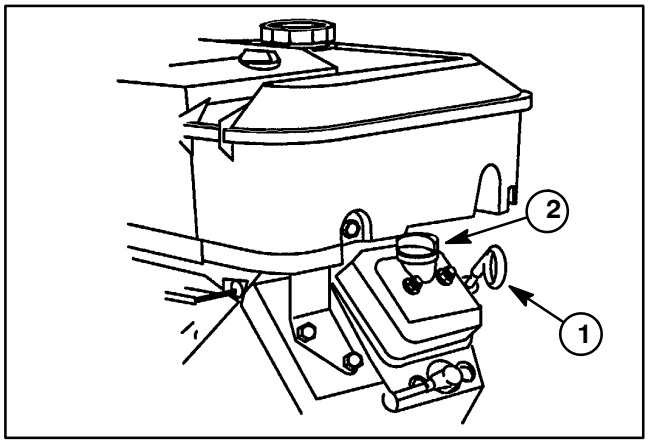


Figure 8

1. Dipstick **2. Filler cap**

Change Engine Oil Filter

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

1. Drain oil from the engine (see Change Engine Oil).

2. Remove existing oil filter (Fig.7). Apply light coat of clean oil to the new filter gasket.

3. Screw filter on until gasket contacts mounting plate, then tighten filter an additional 1/2 to 3/4 turn further. **Do not overtighten.**

Note: See Check Engine Oil for the proper type and viscosity of oil to add to the engine.

4. Pour oil into fill opening until the oil level is up to the "**FULL**" mark on the dipstick. Add oil slowly and check level often during this process. **Do not overfill (Fig. 8).**

5. Start and run engine to check for leaks.

6. Stop engine and recheck the oil level. Add oil if necessary.

Service Air Cleaner

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Raise bed and support with prop rod (see Operator's Manual).

3. Check air cleaner body and hoses for damage which could possibly cause an air leak. Replace air cleaner body if damaged.

4. Release latches securing the air cleaner cover to the air cleaner body. Separate cover from the body. Clean inside of air cleaner cover.

5. Gently slide filter out of the air cleaner body to reduce the amount of dust dislodged. Avoid knocking filter against the air cleaner body.

IMPORTANT: Do not wash or reuse a damaged filter.

6. Inspect filter. Discard filter if damaged.

7. Clean filter element using either the washing method or compressed air method:

Washing Method

A. Prepare a solution of filter cleaner and water. Soak filter element for about 15 minutes. Refer to directions on the filter cleaner carton for complete information.

IMPORTANT: Maximum water pressure must not exceed 40 psi to prevent damage to the filter element.

B. After soaking the filter for 15 minutes, rinse it with clear water. Rinse filter from the clean side to the dirty side.

IMPORTANT: Do not use a light bulb to dry the filter element because damage could result.

C. Dry filter element using warm, flowing air that does not to exceed 160ºF (71ºC), or allow element to air–dry.

Compressed Air Method

CAUTION

Use eye protection such as goggles when using compressed air.

IMPORTANT: Maximum air pressure must not exceed 100 psi to prevent damage to the element.

A. Blow compressed air from the inside to the outside of the dry filter element.

B. Keep air hose nozzle at least 2 inches (5 cm) from the filter. Move nozzle up and down while rotating the filter element. Inspect for holes and tears by looking through the filter toward a bright light.

8. If filter element is being replaced, inspect new filter for shipping damage. Check sealing end of the filter. Do not install a damaged filter.

9. Insert new (or cleaned) filter correctly into the air cleaner body. Make sure filter is sealed properly by applying pressure to the outer rim of the filter when installing. Do not press on the flexible center of the filter.

10. Reinstall cover and secure latches.

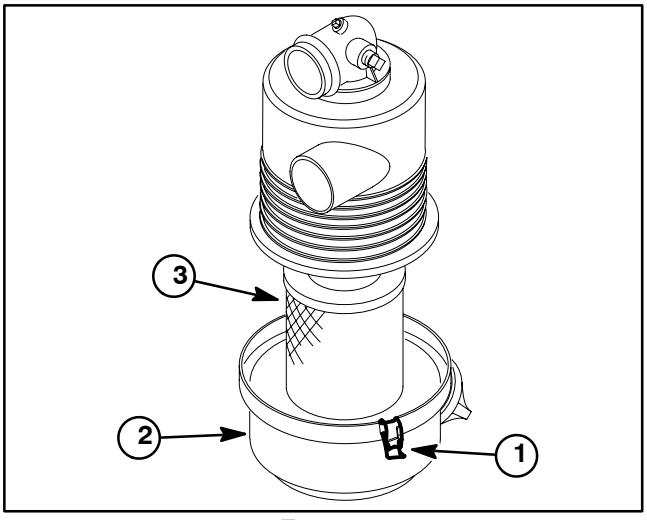


Figure 9

1. **Air cleaner latches**
2. **Cover**
3. **Filter element**

Service Drive Belt

Inspection

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Raise bed and support with prop rod (see Operator's Manual).

3. Put vehicle transmission in neutral (see Set Neutral Lock Assembly in Chapter 1 – Safety).

4. Rotate and inspect belt for excessive wear or damage. Replace as necessary.

Replacement

1. Rotate and route belt over the driven clutch. Remove belt from the drive clutch.

2. Place new belt around drive clutch. Rotate driven clutch while routing the belt on.

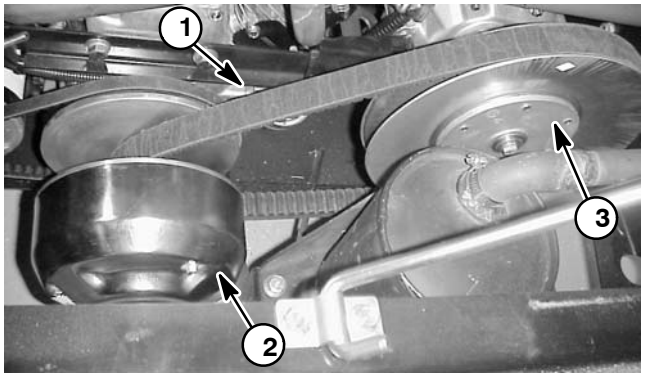


Figure 10

1. **Drive belt**
2. **Drive clutch**
3. **Driven clutch**

Replace Fuel Filter

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

WARNING

Use caution when working with fuel system components (see Fill Fuel Tank and Fuel Safety Precautions).

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

2. Raise bed and support with prop rod (see Operator's Manual).

3. Place a clean container under fuel filter.

4. Remove clamps securing fuel filter to fuel lines.

5. Remove fuel lines from fuel filter.

IMPORTANT: Mount filter so the arrow points in the direction of fuel flow to the fuel pump.

6. Install new fuel filter to fuel lines with clamps previously removed.

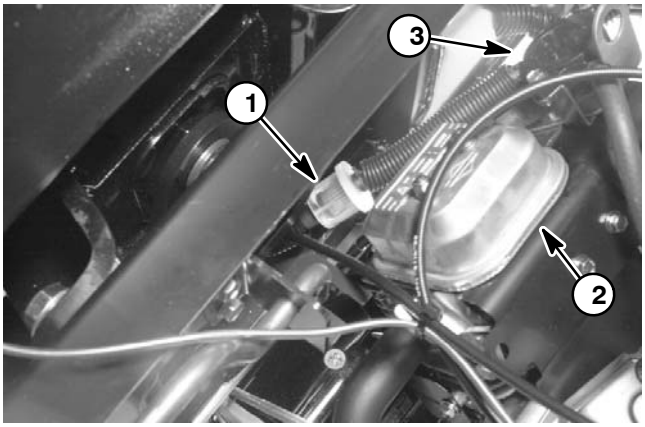


Figure 11

1. **Fuel filter**
2. **Rear cylinder head**
3. **Fuel pump**

Spark Plugs

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

Type: Champion RC 12YC (or equivalent)
Air Gap: 0.030 inch (0.76 mm)

Note: A spark plug usually lasts a long time; however, the plug should be removed and checked whenever the engine malfunctions.

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

2. Raise cargo bed to allow access to engine.

3. Clean area around spark plugs so foreign matter cannot fall into cylinder when spark plug is removed.

4. Pull spark plug wires off spark plugs and remove plugs from cylinder head.

IMPORTANT: Replace cracked, fouled, dirty, or malfunctioning spark plugs. Do not clean plugs. Grit from the plug may damage the engine.

5. Check condition of side electrode, center electrode, and center electrode insulator for damage.

6. Set air gap between center and side electrodes at 0.030" (0.76 mm). Install correctly gapped spark plug and tighten plug to 180 in-lb (20 N–m).

7. Install spark plug wires.

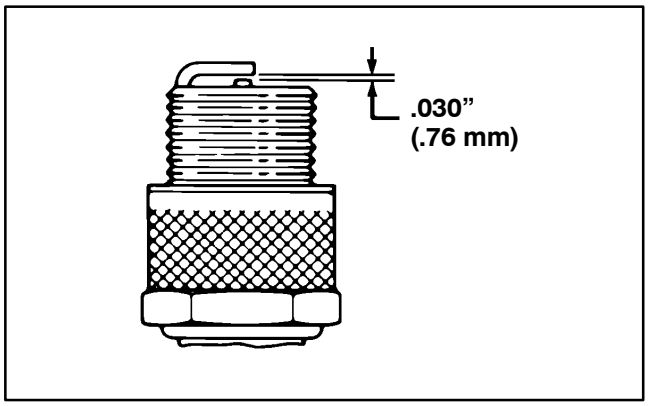


Figure 12

Clean Debris from Engine

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

IMPORTANT: This engine is air–cooled. Operating the engine with dirty or plugged cooling fins, a blocked rotating screen, or plugged or dirty blower housing will result in overheating and engine damage.

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

2. Raise bed and support with prop rod (see Operator's Manual).

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

3. Clean cooling fins on both cylinder heads (Fig. 13).

4. Clean rotating screen and blower housing of dirt and debris. Remove screen and housing if necessary (Fig.14).

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

5. Make sure rotating screen and blower housing are reinstalled to the engine if removed.

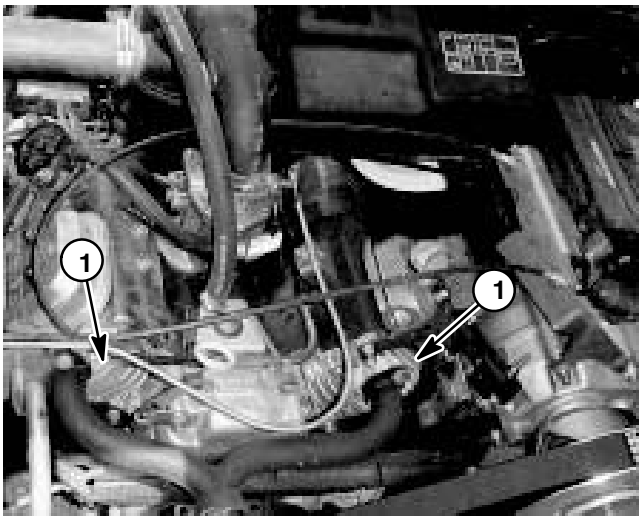


Figure 13
1. Cylinder head cooling fins

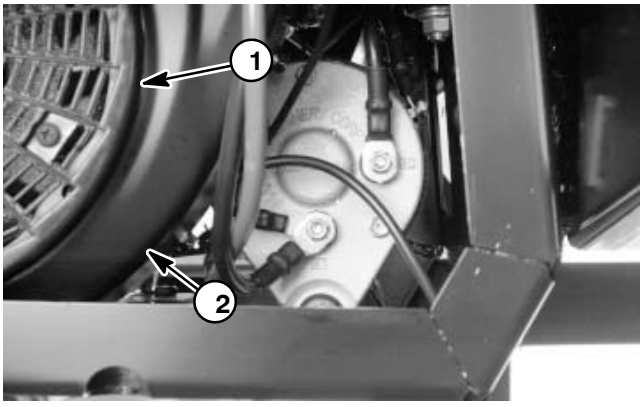


Figure 14
1. Rotating screen 2. Blower housing

Muffler

Removal

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

2. Raise bed and support with prop rod.

CAUTION

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

3. Remove two coupler springs securing the exhaust coupler to the muffler.

4. Remove two flange screws securing the muffler to the frame.

5. Separate muffler carefully from the frame and exhaust coupler. Remove muffler from machine.

6. If manifold needs to be removed from engine, remove socket head screws and lock washers securing the exhaust manifold to the engine.

7. Remove exhaust manifold with coupler and exhaust gaskets from engine.

Installation

1. Make sure engine is off.

Note: Mount all fasteners before securing tightly to ensure a proper fit of exhaust system.

2. If the exhaust manifold was removed from engine, install manifold to engine with new gaskets. Attach exhaust manifold loosely to the engine with fasteners.

3. Position muffler to the frame and exhaust coupler.

4. Carefully attach muffler to the exhaust coupler. Secure muffler loosely to the frame bracket with two flange head screws.

5. Install two coupler springs securing the muffler to the coupler.

6. Tighten socket head screws that secure exhaust manifold to the engine.

7. Tighten flange head screws that secure muffler to the frame.

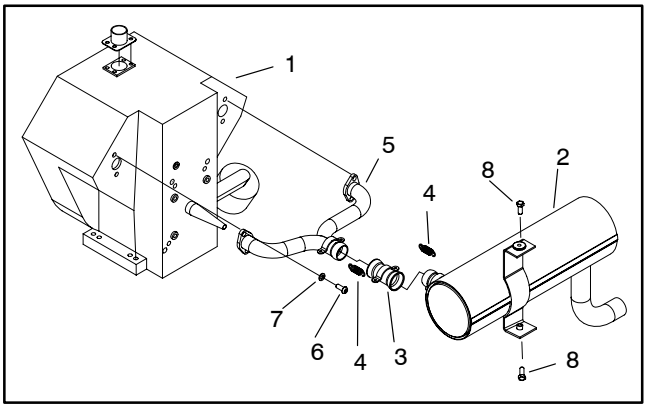


Figure 15

1. **Engine**
2. **Muffler**
3. **Exhaust coupler**
4. **Coupler spring (4 used)**
5. **Exhaust manifold**
6. **Socket head screw**
7. **Lock washer**
8. **Flange head screw**

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Seat Base and Fuel Tank

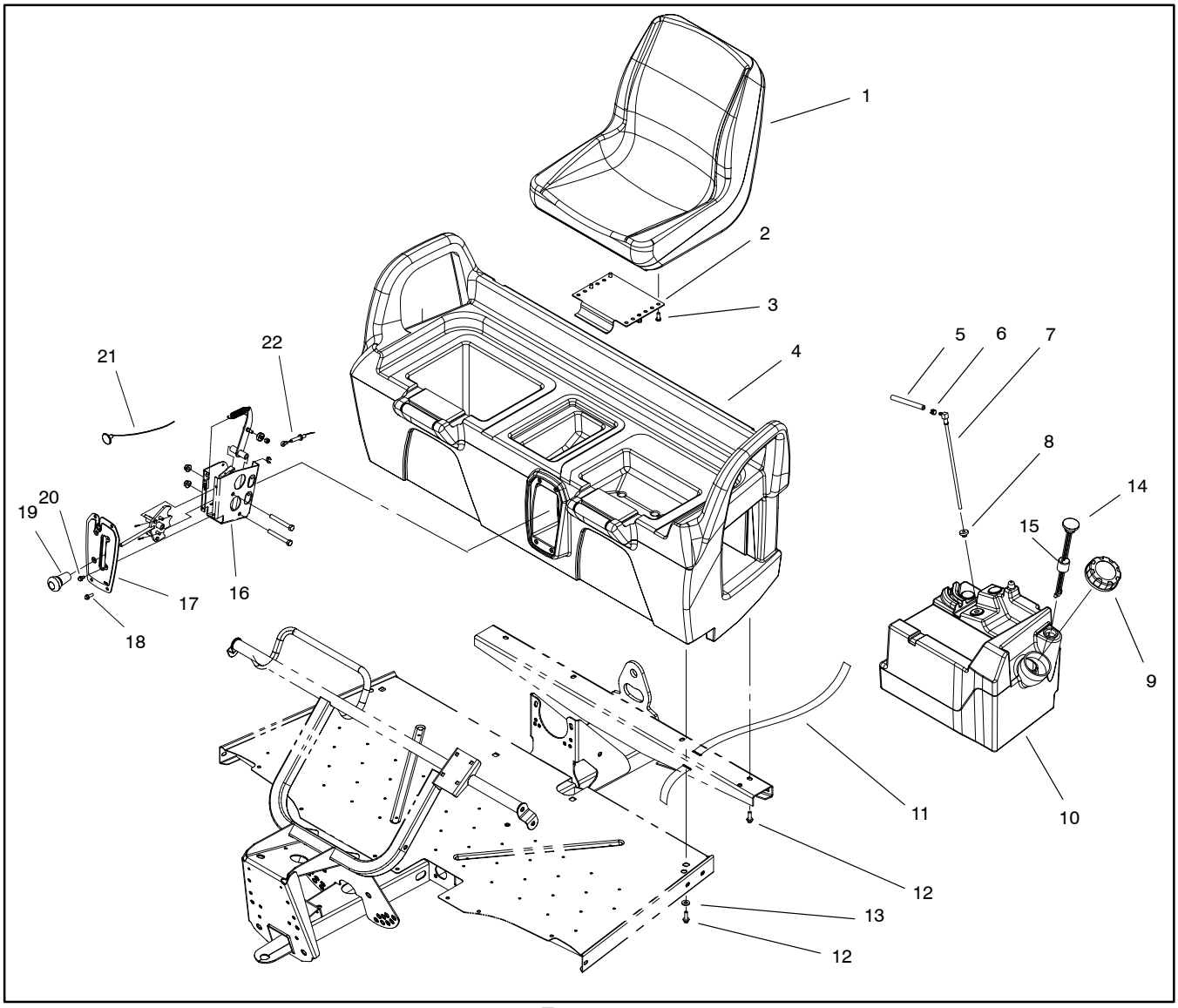

Figure 16

1. **Seat**
2. **Seat bracket**
3. **Cap screw**
4. **Seat base**
5. **Fuel hose (to filter)**
6. **Clamp**
7. **Stand pipe**
8. **Bushing**
9. **Gas cap**
10. **Fuel tank**
11. **Web strapping (48 inch)**
12. **Hex head flange screw**
13. **Flat washer**
14. **Fuel gauge**
15. **Grommet**
16. **Shift bracket**
17. **Shifter plate**
18. **Long cap screw (4 used)**
19. **Knob**
20. **Short cap screw (4 used)**
21. **Choke cable**
22. **Shift cable (2 used)**

Seat Base Removal (Fig. 16)

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. On Workman 2110 machines, remove parking brake assembly from seat base (see Parking Brake Disassembly in the Service and Repairs section of Chapter 7 – Chassis, Wheels, and Brakes).

4. Unscrew knob from the shift lever. Remove four short cap screws securing the shift plate to the shift bracket (Fig. 17).

5. Remove four long cap screws securing the shift plate to the seat base (Fig. 17). Separate shift bracket from the choke cable and seat base.

6. Remove four hex head flange screws and flat washers securing the front of the seat base to the frame. Remove four hex head flange screws securing the back of the seat base to the frame.

IMPORTANT: Make sure shift bracket, shift cables, choke cable, and fuel tank do not catch on the seat base during removal.

7. Lift seat base carefully from the machine.

Seat Base Installation

IMPORTANT: Make sure shift bracket, shift cables, choke cable, and fuel tank do not catch on the seat base during installation.

1. Position seat base carefully to the frame.

Note: Do not tighten fasteners securing the seat base to the frame until all of them are installed.

2. Install four hex head flange screws and flat washers through the frame and to the front of the seat base. Install four hex head flange screws through the frame and into the back of the seat base. Tighten all fasteners.

3. Place shift bracket, shift cables, and choke cable through the opening at the front of the seat base.

4. Position choke cable and shift plate to shift bracket making sure to capture cable flange. Secure shift plate to shift bracket with four short cap screws. Screw knob onto the shift lever (Fig. 17).

5. Position shift plate with shift bracket to the seat base. Secure shift plate to seat base with 4 long cap screws (Fig. 17).

6. On Workman 2110 machines, install parking brake assembly to seat base (see Parking Brake Assembly in the Service and Repairs section of Chapter 7 – Chassis, Wheels, and Brakes).

Fuel Tank Removal (Fig. 18)

WARNING

Use caution when working with fuel system components (see Fill Fuel Tank and Fuel Safety Precautions).

1. Remove seat base from the frame (see Seat Base Removal).

2. Loosen hose clamp and disconnect fuel hose from the tank.

3. Release tank strap from fuel tank. Do not remove strap from floor plate and frame cross member. Remove tank from frame.

Fuel Tank Installation (Fig. 18)

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

2. Connect fuel hose to the tank and secure with hose clamp.

3. Install seat base to the frame (see Seat Base Installation).

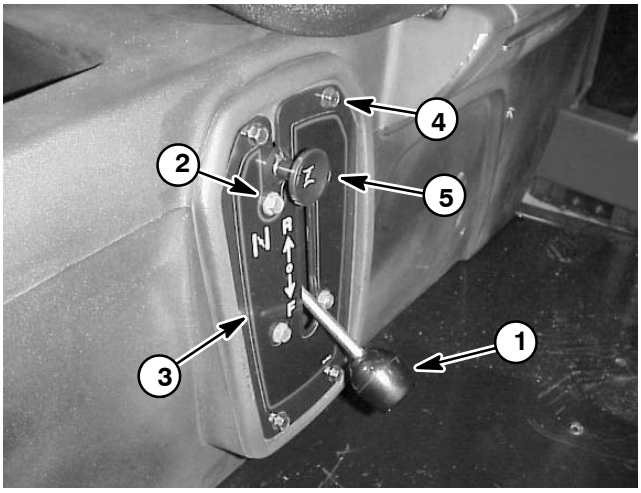

Figure 17

1. Shift lever
2. Cap screw (short)
3. Shift plate
4. Cap screw (long)
5. Choke cable

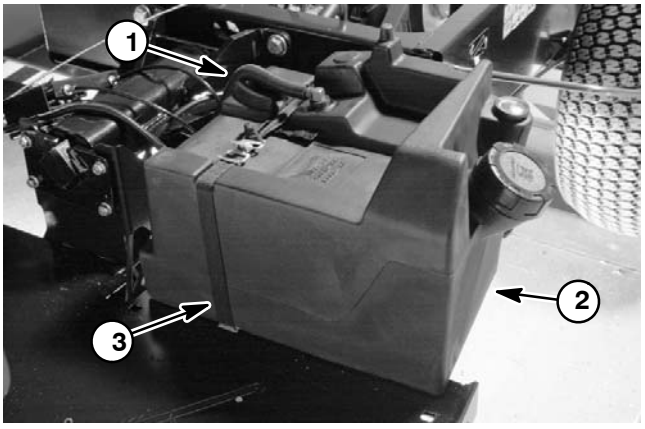

Figure 18

1. Fuel hose
2. Fuel tank
3. Tank strap

Engine

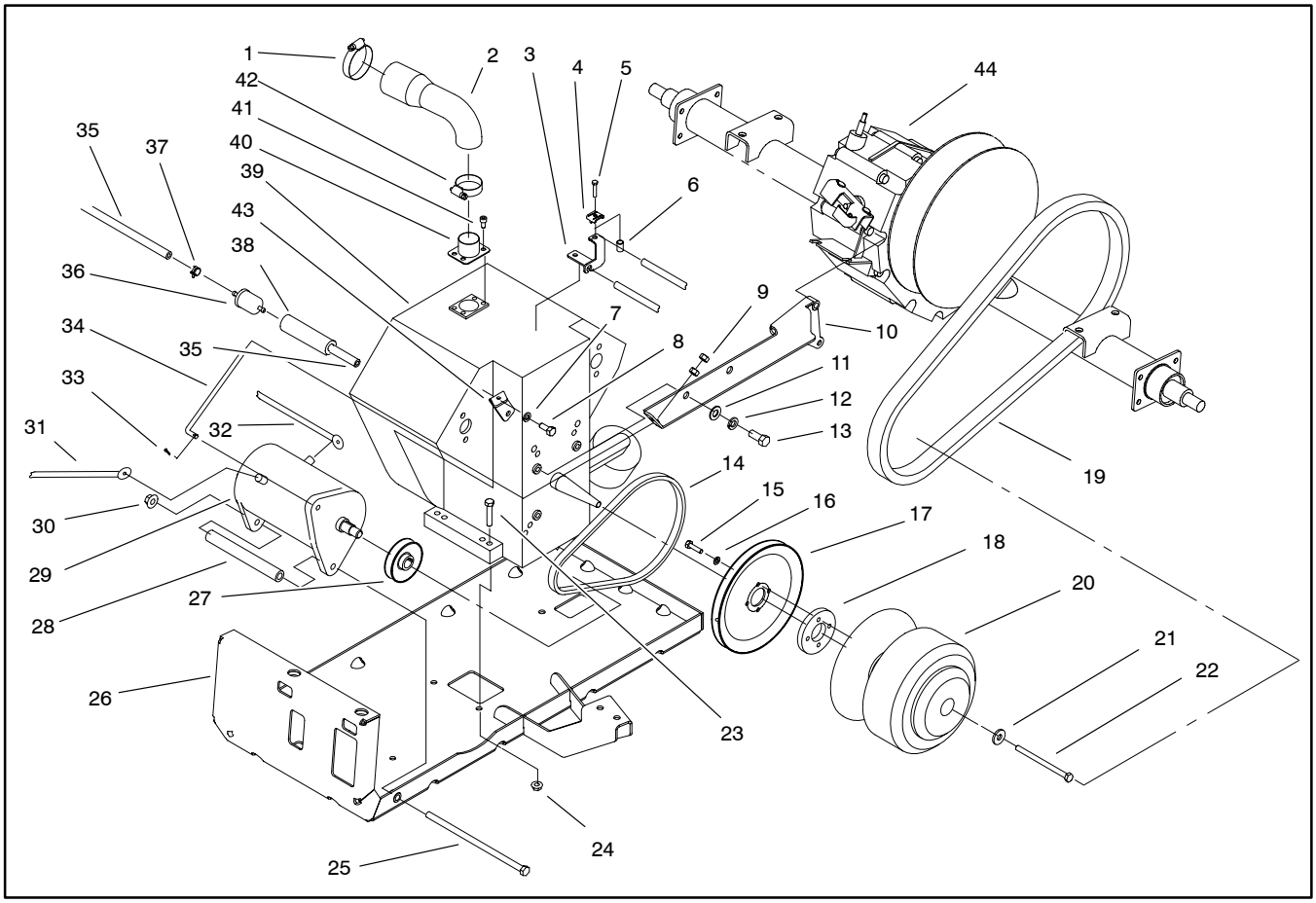

Figure 19

1. Hose clamp
2. Air intake hose
3. Cable bracket
4. Cable clamp
5. Cap screw
6. Threaded insert
7. Washer
8. Cap screw
9. Nut
10. Torque arm
11. Flat washer (2 used)
12. Lock washer (2 used)
13. Cap screw (2 used)
14. Starter V–belt
15. Cap screw (4 used)
16. Lock washer (4 used)
17. Engine pulley
18. Starter spacer
19. Drive belt
20. Drive clutch
21. Washer
22. Cap screw
23. Cap screw (4 used)
24. Flange lock nut (4 used)
25. Screw
26. Engine mount
27. Starter/generator pulley
28. Starter/generator pivot
29. Starter/generator
30. Flanged lock nut
31. Negative battery cable
32. Positive battery cable
33. Cotter pin
34. Starter rod
35. Fuel hose
36. Fuel filter
37. Fuel line clamp
38. Fuel line conduit
39. Briggs & Stratton engine
40. Intake bracket
41. Screw (4 used)
42. Hose clamp
43. Cable bracket
44. Transaxle with driven clutch

Engine Removal (Fig. 19)

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

2. Remove cargo bed to gain access to the engine.

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

IMPORTANT: Make sure all hoses and engine openings are plugged after disconnecting. Prevent contaminants from entering the engine and fuel system and damaging the engine.

4. Disconnect the following components:

   A. Choke and throttle cables from the carburetor and cable bracket (Fig. 20).

   B. Air intake hose from the carburetor (Fig. 21).

   C. Breather hose from the crankcase (Fig. 21).

CAUTION

Read safety precautions for handling gasoline before working on the fuel system (see Fill Fuel Tank and Fuel Safety Precautions).

5. Disconnect fuel hose from the fuel pump. Remove cable tie securing the choke, throttle, and shift cables to the bracket on the front cylinder head (Fig. 21).

6. Remove muffler and exhaust pipe from the cylinder heads (see Muffler Removal).

7. Remove drive belt (see Service Drive Belt).

8. Remove V–belt from the engine and starter/generator by loosening the tension on the belt. Disconnect starter rod from the torque arm (see Adjust Starter/Generator Belt).

9. Remove torque arm from the engine and transaxle.

10. Disconnect electrical connections from the following engine components:

   A. Disconnect ground cable to engine at starter/generator terminal A1 (Fig. 22).

   B. Disconnect engine harness connector from the main harness.

11. Remove four flange lock nuts and cap screws securing the engine to the engine mount.

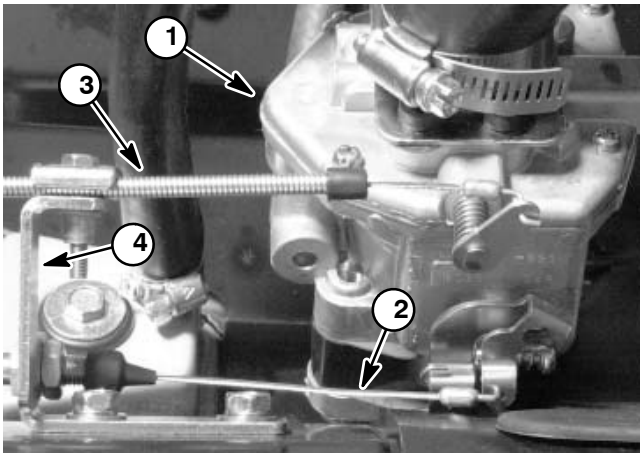

Figure 20

1. Carburetor
2. Throttle cable
3. Choke cable
4. Cable bracket

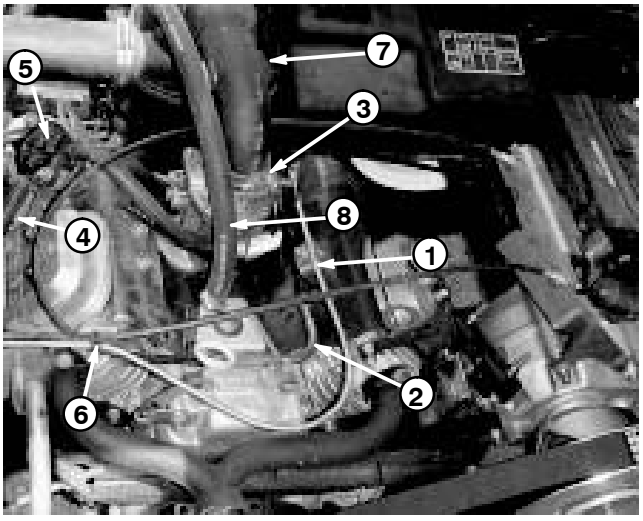

Figure 21

1. Choke cable
2. Throttle cable
3. Carburetor
4. Fuel hose
5. Fuel pump
6. Cable tie
7. Air intake hose
8. Breather hose

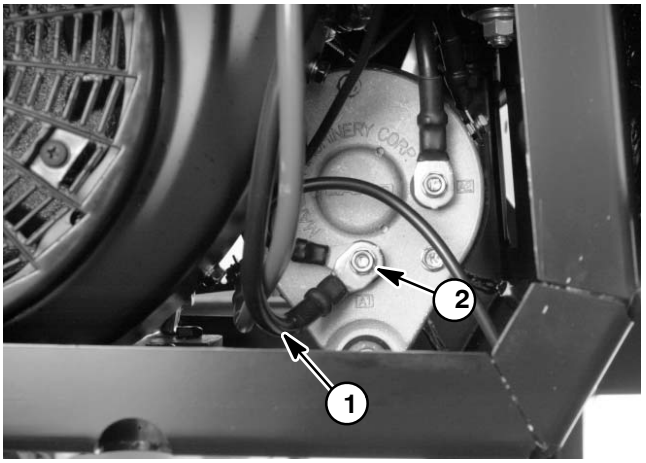

Figure 22

1. Starter/Generator ground cable to engine
2. Starter/Generator terminal (A1)

CAUTION

One person should operate the chain fall or hoist while the other person guides the engine out of the frame.

12. Remove engine from the engine mount.

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

    B. Connect hoist or chain fall to center of chain.

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

    C. Slowly remove engine and mounts from the machine.

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

Engine Installation (Fig. 19)

1. If removed, install engine parts and attachments to the engine.

CAUTION

One person should operate the chain fall or hoist while the other person guides the engine into the frame.

2. Install engine to the frame.

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

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

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

    C. Carefully lower engine onto the engine mount.

3. Secure engine to the engine mount with flange lock nuts and cap screws.

4. Connect the following electrical components:

    A. Connect ground cable from the engine at starter/generator terminal A1 (Fig. 22).

    B. Connect engine harness connector to the main harness connector.

5. Install torque arm to the engine and transaxle.

6. Secure starter rod to the torque arm. Install V–belt to the engine and starter/generator. Tension and adjust the V–belt (see Adjust Starter/Generator Belt).

7. Install drive belt (see Service Drive Belt).

8. Install muffler and exhaust pipe to the cylinder heads (see Muffler Removal).

9. Connect fuel hose to the fuel pump (Fig. 21).

10. Connect the following components:

IMPORTANT: Make sure all hoses and engine opening plugs are removed.

    A. Choke and throttle cables to the carburetor and cable bracket (Fig. 20).

    B. Air intake hose to the carburetor (Fig. 21).

    C. Breather hose to the crankcase (Fig. 21).

11. Secure choke, throttle, and shift cables to the bracket on the front cylinder head with cable tie (Fig. 21).

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

13. Install cargo bed to the frame.

14. Make sure engine oil level is correct (see Check Engine Oil).

15. When starting a new or repaired engine, observe the following:

    A. After starting a cold engine, let it warm up for about 15 seconds before applying any load to it.

    B. Check engine oil level regularly. Be alert for conditions of overheating.

Chapter 4

Kohler Gasoline Engine

Table of Contents

Introduction

This Chapter gives information about specifications, maintenance, troubleshooting, testing, and repair of the Kohler gasoline engine used in the Workman 1100 and 1110.

Most repairs and adjustments require tools which are commonly available in many service shops. Special tools are described in the Kohler Service Manual for COMMAND PRO CS Series Engines. The use of some specialized test equipment is explained. However, the cost of the test equipment and the specialized nature of some repairs may dictate that the work be done at an engine repair facility.

Service and repair parts for Kohler engines are supplied through your local Kohler dealer or distributor. If no parts list is available, be sure to provide your distributor with the Toro model and serial number.

Specifications

Item	Description
Make / Designation	Kohler, 4–cycle, Single Cylinder, OHV, Air Cooled, Gasoline Engine – Model CH12 PA–941521
Horsepower	12 HP @ 3600 RPM
Torque N–m (ft–lb)	22.6 (16.7) @ 2000 RPM
Bore x Stroke mm (in.)	85 x 63 (3.35 x 2.48)
Total Displacement cc (cu. in.)	357 (21.8)
Dry Weight (approximate) kg (lb.)	31.9 (70.5)
Fuel	Unleaded regular grade gasoline
Fuel Capacity liters (gallons)	26.5 (7.0)
Fuel Pump	Pulsating Crankcase Vacuum
Carburetor	Float Feed, Single Barrel
Governor	Transaxle, Ground Speed Governing
Engine Oil	See Change Engine Oil in Service and Repairs Section
Lubrication System	Splash Lubrication
Crankcase Oil Capacity liters (U.S. qt.)	1.1 (1.2)
Spark Plugs	Champion RC 14YC (or equivalent)
Spark Plug Gap mm (inch)	0.76 (0.030)
Starter/Generator	10.5 VDC 100 Amps/14 VDC and 23 Amps

Fill Fuel Tank and Fuel Safety Precautions

The Toro Company strongly recommends the use of fresh, clean, UNLEADED regular grade gasoline in Toro gasoline powered products. Unleaded gasoline burns cleaner, extends engine life, and promotes good starting by reducing the build-up of combustion chamber deposits. Minimum Octane rating of 87.

IMPORTANT: Never use gasoline containing METHANOL, gasoline containing more than 10% ethanol, gasoline additives, or white gas. Damage could result to the engine fuel system.

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

2. Clean area around fuel tank cap.

3. Remove fuel tank cap.

4. Fill tank to about one inch below the top of tank, (bottom of filler neck). This space in the tank allows gasoline to expand. **Do not overfill.**

5. Install fuel tank cap securely. Wipe up any fuel that may have spilled.

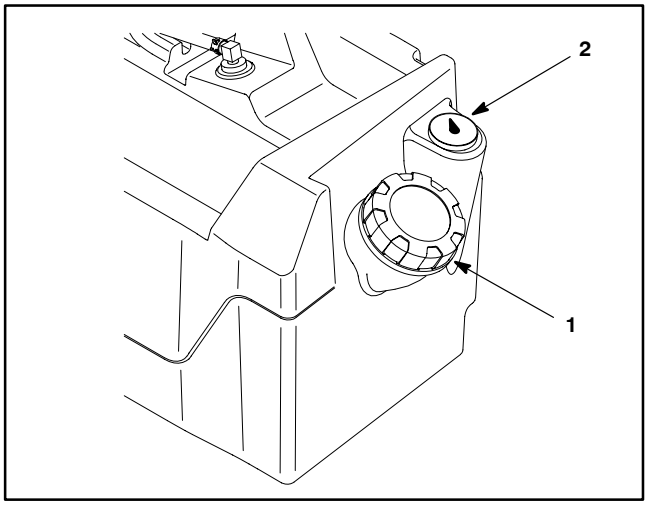

Figure 1

1. **Fuel tank cap**
2. **Fuel gauge**

DANGER

POTENTIAL HAZARD

- **Gasoline is extremely flammable and highly explosive under certain conditions.**

WHAT CAN HAPPEN

- **A fire or explosion from gasoline can burn you, others, and cause property damage.**

HOW TO AVOID THE HAZARD

- **Use a funnel and fill the fuel tank outdoors, in an open area, when the engine is cold. Wipe up any gasoline that spills.**
- **Do not fill the fuel tank completely full. Add gasoline to the fuel tank until the level is no higher than 1 inch (25 mm) below the bottom of the filler neck. This empty space in the tank allows gasoline to expand.**
- **Never smoke when handling gasoline, and stay away from an open flame or where gasoline fumes may be ignited by a spark.**
- **Store gasoline in an approved container and keep it out of the reach of children. Never buy more than a 30-day supply of gasoline.**
- **Always place gasoline containers on the ground away from your vehicle before filling.**
- **Do not fill gasoline containers inside a vehicle or on a truck or trailer bed because interior carpets or plastic truck bed liners may insulate the container and slow the loss of any static charge.**
- **When practical, remove gas–powered equipment from the truck or trailer and refuel the equipment with its wheels on the ground.**
- **If this is not possible, then refuel such equipment on a truck or trailer from a portable container, rather than from a gasoline dispenser nozzle.**
- **If a gasoline dispenser nozzle must be used, keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete.**

Check Engine Oil

Procedure (Fig. 2)

The engine is shipped with oil in the crankcase; however, level of oil must be checked before and after the engine is first started.

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

2. Remove dipstick and wipe it with a clean rag. Insert dipstick into tube and make sure it is seated fully. Remove dipstick and check level of oil.

3. If oil level is low, pour oil with proper type and viscosity into the filler tube until the oil level is up to the “FULL” mark on the dipstick. Add oil slowly, and check the level often during this process. **Do not overfill.**

4. Install dipstick firmly in place.

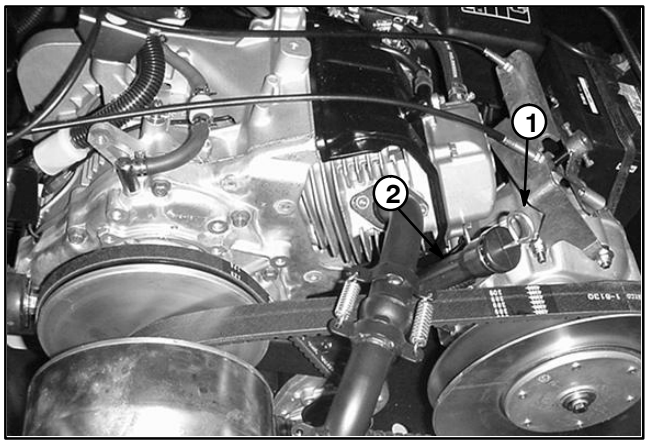

Figure 2

1. **Dipstick**
2. **Filler tube**

Oil Type and Viscosity (Fig. 3)

Oil Type: Detergent oil (API service SG, SH, SJ, or higher).

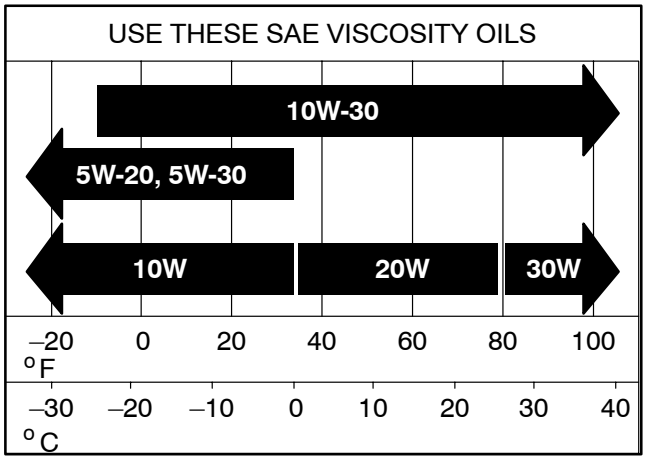

Figure 3

Adjustments

Adjust Starter/Generator Belt

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Lift cargo bed and prop with rod to gain access to the engine.

3. Loosen starter/generator pivot bolt.

4. Wedge a pry bar between the engine mount and starter. Loosen the nut on the adjusting carriage bolt.

5. Pivot the starter in the slot until the belt flexes 1/4 inch (6 mm), with 10 lb (4.5 Kg) of force.

6. Tighten the carriage bolt nut. Tighten starter generator pivot bolt.

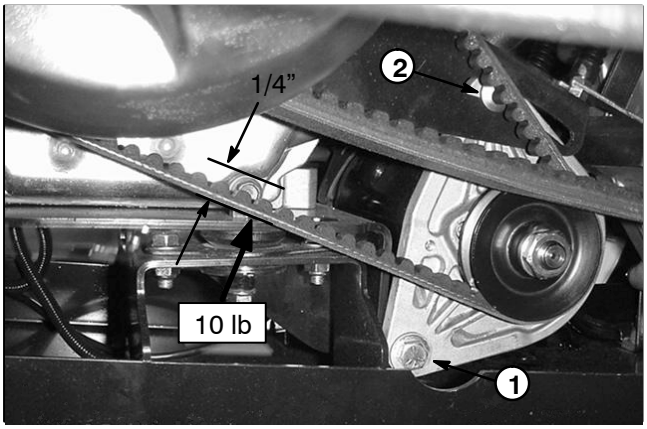

Figure 4

1. **Starter/Gen. pivot bolt**
2. **Carriage bolt**

Adjust Throttle Cable

Releasing the accelerator pedal should allow the throttle cable to close the carburetor throttle control lever so that the lever touches the adjustment screw. The adjustment screw keeps the throttle valve inside the carburetor open slightly to prevent the valve from binding.

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

2. Lift cargo bed and prop with rod to gain access to the engine.

3. Rotate governor arm fully clockwise (Fig. 5).

4. Make sure of the following:

   A. The throttle control lever should be to the fully open position.

   B. Adjust throttle cable at the cable bracket as necessary, so there is no compression of the throttle cable (Fig. 5). This will allow the throttle control lever to fully close when the accelerator pedal is released.

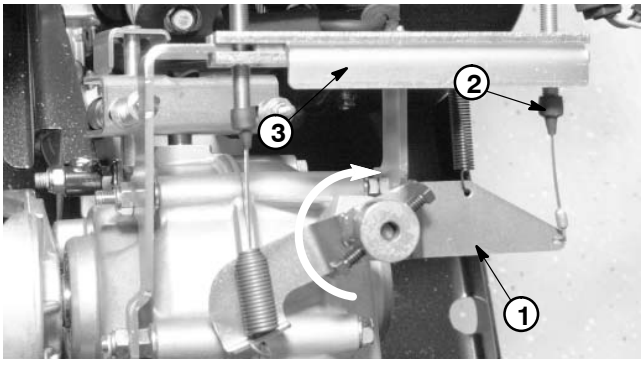

Figure 5

1. **Governor arm**
2. **Throttle cable**
3. **Cable bracket**

Change Engine Oil

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

1. Start vehicle and let it run for a few minutes to warm the oil.

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

3. Raise bed and secure it with the prop rod.

4. Disconnect spark plug wire.

5. Remove drain plug and let the oil flow into a drain pan. When the oil stops, reinstall the drain plug (Fig. 6) and torque it to 13 ft–lb (17.6 N–m).

Note: Dispose of the used oil at a certified recycling center.

Note: See Check Engine Oil for the proper type and viscosity of oil to add to the engine.

6. Pour oil into filler tube until the oil level is up to the "**FULL**" mark on the dipstick. Add oil slowly and check level often during this process. **Do not overfill (Fig. 7).**

7. Install dipstick firmly in place (Fig. 7).

8. Connect spark plug wire.

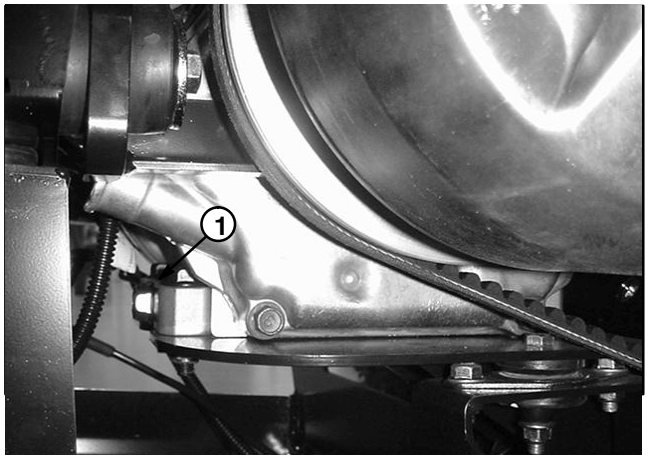

Figure 6

1. Drain plug

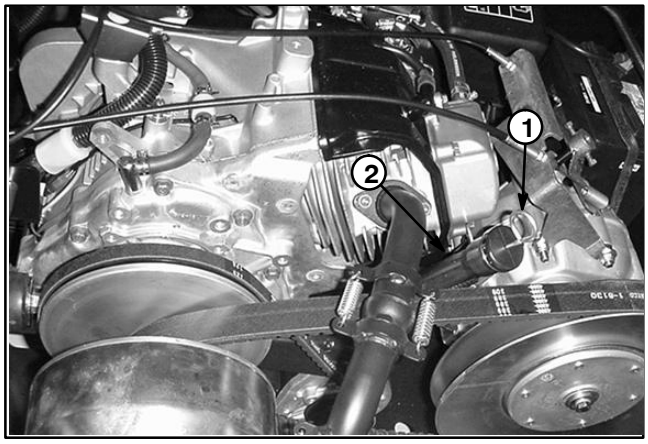

Figure 7

1. Dipstick **2. Filler tube**

Service Air Cleaner

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Raise bed and secure with prop.

3. Check air cleaner body and hoses for damage which could possibly cause an air leak. Replace air cleaner body if damaged.

4. Release latches securing the air cleaner cover to the air cleaner body. Separate cover from the body. Clean inside of air cleaner cover.

5. Gently slide filter out of the air cleaner body to reduce the amount of dust dislodged. Avoid knocking filter against the air cleaner body.

IMPORTANT: Do not wash or reuse a damaged filter.

6. Inspect filter. Discard filter if damaged.

7. Clean filter element using either of the following two methods:

Washing Method

A. Prepare a solution of filter cleaner and water. Soak filter element for about 15 minutes. Refer to directions on the filter cleaner carton for complete information.

IMPORTANT: Maximum water pressure must not exceed 40 psi to prevent damage to the filter element.

B. After soaking the filter for 15 minutes, rinse it with clear water. Rinse filter from the clean side to the dirty side.

IMPORTANT: Do not use a light bulb to dry the filter element because damage could result.

C. Dry filter element using warm, flowing air that does not to exceed 160ºF (71ºC), or allow element to air–dry.

Compressed Air Method

CAUTION

Use eye protection such as goggles when using compressed air.

IMPORTANT: Maximum air pressure must not exceed 100 psi to prevent damage to the element.

A. Blow compressed air from the inside to the outside of the dry filter element.

B. Keep air hose nozzle at least 2 inches (5 cm) from the filter. Move nozzle up and down while rotating the filter element. Inspect for holes and tears by looking through the filter toward a bright light.

8. If filter element is being replaced, inspect new filter for shipping damage. Check sealing end of the filter. Do not install a damaged filter.

9. Insert new (or cleaned) filter correctly into the air cleaner body. Make sure filter is sealed properly by applying pressure to the outer rim of the filter when installing. Do not press on the flexible center of the filter.

10. Reinstall cover and secure latches.

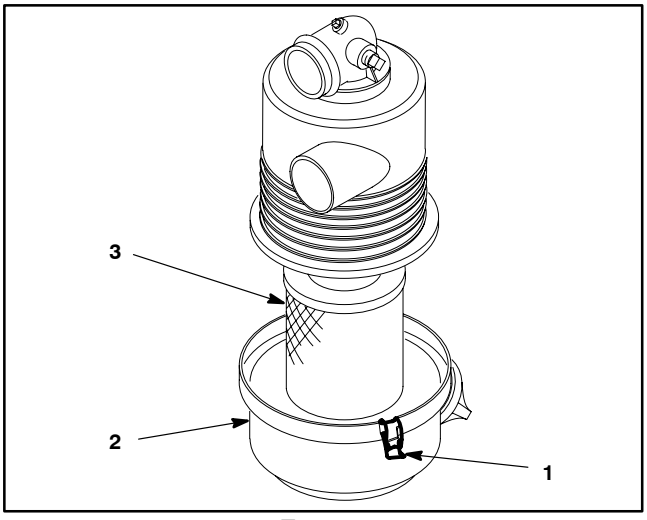

Figure 8

1. Air cleaner latches
2. Cover
3. Filter element

Service Drive Belt

Inspection

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Raise bed and secure with prop rod.

3. Put vehicle transmission in neutral (see Set Neutral Lock Assembly in Chapter 1 – Safety).

4. Rotate and inspect belt for excessive wear or damage. Replace as necessary.

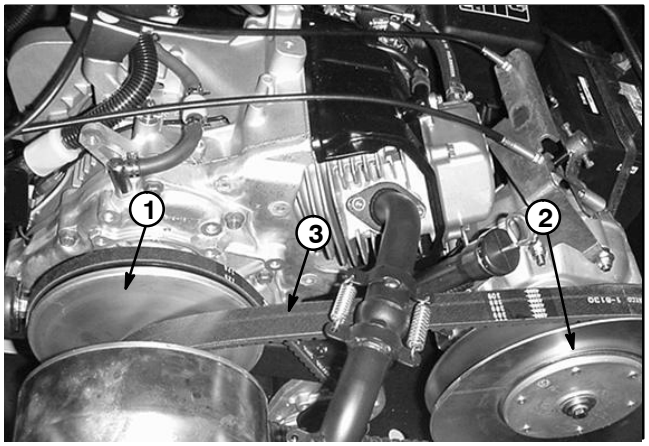

Figure 9

1. **Drive clutch**
2. **Driven clutch**
3. **Drive belt**

Replacement

1. Rotate and route belt over the driven clutch.

2. Remove belt from the drive clutch.

3. Place new belt around drive clutch.

4. Rotate driven clutch while routing the belt on.

Replace Fuel Filter

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

WARNING

Use caution when working with fuel system components (see Fill Fuel Tank and Fuel Safety Precautions).

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

2. Raise bed and support with prop rod.

3. Place a clean container under fuel filter (Fig. 10).

4. Remove clamps securing fuel filter to fuel lines.

5. Remove fuel lines from fuel filter.

IMPORTANT: Mount filter so the arrow points in the direction of fuel flow to the carburetor.

6. Install new fuel filter to fuel lines with clamps previously removed.

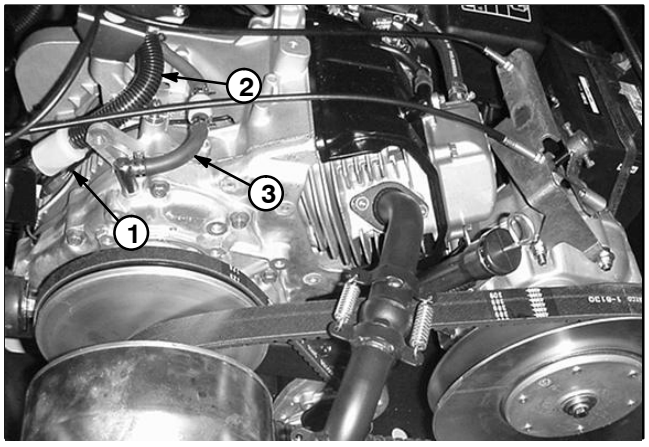

Figure 10

1. **Fuel filter**
2. **Fuel line**
3. **Vacuum line**

Spark Plug

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

Type: Champion RC 14YC (or equivalent)
Air Gap: 0.030 inch (0.76 mm)

Note: A spark plug usually lasts a long time; however, the plug should be removed and checked whenever the engine malfunctions.

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

2. Raise bed and support with prop rod.

3. Clean area around spark plug so foreign matter cannot fall into cylinder when spark plug is removed.

4. Pull spark plug wire off spark plug and remove plug from cylinder head.

IMPORTANT: Replace cracked, fouled, dirty, or malfunctioning spark plug. Do not clean plug. Grit from the plug may damage the engine.

5. Check condition of side electrode, center electrode, and center electrode insulator for damage.

6. Set air gap between center and side electrodes at 0.030" (0.76 mm). Install correctly gapped spark plug and tighten plug to 14 ft-lb (20 N–m).

7. Install spark plug wire.

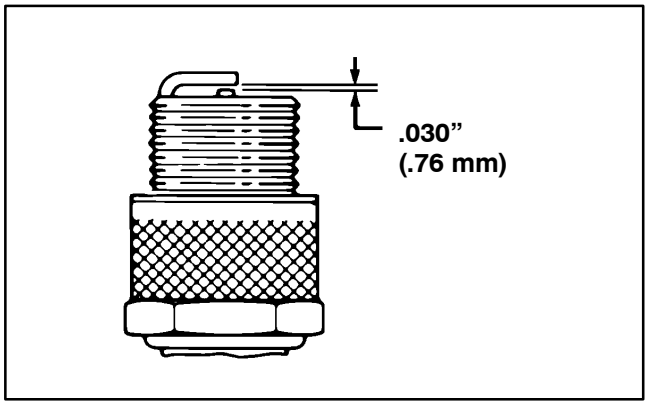

Figure 11

Clean Debris from Engine

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

IMPORTANT: This engine is air–cooled. Operating the engine with dirty or plugged cooling fins, a blocked debris screen, or a plugged or dirty blower housing will result in overheating and engine damage.

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

2. Raise bed and support with prop rod.

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

3. Clean cooling fins on cylinder head.

4. Clean static debris screen and blower housing of dirt and debris. Remove screen and housing if necessary (Fig. 12).

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

5. Make sure static screen and blower housing are reinstalled to the engine if removed.

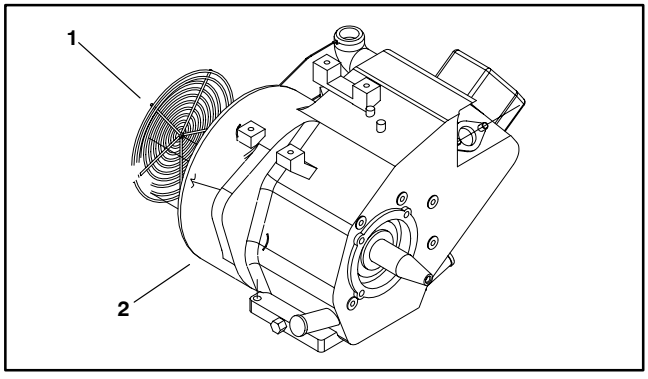

Figure 12

1. Static debris screen **2. Blower housing**

Muffler

Removal

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

2. Raise bed and support with prop rod.

CAUTION

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

3. Remove springs securing the exhaust coupler to the muffler and exhaust manifold (Fig. 13).

4. Remove four screws securing the muffler to the frame.

5. Remove exhaust coupler and muffler.

6. If needed, remove exhaust manifold from engine by removing two exhaust nuts. Replace gasket if necessary.

Installation

1. Make sure engine is off.

Note: Mount all exhaust fasteners before tightening to ensure a proper fit.

2. If the exhaust manifold was removed, install manifold to engine with new gasket. Position manifold loosely to the engine with exhaust nuts.

