LCE Products

Z Master Z400 Series

Service Manual

ABOUT THIS MANUAL

This service manual was written expressly for Toro service technicians. The Toro Company has made every effort to make the information in this manual complete and correct.

Basic shop safety knowledge and mechanical/electrical skills are assumed. The Table of Contents lists the systems and the related topics covered in this manual.

The following service materials are available in addition to this service manual:

Hydrostatic Pumps:	Hydro-Gear BDP-10A/16A/21L - Service and Repair Manual Form #492-4789
Wheel Motors:	Parker/Ross Wheel Motor Service Manual Form #492-4753
Diesel Engine:	Briggs & Stratton Daihatsu 3 Cylinder Liquid-Cooled Engine Repair Manual Form #492-0670
Hydraulic Troubleshooting:	Interactive hydraulic troubleshooting and failure analysis on compact disk Form #492-4777
Electrical Troubleshooting:	Interactive electrical troubleshooting and wiring diagrams on compact disk Form # 492-9143

The Z Master 597 model years 2004 and 2005 are covered in this manual. The manual may also be specified for use on later model products.

The hydrostatic drive system is precision machinery. Maintain strict cleanliness control during all stages of service and repair. Cover or cap all hose ends and fittings whenever they are exposed. Even a small amount of dirt or other contamination can severely damage the system.

We are hopeful that you will find this manual a valuable addition to your service shop. If you have any questions or comments regarding this manual, please contact us at the following address:

The Toro Company
LCE Service Training Department
8111 Lyndale Avenue South
Bloomington, MN 55420

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

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SAFETY INFORMATION

General Information

This symbol means WARNING or PERSONAL SAFETY INSTRUCTION - read the instruction because it has to do with your safety. Failure to comply with the instruction may result in personal injury or even death.

This manual is intended as a service and repair manual only. The safety instructions provided herein are for troubleshooting, service, and repair of the Z Master Z400 Series Zero-turn Riding Mower.

The riding mower and attachment operator's manual contain safety information and operating tips for safe operating practices. Operator's manuals are available through the Internet, your Toro parts source, or:

The Toro Company
Publications Department
8111 Lyndale Avenue South
Bloomington, MN 55420

Think Safety First

Avoid unexpected starting of engine...

Always turn off the engine and disconnect the spark plug wire(s) before cleaning, adjusting, or repair.

Avoid lacerations and amputations...

Stay clear of all moving parts whenever the engine is running. Treat all normally moving parts as if they were moving whenever the engine is running or has the potential to start.

Avoid burns...

Do not touch the engine, muffler, or other components which may increase in temperature during operation, while the unit is running or shortly after it has been running.

Avoid fires and explosions...

Avoid spilling fuel and never smoke while working with any type of fuel or lubricant. Wipe up any spilled fuel or oil immediately. Never remove the fuel cap or add fuel when the engine is running. Always use approved, labeled containers for storing or transporting fuel and lubricants.

Avoid asphyxiation...

Never operate an engine in a confined area without proper ventilation.

Avoid injury from batteries...

Battery acid is poisonous and can cause burns. Avoid contact with skin, eyes, and clothing. Battery gases can explode. Keep cigarettes, sparks, and flames away from the battery.

Avoid injury due to inferior parts...

Use only original equipment parts to ensure that important safety criteria are met.

Avoid injury to bystanders...

Always clear the area of bystanders before starting or testing powered equipment.

Avoid injury due to projectiles...

Always clear the area of sticks, rocks, or any other debris that could be picked up and thrown by the powered equipment.

Avoid modifications...

Never alter or modify any part unless it is a factory approved procedure.

Avoid unsafe operation...

Always test the safety interlock system after making adjustments or repairs on the machine. Refer to the Electrical section in this manual for more information.

SPECIFICATIONS

Z 400 Estate Series

19 hp Kawasaki OHV V-Twin

Fig 001 DSC-4765a

Fig 003 DSC-4767a

Fig 002 DSC-4766a

Fig 004 DSC-4768a

Z 400 Estate Series

18 hp Kohler

Fig 005 DSC-4842a

Fig 007 DSC-4844a

Fig 006 DSC-4843a

Fig 008 DSC-4846a

SPECIFICATIONS

Z 450 Pro Performance Series

20 hp Kohler OHV V-Twin

Fig 009 DSC-4833a

Fig 011 DSC-4835a

Fig 010 DSC-4834a

Fig 012 DSC-4838a

Z 100 Series

19 hp Kawasaki KAI OHV V-Twin

Fig 013 DSC-0437a

Fig 015 DSC-0440a

Fig 014 DSC-0436a

Fig 016 DSC-0435a

SPECIFICATIONS

Z 450 Pro Performance Series

23 hp Kawasaki OHV V-Twin

Fig 017 DSC-0444a

Fig 019 DSC-0442a

Fig 018 DSC-0445a

Fig 020 DSC-0448a

Z 440 Pro Value Series

19 hp Kawasaki KAI OHV V-Twin

Fig 021 DSC-0452a

Fig 023 DSC-0455a

Fig 022 DSC-0451a

Fig 024 DSC-0450a

SPECIFICATIONS

Engines

Output	Make	High Idle	Low Idle	Charging Coil
19 HP (14.2kW)	Kawasaki OHV V-Twin Forced Air Cooled	3650 ± 100 RPM	1500 RPM	13 AMP
18 HP (13.4kW)	Kohler OHV Single Forced Air Cooled	3650 ± 100 RPM	1500 RPM	13 AMP
19 HP (14.2kW)	Kawasaki OHV V-Twin Forced Air Cooled	3650 ± 100 RPM	1500 RPM	13 AMP
20 HP (14.9kW)	Kohler OHV V-Twin Forced Air Cooled	3650 ± 100 RPM	1500 RPM	13 AMP
23 HP (17.1kW)	Kawasaki OHV V-Twin Forced Air Cooled	3650 ± 100 RPM	1500 RPM	13 AMP
19 HP (14.2kW)	Kawasaki OHV V-Twin Forced Air Cooled	3650 ± 100 RPM	1500 RPM	13 AMP

Dimensions and Weight

		ROPS Height		Width		
Model	**Weight**	**Folded**	**Upright**	**Deck**	**Deflector**	**Length**
19 HP Kawasaki 52” 7-Gauge Deck	924 lbs (419.2kg)	51” (129.54cm)	69” (175.26cm)	53.7” (136.4cm)	68” (172.72cm)	78” (198cm)
18 HP Kohler 48” 7-Gauge Deck	889 lbs (407.78kg)	51” (129.54cm)	69” 175.26cm)	49.7” (126.24cm)	64” (162.56cm)	78” (198cm)
19 HP Kawasaki 44” SFS Deck	941 lbs (426.83kg)	52” (132.08cm)	70” (177.8cm)	47” (119.38cm)	61.3” (155.7cm)	78” (198cm)
19 HP Kawasaki 48” TF Deck	1010 lbs (458.13kg)	52” (132.08cm)	70” (177.8cm)	49.7” (126.24cm)	64” (162.56cm)	78” (198cm)
20 HP Kohler 52” TF Deck	1092 lbs (495-32kg)	52” (132.08cm)	70” (177.8cm)	53.7” (136.4cm)	68” (172.72cm)	78” (198cm)
19 HP Kawasaki 52” TF Deck	1092 lbs (495-32kg)	52” (132.08cm)	70” (177.8cm)	53.7” (136.4cm)	68” (172.72cm)	78” (198cm)
23 HP Kawasaki 52” TF Deck	1092 lbs (495-32kg)	52” (132.08cm)	70” (177.8cm)	53.7” (136.4cm)	68” (172.72cm)	78” (198cm)
23 HP Kawasaki 48” TF Deck	1067 lbs (483-98kg)	52” (132.08cm)	70” (177.8cm)	49.7” (126.24cm)	64” (162.56cm)	78” (198cm)
19 HP Kawasaki 44” SFS Deck (112cm)	941 lbs (426.83kg)	52” (132.08cm)	70” (177.8cm)	47” (119.38cm)	61.3” (155.7cm)	78” (198cm)
23 HP Kawasaki 52” TF Deck (132cm)	1092 lbs (495.32kg)	52” (132.08cm)	70” (177.8cm)	53.7” (136.4cm)	68” (172.72cm)	78” (198cm)

Z 400 Series Manual Specifications

Frame Assembly	Consists of front and rear frames bolted together
Front Frame	Welded 2 x 2 x .188” structural steel tube, 7 Gauge front cross member
Rear Frame	Welded tube and fabricated steel

Fuel System

Tanks	Dual fuel tanks containing large fill necks and vented caps. Rotational molded high density polyethylene. Mounted above drive wheels.
Capacity	10 gallons (37.8 l) [5 gallons per tank]
Check Valve	In-line check valves
Fuel Filter	15 micron, replaceable in-line filter

Traction System

	Models with 7-Gauge Deck	Models with SFS and TF Decks
Hydraulic Pumps	HydroGear 10cc BDP-10A with 2300psi shock valve	HydroGear 10cc BDP-10A with no shock valve
Pump Drive	Self-tensioning belt drive	
Wheel Motors	Parker TE Series (13.9cc)	HydroGear HGM-15E (15.4cc)
Ground Speeds	Infinitely variable: Forward: 0-7.2 mph (11.6 km/hr) Reverse: 0-4.2 mph (6.7 km/hr)	Infinitely variable: Forward: 0-8.3 mph (13.3 km/hr) Reverse: 0-5.5 mph (8.8 km/hr)
Release Valves	Contained in Pumps. Allow unit to be moved without engine running.	
Hydraulic Fluid	Mobil 1 Extended Performance 15W-50 Synthetic	
System Capacity	2.1 quarts (2.0 liters)	

SPECIFICATIONS

Deck Drive

	Models with 7-Gauge Deck	Models with SFS and TF Decks
Clutch	Warner Electromagnetic “Mag-Stop” with 120 ft-lbs. (162.7 Nm) rating	Warner Electromagnetic “Mag-Stop” with 175 ft-lbs. (237-3 Nm) rating
Type	Deep B-Groove pulley with belt from engine to deck	
Take-Up	Spring Idler system	

Tires

	Models with 7-Gauge Deck	Models with SFS and TF Decks
Rear Drive Tires	4-ply with “turf master” tread 20” x 10” – 10”	4-ply with “turf master” tread 23” x 9.5” – 12” [Except as noted]
Front Caster Tires	4-ply with smooth tread 11” x 4” – 5”	4-ply with smooth tread 13” x 5” – 6” [Except as noted]
Tire Pressure	13psi (90 KPA) 20# rear and 25# front if equipped with mechanical bagger	

Electrical System

Voltage	12 volt, negative ground
Battery Type	230 CCA
Fuses	Blade type. Located by LH Side Control

Cutting Decks

	48” (121.9cm) & 52” (132.1cm) 7-Gauge Deck	44” (111.8cm) SFS Deck	48” (121.9cm) TF Deck	52” (132.1cm) TF Deck	112cm (44”) SFS Deck	132cm (52”) TF Deck
Configuration	Side Discharge, mid-mounted rotary with three blades.					
Construction	7-Gauge, High Strength 50,000 psi (3515.3 Kg-f / 59cm) steel welded construction. 3/8” (9.5mm) steel discharge reinforcement plate	Drawn 12 gauge steel super flow system deck with welded mounting brackets and gage wheel brackets. 1/2” (12.7mm) diameter steel reinforcement rod on left side. 11 gauge steel front reinforcement plate doubles as bagger attachment point	7 Gauge, High Strength 50,000 psi (3515.3 Kg-f / 59cm) steel 5” (12.7cm) advanced Turbo Force flow system, welded construction. 3/8” (9.5mm) steel discharge reinforcement plate doubles as a bagger attachment point.		Drawn 12 gauge steel super flow system deck with welded mounting brackets and gage wheel brackets. 1/2” (12.7mm) diameter steel reinforcement rod on left side. 11 gauge steel front reinforcement plate doubles as bagger attachment point.	7 Gauge, High Strength 50,000 psi (3515.3 Kg-f / 59cm) steel 5” (12.7cm) advanced Turbo Force flow system, welded construction. 3/8” (9.5mm) steel discharge reinforcement plate doubles as a bagger attachment point.
Discharge	Rubber discharge chute, spring biased down toward operating position		Rubber discharge chute, spring biased down toward operating position. Adjustable flow control baffle.		Rubber discharge chute, spring biased down toward operating position	Rubber discharge chute, spring biased down toward operating position. Adjustable flow control baffle.
Blade Tip Speed	18,000+ ft/min (548.640cm/min) at high idle					
Height of Cut	Adjustable from the seat with range of 1.5” (38mm) – 4.5” (114mm) in .25” (6.4mm) increments.					

Cutting Decks cont.

	48” (121.9cm) & 52” (132.1cm) 7-Gauge Deck	44” (111.8cm) SFS Deck	48” (121.9cm) TF Deck	52” (132.1cm) TF Deck	112cm (44”) SFS Deck	132cm (52”) TF Deck
Deck Suspension	Deck suspended from machine by four lift chains, and attached to front cross member by flat strut arms and cross brace. The deck is pulled along the ground.	Deck suspended from machine by four lift chains, and attached to rear wheel supports by two struts. The deck is pulled along the ground.				
Belt Covers	Plastic HDPE deck covers. Attached with swell latches.	14-gauge, formed steel covers with access holes to allow greasing of outer spindles without removal. Attached with draw latches.	Plastic HDPE deck covers. Attached with swell latches.		14-gauge, formed steel covers with access holes to allow greasing of outer spindles without removal. Attached with draw latches.	Plastic HDPE deck covers. Attached with swell latches.
Gage Wheels	Three adjustable gage wheels to reduce scalping on the front of deck (one on the left-hand side and two in the center). Wheels have four adjustment positions.	Three adjustable gage wheels to reduce scalping: three on front of deck (one on left-hand side and two in center). Wheels have four adjustment positions. Rear gage wheels are optional.				

Lubrication Fittings

	48”/52” (132.1cm/121.9cm) 7-Gauge Decks	SFS and TF Decks
Front Caster Pivots	2 removable plugs (1 per side) for periodic lubrication	
Front Caster Wheels	n/a	2 fittings (1 per side)
Lift Assembly	5 fittings	
Brake Arms	2 fittings (1 per side)	
Rear Deck Struts	2 fittings (1 per side)	
Deck Spindles	3 fittings (1 per spindle)	
Pump Idler Pivot	1 fitting	

General Specifications

Greasing and Lubrication:

Grease:	No. 2 general purpose lithium base or molybdenum grease
Where to add grease:	See Service Aid and Belt Routing decals below (Fig. 025, 026, 027, 028).

Service Aid Decals

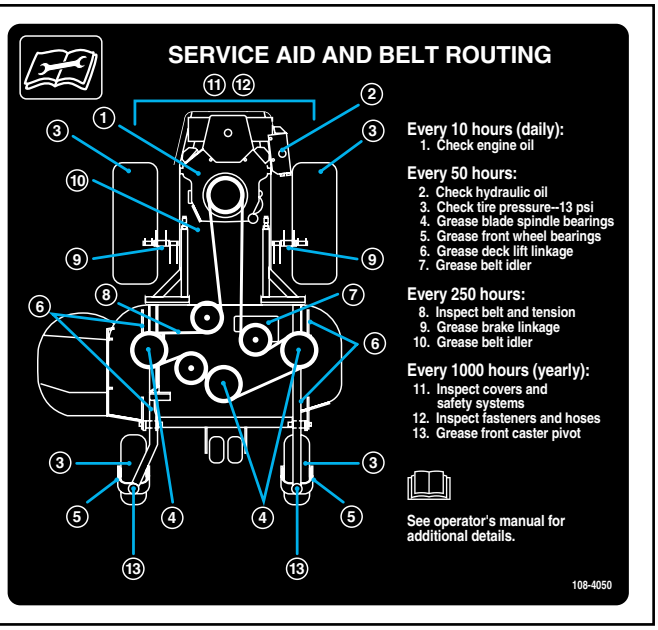

Fig 025 108-4050

19 hp Kawasaki / 44” SFS Deck

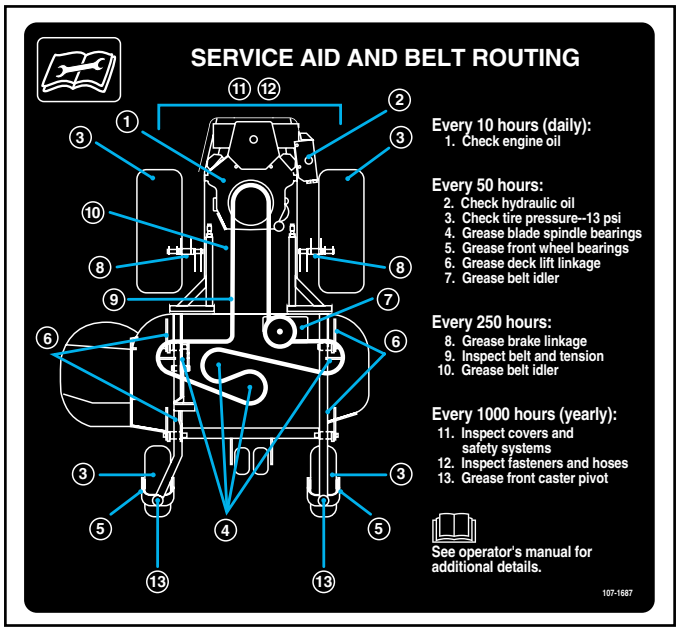

Fig 026 107-1687A

19 hp Kawasaki / 52” 7-Gauge Deck
18 hp Kohler / 48” 7-Gauge Deck
19 hp Kawasaki / 48” TF Deck
20 hp Kohler / 52” TF Deck
19 hp Kawasaki / 52” TF Deck
23 hp Kawasaki / 52” TF Deck
23 hp Kawasaki / 48” TF Deck

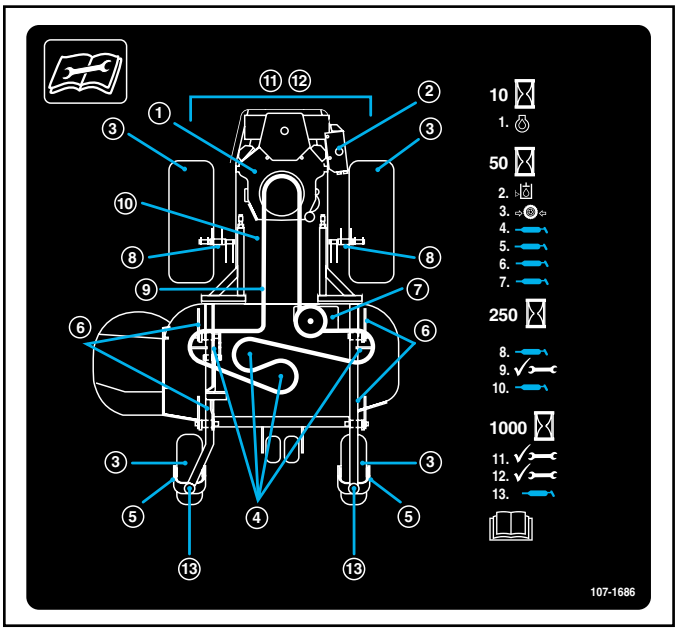

Fig 027 107-1686A

23 hp Kawasaki / 132cm (52” TF Deck)

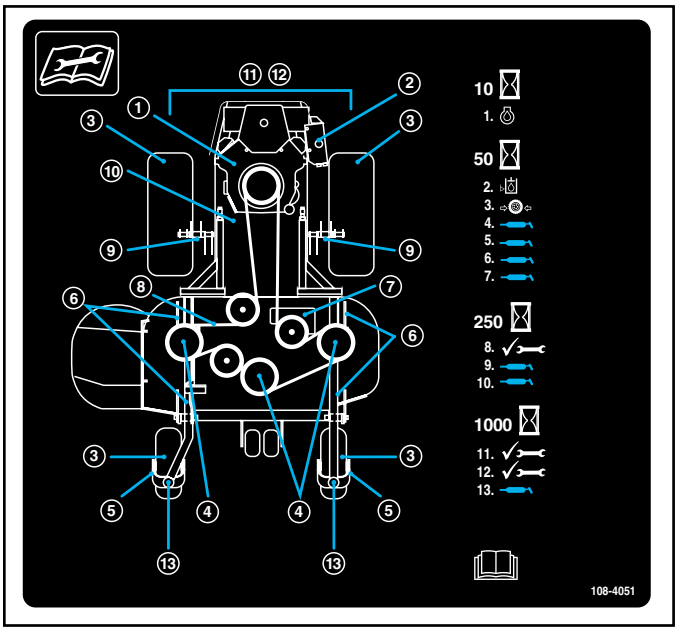

Fig 028 108-4051

19 hp Kawasaki / 112cm (44” SFS Deck)

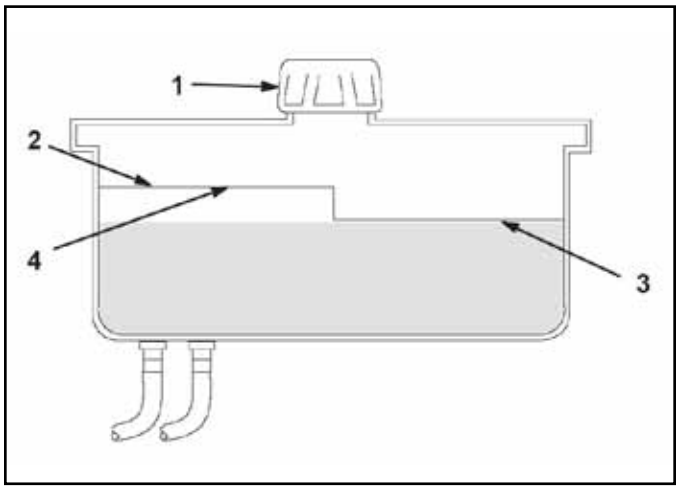

Fig 029 fig. 55 m-5615

1. Cap
2. Baffle
3. Cold fluid level - full
4. Hot fluid level - full

Hydraulic System Oil Capacity:	2.1 quarts (2.0 liters)
Fluid Type:	Mobil 1 Extended Performance 15W-50 Synthetic
Fluid Level:	Check the fluid level while the fluid is warm. The fluid should be between cold and hot. **Note: The fluid level should be to the top of the hot level of the baffle, when the fluid is hot (Fig. 000 above).**

Model and Serial Number Location	The unit model and serial number plate is located on the right hand side of the unit, below the right side motion control lever (Fig. 000).

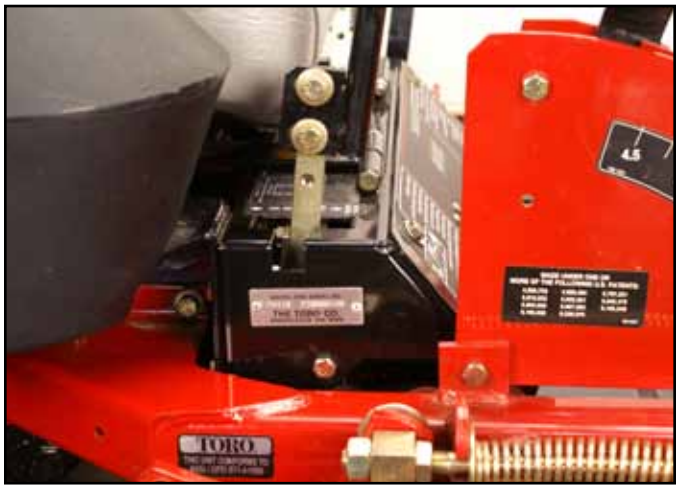

Fig 030 PICT-0046

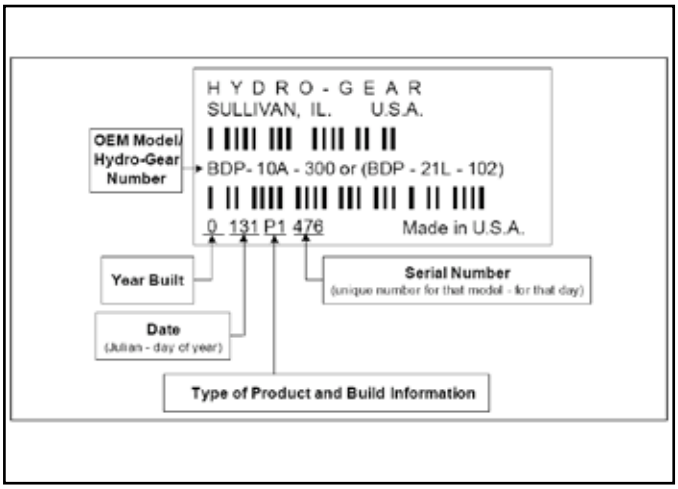

Fig 031 configuration

Engine Model and Serial Number Identification:	Consult the appropriate engine manufacture's service literature for the location and translation of the engine model and serial number information.
Hydrostatic Pumps Model and Serial Number:	The label (Fig. 000), can be located on the pump housing. It identifies the model and configuration of the BDP pump.

Available Service Manuals / Service Aids

Hydrostatic Pumps:	Hydro-Gear BDP-10A/16A/21L – Service and Repair Manual Form # 492-4789
Wheel Motors:	Parker/Ross Wheel Motor Service Manual Form # 492-4753
Hydraulic Troubleshooting:	Interactive hydraulic troubleshooting and failure analysis on compact disk Form #492-4777
Electrical Troubleshooting:	Interactive electrical troubleshooting and wiring diagrams on compact disk Form #492-9143

Torque Specifications

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

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

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

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

Fastener Identification

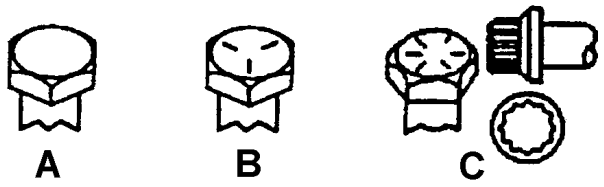

Figure A

Inch Series Bolts and Screws	
(A) Grade 1 (B) Grade 5	(C) Grade 8

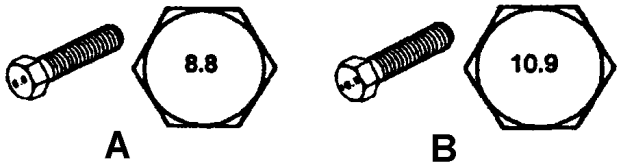

Figure B

Metric Bolts and Screws	
(A) Class 8.8	(B) Class 10.9

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

Thread Size	Grade 1, 5, & 8 with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs, & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 5 Bolts, Screws, Studs, & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs, & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)	
	In-lb	In-lb	N-cm	In-lb	N-cm	In-lb	N-cm
# 6 - 32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	170 ± 20	23 ± 2	260 ± 20
# 6 - 40 UNF				17 ± 2	190 ± 20	25 ± 2	280 ± 20
# 8 - 32 UNC	13 ± 2	25 ± 5	282 ± 30	29 ± 3	330 ± 30	41 ± 4	460 ± 45
# 8 - 36 UNF				31 ± 3	350 ± 30	43 ± 4	31 ± 3
# 10 - 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 4	475 ± 45	60 ± 6	674 ± 70
#10 - 32 UNF				48 ± 4	540 ± 45	68 ± 6	765 ± 70
1/4 - 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1125 ± 100	140 ± 15	1580 ± 170
1/4 - 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 10	1300 ± 100	160 ± 15	1800 ± 170
5/16 - 18 UNC	115 ± 15	105 ± 17	1186 ± 169	200 ± 25	2250 ± 280	300 ± 30	3390 ± 340
5/16 - 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2540 ± 280	325 ± 30	3670 ± 340
	ft-lb	ft-lb	N-m	ft-lb	N-m	ft-lb	N-m
3/8 - 16 UNC	16 ± 2	16 ± 2	22 ± 3	30 ± 3	41 ± 4	43 ± 4	58 ± 5
3/8 - 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 3	47 ± 4	50 ± 4	68 ± 5
7/16 - 14 UNC	27 ± 3	27 ± 3	37 ± 4	50 ± 5	68 ± 7	70 ± 7	68 ± 9
7/16 - 20 UNF	29 ± 3	29 ± 3	39 ± 4	55 ± 5	75 ± 7	77 ± 7	104 ± 9
1/2 - 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 10	142 ± 14
1/2 - 20 UNF	32 ± 3	53 ± 7	72 ± 9	85 ± 8	115 ± 11	120 ± 10	163 ± 14
5/8 - 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 20	285 ± 27
5/8 - 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 15	230 ± 20	240 ± 20	325 ± 27
3/4 - 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 25	359 ± 34	374 ± 35	508 ± 47
3/4 - 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 25	407 ± 34	420 ± 35	569 ± 47
7/8 - 9 UNC	140 ± 20	225 ± 25	305 ± 34	430 ± 45	583 ± 61	600 ± 60	813 ± 81
7/8 - 14 UNF	155 ± 25	260 ± 30	353 ± 41	475 ± 45	644 ± 61	660 ± 60	895 ± 81

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

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

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

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

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

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

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

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

Other Torque Specifications

SAE Grade 8 Steel Set Screws

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

Wheel Bolts and Lug Nuts

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

** For steel wheels and non-lubricated fasteners.

Thread Cutting Screws (Zinc Plated Steel)

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

Thread Cutting Screws (Zinc Plated Steel)

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

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

Conversion Factors

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

N-cm X - 0.08851 = in-lb
N-cm X 0.73776 - ft-lb

Equivalents and Conversions

Decimal and Millimeter Equivalents

Fractions	Decimals	mm	Fractions	Decimals	mm
1/64	0.015625	0.397	33/64	0.515625	13.097
1/32	0.03125	0.794	16/32	0.53125	13.484
3/64	0.046875	1.191	35/64	0.546875	13.891
1/16	0.0625	1.588	9/16	0.5625	14.288
5/64	0.078125	1.984	37/64	0.578125	14.684
3/32	0.9375	2.381	19/32	0.59375	15.081
1/8	0.1250	3.175	5/8	0.6250	15.875
9/64	0.140625	3.572	41/64	0.640625	16.272
5/32	0.15625	3.969	21/32	0.65625	16.669
11/64	0.171875	4.366	43/64	0.671875	17.066
3/16	0.1875	4.762	11/16	0.6875	17.462
13/64	0.203125	5.159	45/64	0.703125	17.859
7/32	0.21875	5.556	23/32	0.71875	18.256
15/64	0.234375	5.953	47/64	0.734375	18.653
1/4	0.2500	6.350	3/4	0.7500	19.050
17/64	0.265625	6.747	49/64	0.765625	19.447
9/32	0.28125	7.144	25/32	0.78125	19.844
19/64	0.296875	7.541	51/64	0.796875	20.241
5/16	0.3125	7.541	13/16	0.8125	20.638
21/64	0.328125	8.334	53/64	0.828125	21.034
11/32	0.34375	8.731	27/32	0.84375	21.431
23/64	0.359375	9.128	55/64	0.859375	21.828
3/8	0.3750	9.525	7/8	0.8750	22.225
25/64	0.390625	9.922	57/64	0.890625	22.622
13/32	0.40625	10.319	29/32	0.90625	23.019
27/64	0.421875	10.716	59/64	0.921875	23.416
7/16	0.4375	11.112	15/16	0.9375	23.812
29/64	0.453125	11.509	61/64	0.953125	24.209
15/32	0.46875	11.906	31/32	0.96875	24.606
31/64	0.484375	12.303	63/64	0.984375	25.003
1/2	0.5000	12.700	1	1.000	25.400
1 mm = 0.03937 in.			0.001 in. = 0.0254 mm		

U.S. to Metric Conversions

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

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Caster Fork Assembly Removal

Estate Series with bushing front casters

1. Raise the front of the unit off the ground, allowing enough clearance to remove the caster fork from the bottom hub.

2. With a hammer and chisel, remove the top grease cap (Fig. 032).

Fig 032 PICT-0001 rev

3. Remove the E-ring (Fig. 033).

Fig 033 PICT-0002

4. Remove the caster fork assembly from the front frame (Fig. 034).

Fig 034 PICT-0003

5. Remove the spacer (Fig. 035).

Fig 035 PICT-0004

6. Remove the top and bottom bushings (Fig. 036).

Fig 036 PICT-0005 rev

Caster Fork Assembly Installation

Estate Series with bushing front casters

1. Drive the upper and lower bushings in until they seat against the step in the housing (Fig. 037).

Fig 037 PICT-0006 rev

2. Install the caster fork assembly into the front frame (Fig. 038).

Fig 038 PICT-0008

Note: Ensure short caster spacer is installed prior to assembling the caster assembly.

3. Install the tall spacer (Fig. 039).

Fig 039 PICT-0009

4. When reinstalling the castor fork assembly on early production Z400 Estates Series check for excessive endplay between the E-ring groove and the top of the spacer. To minimize endplay, adjust as needed with 7/8” ID shims (Fig. 040).

Fig 040 PICT-0010

5. Install the E-ring (Fig. 041).

Fig 041 PICT-0011 rev

6. Install the top grease cap (Fig 042).

Fig 042 PICT-0012

Caster Fork Assembly Removal

Pro 100/400 Series with tapered roller front casters

1. Raise the front of the unit off the ground, allowing enough clearance to remove the caster fork from the bottom hub.

2. With a hammer and chisel, remove the top grease cap (Fig. 043).

Fig 043 PICT-0205

3. Loosen and remove the caster nut (Fig. 044).

Fig 044 PICT-0206

4. Remove the caster fork and wheel assembly from the frame (Fig. 045)

Fig 045 PICT-0207

5. Remove cup washers (3) (Fig. 046).

Fig 046 PICT-0208

6. Remove the top tapered roller bearing (Fig. 047).

Fig 047 PICT-0209

7. Remove the lower seal and lower tapered bearing (Fig. 048).

Fig 048 PICT-0210

8. Remove the lower tapered bearing cup (Fig. 049)

Fig 049 PICT-0211

9. Remove the upper tapered bearing cup (Fig. 050)

Fig 050 PICT-0212

Caster Fork Assembly Installation

Pro 100/400 Series with tapered roller front casters

1. Install the upper and lower tapered bearing cups with the thick edge facing inside (Fig. 051).

Fig 051 PICT-0213

2. Pack the upper and lower tapered roller bearings prior to installation (Fig. 052).

Fig 052 PICT-0214

3. Install the lower tapered bearing and lower seal with the open end of the seal facing up (Fig. 053).

Fig 053 PICT-0215

4. Install the upper tapered bearing (Fig. 054).

Fig 054 PICT-0216

5. Install the caster fork into the frame (Fig. 055).

Fig 055 PICT-0207

6. Install the three spring washers (Fig. 056).

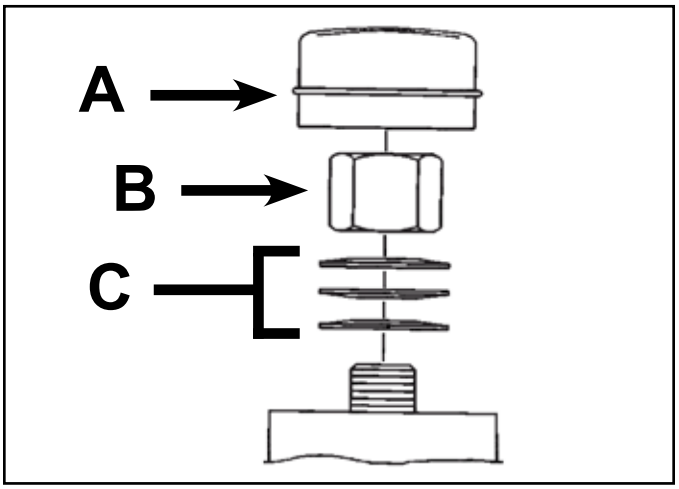

Fig 056 washers line art

A. Dust cap
B. Locknut
C. Spring washers

7. Install the locknut and tighten until the spring washers are flat, then back off 1/4 turn to properly set the preload on the bearings (Fig. 057).

Fig 057 PICT-0206

8. Remove the grease plug located on the side of the hub on the frame for the caster fork. Install a grease fitting, and pump grease into the housing until grease is passing through the upper bearing (Fig. 058).

Fig 058 PICT-0217

9. Replace the grease plug.

10. Install the top grease cap.

Front Wheel Removal and Bearing Replacement (Estate Series)

1. Raise the front of the unit off the ground.

2. Remove the wheel bolt and nut from the fork (Fig. 059).

Fig 059 PICT-0013

3. Remove the wheel from the fork (Fig. 060).

Fig 060 PICT-0014

4. Remove the spacer nut from one side of the wheel (Fig. 061).

Fig 061 PICT-0015 rev

5. Remove the caster axle and second spacer nut from the wheel (Fig. 062).

Fig 062 PICT-0016 rev

6. Remove both caster seals from the wheel (Fig. 063).

Fig 063 PICT-0017

Caster Fork Wheel and Tire Assembly (Fig. 064)

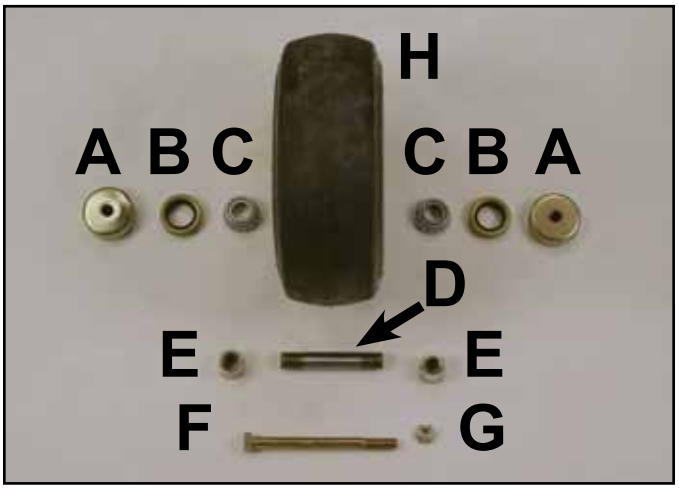

Fig 064 PICT-0018 rev

A. Seal Guard
B. Caster Seal
C. Taper Cone Bearing
D. Caster Axle
E. Spacer Nuts
F. Axle Bolt
G. Axle Bolt Nut
H. Wheel & Tire Assembly

7. Fill the center of the wheel cavity with grease and work the grease into the race (Fig. 065).

Fig 065 PICT-0020 rev

8. Pack the wheel bearing prior to installation (Fig. 066).

Fig 066 PICT-0019 rev

9. Install the wheel bearing (Fig. 067).

Fig 067 PICT-0022 rev

10. Install the caster seal (Fig. 068).

Fig 068 PICT-0021 rev

11. Repeat steps 8-10 for the other side of the wheel.

12. Install one spacer nut onto the caster axle (Fig. 069).

Fig 069 PICT-0024 rev

13. Insert caster axle/nut assembly into the wheel hub and install the second spacer nut (Fig. 070).

Fig 070 PICT-0025 rev

Note: Spacer nuts should be installed an equal distance onto each end of the caster axle.

