TORO®

LCE Products

Z Master 500 Series

Gasoline Engine Models

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 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
Gas Engine:	Through engine manufacturer
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

Z Master 500 Series gasoline engine machines, model years 2004 and 2005 are covered in this manual. This 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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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

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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 Z500 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 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 is 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

Kawasaki Liquid Cooled Product Shots

Fig 001 DSC-2861a

Fig 003 DSC-3792a

Fig 002 DSC-2860a

Fig 004 DSC-2864a

Kohler EFI Product Shots

Fig 005 DSC-2865b

Fig 007 DSC-2867a

Fig 006 DSC-2866a

Fig 008 DSC-2868a

SPECIFICATIONS

Kohler Gas Product Shots

Fig 009 DSC-2870a

Fig 011 DSC-2875a

Fig 010 DSC-2869a

Fig 012 DSC-2874a

Kawasaki Gas Product Shots

Fig 013 DSC-2877a

Fig 015 DSC-2880a

Fig 014 DSC-2879a

Fig 016 DSC-2882a

SPECIFICATIONS

Engines

Output	Make	High Idle	Low Idle	Charging Coil
20 HP (14.9kW)	Kohler OHV V-Twin Air Cooled	3750 +50/-100 RPM	1500 RPM	15 AMP
23 HP (17.2 kW)	Kohler OHV V-Twin Air Cooled	3750 +50/-100 RPM	1500 RPM	15 AMP
25 HP (18.6 kW)	Kawasaki OHV V-Twin Air Cooled	3750 +50/-100 RPM 3000 ± 100 Int'l	1500 RPM	13 AMP
27 HP (20.1 kW)	Kohler OHV V-Twin Air Cooled	3750 +50/-100 RPM	1500 RPM	15 AMP
27 HP (20.1 kW)	Kawasaki OHV V-Twin Liquid Cooled	3750 +50/-100 RPM	2250 RPM	30 AMP
28 HP (20.8 kW)	Kohler OHV V-Twin EFI Air-Cooled	3750 +50/-100 RPM	1500 RPM	25 AMP

Dimensions and Weight

		ROPS Height		Width		
Model	**Weight**	**Folded**	**Upright**	**Deck**	**Deflector**	**Length**
23 hp Kohler/52” TF Deck	1140 lbs (517kg)	53” (134cm)	72” (183cm)	53.7” (136cm)	68” (173cm)	79.5” (202cm)
23 hp Kohler/60” TF Deck	1215 lbs (551kg)	53” (134cm)	72” (183cm)	61.7” (157cm)	76” (193cm)	81.5” (207cm)
25 hp Kawasaki/60” TF Deck	1215 lbs (551kg)	53” (134cm)	72” (183cm)	61.7” (157cm)	76” (193cm)	81.5” (207cm)
27 hp Kohler/52” TF Deck	1176 lbs (533kg)	53” (134cm)	72” (183cm)	53.7” (136cm)	68” (173cm)	79.5” (202cm)
27 hp Kohler/60” TF Deck	1215 lbs (551kg)	53” (134cm)	72” (183cm)	61.7” (157cm)	76” (193cm)	81.5” (207cm)
27 hp Kohler/72” TF Deck	1280 lbs (583kg)	53” (134cm)	72” (183cm)	73.6” (187cm)	88” (223cm)	84.5” (215cm)
27 hp Kawasaki LC/60”TF Deck	1330 lbs (603kg)	53” (134cm)	72” (183cm)	61.7” (157cm)	76” (193cm)	81.5” (207cm)
27 hp Kawasaki LC/72”TF Deck	1395 lbs (633kg)	53” (134cm)	72” (183cm)	73.6” (187cm)	88” (223cm)	84.5” (215cm)
28 hp Kohler EFI/60” TF Deck	1254 lbs (569kg)	53” (134cm)	72” (183cm)	61.7” (157cm)	76” (193cm)	81.5” (207cm)
28 hp Kohler EFI/72” TF Deck	1319 lbs (598kg)	53” (134cm)	72” (183cm)	73.6” (187cm)	88” (223cm)	84.5” (215cm)

Construction

Frame Assembly	Consists of front and rear frames bolted together
Front Frame	Welded 2 x 2 x .188 structural steel tube
Rear Frame	Welded tube and fabricated steel

Fuel System

Tanks	Dual fuel tanks containing large fill necks and vented caps Mounted above the drive wheels
Capacity	12 gallons (45.4l) [6 gallons per tank]
Check Valve	In-line check valves (Selector valve on EFI units)
Fuel Filter	40 micron, replaceable in-line filter

SPECIFICATIONS

Traction System

Hydraulic Pumps	Twin Hydro-Gear BDP/PJ Series variable displacement hydrostatic with shock valves
Pump Drive	Self-tensioning belt drive
Wheel Motors	Twin Parker-Ross Torqmotor™ positive displacement with 1.25 inch heavy duty tapered shafts
Ground Speeds	Infinitely variable: Forward: 0 - 10 mph (16.1 km/hr) Reverse: 0 - 6.3 mph (10.1 km/hr)
Release Valves	Contained in pumps. Allow unit to be moved without engine running
Hydraulic Fluid	Mobil 1, 15W50 (Synthetic motor oil)
System Capacity	2.1 quarts (2.0l)

Deck Drive

Clutch	Warner® Electromagnetic “Mag-Stop” with 200 ft-lb. (271 Nm) rating
Type	Mule drive from engine to deck
Take-Up	Spring-loaded idler system

Tires

Rear Drive Tires	4-ply with “Turf Master” tread 24” x 12.0” – 12 [Models with 62” or 72” deck] 23” x 9.5” – 12 [Models with 52” deck]
Front Caster Tires	4-ply with smooth tread 13” x 6.5” – 6
Tire Pressure	13 psi (90 kpa)

Electrical System

Voltage	12 volt, negative ground
Battery Type	BCI group U1
Fuses	Blade Type

Cutting Decks

Configuration	Side discharge, mid-mounted rotary with three blades.
Construction	7 gauge, high strength 50,000 psi steel, 5-1/2" deep, advanced, super flow system, welded construction. 3/8" steel discharge reinforcement plate doubles as bagger attachment point.
Discharge	Right hand as viewed from operator seat. Rubber chute, spring biased down toward operating position. Adjustable flow control baffle.
Blade Tip Speed	18,000 + ft/min at high idle 152cm mower – 4600.7 m/min @3000 RPM
Height of Cut	Adjustable from the seat with range 1.5" – 5" in 1/4" increments (3.8cm - 12.7cm)
Deck Suspension	Deck suspended from machine by four lift chains, and attached to rear wheel supports by two struts.
Belt Covers	16-gauge, formed steel covers. Attached with swell latches.
Gauge Wheels	52" Cutting Deck – Five adjustable gauge wheels to reduce scalping: three on front of deck (one on left-hand side and two in center) and two on rear of deck (left and right sides). Wheels have four adjustment positions.
	60", 72", and 152cm Cutting Decks – Six adjustable gauge wheels to reduce scalping: four on front of deck (one each left-hand and right-hand sides, and two center) and two on rear of deck (left and right sides). Wheels have four positions.
Lubrication Fittings:	
Front Castor Pivots	2 removable plugs (1 per side) for periodic lubrication.
Front Castor Wheels	2 fittings (1 per side).
Lift Assembly	5 fittings.
Mule Drive Idler	1 fitting.
Brake Arms	2 fittings (1 per side).
Rear Deck Struts	2 fittings (1 per side).
Deck Spindles	3 fittings (1 per spindle).
Hydraulic Pump Drive Tensioner	1 fitting.

SPECIFICATIONS

General Specifications

Greasing and Lubrication:

Grease:	No. 2 general purpose lithium base or molybdenum grease.
Where to Add Grease:	See Check Service Reference Aid decal below (Fig. 017).

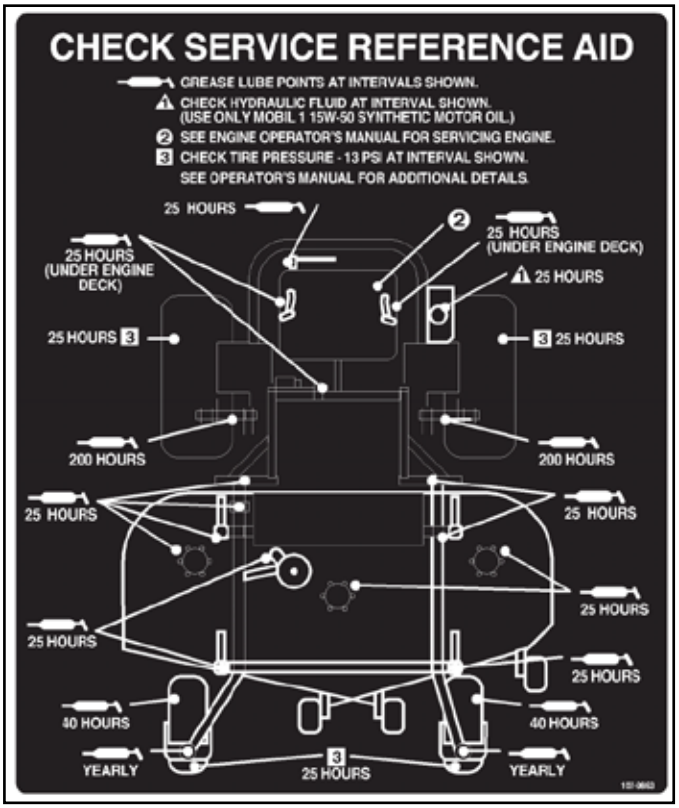

Fig 017 fig. 50 decal

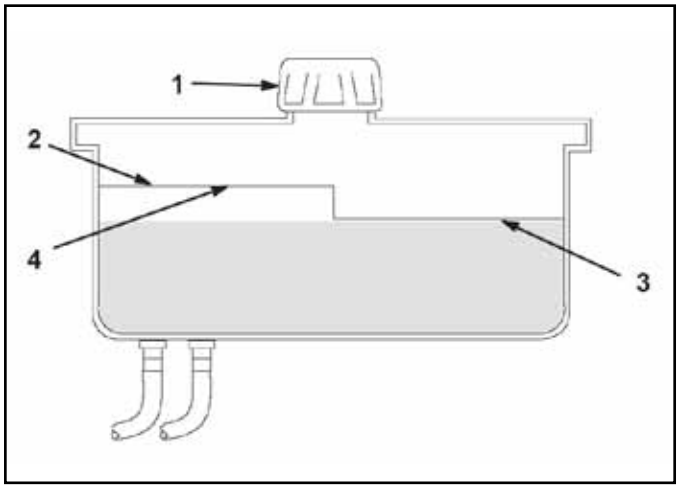

Fig 018 fig. 55 m-5615

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

Hydraulic System Oil Capacity:	4 quarts (3.8 l)
Fluid Type:	Mobil 1 15w50 synthetic motor oil or equivalent synthetic oil
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. 018 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. 019).

Fig 019 DSC-2351

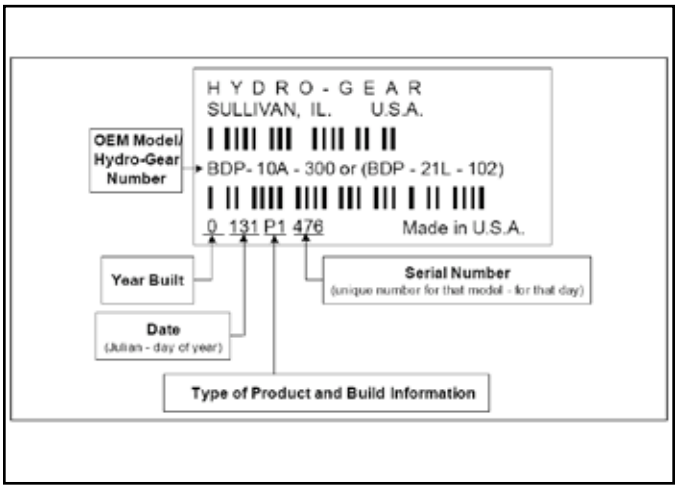

Fig 020 configuration

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 above (Fig. 020), is located on the pump housing. It identifies the model and configuration of the BDP pump.

