



Promaster 250Z, 260Z, 272Z

Service Manual

992018, 020, 023, 027, 029, 030
992032, 033, 034, 035

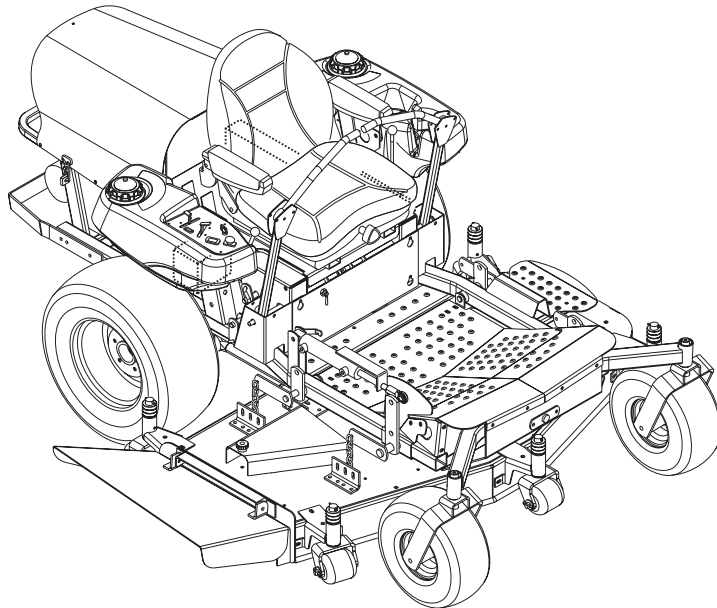


TABLE OF CONTENTS

Introduction	5	Mower Blades	21
The Manual	5	Adjusting Control Levers	22
Service and Replacement Parts	5	Adjusting the Parking Brake	22
Product Registration	5	Adjusting Unit To Track Straight	22
Unauthorized Replacement Parts	5	Leveling the Mower Deck	23
Disclaimer	5	Engine	24
Technical Service Communications	5	Engine Troubleshooting	24
Preparation	5	Removing the Engine	25
Safety	6	Installing the Engine	25
Safety Alert Symbol	6	Electric Clutch	25
Signal Words	6	Drive Train	26
Notations	6	Checking the Hydraulic Fluid Level	26
Practices and Laws	6	Changing Hydraulic Fluid and Filter	26
Required Operator Training	6	Hydraulic Drive Flow Test	26
Safety Decals And Locations	6	Replacing the Hydraulic Pump	27
Safety Rules	8	Replace Wheel Motor	27
Specifications	12	Hydraulic Deck Lift Pressure Test	28
Controls and Features	14	Replace Lift Valve	28
General Maintenance & Adjustments	15	Hydraulic Diagram	29
Maintenance Schedule	15	Mower Deck	31
Service and Adjustments	16	Anti-Scalp Rollers	31
Service Positions	16	Front Suspension	32
Moving Unit Manually	16	Electrical	33
Transporting Unit	17	Tools	33
Starting and Shutting Off the Engine	17	Electrical Measurements	33
Cleaning and Storage	17	Battery	34
Filling Fuel Tank	18	Solenoid and Relays	36
Fasteners	18	Fuses	36
General Lubrication	18	Diodes and Rectifiers	36
Servicing the Battery	18	Wiring Diagrams	38
Basic Engine Maintenance	19	Troubleshooting	42
Belts	20		
Tires	21		



Ariens Company
655 West Ryan Street
P.O. Box 157
Brillion, Wisconsin 54110-0157
USA
Telephone (920) 756-2141
Facsimile (920) 756-2407

EC DECLARATION OF CONFORMITY ISSUED BY THE MANUFACTURER –
DÉCLARATION DE CONFORMITÉ CE ÉMISE PAR LE FABRICANT – EU-
ÜBEREINSTIMMUNGSEKTLÄRUNG DES HERSTELLERS – VERKLARING VAN
OVEREENSTEMMING VOOR DE EU, AFGEGEVEN DOOR DE FABRIKANT – EF
OVERENSSTEMMELSESEKTLÆRING UDSTEDT AF FABRIKANTEN – DICHIARAZIONE
DI CONFORMITÀ CE RILASCIATA DAL PRODUTTORE – DECLARACIÓN DE
CONFORMIDAD CE EMITIDA POR EL FABRICANTE – EF-SAMSVARSEKTLÆRING FRA
PRODUSENTEN – EG-DEKLARATIONEN OM ÖVERENSSTÄMMELSE UTFÄRDAD AV
TILLVERKAREN – VALMISTAJAN ANTAMA EY-VAATIMUSTENMUKAISUUSVAKUUTUS –
DEKLARACJA ZGODNOŚCI Z PRZEPISAMI EC WYDANA PRZEZ PRODUCENTA –
DECLARAÇÃO DE CONFORMIDADE CE EMITIDA PELO FABRICANTE

We the undersigned, ARIENS COMPANY, certify that: – Nous, soussignés ARIENS COMPANY, certifions que : – Der Unterzeichnete, ARIENS COMPANY, bescheinigt, dass: – Wij, de ondergetekenden, ARIENS COMPANY, verklaren dat: – Undertegnede, ARIENS COMPANY, attesterer, at: – La sottoscritta società ARIENS COMPANY certifica che: – Nosotros, los abajo firmantes, ARIENS COMPANY, certificamos que: – Undertegnede, ARIENS COMPANY, bekræfter at: – Undertecknad, ARIENS COMPANY, intygar att: – Allekirjoittanut, ARIENS COMPANY, vakuuttaa, että: – My, niżej podpisani, ARIENS COMPANY, oświadczamy, że: – Nós, abaixo assinados, certificamos em nome da ARIENS COMPANY, que:

Type: – Type : – Typ: – Type: – Type: – Tipo: – Tipo: – Type: – Typ: – Tyyppi: – Typ: – Tipo:	Riding Rotary Lawn Mower – Tondeuse à gazon autoportée rotative – Aufsitz-Sichelmäher – Rijdende roterende grasmaaier – Havetraktor med roterende knife – Trattorino con unità di taglio rotativa – Tractor cortacésped giratorio – Plentraktor med rotorklipper – Rotoråkråsklippare – Ajoleikkuri – Samobieźna rotacyjna kosiarka trawnikowa – Tractor Cortador de Relva –
Trade Name: – Appellation commerciale : – Handelsbezeichnung: – Handelsnaam: – Firmanavn: Nome commerciale: – Nombre comercial: – Handelsnavn: – Handelsbeteckning: – Kauppanimi: Nazwa handlowa: – Nome da Marca:	Gravelly
Model: – Modèle : – Modell: – Model: – Model: – Modello: – Modelo: – Modell: – Modell: – Malli: – Model: – Modelo:	992318 992319
Cutting Width (cm): – Largeur de coupe (cm) : – Schnittbreite (cm): – Maaibreedte (cm): – Klippebrede (cm): – Larghezza di taglio (cm): – Ancho de corte (cm): – Klippebrede (cm) : – Klippebrede (cm): – Leikkuuleveys (cm): – Szerokość cięcia (cm): – Largura de corte (cm):	152 152

Conforms to: – Est conforme à : – Mit den Anforderungen der folgenden Richtlinien übereinstimmt: – Voldoet aan: – Er i overensstemmelse med: – È conforme a: – Cumple con: – Er i samsvar med: – Överensstämmer med: – Täyttää seuraavat vaatimukset: – Jest zgodny z: – De acordo com:

98/37/EC, 89/336/EEC;

2000/14/EC Conformity Assessment Annex VI. –

Annexe VI de l'évaluation de conformité. – Konformitätsbewertung, Anhang VI. – Bijlage VI voor beoordeling van overeenstemming. – Vurdering af overensstemmelse Annex VI. – Annesso VI della valutazione di conformità. – Anexo VI de la evaluación de la conformidad. – Samsvars vurdering etter vedlegg VI. – Bedömning av överensstämmelse Bilaga VI. – Vaatimusten mukaisuuden arviointi, liite VI. – Dodatek VI, Ocena zgodności. – Anexo VI da Avaliação de Conformidade.

Representative Measured Sound Power Level (L_{wa}) – Niveau de puissance acoustique représentatif mesuré (L_{wa}) – Repräsentativer gemessener Geräuschpegel (L_{wa}) – Representatief gemeten geluidsniveau (L_{wa}) – Repræsentativt, målt støjefektniveau (L_{wa}) – Livello di potenza sonora rappresentativo rilevato (L_{wa}) – Nivel de potencia acústica representativo medido (L_{wa}) – Representativt målt lyeffektnivå (L_{wa}) – Representativt uppmätt ljudnivå (L_{wa}) – Tyypillinen mitattu äänitehotaso (L_{wa}) – Zmierzony reprezentatywny poziom mocy akustycznej (L_{wa}) – Nivel de Potência de Som Medido Representativo (L_{wa})	Guaranteed Sound Power Level (L_{wa}) – Niveau de puissance acoustique garanti (L_{wa}) – Garantiertes Geräuschpegel (L_{wa}) – Gegarandeerd geluidsniveau (L_{wa}) – Garanteret støjefektniveau (L_{wa}) – Livello di potenza sonora garantito (L_{wa}) – Nivel de potencia acústica garantizado (L_{wa}) – Garantert lyeffektnivå (L_{wa}) – Garanterad uppmätt ljudnivå (L_{wa}) – Taattu äänitehotaso (L_{wa}) – Gwarantowany reprezentatywny poziom mocy akustycznej (L_{wa}) – Nivel de Potência de Som Garantido (L_{wa}) –
992318: 104 dB _A 992319: 104 dB _A	992318: 105 dB _A 992319: 105 dB _A

Notified Body – Organisme notifié – Zertifizierungsstelle – Aangemelde instantie – Bemyndiget organ – Organismo notificato – Organismo notificado – Teknisk kontrollorgan – Anmält organ – Ilmoitettu laitos – Organ zaświadczający – Organismo – Certificador	SNCH 11, Route de Luxembourg L-5230 Sandweiler
--	--

Philip J. Smucker: Quality and Conformance Manager (Keeper of Technical File) – Responsable de la qualité et de la conformité des produits (Dépositaire de la fiche technique) – Manager Qualitätssicherung und Konformität (Archivar der technischen Akte) – Kwaliteits- en normalisatiemanager (Beheerder van technische bestand) – Chef for kvalitet og overensstemmelse (Indehaver af tekniske data) – Responsabile della qualità e della conformità del prodotto (Depositario del file tecnico) – Gerente de calidad y conformidad (Depositario del archivo técnico) – Kvalitet- og samsvarsansvarlig (innehaver av teknisk fil) – Chef för kvalitet och produktöverensstämmelse (Innehavare av tekniska data) – Laadusta ja vaatimustenmukaisuudesta vastaava johtaja (Teknisen tiedoston haltija) – Kierownik do spraw jakości i zgodności (Przechowujący Dokumentację Techniczną) – Gestor de Qualidade e Conformidade (Zelador de Arquivos Técnicos)	 Ariens Company Brillion, WI 54110-0157 USA Signature – Signature – Unterschrift Handtekening – Underskrift – Firma Firma – Signatur – Namnteckning Allekirjoitus – Podpis – Assinatura	11/24/2003 Date – Date – Datum Datum – Dato – Data Fecha – Dato Datum – Päiväys Data – Data
--	---	---

**CE Sound and Vibration – Bruits et vibrations
CE – CE Geräusch- und Vibrationswerte – CE
Geluid en trilling – CE støj og vibration –
Livello sonoro e vibrazioni CE – Sonido y**

**vibración CE – CE-lyd og -vibrasjon – CE
Ijudnivå och vibrationer – CE, melu ja tärinä –
CE Dźwięku i Wibracji – Som e Vibração CE –
(Ref. EN836-2001)**

Model: – Modèle : – Modell: – Model: – Modello: – Modelo: – Modell: Modell: – Malli: – Model: – Modelo:	992318	992319	
Oper. Ear Sound Pressure (L_{pa}) in dB_A – Pression acoustique aux oreilles de l'opérateur (L_{pa}) en dB_A – Geräuschpegel am Ohr des Bedieners (L_{pa}) in dB_A – Geluidsdruk bij het oor van de gebruiker (L_{pa}) in dB_A – Strøjttryk ved brugerens øre (L_{pa}) målt i dB_A – Pressione sonora all'orecchio dell'operatore (L_{pa}) in dB_A – Presión de sonido en el oído (L_{pa}) in dB_A – Lydtrykk ved førerens øre (L_{pa}) inn dB_A – Ljudeffekt vid förarens öron (L_{pa}) i dB_A – Kuljettajan korvaan kohdistuva äänenpaine (L_{pa}), dB_A – Robocze ciśnienie akustyczne na ucho (L_{pa}) w decybelach $_A$ – Oper. Pressão do Som no Ouvido (L_{pa}) em dB_A	90	90	
Vibration Measure (m/sec^2) at Operator – Mesure des vibrations (m/s^2) au niveau de l'opérateur – Vibration (m/s^2) an des Bedieners – Gemeten trilling bij (m/sec^2) – Vibrationsmålinger (m/s^2) ved brugerens – Vibrazioni percepitate dall'operatore (m/sec^2) – Medida de vibración (m/seg^2) en el operador – Vibrasjonsmåling (m/s^2) ved førerens – Vibrationsmått (m/s^2) vid förarens – Tärinä (m/s^2) kuljettajan – Pomiar wibracji (m/sec^2) u operatora – Medida de Vibração ($m/seg.^2$) no Operador			
Hands – Mains – Hände – De handen van de gebruiker – Hænder – Mani – Manos – Hender – Händer – Käsissä – Ręce – Mãos	X Y Z	3.2 0.5 0.9	≤ 2.5 ≤ 2.5 ≤ 2.5
Feet – Pieds – Füße – De voeten van de gebruiker – Fødder – Piedi – Pies – Føtter – Fötter – Jaloissa – Stopy – Pés	X Y Z	0.2 0.2 0.8	0.5 0.5 0.7
Seat – Siège – Sitz – De bestuurdersplaats – Sæde – Sedile – Asiento – Sete – Säte – Istuimella – Siedzenie – Assento	X Y Z	0.3 0.3 0.5	0.5 0.5 0.6

INTRODUCTION

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 Promaster 250Z, 260Z, and 272Z.

