

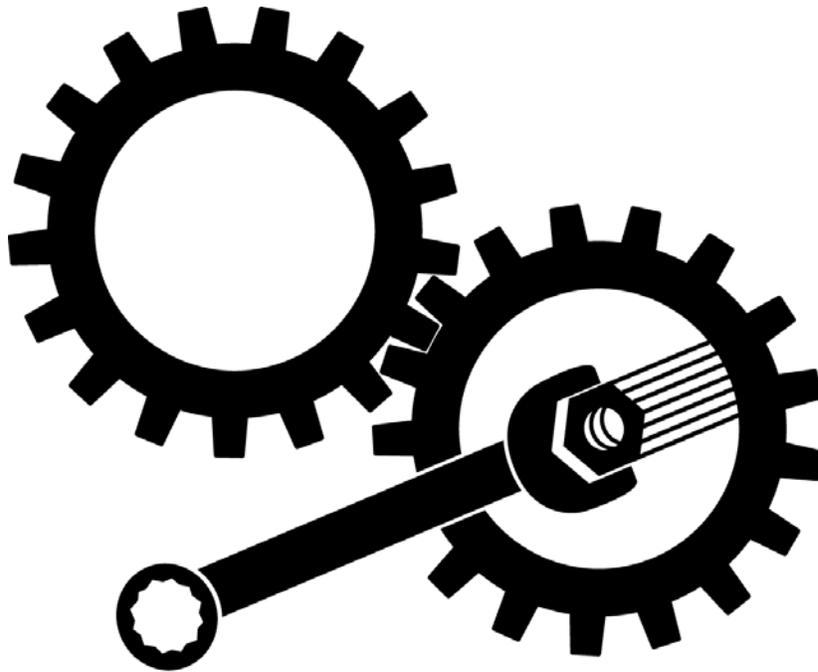


# Pro 100/150/200

## Service Manual

Models 988001-007, 059, 060, 062, 063, 069-072, 074, 075,  
077-082, 085, 087, 088, 309

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# SECTION 1 - INTRODUCTION

## 1.1 THE MANUAL

The purpose of this manual is to provide complete instructions for service, maintenance, disassembly, repair, and installation of the mechanical components for the unit.

Dealer trained service personnel should use this manual as a supplement to and reminder of the training sessions conducted by the company.

Read all information for servicing a part or system before repair work is started to avoid needless disassembly.

### Operation

Before operation of the unit, carefully and completely read manuals supplied with the unit. The contents will provide you with an understanding of safety instructions and controls during normal operation and maintenance.

### Safety Messages

For your safety and the safety of others always read, understand, and follow all DANGER, WARNING, and CAUTION messages found in manuals and on safety decals.

### Directional Reference

All reference to left, right, front, or rear are given from the operator in the operator position and facing the direction of forward travel.

## 1.2 SERVICE AND REPLACEMENT PARTS

When ordering publications, replacement parts, or making service inquiries, know the Model and Serial numbers of your unit and engine.

Numbers are located on the product registration form in the unit literature package. They are printed on a serial number label, located on the frame of your unit.

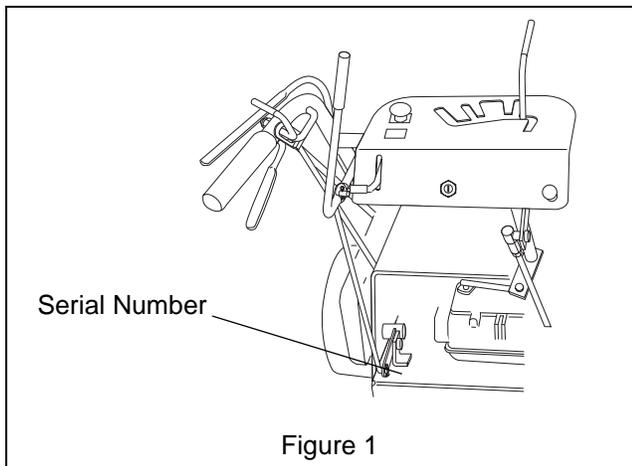


Figure 1

## 1.3 PRODUCT REGISTRATION

A warranty registration card must be filled out, signed, and returned at time of purchase. This card activates the warranty. Claims meeting requirements during limited warranty period will be honored.

## 1.4 UNAUTHORIZED REPLACEMENT PARTS

Use only Gravelly replacement parts. The replacement of any part on this vehicle with anything other than a Gravelly authorized replacement part may adversely affect the performance, durability, or safety of this unit and may void the warranty. Gravelly disclaims liability for any claims or damages, whether warranty, property damage, personal injury, or death arising out of the use of unauthorized replacement parts.

## 1.5 DISCLAIMER

Gravelly reserves the right to discontinue, make changes to, and add improvements upon its products at any time without public notice or obligation. The descriptions and specifications contained in this manual were in effect at printing. Equipment described within this manual may be optional. Some illustrations may not be applicable to your unit.

## 1.6 TECHNICAL SERVICE COMMUNICATIONS

Gravelly Technical Service communicates information to the field using Service Letters, Service Bulletins, Product Notices, and Campaigns. Each communication signifies a type of information and priority. The dealer is responsible to carry out the directive provided in the communication. The types of communication are:

**Service Letter** - General technical information for the dealer. Technical information on how to service the product and product improvements.

**Service Bulletin** - Notification to update products to resolve certain issues or a notification of a policy change.

**Product Notices** - Notification of limited product located in a certain region. This is a limited distribution to only those who received the product involved.

**Campaigns** - Notification of a safety related issue. All products must be updated and are tracked by the factory until all units are corrected.

## SECTION 2 - SAFETY

### 2.1 SAFETY ALERTS



Look for these symbols to point out important safety precautions. They mean:



**Attention!**

**Personal Safety Is Involved!**

**Become Alert!**

**Obey The Message!**

### 2.2 SIGNAL WORDS

The safety alert symbol is used in decals on the unit and with proper operation procedures in this manual. They alert you to the existence and relative degree of hazards.

Understand the safety message. It contains important information about personal safety on or near the unit.



**DANGER: IMMINENTLY HAZARDOUS SITUATION!** If not avoided, WILL RESULT in death or serious injury.



**WARNING: POTENTIALLY HAZARDOUS SITUATION!** If not avoided, COULD RESULT in death or serious injury.



**CAUTION: POTENTIALLY HAZARDOUS SITUATION!** If not avoided, MAY RESULT in minor or moderate injury. It may also be used to alert against unsafe practices.

### 2.3 NOTATIONS

**NOTE:** General reference information for proper operation and maintenance practices.

**IMPORTANT:** Specific procedures or information required to prevent damage to unit or attachment.

### 2.4 PRACTICES AND LAWS

Practice usual and customary safe working precautions, for the benefit of yourself and others. Understand and follow all safety messages. Be alert to unsafe conditions and the possibility of minor, moderate, or serious injury or death. Learn applicable rules and laws in your area.

### 2.5 REQUIRED OPERATOR TRAINING

Original purchaser of this unit was instructed by the seller on safe and proper operation. If unit is to be used by someone other than original purchaser; loaned, rented or sold, ALWAYS provide the Operator's Manual and any needed safety training before operation.

### 2.6 PREPARATION

Before starting any removal of parts, proper preparation is very important for efficient work. A clean work area at the start of each job will allow you to perform service repairs easily and quickly.

To reduce the incidence of misplaced tools or parts, place removed components with all attaching hardware in the disassembly order on a clean work surface. Organization is a key part of proper reassembly.

Tools, instruments, and parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a needless delay. A list of required special tools has been included in this manual.



**CAUTION:** Remove enough fuel so that no spillage will occur. Remove battery to prevent spillage of electrolyte.

### 2.7 CLEANING AND STORAGE

**IMPORTANT:** Never spray unit with water or store unit outdoors.

A unit that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover trouble sources. Dirt and abrasive dust reduce the efficient work life of parts and can lead to costly replacement.

When taking unit out of extended storage:

1. Check for any damage or loose parts. Repair, replace, or tighten hardware before operation.
2. If a preservative fluid was used in fuel tank, drain and discard. Fill fuel tank with fresh new fuel.

### 2.8 SAFETY RULES

#### Walk Around Inspection

Complete a walk around inspection of unit and work area to understand:

- Work area.
- Your unit.
- All safety decals.

#### Work Area

ALWAYS check overhead and side clearances carefully before operation. ALWAYS be aware of traffic when operating along streets or curbs.

ALWAYS keep hands and feet within the limits of the unit.

Keep children, people, and animals away. Keep children out of work area and under watchful care of a responsible adult.

Keep area of operation clear of all toys, pets, and debris. Objects can cause vehicle instability and injury. Check for weak spots on dock, ramps or floors. Avoid uneven work areas and rough terrain. Stay alert for hidden hazards.

DO NOT run engine in an enclosed area. Always provide good ventilation.

### **Unit**

ALWAYS keep protective structures, guards, and panels in good condition, in place and securely fastened. NEVER modify or remove safety devices.

Check Safety Interlock System for proper operation daily (see Operation section). Do not operate unless system operates properly.

### **Operation**

Understand:

- How to operate all controls
- The functions of all controls
- How to STOP in an Emergency
- Speed ranges

Do not operate any of the control levers or power take-off unless both feet are resting on the platform.

DO NOT travel at too fast a rate. DO NOT change engine governor settings or over-speed engine.

Always back up slowly. Always look down and behind before and while backing.

Never leave a running unit unattended. ALWAYS shut off power take off, lower throttle setting, and stop engine before leaving unit. ALWAYS remove key to prevent unauthorized use.

Never carry passengers on any part of unit.

Avoid uneven and rough terrain. DO NOT operate near drop offs, ditches, or embankments. Unit can suddenly turn over if a wheel is over the edge of a cliff or ditch, or if an edge caves in.

If tires lose traction, turn off power take off and proceed slowly straight down slope. Avoid wet surfaces.

Avoid parking on a slope. If necessary, use wheel chocks.

DO NOT leave unit unattended on a slope. ALWAYS use wheel chocks when leaving unit.

ALWAYS operate unit in good visibility and light.

Fuel is highly flammable and its vapors can explode.

Use ONLY approved fuel containers.

NO Smoking!

NO Sparks!

NO Flames!

Allow engine to cool before servicing.

NEVER fill fuel tank when engine is running, hot, or unit is indoors.

Abnormal Vibrations are a warning of trouble. Striking a foreign object can damage unit. Immediately stop unit

and engine. Remove key and wait for all moving parts to stop. Remove wire from spark plug. Inspect unit and make any necessary repairs before restart.

### **Hazardous Slopes**

DO NOT operate on steep slopes. Avoid operating on slopes. When you must operate on a slope, travel up and down the slope. Never operate across a slope. Never operate on a slope greater than 10 degrees.

### **Child Safety**

NEVER allow children to operate or play on or near unit. Be alert and shut off unit if children enter area.

### **Personal Safety**

Read and obey all warning, caution, and instructions on the unit and in provided manuals.

- Only trained adults may operate unit.
- Training includes actual operation.
- Clearly understand instructions.
- Be alert! Conditions can change.

NEVER operate unit after or during the use of medication, drugs or alcohol. Safe operation requires your complete and unimpaired attention at all times.

NEVER allow anyone to operate the unit when their alertness or coordination is impaired.

DO NOT operate unit without wearing adequate outer garments. Wear adequate safety gear and protective gloves. Wear proper footwear to improve footing on slippery surfaces.

Protect eyes, face, and head from objects that may be thrown from unit. Wear appropriate hearing protection.

Avoid Sharp Edges. Sharp edges can cut. Moving parts can cut or amputate fingers or a hand. Wear gloves to service unit when handling sharp edges.

ALWAYS keep hands away from any pinch points.

ALWAYS keep hands and feet away from all moving parts during operation. Moving parts can cut off body parts.

DO NOT touch unit parts which might be hot from operation. Allow parts to cool before attempting to maintain, adjust, or service.

### **Controls**

Come to a complete stop before reversing.

Never jerk the control levers. Always use a steady even action to achieve smooth control.

Always be aware of obstructions that may cause injury to operator or damage to the unit.

## Service Position



**WARNING:** ALWAYS block wheels and know that jack stands or blocks used are stable, strong, or secure and will hold the weight of the unit during maintenance.



**WARNING:** ROTATING PARTS can amputate body parts. Keep hands and feet away. Loose clothing, long hair or scarves can get caught in rotating parts and cause death or serious injury.

Place unit on flat, level surface. ALWAYS stop engine and disengage clutches. Assure unit is secure and will not tip over. Strap and clamp onto lift, if used.

To ensure the unit is positioned in the proper service position:

1. Place jack stands under rear transaxles only.
2. If jacks are not available, place support blocks under both transaxles at the rear of unit.



**CAUTION:** Remove enough fuel so that no spills will occur.

## Maintenance

ALWAYS maintain unit in safe operating condition. Damaged or worn out muffler can cause fire or explosion.

Check the conditions of the unit at the end of each day and repair any damage or defects.

ALWAYS block wheels and know all jack stands are strong and secure and will hold weight of unit during maintenance.

Keep nuts and bolts tight and keep equipment in safe operating conditions.

Before maintenance, adjustments, or service (except where specifically recommended), shut off engine.

Allow hot parts to cool.

Keep unit free of dirt, stones, and other debris. Clean up oil or fuel spills.

## Storage

DO NOT store unit inside a building with fuel in the fuel tank where any ignition sources are present. Allow unit to cool completely.

ALWAYS clean unit before extended storage. See Engine Manual for proper storage.

## Spark Arrester

This product is equipped with an internal combustion engine. DO NOT use on or near any unimproved, forest covered or brush covered land unless the exhaust system is equipped with a spark arrester

meeting applicable local, state or federal laws. A spark arrester, if used, must be maintained in effective working order by the operator.

## Battery

Avoid Electric Shock. DO NOT reverse battery connections.

Explosive Gases! Poisonous battery fluid contains sulfuric acid and its contact with skin, eyes, or clothing can cause severe burns.

No flames. No sparks. No smoking near battery.

Always wear safety glasses and protective gear near battery.

DO NOT TIP battery beyond a 45° angle in any direction.

ALWAYS KEEP BATTERIES OUT OF REACH of children.

## Transport

Use extra care when loading or unloading unit onto trailer or truck. Secure unit chassis to transport vehicle. NEVER secure from rods or linkages that could be damaged.

DO NOT transport with attachment in raised position.

Lower attachment when unit is parked or stored unless a positive mechanical lock is used.

## Attachments and Accessories

Use only attachments or accessories designed for your unit.

## 2.9 CLEAN UNIT

Brush grass, dirt and debris off of unit with a soft brush. Clean packed grass out from under mower deck. Apply paint or oil to exposed, bare metal surfaces to prevent rust.

Inspect unit for visible signs of wear, breakage, or damage. Order any parts required and make necessary repairs to avoid delays when beginning use again.

Clean seat regularly, using a non-solvent cleaner. Extreme temperatures can damage seat when left unprotected against weather. If seat should tear, apply vinyl repair tape to protect damaged area.

Transaxle cooling fins must be kept clean to prevent damage from overheating. Use a cloth or brush to remove grass, chaff and debris.

Unless there are indications of leakage, transaxle does not have to be checked for proper oil level. If leak occurs, have it repaired by your Gravely Dealer.

## SECTION 3 - SPECIFICATIONS

<b>Model Type</b>	<b>Pro 100</b>	<b>Pro 100</b>	<b>Pro 150</b>
<b>Model Number</b>	<b>988001</b>	<b>988002</b>	<b>988059</b>
Manufacture	Briggs & Stratton	Kawasaki	Kawasaki
Horsepower	12 HP	12.5 HP	14 HP
Engine Spec. No.	281702-902512	FB 460V AS20	FC 420V-ES 15
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	3 gal. (11.4L)	3 gal. (11.4L)	4.5 gal. ( 17L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	SAE 30	10W 30	SAE 30
Crankcase Cap.	4 pts. (1.9L)	3 pts. (1.4L)	3 pts. (1.4L)
Engine Oil Filter	N/A	20777000	20777000
Governed RPM	3300 RPM	3300 RPM	3600 RPM
Air Cleaner w/Foam Precleaner	N/A	042926	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 5.00-6 (4 Ply)	13 x 5.00-6 (4 Ply)	13 x 6-6 (2 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 tp 15 psi
Transmission	Tecumseh Pro Line 700-032	Tecumseh Pro Line 700-032	Peerless 700-032
Speed-Forw. Max	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)	5.2 mph (8.4 kph)
Reverse Max.	Assist	Assist	3 mph (4.8 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	Champion
Type	RC19 LM	RCJ-8	RN 11 YC
Spark Plug Gap	0.03	0.024-0.028	0.028-0.031
Wheel Drive Belt (Matched Set)	07225800	07225800	07225800
Traction Drive Belt	049270	049270	04927
PTO Belt	041963	041963	N/A

<b>Model Type</b>	<b>Pro 150</b>	<b>Pro150</b>	<b>Pro 150</b>
<b>Model Number</b>	<b>988060</b>	<b>988069</b>	<b>988070</b>
Manufacture	Kawasaki	Kohler	Kohler
Horsepower	12.5 HP	14 HP	15 HP
Engine Spec. No.	FB 460V-DS20	PS-1411	PS-41532
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	4.5 gal. (17L)	4.5 gal. (17L)	4.5 gal. (17L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	SAE 30	SAE 30/10W30	10W 30
Crankcase Cap.	3 pts. (1.4L)	3 pts. (1.4L)	3 pts. (1.4L)
Engine Oil Filter	20777000	N/A	042366
Governed RPM	3300 RPM	3600 RPM	3600 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 6-6 (2 Ply)	13 x 6-6 (4 Ply)	13 x 6-6 (4 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 to 15 psi
Transmission	Tecumseh Pro Line 700-032	Tecumseh Pro Line 700-032	Peerless 700-032
Speed-Forw. Max	5.2 mph (8.4 kph)	5.2 mph (8.4 kph)	5.2 mph (8.4 kph)
Reverse Max.	3 mph (4.8 kph)	3 mph (4.8 kph)	3 mph (4.8 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	Champion
Type	RN J-8	RC 12 YC	RC 12 YC
Spark Plug Gap	0.024-0.028	0.04	0.04
Wheel Drive Belt (Matched Set)	07225800	07225800	07225800
Traction Drive Belt	049270	049270	049270
PTO Belt	N/A	N/A	N/A