Available Service Manuals

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
Engine:	Engine manufacturer
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

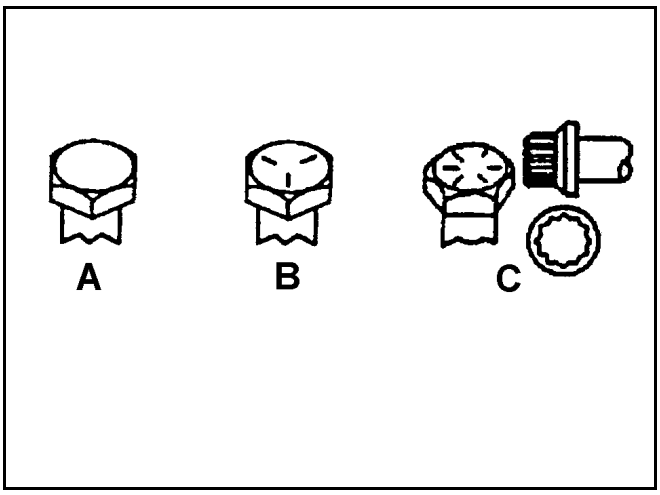

Figure A

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

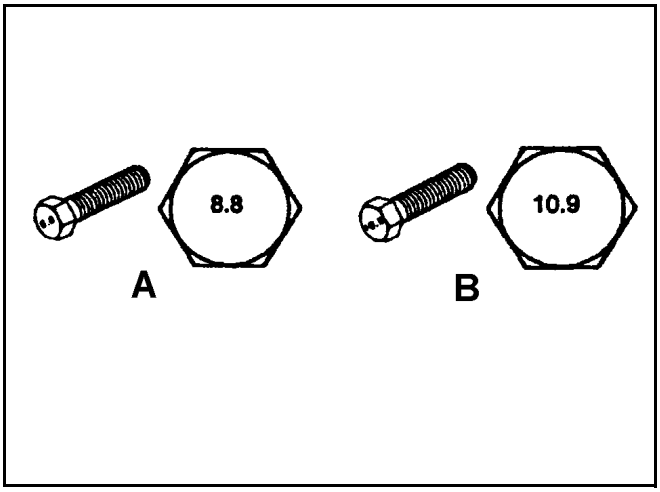

Figure B

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

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

2. With a hammer and chisel, remove the top grease cap (Fig. 021).

Fig 021 mvc-1531

3. Remove the locknut (Fig. 022).

Fig 022 DSC-1532

4. Remove the Belleville washers and caster fork and wheel assembly (Fig. 023).

Fig 023 DSC-1533

Replacing the Caster Bearings

1. Remove the top tapered roller bearing (Fig. 024).

Fig 024 DSC-1534

2. Remove bottom seal and tapered roller bearing (Fig. 025).

Fig 025 DSC-1535

3. With a driver and hammer, remove both the bottom and top tapered bearing cups (Fig. 026).

Fig 026 DSC-1536

4. With a driver and hammer, install new tapered bearing cups. The bearing cups are tapered; make sure the tapered/thicker end of the cup is installed inward for the top and bottom end (Fig. 027). Tap the bearing cups in until they seat against the step in the caster hub.

Fig 027 DSC-1537

5. Pack the upper and lower tapered bearings prior to installation (Fig. 028).

Fig 028 DSC-1539

6. Install the lower bearing and seal, with the open end of the seal facing up (Fig. 029).

Fig 029 DSC-1538

Castor Fork Assembly

1. Install the castor fork into the frame (Fig. 030).

Fig 030 DSC-1533

2. Install the upper bearing.

3. Install the Belleville (spring) washers as shown in (Fig. 031).
   A. Dust Cap
   B. Locknut
   C. Spring Washers

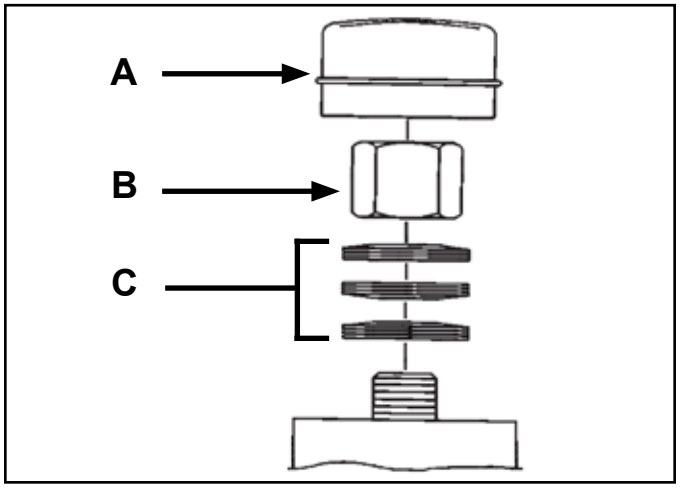

Fig 031 washers line art

4. 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. 032).

Fig 032 DSC-1532

5. Remove the plug located on the side of the hub on the frame for the castor fork. Install a grease fitting, and pump grease into the housing until grease is passing through the upper bearing (Fig. 033).

Fig 033 DSC-1540

6. Remove the grease fitting and install the grease plug.

7. Install the grease cap on the caster hub (Fig. 034).

Fig 034 DSC-1541

Front Wheel Removal and Bearing Replacement

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

2. Remove the wheel bolt from the fork (Fig. 035).

Fig 035 DSC-1543

3. Remove bearing spacers and the front caster spacer. Remove the seals located on each side of the wheel and both the tapered bearings (Fig. 036).

A. Bearing Spacer
B. Bearing Seal
C. Taper Bearing
D. Caster Spacer
E. Retaining wheel nut
F. Retaining wheel bolt

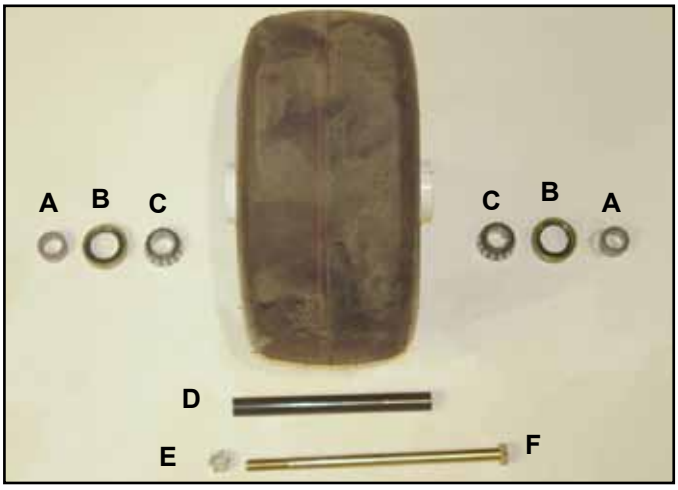

Fig 036 DSC-1546

4. Pack both tapered wheel bearings. Reassemble per Fig. 036. Pump grease into the wheel bearings through the grease fitting located on the rim (Fig. 037).

Fig 037 DSC-1547

Fuel Tank Removal

Left Side Fuel Tank Removal

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

2. Remove the fuel hose clamp at the bottom of the fuel tank (Fig. 038).

Fig 038 DSC-3091

3. Remove the 4 screws retaining the control panel and control panel shield to the tank (Fig. 039).

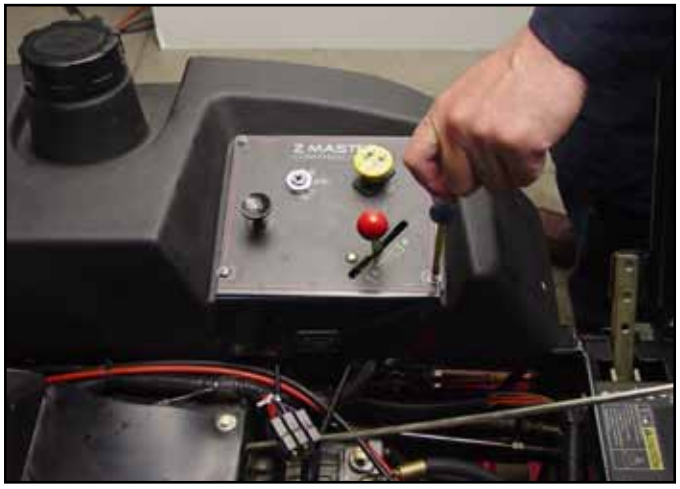

Fig 039 DSC-3092

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

Note: DO NOT disconnect any cables or wiring.

5. Remove the bolt, lock washer, and nut located under the front of the fuel tank (Fig. 040).

Fig 040 DSC-3094

6. Located under the rear portion of the fuel tank, remove the 2 nuts, springs, and washers from the fuel tank studs (Fig. 041).

Fig 041 DSC-3095

Note: Rear tire removed for clarity.

7. On the inside of the frame under the rear portion of the fuel tank, remove the nut, spring, and washer from the fuel tank stud (Fig. 042).

Fig 042 DSC-3098

8. Remove the fuel tank from the frame (Fig. 043).

Fig 043 DSC-3099

Left Side Fuel Tank Installation

Reverse the order of removal.

Right Side Fuel Tank Removal and Installation

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

Hood Assembly Removal

1. Unhook the two rubber latches located on the rear of the hood.

2. Remove the two hairpins, clevis pins, and washers located in the front left and right lower side of the hood (Fig. 044).

Fig 044 DSC-1579

3. Lift the hood and remove the stop lanyards located on each side of the hood. Remove the hood from the frame of the unit (Fig. 045).

Fig 045 DSC-1581

Hood Assembly Installation

Reverse the order of removal.