14. Bearing pre-load is established by the torque of the spacer nuts on the caster axle. Set spacer nuts at 80 in-lbs. (9.0 Nm) with a torque wrench. Loosen, then reset at 20 in-lbs. (2.3 Nm) (Fig. 071).

Fig 071 PICT-0026 rev

15. Install both seal guards onto wheel hub (Fig. 072).

Fig 072 PICT-0027

16. Install wheel and tire assembly into caster fork using wheel bolt and nut (Fig. 073). Tighten.

Fig 073 PICT-0028

Pro 100/400 Series with tapered roller front casters

1. Raise the front of the unit off the ground.

2. Remove the wheel bolt and nut from the fork (Fig. 074).

Fig 074 PICT-0218

3. Remove the wheel from the fork (Fig. 075).

Fig 075 PICT-0220

4. Remove both bearing spacers (Fig. 076).

Fig 076 PICT-0221 rev

5. Remove the front caster spacer (Fig. 077).

Fig 077 PICT-0222 rev

6. Remove both bearing seals (Fig. 078).

Fig 078 PICT-0223 rev

7. Remove both taper cone bearings (Fig. 079).

Fig 079 PICT-0224 rev

Caster Fork Wheel and Tire Assembly (Fig. 080).

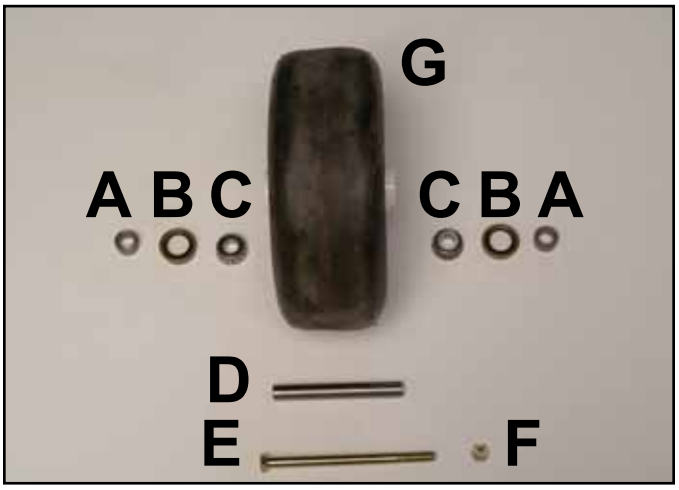

Fig 080 PICT-0225 rev

A. Seal Guard
B. Caster Seal
C. Taper Cone Bearing
D. Caster Axle
E. Axle Bolt
F. Axle Bolt Nut
G. Wheel & Tire Assembly

10. Pack both tapered wheel bearings. Reassemble per Fig. 000 (above).

Note: The axle bolt torque sets the pre-load on the front caster wheel bearings. Tighten the axle bolt to set the bearings then back off 1/4 turn.

Pump grease into the wheel bearings through the grease fitting located on the rim (Fig. 081).

Fig 081 PICT-0227

Fuel Tank Removal

Left Side Fuel Tank Removal

1. Disconnect the negative battery cable from the battery. Drain the fuel tank.

2. Remove the fuel hose clamp from the bottom of the fuel tank (Fig. 082).

Fig 082 PICT-0029

3. Remove the four screws retaining the control panel to the fuel tank (Fig. 083).

Fig 083 PICT-0030

4. Carefully remove the control panel by lifting the panel and sliding it toward the middle of the unit.

Note: Do not disconnect any cables or wiring.

5. Remove the two bolts, lock washers and flat washers from the front of the tank (Fig. 084).

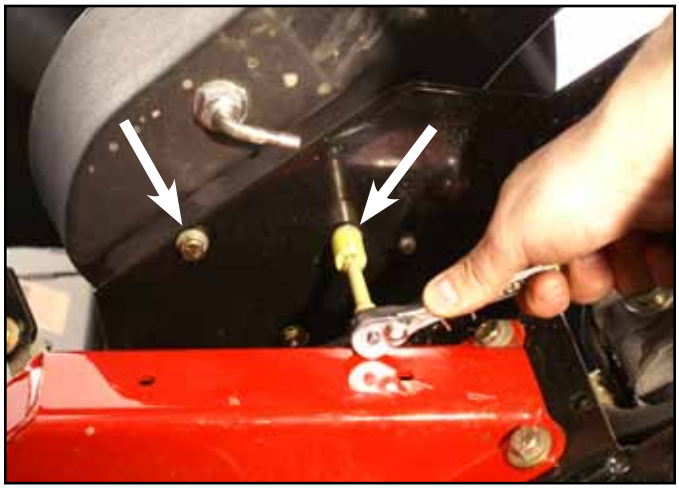

Fig 084 PICT-0031

6. Locate and remove the two nuts, springs, and washers from the studs at the rear of the fuel tank (Fig. 085).

Note: Rear tire removed for clarity.

Fig 085 PICT-0032

7. Remove the fuel tank from the frame (Fig. 086).

Fig 086 PICT-0033

Left Side Fuel Tank Installation

Reverse the order of removal.

Right Side Fuel Tank Removal & Installation

Follow the same procedures for the Left Side Fuel Tank Removal and Installation except skip the instructions for removing the control panel.

Fuel Check Valve

Purpose

The fuel check valve allows fuel to flow in only one direction and equalizes fuel flow from both tanks.

Location

There are two fuel check valves. They are located one beneath each fuel tank approx 6” (15.2cm) down line from the tank (Fig. 087).

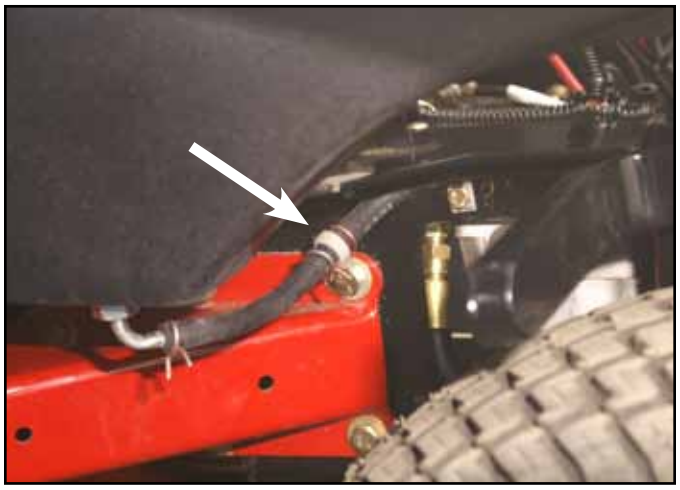

Fig 087 PICT-0001b

Proper Installation

Flat side of the check valve faces fuel tank (Fig. 088).

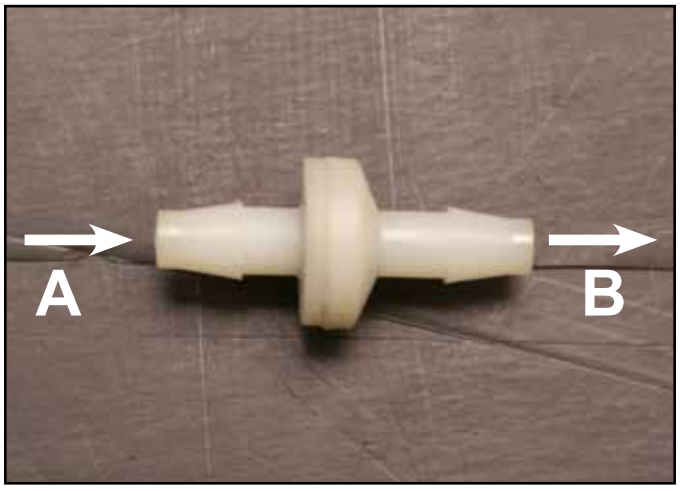

Fig 088 PICT-0002b rev

A. From the tank B. To the engine

Fuel Shut-off Valve

Purpose

The fuel shut-off valve cuts off fuel flow to the engine for transporting.

Location

Estate Series

Fuel shut-off valve is located on the left hand side of the engine (Fig. 089).

Fig 089 PICT-0005b

Pro 400 Series V-Twin Kohler

Fuel shut-off valve is located on the right hand side of the engine behind the seat (Fig. 090).

Fig 090 PICT-0228 new

Proper Installation

The arrow at the bottom of the valve faces toward the engine (Fig. 091).

Fig 091 PICT-0007b rev

Parking Brake Handle/Shaft Assembly Removal

All Models

1. Release the parking brake (forward position).

2. Lift the floor pan and remove the panel assembly by removing the four fasteners retaining the panel to the frame (Fig. 092).

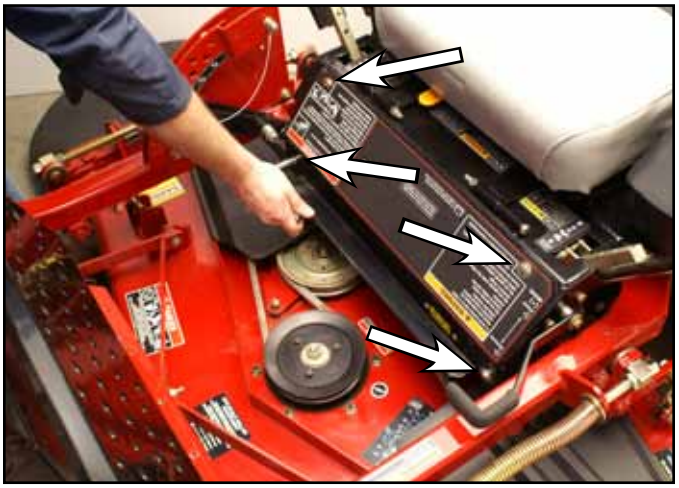

Fig 092 PICT-0034

3. Remove the parking brake handle (Fig. 093).

Fig 093 PICT-0035

4. Remove the bolts from the outer bearing of the parking brake shaft (Fig. 094).

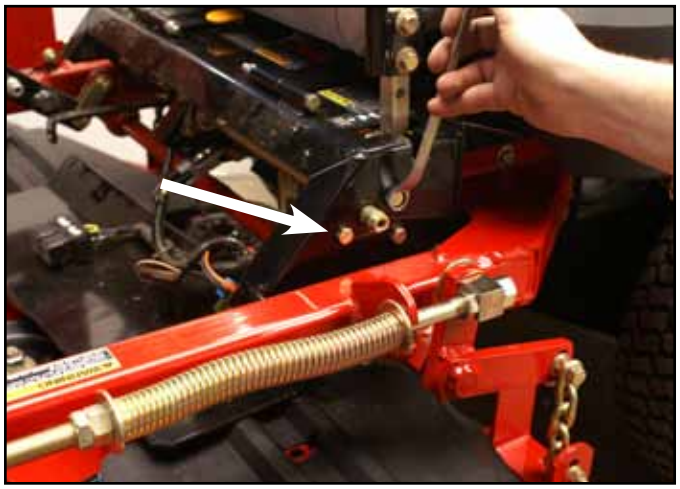

Fig 094 PICT-0036

5. Remove the bolts from the inner bearing of the parking brake shaft (Fig. 095).

Fig 095 PICT-0037

6. Remove the E-ring from the outer end of the parking brake shaft (Fig. 096).

Fig 096 PICT-0038

7. Remove the cotter pin and clevis pin holding the brake rod assembly to the parking brake shaft (Fig. 097).

Fig 097 PICT-0039

8. Slide the parking brake shaft assembly out of the frame (Fig. 098).

Fig 098 PICT-0040 rev

9. Inspect the brake shaft and bushings for excessive wear. Replace any worn or broken components (Fig. 099).

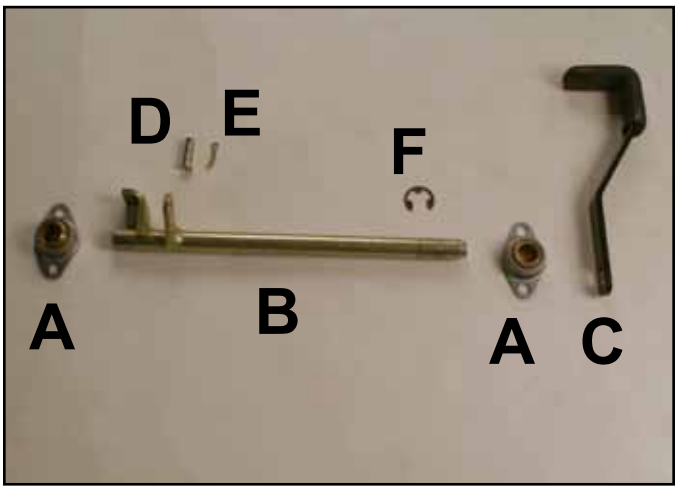

Fig 099 PICT-0041

A. Side Flange Bearings
B. Brake Shaft
C. Brake Lever
D. Clevis pin
E. Cotter pin
F. E-Ring

Parking Brake Handle/Shaft Assembly Installation

All Models

Reverse the order of removal.

Brake Bar Removal (Estate Series)

1. Disengage the brake.
2. Remove the brake return spring (Fig. 100).

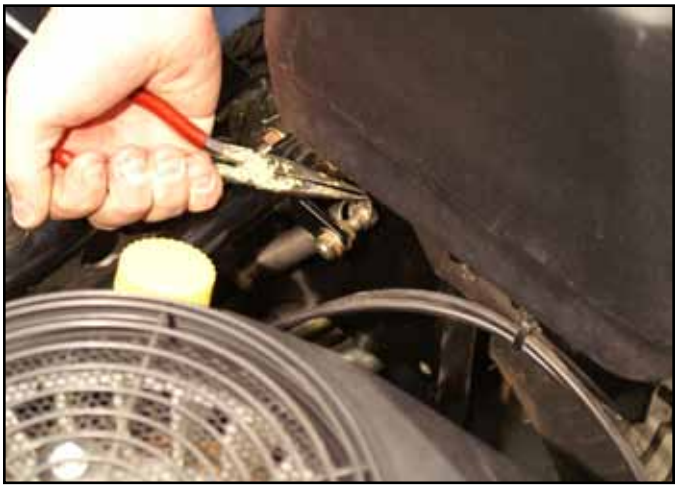

Fig 100 PICT-0042

3. Remove the cotter pin and clevis pin from the brake rod assembly where it attaches to the brake bar (Fig. 101).

Fig 101 PICT-0043

4. Remove the two bolts and nuts retaining the brake bar to each side of the frame (Fig. 102).

Fig 102 PICT-0044

5. Remove the brake bar from the machine (Fig. 103).

Fig 103 PICT-0045

Brake Installation

Reverse the order of removal

Adjusting the Parking Brake

Check the parking brake for proper adjustment.

1. Check tire pressure of all 4 tires.
2. Disengage the brake lever (lever down).
3. Measure the distance vertically between the front of the brake bar and the crown of the tire; the measurement should be 7/8” to 1” (22 to 25mm) (Fig. 104).

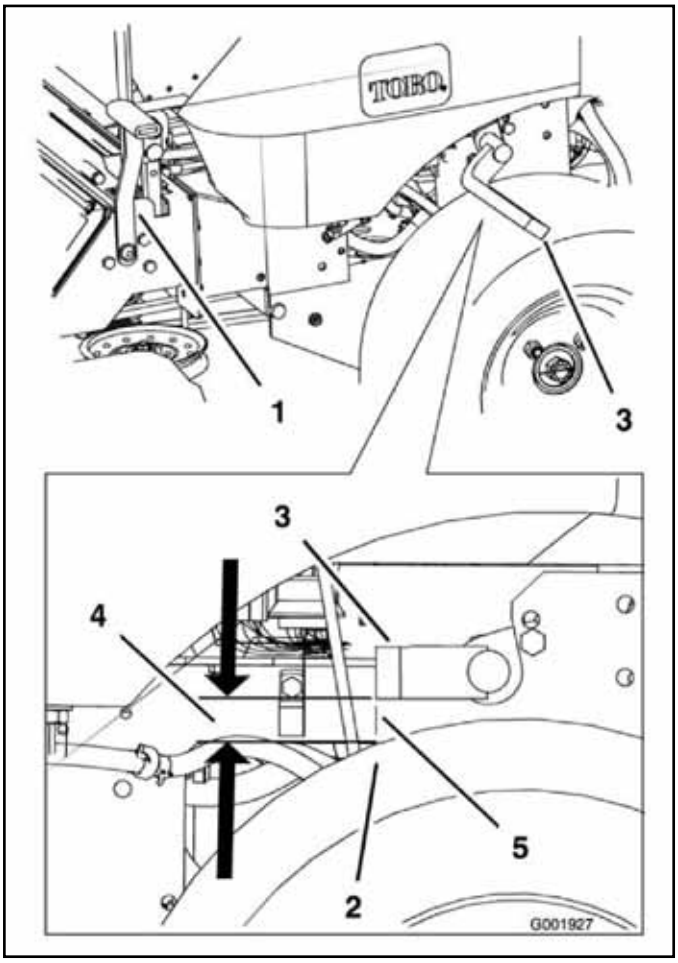

Fig 104 Figure 45

1. Brake lever
2. Tire
3. Brake bar
4. 7/8” to 1” (22 to 25mm)
5. Vertical line from the front of brake bar to the tire crown

4. If the measurement is not correct, proceed to the following steps.

5. Remove the hairpin and cotter pin from the brake linkage (Fig. 105).

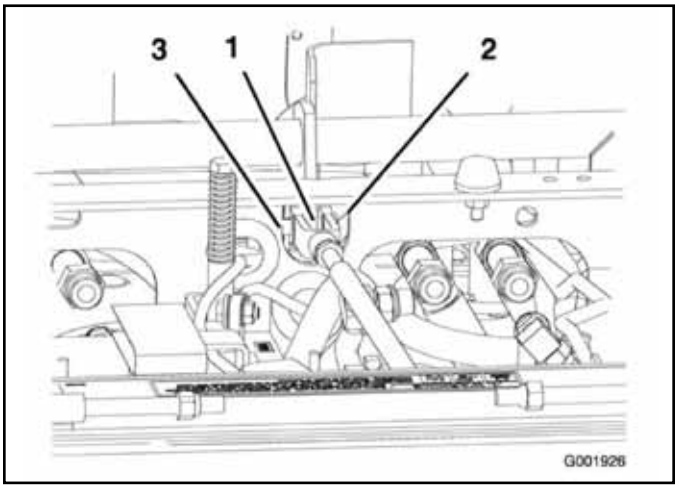

Fig 105 Firgure 44

1. Brake linkage
2. Yoke
3. Hair pin and cotter pin

6. Adjust the yoke clockwise to shorten the distance; counterclockwise to lengthen distance (Fig 105).

7. Measure the distance vertically between the front of the brake bar and the crown of the tire; the measurement should be 7/8” to 1” (22 to 25mm) (Fig. 104).

8. Repeat steps 5 through 7 if additional adjustment is needed.

9. Engage the parking brake (lever up) and ensure the brake bar engages the tire (Fig. 104).

Brake Band Removal (Pro Series)

Note: Procedure can be used for left hand or right hand.

1. Raise the right rear wheel (Fig. 106).

Fig 106 PICT-0229

2. Remove the four wheel lug nuts. Remove the wheel assembly.

3. Remove bolts, brake band retainer, spacers, and brake band (Fig. 107).

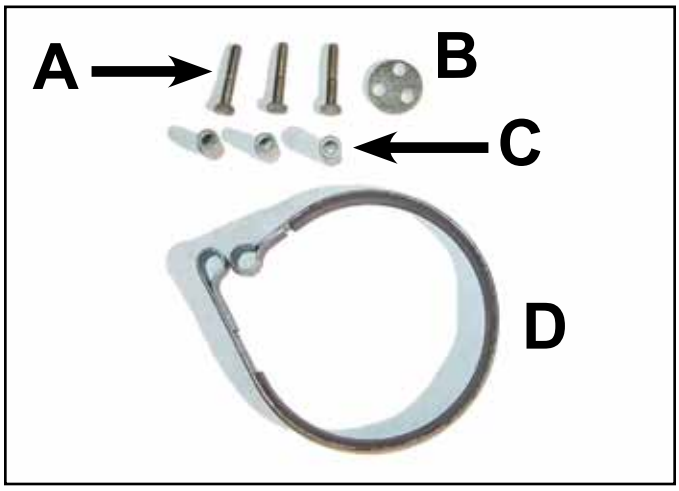

Fig 107 DSC-1626 rev

A. 3 Bolts
B. Brake Band Retainer
C. 3 Spacers
D. Brake Band

Brake Band Installation

1. Install the brake band around the wheel hub (Fig. 108).

Fig 108 DSC-1629 rev

2. Install the 3 bolts, brake band retainer, brake band, and spacers and tighten (Fig. 109).

Fig 109 DSC-1631 rev

3. Install wheel assembly and 4 wheel lug nuts.

Brake Shaft Removal (Pro Series)

1. Raise the rear end of the machine and remove both right and left wheels.

Note: To prevent the unit from rolling, block the two front tires.

2. Remove the cotter pin and clevis pin from the brake rod assembly (Fig. 110).

Fig 110 PICT-0231

3. Remove the left and right clevis spring clips from the brake shaft (Fig. 111).

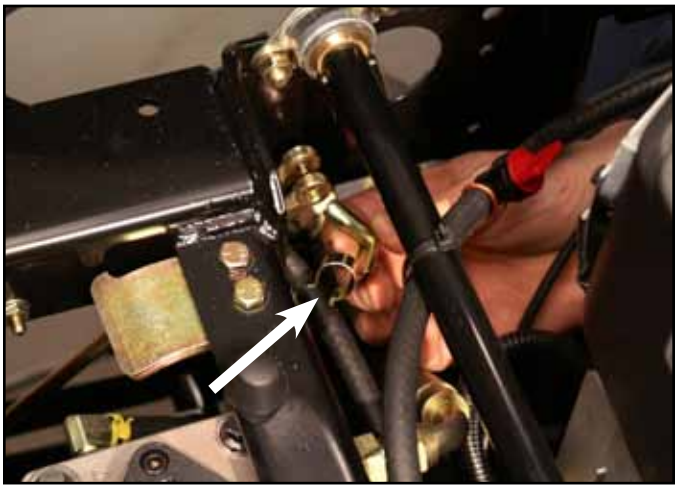

Fig 111 PICT-0234

4. Cut the plastic tie that holds the fuel line to the brake shaft (Fig. 112).

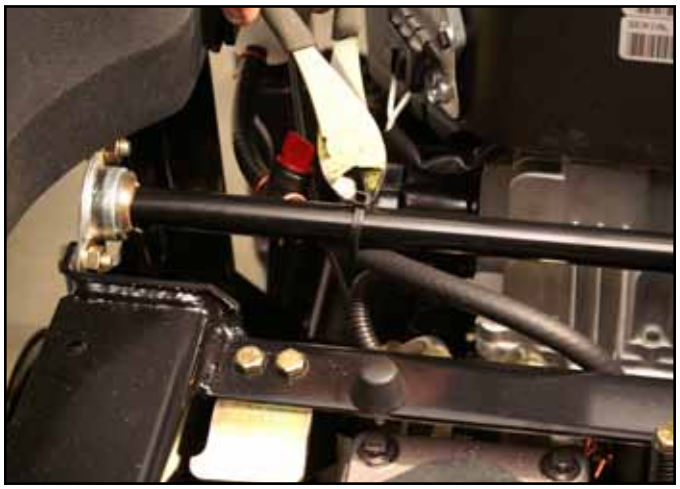

Fig 112 PICT-0235

5. On both the right and left side, remove two bolts and nuts holding the flange bearings (Fig. 113).

Fig 113 PICT-0236

6. Remove the brake shaft from the unit (Fig. 114).

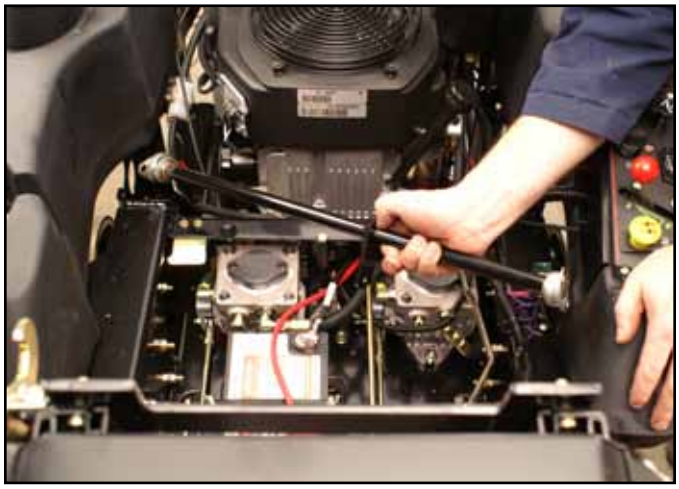

Fig 114 PICT-0237

7. Inspect the brake shaft and flange bearings for excessive wear.

Brake Shaft Installation

Reverse the order of removal.

Deck Lift Lever Removal (All Models)

1. Park the machine on a level surface, disengage the blade control (PTO), and turn the ignition key to OFF to stop the machine. Remove the ignition key.

2. Remove the lower stop bolt from the deck lift plate (Fig. 115).

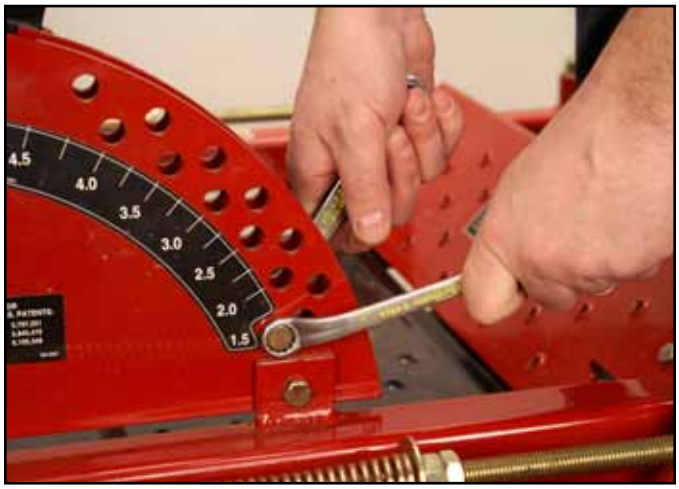

Fig 115 PICT-0047

3. With the mower deck in the transport position, place a 4” x 4” block under each corner of the deck. Lower the mower deck onto the support blocks to remove the weight from the support chains (Fig. 116).

Fig 116 PICT-0048

4. Loosen jam nuts on the deck lift rods until the deck support springs are fully extended. Repeat procedure for both deck lift rods (Fig. 117).

Fig 117 PICT-0049

5. Remove the hex nut from RH rear deck lift assembly. Repeat procedure for LH rear deck lift assembly (Fig. 118).

Fig 118 PICT-0050

6. Remove the two 4” x 4” blocks at the rear of the deck, leaving the blocks in place at the front of the mower deck. The mower deck linkage should now be fully unloaded (Fig. 119).

Fig 119 PICT-0051

7. Remove hex bolt, nut, and lift lever bushing from the lower deck lift plate mounting location (Fig. 120).

Fig 120 PICT-0053

8. Loosen the top hex head flange nut at the deck lift plate mounting location. Pivot the INNER deck lift plate up and back toward the RH motion control lever (Fig. 121).

Fig 121 PICT-0054 rev

9. Lift the floor pan assembly to its fully opened position.

10. Remove the panel assembly by removing the four fasteners retaining the panel to the frame (Fig. 122).

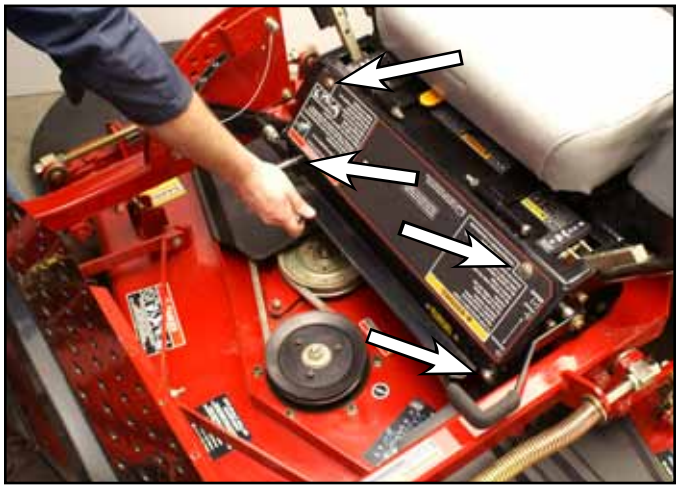

Fig 122 PICT-0034

11. Remove the bracket that supports the lower RH corner of the panel assembly (Fig. 123).

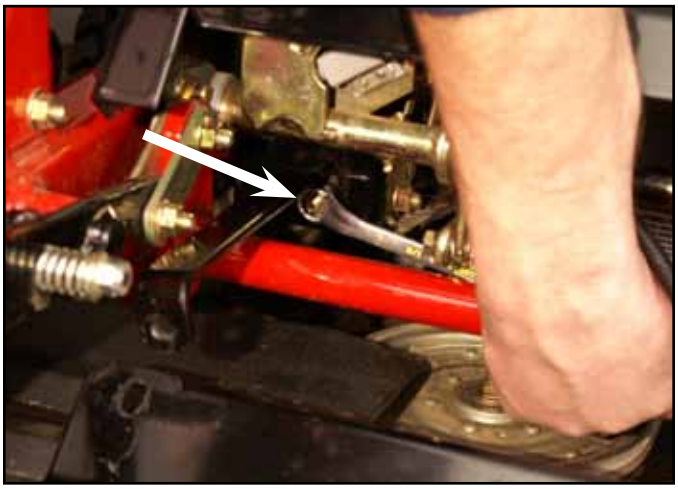

Fig 123 PICT-0055

12. Remove the hex bolts, bushings, and nylock nuts connecting the deck lift arm plates to the mower deck rear cross-shaft lift assembly (Fig. 124).

Fig 124 PICT-0057

13. Remove the retainer clip from the lift lever grip assembly (Fig. 125).

Fig 125 PICT-0059 rev

14. Carefully slide the lift lever grip assembly out of its carrier frame pivot (Fig. 126).

Fig 126 PICT-0060

15. Inspect the deck lift lever assembly components for wear, especially the bushings (Fig. 127).

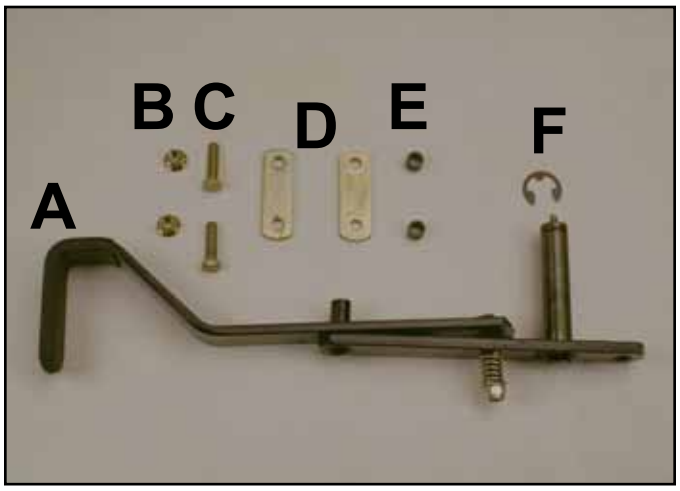

Fig 127 PICT-0061 rev

A. Lift Handle Assembly
B. Nuts
C. Bolts
D. Plates
E. Bushings
F. Retainer Clip

Deck Lift Lever Installation

1. Install the bracket that supports the lower RH corner of the panel assembly (Fig. 128).

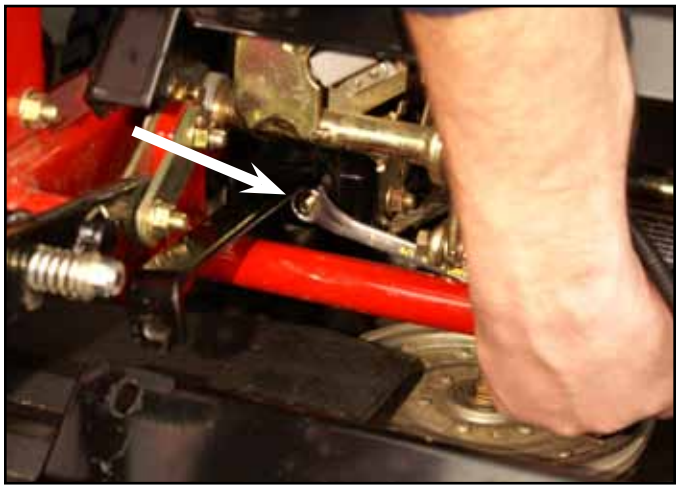

Fig 128 PICT-0055

2. For ease of installation, make sure deck lift arm plates, bushings and hardware are installed on the deck lift lever assembly prior to installation (Fig. 129).

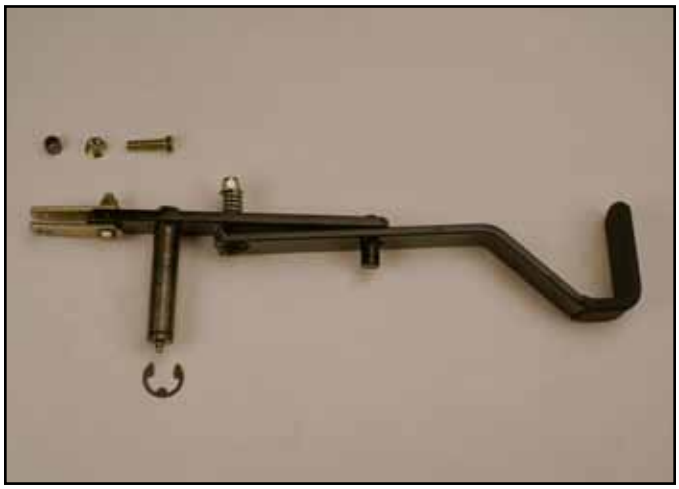

Fig 129 PICT-0062 rev

3. Install lift lever assembly into front frame pivot location (Fig. 130).

Fig 130 PICT-0063

4. Install bolt, nut and bushing through the plates into the rear deck lift cross-shaft (Fig. 131).

Fig 131 PICT-0064

5. Install the retainer clip on the deck lift lever assembly shaft (Fig. 132).

Fig 132 PICT-0065

6. Rotate deck lift plate (inner) downward until lower mounting holes line up with hole in carrier frame and deck lift plate (outer). From the outside of the frame install hex bolt, spacer, and flanged lock nut as shown. Tighten bolt (Fig. 133).

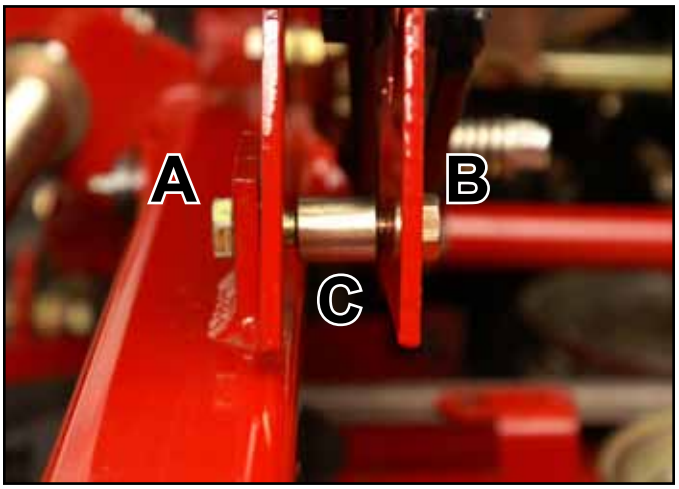

Fig 133 PICT-0066

A. Hex bolt
B. Flange locknut
C. Spacer

7. Align rear deck mount swivels with ends of deck lift rods (Fig. 134).

Fig 134 PICT-0067

8. Raise deck lift lever assembly until deck mount swivels rest against deck rod jam nuts. Install HOC pin into deck lift plate HOC holes that correspond to the 3” (7.62cm) HOC position (Fig. 135).

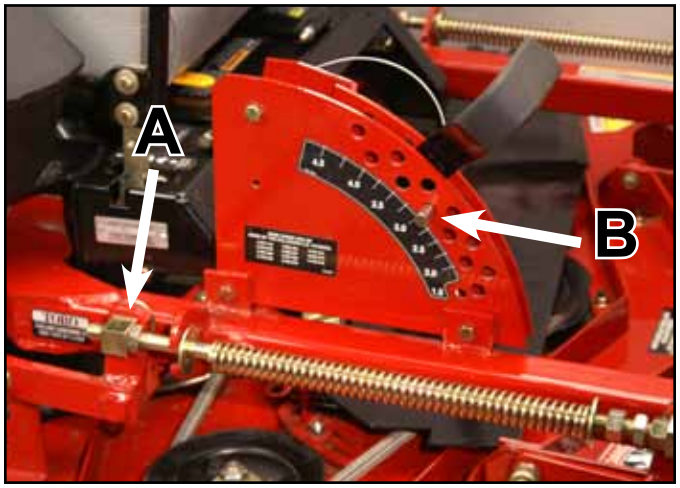

Fig 135 PICT-0068

A. Swivel
B. 3” (7.62mm) HOC location

9. Install lower “stop” bolt through inner and outer deck lift plates. Install nylock nut and tighten until hex nut and bolt are seated firmly against the deck lift plates. DO NOT over-tighten or deck lift plates will deform inward causing HOC pin assembly to bind (Fig. 136).

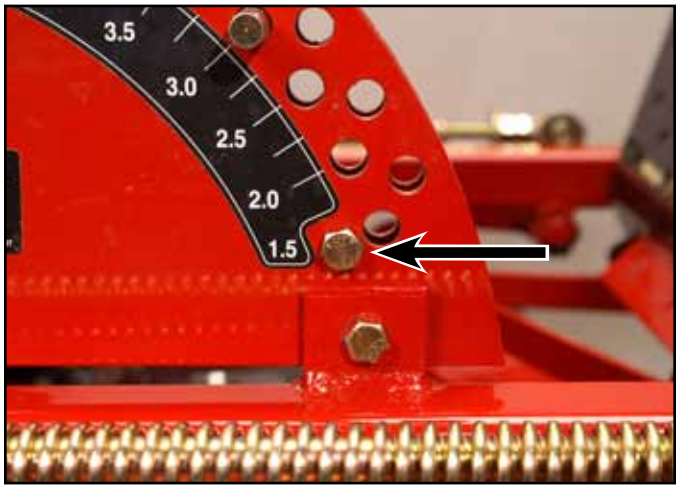

Fig 136 PICT-0069

10. Install hex nut on end of deck lift rod. Tighten against deck mount swivel. Repeat procedure for opposite side deck lift swivel (Fig. 137).