<b>Model Type</b>	<b>Pro 150</b>	<b>Pro 150</b>	<b>Pro 150</b>
<b>Model Number</b>	<b>988074</b>	<b>988075</b>	<b>988077</b>
Manufacture	Kohler	Kawasaki	Kawasaki
Horsepower	12.5 HP	12.5 HP	14 HP
Engine Spec. No.	PS-1283	FB 460V-DS20 GS01	FC 420V-ES 15
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	4.5 gal. (17L)	4.5 gal. (17L)	4.5 gal. (17L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	10W30	SAE 30	SAE 30
Crankcase Cap.	3 pts. (1.4L)	3 pts. (1.4L)	3 pts. (1.4L)
Engine Oil Filter	042366	20777000	20777000
Governed RPM	3600 RPM	3300 RPM	3300 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 6.-6 (4 Ply)	13 x 6-6 (4 Ply)	13 x 6-6 (4 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 to 15 psi
Transmission	Peerless 700-032	Peerless 700-032	Peerless 700-032
Speed-Forw. Max	5.2 mph (8.4 kph)	5.2 mph (8.4 kph)	5.2 mph (8.4 kph)
Reverse Max.	3 mph (4.8 kph)	3 mph (4.8 kph)	3 mph (4.8 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	Champion
Type	RC 12 YC	RCJ-8	RN 11 YC
Spark Plug Gap	0.040	0.024-0.028	0.028-0.031
Wheel Drive Belt (Matched Set)	07225800	07225800	07225800
Traction Drive Belt	049270	049270	049270
PTO Belt	N/A	N/A	N/A

<b>Model Type</b>	<b>Pro 150</b>	<b>Pro 150</b>	<b>Pro 150</b>
<b>Model Number</b>	<b>988078</b>	<b>988079</b>	<b>988088</b>
Manufacture	Kohler	Kohler	Kawasaki
Horsepower	12.5 HP	15 HP	14 HP
Engine Spec. No.	PS-1283	PS-41532	FC 420V-ES 15
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	4.5 gal. (17L)	4.5 gal. (17L)	4.5 gal. (17L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	10W 30	10W 30	SAE 30
Crankcase Cap.	3 pts. (1.4L)	3 pts. (1.4L)	3 pts. (1.4L)
Engine Oil Filter	042366	042366	20777000
Governed RPM	3300 RPM	3300 RPM	3300 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	Foam Precleaner
Tire Size Front	13 x 6.00-6 (4 Ply)	13 x 6.00-6 (4 Ply)	6 " Band/Drum
Tire Pressure	12 to 15 psi	12 to 15 psi	13 x 6.00-6 (2 Ply)
Transmission	Peerless 700-032	Peerless 700-032	12 to 15 psi
Speed-Forw. Max	5.2 mph (8.4 kph)	5.2 mph (8.4 kph)	Peerless 700-079
Reverse Max.	3 mph (4.8 kph)	3 mph (4.8 kph)	5.2 mph (84 kph)
Transmission Lube	Sealed	Sealed	3 mph (4.8 kph)
Spark Plug	Champion	Champion	Sealed
Type	RC 12 YC	RC 12 YC	Champion
Spark Plug Gap	0.04	0.04	RN 11 YC
Wheel Drive Belt (Matched Set)	07225800	07225800	0.028-0.031
Traction Drive Belt	049270	049270	07225800
PTO Belt	N/A	N/A	N/A

<b>Model Type</b>	<b>Pro 150</b>	<b>Pro 150</b>	<b>Pro 200</b>
<b>Model Number</b>	<b>988091</b>	<b>988309</b>	<b>988003</b>
Manufacture	Kawasaki	Kawasaki	Kawasaki
Horsepower	12.5 HP	10.9 HP	12.5 HP
Engine Spec. No.	FB 460V DS20 GS01	FC 420V ES15	FB 460V AS20
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	4.5 gal. (17L)	4.5 gal. (17L)	3 gal. (11.4L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	SAE 30	SAE 30	SAE 30
Crankcase Cap.	3 pts. (1.4L)	3 pts. (1.4L)	3 pts. (1.4L)
Engine Oil Filter	20777000	20777000	20777000
Governed RPM	3300 RPM	2950 RPM	3300 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	Foam Precleaner	6 " Band/Drum	6 " Band/Drum
Tire Size Front	6 " Band/Drum	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)
Tire Pressure	13 x 6.00-6 (4 Ply)	12 to 15 psi	12 to 15 psi
Transmission	12 to 15 psi	Tecumseh Pro Line 700-079	Tecumseh Pro Line 700-052
Speed-Forw. Max	Peerless 700-079	5.2 mph (8.4 kph)	5.4 mph (8.7 kph)
Reverse Max.	5.2 mph (8.4 kph)	3 mph (4.8 kph)	1.8 mph (2.9 kph)
Transmission Lube	3 mph (4.8 kph)	Sealed	Sealed
Spark Plug	Sealed	Champion	Champion
Type	Champion	RN 11 YC	RCJ-8
Spark Plug Gap	RCJ - 8	0.028-0.031	0.024 - 0.028
Wheel Drive Belt (Matched Set)	0.024-0.028	07225800	049029
Traction Drive Belt	07225800	049270	052776
PTO Belt	N/A	N/A	07225000

<b>Model Type</b>	<b>Pro 200</b>	<b>Pro 200</b>	<b>Pro 200</b>
<b>Model Number</b>	<b>988004</b>	<b>988005</b>	<b>988006</b>
Manufacture	Kohler	Kohler	Kawasaki
Horsepower	14 HP	16 HP	17 HP
Engine Spec. No.	PS - 1411	PS - 56518	FC 540V AS04
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	3 gal. (11.4L)	3 gal. (11.4L)	3 gal. (11.4L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	10W 30	10W 30	SAE 30
Crankcase Cap.	4 pts. (1.9L)	4 pts. (1.9L)	3 pts. (1.4L)
Engine Oil Filter	042366	042366	20777000
Governed RPM	3300 RPM	3300 RPM	3300 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 to 15 psi
Transmission	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052
Speed-Forw. Max	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)
Reverse Max.	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	Champion
Type	RC 12 YC	RC 12 YC	RN 11 YC
Spark Plug Gap	0.04	0.035	0.028-0.031
Wheel Drive Belt (Matched Set)	049029	049029	049029
Traction Drive Belt	052776	052776	052776
PTO Belt	07225000	07225000	07225000

<b>Model Type</b>	<b>Pro 200</b>	<b>Pro 200</b>	<b>Pro 200</b>
<b>Model Number</b>	<b>988007</b>	<b>988062</b>	<b>988063</b>
Manufacture	Kohler	Kawasaki	Briggs & Stratton
Horsepower	18 HP	14 HP	16 HP
Engine Spec. No.	PS - 58516	FC 420V AS15	303777 - 0138
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	3 gal. (11.4L)	3.5 gal. (13.3L)	3.5 gal. (13.3L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	10W 30	SAE 30	SAE 30/10W30
Crankcase Cap.	4 pts. (1.9L)	3.4 pts. (1.4L)	4 pts. (1.9L)
Engine Oil Filter	042366	20777000	N/A
Governed RPM	3300 RPM	3300 RPM	3600 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 to 15 psi
Transmission	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052
Speed-Forw. Max	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)
Reverse Max.	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	Champion
Type	RC 12 YC	RN 11 YC	RC 14 YC
Spark Plug Gap	0.035	0.028-0.031	0.03
Wheel Drive Belt (Matched Set)	049029	049029	049029
Traction Drive Belt	052776	052776	052776
PTO Belt	07225000	07225000	07225000
Battery	041358	041358	041358

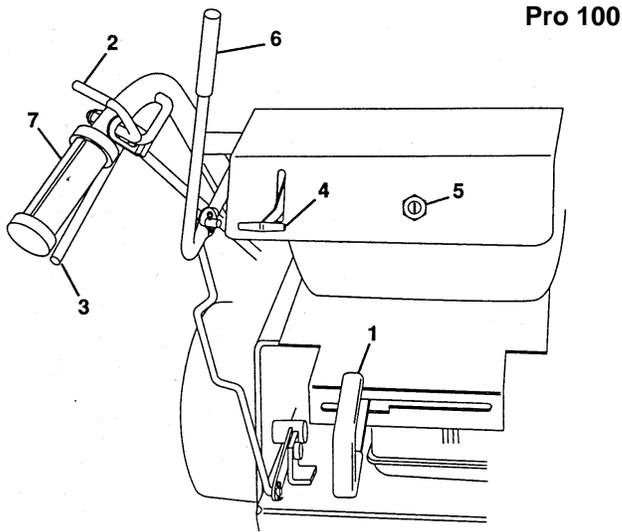
<b>Model Type</b>	<b>Pro 200</b>	<b>Pro 200</b>	<b>Pro 200</b>
<b>Model Number</b>	<b>988071</b>	<b>988072</b>	<b>988080</b>
Manufacture	Kohler	Kohler	Kohler
Horsepower	15 HP	18 HP	15 HP
Engine Spec. No.	PS-41532	PS61527	CV 15T PS-41532
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	3.5 gal. (13.3L)	3.5 gal. (13.3L)	3.5 gal. (13.3L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	10W 30	10W30	10W 30
Crankcase Cap.	4 pts. (1.9L)	2.1 pts. (2L)	4 pts. (1.9L)
Engine Oil Filter	042366	042366	042366
Governed RPM	3300 RPM	3300 RPM	3300 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 to 15 psi
Transmission	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052
Speed-Forw. Max	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)
Reverse Max.	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	Champion
Type	RC 12 YC	RC 12 YC	RC 12 YC
Spark Plug Gap	0.04	0.03	0.04
Wheel Drive Belt (Matched Set)	049029	049029	049029
Traction Drive Belt	052776	052776	052776
PTO Belt	07225000	07225000	07225000
Battery	041358	041358	041358

<b>Model Type</b>	<b>Pro 200</b>	<b>Pro 200</b>	<b>Pro 200</b>
<b>Model Number</b>	<b>988081</b>	<b>988082</b>	<b>988085</b>
Manufacture	Briggs & Stratton	Kohler	Robin
Horsepower	16 HP	18 HP	18 HP
Engine Spec. No.	303777-0138	CV 18S PS-61527	EH 63 V
Fuel	Unleaded	Unleaded	Unleaded
Fuel Tank Cap.	3.5 gal. (13.3L)	3.5 gal. (13.3L)	3.5 gal. (13.3L)
Fuel Filter P/N	040742	040742	040742
Engine Oil	SAE/10W 30	10W 30	10W 30
Crankcase Cap.	4 pts. (1.9L)	2.1 pts. (2L)	4 pts. (1.9L)
Engine Oil Filter	N/A	042366	21527000
Governed RPM	3600 RPM	3300 RPM	3300 RPM
Air Cleaner w/Foam Precleaner	Paper Element	Paper Element	Paper Element
Brakes & Steering	6 " Band/Drum	6 " Band/Drum	6 " Band/Drum
Tire Size Front	13 x 6.50-6 (4 Ply)	13 x 6.50-6 (4 Ply)	13 x 6.00-6 (2 Ply)
Tire Pressure	12 to 15 psi	12 to 15 psi	12 to 15 psi
Transmission	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052	Tecumseh Pro Line 700-052
Speed-Forw. Max	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)	5.4 mph (8.7 kph)
Reverse Max.	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)	1.8 mph (2.9 kph)
Transmission Lube	Sealed	Sealed	Sealed
Spark Plug	Champion	Champion	NGK
Type	RC 14 YC	RC 12 YC	Part # 21526900
Spark Plug Gap	0.03	0.03	0.03
Wheel Drive Belt (Matched Set)	049029	049029	049029
Traction Drive Belt	052776	052776	052776
PTO Belt	07225000	07225000	07225000
Battery	041358	041358	041358

<b>Model Type</b>	<b>Pro 200</b>		
<b>Model Number</b>	<b>988087</b>		
Manufacture	Kawasaki		
Horsepower	14 HP		
Engine Spec. No.	FC 420V-ES 15		
Fuel	Unleaded		
Fuel Tank Cap.	3.5 gal. (13.3L)		
Fuel Filter P/N	040742		
Engine Oil	SAE 30		
Crankcase Cap.	4 pts. (1.9L)		
Engine Oil Filter	20777000		
Governed RPM	3300 RPM		
Air Cleaner w/Foam Precleaner	Paper Element		
Brakes & Steering	6 " Band/Drum		
Tire Size Front	13 x 6.00-6 (2 Ply)		
Tire Pressure	12 to 15 psi		
Transmission	Tecumseh Pro Line 700-052		
Speed-Forw. Max	5.4 mph (8.7 kph)		
Reverse Max.	1.8 mph (2.9 kph)		
Transmission Lube	Sealed		
Spark Plug	Champion		
Type	RN 11 YC		
Spark Plug Gap	0.028-0.031		
Wheel Drive Belt (Matched Set)	049029		
Traction Drive Belt	052776		
PTO Belt	7225000		
Battery	041358		

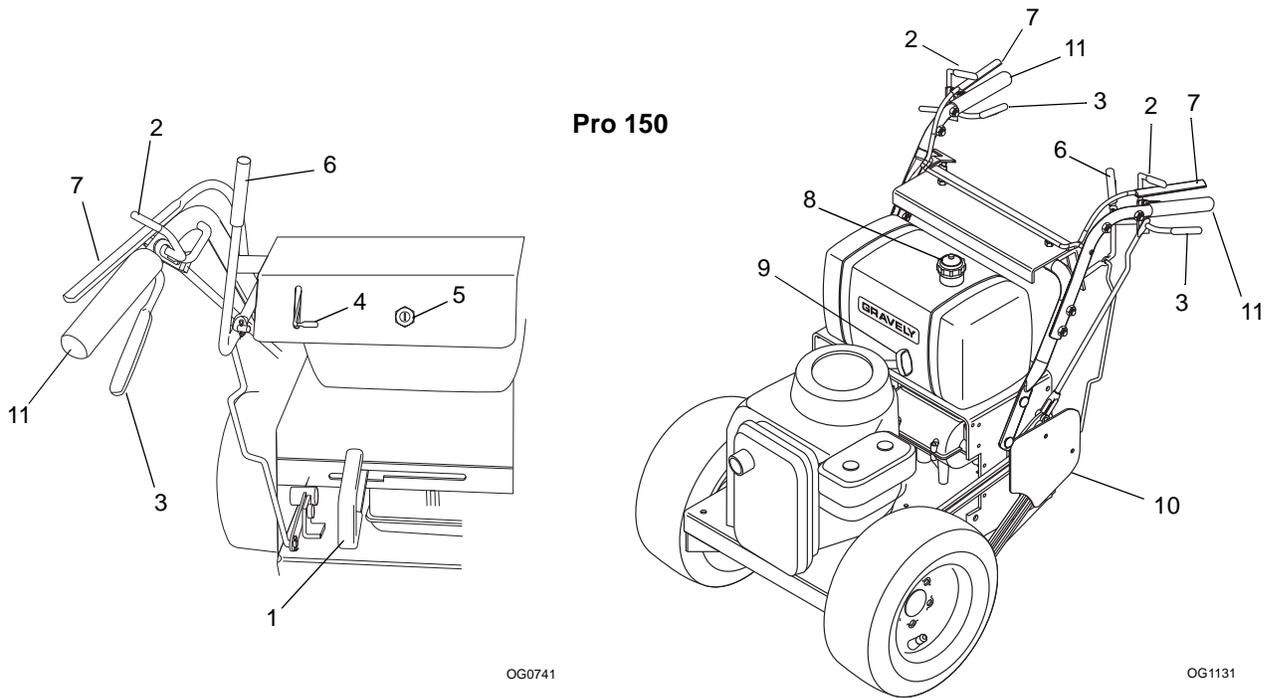
# SECTION 4 - GENERAL MAINTENANCE & ADJUSTMENTS

## 4.1 CONTROLS AND FEATURES



- 1. Shift Lever
- 2. Steering Lever Latch
- 3. Steering Lever
- 4. Throttle-Choke Lever
- 5. Ignition Switch
- 6. PTO Lever
- 7. Operator Presence Controls

Figure 2 - Pro 100

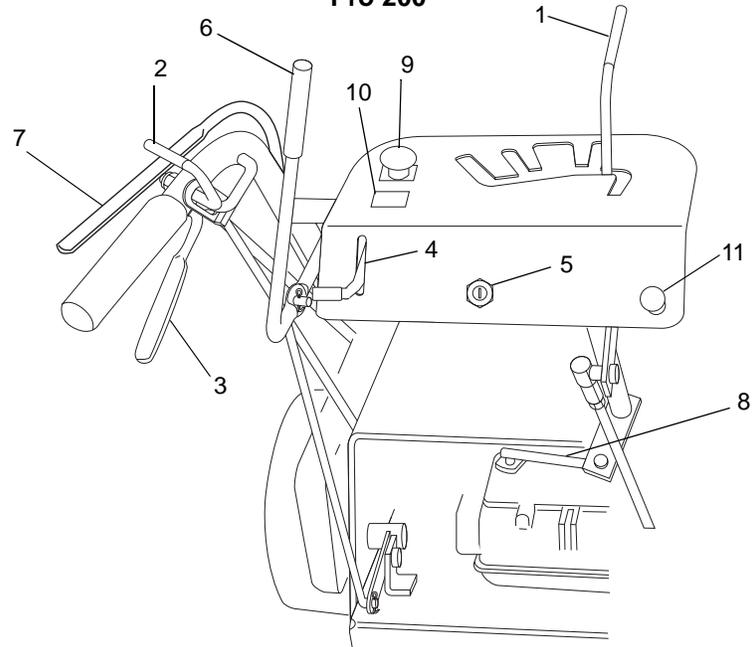


- 1. Shift Lever
- 2. Steering Lever Latches
- 3. Steering Levers
- 4. Throttle-Choke Lever
- 5. Ignition Switch

- 6. PTO Lever
- 7. Operator Presence Controls
- 8. Fuel Cap
- 9. Recoil Starter Handle
- 10. Traction Belt Guard

Figure 3 - Pro 150

**Pro 200**



- |                                    |   |
|------------------------------------|---|
| 1. Shift Lever                     | 8. Transmission Shifter Rod               |
| 2. Steering Lever Latch            | 9. PTO Switch (electric start models)     |
| 3. Steering Lever                  | 10. Hour Meter (electric start models)    |
| 4. Throttle-Choke Lever            | 11. Choke Control (electric start models) |
| 5. Ignition Switch                 |   |
| 6. PTO Lever (recoil start models) |   |
| 7. Operator Presence Control       |   |

Figure 4 - Pro 200

## 4.2 FILLING THE FUEL TANK



**WARNING:** Use caution with fuel. Fuel is very flammable. Keep fuel in a clean and tight container. Keep fuel away from fire and heat. Never put fuel in the fuel tank while the engine is running or hot. Clean up any spilled fuel before starting the engine.

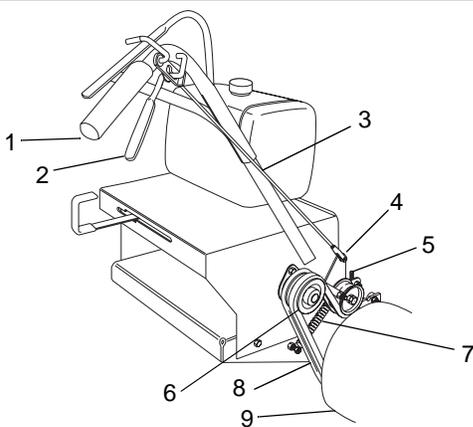
Add fuel to the fuel tank as needed. See your engine manual for the correct type and grade of fuel to be used.