Brake Lever Removal

1. Release the parking brake (forward position).

2. Remove the cotter pin and clevis pin from the brake rod yoke (Fig. 046).

Fig 046 DSC-1618

3. Lift the floor pan assembly to access the brake lever shaft and cotter pin (Fig. 047).

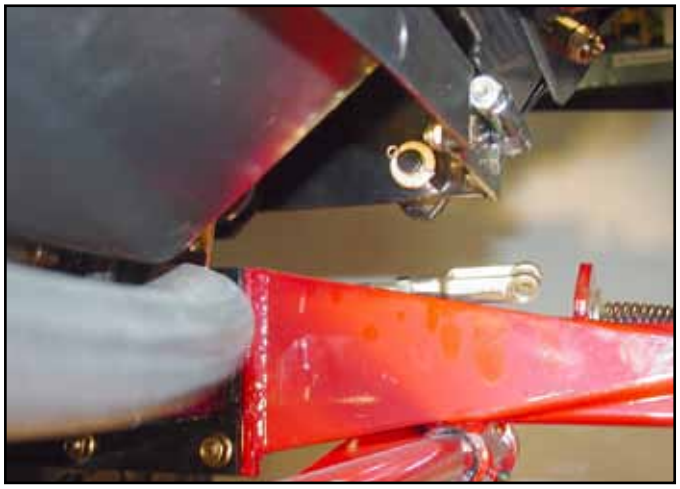

Fig 047 DSC-1619

4. Remove the brake shaft cotter pin (Fig. 048).

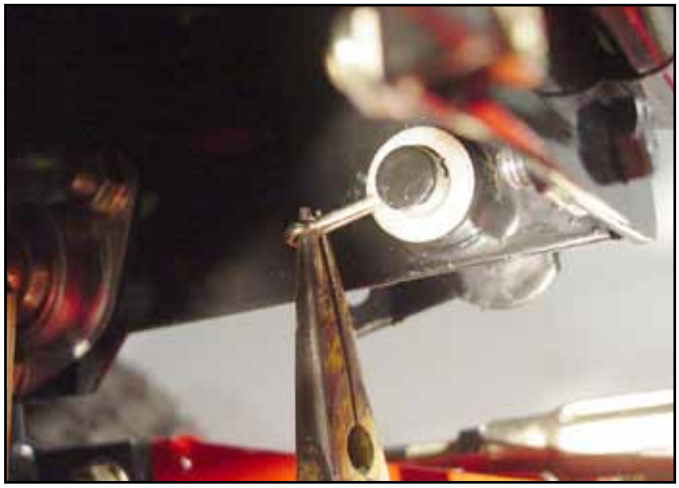

Fig 048 DSC-1620

5. Slide the brake shaft out of the frame pivot bushings (Fig 049).

Fig 049 DSC-1621

6. Using a hammer and punch, drive both brake lever control bearings from the brake pivot (Fig. 050).

Fig 050 DSC-1622

7. Inspect the brake shaft and bushings for excessive wear. Replace any worn or broken components (Fig. 051).

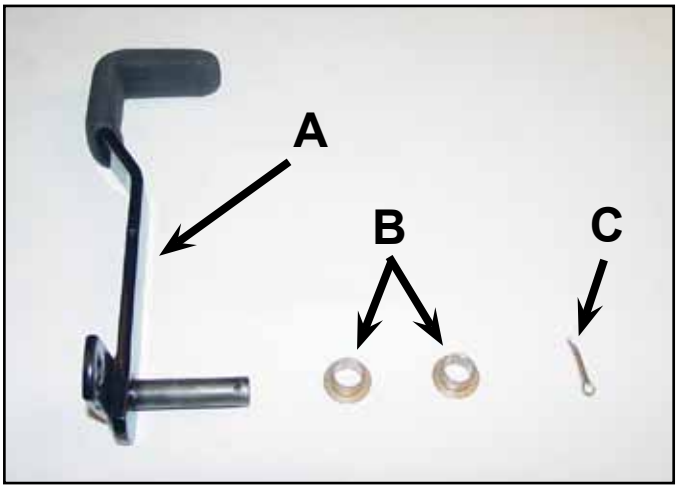

Fig 051 DSC-1623

A. Brake lever
B. Bushings
C. Cotter pin

Brake Lever Installation

Reverse the order of removal

Brake Band Removal

1. Raise the left rear tire off the ground (Fig. 052).

Fig 052 DSC-1624

2. Remove the four wheel lug bolts.

3. Remove bolts, brake band retainer, spacers, and brake band (Fig. 053).

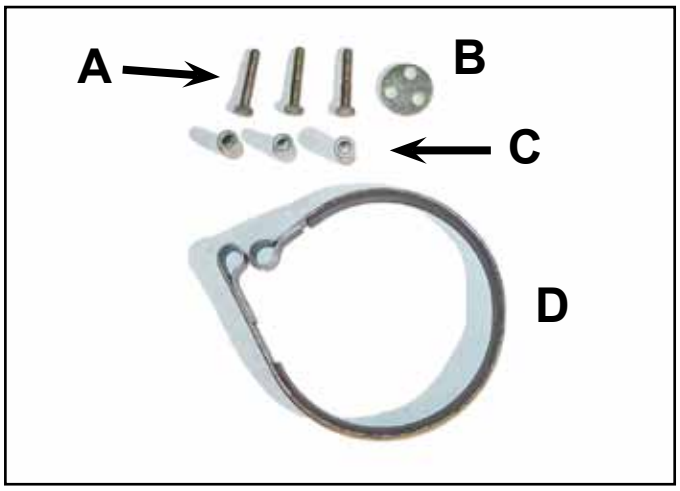

Fig 053 DSC-1626

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. 054).

Fig 054 DSC-1629

2. Install the 3 bolts, brake band retainer, brake band, and spacers and tighten (Fig. 055).

Fig 055 DSC-1631

3. Install tire assembly and the 4 wheel bolts.

Brake Shaft Removal

1. Raise the rear end of the unit and remove the right and left rear tires.

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

2. On the left side of the machine, remove both clevis spring pins, one from the brake rod and the other from the brake shaft (Fig. 056).

Fig 056 DSC-3100

3. On the right side remove the clevis spring clip from the brake shaft (Fig. 057).

Fig 057 DSC-3101

4. On the right side, remove the two bolts and nuts holding the flange bearing (Fig. 058).

Fig 058 DSC-3104

5. On the left side, remove the two bolts and nuts holding the flange bearing (Fig. 059).

Fig 059 DSC-3105

6. Remove the brake shaft from the left side of the unit (Fig. 060).

Fig 060 DSC-3106

7. Inspect the brake shaft and flange bearings for excessive wear (Fig. 061).

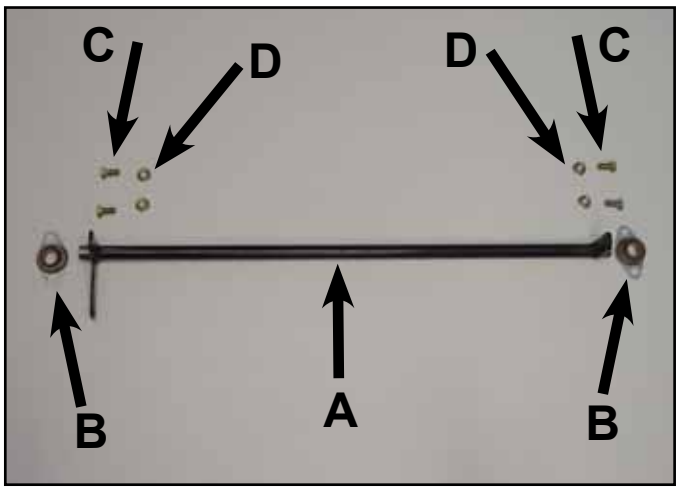

Fig 061 DSC-3107

A. Brake shaft
B. Flange bearings
C. Bolts
D. Nuts

Brake Shaft Installation

Reverse the order of removal.

Adjusting the Parking Brake

Check the parking brake for proper adjustment.

1. Disengage the brake lever (lever down).
2. Measure the length of the spring. The measurement should be 2-3/4” (70mm) between the washers (Fig. 062).

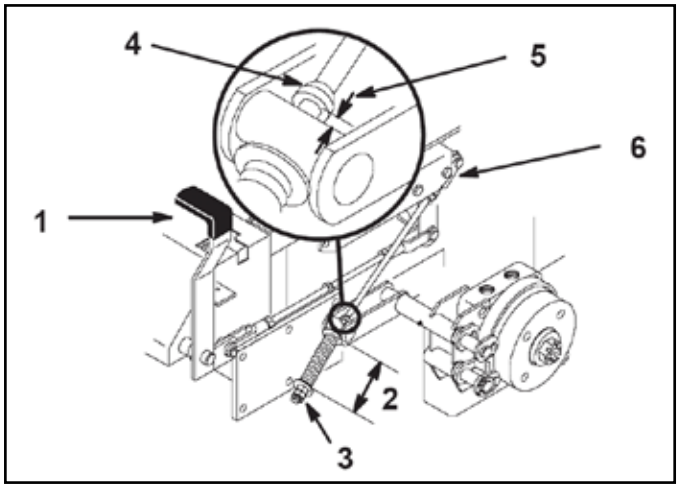

Fig 062 fig. 74 m-3788

1. Brake lever
2. Spring, 2-3/4” (70mm)
3. Adjusting nuts
4. Collar on brake rod
5. 3/16 - 1/4” (5-7mm)
6. Jam nut and yoke

3. If an adjustment is necessary, loosen the jam nut below the spring and tighten the nut directly below the yoke (Fig. 062). Turn the nut until the correct measurement is obtained. Tighten the two nuts together and repeat on the opposite side of the unit.
4. Turn the nuts clockwise to shorten the spring length and counterclockwise to lengthen the spring.
5. Engage the parking brake, lever up.
6. Measure the distance between the trunnion roller and the collar on the brake rod. The measurement should be 3/16 - 1/4” (5 - 8mm) (Fig. 062).
7. If adjustment is necessary, loosen the jam nut directly below the yoke. Turn the bottom rod until the correct measurement is obtained (Fig. 062). Tighten the jam nut at the yoke.

Deck Lift Lever Removal

1. Park the machine on a level surface, disengage the blade control (PTO), and turn the ignition key to *OFF* to stop the engine. Remove the ignition key.
2. Remove the lower stop bolt from the deck lift plate (Fig. 063).

Fig 063 DSC-1647

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. 064).

Fig 064 DSC-1648

4. Loosen jam nuts on deck lift rods until deck support springs are fully extended. Repeat procedure for both deck lift rods (Fig. 065).

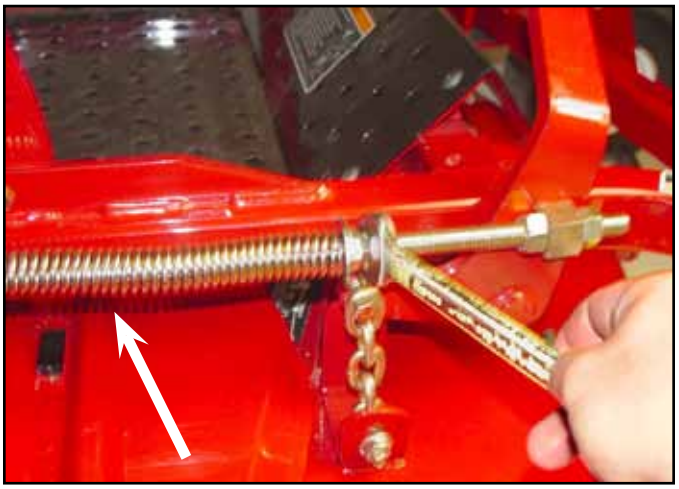

Fig 065 DSC-1649

5. Remove hex nut from RH rear deck lift assembly. Repeat procedure for LH rear deck lift assembly (Fig. 066).

Fig 066 DSC-1650

6. Lower lift lever grip assembly to its lowest position. Rear deck swivel mounts should clear deck lift rods on both sides. The mower deck lift linkage should now be fully unloaded (Fig. 067).

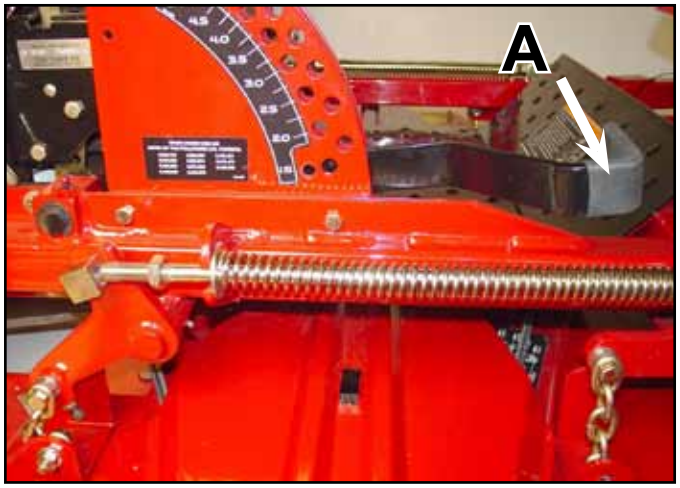

Fig 067 DSC-1651

A. Lift Lever at lowest position

7. Remove hex bolt, nut, and lift lever bushing from the lower deck lift plate mounting location (Fig. 068).

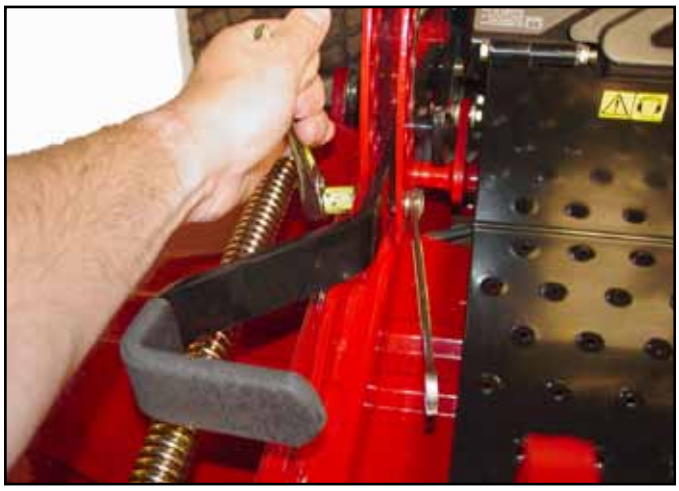

Fig 068 DSC-1652

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. 069).

Fig 069 DSC-1653

9. Lift the floor pan assembly to its fully opened position (Fig. 070).

Fig 070 DSC-3112

10. Remove hex bolt, bushing, and nylock nut connecting the deck lift arm plates to the mower deck rear cross-shaft lift assembly (Fig. 071).

Fig 071 DSC-1655

11. Remove retainer clip from lift lever grip assembly (Fig. 072).

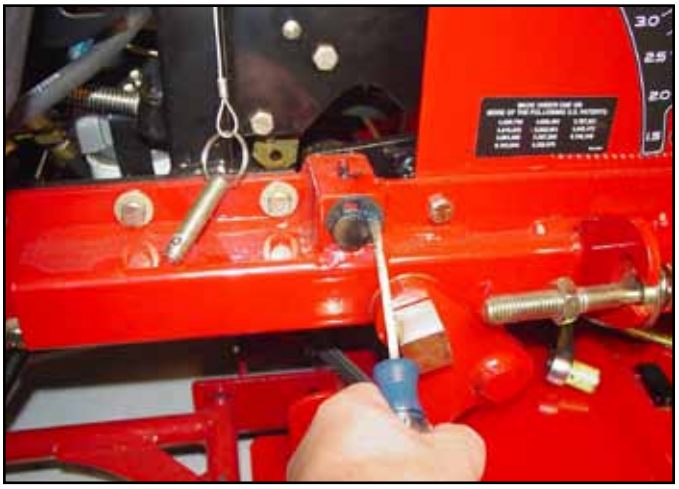

Fig 072 DSC-1656

12. When removing the lift lever grip assembly, you may experience interference with the RH floor pan hinge or the front edge of the RH motion control plate, or both (Fig. 073).