Fig 137 PICT-0070

11. Raise mower deck to the transport position. Remove the support blocks. Check the deck level adjustment (refer to Mower Deck Leveling page x-xx). Readjust compression spring length by turning front nut. Spring should be compressed to a length of 11-1/8" (28.26cm) between washers. Lock the front nut into position by tightening the spring jam nut (Fig. 138).

Fig 138 PICT-0071 rev

12. Install the panel assembly with the four fasteners retaining the panel to the frame (Fig. 139).

Fig 139 PICT-0034

14. Lower the floor pan assembly.

Motion Control Assembly Removal

This procedure applies to either the right or left motion control assembly.

1. Remove the panel assembly by removing the 4 fasteners retaining the panel to the frame (Fig. 140).

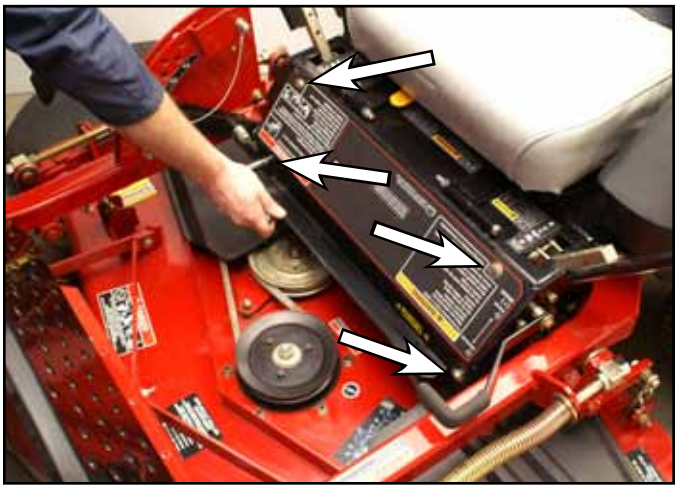

Fig 140 PICT-0034

2. Remove the two bolts and washers retaining the lever assembly to the control arm shaft (Fig. 141).

Fig 141 PICT-0072

3. Remove the cotter pin and clevis pin securing the adjustable yoke of the neutral return bolt (Fig. 142).

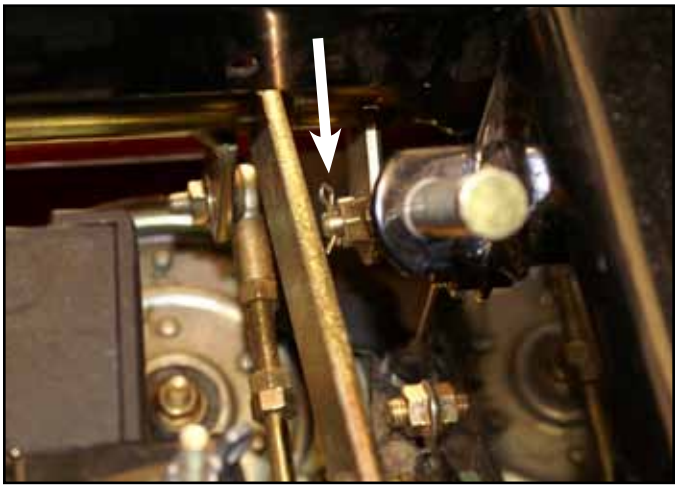

Fig 142 PICT-0073

4. Disconnect the motion control dampener from the motion control assembly (Fig. 143).

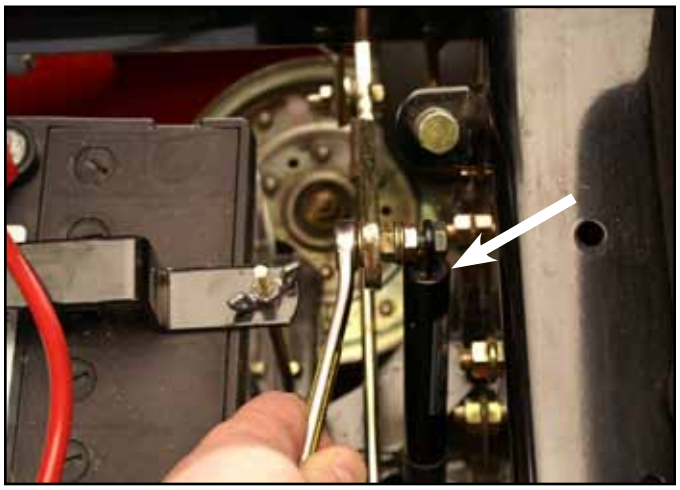

Fig 143 PICT-0074

5. Remove the bolt and nut that retaining the ball joint to the motion control shaft (Fig. 144).

Fig 144 PICT-0076

6. Disconnect neutral switch wire harness from the neutral switch (Fig. 145).

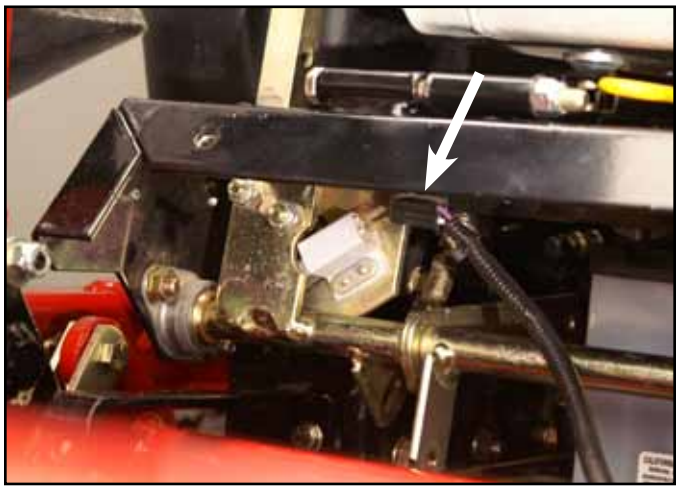

Fig 145 PICT-0078

7. Remove the two bolts and nuts that retain flange bearing on the inside of the motion control (Fig. 146).

Fig 146 PICT-0079

8. Remove the two bolts and nuts that retain the flange bearing on the outside of the motion control (Fig. 147).

Fig 147 PICT-0080

9. Remove the motion control assembly from the frame (Fig. 148).

Fig 148 PICT-0081

Motion Control Assembly Installation

Reverse the order of removal.

3

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Hydrostatic Pump Removal

Note: Cleanliness is a key factor in a successful repair of any hydrostatic system. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals. Protect all exposed sealing areas and open cavities from damage and foreign material.

Upon removal all seals, O-rings, and gaskets should be replaced. During installation, lightly lubricate all seals, O-rings and gaskets with clean petroleum jelly prior to installation.

This procedure shows the LH Hydrostatic Pump being removed. Use these same procedures to remove the RH Hydrostatic Pump.

1. Disconnect the negative battery cable from the battery.

2. Using compressed air, clean the area around the hydrostatic pump to make sure it is free from any dirt and debris.

3. Remove the bolt, washer and nut located between the ball joint and the control arm that retains the tracking link rod to the hydro control arm (Fig. 149).

Fig 149 PICT-0082a

4. Drain the hydraulic oil from the hydraulic reservoir tank.

5. Remove the hose clamp from the case drain hydraulic hose, located on the top inside of the hydrostatic pump (Fig. 150).

Note: Cap the hose and the fitting to prevent entry of dirt and debris.

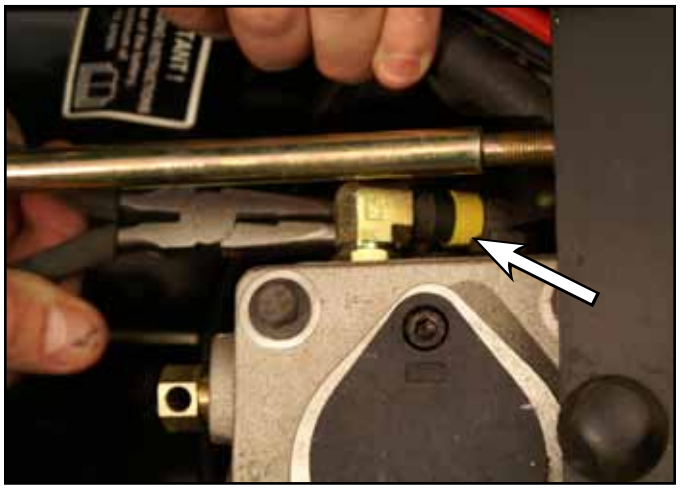

Fig 150 PICT-0083a

6. Remove the pump suction hydraulic line, located on the front of the hydrostatic pump (Fig. 151).

Fig 151 PICT-0084a

7. Remove the two high pressure hydraulic lines, located at the rear of the hydrostatic pump (Fig. 152).

Fig 152 PICT-0086a

8. With a spring puller, remove the extension spring from the idler arm assembly and remove the cog belt (Fig. 153).

Fig 153 PICT-0087a

9. Loosen the two square head set screws located on the pump sheave and remove the pulley (Fig. 154).

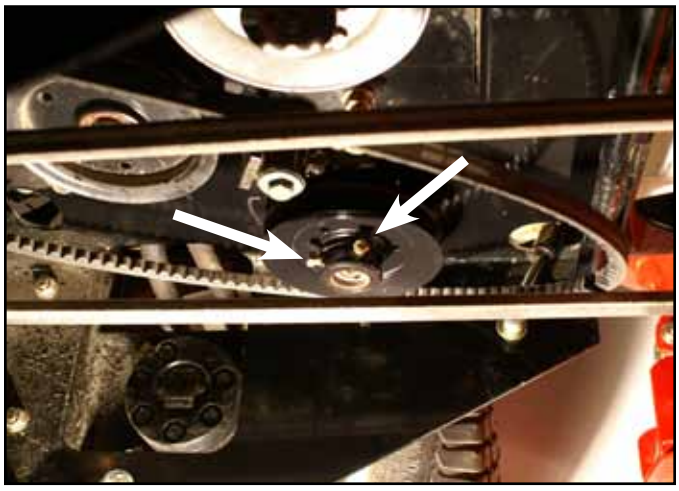

Fig 154 PICT-0090a

10. Loosen and remove the two bolts and nuts retaining the hydrostatic pump to the frame (Fig. 155).

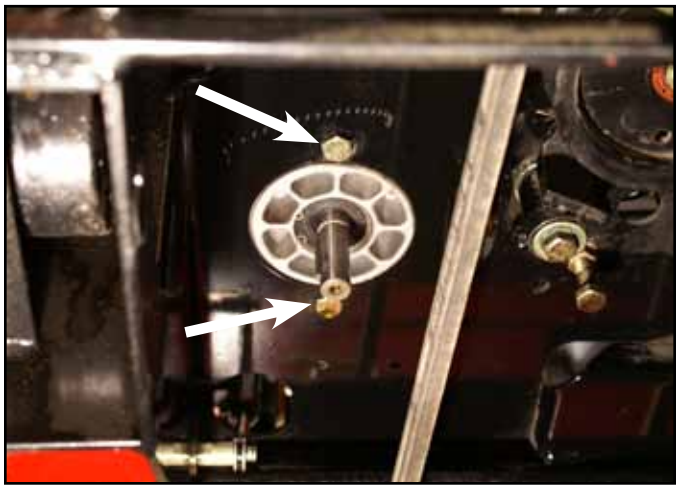

Fig 155 PICT-0091a

11. Remove the seat retainer rod (Fig. 156).

Fig 156 PICT-0092a

12. Remove the hydrostatic pump from the frame (Fig. 157).

Fig 157 PICT-0093a rev

13. For service work on the pump refer to the Hydro Gear BDP-10A (PG)/16A/21L Service Manual, form #492-4789.

Hydrostatic Pump Installation

1. Place the hydrostatic pump into the frame (Fig. 158).

Fig 158 PICT-0093a

2. Install the bolt, washer and nut that retain the tracking link rod to the hydro control arm (Fig. 159). Tighten hardware.

Fig 159 PICT-0082a

3. Loosely install the two bolts and nuts retaining the hydrostatic pump to the frame (Fig. 160).

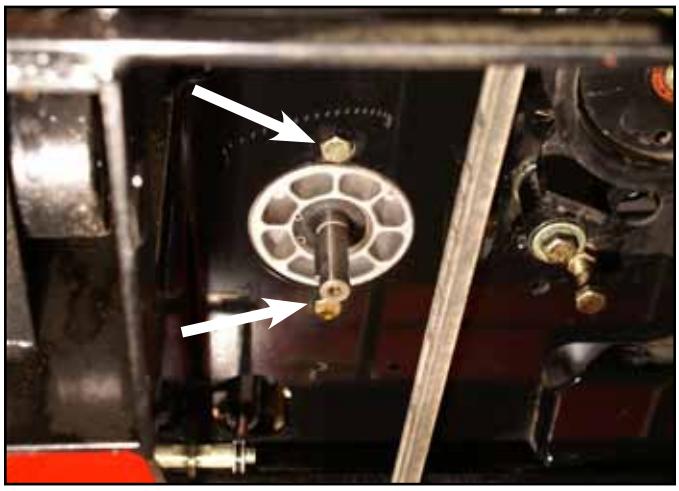

Fig 160 PICT-0091a

4. Install the case drain hydraulic hose and hose clamp located on the top inside of the hydrostatic pump (Fig. 161).

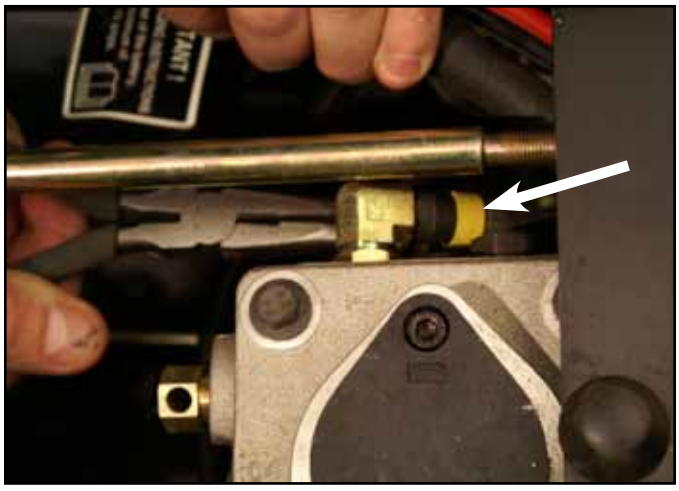

Fig 161 PICT-0083a

5. Install the pump suction hydraulic line located on the front of the hydrostatic pump (Fig. 162).

Fig 162 PICT-0084a

6. Install the two high pressure hydraulic lines located at the rear of the hydrostatic pump (Fig. 163).

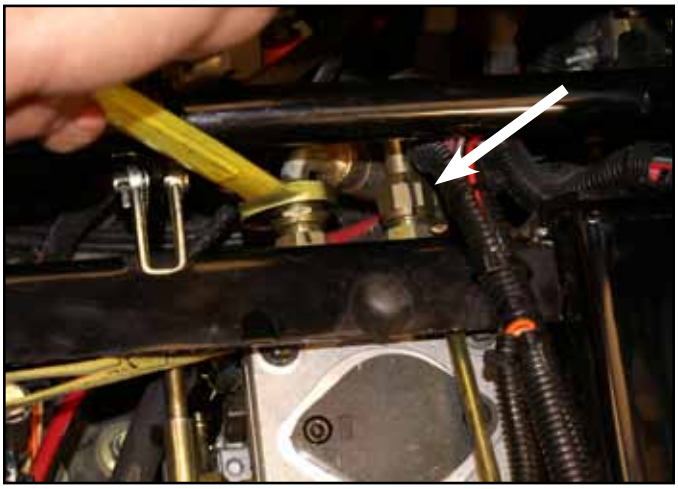

Fig 163 PICT-0086a

7. Tighten the pump mounting bolts (Fig. 164).

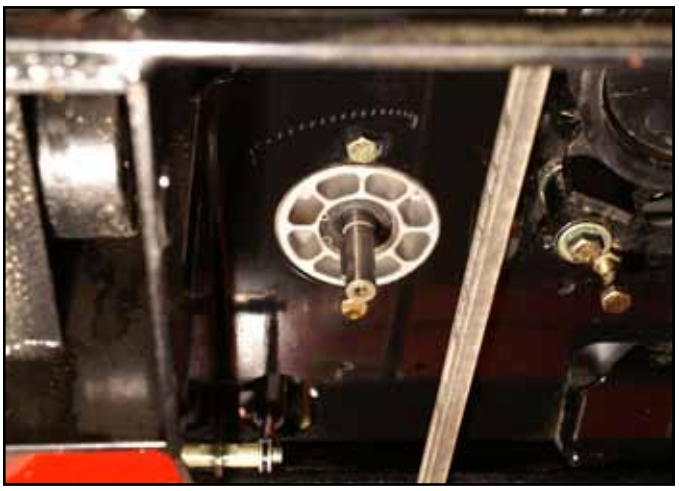

Fig 164 PICT-0091a

8. Install the key in the hydrostatic pump shaft.

9. Apply some anti-seize compound to the shaft (Fig. 165).

Note: Before installing the pulley replace the set screws. The ends of the set screws have a knurled cup point for retention and must not be re-used.

Note: Apply a drop of thread-locking material to the threads of each set screw.

Fig 165 PICT-0094a

10. Install the pulley.

11. Align the outer edge of the hydrostatic pump pulley using a straight edge, to the outer edge of the existing pump pulley (Fig. 166).

Note: Deck drive belt was removed for clarity.

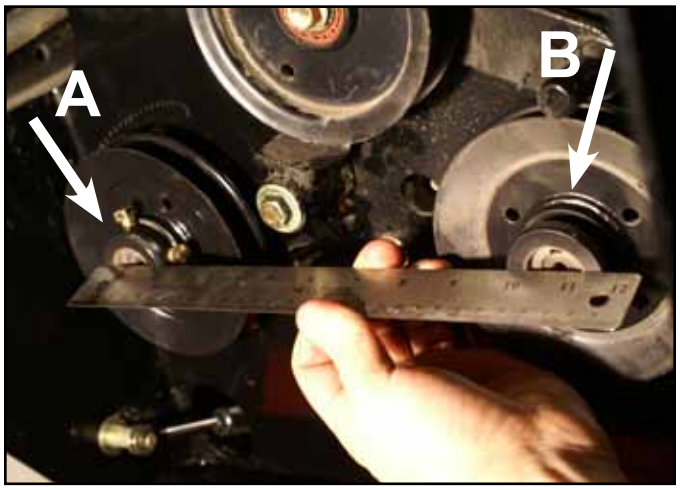

Fig 166 PICT-0096a

A. Pump pulley B. Existing pump pulley

12. Tighten the two square head set screws on the pump sheave (Fig. 167).

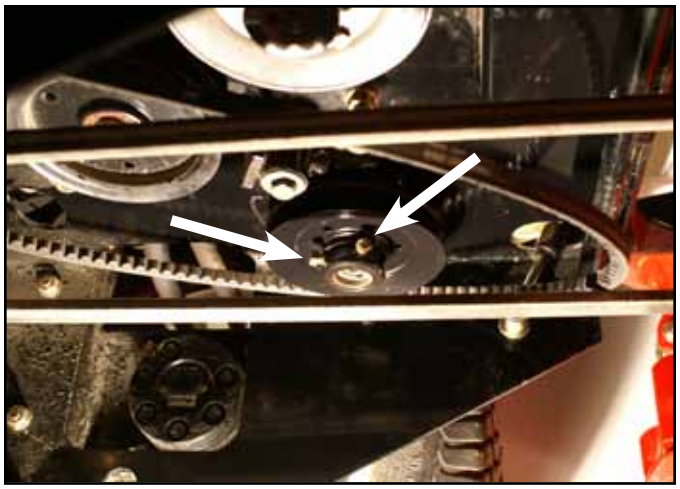

Fig 167 PICT-0090a

13. Install the cog belt onto the drive pulley. With a spring puller, install the extension spring to the idler arm assembly (Fig. 168).

Fig 168 PICT-0087a

14. Install the seat retainer rod (Fig. 169).

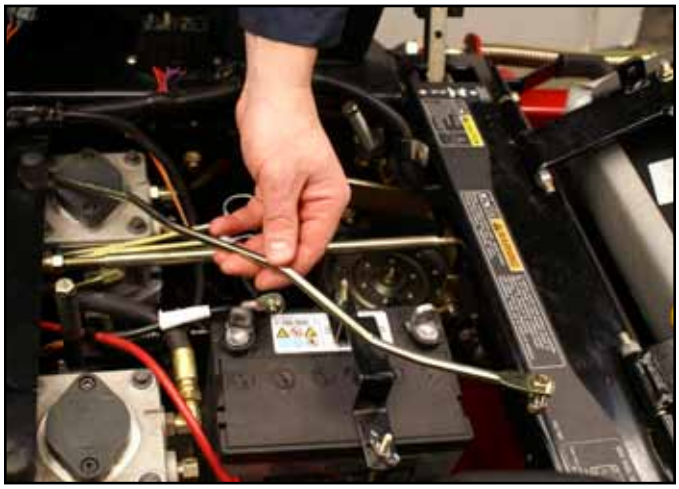

Fig 169 PICT-0092a

15. Connect the negative battery cable to the battery.

16. Check the hydraulic fluid in the reservoir tank. Add oil if necessary. Air will need to be purged from system. Follow the procedures for Purging the Hydraulic System, page x-xx.

17. Check the neutral adjustment. Follow procedures for Adjusting the Handle Neutral, page x-xx.

Replacing the Pump Drive Belt

1. With a spring puller, remove the extension spring from the idler arm assembly and remove the cog belt from the pump drive and idler pulleys (Fig. 170).

Fig 170 PICT-0097a

2. Remove the plastic tie holding the clutch harness to frame (Fig. 171).

Fig 171 PICT-0099a

3. Unplug the clutch pigtail harness from the main harness (Fig. 172).

Fig 172 PICT-0100a

4. Loosen the clutch stop rod and pivot away from the clutch (Fig. 173).

Fig 173 PICT-0104a

5. Remove the belt from the clutch drive pulley (Fig. 174).

Fig 174 PICT-0106a rev

Installing the Pump Drive Belt

Reverse the order of replacement.

Idler Arm Removal

1. With a spring puller, remove the extension spring from the idler arm assembly and remove the cog belt from the pump drive and idler pulleys (Fig. 175).

Fig 175 PICT-0097a

2. Remove the belt from the idler sheave (Fig. 176).

Fig 176 PICT-0107a

3. Remove the Idler Arm (Fig. 177).

Fig 177 PICT-0109a

4. Inspect the idler arm and bushings for excessive wear. Replace any worn or broken components (Fig. 178).

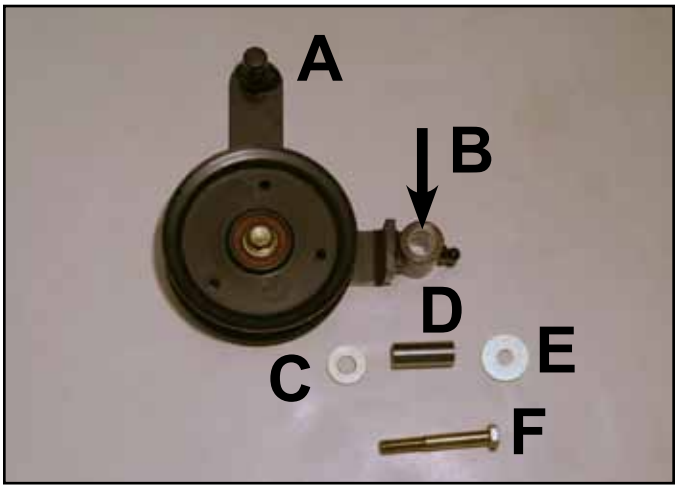

Fig 178 PICT-0110a rev

A. Idler arm Assembly
B. Bearing Sleeve (2)
C. Washer (Thin)
D. Bushing
E. Washer (Thick) (2)
F. Bolt

Idler Arm Installation

Reverse the order of removal

Wheel Motor Removal

This procedure is the same for both the right and left wheel motors.

1. Disconnect the battery negative cable.

2. Raise the rear wheels of the machine off the ground and support the frame with jackstands. Remove the rear wheel (Fig. 179).

Fig 179 PICT-0111a

3. Remove the cotter pin from the wheel motor output shaft (Fig. 180).

Fig 180 PICT-0001a

4. Loosen and remove nut securing hub to the wheel motor output shaft (Fig. 181).

Note: Hold wheel hub in place as shown by installing a pry bar into the notch of the hub.

Fig 181 PICT-0010a

5. Install a wheel hub puller to the wheel hub. Place an impact wrench onto the puller and remove the wheel hub (Fig. 182).

Fig 182 PICT-0003a

Note: Toro Wheel Hub Puller, P/N TOR 4097, is available through SPX (formerly OTC) 1-800-533-0492.

6. Place a drain pan under wheel motor.

7. Clean any dirt or debrис away from the hydraulic line fittings. Remove the hydraulic lines (Fig. 183).

Note: Make sure to cap the fittings and hoses to prevent dirt from entering the hydraulic system.

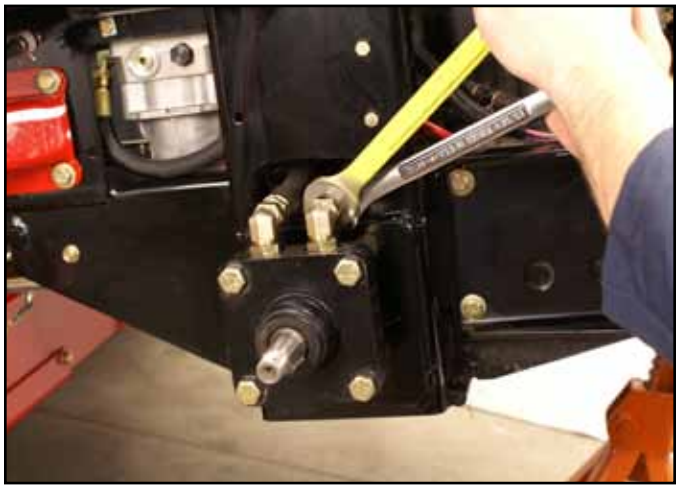

Fig 183 PICT-0004a

8. Remove the wheel motor bolts, lock washers, spacers and nuts (Fig. 184).

Fig 184 PICT-0005a

9. Remove the wheel motor (Fig. 185).

Fig 185 PICT-0006a

10. For service on the wheel motor refer to the Parker Ross Service Manual, Form #492-4753.

Wheel Motor Installation

Note: As a reminder, prior to connecting the hydraulic lines, the O-rings should be replaced with new ones and lightly lubricated with petroleum jelly.

1. Install wheel motor using the 4 bolts, spacers, lock washers and nuts. Install spacer between the frame and the motor housing. (Fig. 186).

Fig 186 PICT-0007a

2. Torque the wheel motor bolts to 75 to 85 ft-lbs. (102 to 115 Nm) (Fig. 187).

Fig 187 PICT-0008a

3. Install and tighten the two hydraulic lines to the wheel motor fittings (Fig. 188)

Fig 188 PICT-0009a

4. Install the wheel hub assembly, making sure the woodruff key is in place. Install the castle nut on the wheel motor shaft. Torque the wheel hub nut to 125 ft-lbs. (169 Nm) (Fig. 189).

Note: Re-torque nut at 100 hours, and every 500 hours thereafter. Washer 1-523157 can be used under nut to keep cotter pin engaged with nut castellations.

Fig 189 PICT-0012a

5. Check the alignment between the cotter pin hole on the motor shaft and the castle nut openings. Adjust the castle nut as needed for cotter pin installation.

6. Install the cotter pin in the castle nut (Fig. 190).

Fig 190 PICT-0011a

7. Install the rear wheel and wheel lug nuts and tighten.

8. Reconnect the battery negative cable to the battery.

9. Check the hydraulic fluid in the reservoir. Add oil if necessary. Air will need to be purged from the system. Follow the procedures on Purging the Hydraulic System, page x-xx.

Adjusting the Handle Neutral

If motion control levers do not align, or move easily into the console notch, adjustment is required. Adjust each lever, spring and rod separately.

Note: Motion control levers must be installed correctly. See Installing the Motion Control Levers in the set up instructions.

1. Lift seat. Install jumper wire in seat switch harness.

2. Disengage the PTO, move the motion control levers to the neutral locked position and set the parking brake.

3. Stop the engine, remove the key and wait for all moving parts to stop before leaving the operating position.

4. Unlatch the seat and tilt the seat forward.

5. Begin with either the left or the right motion control lever.

6. Move the lever to the neutral position but not locked (Fig. 191).

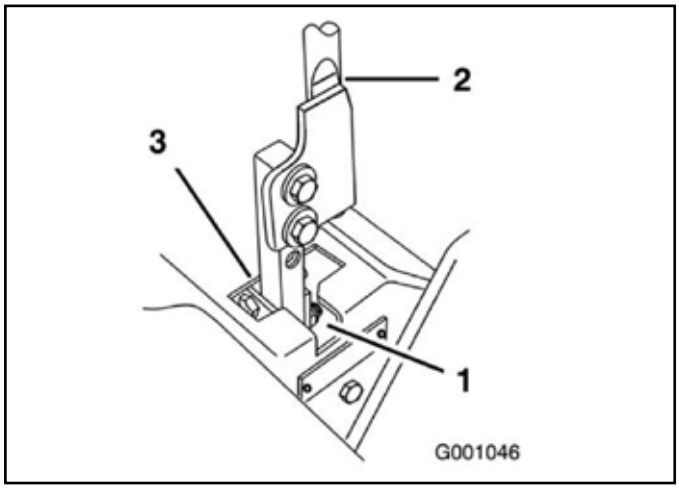

Fig 191 fig 50 G001046

1. Neutral locked position
2. Control lever
3. Neutral position

7. Pull lever back until the clevis pin (on arm below pivot shaft) just begins to contact the end of the slot (just beginning to put pressure on the spring) (Fig. 192).

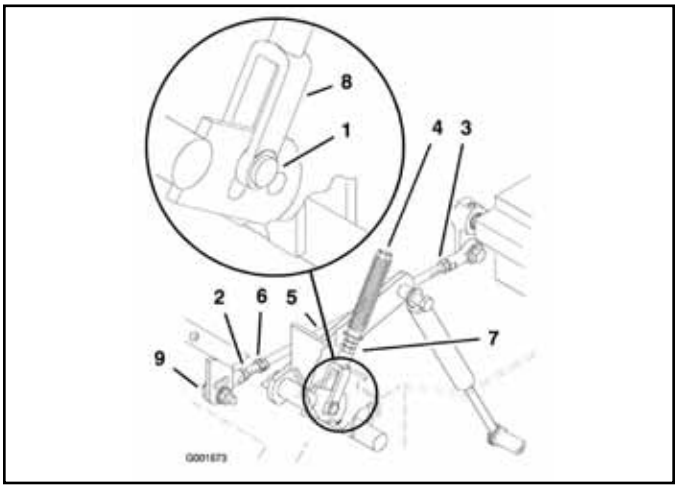

Fig 192 fig 51 G001673

1. Clevis pin in slot
2. Nut
3. Nut - LH thread
4. Adjustment bolt
5. Pump rod
6. Double nuts
7. Jam nut
8. Yoke
9. Ball joint

8. Check where the control lever is relative to the notch on the console (Fig. 000). It should be centered allowing lever to pivot outward to neutral lock position. (fig 50)

9. If adjustment is needed, loosen the nut and jam nut securing the yoke (Fig. 000). fig 51

10. Apply slight rearward pressure on the motion control lever, turn the head of the adjustment bolt in the appropriate direction until the control lever is centered in neutral lock position (Fig. 191).

Note: Keeping rearward pressure on the lower lever will keep the pin at the end of the slot and allow the adjustment bolt to move the lever to the appropriate position.

11. Tighten the nut and jam nut (Fig. 192).

12. Repeat on the opposite side of the machine.

Setting the Hydraulic Pump Neutral

Note: Adjust handle neutral before making the following adjustment. See Adjusting the Handle Neutral, page x-xx.

Note: This adjustment must be made with the drive wheels turning.

1. Raise the frame and block up the machine so drive wheels can rotate freely (Fig. 193).

Fig 193 PICT-0013a rev

2. Slide the seat fully forward, unlatch the seat and tilt the seat forward.

3. Disconnect the electrical connector at the seat switch located between the two hydraulic pumps. Temporarily install a jumper wire across the terminals in the wiring harness connector (Fig. 194).

Fig 194 PICT-0014a

Setting the LH Hydraulic Pump Neutral

1. Start the engine, open the throttle 1/2 way and release parking brake.

Note: The motion control lever must be in neutral while making any adjustments.

2. Adjust the pump rod length by rotating the knob in the appropriate direction, until the wheel is still or slightly creeping in reverse (Fig. 195).

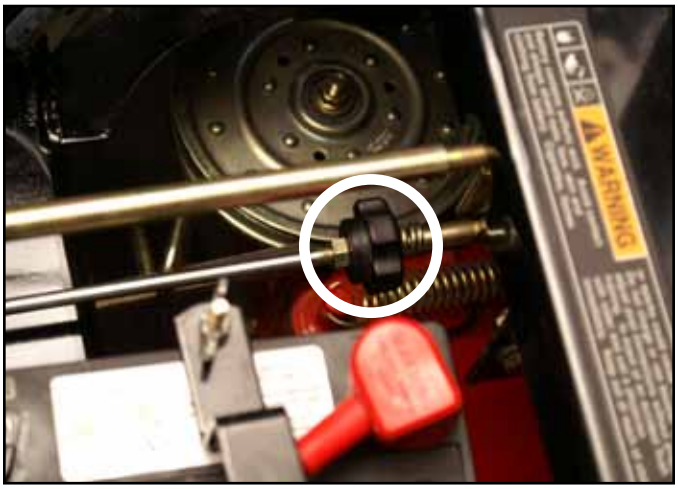

Fig 195 PICT-0015a

3. Move the motion control lever forward and reverse, then back to neutral. The wheel must stop turning or slightly creep in reverse.

4. Run the engine at full speed. Make sure wheel remains stopped or slightly creeps in reverse; adjust if necessary.

Setting the RH Hydraulic Pump Neutral

1. Loosen the locknuts at the ball joints on the pump control rod (Fig. 196).

Fig 196 PICT-0016a rev

2. Start the engine, open throttle 1/2 way and release parking brake.

Note: The motion control lever must be in neutral while making any adjustments.

Note: The front nut on the pump rod has left-hand threads.

3. Adjust the pump rod length by rotating double nuts on the rod, in the appropriate direction, until the wheel is still or slightly creeps in reverse (Fig. 197).

Fig 197 PICT-0016a rev

4. Move the motion control lever forward and reverse, then back to neutral. The wheel must stop turning or slightly creep in reverse.

5. Run the engine at full speed. Make sure the wheel remains stopped or slightly creeps in reverse; adjust if necessary.

6. Tighten the locknuts at the ball joints.

7. After both pump neutrals are set, shut off the machine.

8. Remove the jumper wire from the wire harness connector and plug the connector into the seat switch.

9. Reinstall the seat rod and lower the seat into position.

10. Remove the jack stands.

Adjusting the Tracking

The left hand pump has a knob for adjusting the tracking (Fig. 198).

Fig 198 PICT-0015a

1. Push both control levers forward the same distance (Fig. 199). The machine should travel in a straight line. If not, proceed to step 2.

Fig 199 PICT-0018a

2. Stop the machine and set the parking brake.

3. Unlatch the seat and tilt the seat forward to access the tracking knob.

Note: Determine the left and right sides of the machine from normal operating position.

4. To make the machine go right, turn the knob towards the right side of the machine (Fig. 200).

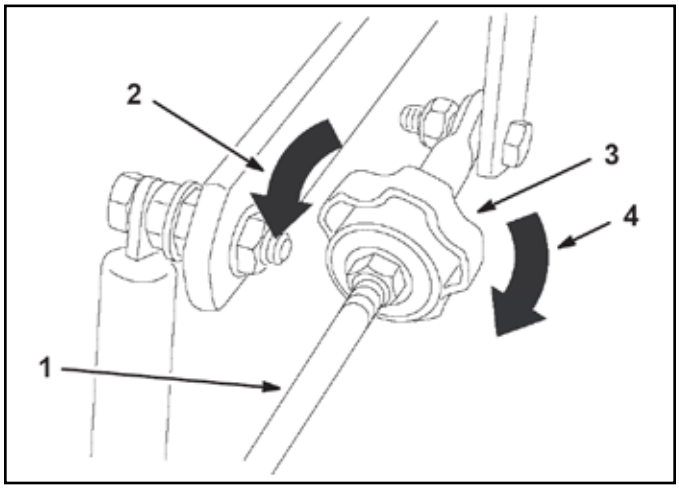

Fig 200 fig. 57 m-6280

1. Pump rod
2. Turn this way to track left
3. Tracking knob
4. Turn this way to track right

5. To make the machine go left, turn the knob towards the left side of the machine (Fig. 000, above)

6. Repeat this adjustment until the tracking is correct.

Purging the Hydraulic System

The traction system is self bleeding; however, it may be necessary to bleed the system if fluid is changed or after work is performed on the system.

1. Raise the machine so the wheels are off the ground and supported with jack stands (Fig. 201).

Fig 201 PICT-0013a rev

2. Start the engine and run at low idle speed. Slowly engage the motion control lever. If the wheel does not rotate immediately, it may be necessary to spin the wheel by hand to start purging air that is trapped in the system (Fig. 202).

Fig 202 PICT-0019a

3. When the wheel begins to spin on its own, keep it engaged until the wheel drives smoothly (minimum 2 minutes).

4. Check the hydraulic fluid level and add fluid as required to maintain proper level.

5. Repeat this procedure on the opposite wheel.

Hydraulic Flow Testing Procedure

Note: Cleanliness is a key factor in successful flow testing of the hydraulic system. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals. Protect all exposed sealing areas and open cavities from damage and foreign material.

Flow tester shown in this procedure, P/N 70661, contact your Distributor Sales Manager to order.

1. Lift the back of the machine so the rear tires (left and right) are off the ground. Place jack stands under the rear frame to support the unit. Remove the rear wheel from side of machine being flow tested; in this case, the left rear wheel is removed (Fig. 203).

Note: Be careful not to place jack stands near any moving parts or areas not capable of supporting the weight of the machine.

Fig 203 PICT-0020a

2. Clean all dirt and debris away from the hydraulic line fittings. Remove the hydraulic lines. Make sure you mark which hydraulic line goes to which fitting on the wheel motor. If the hydraulic lines are reversed, the motor will operate in the opposite direction (Fig. 204).

Fig 204 PICT-0021a

3. Loosen hydraulic lines at the pump to obtain enough clearance to connect flow tester to the hydrostatic high pressure lines (Fig. 205). Retighten fittings at the pump.