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 operator seated in operation position and facing the direction of forward travel.

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.

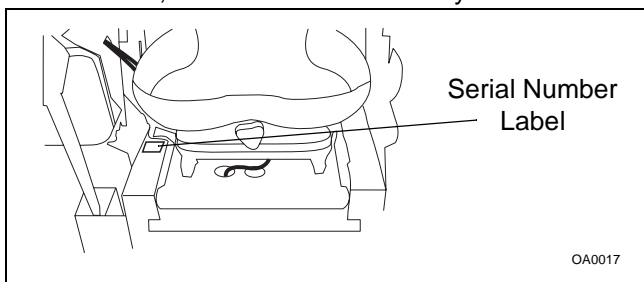


Figure 1

PRODUCT REGISTRATION

The Gravely dealer must register the product at the time of purchase. Registering the product will help the company process warranty claims or contact you with the latest service information. All claims meeting requirements during the limited warranty period will be

honored, whether or not the product registration card is returned. Keep a proof of purchase if you do not register your unit.

Customer Note: If the dealer does not register your product, please fill out, sign, and return the product registration card to Gravely.

UNAUTHORIZED REPLACEMENT PARTS

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

DISCLAIMER

Gravely reserves the right to discontinue, make changes to, and add improvements upon its products at any time without public notice or obligations. 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.

TECHNICAL SERVICE COMMUNICATIONS

Gravely 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.

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.

SAFETY



WARNING: This cutting machine is capable of amputating hands and feet and throwing objects. Failure to observe the safety instructions in the manuals and on decals could result in serious injury or death.

WARNING: Slopes are a major factor related to loss-of-control and tip-over accidents. Operation on all slopes requires extra caution.

WARNING: Tragic accidents can occur if the operator is not alert to the presence of children. Never assume that children will remain where you last saw them.

WARNING: Gasoline is extremely flammable and the vapors are explosive, handle with care.

WARNING: Disengage attachment, stop unit and engine, remove key, engage parking brake, and allow moving parts to stop before leaving operator's position.

SAFETY ALERT SYMBOL

These are safety alert symbols. They mean:

- ATTENTION!
- YOUR SAFETY IS INVOLVED!

When you see this symbol:

- BECOME ALERT!
- OBEY THE MESSAGE!



OL1253



OL3900

SIGNAL WORDS

The safety alert symbols above and signal words below are used on decals and in this manual.

Read and understand all safety messages.



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.

NOTATIONS

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

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

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.

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 this manual and any needed safety training before operation.

SAFETY DECALS AND LOCATIONS

ALWAYS replace missing or damaged safety decals. See Figure 2 for safety decal locations.

1. DANGER! TO AVOID SERIOUS INJURY OR DEATH

Read Operator's Manual.



OL 1801

Keep children and others away from unit while operating.



OL 4370

Never direct discharge toward other people. Thrown objects can cause injury.



OL 0910

Look down and behind before and while backing.



OL 4460

Never carry children.



OL 4470

Go up and down slopes, not across. DO NOT operate on slopes over 17°.



OL 4450

- If machine stops going uphill, stop blade and back down slowly.
- Avoid sudden turns.
- Keep safety devices (guards, shields, switches, etc.) in place and working.
- Check interlock system per manual before use.
- Understand location and function of all controls.
- Never allow operation by untrained persons.

2. DANGER!



OL 3030

Always keep feet and hands away from rotating parts.



OL 0910

Always stand clear of discharge area. Do not direct discharge toward other people.



OL 4370

Keep people away from unit while operating.



OL 4010

Shut off engine, remove key, and read manual before you adjust or repair unit.



OL 4420

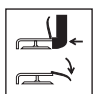
NO STEP! Always keep feet away from rotating parts.

3. WARNING!



OL 4430

Always stand clear of discharge area.



OL 3320

Do not operate mower unless guards are in operating position or bagger is attached.

4. HOT SURFACES!



OD 0061

DO NOT touch parts which are hot from operation. **ALWAYS** allow parts to cool.

5. DANGER!



OL 4730

AVOID INJURY. Stay clear of rotating parts.



OL 4740

AVOID INJURY. Stay clear of rotating fan.

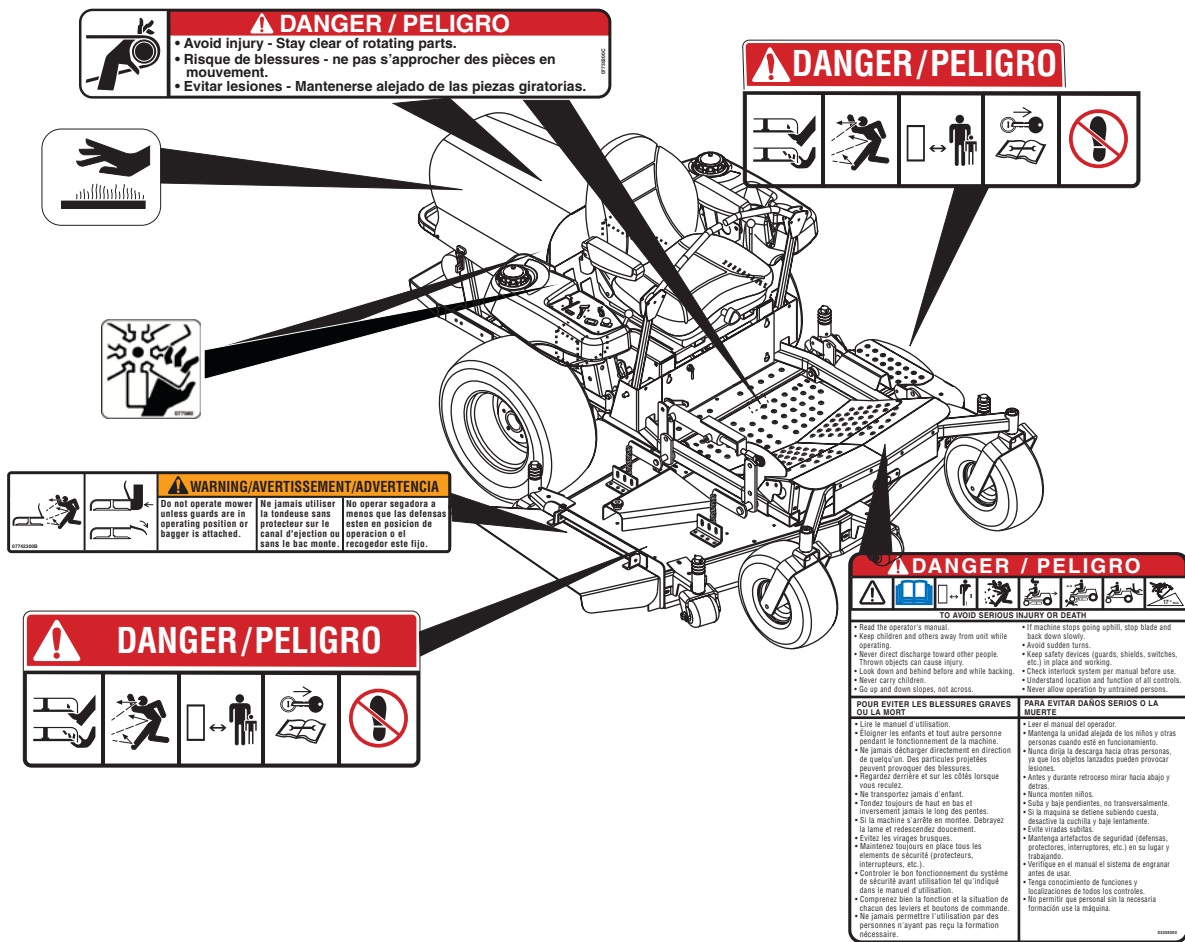


Figure 2 - Safety Decals

SAFETY RULES

Read, understand, and follow all safety practices in Owner/Operator Manual before beginning assembly. Failure to follow instructions could result in personal injury and/or damage to unit.

ALWAYS remove key from ignition and wire from spark plug before assembly. Unintentional engine start up can cause death or serious injury.

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

- Work area
- Your unit
- All safety decals

Inspect unit before each use for: missing or damaged decals and shields, correctly operating safety interlock system, and deterioration of grass catchers. Replace or repair as needed.

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

Keep children and people away.

Keep children out of work area and under watchful care of a responsible adult.

Keep area of operation clear of all toys, and debris. Thrown objects can cause injury.

Check for weak spots on docks, ramps or floors, Avoid uneven work areas and rough terrain. Stay alert for hidden hazards or traffic.

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.

Data indicates that operators, age 60 and above, are involved in a larger percentage of riding mower related injuries. These operators should evaluate their ability to operate the riding mower safely enough to protect themselves and others from serious injury.

Read the entire Owner/Operator manual and other training material. If the operator or the mechanic cannot read the manual, it is the owner's responsibility to explain it to them. Only the user can prevent and is responsible for accidents or injuries occurring to themselves, other people or property.

Only trained adults may operate unit. Training includes actual operation.

Local regulations may restrict the age of the operator.

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

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

DO NOT wear loose clothing or jewelry and tie back hair that may get caught in rotating parts.

Wear adequate outer garments.

NEVER wear open sandals or canvas shoes during operation. Wear adequate safety gear, protective gloves and footwear.

Wear proper footwear to improve footing on slippery surfaces.

Always wear safety goggles or safety glasses with side shields when operating mower.

Moving parts can cut or amputate fingers or a hand. Wrap blade(s) or wear gloves to service. On multiblade mowers, rotation of one blade will cause all blades to rotate.

NEVER place your hands or any part of your body or clothing inside or near any moving part while unit is running.

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

ALWAYS keep body and hands away from pin holes or nozzles which eject hydraulic fluid under pressure.

DO NOT touch parts which are hot. Allow parts to cool.

ALWAYS keep hands and feet away from all pinch points.

Fumes from the engine exhaust can cause death or serious injury. DO NOT run engine in an enclosed area. Always provide good ventilation.

Read, understand, and follow all instructions in the manual and on the machine before starting.

Understand:

- How to operate all controls
- The functions of all controls
- How to STOP in an Emergency
- Braking and steering characteristics
- Turning radius and clearances

Keep safety devices or guards in place and functioning properly. NEVER modify or remove safety devices.

Do not operate without either entire grass catcher or the discharge guard in place.

Stop engine before removing grass catcher or unclogging chute.

Ensure Safety Interlock System is functioning properly. DO NOT operate unit if safety interlock is damaged or disabled.

Start and operate unit only when seated in operator's position. Steering control levers must be in neutral, PTO disengaged and parking brake set when starting engine.

Use care when approaching blind corners, shrubs, trees or other objects that may obscure vision.

Dust, smoke, fog, etc. can reduce vision and cause an accident. Mow only in daylight or good artificial light.

Avoid slippery surfaces. Always be sure of your footing.

DO NOT mow on wet grass. Reduced traction could cause sliding and effect the machine's stability.

Watch for traffic when operating near or crossing roadways.

Never carry passengers.

DO NOT try to stabilize the machine by putting your foot on the ground.

Never direct discharge towards persons or property that may be injured or damaged by thrown objects. Use extreme caution on gravel surfaces.

Always stand clear of the discharge area.

ALWAYS disengage PTO, stop unit and engine, remove key, engage parking brake and allow moving parts to stop before leaving operator's position.

Never engage PTO while raising attachment or when attachment is in raised position.

DO NOT operate at too fast a rate. DO NOT change engine governor settings or over-speed engine. Slow down before turning.

DO NOT operate in reverse unless absolutely necessary.

ALWAYS look down and behind before and while backing.

Stop and inspect equipment if you strike an object or if there is an unusual vibration. Repair, if necessary, before restarting. Never make adjustments or repairs with the engine running.

Mower blades are sharp and can cut you. Wrap the blade(s) or wear gloves, and use extra caution when servicing them.

NEVER weld or straighten mower blades.

Rotation of one blade may cause rotation of the other blades.

Take all possible precautions when leaving unit unattended. Shut off engine. Remove wire from spark plug and secure it away from spark plug.

ALWAYS remove key to prevent unauthorized use.

Know the weight of loads. Limit loads to those you can safely control and the unit can safely handle.

Disengage PTO when attachment is not in use.

ALWAYS turn off power to attachment when traveling, crossing driveways, etc.

Mow up and down slopes, not across them.

DO NOT operate on slopes of more than 17 degrees.

Use of a Rollover Protection System (ROPS) is recommended for slope operation.

Always wear a seat belt when operating unit using a Rollover Protection System (ROPS).

Keep all movements on the slope slow and gradual. Do not make sudden changes in speed or direction.

Avoid starting or stopping on the slope. If tires lose traction, disengage the blades and proceed slowly straight down the slope.

If you cannot back up a slope or you feel uneasy on it, do not mow it.

DO NOT park on slopes unless necessary. When parking on slope always chock or block wheels. Always set parking brake.

Use a slow speed. Tires may lose traction on slopes even though the brakes are functioning properly.

DO NOT bypass transmission when on a slope.

Tow only with a machine that has a hitch designed for towing. Do not attach towed equipment except at the hitch point.

Follow the manufacturer's recommendations for weight limits for towed equipment and towing on slopes.

NEVER allow children or others in or on towed equipment.

On slopes, the weight of the towed equipment may cause loss of control.

Travel slowly and allow extra distance to stop.

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 machine while engine is running.

ALWAYS turn off power to attachment and shut off fuel when transporting unit.

Keep unit free of debris. Clean up oil or fuel spills.

This product is equipped with an internal combustion type engine. DO NOT use unit on or near any unimproved, forest-covered or brush covered land unless exhaust system is equipped with a spark arrester meeting applicable local, state or federal laws. A spark arrester, if it is used, must be maintained in effective working order by operator.