3. Install muffler to the frame with four screws.

4. Insert coupler between muffler and manifold. Install springs to attach coupler to the exhaust manifold and muffler.

5. Tighten all fasteners.

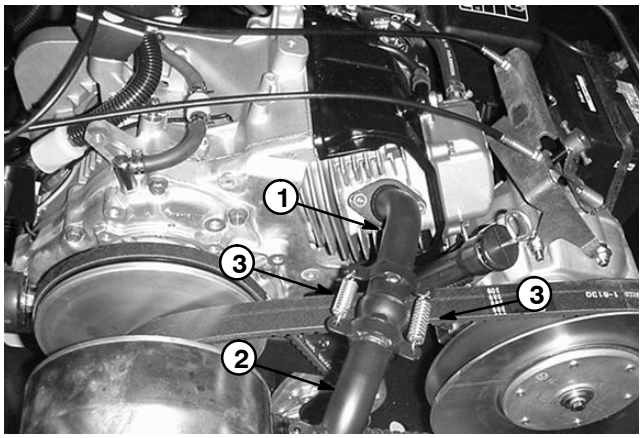

Figure 13

1. **Exhaust manifold**
2. **Exhaust coupler**
3. **Spring**

Seat Base and Fuel Tank

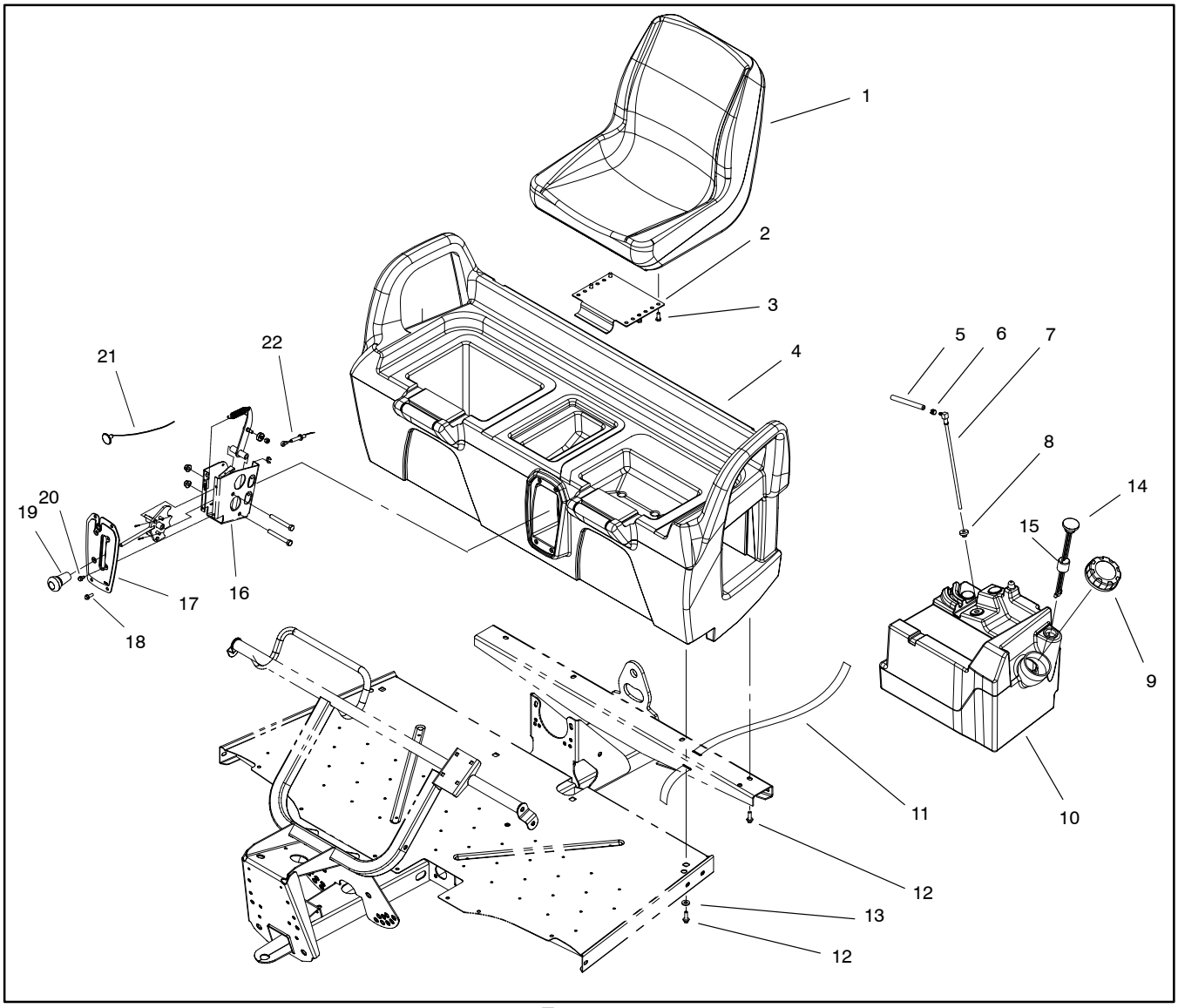

Figure 14

1. **Seat**
2. **Seat bracket**
3. **Cap screw**
4. **Seat base**
5. **Fuel hose (to filter)**
6. **Clamp**
7. **Stand pipe**
8. **Bushing**
9. **Gas cap**
10. **Fuel tank**
11. **Web strapping (48 inch)**
12. **Hex head flange screw**
13. **Flat washer**
14. **Fuel gauge**
15. **Grommet**
16. **Shift bracket**
17. **Shifter plate**
18. **Long cap screw (4 used)**
19. **Knob**
20. **Short cap screw (4 used)**
21. **Choke cable**
22. **Shift cable (2 used)**

Seat Base Removal (Fig. 14)

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. On Workman 1110 machines, remove parking brake assembly from seat base (see Parking Brake Disassembly in the Service and Repairs section of Chapter 7 – Chassis, Wheels, and Brakes).

4. Unscrew knob from the shift lever. Remove four short cap screws securing the shift plate to the shift bracket (Fig. 15).

5. Remove four long cap screws securing the shift plate to the seat base (Fig. 15). Separate shift bracket from the choke cable and seat base.

6. Remove four hex head flange screws and flat washers securing the front of the seat base to the frame. Remove four hex head flange screws securing the back of the seat base to the frame.

IMPORTANT: Make sure shift bracket, shift cables, choke cable, and fuel tank do not catch on the seat base during removal.

7. Lift seat base carefully from the machine.

Seat Base Installation (Fig. 14)

IMPORTANT: Make sure shift bracket, shift cables, choke cable, and fuel tank do not catch on the seat base during installation.

1. Position seat base carefully to the frame.

Note: Do not tighten fasteners securing the seat base to the frame until all of them are installed.

2. Install four hex head flange screws and flat washers through the frame and to the front of the seat base. Install four hex head flange screws through the frame and into the back of the seat base. Tighten all fasteners.

3. Place shift bracket, shift cables, and choke cable through the opening at the front of the seat base.

4. Position choke cable and shift plate to shift bracket making sure to capture cable flange. Secure shift plate to shift bracket with four short cap screws. Screw knob onto the shift lever (Fig. 15).

5. Position shift plate with shift bracket to the seat base. Secure shift plate to seat base with 4 long cap screws (Fig. 15).

6. On Workman 1110 machines, install parking brake assembly to seat base (see Parking Brake Assembly in the Service and Repairs section of Chapter 7 – Chassis, Wheels, and Brakes).

Fuel Tank Removal (Fig. 16)

WARNING

Use caution when working with fuel system components (see Fill Fuel Tank and Fuel Safety Precautions).

1. Remove seat base from the frame (see Seat Base Removal).

2. Loosen hose clamp and disconnect fuel hose from the tank.

3. Release tank strap from fuel tank. Do not remove strap from floor plate and frame cross member. Remove tank from frame.

Fuel Tank Installation (Fig. 16)

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

2. Connect fuel hose to the tank and secure with hose clamp.

3. Install seat base to the frame (see Seat Base Installation).

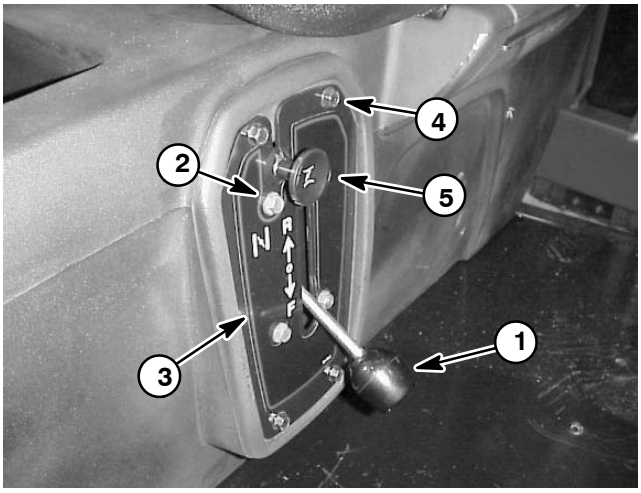

Figure 15

1. Shift lever
2. Cap screw (short)
3. Shift plate
4. Cap screw (long)
5. Choke cable

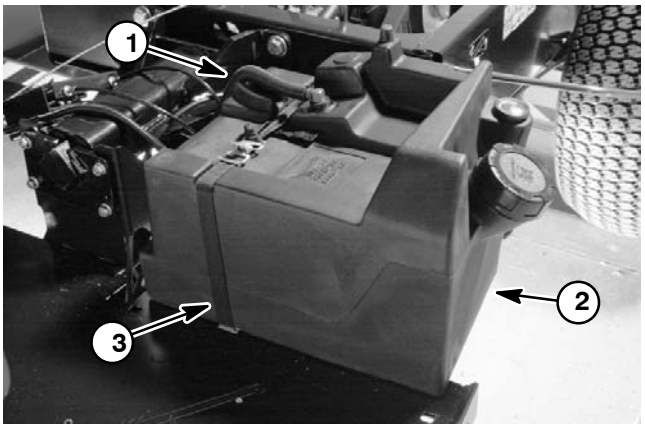

Figure 16

1. Fuel hose
2. Fuel tank
3. Tank strap

Engine

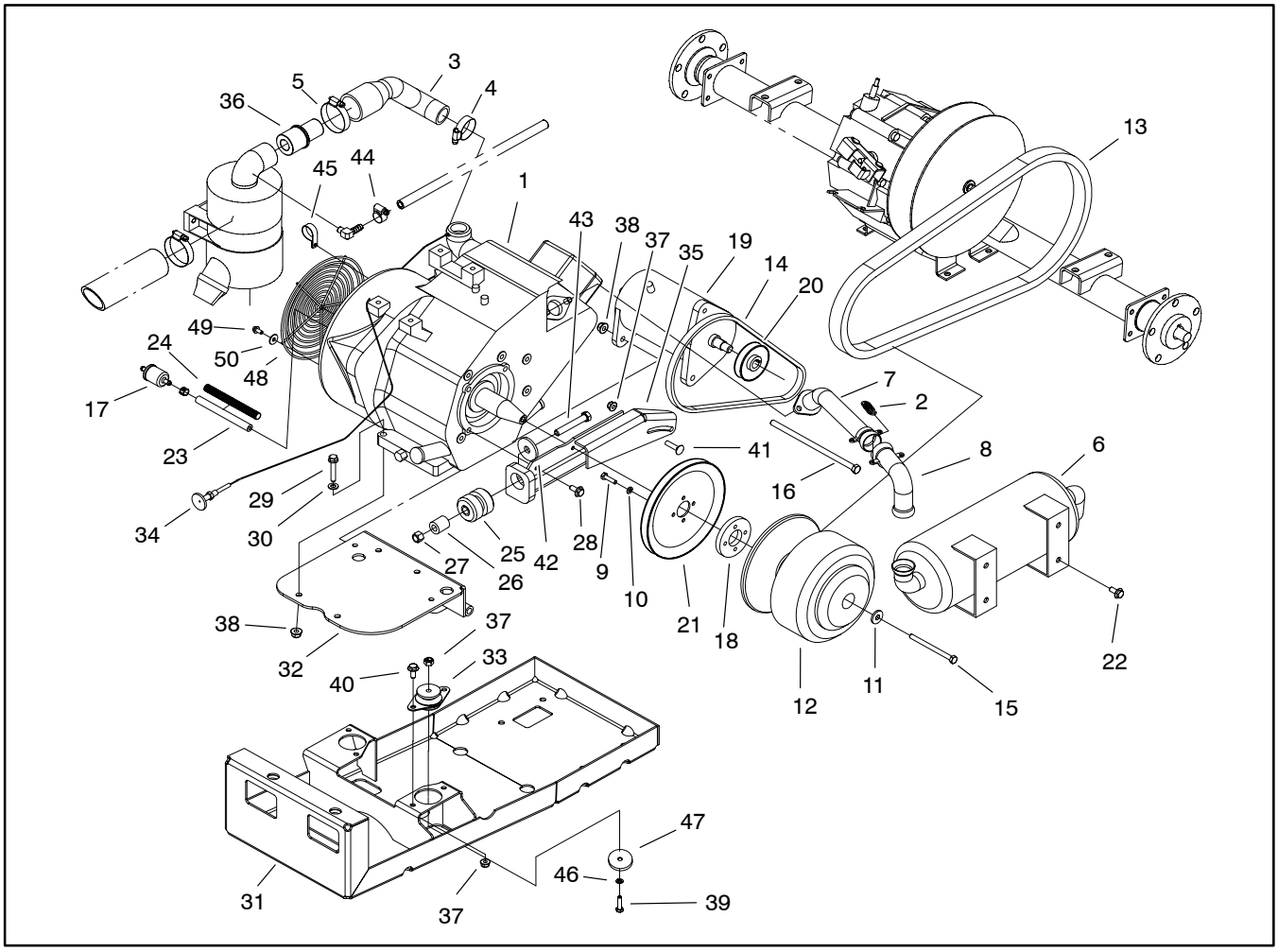

Figure 17

1. Kohler engine
2. Exhaust spring
3. Intake hose
4. Hose clamp
5. Hose clamp
6. Muffler
7. Exhaust manifold
8. Exhaust coupler
9. Cap screw
10. Lock washer
11. Washer
12. Drive clutch
13. Drive belt
14. Starter V–belt
15. Cap screw
16. Cap screw
17. Fuel filter
18. Engine pulley spacer
19. Starter/generator
20. Starter pulley
21. Engine pulley
22. Screw
23. Fuel hose
24. Fuel hose conduit
25. Engine mount assembly
26. Frame spacer
27. Lock nut
28. Cap screw
29. Flange head screw
30. Flat washer
31. Engine mount
32. Engine base
33. Iso mount
34. Choke cable
35. Starter bracket
36. Intake restrictor
37. Flange nut
38. Flange nut
39. Cap screw
40. Cap screw
41. Carriage bolt
42. Thrust washer
43. Cap screw
44. Hose clamp
45. Clamp
46. Flat washer
47. Rebound washer
48. Static debris screen
49. Screw
50. Washer

Engine Removal (Fig. 17)

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

2. Remove cargo bed to gain access to the engine (see Cargo Bed and Tailgate Removal – Chapter 7).

3. Disconnect ground (black) cable from the battery. Then, disconnect positive (red) cable from the battery.

IMPORTANT: Make sure all hoses and engine openings are plugged after disconnecting. Prevent contaminants from entering the engine and fuel system and damaging the engine.

4. Disconnect the following components:

   A. Choke and throttle cables from the carburetor and cable bracket.

   B. Air intake hose from the carburetor.

   C. Breather hose from the engine valve cover.

CAUTION

Read safety precautions for handling gasoline before working on the fuel system (see Fill Fuel Tank and Fuel Safety Precautions).

5. Disconnect fuel hose from the fuel pump (Fig. 18). Remove cable tie securing the choke and throttle cables to the fuel pump bracket.

6. Remove muffler and exhaust coupler (see Muffler Removal).

7. Remove drive belt (see Service Drive Belt).

8. Remove V–belt from the engine and starter/generator by loosening the tension on the belt (see Adjust Starter/Generator Belt).

9. Remove starter bracket from the engine and frame.

10. Disconnect engine electrical harness connector from the main harness.

11. Remove four flange lock nuts and flange head screws securing the engine to the engine mount. Note location of ground cable for proper reassembly.

CAUTION

One person should operate the chain fall or hoist while the other person guides the engine out of the frame.

12. Remove engine from the engine mount.

   A. Attach a short section of chain between fuel pump bracket lift hole and exhaust manifold (Fig. 18).

   B. Connect hoist or chain fall to center of chain.

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

   C. Slowly remove engine and attachments from the machine.

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

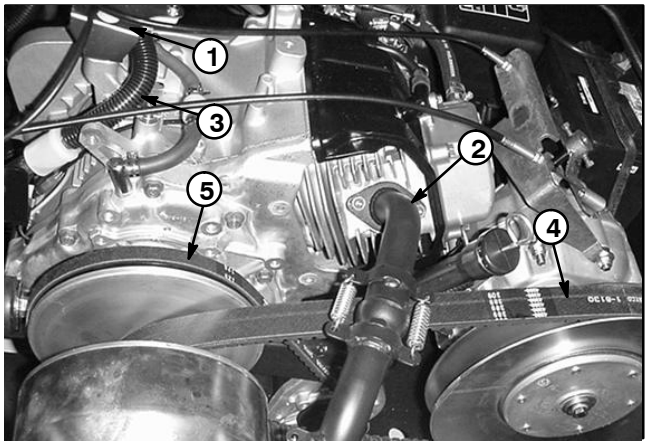

Figure 18

1. **Fuel pump bracket**
2. **Exhaust manifold**
3. **Fuel line**
4. **Drive belt**
5. **Starter/generator belt**

Engine Installation (Fig. 17)

1. If removed, install engine parts and attachments to the engine.

CAUTION

One person should operate the chain fall or hoist while the other person guides the engine into the frame.

2. Install engine to the frame.

   A. Attach a short section of chain between fuel pump bracket lift hole and exhaust manifold (Fig. 18).

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

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

   C. Lower engine into the engine mount.

3. Route ground cables to proper mounting point. Secure engine to the engine mount with four flange lock nuts and flange head screws.

4. Connect engine harness connector to the main harness connector.

5. Install starter bracket to the engine and frame.

6. Install V–belt to the engine and starter/generator. Tension and adjust the V–belt (see Adjust Starter/Generator Belt).

7. Install drive belt (see Service Drive Belt).

8. Install muffler and coupler to the exhaust manifold (see Muffler Removal).

9. Connect fuel hose to the fuel pump (Fig. 18).

10. Connect the following components:

IMPORTANT: Make sure all hoses and engine opening plugs are removed.

   A. Choke and throttle cables to the carburetor and cable bracket.

   B. Air intake hose to the carburetor.

   C. Breather hose to the engine valve cover.

11. Secure choke and throttle cables to the fuel pump bracket with cable tie.

12. Connect positive (red) cable to the battery. Then, connect ground (black) cable to the battery.

13. Install cargo bed to the frame (see Cargo Bed and Tailgate Installation – Chapter 7).

14. Make sure engine oil level is correct (see Check Engine Oil).

15. When starting a new or repaired engine, observe the following:

   A. After starting a cold engine, let it warm up for about 15 seconds before applying any load to it.

   B. Check engine oil level regularly. Be alert for conditions of overheating.

Chapter 5

Drive Train

Table of Contents

Specifications

Item	Description
Transaxle Transaxle Fluid Capacity Transaxle Fluid	Mechanically governed differential 1.5 quarts (1.4 liters) 10W–30 Motor Oil
Clutch System Drive Clutch Driven Clutch	Continuously variable transmission type, torque convertor Speed sensing with mechanical fly weights Torque sensing with spring loaded cam

Note: Workman 2100 and 2110 vehicles with serial numbers above 240000000 use an engine governor for speed control rather than a transaxle governor.

Special Tools

OTC (Owatonna Tool Company) supplies special tools for servicing Toro Commercial Products. The *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE* shows service tool applications.

Some tools may have been supplied with your vehicle or available as TORO parts. Some tools may also be available from a local supplier.

Clutch Removal Tool - TOR4094

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 holding cap screw is removed.

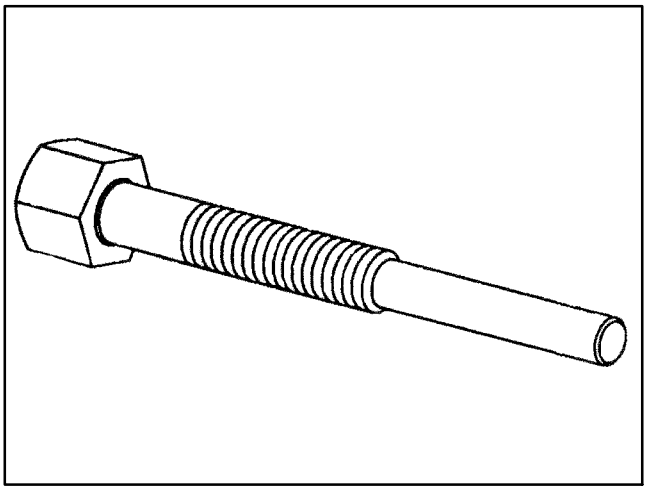

Figure 1

Spider Removal Tool Kit (Drive Clutch) - TOR4098

This kit is required to remove the drive clutch spider from the post of the fixed sheave. Kit includes spanner and clutch holding bar.

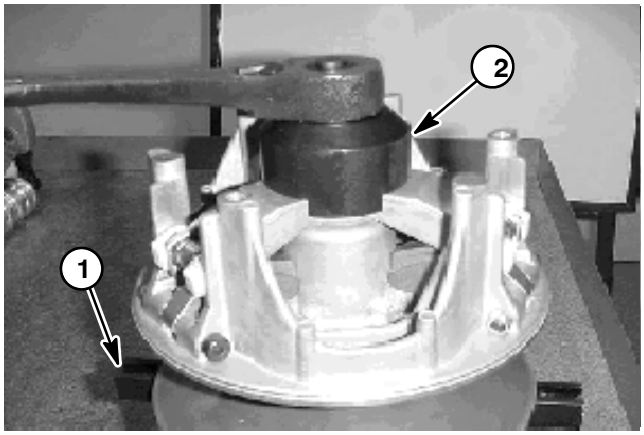

Figure 2

1. **Holding bar**
2. **Spanner**

Clutch Dry Lubricant - Toro Part #104-7011

This lubricant should be used to properly lubricate drive clutch components.

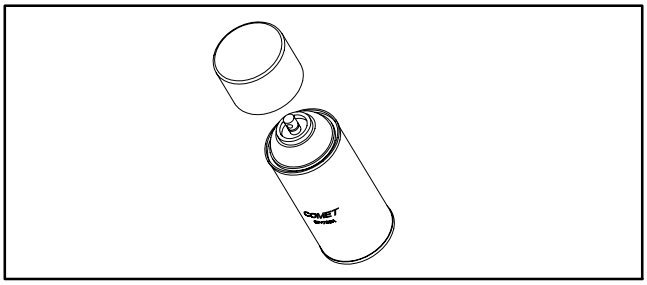

Figure 3

Adjustments

Adjust Ground Speed (Vehicles With Transaxle Governor)

Note: All Workman 1100 and 1110 models are equipped with a transaxle governor. Workman 2100 and 2110 models with serial numbers below 240000000 are also equipped with a transaxle governor.

WARNING

Vehicles operating at ground speeds greater than the recommended speed will require further distances to fully stop. Do not adjust ground speed greater than specified.

1. Park machine on a level surface, stop engine, and remove key from the ignition switch. Raise and latch cargo bed.

WARNING

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

2. Jack up rear of vehicle so both rear wheels are at least 1 inch (25mm) off the ground with the rear axle tubes supported on jack stands.

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

4. Lock transaxle into neutral (see Transaxle Neutral Position in Chapter 1 – Safety).

5. Verify ground speed as follows:

   A. Start engine and hold accelerator pedal to the floor.

   B. Verify driven clutch RPM with a tachometer. With the accelerator pedal to the floor, the driven clutch speed should be as follows:

MODEL	DRIVEN CLUTCH RPM
1100	2900 – 3000 RPM
2100	3250 – 3350 RPM
2110	2950 – 3050 RPM

   C. If unable to identify the driven clutch RPM, an alternate method to verify ground speed would be to determine the distance that the vehicle will travel in three (3) seconds with the accelerator pedal to the floor. Use the following chart to determine if vehicle ground speed is correct:

MODEL	DISTANCE IN 3 SECONDS	GROUND SPEED
1100	62 ft (18.9 m)	14 mph (23 kph)
2100/2110	70 ft (21.3 m)	16 mph (26 kph)

6. If ground speed adjustment is necessary, drill out anodized rivet and retain anti–tamper bracket for reinstallation (Fig. 4).

7. Adjust throttle cable (accelerator pedal to transaxle) at the cable bracket until the correct driven clutch RPM is obtained with the accelerator pedal fully to the floor (Fig. 4).

8. Reinstall anti–tamper bracket to the cable bracket with a new anodized rivet (Toro P/N 99–7122) (Fig. 4).

9. Lower machine to ground. Lower cargo bed.

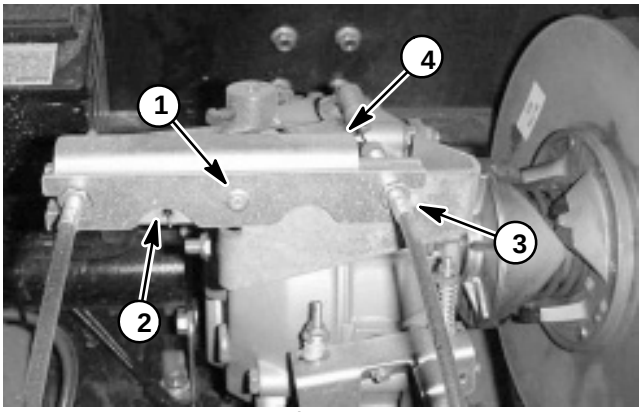

Figure 4

1. **Anodized rivet**
2. **Anti–tamper bracket**
3. **Throttle cable**
4. **Cable bracket**

Adjust Ground Speed (Vehicles Without Transaxle Governor)

Note: Workman 2100 and 2110 models with serial numbers above 240000001 are not equipped with a transaxle governor. These models use an engine governor for speed control.

WARNING

Vehicles operating at ground speeds greater than the recommended speed will require further distances to fully stop. Do not adjust ground speed greater than specified.

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

2. Lock transaxle into neutral (see Transaxle Neutral Position in Chapter 1 – Safety).

3. Verify engine speed to ensure correct ground speed as follows:

   A. Start engine and hold accelerator pedal to the floor.

   B. Using a tachometer, verify that engine RPM is 3300 RPM with the accelerator pedal to the floor.

   C. If engine RPM is incorrect, refer to the Briggs and Stratton Repair Manual found after Chapter 3 for governor adjustment procedure.

4. Lower cargo bed.

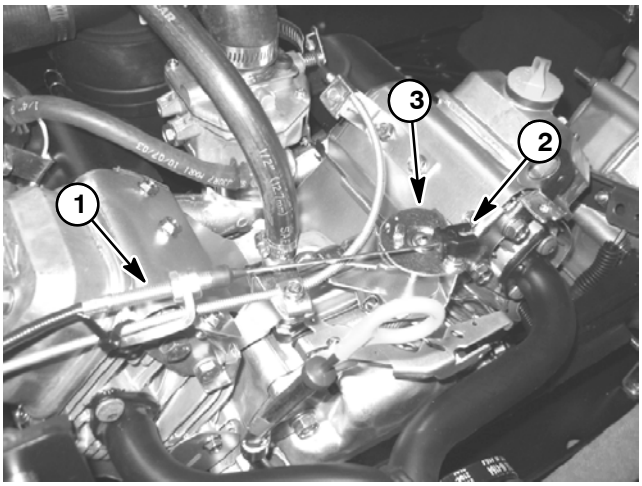

Figure 5

1. **Accelerator cable**
2. **Accelerator cable end**
3. **Governor control**

Adjust Shift Cables

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

2. On vehicles with a shift lever neutral position (Fig. 6):

   A. Set the shift lever into the Neutral position.

   B. The transaxle select lever assembly should be in a level position.

   C. Tighten the locknut on one of the shift cables just enough to take up any cable slack. Note: the locknut below the bracket must be held to allow adjustment.

   D. Repeat process for other shift cable.

   E. Pull up on each shift cable to make sure that there is no gap between the nut/washer and the select lever. If a gap exists, tighten nut further (Fig. 7).

   F. Start engine and check operation in forward, reverse and neutral. Readjust if needed for correct operation.

3. On vehicles without a shift lever neutral position (Fig. 8):

   A. Move shift lever to forward.

   B. Extended spring length on shift cable should be 1 to 1 1/8" (25 to 25 mm). Adjust lock nut as needed.

   C. Move shift lever to reverse. Check other shift cable as in Step 3. Adjust lock nut as needed.

   D. Start engine and check operation in forward and reverse. Readjust if needed for correct operation.

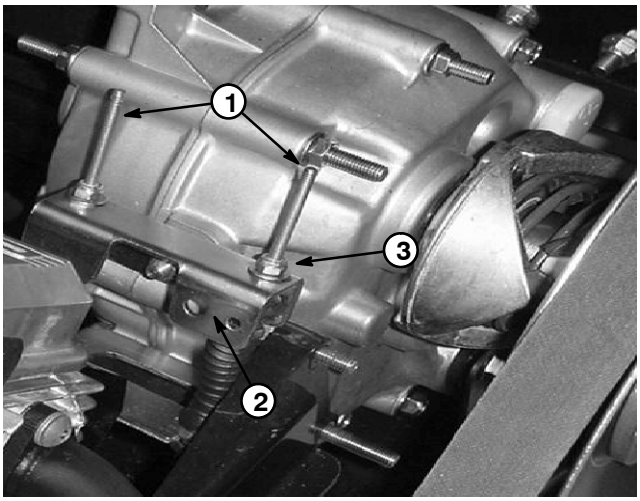

Figure 6

1. Shift cable
2. Select lever assembly
3. Locknut

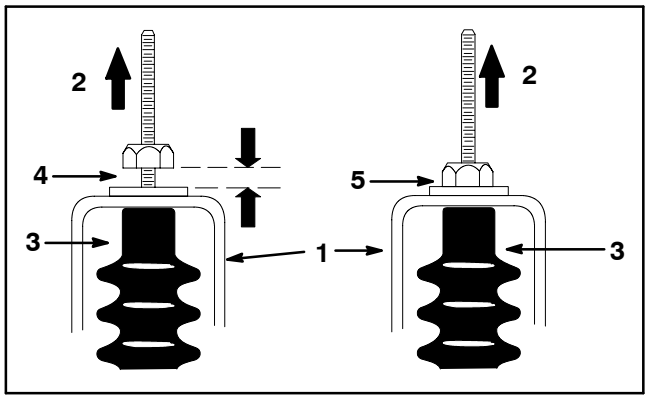

Figure 7

1. Select lever
2. Cable pull direction
3. Cable boot
4. Incorrect adjustment
5. Correct adjustment

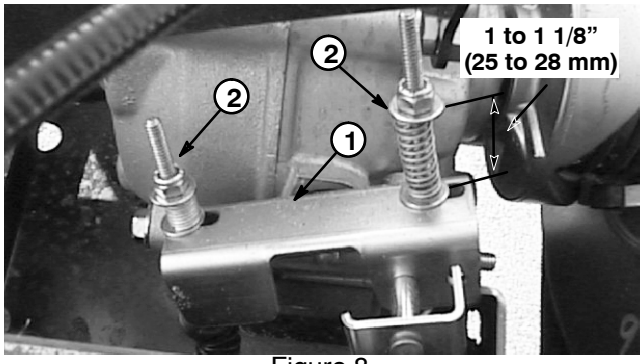

Figure 8

1. Select lever assembly
2. Shift cable

Clutch System Operation

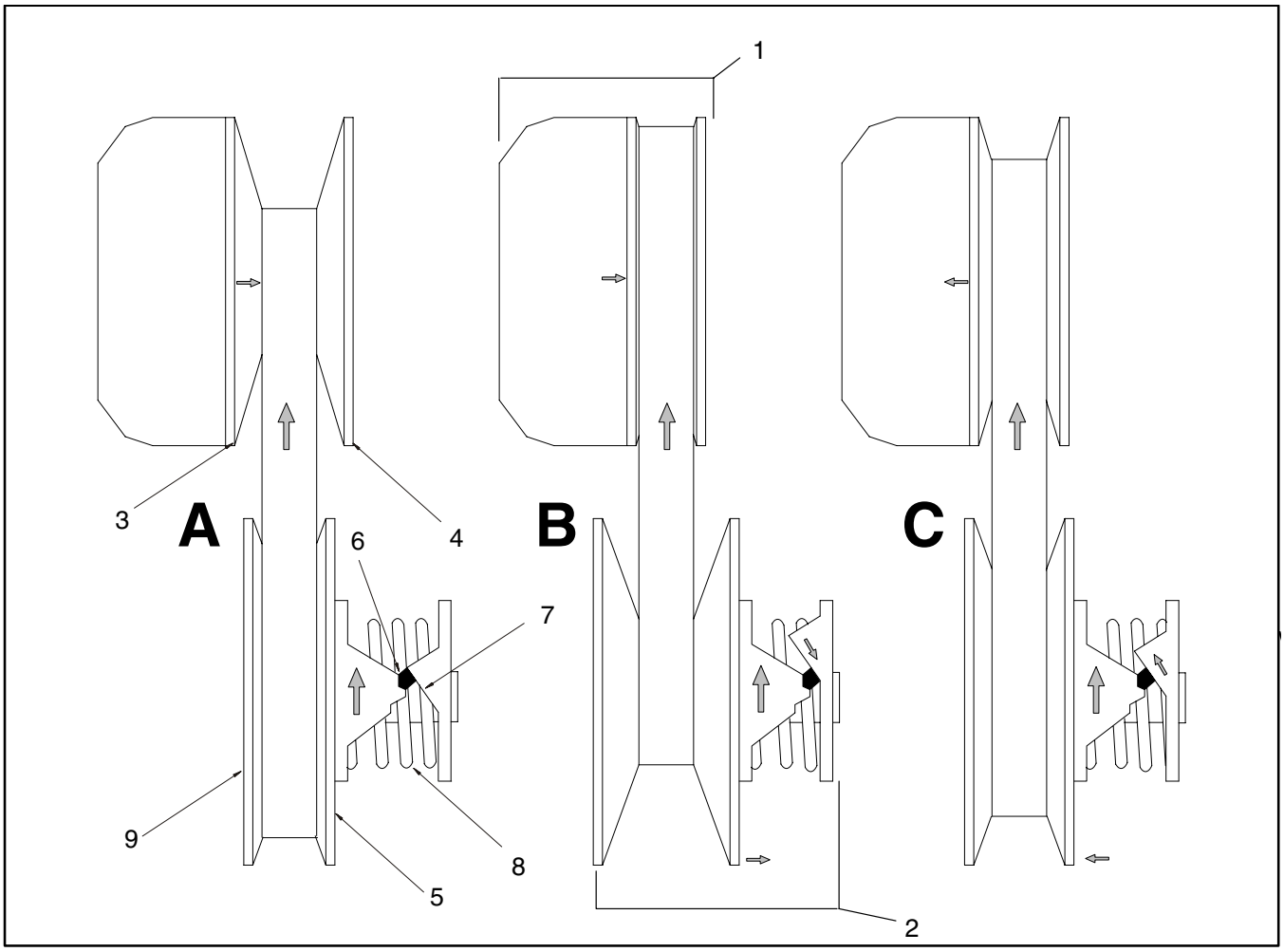

Figure 7

1. Drive clutch
2. Driven clutch
3. Moveable sheave (drive clutch)
4. Fixed sheave (drive clutch)
5. Moveable sheave (driven clutch)
6. Button
7. Ramp (fixed cam)
8. Spring
9. Fixed sheave (driven clutch)

Two Clutch System (Fig. 4)

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

Both clutches work together as a matched unit. The units automatically up–shift and back–shift with changes in load and speed. This shifting changes the turning ratio between the drive and driven clutches and allows the engine to operate at optimum efficiency.

Drive Clutch

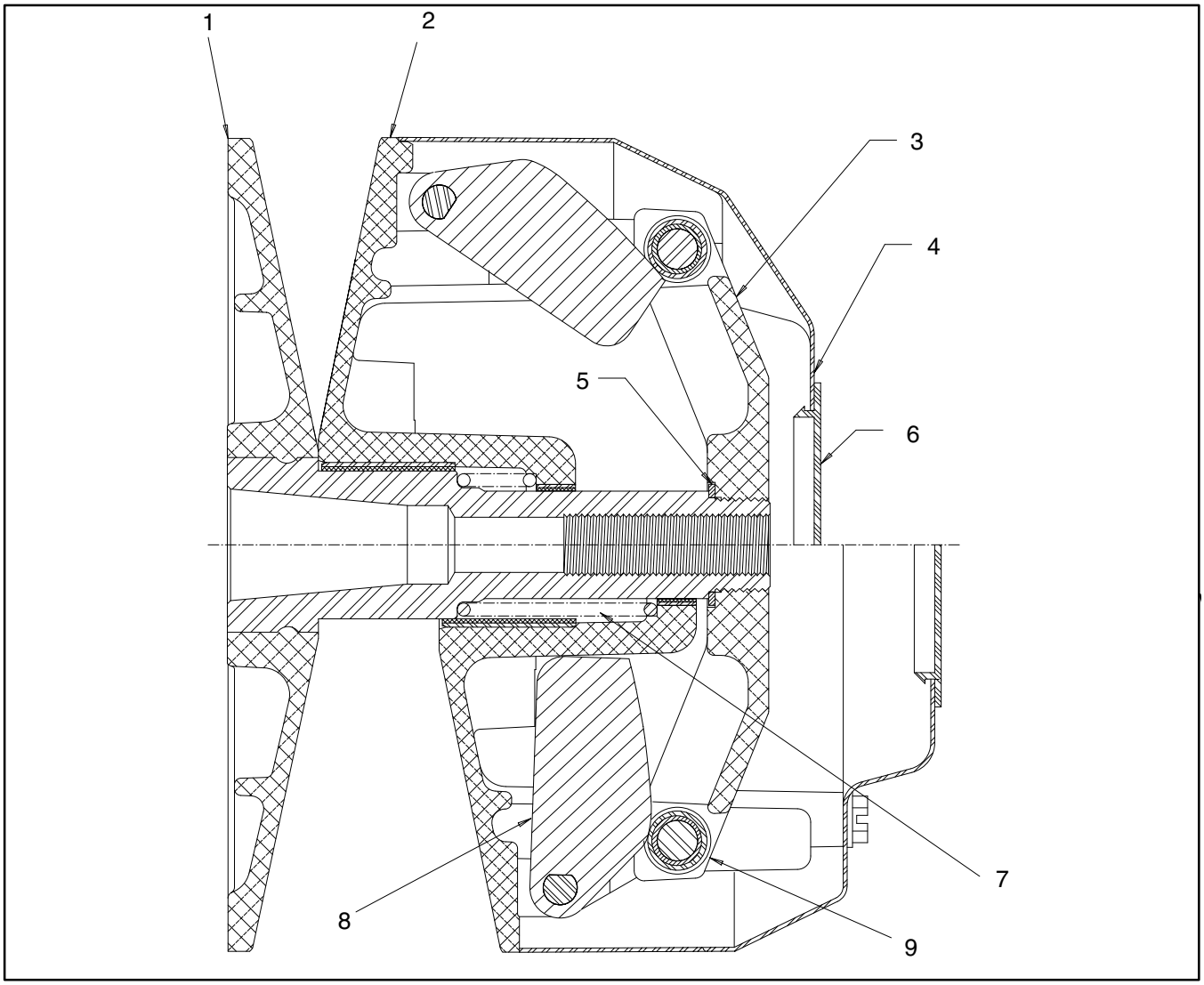

Figure 8

1. **Fixed sheave**
2. **Moveable sheave**
3. **Spider assembly**
4. **Cover**
5. **Washer**
6. **Plastic cap**
7. **Spring**
8. **Cam weight**
9. **Roller**

Principles of Operation (Fig. 8)

The operation of the drive clutch is affected by engine shaft speed. With the engine not turning, the drive belt rests low within the clutch sheaves as the pressure of the spring holds the sheaves apart. As the engine increases in speed, the cams attached to the moveable sheave move outward as they spin about the engine drive shaft. The outward movement of the cams 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.

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 cams exert less force on the rollers and thus the spring. The spring pressure overcomes the force of the cams, 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 weights.

Removal

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

2. Remove drive belt from the drive clutch (see Service Drive Belt in Engine Chapter).

3. Remove starter/generator V–belt from the engine pulley (see Replace Starter/Generator Belt in Engine Chapter).

4. Remove plastic cap carefully from the drive clutch.

5. Remove cap screw and washer securing the drive clutch to the engine tapered shaft.

IMPORTANT: Grease end of clutch removal tool lightly to prevent wear. Prevent damage to clutch threads; thread tool only enough to remove the clutch.

6. Use clutch removal tool (see Special Tools) to remove drive clutch from the engine tapered shaft.

7. If necessary, the engine starter pulley can be removed from the drive clutch. Remove four cap screws and lock washers securing the pulley and starter spacer to the clutch.

Installation

1. Install engine pulley to the drive clutch as follows:

   A. Insert four cap screws through lock washers pulley, and spacer.

   B. Apply Loctite Blue #242 or equivalent to the threads of the cap screws.

   C. Secure pulley and starter spacer to the clutch with cap screws.

2. Slide drive clutch onto the tapered engine shaft.

   A. Apply Loctite Blue #242 or equivalent to the threads of the cap screw.

   B. Secure clutch to shaft with cap screw and washer. Torque cap screw from 25 to 30 ft–lb (34 to 41 N–m).

3. Install plastic cap carefully to the drive clutch.

4. Install starter/generator V–belt to the engine and starter pulley and adjust (see Install Starter/Generator Belt and Adjust Starter/Generator Belt in Engine Chapter).

5. Install drive belt to the drive clutch (see Service Drive Belt in Engine Chapter).

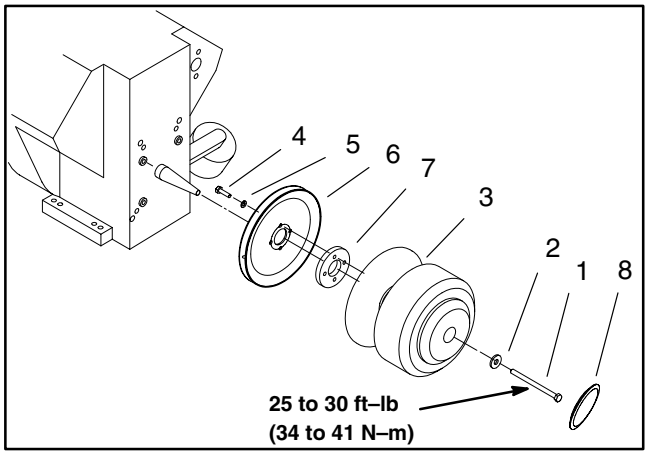

Figure 9

1. Cap screw
2. Washer
3. Drive clutch
4. Cap screw
5. Lock washer
6. Engine starter pulley
7. Starter spacer
8. Plastic cap

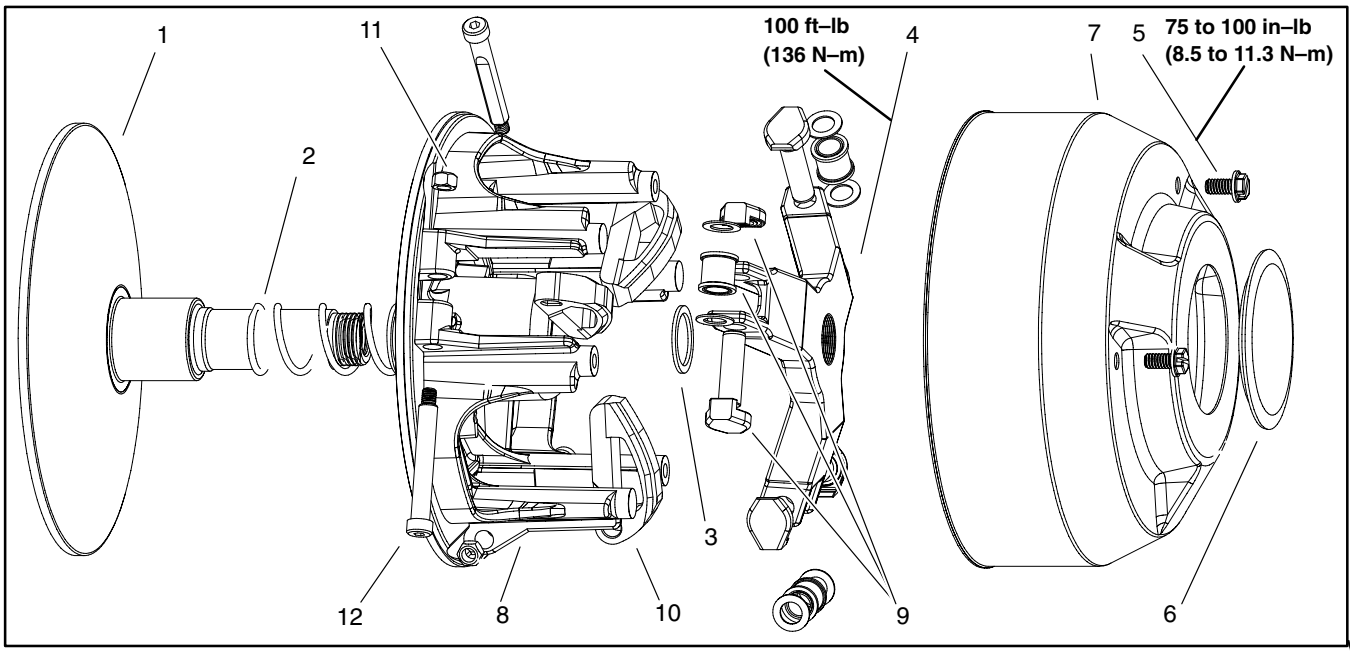

Figure 10

1. Fixed sheave
2. Spring
3. Washer
4. Spider assembly
5. Cap screw
6. Plastic cap
7. Cover
8. Moveable sheave
9. Roller kit
10. Cam weight
11. Nut
12. Pilot bolt

Disassembly (Fig. 10)

IMPORTANT: Do not pry off cover, damage may result. Cover should pop off.

1. Remove cap screws securing the cover to the movable sheave. Pull cover from clutch.

2. Remove the engine pulley from the drive clutch. Remove four cap screws and lock washers securing the pulley and starter spacer to the clutch.

3. Use two 1/4–20 X 1" cap screws to secure the spider removal holding bar (TOR4098: see Special Tools) to drive clutch (Fig. 11).

4. Place clutch with attached spider removal holding bar into vise.

5. Matchmark position of spider and moveable sheave for reassembly.

IMPORTANT: Use spider removal tool kit to remove spider. Unequal pressure on the cam towers may damage them.

CAUTION

Remove spider from fixed sheave slowly. The moveable sheave is under pressure from the spring.

6. Using spider removal spanner tool (TOR4098: see Special Tools), remove spider from the fixed sheave post (Fig. 11).

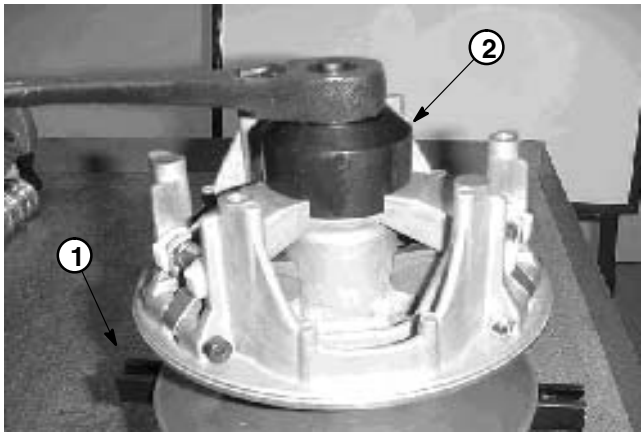

Figure 11

1. Holding bar
2. Spanner

Inspection

1. Inspect the tapered ends of the crankshaft and primary fixed sheave for scratches. If either is severely scratched, replace component. If scratches are minor, burnish the component with emery cloth.

2. Check the surface of the cam weights. If worn, replace all cam weights as a set (Fig. 14).

3. Check the rollers. If binding or uneven wear is found, replace all rollers as a set (Fig. 15).

4. Clean pilot bolts and roller pins with 800 – 1000 grit abrasive paper. If the chrome–plated surface of the bolts or pins is scaled off, replace the damaged components.

5. Check the contact surface of the movable sheave for wear and/or fraying. If surface is worn/frayed, replace component.

6. Inspect the clutch spring and replace if damaged or fatigued.

Assembly (Fig. 12)

1. If removed, install rollers, washers, and roller pins to spider. Roller pins should be lubricated with Toro part #104–7011 (or equivalent).

2. Lubricate cam weights with Toro part #104–7011 (or equivalent). Make sure lubricant penetrates to pilot bolts by rotating and sliding the weights side to side, or remove weights if needed to lubricate properly. Assemble cam weights to moveable sheave as follows:

   A. Make sure the threads of the pilot bolts are clean and dry. Apply Loctite #271 (or equivalent) to the threads of each bolt.

IMPORTANT: To maintain the balance of the clutch, all pilot bolts must be installed with their threads pointing in a clockwise direction (Fig. 16).

   B. Immediately install new self locking nuts on the pilot bolts. Tighten nuts until they just touch the sheave casting. Never reuse self–locking nuts.

3. Apply Loctite #271 (or equivalent) to the threads of the fixed sheave post.

4. Install spider to the fixed sheave post using spider removal tool kit (TOR4098: see Special Tools). Make sure to align matchmark.

5. Torque spider to 100 ft–lb (136 N–m).

6. Position cover to clutch. Secure cover to the movable sheave with cap screws. Torque cap screws from 75 to 100 in–lb (8.5 to 11.3 N–m).

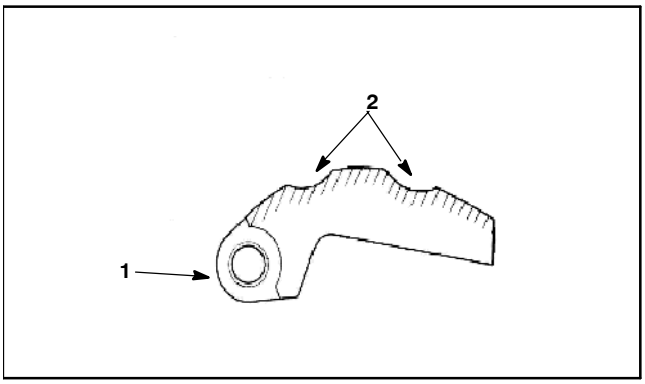

Figure 14

1. **Cam weight**
2. **Worn contact surface**

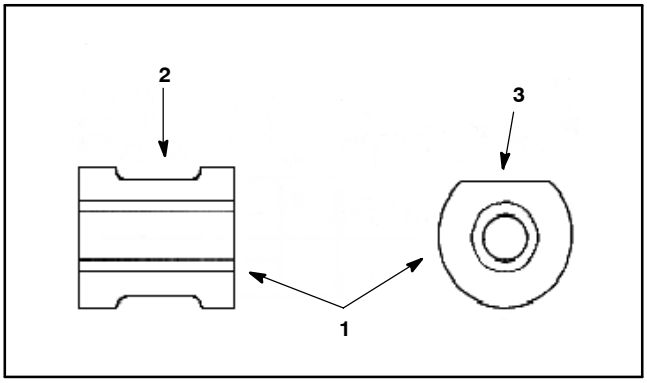

Figure 15

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

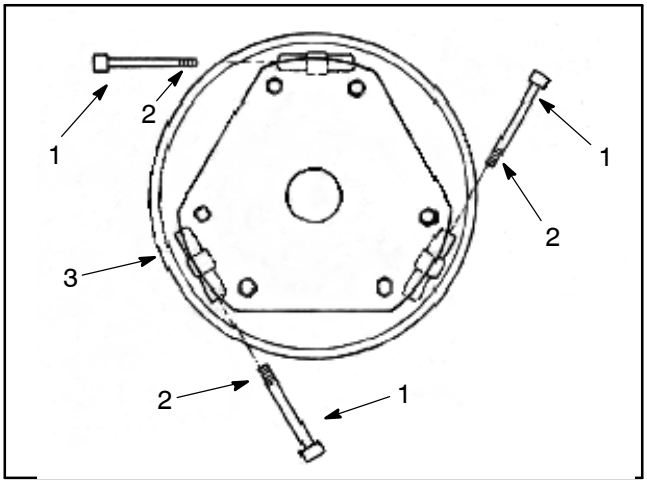

Figure 16

1. **Pilot bolt**
2. **Pilot bolt threads**
3. **Moveable sheave**

Driven Clutch

Principles of Operation (Fig. 17)

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 clutch sheaves from the pressure of the spring pushing the moveable sheave against the fixed sheave and away from the fixed cam. Three sets of buttons on the moveable sheave provide a low friction surface on which the sheave can slide on the ramp of the fixed cam.

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

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

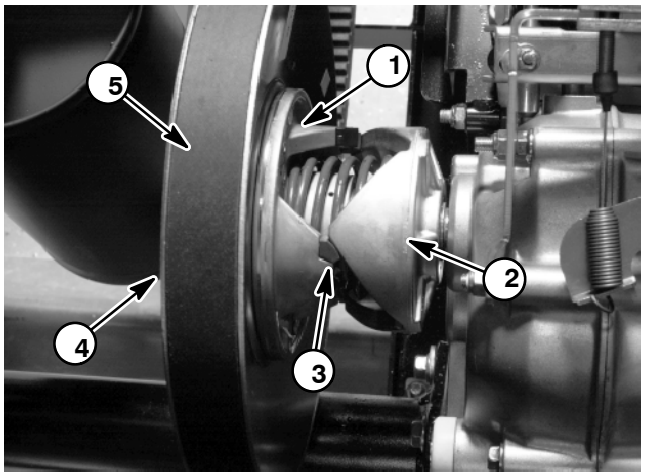

Figure 17

1. Moveable sheave
2. Ramp (fixed cam)
3. Button
4. Fixed sheave
5. Drive belt

Removal (Fig. 18)

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

2. Remove muffler from the engine and engine mount (see Muffler Removal in Engine Chapter).

3. Remove drive belt from the driven clutch (see Service Drive Belt in Service and Repairs section of Engine Chapter).

4. Remove cap screw, washer, and spacer (if equipped) securing the driven clutch to the input shaft of the transaxle.

5. Pull driven clutch from the input shaft.

Installation (Fig. 18)

1. Coat input shaft of the transaxle with never seize lubricant.

2. Position driven clutch to the input shaft. Make sure pulley side of the clutch faces away from the transaxle case.

3. Apply Loctite #242 (blue) (or equivalent) to the cap screw threads.

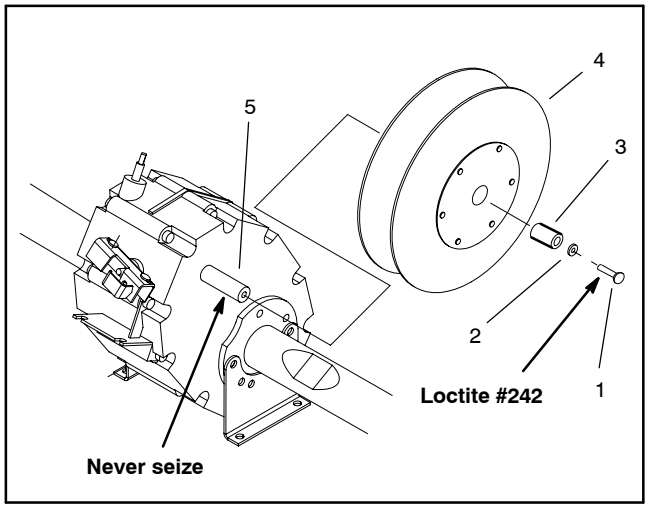

Figure 18

1. Cap screw
2. Washer
3. Spacer (if equipped)
4. Driven clutch
5. Input shaft (transaxle)

4. Secure driven clutch to the transaxle input shaft with cap screw, washer, and spacer (if equipped).

A. For machines that have a 5/16" - 18 cap screw, torque cap screw from 25 to 30 ft-lb (34 to 41 N-m).

B. For machines that have a 3/8" - 16 cap screw, torque cap screw from 39 to 47 ft-lb (53 to 64 N-m).

5. Install drive belt to the driven clutch (see Service Drive Belt in Service and Repairs section of Engine Chapter).

6. Install muffler to the engine and engine mount (see Muffler Removal in Service and Repairs section of Engine Chapter).

Ramp Button Replacement (Fig. 17)

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

2. Remove drive belt from the driven clutch (see Service Drive Belt in Service and Repairs section of Engine Chapter).

3. Turn fixed and moveable sheaves in opposite directions so button is separated sufficiently enough from the ramp to allow removal.

4. Place small block of wood between the outer ramps to keep the ramps apart.

CAUTION

To prevent burns, hold allen wrench with locking pliers when heating allen wrench.

5. Clamp long end of a 2 mm allen wrench with locking pliers. Heat short end of the allen wrench until it is red hot.

6. Insert hot end of the allen wrench into the button so it melts around the end of the wrench. Hold wrench in place until the button hardens.

7. Pull and twist on the allen wrench to remove the button from the ramp.

Note: If the new button is difficult to install, sand its mounting tab as necessary. If the button is loose, apply Loctite #242 (blue) (or equivalent) on its mounting tab.

8. Install new button to ramp. Push button in straight with a screw driver by prying against the ramp.

9. Remove and install remaining buttons.

10. Carefully remove block of wood that was placed to keep the clutch ramps apart.

11. Install drive belt to the driven clutch (see Service Drive Belt in Service and Repairs section of Engine Chapter).

Check Driven Clutch Spring Torsion

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

2. Place transaxle in gear to prevent the fixed sheave from moving.

3. Remove drive belt from the driven clutch (see Service Drive Belt in Engine Chapter).

IMPORTANT: Use protective strips of soft metal when clamping the moveable sheave with locking pliers to prevent damage to the sheave.

4. Clamp moveable sheave with locking pliers.

5. Measure spring torsion.

   A. Pull scale tangentially to the outer diameter of the moveable sheave.

   B. When the button on the ramp of the moveable sheave is 0.125 inch (3.18 mm) from the ramp of the fixed sheave, read the scale.

   C. The reading should be 16 to 20 lbf (71 to 89 N).

6. If the above specification is not met, replace the driven clutch.

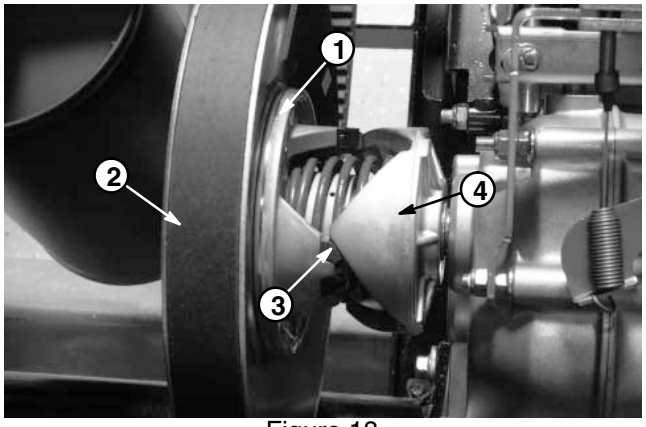

Figure 18

1. Moveable sheave
2. Drive belt
3. Button
4. Ramp (fixed sheave)

Change Transaxle Fluid

Note: Perform this maintenance procedure at the interval specified in the Operator's Manual or Chapter 2 – Product Records and Maintenance.

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

2. Remove drain plug from the right side of the transaxle case. (Fig. 19) Let fluid flow into a drain pan.

3. When fluid stops draining, reinstall and tighten drain plug (Fig. 19). Torque plug from 15 to 18 ft–lb (21 to 25 N–m).

4. Use 10W–30 motor oil to fill the transaxle case.

   A. Fill case with about 1.5 quarts (1.4 liters) of motor oil (Fig. 20).

   B. Or, fill case until oil level is at the bottom level of the indicator hole with the plug removed (Fig. 19).

5. Reinstall level indicating plug and fill cap. Tighten plugs that were removed (Fig. 19 and 20).

6. Start engine and operate vehicle to allow the transaxle to fill. Recheck oil level. Replenish oil if required.

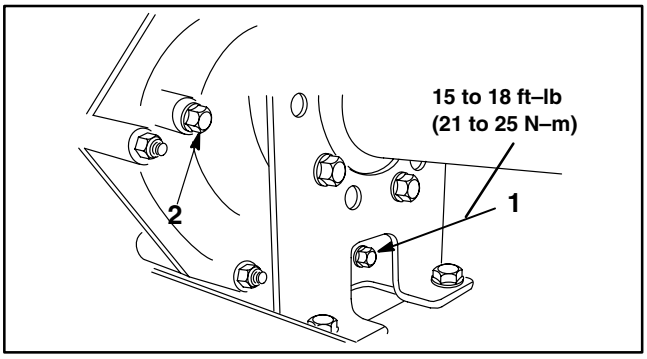

Figure 19

1. Drain plug
2. Level indicating plug

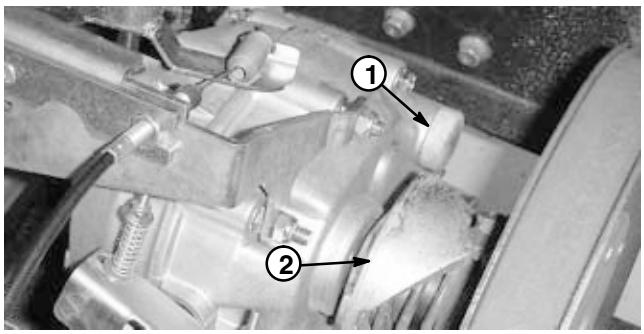

Figure 20

1. Fill cap
2. Driven clutch

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Transaxle

Removal

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 frame (see Cargo Box Removal in Chapter 7 – Chassis, Wheels, and Brakes).