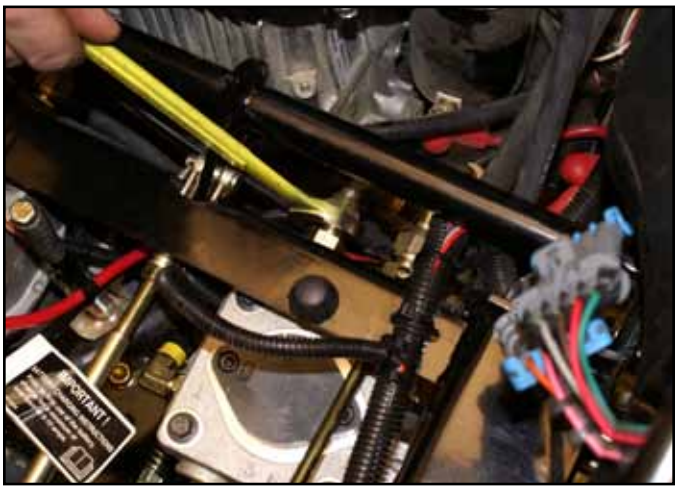

Fig 205 PICT-0022a

4. Connect the hydraulic hose fittings to the hydraulic flow tester and tighten the fittings (Fig. 206). If the flow tester is not bidirectional, make sure to connect hoses correctly.

Fig 206 PICT-0023a

5. Check the hydraulic reservoir and fill as needed with Mobil 1 Extended Performance, 15w50 oil.

6. Disconnect the electric PTO clutch from the wiring harness to prevent accidental engagement of the mower deck.

7. Disconnect the seat switch from the harness. Temporarily install a jumper wire across the harness (Fig. 207). Move the seat back to the operating position.

Fig 207 PICT-0014a

8. Verify the restrictor valve on the hydraulic flow tester is in the fully “Opened” position.

9. Start the machine. Run the unit for approximately 5 minutes to warm the oil in the hydrostatic pumps.

10. Release the parking brake and bring both levers to the inside neutral position. Run the engine at full RPM.

11. Stroke the left hand hydrostatic lever fully forward. Very slowly, rotate the “T” handle of the adjustable flow tester restrictor valve until the pressure gauge reaches 300 psi (21 bar). Record the measured flow (gallons/liters per minute).

12. With the unit at full engine speed, slowly rotate the “T” handle of the flow tester restrictor valve clockwise until the pressure gauge reads approximately 1000 to 1200 psi (69 to 83 bar).

CAUTION: DO NOT operate the machine for extended period of time at high pressure.

13. Record the difference of “flow droop” of the pump. For the Hydro-Gear 10A and BDP 12 pump, maximum allowable “flow droop” is 1.5 gpm (6.8 liters/min). Any droop greater than 1.5 gpm (6.8 liters/min) is considered unacceptable and the pump should be replaced, barring any other potential causes for the pressure drop.

14. Return the motion control lever to neutral position and return the levers to the neutral lock position. Engage the parking brake. Slow the engine speed to idle and turn the ignition switch to the OFF position.

15. Disconnect the hydraulic flow tester from the hydraulic lines.

16. Reconnect the hydraulic lines to the wheel motor. Tighten the fittings.

17. Tighten the hydraulic lines at the pump.

18. Check the hydraulic reservoir and fill as necessary to the “HOT” level mark. See, Checking the Hydraulic Fluid, page x-xx.

19. Reinstall the rear tire and lower the unit to the ground. Remove the temporary jumper cable for the seat and reconnect the seat switch. Reconnect the electric PTO clutch connector.

Pushing the Machine by Hand

Important: Always push the machine by hand. Never tow the machine because hydraulic damage may occur.

1. Disengage the power take off (PTO) and turn the ignition key to OFF. Move the levers to the neutral position and apply the parking brake.

2. To hand push, rotate the by-pass valves counter-clockwise 1 turn. This allows hydraulic fluid to by-pass the pump enabling the wheels to turn (Fig. 208).

Important: Do not rotate the by-pass valves more than 1 turn or the valves can come out of the body and cause fluid to run out.

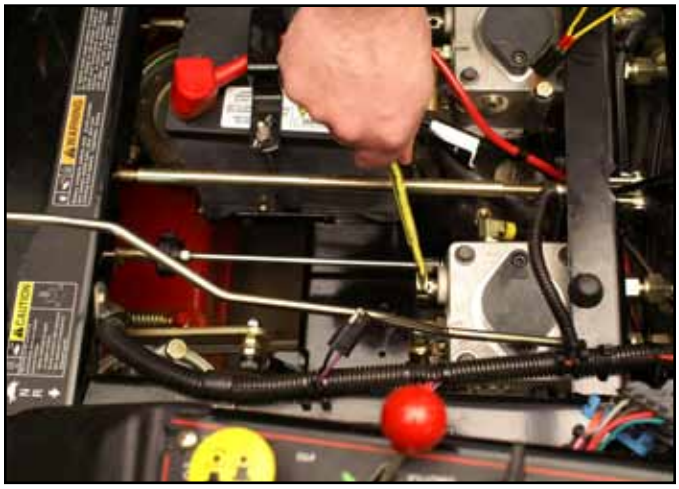

Fig 208 PICT-0024a

3. Disengage the parking brake before pushing.

Changing to Machine Operation

1. Rotate the by-pass valves clockwise 1 turn to operate the machine (Fig. 209).

Note: Do not over-tighten the by-pass valves.

Note: The machine will not drive unless the by-pass valves are turned in.

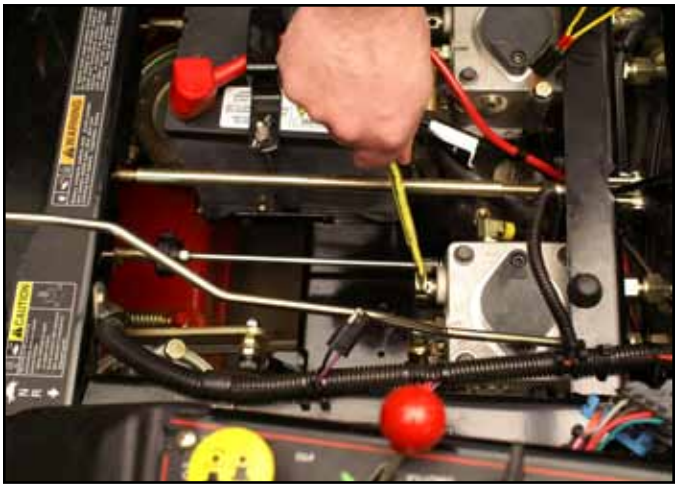

Fig 209 PICT-0024a

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Kawasaki FH580V 19 hp Engine Removal

1. Remove the battery negative cable from the battery.
2. Disconnect the choke cable by removing the top clamp (Fig. 210).

Note: Rear Bumper removed for clarity.

Fig 210 PICT-0003b

3. Disconnect the throttle cable by removing the bottom clamp (Fig. 211).

Fig 211 PICT-0004b

4. Disconnect the oil pressure switch harness (Fig. 212).

Fig 212 PICT-0008c

5. Remove the positive (red) wire from the starter (Fig. 213).

Fig 213 PICT-0009c

6. Remove the (violet) wire from the voltage rectifier/ regulator (Fig. 214).

Fig 214 PICT-0010c

7. Disconnect the pink wire from the green wire connected to the fuel solenoid (Fig. 215).

Fig 215 PICT-0011c

8. Disconnect the white wire from the black wire connected to the engine magneto (Fig. 216).

Fig 216 PICT-0012c

9. Turn the fuel shot-off valve to the “on” position (Fig. 217).

Fig 217 PICT-0406

10. Remove the fuel line clamp holding the fuel line to the fuel pump. Remove the fuel line from the fuel pump (Fig. 218).

Fig 218 PICT-0013c

11. Remove the Mower Deck Drive Belt. Refer to Replacing the Mower Deck Drive Belt on page x-xx.

12. Remove the plastic tie holding the clutch harness to frame (Fig. 219).

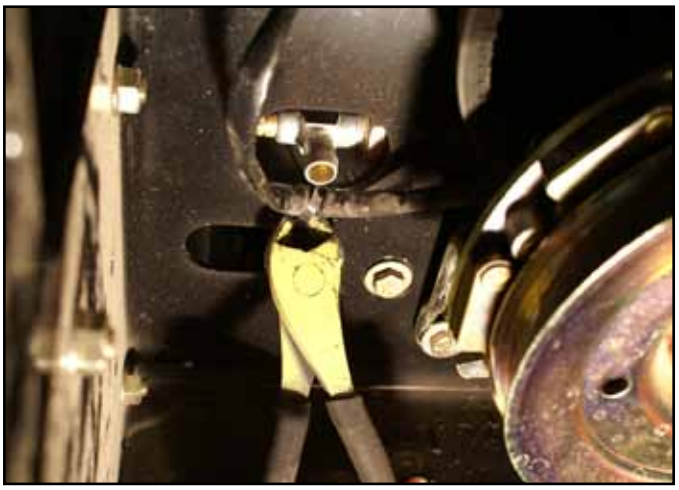

Fig 219 PICT-0099a

13. Unplug the clutch pigtail harness from the main harness (Fig. 220).

Fig 220 PICT-0100a

14. Remove the center bolt and two spring washers holding the electric PTO clutch (Fig. 221).

Fig 221 PICT-0014c

15. Remove the electric PTO clutch (Fig. 222).

Fig 222 PICT-0015c

16. With a spring puller, remove the extension spring from the idler arm assembly and remove the cog belt from the pump drive and idler pulleys (Fig. 223).

Fig 223 PICT-0016c

17. Remove the drive belt from the pulley (Fig. 224).

Fig 224 PICT-0017c

18. Remove the pulley (Fig. 225).

Fig 225 PICT-0018c

19. Remove the five engine mounting bolts (Fig. 226).

Note: The left rear mounting bolt has 4 ground wires attached.

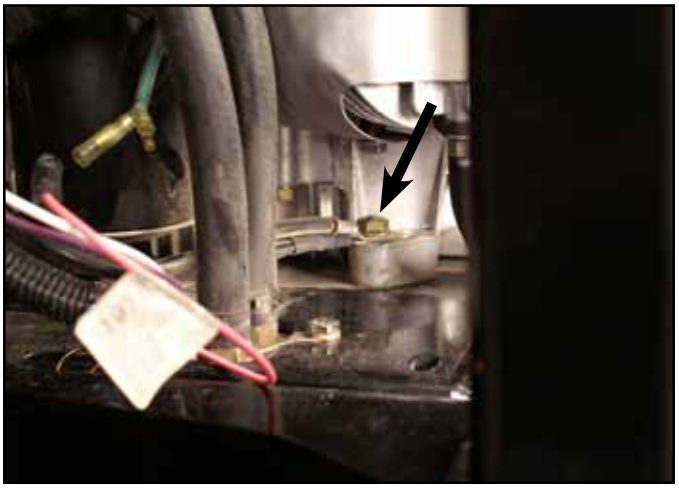

Fig 226 PICT-0019c

20. Connect a lift chain to the lift points on the engine. Raise the engine from the frame (Fig. 227).

Fig 227 PICT-0020c

Kawasaki FH580V 19 hp Engine Installation

1. Lower the engine to the frame (Fig. 228).

Fig 228 PICT-0021c

2. Install the five engine mounting bolts.

   a. Install the clutch stop rod in the right rear engine mounting bolt hole (Fig. 229). Do not tighten.

Fig 229 PICT-0022c

b. Install the four ground wires in the left rearmost mounting bolt hole (Fig. 230).

Fig 230 PICT-0019c

3. Apply anti-seize compound to the engine shaft (Fig. 231).

Fig 231 PICT-0025c

4. Apply a thread-locking compound to the clutch retainer bolt (Fig. 232).

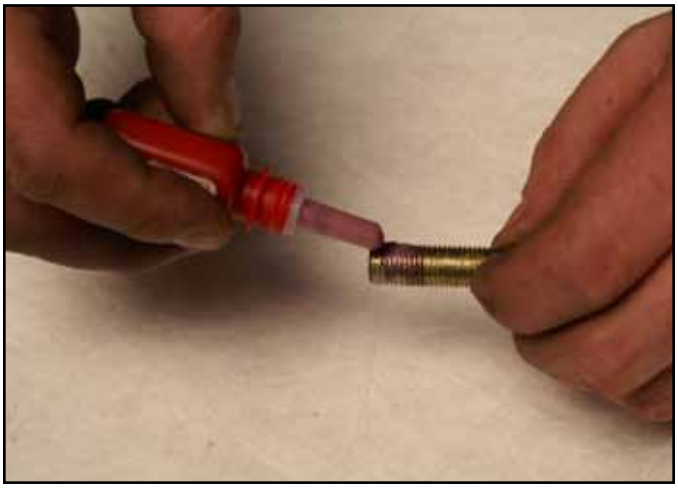

Fig 232 PICT-0026c

5. Install the hydro pump drive pulley and the electric PTO clutch with the bolt and spring washers. Torque the bolt to 55 ft-lbs. (74.6 Nm) (Fig. 233).

Fig 233 PICT-0027c

6. Install the hydro pump drive belt (Fig. 234).

Fig 234 PICT-0106a rev

7. Align the clutch stop rod with the slot of the electric PTO clutch (Fig. 235). Rotate the clutch stop rod into the slot on the clutch. Tighten the stop rod mounting bolt.

Fig 235 PICT-0104a

8. Install the mower drive belt. Refer to Replacing the Mower Deck Drive Belt on page 7-24.

9. Plug the clutch pigtail harness into the main harness (Fig. 236).

Fig 236 PICT-0100a

10. Replace the plastic tie holding the clutch harness to frame (Fig. 237).

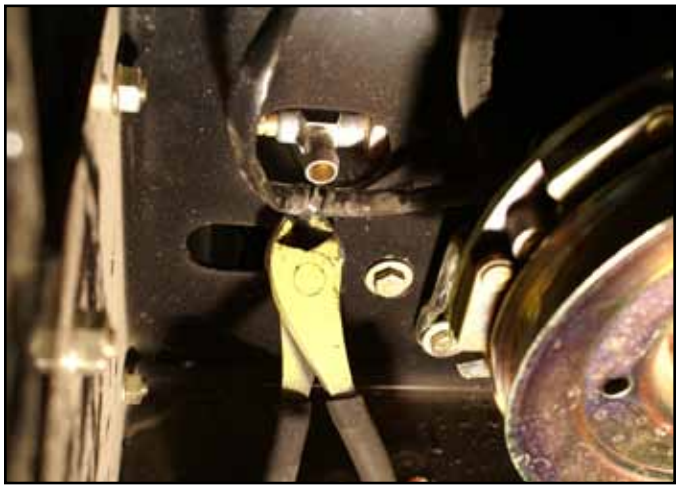

Fig 237 PICT-0099a

11. Install the fuel line clamp that holds the fuel line to the fuel pump. Reinstall the fuel line to the fuel pump (Fig. 238).

Fig 238 PICT-0013c

12. Reconnect the white wire to the black wire that connects to the engine magneto (Fig. 239).

Fig 239 PICT-0012c

13. Reconnect the pink wire to the green wire that connects to the fuel solenoid (Fig. 240).

Fig 240 PICT-0011c

14. Reconnect the (violet) wire to the voltage rectifier/ regulator (Fig. 241).

Fig 241 PICT-0010c

16. Reconnect the oil pressure switch harness (Fig. 242).

Fig 242 PICT-0008c

15. Reconnect the positive (red) wire to the starter (Fig. 243).

Fig 243 PICT-0009c

17. Reconnecting the choke cable:

    a. Reconnect the z-bend of the choke cable to the choke linkage (Fig. 244).

Note: The air cleaner cover has been removed for clarity.

Fig 244 PICT-0030c

b. With the choke knob in the full down position (Fig. 245) and the choke linkage in the full open position (left), tighten the cable clamp (Fig. 246).

Fig 245 PICT-0031c

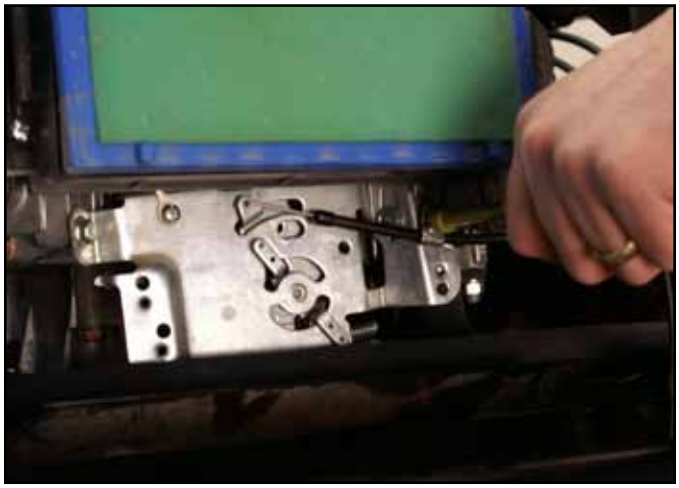

Fig 246 PICT-0032c

18. Reconnect the throttle cable:

a. Reconnect the z-bend of the throttle cable to the throttle linkage (Fig. 247).

Fig 247 PICT-0034c

b. Position the throttle control lever so that there is approximately 1/2” (12.7mm) between the lever and the full throttle position of the throttle slot (Fig. 248).

Fig 248 PICT-0035c

c. Pull the cable housing until the throttle linkage is in the full throttle position. Tighten the cable clamp (Fig. 249).

Fig 249 PICT-0036c

19. Connect the battery negative cable.

Kohler V-Twin 20 hp Engine Removal

1. Remove the battery negative cable from the battery.
2. Raise the rear wheels of the machine off the ground and support frame with jack stands. Remove both rear wheels.
3. Remove the eight bolts, washers and nuts that hold the notched weight onto the rear of the machine. Remove the notched weight from the rear of the machine (Fig. 250).

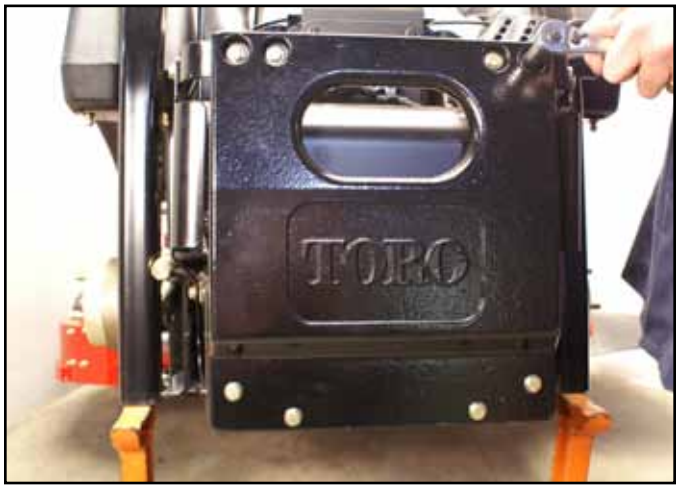

Fig 250 PICT-0265

4. Remove the 4 bolts and nuts that hold the tailpipe guard to the right hand guard strap (Fig. 251).

Fig 251 PICT-0267

5. Remove the three sets of fasteners holding the right hand muffler guard and guard strap to the frame (Fig. 252).

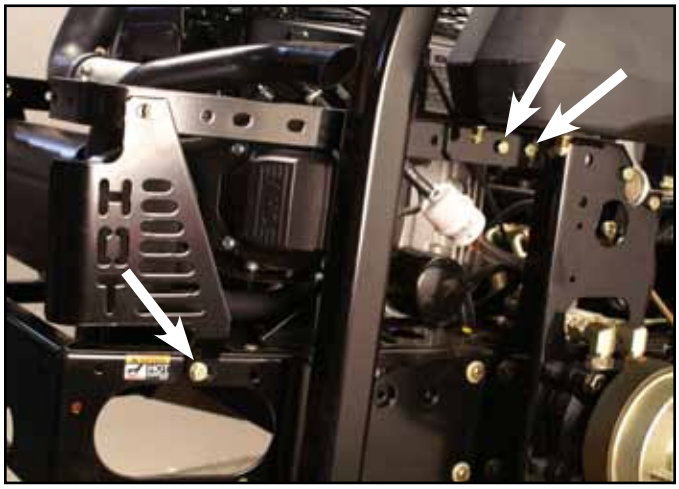

Fig 252 PICT-0269

6. Remove the right hand muffler guard and guard strap (Fig. 253).

Fig 253 PICT-0275

7. Remove the two sets of fasteners holding the hydraulic oil tank to the guard strap and fuel tank support (Fig. 254).

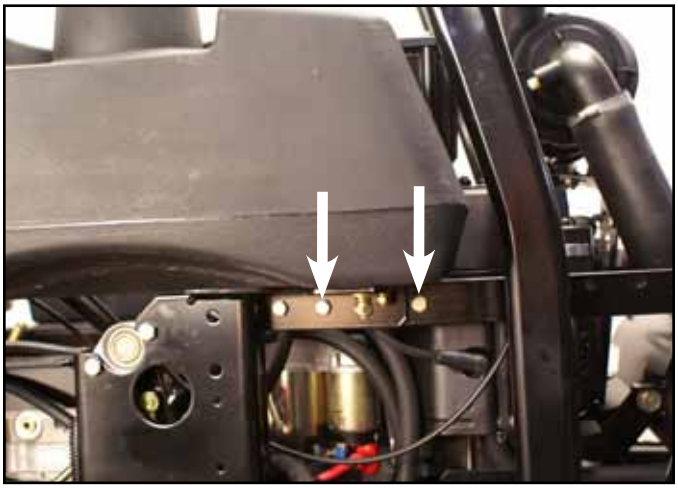

Fig 254 PICT-0272

8. Remove the two sets of fasteners holding the left hand guard strap and muffler guard to the frame (Fig. 255).

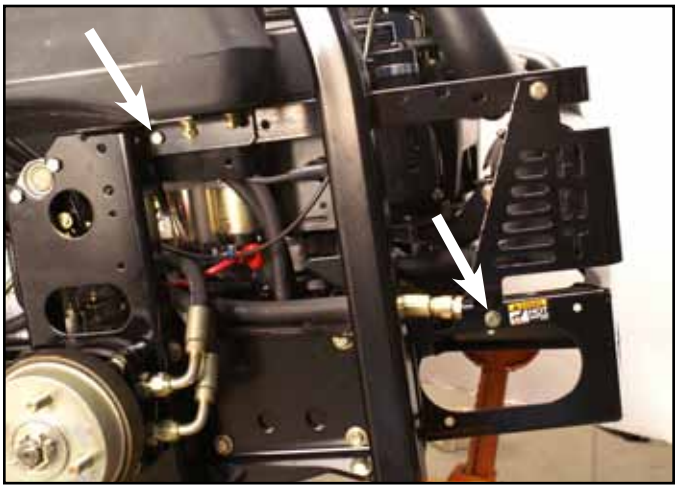

Fig 255 PICT-0273

9. Remove the left hand guard strap and muffler guard (Fig. 256).

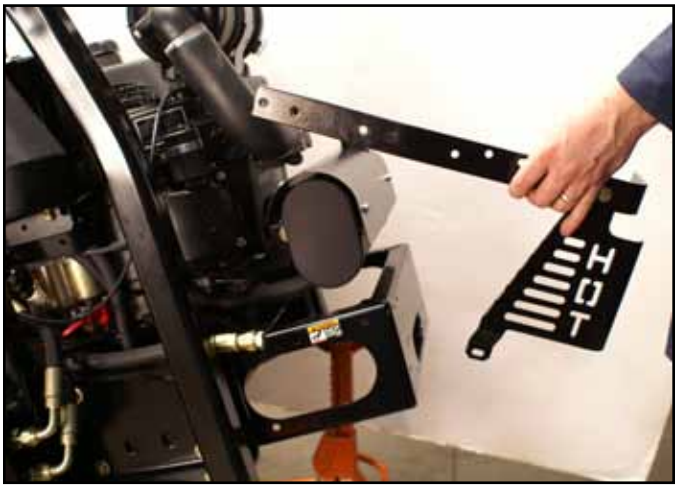

Fig 256 PICT-0274

10. Loosen the left clamp and disconnect the choke cable (Fig. 257).

Fig 257 PICT-0279

11. Loosen the right clamp and disconnect the throttle cable (Fig. 258).

Fig 258 PICT-0280

12. Turn the fuel shut-off valve to the “Off” position (Fig. 259).

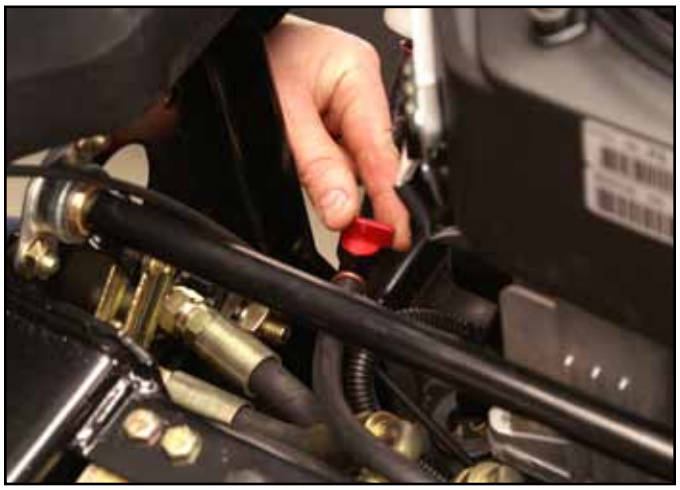

Fig 259 PICT-0281

13. Remove the fuel hose clamp, then the fuel hose located at the fuel pump (Fig. 260).

Fig 260 PICT-0282

14. Remove the red wires located on the starter solenoid (Fig. 261).

Fig 261 PICT-0283

15. Remove the blue wire located on the starter solenoid (Fig. 262).

Fig 262 PICT-0284

16. Unplug the engine wiring harness (Fig. 263).

Fig 263 PICT-0285

17. Remove the mower drive belt from the electric PTO clutch, refer to Replacing the Mower Deck Drive Belt page x-xx.

18. Unplug the clutch pigtail harness from the main harness (Fig. 264).

Fig 264 PICT-0100a

19. Remove the center bolt and two spring washers holding the electric PTO clutch to the engine crankshaft (Fig. 265).

Fig 265 PICT-0014c

20. Remove the electric PTO clutch (Fig. 266).

Fig 266 PICT-0015c

21. With a spring puller, remove the extension spring from the idler arm assembly. Remove the cog belt from the pump drive and idler pulleys (Fig. 267).

Fig 267 PICT-0016c

22. Remove the drive belt from the engine pulley (Fig. 268).

Fig 268 PICT-0017c

23. Remove the engine pulley (Fig. 269).

Fig 269 PICT-0018c

24. Remove the 4 engine mounting bolts (Fig. 270).

Note: The left rear engine mounting bolt has 3 ground wires attached.

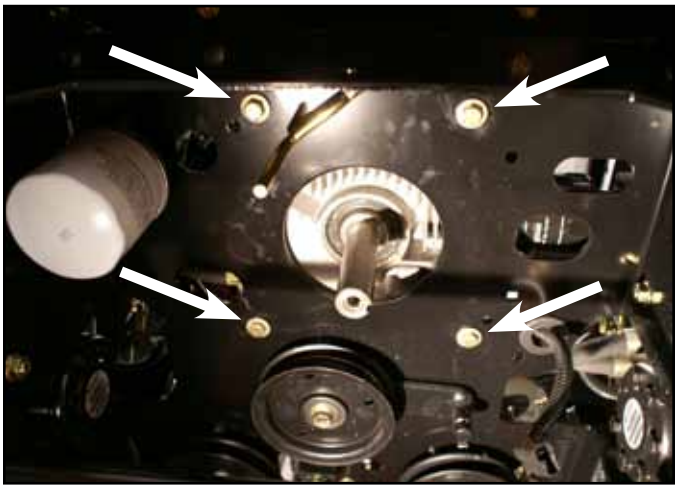

Fig 270 PICT-0287

25. Connect chains to the two lift points on the engine and raise the engine from the frame (Fig. 271).

Fig 271 PICT-0290

Kohler V-Twin 20 hp Engine Install

1. Lower the engine onto the frame. Install 4 bolts and spring washers through the frame and into the base of the engine. Tighten the bolts (Fig. 000). 0287 left

Note: The 3 ground wires attach to the left rear engine mounting bolt.

2. Apply anti-seize compound to the engine shaft (Fig. 272).

Fig 272 PICT-0025c

3. Apply a thread-locking compound to the clutch retainer bolt (Fig. 273).

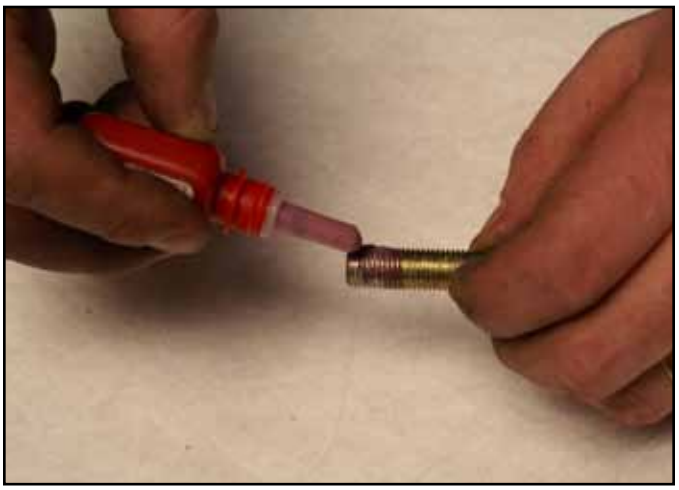

Fig 273 PICT-0026c

4. Install the engine pulley (Fig. 274).

Fig 274 PICT-0018c

5. Install the drive belt onto the engine pulley (Fig. 275).

Fig 275 PICT-0017c

6. Install the cog belt onto the pump drive and idler pulleys. With a spring puller, install the extension spring onto the idler arm assembly (Fig. 276).

Fig 276 PICT-0016c

7. Install the electric PTO clutch (Fig. 277).

Fig 277 PICT-0015c

8. Install the center bolt and two spring washers that hold the electric PTO clutch to the engine crankshaft (Fig. 278).

Fig 278 PICT-0014c

9. Torque the center bolt to 55 ft-lbs. (74.6 Nm) (Fig. 279).

Fig 279 PICT-0027c

10. Plug the clutch pigtail harness into the main harness (Fig. 280).

Fig 280 PICT-0100a

11. Install the mower drive belt onto the electric PTO clutch. Refer to Replacing the Mower Deck Drive Belt page 7-24.

12. Plug in the engine wiring harness (Fig. 281).

Fig 281 PICT-0285

13. Connect the blue wire onto the starter solenoid (Fig. 282).

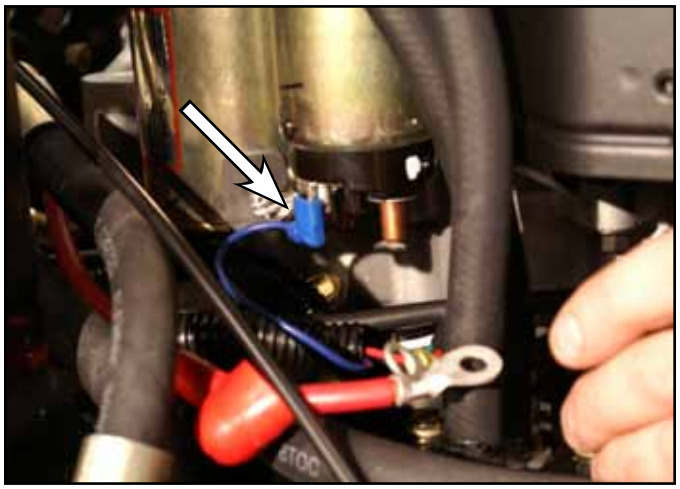

Fig 282 PICT-0284

14. Connect the red wires onto the starter solenoid (Fig. 283).

Fig 283 PICT-0283

15. Connect the fuel hose clamp onto the fuel hose at the fuel pump (Fig. 284).

Fig 284 PICT-0282

16. Turn the fuel shut-off valve to the “on” position (Fig. 285).

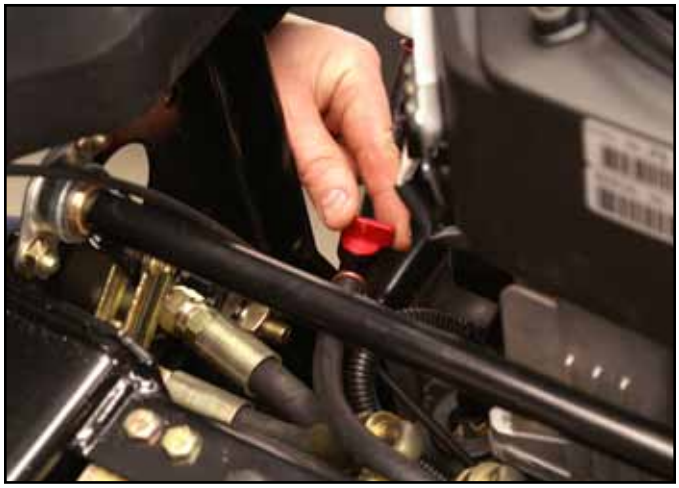

Fig 285 PICT-0281

17. Reconnect the throttle cable:

    a. Position the throttle control lever so that there is approximately 1/2” (12.7mm) between the lever and the full throttle position of the throttle slot (Fig. 286).

Fig 286 PICT-0293

    b. Reconnect the z-bend of the throttle cable to the throttle linkage (the hole furthest from the pivot point). Pull the cable housing until the throttle linkage is in the full throttle position. Tighten the cable clamp (Fig. 287).

Fig 287 PICT-0294

18. Reconnecting the choke cable:

    a. Push the choke knob into the full down position (Fig. 288).

Fig 288 PICT-0296

    b. Reconnect the z-bend of the choke cable to the choke linkage. The choke linkage should be in the full open position (right). Tighten the cable clamp (Fig. 289).

Fig 289 PICT-0297

19. Install the left hand guard strap and muffler guard to the frame using the two sets of fasteners (Fig. 290).

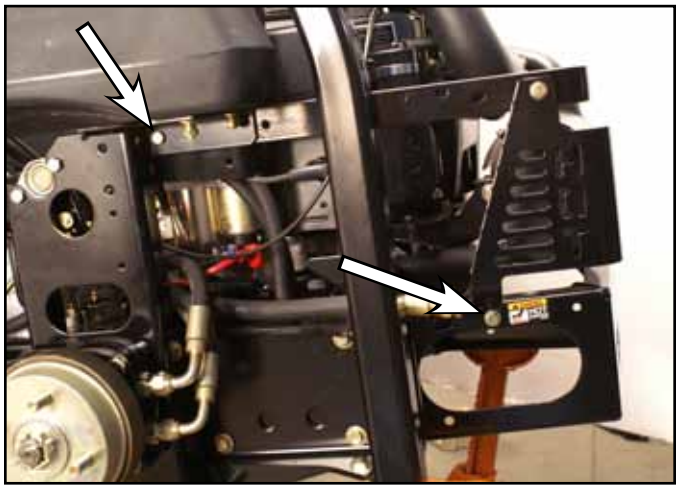

Fig 290 PICT-0273

20. Install the hydraulic oil tank to the guard strap and fuel tank support using the two sets of fasteners (Fig. 291).

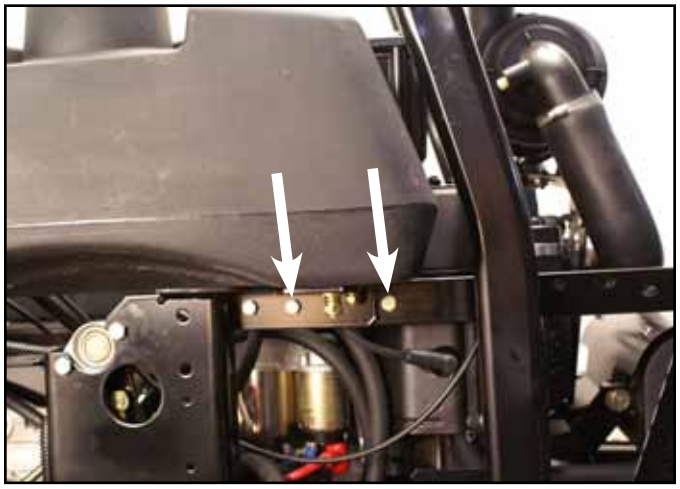

Fig 291 PICT-0272

21. Install the right hand muffler guard and strap guard using three sets of fasteners (Fig. 292).

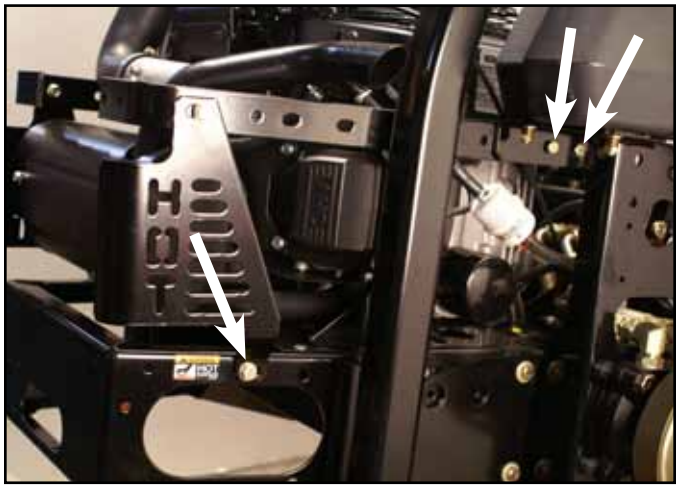

Fig 292 PICT-0269

22. Install the tailpipe guard to the right hand guard strap using two bolts and nuts on the right hand side of the machine (Fig. 293).

Fig 293 PICT-0267

23. Install the notched weight onto the rear of the machine using eight bolts, washers and nuts (Fig. 294).

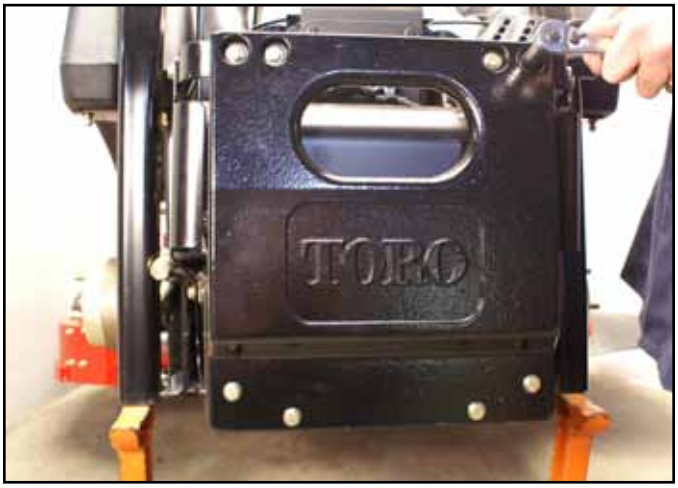

Fig 294 PICT-0265

24. Install the rear wheels. Lower the rear of the machine.

25. Reconnect the battery negative cable.

Kohler 18 hp Single Cylinder Removal

1. Remove the battery negative cable from the battery.
2. Raise the rear wheels of the machine off the ground and support the frame with jack stands. Remove both rear wheels.
3. Remove the 6 bolts, washers and nuts holding the rear bumper to the frame (Fig. 295). Remove the rear bumper.