Fuel is highly flammable and its vapors are explosive. Handle with care. Use an approved fuel container.

NO smoking, NO sparks, NO flames. ALWAYS allow engine to cool before servicing.

NEVER fill fuel tank when engine is running or hot from operation.

NEVER fill or drain fuel tank indoors.

Replace fuel cap securely and clean up spilled fuel.

Never fill containers inside a vehicle or on a truck or trailer bed with a plastic liner. Always place containers on the ground away from your vehicle before filling.

When practical, remove gas-powered equipment from the truck or trailer and refuel it on the ground. If this is not possible, then refuel such equipment on a trailer with a portable container, rather than from a gasoline dispenser nozzle.

Keep the nozzle in contact with the rim of the fuel tank or container opening at all times until fueling is complete. Do not use a nozzle lock-open device.

If fuel is spilled on clothing, change clothing immediately.

Avoid Electric Shock. Objects contacting both battery terminals at the same time may result in injury and unit damage. DO NOT reverse battery connections.

Reversed connections may result in sparks which can cause serious injury. Always connect positive (+) cable FIRST, and negative (-) cable SECOND.

Explosive Gases from battery can cause death or serious injury. Poisonous battery fluid contains sulfuric acid and its contact with skin, eyes or clothing can cause severe chemical burns.

No flames, No sparks, No smoking near battery.

ALWAYS wear safety glasses and protective gear near battery. Use insulated tools.

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

ALWAYS keep batteries out of reach of children.

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

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

Release pressure slowly from components with stored energy.

NEVER attempt to make any adjustments to unit while engine is running (except where specifically recommended). Stop engine, remove key or spark plug wire and wait for all moving parts to stop before servicing or cleaning.

Check parking brake operation frequently. Adjust and service as required.

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

Maintain or replace safety and instruction labels, as necessary.

NEVER store unit with fuel in fuel tank, inside a building where any ignition sources are present.

Shut off fuel and allow engine to cool completely before storing in closed area or covering unit.

Clean grass and debris from unit, especially from around muffler and engine, to help prevent fires.

For extended storage, shut off fuel and clean unit thoroughly. See engine manual for proper storage.

Lower cutting deck unless a positive mechanical lock is used.

Use only attachments or accessories designed for your unit.

Check all hardware at regular intervals, especially blade attachment bolts. Keep all hardware properly tightened.

Check attachment components frequently. If worn or damaged, replace with manufacturer's recommended parts.

Safety Interlock System



WARNING: Safety interlock system failure and improper operation of unit can result in death or serious injury. Test this system each time unit is operated. If this system does not function as described, do not operate until repairs are made.

Perform the following tests to ensure safety interlock system is working properly. If unit does not perform as stated contact your Gravely dealer for repairs.

NOTE: For all models, when parking brake is engaged, steering levers are locked in neutral.

Test	Steering Levers	PTO	Parking Brake	Engine
STARTING INTERLOCK				
1	Neutral	Off	Engaged	Start
2	Neutral	On	Engaged	Doesn't Start
3	Neutral	Off	Disengaged	Doesn't Start
OPERATING INTERLOCK (ENGINE ON)				
4*	Neutral	On	Engaged	Shuts Off
5*	Neutral	Off	Disengaged	Shuts Off
6*	Neutral	Off	Engaged	On
*Operator lifts off seat.				

Parking Brake Interlock System

With parking brake engaged, steering levers must be locked in neutral.

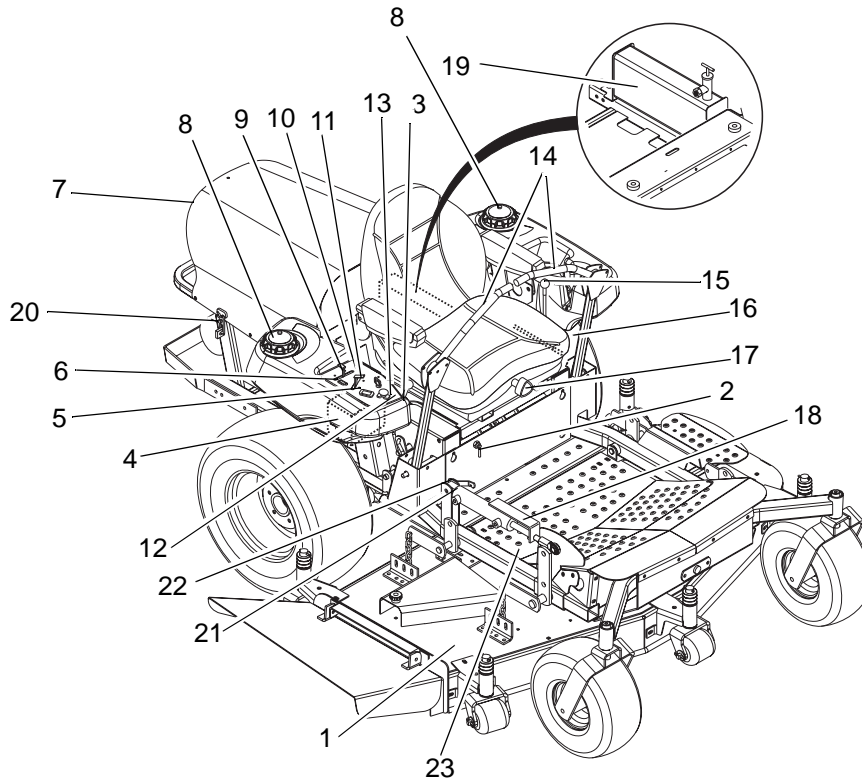
With parking brake disengaged, engine must not start and engine must shut off if operator leaves seat.

SPECIFICATIONS

Model Number	992018	992023	992027
Model	PM260Z 25 HP Kohler with 50 Inch Deck	PM250Z 20 HP Briggs & Stratton with 50 Inch Deck	PM260Z 25 HP Kohler with 72 Inch Deck
Length - in (cm)	87 (221)		90 (229)
Height - in (cm)	50 (127)		
Width - in (cm)	63 (160)		85 (216)
Weight Actual - lbs (kg)	1100 (499)	1080 (490)	1259 (572)
Battery	12 volt		
Brakes	Hydro/Dynamic Disk - Parking		
Turning Radius	0		
Tire Size Front	15 x 6 - 6	15 x 6 - 6	15 x 6 - 6
Rear	23 x 10.5 - 12	23 x 8.5 - 12	12 x 1.5 - 12
Engine - Manufacturer	Kohler	Briggs & Stratton	Kohler
Model Number	CV25S	351777	CV25S
Cycle	4		
Engine Power- HP (KW/min ⁻¹)	25 HP (18.6 KW/min ⁻¹)	20 HP (14.7 KW/min ⁻¹)	25 HP (18.6 KW/min ⁻¹)
Starting System	Electric		
Fuel Tank Capacity	9 gals. US (34 liters)		
Fuel	See Engine Manual		
Idle RPM	1800		
Governed RPM	3600		
Air Cleaner	Large Capacity Dual Element		
Cooling Capacity	Air Cooled		
Engine Oil Type	See Engine Manual		
Spark Plug Gap	See Engine Manual		
Transmission	Hydrostatic Drive		
Speed - Forward Max.	9 MPH		
Reverse Max.	4.5 MPH		
Transmission Lube	Mobil 1 15W - 50 Synthetic		
Drive Clutch	Hydrostatic		
Tire Pressure Front	20-25 psi		
Rear	12-15 psi		
Lift system	Hydraulic		
Power Take Off	Electric PTO Clutch/Brake		
Cutting Width - in (cm)	50 (127)		72 (183)
Cutting Height - in (cm)	1 - 5 (2.5 - 12.7)		
Cutting Increments - in (cm)	Infinite between 1 - 5 (2.5 - 12.7)		

Model Number	992020	992029	992030	992032	992033	992034	992035
Model	260Z 25 HP Kohler w/60" deck	260Z 25 HP Kawasaki w/60" deck	272Z 25 HP Kawasaki w/72" deck	272Z 26 HP EFI Kohler w/72" deck	260Z 26 HP Kawasaki w/50" deck	250Z 23 HP Kawasaki w/50" deck	250Z 23 HP Kawasaki w/50" dek
Length - in (cm)	80 (203)		84 (213.4)		80 (203)		
Height - in (cm)	50 (127)						
Width - in (cm)	73 (185)		85 (216)		73 (185)	63 (160)	
Weight Actual - lbs (kg)	1125 (510)		1259 (572)		1125 (510)	1100 (499)	
Battery	12 volt						
Brakes	Hydro/Dynamic Disk - Parking						
Turning Radius	0						
Tire Size Front	15 x 6 - 6						
Rear	23 x 10.5 - 12						
Engine - Manufacturer	Kohler	Kawasaki		Kohler		Kawasaki	
Model Number	CV25S	FH721V		CV26S		FH601V	FH680V
Cycle	4						
Engine Power - HP (kw) @ Governed RPM	25 (18.6)		26 (19.3)		19 (14.1)	23 (17.2)	
Governed RPM	3600						
Idle RPM	1800						
Starting System	Electric						
Fuel Tank Capacity	9 gals. US (34 liters)						
Fuel	See Engine Manual						
Air Cleaner	Large Capacity Dual Element						
Cooling Capacity	Air Cooled						
Engine Oil Type	See Engine Manual						
Spark Plug Gap	See Engine Manual						
Transmission	Hydrostatic Drive						
Speed - Forward Max.	9 MPH						
Reverse Max.	4.5 MPH						
Transmission Lube	Mobil 1 15W - 50 Synthetic						
Drive Clutch	Hydrostatic						
Tire Pressure Front	20-25 psi						
Rear	12-15 psi						
Lift system	Hydraulic						
Power Take Off	Electric PTO Clutch/Brake						
Cutting Width - in (cm)	60 (152)		72 (183)		60 (152)	50 (127)	
Cutting Height - in (cm)	1 - 5 (2.5 - 12.7)						
Cutting Increments - in (cm)	Infinite between 1 - 5 (2.5 - 12.7)						

CONTROLS AND FEATURES



OF 1722

- | | |
|---------------------------------------|---|
| 1. Mower Deck with Chute Deflector | 12. Ignition Switch |
| 2. Fuel Shut off Valve | 13. Power Take Off (PTO) Switch |
| 3. Parking Brake | 14. Steering Levers |
| 4. Battery | 15. Mower Lift Lever |
| 5. Hour Meter | 16. Seat Adjustment Lever |
| 6. Oil Pressure Indicator | 17. Seat Suspension Adjustment Knob (not on model 992034) |
| 7. Engine Frame and Hood | 18. Height of Cut Indicator |
| 8. Fuel Tanks and Caps | 19. Hydraulic Oil Reservoir |
| 9. Choke Control (not on EFI* models) | 20. Engine Hood Latch |
| 10. Malfunction Indicator Light | 21. Cylinder Stop Storage Post |
| 11. Throttle Lever | 22. Cylinder Stops |

*Electronic Fuel Injection

Figure 3

GENERAL MAINTENANCE & ADJUSTMENTS

MAINTENANCE SCHEDULE



WARNING: AVOID INJURY. Read and understand the entire *Safety* section before proceeding.

Proper maintenance can prolong the life of unit. The following chart shows the recommended service schedule. More frequent service may be required due to working conditions (Heavy loads, high ambient temperatures, dusty conditions, or airborne debris).

See the maintenance instructions in Engine Manual for additional information.

Interval	Task	Action
Each Use	Check Safety Interlock	WARNING: Safety interlock system failure and improper operation of unit can result in death or serious injury. Test this system each time unit is operated. If this system does not function as described, do not operate until repairs are made (see Safety Interlock System on page 11).
	Check Parking Brake Interlock System	See Parking Brake Interlock System on page 11.
	Check Parking Brake	Engage parking brake. Push unit. If unit rolls adjust parking brake (see Parking Brake Adjustment on page 22).
	Check Hydraulic Oil Level	See Checking Hydraulic Oil Level on page 26.
	Check Tires	See Specifications on page 12 for correct tire pressure.
	Clean Unit	Clean engine, battery, seat, mower deck, etc. of all dirt and debris. Do not use solvents, hard cleaners, or abrasives. NOTE: Protect painted surfaces with automotive type wax.
	Follow Engine Manual Maintenance Schedule	Perform scheduled engine maintenance. Refer to Engine Manual for detailed instructions.
Every 25 Hours	Check Cooling System	Check cooling system for dirt and debris. Refer to Engine Manual for detailed instructions.
	Check Mower Blades	Ensure mower blade hardware is tightened to 115 – 125 lbf-ft. (156 – 169 Nm). Check mower blades for wear, Sharpen or replace mower blades as needed (see Sharpening Mower Blade on page 19).
Every 50 Hours	Lubricate Front Axle and Pivot Points	Oil all pivot points, pin connections and apply grease to front axle grease zerk (see General Lubrication on page 18).
Every 100 Hours	Clean Battery	Keep battery and battery terminals clean (see Cleaning the Battery on page 19).
	Check Fasteners	Check mower blade mounting hardware and all other fasteners. Replace missing or damaged fasteners. Tighten all nuts and bolts to their correct torque value.
	Check Belts	Replace worn or deteriorated belts. <ul style="list-style-type: none"> • Check mower drive belt (see Replacing Mower Belts on page 20 for mower drive belt location). • Check PTO belt (see PTO Belt Removal on page 20 for PTO belt location). • Check radiator fan belt (refer to Engine Manual).
Every 400 Hours	Grease Front Axle Caster Pivots	Repack front axle caster pivots (see General Lubrication on page 18).
Every 500 Hours	Change Hydraulic Oil and Filter	See Hydraulic Oil System on page 26.

SERVICE AND ADJUSTMENTS

Gravely Dealers will provide any service which may be required to keep your unit operating at peak efficiency. Should engine service be required, it can be obtained from a Gravely Dealer or engine manufacturer's authorized service center.