3. Remove drive belt from the driven clutch (see Service Drive Belt in Engine Chapter).

4. Remove tie wraps securing both battery cables to the passenger side axle tube.

5. Remove governor and cable brackets from the transaxle as follows (Fig. 21).

   A. Scribe mark across governor bracket and governor shaft to help reinstallation. Loosen both set screws securing the bracket to the shaft.

   B. Remove both lock nuts securing the cable bracket to the transaxle case. Remove both brackets and cables as a complete unit from the transaxle case and governor shaft.

6. Remove lock nut securing the select lever assembly to the selector shaft. Loosen jam nuts securing both shift cables to the cable bracket. Separate select lever assembly and shift cables from the transaxle (Fig. 22).

WARNING

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

7. Jack up both sides of the frame (at the jacking point indicated) enough to remove rear wheels (Fig. 23).

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

   B. Support both sides of the frame with jackstands positioned just in front of the axle tubes. This will allow the transaxle to be removed from the rear of the vehicle.

8. Remove both wheels and brake assemblies from the transaxle (see Rear Wheel and Brake Removal in Chapter 7 – Chassis, Wheels, and Brakes).

9. Attach hoist or chain fall to the engine mount to lower the engine and transaxle. Make sure lifting device is attached to hold the full weight of the engine and mount.

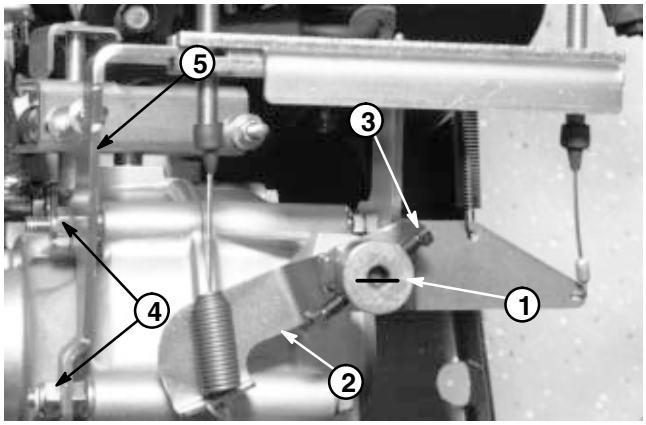

Figure 21

1. Scribe mark
2. Governor bracket
3. Set screw
4. Lock nuts
5. Cable bracket

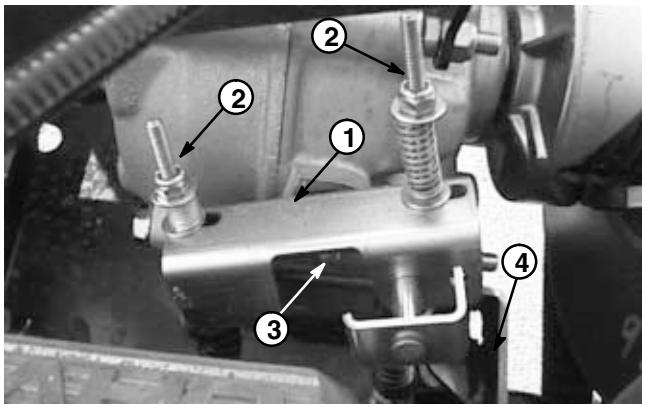

Figure 22

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

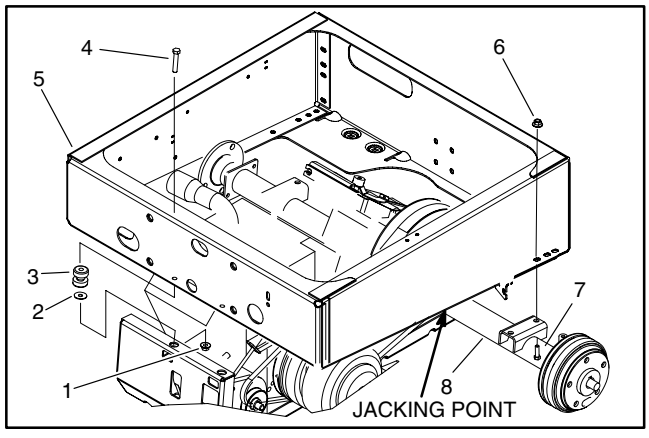

Figure 23

1. Flange lock nut
2. Flat washer
3. Isolation mount
4. Cap screw
5. Rear frame
6. Flange lock nut
7. Hex head flange screw
8. Transaxle

10. Remove both flange lock nuts, flat washers, isolation mounts, and cap screws securing the engine mount to the rear frame (Fig. 23).

11. Remove four flange lock nuts and hex head flange screws securing the transaxle to the engine mount (Fig. 24).

12. Lower engine mount enough to allow the transaxle and driven clutch to be removed from the rear of the vehicle.

13. Remove four flange lock nuts and hex head flange screws securing the transaxle to the rear frame. Remove transaxle from the rear of the vehicle (Fig. 23).

Installation

1. Position transaxle and driven clutch to the rear frame. Secure transaxle to the rear frame with four hex head flange screws and flange lock nuts (Fig. 23).

2. Raise engine mount.

3. Secure transaxle to the engine mount with four hex head flange screws and flange lock nuts. Make sure R–clamp with both shift cables is secured to the engine mount with screw (Fig. 24).

4. Secure engine mount to the rear frame as follows (Fig. 23 and 25):

A. Attach both isolation mounts to the engine mount.

B. Align engine mount to rear frame. Insert cap screw through rear frame channel, isolation mounts, and engine mount.

C. Secure cap screw with flat washer and flange lock nut.

5. Position select lever assembly and shift cables to the transaxle. Secure select lever assembly to the selector shaft with lock nut. Secure both shift cables to the cable bracket with jam nuts (Fig. 22).

6. Secure governor and cable brackets to the transaxle as follows (Fig. 21).

A. Position governor and cable brackets with cables as a complete unit to the transaxle case and governor shaft.

B. Secure cable bracket to the transaxle case with both lock nuts.

C. Align scribe marks on the governor bracket and shaft. Secure bracket to the shaft with both set screws.

7. Secure both battery cables to the passenger side axle tube with tie wraps.

8. Install drive belt to the driven clutch (see Service Drive Belt in Engine Chapter).

9. Install both brake assemblies and wheels to the transaxle (see Rear Wheel and Brake Installation in Chapter 7 – Chassis, Wheels, and Brakes).

10. Install cargo box to the frame (see Cargo Box Installation in Chapter 7 – Chassis, Wheels, and Brakes).

11. Verify proper ground speed (see Adjust Ground Speed).

12. Check brakes for proper adjustment (see Adjust Brakes in Chapter 7 – Chassis, Wheels, and Brakes).

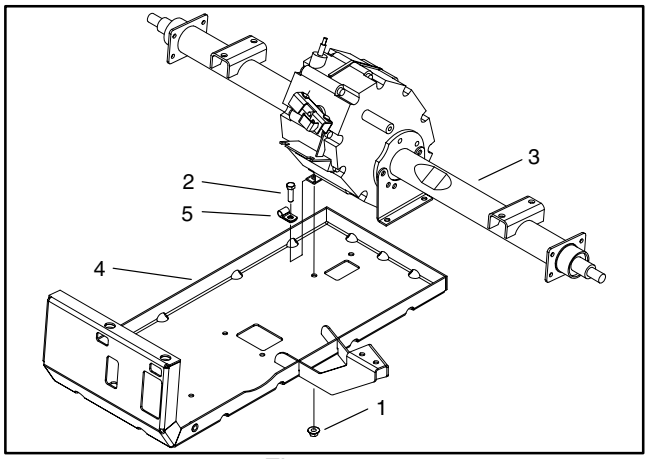

Figure 24

1. **Flange lock nut**
2. **Hex head flange screw**
3. **Transaxle**
4. **Engine mount**
5. **R–clamp**

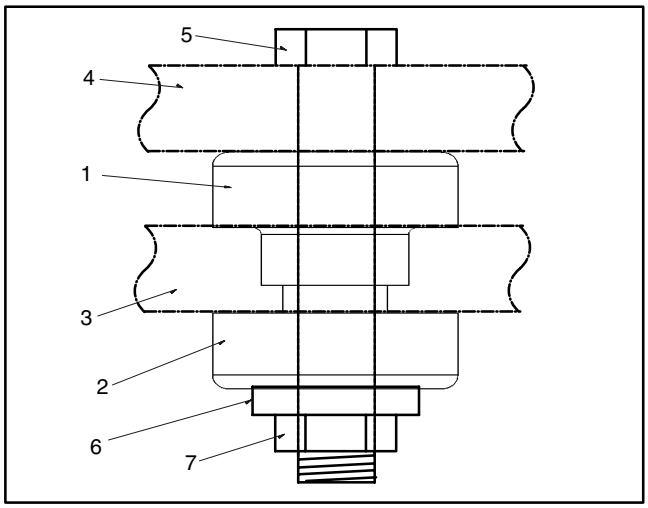

Figure 25

1. **Iso mount (top)**
2. **Iso mount (bottom)**
3. **Engine mount**
4. **Rear frame channel**
5. **Cap screw**
6. **Flat washer**
7. **Flange lock nut**

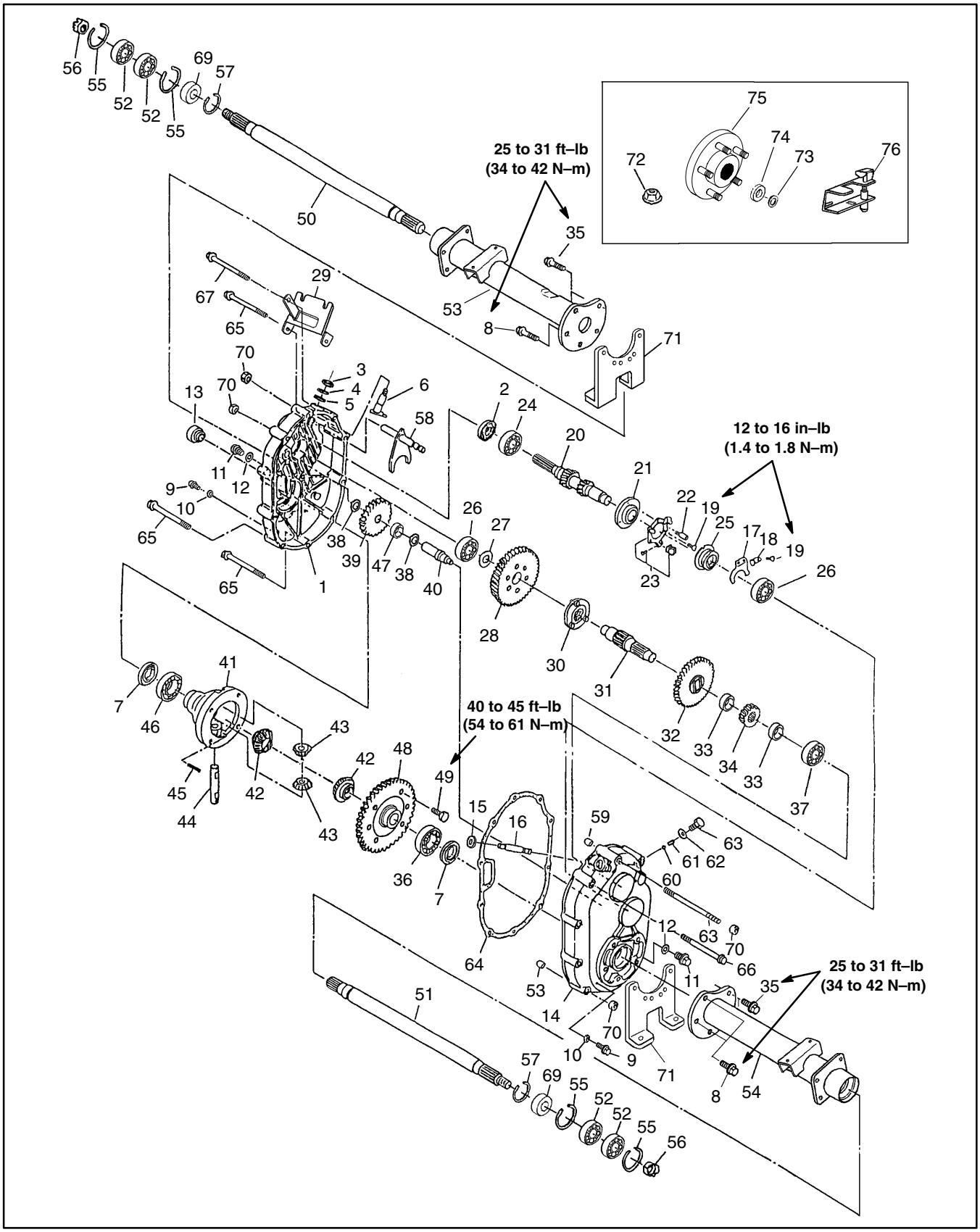
25 to 31 ft–lb
(34 to 42 N–m)
12 to 16 in–lb
(1.4 to 1.8 N–m)
40 to 45 ft–lb
(54 to 61 N–m)
25 to 31 ft–lb
(34 to 42 N–m)

Figure 26

Figure 26 (Continued)

1. Case (LH)
2. Oil seal
3. Oil seal
4. Snap ring
5. Spacer
6. Selector shaft
7. Oil seal
8. Flange bolt
9. Oil check plug
10. Gasket
11. Oil drain plug
12. Gasket
13. Oil filler plug
14. Case (RH)
15. Oil seal
16. Governor shaft
17. Governor fork
18. Stopper
19. Screw and washer
20. Input shaft
21. Governor base
22. Lock pin
23. Governor plate unit
24. Ball bearing
25. Governor sleeve
26. Ball bearing
27. Spacer
28. Gear 55
29. Cable bracket
30. Pin clutch
31. Center shaft
32. Gear 47
33. Collar
34. Gear
35. Flange bolt
36. Ball bearing
37. Ball bearing
38. Spacer
39. Gear 34
40. Counter shaft
41. Differential case
42. Side gear
43. Pinion gear
44. Pinion shaft
45. Spring pin
46. Ball bearing
47. Needle bearing
48. Gear 62
49. Bolt
50. Axle shaft (LH)
51. Axle shaft (RH)
52. Ball bearing
53. Axle case (LH)
54. Axle case (RH)
55. Snap ring
56. Castle nut
57. Snap ring
58. Shift shaft
59. Pipe knock
60. Steel ball
61. Spring
62. Gasket
63. Bolt
64. Gasket
65. Flange bolt
66. Flange bolt
67. Flange bolt
68. Bolt
69. Collar
70. Flange bolt
71. Axle bracket
72. Lock nut
73. Spring washer
74. Washer
75. Wheel hub (complete)
76. Select lever

Disassembly and Inspection

1. Disassemble case (LH and RH)

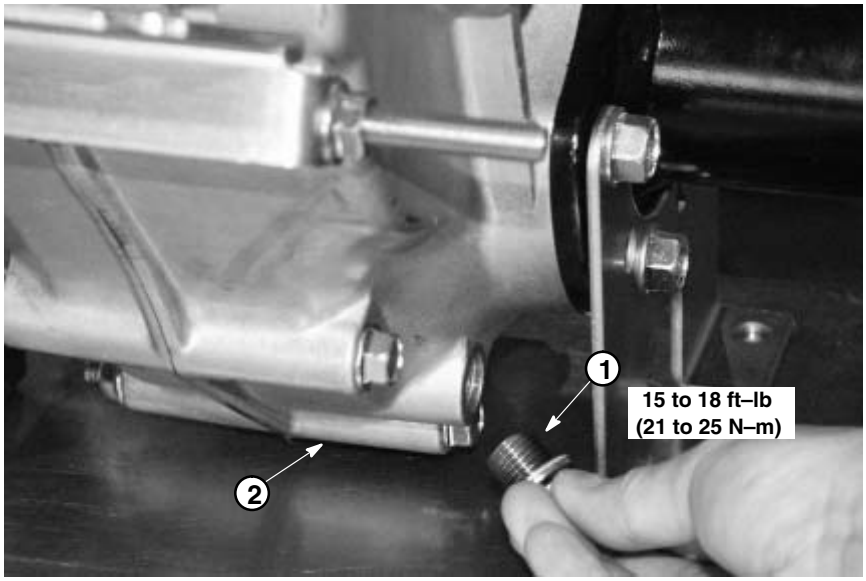

Figure 27

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).

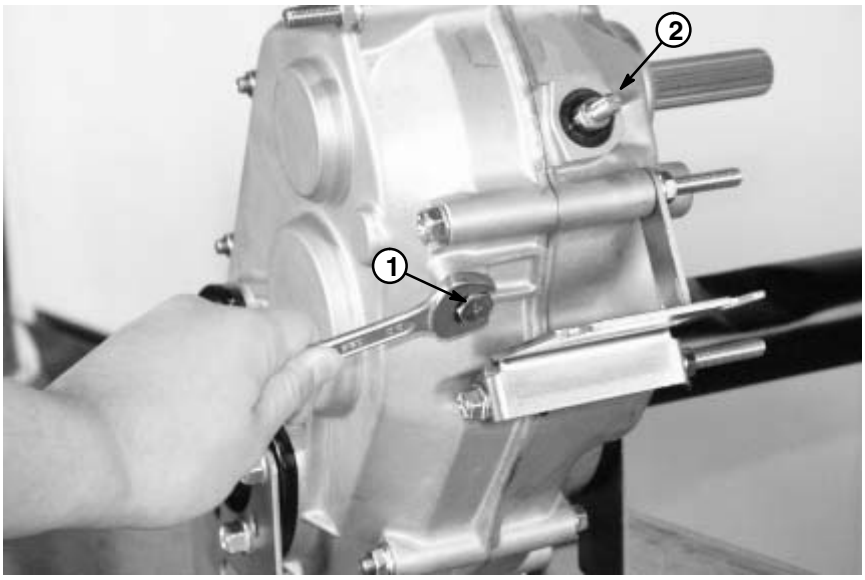

Figure 28

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.

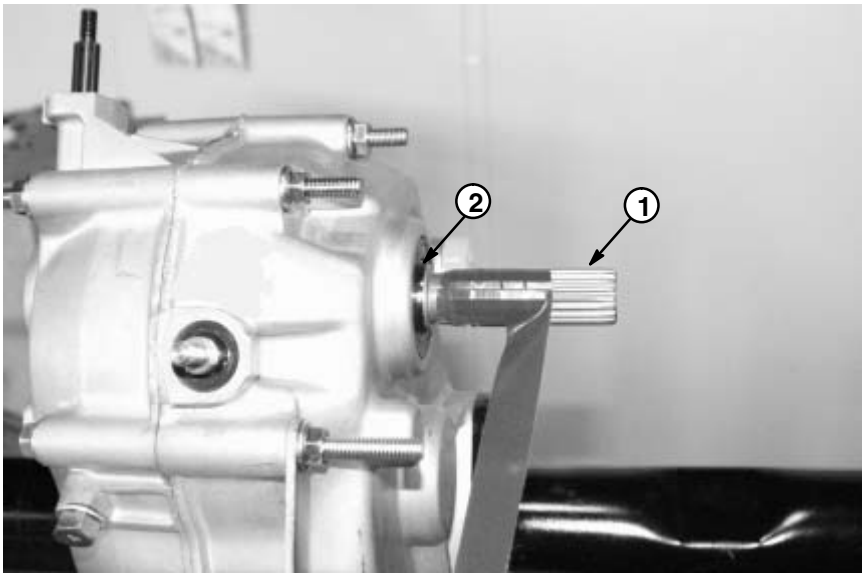

Figure 29

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.

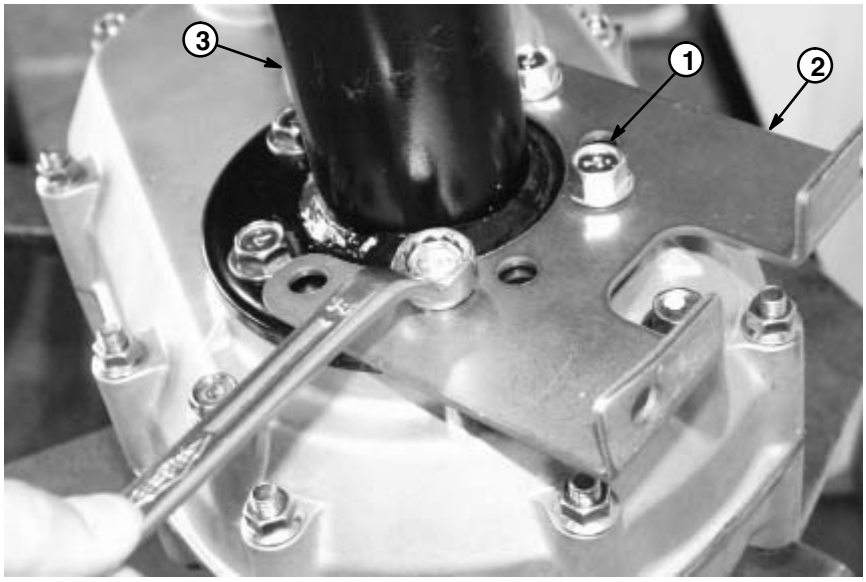

Figure 30

1. **Flange bolts**
2. **Axle bracket**
3. **Axle case**

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

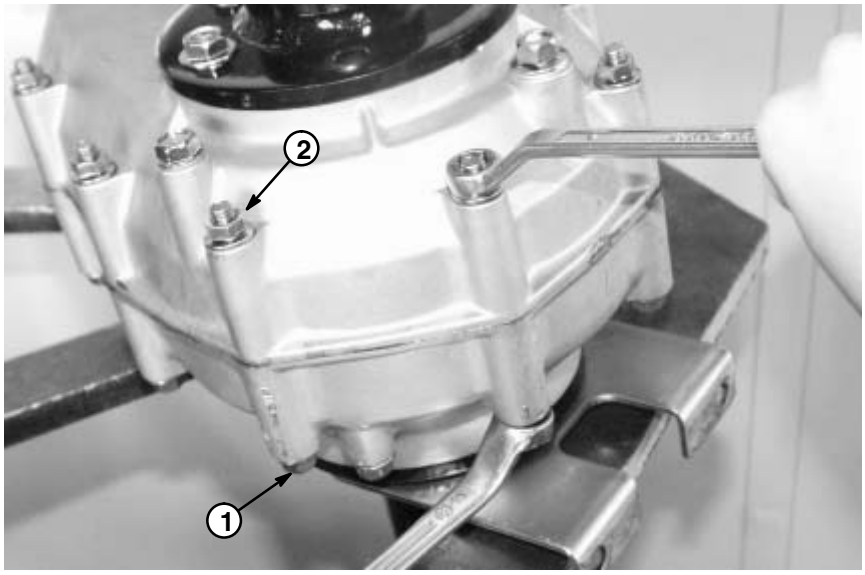

Figure 31

1. **Flange bolt**
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.

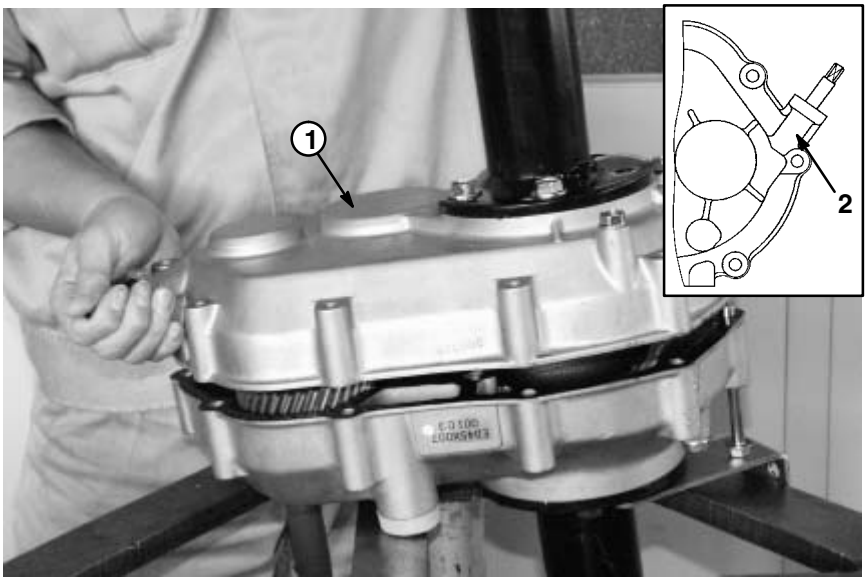

Figure 32

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

IMPORTANT: Make sure not to 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.

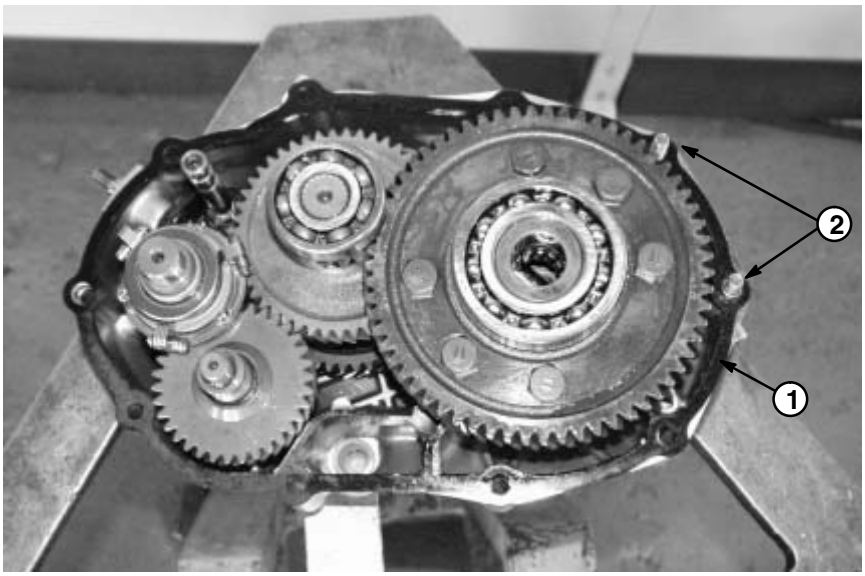

Figure 33

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

A. Remove gasket and pipe knocks.

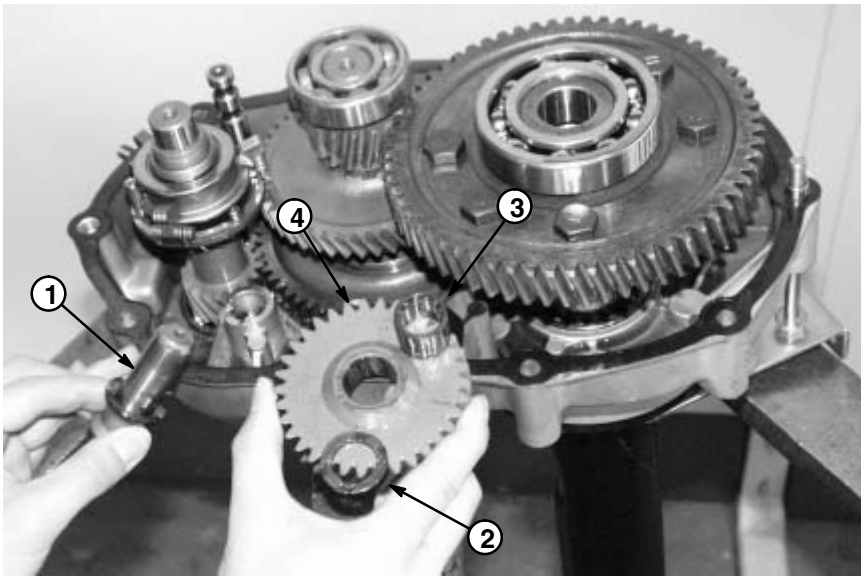

Figure 34

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

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

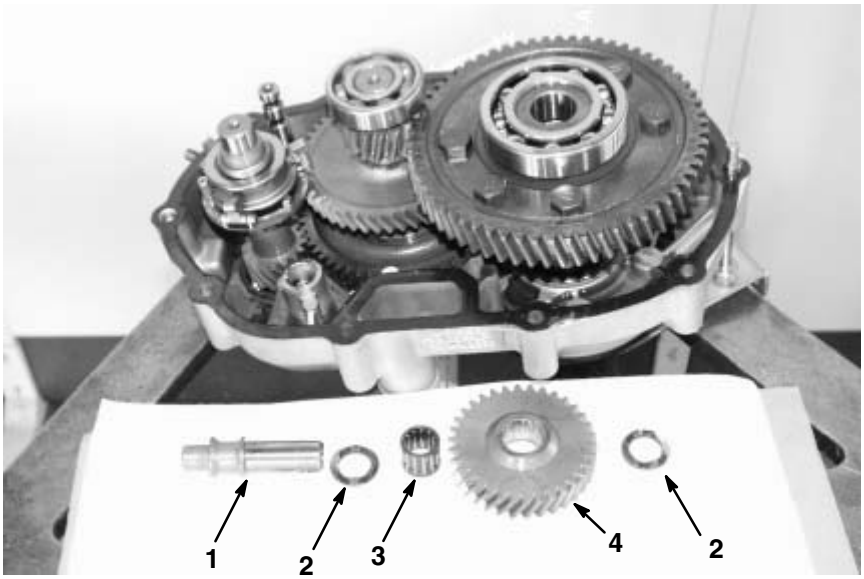

Figure 35

1. **Counter shaft**
2. **Spacer**
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.

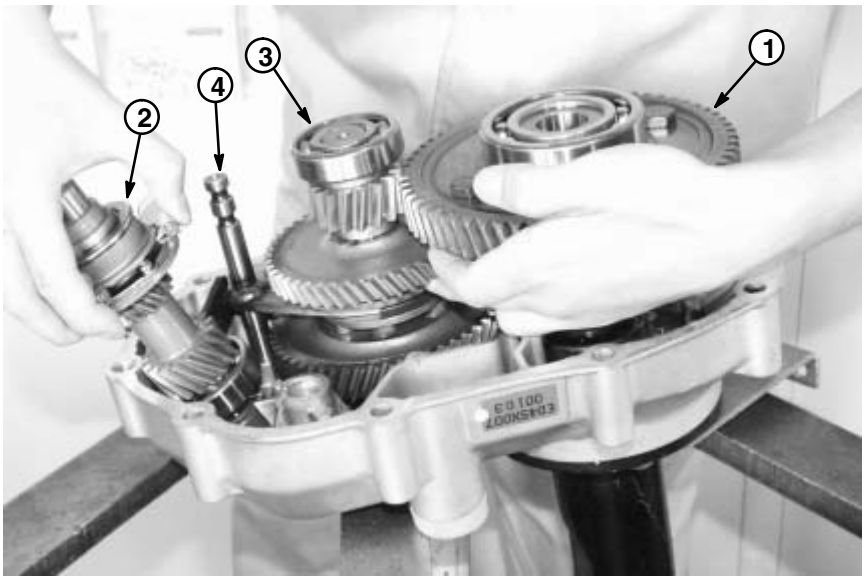

Figure 36

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

IMPORTANT: Make sure not to 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.

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.

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

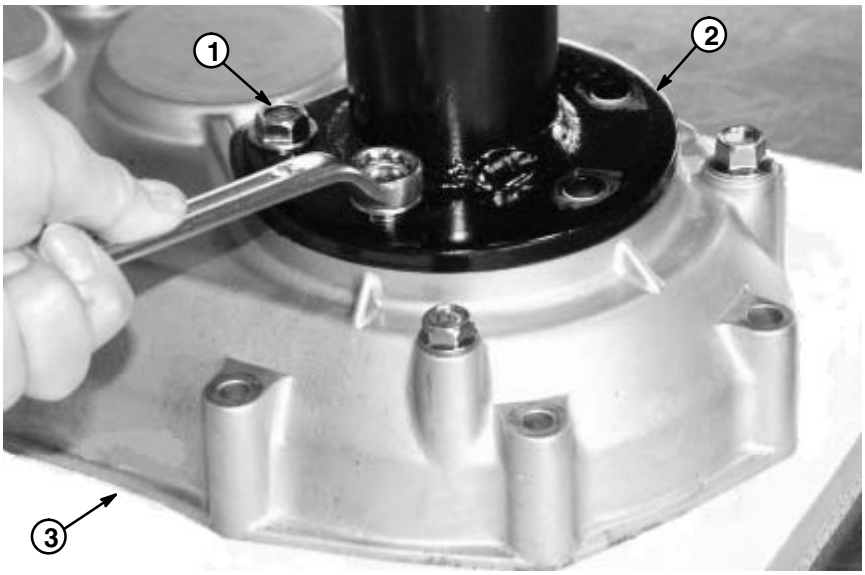

Figure 37

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

A. Remove flange bolts securing each axle case to the case. Remove axle case from the case.

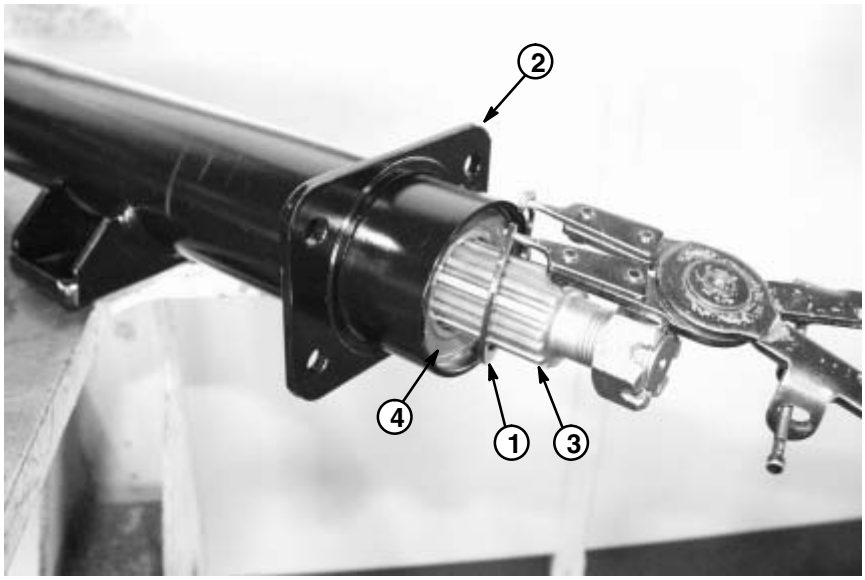

Figure 38

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.

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.

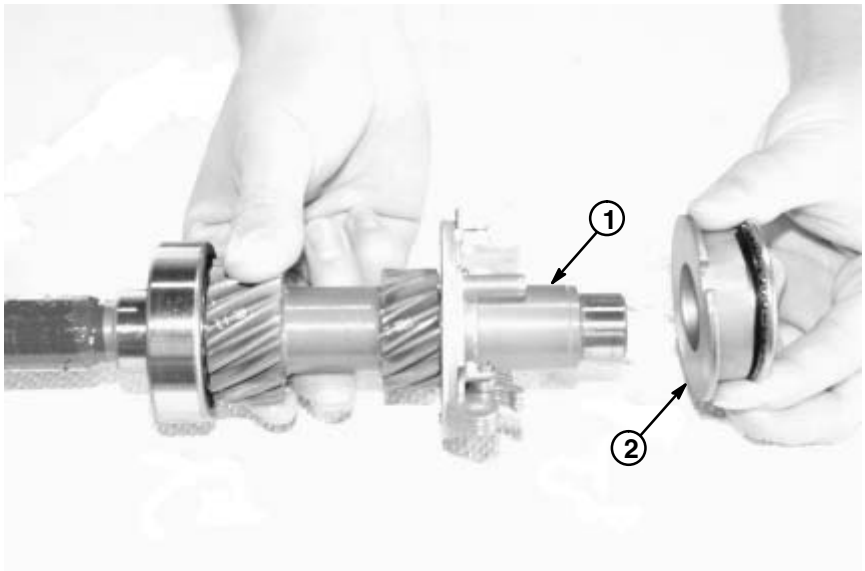

Figure 39

1. Input shaft
2. Governor sleeve

A. Remove governor sleeve from the input shaft.

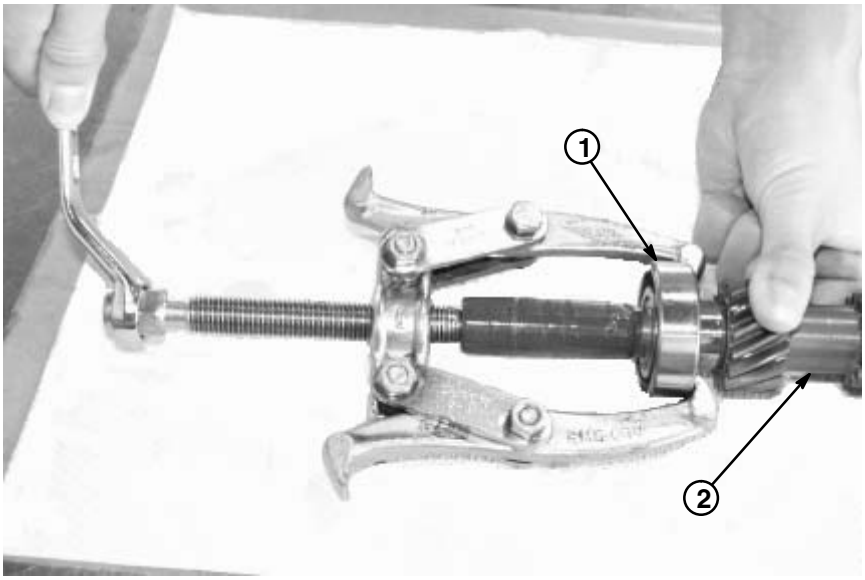

Figure 40

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

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

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

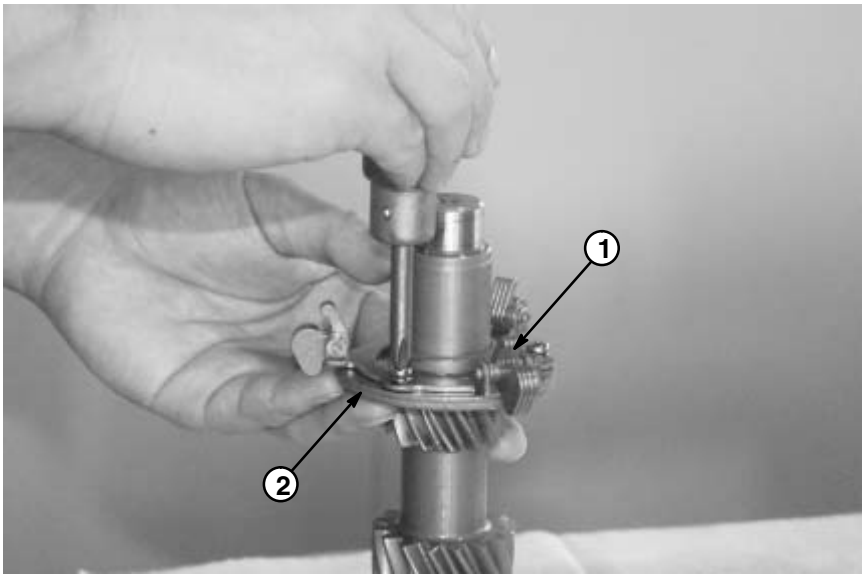

Figure 41

1. **Governor plate assembly**
2. **Governor base**

IMPORTANT: Make sure not to damage the screw heads when removing screws. Each screw is secured with an adhesive.

C. Remove screws securing the governor plate assembly to the governor base.

Figure 42

1. **Input shaft**
2. **Ball bearing**
3. **Governor plate (weight)**
4. **Governor sleeve**
5. **Lock pin**
6. **Screw**

D. Replace input shaft if worn or damaged. Gear teeth that are cracked, broken, chipped or missing 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 governor plate if cracked, bent, or any weight is missing. Weights must swing freely.

G. Replace governor sleeve if cracked or worn.

5. Disassemble center shaft assembly.

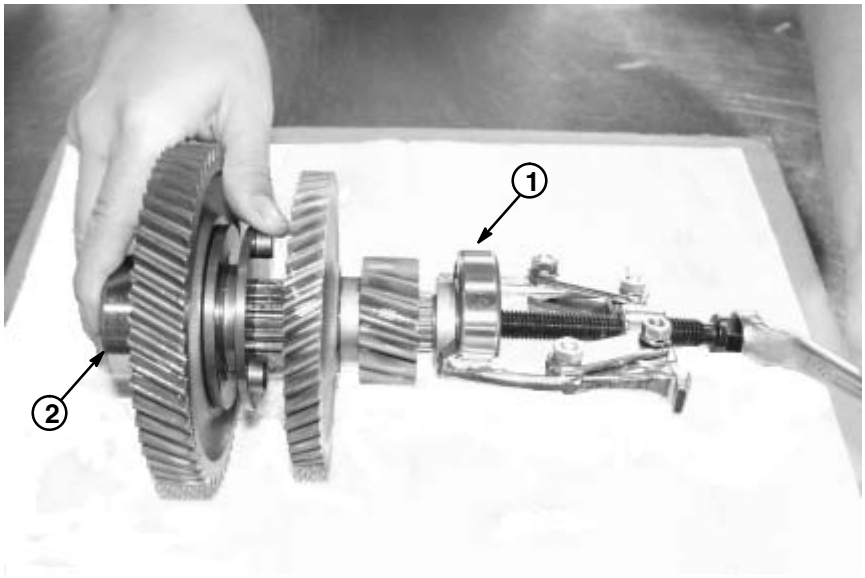

Figure 43

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.

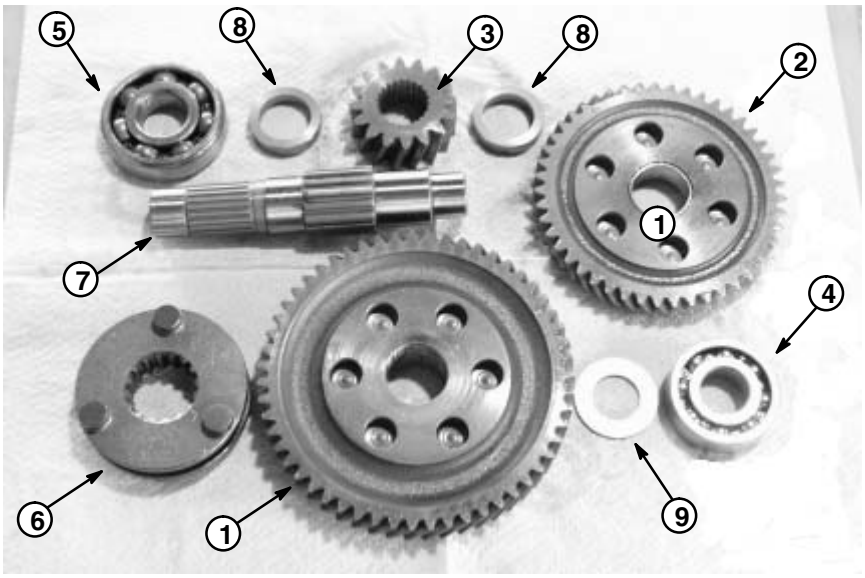

Figure 44

1. **Gear 55**
2. **Gear 47**
3. **Gear (small)**
4. **Ball bearing**
5. **Ball bearing**
6. **Pin clutch**
7. **Center shaft**
8. **Collar**
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. Ball bearing roller balls must be free of deformation and scoring. Ball bearings must spin freely and have minimum axial play. Replace ball bearings as necessary.

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

6. Disassemble differential case assembly.

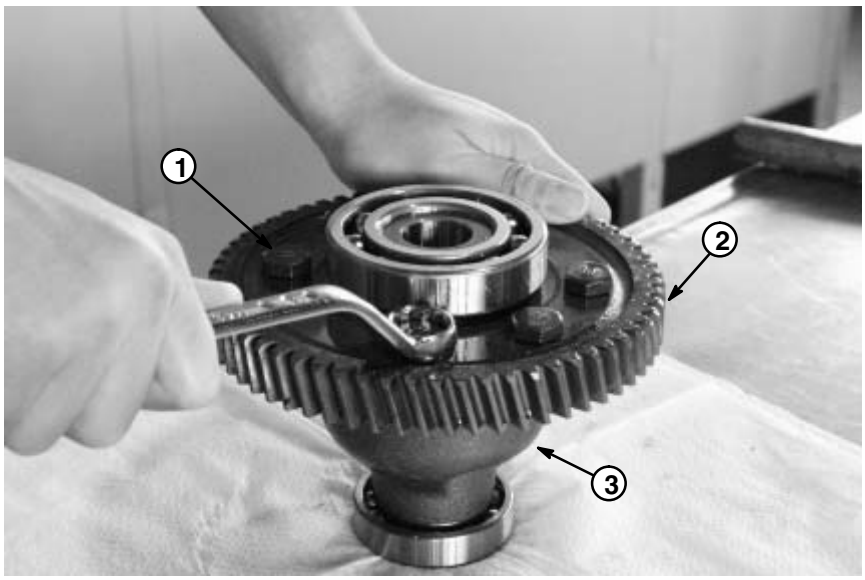

Figure 45

1. **Bolt**
2. **Gear 62**
3. **Differential case**

A. Remove bolts securing gear 62 to the differential case.

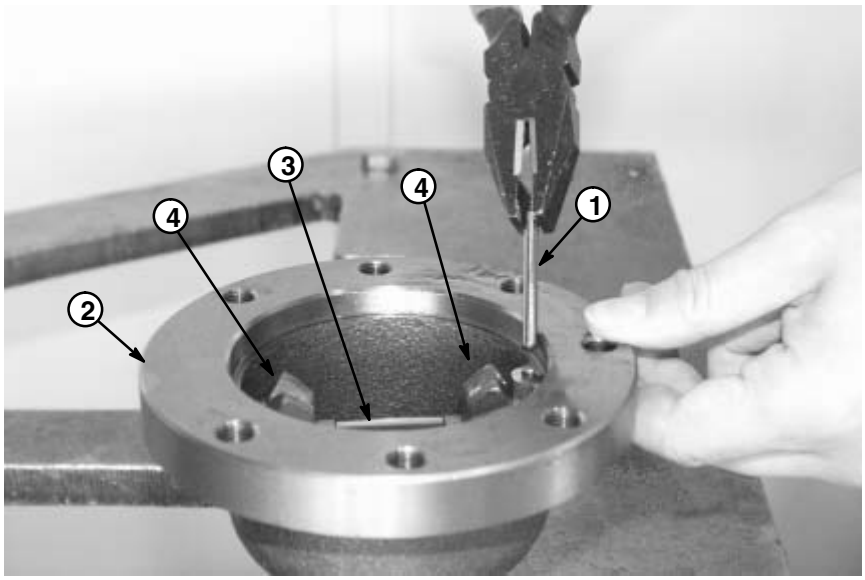

Figure 46

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.

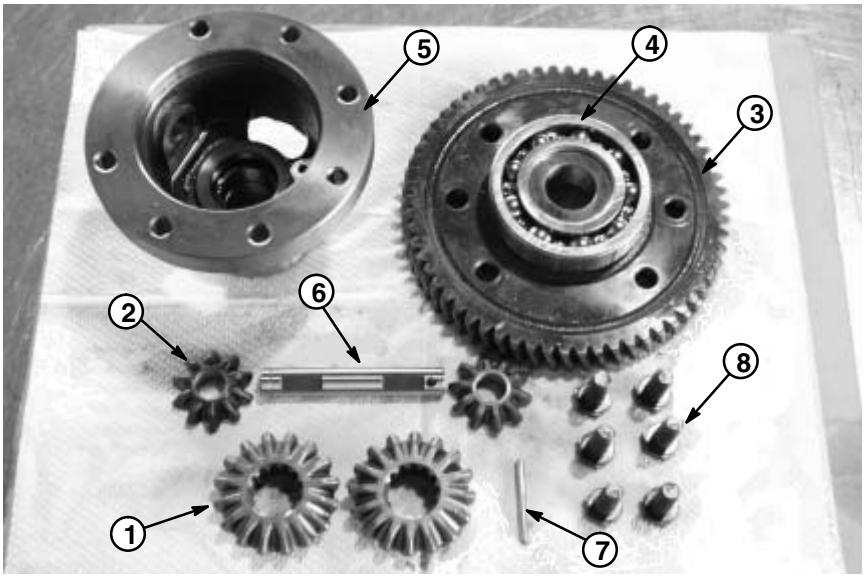

Figure 47

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

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.

7. Disassemble governor fork and shaft.

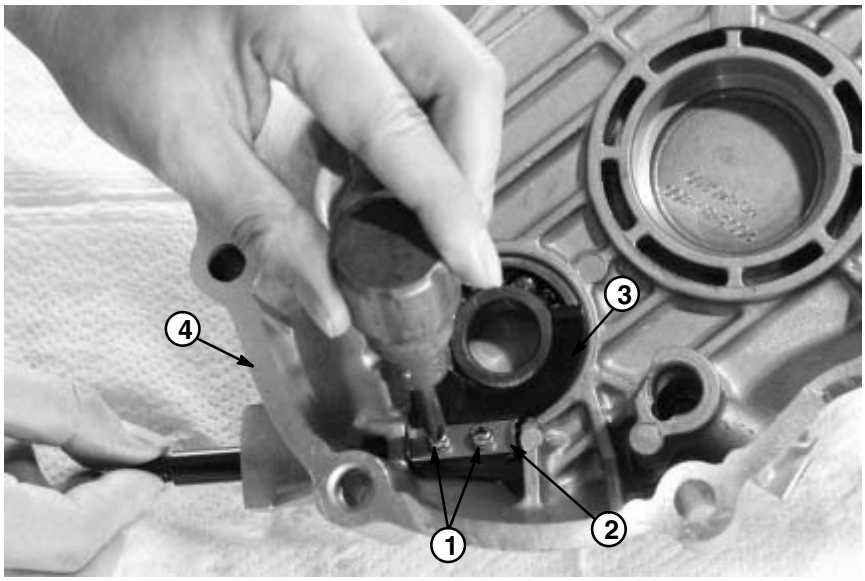

Figure 48

1. Screw
2. Stopper
3. Governor fork
4. Case (RH)

IMPORTANT: Make sure not to damage the screw heads when removing screws. Each screw is secured with an adhesive.

A. Remove both screws and washers securing the stopper and governor fork to the case (RH). Remove stopper and fork from the case.

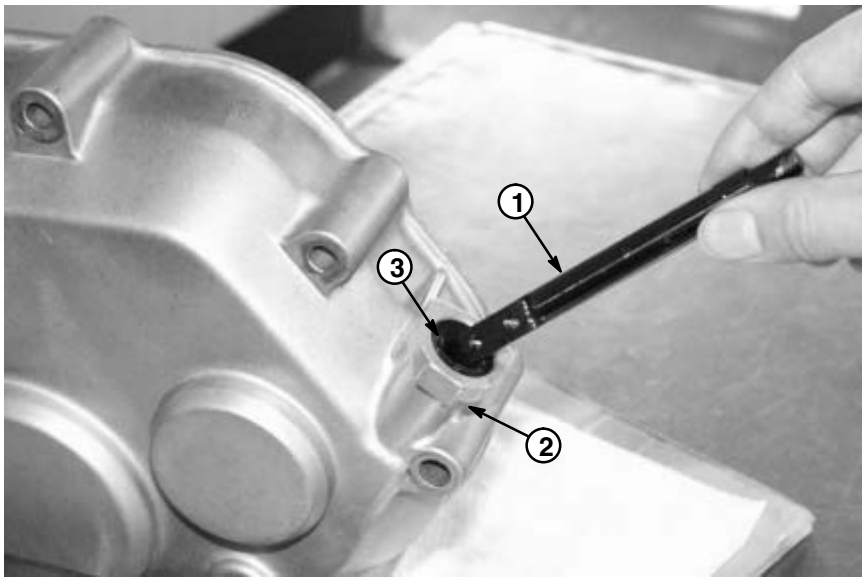

Figure 49

1. Governor shaft
2. Boss
3. Oil seal

IMPORTANT: Make sure not to damage the oil seal when removing the governor shaft from the governor boss.

B. Pull governor shaft from the boss.

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

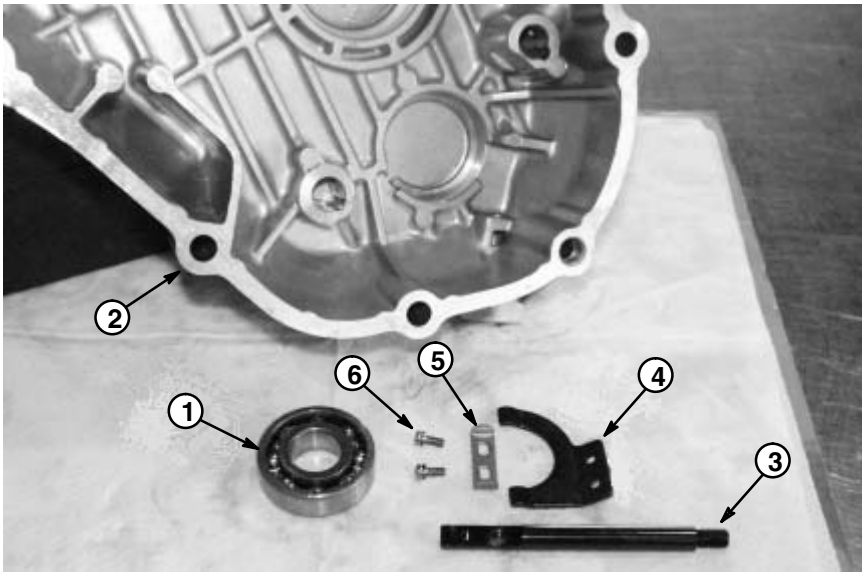

Figure 50

1. **Ball bearing**
2. **Case (RH)**
3. **Governor shaft**
4. **Governor fork**
5. **Stopper**
6. **Screws**

D. Remove ball bearing from the case. 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.

E. Replace governor shaft if cracked, bent, or excessively worn.

F. Replace governor fork or stopper if bent or deformed.

Assembly

1. Assemble input shaft assembly.

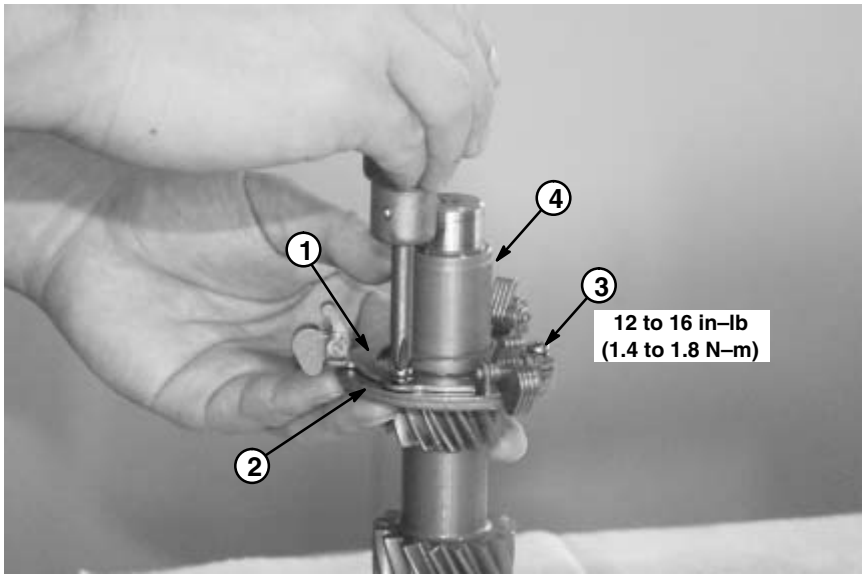

Figure 51

1. Governor plate
2. Governor base
3. Screw
4. Governor sleeve

IMPORTANT: To prevent the screws that secure the governor plate to the governor from loosening, apply Loctite Blue No. 242 or equivalent to the screw threads.

A. Secure governor plate unit to the governor base with screws. Torque screws from 12 to 16 in–lb (1.4 to 1.8 N–m).

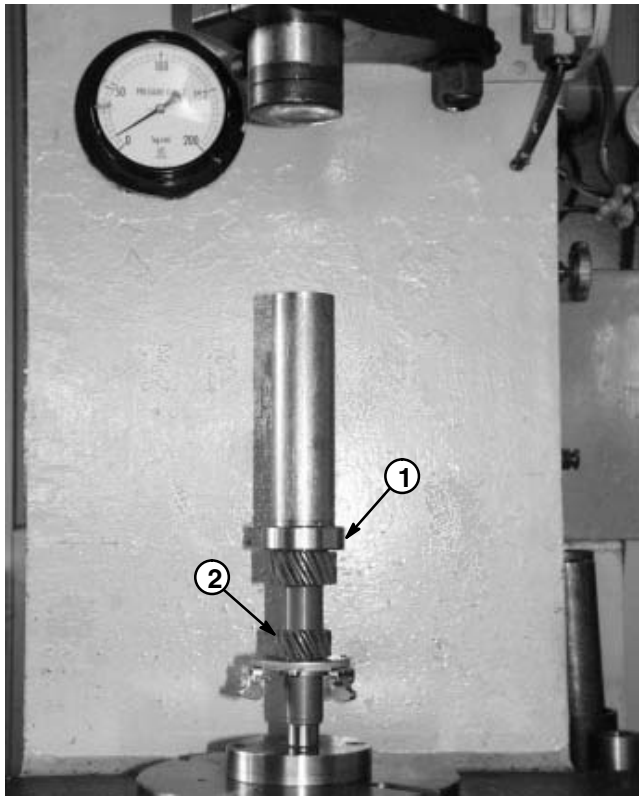

Figure 52

1. Ball bearing
2. Input shaft

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

B. Press ball bearing onto the input shaft.

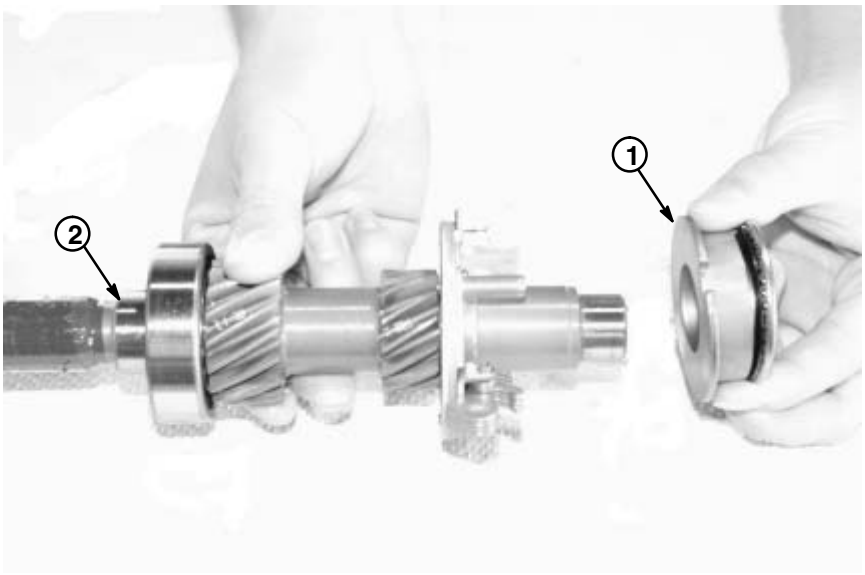

Figure 53

1. **Governor sleeve**
2. **Input shaft**

C. Apply molybdenum disulfide grease to the inside of the governor sleeve. Slide sleeve onto the input shaft.

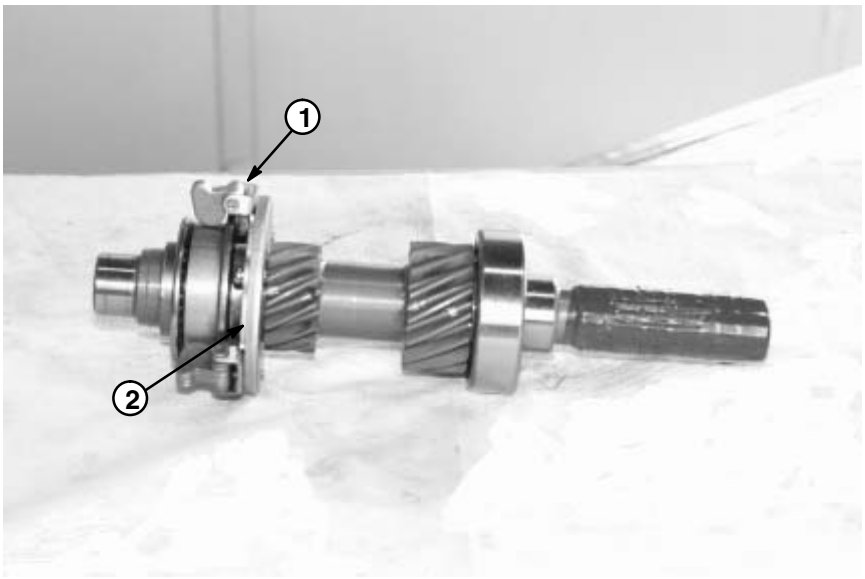

Figure 54

1. **Pivot point**
2. **Governor plate**

D. Make sure to apply molybdenum disulfide grease to the pivot points of the weights on the governor plate unit.

2. Assemble the center shaft assembly.

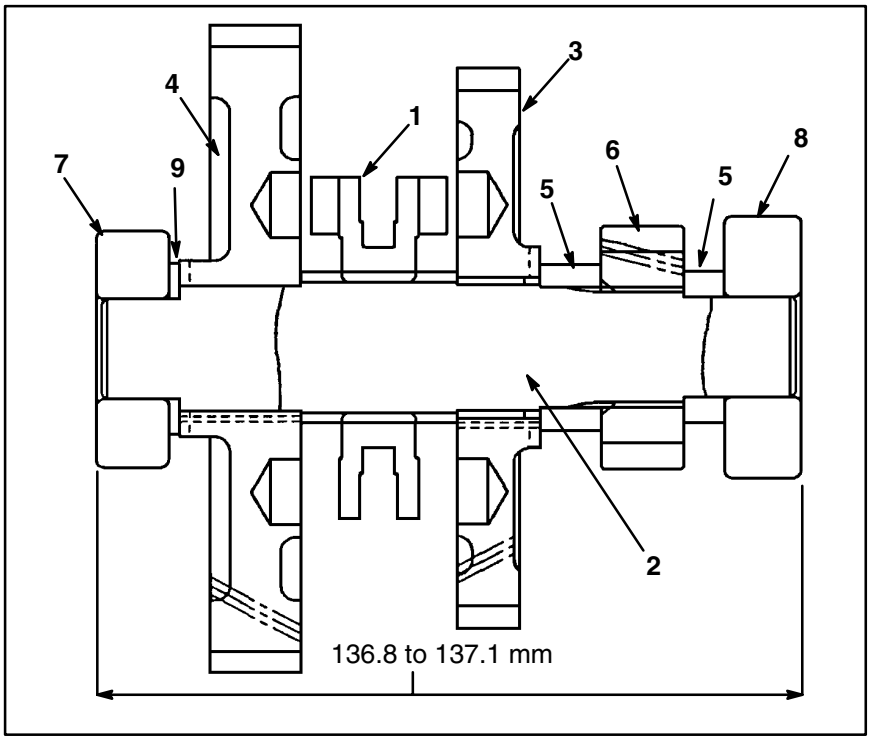

Figure 55

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.