Fig 295 PICT-0321

4. Loosen the rear cable clamp and disconnect the choke cable (Fig. 296).

Fig 296 PICT-0323

5. Remove the front cable clamp and disconnect the throttle cable (Fig. 297).

Fig 297 PICT-0324

6. Remove the green oil sending wire from the oil pressure switch (Fig. 298).

Fig 298 PICT-0325

7. Unplug the magneto and charging circuit wire harness (Fig. 299).

Fig 299 PICT-0327

8. Disconnect the three ground wires located at the right hand engine lift point (Fig. 300). Reinstall the engine lift bracket.

Fig 300 PICT-0328

9. Turn the fuel shut-off valve to the “off” position (Fig. 301).

Fig 301 PICT-0329

10. Remove the fuel hose clamp on the fuel hose located at the fuel pump (Fig. 302).

Fig 302 PICT-0330

11. Remove the red wires located on the starter solenoid (Fig. 303).

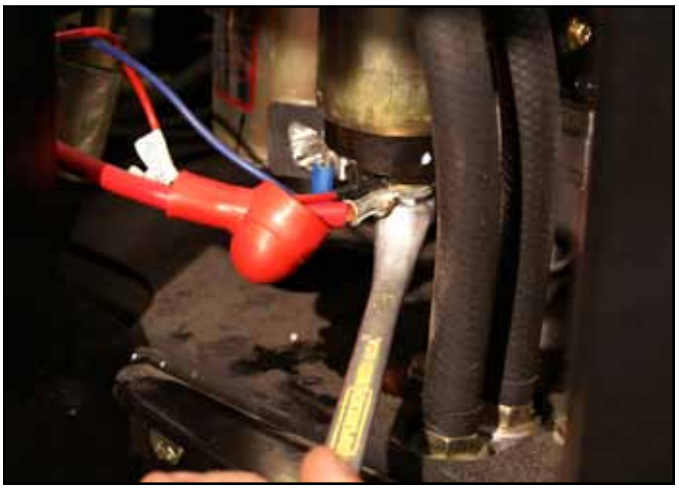

Fig 303 PICT-0331

12. Remove the blue wire located on the starter solenoid (Fig. 304).

Fig 304 PICT-0332

13. Remove the mower drive belt from the electric PTO clutch. Refer to Replacing the Mower Deck Drive Belt page x-xx.

14. Remove the plastic tie holding the clutch harness to frame (Fig. 305).

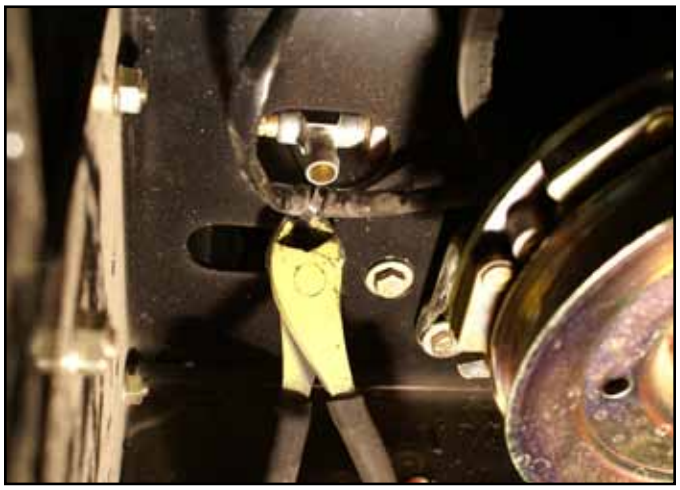

Fig 305 PICT-0099a

15. Unplug the clutch pigtail harness from the main harness (Fig. 306).

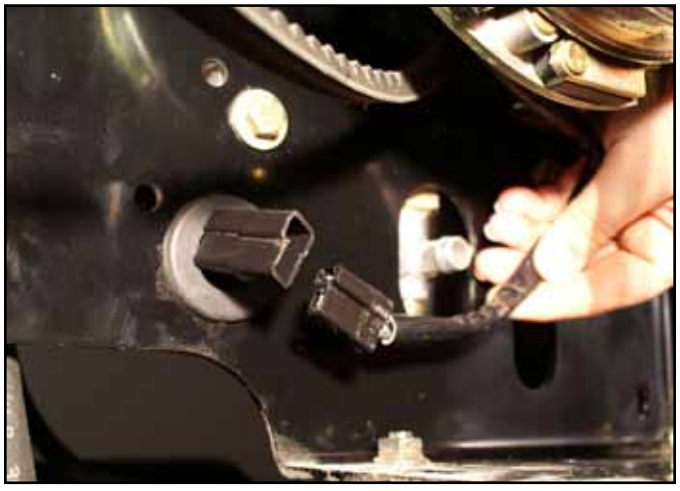

Fig 306 PICT-0100a

16. Remove the center bolt and two spring washers holding the electric PTO clutch to the engine crankshaft (Fig. 307).

Fig 307 PICT-0014c

17. Remove the electric PTO clutch (Fig. 308).

Fig 308 PICT-0015c

18. With a spring puller, remove the extension spring from the idler arm assembly and remove the cog belt from the pump drive and idler pulleys (Fig. 309).

Fig 309 PICT-0016c

19. Remove the drive belt from the engine pulley (Fig. 310).

Fig 310 PICT-0017c

20. Remove the engine pulley (Fig. 311).

Fig 311 PICT-0018c

21. Remove the 4 engine mounting bolts and washers (Fig. 312).

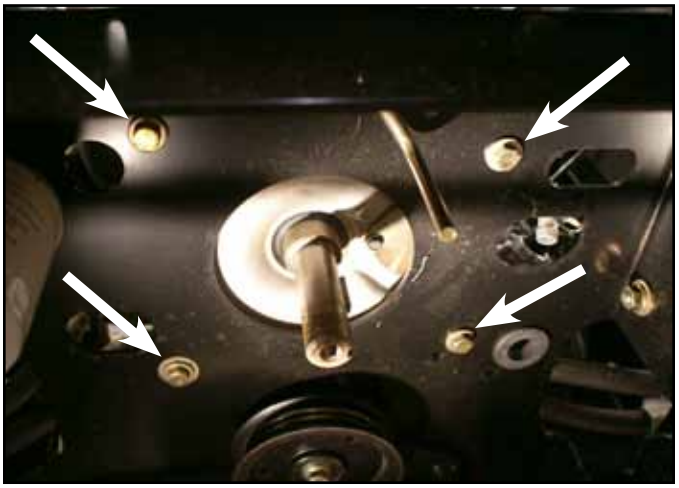

Fig 312 PICT-0334

22. Connect chains to the two lift points on the engine and raise the engine from the frame (Fig. 313).

Fig 313 PICT-0341

Kohler 18 hp Single Cylinder Install

1. Lower the engine onto the frame. Install 4 bolts and spring washers through the frame and into the base of the engine. Tighten the bolts.

2. Apply anti-seize compound to the engine crankshaft (Fig. 314).

Fig 314 PICT-0025c

3. Install the engine pulley (Fig. 315).

Fig 315 PICT-0018c

4. Install the drive belt onto the engine pulley (Fig. 316).

Fig 316 PICT-0017c

5. Install the cog belt onto the pump drive and idler pulleys. With a spring puller, install the extension spring onto the idler arm assembly (Fig. 317).

Fig 317 PICT-0016c

6. Install the electric PTO clutch (Fig. 318).

Fig 318 PICT-0015c

7. Apply a thread locking compound to the clutch retainer bolt (Fig. 319).

Fig 319 PICT-0026c

8. Install the center bolt and two spring washers that hold the electric PTO clutch to the engine crankshaft (Fig. 320).

Fig 320 PICT-0014c

9. Torque the center bolt to 55 ft-lbs. (Fig. 321).

Fig 321 PICT-0027c

10. Plug the clutch pigtail harness into the main harness (Fig. 322).

Fig 322 PICT-0100a

11. Replace the plastic tie holding the clutch harness to frame.

12. Install the mower drive belt onto the electric PTO clutch. Refer to Replacing the Mower Deck Drive Belt page 7-24.

13. Plug in the engine wiring harness (Fig. 323).

Fig 323 PICT-0283

14. Connect the red wires to the starter solenoid (Fig. 324).

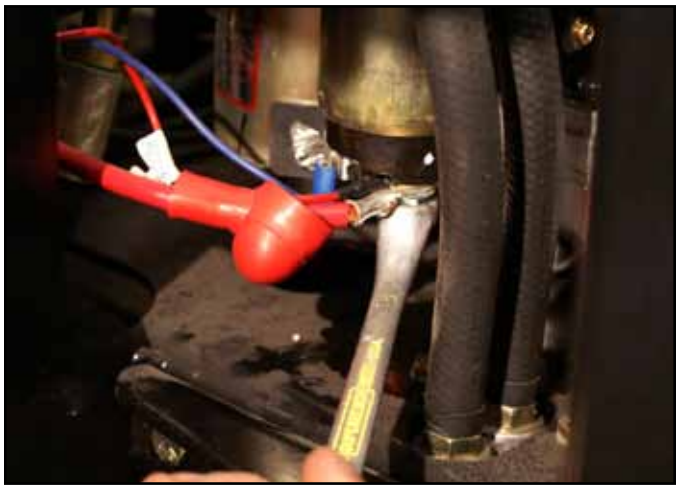

Fig 324 PICT-0331

15. Connect the fuel hose clamp onto the fuel hose located at the fuel pump (Fig. 325).

Fig 325 PICT-0330

16. Turn the fuel shut-off valve to the “On” position (Fig. 326).

Fig 326 PICT-0329

17. Connect the three ground wires located at the right hand engine lift point (Fig. 327). Reinstall the engine lift bracket.

Fig 327 PICT-0328

18. Plug in the magneto and charging circuit wire harness (Fig. 328).

Fig 328 PICT-0327

19. Connect the green oil sending wire to the oil pressure switch (Fig. 329).

Fig 329 PICT-0325

20. Reconnecting the choke cable:

    a. Position the choke knob in the full down position (Fig. 330).

Fig 330 PICT-0296

b. Reconnect the z-bend of the choke cable to the choke linkage (the middle hole in the choke plate). The choke linkage should be in the full open position (up). Tighten the cable clamp (Fig. 331).

Fig 331 PICT-0342

21. Reconnect the throttle cable:

    a. Position the throttle control lever so that there is approximately 1/2" (12.7mm) between the lever and the full throttle position of the throttle slot (Fig. 332).

Fig 332 PICT-0293

b. Reconnect the z-bend of the throttle cable to the throttle linkage (the lowermost hole of the throttle plate). Push down on the throttle linkage to hold it in the wide open throttle (WOT) position. Tighten the cable clamp (Fig. 333).

Fig 333 PICT-0343 rev

22. Install the 6 bolts, washers and nuts holding the rear bumper to the frame (Fig. 334).

Fig 334 PICT-0321

23. Install the rear wheels. Lower the machine to the ground.

24. Connect the battery negative cable.

Z 100 Series FH580V (KAI) 19 hp Kawasaki Removal

1. Remove the battery negative cable from the battery.

2. Raise the rear wheels of the machine off the ground and support frame with jack stands. Remove both rear wheels.

3. Remove the four bolts and nuts that hold the tailpipe guard to the right hand guard strap and rear muffler guard (Fig. 335).

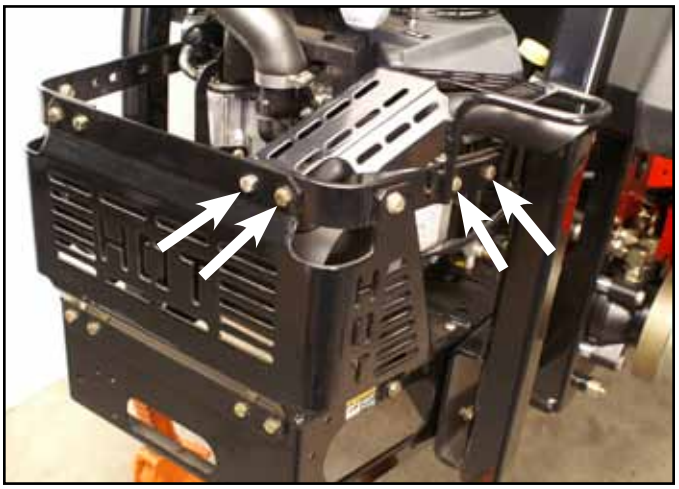

Fig 335 PICT-0397

4. Remove the two bolts and nuts holding the hydraulic oil tank to the guard strap and fuel tank support (Fig. 336).

Fig 336 PICT-0398

5. Remove the plastic tie holding the throttle and choke cable to the right hand guard strap (Fig. 337).

Fig 337 PICT-0399

6. Remove the 9 sets of fasteners holding the right hand muffler guard and guard strap to the frame. Remove the muffler guard assembly (Fig. 338).

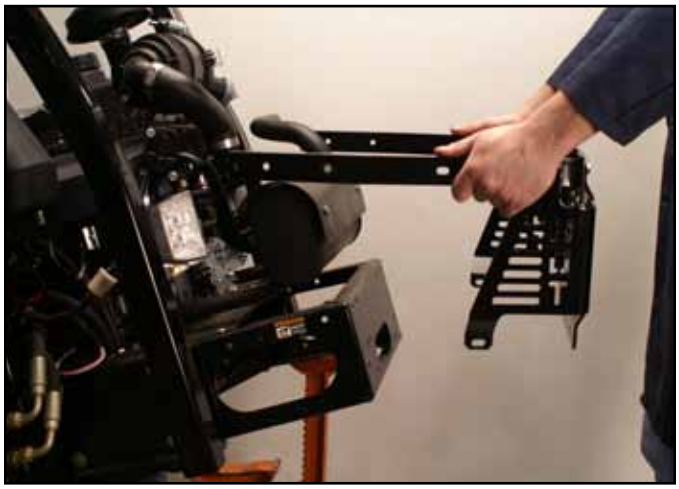

Fig 338 PICT-0400

7. Remove the top cable clamp and disconnect the choke cable (Fig. 339).

Fig 339 PICT-0401

8. Remove the bottom cable clamp and disconnect the throttle cable (Fig. 340).

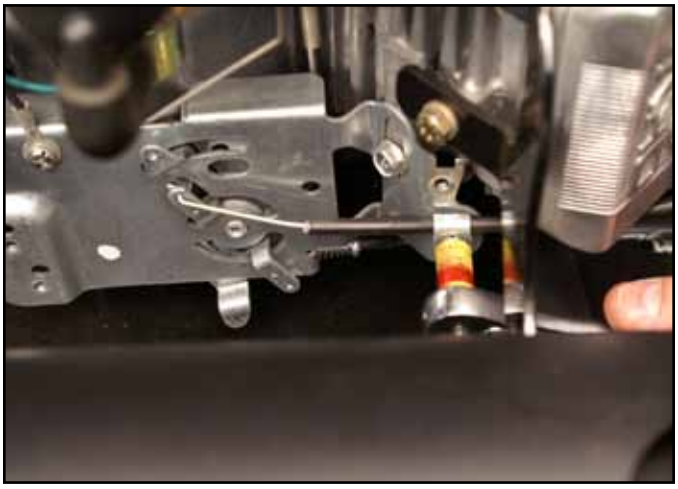

Fig 340 PICT-0402

9. Remove the green oil sending wire from the oil pressure switch (Fig. 341).

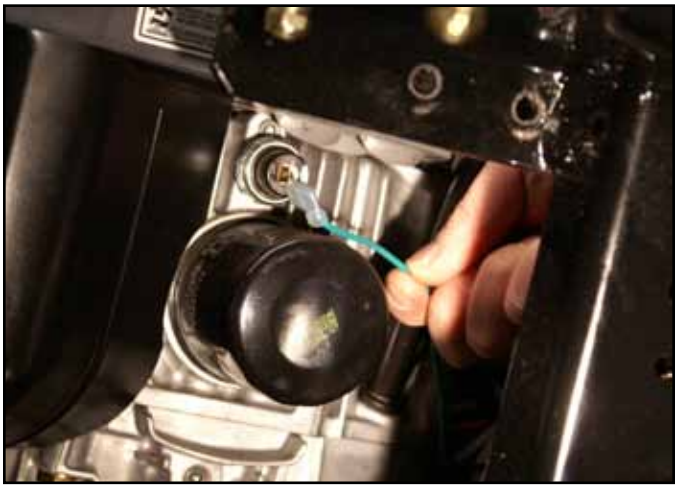

Fig 341 PICT-0404

10. Unplug the electric PTO clutch plug (Fig. 342).

Fig 342 PICT-0405

11. Turn the fuel shut-off valve to the “off” position (Fig. 343).

Fig 343 PICT-0406

12. Remove the fuel hose clamp on the fuel hose located at the fuel pump (Fig. 344).

Fig 344 PICT-0407

13. Unplug the violet wire from the B+ side of the regulator (Fig. 345).

Fig 345 PICT-0408

14. Unplug the pink wire from the green wire (fuel shut-off solenoid) and the white wire from the black wire (magneto) (Fig. 346).

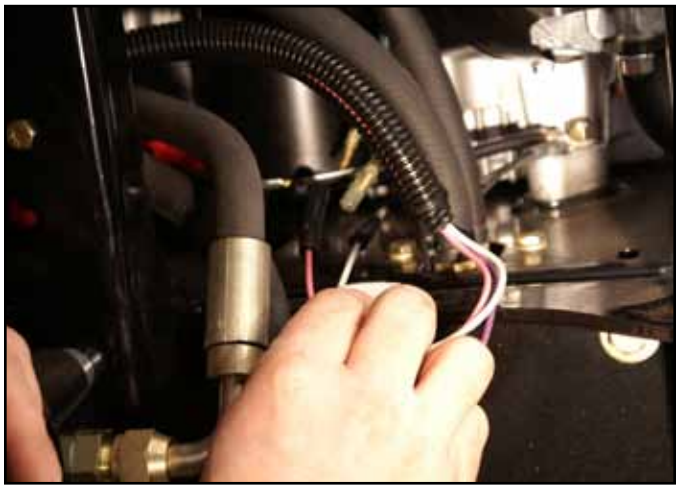

Fig 346 PICT-0409

15. Remove the red wire located on the starter solenoid (Fig. 347).

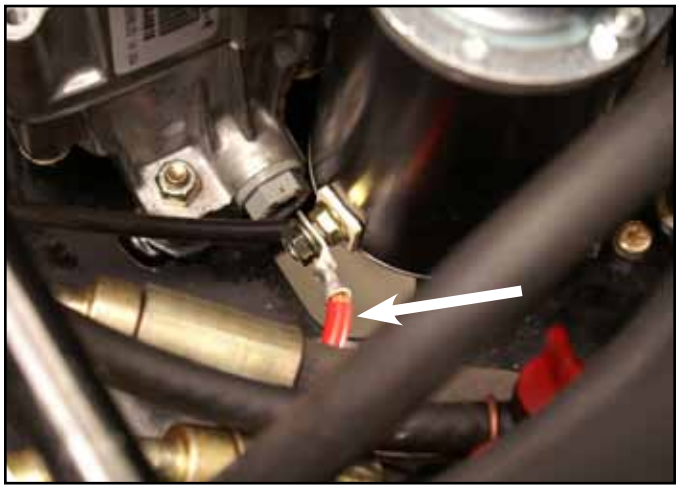

Fig 347 PICT-0413

16. With a spring puller, remove the extension spring from the mower deck (Fig. 348).

Fig 348 PICT-0375

17. Remove the belt from the electric PTO clutch (Fig. 349).

Fig 349 PICT-0122

18. Remove the center bolt and two spring washers holding the electric PTO clutch to the engine crankshaft (Fig. 350).

Fig 350 PICT-0014c

19. Remove the electric PTO clutch (Fig. 351).

Fig 351 PICT-0015c

20. With a spring puller, remove the extension spring from the idler arm assembly and remove the cog belt from the pump drive and idler pulleys (Fig. 352).

Fig 352 PICT-0016c

21. Remove the drive belt from the engine pulley (Fig. 353).

Fig 353 PICT-0017c

22. Remove the engine pulley, spacer and key (Fig. 354).

Fig 354 PICT-0414

23. Remove the 4 engine mounting bolts, washers and nuts (Fig. 355).

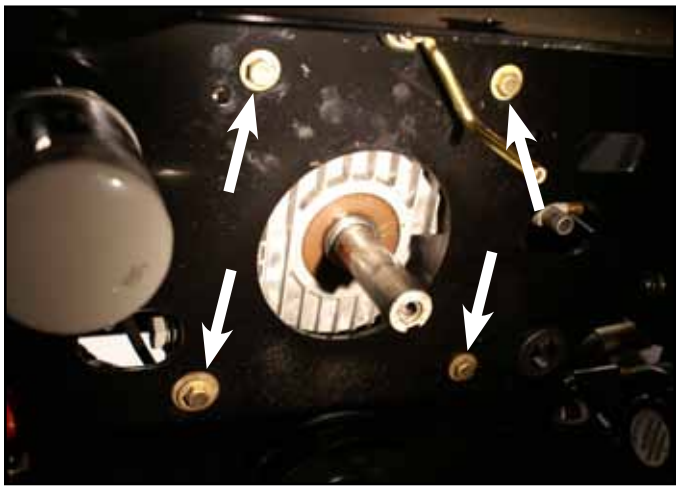

Fig 355 PICT-0416

24. Connect chains to the two lift points on the engine and raise the engine from the frame (Fig. 356).

Fig 356 PICT-0419

Z 100 Series FH580V (KAI) 19 hp Kawasaki Install

1. Lower the engine onto the frame. Install the 4 engine mounting bolts, washers and nuts through the frame and engine mounts. Tighten the bolts.

2. Apply anti-seize compound to the engine shaft (Fig. 357).

Fig 357 PICT-0025c

5

3. Install the engine pulley, spacer and key (Fig. 358).

Fig 358 PICT-0414

4. Install the drive belt onto the engine pulley (Fig. 359).

Fig 359 PICT-0017c

5. Install the cog belt onto the pump drive and idler pulleys. With a spring puller, install the extension spring onto the idler arm assembly (Fig. 360).

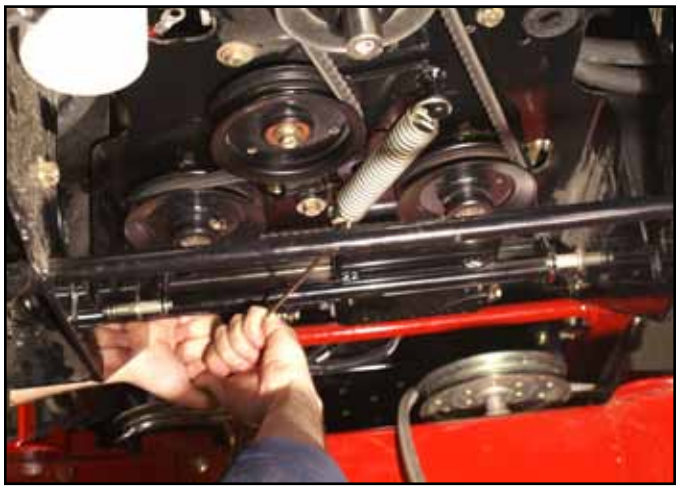

Fig 360 PICT-0016c

6. Install the electric PTO clutch (Fig. 361).

Fig 361 PICT-0015

7. Apply a thread-locking compound to the clutch retainer bolt (Fig. 362).

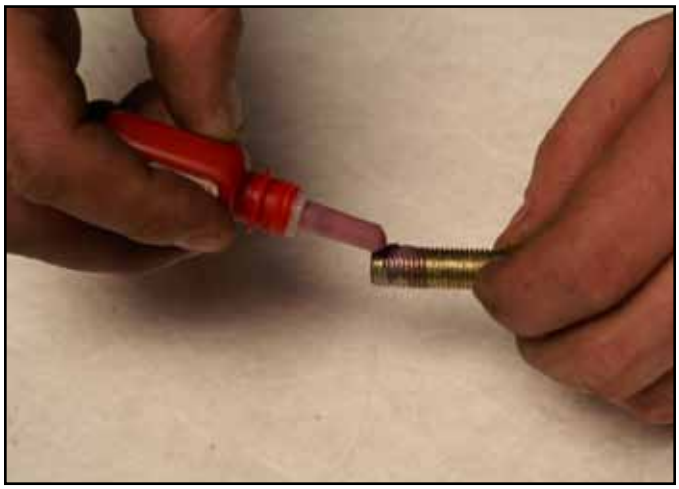

Fig 362 PICT-0026c

8. Install the clutch retainer bolt and two spring washers that hold the electric PTO clutch to the engine crankshaft (Fig. 363).

Fig 363 PICT-0014

9. Torque the center bolt to 55 ft-lbs. (74.6 Nm) (Fig. 364).

Fig 364 PICT-0027c

10. Plug the clutch pigtail harness into the main harness (Fig. 365).

Fig 365 PICT-0100a

11. Connect the red wire onto the starter solenoid (Fig. 366).

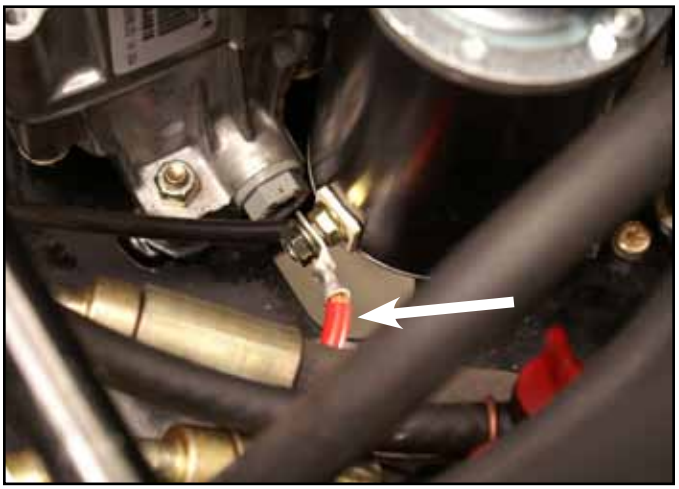

Fig 366 PICT-0413

12. Connect the pink wire to the green wire (fuel shut-off solenoid) and the white wire to the black wire (magneto) (Fig. 367).

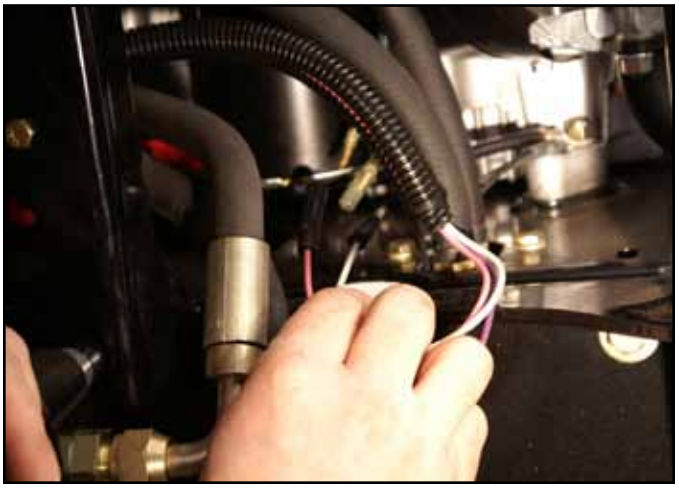

Fig 367 PICT-0409

13. Connect the violet wire to the B+ side of the regulator (Fig. 368).

Fig 368 PICT-0408

14. Install the fuel hose clamp onto the fuel hose located at the fuel pump (Fig. 369).

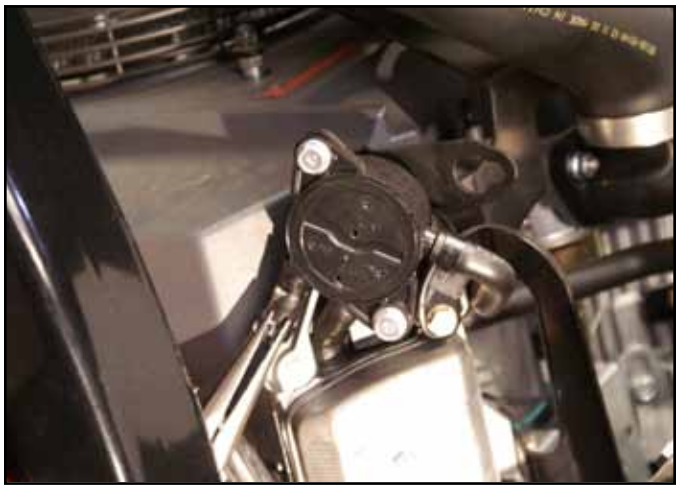

Fig 369 PICT-0407

15. Turn the fuel shut-off valve to the “on” position (Fig. 370).

Fig 370 PICT-0406

16. Connect the green oil sending wire to the oil pressure switch (Fig. 371).

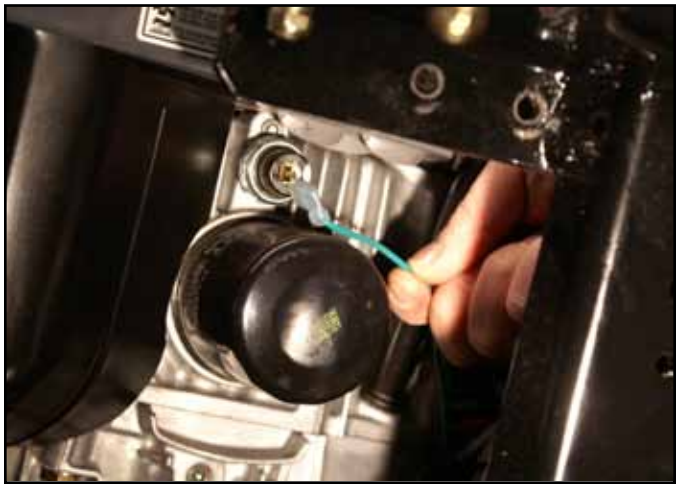

Fig 371 PICT-0404

17. Reconnect the throttle cable:

    a. Position the throttle control lever so that there is approximately 1/2” (12.7mm) between the lever and the full throttle position of the throttle slot (Fig. 372).

Fig 372 PICT-0293

    b. Reconnect the z-bend of the throttle cable to the throttle linkage (the top hole of the throttle plate). Pull the throttle linkage all the way to the right and hold it in the wide open throttle (WOT) position. Install and tighten the cable clamp (Fig. 373).

Fig 373 PICT-0420

18. Reconnecting the choke cable:

    a. Position the choke knob in the full down position (Fig. 374).

Fig 374 PICT-0296

    b. Reconnect the z-bend of the choke cable to the choke linkage. The choke linkage should be in the full open position (far left). Tighten the cable clamp (Fig. 375).

Fig 375 PICT-0421

19. Install the muffler guard assembly using 9 sets of fasteners (Fig. 376).

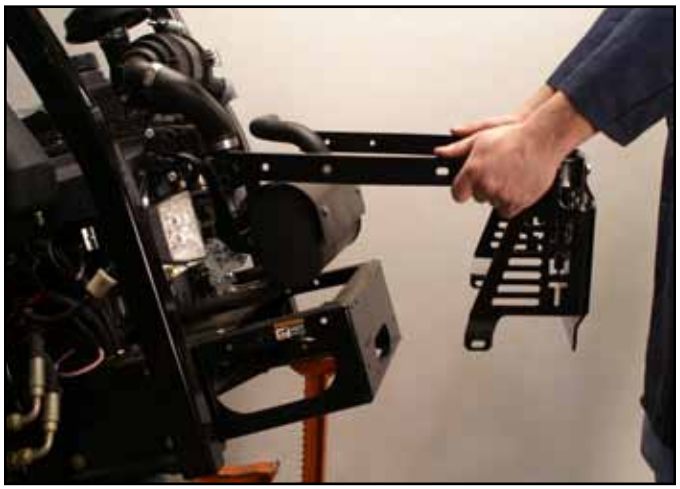

Fig 376 PICT-0400

20. Install the hydraulic oil tank using two bolts and nuts. Secure the tank to the guard strap and fuel tank support (Fig. 377).

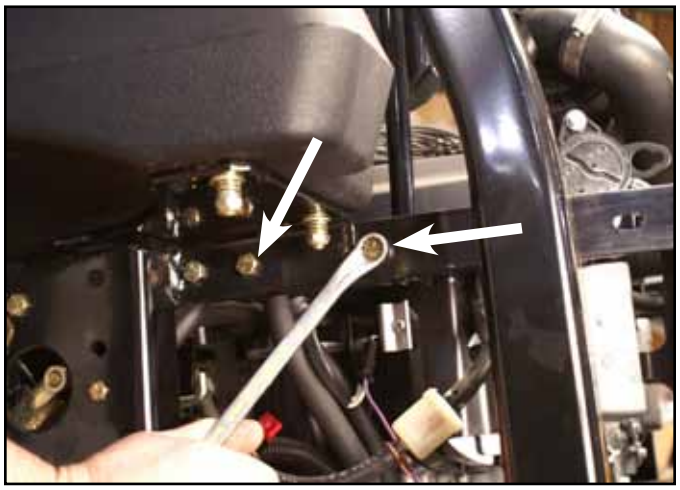

Fig 377 PICT-0398

21. Install the four bolts and nuts that hold the tailpipe guard to the right hand guard strap and rear muffler guard (Fig. 378).

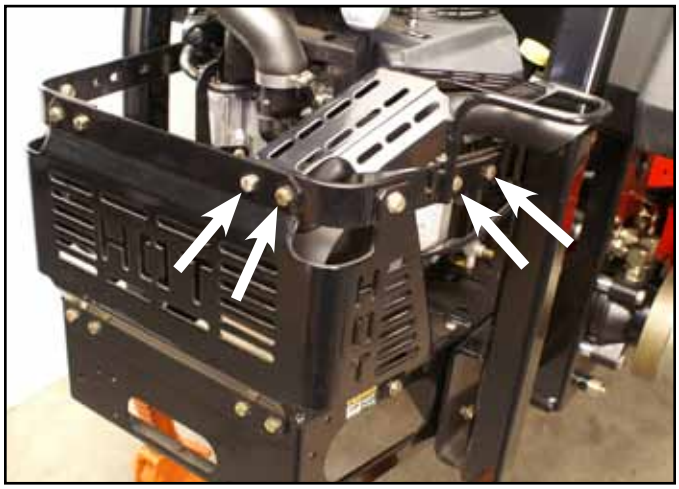

Fig 378 PICT-0397

22. Install a plastic tie to hold the throttle and choke cable to the right hand guard strap (Fig. 379).

Fig 379 PICT-0422

23. Install the rear wheels. Lower the machine to the ground.

24. Connect the battery negative cable.

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ELECTRICAL

General

Note: Interactive Electrical Troubleshooting CD, Form 492-9143 is also available.

Relays

Purpose

There are 2 relays:

1. Start Relay
2. Kill Relay

1. Start Relay: Functions as an electronic switch. Once the safety connections are met, the relay will activate completing the circuit to the starter solenoid.

2. Kill Relay: Functions like an electronic switch. If all conditions for operation are not met, the relay closes, grounding the engine ignition system.

Location

The relays are located under the panel assembly (Fig. 380).

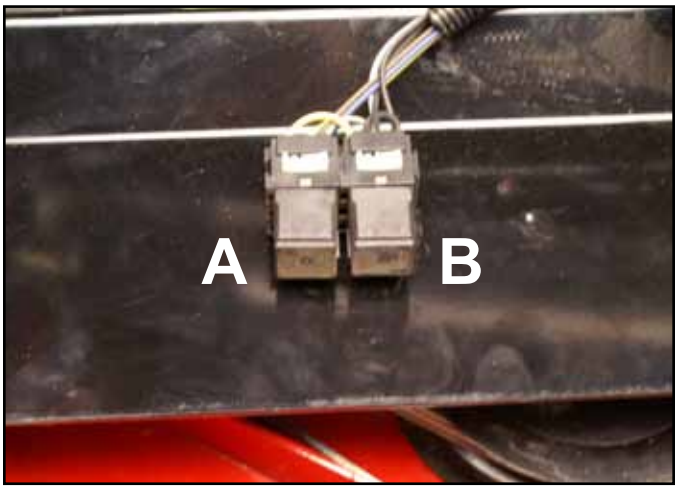


Fig 380 PICT-0189

A - Start relay B - Kill relay

How It Works

A relay is an electrically actuated switch.

1. Coil: Terminals 85 and 86 are connected to a coil. Applying 12 volts to these terminals energizes the coil turning it into an electromagnet.

2. Switch: Terminals 30, 87 and 87a are actually part of a single pole, double throw (SPDT) switch. Terminal 30 is the common lead. The switch is spring loaded so that 30 and 87a are connected when the coil is not energized, the switch is “thrown” and 30 and 87 are connected (Fig. 381).

Fig 381 DSC-2517

Testing

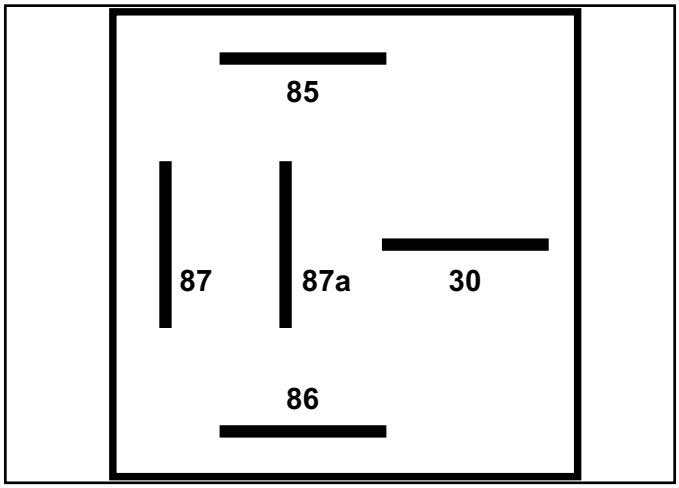


Fig 382 relay pin diagram

1. Disconnect the relay from the harness.

2. Verify the coil resistance between terminals 85 and 86 with a multimeter (ohms setting). Resistance should be from 70 to 90 ohms. There should be continuity between terminals 87a and 30.

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

4. Connect multimeter (ohms setting) leads to relay terminals 30 and 87a. Apply +12VDC to terminal 85. With terminal 86 still grounded, the relay should break and make continuity between terminals 30 and 87a as 12 VDC is applied and removed from terminal.