WARNING: AVOID INJURY. Read and understand the entire *Safety* section before proceeding.



CAUTION: HOT SURFACES may result in injury. DO NOT touch engine or drive parts which are hot from operation. Allow parts to cool before servicing.

SERVICE POSITIONS

IMPORTANT: Place unit on a flat level surface. ALWAYS shut off engine, set parking brake, and remove ignition key. Ensure unit is secure and will not tip over. When a lift is used, strap and clamp unit to the lift.

1. Place steering levers in neutral position and set parking brake.
2. Unhook hood latches. Firmly grasp hood frame handle and lift to the desired service position (Figure 4).



CAUTION: When opening hood, use care to properly engage hood prop rod into service slot. Be sure footing is secure to accommodate weight shift of hood when rotating to full service position.

Daily Service Position: Place hood prop rod into service slot. Ensure prop rod is engaged in service slot properly.

Full Service Position: Slowly release hood after seat contacts foot board. Use care and be sure of your footing. Do not step on mower deck.

3. When service is complete, lower hood, and secure with hood latches.

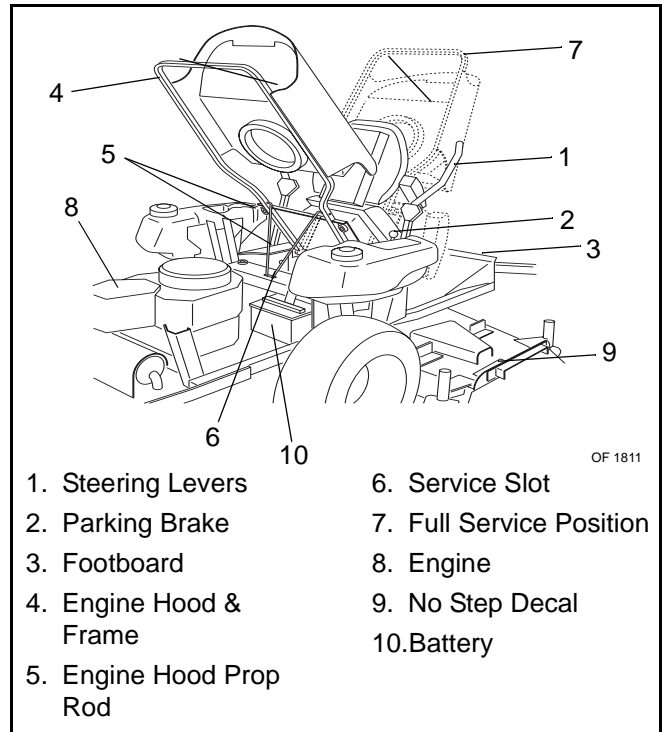


Figure 4

MOVING UNIT MANUALLY

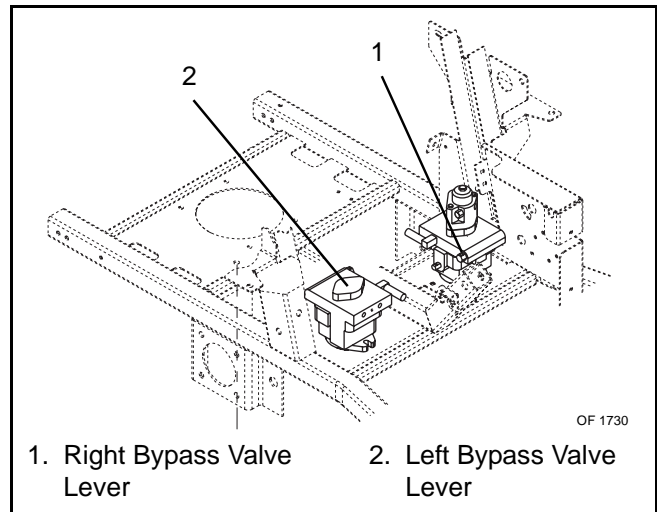


Figure 5

IMPORTANT: Never tow unit.

1. Place hood in the full service position (see Service Positions on page 16).
2. Rotate the bypass valve dump levers located on the pumps using a wrench.



WARNING: Do not bypass transmission when on a slope.

3. Disengage parking brake.
4. Push unit to desired location.

5. Engage parking brake.
6. Levers must be returned to their original position in order to operate the unit (Figure 5).

TRANSPORTING UNIT

ALWAYS shut off engine, set parking brake, and remove key when transporting unit on a truck or trailer. Tie unit down securely. Do not tie down by linkages, guards, cables or other parts that may be damaged.

STARTING AND SHUTTING OFF THE ENGINE

NOTE: DO NOT operate starter more than 15 seconds per minute, as overheating and damage can occur. If engine will not start, see Troubleshooting on page 42 or refer to Engine Manual.

NOTE: PTO must be disengaged and parking brake engaged prior to starting engine.

To start:

1. Insert ignition key (Figure 6).
2. Move throttle control lever to middle position.

NOTE: If engine is cold, move choke control to the on position. Once engine has started and is warmed up, move choke control to the off position. If engine is warm, do not use choke.

3. Turn ignition key to Start (3) position. If engine does not start in five seconds, release ignition key, wait, and then repeat. Once engine has started, ignition key will return to the Run (2) position.

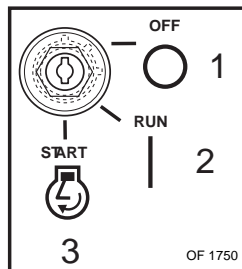


Figure 6

To shut off:

1. Disengage PTO.
2. Set parking brake.
3. Turn ignition key to Off (1) position.

CLEANING AND STORAGE



WARNING: AVOID SHARP EDGES which can cut. Movement of parts can cut off fingers or a hand. Wrap blades, wear gloves, and use extreme caution when servicing.

IMPORTANT: Never spray unit with water or store unit outdoors. Water can seep into sealed bearings and reduce component life. Bearings are sealed against dirt and debris only.

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.



WARNING: AVOID INJURY. Read and understand the entire Safety section before proceeding.

Short Term

NEVER spray unit with high-pressure water or store unit outdoors.

Inspect unit for visible signs of wear, breakage or damage.

Keep all nuts, bolts and screws properly tightened and know unit is in safe working condition.

Store unit in a cool, dry protected area.

Long Term

Clean unit thoroughly and lubricate. Touch up all scratched painted surfaces.

Remove weight from wheels by putting blocks under frame or axle.

When storing unit for extended periods of time, remove all fuel from tank and carburetor (run dry). Refer to Engine Manual.

Clean and charge battery. Charge battery every three to four weeks when storing unit.

When taking unit out of extended storage:

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

FILLING FUEL TANK



EXPLOSIVE VAPORS and FLAMMABLE FUEL can result in serious injury or death. Handle fuel with care. ALWAYS use an approved fuel container.

No Smoking!

No Lighted Materials!

No Open Flame!

Allow engine to cool.

Use caution with fuel. Fuel is very flammable. Keep fuel in a clean and tight container. Keep fuel away from fire or 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 tank as needed.

IMPORTANT: Refer to Engine Manual for correct type and grade of fuel. See Specifications for fuel tank capacity.

To add fuel to the fuel tank:

1. Refuel the unit only in a well ventilated, open area.
2. Stop the engine.
3. Clean the fuel cap and the area around the fuel cap to prevent dirt from entering the fuel tank. Remove the cap from the fuel tank.
4. Fill the fuel tank. Be careful not to spill the fuel. Do not overfill, allow for fuel expansion. Stop filling when fuel is about 1" below the bottom of the neck.
5. Install the cap on the fuel tank and tighten.
6. Clean up any spilled fuel before starting the engine.

FASTENERS

Each day before operating, check mower blade mounting hardware and all other fasteners. Replace fasteners that are missing or damaged. Tighten all nuts and bolts to their correct torque value.

GENERAL LUBRICATION

IMPORTANT: Wipe each fitting clean before and after lubrication.

Lube fitting locations are: front axle pivot (1) (Figure 7)

Apply Sten Mix Hi-Temp Grease or equivalent to the lube fittings. Order P/N: 00036700 - Ten pack of 14 oz. cartridges.

When using Sten Mix Grease for the first time, all components should be thoroughly cleaned prior to lubricating.

Apply oil at all pivot points and pin connections.

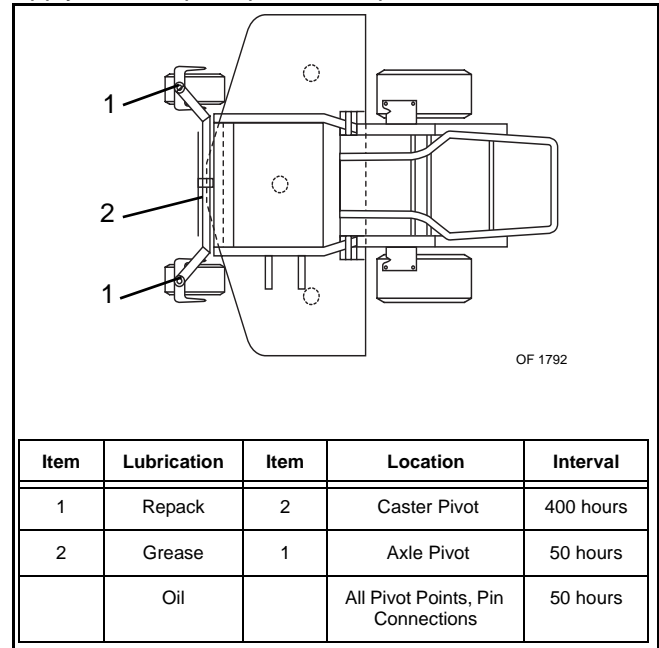


Figure 7

IMPORTANT: Wipe front axle grease zerk and two front axle caster pivots clean before and after lubrication.

NOTE: Use Stens Mix Hi-Temp Grease or equivalent (part number 00036700).

Description	Use	Interval
Grease fittings	Sten Mix HI-Temp grease or equivalent	50 hrs. running time
Hydraulic system	Mobil 15W50 synthetic oil	500 hrs. running time

SERVICING THE BATTERY



WARNING: AVOID INJURY. Read and understand the entire Safety section before proceeding.



WARNING: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

NOTE: Unit comes equipped with a maintenance-free battery that requires no regular maintenance except cleaning the terminals.

Battery Removal and Installation

Remove

1. Place hood in full service position (see Service Positions on page 16).
2. Disconnect negative (-) cable first, then positive (+) cable (Figure 8).
3. Remove battery hold-down bracket and battery from unit.

Install

1. Install battery on unit with battery hold-down bracket.
2. Connect positive (+) cable first, then negative (-) cable.
3. Coat terminals with dielectric grease or petroleum jelly.
4. Close hood.

Cleaning the Battery

1. Disconnect negative (-) cable first, then positive (+) cable.
2. Clean battery cable ends and terminals with wire brush. Rinse with a weak baking soda solution.
3. Connect positive (+) cable first, then negative (-) cable.
4. Coat terminals with dielectric grease or petroleum jelly.

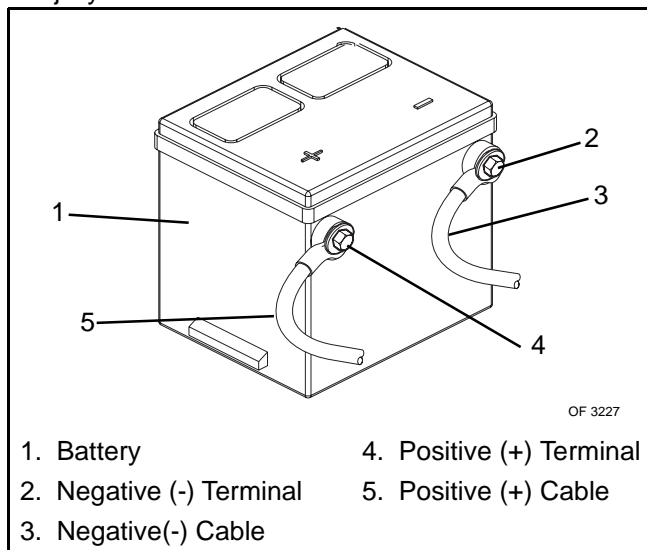


Figure 8

Charging the Battery



WARNING: FROZEN BATTERIES CAN EXPLODE and result in death or serious injury. **DO NOT** charge a frozen battery. Let battery thaw before charging.

Follow First Aid directions for contact with battery fluid.

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

IMPORTANT: DO NOT fast charge. Charging at a higher rate will damage or destroy battery. **ALWAYS** follow information provided on battery and battery charger. Contact battery manufacturer and battery charger manufacturer for detailed instructions.

1. Remove battery from unit (see Battery Removal and Installation on page 19).
2. Place battery on bench or other well-ventilated area.
3. Connect positive (+) lead of charger to positive (+) terminal, and negative (-) lead to negative (-) terminal.
4. Charge battery according to the instructions from battery charger manufacturer and battery manufacturer.

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. Before reinstalling the battery in the spring, it should always be fully recharged.

BASIC ENGINE MAINTENANCE

See your engine manual and Engine Chapter of this manual for detailed information on the operation and maintenance of your engine.

1. Each day before operating, check the level of the oil in the engine. Never operate the engine when the oil level is below the add mark.
2. Each day before operating, check the air cleaner element. Dirt can decrease the flow of air to the engine.
3. Each day before operating, check the air cooling system on the engine. Debris can decrease the flow of air cooling the engine.
4. Follow the maintenance instructions in your engine manual concerning oil and filter changes.