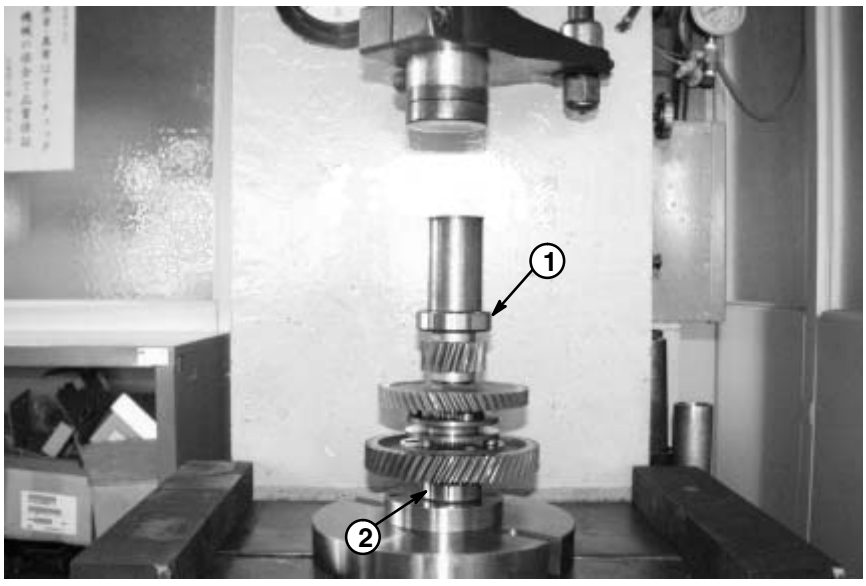

Figure 56

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 136.8 to 137.1 mm (Fig. 55).

Figure 57

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

3. Assemble differential assembly.

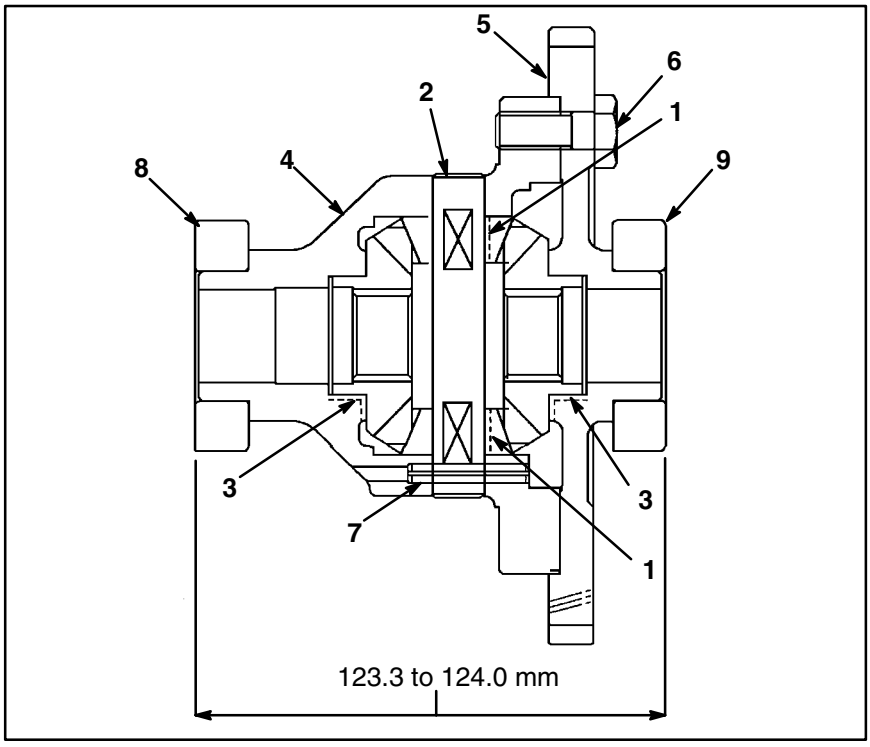

Figure 58

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.

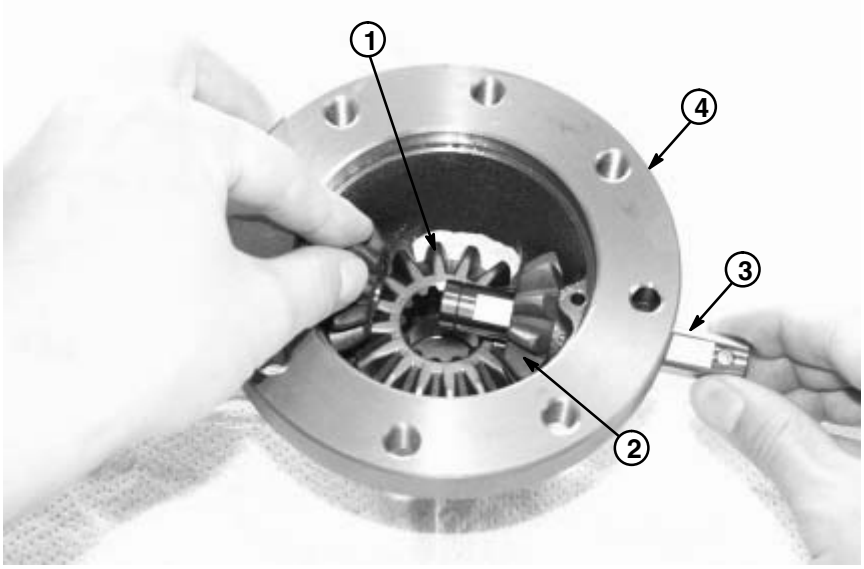

Figure 59

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.

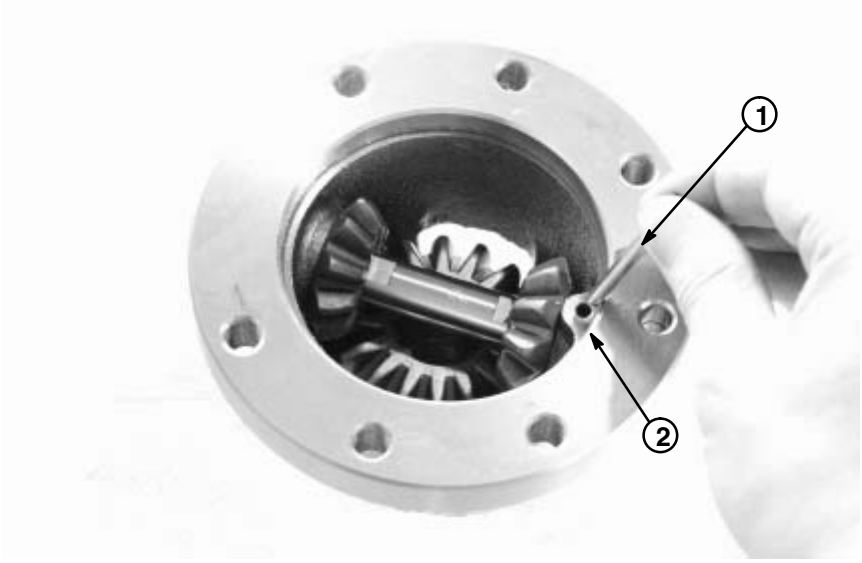

Figure 60

1. **Spring pin**
2. **Differential case**

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

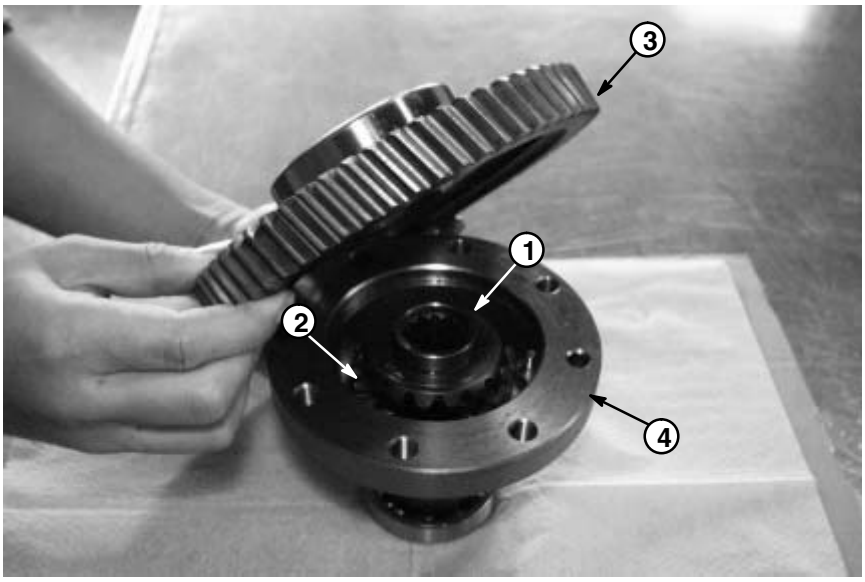

Figure 61

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 bolts. Torque bolts from 40 to 45 ft–lb (54 to 61 N–m) in a criss–cross pattern.

Figure 62

IMPORTANT: The length from the outer most side of each ball bearing must be from 123.3 to 124.0 mm (Fig. 58).

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. Assemble governor fork.

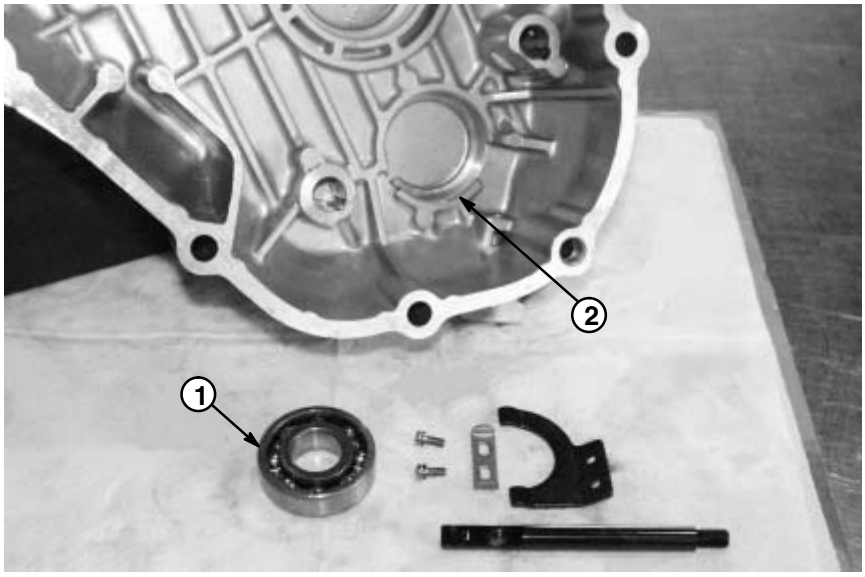

Figure 63

1. **Ball bearing**
2. **Case (bore)**

A. Install ball bearing into the bore of the case (RH).

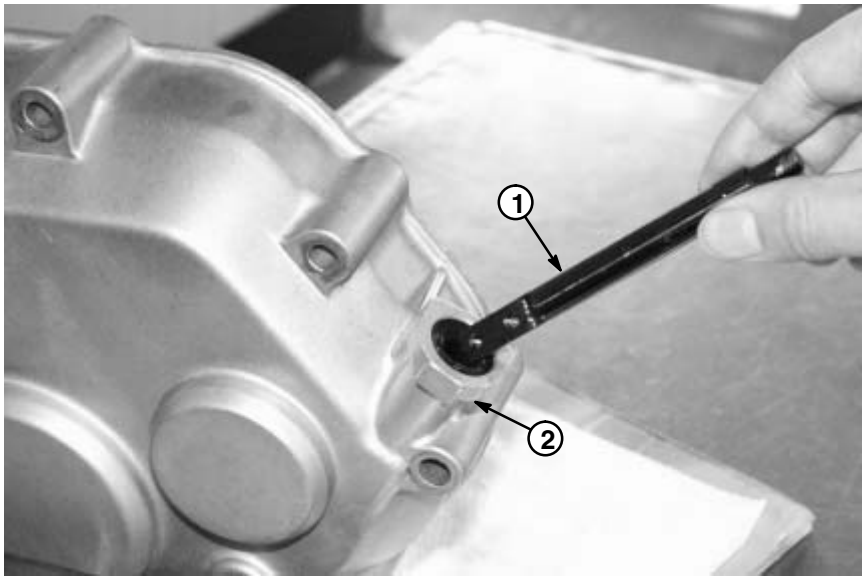

Figure 64

1. **Governor shaft**
2. **Boss**

IMPORTANT: Make sure not to damage the oil seal when installing the governor shaft into the governor boss.

B. Lubricate governor shaft with molybdenum disulfide grease before installing.

C. Install governor shaft into the boss.

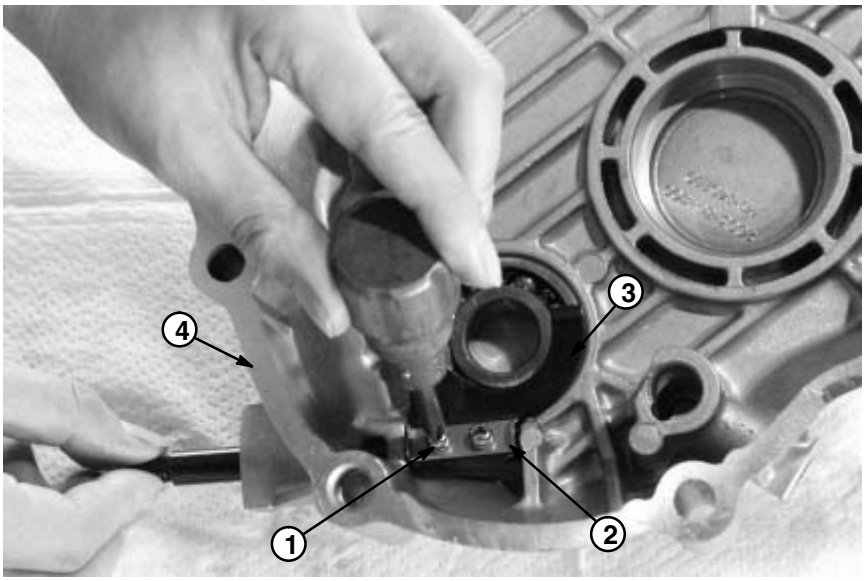

Figure 65

1. Screw
2. Stopper
3. Governor fork
4. Case (RH)

IMPORTANT: To prevent the screws that secure the governor fork and stopper to the governor shaft from loosening, apply Loctite Blue No. 242 or equivalent to the screw threads.

D. Secure stopper and governor fork to the governor shaft with both screws.

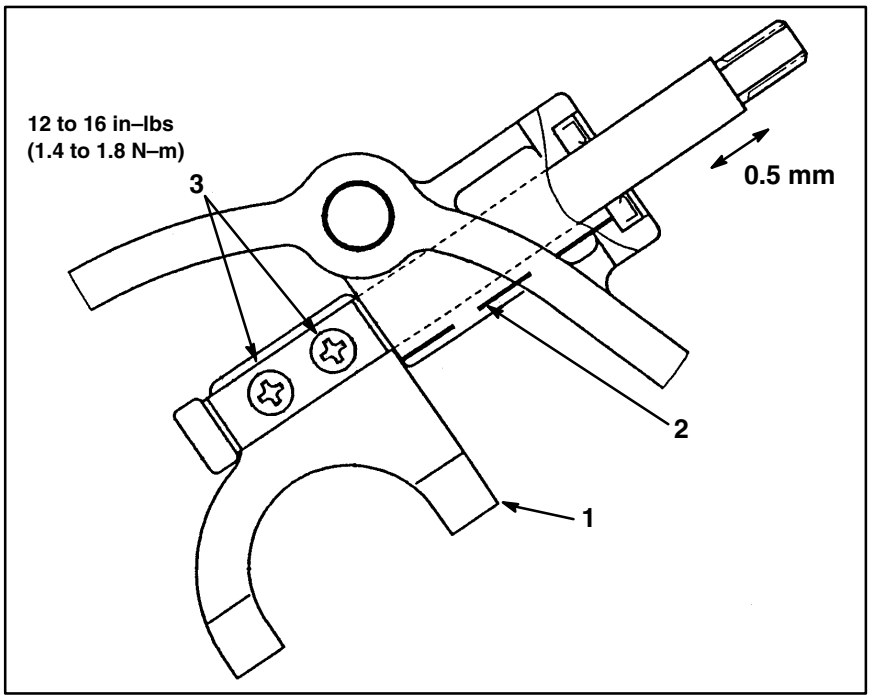

Figure 66

1. Governor fork
2. Governor shaft (greased surface)
3. Screw

E. Adjust governor fork center to the center of the ball bearing hole. Also, adjust thrust clearance of the governor shaft to less than 0.5 mm.

F. Torque screws from 12 to 16 in–lbs (1.4 to 1.8 N–m).

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

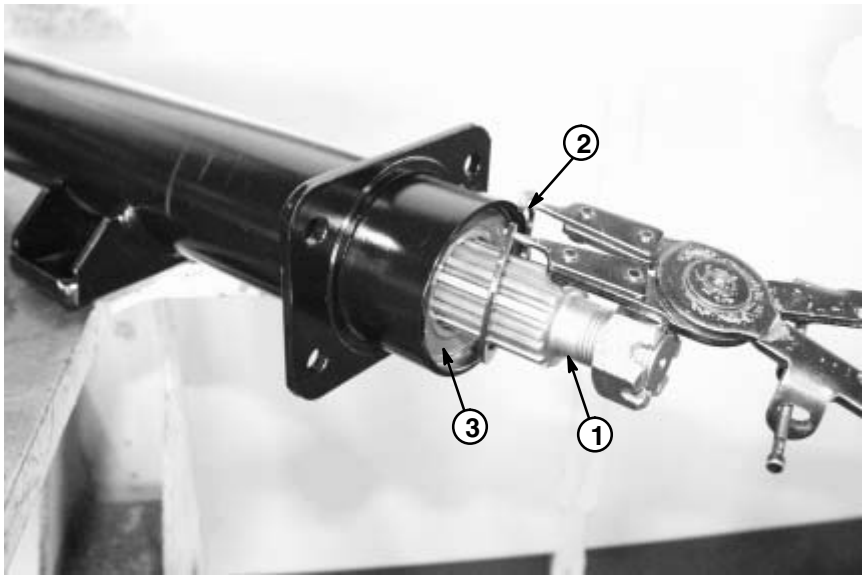

Figure 67

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.

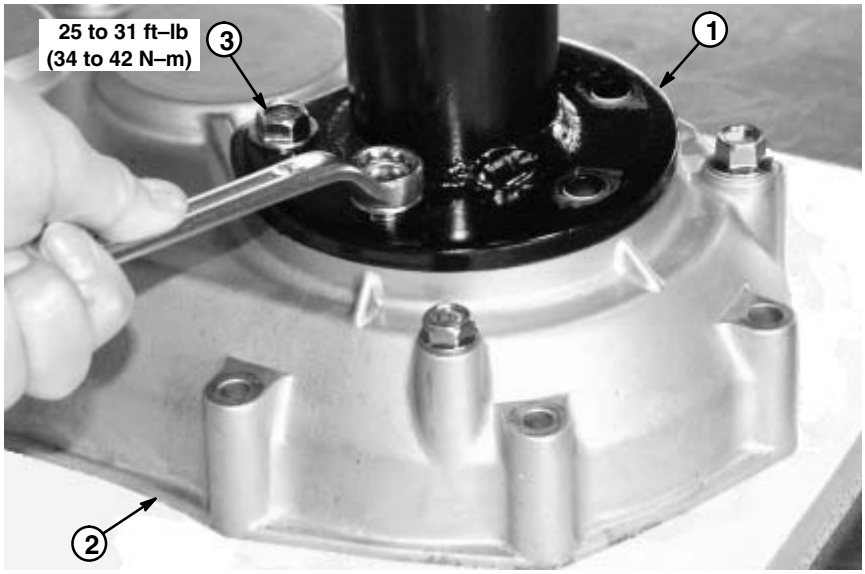

Figure 68

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 not to 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).

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

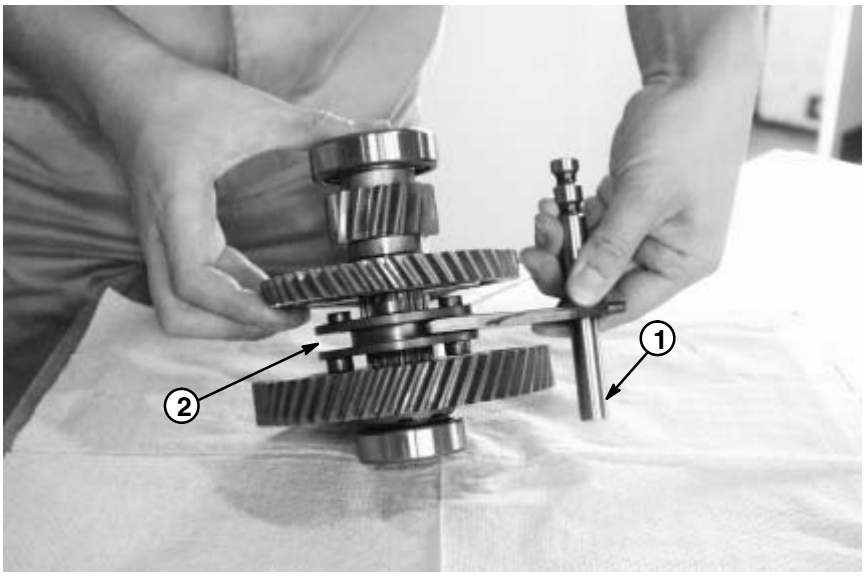

Figure 69

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

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

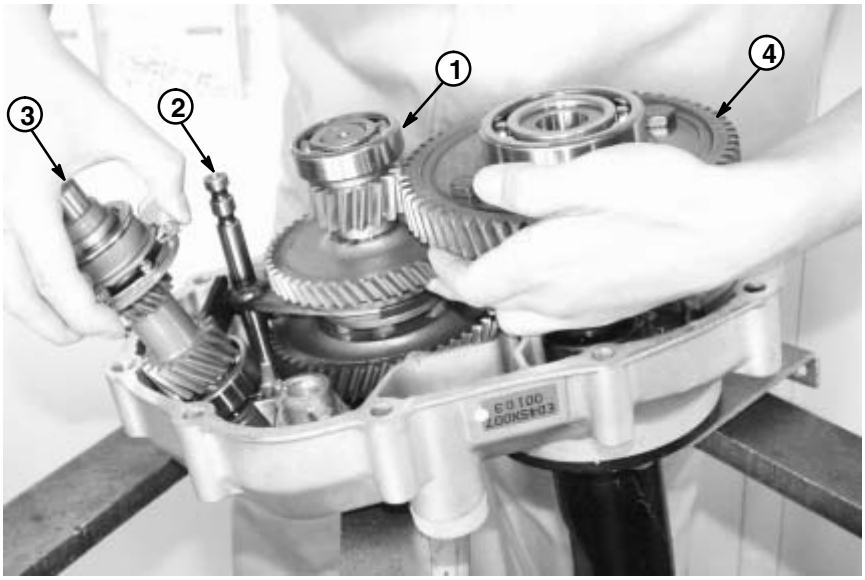

Figure 70

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 not to 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.

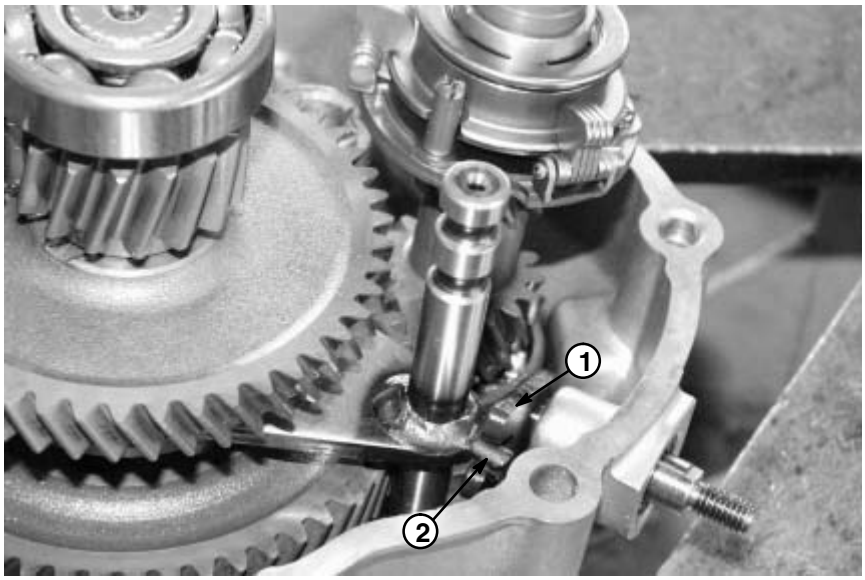

Figure 71

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

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

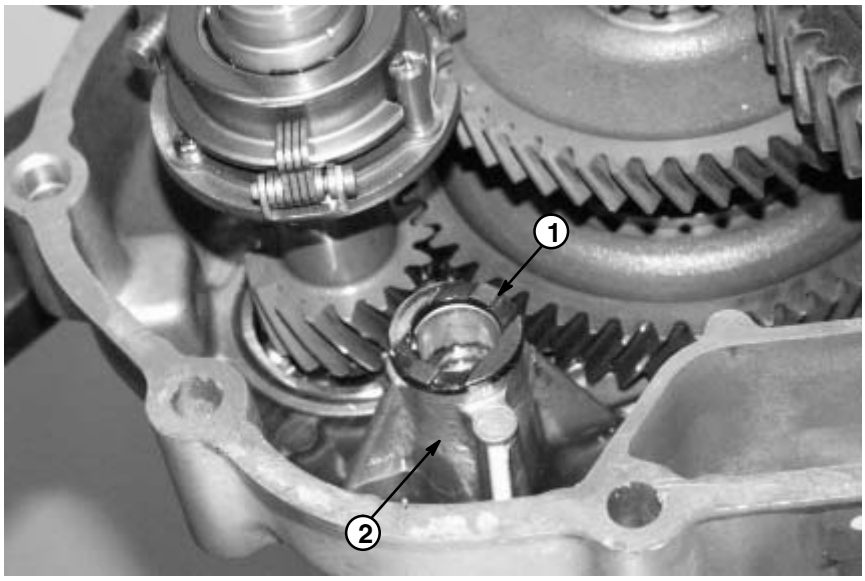

Figure 72

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

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

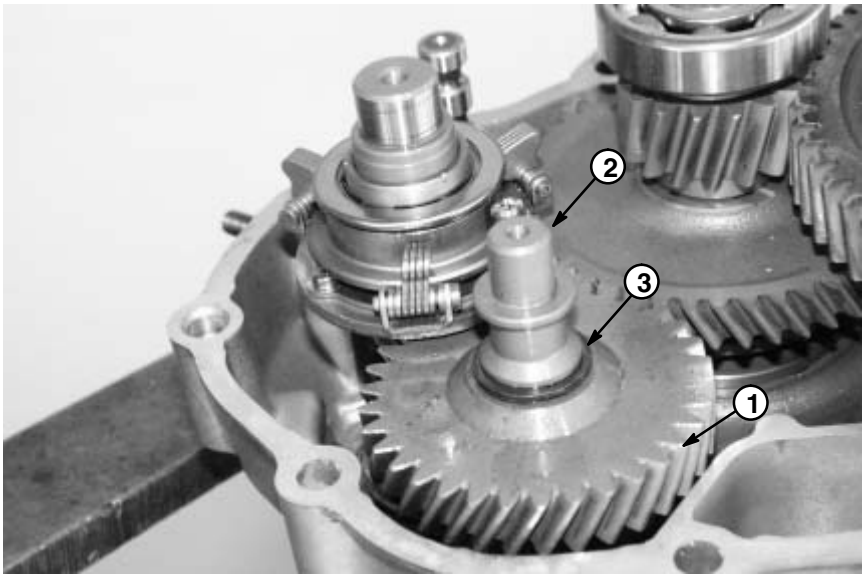

Figure 73

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.

7. Assemble case (LH and RH).

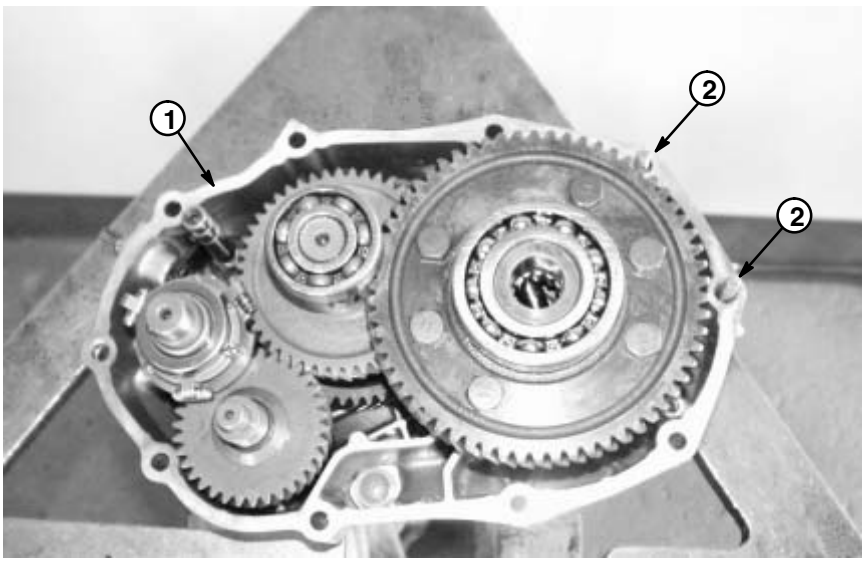

Figure 74

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).

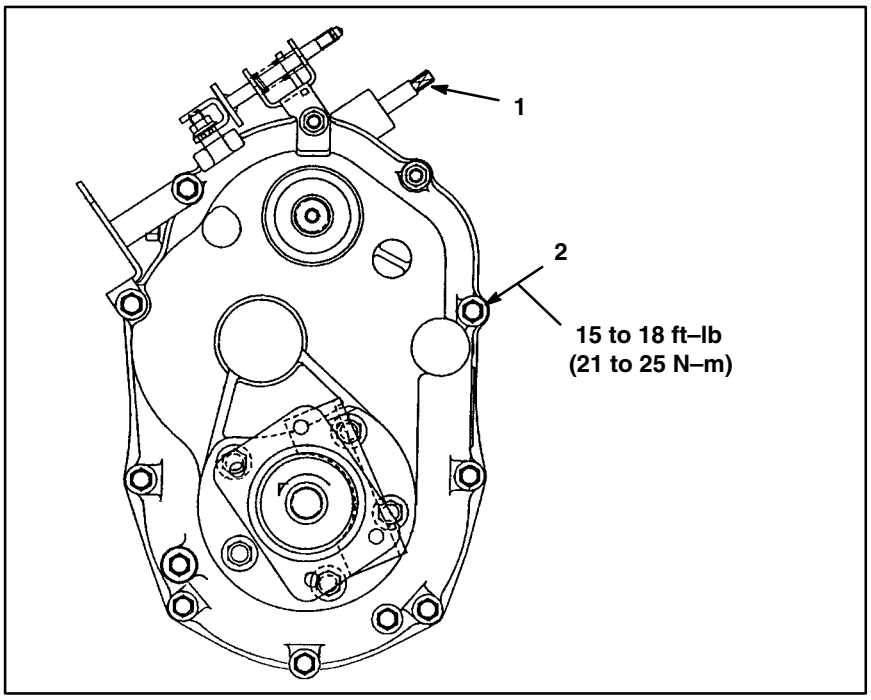

Figure 75

1. Governor shaft
2. Bolt

Note: When installing case (RH) to the case (LH), hold governor shaft so the ball bearing will not drop off. 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. Secure case (RH) to case (LH) with bolts. Torque bolts from 15 to 18 ft–lb (21 to 25 N–m).

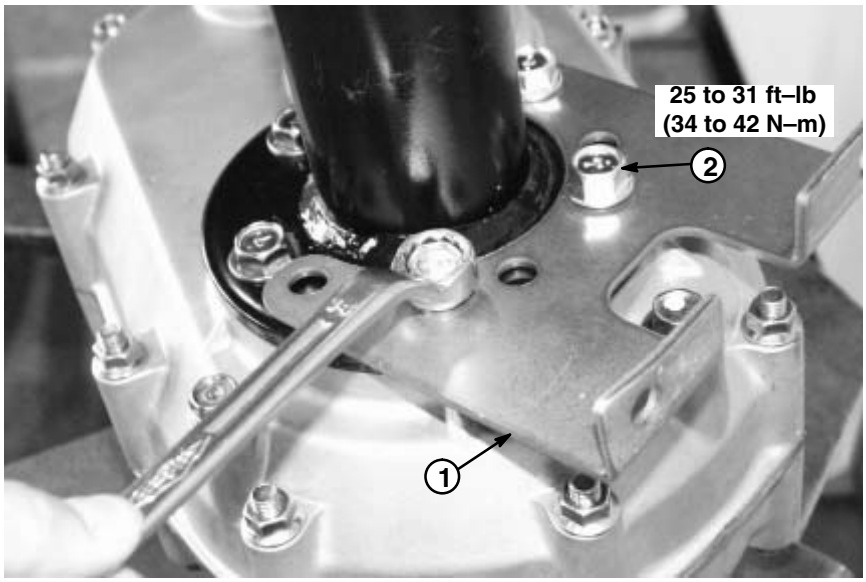

Figure 76

1. Axle bracket
2. Flange bolt

E. 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).

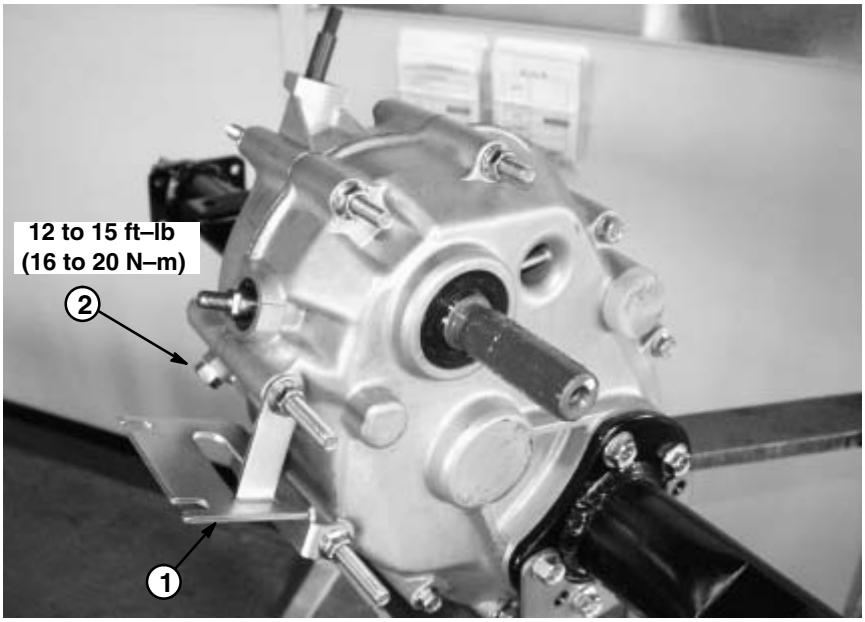

Figure 77

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

F. Install cable bracket to the transaxle.

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 10W–30 motor oil.

TORO

Chapter 6

Electrical System

Table of Contents

Electrical Schematics

The electrical schematics and other electrical drawings for the Workman 1100, 1110, 2100, and 2110 are located in Chapter 8 – Electrical Diagrams.

Special Tools

Order special tools from the *TORO SPECIAL TOOLS AND APPLICATIONS GUIDE (COMMERCIAL PRODUCTS)*. 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.

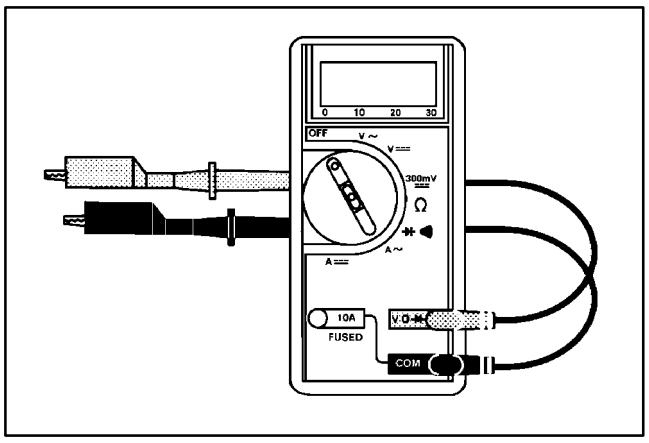

Figure 1

Skin–Over Grease

Special non–conductive grease (Toro Part No. 505–47) which forms a light protective skin which helps waterproof electrical switches and contacts.

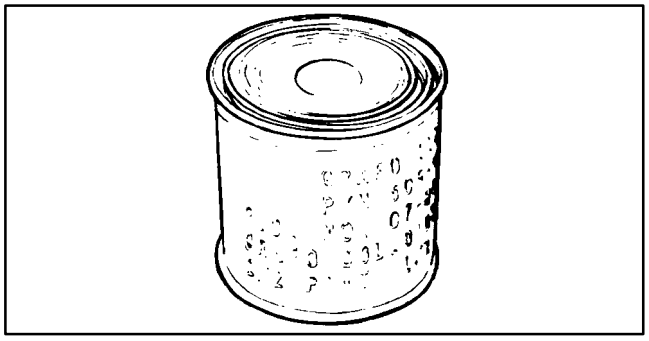

Figure 2

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 Wiring Schematics in Chapter 8).

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 charge is low. 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 solenoid.
Nothing happens when start attempt is made.	Battery is dead. Wiring to the start circuit (see Wiring Schematics) components is loose, corroded, or damaged. Battery cables are loose or corroded. Battery ground to frame is loose or corroded. Fuse block is faulty. 10 ampere fuse to the ignition switch is loose or blown. The ignition switch is faulty. Switch at accelerator pedal is faulty or needs adjustment. Starter solenoid is faulty. Shutdown module is faulty (Workman 2100 and 2110).
Engine cranks, but does not start.	Wiring to start circuits (see Wiring Schematics) is loose, corroded, or damaged. Shutdown module is faulty (Workman 2100 and 2110). Engine or fuel system is malfunctioning (see Engine Chapter). Engine and fuel may be too cold.

General Run Problems

Problem	Possible Causes
Battery does not charge.	Wiring to the charging circuit (see Wiring Schematics) components is loose, corroded, or damaged. Voltage regulator and/or starter/generator is faulty. Battery is dead.
Engine kills during operation.	Wiring to the run circuit (see Wiring Schematics) components became broken or disconnected. RPM shutdown module is faulty (Workman 2100 and 2110). Engine or fuel system is malfunctioning (see Engine Chapter).

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 60° to 100° F. 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 the 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

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 **Briggs and Stratton Repair Manual for 4 Cycle, V–Twin Cylinder, OHV Head Engines** or the **Kohler Service Manual for Command Pro CS Series Engines** for additional 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

Two types of ignition (key) switches have been used on the Workman 1100,1110, 2100, and 2110.

Early production switches had four switch terminals and two key positions (OFF and RUN). The switch terminals are marked as shown in Figure 3.

Later production switches had five switch terminals and three key switch positions, but only two or those positions are used (OFF and RUN). The switch terminals are marked as shown in Figure 4.

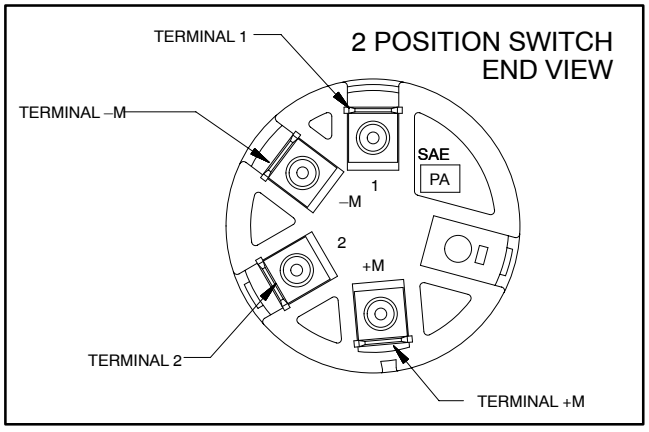

Figure 3

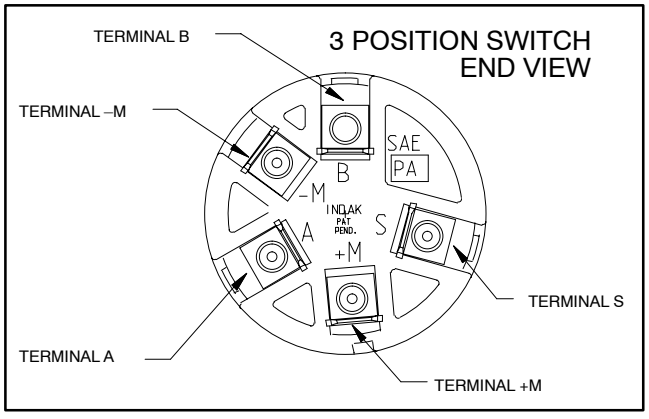

Figure 4

Testing

The circuitry of the ignition switch is shown in the charts 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 key position. Verify continuity between switch terminals.

1. For 2 position switch (Fig. 3):

POSITION	CIRCUIT “MAKE”	AMPS
OFF	+M + –M	1
RUN	1 + 2	15

2. For 3 position switch (Fig. 4):

POSITION	CIRCUIT “MAKE”	AMPS
OFF	+M + –M	1
RUN	A + B	15

Hour Meter

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

1. Isolate hour meter from the circuit.

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 minutes.

5. Disconnect voltage source from the hour meter. Reconnect hour meter to the circuit.

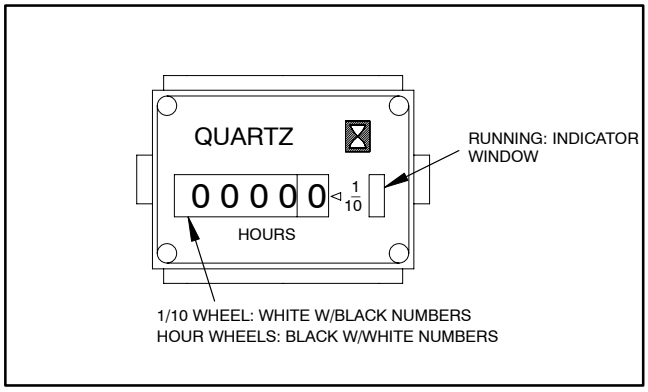

Figure 5

Audio Alarm (Reverse)

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

1. Isolate alarm from the circuit. Correctly connect 12VDC source to the terminals (Fig. 6).

2. Alarm should sound. Remove voltage source from the alarm. Reconnect alarm to the circuit or replace as needed.

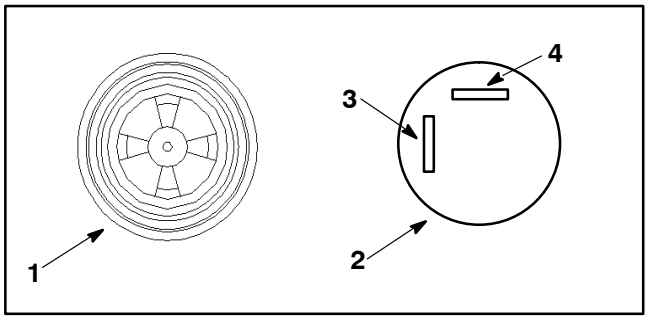

Figure 6

1. **Top view**
2. **Bottom view**
3. **Positive (+) terminal**
4. **Negative (–) terminal**

Headlight Switch

The headlight switch is located on the control panel (Fig. 7). This rocker switch allows the headlights to be turned on and off.

The switch terminals are marked as shown in Figure 7. 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

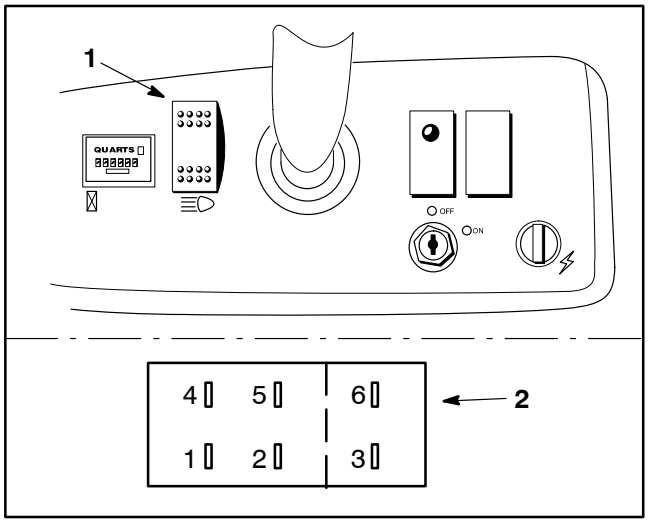

Figure 7

1. **Headlight switch**
2. **Back of switch**

Starter Solenoid

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

1. Make sure engine is off. Disconnect battery. Disconnect solenoid electrical connections.

2. Apply 12 VDC directly across the solenoid coil posts. The solenoid should click. Make sure resistance across the main contact posts is less than **1 ohm**.

3. Remove voltage from solenoid coil posts. The solenoid should click. Make sure resistance across the main contact posts is **infinite ohms**.

4. Resistance across the solenoid coil posts should be approximately **15.5 ohms**.

5. Replace starter solenoid if necessary.

6. Reconnect electrical connections to solenoid: positive battery cable and wire to fuse block on one main contact post and starter/generator cable and wire to regulator on the other main contact post. Reconnect battery.

NOTE: Voltage is supplied to the solenoid on the Workman whenever the key is in the RUN position and the accelerator pedal is depressed.

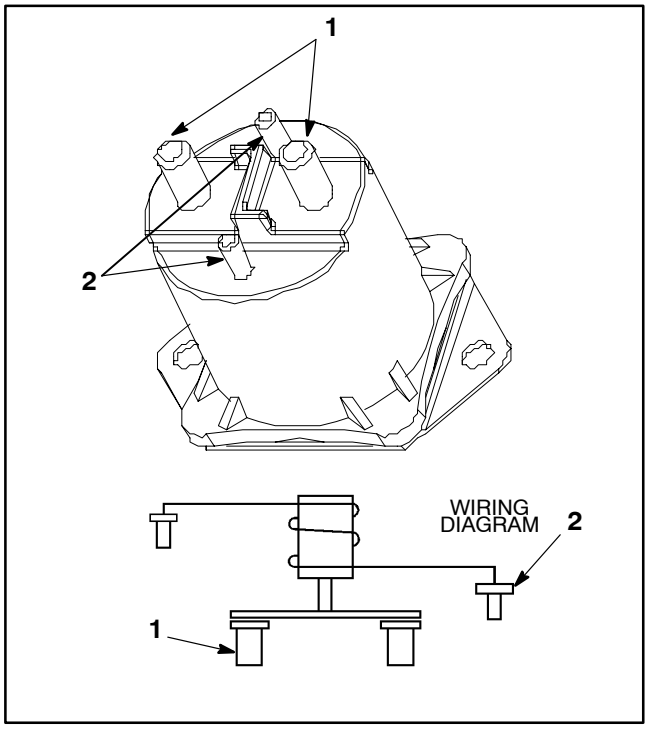

Figure 8

1. **Main posts (copper)**
2. **Solenoid posts (steel)**

Fuse Block

There are 3 fuses in the vehicle's electrical system. They are located beneath the bed in a box on the right hand side of the frame. Fuses can be removed to check continuity. The test meter should read **less than 1 ohm**.

Fuses supply power to the following (Fig. 9):

1. The extreme left 10 ampere fuse supplies power to the start/run systems.

2. The middle left 10 ampere fuse supplies power to the lights.

3. The middle right 10 ampere fuse supplies power to the power point. A maximum of a 15 ampere fuse is allowed.

4. The extreme right fuse supplies power to an optional bed lift (if equipped).

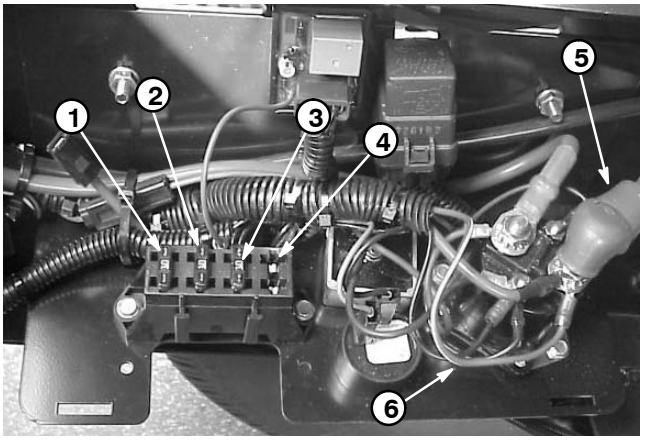

Figure 9

1. **Ignition system fuse**
2. **Lights fuse**
3. **Power point fuse**
4. **Option**
5. **Positive battery cable**
6. **Wire to fuse block**

Starter/Generator & Voltage Regulator

1. Place machine in the NEUTRAL position (see Operator's Manual). Set parking brake.

2. Raise bed and secure with prop rod. Gain access to electric components by removing the electrical cover.

3. Make sure all wires in the charging circuit are connected correctly and tightly. Note the correct location of starter/generator cable and voltage regulator wire at the start/run solenoid (Fig. 10).

4. Make sure the battery is fully charged. Operate the vehicle for several minutes so the voltage regulator is warmed up. Stop engine and turn key to OFF.

5. Test charging circuit:

   A. Set multimeter to VDC. Connect red (+) probe of the multimeter to the positive (+) battery post. Connect black (–) probe of the multimeter to the negative (–) post of the battery.

   B. Start and run the engine at mid–range RPM.

   C. Battery voltage should rise to approximately 14.5 VDC identifying a correctly operating charging circuit. If the battery has a low charge, this may take a few minutes.

   D. Stop engine and turn key to OFF.

6. If battery voltage did not rise to 14.5 VDC, test starter/generator:

   A. Disconnect green wire connector from voltage regulator (Fig. 10). Connect disconnected green wire lead from starter/generator to ground with a jumper lead.

   B. Set multimeter to VDC. Connect red (+) probe of the multimeter to the positive (+) battery post. Connect black (–) probe of the multimeter to the negative (–) post of the battery.

IMPORTANT: Run engine only long enough to get battery voltage reading and not for more than 15 seconds.

   C. Start and run engine at mid–range RPM.

   D. Battery voltage should rise steadily to approximately 18 VDC identifying a correctly operating starter/generator. An incorrect reading indicates the need for starter/generator repair.

   E. Stop engine and turn key to OFF.

7. Reconnect green wire connector from the regulator and test voltage regulator:

   A. Set multimeter to VDC. Connect red (+) probe of the multimeter into the green wire connection. Connect black (–) probe of the multimeter to a known good ground.

   B. Start and run the engine at mid–range RPM.

   C. The measured voltage should be approximately 2 VDC when battery is charging and 6–8 VDC when battery is fully charged. This voltage may rise to 12–14 VDC when the accelerator pedal is released and the engine is coasting to a stop.

   D. If measured voltage is incorrect, stop engine and replace voltage regulator. Retest charging circuit (Step 5 above).

8. Stop engine and remove multimeter leads.

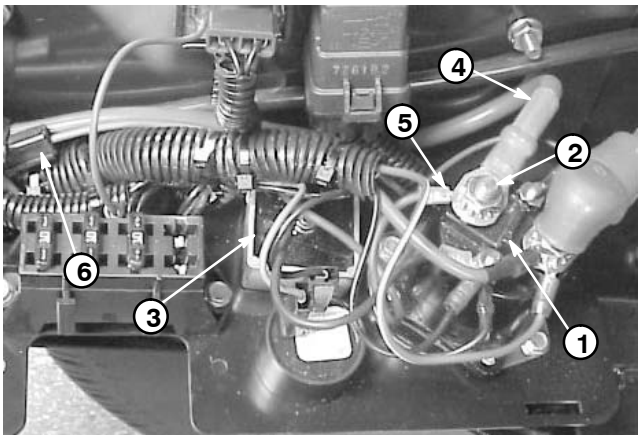

Figure 10

1. **Start/run solenoid**
2. **Main contact post**
3. **Voltage regulator**
4. **Cable to starter/gen.**
5. **Wire to voltage regulator**
6. **Green wire connector**

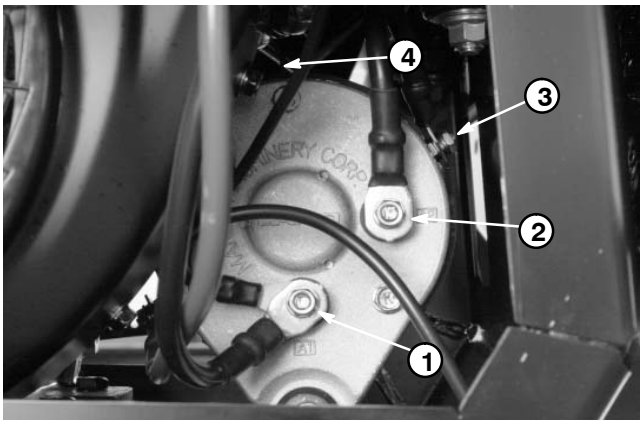

Figure 11

1. **Terminal A1**
2. **Terminal A2**
3. **Terminal F1 location**
4. **Terminal DF location**

Starter/Generator

Testing of starter/generator field and armature windings is difficult with the starter/generator still mounted in the Workman. Follow the procedures for Starter Generator & Voltage Regulator Component Testing prior to removing the starter generator for further testing and repairs. Starter generator resistance tests are as follows:

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

1. Measure resistance (Ohms) between starter generator terminals DF and F1 (field). The meter reading should be 5.5 to 5.9 Ohms.

2. Measure resistance (Ohms) between starter generator terminals A1 and A2 (armature). The meter reading should be under 1 Ohm.

3. Measure resistance between each terminal (Fig. 12) and ground. The meter reading should be infinite.

4. Starter/generator disassembly and repair will be needed if readings are incorrect.

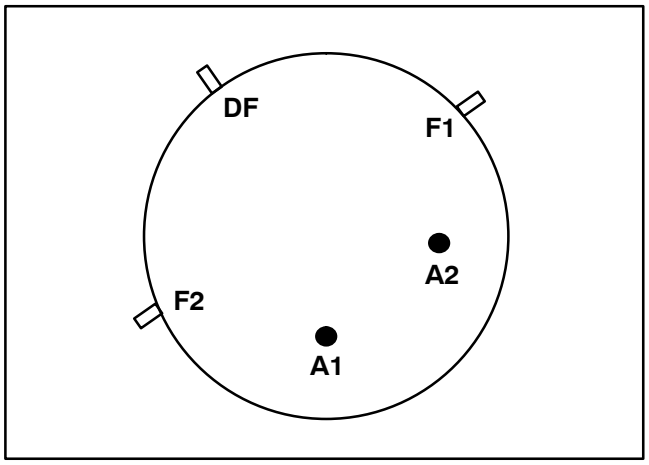

Figure 12

1. Starter/Generator end cover view

Accelerator Switch

The accelerator switch is a four terminal, two circuit switch. When the accelerator pedal is pushed, the switch allows current flow to the start/run solenoid, hour meter, and engine oil indicator and provides an open circuit to the engine ignition system. With the accelerator pedal released, the switch provides a grounding circuit for the engine ignition system and prevents current flow to the start/run solenoid, hour meter, and engine oil indicator.

Testing

1. Place machine in the NEUTRAL position. Turn ignition switch off, remove key from ignition switch, and engage parking brake.

2. If equipped, remove floor mat from around pedal area of machine.

3. Remove two screws that secure pedal cover to floor of machine. Remove pedal cover to gain access to accelerator switch.

4. Unplug wiring harness connector from switch.

5. With the use of a multimeter (ohms setting), the switch functions may be tested to determine whether continuity exists between the switch terminals for both switch positions. Verify continuity between switch terminals using the following table:

PLUNGER POSITION	CONTINUITY	NO CONTINUITY
IN	1 and 2	3 and 4
OUT	3 and 4	1 and 2

Adjustment

1. Release the parking brake.

2. With the accelerator pedal released, adjust the distance between the head of the accelerator switch bolt and the body of the switch to 5/8 inch (1.6 cm) (Fig. 14).

3. After switch adjustment, make sure that the engine starter does not engage when the parking brake is engaged. If starter does engage when parking brake is set, accelerator switch should be readjusted by reducing the distance between the head of the accelerator switch bolt and the body of the switch slightly.