5. Disconnect voltage and multimeter leads from relay terminals (Fig. 383).

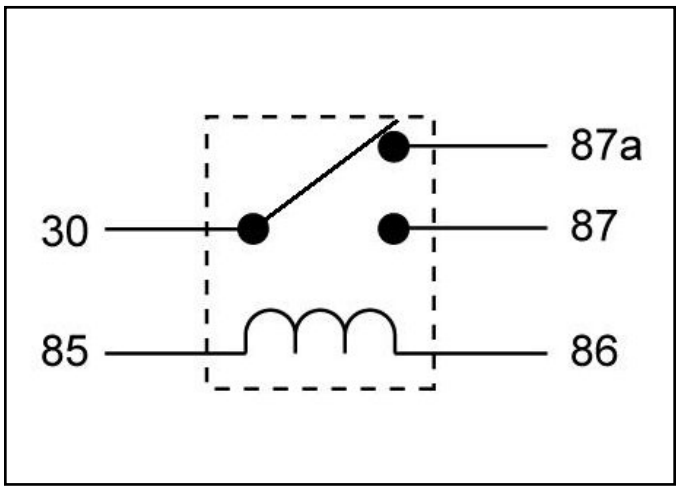


Fig 383 xl relay

PTO Switch

Purpose

The PTO (Power Take Off) switch is typically used to activate the Electric PTO Clutch and to function as part of the safety interlock system.

Location

The PTO Switch is located on the control panel on the left side of the operator (Fig. 384).

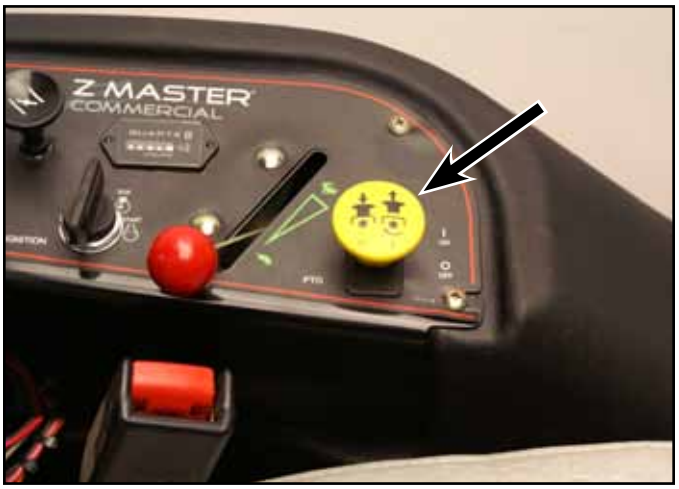


Fig 384 PICT-0190

How It Works

Contacts inside the switch electrically connect various terminals in both “On” and “Off” position. When the PTO is pulled out to the ON position, current flows to the electric clutch and it engages. When the switch is pushed in to the OFF position, current flows through the PTO switch to the Park Brake switch as part of the circuit used to ensure safe starting.

Testing

1. Disengage the PTO, set the parking brake, and turn the ignition to OFF. Remove the key.
2. Remove the 4 screws holding the control panel to the fuel tank.
3. Disconnect the wiring harness from the PTO switch.
4. Press in the locking tabs, on each side of the switch, and pull the switch out of the control panel.
5. Verify that there is continuity between the appropriate terminals in the ON and OFF positions (Fig. 385).

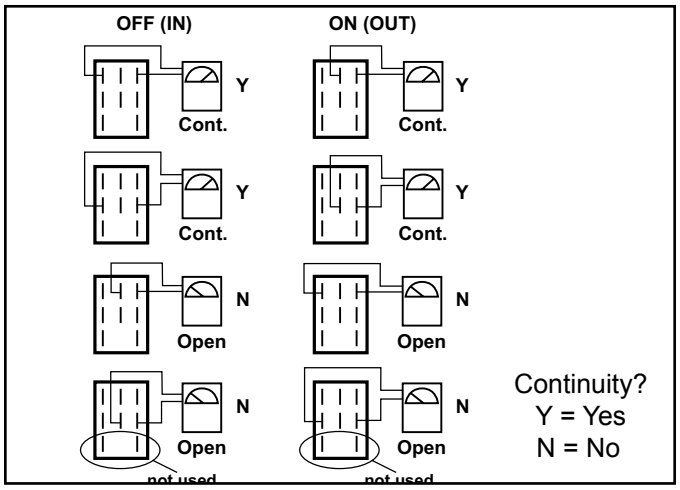


Fig 385 PTO switch test

6. Replace the switch if your test results do not correspond with those given in (Fig. 385).

7. Mount the PTO switch back into the control panel and reinstall the wiring harness (Fig. 386).

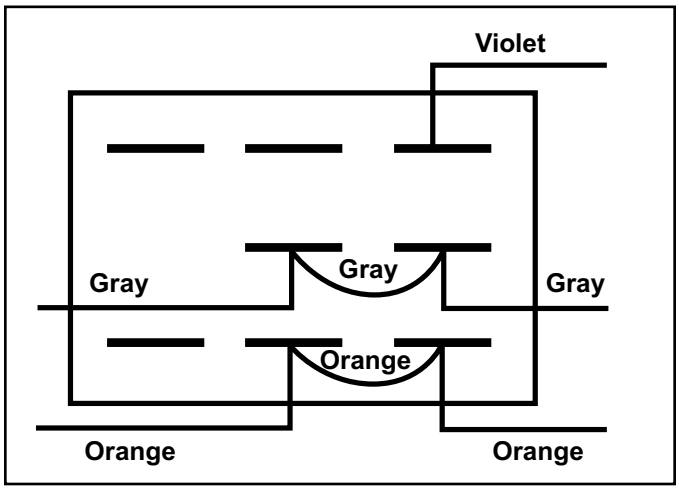


Fig 386 PTO clutch switch

Ignition Switch

Purpose

The ignition switch makes the proper connections for the starter, accessories, and safety circuits.

Location

The ignition switch is located on the control panel, to the left side of the operator (Fig. 387).

Fig 387 PICT-0191

6

How It Works

Detents inside the switch give it 3 positions: OFF, RUN, and START. The START position is spring loaded so the cylinder automatically returns to RUN once the key is released (Fig. 388).

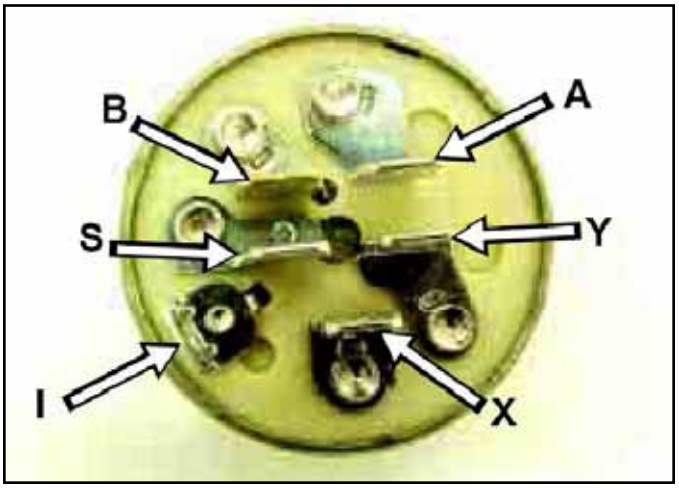


Fig 388 MVC-166

Ignition Switch Wiring Connections
B = Battery voltage “in”
S = Starting Circuit
I = Safety Circuit, Gauges, and Start Circuit
A = Alternator/Charge Circuit
Y = Safety and Start Circuit
X = Safety/Start/Delay Module

6

Testing

1. Disconnect the switch from the wiring harness.

2. Verify that continuity exists between the terminals listed for the switch position.

3. Verify that there is NO continuity between terminals not listed for the switch position.

OFF	No continuity between terminals
RUN	Continuity - B I A XY
START	Continuity - B I S

Neutral Safety Switch

Purpose

Used to ensure the motion control handles are in neutral to start the unit. It is activated by moving the motion control handles to the neutral position (handles outward).

Location

To gain access to the neutral safety switches, remove the panel assembly. There are 2 neutral switches. One for the right motion control handle and one for the left motion control handle (Fig. 389 Right Hand side) (Fig. 390 Left Hand side).

Note: Harness removed for clarity

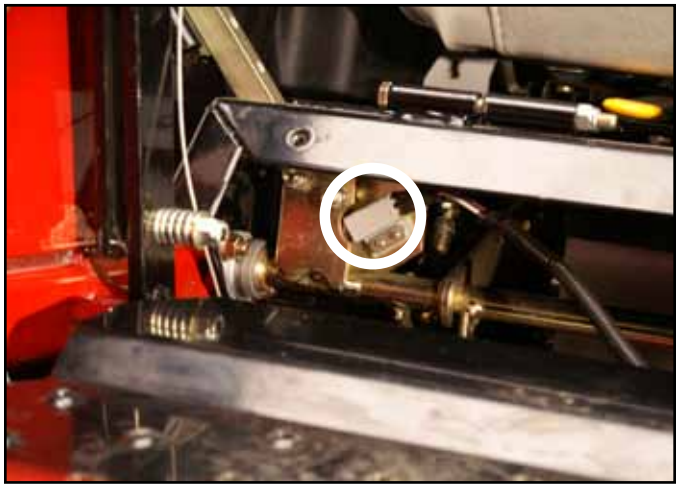


Fig 389 PICT-0192

Fig 390 PICT-0197

How It Works

This single pole plunger (normally open) type switch has two terminals. When the motion control handles are in the neutral position (handles in the out position), it pushes on the plunger, closing the contact and connecting the terminals (Fig. 391).

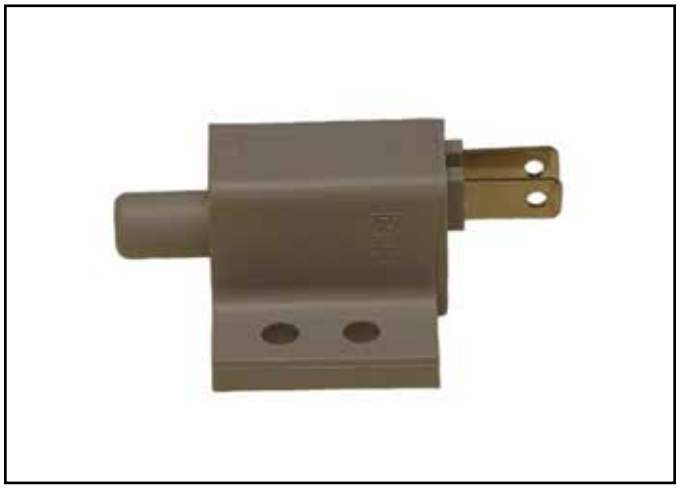


Fig 391 DSC-2527

Testing

1. Disconnect the switch from the wiring harness.
2. Using a VOM or test light, check first to ensure there is no continuity between the terminals, plunger out.
3. With the plunger pushed in, there should be continuity between the terminals.

Park Brake Switch

Purpose

The purpose of the brake switch is to ensure the machine is in neutral and the parking brake is applied before attempting to start the machine.

Location

The park brake switch is located in the middle of the machine under the panel assembly (Fig. 392).

Fig 392 PICT-0193

How It Works

When starting, it functions to ensure the park brake is in the ON position. At the same time it allows current to flow through the remainder of the starting safety circuit. When the park brake is released in the (Off position) it bypasses both neutral switches, permitting the control levers to be used, as long as the operator is in the seat to maintain current for the safety circuit (Fig. 393).

Fig 393 DSC-2528

Testing

1. Disconnect the switch from the wiring harness. The park brake is a double pole switch. When the park brake is in the “On” position, a pair of closed terminals is part of the starting safety interlock circuit. When the brake is released after starting, the other pair of terminals closes, bypassing the neutral switches and applying power to the seat switch circuit.
2. Using a multimeter, follow the procedures listed below (Fig. 394).

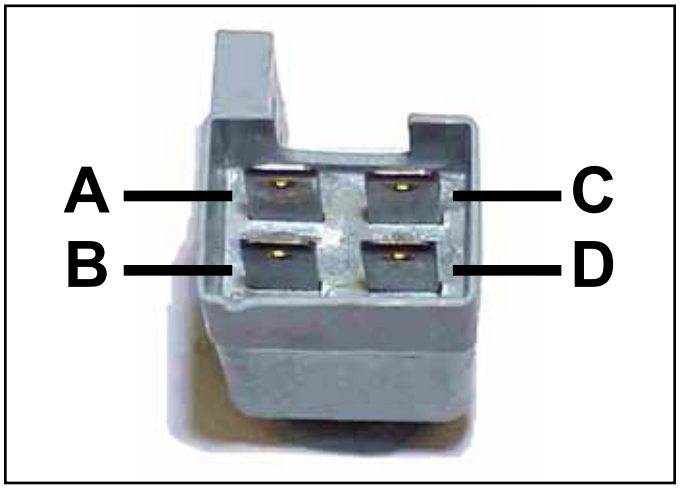


Fig 394 brake switch a

Plunger Not Depressed	Plunger Depressed
A/B Terminals - Closed Circuit - Continuity	A/B Terminals - Open Circuit - No Continuity
C/D Terminals - Open Circuit - No Continuity	C/D Terminals - Closed Circuit - Continuity

Seat Switch

Purpose

The switch is in the safety circuit. If the engine is running and the operator vacates the seat with either the PTO engaged or the parking brake disengaged, the engine will shut down.

Note: There is a delay module in the system; there will be a slight delay before the engine shuts down after the operator vacates the seat.

Location

The seat switch is mounted to the frame directly under the seat (Fig. 395).

Fig 395 PICT-0198

How It Works

When the seat is vacated, the switch is open and there should be NO continuity between the two terminals. When the seat is occupied, the switch closes and there should be continuity between the two terminals (Fig. 396) (Deluxe suspension seat switch shown).

Fig 396 DSC-2556

Testing

1. Disconnect the switch from the wiring harness.
2. Using a VOM or test light, check first to ensure there is no continuity between either terminal, plunger out.
3. With the plunger pushed in, there should be continuity between the terminals.

Seat Delay Module

Purpose

When operating the unit on rough terrain, if the operator should come off the seat momentarily, the seat delay module will temporarily delay the engine shutting down.

Location

The seat delay module is located under the panel assembly (Fig. 397).

Fig 397 PICT-0194

How It Works

The seat delay module circuit board is made up with several different electronic components such as transient voltage suppressor diodes, capacitor, transistors, carbon film resistors, and a relay. The components work together to allow a short term voltage interruption by the seat switch and supplies temporary voltage to the safety circuit to keep the engine running (Fig. 398).

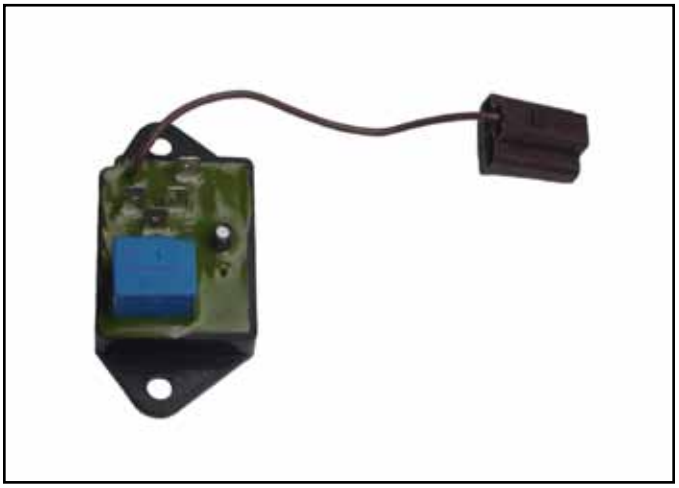


Fig 398 DSC-2532

Testing

1. Raise the seat and disconnect the seat switch. Install a jumper wire in place of the seat switch (Fig. 399).

Fig 399 rev DSC-3157

2. Remove the 4 bolts mounting the console panel to the frame.

3. Connect a VOM positive lead to the violet wires on the module. Connect the negative lead to the battery negative terminal.

4. While sitting in the seat, follow the procedure below to test the delay module function.
   a. Disengage the parking brake.
   b. Pull the right and left motion control levers out of the neutral position.
   c. Turn the ignition key to the RUN position.
   d. The meter should read approximately 12 volts DC.
   e. Lift off the seat or disconnect one of the seat jumper wire leads. The meter should hold around 12 volts and then read 0 volts DC after approximately 1 to 3 seconds. This test shows the delay module is working.

5. If you do not get 12 volts DC at the violet wire when turning the ignition switch to the RUN position, verify the following:
   a. 12VDC at the Tan wire terminal.
   b. 12VDC at the Brown wire terminal.
   c. 0 VDC at the Gray wire terminal.
   d. If all these conditions are met, replace the seat delay module.

Hour Meter

Purpose

The hour meter keeps track of the actual unit running hours or the time that the ignition key switch is in the RUN position.

Location

The hour meter is located on the control panel as shown (Fig. 400).

Fig 400 PICT-0199

How It Works

Since a normal clock might be affected by variations in voltage and current, the hour meter is made up of an electric “winder” and a mechanical clock movement. When power is applied, a coil is energized to wind the movement. The movement unwinds in about 2 seconds. As it finishes its rotation, it re-energizes the coil so that the cycle can start over (Fig. 401).

Fig 401 DSC-2560

Testing

Verify that 12 volts DC is present across the two terminals when the ignition key is in the RUN position. If so, and the meter is not running, replace the meter. If 12 volts is not present, check the connections. The meter is a permanently sealed unit and is not repairable.

Electric PTO Clutch

Purpose

The electric clutch controls the engagement and disengagement of the Power Take Off (PTO) pulley.

Location

The electric clutch is located on the PTO end of the crankshaft.

How It Works

The PTO clutch is composed of three major components; the field, the clutch plate, and the friction plate. The clutch plate always turns with the engine. The field is a coil of wire wound around an iron core, which acts like an electromagnet when power is applied. The friction plate is the only piece that can slide inward and outward on the crankshaft axis. It is spring loaded away from contact with the clutch plate. When the clutch is not energized, the clutch plate rests against the brake material opposite the clutch plate. When energized the friction plate is drawn into the clutch plate magnetically and the two rotate as one component.

Testing

If the electric PTO clutch does not engage or is suspect as the cause of an electrical problem in the PTO circuit, use the following troubleshooting steps to determine whether the clutch has failed or another electrical problem exists.

Coil Resistance Measurement

1. Disengage the PTO, set the parking brake, turn the ignition to the “off” position and remove the ignition key.
2. Disconnect the clutch harness from the main harness.
3. Set the multimeter or volt/ohm meter to check resistance (ohms).
4. Connect the meter lead wires to the clutch wires as shown (Fig. 402).

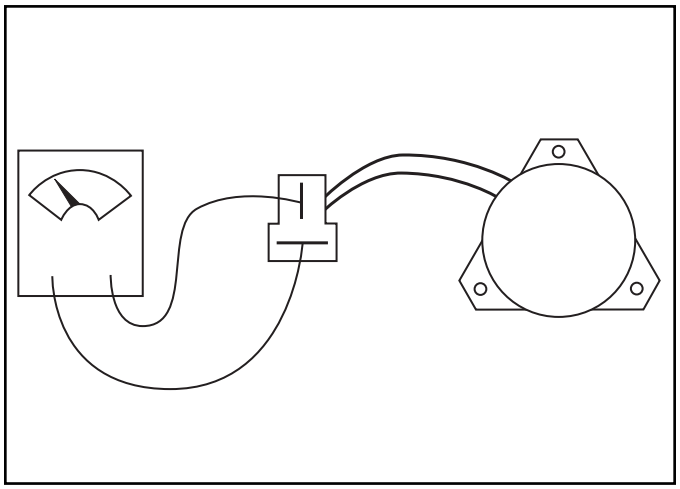


Fig 402 coil resist measure

5. The meter should read around 1.84 ohms (meter readings may vary). If the reading is above or below these readings, the field has failed and needs to be replaced. If the reading falls between 2-4 ohms, measure clutch current draw.

Measuring Clutch Current Draw

1. Disengage the PTO, set the parking brake, turn the ignition key to OFF, and remove the key.
2. Disconnect the PTO clutch harness from the main harness.
3. Set the multimeter to check amps (10 amp scale).
4. Connect the positive meter lead to terminal (1) of the main harness (Fig. 403).

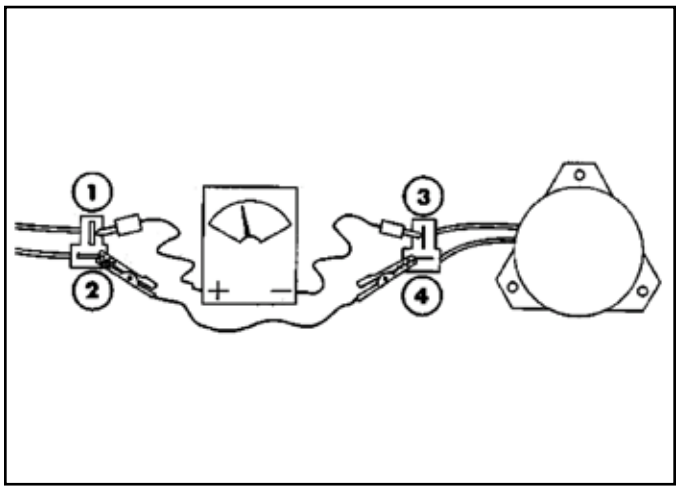


Fig 403 diag 3-7

5. Connect the negative meter lead to the clutch harness terminal (3), Fig. 403.
6. Connect a short jumper lead from terminal (2) to terminal (4) Fig. 403.
7. Turn the ignition switch to the “RUN” position. Turn the PTO switch to the “ON” position.
8. If the meter reading is 6.5 amps or above, the system is functioning properly. If the meter reading is below 6.5 amps, check the electrical system for problems (i.e., the battery, ignition switch. PTO switch, or wiring harness). Make sure the negative side of the wiring has a good connection to chassis ground.

Solenoid

Purpose

The solenoid’s purpose is simply to connect the battery to the starter motor when the ignition switch is turned to “START”. The solenoid is used to protect the ignition switch from the high current drawn by the starter motor.

Location

The starter solenoid is located under the left hand fuel tank (Fig. 404).

Fig 404 PICT-0200

How It Works

The solenoid has two primary parts. One is a coil of wire wrapped around an iron core. Whenever 12 volts is applied to the coil, it becomes a magnet. The other part is a bar type switch (Fig. 405).

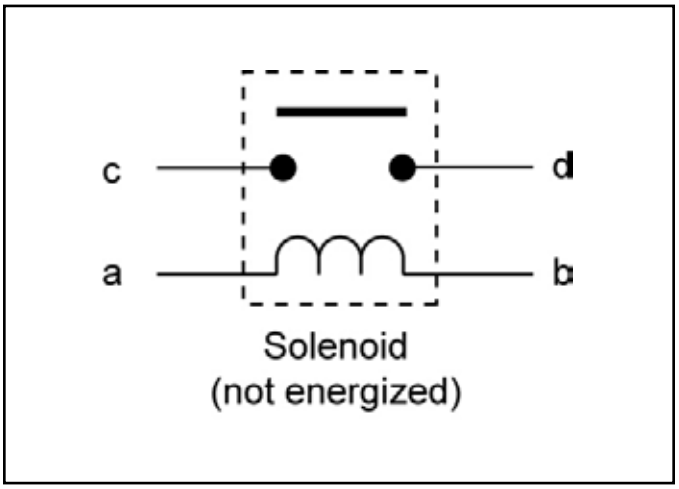


Fig 405 xl solenoid a

Because it has a large contact area with the contact terminals it can easily handle the high current loads required by the starter motor. When 12 volts is applied to the coil, it becomes an electromagnet. This quickly pulls the bar toward contacts and closes the switch. When power is removed from the coil, the spring loaded bar returns to its “normally open” position. The solenoid closes and opens the switch very quickly. This minimizes the “arcing” that can damage other types of switches.

The ignition switch is protected because only a small amount of current is needed to activate the coil.

Testing

1. Disconnect the solenoid from the wiring harness.
2. With a multimeter (ohms setting), check to ensure that terminals “C” and “D” are open (no continuity) (Figure 20).
3. Apply +12 VDC between terminal “A” and ground terminal “B”. Terminals “C” and “D” should now be closed (continuity) (Figure 20).
4. You should be able to hear the solenoid switch “click” when you make the connection (Fig. 406).

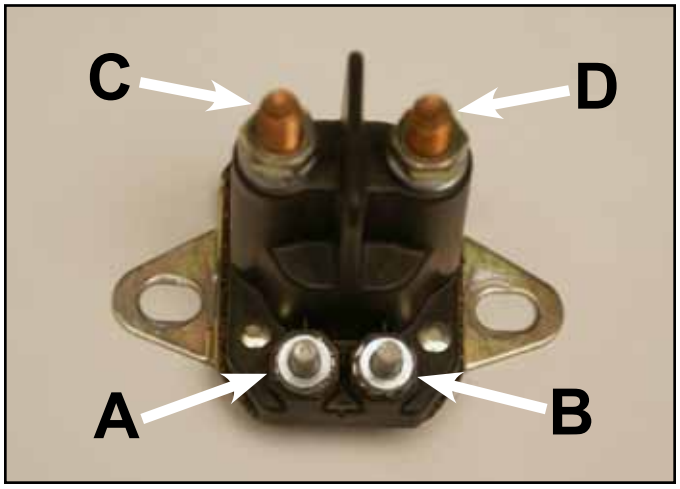


Fig 406 PICT-0204 rev

A & B Coil Terminals	C & D Contact Terminals

Fuse Block

Purpose

House the electrical system fuses.

Location

Located below the control panel on the left hand side of the frame (Fig. 407).

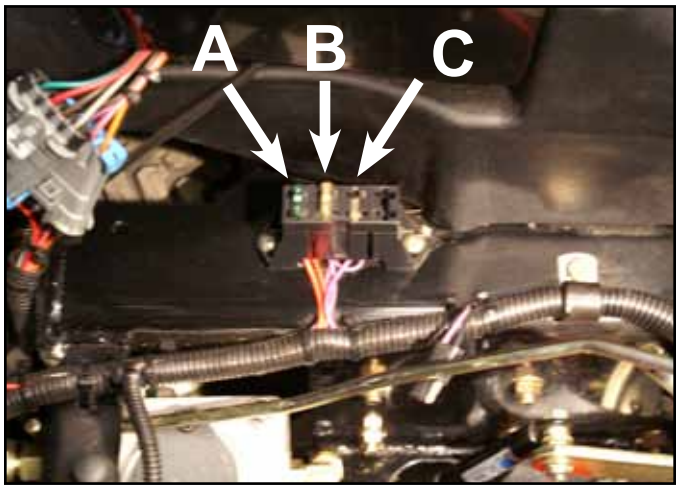


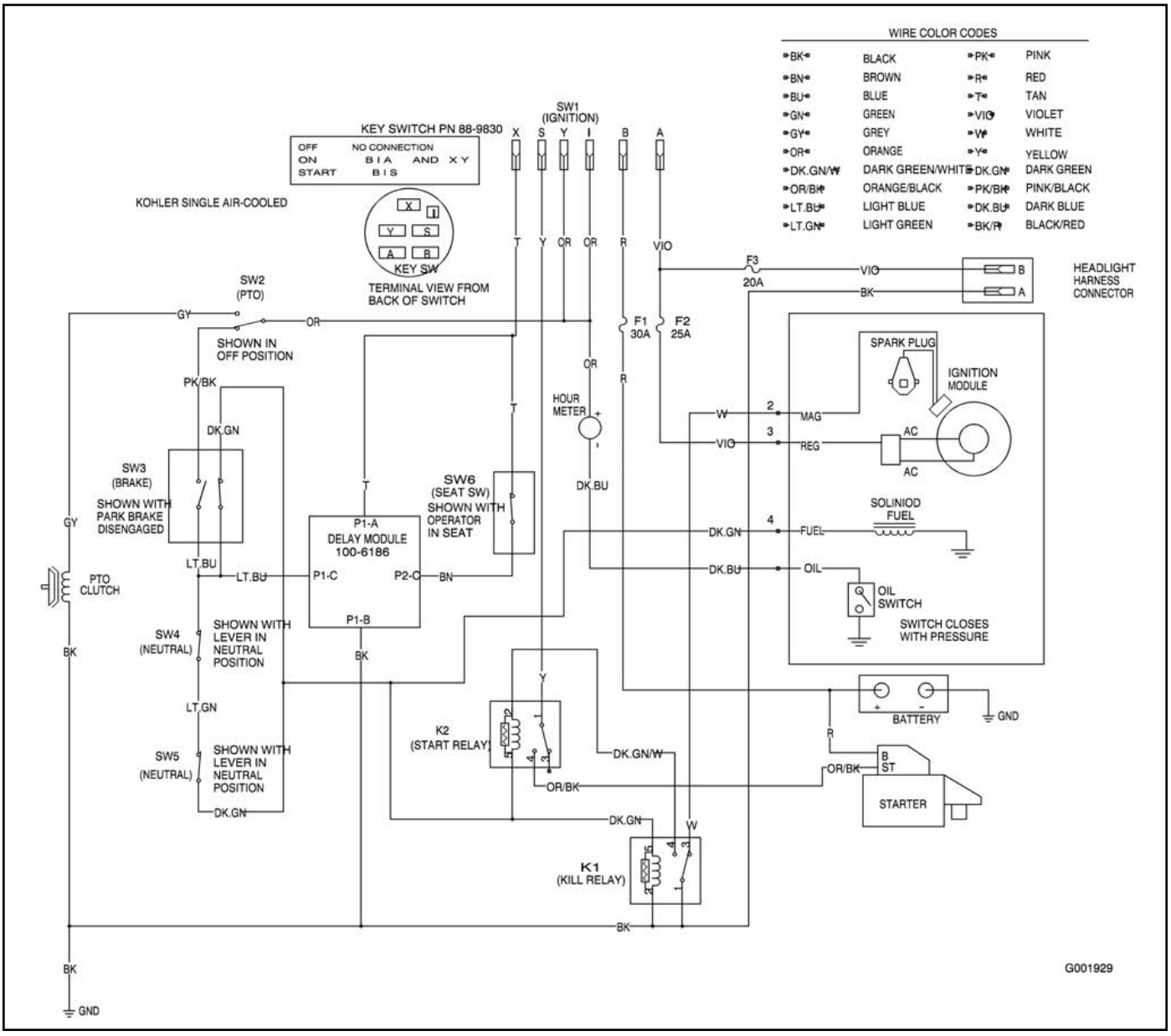
Fig 407 PICT-0202

A. Main circuit (30 amp)
B. Charge circuit (25 amp)
C. Optional head light kit circuit (10 amp)

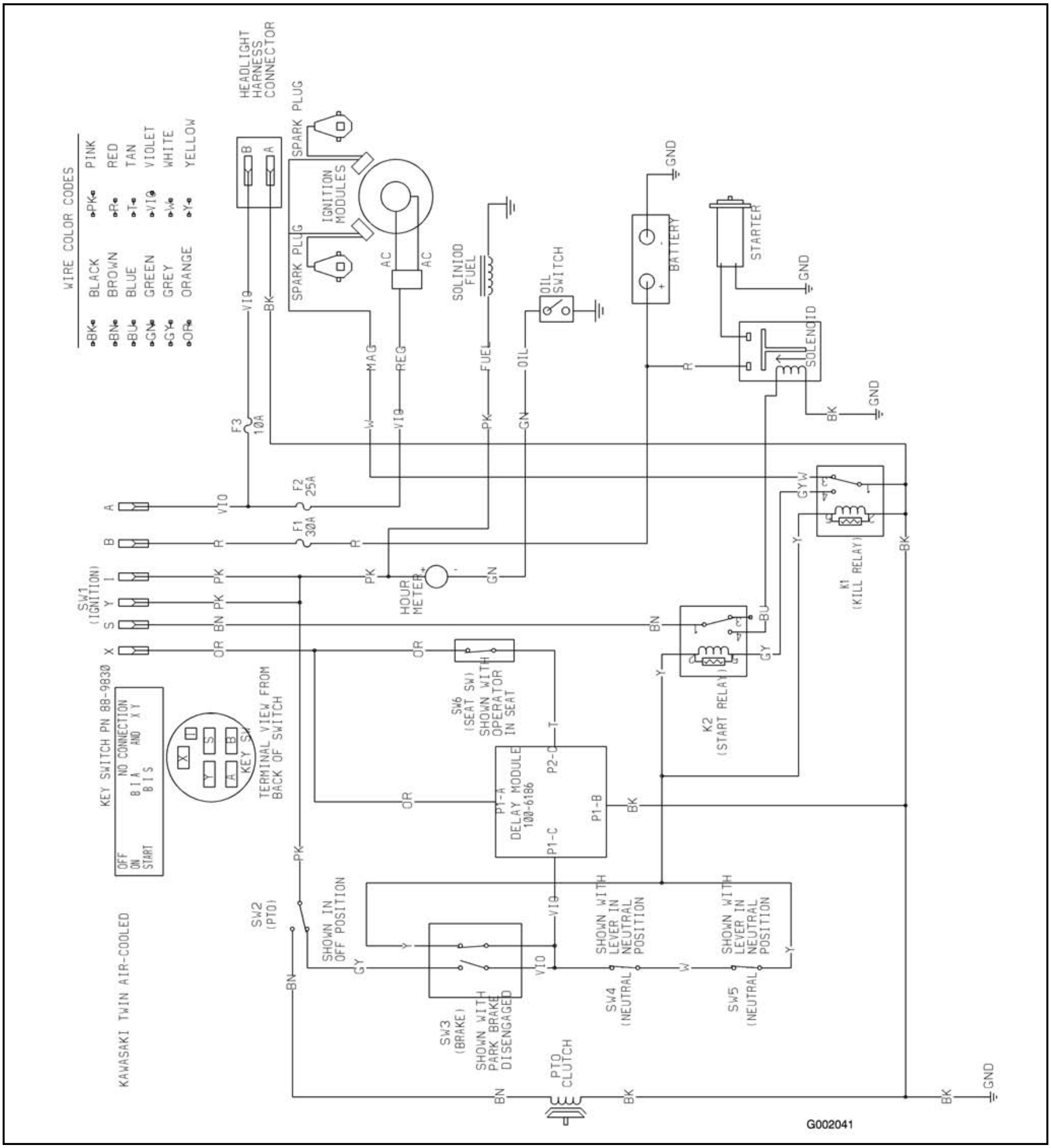
How It Works

The fuse block contains the fuses that protect the system from electrical surges.