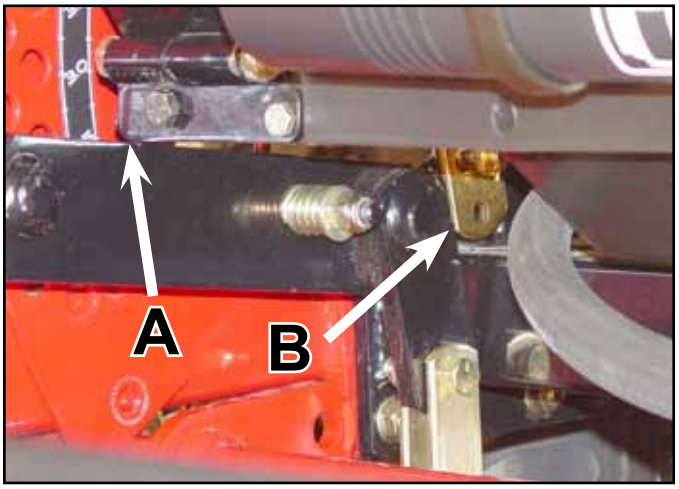

Fig 073 DSC-1657

A. RH Floor pan hinge B. RH Motion control plate

13. If the lift lever grip assembly contacts the RH floor pan hinge, loosen the RH floor pan hinge mounting hardware. Push the RH hinge upward. Re-tighten the RH floor pan hinge mounting hardware (Fig. 074).

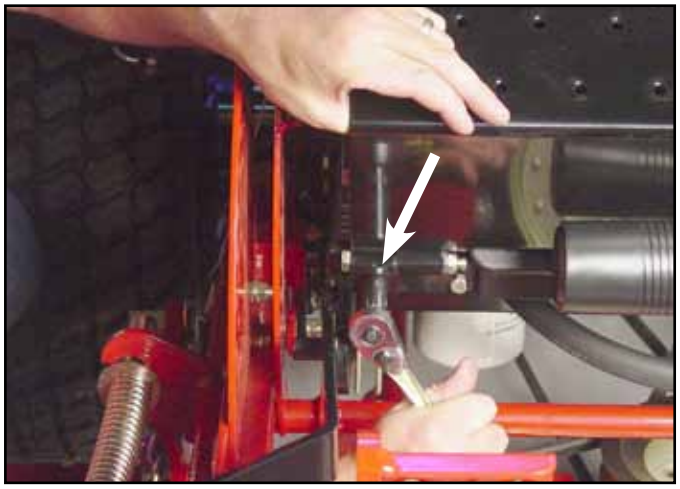

Fig 074 DSC-1661

14. If the lift lever grip assembly contacts the RH motion control plate, tilt and hold the floor pan assembly slightly forward. Move the RH motion control lever out of the neutral lock position and push it in the full forward position. Using a tie strap or wire, tie the floor pan assembly to the motion control arm to hold the floor pan assembly in place (Fig. 075).

Fig 075 DSC-1665

15. Carefully slide the lift lever grip assembly out of its carrier frame pivot (Fig. 076).

Fig 076 DSC-1667

Deck Lift Lever Installation

1. For ease of installation, make sure deck lift arm plates, bushing, and hardware are installed on the lift lever grip assembly prior to installation (Fig. 077).

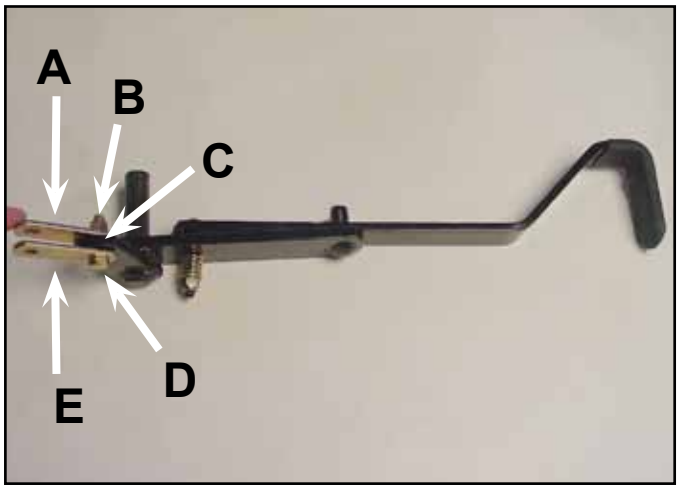

Fig 077 DSC-1668

A. Plate
B. Nut
C. Bushing
D. Bolt
E. Plate

2. Install lift lever grip assembly into front frame pivot location (Fig. 078).

Fig 078 DSC-1670

3. Install retainer clip to lift lever grip assembly (Fig. 079).

Fig 079 DSC-1672

4. Install bushing into rear lift arm cross shaft (Fig. 080).

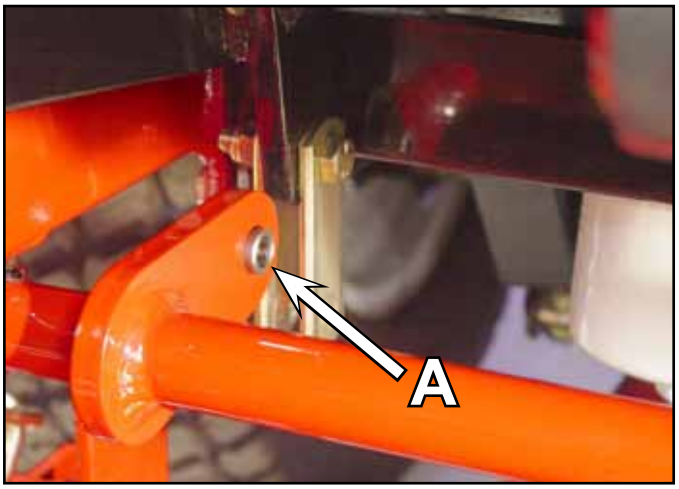

Fig 080 DSC-1674

A. Bushing

5. Install hex bolt through deck lift plates and rear lift arm cross shaft bushing. Install nylock nut and tighten (Fig. 081).

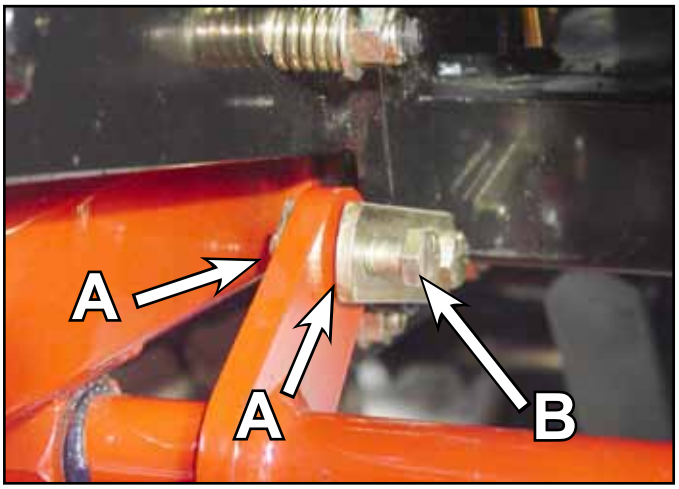

Fig 081 DSC-1675

A. Rear lift arm plates B. Hex bolt

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. 082).

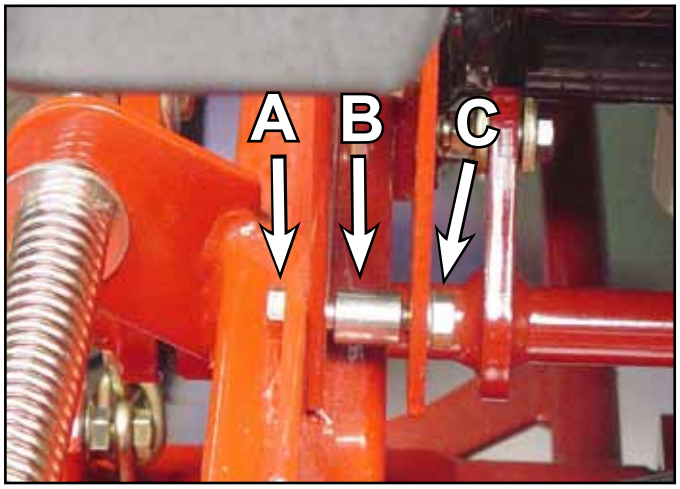

Fig 082 DSC-1677

A. Hex bolt B. Spacer
C. Flanged locknut

7. Align rear deck mount swivels with ends of deck lift rod (Fig. 083).

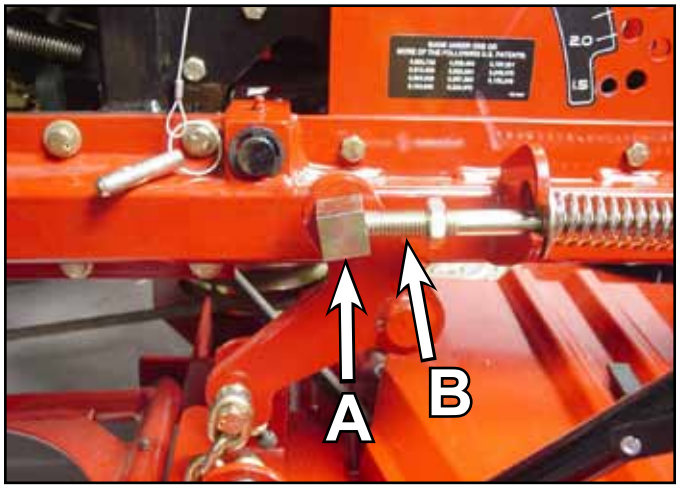

Fig 083 DSC-1680

A. Rear deck mount swivel B. Lift rod

8. Raise lift lever grip assembly until deck mount swivels rest against deck rod jam nuts. Install HOC pin into deck lift plate height of cut holes that correspond to the 3” (7.62cm) HOC position (Fig. 084).

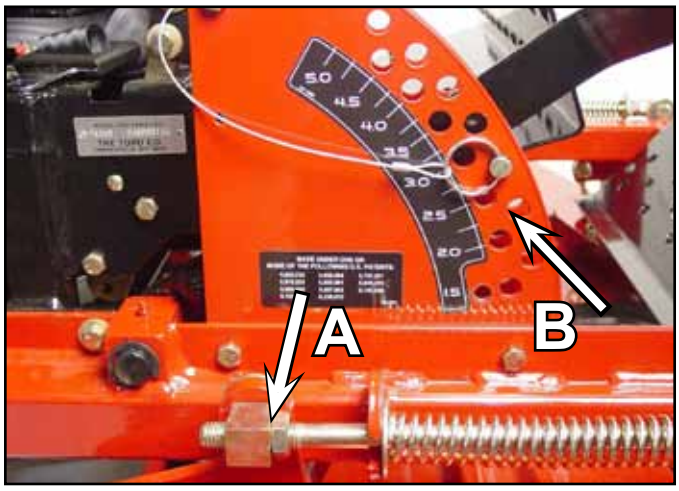

Fig 084 DSC-1681

A. Rear deck mount swivel B. HOC Pin

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. 085).

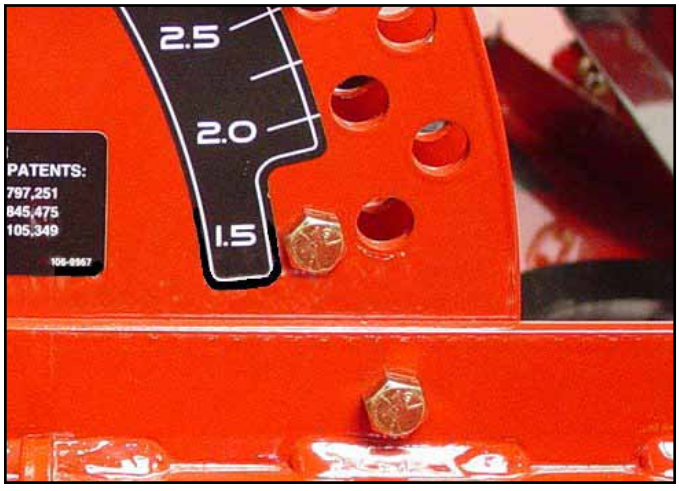

Fig 085 DSC-1682

10. Install Hex nut on end of deck lift rod. Tighten against deck mount swivel. Repeat procedure for opposite side deck lift rod (Fig. 086).

Fig 086 DSC-1683

11. Raise mower deck to the transport position. Remove support blocks. Check deck level adjustment (refer to Mower Deck Leveling page 7-27). Readjust compression spring length by turning front nut. Spring should be compressed to a length of 11-1/2” (29.2cm) between washers. Lock the front nut into position by tightening the spring jam nut (Fig. 087).