4. After final switch adjustment, make sure that switch plunger is not bottomed out when accelerator pedal is released.

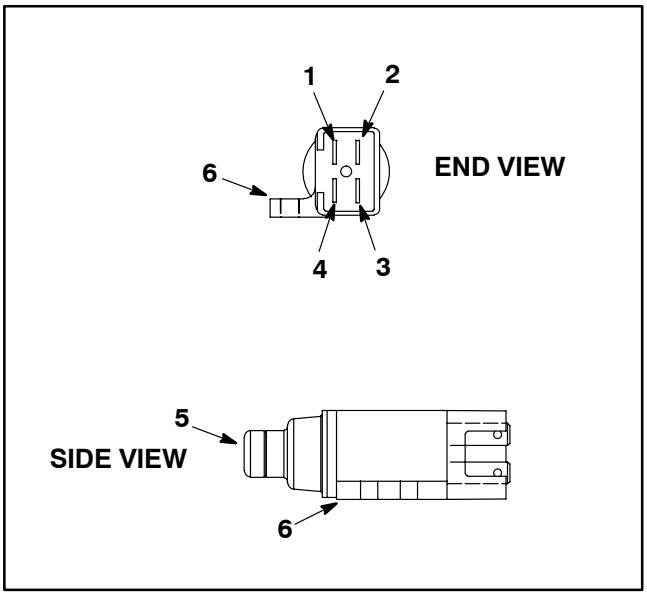

Figure 13

1. Terminal 1
2. Terminal 2
3. Terminal 3
4. Terminal 4
5. Switch plunger
6. Mounting tab

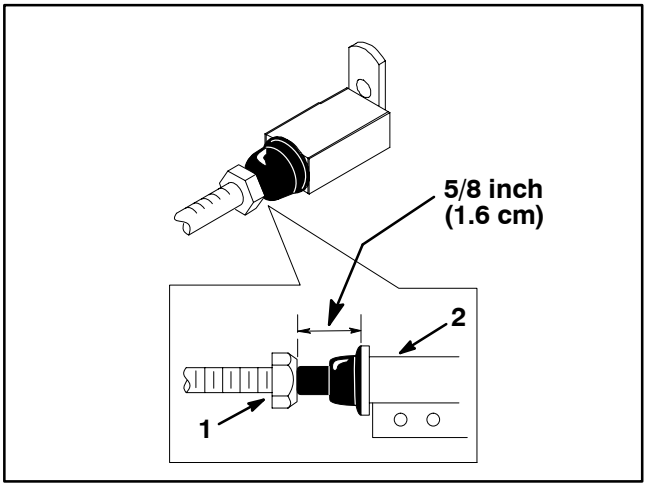

Figure 14

1. Switch bolt
2. Accelerator switch

Diode Assembly

The diode D1 (Fig. 15) is used to protect the ignition switch from voltage spikes that can occur when the starter solenoid is de–energized. The diode plugs into the wiring harness.

Testing

The diode can be tested using a digital multimeter (diode test or ohms setting) and the table to the right.

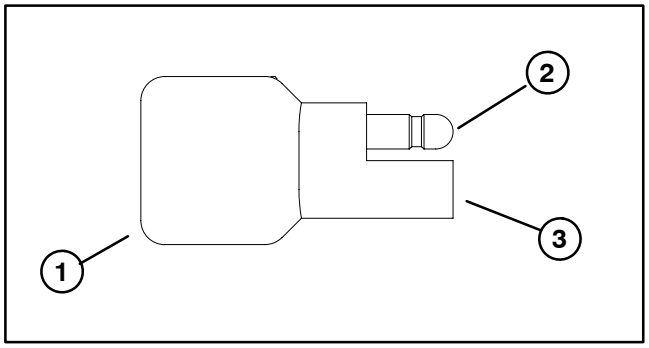

Figure 15

1. Diode
2. Male terminal
3. Female terminal

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

RPM Shutdown Module (Workman 2100/2110)

The RPM shutdown module allows the engine to continue running briefly after the accelerator pedal is released and the vehicle is decelerating. The module monitors engine speed at the engine stop switch terminal. Through the RPM shutdown module, the engine ignition system is not grounded until the engine speed has slowed to approximately 1300 RPM. By allowing the engine to continue running briefly during vehicle deceleration, better vehicle performance can be achieved.

Testing

1. Make sure that accelerator switch is working correctly and is adjusted properly (see Accelerator Switch).

2. Place drive system in the NEUTRAL position (see Operator's Manual).

3. Connect an ignition spark tester in series between spark plug and spark plug wire.

4. Start engine and monitor engine speed with a tachometer. Press the accelerator pedal to raise engine speed briefly and then release pedal while watching tachometer and spark tester. When engine speed decreases to approximately 1300 RPM, spark tester should register no spark and the engine should stop.

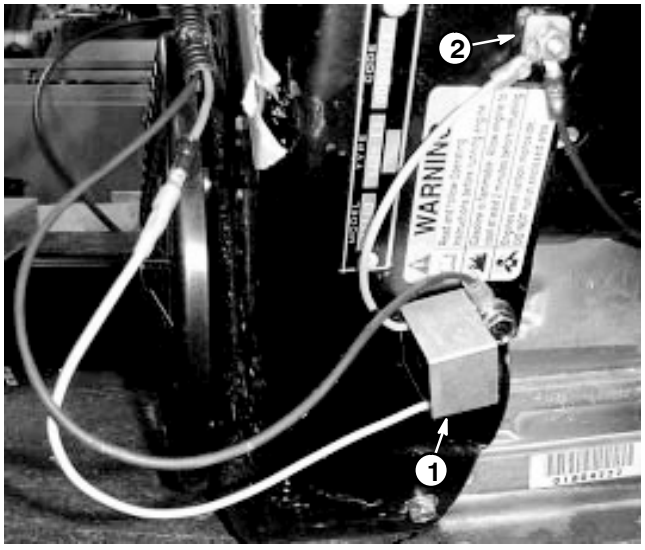

Figure 16

1. RPM shutdown module
2. Stop switch terminal

Oil Pressure Switch (Workman 2100/2110)

The oil pressure switch is located on the mounting adapter for the oil filter. It is a normally closed switch and opens with pressure.

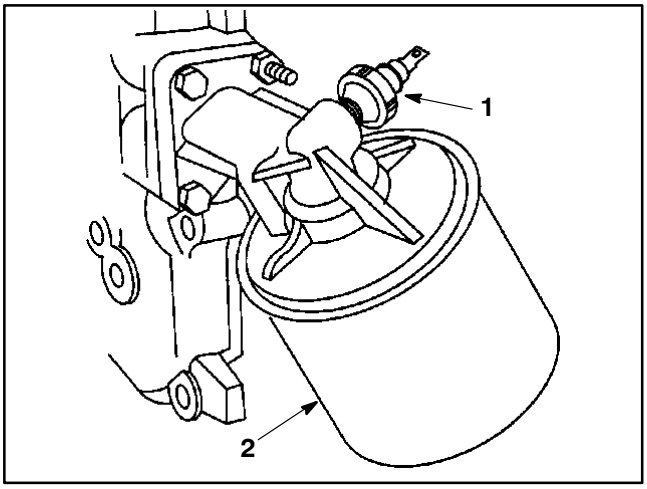

Figure 17

1. Oil pressure switch 2. Oil filter

Oil pressure switch testing

1. Turn the ignition switch to ON. The oil indicator light should be on.

2. If the light is not on, disconnect the wire from the oil pressure switch and ground the wire to the engine block.

3. If the light comes on, the oil pressure switch is bad.

4. If the light does not come on after step 2, check the indicating circuit (see Electrical Schematic).

If the lamp comes on with the engine running:

1. Shut off the engine **immediately**.

2. Disconnect the wire from the oil pressure switch.

3. Turn the ignition switch to ON. The oil pressure lamp should go out.

4. If the light is still on, check for short circuiting in the indicating circuit (see Electrical Schematic).

5. Refer to the Briggs and Stratton Repair Manual for 4 Cycle, V–Twin Cylinder, OHV Head Engines for additional testing information.

Service and Repairs

NOTE: For more component testing information, see the **Briggs and Stratton Vanguard Service and Repair Manual for 4–Cycle, V–Twin Cylinder, OHV Engines** or the **Kohler Service Manual for Command Pro CS Series Engines**.

Headlights

Specification: GE Headlight #H7610

1. Set parking brake, turn ignition off, and remove key.

2. Reach beneath dash and push headlight out of the hood.

3. Remove screws attaching the wire harness to the headlight.

4. Remove rubber seal from around the headlight. Discard headlight.

5. Align notch on the inside of the seal with the notch on the new headlight. Slide seal onto the headlight until the seal is firmly in place.

6. Attach headlight to the wire harness using the previously removed screws.

NOTE: Applying soapy water to the outside of the seal may aid in sliding the seal into the hood.

7. Align notch on the outside of the seal with the notch in the hood. Push headlight and seal into the hood until it is firmly in place.

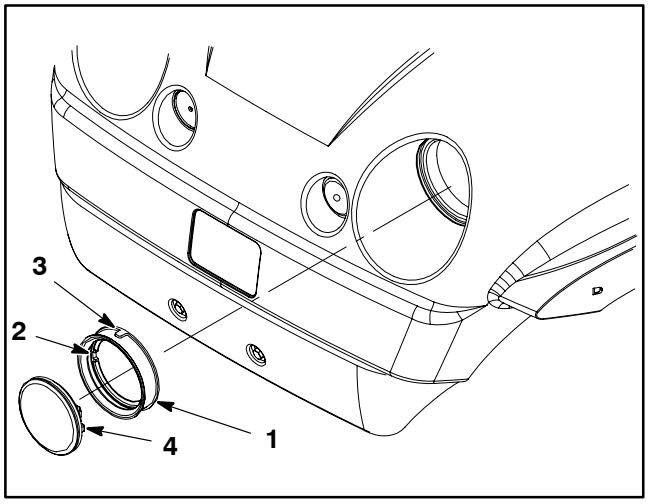

Figure 18

1. **Rubber seal**
2. **Inside notch**
3. **Outside notch**
4. **Headlight**

Starter/Generator

Removal

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

2. Raise bed and secure with prop rod to gain access to the starter/generator.

NOTE: Place all fasteners back onto starter/generator terminals after disconnecting wires to prevent loss of fasteners.

3. Label all wires on the starter/generator. Disconnect all wires from the starter/generator.

4. Loosen starter/generator pivot bolt and flanged lock nut.

5. On the Workman 2100 and 2110 (Fig. 19):

   A. Loosen jam nuts on the starter rod enough to allow the V–belt to be removed from the pulley. Remove V–belt from the pulley.

   B. Remove cotter pin from the starter rod. Separate starter rod from the starter/generator.

6. On the Workman 1100 and 1110 (Fig. 20):

   A. Loosen flange nut on starter bracket carriage bolt. Rotate starter to allow the V–belt to be removed from the pulley.

   B. Remove flange nut and carriage bolt from starter bracket.

7. Remove pivot bolt and flanged lock nut. Remove starter/generator from the vehicle.

8. Remove pulley from the starter/generator shaft (Fig. 21).

   A. Remove nut and spring washer from the shaft. Use puller to remove pulley from the shaft.

   B. Remove woodruff key and spacer from the shaft.

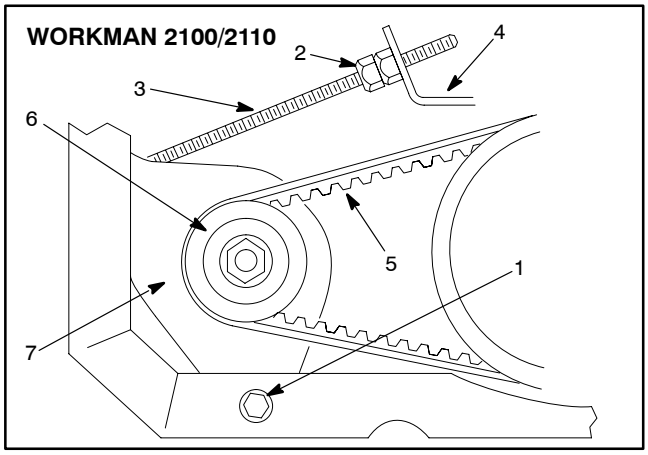

Figure 19

1. **Pivot bolt**
2. **Jam nut**
3. **Starter rod**
4. **Torque arm**
5. **V–belt**
6. **Pulley**
7. **Starter/Generator**

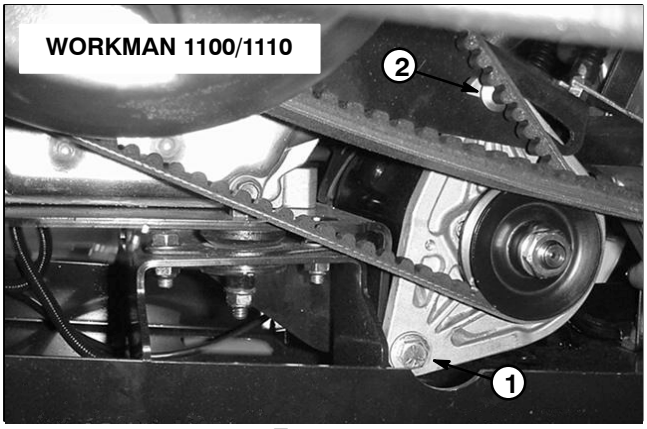

Figure 20

1. **Starter/Gen. pivot bolt**
2. **Carriage bolt**

Installation

1. Install pulley to the starter/generator shaft (Fig. 21).

   A. Position spacer and woodruff key onto the shaft. Place pulley onto the shaft.

   B. Secure pulley to the shaft with spring washer and nut. Torque nut from 15 to 25 ft–lb (20 to 34 N–m).

2. Position starter/generator to the engine mount.

   A. Insert pivot bolt through the engine mount, starter/generator front bracket, pivot, and starter/generator rear bracket.

   B. Install flanged lock nut onto the pivot bolt.

   C. Tighten lock nut enough so starter/generator pivots with slight resistance.

3. On the Workman 2100 and 2110 (Fig. 19):

   A. Insert end of starter rod with jam nuts through the torque arm.

   B. Secure starter rod to the starter/generator with the cotter pin.

4. On the Workman 1100 and 1110 (Fig. 20):

   A. Install carriage bolt through starter flange and starter bracket.

   B. Thread flange nut onto carriage bolt.

5. Correctly connect all wires to the starter/generator.

6. Install V–belt to the pulley. Adjust V–belt (see Adjust Starter/Generator Belt in Engine Chapter).

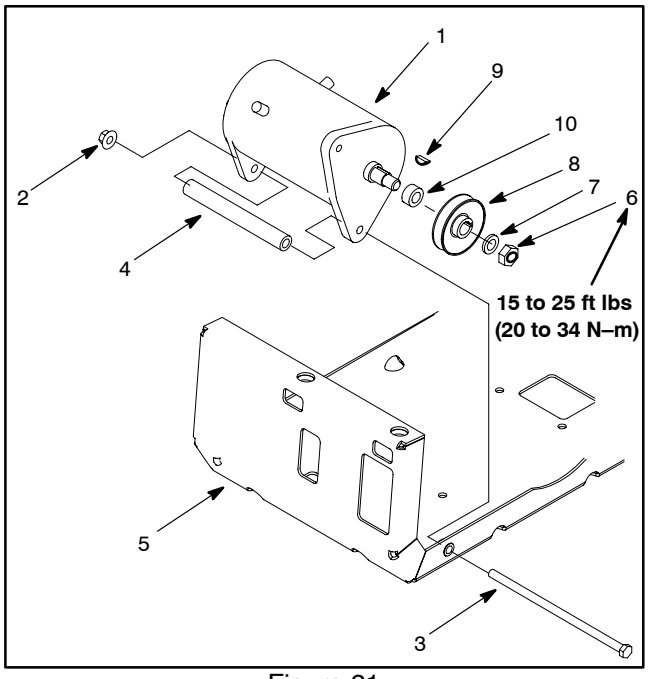

Figure 21

1. **Starter/generator**
2. **Flanged lock nut**
3. **Pivot bolt**
4. **Pivot**
5. **Engine mount**
6. **Nut**
7. **Lock washer**
8. **Pulley**
9. **Woodruff key**
10. **Spacer**

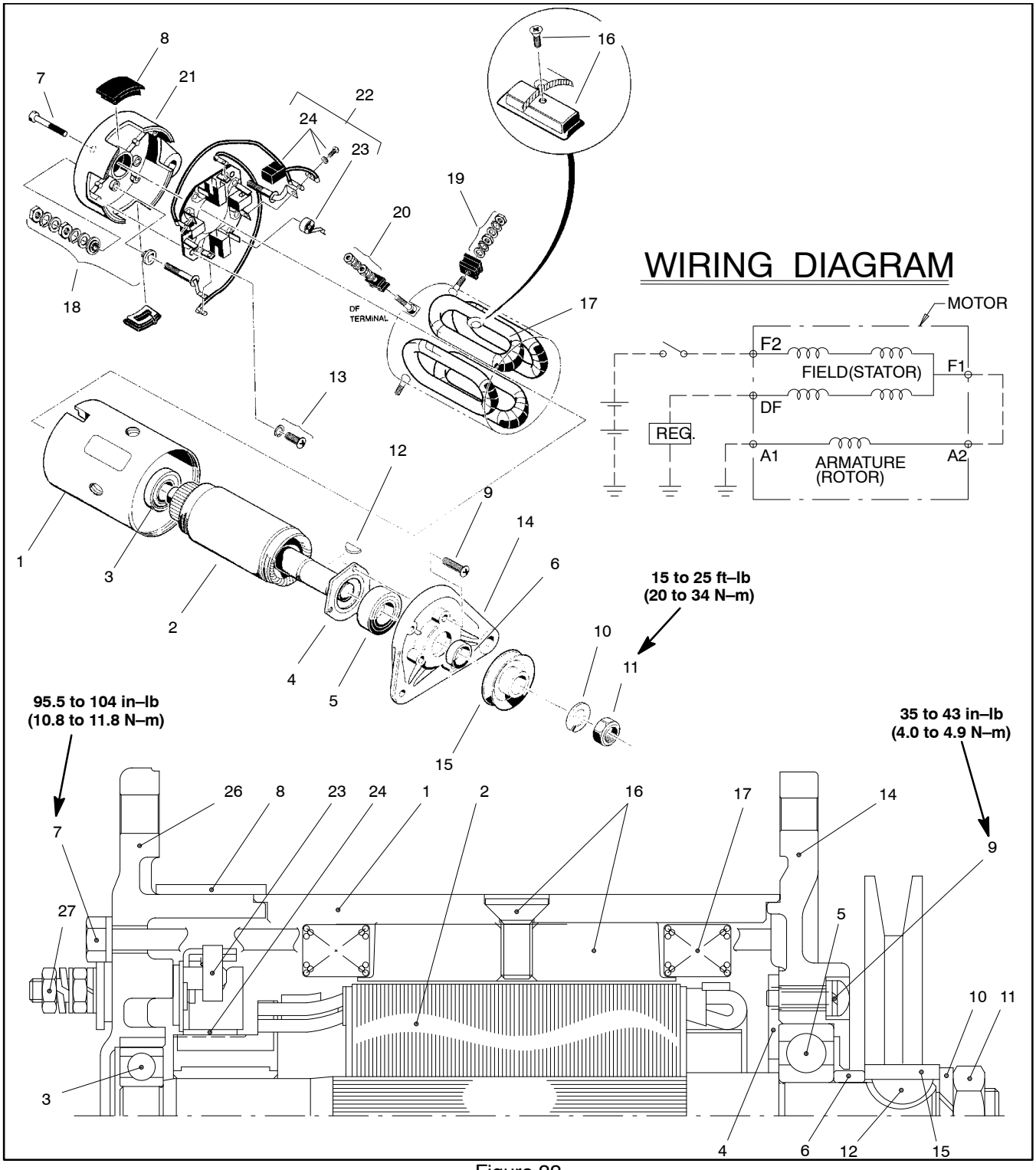

Figure 22

1. Yoke
2. Armature kit
3. Ball bearing
4. Bearing retainer
5. Ball bearing
6. Spacer
7. Through bolt & flat washer
8. Brush cover
9. Screw, lock washer, & flat washer
10. Spring washer
11. Hex nut
12. Woodruff key
13. Screw and washer
14. End cover (front)
15. Pulley
16. Pole piece and set screw
17. Field coil (stator) assembly
18. Screw and mold assembly
19. Screw set
20. Screw set
21. End cover (commutator)
22. Brush holder kit
23. Brush spring
24. Brush and screw set

Brush and Brush Spring Service (Fig. 22)

IMPORTANT: When removing or installing the commutator end cover, make sure brushes do not contact the commutator. Damage to the brushes may result.

1. Remove brush covers from the commutator end cover. Lift brush springs from the notch at the end of the brushes while pulling the brushes out. Allow springs to hold brushes out from the center (Fig. 23).

2. Remove both through bolts and flat washers securing the commutator end cover to the yoke. Separate end cover from the commutator and yoke.

IMPORTANT: Use clean, dry, lint–free rags when cleaning the starter/generator. When using compressed air, air should be filtered and not exceed 15 PSI (1 Bar).

3. Remove brushes from their holders. Clean carbon dust from the commutator end cover and brushes.

IMPORTANT: Label armature leads connected to brush leads prior to disconnecting any brush leads.

4. Inspect brushes for damage.

   A. Replace any brush that is cracked or severely chipped.

   B. If the length from the end of the brush to the wear line is less than 1/16 inch (1.6 mm), replace all four brushes (Fig. 24).

5. Inspect brush springs for heat discoloration. Replace all four brushes if any brush is straw or bluish colored.

6. Check brush springs for correct tension.

   A. Secure all four brushes into their holders with the brush springs.

   B. Using a spring scale, check tension on all four brushes in the direction of the spring (Fig. 25).

   C. Replace all four springs if any spring's tension is less than 24 ounces (1.6 N).

7. Secure brush and armature leads with set screws and lock washers.

8. Lift brush springs from the notch at the end of the brushes while pulling the brushes out. Allow springs to hold brushes out from the center (Fig. 23).

9. Position commutator end cover to the commutator and yoke. Secure commutator end cover to the yoke with both through bolts and flat washers. Torque bolts from 95.5 to 104 in–lbs (10.8 to 11.8 N–m).

10. Slide brushes into holders. Secure brushes by positioning brush springs into the notch at the end of the brushes (Fig. 25).

11. Install brush covers to the commutator end cover.

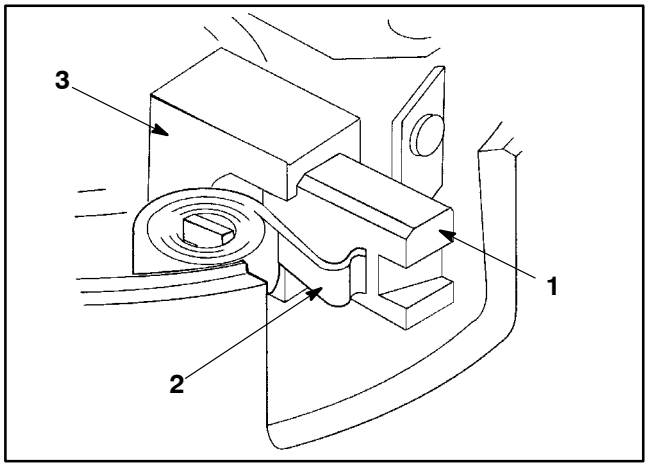

Figure 23

1. **Brush**
2. **Spring**
3. **Brush holder**

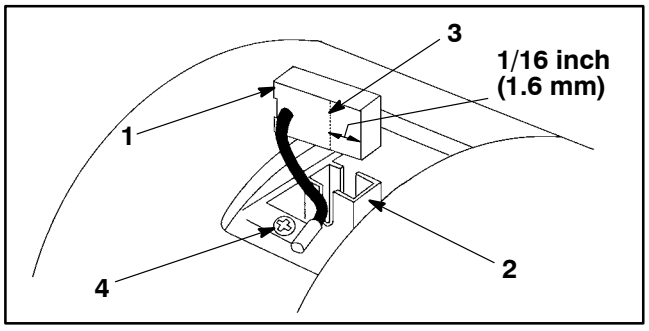

Figure 24

1. **Brush**
2. **Brush holder**
3. **Wear line**
4. **Set screw**

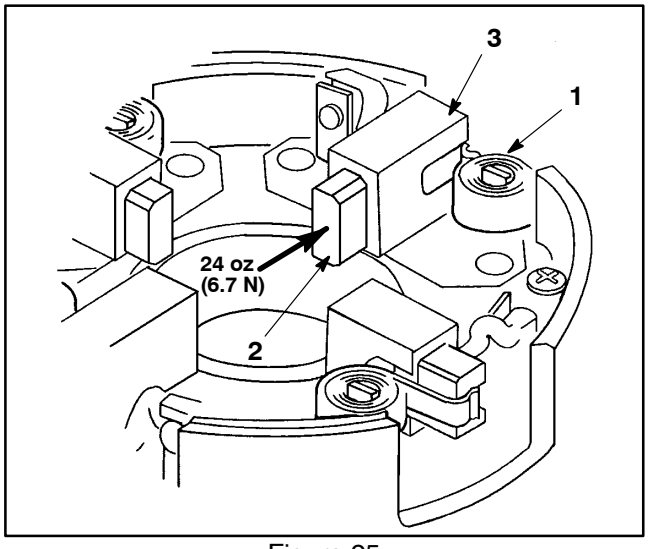

Figure 25

1. **Brush spring**
2. **Brush**
3. **Brush holder**

Armature and Field Coil Service (Fig. 22)

IMPORTANT: When removing the commutator end cover, make sure brushes do not contact the commutator. Damage to the brushes may result.

1. Remove brush covers from the commutator end cover. Lift brush springs from the notch at the end of the brushes while pulling the brushes out. Allow springs to hold brushes out from the center (Fig. 23).

2. Remove both through bolts and flat washers securing the commutator end cover to the yoke. Separate end cover from the commutator and yoke.

3. Separate front end cover from the armature shaft.

   A. Remove hex nut, spring washer, pulley, spacer and woodruff key from the armature shaft.

   B. Remove screws, lock washers, and flat washers securing the retainer to the end cover.

IMPORTANT: Use clean, dry, lint–free rags when cleaning the starter/generator. When using compressed air, air should be filtered and not exceed 15 PSI (1 Bar).

IMPORTANT: Remove bearings only if they are to be replaced. Use proper removal and installation tools.

4. Clean bearings using a clean cloth. Inspect bearings for damage. Replace both bearings if either bearing meets any of the following conditions:

   A. Bearings do not spin smoothly, are noisy when spinning, or have excessive end or axial play.

   B. The balls or rolling surfaces are pitted or worn.

   C. Bearings are rusted, worn, cracked, or show abnormal color due to overheating.

5. Clean and inspect armature. Replace armature if insulation is burned or charred, wires are broken, shaft is damaged or bent, armature core lamination is damaged, or solder is thrown.

IMPORTANT: Never use emery cloth on the commutator; short circuiting of the commutator bars may result. Never use oil or lubricants on the commutator or brushes.

6. Clean and inspect commutator.

   A. Remove carbon dust, dirt, and oil from the commutator.

   B. Lightly remove slight roughness, burning, or glazing of the commutator with 400 grit (or finer) sandpaper. Clean commutator after sanding.

   C. Replace armature and bearings if commutator bars are loose. Raised bars may be reworked (see Rework Starter/Generator).

7. Measure diameter of the commutator using a micrometer.

   A. Measure diameter at two points along the axis of the commutator and shaft. Measurements must also be 90º apart along the circumference of the commutator.

   B. If diameter is less than 1.575 inches (40 mm), replace armature and bearings.

8. Clean armature completely with clean cloth and/or air. **Do not use solvent.** Make sure slots between commutator bars are free of dust and metal particles.

9. Inspect field coils (Fig. 27).

   A. Replace field coils if insulation is blackened, charred, flaking, or cracked.

   B. Make sure poles are tight.

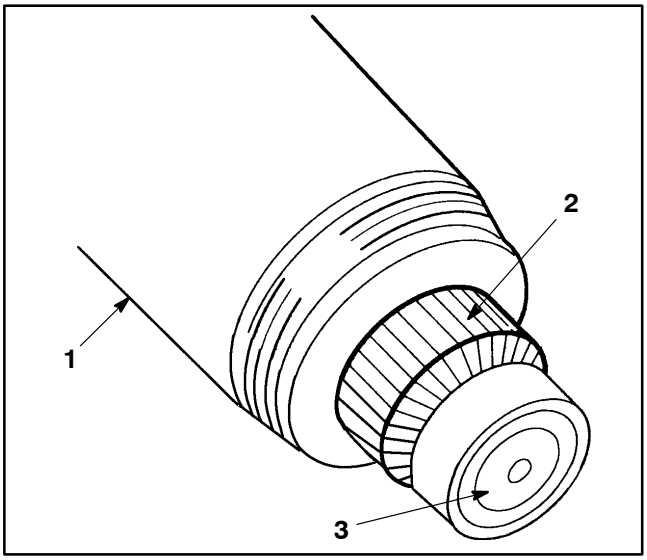

Figure 26

1. **Armature**
2. **Commutator**
3. **Armature shaft**

IMPORTANT: Do not remove field coils unless they are to be replaced.

10. To remove field coils (Fig. 27):

    A. Remove nuts from threaded terminal, and slide insulator and terminal out of yoke.

    B. Remove four pole piece screws and pole sets from the yoke. Remove field coils from the yoke.

11. Assemble starter/generator as follows:

    A. Position field coil into yoke. Make sure both insulators that look similar go into the slots marked F1 and F2. The different looking insulator goes into the slot marked DF. Seat insulators into slots (Fig. 27).

IMPORTANT: Make sure field coil terminal wire will not make contact with the armature.

    B. Install terminals through wire connectors and insulators. Secure flat washer, lock washer, and nut onto each terminal. Torque nuts from 43 to 52 in–lb (4.9 to 5.9 N–m) (Fig. 27).

    C. Position all four pole pieces into the yoke. Secure pole pieces with set screws. Torque screws to 9 ft–lb (12 N–m) (Fig. 27).

    D. Position bearing retainer onto the output shaft of the armature. Press new ball bearing onto the shaft being careful not to damage the retainer.

    E. Press new ball bearing onto the commutator end of the armature shaft.

    F. Position front end cover onto the output shaft. Secure bearing retainer to the end cover with flat washers, lock washers, and screws. Torque screws from 35 to 43 in–lb (4.0 to 4.9 N–m).

    G. Position armature carefully into the yoke. Make sure not to damage field coils. Align front end cover to the yoke with the locating pin.

IMPORTANT: When installing the commutator end cover, make sure brushes do not contact the commutator. Damage to the brushes may result.

    H. Lift brush springs from the notch at the end of the brushes while pulling the brushes out. Allow springs to hold brushes out from the center (Fig. 23).

    I. Position commutator end cover carefully to the commutator and yoke. Align end cover to the yoke with the locating pin.

    J. Secure both end covers to the yoke with both through bolts and flat washers. Torque bolts from 95.5 to 104 in–lbs (10.8 to 11.8 N–m).

    K. Slide brushes into holders. Secure brushes by positioning brush springs into the notch at the end of the brushes (Fig. 25).

    L. Install brush covers to the commutator end cover.

    M. Position spacer and woodruff key onto the shaft. Place pulley onto the shaft.

    N. Secure pulley to the shaft with spring washer and nut. Torque nut from 15 to 25 ft–lb (20 to 34 N–m).

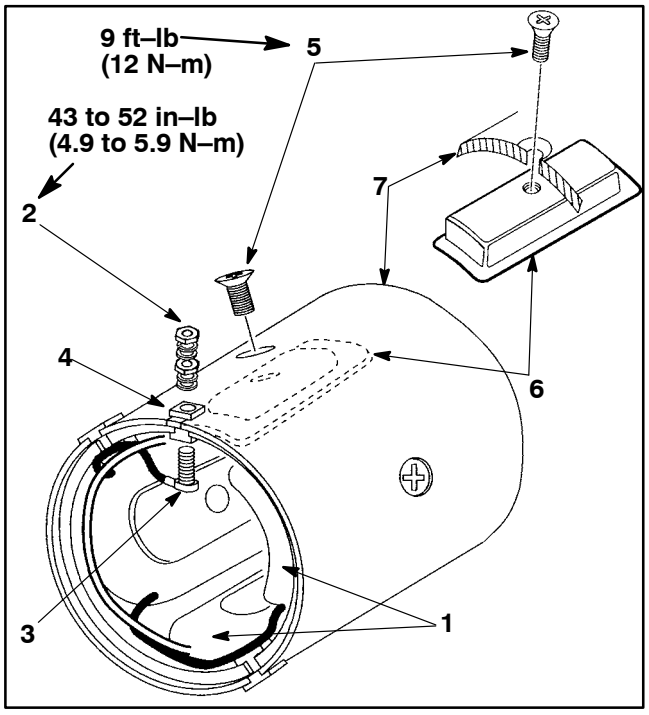

Figure 27

1. Field coils
2. Nut and washers
3. Threaded terminal
4. Insulator
5. Set screw
6. Pole piece
7. Yoke

Rework Starter/Generator (Fig. 22)

NOTE: Rework to the starter/generator must be performed by a properly trained technician using the correct tools and equipment for testing and reworking electrical motors and generators. It may be more economically feasible to replace the starter/generator than have it reworked.

Detail	Specification
Minimum commutator diameter	1.575 inches (40mm)
Commutator concentricity to the shaft	0.0003 inch (0.008 mm)
Commutator machining limit per cut	0.005 inch (0.127 mm)
Insulator depth between commutator bars	0.020 inch (0.5 mm)
Armature insulation resistance	0.2 Mohm at 500 VDC
Dielectric (insulation strength)	500 VDC for one minute with no insulation break down
Starter field coil resistance	2.38 to 2.44 ohms at 20°C (68°F)
Generator field coil resistance	0.041 ohm for F1 and 0.043 ohm for F2 at 20°C (68°F)

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 RECONNECT the positive (red) battery cable before reconnecting 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 strap in place to protect and secure the battery.

Electrolyte Specific Gravity
Fully charged: 1.265 corrected to 80°F (26.7°C)
Discharged: less than 1.240

Battery Specifications
BCI Group Size UI:
300 Amp Cranking Performance at 0° F (–17.8°C)
Reserve Capacity at 25 Amps and 80°F (26.7°C) is 34 Minutes

Removal (Fig. 28)

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

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

2. Raise bed and secure with prop rod. Unhook battery strap.

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

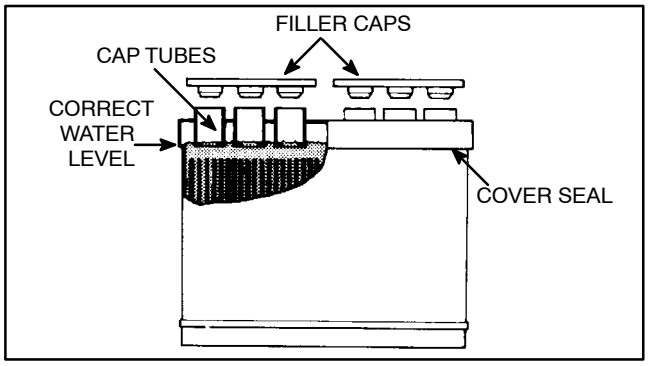

Figure 28

4. Make sure that filler caps are on tightly.

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

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.

Inspection, Maintenance, and Testing

1. Perform the following inspections and maintenance:

   A. Check for cracks caused by overly tight or loose hold–down clamp. Replace battery if cracked and leaking.

   B. 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.

C. Check for signs of wetness or leakage on the top of the battery which might indicate a loose or missing filler cap, overcharging, loose terminal post, or overfilling. Also, check the battery case for dirt and oil. Clean the battery with a solution of baking soda and water, then rinse it with clean water.

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

E. Check the electrolyte level in each cell. If the level is below the tops of the plates in any cell, fill all cells with **distilled** water 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.

2. Conduct a hydrometer test of the battery electrolyte.

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

A. Measure the specific gravity of each cell with a hydrometer. Draw electrolyte in and out of the hydrometer barrel prior to taking a reading to warm–up the hydrometer. At the same time take the temperature of the cell.

B. Temperature correct each cell reading. For each 10°F (5.5°C) above 80°F (26.7°C) add 0.004 to the specific gravity reading. For each 10°F (5.5°C) below 80°F (26.7°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 **Charging** or until all cells specific gravity is 1.225 or greater with the difference in specific gravity between the highest and lowest cell less than 0.050. If these charging conditions can not be met, replace the battery.

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

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

CAUTION

Follow the manufacturer's instructions when using a battery 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.

B. If the battery has been charged, apply a 150 amp load for 15 seconds to remove the surface charge. Use a battery load tester following the manufacturer's instructions.

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

D. Measure the temperature of the center cell.

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

F. Apply a test load of one half the Cranking Performance (see Battery Specifications) rating of the battery for 15 seconds.

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

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

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

Installation

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 base is clean and repainted if necessary.

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

4. Set battery on the battery base with its posts toward the rear of the vehicle. Push the positive cable (red) connector onto positive battery post. Do not hammer; this will damage the battery. Tighten bolt and wing nut.

5. Secure battery to the base with rubber strap.

6. 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 unit's electrical system should be tested and repaired.

7. Connect negative cable (black) connector to the negative battery post. Tighten bolt and wing nut.

8. Apply a light coat of grease on battery posts and cable connectors to reduce corrosion after connections are made.

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 shops.

CAUTION

Follow the 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 manufacturer's battery charger instructions** or the following table.

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

CAUTION

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

Charge 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 manufacturer's instructions.** Connect charger cables to the battery. Make sure a good connection is made.

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

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

6. Three hours prior to the end of the charging, measure the specific gravity of a battery cell once per hour. The battery is fully charged when the cells are gassing freely at a low charging rate and there is less than a 0.003 change in specific gravity for three consecutive readings.

Battery Storage

If the vehicle will be stored for more than 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 7

Chassis, Wheels, and Brakes

Table of Contents

Specifications

Item	Description
Workman 1100 front tire (20 x 10 – 8, 4 ply) pressure	6 to 12 PSI (0.41 to 0.83 bar)
Workman 1100 rear tire (22.5 x 10 – 8, 4 ply) pressure	8 to 22 PSI (0.55 to 1.52 bar)
Workman 2100 front tire (22.5 x 10 – 8, 4 ply) pressure	8 to 22 PSI (0.55 to 1.52 bar)
Workman 2100 rear tire (25 x 12 – 9, 4 ply) pressure	8 to 22 PSI (0.55 to 1.52 bar)
Workman 1110 and 2110 front tire (22 x 9.5 – 10, 4 ply) pressure	8 to 22 PSI (0.55 to 1.52 bar)
Workman 1110 and 2110 rear tire (24 x 12 – 10, 4 ply) pressure	8 to 22 PSI (0.55 to 1.52 bar)
Front wheel bolt torque (WM1100 and WM2100)	135 to 165 ft–lb (183 to 224 N–m)
Wheel lug nut torque	45 to 65 ft–lb (61 to 88 N–m)

Troubleshooting

Suspension and Steering

Problem	Possible Cause
Front end is noisy.	Front wheel bearings are loose or worn. Front wheel lug nuts are loose. Front end components are loose or worn. Steering gear is loose. Control arm bushings are worn.
Rear end is noisy.	Clutch or transaxle problem (see Chapter 5 – Drive Train). Rear wheel lug nuts are loose.
Excessive steering play.	Front wheel bearings are loose or worn. Front wheel lug nuts are loose. Steering linkage is loose or worn. Tie rod ends are worn. Steering gear is incorrectly adjusted.
Front end shimmies.	Front wheel bearings are loose or worn. Front wheel lug nuts are loose. Steering linkage is loose or worn. Tie rod ends are worn. Front wheel alignment (toe–in) is incorrect. Rubber shock insert in A–arm is worn.
Vehicle is unstable or wanders.	Tire pressure is low or uneven between tires. Front wheel bearings are loose. Wheel lug nuts are loose. Steering column bushings are worn. Rubber shock insert in A–arm is worn. Steering gear is incorrectly adjusted. Front wheel alignment (toe–in) is incorrect.

Suspension and Steering (continued)

Problem	Possible Cause
Steering is hard.	Steering linkage is binding or damaged. Tire pressure is low or uneven between tires. Steering gear is damaged or worn. Front wheel alignment (toe–in) is incorrect.
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 bent.

Brakes

Problem	Possible Cause
Brake pedal goes to the floor.	Brakes are incorrectly adjusted (Workman 1100 and 2100). Brake cable is loose or broken (Workman 1100 and 2100). Rear brake shoes are excessively worn. Front brake pads are excessively worn (Workman 1110 and 2110). Brake fluid level low (Workman 1110 and 2110). Brake fluid leak at hose, caliper, or wheel cylinder (Workman 1110 and 2110). Brake master cylinder faulty (Workman 1110 and 2110).
Brake pedal is spongy.	Brake drums are excessively worn or cracked (Workman 1100 and 2100). Brake shoes are not burnished. Brake cable is loose or broken (Workman 1100 and 2100). Brakes are incorrectly adjusted (Workman 1100 and 2100). Air in brake lines (Workman 1110 and 2110). Ground speed is too fast (see Chapter 5 – Drive Train). Engine has excessive run–on when accelerator pedal is released due to carburetor not fully closing (see Engine Chapter).
Brakes pull to either side.	Tire pressure is incorrect or uneven between tires. Brake linings are contaminated. Front wheel alignment (toe–in) is incorrect. Brake cable is loose or broken (Workman 1100 and 2100). Brake cable is binding (Workman 1100 and 2100). Brake shoes are distorted. Tires on same axle are unmatched.

Brakes (continued)

Problem	Possible Cause
Brakes squeal.	Brake lining is glazed or saturated. Shoe–to–shoe spring(s) is (are) weak or broken. Brake shoes are distorted. Anchor plate is bent. Brake drums and shoes are dusty. Brake drums are scored or out–of–round.
Brakes drag.	Parking brake is set. Brakes are incorrectly adjusted (Workman 1100 and 2100). Shoe–to–shoe spring(s) is (are) weak or broken. Brake pedal is binding. Brake cable is binding (Workman 1100 and 2100). Brake linings are saturated. Brake drums are bent or out–of–round.
Brake pedal is hard to push.	Incorrect brake lining material. Brake pedal linkage is binding. Brake cable is binding (Workman 1100 and 2100).
Wheels lock–up when braking.	Brake linings are contaminated. Brake linings are loose or damaged. Wheel or transaxle bearings are damaged. Shoe–to–shoe springs are weak. Brake drums are grooved in the contact face with brake shoes.
Brakes fade.	Brake drums are overheated. Brake linings are saturated.
Vehicle surges at slow speeds and chatters at fast speeds.	Brake drums are bent or out–of–round.
Brakes do not self adjust.	Adjuster bolt is seized (Workman 1100 and 2100). Adjuster lever does not engage star wheel (Workman 1100 and 2100).

Adjustments

Adjust Brakes (Workman 1100 and 2100, Serial Number Below 230000000)

CAUTION

Before and after adjusting the brakes, always check the brakes in a wide open area that is flat and free of other persons and obstructions.

1. While driving the machine, depress brake pedal. Both wheels should lock equally.

2. Park machine on a level surface. Make sure engine is off. Remove key from ignition switch.

WARNING

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

3. Jack front of the vehicle off the ground.

4. Tighten cable adjusting screw, located beneath the floor panel, until the cables are snug in the brake equalizer. Do not overtighten. There should be some free play in the brake pedal before the brake engages. The actuator levers on the brakes should fully return when the brake pedal is released.

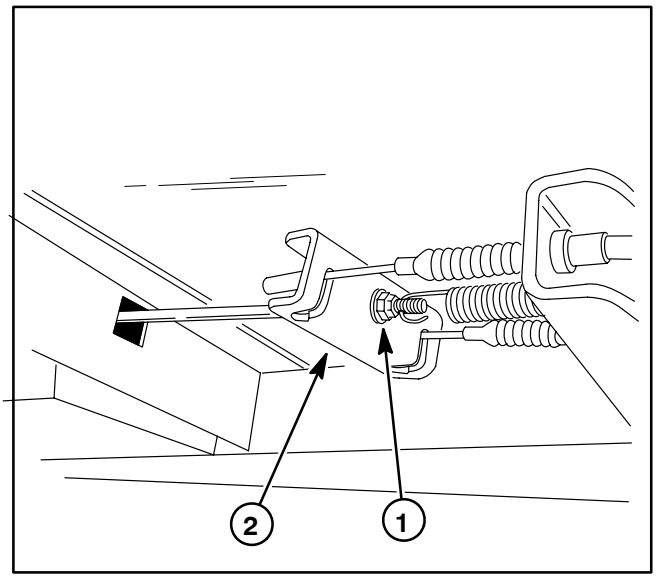

Figure 1

1. Cable adjusting screw **2. Brake equalizer**

Adjust Brakes (Workman 1100 and 2100, Serial Number Above 230000000)

The recommended brake pedal travel is from 1" to 1 1/2" (25.4 to 38.1 mm) with a 75 to 100 pound (34 to 45.4 kg) input force to the brake pedal.

Adjustment Procedure (Fig. 2)

1. Park vehicle on a level surface, turn on/off switch OFF and remove key from the on/off switch.

2. Depress brake pedal lightly (10 to 15 pound input force) until resistance is achieved. Check the gap between the brake lever and the brake lever stop to determine the distance the brake equalizer needs to be adjusted.

3. Remove the cotter pin and clevis pin that secure the brake rod clevis to the brake lever.

4. Disconnect the spring from the hole near the end of the brake rod.

5. Press the brake pedal down fully to raise the brake lever away from the brake rod clevis.

IMPORTANT: When adjusting the brake rod, do not overtighten! The self–adjusting mechanism on the brakes requires the brake levers to fully return. Overtightening of the brake rod will not allow self–adjusting of the brakes and will cause premature brake wear.

6. Thread the brake rod in or out of the brake equalizer as needed to remove the gap identified in Step 2.

7. Reinstall the spring into the hole in the brake rod.

NOTE: Use a pry bar placed between the accelerator pivot shaft and the brake equalizer to aid in installation of the clevis pin that secures the brake rod clevis to the brake lever.

8. Connect the brake rod clevis to the brake lever using the clevis pin and cotter pin removed previously.

9. Verify that brake pedal travel is from 1" to 1 1/2" (25.4 to 38.1 mm) with a 75 to 100 pound (34 to 45.4 kg) input force to the brake pedal.

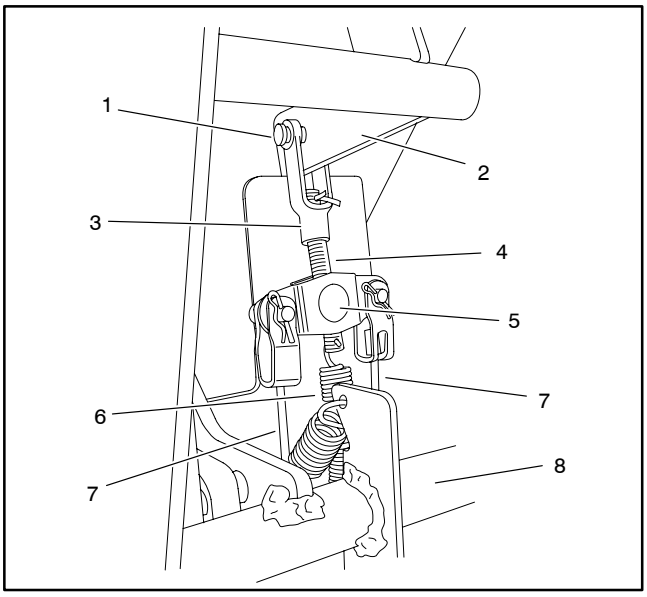

Figure 2

1. **Clevis pin/cotter pin**
2. **Brake lever**
3. **Brake rod clevis**
4. **Brake rod**
5. **Brake equalizer**
6. **Spring**
7. **Brake cable**
8. **Accelerator pedal shaft**

Adjust Parking Brake (Workman 1110 and 2110)

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 of 30–35 lb. (133–156 N) is required to actuate the lever.

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

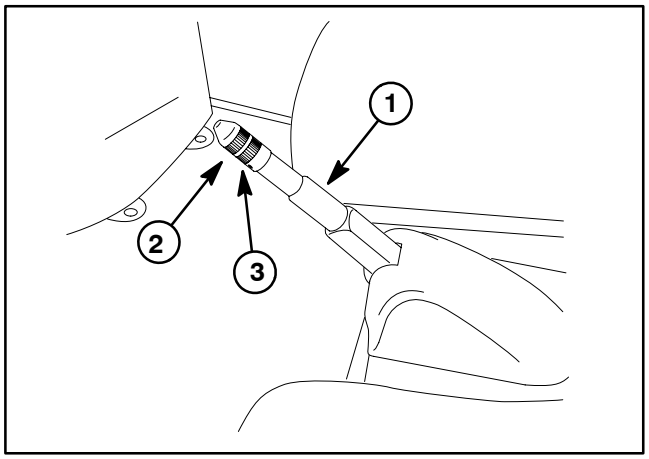

Figure 3

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

Check Front Ride Height

1. Adjust tire pressures to 12 psi before checking front ride height.

2. With a 175 to 225 lb (79 to 102 kg) operator in the driver's seat, drive vehicle back and forth a few times on a level surface to relax suspension.

3. Stop vehicle. With operator still in driver's seat and wheels pointed straight ahead, measure the front ride height. The front ride height is the distance from the bottom of the front towing tongue to the ground. Front ride height should be as follows:

   A. For the Workman 1100, front ride height should be from 7–1/2 to 8–1/4 inches (19.1 to 21 cm).

   B. For the Workman 1110, 2100 and 2110, front ride height should be from 8–3/4 to 9–1/2 inches (22.2 to 24.1 cm).

4. If the ride height is incorrect, adjustment needs to be made (see Adjust Front Ride Height).

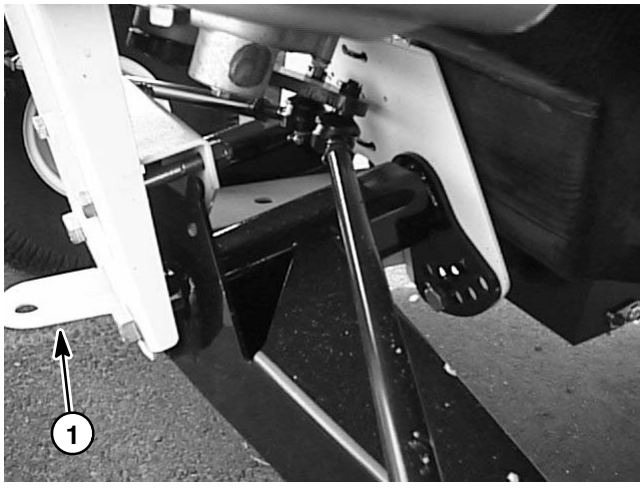

Figure 4

1. **Front towing tongue**

Adjust Front Ride Height

1. If front ride height adjustment is needed, 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. Jack front end of the vehicle off the ground.

3. Remove travel limiting bolt (Fig. 5).

4. Loosen centering bolts (front and rear) in the A–arm (Fig. 5).

5. Remove ride height adjustment bolt (Fig. 6).

NOTE: The A-arms suspension inserts are made with rubber and have different spring rates. Because of the different spring rates, the A-arms come adjusted from the factory based on that spring rate. Generally, the ride height adjustment bolts will be installed in hole number 2, 3, or 4 (Fig. 7) and it may be different from the left side (driver side) to the right side (passenger side). If the A-arms look like they are sagging, then they should be adjusted to the next higher number (Fig. 7). Each hole equals about 3/4 inch (19 mm) of adjustment at the wheel. Ride height should be adjusted to the next higher position when adding heavy attachments or carrying heavy loads often.

6. Rotate A–arm to the desired position and replace ride height adjustment bolt.

7. Tighten and torque ride height adjustment bolt from 135 to 165 ft-lb (183 to 224 N–m).

NOTE: To reinstall the travel limiting bolt, it may be necessary to lower the machine to the ground.

8. Replace travel limiting bolt (Fig. 5 and 6).

9. Tighten and torque centering bolts from 240 to 290 ft-lb (325 to 393 N–m).

10. Repeat procedure on opposite side of the vehicle.

11. Recheck front ride height.

12. After front ride height is adjusted, check and adjust front wheel toe–in (see Adjust Front Wheel Toe–in).

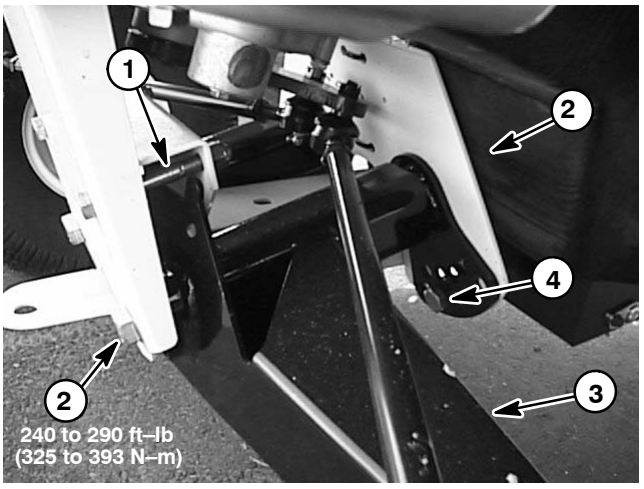

Figure 5

1. Travel limiting bolt
2. Centering bolt
3. A–arm
4. Ride height adj. bolt

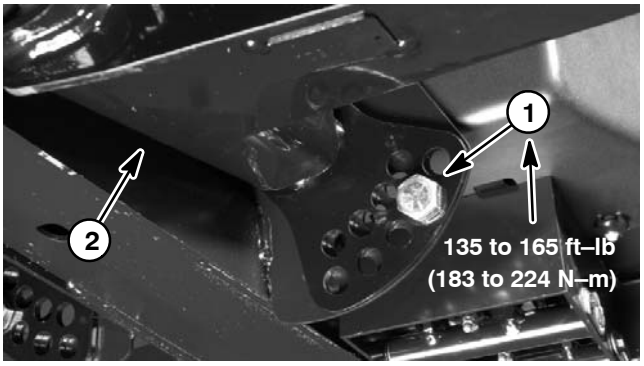

Figure 6

1. Ride height adj. bolt
2. A–arm

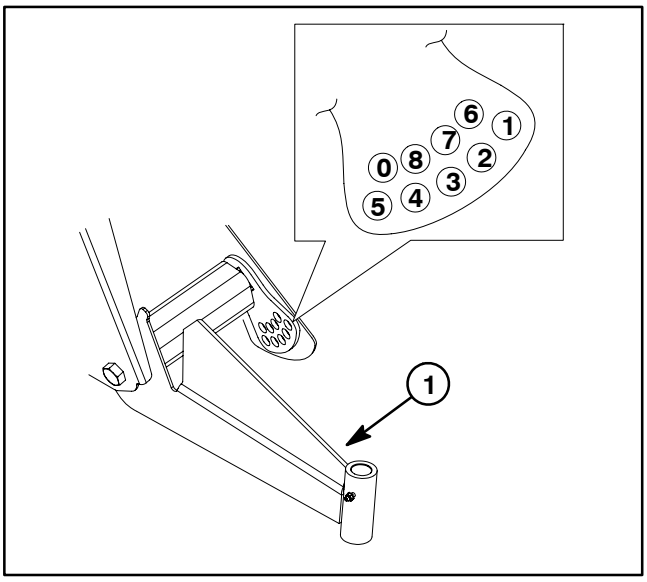

Figure 7

1. Front A–arm (LH shown)

Adjust Front Wheel Toe–in

Note: Adjust front wheel ride height before checking or adjusting front wheel toe–in.

1. Adjust tire pressures to 12 psi before checking front wheel toe–in.

2. With a 175 to 225 lb (79 to 102 kg) operator in the driver's seat, drive vehicle back and forth a few times on a level surface to relax suspension.

3. Stop vehicle. With operator still in driver's seat and wheels pointed straight ahead, measure the front wheel toe–in.

4. Measure distance between the front tires at axle height at both the front and rear of the tires. To obtain an accurate measurement at axle height, a universal alignment gauge (or equivalent) should be used (Fig. 8). Front wheel toe–in should be 1/8 to 5/8 inch (3 to 16 mm).

NOTE: If the vehicle will be run with medium to heavy loads most of the time, adjust the toe–in toward the maximum specification. Conversely, if light loads are carried, adjust toe–in toward the minimum specification.

5. If the front wheel toe–in is incorrect, adjust as follows:

   A. Loosen jam nuts at both ends of tie rods (Fig. 9).

   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.

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

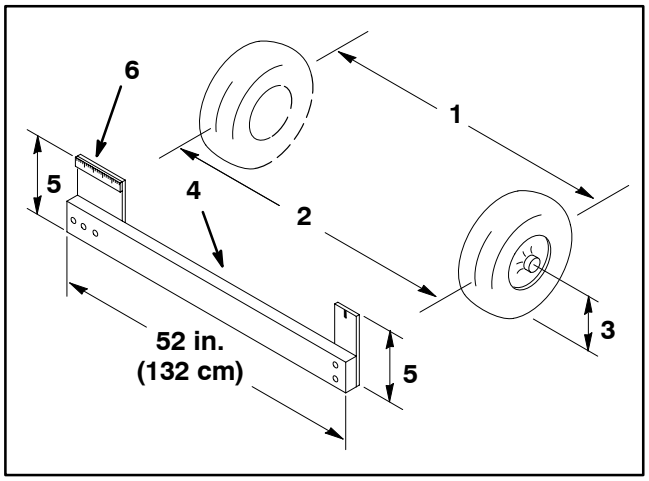

Figure 8

1. Tire center line (back)
2. Tire center line (front)
3. Axle center line
4. Alignment gauge
5. Axle center line height
6. Ruler

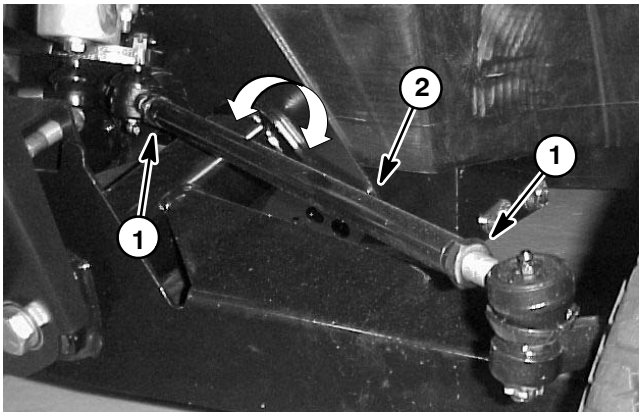

Figure 9

1. Jam nut
2. Tie rod

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Check Tire Pressure

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

The air pressure needed is determined by the payload carried. The **lower** the air pressure, the less the compaction and tire marks are minimized. Lower pressure should not be used for heavy payloads at high 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, so inspect tire condition after an accident.

Check wheels to ensure they are mounted securely. Torque wheel lug nuts to 45 to 65 ft-lb (61 to 88 N–m). The front wheel bolts on Workman 1100 and 2100 should be torqued from 135 to 165 ft-lb (183 to 224 N–m).