1. Put the unit in an open and well ventilated area prior to refueling.
2. Stop the engine.
3. Allow the engine to cool.
4. Clean the fuel cap and in the area around the fuel cap. Remove the cap from the fuel tank.
5. Fill the fuel tank with the proper grade of fuel recommended by the engine manufacturer. Be careful not to spill any fuel.
6. Install fuel cap on the fuel tank and tighten.
7. Clean up any spilled fuel before starting engine.

## 4.3 GENERAL LUBRICATION

Apply a small amount of oil to the pivot points as required for smooth and proper operation.

Every 8 hours of operation, add Sten Mix Hi-Temp Grease or equivalent to the lube fittings, in each of the wheel hubs. After every 8 hours of operation, apply a small amount of oil to the drive chain.



- |                               |   |
|-------------------------------|---|
| 1. Handlebar                  | 6. Transmission Shaft Pulley                            |
| 2. Steering Lever             | 7. Clutch Idler Pulley Spring                           |
| 3. Wheel Clutch Actuating Rod | 8. Traction Belt (Pro 200 shown - Pro 100 has one belt) |
| 4. Wheel Clutch Arm Weldment  | 9. Drive Wheel  |
| 5. Brake Rod                  |   |

Figure 5

OG0751

## 4.4 CHECKING FASTENERS

Each day before operating, check all nuts, bolts, and other fasteners. Replace fasteners that are missing or damaged.

## 4.5 CHECK TIRES

Keep tires properly inflated at all times. The correct air pressure is 12 to 15 psi 83 to 103 kN/m<sup>2</sup>. After checking and/or inflating, replace and tighten valve caps to prevent air loss.

## 4.6 THE STEERING LEVERS

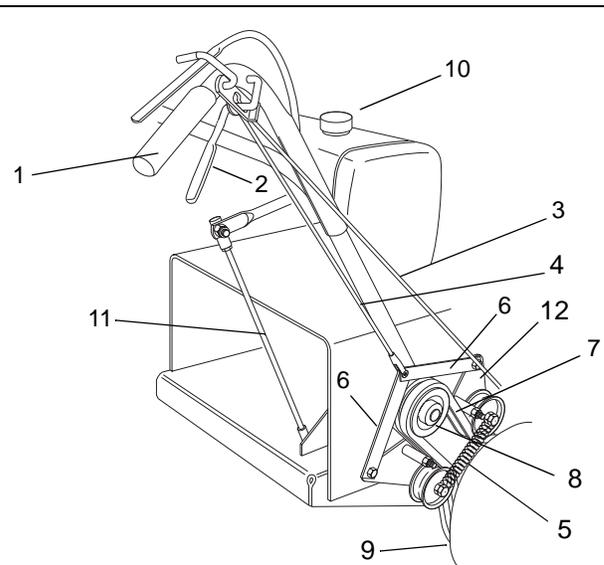
The steering levers are used to steer the unit. Pull up on the left hand lever to turn to the left. Pull up on the right lever to turn to the right. Holding both levers up stops the unit. See Figures 5 and 6.



**WARNING:** When the engine is running and transmission is in gear, holding only one steering lever up will cause the unit to circle around one drive wheel.

## 4.7 THE STEERING LEVER LATCHES

The steering lever latches are used to hold the steering levers in the up position. Engaging both steering lever latches will free one of the operator's hands for a throttle adjustment, etc. (see Figures 2 and 3).



- |                           |                               |
|---------------------------|-------------------------------|
| 1. Handlebar              | 8. Clutch Idler Pulley Spring |
| 2. Steering Lever         | 9. Drive Wheel                |
| 3. Brake Rod              | 10. Fuel Cap                  |
| 4. Clutch Rod             | 11. Clutch Actuating Rod      |
| 5. Jack-Shaft Pulley      | 12. Wheel Clutch Arm Weldment |
| 6. Clutch Actuating Strap |                               |
| 7. Traction Belt          |                               |

Figure 6 - Pro 200

## 4.8 ADJUSTING THE LEVERS

Initial adjustment:

1. Stop the engine.
2. Shift the transmission into neutral and operate the steering levers a couple of times. Do not roll the machine.
3. With the steering levers in the disengaged position, adjust the clutch rods until the gap between the end of each steering lever and handlebar grip is 2-1/2 to 3 inches. Obtain this measurement by adjusting the clevis on the end of each clutch rod.
4. Adjust the brakes by turning the wing nut below the compression spring on each brake rod until the desired amount of brake engagement is achieved when each steering lever is fully engaged. The brake adjustment is correct when the compression springs on the brake rods measure from 7/8 to 1 inch with the steering levers engaged into the steering lever latches.

**NOTE:** The traction belt must be disengaged as the brake starts to engage.

5. Start the engine and try in low gear to check for proper engagement. With a new unit, new brakes or new belts, two or three readjustments will be required in the first hour of operation.

Readjusting the steering levers:

1. Repeat steps 3 and 4 above.
2. Check to see if the gap between the steering lever and handlebar is 2-1/2 to 3 inches. If not, readjust per step 4 above.



**WARNING:** Improper adjustment of steering levers can cause a loss of steering control.

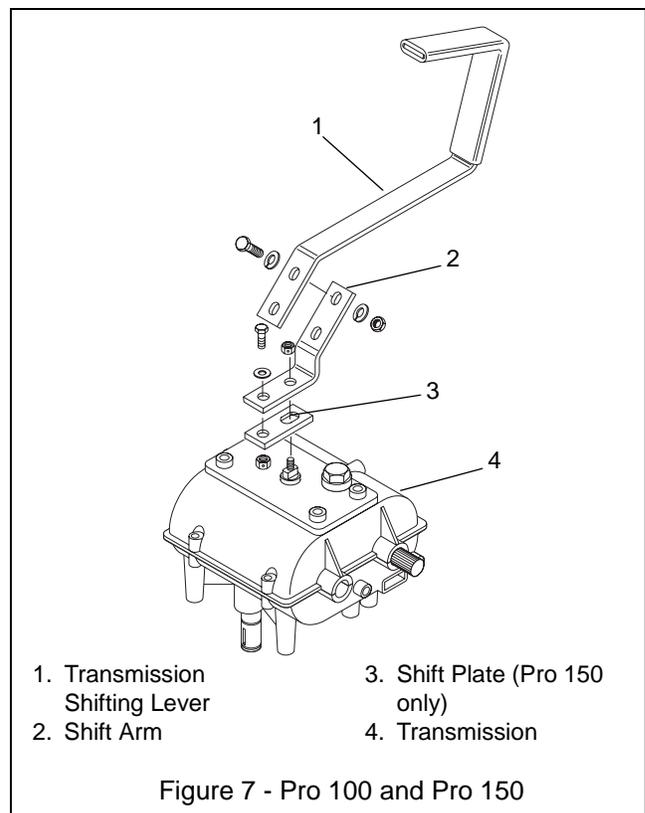
## 4.9 ADJUSTING THE SHIFT LEVER

### Pro 100 & Pro 150

The transmission shift lever is fastened to the transmission shift arm with two 5/16-18 bolts. The bolt holes in both the arm and lever are slotted. When the shift lever is adjusted correctly, it is centered in the forward slot and is just touching the reverse stop when the transmission is in neutral.

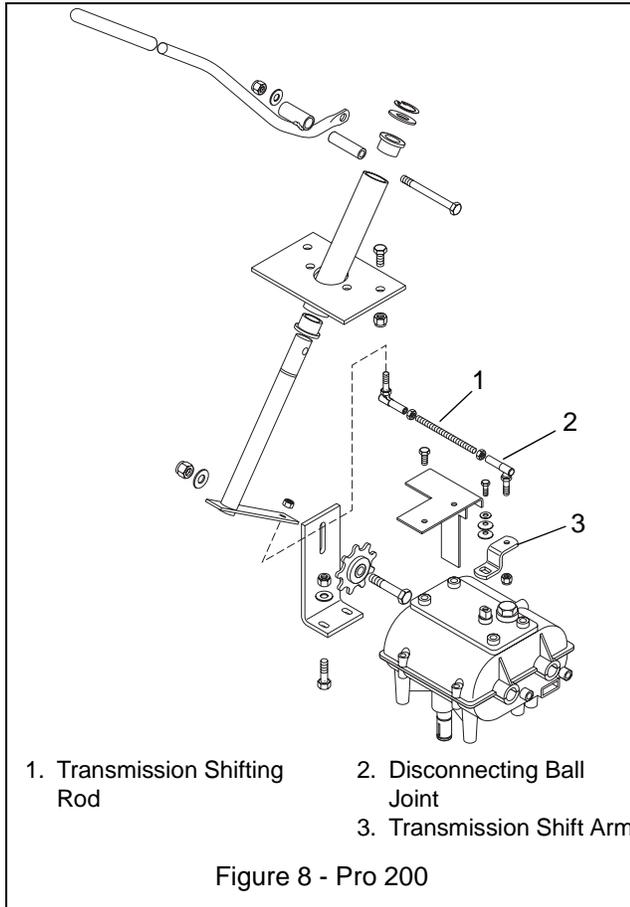
**NOTE:** You should not be able to shift into reverse without pushing down on the shift lever.

1. Stop engine and disconnect the shifting lever from the shift arm.
2. Make sure the transmission is shifted into neutral (move the shift arm until the unit rolls freely).
3. Move the shift lever to the first gear position by rotating the shift arm on the transmission counterclockwise on position (this will be first gear).
4. Loosely attach the shifting lever.
5. Position the shifting lever in the first gear position and tighten the bolts.



## Pro 200

To adjust the shift lever linkage, it may be necessary to adjust two different rods: (1) the transmission shifter rod and (2) the clutch actuating rod. See Figures 5 and 6 for the locations of these rods.



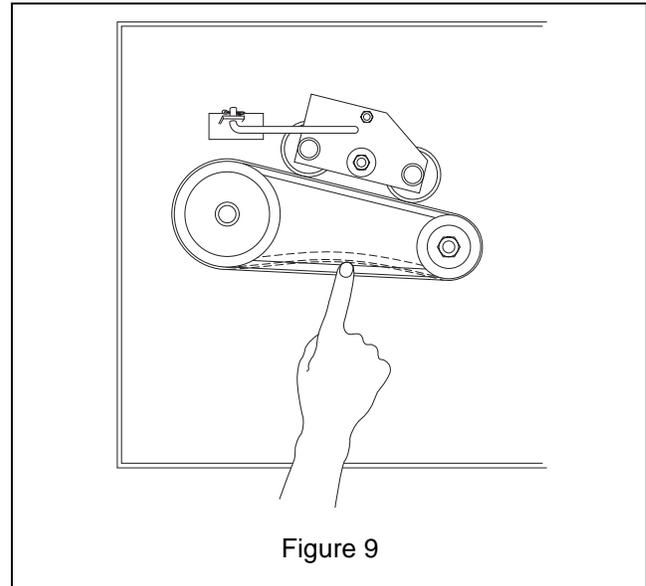
1. Stop the engine.
2. Move the shift lever to the neutral position.
3. Disconnect the ball socket from the ball stud on the transmission shift arm on the transmission. (Pry apart with a wrench or screwdriver).
4. Make sure the transmission is shifted into neutral. (Move the transmission arm until the unit will roll freely.)
5. Move the shift lever to the first gear position. Rotate the transmission shift arm on the transmission counterclockwise one position. (This will be first gear.)
6. Loosen the jam nuts on the ends of the transmission shifter rod and adjust the ball socket until it lines up with the ball stud.
7. Snap the ball joint back together and tighten the jam nuts.

To adjust the clutch actuating rod:

1. Stop the engine.
2. Put the gear shift lever in the neutral position.

3. Loosen the jam nut at the ball joint on the gear shift lever.
4. Rotate the clutch actuating rod until the clutch arm which is sticking down through the frame, is at a right angle with the underside of the frame.

The rod is adjusted correctly when both idlers are parallel with the transmission belt with tension (finger pressure) on the back side of transmission belt (Figure 9).



5. Tighten the lock nut at the ball joint.

## 4.10 ADJUSTING THE PTO CLUTCH

(Recoil Start Model Only)

1. Stop the engine.
2. Move the PTO lever to the "ON" position.
3. Loosen the two jam nuts on the rear end of the PTO clutch actuating rod.
4. With the PTO lever in the "ON" position, turn the two jam nuts forward until the gap in the coils of the spring is approximately .005 inches (.12 mm), see Figure 10.
5. Lock the two jam nuts on the rear end of the PTO clutch actuating rod.

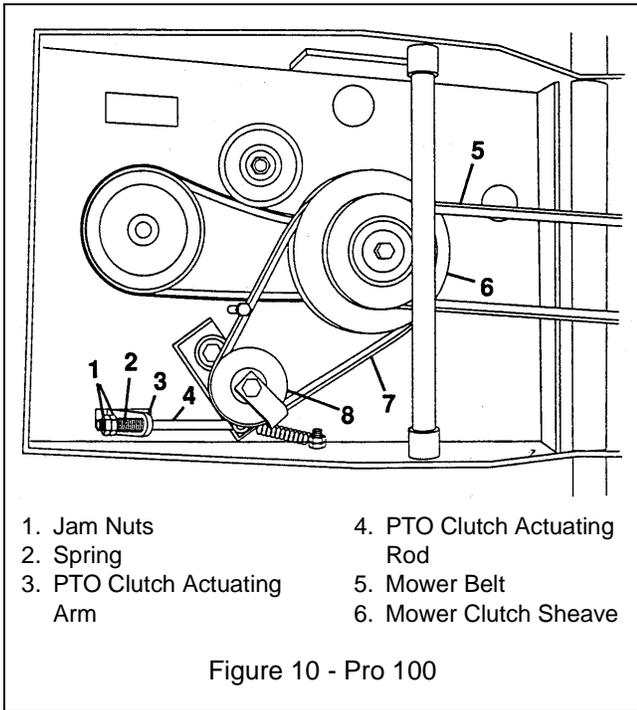


Figure 10 - Pro 100

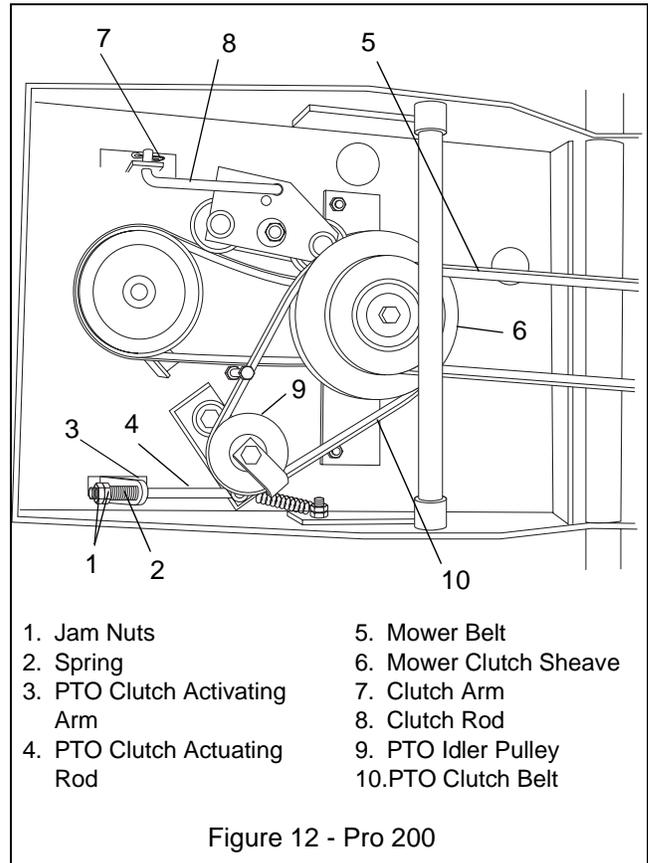


Figure 12 - Pro 200

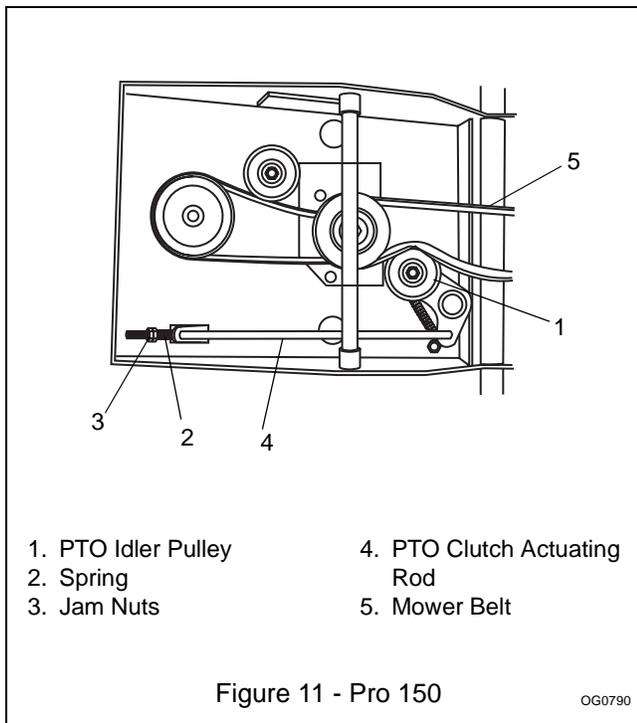


Figure 11 - Pro 150

OG0790

#### 4.11 ADJUSTING THE ROLLER CHAIN (Between The Transmission And The Jackshaft)

1. Loosen the nut slightly on the bolt that fastens the idler sprocket to the idler sprocket bracket.
2. Tap up on the nut to raise the idler sprocket and take the slack out of the chain. (A little slack is desirable.)
3. Tighten the nut to secure the idler sprocket.

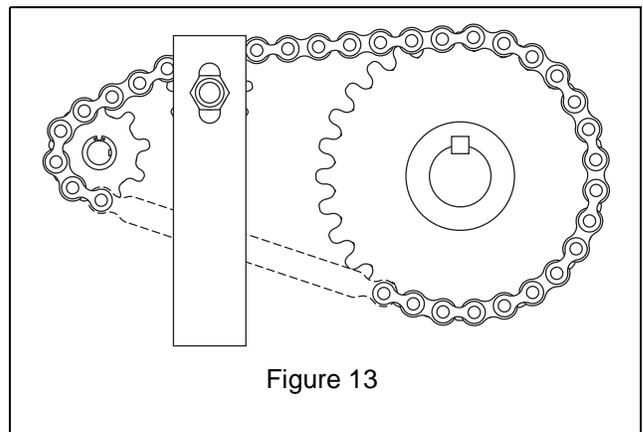


Figure 13

## SECTION 5 - ENGINE

### 5.1 ENGINE TROUBLESHOOTING

The following troubleshooting chart is to be used to isolate engine problems and give possible causes and corrective action responses.