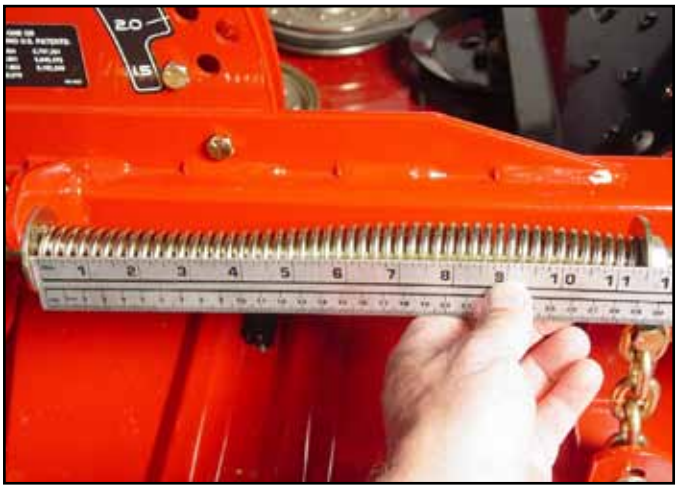

Fig 087 DSC-1685

12. Untie the floor pan assembly and lower. Return motion control lever to its neutral locked position.

Motion Control Assembly Removal

1. Remove both floor pan assembly hinge bolts (Fig. 088).

Fig 088 DSC-1686

2. Remove floor pan assembly (Fig. 089).

Fig 089 DSC-1689

3. Remove (4) pocket mounting bolts (Fig. 090).

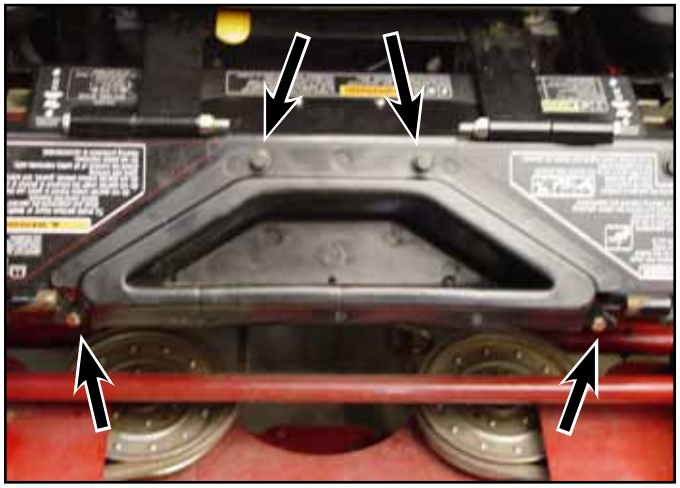

Fig 090 DSC-3108

4. Remove pocket (Fig. 091).

Fig 091 DSC-3109

5. Remove the two bolts retaining the lever assembly to the control arm shaft (Fig. 092).

Fig 092 DSC-2062

6. Disconnect Motion Control Dampener from motion control assembly (Fig. 093).

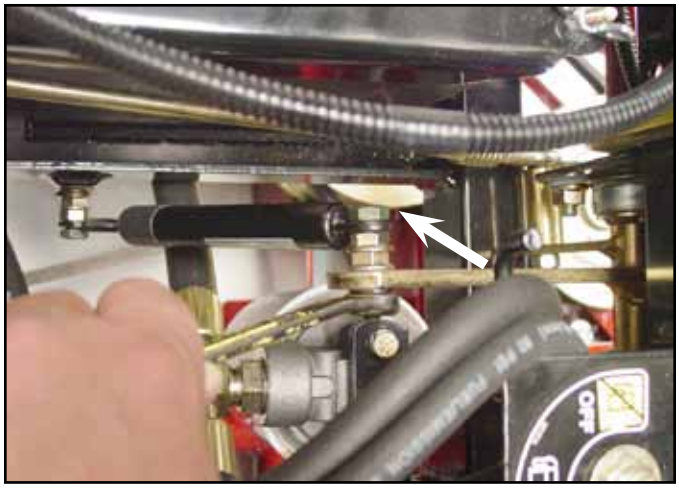

Fig 093 DSC-1695

7. Disconnect neutral switch wire harness from neutral switch (Fig. 094).

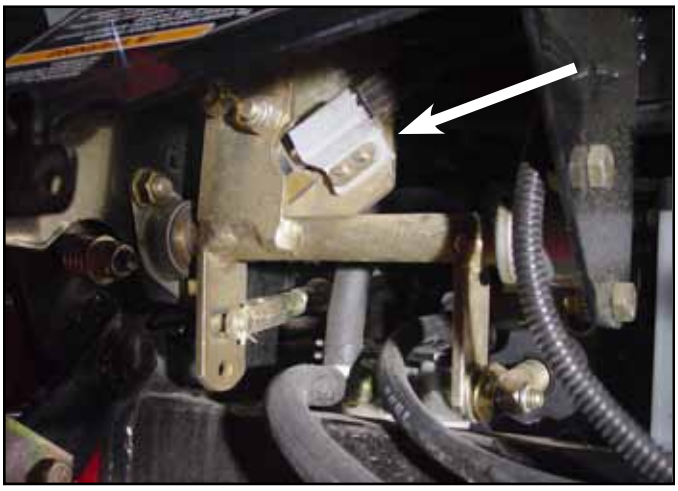

Fig 094 DSC-3110

8. Remove bolt and nut that retains the ball joint to the motion control (Fig. 095).

Fig 095 DSC-3111

9. Remove the cotter pin and clevis pin through the adjustable yoke for the neutral return bolt (Fig. 096).

Fig 096 DSC-2064

10. Remove the two bolts and nuts that retain the flange bearing on the inside of the motion control (Fig. 097).

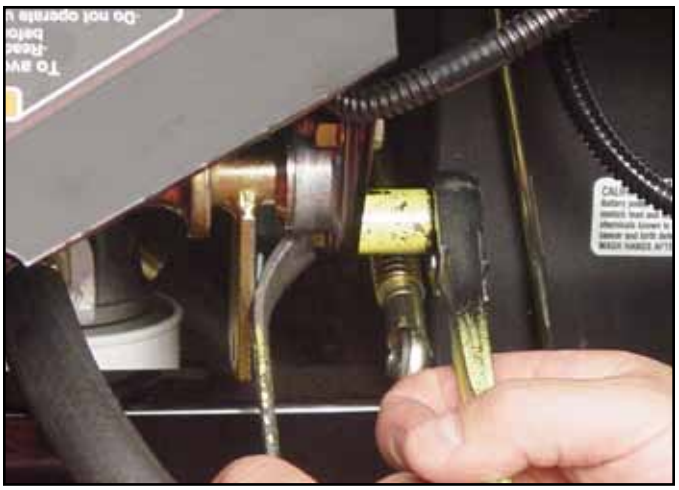

Fig 097 DSC-2066

11. Remove the two bolts and nuts that retain the flange bearing on the outside of the motion control (Fig. 098).

Fig 098 DSC-2067

12. Remove the motion control from the frame (Fig. 099).

Fig 099 DSC-2068

Motion Control Assembly Installation

Reverse the order of removal.

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 and then the positive 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 seat prop rod from the seat and the frame (Fig. 100).

Fig 100 DSC-2986

4. Lift the engine shield. Using a pry bar, relieve the spring tension on the idler assembly and remove the pump drive belt (Fig. 101).

Fig 101 DSC-2991

5. Loosen the two square head set-screws located on the pump sheave and remove the pulley (Fig. 102).

Fig 102 DSC-2993

6. Remove bolt, washer, and nut located between ball joint and control arm that retains the tracking link rod to the hydro control arm (Fig. 103).

Note: It may be necessary to move the hydro lever forward in order to remove the bolt.

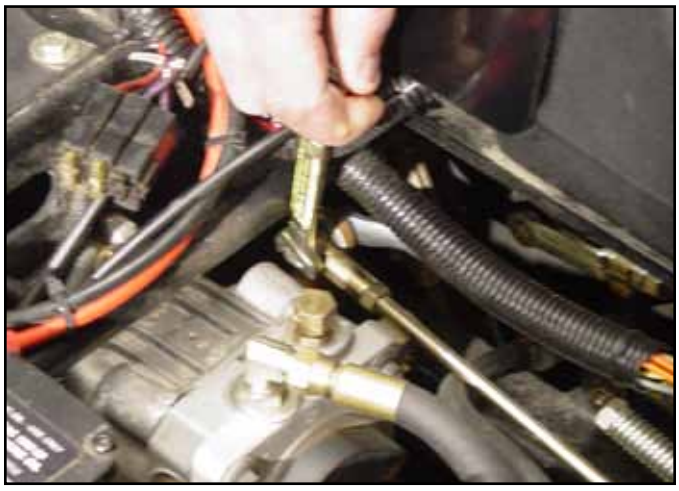

Fig 103 DSC-2994

7. Remove the two high pressure hydraulic lines, located at the bottom of the hydrostatic pump (Fig. 104).

Note: Cap the hose and the fitting to prevent entry of dirt and debris. Mark or tag one of the hoses to ensure correct reassembly.

Fig 104 DSC-2996

8. Remove the hose clamp around the case drain hydraulic hose, located on the left side of the hydrostatic pump (Fig. 105).

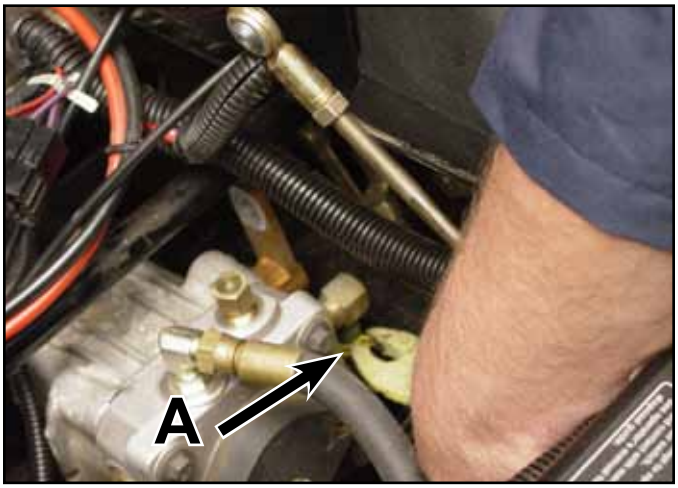

Fig 105 DSC-2998

A. Case drain hose clamp

9. Remove the pump suction hydraulic line, located on top of the hydrostatic pump (Fig. 106).

Fig 106 DSC-2999

10. Loosen and remove the two bolts and nuts retaining the hydrostatic pump to the frame (Fig. 107).

Fig 107 DSC-3000

Note: Engine shield removed for clarity.

11. Remove the hydrostatic pump from the frame (Fig. 108).

Fig 108 DSC-3002

12. For service work on the pump refer to the Hydro-Gear BDP10A/16A/21L Service Manual, form #492-4789.

Hydrostatic Pump 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 the hydrostatic pump to the frame. Install and tighten the two bolts and nuts (Fig. 109).

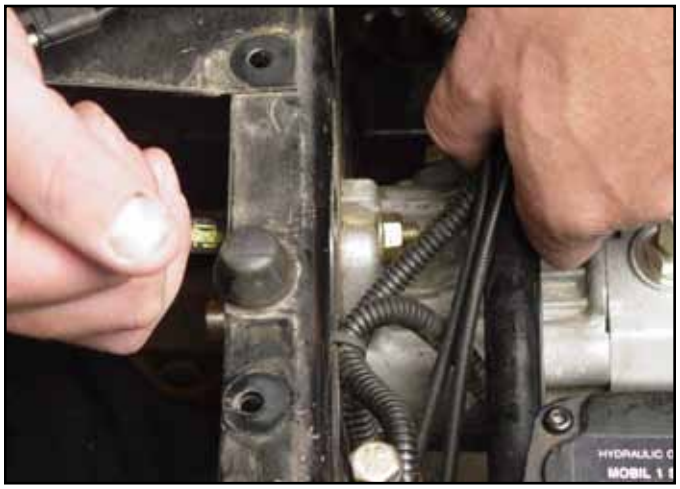

Fig 109 DSC-3000

2. Install the pump suction hydraulic line, located on top of the hydrostatic pump, that comes from the hydraulic filter (Fig. 110).

Fig 110 DSC-2999

3. Install the case drain hose and hose clamp onto the pump case drain fitting, located around the left side of the hydrostatic pump (Fig. 111).