Upper Steering

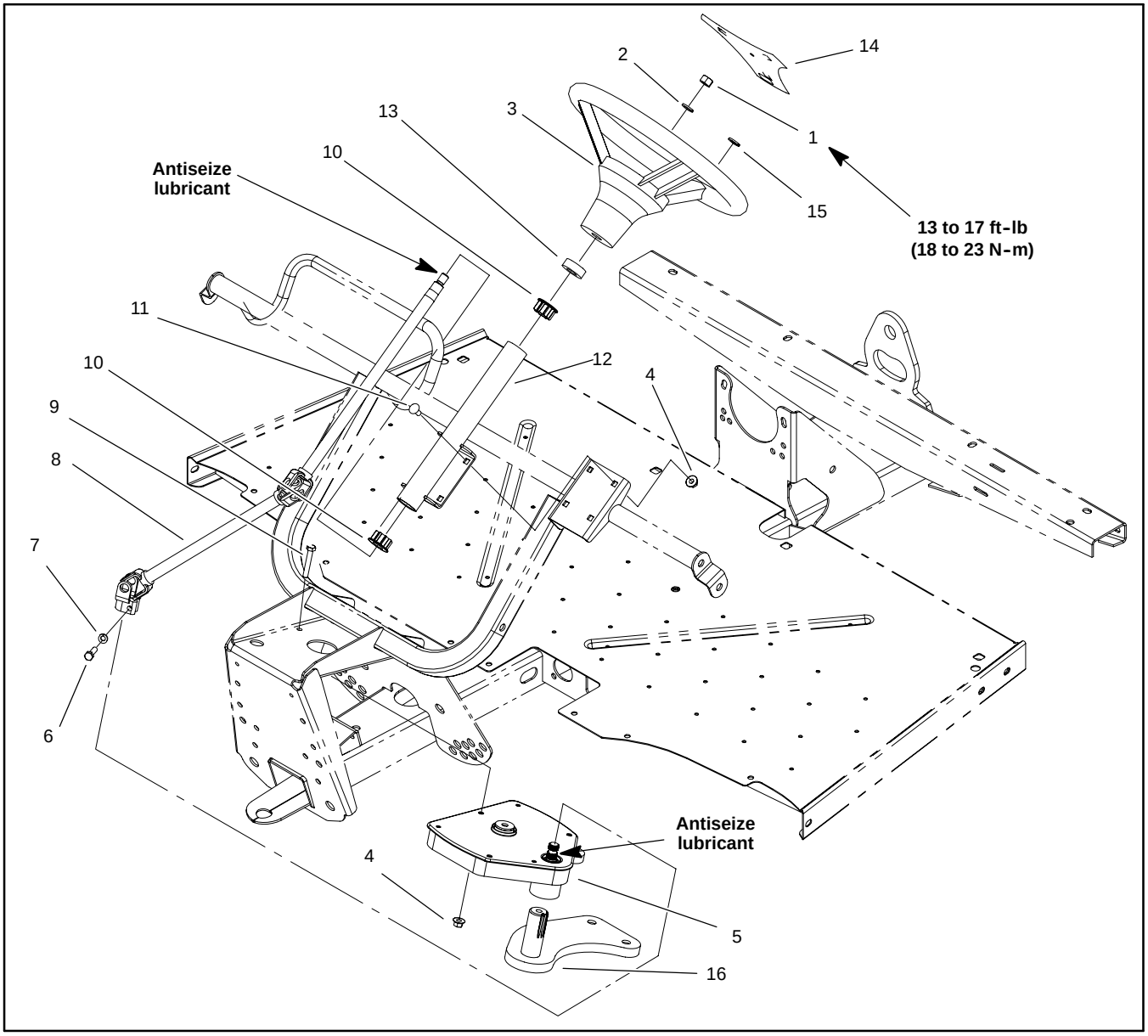

Figure 10

1. **Nut**
2. **Lock washer**
3. **Steering wheel**
4. **Flanged lock nut**
5. **Steering gearbox**
6. **Cap screw**
7. **Washer**
8. **Steering shaft**
9. **Cap screw**
10. **Upper steering bushing**
11. **Carriage screw**
12. **Steering column**
13. **Dust cover**
14. **Steering wheel cover**
15. **Decal**
16. **Pitman arm**

Removal

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

2. Remove front hood to gain access to the steering mechanism (see Front Hood Removal).

3. Remove steering wheel cover carefully from the steering wheel. Remove nut and lock washer securing the steering wheel to the steering shaft. Pull wheel from the shaft.

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

5. Remove four flange lock nuts and carriage screws securing the steering column to the mounting plate on the frame.

6. Remove dust cover 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).

8. Remove flange lock nuts and cap screws securing the steering gearbox to the tower plate on the front frame. Remove gearbox from the tower plate.

Installation

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 cap screws and flange lock nuts.

3. Insert steering shaft up through the steering column. Place dust cover onto the shaft.

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

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

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

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

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

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

8. Secure steering wheel to shaft with lock washer and nut. Torque nut from 13 to 17 ft–lb (18 to 23 N–m). Install steering wheel cover to wheel.

9. Install front hood to the frame and fenders (see Front Hood Installation).

10. Check front wheel alignment (see Adjust Front Wheel Toe–in).

Steering Gearbox

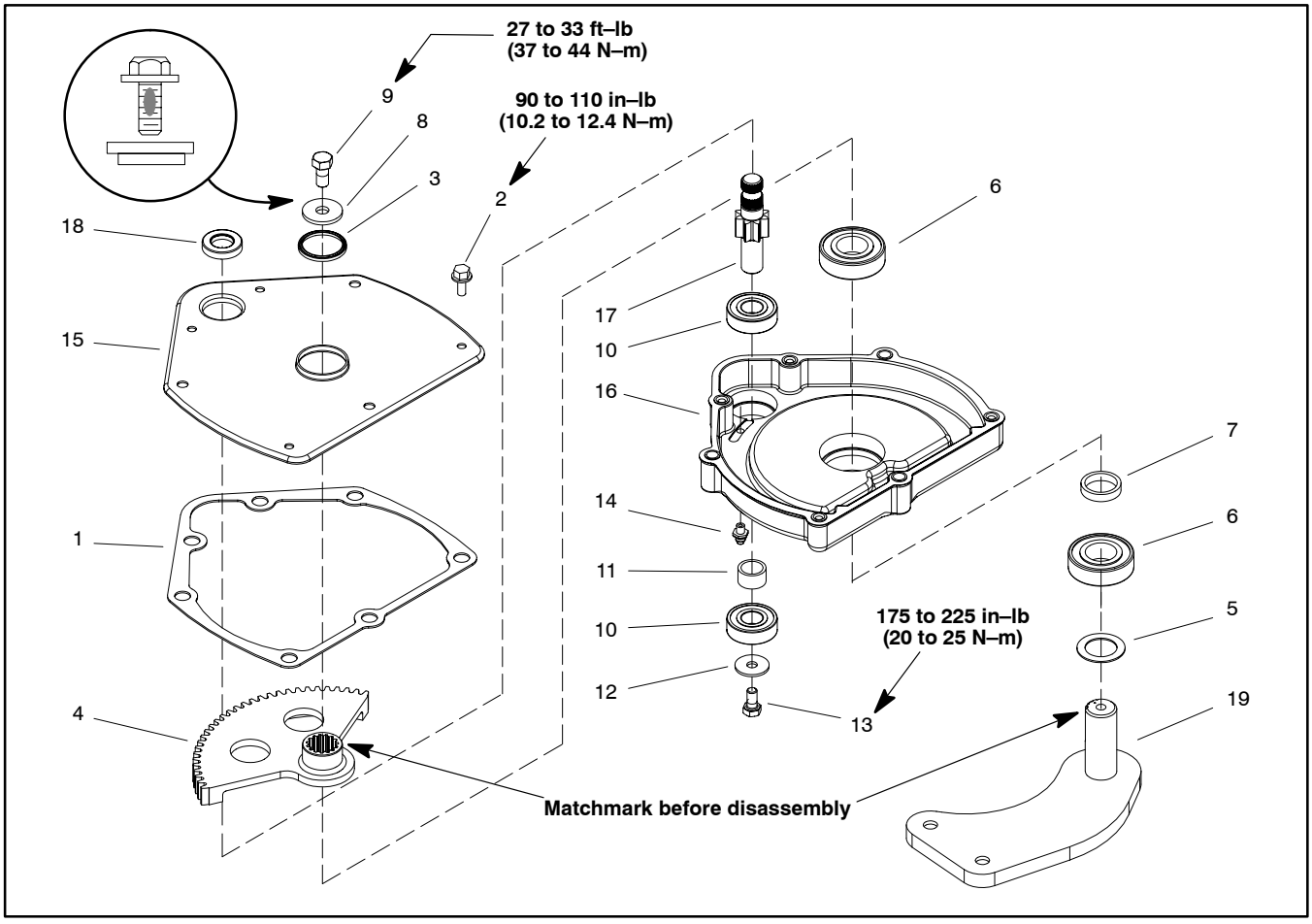

Figure 11

1. Gasket
2. Hex washer head screw
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. Cap screw
14. Lube fitting
15. Steering housing cover
16. Steering housing
17. Pinion gear
18. Oil seal
19. Pitman arm

Disassembly

IMPORTANT: Do not reuse flange head screw with patch lock after it has been removed.

1. Remove flange head screw with patch lock and stepped washer from Pitman arm. Discard flange head screw.

2. Remove cap screw and flat washer from pinion gear shaft.

3. Remove hex washer head screws 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 from the housing.

IMPORTANT: Matchmark pitman arm shaft and sector gear. Their position is critical during reassembly.

6. Separate Pitman arm from the sector gear 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

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 onto shaft of the Pitman arm. Insert shaft into steering housing.

IMPORTANT: The position of the Pitman arm and sector gear is critical during reassembly. If either or both of these parts is replaced, make sure their alignment matches the matchmark position of the original gear and arm.

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

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

5. Insert pinion gear into the small bearing in the steering housing.

6. Fill steering housing with number 2 general purpose grease. Make sure all gear teeth on the sector and pinion gears are covered.

7. Place gasket and steering housing cover onto the housing. Secure cover to housing with four hex washer head screws. Torque screws from 90 to 110 in–lb (10.2 to 12.4 N–m).

IMPORTANT: Flange head screw with patch lock should be replaced whenever it is removed.

8. Secure flange head screw with patch lock and step washer to the Pitman arm. Make sure to position step washer as in Figure 11. Torque screw from 27 to 33 ft–lb (37 to 44 N–m).

9. Secure cap screw and flat washer to the pinion gear shaft. Torque screw from 175 to 225 in–lb (20 to 25 N–m).

Lower Steering and Front Wheels (Workman 1100 and 2100)

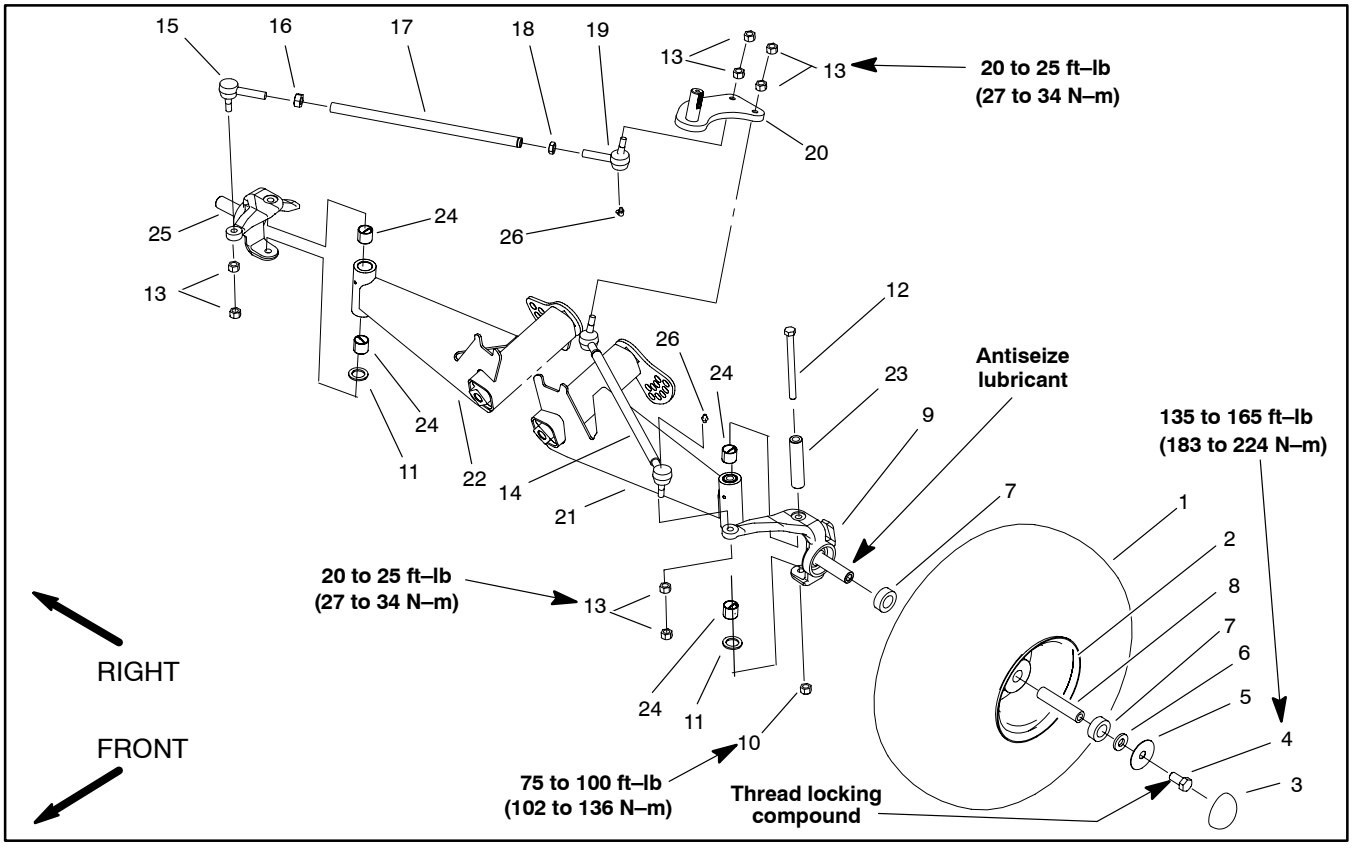

Figure 12

1. Tire
2. Front wheel
3. Plastic dust cap
4. Cap screw
5. Large flat washer
6. Flat washer
7. Bearing
8. Spacer
9. Spindle (LH)
10. Lock nut
11. Thrust washer
12. Cap screw (king pin)
13. Jam nuts
14. Tie rod assembly
15. Ball joint (RH thread)
16. Jam nut (RH thread)
17. Tie rod
18. Jam nut (LH thread)
19. Ball joint (LH thread)
20. Pitman arm
21. A–arm (LH)
22. A–arm (RH)
23. Kingpin sleeve
24. Bushing
25. Spindle (RH)
26. Grease fitting

NOTE: Both front wheels (2) have two bearings (7) and one spacer (8).

NOTE: Both tie rod assemblies (14) consist of the following parts: ball joints (15 and 19), jam nuts (16 and 18), and tie rod (17).

Removal

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 place blocks beneath the frame.

3. Remove tire and front wheel as follows:

   A. Remove plastic dust cap carefully from the wheel to prevent damage to the cap.

   B. Remove cap screw and washers securing the wheel to the spindle. Slide tire and wheel assembly from the spindle shaft.

4. Remove spindle as follows:

   A. Remove jam nuts securing tie rod ball joint to the spindle. Separate ball joint from the spindle. Remove tie rod from Pitman arm if necessary.

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

Installation

1. Install spindle as follows:

   A. Position king pin sleeve into the pivot hub of the A–arm. Spacer must extend through the bottom of the hub.

   B. Place thrust washer onto the bottom of the king pin sleeve. Then position spindle over the hub, king pin sleeve, and thrust washer.

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

   C. Secure spindle to A–arm hub with cap screw (king pin) and lock nut. Torque fasteners from 75 to 100 ft–lb (102 to 136 N–m).

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

   E. Torque first jam nut from 20 to 25 ft–lb (27 to 34 N–m) to secure ball joint to spindle and Pitman arm. Then torque second jam nut to the same value.

2. Install tire and front wheel as follows:

   A. Place antiseize lubricant on spindle shaft.

   B. Slide tire and wheel assembly onto the shaft with the valve stem facing out.

NOTE: Apply thread locking compound to the threads of the cap screw.

   C. Place large washer and then small washer onto the cap screw. Thread cap screw with washers into the spindle shaft.

   D. Torque cap screw from 135 to 165 ft–lb (183 to 224 N–m).

3. Lower machine to ground.

4. Align steering and toe–in (see Adjust Front Wheel Toe–in).

5. Lubricate tie rod ball joints and king pin (see Lubrication in Chapter 2 – Product Records and Maintenance).

Lower Steering and Front Wheels (Workman 1110 and 2110)

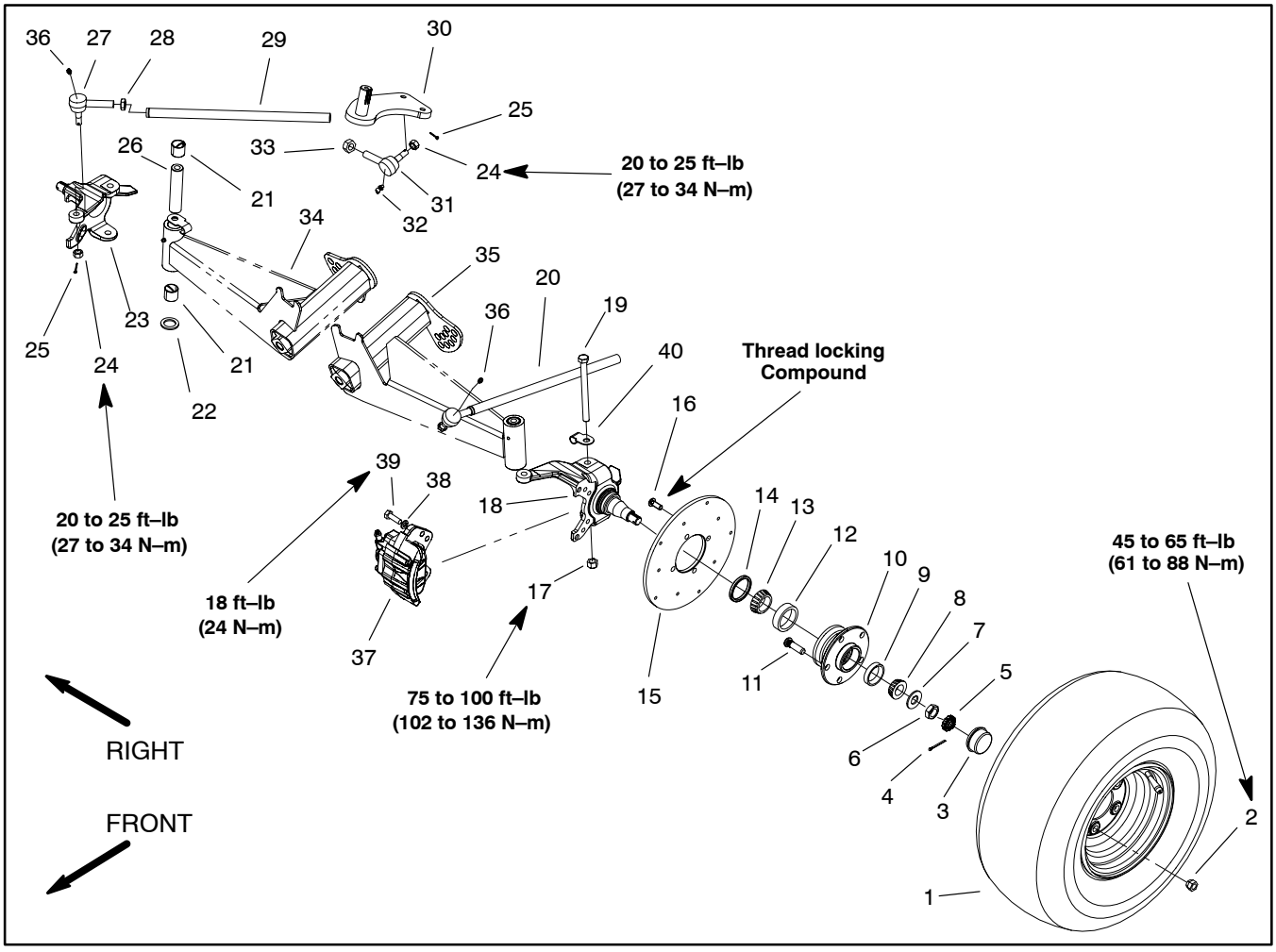

Figure 13

1. Wheel assembly
2. Lug nut
3. Dust cap
4. Cotter pin
5. Nut retainer
6. Jam nut
7. Tab washer
8. Bearing cone
9. Bearing cup
10. Wheel hub
11. Wheel stud
12. Bearing cup
13. Bearing cone
14. Seal
15. Brake rotor
16. Socket head screw
17. Lock nut
18. LH spindle
19. Cap screw
20. Tie rod assembly
21. Bushing
22. Thrust washer
23. RH spindle
24. Castle nut
25. Cotter pin
26. Kingpin sleeve
27. Ball joint (RH thread)
28. Jam nut (RH thread)
29. Tie rod tube
30. Pitman arm
31. Ball joint (LH thread)
32. Grease fitting
33. Jam nut (LH thread)
34. A–arm (RH)
35. A–arm (LH)
36. Grease fitting
37. Brake caliper (LH shown)
38. Lock washer
39. Cap screw
40. Brake hose bracket

NOTE: Both tie rod assemblies (20) consist of the following parts: ball joints (27 and 31), jam nuts (28 and 33), tie rod tube (29) and grease fittings (32 and 36).

Removal

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 place blocks beneath the frame.

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

4. Remove brake caliper from spindle (see Front Brake Caliper). 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 rotor from spindle.

8. Disassemble the wheel hub:

   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 four socket head screws and brake rotor from wheel hub.

9. Remove spindle:

   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 Pitman arm if necessary.

   B. Remove lock nut and cap screw (19) 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 bracket from top of A–arm. Remove kingpin sleeve from A–arm if necessary.

Installation

1. Install spindle as follows:

   A. Position king pin sleeve 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 position spindle over the hub, king pin sleeve, and thrust washer.

NOTE: Make sure cap screw (19) is inserted down through the spindle and A–arm hub.

   C. Install brake hose bracket onto cap screw (19).Secure spindle to A–arm hub with cap screw (19) and lock nut. Torque fasteners from 75 to 100 ft–lb (102 to 136 N–m).

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

   E. Torque castle nuts from 20 to 25 ft–lb (27 to 34 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.

2. Assemble wheel hub:

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

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

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

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

   D. If brake rotor was removed, apply thread locking compound to socket head screws and install rotor to hub.

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

4. 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.

5. Rotate the wheel by hand and re-tighten the jam nut from 15 to 20 in-lb (1.7 to 2.3 N–m).

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

7. Install brake caliper to spindle (see Front Brake Caliper).

8. Install wheel assembly with valve stem facing out. Torque lug nuts from 45 to 65 ft–lb (61 to 88 N–m).

9. Lower machine to ground.

10. Align steering and toe–in (see Adjust Front Wheel Toe–in).

11. Lubricate tie rod ball joints and king pin (see Lubrication in Chapter 2 – Product Records and Maintenance).

A–arm and Frame Pivot Yoke

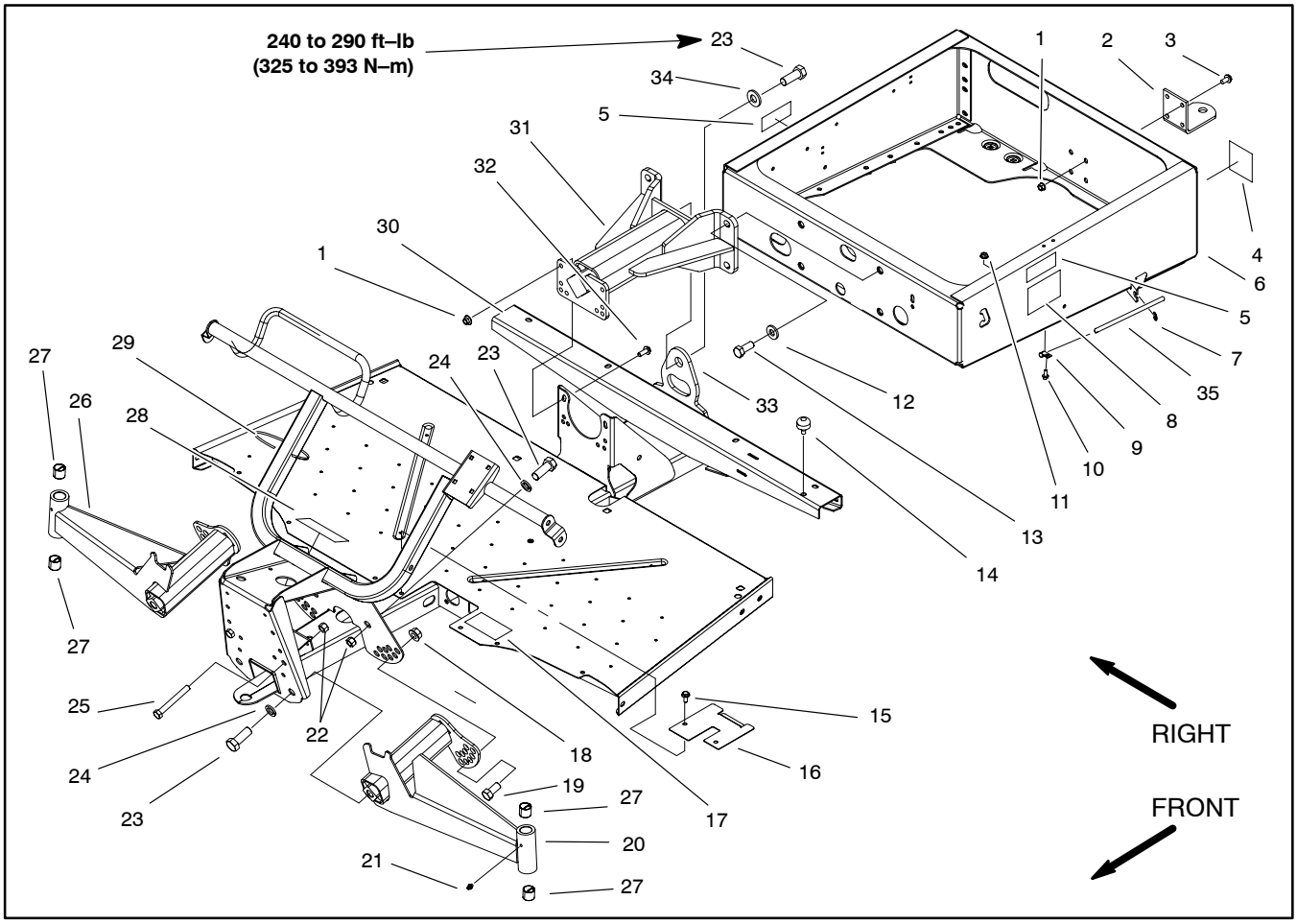

Figure 14

1. Flange lock nut
2. Light duty hitch
3. Flange head screw
4. Decal
5. Decal
6. Rear frame
7. Retaining ring
8. Decal
9. R–clamp
10. Flange head screw
11. Flange nut
12. Flat washer
13. Cap screw
14. Rubber bumper
15. Flange head screw
16. Pedal cover
17. Decal
18. Flange nut
19. Ride height adjustment bolt
20. A–arm (LH)
21. Grease fitting
22. Lock nut
23. Cap screw
24. Lock washer
25. Travel limiting bolt
26. A–arm (RH)
27. Bushing
28. Decal
29. Cable tie
30. Front frame
31. Pivot yoke
32. Flange head screw
33. Front frame tab
34. Hardened washer
35. Brake cable

A–arm Removal (Fig. 14 and 15)

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 blocks beneath the frame.

3. Remove front wheel and spindle from A–arm (see Lower Steering and Front Wheel Removal).

4. Remove lock nut (22) and travel limiting bolt (25) from the frame.

NOTE: To aid reassembly, note hole location of ride height adjustment bolt in A–arm.

5. Remove flanged nut (18) and ride height adjustment bolt (19) from the adjustment pattern of the A–arm and frame.

6. Remove both cap screws (23) and lock washers (24) securing the A–arm to the the frame. Lower A–arm from the frame.

A–arm Installation (Fig. 14 and 15)

1. Position A–arm to the frame. Secure A–arm to the frame with cap screws (23) and lock washers (24). Do not tighten cap screws.

2. Install spindle and front wheel to the A–arm (see Lower Steering and Front Wheel Installation).

NOTE: If A–arm is being replaced, look for number between 200 and 400 written next to the serial tag on the bottom of the replacement A–arm. This number should be used to identify the location of the ride height adjustment bolt (Fig. 16):

Number from 200 to 220 use hole 4.
Number from 225 to 285 use hole 3.
Number from 290 to 400 use hole 2.

3. Lower machine to ground.

4. Adjust front ride height (see Adjust Front Ride Height).

5. Align front wheel toe–in (see Adjust Front Wheel Toe–in).

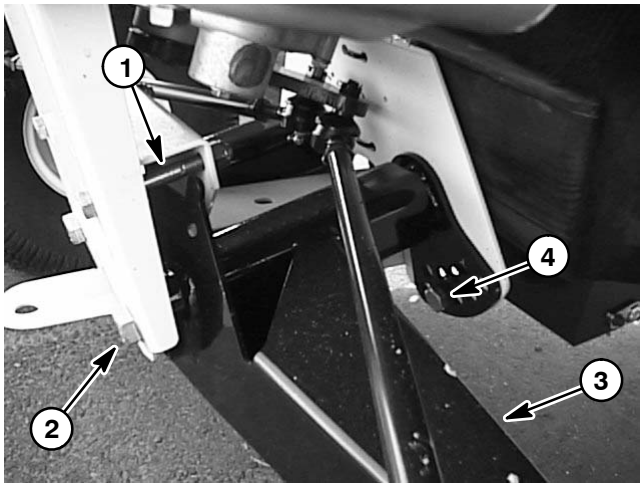

Figure 15

1. **Travel limiting bolt**
2. **Centering bolt**
3. **A–arm**
4. **Ride hgt. adj. bolt**

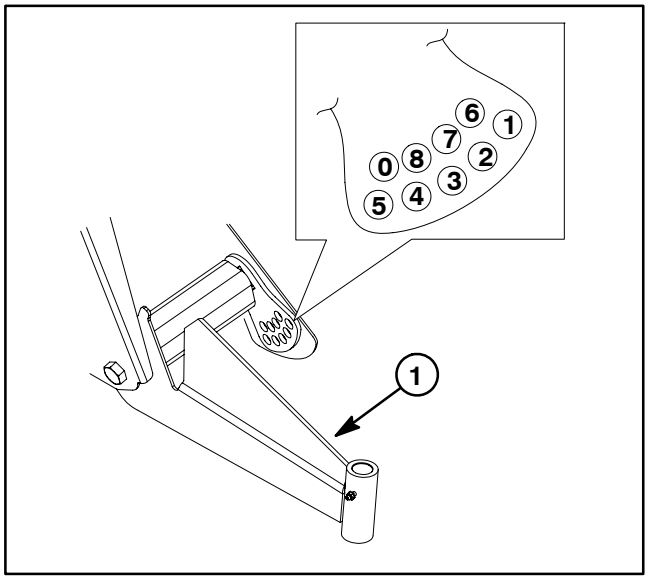

Figure 16

1. **Front A–arm (LH shown)**

Pivot Yoke Removal (Fig. 14 and 17)

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

2. Remove cargo bed from the rear frame (see Cargo Bed and Tailgate Removal).

3. Remove seat base from the front frame (see Seat Base Removal in Engine Chapter).

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. Remove four cap screws and flat washers securing the pivot yoke to the rear frame.

5. 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.

6. Remove four 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. 14 and 17)

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 flange head screws and flanged lock nuts. Tighten lower two fasteners first, then tighten upper two 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 (325 to 393 N–m).

3. Secure pivot yoke to the rear frame with four cap screws and flat washers.

4. Install seat base to the front frame (see Seat Base Installation in Engine Chapter).

5. Install cargo bed to the rear frame (see Cargo Bed and Tailgate Installation).

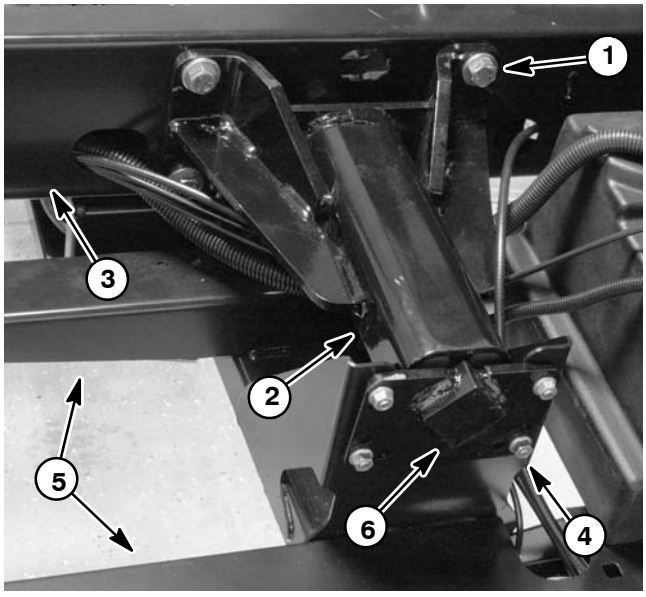

Figure 17

1. **Cap screw & flat washer**
2. **Pivot yoke**
3. **Rear frame**
4. **Flange lock nut**
5. **Front frame**
6. **Diamond pattern**

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Rear Wheels and Brakes (Workman 1100 and 2100)

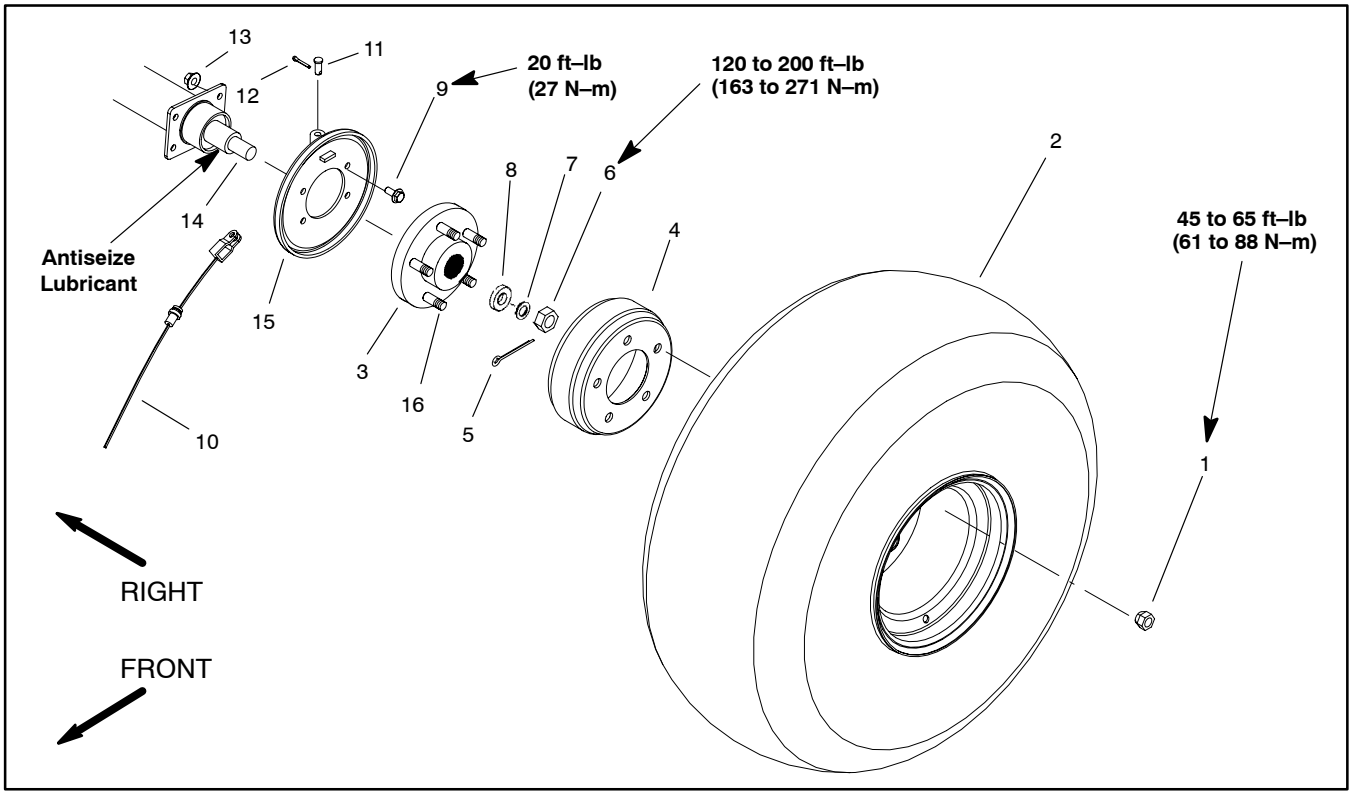

Figure 18

1. Lug nut
2. Wheel assembly
3. Wheel hub
4. Brake drum
5. Cotter pin
6. Castle nut
7. Lock washer
8. Spacer
9. Cap screw
10. Brake cable
11. Clevis pin
12. Cotter pin
13. Flange lock nut
14. Transaxle shaft
15. Brake assembly (LH shown)
16. Wheel stud

Removal (Fig. 18)

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 place blocks beneath the frame under the axle tube.

3. Remove five lug nuts, tire and wheel, and brake drum from the wheel hub.

4. Remove cotter pin from the castle nut and transaxle shaft. Remove castle nut, lock washer, and spacer from the shaft. Remove the wheel hub from the shaft.

NOTE: The brake assembly can be removed from the transaxle shaft for disassembly.

5. Remove brake assembly as follows:

   A. Remove cotter pin and clevis pin securing the cable bracket to the actuator lever (Fig. 19).

   B. Remove four cap screws and flanged lock nuts securing the anchor plate of the brake assembly to the transaxle. Remove brake assembly from the transaxle.

Installation (Fig. 18)

IMPORTANT: Brake actuator levers must be positioned above the transaxle mount. When positioned correctly, actuator lever will point toward the rear of the axle (Fig. 19).

1. If brake assembly was removed from axle, position brake assembly to the transaxle. Secure backing plate of the brake assembly to the transaxle with four cap screws and flanged lock nuts. Torque screws to 20 ft–lb (27 N–m).

2. Secure cable bracket to the actuator lever with clevis pin and cotter pin (Fig. 19).

IMPORTANT: Do not get antiseize lubricant onto brake shoes.

3. Apply light coat of antiseize lubricant to the transaxle shaft splines.

4. Secure wheel hub to the shaft with spacer, lock washer, and castle nut.

5. Torque castle nut to the shaft between 120 to 200 ft–lb (163 to 271 N–m) while aligning nut to hole in shaft. Install cotter pin.

6. Slide brake drum onto wheel hub.

7. Position wheel assembly to the machine with valve stem facing out and secure with five lug nuts. Torque lug nuts in a criss–cross pattern from 45 to 65 ft–lb (61 to 88 N–m).

8. Lower machine to ground.

CAUTION

After servicing the brakes, always check the brakes in a wide open, level area that is free of other persons and obstructions.

9. Check and adjust brakes (see Brake Adjustment).

Burnish Brake Shoes

Sintered metal linings may not provide maximum brake stopping distance after brake shoes are replaced. It is necessary to burnish new brake shoe linings.

IMPORTANT: Do not drive machine with the brakes applied. The brake shoe linings will overheat.

IMPORTANT: Do not allow the brakes to lock up. Allow brakes to cool between applications.

1. Drive machine while making 6 to 7 normal stops at about 200 ft (60 m) intervals while traveling at 10 to 15 mph (16 to 24 KPH).

2. Make several normal stops with the machine going in the reverse direction. This will self adjust the clearance between the brake shoe and drum.

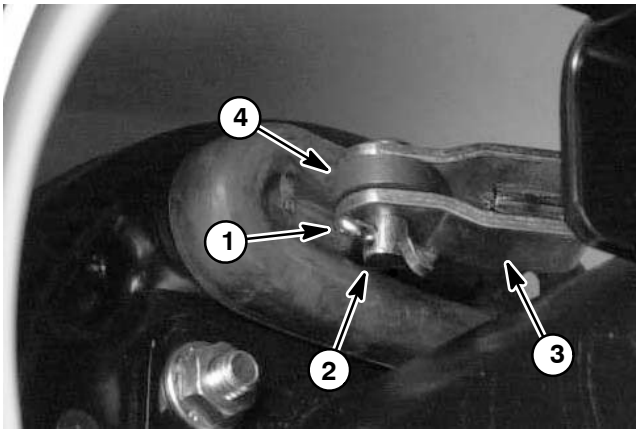

Figure 19

1. Cotter pin
2. Clevis pin
3. Brake cable bracket
4. Actuator lever

Rear Brake Service (Workman 1100 and 2100)

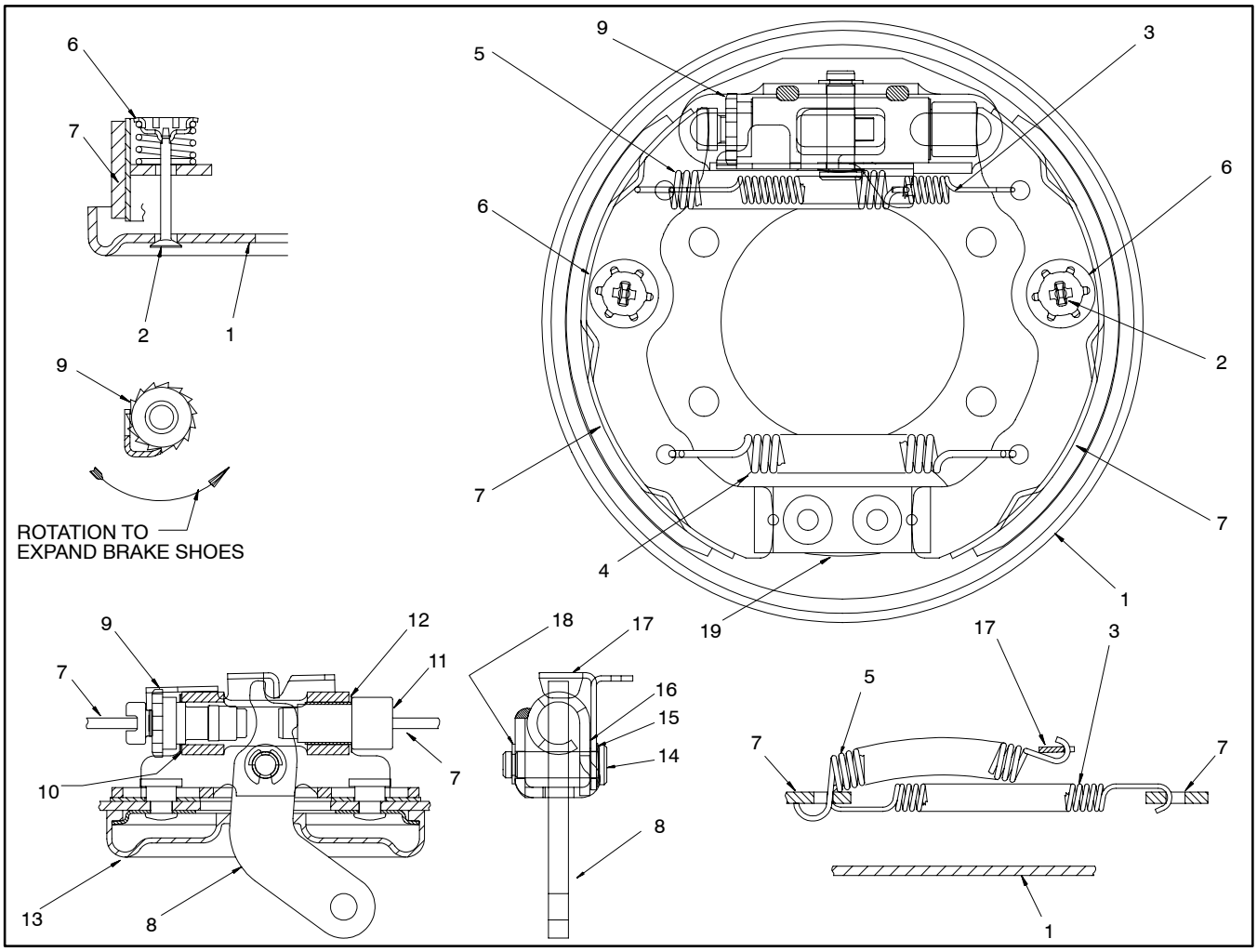

Figure 20

1. Backing plate
2. Hold down pin
3. Top shoe–to–shoe spring
4. Bottom shoe–to–shoe spring
5. Auto adjust spring
6. Shoe cup (spring loaded)
7. Brake shoe
8. Actuator lever
9. Adjusting screw
10. P TFE coated washer
11. Push rod
12. Shim washer
13. Protective boot
14. Pivot pin
15. Wave washer
16. Washer
17. Adjusting lever
18. Retaining clip
19. Anchor abutment

Disassembly (Fig. 20)

1. Remove auto adjust spring and shoe–to–shoe springs from brake shoes.

2. Remove hold down pins and shoe cups securing the brake shoes to the backing plate.

3. Remove brake shoes from backing plate.

Inspection (Fig. 18 and 20)

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 (16.05 cm), replace both brake drums.

B. Replace drums that are cracked, deeply grooved, tapered, significantly out–of–round, scored, excessively rusted, or heat spotted.

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, shoe–to–shoe springs, and auto adjust spring 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 and shoe cups 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 anchor abutment and rivets for deformation. Replace entire brake assembly if deformation or excessive rust is found.

5. Replace adjuster screw and shim washers if rusted, corroded, bent, or fatigued.

6. Replace brake cables if frayed, stretched, or kinked.

Assembly (Fig. 20)

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. Surfaces of the shoe web that contact the backing plate, push rod, and adjusting screw.

B. Six ledges on which the brake shoes rest.

C. Entire surfaces of PTFE coated washers.

D. Entire surface of pivot pin.

E. Slot in push rod that contacts actuator lever.

F. Surfaces of adjusting lever that contact wave washer, washer, and pivot pin.

G. Surfaces of the actuator bracket that contact the star wheel of the adjusting screw.

2. Position brake shoes to backing plate. Secure shoes to plate with shoe cups and hold down pins.

3. Secure brake shoes with shoe–to–shoe springs and auto adjust spring.

Parking Brake (Workman 1110 and 2110)

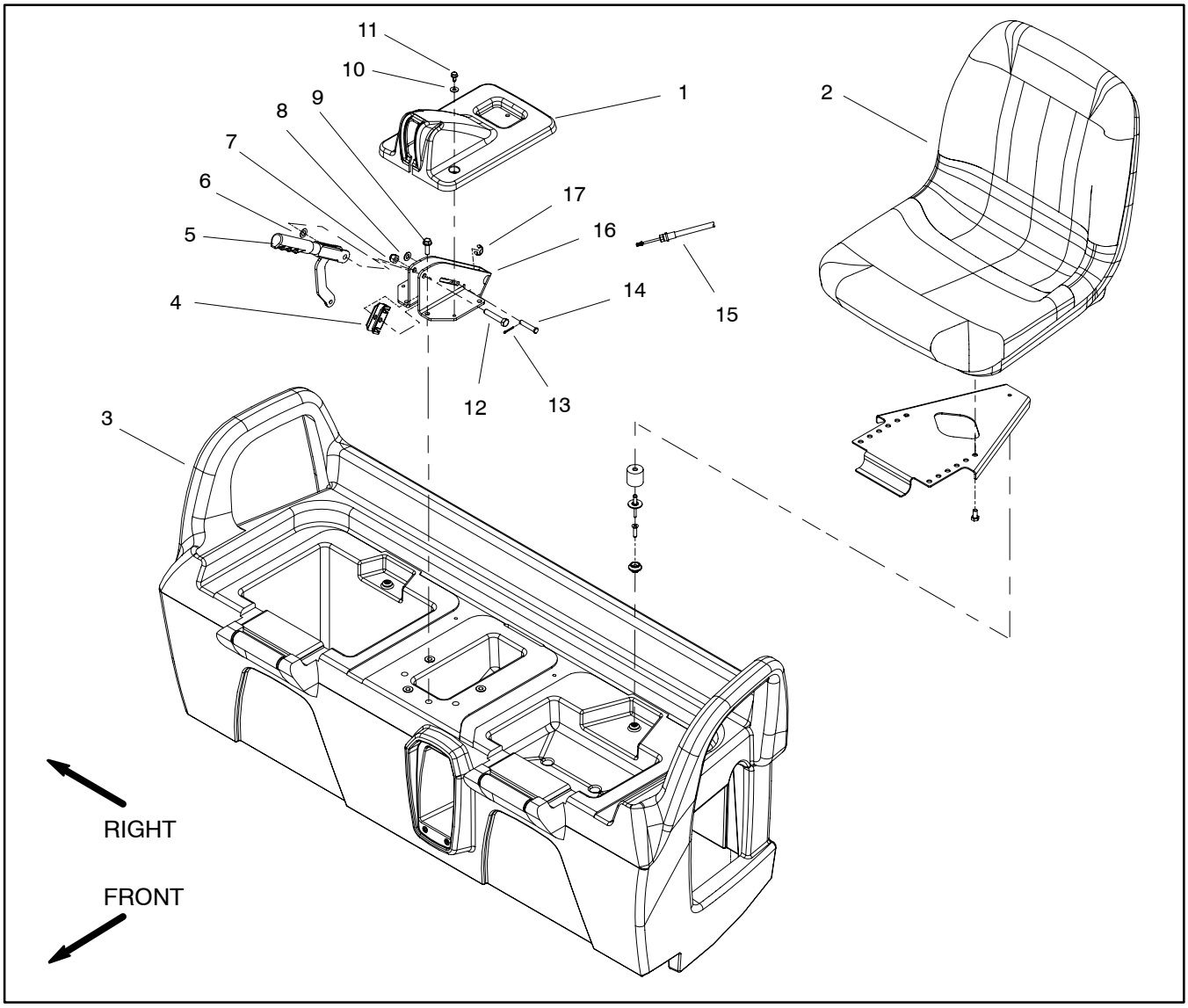

Figure 21

1. Parking brake cover
2. Operator seat
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. 21)

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 brake cables from rear of machine:

   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 frame.

   C. Remove screw and flange nut that secure each R–clamp to rear frame.

3. Note routing of brake cables for assembly purposes.

4. Remove parking brake cover from seat base.

5. Remove four (4) flange head screws that secure parking brake support to seat base.

6. Carefully remove parking brake support and brake cables from machine. Take care to not damage brake cables while removing them from seat base opening.

7. Remove brake cables from parking brake support and cable equalizer bracket using Figure 21 as a guide.

Assembly (Fig. 21)

1. Secure brake cables to parking brake support and cable equalizer bracket using Figure 21 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 brake cables to rear of machine:

   A. Secure each R–clamp to rear frame with screw and flange nut.

   B. Secure each brake cable to frame with retaining ring.

   C. Secure each brake cable end to brake lever with clevis pin and cotter pin.

6. Check parking brake operation and adjust if necessary (see Adjust Parking Brake (Workman 1110 and 2110) in the Adjustments section).

Rear Wheels and Brakes (Workman 1110 and 2110)

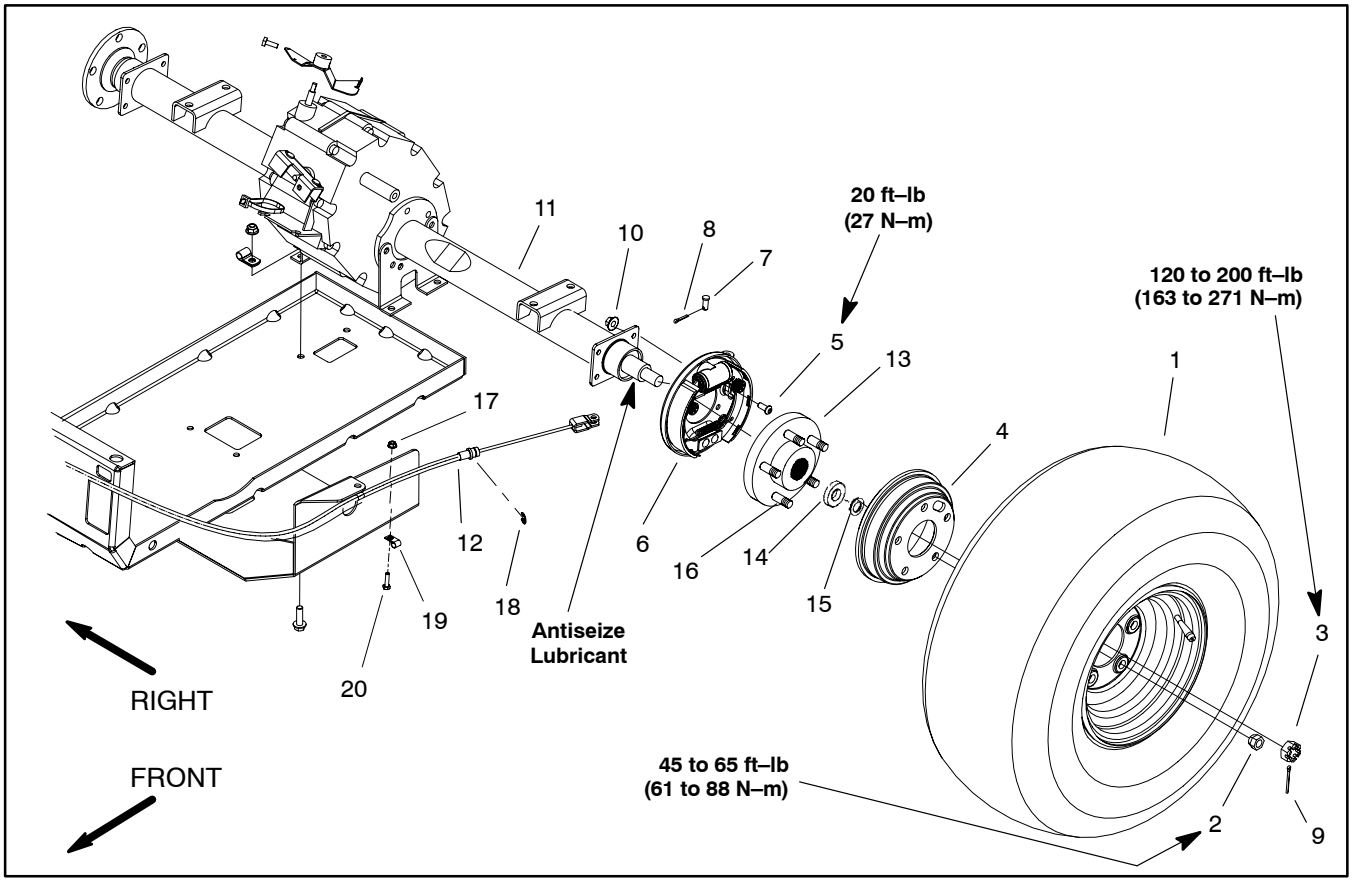

Figure 22

1. **Wheel assembly**
2. **Lug nut**
3. **Castle nut**
4. **Brake drum**
5. **Socket head screw**
6. **Brake assembly (LH shown)**
7. **Clevis pin**
8. **Cotter pin**
9. **Cotter pin**
10. **Flange lock nut**
11. **Transaxle**
12. **Parking brake cable**
13. **Wheel hub**
14. **Washer**
15. **Spring washer**
16. **Wheel stud**
17. **Flange nut**
18. **Retaining ring**
19. **R–clamp**
20. **Cap screw**

Removal (Fig. 22)

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 place blocks beneath the frame under the axle tube.

3. Remove five 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. Loosen and disconnect brake line from wheel cylinder. Plug brake line and position it away from brake assembly.

   C. Remove four socket head screws and flange lock nuts that secure the brake assembly to the transaxle.

   D. Remove brake assembly from the transaxle.

Installation (Fig. 22)

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 socket head screws and flanged lock nuts. Torque screws to 20 ft–lb (27 N–m).

2. Secure parking brake cable to the brake lever with clevis pin and cotter pin.

IMPORTANT: Do not get antiseize lubricant onto brake shoes.

3. Apply light coat of antiseize lubricant to the transaxle shaft splines.

4. Secure wheel hub to the shaft with washer, spring washer, and castle nut.

5. Torque castle nut from 120 to 200 ft–lb (163 to 271 N–m) while aligning nut to hole in transaxle shaft.

6. Secure castle nut to shaft with cotter pin.

7. Slide brake drum onto wheel hub.

8. Position wheel assembly to the machine with valve stem facing out and secure with five lug nuts. Torque lug nuts in a criss–cross pattern from 45 to 65 ft–lb (61 to 88 N–m).

9. Lower machine to ground.

10. Check and adjust parking brake (see Parking Brake Adjustment).

11. Bleed brakes (see Bleed Brake System).

CAUTION

After servicing the brakes, always check the brakes in a wide open, level area that is free of other persons and obstructions.

12. Check brake operation.

Burnish Brake Shoes

Sintered metal linings may not provide maximum brake stopping distance after brake shoes are replaced. It is necessary to burnish new brake shoe linings.

IMPORTANT: Do not drive machine with the brakes applied. The brake shoe linings will overheat.

IMPORTANT: Do not allow the brakes to lock up. Allow brakes to cool between applications.

1. Drive machine while making 6 to 7 normal stops at about 200 ft (60 m) intervals while traveling at 10 to 15 mph (16 to 24 KPH).