The troubleshooting key is generic and can be used for several types of engines. Use only those possible causes and corrective actions that apply to the unit.

TROUBLE	POSSIBLE CAUSES (Refer to Key Below)	CORRECTIVE ACTION
Black Exhaust	1, 20, 22, 25, 29, 31, 32, 33	repair or replace
Blue/White Exhaust	4, 20, 25, 31, 33, 34	repair or replace
Difficult Starting	1, 5, 7, 8, 9, 10, 20, 21, 22, 29, 31, 32, 33	repair or replace
Erratic Running	1, 7, 8, 9, 10, 20, 21, 23, 26, 29, 33, 59, 62	repair or replace
Excessive Fuel Consumption	1, 20, 22, 23, 25, 29, 31, 32, 33	repair or replace
Excessive Crankcase Pressure	25, 31, 33, 34, 45, 55	repair or replace
High Oil Pressure	4, 41	repair or replace
Knocking	22, 26, 29, 31, 33, 36, 46, 59	repair or replace
Loss of Power or System	1, 8, 10, 20, 21, 22, 23, 25, 26, 31, 32, 33	repair or replace
Low Cranking Power	2, 3, 4, 11	repair or replace
Low Oil Pressure	4, 36, 37, 39	repair or replace
Misfiring	10, 20, 25, 26, 28, 29, 32	repair or replace
Overheating	1, 19, 25,	repair or replace
Poor Compression	25, 28, 29, 31, 32, 33, 34, 59,	repair or replace
Starts and Stops	1, 6, 10, 62	repair or replace see electrical systems see engine service manual
Vibration	20, 23, 25, 26, 29, 33, 45, 49	repair or replace
Will Not Crank	2, 11, 45	charge battery or replace
Will Not Start	1, 10, 62	repair or replace see electrical systems see engine service manual

TROUBLESHOOTING KEY					
1	Restriction in air cleaner	22	Incorrect grade of fuel	43	Faulty suction pipe
2	Bad electrical connection	23	Sticking throttle/restricted movement	44	Choked oil filter
3	Faulty starter motor	24	Exhaust pipe restriction	45	Bad solenoid switch
4	Incorrect grade of lubricating oil	25	Leaking cylinder head gasket	46	Incorrect piston height
5	Low cranking speed	26	Overheating	47	Damaged fan
6	Fuel tank empty	27	Cold running	48	Faulty engine mounting
7	Controls not in correct operation position	28	Incorrect tappet adjustment	49	Incorrectly aligned flywheel and/or flywheel housing
8	Blocked fuel feed line	29	Sticking valves	50	Faulty thermostat
9	Faulty fuel lift pump	30	Incorrect high pressure pipes	51	Restriction in water jacket
10	Choked fuel filter	31	Worn cylinder bores	52	Loose fan belt
11	Battery capacity low	32	Pitted valves and seats	53	Choked radiator
12	Air in fuel system	33	Broken, worn or sticking piston ring(s)	54	Faulty water pump
13	Faulty fuel injection pump	34	Worn valve stems and guides	55	Choked breather pipe
14	Faulty fuel injectors or incorrect type	35	Restriction in air cleaner	56	Damaged valve stem oil deflector (if fitted)
15	Incorrect use of cold start equipment	36	Worn or damaged bearings	57	Coolant level too low
16	Faulty cold start equipment	37	Insufficient oil in sump	58	Blocked sump strainer
17	Broken fuel injection pump drive	38	Bad/defective oil temperature switch	59	Broken valve spring
18	Incorrect fuel pump timing	39	Oil pump worn	60	Exhaust or vacuum pipe leak
19	Incorrect valve timing	40	Pressure relief valve sticking open	61	Bad or defective water temperature switch
20	Poor compression	41	Pressure relief valve sticking closed	62	Bad spark plug(s)
21	Blocked fuel tank vent	42	Broken relief valve spring		

## **5.2 CHECKING ENGINE OIL**

Check the engine oil BEFORE EACH USE OR TWICE DAILY ON COMMERCIAL USE.

## **5.3 CHANGING OIL FILTER**

Some engines are equipped with an oil filter. Replace the oil filter every other oil change, in accordance with the *Oil Change Intervals*. See engine manufacturers manual for proper intervals and type.

## **5.4 AIR CLEANER**

This engine is equipped with a replaceable, high density paper air cleaner element. Some engines are also equipped with an oiled, foam precleaner which surrounds the paper element.

## **5.5 CHECK SPARK PLUG**

Every 100 hours or operation, remove the spark plugs, check condition, and reset gaps or replace with new plugs as necessary.

1. Before removing spark plugs, clean the area around base of plugs to keep dirt and debris out of the engine.
2. Remove plugs and check condition. Replace plugs if worn or reuse is questionable.

**NOTE:** Do not clean the spark plug in a machine using abrasive grit. Some grit could remain in the spark plug and enter the engine causing extensive wear and damage.

## **5.6 ENGINE REMOVAL**

1. Remove the battery cover and disconnect battery cables. Remove negative cable first. Remove the battery.
2. Turn off fuel at fuel tank shut-off valve and disconnect the fuel line at the engine filter.
3. Disconnect the choke and throttle cables.
4. Disconnect the wiring harness at engine, starter cable, battery ground cable, engine ground wires, and oil sensor wire.
5. Loosen the tension on the PTO clutch belt and remove belts from the engine sheaves.

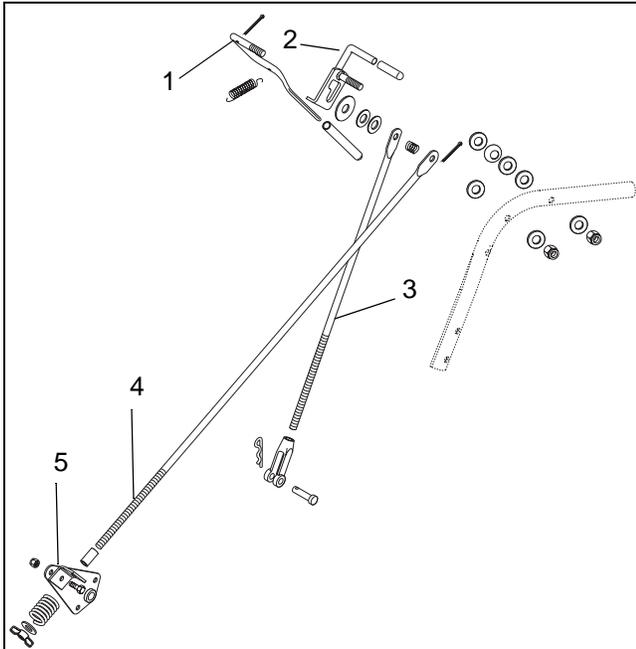
## **5.7 ENGINE INSTALLATION**

The engine is replaced in reverse order.

## SECTION 6 - STEERING AND CONTROLS

### 6.1 STEERING CONTROLS

The right and left hand controls should be checked each time the unit is used. Any parts or pivot points that show signs of wear should be replaced.



- |                               |                         |
|-------------------------------|-------------------------|
| 1. Hand Control Lever         | 3. Clutch Actuating Rod |
| 2. Brake Lock Clutch Weldment | 4. Brake Rod            |
|                               | 5. Brake Rod Bracket    |

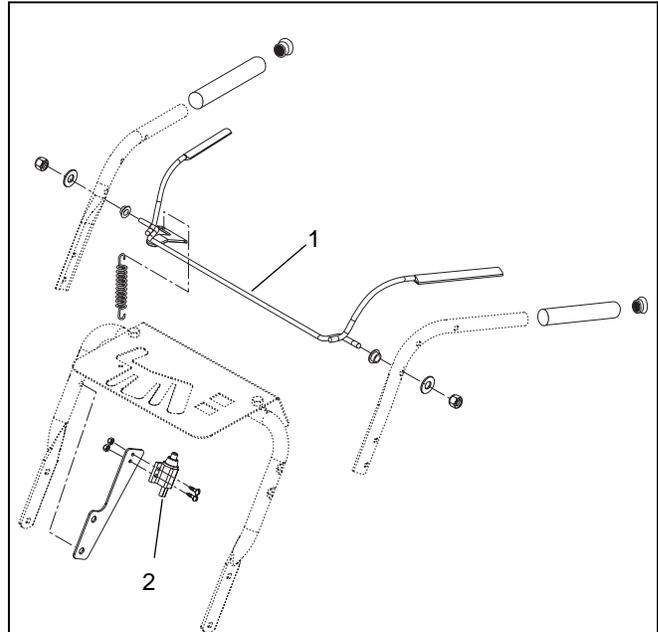
Figure 14

PG0521

### 6.2 OPERATOR PRESENCE CONTROL

The presence control linkage opens a switch when the hand grips are squeezed by the operator.

The electrical switch is normally open and will shut off the engine when the hand grips are released.



- |                       |
|-----------------------|
| 1. Hand-Grip Weldment |
| 2. Single Pole Switch |

Figure 15

PG0790

## SECTION 7 - DRIVE TRAIN

### 7.1 TROUBLESHOOTING

If the unit will not move or mow when the engine is running, do the following:

1. Stop the engine. Remove the ignition key.
2. See if the drive chain is broken or off the sprockets. If necessary, install or replace the drive chain.
3. See if the transmission belt is broken or out of place. If necessary, install, replace or adjust the transmission belt. See section on *Adjustments*.
4. See if the PTO clutch belt is broken or off the pulleys. If necessary, install or replace the PTO clutch belt.
5. See if the mower belt is broken or off the pulleys. If necessary, install, replace or adjust the mower belt. See mower operator's manual.

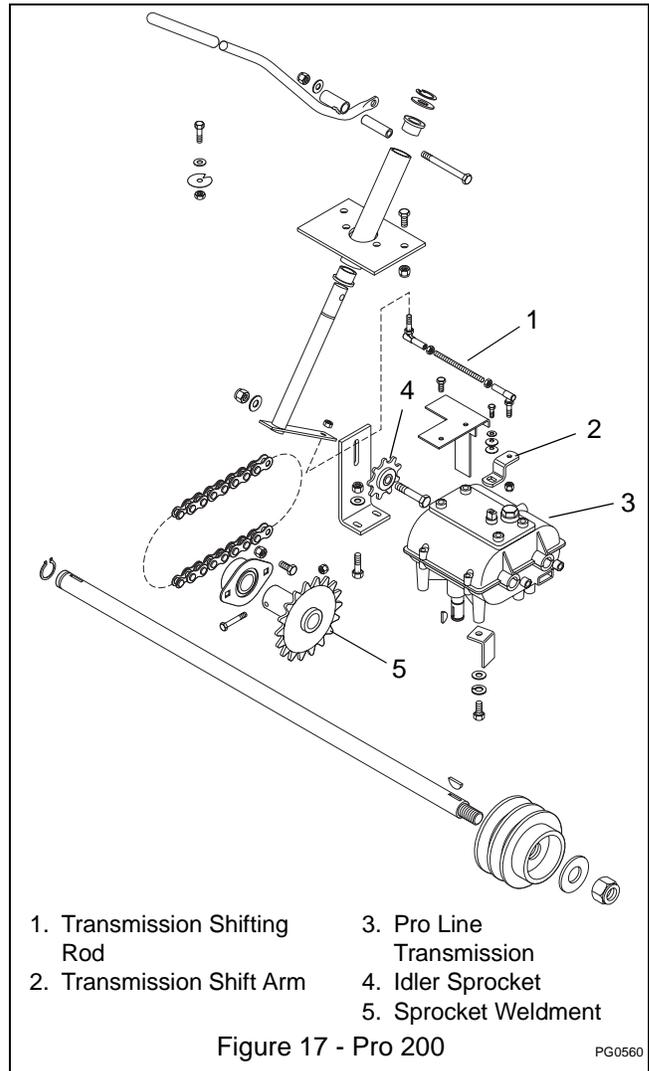
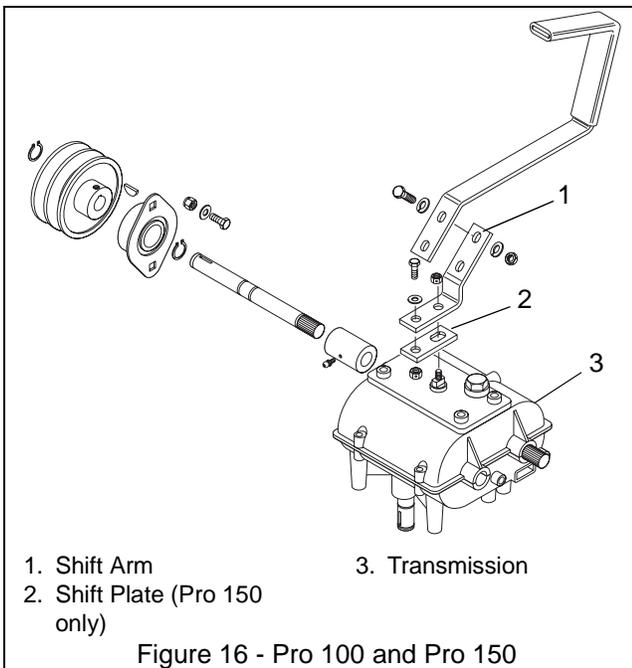
### 7.2 TRANSMISSION

The transmission is not serviceable. Place gear selector in gear and turn the input shaft. The output shaft will turn. It may be easier to remove the drive chain when performing this test. If the output shaft does not turn, replace the transmission.

### 7.3 TRANSMISSION REMOVAL

1. Remove the chain and sprocket.
2. Disconnect the shift linkage from the shift arm.
3. Remove mounting bolts.

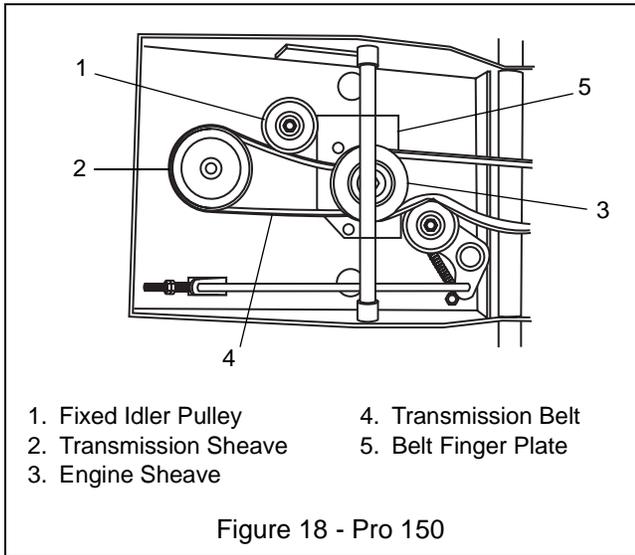
Replace in reverse order, making sure the chain sprockets line up.



### 7.4 REPLACING THE TRANSMISSION BELT

#### Pro 100 and Pro 150

1. Stop the engine. Remove ignition key. Put PTO lever in the "OFF" position. Put the shift lever in neutral.
2. Loosen belt finger plate and remove mower belt from engine sheave (Figures 18 and 19).



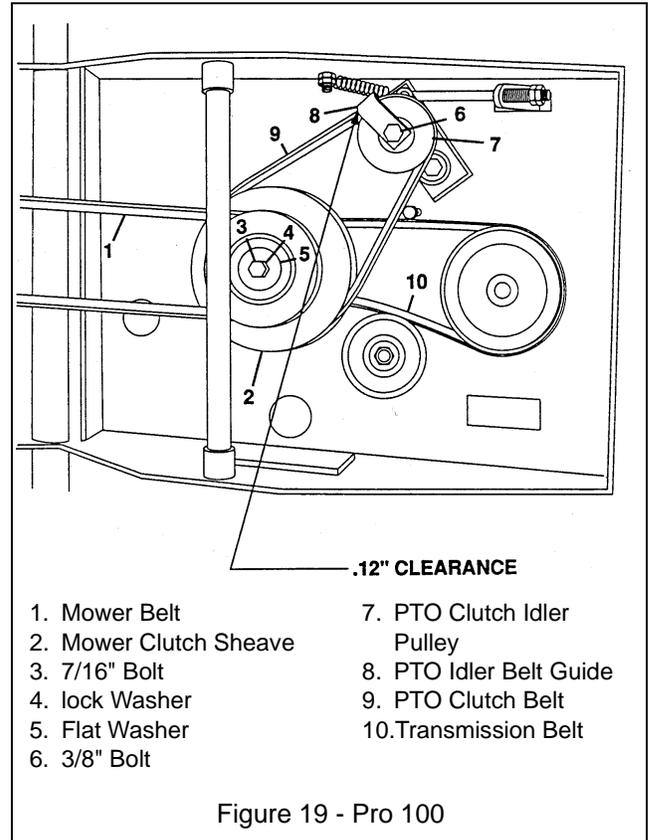
3. On Pro 100 models: Remove the PTO clutch belt from the clutch hub.
4. Loosen the 3/8-16 bolt which fastens the fixed idler pulley to the frame and slide the pulley to the end of slot.

**NOTE:** Remove the bolt, spacer and idler pulley if necessary.

5. Remove old transmission drive belt.
6. Put new transmission belt in the top groove of the clutch hub and on the transmission sheave.
7. Tension the belt with fixed idler pulley and tighten the 3/8-16 nut and bolt.