74412


WIRE COLOR CODES
BK BLACK
BN BROWN
BU BLUE
GN GREEN
GY GREY
OR ORANGE
DK.GN/W DARK GREEN/WHITE
OR/BK ORANGE/BLACK
LT.BU LIGHT BLUE
LT.GN LIGHT GREEN
PK PINK
R RED
T TAN
VIO VIOLET
W WHITE
Y YELLOW
DK.GN DARK GREEN
PK/BK PINK/BLACK
DK.BU DARK BLUE
BK/R BLACK/RED
SW1 (IGNITION)
KEY SWITCH PN 88-9830
OFF NO CONNECTION
ON B I A AND X Y
START B I S
KOHLER SINGLE AIR-COOLED
KEY SW
TERMINAL VIEW FROM BACK OF SWITCH
SW2 (PTO)
SHOWN IN OFF POSITION
F1 30A
F2 25A
F3 20A
HEADLIGHT HARNESS CONNECTOR
SPARK PLUG
IGNITION MODULE
MAG
AC
REG
HOUR METER
SW3 (BRAKE)
SHOWN WITH PARK BRAKE DISENGAGED
SW6 (SEAT SW)
SHOWN WITH OPERATOR IN SEAT
P1-A DELAY MODULE 100-6186
P1-C
P2-C
P1-B
PTO CLUTCH
SOLINIOD FUEL
FUEL
OIL
OIL SWITCH
SWITCH CLOSES WITH PRESSURE
SW4 (NEUTRAL)
SHOWN WITH LEVER IN NEUTRAL POSITION
SW5 (NEUTRAL)
K2 (START RELAY)
K1 (KILL RELAY)
BATTERY
GND
STARTER
B
ST
G001929

74410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HEADLIGHT HARNESS CONNECTOR
SPARK PLUG
IGNITION MODULES
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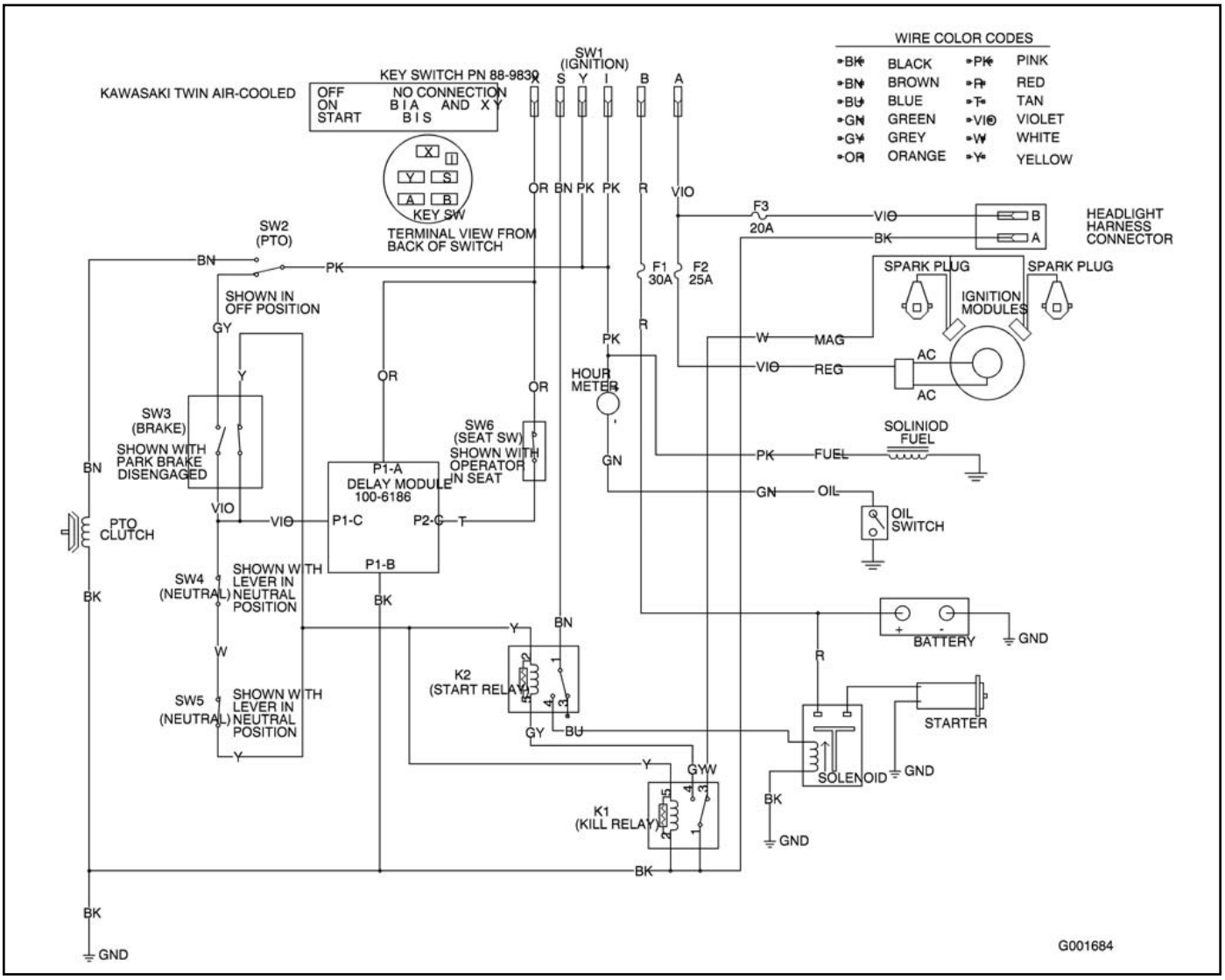
OIL SWITCH
BATTERY
GND
STARTER
GND
SOLENOID
GND
MAG
REG
FUEL
OIL
F3 10A
F2 25A
F1 30A
SW1 (IGNITION)
HOUR METER
K1 (KILL RELAY)
K2 (START RELAY)
KEY SWITCH PN 88-9830
OFF
ON
START
NO CONNECTION
B I A AND X Y
B I S
KEY SW
TERMINAL VIEW FROM BACK OF SWITCH
SW6 (SEAT SW) SHOWN WITH OPERATOR IN SEAT
DELAY MODULE 100-6186
P1-A
P1-B
P1-C
P2-C
SW2 (PTO) SHOWN IN OFF POSITION
SW3 (BRAKE) SHOWN WITH PARK BRAKE DISENGAGED
SW4 (NEUTRAL) SHOWN WITH LEVER IN NEUTRAL POSITION
SW5 (NEUTRAL) SHOWN WITH LEVER IN NEUTRAL POSITION
PTO CLUTCH
GND
KAWASAKI TWIN AIR-COOLED
G002041

74411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Y YELLOW
KAWASAKI TWIN AIR-COOLED
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NO CONNECTION
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B I S
KEY SW
TERMINAL VIEW FROM BACK OF SWITCH
SW1 (IGNITION)
SW2 (PTO)
SHOWN IN OFF POSITION
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P1-A DELAY MODULE 100-6186
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F2 25A
F3 20A
HOUR METER
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SPARK PLUG
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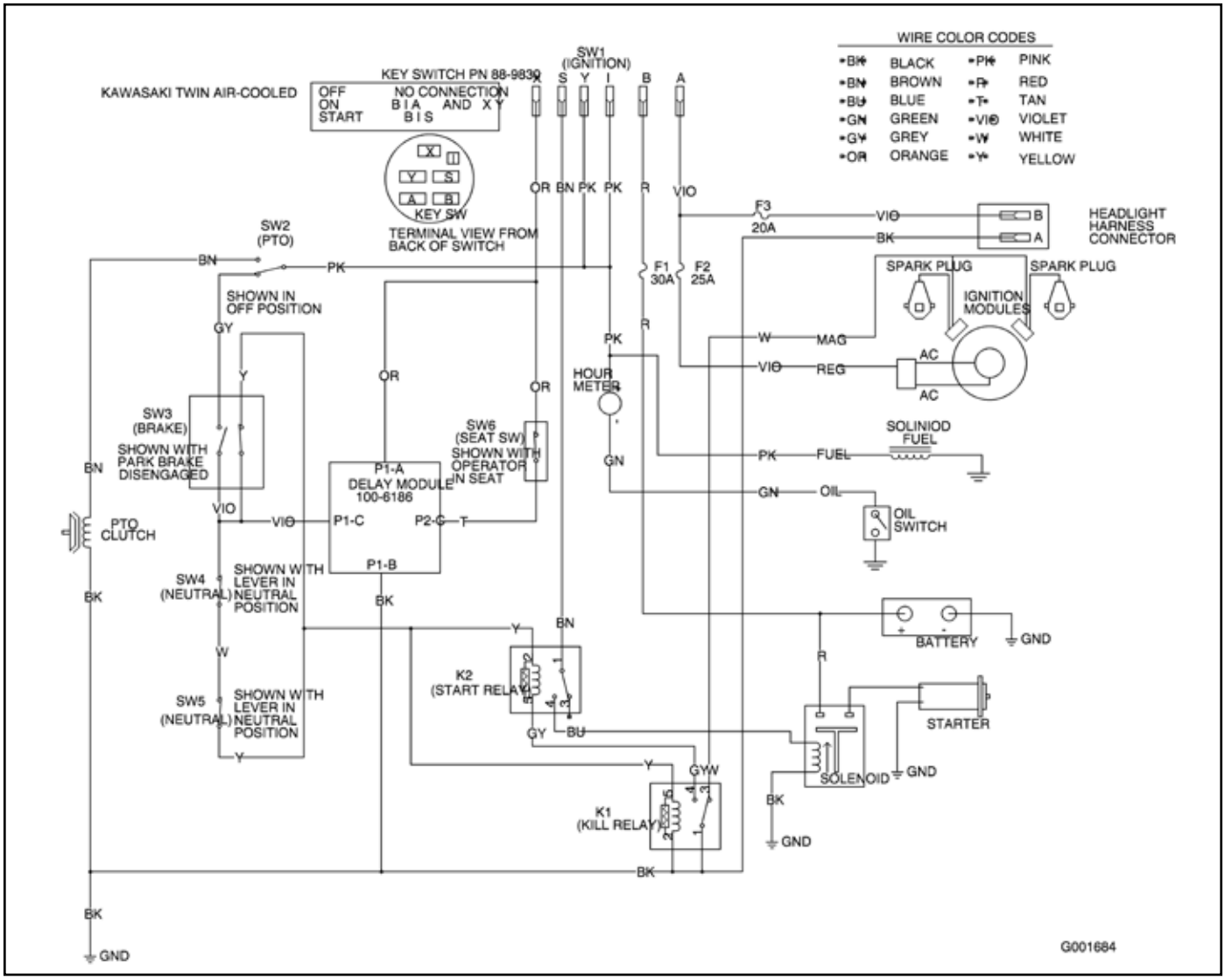
74413 and 74415



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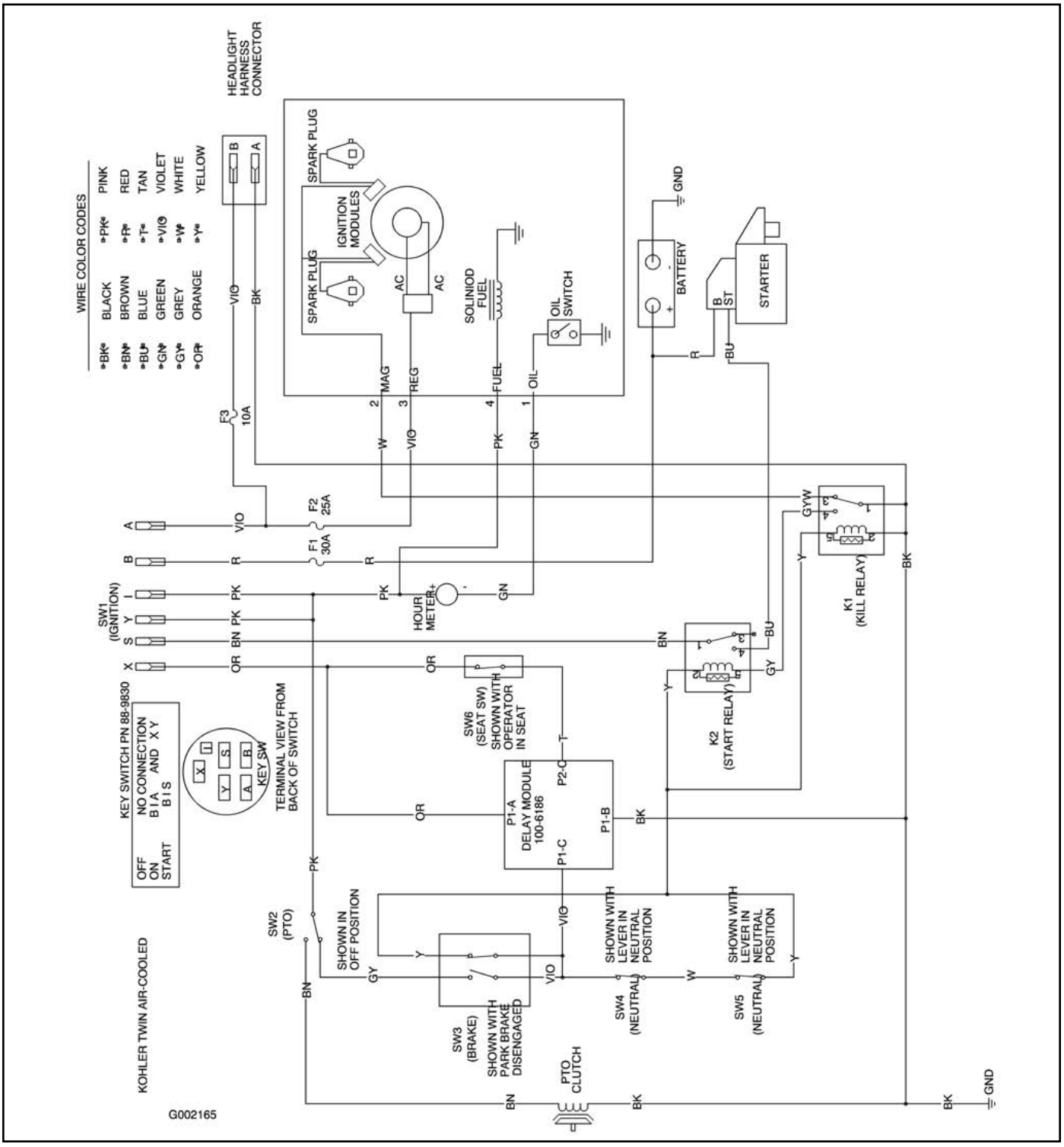
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HEADLIGHT HARNESS CONNECTOR
SPARK PLUG
IGNITION MODULES
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SOLINIOD FUEL
OIL SWITCH
BATTERY
GND
STARTER
F3 10A
F2 25A
F1 30A
HOUR METER
SW1 (IGNITION)
KEY SWITCH PN 88-9830
OFF
ON
START
NO CONNECTION
B1A AND X Y
B1S
KEY SW
TERMINAL VIEW FROM BACK OF SWITCH
SW6 (SEAT SW) SHOWN WITH OPERATOR IN SEAT
P1-A DELAY MODULE 100-6186
P1-B
P1-C
P2-C
K1 (KILL RELAY)
K2 (START RELAY)
SW2 (PTO)
SHOWN IN OFF POSITION
SW3 (BRAKE)
SHOWN WITH PARK BRAKE DISENGAGED
SW4 (NEUTRAL)
SW5 (NEUTRAL)
SHOWN WITH LEVER IN NEUTRAL POSITION
PTO CLUTCH
KOHLER TWIN AIR-COOLED
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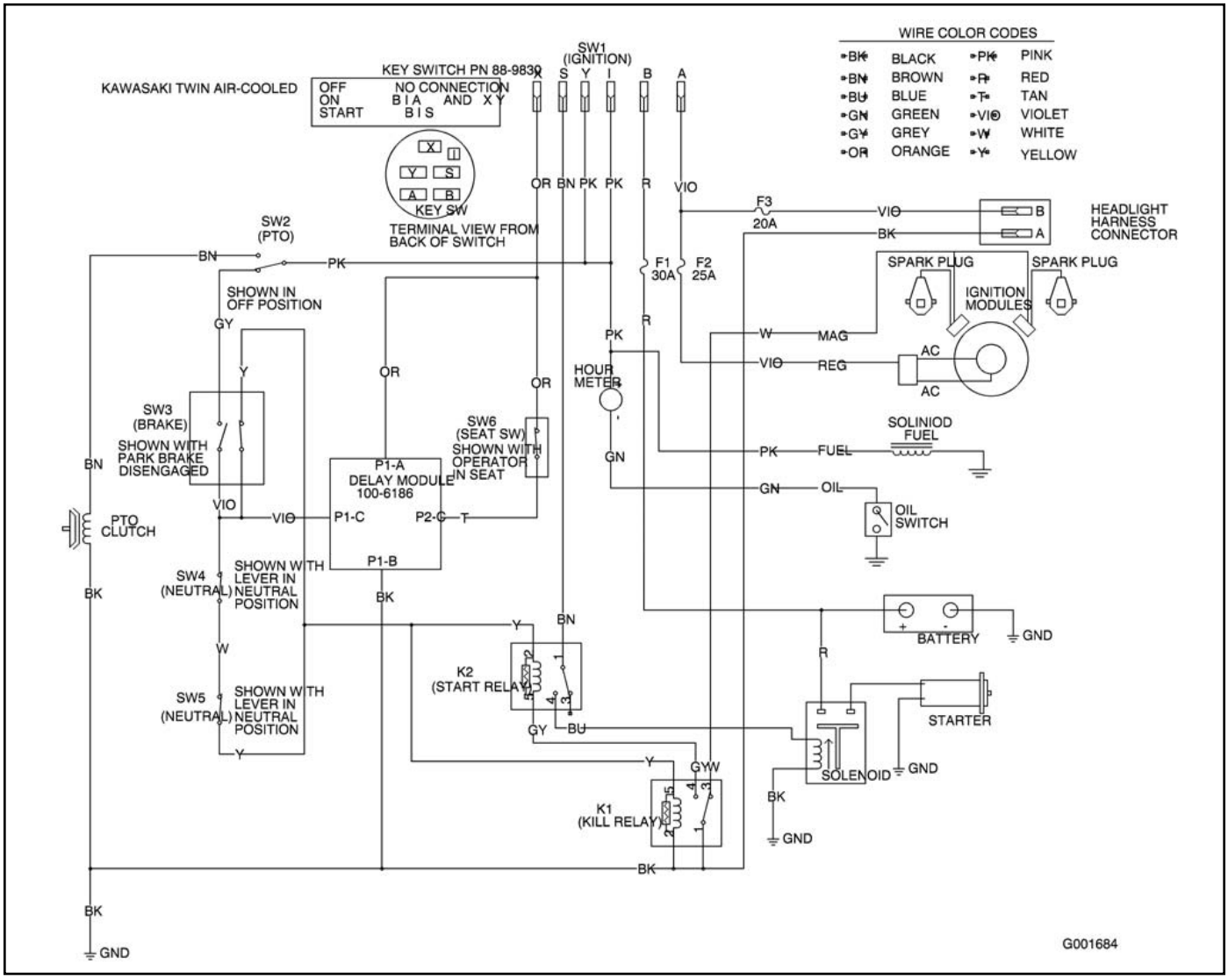
74416 and 74417



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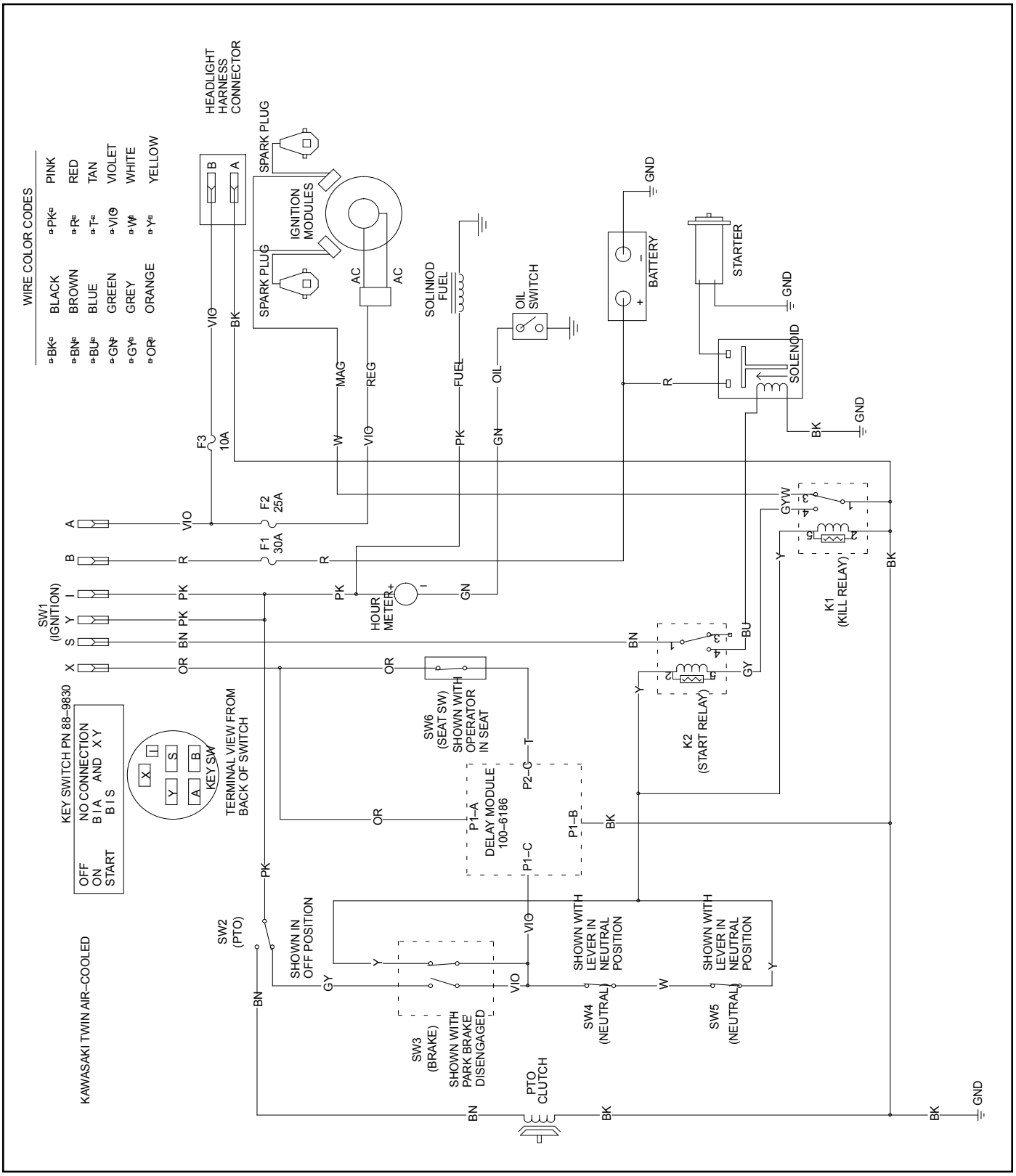
WIRE COLOR CODES
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VIO VIOLET
W WHITE
Y YELLOW
HEADLIGHT HARNESS CONNECTOR
SPARK PLUG
IGNITION MODULES
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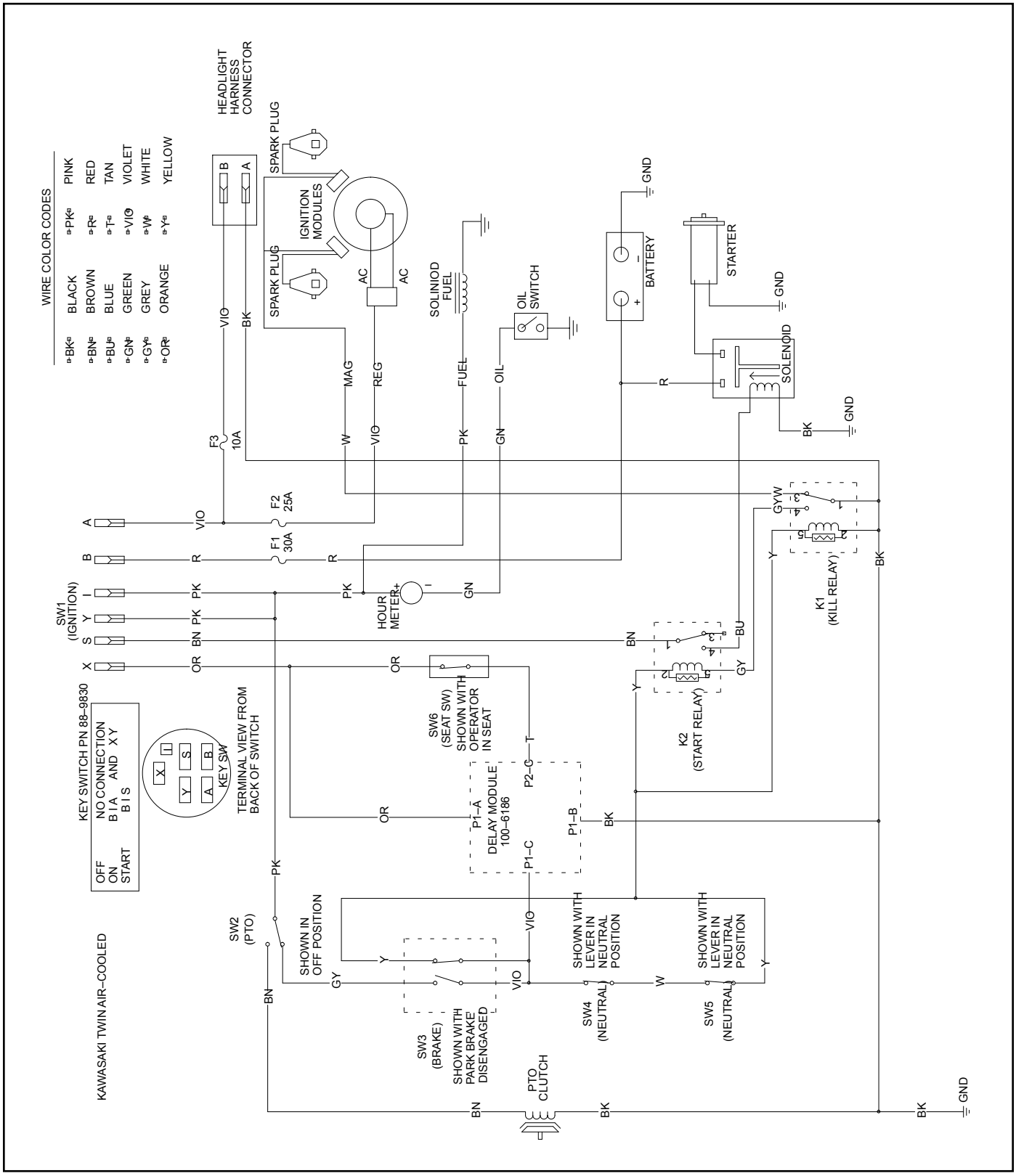
MAG
REG
SOLINOID FUEL
FUEL
OIL SWITCH
OIL
BATTERY
GND
STARTER
SOLENOID
F3 10A
F2 25A
F1 30A
SW1 (IGNITION)
HOUR METER
K1 (KILL RELAY)
K2 (START RELAY)
SW6 (SEAT SW) SHOWN WITH OPERATOR IN SEAT
KEY SWITCH PN 88–9830
OFF
ON
START
NO CONNECTION
B I A AND X Y
B I S
KEY SW
TERMINAL VIEW FROM BACK OF SWITCH
DELAY MODULE 100–6186
P1–A
P1–B
P1–C
P2–C
SW2 (PTO)
SHOWN IN OFF POSITION
SW3 (BRAKE)
SHOWN WITH PARK BRAKE DISENGAGED
SW4 (NEUTRAL)
SHOWN WITH LEVER IN NEUTRAL POSITION
SW5 (NEUTRAL)
PTO CLUTCH
KAWASAKI TWIN AIR–COOLED

74416TE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STARTER
SOLENOID
F3 10A
F2 25A
F1 30A
SW1 (IGNITION)
HOUR METER
K1 (KILL RELAY)
K2 (START RELAY)
SW6 (SEAT SW) SHOWN WITH OPERATOR IN SEAT
KEY SWITCH PN 88–9830
OFF
ON
START
NO CONNECTION B I A AND X Y B I S
KEY SW
TERMINAL VIEW FROM BACK OF SWITCH
DELAY MODULE 100–6186
P1–A
P1–B
P1–C
P2–C
SW2 (PTO)
SHOWN IN OFF POSITION
SW3 (BRAKE)
SHOWN WITH PARK BRAKE DISENGAGED
SW4 (NEUTRAL)
SW5 (NEUTRAL)
SHOWN WITH LEVER IN NEUTRAL POSITION
PTO CLUTCH
KAWASAKI TWIN AIR–COOLED

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Mower Deck Removal

Estate Series

1. Disengage the PTO, move the motion control levers to the neutral locked position, and set the parking brake.

2. Lift the floor pan and remove the right side mower belt cover (Fig. 408).

Fig 408 PICT-0116

3. Loosen the two nuts located on the idler plate to remove tension on the belt (Fig. 409)

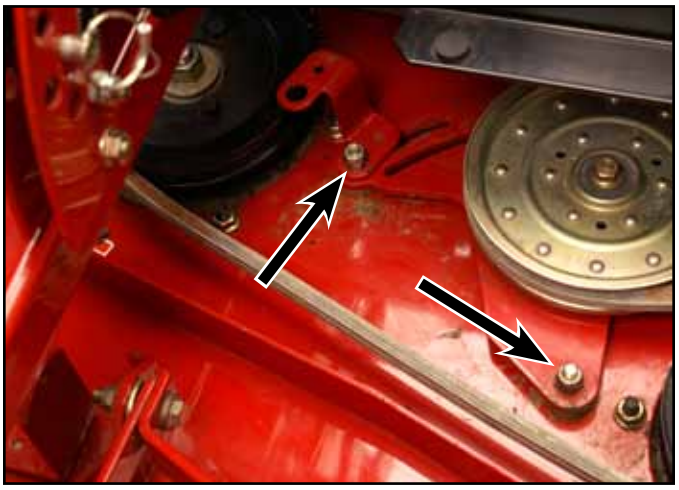

Fig 409 PICT-0121

4. Remove the belt from the electric PTO clutch (Fig. 410).

Fig 410 PICT-0122

5. Raise the mower deck to the transport position. Place 4 x 4 wood blocks under the edge of the mower deck. Lower the mower deck to relieve the tension on all four lift chains (Fig. 411).

Note: It may be necessary to push down on the lift lever and pin into place to relieve tension on the lift chains.

Fig 411 PICT-0124

6. Remove the front and rear lift chains from the mower deck (Fig. 412).

Fig 412 PICT-0126

7. Remove the bolts holding the cross brace to the deck (Fig. 413).

Note: Check the cross brace bushings for wear. Replace as needed.

Fig 413 PICT-0128

8. Secure the cross brace to the frame so it is out of the way when removing the mower deck.

9. Raise the lift lever to the transport position.

10. Remove the 4 x 4 wood blocks from under the deck.

11. Turn the right front wheel so the castor fork is angled forward. This will allow more clearance to slide the mower deck out from under the frame (Fig. 414).

Fig 414 PICT-0130

12. Slide the mower deck out the right side of the unit (Fig. 415).

Fig 415 PICT-0129

Mower Deck Installation

Estate Series

1. Slide the deck under the unit.
2. Place 4 x 4 wood blocks under the edge of the mower deck.
3. Position the lift handle to the lowest position and pin in place (Fig. 416).

Fig 416 PICT-0138

4. Inspect the cross brace bushings for wear. Replace as needed.
5. Install the cross brace to the deck using the hardware as shown (Fig. 417).

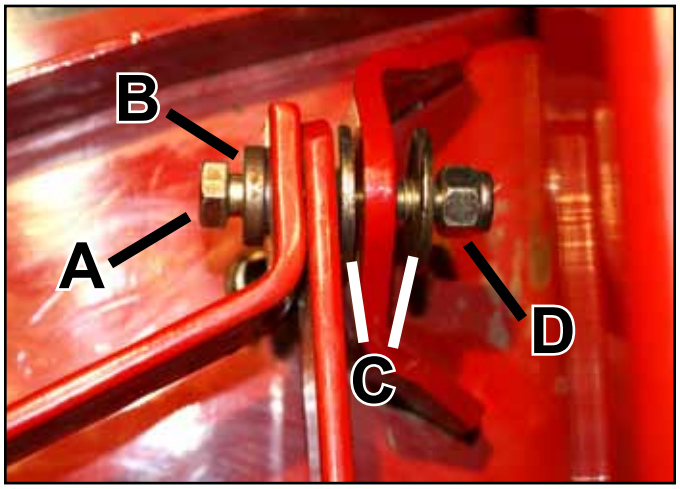

Fig 417 PICT-0143

A. Bolt
B. Bushing
C. Washer (2)
D. Nut

6. Attach the front and rear lift chains to the mower deck (Fig. 418).

Fig 418 PICT-0126

7. Raise the deck to the transport position. Remove the 4x4 wood blocks.

8. Set the lift handle at the 3” (7.6cm) height-of-cut position. Pin in place (Fig. 419).

Fig 419 PICT-0146

9. Route the belt around the spindles, idler pulleys and the PTO clutch (Fig. 420).

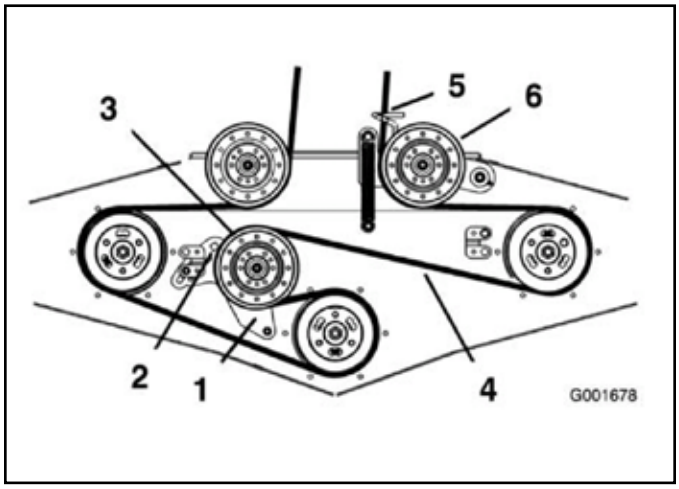

Fig 420 fig. 46 G001678

1. Fixed idler arm
2. Square hole
3. Fixed idler pulley
4. Mower belt
5. Belt guide
6. Spring-loaded idler pulley

10. Insert a ratchet with a short extension or a breaker bar into the square hole in the fixed idler arm. Rotate the ratchet or breaker bar counterclockwise to move the fixed idler arm until you feel increased resistance and the spring-loaded idler pulley stops moving.

Note: Do not increase the belt tension beyond the point where the fixed idler arm stops.

Tighten the nut on the slotted idler plate (Fig. 421).

Fig 421 PICT-0147

11. Tighten the pivot bolt (Fig. 422).

Fig 422 PICT-0150

Mower Deck Removal

Z 400 Series (48" and 50" Decks)

1. Disengage the PTO, move the motion control levers to the neutral locked position, and set the parking brake.

2. Lift the floor pan and remove the right side mower belt cover (Fig. 423).

Fig 423 PICT-0299

3. Loosen the two nuts located on the idler plate to remove tension on the belt (Fig. 424).

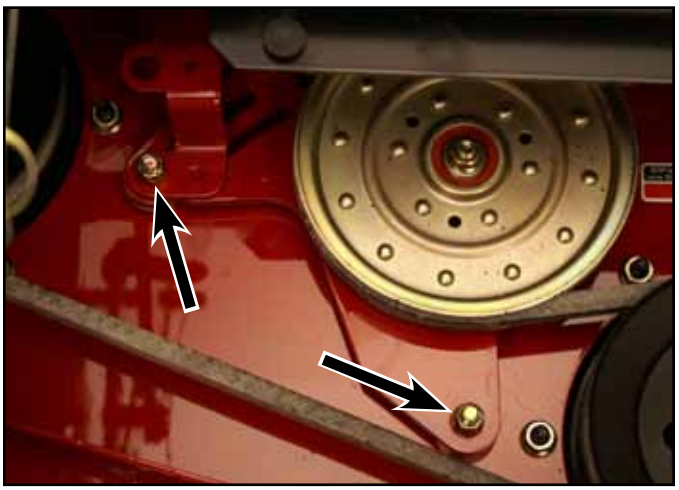

Fig 424 PICT-0302

4. Remove the belt from the electric PTO clutch (Fig. 425).

Fig 425 PICT-0122

5. Raise the mower deck to the transport position. Place 4 x 4 wood blocks under the edge of the mower deck. Lower the mower deck to relieve the tension on all four lift chains (Fig. 426).

Note: It may be necessary to push down on the lift lever and pin into place to relieve tension on the lift chains.

Fig 426 PICT-0304

6. Remove the front and rear lift chains from the mower deck (Fig. 427).

Fig 427 PICT-0305

7. Remove the right and left struts from the strut bases (Fig. 428).

Fig 428 PICT-0306

8. Check the bolt, bushing and strut base for wear (Fig. 429).

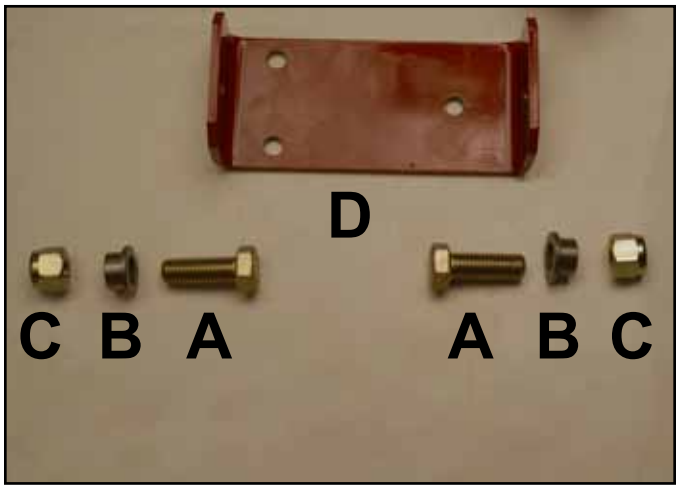

Fig 429 PICT-0312 rev

A. Bolt
B. Bushing
C. Nut
D. Strut base

9. Raise the lift lever to the transport position.

10. Remove the 4 x 4 wood blocks from under the deck.

11. Turn the right front wheel so the castor fork is angled forward. This will allow more clearance to slide the mower deck out from under the frame (Fig. 430).

Fig 430 PICT-0307

12. Slide the mower deck out the right side of the unit (Fig. 431).

Fig 431 PICT-0308

Mower Deck Installation

Z 400 Series (48" and 50" Decks)

1. Turn the right front wheel so the castor fork is angled forward. This will allow more clearance to slide the mower deck under the frame (Fig. 432).

Fig 432 PICT-0307

2. Slide the deck under the unit.

3. Place 4 x 4 wood blocks under the edge of the mower deck (Fig. 433).

Fig 433 PICT-0304

4. Install the right and left struts into the strut bases.

Note: When installing the rear push struts you must mount the push strut into the lower hole on the inside of the strut base (Fig. 434).

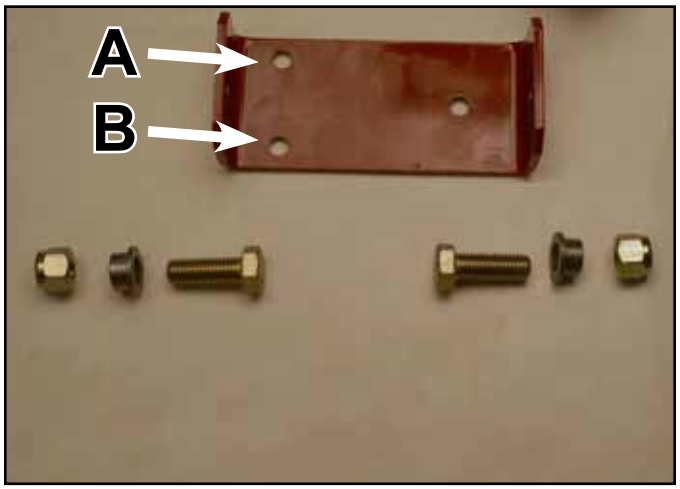

Fig 434 PICT-312 rev

A. Right hand push strut install

B. Left hand push strut install

5. Install the front and rear lift chains to the mower deck (Fig. 435).

Fig 435 PICT-0305

6. Raise the deck to the transport position. Remove the 4x4 wood blocks.

7. Set the lift handle at the 3” (7.6cm) height-of-cut position. Pin in place (Fig. 436).

Fig 436 PICT-0313

8. Route the belt around the spindles, idler pulleys and the PTO clutch (Fig. 437).

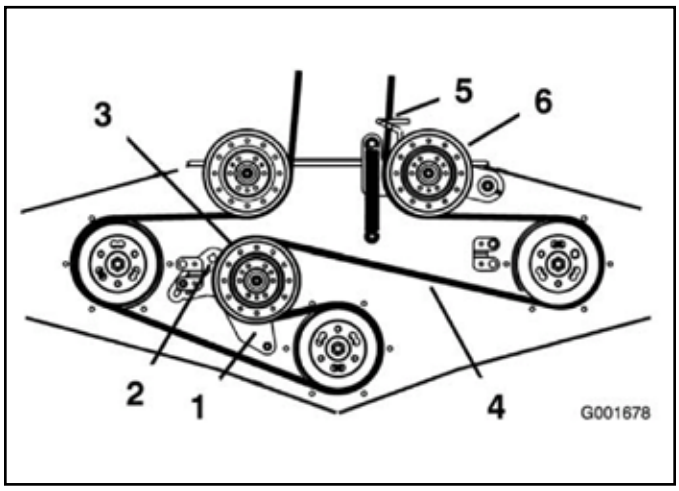

Fig 437 fig. 49 G001678

1. Fixed idler arm
2. Square hole
3. Fixed idler pulley
4. Mower belt
5. Belt guide
6. Spring-loaded idler pulley

7

9. Insert a ratchet or breaker bar with a short extension into the square hole in the fixed idler arm. Rotate the ratchet or breaker bar counterclockwise to move the fixed idler arm until you feel increased resistance and the spring-loaded idler pulley stops moving.

Note: Do not increase the belt tension beyond the point where the fixed idler arm stops.

Tighten the nut on the slotted idler plate (Fig. 438).

Fig 438 PICT-0315

10. Tighten the pivot bolt (Fig. 439).

Fig 439 PICT-0316

Mower Deck Removal

Z 100 Series (44" Deck)

1. Disengage the PTO, move the motion control levers to the neutral locked position, and set the parking brake.

2. Lift the floor pan and remove both the right and left side mower belt cover (Fig. 440).

Fig 440 PICT-0374

3. With a spring puller, remove the spring from the idler arm assembly to remove tension on the belt (Fig. 441).

Fig 441 PICT-0375

4. Remove the belt from the electric PTO clutch (Fig. 442).

Fig 442 PICT-0122

5. Raise the mower deck to the transport position. Place 4 x 4 wood blocks under the edge of the mower deck. Lower the mower deck to relieve the tension on all four lift chains (Fig. 443).