Rear Brake Service (Workman 1110 and 2110)

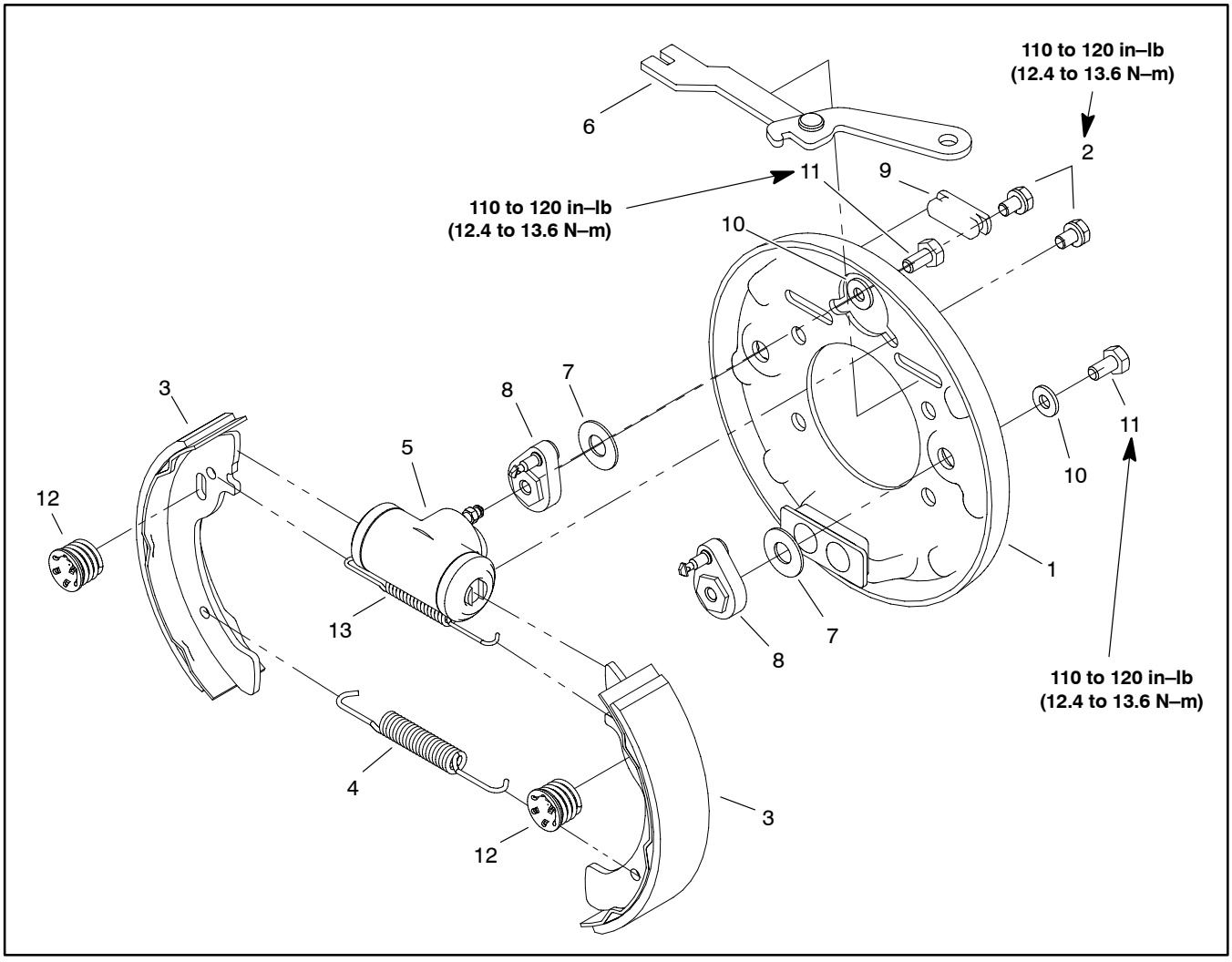

Figure 23

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. 23)

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 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. 23)

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 (16.05 cm), 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. 23)

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 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 (Workman 1110 and 2110)

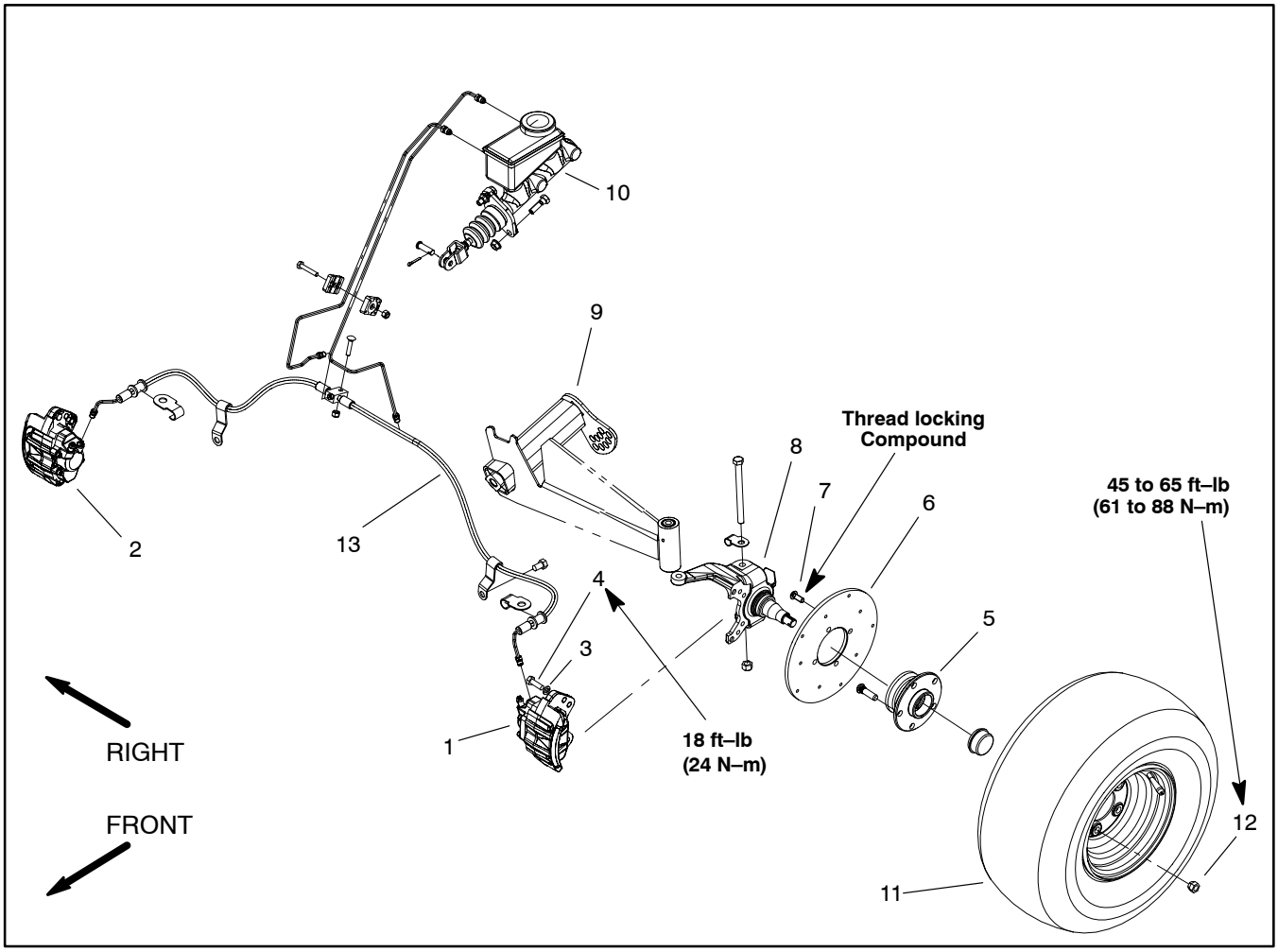

Figure 24

1. LH brake caliper
2. RH brake caliper
3. Lock washer (2 per caliper used)
4. Cap screw (2 per caliper used)
5. Wheel hub assembly
6. Brake rotor
7. Socket head screw (4 per rotor used)
8. Spindle (LH shown)
9. A–arm (LH shown)
10. Brake master cylinder
11. Wheel assembly
12. Lug nut
13. Brake hose

Removal

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 blocks beneath the frame.

3. Remove front wheel from machine (see Lower Steering and Front Wheel Removal).

4. Clean hydraulic brake line area of brake caliper to prevent contamination. Loosen and disconnect brake line from caliper. Plug brake line and position it away from caliper.

5. Remove two cap screws and lock washers that secure the brake caliper to the spindle.

6. Slide brake caliper from brake rotor and remove caliper from machine.

Installation

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 cap screws and lock washers. Torque screws 18 ft–lb (24 N–m).

3. Install brake hose to caliper.

4. Install front wheel assembly. Torque lug nuts from 45 to 65 ft–lb (61 to 88 N–m).

5. Lower machine to ground.

6. Bleed brakes (see Bleed Brake System).

CAUTION

After servicing the brakes, always check the brakes in a wide open, level area that is free of other persons and obstructions.

7. Check brake operation.

Front Brake Caliper Service (Workman 1110 and 2110) (Serial Number Below 240000000)

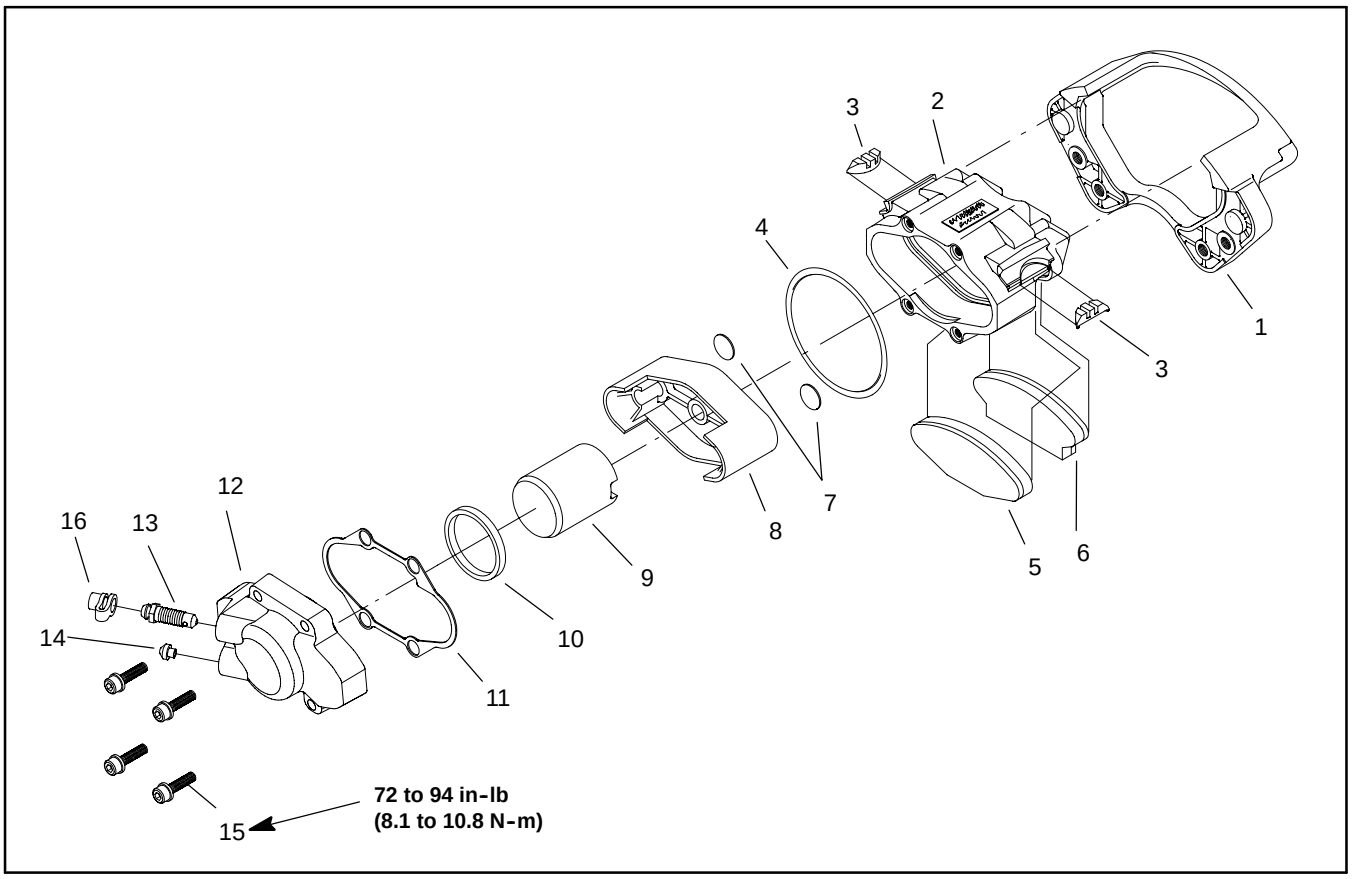

Figure 25

1. **Caliper bracket**
2. **Caliper housing**
3. **Rubber spring**
4. **O-ring**
5. **Inner brake pad**
6. **Outer brake pad**
7. **Piston plug**
8. **Oval piston**
9. **Round piston**
10. **Square seal**
11. **Gasket**
12. **Cover (LH shown)**
13. **Bleeder screw**
14. **Seat insert**
15. **Cover screw (4 used)**
16. **Cap**

Disassembly (Fig. 25)

1. Slide caliper from bracket rails being careful not to damage rubber springs.

2. Remove inner and outer brake pads from housing.

3. Remove four cover screws and separate cover from caliper housing. Remove gasket from between cover and housing.

4. Remove oval piston and o-ring from housing. Remove round piston and square seal from cover.

IMPORTANT:The seat insert is pressed into the caliper cover and should not be removed.

5. If necessary, remove rubber springs from housing and piston plugs from oval piston.

Inspection

1. Clean all metal parts with isopropyl alcohol, then clean out and dry grooves and passageways with compressed air. Make sure components are thoroughly clean.

2. Check piston bore and pistons for damage or excessive wear. Replace caliper parts as required.

3. Replace pads when pad thickness is less than .250 in (6.35 mm).

Assembly (Fig. 25)

1. Coat round piston with a small amount of silicone grease and coat square seal with clean brake fluid.

2. Install square seal and round piston into cover.

3. Insert o−ring into bore of caliper housing.

4. Coat housing bore with a small amount of silicone grease. Insert oval piston into housing with logo on piston face orientated to the rubber spring side of the housing.

5. Rotate round piston so the piston slot will mate with oval piston boss.

6. Position gasket and cover to housing. Secure cover to housing with four cover screws. Torque screws from 72 to 94 in−lb (8.1 to 10.8 N−m).

7. If removed, press piston plugs into oval piston and place rubber springs to housing.

8. Apply light coat of grease to rubber springs.

9. Place outer and inner brake pads to caliper assembly.

10. Push caliper on to bracket rails being careful not to damage rubber springs.

Front Brake Caliper Service (Workman 1110 and 2110) (Serial Number Above 240000000)

Disassembly (Fig. 26)

1. If caliper is equipped with anti−rattle clip, remove clip from caliper, pins and brake pads.

2. Remove pins from caliper by prying with a flat blade screwdriver through loop in pins.

3. Slide brake pads from caliper. For assembly purposes, note orientation of inner and outer pads as the pads are not the same.

4. Replace the brake pads if the friction material is worn to less than 1/32” (0.8 mm).

Assembly (Fig. 26)

1. 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 into caliper. Make sure that lining material on pads is toward brake rotor position.

3. Secure pads into caliper with two (2) pins. Make sure that pins snap into caliper slots.

4. If caliper is equipped with anti−rattle clip, install clip to caliper, pins and brake pads.

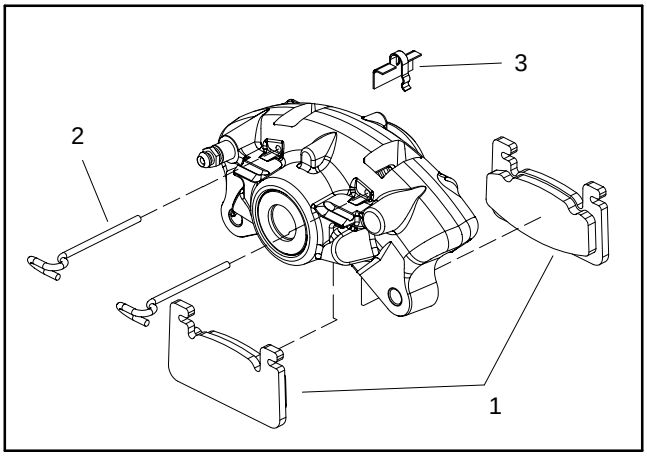

Figure 26

1. **Brake pad**
2. **Pin (2 used)**
3. **Clip (if equipped)**

Brake Master Cylinder (Workman 1110 and 2110)

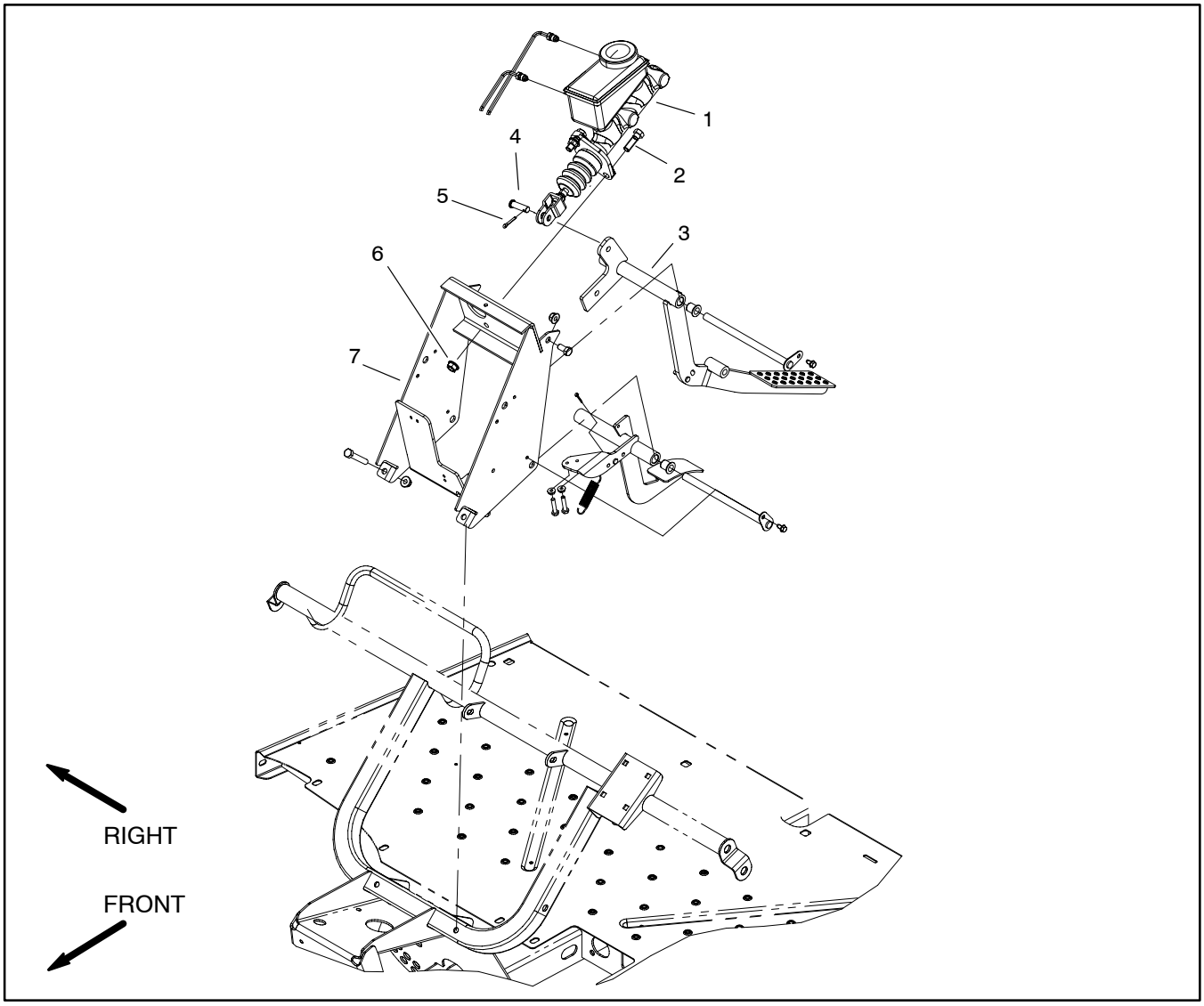

Figure 26

1. **Master cylinder**
2. **Cap screw**
3. **Brake pedal**
4. **Clevis pin**
5. **Cotter pin**
6. **Flange head nut**
7. **Pedal frame**

Removal

1. Remove front hood from machine.

2. Remove cotter pin from the clevis pin that connects master cylinder to brake pedal.

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 flange head nuts from cap screws that secure master cylinder to pedal frame.

5. Pull master cylinder from machine.

Installation

1. Position master cylinder to pedal frame and secure with 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. Install front hood to machine.

5. Bleed brakes (see Bleed Brake System). Check brake operation.

Brake Master Cylinder Service (Workman 1110 and 2110)

Disassembly (Fig. 27)

1. Remove reservoir and flange seal. Push in on the push rod so the stop pin can be removed.

2. Disconnect lower end of the dust cover from the housing.

3. Push in on the push rod and remove circlip, then remove push rod with dust cover and clevis. Remove retainer washer.

4. Remove primary piston assembly and secondary piston assembly from cylinder housing.

Inspection

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. 27)

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.

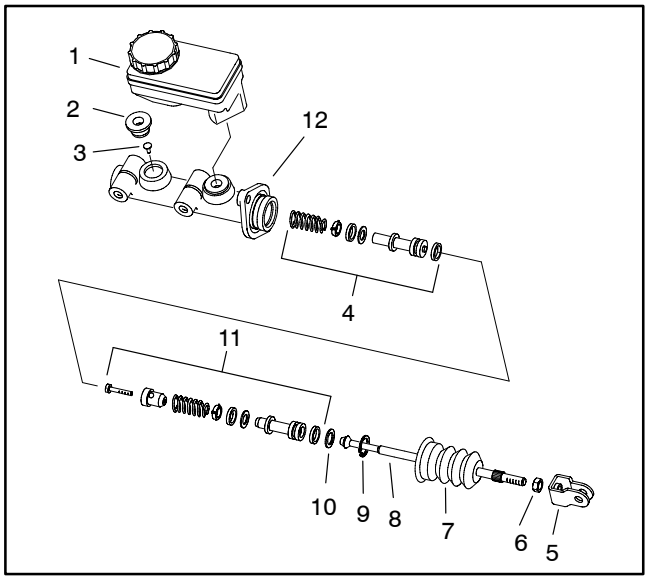

Figure 27

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**

Hydraulic Brake System (Workman 1110 and 2110)

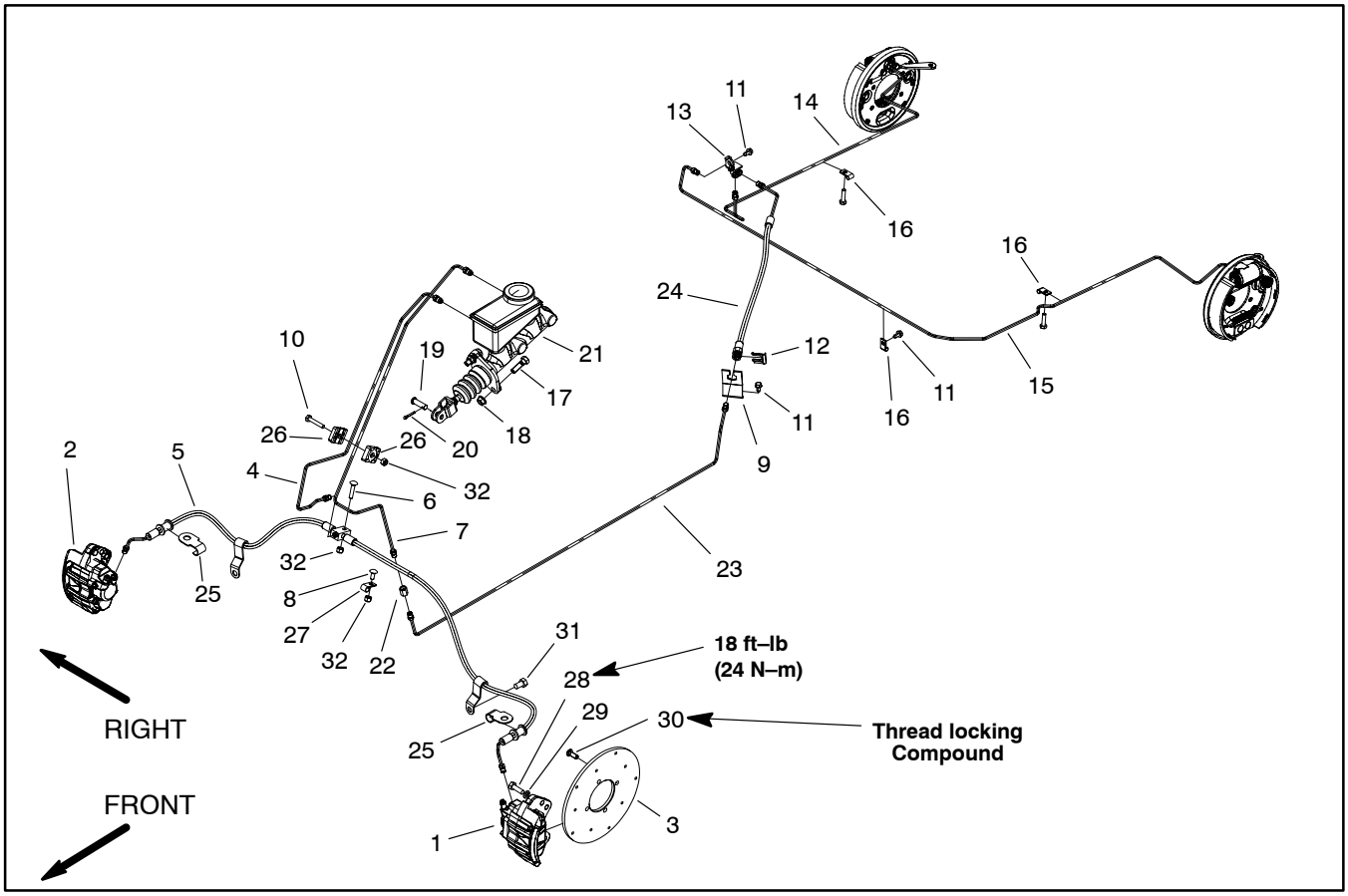

Figure 28

1. Brake caliper (LH)
2. Brake caliper (RH)
3. Brake rotor
4. Front brake tube
5. Front brake hose
6. Carriage screw
7. Rear brake tube
8. Carriage screw
9. Rear brake hose bracket
10. Cap screw
11. Thread forming screw
12. Clip
13. Tee fitting
14. Rear brake tube (RH)
15. Rear brake tube (LH)
16. Insulated clip
17. Cap screw
18. Flange head screw
19. Clevis pin
20. Cotter pin
21. Master cylinder
22. Union fitting
23. Rear brake tube
24. Rear brake hose
25. Hose bracket
26. Tube clamp
27. Clamp
28. Cap screw (2 per caliper used)
29. Lock washer (2 per caliper used)
30. Socket head screw (4 per rotor used)
31. Cap screw
32. Lock nut

When performing service work on the Workman 1110 and 2110 hydraulic brake system, make sure to clean components before disassembly. Use Figure 28 as a guide for removal and installation of hydraulic brake components.

Bleed Brake System (Workman 1110 and 2110)

1. Connect a suitable transparent hose to bleeder valve on wheel cylinder or caliper and submerge other end of hose in a glass container partially filled with clean brake fluid.

2. Have a helper 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. Repeat steps 1 to 4 for other brake cylinders and calipers.

CAUTION

After servicing the brakes, always check the brakes in a wide open, level area that is free of other persons and obstructions.

6. After bleeding of brakes is completed, road test vehicle to make sure brakes are operating correctly and pedal is solid.

Front Hood

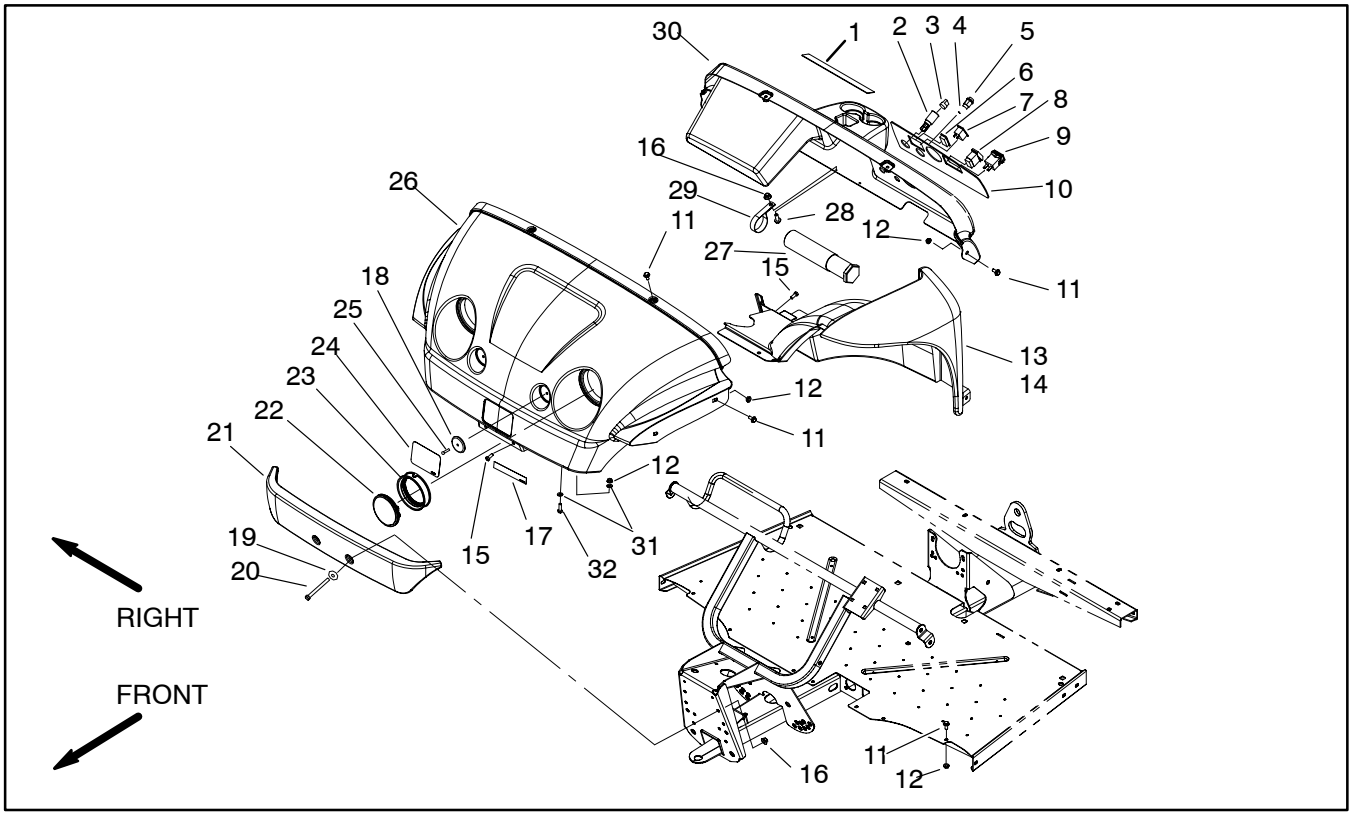

Figure 29

1. **Decal**
2. **Power point**
3. **Cap**
4. **Ignition switch**
5. **Ignition key**
6. **Hole plug**
7. **Oil light**
8. **Light switch**
9. **Hourmeter**
10. **Decal**
11. **Hex flange head screw**
12. **Flange lock nut**
13. **Fender (LH) (shown)**
14. **Fender (RH) (not shown)**
15. **Self tapping screw**
16. **Flange lock nut**
17. **Decal**
18. **Reflector**
19. **Lock washer**
20. **Cap screw**
21. **Plastic bumper**
22. **Headlight**
23. **Headlight mount**
24. **Decal**
25. **Self tapping screw**
26. **Hood**
27. **Manuals tube**
28. **Hex flange head screw**
29. **R–clamp**
30. **Dash**
31. **Flat washer**
32. **Cap screw**

Removal

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

2. Remove screws attaching the wire harness to each head light.

3. Remove both self tapping screws (15) securing the center–lower hood to the front frame support.

4. Remove flange lock nut (12), both flat washers (31), and cap screw (32) securing the hood to each fender front.

5. Remove both flange lock nuts (12) and hex flange head screws (11) securing the hood to the top of each fender.

6. Remove both hex flange head screws (11) securing the hood to the dash. Remove hood from the vehicle.

Installation

NOTE: Do not tighten fasteners securing the hood until all fasteners are in place.

1. Position hood to the machine. Secure hood to the dash with both hex flange head screws (11).

2. Secure hood to the top of each fender with two hex flange head screws (11) and flange lock nuts (12).

3. Secure hood to each fender front with cap screw (32), two flat washers (31), and flange lock nut (12).

4. Secure center–lower hood to the front frame support with two self tapping screws (15).

5. Connect each headlight to the wire harness with screws. Tighten all fasteners securing the hood.

Cargo Bed and Tailgate

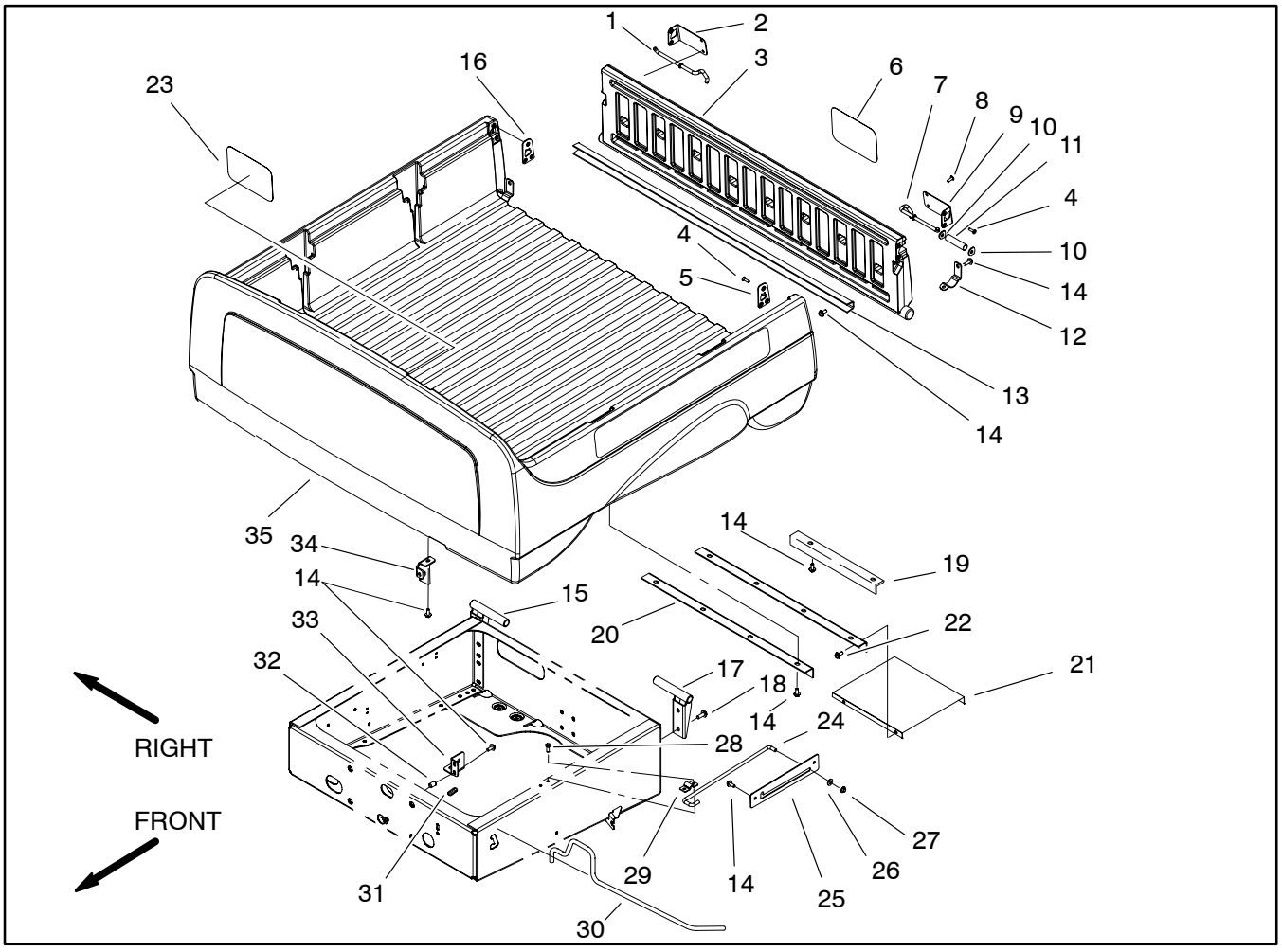

Figure 30

1. Tailgate rod (RH)
2. Tailgate latch bracket (RH)
3. Tailgate
4. Cap screw
5. Striker plate (LH)
6. Decal
7. Tailgate rod (LH)
8. Screw
9. Tailgate latch bracket (LH)
10. Latch washer
11. Spring
12. Tailgate pivot bracket
13. Tailgate channel
14. Hex flange head screw
15. Pivot bracket (RH)
16. Striker plate (RH)
17. Pivot bracket (LH)
18. Hex flange head screw
19. Box brace (short)
20. Box brace (long)
21. Heat shield
22. Screw
23. Decal
24. Prop rod
25. Prop rod bracket
26. Flat washer
27. Push on retainer
28. Cap screw
29. Prop rod clip
30. Latch rod
31. Spring
32. Insert nut
33. Latch bracket
34. Latch hook (RH)
35. Cargo bed

Removal

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

2. Remove hex flange head screws securing both pivot brackets to the rear frame.

3. Release latch rod from the latch bracket. Remove cargo bed from the frame. Disassemble cargo bed as necessary using Figure 30 as a guide.

Installation

1. Reassemble cargo bed using Figure 30 as a guide.

2. Position cargo bed to the frame locking the latch rod to the latch bracket.

3. Secure both pivot brackets to the rear frame with hex flange head screws.

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Chapter 8

Electrical Diagrams

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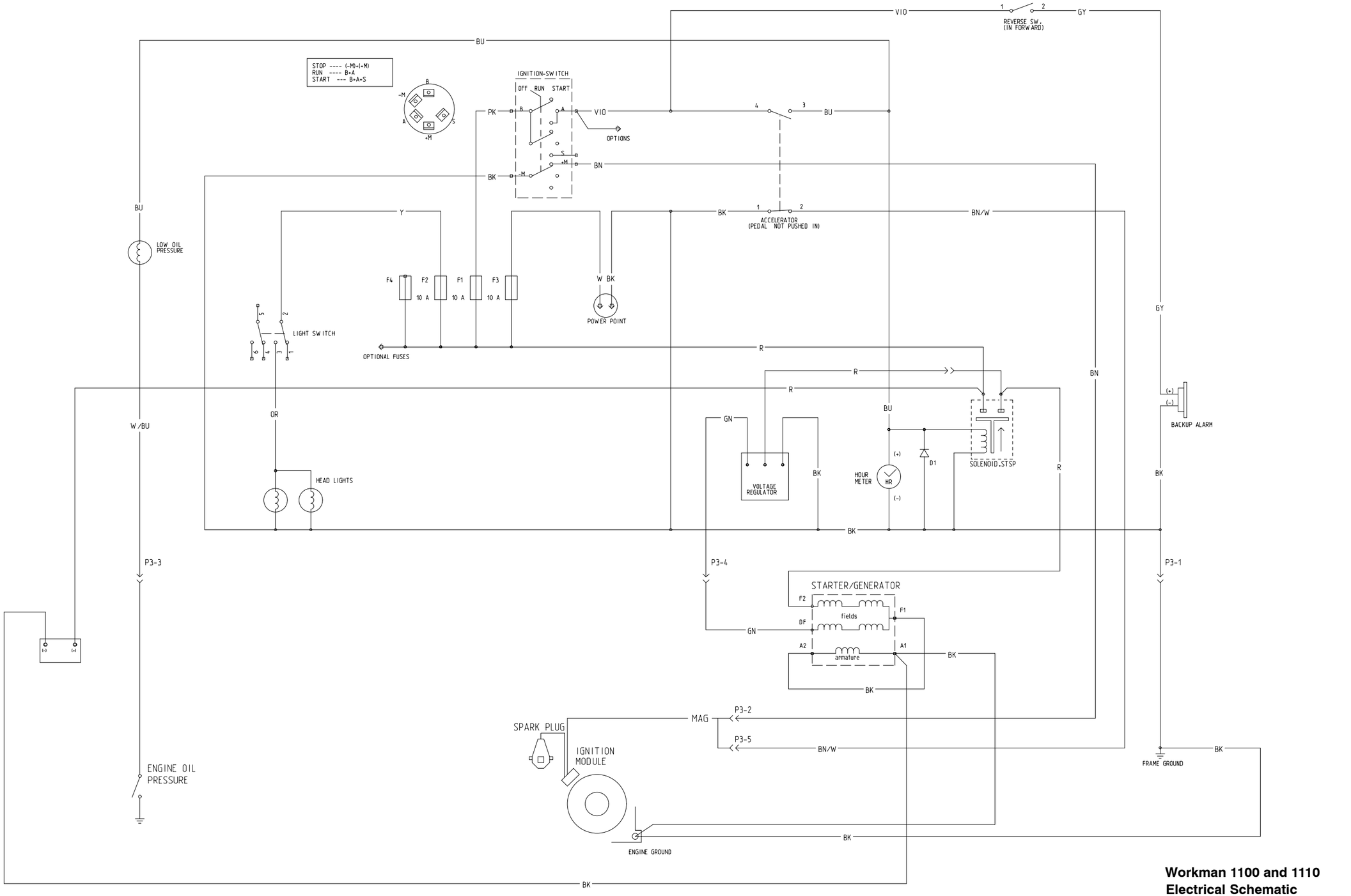
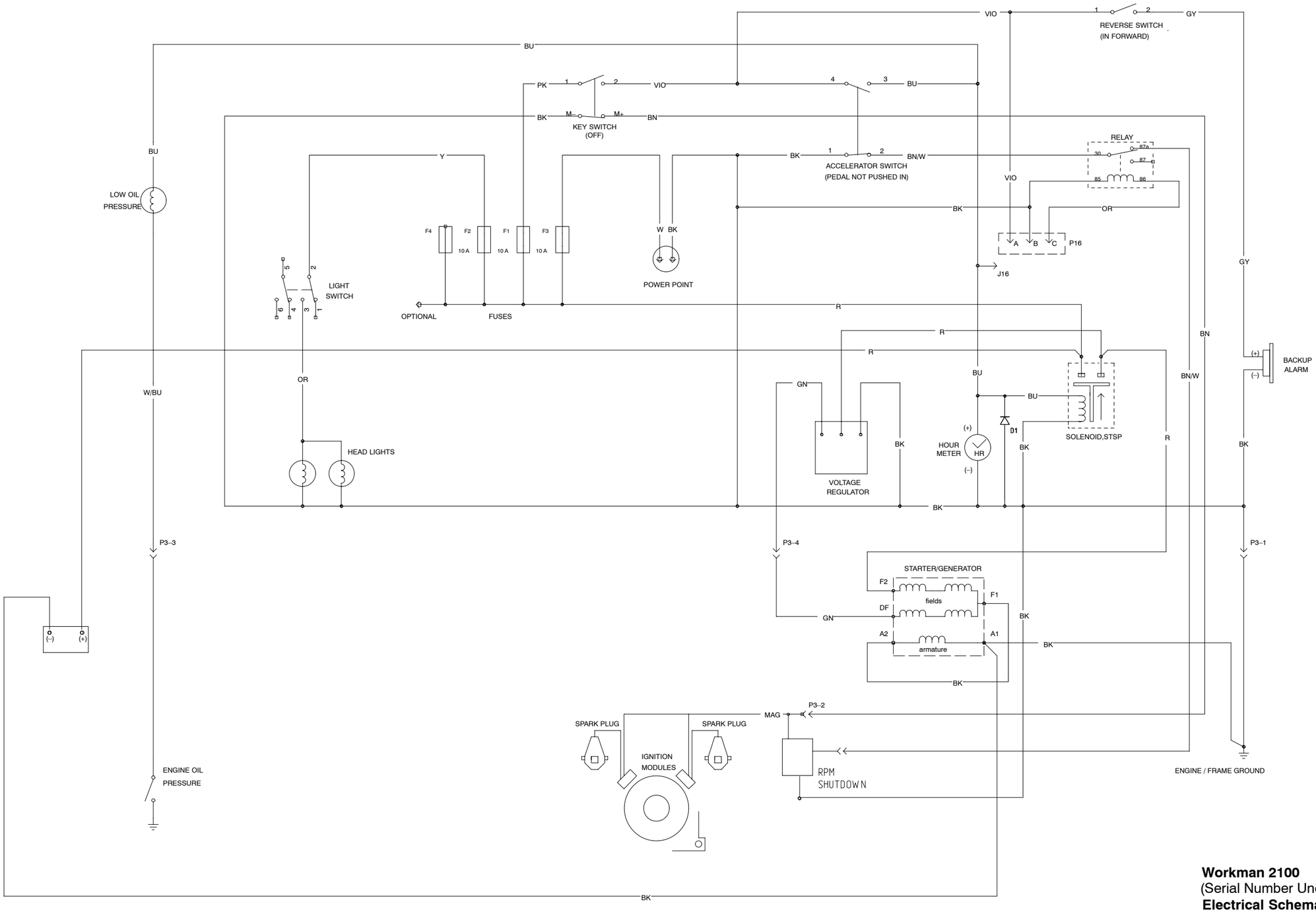


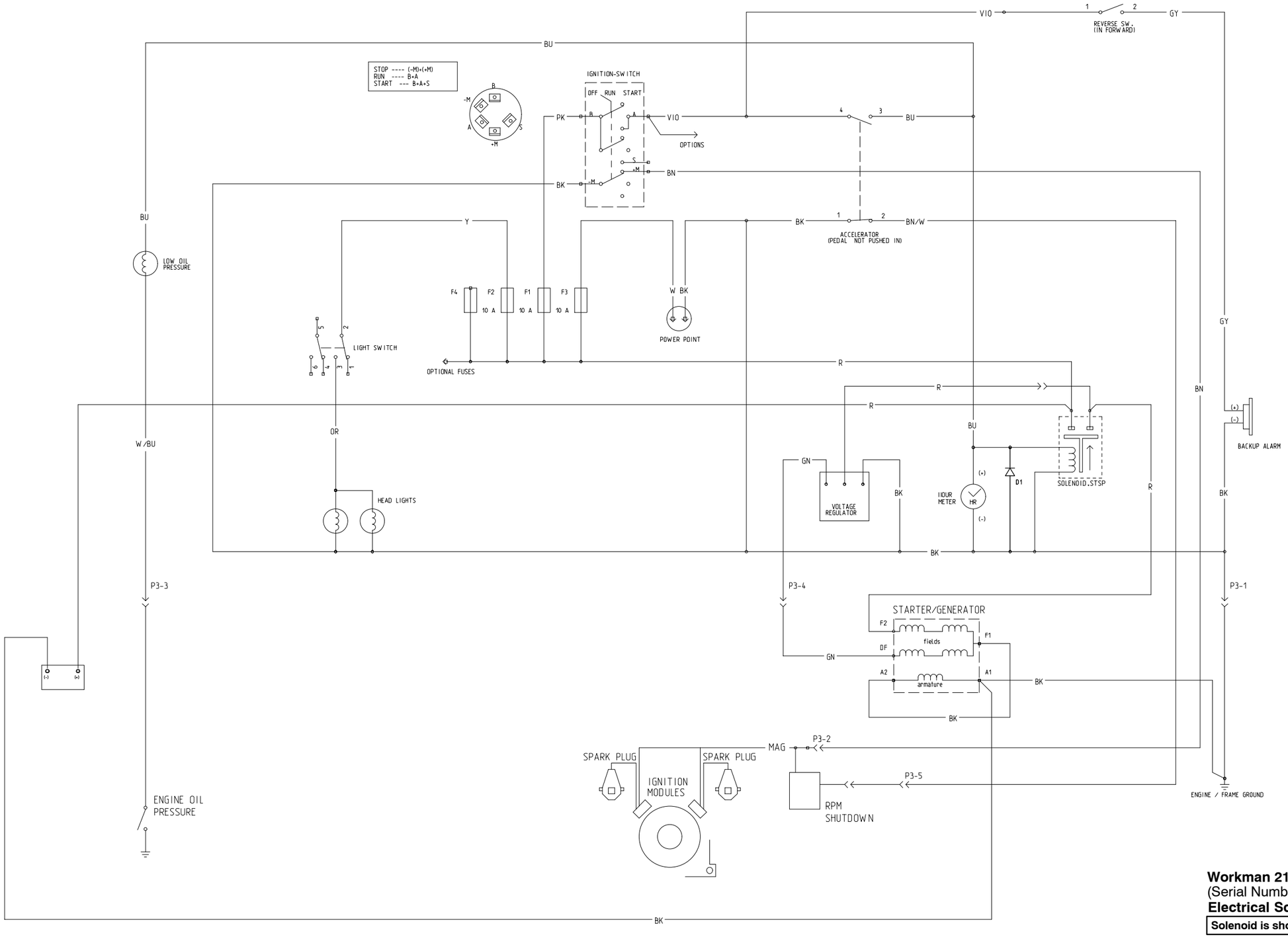
Workman 1100 and 1110
Electrical Schematic

Solenoid is shown de–energized



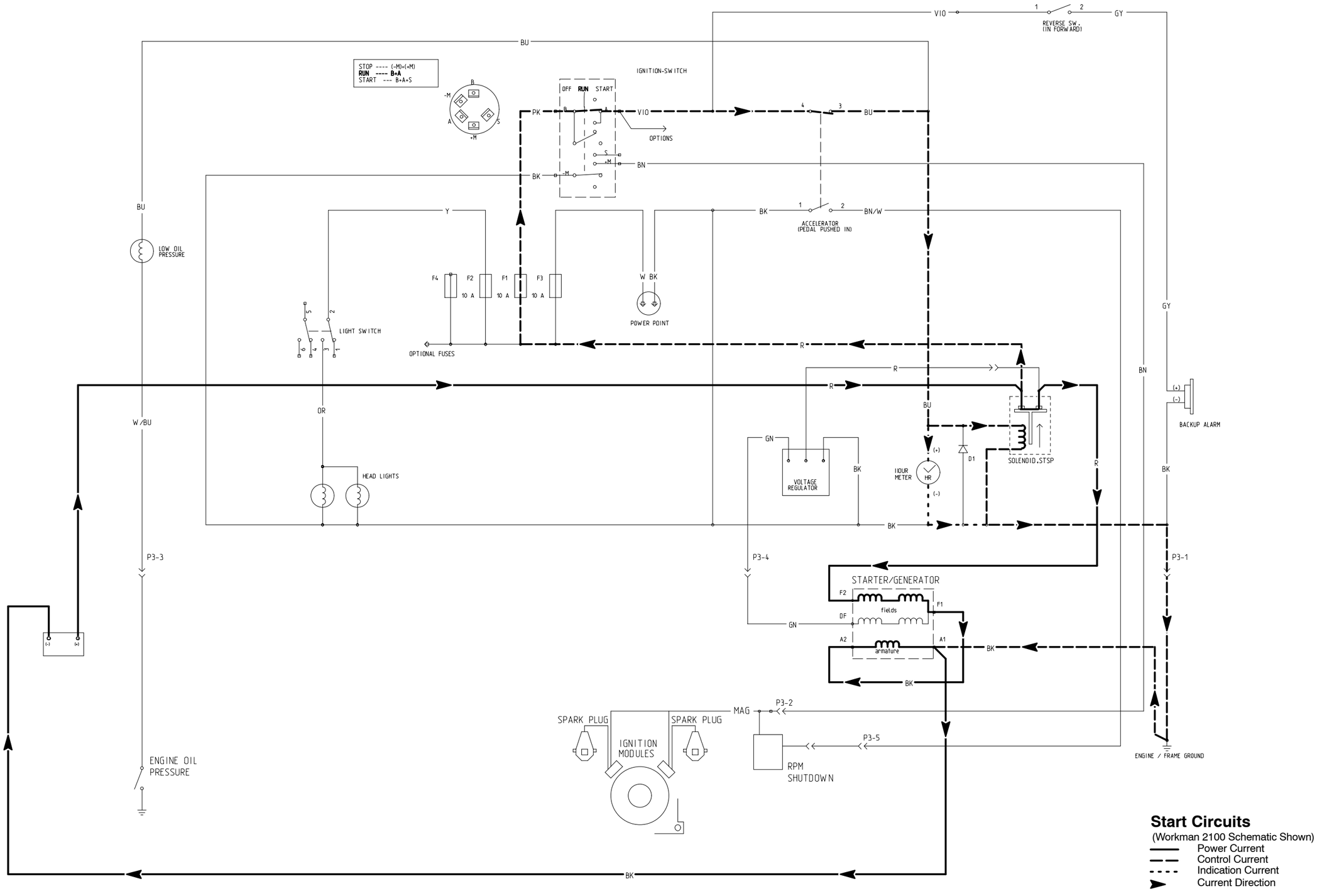
Workman 2100
(Serial Number Under 220000000)
Electrical Schematic

Solenoid is shown de–energized



Workman 2100 and 2110
(Serial Number Over 220000000)
Electrical Schematic

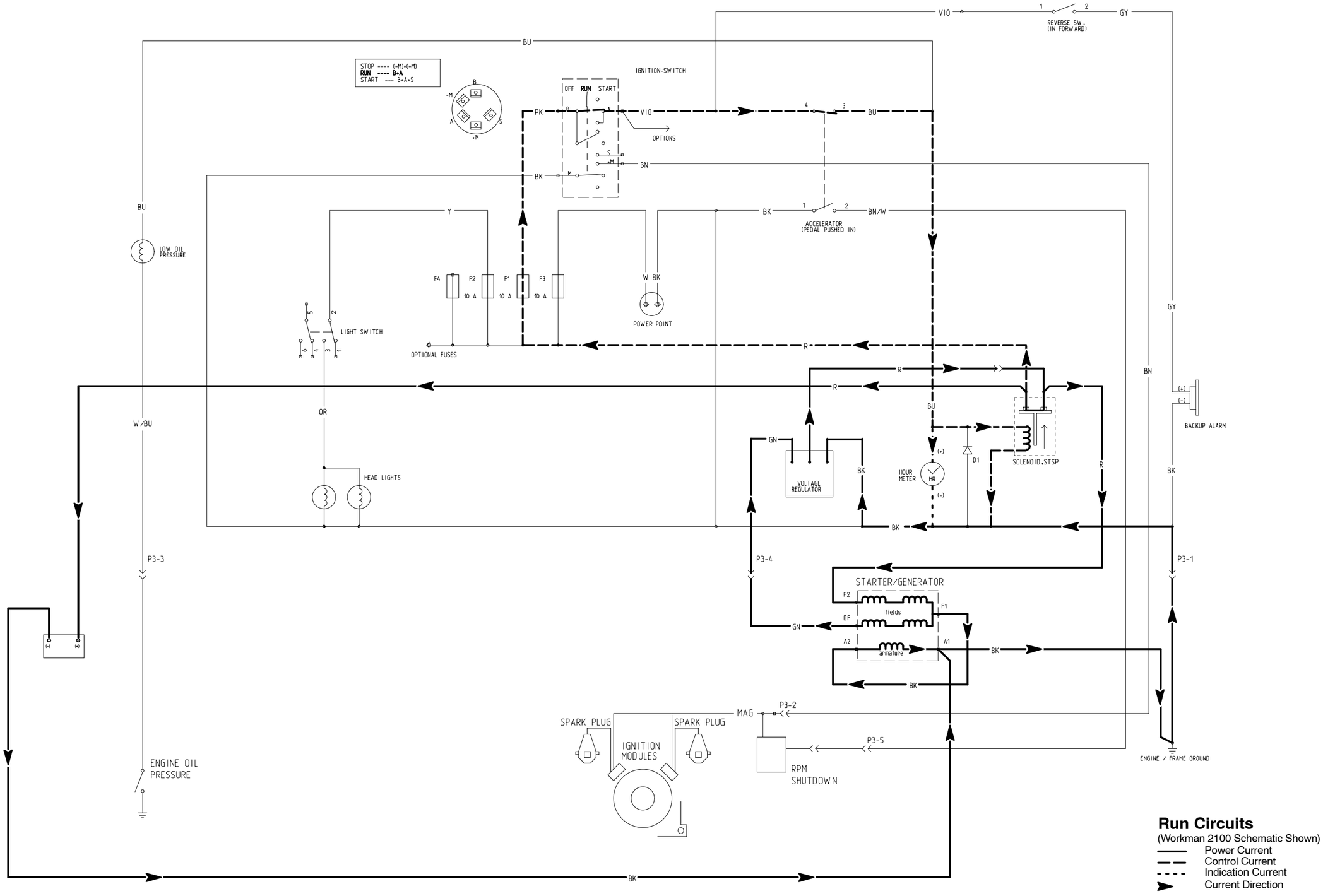
Solenoid is shown de–energized



Start Circuits

(Workman 2100 Schematic Shown)

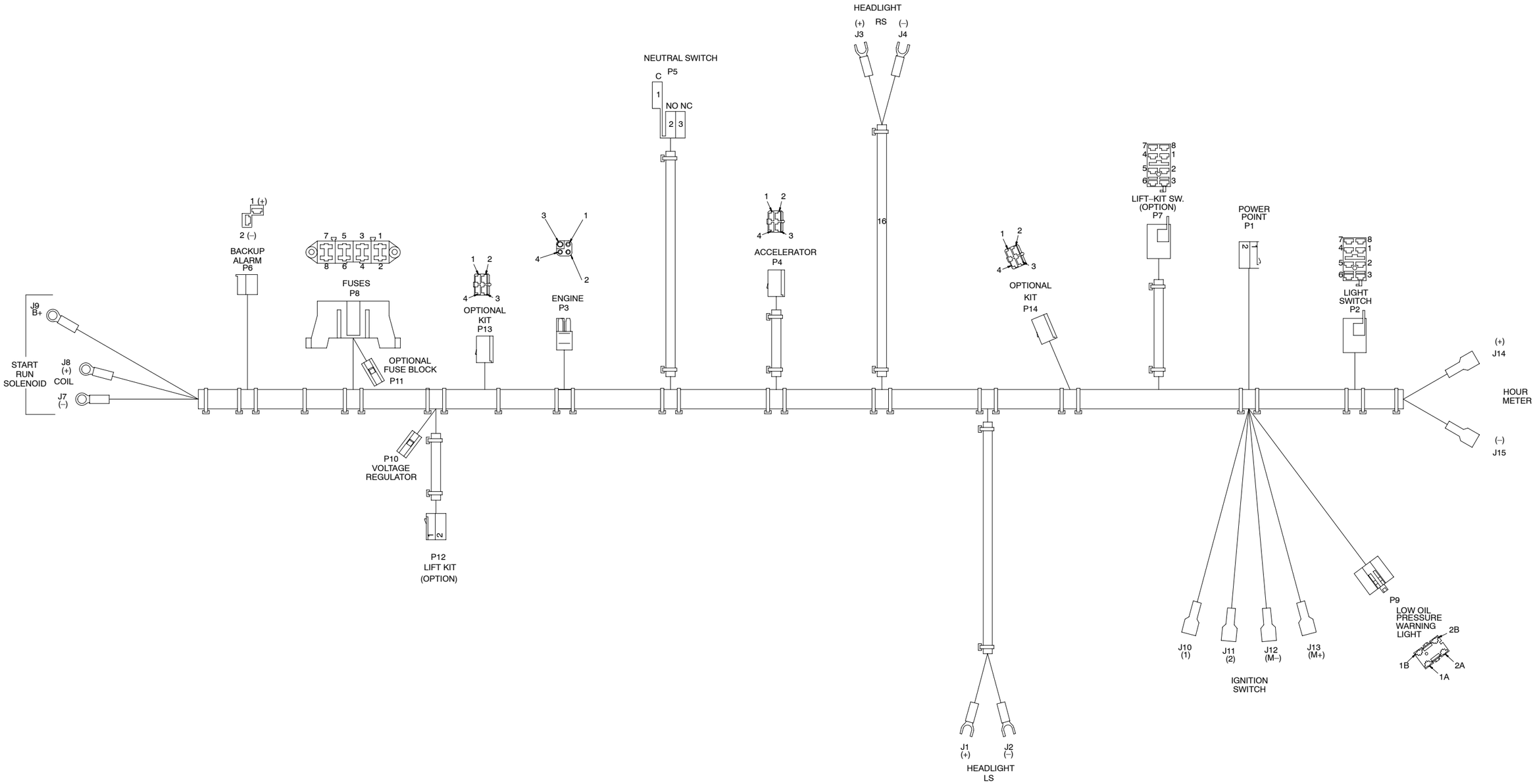
- Power Current
- Control Current
- Indication Current
- Current Direction