**NOTE:** It may be necessary to re-tension this belt during break-in.

8. Put the mower belt (and PTO belt on the Pro 100) back on engine sheave. Tighten the belt finger plate.



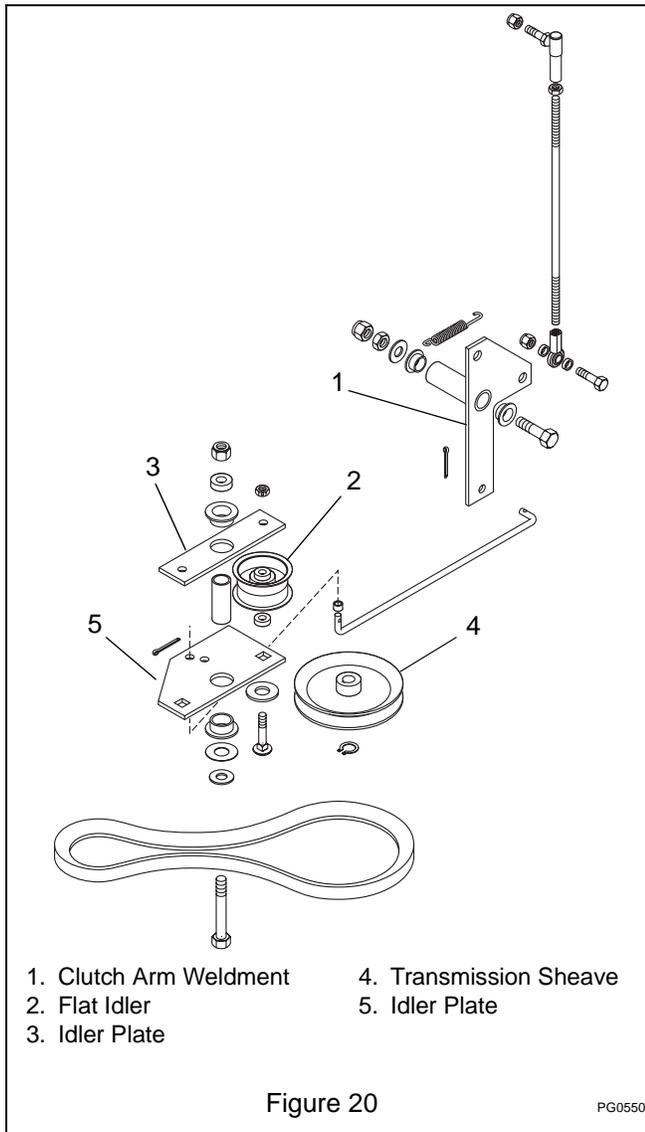
### Pro 200

1. Stop the engine. Remove the ignition key. Put the PTO lever/switch in the "OFF" position. Put the shift lever in the neutral "N" position.
2. Remove the mower belt from the mower clutch sheave, Figure 20.
3. Remove the PTO clutch belt from clutch hub (recoil model only).
4. Remove the PTO clutch stop bracket (electric model only).
5. Loosen the 5/16-18 bolt holding the small belt guide at the left of the transmission sheave. If necessary, loosen or remove the bolts which fasten the belt guide weldment to the frame.
6. Remove the old transmission drive belt.

## 7.5 TRACTION CLUTCH

### Pro 200 Only

The linkage for the traction clutch should be inspected every 30 days (more often under severe conditions). Inspect all pivot points for wear. Check pulleys with the belt off. Inspect belt for cracks and wear. Replace parts as needed.



7. Loosen the nut on the bolt that fastens each wheel clutch arm weldment.
8. While slowly turning the drive wheel, work the outside traction belt off the jackshaft pulley and remove over the drive wheel. See Figure 5 for units with two belts.
9. While slowly turning the drive wheel, work the inside traction belt to the outside groove of the jackshaft pulley, then off the jackshaft pulley and remove over the drive wheel.
10. Install the new traction belts, one at a time, by reversing steps 8 and 9 above. Be sure the first belt is seated correctly in the outside belt groove before working it back to the inside groove.
11. Tighten the nut on the bolt that fastens each wheel clutch arm weldment.
12. Connect the clutch rod to the clutch actuating straps with the clevis pin and cotter pin.
13. Put the clutch idler pulley spring back on.
14. Put the traction belt cover back on.
15. Lower the unit.
16. Check the adjustment of the steering levers. See section 4.6.

## 7.6 REPLACING THE TRACTION BELTS

1. Stop the engine. Remove the ignition key.
2. Release the steering levers.
3. Raise the rear of the unit so that the drive wheel is off the ground.
4. Remove the traction belt guard.
5. Remove the clutch idler pulley spring.

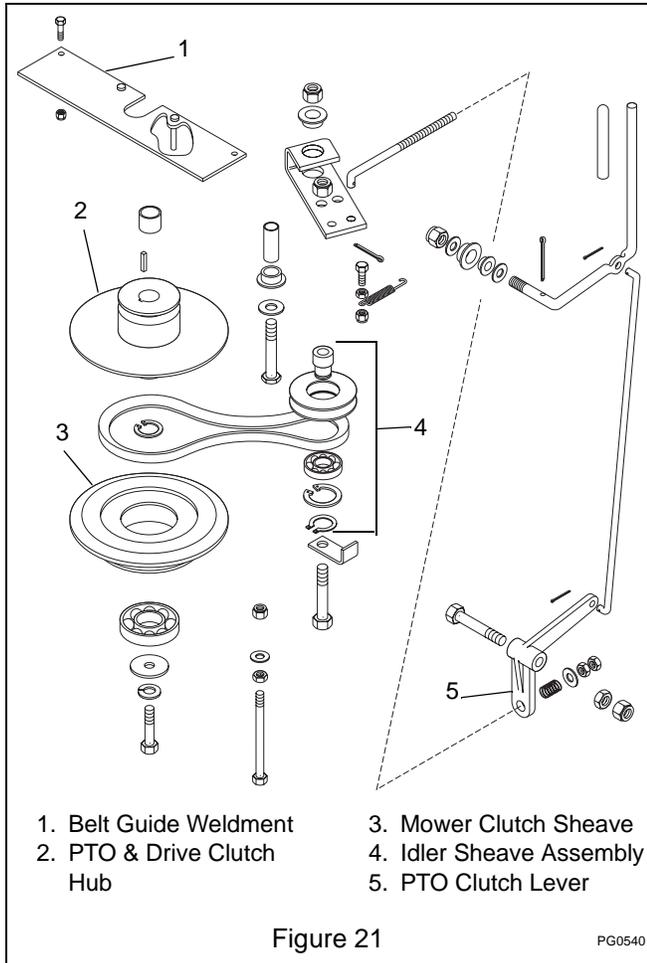


**WARNING:** An extension spring, when extended, stores energy and can be dangerous. Always use tools specifically designed for installing or removing an extension spring. Always compress or extend springs slowly.

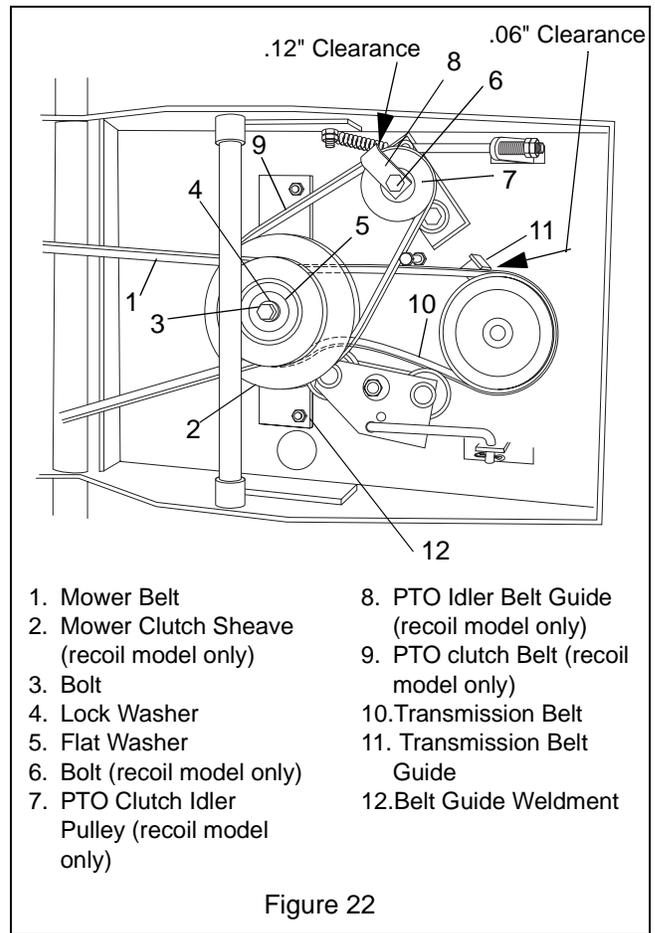
6. Remove cotter pin and clevis pin holding the clutch rod to the clutch actuating straps (Pro 200), Wheel clutch arm weldment (Pro 100 and 150). See Figure 6.

## 7.7 REPLACING THE PTO CLUTCH BELT

Pro 100 And Pro 200 (All Models Except 988085)



of the ignition key-from the belt's surface and tighten the bolt holding the belt guide. See Figure 22 for the correct position of the belt guide.



1. Stop the engine. Remove the ignition key. Put the PTO lever in the "OFF" position.
2. Remove the mower belt from the mower clutch sheave.
3. Loosen the two jam nuts on the rear end of the PTO clutch actuating rod and back the nuts off to the end of the rod. Remove the old PTO clutch belt. It is not necessary to move the long PTO clutch belt guide.
4. Put the new PTO belt on the clutch hub and on the PTO idler pulley.
5. Readjust the PTO clutch.
6. Put the mower belt back on the mower clutch sheave and tighten the mower belt.
7. Put the new transmission belt in the top groove of the clutch hub and on the transmission sheave. Move the shift lever into the number one slot.
8. If a belt guide was loosened or removed, fasten the weldment back to the frame.
9. Hold the transmission belt guide at the correct angle and approximately .06 inches-the thickness

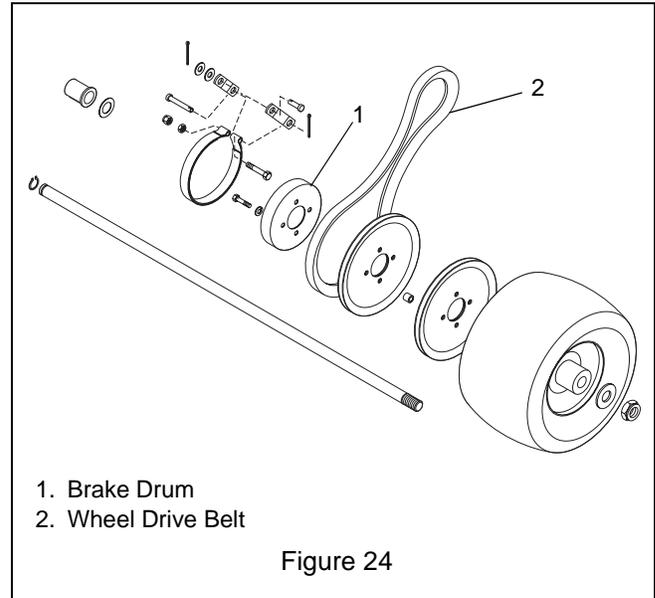
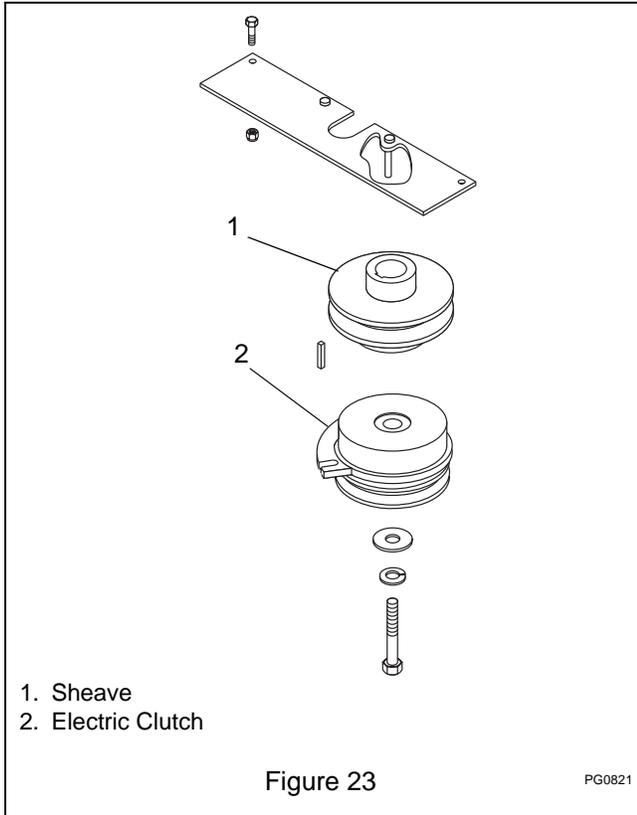
10. Put the PTO clutch belt back on the clutch hub.
11. Put the mower belt back on the mower clutch sheave. Tighten the belt.
12. Move the shift lever to the neutral "N" position and the PTO lever to the "OFF" position.
13. Check the adjustment of the shift linkage referring to the *Adjustment* section.

## 7.8 ELECTRIC CLUTCH

To remove electric clutch:

1. Remove belt.
2. Remove bolt and washers at end of shaft.
3. Clutch should slide off shaft.
4. Remove and inspect square key.

Replace clutch in reverse order.



5. The wheel will be loose from the pulleys and can be slid from the axle.
6. Assemble in reverse order.

**NOTE:** Coat shaft with anti-sieze before placing clutch on shaft.

## 7.9 WHEEL REMOVAL

To remove wheels:

1. Jack unit to lift wheels off the ground.
2. Remove axle nut and washer.
3. Remove belts from pulleys.

**NOTE:** The Pro 100 has one belt.

4. Loosen bolts from inside of brake drum.

## SECTION 8 - FUEL SYSTEM

### 8.1 FUEL SYSTEM TROUBLESHOOTING

The following troubleshooting chart is to be used to isolate fuel system problems and give possible causes are corrective action responses

The troubleshooting key is generic and can be used for several types of transmissions. Use only those possible causes and corrective actions that apply to the unit.

TROUBLE	POSSIBLE CAUSES (Refer to Key Below)	CORRECTIVE ACTION
Hard Starting	1, 3, 4, 6, 11, 12, 14, 16, 17, 18	clean, repair or replace
Fuel Leak at Carburetor	5, 7, 17	repair or replace
Engine Floods	5, 15, 17	repair or replace
Will not idle	1, 2, 3, 6	repair or replace
Rich idle	1, 6, 14	repair or replace
idles with Needle Closed	14	repair or replace
Hunts Erratic Idle	2, 3, 6, 7, 12, 13, 14, 15, 18	repair or replace
Idles Fast Lean	2, 3, 7	repair or replace
Will Not Accelerate	1, 6, 11, 12, 14, 15, 16	repair or replace
Over Rich Acceleration	1, 15	repair or replace
Hesitates	2, 6, 11, 12, 16	repair or replace
Will Not Run at High Speed	1, 11, 12, 14, 16	repair or replace
Low Power	1, 3, 11, 14, 15, 16, 17, 18	repair or replace
Hunts at High Speed	3, 6, 7, 12, 14, 15, 16, 18	repair or replace
Runs With Needle Closed	14	repair or replace
Engine Overspeeds	2, 3, 7, 14	repair or replace

#### TROUBLESHOOTING KEY

1	Plugged Air Filter
2	Leaky Carburetor Gasket
3	Throttle or Choke Shaft Worn
4	Choke Not Functioning Properly
5	Plugged Atmospheric Vent
6	Air Bleed Restricted
7	Damaged or Leaky "O" Rings
8	Damaged Diaphragm
9	Stuck or Dirty Ball Check
10	Diaphragm Upside Down
11	Plugged Tank or Vent
12	Fuel Pick-up Restricted
13	Idler Port Restricted
14	Damaged Adjustment Needle and Seat
15	Incorrect Float Height
16	Main Nozzle Restricted
17	Dirty, Stuck Needle and Seat
18	Fuel Inlet Plugged

### 8.2 FUEL PUMP

The impulse style fuel pump is the most commonly used fuel pump. Impulse fuel pumps may either be mounted externally onto the carburetor fuel inlet or remotely mounted. These pumps are connected in the fuel line between the fuel supply and the carburetor or directly to the fuel inlet.

Impulse fuel pumps are operated by crankcase impulses created by the up and down movement of the piston. A hose called a pulse line connects the fuel pump diaphragm chamber and transmits the impulses to the pump diaphragm. The impulses actuate the diaphragm and the flap valves to lift the fuel from the fuel tank to the carburetor.

### 8.3 FUEL SYSTEM CONTAMINATION

Any time fuel contamination is found in the fuel system (dirt, water algae, etc.) replace the fuel, fuel filter and flush the fuel lines. Remove the carburetor bowl and clean. Replace all items that cannot be cleaned. Reassemble the fuel system and check for proper operation.

### 8.4 FUEL TANK

The fuel tank is made of composite material for long life without breaking down from the additive used in today's blended fuels.

## SECTION 9 - ELECTRICAL

### 9.1 TOOLS

There are some specialized tools and test equipment that are needed for electrical repair work. A brief description of these follows.

**Long or needle nose pliers** - used to connect or bend wires and connectors in close quarters.

**Diagonal cutters** - used to cut wires or trim connections.

**Wire stripper/crimping tool** - available separately or as a combination tool. Used to strip insulation from wires of various sizes, crimp terminals and connector or wires.

**Soldering gun or soldering iron** - used to solder all splices and connections to terminals, connector, etc. A soldering gun is faster and more convenient than waiting for a soldering iron to heat.

**Multimeter** - analog or digital, to measure voltage, amperage and ohms.

**Tachometer** - used to measure engine speed.

Required to properly test alternator and charging circuits where output is dependent upon engine speed.

**Heat gun** - used to shrink insulated tubing in place. Used to replace electrical tape or insulated sleeving. To use, place a piece of shrink tubing over a wire joint, heat with the heat gun, until it shrinks slightly around the joint.

**Supplies** - electrical tape, rosin core solder (never use acid or acid core solder on electrical joints), an assortment of various size terminals, connectors, insulated or heat shrink tubing (for use on joints and connections), and an assortment of automotive type wire (in several colors).

Gravely Company recommends that all work be done in a professional manner. The use of the tubing to cover joints and the soldering of connections contribute to a professional looking job. In addition to a pleasing appearance, repairs made in this manner are more likely to withstand vibration. (The weakest points in an electrical system are the joints where wires are attached.)

Replace all defective components with Gravely replacement parts only. Engine parts, such as rectifiers or alternator components should be secured through the nearest engine service center.

Gravely Company does not recommend attempting to repair electrical components. Most do not lend themselves to repair and you would have more money invested in "time of repair" than the part would cost and the results may not be as good.

### 9.2 ELECTRICAL MEASUREMENTS

In many electrical circuits, there is some visible effect which indicates that the circuit is functioning properly. A switch is turned "ON" and a lamp lights. A key is turned, a starter motor runs and cranks the engine. If the lamp does not light, or the starter motor does not run, some means of measuring voltage, current flow, resistance and continuity is needed, (continuity means there is a complete electrical path through the circuit or component.)

To know exactly what conditions exist in an electrical circuit requires AC and DC Voltmeter, AC and DC Ammeter, and an Ohmmeter.

#### Multimeter

A single combination meter that does all of these things is available. Such a meter is called a Multimeter or Volt-Ohm-multitester (VOM). Meters of this kind are available in many forms and all change functions and ranges with switches, or by plugging test leads into different jacks. Multimeters are available in two basic types, Analog and Digital.

#### Analog Meters

Analog Meters have a needle that moves across a scale to give a reading. The longer the scale, the easier it is to read and more accurate the reading will be. A jeweled movement is used in this type of meter is more likely to be damaged through rough handling (except for overloaded Protected Meters) or by measuring high values that exceed the range set on the meter than a digital meter. They provide excellent service for the money as long as they are used with care.