BELTS



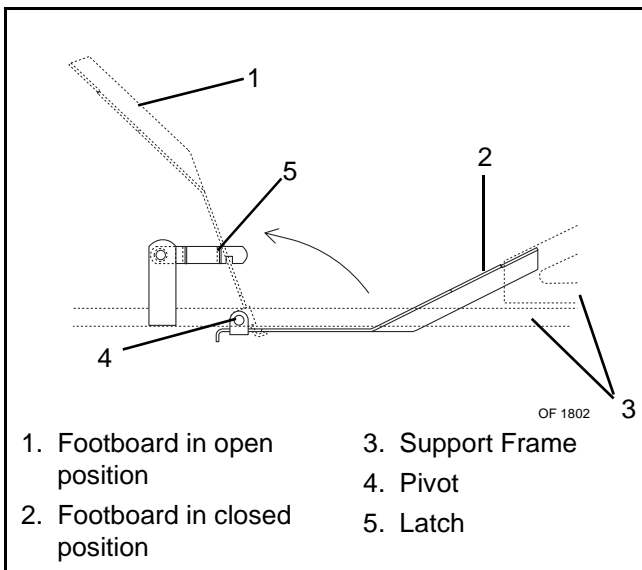
WARNING: MOVING PARTS can cut or amputate body parts. ALWAYS wait for moving parts to stop before performing maintenance or service.



CAUTION: DAMAGED OR WORN BELTS may result in injury and/or damage to the unit. Check belts for excessive wear or cracks often.

Belt Access

1. Properly stop and park unit (refer to Owner's Manual).
2. Lower the mower.
3. Place seat in most rearward position.
4. Remove belt covers.
5. Place foot board in open position (Figure 9).
6. Secure raised footboard with latch.



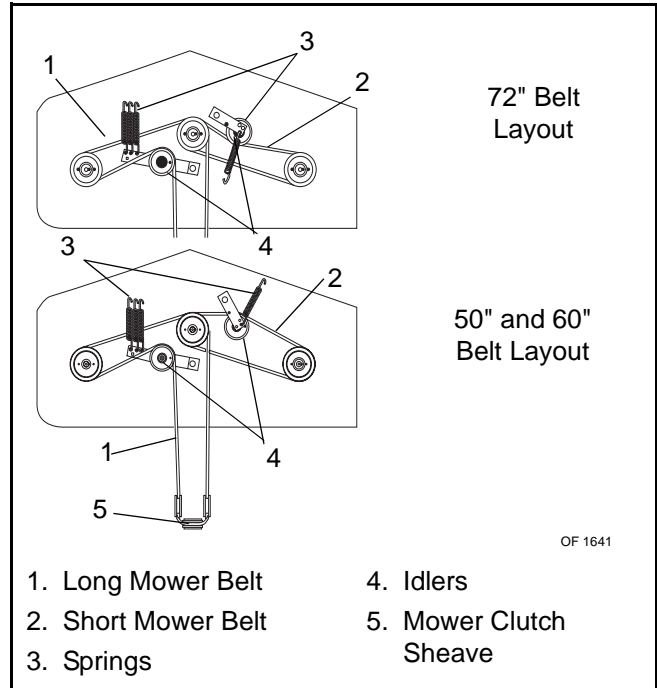
- | | |
|---------------------------------|------------------|
| 1. Footboard in open position | 3. Support Frame |
| 2. Footboard in closed position | 4. Pivot |
| | 5. Latch |

Figure 9

Replacing Mower Belts

NOTE: Long belt must be removed to remove short belt.

1. Roll long belt off left blade spindle and remove from deck.
2. Roll short belt off right blade spindle and remove from deck. Idler pivot bolt must be loosened slightly to gain clearance to remove belt from under idler pulley (Figure 10).



- | | |
|---------------------|------------------------|
| 1. Long Mower Belt | 4. Idlers |
| 2. Short Mower Belt | 5. Mower Clutch Sheave |
| 3. Springs | |

Figure 10



CAUTION: Use care when releasing idler spring tension. Keep body parts well away from idlers when performing this operation.

3. Arrange new mower belt(s) on deck (short belt first). Retighten short belt idler pivot bolt. Install belts on sheaves. Roll belts onto blade sheave last.
4. Replace belt covers and return foot board to closed position.

Replacing the Hydro Pump Belt

1. Properly stop and park unit (refer to unit Owner's Manual).
2. Remove the mower belt from the mower clutch sheave. See replacing Mower Belts.
3. Remove old hydro pump belt by rolling belt off right hand hydrostat sheave first. (Figure 11)
4. Install new pump belt by positioning belt on sheaves. Roll belt onto right hand hydrostat sheave last.
5. Put the mower belt back on mower clutch sheave. See Replacing Mower Belts.

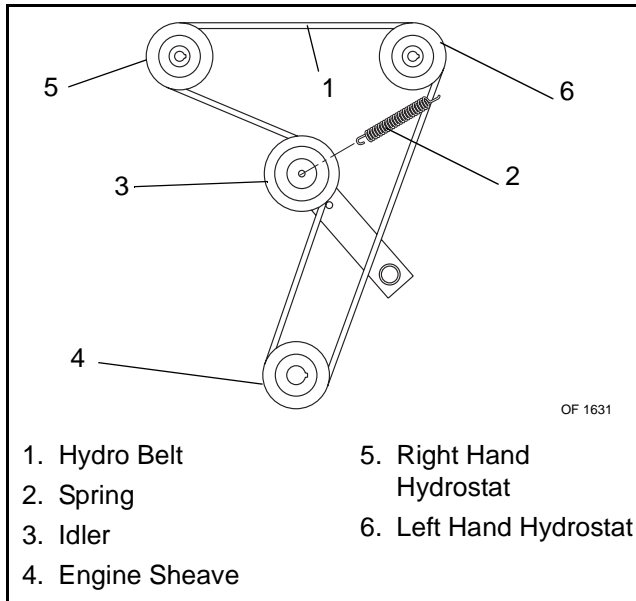


Figure 11

- | | |
|------------------|-------------------------|
| 1. Hydro Belt | 5. Right Hand Hydrostat |
| 2. Spring | |
| 3. Idler | 6. Left Hand Hydrostat |
| 4. Engine Sheave | |

TIRES

Before each use, make a visual check of tires. The correct air pressure is 12-15 psi (83-103 kn/m^2) for the rear tires, and 20-25 psi (138-172 kn/m^2) for the front tires.

MOWER BLADES

NOTE: If mower is used under sandy soil conditions, replace mower blades when air lifts become eroded through at ends (Figure 12).

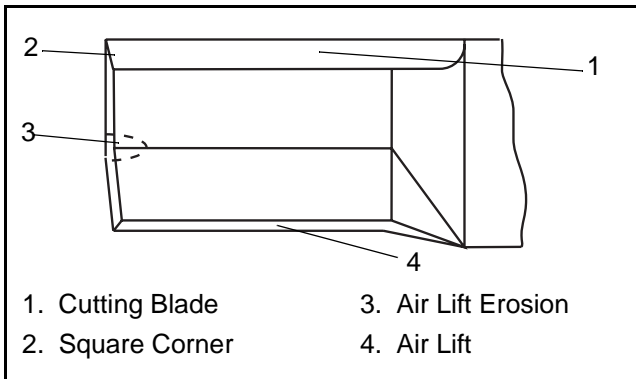


Figure 12

- | | |
|------------------|---------------------|
| 1. Cutting Blade | 3. Air Lift Erosion |
| 2. Square Corner | 4. Air Lift |

Sharpening Mower Blade



CAUTION: Use sturdy gloves or padding to protect hands when working with mower blades.

1. Turn the engine off. Remove the ignition key.
2. Remove the bolts, lock washer, the flat washers, and blades from the spindle shafts.

3. Sharpen the beveled edges of the blades in a straight line. Do not change the angle of the beveled edge. If more than 0.5 inches (12.7 mm) are removed from the width of a blade, discard the blade. Make sure the sharpened blades are balanced. Balance must be held within 1.3 inch ounces.
4. Put the blades, the flat washers, lock washers, and the bolts back on the spindle shafts.
5. Tighten the bolts to a torque of 70 ft. lbs (95 Nm). Put the ignition wires back on the spark plugs.

STEERING CONTROL NEUTRAL ADJUSTMENT

If the unit has excessive creep when the control levers are in neutral, adjust as follows: (Figure 13)

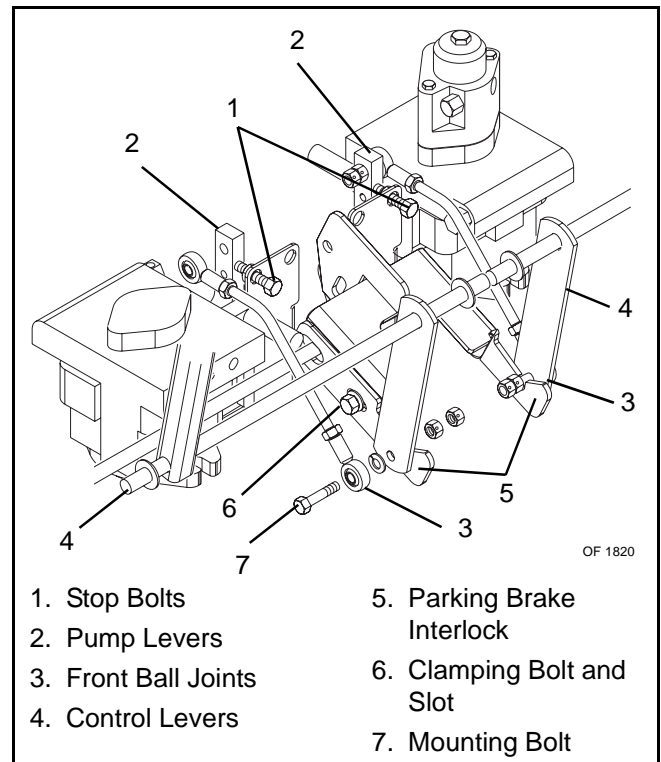


Figure 13

- | | |
|----------------------|----------------------------|
| 1. Stop Bolts | 5. Parking Brake Interlock |
| 2. Pump Levers | 6. Clamping Bolt and Slot |
| 3. Front Ball Joints | 7. Mounting Bolt |
| 4. Control Levers | |



WARNING: This adjustment requires operation of the engine and opening of hood. Use extreme care to avoid contact with moving parts and hot surfaces. Be sure rear of unit is well supported and secure before starting engine.

1. If hydraulic system is cold, run unit for a minimum of five minutes, then shut off unit.
2. Make sure both control levers are in neutral. Raise hood.
3. With the unit up to and facing a wall, jack the unit up so that both drive wheels are off the ground.

4. Have someone depress center of seat to activate seat switch.
 5. Start the engine and run at about half throttle or faster. Release parking brake.
 6. Move the control levers from Forward to Reverse several times to make sure controls are free and check neutral adjustment. If binding is found, correct it.
 7. Minor adjustments may be made by simply adjusting the stop screw which contacts the lever on the pump. The screw may be turned in or out to bring the unit into neutral.
 8. If major adjustment is needed, it is best to remove the front ball joint from the bottom of the control levers and turn the stop screw in or out until neutral is found.
 9. Then, with the adjustable arms of the parking brake interlock positioned so the clamping bolt is in the middle of the slot, adjust the ball joint on or off the control link rod so that their mounting bolts fit into the slot at the end of the adjustable interlock.
 10. Reinstall the front ball joint(s)
- NOTE:** When properly adjusted, the parking brake interlock will move upward when the parking brake is set and hold the steering control levers in neutral. The parking brake starting interlock switch will not be depressed unless the steering control levers are in neutral. The interlock holds the levers in neutral until the parking brake is released.
11. Move the control levers, from forward to reverse several times to make sure it is adjusted to neutral. Readjust if necessary.
 12. Stop the engine.

ADJUSTING CONTROL LEVERS

To be done after neutral has been set. (Figure 13).

1. If desired the steering control levers can be set to match (be in line) when in neutral.
2. Remove front ball joint from bottom of steering control lever on side which is going to be adjusted. Screw ball joint on or off link rod to hydrostat so that control levers align. Replace rod end on lower part of steering control lever.
3. If needed, adjust parking brake interlock so that interlock is able to move up when both steering control levers are in neutral. To do this, loosen the clamping bolt on the adjustable member of the interlock and slide it in either direction until the interlock moves up and latches the ball joint mounting bolts.
4. Tighten the clamping bolt.

ADJUSTING THE PARKING BRAKE

1. The parking brake may be adjusted through the use of the jam nuts on the brake rod which push against the compression spring which pushes on the caliper arm. See Figure 14.
2. Turn the nuts further on the rod (clockwise) to tighten the brake and further off the rod (counterclockwise) to loosen the brake.
3. Ensure when the brake is applied, the caliper arms do not contact the return nuts on the rods in front of the caliper arms. If they do, back them off slightly.
4. When installing new pads in the calipers, they must be burnished by driving for a short distance (about 200 feet) with the brake. To do this, bring the parking brake lever part way up, while driving normally (in a straight line). This quickly breaks-in the pads for maximum effectiveness.

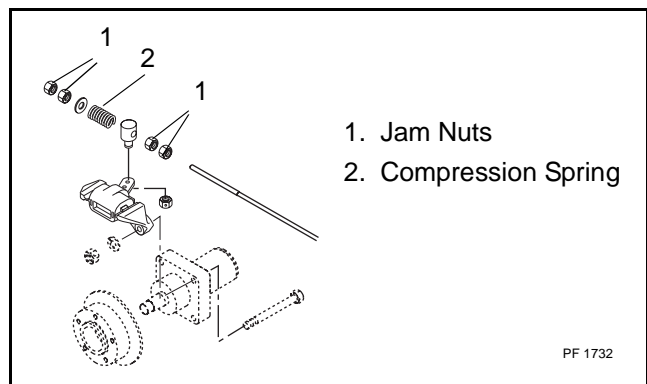


Figure 14

ADJUSTING UNIT TO TRACK STRAIGHT

Check and adjust tire pressure. Increase pressure on side unit tracks to. **DO NOT** exceed maximum recommended tire pressure (refer to Specifications).

If tire pressure adjustment does not solve tracking problem, the limiter bolts at base of handles can be adjusted. See Figure 15. Front bolts are for forward and rear bolts are for reverse. Lengthen bolts (move closer to lever) on side which is too fast.