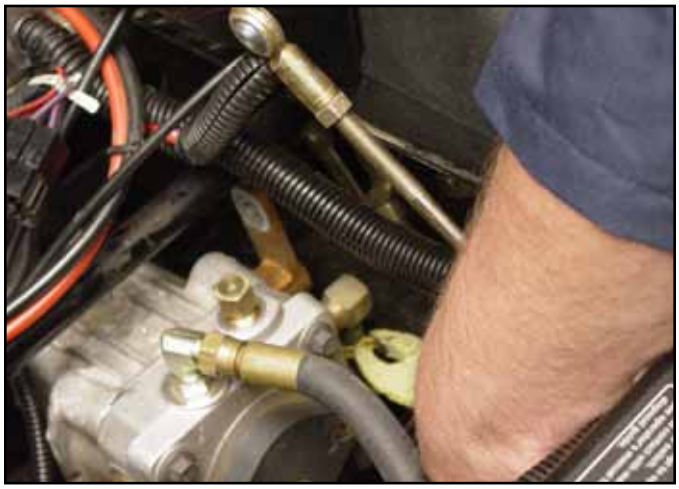

Fig 111 DSC-2998

4. Install the two high pressure hydraulic lines, located at the bottom of the hydrostatic pump (Fig. 112).

Fig 112 DSC-2996

5. Install the bolt, washer, and nut between the ball joint and control arm to secure the tracking link rod to the hydro control arm (Fig. 113). Tighten the bolt and nut.

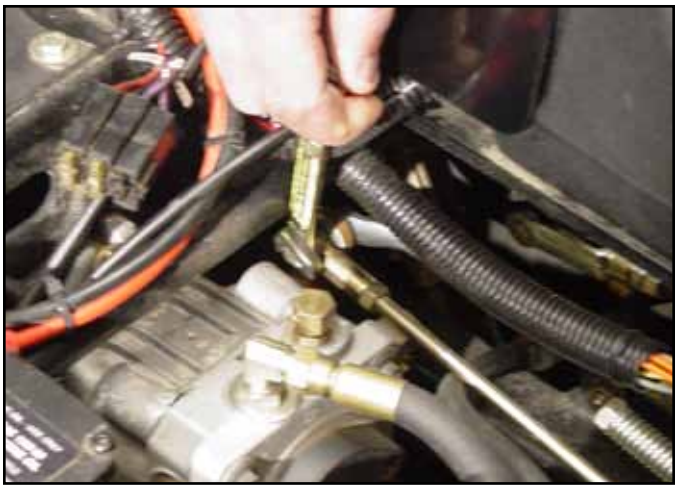

Fig 113 DSC-2994

6. Install the key in the hydrostatic pump shaft.

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

Apply some anti-seize compound to the shaft (Fig. 114). Install the pulley to the shaft.

Fig 114 DSC-3066

7. Align the outer edge of the hydrostatic pump pulley, using a straight edge, to the outer edge of the engine drive pulley (Fig. 115). Tighten the two set screws once alignment is achieved.

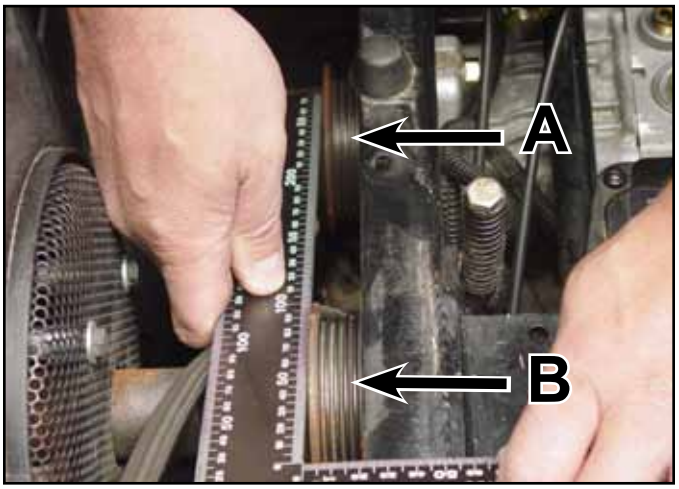

Fig 115 DSC-3067

A. Pump pulley B. Engine pulley

8. Using a pry bar, release the spring tension on the idler assembly and install the pump drive belt (Fig. 116).

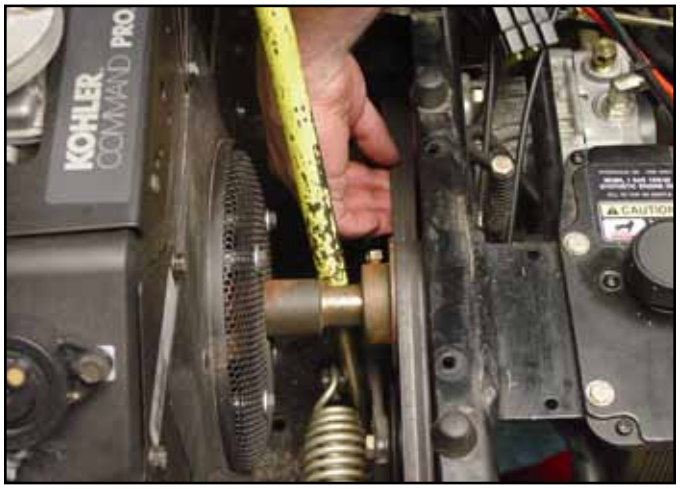

Fig 116 DSC-3068

Note: The engine shield has been removed for clarity.

9. Install the seat prop rod to the frame (Fig. 117).

Fig 117 DSC-2986

10. Install the battery positive and then the negative cable to the battery.

11. Check the hydraulic fluid in the reservoir tank. Add oil if necessary. Air will need to be purged in the system. Follow procedures on Purging the Hydraulic System, page 4-18.

12. Check the neutral adjustment. Follow procedures on Adjusting the Handle Neutral, page 4-12.

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 frame with jackstands. Remove the rear wheel (Fig. 118).

Fig 118 DSC-3069

3. Apply the parking brake and remove the cotter pin from the wheel motor output shaft (Fig. 119).

Fig 119 DSC-3070

4. Loosen and remove nut securing hub to the wheel motor output shaft (Fig. 120).

Fig 120 DSC-3071

5. Remove the 3 bolts securing the brake band to the actuator (Fig. 121).

Fig 121 DSC-3072

6. Remove the brake band from the hub (Fig. 122).

Fig 122 DSC-3073

7. Install wheel puller on to the hub and remove the hub from motor output shaft (Fig. 123).

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

Fig 123 DSC-3074

8. Clean any dirt or debris away from the hydraulic line fittings. Remove the hydraulic lines.

Note: Make sure to cap the fittings and hoses to prevent dirt from entering the hydraulic system (Fig. 124).

Fig 124 DSC-3075

9. Remove the front two wheel motor bolts, lock washers, spacers, and nuts (Fig. 125).

Fig 125 DSC-3076

10. Swing the brake linkage forward out of the way of the wheel motor. It may be necessary to loosen the back two bolts to remove the spacers (Fig. 126).

Fig 126 DSC-3077

11. Remove the back two bolts, lock washers, spacers, and nuts and remove the wheel motor from the frame (Fig. 127).

Fig 127 DSC-3078

12. For service work 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.

Note: There are two different spacers used on the wheel motors (Fig. 128). The short spacers are used in the front of the wheel motors(with the brake linkage) and the long spacers are used to retain the back of the wheel motor.

Fig 128 DSC-3079

A. Front Spacer (short) B. Back Spacer (long)

1. Install wheel motor in the frame. Loosely install the back two bolts, long spacers, lock washers and nuts (Fig. 129).

Fig 129 DSC-3080

2. Align the brake linkage with the two front bolt holes (Fig. 130).

Fig 130 DSC-3081

3. Install the two bolts, short spacers, lock washers, and nuts through the wheel motor, brake linkage and the frame (Fig. 131).

Fig 131 DSC-3082

4. Torque the bolts to 80 to 90 ft-lbs. (108 to 122 Nm) (Fig. 132).

Fig 132 DSC-3085

5. Install and tighten the two hydraulic lines to the wheel motor (Fig. 133).

Fig 133 DSC-3086

6. Install wheel hub assembly, making sure the woodruff key is in place (Fig. 134).

Note: It is recommended to replace the wheel hub assembly prior to installation.

Fig 134 DSC-3087

7. Install the nut on the wheel motor shaft, DO NOT tighten (Fig. 135).

Fig 135 DSC-3088

8. Install spacers, brake band retainer, and brake band around the wheel hub and tighten all three retainer bolts (Fig. 136).

Fig 136 DSC-3089

9. Engage the parking brake, torque the wheel hub nut to 125 ft-lbs. (169 Nm) (Fig. 137). Install the cotter key through the nut and motor wheel shaft.

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

Fig 137 DSC-3090

10. Check the park brake and adjust park brake if necessary. Refer to Adjusting the Parking Brake, page xxx.

11. Install rear wheel and wheel lug nuts and tighten.

12. Reconnect the battery negative cable to the battery.

13. Check the hydraulic fluid in the reservoir tank. Add oil if necessary. Air will need to be purged in the system. Follow the procedures on Purging the Hydraulic System, page 4-18.

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. 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. Unlatch the seat and tilt the seat forward.

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

5. Move the lever to the neutral position but not locked (Fig. 138).

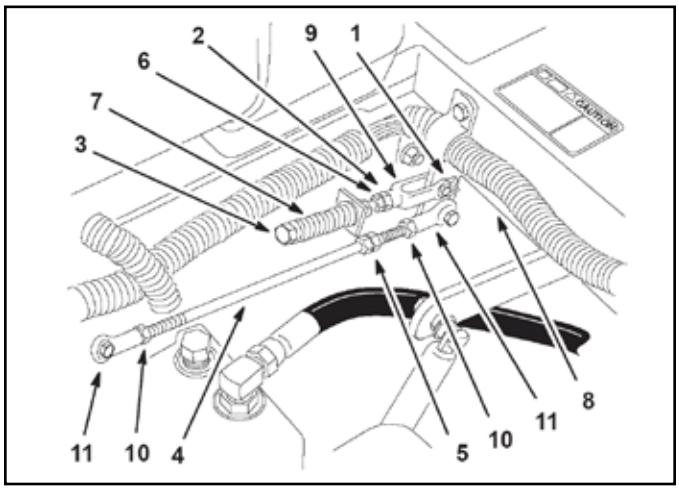

Fig 138 fig. 59 m-6278

1. Clevis pin in slot
2. Nut against yoke
3. Adjustment bolt
4. Pump rod
5. Double nuts
6. Jam nuts
7. Spring
8. Pivot shaft
9. Yoke
10. Locknut
11. Ball joint

6. 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. 138).

7. Check where the control lever is relative to notch in console (Fig. 139). It should be centered allowing lever to pivot outward to the neutral lock position.

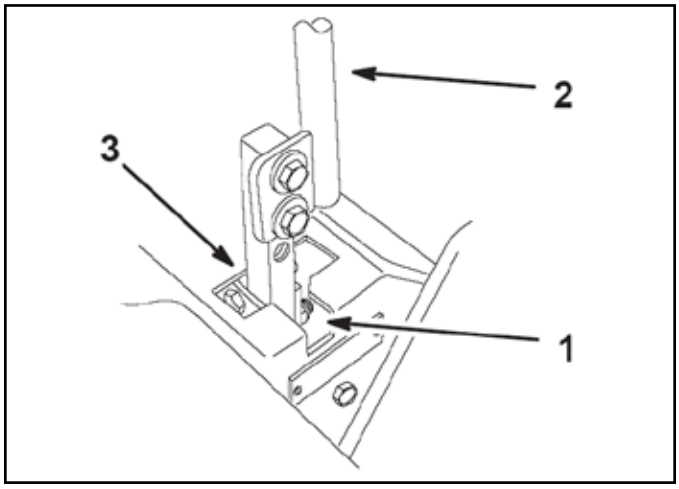

Fig 139 fig 58 m-6282

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

8. Check where the control lever is relative to notch in console (Fig. 139). It should be centered allowing lever to pivot outward to the neutral lock position.

9. If adjustment is needed, loosen the nut and jam nut against the yoke (Fig. 138).

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. 139).

Note: Keeping rearward pressure on the 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. 138).

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 4-12.

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. 140).

Fig 140 DSC-3114

2. Slide the seat fully forward, unlatch the seat and tilt the seat forward. Disconnect the prop rod for the seat.

3. Disconnect the electrical connector at the switch, located between the frame cross member and the hydraulic tank. Temporarily install a jumper wire across the terminals in the wiring harness connector (Fig. 141).

Fig 141 DSC-3116

Setting the RH Hydraulic Pump Neutral

1. Start the engine, open the throttle half way and release the park 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. 142).