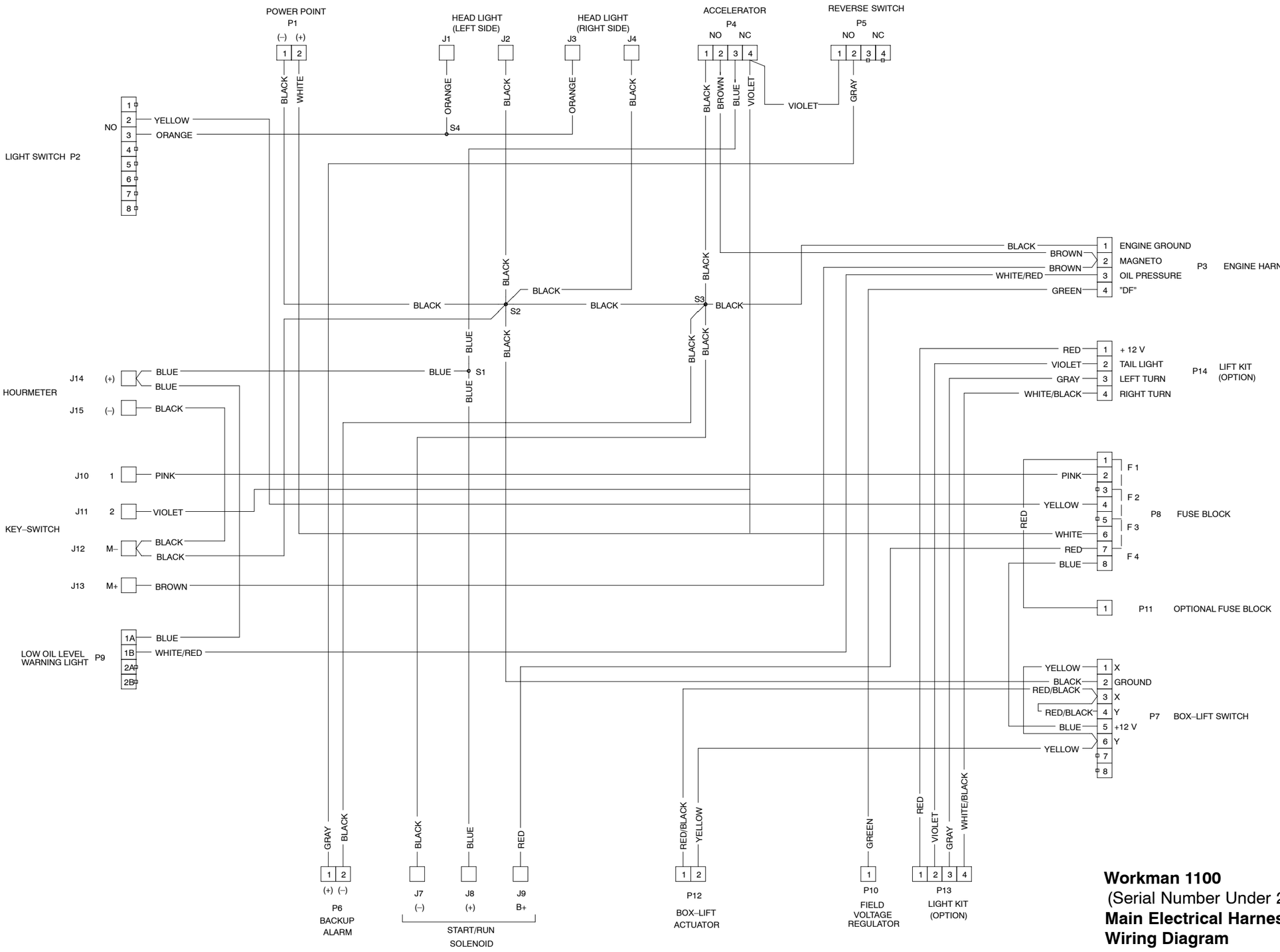
Run Circuits

(Workman 2100 Schematic Shown)

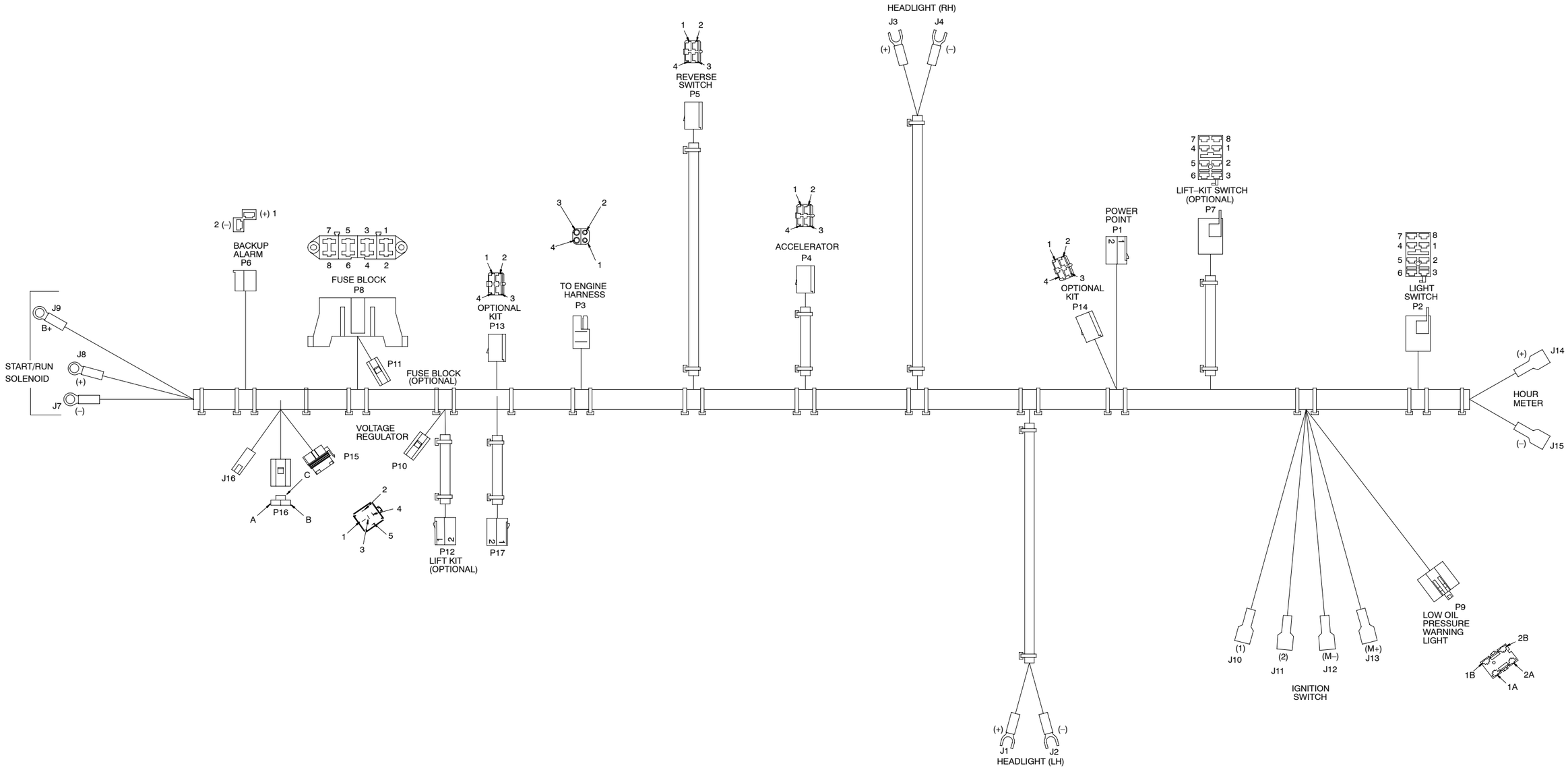
- Power Current
- Control Current
- Indication Current
- Current Direction



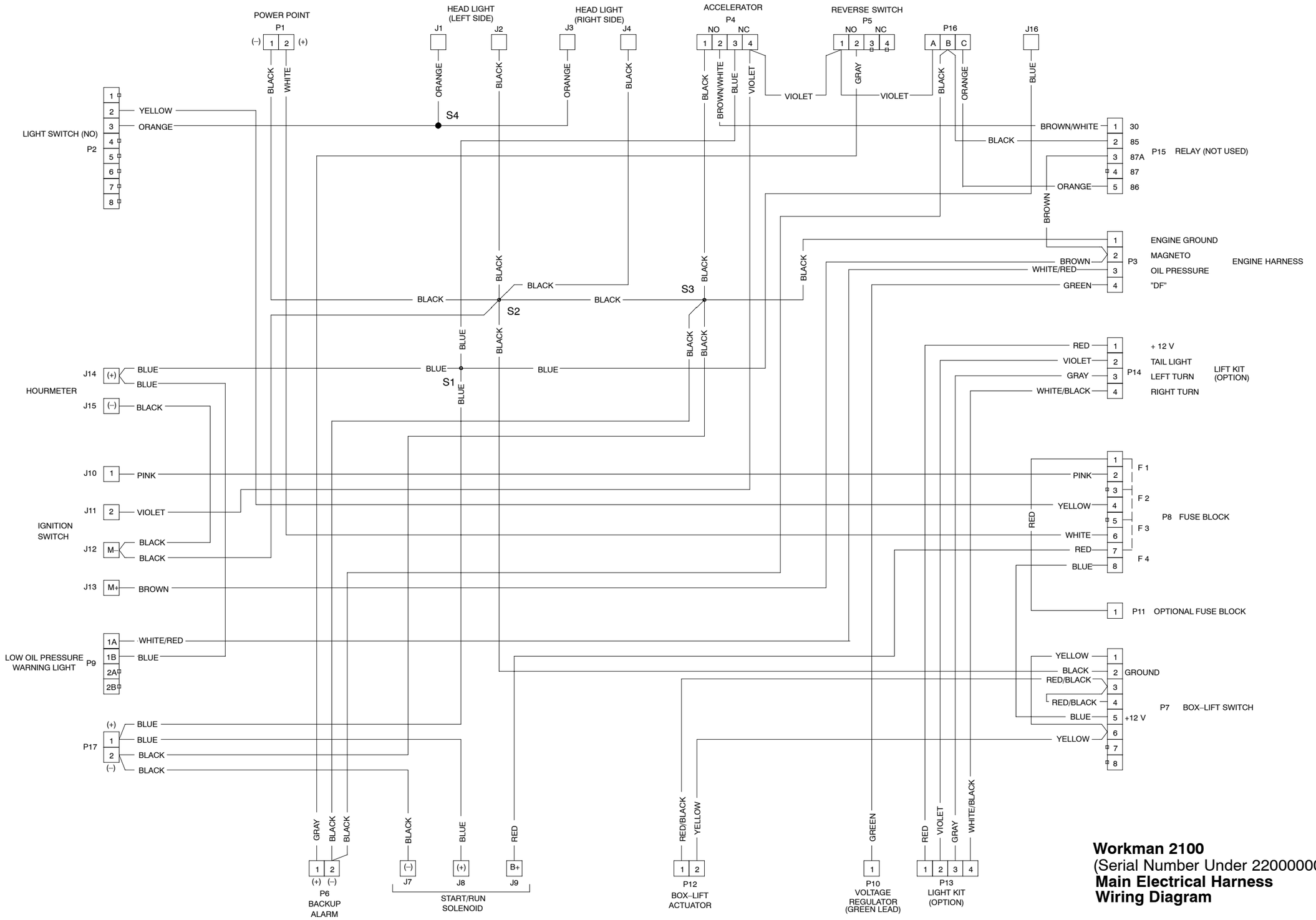
Workman 1100
(Serial Number Under 220000000)
Main Electrical Harness Drawing



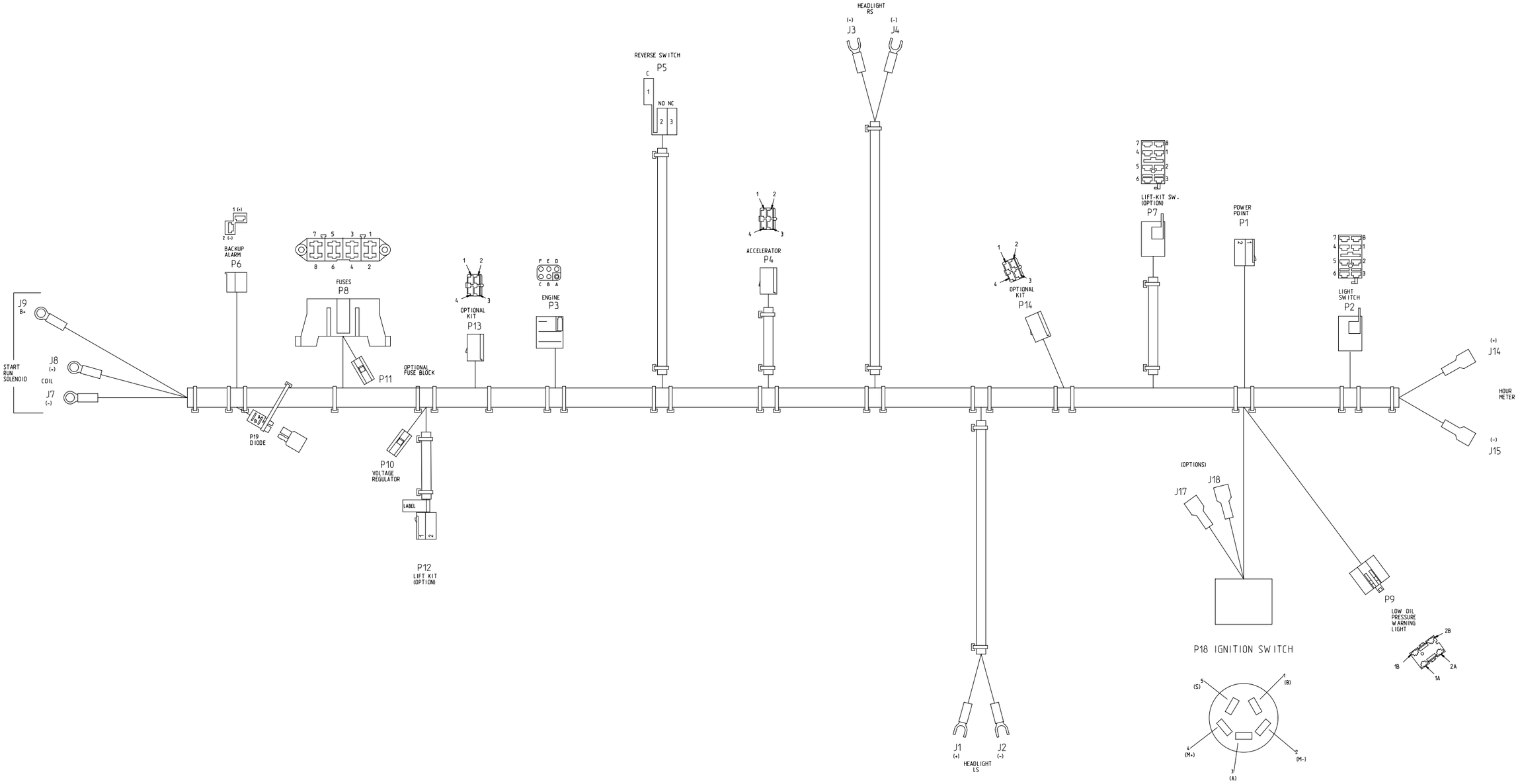
Workman 1100
(Serial Number Under 220000000)
Main Electrical Harness
Wiring Diagram



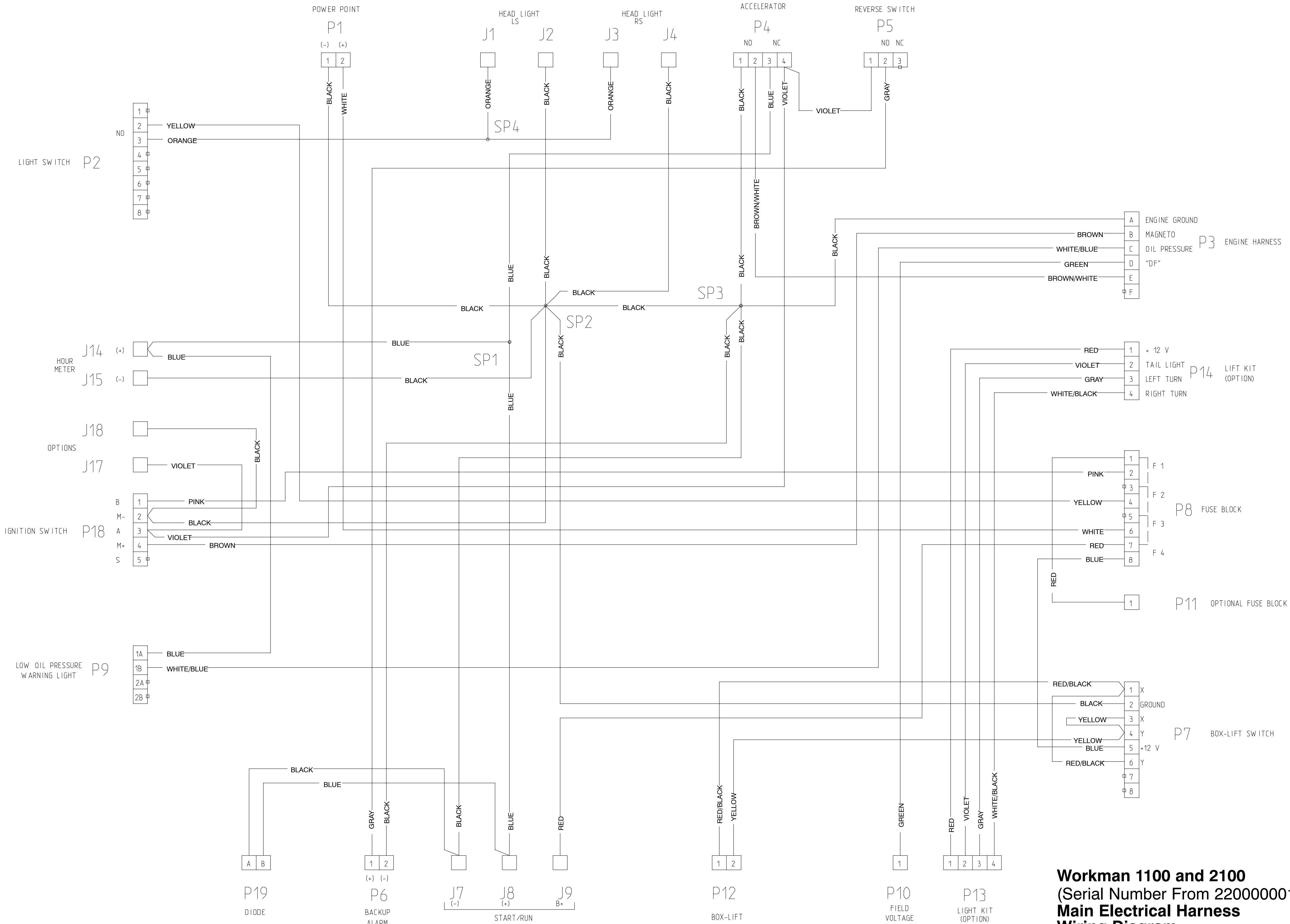
Workman 2100
(Serial Number Under 220000000)
Main Electrical Harness Drawing



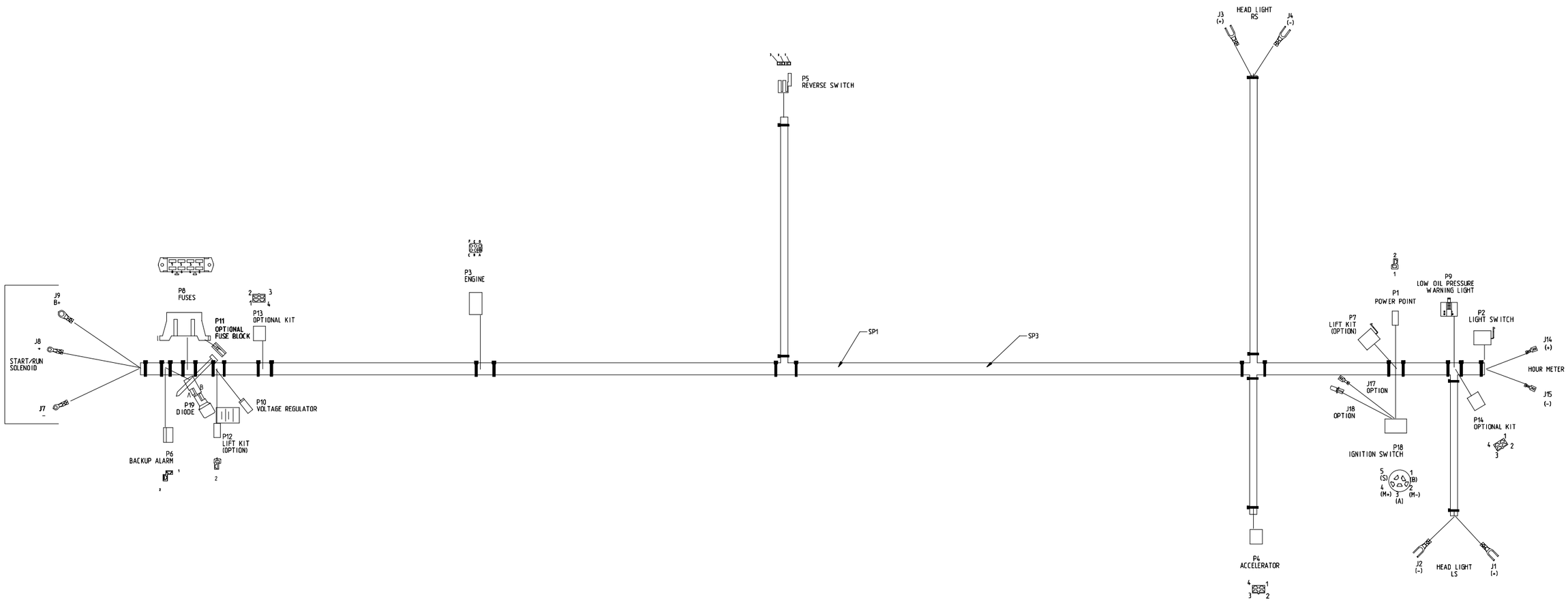
Workman 2100
(Serial Number Under 220000000)
Main Electrical Harness Wiring Diagram



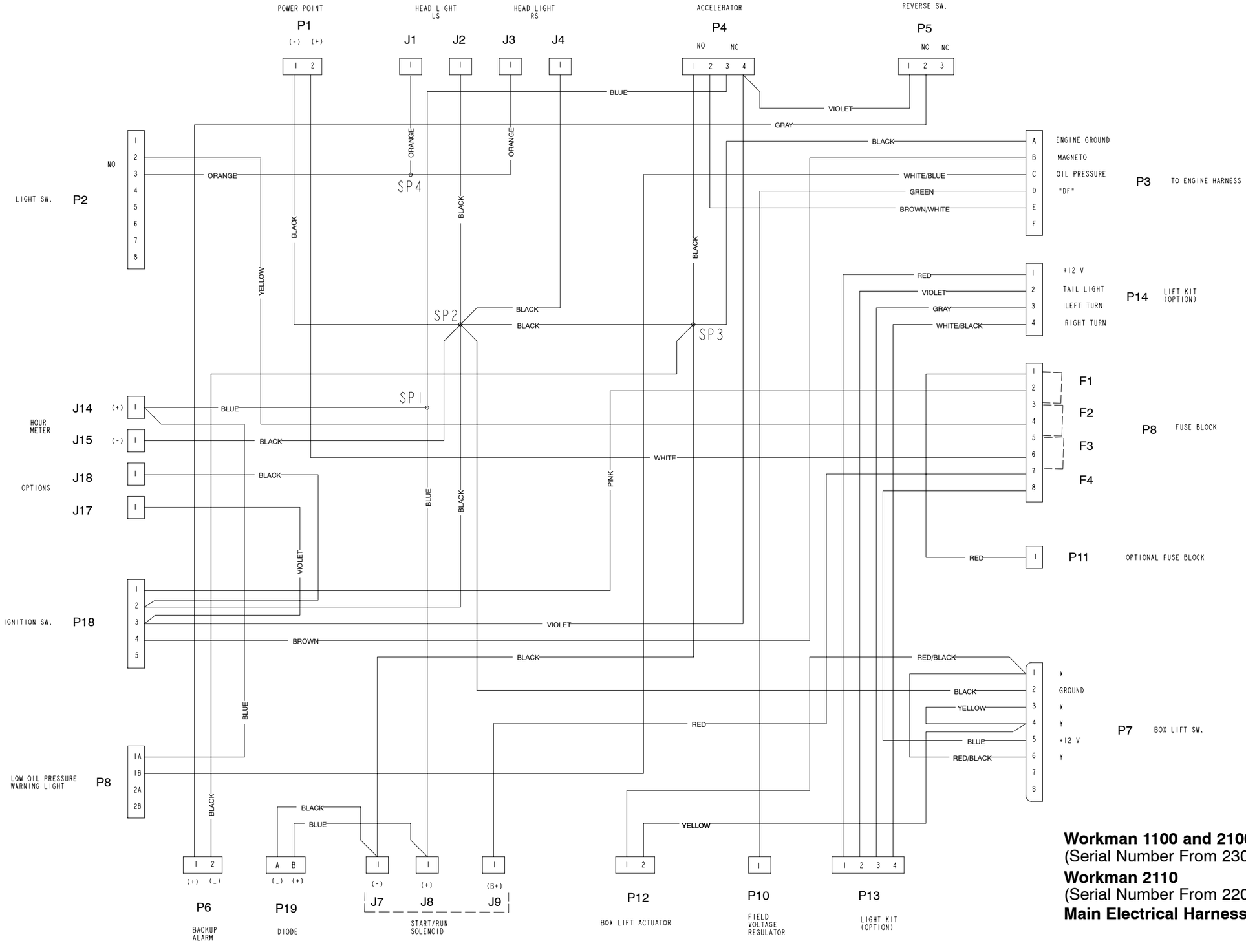
Workman 1100 and 2100
(Serial Number From 220000001 To 220999999)
Main Electrical Harness Drawing



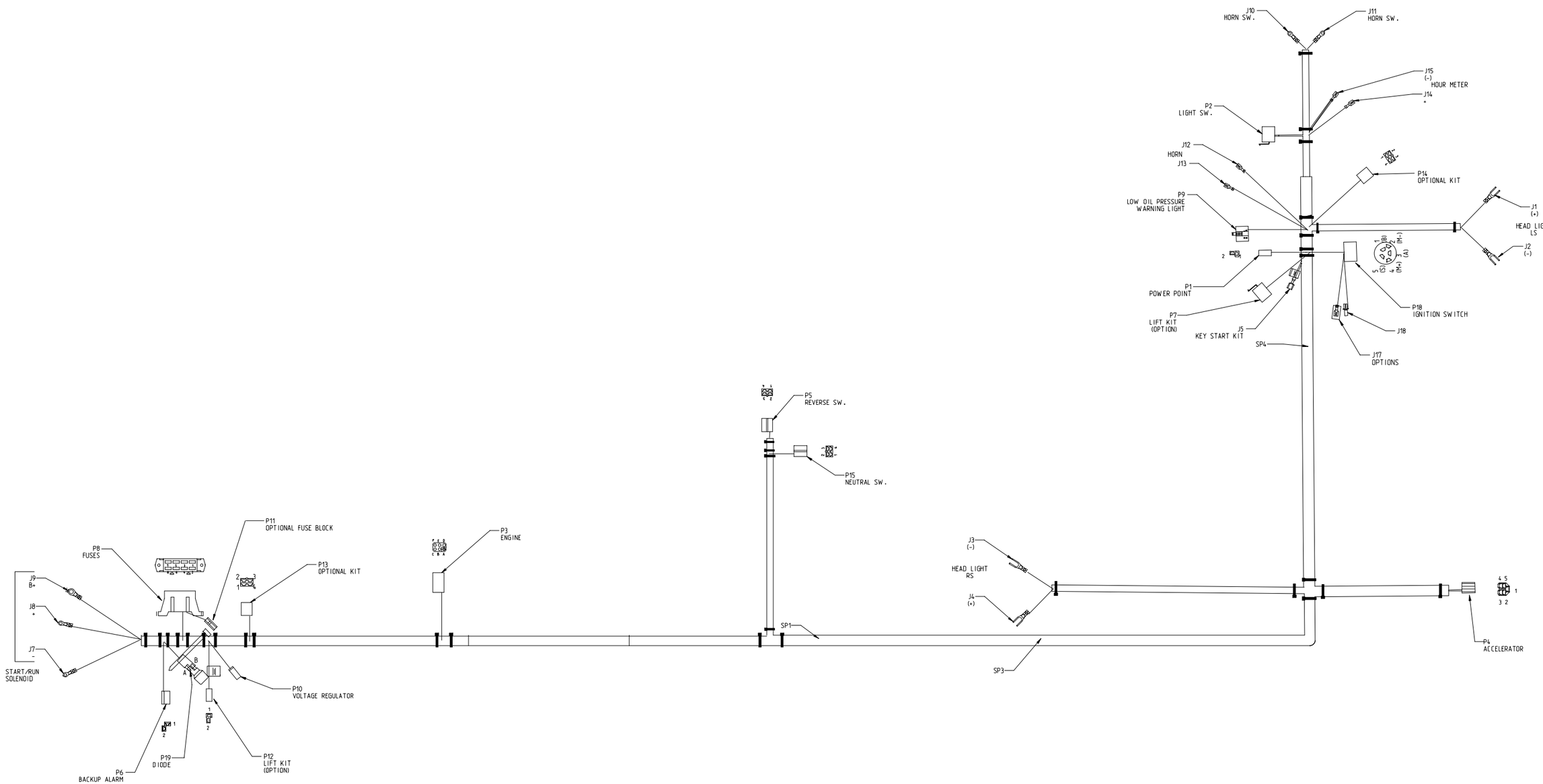
Workman 1100 and 2100
(Serial Number From 220000001 To 220999999)
Main Electrical Harness
Wiring Diagram



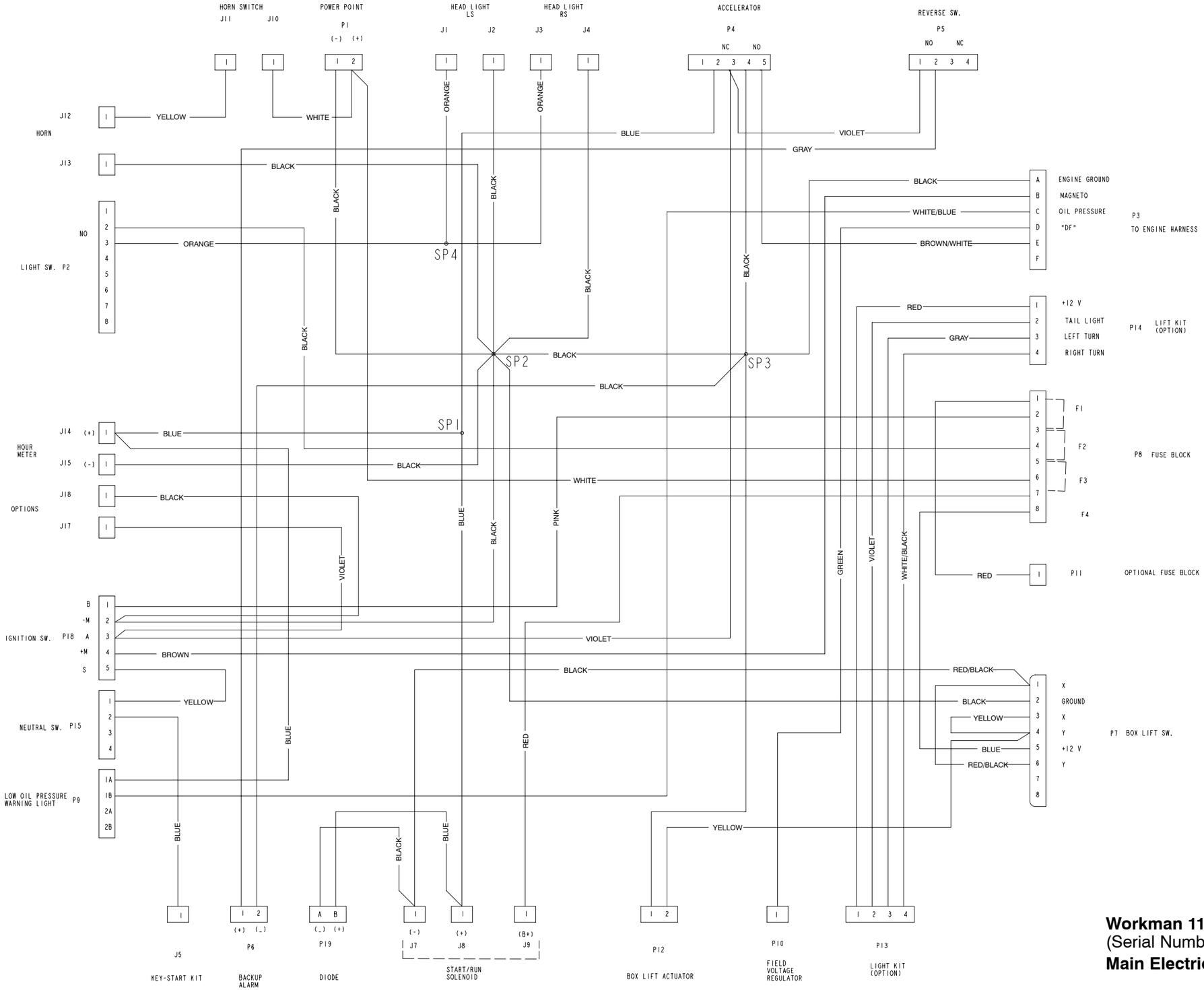
Workman 1100 and 2100
(Serial Number From 230000001 To 230999999)
Workman 2110
(Serial Number From 220000001 To 230999999)
Main Electrical Harness Drawing



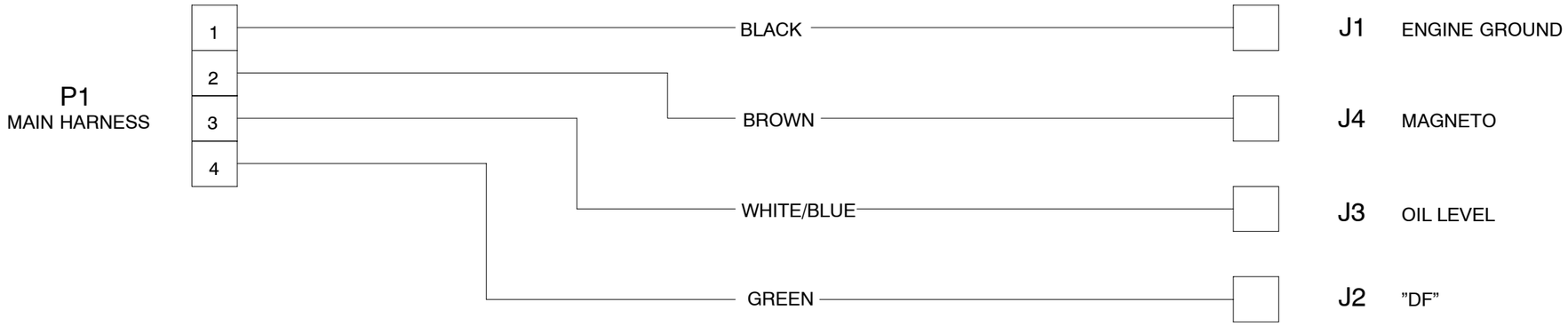
Workman 1100 and 2100
(Serial Number From 230000001 To 230999999)
Workman 2110
(Serial Number From 220000001 To 230999999)
Main Electrical Harness Wiring Diagram

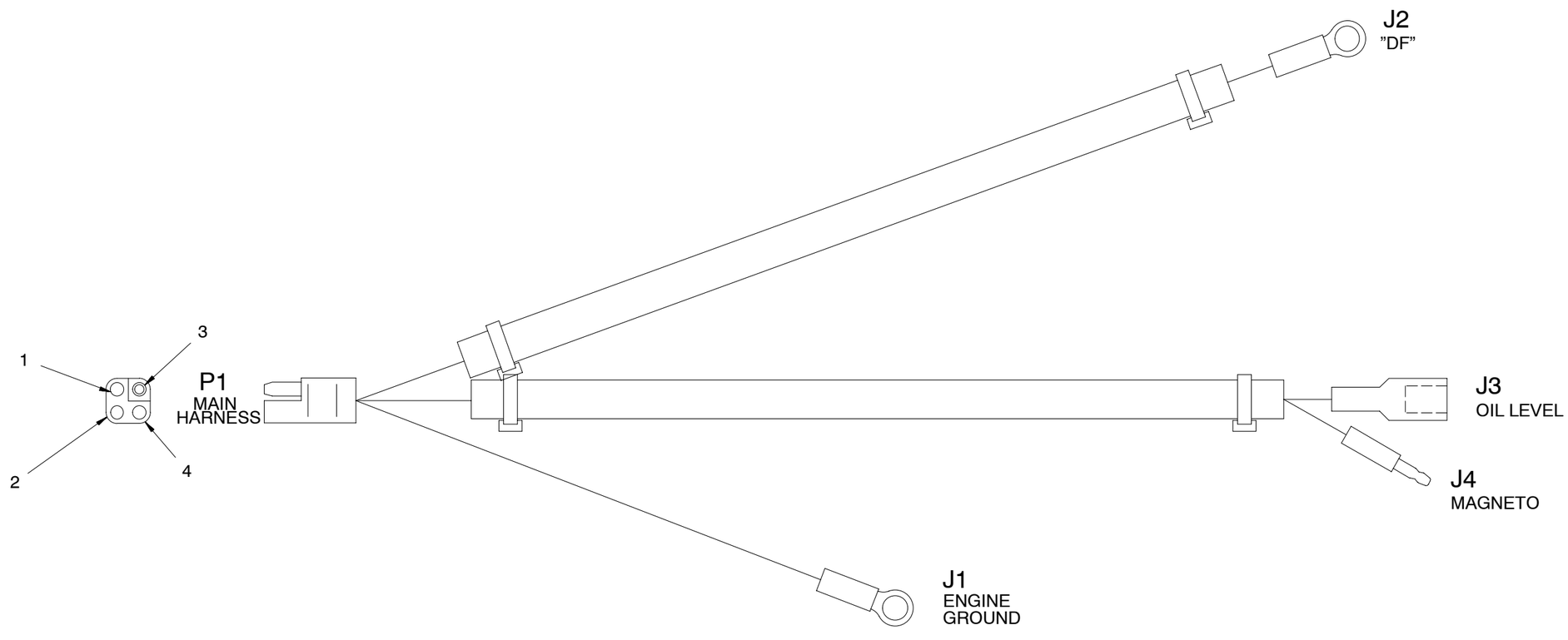


Workman 1100, 1110, 2100 and 2110
(Serial Number Above 240000000)
Main Electrical Harness Drawing

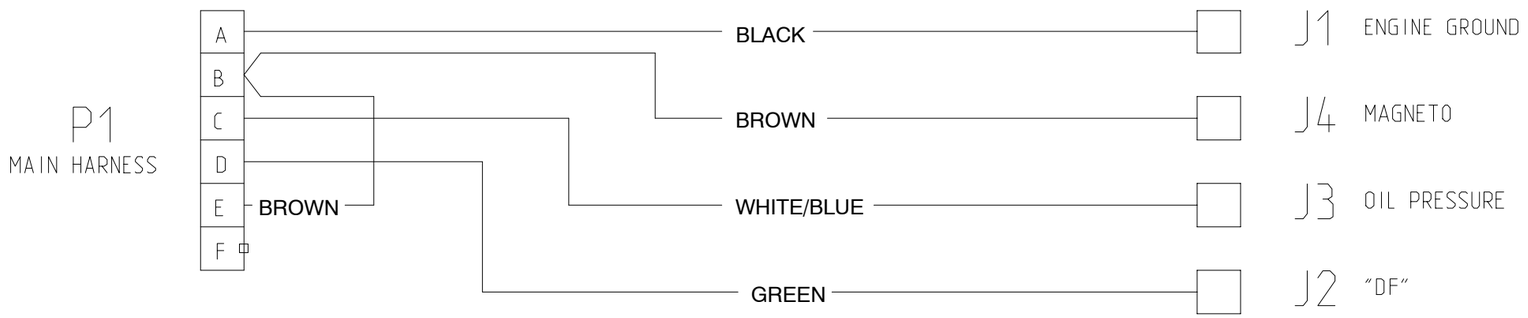


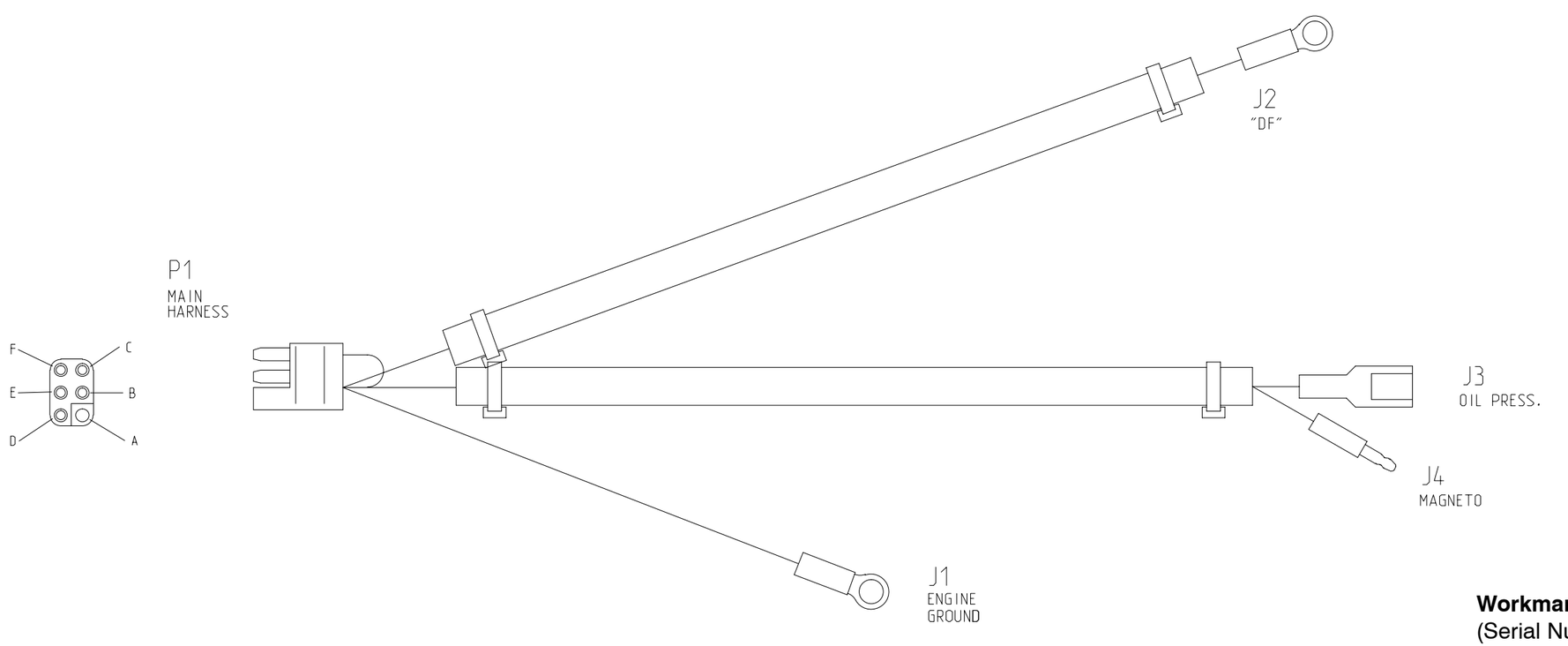
Workman 1100, 1110, 2100 and 2110
(Serial Number Above 240000000)
Main Electrical Harness Wiring Diagram



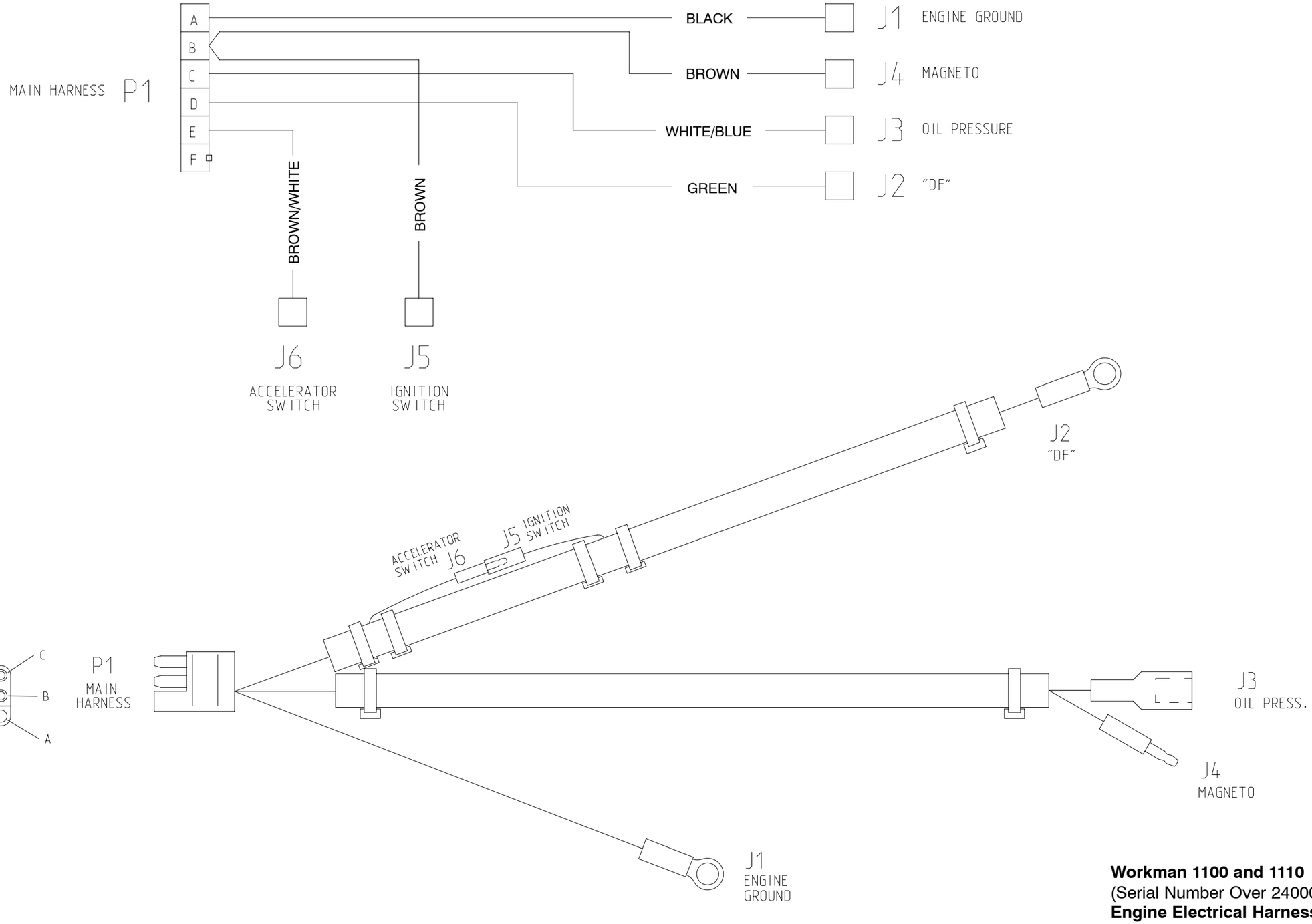


Workman 1100
(Serial Number Under 220000000)
Engine Electrical Harness Drawing and Wiring Diagram

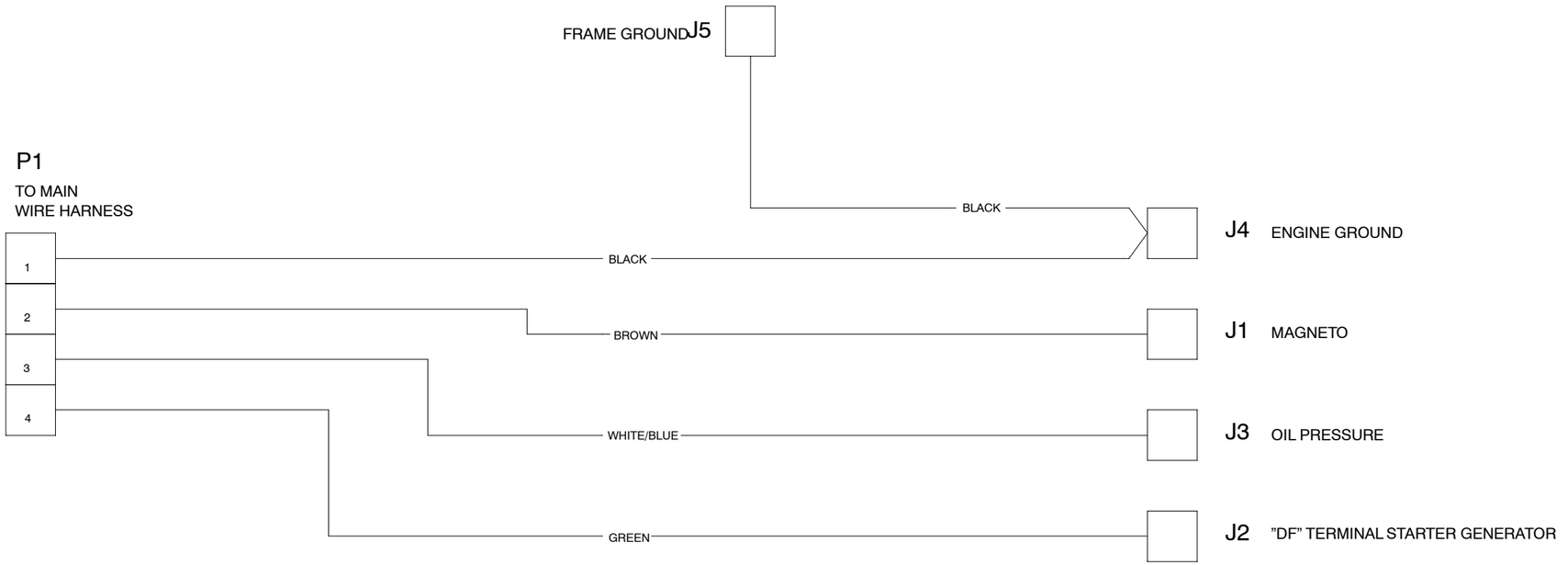


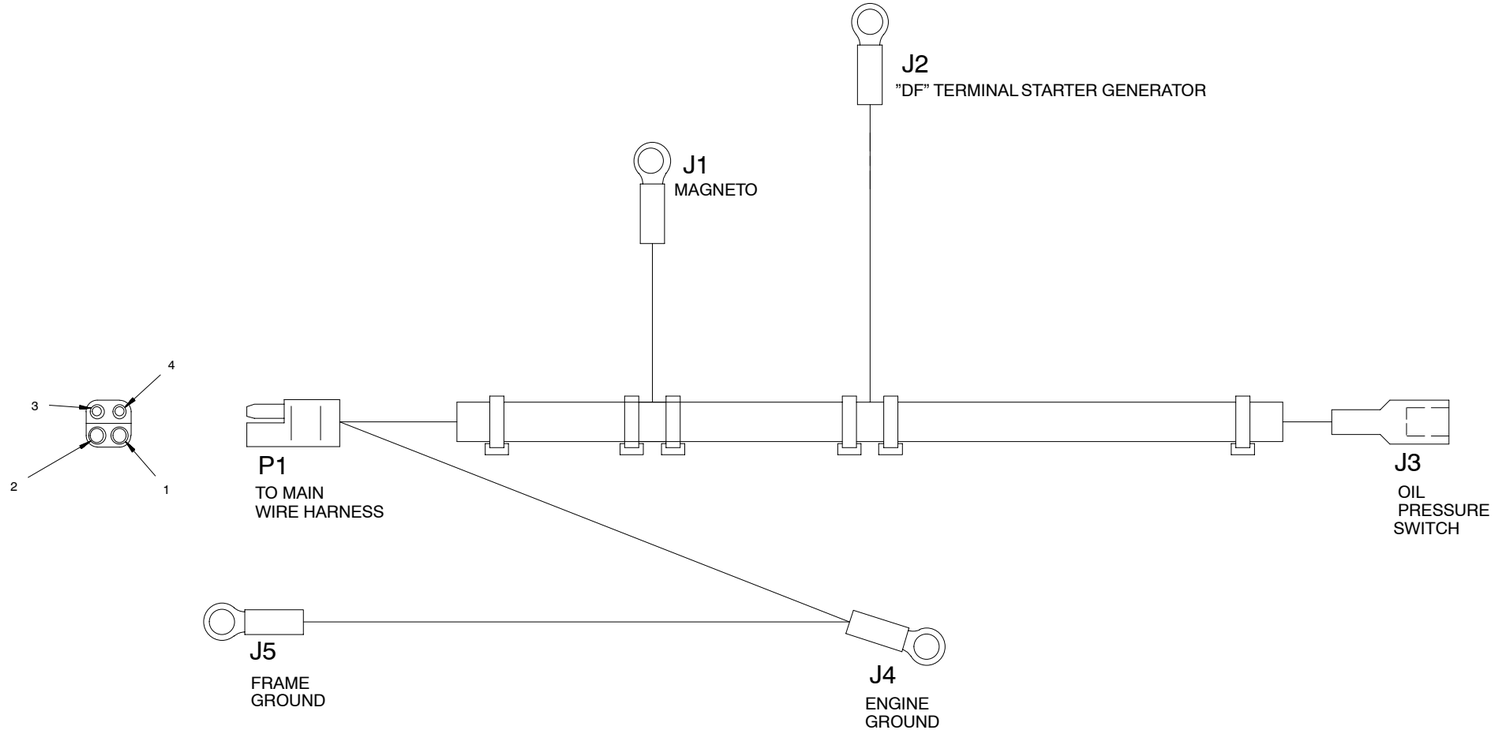


Workman 1100
(Serial Number From 220000001 To 230999999)
Engine Electrical Harness Drawing
and Wiring Diagram

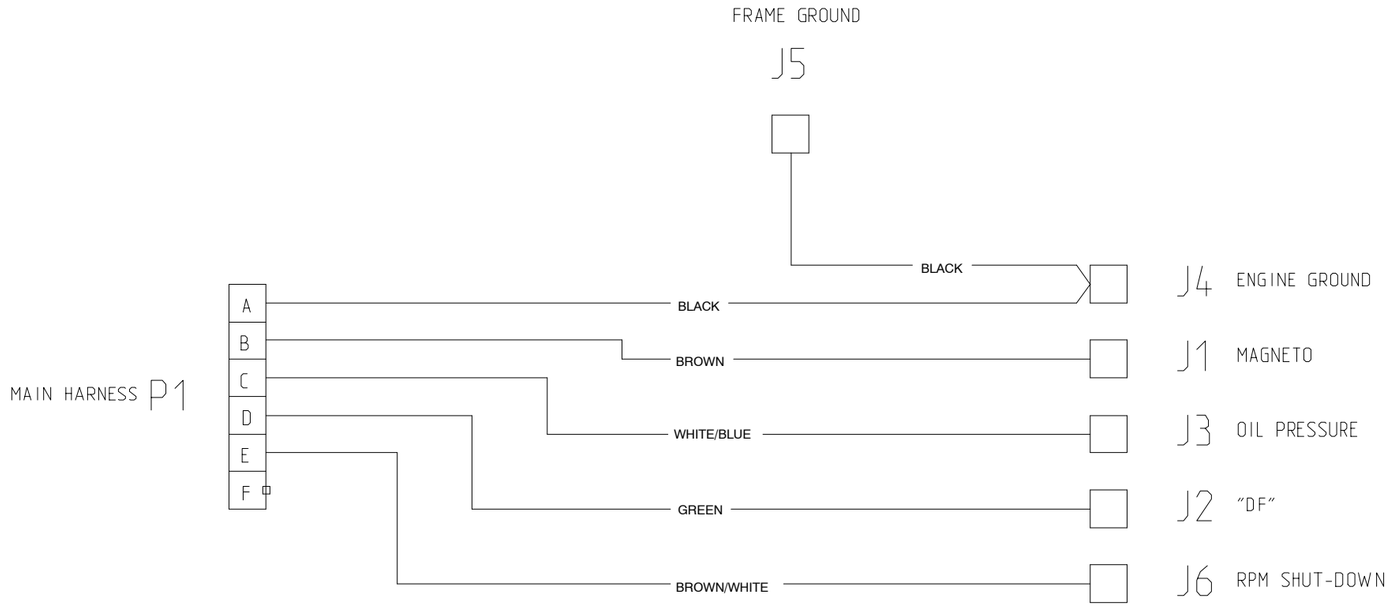


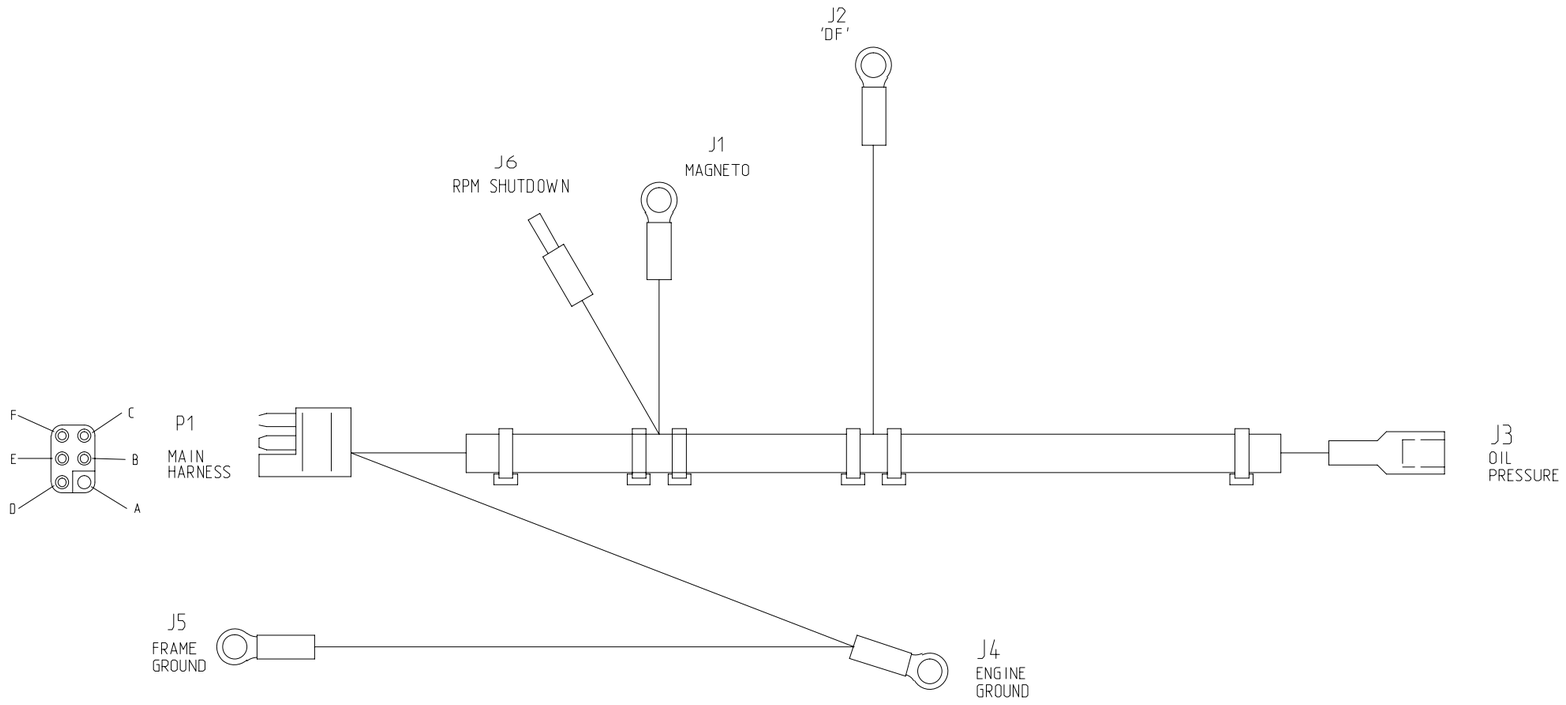
Workman 1100 and 1110
(Serial Number Over 240000000)
Engine Electrical Harness Drawing and Wiring Diagram





Workman 2100
(Serial Number Under 220000000)
Engine Electrical Harness Drawing and Wiring Diagram





Workman 2100 and 2110
(Serial Number Over 220000000)
Engine Electrical Harness Drawing and Wiring Diagram