#### Digital Meters

Digital Meters do not have a movement and are therefore more rugged. The reading shows up directly on a display window of some type. Since they read direct, no skill in reading the scale is required, nor is it necessary to set the range. The meter switches the ranges automatically. One has only to select the function DC Volts, AC Ampere, Ohms, etc.,) connect the test leads, and the reading is shown on the display. Because of the internal circuitry and the lack of a movement, these meters are not likely to be damaged by overloads. In the discussions that follow, either type of meter may be used. Test procedures are the same. It is best to learn proper procedures, even though some meters may be more forgiving of mistakes. Where differences in use may occur, they will be covered in the discussion.

## Voltage Measurement

There are two basic rules to be remembered when using a voltmeter. A voltmeter measures the voltage difference between the test leads and the voltmeter is always connected across the circuit under test.

## Current Measurement

The two rules to remember when measuring current with an ammeter are; an ammeter measures the current that flows through the meter, and to measure current an ammeter must be connected into the circuit. The latter rule means that the circuit must be opened, and the ammeter wired into it. Because this procedure is usually difficult, an ammeter is seldom used for troubleshooting.

## Resistance Measurement

An ohmmeter is used to make resistance measurements and to check continuity through wires and electrical components.

There is one rule to keep in mind when using an ohmmeter. The ohmmeter has a self contained battery and requires no electrical power. Using the ohmmeter on a circuit that has power applied may result in damage to the meter.

**IMPORTANT:** Disconnect the equipment battery when making Ohmmeter test or damage to the Ohmmeter may result.

**IMPORTANT:** An ohmmeter reads the resistance of whatever component is connected between the test leads. It can be used to check wires, coils, light bulbs, or any item that conducts current.

## 9.3 BATTERY

When charging battery, remove it from unit first. Keep batteries out of reach of children. ALWAYS follow information provided on battery by battery manufacturer. Lead acid batteries generate explosive gases. Severe chemical burns can result from improper handling of battery electrolyte. Wear safety glasses and proper protective gear when handling batteries to prevent electrolyte from coming in contact with eyes, skin or clothing.



**WARNING:** ELECTRIC SHOCK may result in injury and/or damage to unit.

DO NOT allow tools or other objects to come into contact with both terminal at the same time. ALWAYS remove Negative (-) Cable first to reduce risk of sparks when removing battery. ALWAYS connect Positive (+) Cable first, then connect Negative (-) Cable when installing battery.



**WARNING:** EXPLOSIVE GASES can result in serious injury or death. ALWAYS keep open flames, sparks, or smoking materials away from battery.

POISONOUS BATTERY FLUID contains sulfuric acid and its contact with skin, eyes or clothing can cause severe chemical burns. ALWAYS wear safety glasses and protective gear near battery.

DO NOT TIP any battery beyond 45 degree angle in any direction.

ALWAYS KEEP BATTERIES OUT OF REACH of children.



**WARNING:** REVERSE CONNECTIONS may result in sparks which may result in injury. ALWAYS connect/disconnect cables in proper order.

## Set-Up

The new battery is dry charged. The dealer or customer must add electrolyte (sulfuric acid and water).

1. Remove the battery from the unit.
2. Remove all the vent caps from the battery and set the caps to one side.
3. Take the electrolyte which should be 1.265 specific gravity at 80°F, and fill each cell so that the electrolyte is level with the bottom of the fill ring.
4. The battery should stand for 1/2 hour. Now check electrolyte level in each cell again. If necessary add more electrolyte to bring the level up to the bottom of the ring.
5. Charge until all cells are gassing freely, and the specific gravity is constant over three successive readings taken at 30 minute intervals.
6. Immediately after charging check level of electrolyte. If the level is low add distilled water to bring it up to the required level.
7. Replace the vent caps. It is not necessary to tighten more than finger tight.
8. Wash off the battery to remove electrolyte which may have spilled.

## Battery Electrolyte First Aid

**External contact:** Flush with water.

**Eyes:** Flush with water for at least 15 minutes and get medical attention immediately!

**Internal contact:** Drink large quantities of water. Follow with Milk of Magnesia, beaten egg or vegetable oil. Get medical attention immediately!

**IMPORTANT:** In case of internal contact, DO NOT induce vomiting!

## Clean Battery

Corrosion and dirt on the battery and terminals can cause the battery to "leak" power.

- Remove battery. (See *Battery Removal and Installation*)
- Rinse the battery with plain water and dry.
- Clean terminals and battery cable ends with wire brush until bright.
- Coat terminals with grease or petroleum jelly.
- Reinstall battery.

## Inspection, Cleaning, Drying, and Maintenance

Inspect the top of battery, terminals, cables, terminal posts, and case for any accumulation of dirt, corrosion cracks or loose or broken parts. Keep battery and its terminals clean. Inspect monthly to maintain best performance. Replace battery if damaged.

Remove hold down and bolt and lift battery out. Clean or service battery away from unit. Remove corrosion from battery terminals and cable connections with wire brush, then wash with a weak baking soda solution.

Scrub the exterior of the battery and cable terminals with a nonmetallic brush which has been dipped into a mixture of baking soda and water.

After cleaning, apply a thin coat of grease or petroleum jelly to terminals and cable ends to retard corrosion. Reinstall battery.

Check the alternator voltage regulator output (if used) at every periodic maintenance inspection. Over charging is a common cause of battery failure.

## Electrolyte Level

Every 25 hours of operation, check electrolyte level of each cell by removing caps one at a time. The electrolyte level should be at level indicated. Use distilled water to fill each cell if needed. Install and tighten each cap after checking.

**IMPORTANT:** When distilled water is added to battery during freezing weather, battery must be charged to mix water with electrolyte, or water will remain at top and freeze.

## Charging

ALWAYS follow information provided on battery by battery manufacturer. Contact battery manufacturer for extensive instructions to charge battery.

Place unit on a level surface, shut off engine and open battery compartment to gain access to battery.

Disconnect negative (-) cable first, then positive (+) cable.

To charge battery:

1. Loosen strap and remove battery from unit.
2. Place battery on bench or other well ventilated place where electrolyte spill will not create damage.

3. Remove caps and fill each cell to level indicated with electrolyte at 1.230 specific gravity and 80°F (27°C).
4. Let battery stand for one half hour.
5. Check electrolyte level and add more if necessary.
6. Connect positive (+) lead of charger to positive (+) terminal, and negative (-) lead to negative (-) terminal.
7. Charge the battery at two and a half amps for ten hours or until all cells are gassing freely and the specific gravity is constant over three 30 minute intervals.

## Specific Gravity Check

The specific gravity should be checked with a hydrometer.

**NOTE:** The specific gravity should be checked in each cell and should be the same for all cells. A variation in a cell reading could be an indication of a problem. Subtract .004 from 1.265 for each 10°F below 80°F (27°C) or add .004 to 1.265 for each 10°F above 80°F (27°C).

A special temperature compensated hydrometer is used to read the battery's state of charge.

The reading on the hydrometer gauge should be above 1.225. If the reading falls below 1.225 specific gravity there will be an insufficient charge.

ALWAYS charge the battery until the specific gravity of 1.265 is reached over 3 successive readings. Check monthly to ensure charge is maintained. The approximate state of charge can be determined by the cell specific gravity of the rested open circuit voltage at room temperature and the charging time can be estimated. For example:

OCV	Specific Gravity	% of Charge	Charging Time
12.60	1.265	100%	---
12.4	1.225	75%	3 hours
12.20	1.180	50%	7 hours
12.00	1.130	25%	10 hours
11.80	1.100	0%	12 hours

If using an automatic tapering 12 volt charger, choosing a good quality 5 to 10 amps 15VDC minimum output charger and charge for 3 to 12 hours according to the battery state of charge (see table above) or until the specific gravity in each cell reaches 1.255 - 1.265 specific gravity at 80°F (27°C).

If using a constant current charger, charge at 1 to 2 amperes for the time given on the table above or until full specific gravity is reached.

**IMPORTANT:** Charging at higher rates will damage the battery and cause excessive gassing and acid spewing.

### Battery Charger

Under normal conditions the engine alternator will keep the battery charged. When unit has set for an extended period of time without operation and the battery has been completely discharged, a battery charger will be required for recharging.

Before using a charger, an attempt can be made to recharge the battery using the engine alternator by jump starting the unit and allowing the engine to run.

### Jump Starting

Jump starting, battery charging, or replacement is required when the starter motor will not crank the engine.

The unit used for jump starting should have a 12 volt battery with at least 500 cold cranking amperes, and a negatively grounded system.



**WARNING:** FROZEN BATTERIES CAN EXPLODE and result in death or serious injury. DO NOT charge a frozen battery. Let the battery thaw out before putting on a charger.  
UNIT MOVEMENT can result in death or serious injury. NEVER jump start unit directly to the starter or starter solenoid. Unit can move forward or backward and injure the person jump starting unit.

To jump start the battery:

1. Ensure battery is not frozen. If the fluid is frozen, remove battery from unit and allow to thaw before charging.
2. Connect the positive (+) jumper cable to the positive (+) terminal of the discharged battery.
3. Connect the other end of the same jumper cable to the positive (+) terminal of the booster battery.
4. Connect one end of the second jumper cable to the negative (-) terminal of the booster battery.
5. Make the final jumper cable connection to the engine block or the furthest ground point away from the discharged battery.



**WARNING:** Make sure cables are clear of any moving engine parts before starting engine.

6. Start engine (refer to Owner's Manual). If engine will not start after several tries, unit or battery may need service.
7. After engine starts, leave cables connected for one to two minutes.
8. Disconnect cables in reverse order.

9. Operate unit as normal to charge battery.

### Storage

The battery is a perishable item and it should be stored properly to obtain a long, useful life. Batteries not in use will self discharge.

If the battery will not be used for more than three months, it should be removed and stored in a cool, dry place.

Any collection of dirt, grease, or electrolyte should be removed from the top of the battery.

The battery must be recharged monthly or when the cell specific gravity reads less than 1.255 specific gravity. Before reinstalling the battery in the spring, it should always be fully recharged.

### 9.4 SWITCHES

Switches either open a circuit to stop current flow or close and allow current to flow through.

A normally open (N.O.) switch prevents current flow until the switch is actuated, completing the circuit and allowing current to flow through it. An example is a light switch - the lights are off until the switch is actuated and the lights go on.

A normally closed (N.C.) switch allows current to flow until the switch is actuated, breaking the circuit and stopping current flow through it. An example is an ignition switch that grounds the magneto when in the off position (completing the circuit) but opens the circuit when in the ON position allowing the engine to operate.

Switches are selected with regard to Current rating (contacts must be of sufficient size to carry the required current), Voltage rating (switches insulated for specific voltages), Case or housing (switches that are exposed to moisture and must be sealed to prevent moisture from entering), and Actuating type (push, pull, rotary, momentary contact, or micro switches).

**NOTE:** Check that the connections to the switches are secure and that a switch is being activated properly before performing electrical test on switches. (Safety switches on speed selector and clutch levers may be out of adjustment and not activating.)

**IMPORTANT:** When checking switches, remove them from their respective circuit by disconnecting the wires from the switch at the connector(s). Damage could result to the meter or machine components if switches are left in.

### Normally Open Switch

To test a normally open switch (key, headlight, safety, or seat) connect the ohmmeter across the switch terminals. Meter should indicate open circuit (infinite resistance). Activate the switch. The ohmmeter should read up scale to zero resistance (Close Circuit). This indicates the switch is operating properly. Also check from each terminal to the switch case (if case is metal).

reading should show infinite resistance indicating no short to ground.

Variation from test results described indicates a defective switch.

### **Normally Closed Switch**

To test a normally closed switch connect the ohmmeter across the switch terminals. Meter should indicate a closed circuit (zero resistance). Activate the switch and the meter should move to open circuit (infinite resistance). Check from each terminal to ground (switch case). Meter should show open circuit (infinite resistance).

Variation from test results described indicates a defective switch.

### **Ignition Switch**

**NOTE:** Refer to the wiring diagram of the unit involved to determine switch functions and test using the methods described.

The ignition switch incorporates a number of functions, although not all functions are used on all equipment. The switch has three positions: OFF, RUN, and a momentary contact START position. Use an ohmmeter to check the continuity of the switch in each position.

**OFF Position** - Should be continuity between contacts G and M. These connections ground the engine magneto and stop the engine in the OFF position.

**RUN Position** - Should be continuity between contacts B and A. These connections supply power to the rest of the wiring harness. Connections G and M open to each other.

**START Position** - Hold switch in START position while testing. There should be continuity between contacts S1 and S2. These connections apply power to close the solenoid contacts and operate the starter motor.

In addition to the above test, place the switch in the run position and check between each contact and ground (metal case) to be sure no terminals are grounded. If the switch is operating properly, there will be no continuity between contacts other than those described.

## **9.5 SOLENOID AND RELAYS**

Solenoid and relays are both magnetically operated devices. Both devices operate on the principle that passing a current of electricity through a coil of wire will create a magnetic field strong enough to attract a piece of iron or steel. Each device uses this principle in a slightly different manner.

**Relay** - A basic relay consists of a coil of wire wound around a soft iron (magnetic) core. When current is passed through the coil, the core is magnetized and pulls down on a magnetic lever. The lever in turn is attached to several switch contacts which open or close other electrical circuits. In this fashion, a small current can control one or more larger electrical currents and actuate several other devices. In most

cases a relay contact moves only a fraction of an inch and the magnetic pull is small.

**Solenoid** - A basic solenoid consists of a coil of wire wound around a hollow tube. A magnetic core slides inside the tube. When current is passed through the coil, the core is pulled into the solenoid with considerable force. With proper design, a solenoid can exert considerable force over a distance of several inches. A solenoid can therefore, pull a lever, close a heavy contact, or perform other jobs that require a straight line pull.

If a relay or solenoid fails to operate, the cause may be either electrical or mechanical.

To check electrically, connect a voltmeter across the coil of the device and activate the circuit that operates the relay or solenoid. If the meter indicates no voltage is applied, the cause is in the control circuit.

If the meter indicates proper voltage across the coil but the device does not function, remove the power, disconnect the wiring and check the continuity of the coil with an ohmmeter. The meter should indicate resistance, in the order of 3 to 5 ohms, if the coil is intact. A high resistance indicates an open coil and a defective device.

There are also a number of mechanical problems that may cause the problem.

The starter solenoid in the Gravely equipment is a sealed unit used to actuate the starter motor on the engines. These solenoids may have three or four connections. The two large connections carry high current to operate the starter motor. The small connections are connected to the coil and carry the control current.

To check the solenoid, disconnect the cables to the starter motor, turn the ignition switch to the start position, and listen for the solenoid to snap inside contacts closed.

If no snap is heard, check across the coils with a voltmeter. The voltage should read 12 volts with the ignition switch in the start position. If no voltage appears, the defect is in the start circuit.

If the voltage is correct, turn off the power and check continuity of the coil with an ohmmeter. If the coil is open, the solenoid is defective and must be replaced.

If the coil has the proper voltage applied, and the continuity check indicates the coil is intact, the solenoid plunger is stuck or the contacts are welded shut and the solenoid must be replaced.

If the solenoid snaps shut, but the start does not operate, check across the large contacts with an ohmmeter. If there is no continuity when the solenoid snaps shut, the contacts are defective and the solenoid must be replaced.

## 9.6 LIGHTING CIRCUITS

Lighting circuits are simple circuits and easiest to trouble shoot in most equipment. They consist of the lights connected in parallel; a normally open switch, a protective fuse and a source of power (battery or engine alternator).

If only one light is out, check the connector, then check the bulb for continuity (high resistance indicates a defective or burned out bulb).

If all the lights are out, check the fuse for continuity (high resistance indicates a defective or blown fuse). If the fuse is blown, check for a short in the wiring and correct before replacing the fuse.

If the fuse and lamps are good, check the circuit with an AC/DC voltmeter.

## 9.7 FUSES

Fuses are connected in electrical circuits to protect the circuits from damage due to overload or short circuits. Fuses are a "weak link" in the circuit. They contain a metal link designed to melt when a certain current value is exceeded thus opening or disconnecting the wiring. Once a fuse blows or melts it must be discarded and replaced with a new fuse of the same value.

Since the function of the fuse is to protect the circuit, NEVER attempt to defect the protective device by bridging or replacing with a device of a higher current rating.

Electrical testing of these devices is simple. Since the device either conducts current (and is therefore functioning) or the device is open and is therefore defective. Use an ohmmeter to check for continuity.

## 9.8 DIODES AND RECTIFIERS

Diodes are solid state, semiconductor devices. They contain no moving parts and conduct current better in one direction than the other.

Diodes allow current to flow through one circuit without "backing up" into another. In engine alternator circuits, a diode is used to convert current which flows back and forth (AC) in a circuit to current which flows only in one direction (DC). A device which converts alternating current to a direct current is called a RECTIFIER. A diode is one type of rectifier.

To check a diode, isolate it from the circuit by disconnecting one end. With a multimeter set on the lowest ohms scale setting, measure the resistance in one direction, reverse the test leads, and measure in the other direction. Readings should be high in one direction and low in the other. (If the readings are low in both directions, the diode is shorted, and if the readings are high, the diode is open.) If the readings are the same in both directions, the diode is defective and must be replaced.

**IMPORTANT:** Diodes are marked to indicate polarity (a band on one end, an arrow on the side, or they fit on a holder only one way).

## Rectifiers

A battery is charged through the use of an alternator located in or on the engine. A charging circuit contains a rectifier because alternators produce alternating current (AC) and batteries require direct current (DC) for charging.

The rectifier may be built into the engine or it may be an external part. It may also contain a regulator to prevent overcharging the battery. (Servicing of rectifiers built into the engine should be done by an approved engine manufacturer's service center. Such a service center has access to the information and parts required to test and repair or replace engine components, including rectifiers and regulators.)

Units that contain both a rectifier and regulator are tested in a working circuit to make sure the regulator portion of the device is operating.

## 9.9 ELECTRIC CLUTCH

The electric clutch is used to turn on and off the attachment used on the unit by use of a switch. The clutch is also designed so that a brake is applied to the output shaft when the clutch is disengaged (off).

The field coil is mounted to a bearing support and does not rotate. The rotor is attached to the power output shaft and rotates around the field assembly. The armature is attached to the output pulley. The armature assembly is held close to the rotor by the brake assembly. The clutch is engaged by applying current to the coil connection. This results in a current flowing through the coil, magnetizing the coil pulling the armature onto the rotor with sufficient force to hold the two pieces together, effectively connecting the output and the input shafts together. Pulling the armature against the rotor pulls it away from the brake, releasing the brake.

## Engine Electrical Components

Engine servicing and repair should be referred to local engine manufacturers service centers that have the service information and parts available to properly service the engine. Gravelly dealers should be able to test engines and engine components to pinpoint troubles and narrow them down to properly advise the engine serviceman.