Fig 142 DSC-3117

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

4. Open engine throttle to fast. Make sure wheel remains stopped or slightly creeps in reverse, adjust if necessary.

Setting the LH Hydraulic Pump Neutral

1. Loosen the locknuts at the pump ball joint on the motion control rod (Fig. 143).

Fig 143 DSC-3118

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

Note: 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 pump rod length by rotating the double nuts in the appropriate direction, until wheel is still or slightly creeps in reverse (Fig. 144).

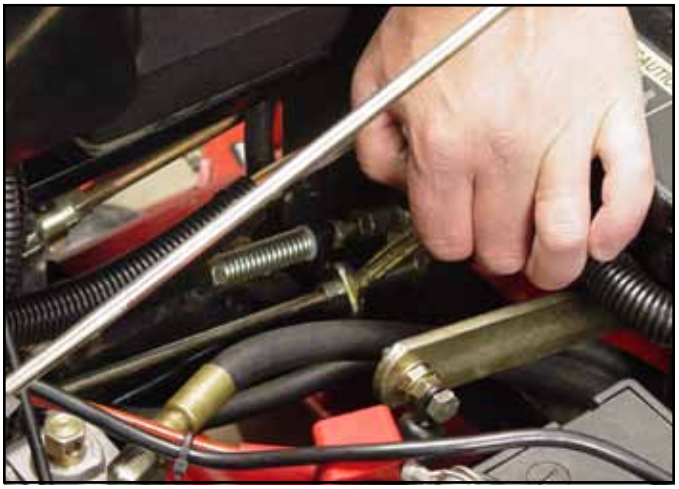

Fig 144 DSC-3120

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

5. Open the throttle to fast. Make sure the wheel remains stopped or slightly creeps in reverse; readjust 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 wiring harness connector and reconnect to the seat switch.

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

10. Remove the jack stands.

Adjusting the Tracking

The right hand pump has a knob for adjusting the tracking (Fig. 145).

Fig 145 DSC-3117

Important: Adjust the handle neutral and hydraulic pump neutral before adjusting the tracking. Refer to Adjusting the Handle Neutral on page 4-12 and Setting the Hydraulic Pump Neutral page 4-14.

1. Push both control levers forward the same distance (Fig. 146). The machine should travel in a straight line. If not, proceed to step 2.

Fig 146 DSC-3121

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. 147).

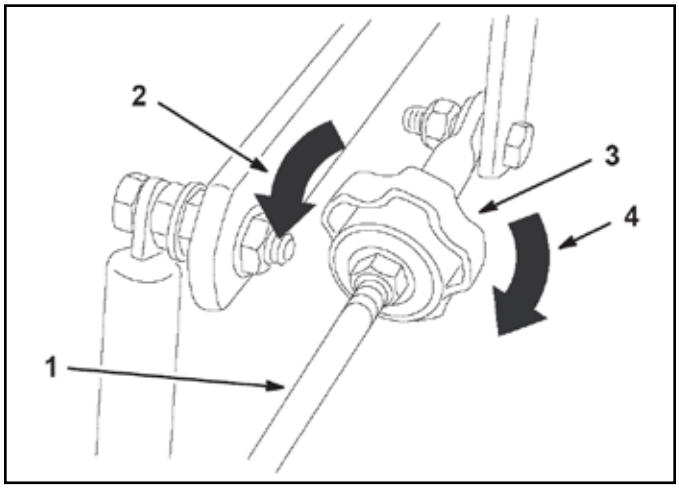

Fig 147 fig. 57 m-6280

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. 147, above).

6. Repeat this adjustment until the tracking is correct.

Replacing the Pump Drive Belt

1. Pull the spring loaded idler down and remove traction belt from the engine and hydro pump pulleys (Fig. 148). Remove belt between the pulleys.

Fig 148 DSC-3122

2. Install new belt around engine and hydro pump pulleys (Fig. 149).

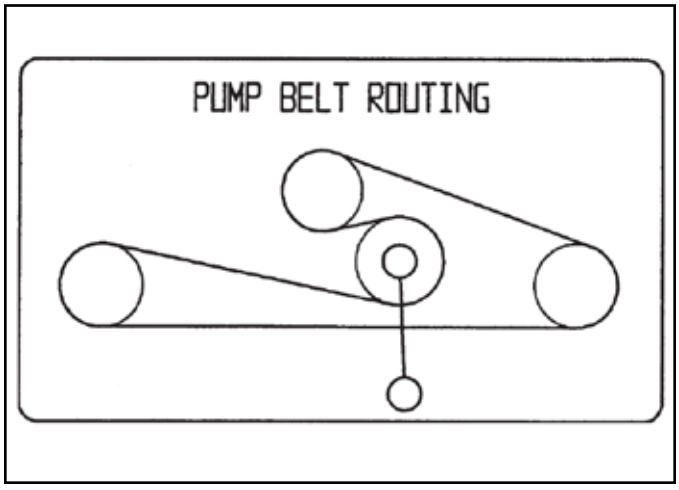

Fig 149 pump belt routing

3. Pull spring loaded idler down and align below traction belt. Release pressure on spring loaded idler.

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. 150).

Fig 150 DSC-3123

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. 151).

Fig 151 DSC-3124

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 P/N 70661, contact your DSM to order.

1. Lift the back of the unit so the rear tires (left and right) is off the ground. Place jack stands under the rear frame to support the unit. Remove the rear tire; in this case the left rear tire is being removed (Fig. 152).

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

Fig 152 DSC-3125

2. Clean any dirt or 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.

Note: Make sure you cap the fittings to prevent dirt from entering the system (Fig. 153).

Fig 153 DSC-3126

3. Connect the hydraulic hose fittings to the hydraulic flow tester and tighten the fittings (Fig. 154). If the flow tester is bidirectional, make sure to connect hoses correctly.

Fig 154 DSC-3128

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

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

6. Disconnect the seat switch from the harness. Temporarily install a jumper wire across the harness (Fig. 155). Move the seat back to the operating position.

Fig 155 DSC-3116

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

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

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

10. 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).

11. With the unit at full engine throttle 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.

12. Record the difference or “flow droop” of the pump. For the Hydro-Gear BDP 10A and BDP 12 pump, maximum allowable “flow droop” is 1.5 gpm. 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.

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

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

15. Re-connect the hydraulic lines to the wheel motor. Tighten fittings.

16. Check the hydraulic reservoir and fill as necessary to the “Hot” level mark, see, Checking the Hydraulic Fluid page 2-10.

17. Re-install the left rear tire and lower the unit to the ground. Remove the temporary jumper cable for the seat and reconnect the seat switch. Reconnect the connector for the electric PTO clutch.

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. Rotate the by-pass valves counterclockwise 1 turn to push. This allows hydraulic fluid to by-pass the pump enabling the wheels to turn (Fig. 156).

Fig 156 DSC-3130

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.

3. Disengage the parking brake before pushing.

Changing to Machine Operation

1. Rotate the bypass valves clockwise 1 turn to operate the machine (Fig. 157).

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

Fig 157 DSC-3130

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

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Kohler Air-Cooled Engine Removal

1. Remove the battery negative cable from the battery.

2. Remove the bolt, spacer, spring, and nut on the top of the air cleaner bracket (Fig. 158).

Fig 158 DSC-2956

3. Remove the air cleaner hose on the engine (Fig. 159).

Fig 159 DSC-2957

4. Remove the air cleaner end cap and slide the air cleaner assembly out of the bracket (Fig. 160).

Fig 160 DSC-2958

5. Loosen the clamps and remove the throttle and choke cable from the engine control levers (Fig. 161).

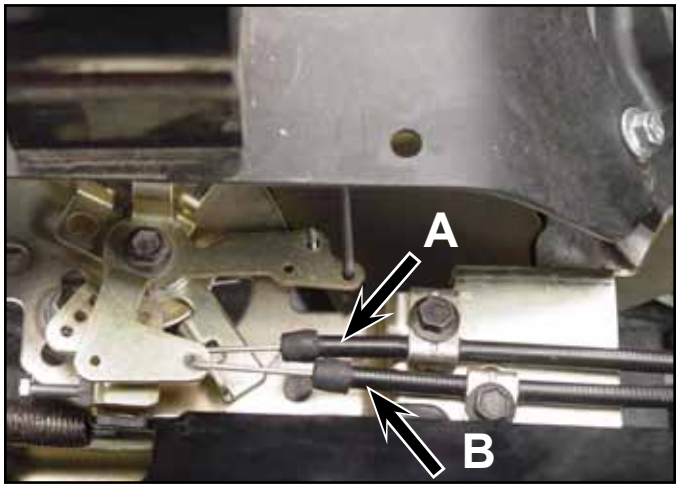

Fig 161 DSC-2959

A. Throttle Cable B. Choke Cable

6. Remove the tie strap securing the choke/throttle cables to the bracket located on the valve cover (Fig. 162).

Fig 162 DSC-2961

7. Turn the fuel shut off valve OFF. Remove the fuel line hose clamp at the engine and remove the fuel line (Fig. 163).

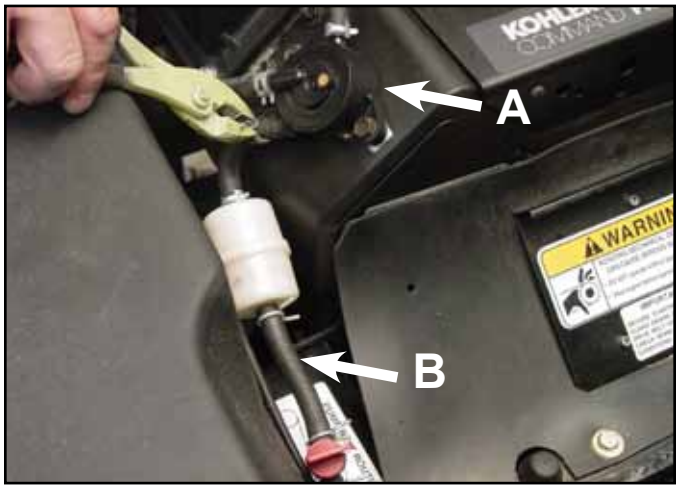

Fig 163 DSC-2962

A Fuel Valve B Fuel Line

8. With a pry bar, relieve spring tension on the idler assembly and remove pump drive belt (Fig. 164).

Fig 164 DSC-2963

9. Remove two red cables from the starter solenoid (Fig. 165).

Fig 165 DSC-2964

5

10. Remove the blue wire from the starter solenoid (Fig. 166).

Fig 166 DSC-2965

11. Unplug the engine wiring harness from the main electrical harness (Fig. 167).

Fig 167 DSC-2970

12. Unplug the electric PTO clutch harness from the clutch. Remove the tie strap holding the clutch wire to the PTO stop rod (Fig. 168).

Fig 168 DSC-2966

13. Remove the mower drive belt from the electric PTO clutch, refer to Replacing the Mower Belt page 7-24.

14. Remove the 4 engine mounting bolts, spring washers, and nuts.

Note: The front left engine mount has two ground cables (Fig. 169).

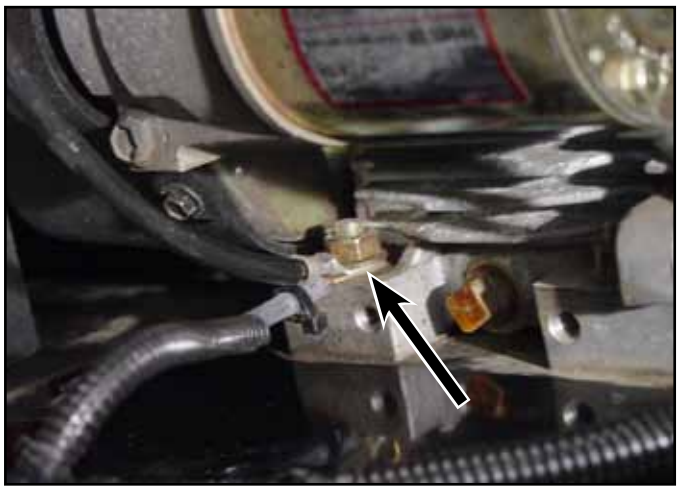

Fig 169 DSC-2967

15. Connect lift chains/straps to the engine lift brackets. Raise the engine from the frame of the unit (Fig. 170).

Fig 170 DSC-2969

Kohler Air-Cooled Engine Installation

1. Lower the engine to the frame of the unit.

2. Install the engine with 4 mounting bolts, spring washers, and nuts.

Note: The front left engine mounting bolt has the two ground cables (Fig. 171). Tighten the bolts.