Note: It may be necessary to push down on the lift lever and pin into place to relieve tension on the lift chains.

Fig 443 PICT-0376

6. Remove the four sets of bolts, spacers and washers holding the front and rear lift chains to the mower deck (Fig. 444).

Fig 444 PICT-0377

7. Remove the nut and bolt holding the strut pin to the deck (Fig. 445).

Fig 445 PICT-0379

8. Remove the strut pin (Fig. 446).

Note: The gauge wheels may need to be loosened or removed to remove the strut pin.

Fig 446 PICT-0380

9. Raise the lift lever to the transport position.

10. Remove the 4 x 4 wood blocks from under the deck.

11. Turn the right front wheel so the castor fork is angled forward. This will allow more clearance to slide the mower deck from under the frame (Fig. 447).

Fig 447 PICT-0381

12. Slide the mower deck out the right side of the unit (Fig. 448).

Fig 448 PICT-0382

Mower Deck Installation

Z 100 Series (44" Deck)

1. Turn the right front wheel so the castor fork is angled forward. This will allow more clearance to slide the mower deck under the frame (Fig. 449).

Fig 449 PICT-0393

2. Slide the deck under the frame.

3. Place 4 x 4 wood blocks under the edge of the mower deck (Fig. 450).

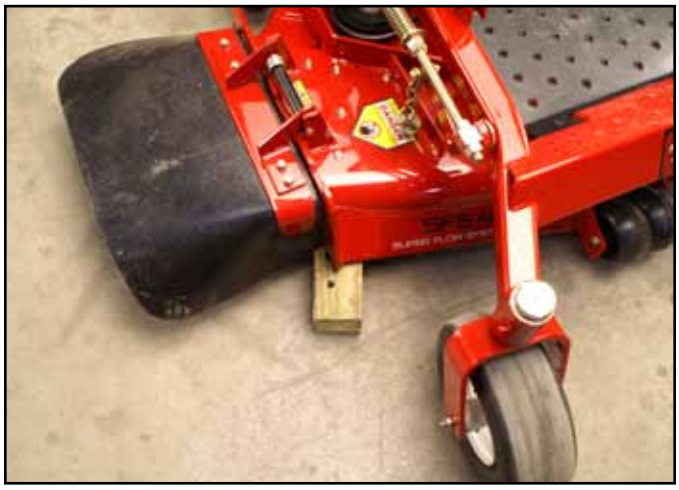

Fig 450 PICT-0394

4. Install the right and left strut pins (Fig. 451).

Note: The gauge wheels may need to be loosened or removed to install the strut pin.

Fig 451 PICT-0380

5. Install the nut and bolt that holds the strut pin to the deck (Fig. 452).

Fig 452 PICT-0379

6. If needed tighten the anti-scalp roller bolts.

7. Set the lift handle at the 3” (7.6cm) height-of-cut position. Pin in place (Fig. 453).

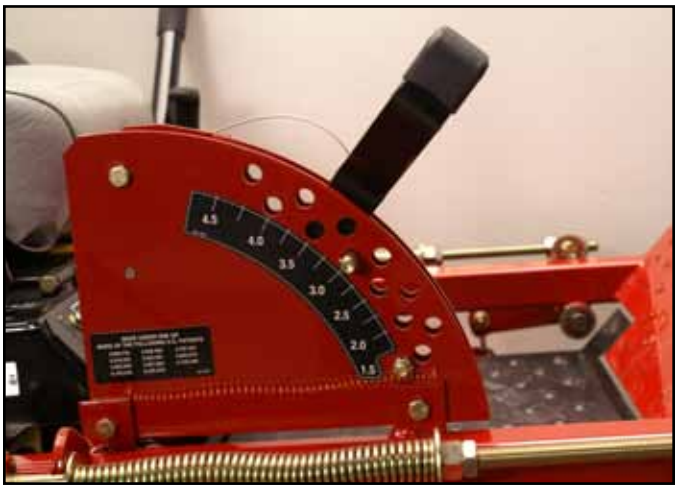

Fig 453 PICT-0396

8. Route the belt around the spindles, idler pulleys and the PTO clutch (Fig. 454).

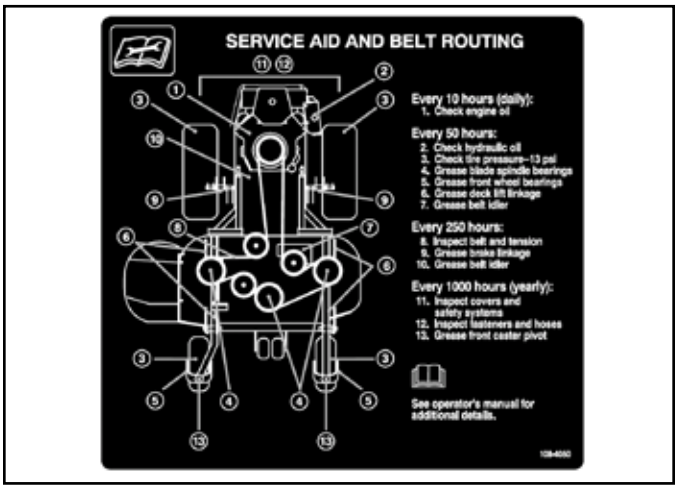

Fig 454 108-4050

9. With a spring puller, install the extension spring to the idler arm assembly (Fig. 455).

Fig 455 PICT-0375

10. Lower the lift lever.

11. Install the lift chains with the four sets of bolts, spacers and washers that hold the front and rear lift chains to the mower deck (Fig. 456).

Fig 456 PICT-0377

12. Install the left and right deck belt covers (Fig. 457).

Fig 457 PICT-0374

13. Raise the deck to the transport position. Remove the 4x4 wood blocks.

Mower Spindle Removal

Pro 100 Series

This applies to removing any of the three mower spindles. This procedure shows removing the right side spindle.

1. Raise the front of the mower.

Note: The mower deck was removed for photo clarity.

2. Chock or block the drive wheels.
3. Disconnect the battery negative cable.
4. Lower the mower deck to the lowest position.
5. Lift the floor pan and remove the right side mower belt cover (Fig. 458).

Fig 458 PICT-0374

6. With a spring puller, remove the spring from the idler arm assembly to remove tension on the belt (Fig. 459).

Fig 459 PICT-0375

7. Remove the mower belt from the right side spindle pulley.
8. Block the mower blade using a 4 x 4 wood block. Remove the spindle shaft nut located at the top of the pulley (Fig. 460).

Fig 460 PICT-0384

7

9. Remove the nut, washer, key, and pulley from the spindle shaft (Fig. 461).

Fig 461 PICT-0385

10. Remove the mower blade. Remove the 4 bolts that mount the spindle to the deck housing (Fig. 462).

Fig 462 PICT-0386

11. Remove spindle from mower deck (Fig. 463).

Fig 463 PICT-0387

Mower Spindle Installation

Pro 100 Series

Reverse the order of mower spindle removal

Mower Spindle Removal

Estate Series and Pro 400 Series

This applies to removing any of the three mower spindles. This procedure shows removing the right side spindle.

1. Use a hoist or the Z-Stand to raise the front of the mower deck.
2. Chock or block the drive wheels.
3. Disconnect the battery negative cable.
4. Lower the mower deck to the lowest position.

5. Lift the floor pan and remove the right side mower belt cover (Fig. 464).

Fig 464 PICT-0116

6. Loosen the two nuts located on the idler plate to remove tension on the belt (Fig. 465).

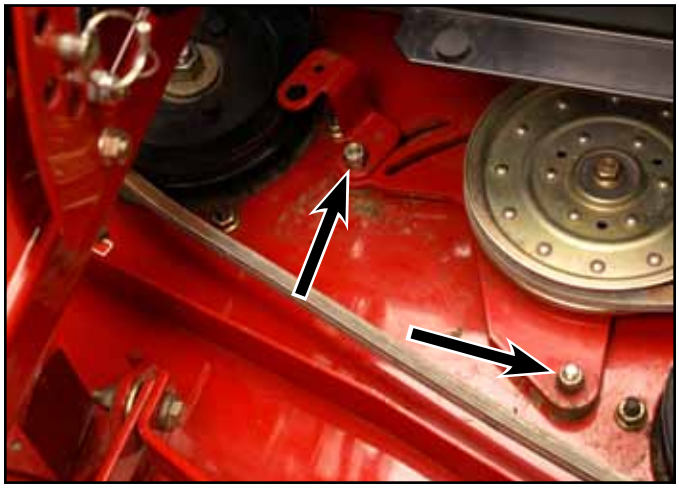

Fig 465 PICT-0121

7. Slip the mower drive belt off the right mower spindle pulley (Fig. 466).

Fig 466 PICT-0151

8. Lock the blade in position with a 4 x 4 wood block and remove the three bolts retaining the pulley to the pulley hub (Fig. 467).

Fig 467 PICT-0152

9. Remove the blade (Fig. 468).

Note: Mower deck was removed for photo clarity.

Fig 468 PICT-0133

10. Remove the six bolts and nuts from the spindle assembly (Fig. 469).

Fig 469 PICT-0134

11. Remove the spindle assembly.

Mower Spindle Installation

Estate Series and Pro 400 Series

Reverse the order of mower spindle removal

Mower Spindle Disassembly

Estate Series and Pro 400 Series

1. Remove the nut and washer (Fig. 470).

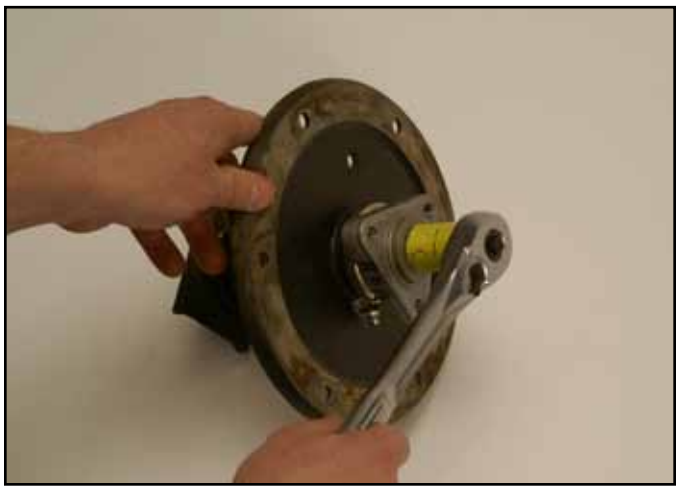

Fig 470 PICT-0153 rev

2. Remove the pulley hub and square key (Fig. 471).

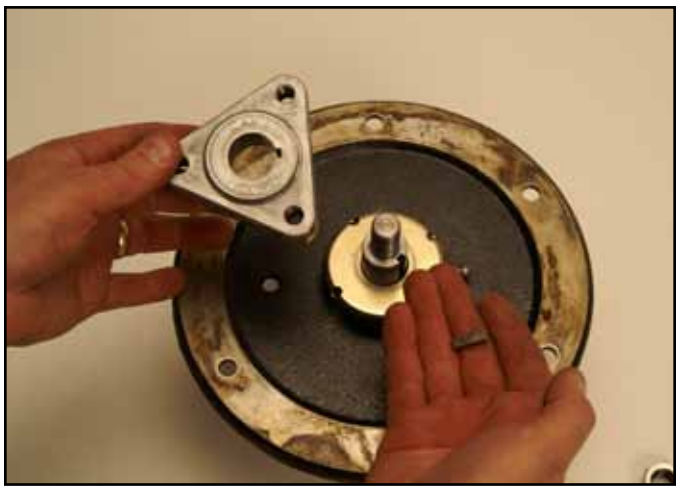

Fig 471 PICT-0157

3. Remove the bearing shield and thrust washer (Fig. 472).

Fig 472 PICT-0158

4. Remove the spindle housing from the spindle shaft assembly (Fig. 473).

Fig 473 PICT-0159 rev

5. Remove the ball bearing from the top of the spindle housing (Fig. 474).

Fig 474 PICT-0160 rev

6. Remove the bearing spacer (Fig. 475).

Fig 475 PICT-0161

7. Remove the ball bearing from the bottom of the spindle housing (Fig. 476)

Note: On later production models the bottom ball bearing may be locked into place with a chemical locking compound or half the bearing race may be press-fit into the spindle housing. If a chemical locking compound is used, the lower housing may require heat to release the locking compound.

Fig 476 PICT-0165

Mower Spindle Assembly

Estate Series and Pro 400 Series

1. Install the bottom bearing:

For a press-fit bearing:

2. Using a press, install the lower bearing with the open end of the bearing to the inside of the housing (Fig. 477).

   a. Press until the bearing is fully seated.

Fig 477 PICT-0172

For a compound locked bearing:

b. Thoroughly clean the spindle housing and the outer race of the bearing.

c. Apply an even coat of chemical locking compound to the outer race and inner spindle housing (Fig. 478).

Caution: DO NOT get chemical locking compound on the inside of the bearing.

Fig 478 PICT-0168

d. Install the open end of the bearing to the inside of the housing until the bearing is fully seated (Fig. 479).

Fig 479 PICT-0170

3. Install the bearing shield and thrust washer onto the spindle shaft (Fig. 480).

Fig 480 PICT-0173 rev

4. Install the housing (bearing installed) onto the spindle shaft (Fig. 481).

Fig 481 PICT-0175

5. Install the bearing spacer into the spindle housing opening (Fig. 482).

Fig 482 PICT-0176 rev

6. Install the upper ball bearing with the open end of the bearing to the inside of the housing (Fig. 483).

Fig 483 PICT-0180

7. Install the upper thrust washer and bearing shield onto the spindle shaft (Fig. 484).

Fig 484 PICT-0181 rev

8. Install the pulley hub onto the spindle shaft.

Note: The raised center of the hub faces away from the spindle (Fig. 485).

Fig 485 PICT-0183 rev

9. Install the key into the spindle shaft (Fig. 486).

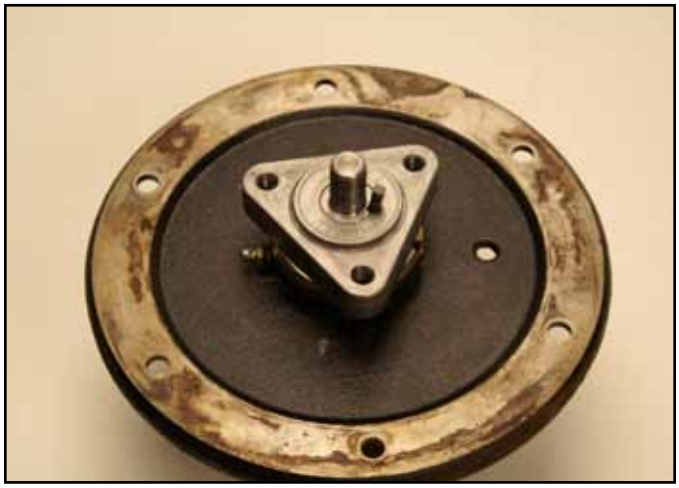

Fig 486 PICT-0184

10. Install the washer and the nut onto the spindle shaft (Fig. 487).

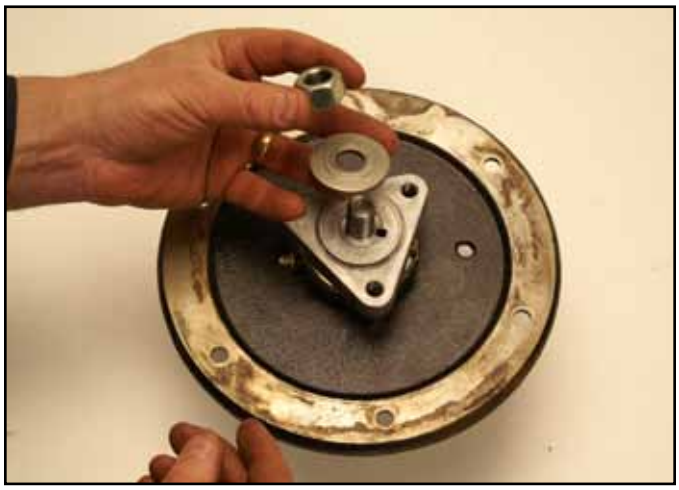

Fig 487 PICT-0185

11. Torque the top nut to 100 to 120 ft-lbs. (135.6 to 162.7 Nm) (Fig. 488).

Fig 488 PICT-0187

Mower Spindle Disassembly

Z 100 Series (44" Deck)

1. Remove the spindle shaft, bearing shield and hardened washer from the spindle housing assembly (Fig. 489).

Fig 489 PICT-0388 rev

2. Remove the spindle bearings and spacer (Fig. 490)

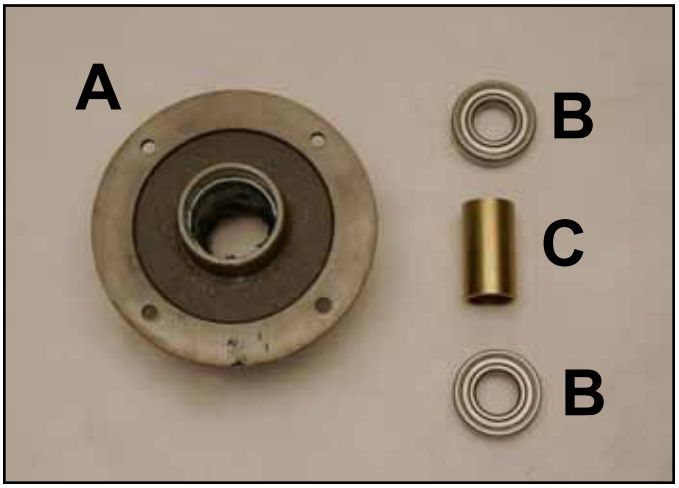

Fig 490 PICT-0390

A. Spindle housing
B. Bearings (2)
C. Spacer

Mower Spindle Assembly

Z 100 Series (44" Deck)

Reverse the order of mower spindle removal

Replacing the Mower Deck Drive Belt

All Z 400 models

Squealing when the belt is rotating, blades slipping when cutting grass, frayed belt edges, burn marks and cracks are signs of a worn mower belt. Replace the mower belt if any of these conditions are evident.

1. Disengage the PTO, move the motion control levers to the neutral locked position, and set the parking brake.

2. Lift the floor pan and remove the mower belt covers (Fig. 491).

Fig 491 PICT-0116

3. Loosen the two nuts located on the idler plate to remove tension on the belt (Fig. 492).

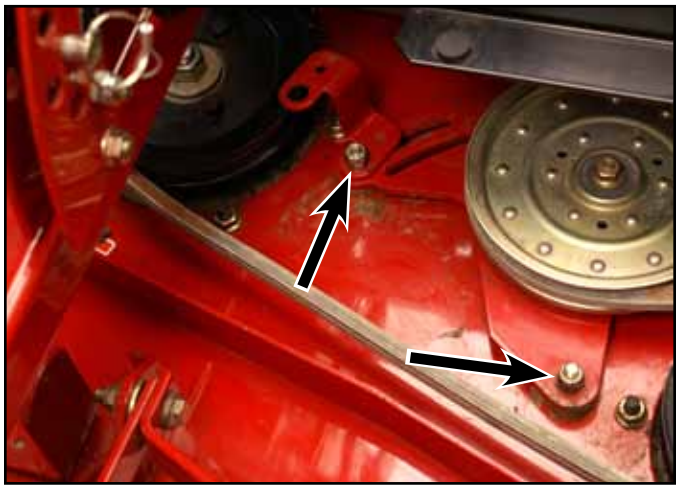

Fig 492 PICT-0121

4. Remove the worn/broken belt.

5. Route the new belt through the left side belt guide (Fig. 493).

Fig 493 PICT-0188

6. Install the new belt onto the electric PTO clutch (Fig. 494).

Fig 494 PICT-0122

7. Route the belt around the idlers as shown (Fig. 495).

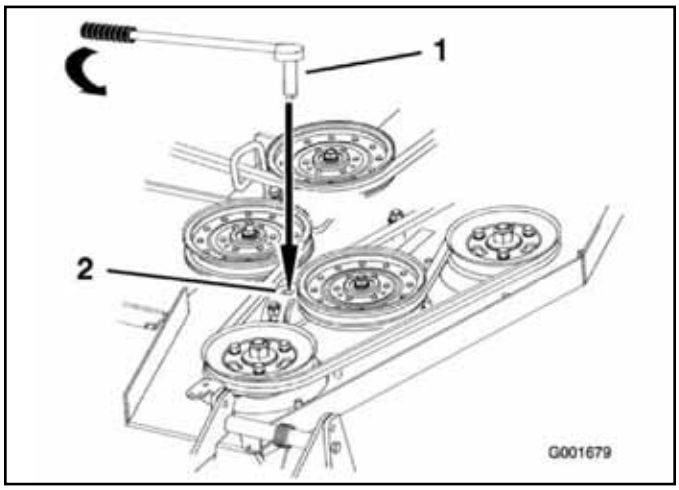

Fig 495 fig. 47 G001679

1. Ratchet with short extension or breaker bar
2. Square hole

8. Insert a ratchet with a short extension or a breaker bar into the square hole in the fixed idler arm. Rotate the ratchet or breaker bar counterclockwise to move the fixed idler arm until you feel increased resistance and the spring-loaded idler pulley stops moving.

Note: Do not increase the belt tension beyond the point where the fixed idler arm stops.

9. Tighten the nut on the slotted on the idler plate (Fig. 496).

Fig 496 PICT-0147

10. Tighten the pivot bolt (Fig. 497).

Fig 497 PICT-0150

11. Reinstall belt covers.

Replacing the Mower Deck Drive Belt

Z 100 Series

1. Disengage the PTO, move the motion control levers to the neutral locked posistion, and set the parking brake.

2. Stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.

3. Remove the belt covers over the outside spindles.

4. Loosen the outer nut on the spring eye bolt (Fig. 498).

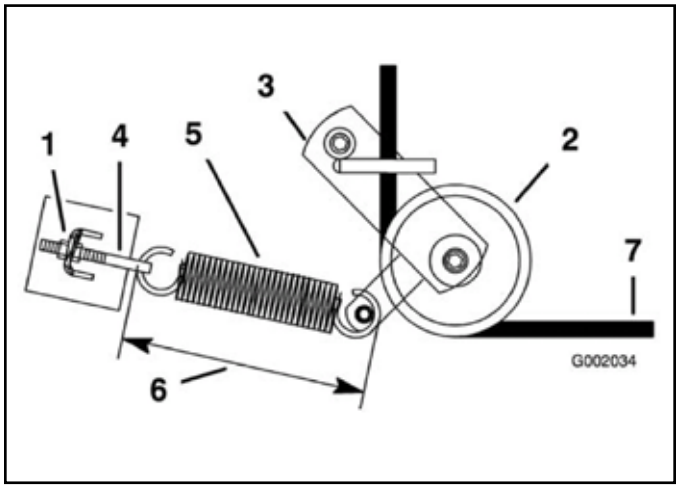

Fig 498 fig. 45 G002034

1. Outer nut
2. Idler pulley
3. Idler arm
4. Spring eye bolt
5. Spring
6. 9-3/8 ± 1/8 inch (238 ± 3mm)
7. Mower belt

5. Remove the old belt.

Note: Start at the outside pulley and rotate the belt off (Fig. 499).

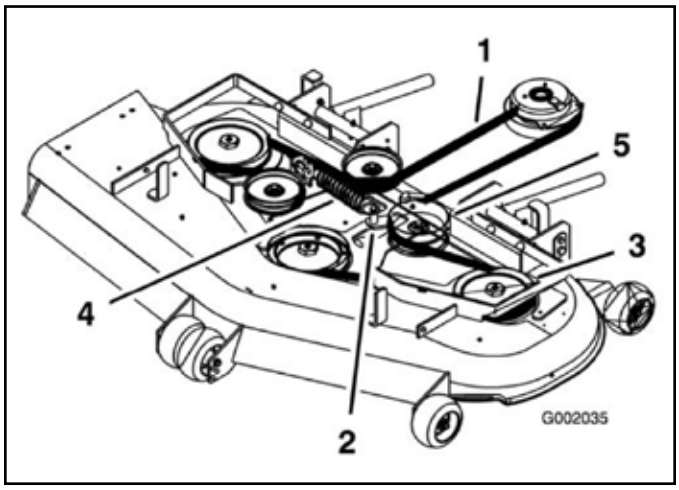

Fig 499 fig. 46 G002035

1. Mower belt
2. Idler arm
3. Outside pulley
4. Spring
5. Idler pulley

Note: Do not remove the spring from the eye bolt.

The spring is under tension when installed and can cause personal injury.

Do not remove the spring from the spring eye bolt.

6. Remove the spring loaded idler pulley (Fig. 498).
7. Route the new bolt through the idler arm (Fig. 498).
8. Install the idler pulley and route the belt onto the other pulleys (Fig. 499).
9. Tighten the outer nut on the spring eye bolt (Fig. 498).

Note: Check the spring length. The spring should measure 9-3/8 ± 1/8 inch (238 ± 3mm) with belt installed. Adjust it if it does not (Fig. 498).

10. Install the belt covers over the outside spindles.

Adjusting the Mower Belt Tension

Z 100 Series

1. Disengage the PTO, move the motion control levers to the neutral locked position, and set the parking brake.
2. Stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Remove the belt covers over the outside spindles.
4. Loosen the outer nut on the spring eye bolt (Fig. 500).

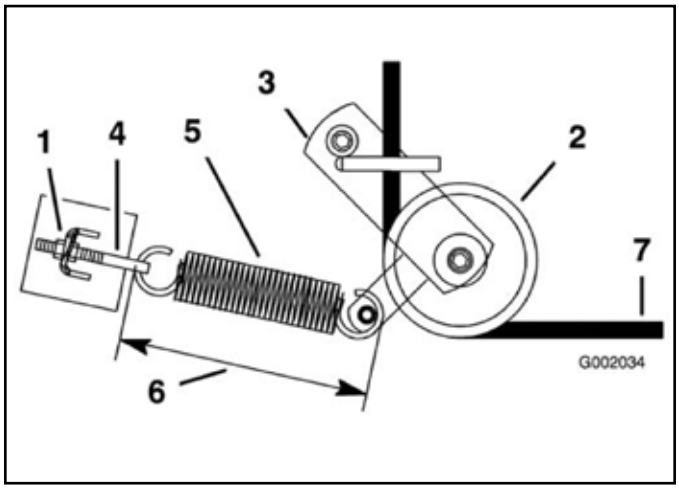

Fig 500 fig. 45 G002034

1. Outer nut
2. Idler pulley
3. Idler arm
4. Spring eye bolt
5. Spring
6. 9-3/8 ± 1/8 inch (238 ± 3mm)
7. Mower belt

5. Install the belt covers over the outside spindles.

6. Tighten the outer nut on the spring eye bolt (Fig. 500).

Note: Check the spring length. The spring should measure 9-38 ± 1/8 inch (238 ± 3mm) with belt installed. Adjust it if it does not (Fig. 500).

Adjusting the Mower Belt Tension

Z 400 Series

1. Disengage the PTO, move the motion control levers to the neutral locked position, and set the parking brake.

2. Stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating postition.

3. Remove the belt covers over the outside spindles.

4. Loosen the fixed idler arm and adjust it to relieve the belt tension on the fixed idler pulley (Fig. 501).

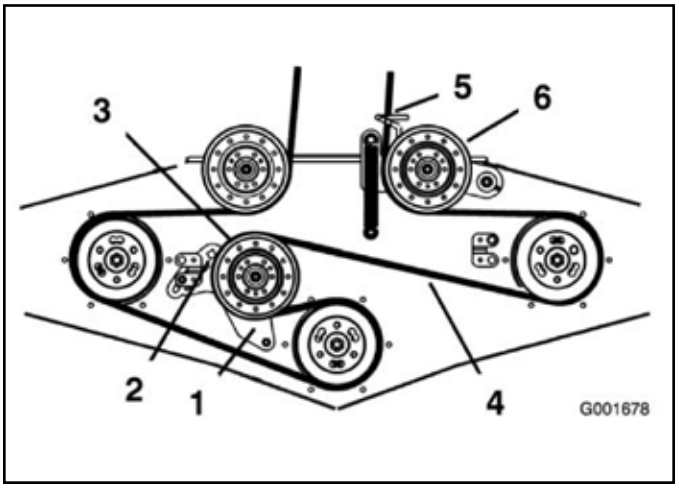

Fig 501 fig. 49 G001678

1. Fixed idler arm
2. Square hole
3. Fixed idler pulley
4. Mower belt
5. Belt guide
6. Spring-loaded idler pulley

5. To increase the belt tension, rotate the ratchet or breaker bar counterclockwise to move the fixed idler arm until you feel increased resistance and the spring-loaded idler pulley stops moving (Fig. 502).

Note: Do not increase the belt tension beyond the point where the fixed idler arm stops.

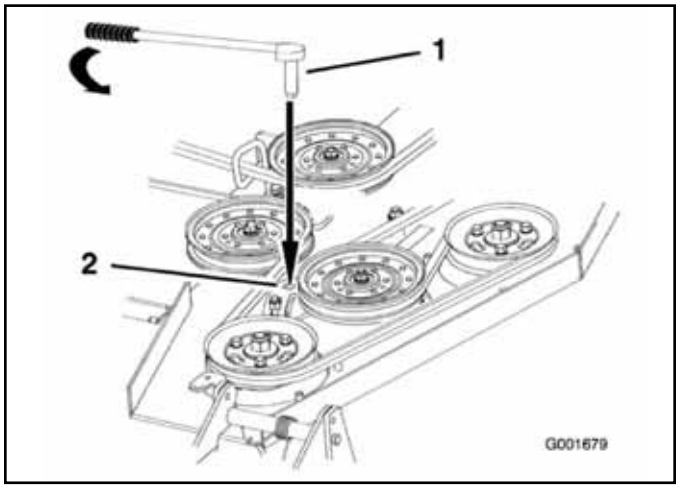

Fig 502 fig. 50 G001679

1. Ratchet with short extension or breaker bar
2. Square hole

6. While holding the belt in tension, tighten the 2 nuts that secure the fixed idler arm.

7. Remove the ratchet or breaker bar from the square hole in the fixed idler arm.

8. Install the belt covers over the outside spindles.

Leveling the Mower at 3 Postions

Setting Up the Machine

All models

1. Position mower on a flat surface.
2. Disengage the PTO, move the motion control levers to the neutral locked position and set the parking brake.
3. Stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
4. Check tire pressure of all four tires. If needed, adjust to 13 psi (90kPa).
5. Lower the mower to the 3 inch (76mm) height-of-cut position.
6. Inspect the four chains. The chains need to have tension.

Note: Adjust the rear chains to the top of the slot, where they are attached to the mower.

- If one rear chain is loose, lower (loosen) the front support arm on the same side. Refer to Adjusting the Front-to-Rear Mower Pitch page 7-30.
- If one front chain is loose, raise (tighten) the front support arm for that chain. Refer to Adjusting the Front-to-Rear Mower Pitch page 7-30.

7. Level the mower side-to-side and front-to-rear.

Leveling the Mower Side-to-Side

1. Position the right blade side-to-side (Fig. 503).

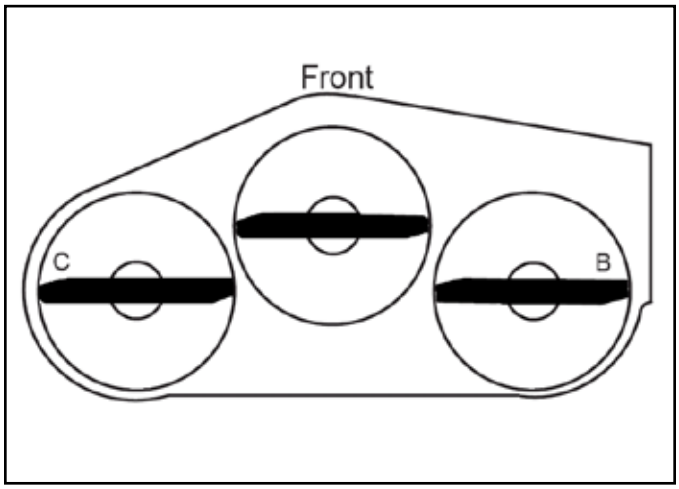

Fig 503 fig. 65 m-1078

2. Measure the right blade at the **B** location, from a flat surface to the cutting edge of the blade tip (Fig. 503).
3. Record this measurement. Measurement should be 3-1/8 to 3-1/4 inches (79 - 83mm).
4. Position the left blade side-to-side (Fig. 503).
5. Measure the left blade at the **C** location (Fig. 503), from a flat surface to the cutting edge of the blade tip.
6. Record this measurement. With the height of cut set at 3 inches (76mm) this measurement should be 3-1/8 to 3-1/4 inches (79 to 83mm).

7. If the measurements at positions **B** or **C** are not correct, loosen the bolt attaching the rear chain to the rear support arm (Fig. 504).

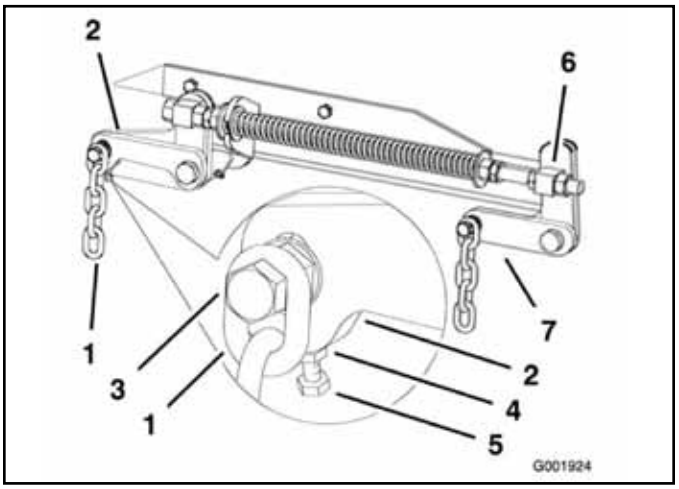

Fig 504 fig. 57 G001924

1. Rear chain
2. Rear support arm
3. Bolt
4. Jam nut
5. Adjustment bolt
6. Front swivel
7. Front support arm

8. Loosen the jam nut under the rear support arm and turn the adjustment bolt to get a measurement of 3-1/8 to 3-1/4 inches (79 - 83mm) (Fig. 504).

Note: It is recommended that both sides of the mower are adjusted the same distance.

9. Tighten the jam nut under the rear support arm and tighten the bolt securing the chain to the rear support arm.

10. Adjust the opposite side if needed.

Adjusting the Front-to-Rear Mower Pitch

1. Position the right blade front-to-rear (Fig. 505).

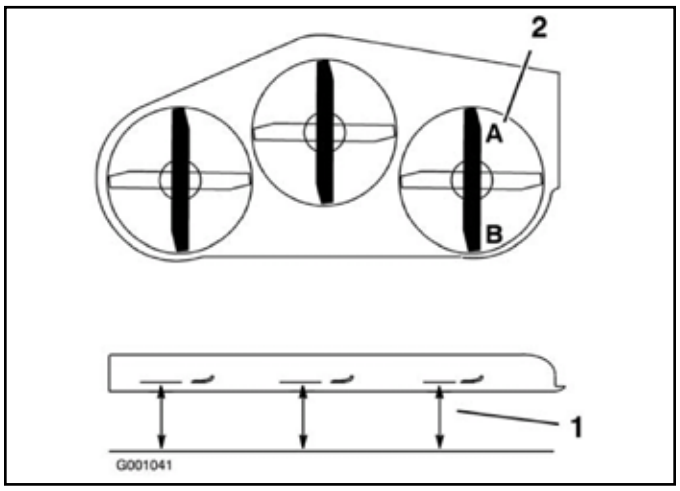

Fig 505 fig. 58 G001041

1. Measure here from blade to flat surface
2. Measure at A and B

2. Measure the right blade at the **A** location, from a flat surface to the cutting edge of the blade tip (Fig. 505).

3. Record this measurement.

4. Measure the right blade at the **B** location, from a level surface to the cutting edge of the blade tip (Fig. 505).

5. Record this measurement.

6. The mower blade should be 1/4 to 3/8 inch (6 to 10mm) lower at position A than at position B (Fig. 505). If it is not correct, proceed to the following steps.

Note: Both of the front swivels need to be adjusted the same amount to maintain equal chain tension and side-to-side level.

7. Loosen the front swivel jam nuts, at the front of the right and left swivels, approximately 1/2 inch (13mm) (Fig. 504).

8. Adjust the lift nuts on both the left and the right side of the machine to achieve 1/4 to 3/8 inch (6 to 10mm) lower in front at **A** than in the rear at **B** (Fig. 504).

9. Tighten both swivel jam nuts against the front swivel to lock the height.

10. Check to make sure there is equal tension on the chains and adjust again if needed.

Adjusting the Compression Spring

1. Raise the mower lift lever to the transport position.

2. Check the distance between the two large washers. It should be 11-1/8 inches (28.2cm) for 52 inch (132.1cm) mower decks (Fig. 506).

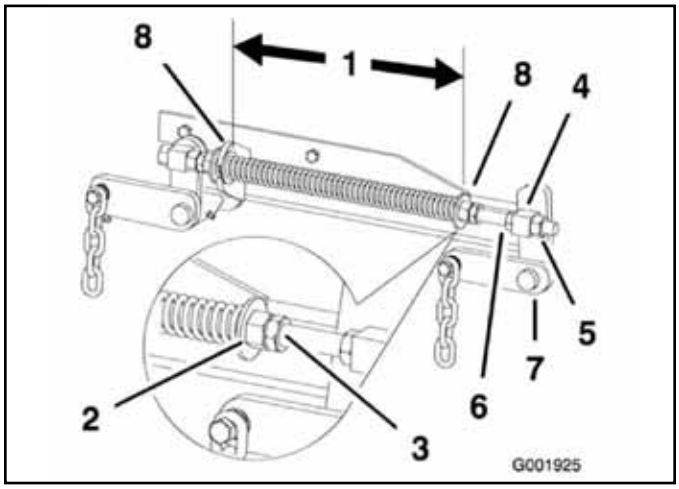

Fig 506 fig. 59 G001925

1. 11-1/8” (28.2cm)
2. Front nut
3. Spring jam nut
4. Front swivel
5. Swivel jam nut
6. Lift nut
7. Front support arm
8. Large washer

3. Adjust this distance, by loosening the spring jam nut and turning the nut in front of each spring (Fig. 506).

Note: Turning the nut clockwise will shorten the spring; counter-clockwise will lengthen the spring.

4. Lock the nut into position by tightening the spring jam nut (Fig. 506).

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Z Master Z400 Series

Service Manual

Form No. 492-9166