## 9.10 CHECKING THE PTO CLUTCH

### Measure Clutch Coil Resistance

1. Turn engine and PTO switch off.
2. Disconnect clutch wire connections.
3. Select meter to check ohms.



Figure 25

4. Connect meter leads wires in clutch connector.
5. If meter reads below 2.50 ohms or above 3.50 ohms, then the clutch has failed and needs to be replaced.
6. If meter reads between 2.50 to 3.50 ohms, proceed to Measure Clutch Current Draw.

#### Measure Clutch Current Draw

1. Turn engine off.
2. Disconnect clutch wire connections. Remove 30 amp fuse.
3. Select meter to check amps (10 amp scale).
4. Place meter leads into fuse holder.
5. Sit on the seat to make seat switch connections.
6. Turn the ignition switch to RUN and the PTO switch to ON.
7. If the meter reads below 4.5 amps, the problem is in the electrical system leading to the clutch (Battery, relay, switch wiring).

If you find after measuring clutch coil resistance and clutch current draw that:

1. The resistance falls between 2.50 and 3.50 ohms.
2. The amp draw is 4.50 or above.
3. The electric clutch is within factory specifications and is not the source of the problem.

### 9.11 INTERLOCK SWITCH

1. Remove the subject interlock switch from the unit.
2. Set a VOM switch in the ohm (Rx1) position.
3. Connect the meter leads to the switch pins
4. No circuit (infinity) should be indicated.
5. Push in on the interlock switch plunger. A circuit (zero ohms) should be indicated.
6. Connect one lead to the case and sequentially through the switch pins with the other lead. No circuit (infinity) should be indicated.
7. Replace the switch if it fails the above test.

### 9.12 FUSE HOLDER

1. Use a VOM with the switch set in the ohm (Rx1) position.
2. Make a visual check of the fuse to determine that it is not burned out. If the glass is clouded, check with an ohmmeter (zero ohms).
3. Unplug the fuse holder and connect the ohmmeter to the pins. A circuit (zero ohms) reading should be indicated.
4. If no circuit is indicated, replace the fuse holder.

### 9.13 PRO 200 CHECK-OUT

#### Kohler Engine

Make sure that all switches are in their proper position, with operator presence switched activated.

**Step 1** - Check out the battery. Use a hydrometer on all battery cells to see if one or more is bad. Also use a voltmeter to check for proper voltage. Replace the battery if necessary and/or charge to proper level.

**Step 2** - Use a voltmeter to verify there is power to terminal B, with the key switch in the off position. If there isn't, check connections at the start solenoid.

**Step 3** - With the key in the run position, see that power is transferred to terminal A. Terminal A supplies power to the hourmeter. Terminal M is connected to the engine magneto kill circuit, as terminal B brings in the charge current from the engine to the battery.

**Step 4** - With the key in the start position, power is transferred to terminal S, and on to the start solenoid, out the other side and through the neutral and PTO switches, and one of the presence switches to ground. Also from the solenoid to power the control module.

**NOTE:** One presence switch must be activated for starting.

## Pro 200 Walk-Behind Kohler Engine

Ignition Switch	Off	Run	Start
Red (B)	12.00	12.00	12.00
Brown (S)			12.00
Pink (A)		12.00	12.00
Red/White (M)	Connected to kill (magneto) circuit to ground		

Left and Right Presence Switch	Off	Run	Start
Brown			12.00
White (When activated)			12.00 to ground

NOTES: NORMALLY OPEN SWITCHES. MANUALLY ACTIVATED. CONTACT RESISTANCE IS 0.1 - 0.3 OHMS RESISTANCE.

Hourmeter	Off	Run	Start
Pink		12.00	12.00
White		12.00	12.00

Solenoid	Off	Run	Start
Triple Red	12.00	12.00	12.00
Red (starter input)			12.00
Brown (input lead)			12.00
Brown and Yellow (output)			12.00

NOTES: NORMALLY OPEN SWITCH. LARGE CONTACTS ARE 3 TO 5 OHMS RESISTANCE. SMALL TERMINALS 0.1 TO 0.3 OHMS.

Interlock Module	Off	Run	Start
Red	Connected to engine ground for engine kill		
Yellow		12.00	12.00
Brown		12.00	12.00

Transmission Interlock Switch	Off	Run	Start
Brown		12.00	12.00
Brown/White		12.00	12.00

NOTES: NORMALLY CLOSED SWITCH. 0.1 TO 0.3 OHMS RESISTANCE WHEN CORRECT.

PTO Interlock Switch	Off	Run	Start
Brown/White		12.00	12.00
Brown		12.00	12.00

NOTES: NORMALLY CLOSED SWITCH. 0.1 TO 0.3 OHMS RESISTANCE WHEN CORRECT.

### Briggs/Stratton Engine

Make sure that all switches are in their proper position, with operator presence switched activated.

**Step 1** - Check out the battery. Use a hydrometer on all battery cells to see if one or more is bad. Also use a voltmeter to check for proper voltage. Replace the battery if necessary and/or charge to proper level.

**Step 2** - Use a voltmeter to verify there is power to terminal B, with the key switch in the off position. If there isn't, check the fuse, and/or the connections at the start solenoid.

**Step 3** - With the key in the run position, see that power is transferred to terminals A and L. Terminal A supplies power to the hourmeter and brings in charge

power from the engine to the battery. Terminal L supplies power to the fuel shut-off solenoid for starting.

Terminal G is connected to the kill circuit of the engine for an additional ground kill connection.

Terminal M supplies ground for the key switch.

**Step 4** - In start, power is transferred to terminal S. Terminal S supplies power to the start solenoid and out the other terminal, through the interlock switches, and one presence control switch to ground for start. Power also leaves the solenoid and goes to activate the control module.

**NOTE:** One presence switch must be activated for starting.

Ignition Switch	Off	Run	Start
Red	12.00	12.00	12.00
Brown (S)			12.00
White (M)	Connected to ground for switch ground		
Yellow (L)		12.00	12.00
White/Red (G)	Connect to engine kill. Positive ground.		
Red (A)		12.00	12.00

NOTES: CONTACT RESISTANCE IS 0.1 - 0.3 OHMS WHEN CORRECT.

<b>Left and Right Presence Switch</b>	<b>Off</b>	<b>Run</b>	<b>Start</b>
Brown		12.00	12.00
White (When activated)		12.00	12.00

NOTES: NORMALLY OPEN SWITCHES. MANUALLY ACTIVATED. CONTACT RESISTANCE IS 0.1 - 0.3 OHMS RESISTANCE.

<b>Hourmeter</b>	<b>Off</b>	<b>Run</b>	<b>Start</b>
Pink		12.00	12.00
White		12.00 to ground	12.00 to ground

<b>Solenoid</b>	<b>Off</b>	<b>Run</b>	<b>Start</b>
Red (battery input lead)	12.00	12.00	12.00
Red (starter input)			12.00
Brown (input lead)			12.00
Brown (output to switches and module)		12.00	12.00

NOTES: NORMALLY OPEN SWITCH.ELECTRICALLY ACTIVATED. LARGE CONTACTS ARE 3 TO 5 OHMS RESISTANCE. SMALL TERMINALS 0.1 TO 0.3 OHMS.

<b>Interlock Module</b>	<b>Off</b>	<b>Run</b>	<b>Start</b>
Red		12.00	
Yellow		12.00	12.00
Brown		12.00	12.00

NOTES: NORMALLY CLOSED SWITCH. CONTACT RESISTANCE 0.1 TO 0.3 WHEN CORRECT.

<b>Transmission Interlock Switch</b>	<b>Off</b>	<b>Run</b>	<b>Start</b>
Brown		12.00	12.00
Brown/White		12.00	12.00

NOTES: NORMALLY CLOSED SWITCH. 0.1 TO 0.3 OHMS RESISTANCE WHEN CORRECT.

<b>PTO Interlock Switch</b>	<b>Off</b>	<b>Run</b>	<b>Start</b>
Brown/White		12.00	12.00
Brown		12.00	12.00

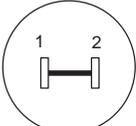
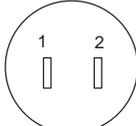
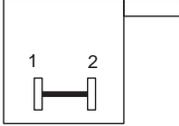
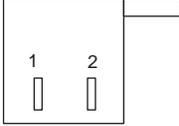
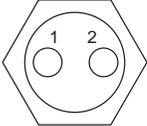
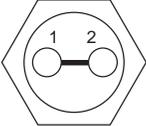
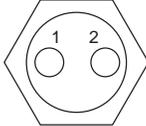
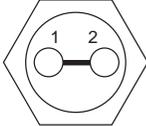
NOTES: NORMALLY CLOSED SWITCH. 0.1 TO 0.3 OHMS RESISTANCE WHEN CORRECT.

## 9.14 CONTINUITY DIAGRAMS

### Recoil Start Models

The diagrams below show the various states of connection for electrical components.  
The solid lines on switches show continuity.

**NOTE:** All switches are viewed from the rear.

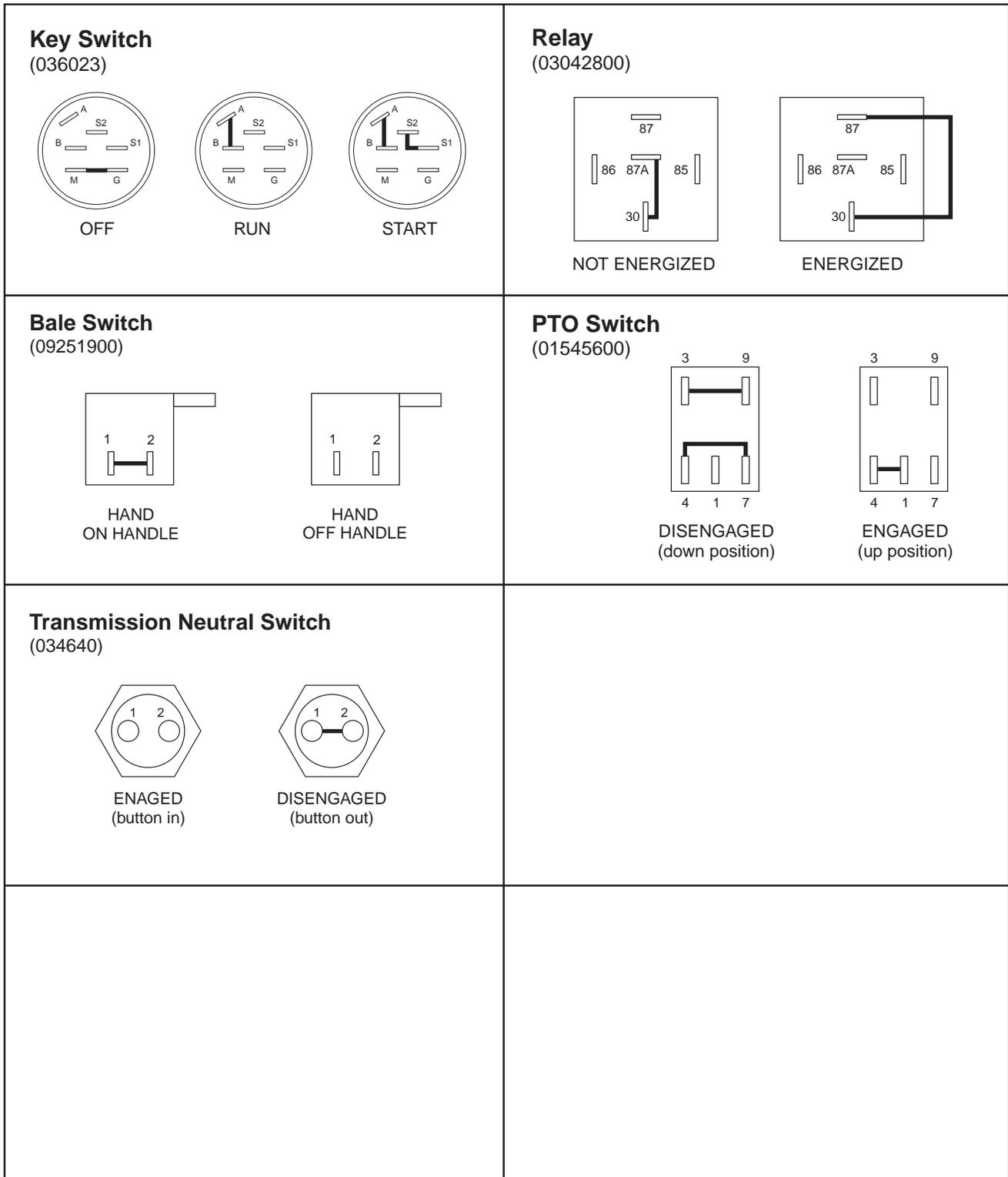
<p><b>Key Switch</b> (02456500)</p>  <p>OFF (button up)</p>  <p>RUN (button down)</p>	<p><b>Bale Switch</b> (09251900)</p>  <p>HAND ON HANDLE</p>  <p>HAND OFF HANDLE</p>
<p><b>Transmission Neutral Switch</b> (034640)</p>  <p>ENAGED (button in)</p>  <p>DISENGAGED (button out)</p>	<p><b>PTO Switch</b> (020916)</p>  <p>RUN (button up)</p>  <p>NEUTRAL (button down)</p>

## Electric Start Models

The diagrams below show the various states of connection for electrical components.

The solid lines on switches show continuity.

**NOTE:** All switches are viewed from the rear.



## Pro 100 and Pro 150 with Handlebar Switch

The diagrams below show the various states of connection for electrical components.

The solid lines on switches show continuity.

**NOTE:** All switches are viewed from the rear.

<p><b>Key Switch</b> (02456500)</p> <p>OFF (button up)</p> <p>RUN (button down)</p>	<p><b>Handlebar Switch</b> (08828300)</p> <p>HAND ON HANDLE</p> <p>HAND OFF HANDLE</p>
<p><b>Transmission Neutral Switch</b> (034640)</p> <p>ENAGED (button in)</p> <p>DISENGAGED (button out)</p>	<p><b>PTO Switch</b> (020916)</p> <p>RUN (button up)</p> <p>NEUTRAL (button down)</p>

## Pro 100 and Pro 150 with Bale Switch

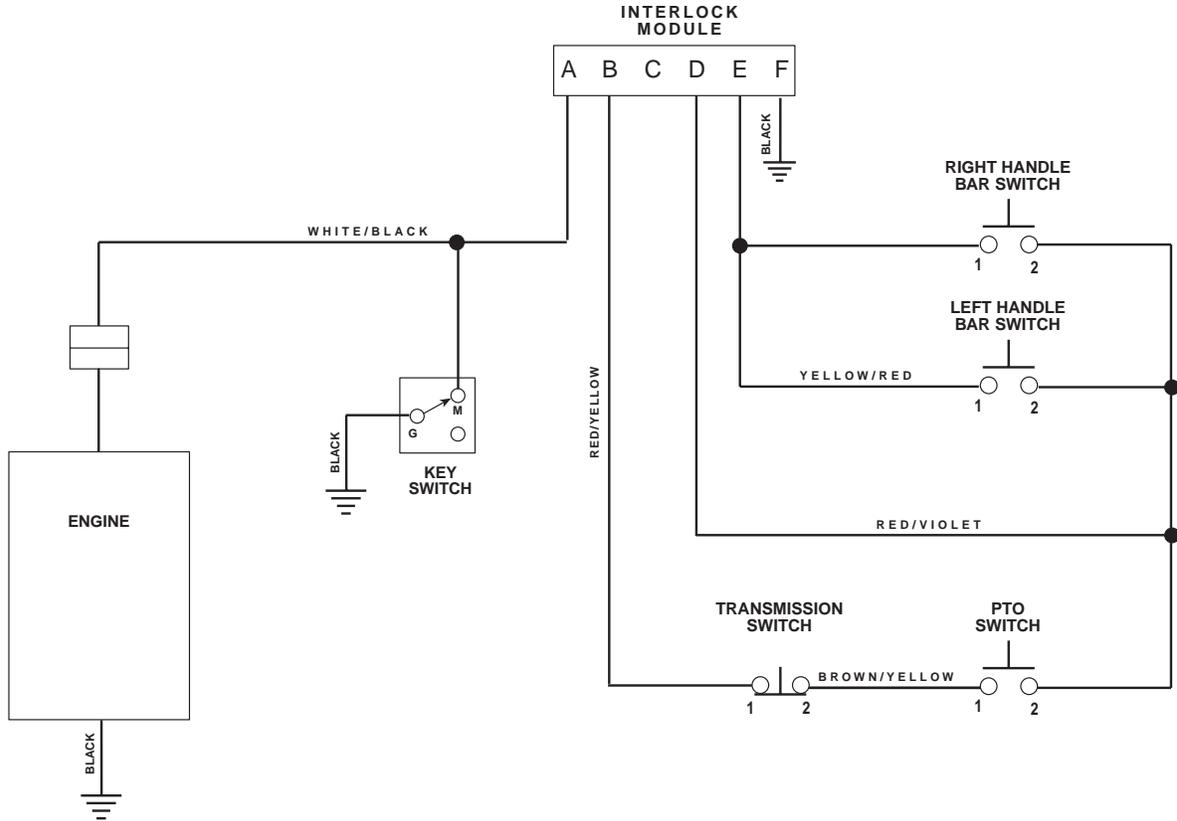
The diagrams below show the various states of connection for electrical components.  
The solid lines on switches show continuity.