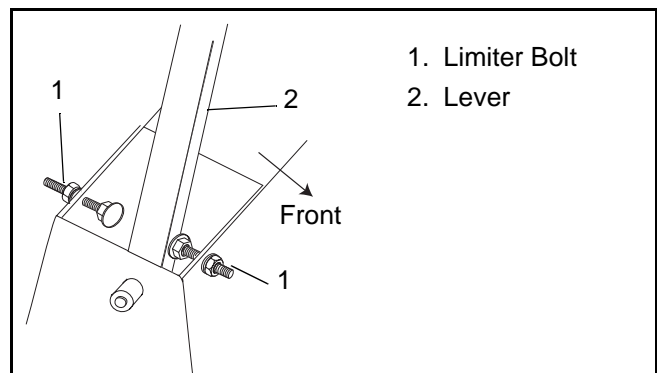


Figure 15

LEVELING THE MOWER DECK

These adjustments should be made on a level surface with the tires inflated to the correct air pressure.

The mower is leveled from side to side with the slots where 4 chains fasten to the mower mounting brackets. The mower is leveled from front to rear by adjusting the rod running down each side of the frame (Figure 16).

1. Raise mower deck and insert 3" (7.6 cm) tall blocks to support deck.
2. Lower deck onto blocks so chains are slack.
3. Measure from bottom of mower blade end to ground.
4. Shut off engine. Engage parking brake. Remove the ignition key.
5. Set hydraulic lift cylinder so cut of height reads the same as blade height measurement.
6. Loosen the locknuts on the side where the chains are slack and slide the bolt down the slot until the chain is tight.
7. Tighten bolt and nuts in mower mounting brackets.
8. Lift mower and remove blocks.
9. Measure height of deck at each side. Measurements must be within 1/16" (1.5 mm) of each other.
10. If measurements are out of range, fix by adjusting chains on low side of deck.
11. Once deck is level side to side, measure height of deck at middle of front and on both sides of rear. Front of deck should be 1/8" (3 mm) lower than rear.
12. To adjust, loosen rear hex nut of the front mower lift pivot on each rod.
13. Turn the front hex nut on each rod until mower is 1/8" (3 mm) lower in front.

NOTE: If mower cannot be leveled, it may be necessary to loosen the rear nut of the rear mower lift pivot to get more threads at the front of rod for adjustment. After loosening rear nut and adjusting level, tighten front nut on rear mower lift pivot.

14. Tighten rear hex nut on each rod that was loosened in step 11.

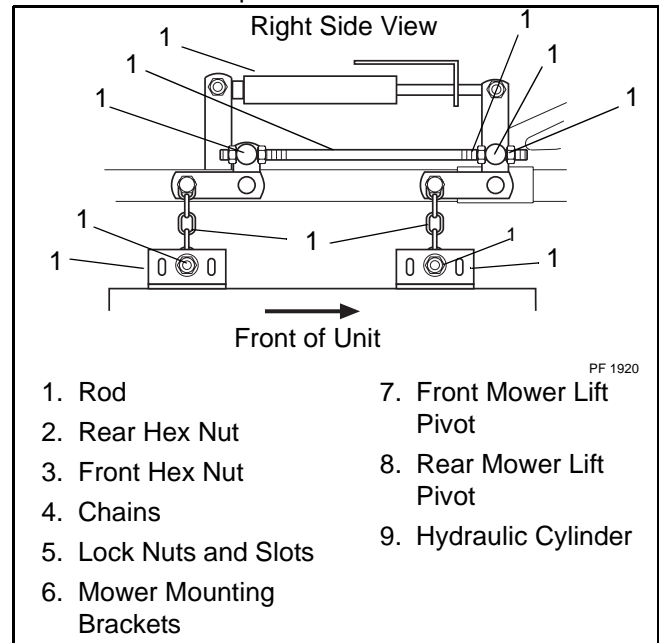


Figure 16

ENGINE

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, 39, 31, 32, 33	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		

REMOVING THE ENGINE

1. Place the mower in the full service position.
2. Disconnect the battery cables, negative first.
3. Disconnect ignition wires using the connectors.
4. Remove the belts from the pulley and clutch.
5. Unscrew the bolt from the center of the output shaft and remove clutch. Refer to "Replacing the Clutch".
6. Remove the square key and the pulley.
7. Unclamp and remove the fuel line. Plug the fuel line and wipe up any spills.
8. Remove the engine mounting bolts and lift engine out the top.

INSTALLING THE ENGINE

1. Position the new engine in the chassis, insert mounting bolts and tighten.
2. Install pulley and then the clutch on the output shaft.

NOTE: Check condition of square key and replace if needed.

3. Place belts on pulley and clutch. Check for proper routing of belts.
4. Connect fuel line and ignition wires.
5. Connect battery, positive first.
6. Check oil level and add as needed.

ELECTRIC CLUTCH

The motor output shaft has two pulley mechanisms. The top pulley is direct drive and powers the hydraulic system. The lower pulley is engaged by an electric clutch and supplies power to the mower blades. See Figure 17.

The clutch has no repairable parts.

If the clutch does not operate, before replacing clutch:

1. Check the deck for debris that may be blocking blades.
2. Check PTO switch and wire harness for proper operation.

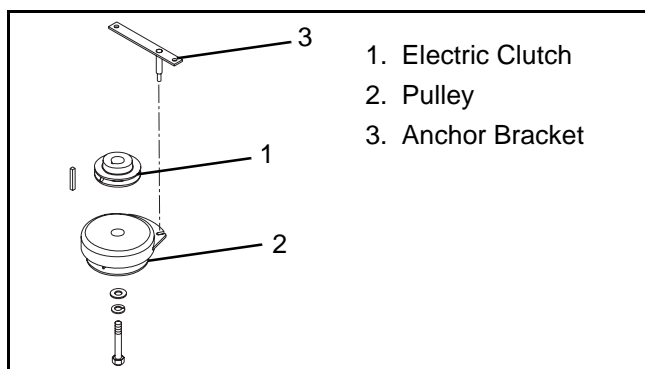


Figure 17

To Replace the Clutch

1. Remove the belt by relaxing the idler pulley.
2. Remove the center bolt.



CAUTION: DO NOT ALLOW the engine crankshaft to rotate. Damage to the engine may occur.

3. Disconnect electrical wires.
4. Remove nut from the anchor bracket.
5. Pull clutch from shaft.
6. Position new clutch on the shaft by aligning the square key on the shaft with the keyway of the clutch.
7. Clutch should be rotated to position the anchor bracket with the slot in the stationary shell. Replace nut and tighten.
8. Replace bolt and washers. Torque to 55 foot pounds (74.5 Nm).

DRIVE TRAIN



WARNING: Hydraulic Fluid can result in severe burns. Fluid in hydraulic system can penetrate skin and result in serious injury or death.

Be sure to stop the engine before doing any work on hydraulic parts.

Keep body and hands away from pin holes or nozzles which expel hydraulic fluid when under pressure. Use paper or cardboard, not hands, to search for leaks.

Insure all hydraulic fluid connections are tight and all hydraulic hoses and lines are in good condition before applying pressure to system.



WARNING: FOREIGN FLUID INJECTED INTO BODY can result in gangrene. Fluid must be surgically removed within a few hours by a doctor familiar with this form of injury.

CHECKING THE HYDRAULIC FLUID LEVEL

A check of the hydraulic fluid level should be made daily.

NOTE: The oil level should be centered between the two marks on the dipstick.

To Check:

First, remove any dirt that may be around the cap on the tank. Remove the dipstick and check the oil level. If required, add Mobil 15W50 synthetic oil through the dipstick tube. Do not overfill.

CHANGING HYDRAULIC FLUID AND FILTER

The hydraulic fluid and filter should be changed every 500 hours of operation. To drain the hydraulic oil reservoir, remove the filter and catch the hydraulic oil in a pan.

The filter for the hydraulic system is located under the chassis behind the left rear wheel. It is accessed from the rear of the unit.

To Replace the Filter

1. Unscrew the filter and dispose of properly. Allow tank to drain into container.
2. Place a film of oil on the new filter's gasket.
3. Screw the filter on until it makes contact with the sealing surface of the filter head.

4. Turn the filter by hand, an additional 1/2 to 3/4 turn.
5. Fill the hydraulic oil reservoir to the top mark on the dipstick. It will take about 5 quarts. Use Mobil 15W50 synthetic oil. Start the engine and run for 1 to 2 minutes.
6. After shutting off the engine, check the fluid level. The dipstick should read the fluid level between the high and low markings.
7. Properly dispose of waste oil.

HYDRAULIC DRIVE FLOW TEST

Use this procedure for trouble shooting the drive system if the unit becomes sluggish or loss of drive becomes apparent. This test is to be performed one side at a time.

1. Block and jack the unit up so that both drive wheels are off the ground.
2. Place hood into the full service position.
3. Verify that the bypass valves are closed and there is no binding in the steering control linkage. If binding occurs, you will need to correct that problem before proceeding to the next steps.
4. Make sure hydraulic fluid level is correct.
5. Clean hydraulic hoses at the wheel motor.
6. Disconnect the hydraulic hoses at the wheel motor, note the proper orientation of hoses.
7. Install a bi-directional flow gauge.
8. Have someone depress center of seat to activate seat switch.
9. Start the engine and run at about 3/4 throttle or faster. Release parking brake.
10. Stroke the appropriate control lever full stroke forward and hold.
11. Set the hydraulic system pressure to 200-400 PSI by using the restriction valve. Note the GPM (gallon per minute) flow on the meter. While keeping the pump in full stroke, increase the hydraulic system pressure to 1000-1200 PSI by using the restriction valve. Note the GPM flow on the meter. Do not keep hydraulic system under pressure for an extended period of time to prevent damaging the hydraulic system by inducing too much heat to the system.
12. Open the restriction valve and move the control lever back to neutral. Idle unit down for a few seconds and shut off engine.
13. The acceptable flow drop would be less than 1 GPM difference between the low and high pressure settings. If flow drop is greater than 1 GPM, the hydro-pump will need to be repaired or

replaced. If the flow drop is less than 1 GPM you will need to replace the wheel motor.

REPLACING THE HYDRAULIC PUMP

The two hydraulic pumps are located inside the chassis in front of the engine. The pumps are maintenance free and should be replaced in the event of a failure. See Figure 18.

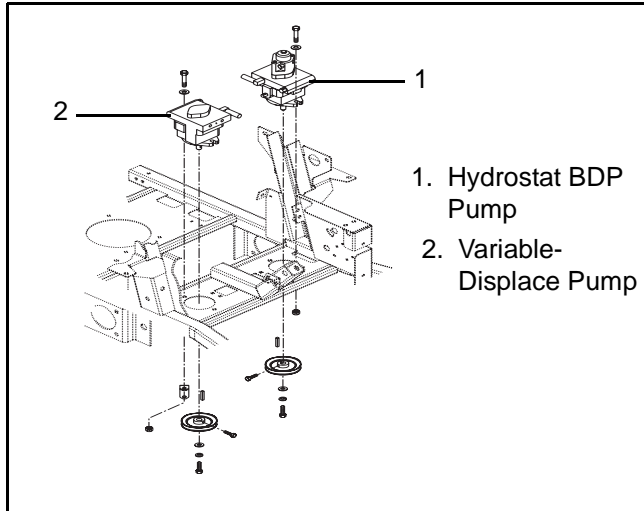


Figure 18

To Replace a Hydraulic Pump

1. Lift cover to full service position.
2. Remove the cross channel.
3. Clean hoses and fittings and mark for location.
4. Disconnect hoses from pump.



CAUTION: Some fluid will leak out. Clean up any spills.

5. Remove belt from pulley.
6. Remove bolt and washers from end of shaft.
7. Loosen pulley lock bolt and slide pulley from shaft. Remove and inspect square key. Replace key if damaged.
8. Remove back bolt on pump and loosen front bolt.
9. Remove pump.
10. Insert the new pump into position with the front bolt in the mounting flange slot.
11. Insert rear bolt and tighten both bolts.
12. Attach hydraulic hoses to correct ports and tighten.
13. Position square key in shaft keyway and slide pulley into position.
14. Screw the bolt, washer and lock washer into the end of the shaft. Tighten securely.
15. Tighten pulley lock bolt.
16. Place belt on pulley.
17. Replace cross channel.

18. Lower the cover and start the engine. Run the engine for 1 - 2 minutes. After shutting off the engine, check the hydraulic fluid level. The dipstick should read between the high and low markings.

REPLACE WHEEL MOTOR

Each drive wheel is mounted to a hydraulic drive motor. The drive motors are maintenance free. In the event of a failure, the drive motors should be replaced.

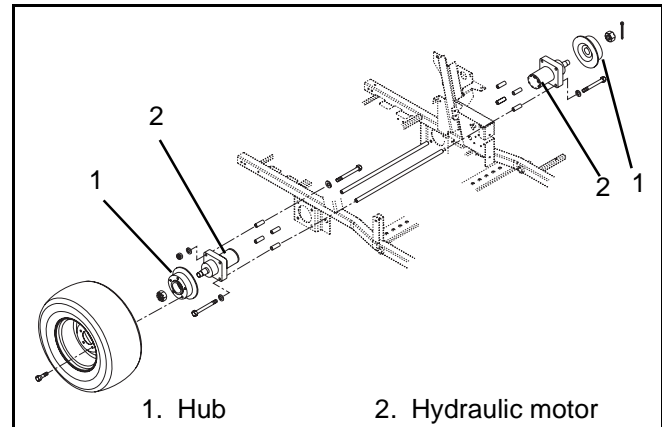


Figure 19

To Replace a Drive Motor

1. Loosen the wheel lugs 1/4 turn. (Figure 19)
2. Jack the drive wheels off the ground and securely support the unit.
3. Remove the wheel.
4. Remove the brake caliper assembly by removing the two bolts.
5. Unscrew the axle bolt at the center of the hub and remove the hub. The hub is a taper fit on the axle. Use a wheel puller to assist in removal.
6. Mark the hydraulic lines and remove.