**NOTE:** All switches are viewed from the rear.

<p><b>Key Switch</b> (02456500)</p> <p>The Key Switch diagrams show two circular terminals labeled 1 and 2. In the OFF state (button up), there is a solid horizontal line connecting the two terminals. In the RUN state (button down), there is no solid line between the terminals.</p> <p>OFF (button up)</p> <p>RUN (button down)</p>	<p><b>Bale Switch</b> (09251900)</p> <p>The Bale Switch diagrams show a rectangular switch with two circular terminals labeled 1 and 2. In the HAND ON HANDLE state, there is a solid horizontal line connecting the two terminals. In the HAND OFF HANDLE state, there is no solid line between the terminals.</p> <p>HAND ON HANDLE</p> <p>HAND OFF HANDLE</p>
<p><b>Transmission Neutral Switch</b> (034640)</p> <p>The Transmission Neutral Switch diagrams show two circular terminals labeled 1 and 2 within a hexagonal frame. In the ENAGED state (button in), there is a solid horizontal line connecting the two terminals. In the DISENGAGED state (button out), there is no solid line between the terminals.</p> <p>ENAGED (button in)</p> <p>DISENGAGED (button out)</p>	<p><b>PTO Switch</b> (020916)</p> <p>The PTO Switch diagrams show two circular terminals labeled 1 and 2 within a hexagonal frame. In the RUN state (button up), there is a solid horizontal line connecting the two terminals. In the NEUTRAL state (button down), there is no solid line between the terminals.</p> <p>RUN (button up)</p> <p>NEUTRAL (button down)</p>

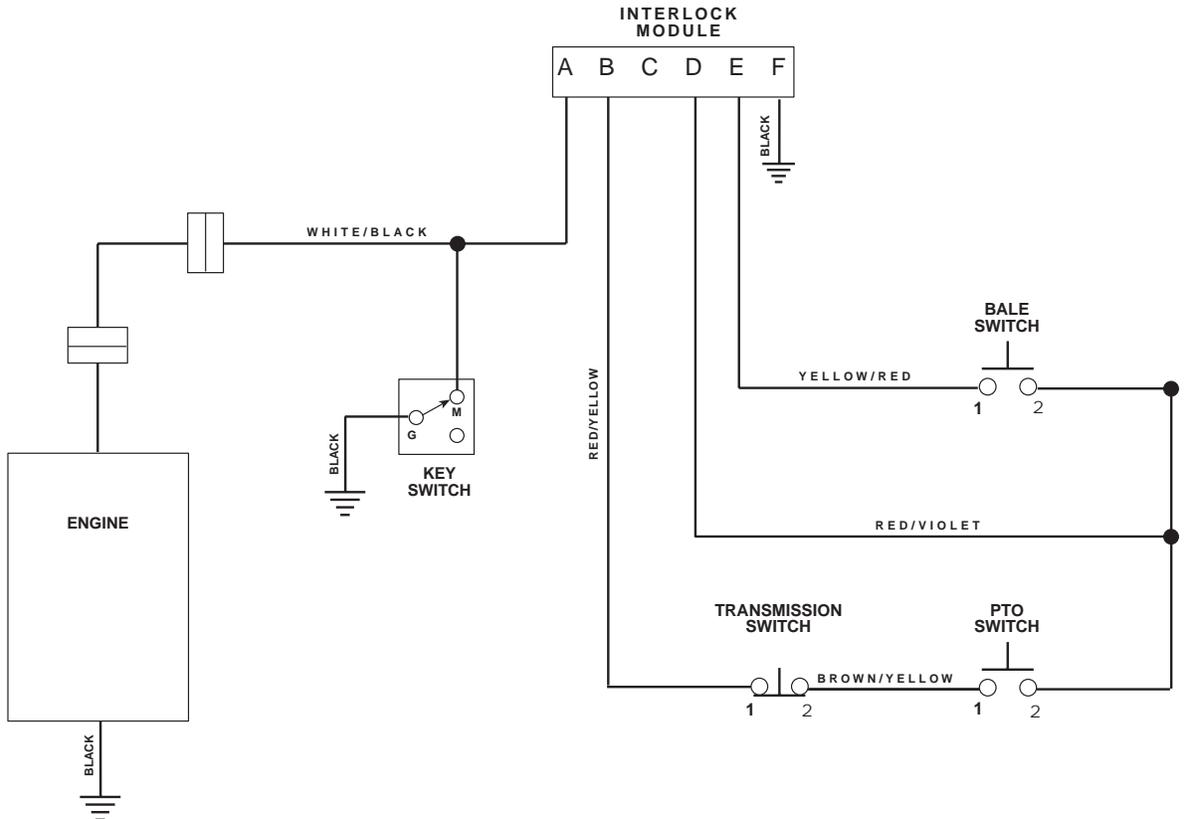
# 9.15 WIRING DIAGRAM

Models 988089, 310

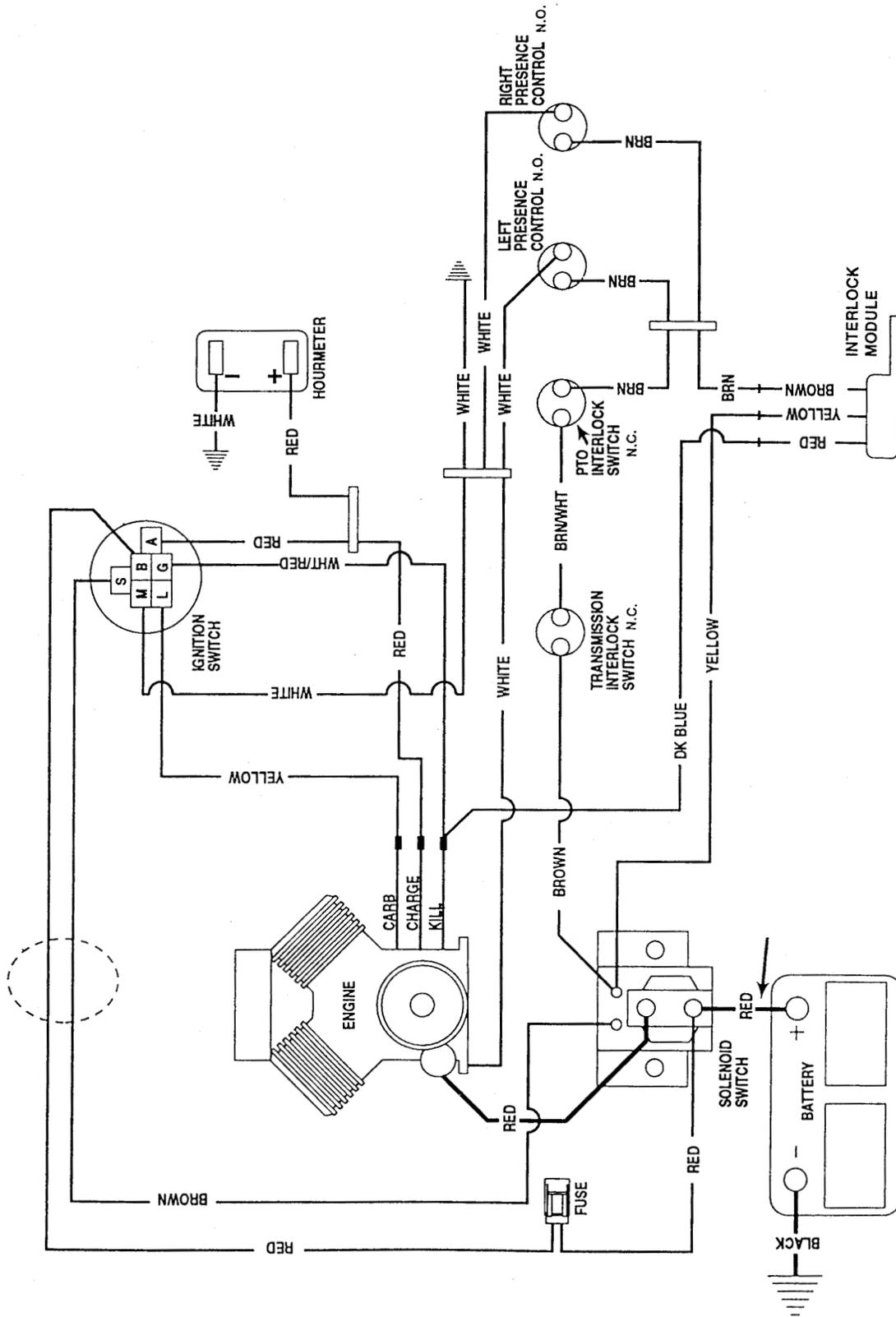


PG0500

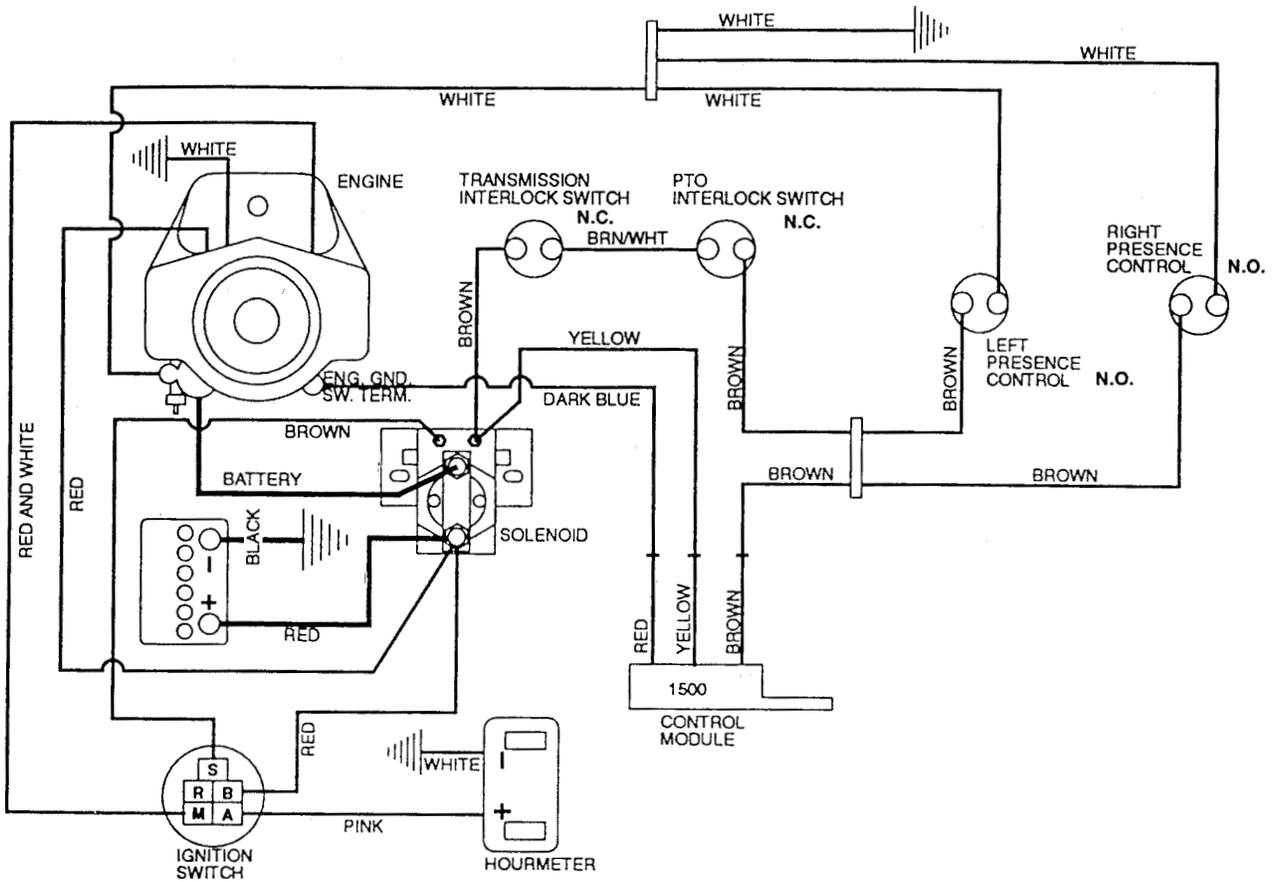
Models 988088, 091, 309



Pro 200, Briggs & Stratton 16 HP

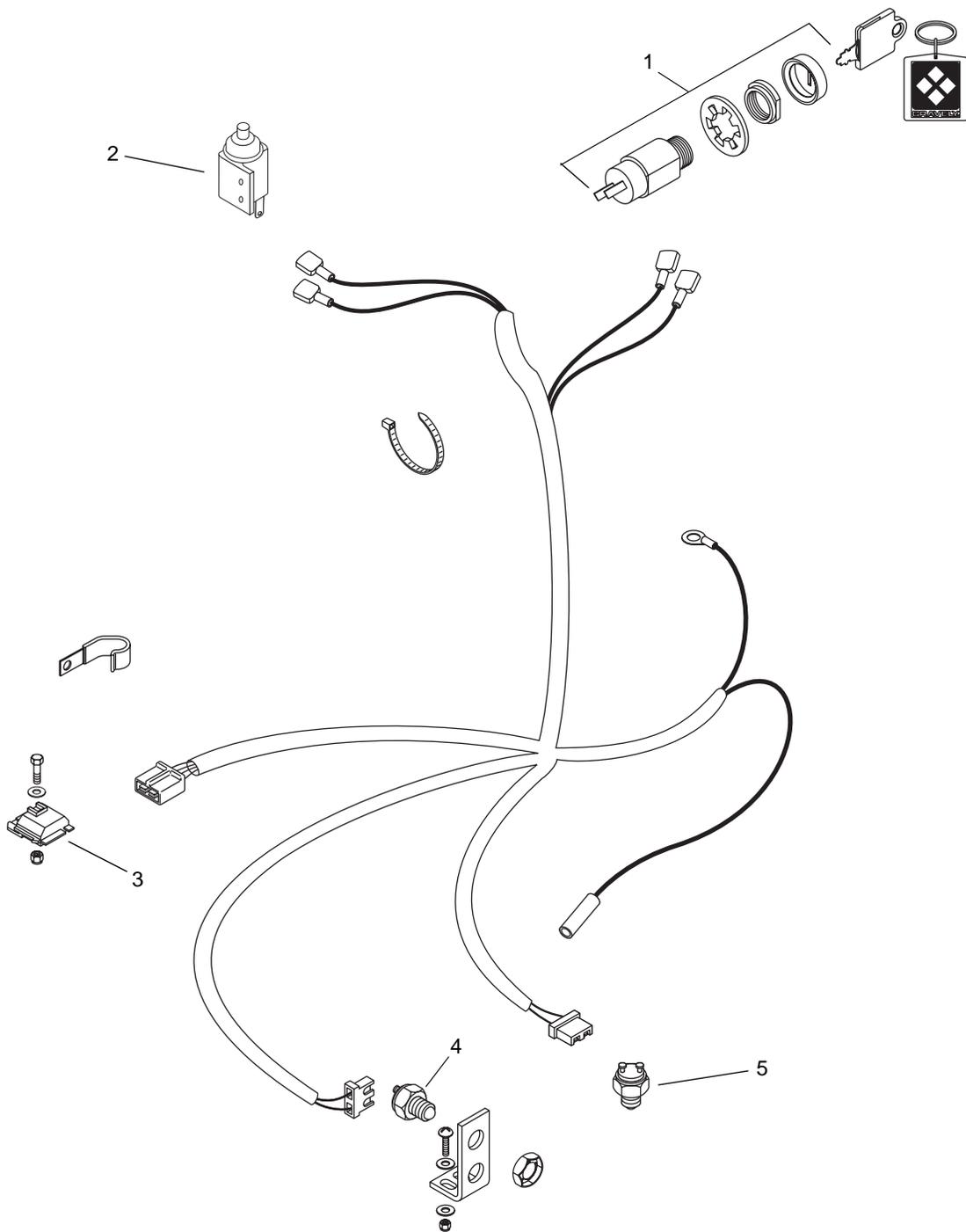


# Pro 200, Kohler Engine



## 9.16 ELECTRICAL SYSTEM

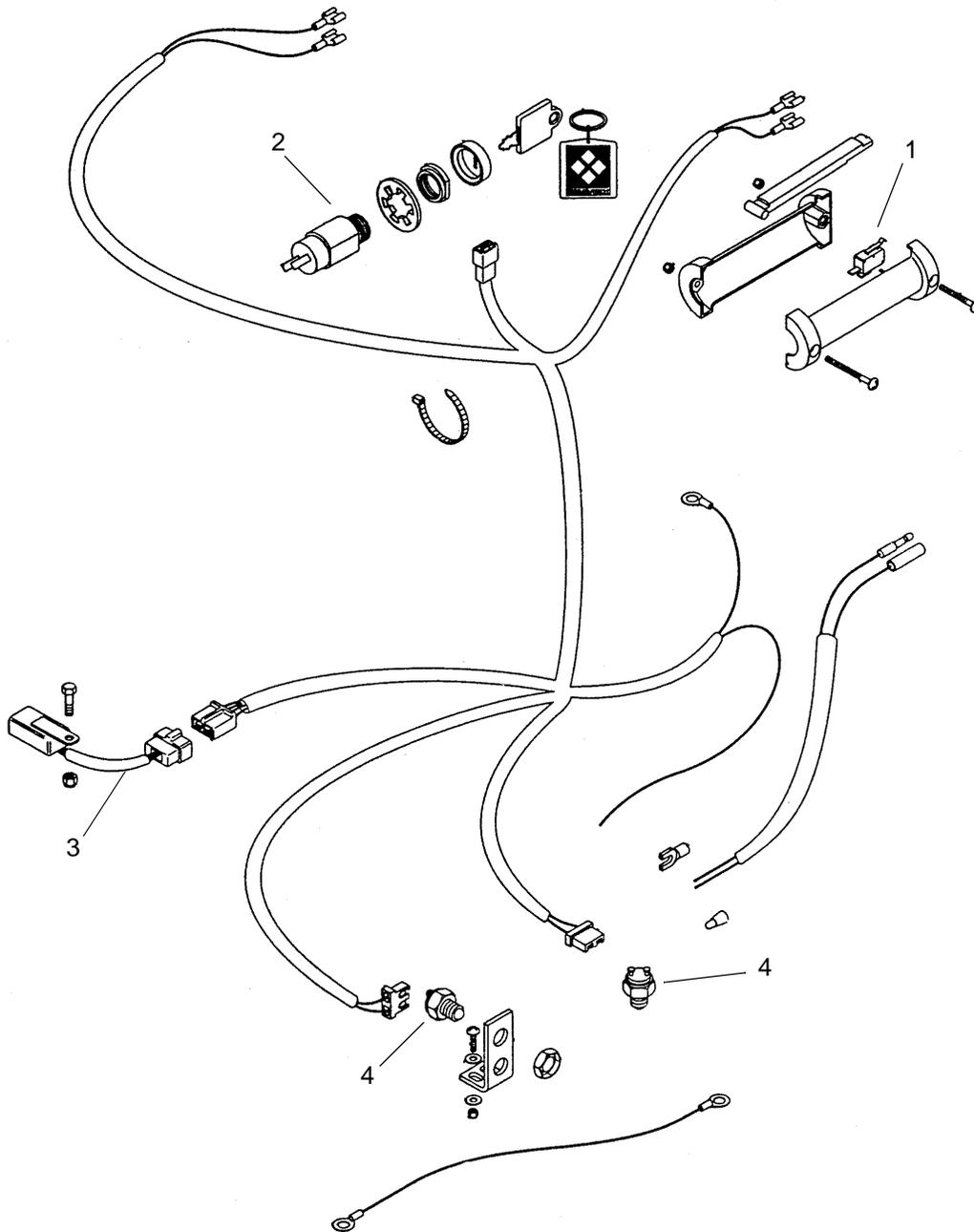
Model 988085, 087, 088, 091, 309



- 1. Key Switch Assembly
- 2. Single Pole N.O. with Cover
- 3. Electrical Interlock Module

- 4. Neutral Start Switch
- 5. Neutral Start Switch (N.C.)

All Models Except 988085, 087, 088, 091, 309



- 1. Switch
- 2. Ignition Switch
- 3. Interlock Module
- 4. Neutral Start Switch



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