CAUTION: Some fluid will leak out. Clean up any spills.

7. Unscrew the two bottom bolts and pull the hydraulic motor out.
8. Remove the four bolt sleeves.
9. Insert the sleeves into the four bolt holes in the new hydraulic motor.
10. Slide the motor into place and secure with two bottom bolts. Apply Loctite to bolts.
11. Reattach hydraulic lines to proper ports and tighten.
12. Clean the axle and the inside of the hub. Place hub over axle and lightly tap into position. Screw the axle nut onto the axle and tighten to 300-400 ft. lbs. (406-542 Nm)

13. Place the brake caliper into position and insert bolts from the inside of the frame outward. Use lock washer and nut and tighten.
14. Position wheel on hub and insert lug nuts finger tight.
15. Tighten lug nuts using the pattern shown in Figure 20.
16. Lower the unit to the ground and start the engine. Drive forward twenty feet and stop the engine. Check the hydraulic fluid level. The dipstick should read between the high and low markings.

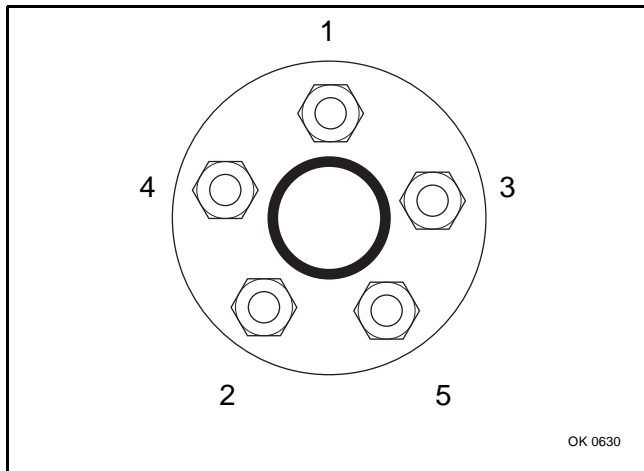


Figure 20

HYDRAULIC DECK LIFT PRESSURE TEST

Use this test for trouble shooting the hydraulic lift system if the lift becomes sluggish or loss of lift occurs.

1. Place unit into the service position.
2. Clean and disconnect the hydraulic hose at the lower side of hydraulic lift valve (Figure 21) and install a 1500 psi minimum hydraulic pressure gauge using a tee fitting.
3. Have someone depress center of seat to activate seat switch.
4. Start the engine and run at about 3/4 throttle or faster.
5. Move the deck lift lever to the raise position and hold. Relief pressure should be 650 psi minimum from the Hydro-Gear auxiliary pump.
6. If the mower deck height creeps down during operation, the hydraulic valve, cylinder or hydraulic hose is faulty. You will need to check the condition of the hoses and verify that there are no hydraulic leaks and the fittings are tight.
7. Remove the valve.

REPLACE LIFT VALVE

The lift valve is located inside the chassis on the left side. See Figure 21.

1. Place hood in full service position.

2. Clean hose fittings, mark hoses for position and disconnect from valve.



CAUTION: Some hydraulic fluid will leak out of the hoses. Clean up any spills.

3. Loosen mounting bolts and remove valve.
4. Mount new valve and tighten bolts.
5. Connect hoses to proper ports.
6. The hydraulic system is self-bleeding. Check hydraulic fluid level after running the engine. The dipstick should read between the high and low markings.

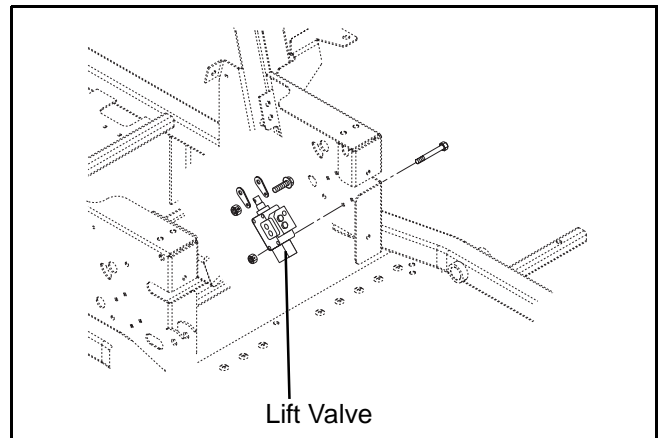
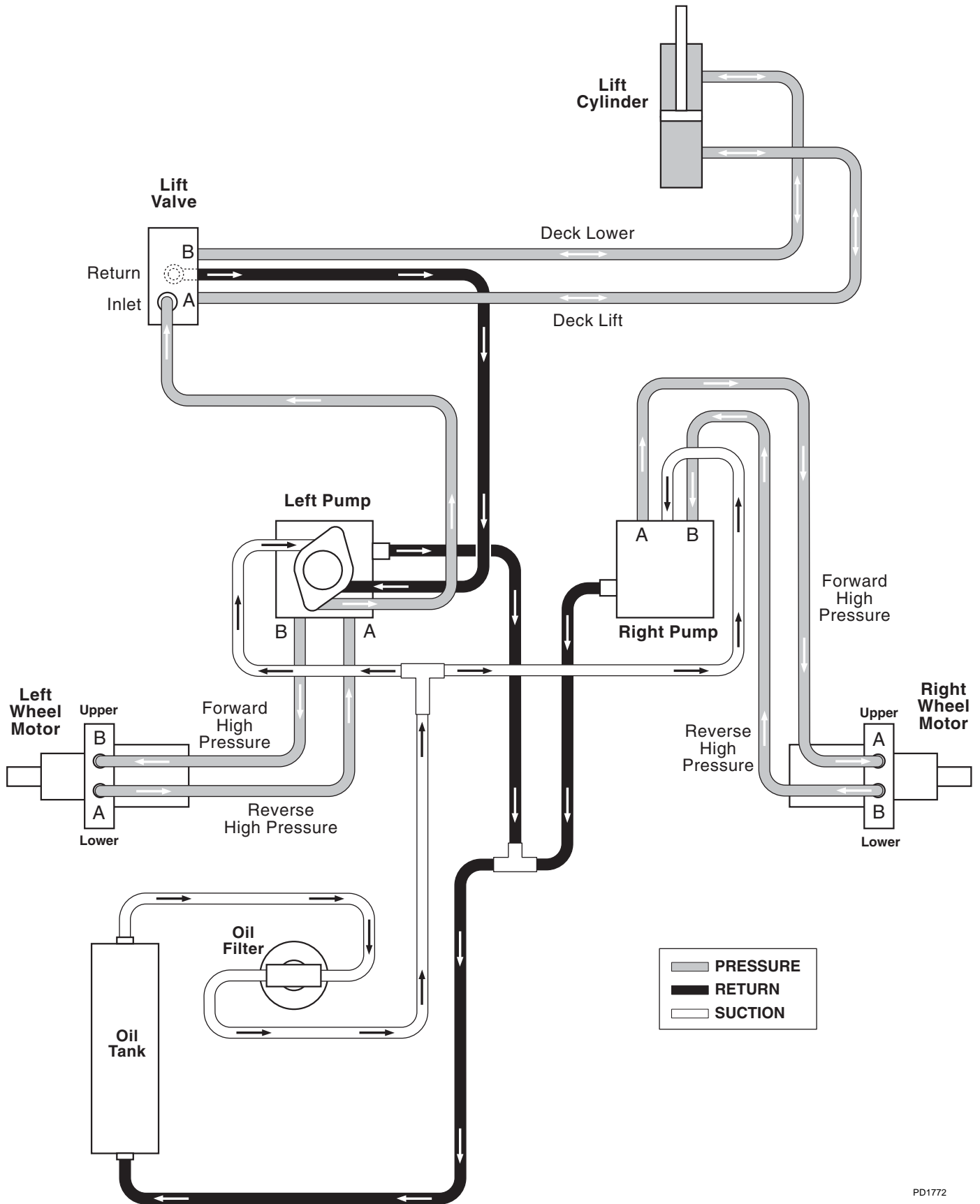


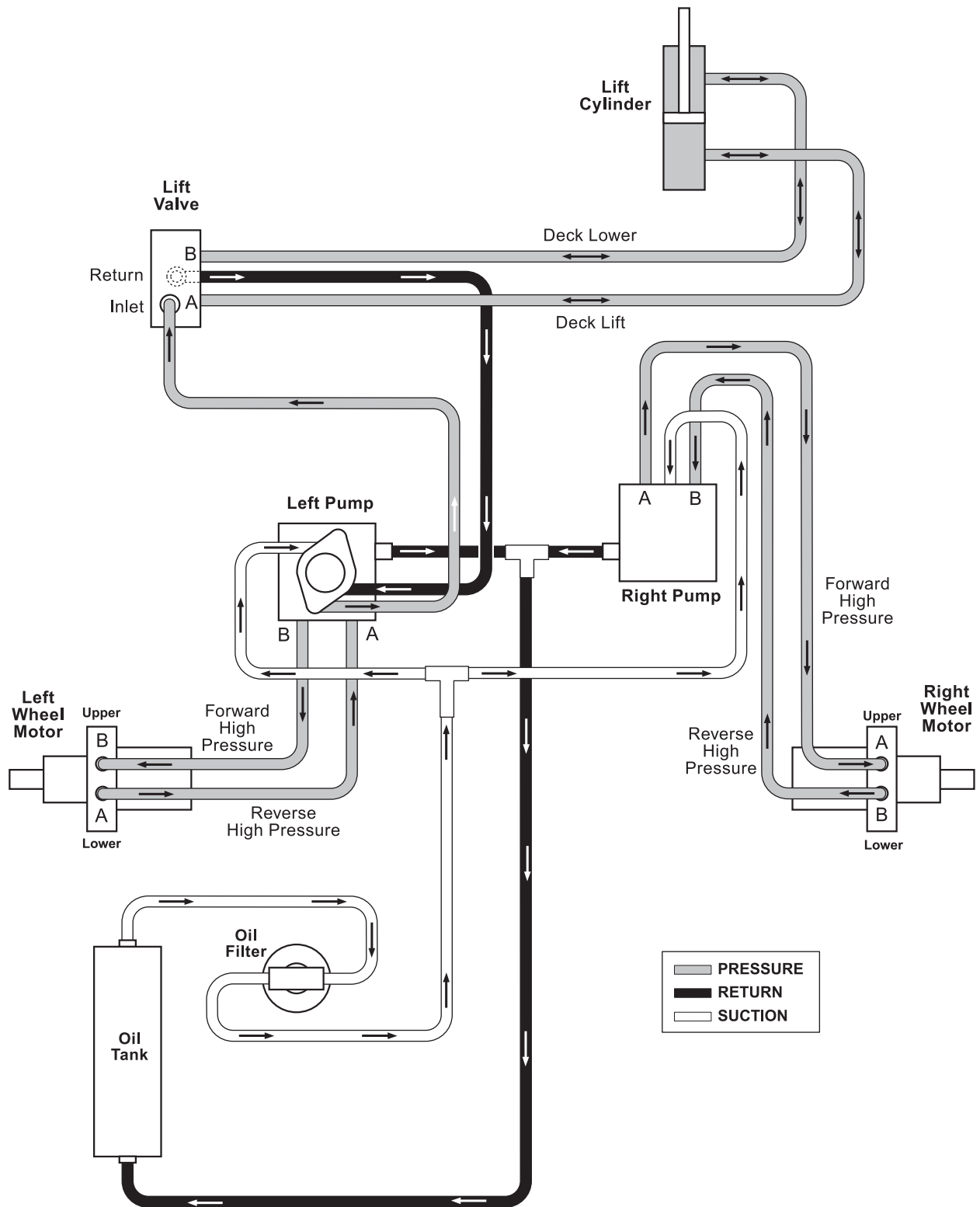
Figure 21

HYDRAULIC DIAGRAM

992018, 023, 027



PD1772



MOWER DECK

Mower Spindles

This unit utilizes a maintenance free extended life spindle. No routine maintenance is required. In the event of bearing failure or a bent shaft the spindle should be replaced.

To Remove the Spindle

1. Place the unit in service position. Turn key off and remove the spark plug wire from contact with spark plug.
2. Remove cutting blade by unscrewing bolt.



CAUTION: Use sturdy gloves or padding to protect hands when working with mower blades

3. Remove belt from pulley.
4. Remove pulley by unscrewing bolt. Lift pulley off the shaft and check placement and condition of key.
5. Unbolt spindle from deck.

To Install Spindle

1. Bolt new spindle to mower deck.
2. Place square key in position and slide pulley down the shaft. Tighten bolt and washer.
3. Replace belts.
4. Install blade using flat washer, lock washer and bolt. Torque to 70 ft. lbs. (95 Nm)

ANTI-SCALP ROLLERS

All of the anti-scalp rollers are maintenance free. If any roller, shaft, or weldment shows excessive wear it should be replaced.

The caster-type rollers are replaced by removing the top pin and dropping the weldment with roller out the bottom. Note the position of spacers and bushings for installation.

The rollers are replaced by removing the shaft. Note the position of spacers for installation.

FRONT SUSPENSION

The front suspension consists of a weldment that is a square tube (Figure 22). A pivot pin holds the axle to the chassis. Two caster wheels are attached. The front axle is maintenance free except for one grease fitting at the chassis for the pivot pin. This fitting is greased as needed with Sten Mix Hi-Temp grease or equivalent.

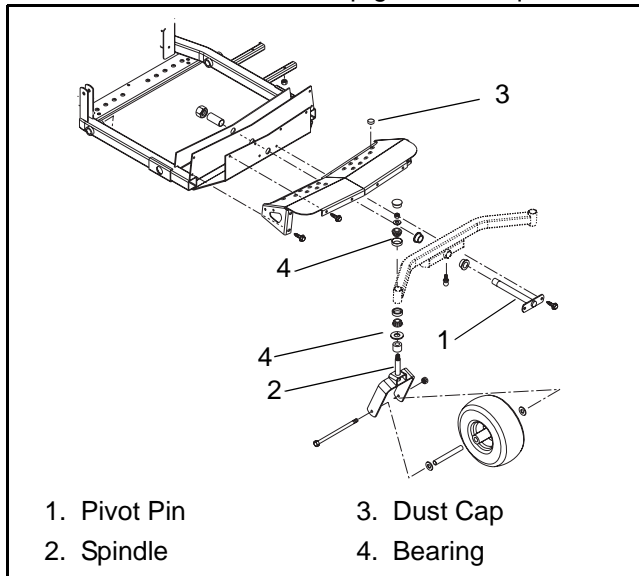


Figure 22

To Replace the Caster Wheel

1. Support the axle to keep the wheel off the ground.
2. Remove dust cap and spindle nut at top of spindle.
3. Lift axle to allow caster spindle to drop out of sleeve, check washers, bearings, and spacers for position.
4. Place washers bearings, and spacers onto the new caster spindle.
5. Insert spindle into the axle sleeve.
6. Place washer and nut onto the spindle and tighten. Fork should pivot freely with no end play.
7. Replace dust cap.

ELECTRICAL

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 tightly 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.

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 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.

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 terminals 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.

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



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



WARNING: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

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.

Inspection, Cleaning, Drying, and Maintenance

Inspect the top of the 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.

Reinstall battery.

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

Battery Charger

Under normal conditions, the engine alternator will have no problem keeping 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.

Charging a New Battery



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.

IMPORTANT: DO NOT fast charge. Charging at a higher rate will damage or destroy battery.

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

1. Put unit into service position to gain access to battery.
2. Disconnect Negative (-) cable first, then Positive (+) cable.
3. Remove hold down and remove battery.
4. Place battery on bench or other well-ventilated place where electrolyte spill will not create damage.
5. Connect Positive (+) lead of charger to Positive (+) terminal. Connect Negative (-) lead to Negative (-) terminal.
6. Charge battery at two and half amps for ten hours or until all cells are gassing freely.
7. Reinstall battery into unit and connect Positive (+) cable first, then Negative (-) cable.

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.

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 Ariens 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.

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 defeat 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.

DIODES AND RECTIFIERS

Diodes are solid state, semiconductor devices. They contain no moving parts and conduct current better in one direction than the other. They are electrical "check valves" and permit current flow in one direction, but not in 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). They fit on a holder only one way.

Rectifiers

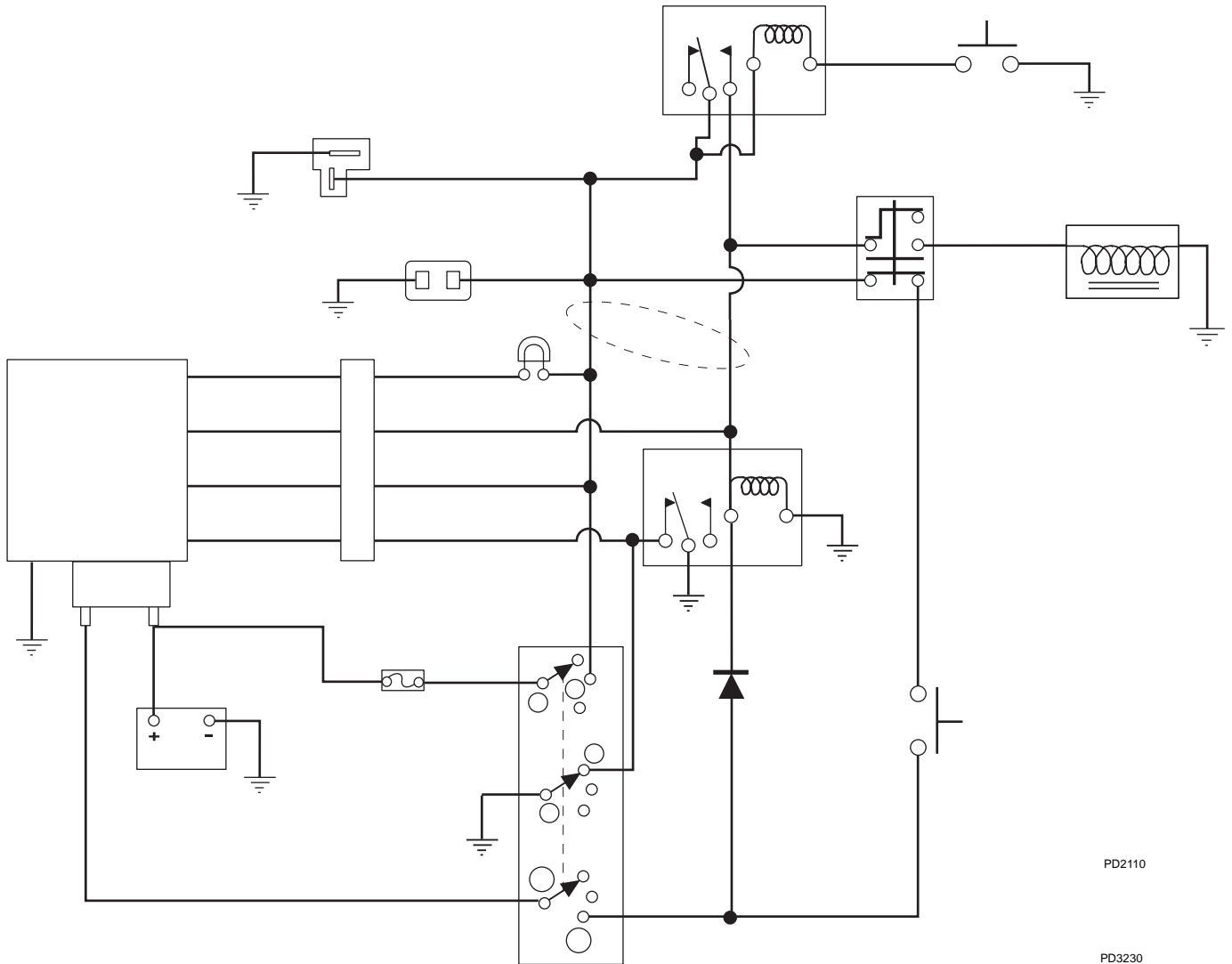
A battery is charged through the use of an alternator located in or on the engine. A charging circuit contains a rectifier because alternators produce alternating current (AC) and batteries require direct current (DC) for charging.

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.

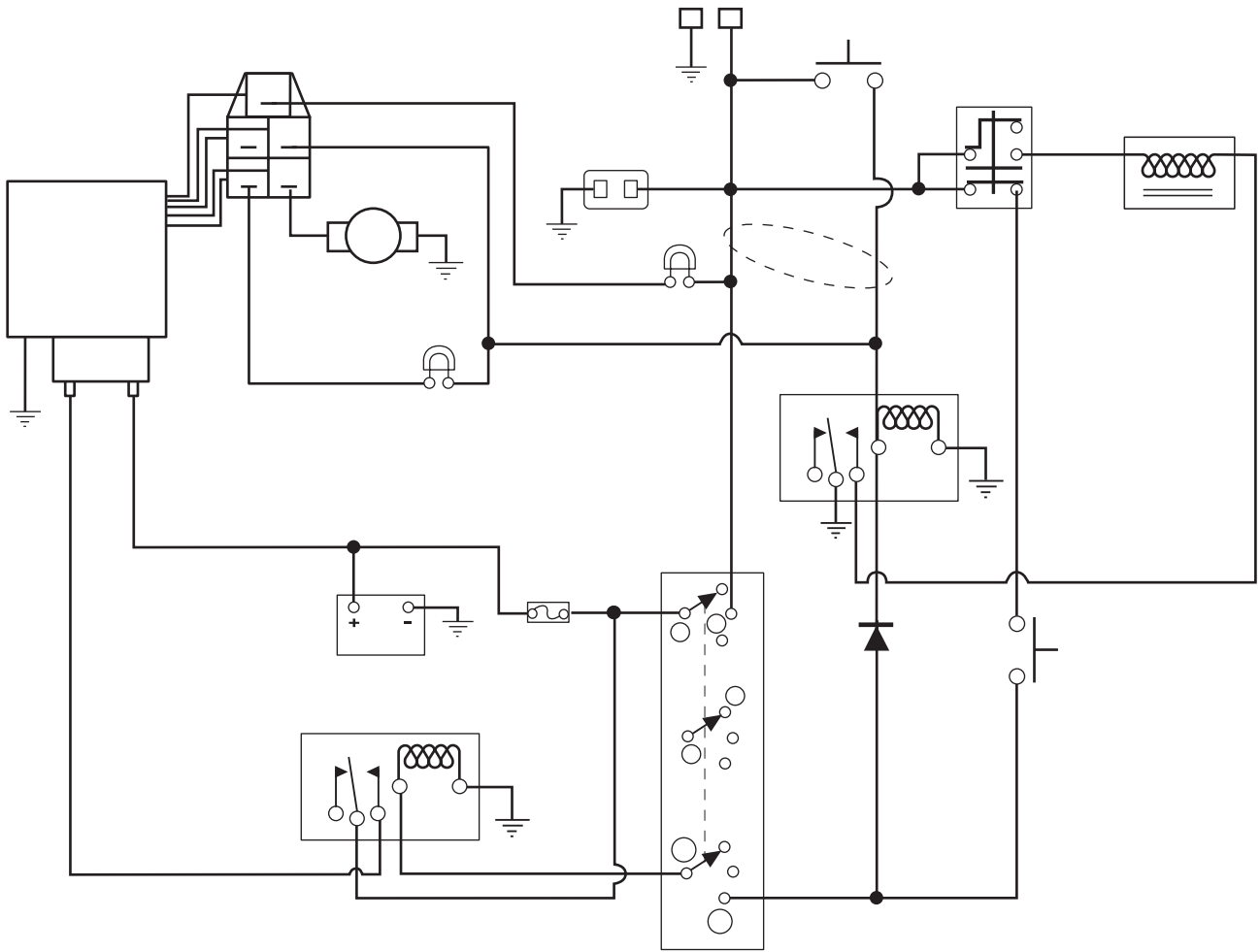
WIRING DIAGRAMS

Models 992018, 020, 027



PD2110

PD3230



TROUBLESHOOTING

TROUBLESHOOTING		
PROBLEM	PROBABLE CAUSE	CORRECTION
Engine does not crank.	<ol style="list-style-type: none"> 1. PTO engaged. 2. Parking brake disengaged. 3. Loose or corroded battery cables. 4. Discharged battery. 5. Faulty starter. 	<ol style="list-style-type: none"> 1. Disengage PTO. 2. Engage parking brake. 3. Clean and tighten battery cables (see Servicing the Battery on page 18). 4. Charge battery (see Charging the Battery on page 19). 5. See your Gravely Dealer.
Engine cranks but does not start.	<ol style="list-style-type: none"> 1. Fuel tank empty. 2. Faulty spark plug. 3. Air cleaner is plugged or dirty. 4. Fuel filter is dirty. 5. Faulty engine. 	<ol style="list-style-type: none"> 1. Fill fuel tank (see Filling Fuel Tank on page 18). 2. Replace spark plug. Refer to Engine Manual. 3. Clean or replace air cleaner. Refer to Engine Manual. 4. Clean or replace fuel filter. Refer to Engine Manual 5. Refer to Engine Manual or see your Gravely Dealer.
Battery light does not light up when starting engine.	<ol style="list-style-type: none"> 1. Discharged battery. 	<ol style="list-style-type: none"> 1. Charge battery (see Charging the Battery on page 19).
Oil pressure light is on.	<ol style="list-style-type: none"> 1. Oil pressure is low. 	<ol style="list-style-type: none"> 1. Refer to Engine Manual.
Fuel/Water separator light is on.	<ol style="list-style-type: none"> 1. Fuel/water separator filter dirty or damaged. 	<ol style="list-style-type: none"> 1. Clean or replace fuel/water separator filter. Refer to Engine Manual
Engine is overheating	<ol style="list-style-type: none"> 1. Engine oil level is low. 2. Cooling fins/screen on engine plugged with debris. 	<ol style="list-style-type: none"> 1. Add engine oil. Refer to Engine Manual. 2. Clean engine and surrounding area.
Engine continues to run when ignition key is in the off position.	<ol style="list-style-type: none"> 1. Ignition ground wire disconnected. 2. Ignition switch failure. 	<ol style="list-style-type: none"> 1. Connect ground wire to clean metal surface. 2. Replace ignition switch (see your Gravely Dealer).
PTO or mower blades do not engage or shuts off.	<ol style="list-style-type: none"> 1. Operator presence switch not depressed. 2. Eye-Q alarm setting is turned on. 3. The Eye-Q circuitry senses an overload to the PTO clutch and is shutting off the PTO switch. 4. Faulty PTO switch. 	<ol style="list-style-type: none"> 1. Depress operator presence switch by sitting on seat. 2. Turn off the alarm that deactivates the PTO on a regular schedule. See the Owner's Manual. 3. Check the mower deck for clogging or debris. Check the electrical system to the clutch for damage or wear. 4. See your Gravely Dealer.

TROUBLESHOOTING		
PROBLEM	PROBABLE CAUSE	CORRECTION
Unit does not drive.	<ol style="list-style-type: none"> 1. Parking brake engaged. 2. Transmission bypass levers open. 3. Hydraulic oil level low. 4. Faulty hydraulic drive system. 	<ol style="list-style-type: none"> 1. Disengage parking brake. 2. Close transmission bypass levers (see Moving Unit Manually on page 16). 3. Add hydraulic oil (see Checking Hydraulic Oil Level on page 26). 4. See your Gravely dealer.



GRAVELY
A Division of Ariens Company
655 West Ryan Street
P.O. Box 157
Brillion, WI 54110-0157
920-756-2141
Fax 920-756-2407
www.gravelly.com

 **WARNING** 

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.