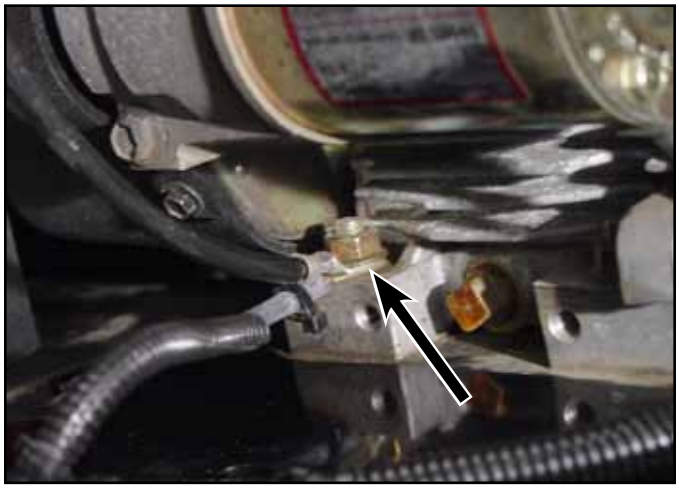

Fig 171 DSC-2967

3. Install the mower drive belt around the electric PTO clutch; refer to Replacing the Mower Belt page 7-24.

4. Plug the electric PTO clutch harness into the clutch (Fig. 172). Secure the clutch wire to the PTO stop rod with a tie strap.

Fig 172 DSC-2966

5. Connect the blue wire to the starter solenoid terminal as shown (Fig. 173).

Fig 173 DSC-2965

6. Attach the two red cables to the starter solenoid (Fig. 174).

Fig 174 DSC-2964

7. Install hydrostatic pump drive belt, using a pry bar to relieve the tension on the spring loaded idler pulley (Fig. 175).

Fig 175 DSC-2963

8. Install the fuel line to the engine and install a hose clamp. Turn the fuel shut off valve to the ON position (Fig. 176).

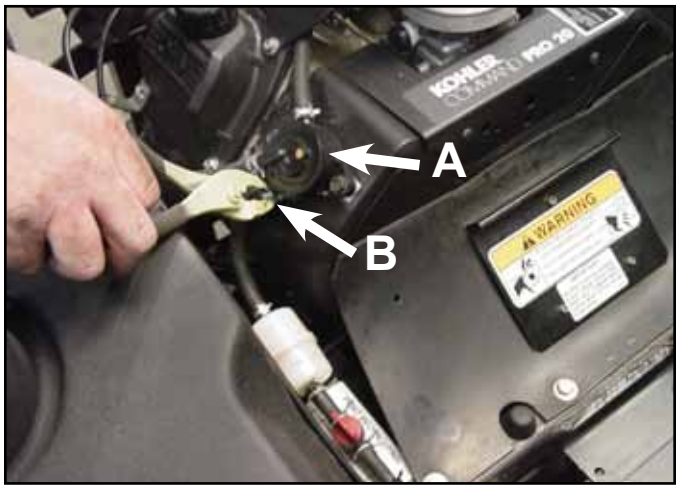

Fig 176 DSC-2971

A Fuel Valve B Fuel Line Clamp

9. Install the throttle and choke cables to the throttle linkage. Position the throttle lever so it is approximately 1/2” (12.7mm) from the full throttle position. Make sure the choke lever is pushed down to the OFF position. Then tighten both cable clamps (Fig. 177).

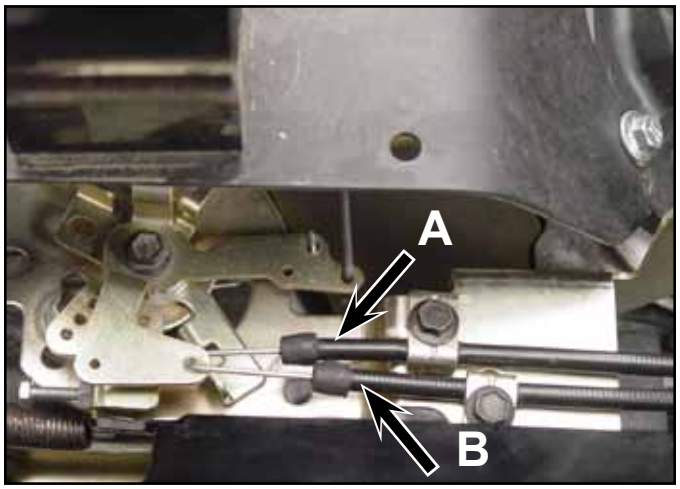

Fig 177 DSC-2959

A Throttle Cable B Choke Cable

10. Secure the throttle and choke cables to the bracket located on the engine valve cover with a tie strap (Fig. 178).

Fig 178 DSC-2972

11. Install the air cleaner assembly through the air cleaner assembly bracket and install the air cleaner end cap (Fig. 179).

Fig 179 DSC-2958

12. Install the bolt, spacer, spring, and nut on the top of the air cleaner bracket and tighten (Fig. 180).

Fig 180 DSC-2956

13. Install the hose to the engine and tighten the hose clamp (Fig. 181).

Fig 181 DSC-2957

14. Install the battery negative cable to the battery.

15. Test operate engine; adjust choke and throttle cables as required. Check engine low and high idle are to specification.

Kawasaki Air-Cooled Engine Removal

1. Remove the battery negative cable from the battery.

2. Remove the air cleaner cover (Fig. 182).

Note: This engine has a standard air cleaner cover. If engine is equipped with a heavy duty air cleaner assembly, remove the complete air cleaner assembly.

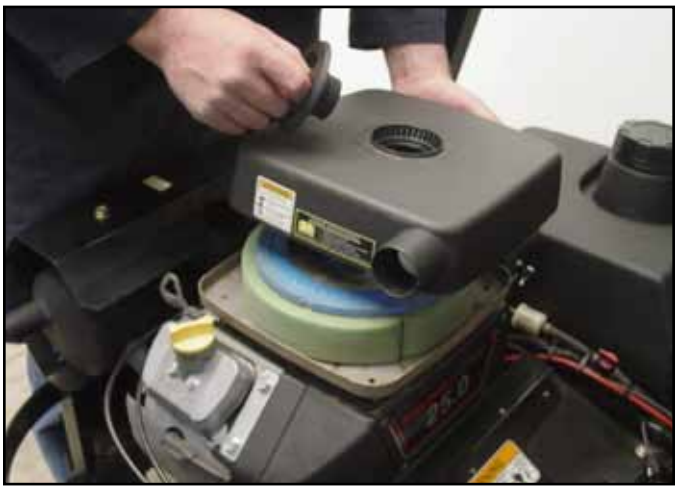

Fig 182 DSC-2973

3. Loosen the throttle and choke cable clamps and disconnect both cables (Fig. 183).

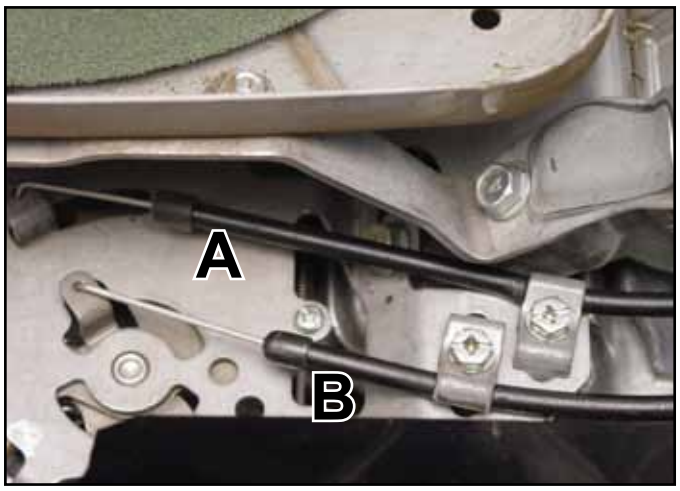

Fig 183 DSC-2975

A. Choke Cable B. Throttle Cable

4. On the right side of the engine, next to the engine oil filter, is the oil pressure sending unit. Remove the wire from the sending unit (Fig. 184).

Fig 184 DSC-2976

5. Disconnect the electric PTO clutch wire from the clutch (Fig. 185).

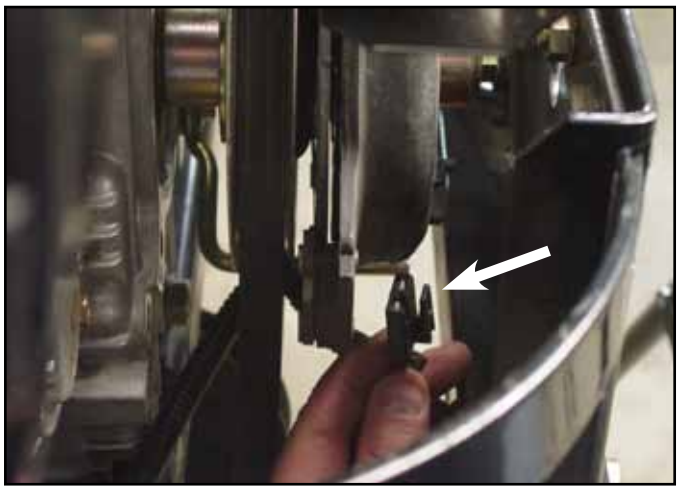

Fig 185 DSC-2977

6. Remove the tie strap securing the electric PTO clutch wire to the PTO stop bracket.

7. Remove the mower drive belt from the electric PTO clutch; refer to Replacing the Mower Belt page 7-24.

8. Remove the red heavy gauge wire from the solenoid to the engine starter (Fig. 186).

Fig 186 DSC-2978

9. Disconnect three wires going from the main harness to the engine (Fig. 187).
   - Violet wire to the Regulator/Rectifier
   - White wire to the Engine Magneto wire
   - Pink wire to the Fuel Solenoid

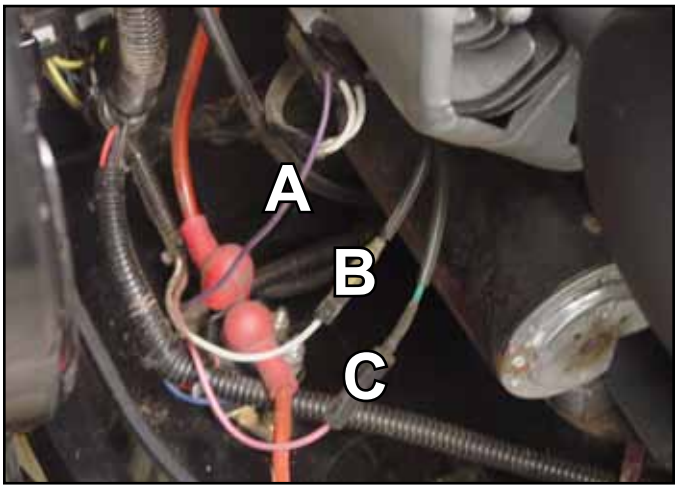

Fig 187 DSC-2980

A. Violet Wire
B. White Wire
C. Pink Wire

10. Turn the fuel shut-off OFF. Remove the fuel line clamp at the engine and remove the fuel line (Fig. 188).

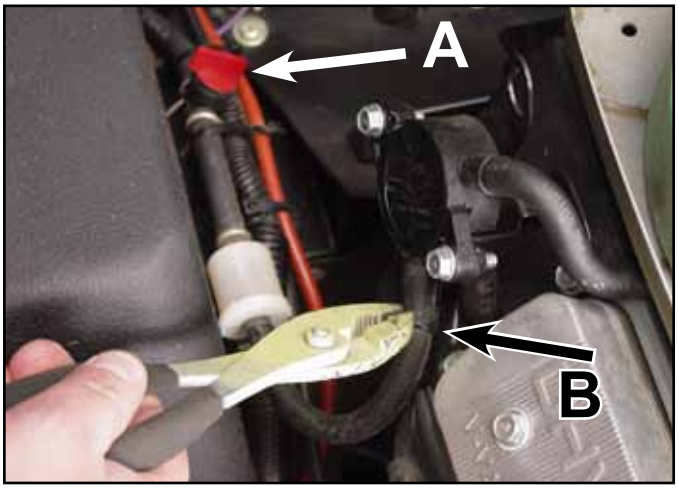

Fig 188 DSC-2981

A Fuel Valve
B Fuel Line Clamp

11. With a pry bar, relieve tension on the spring loaded idler and remove the pump drive belt (Fig. 189).

Fig 189 DSC-2982

12. Remove the 4 engine bolts, spring washers, and nuts mounting the engine to the frame. There are two ground wires located on the left front engine mount bolt (Fig. 190).

Fig 190 DSC-2983

13. Connect a lift chain to the lift points on the engine. Raise the engine from the frame (Fig. 191).

Fig 191 DSC-2984

Kawasaki Air-Cooled Engine Installation

1. Lower the engine to the frame of unit.

2. Install the engine with 4 mounting bolts, spring washers, and nuts.

Note: The front left engine mounting bolt has two ground cables (Fig. 192). Tighten the bolts.

Fig 192 DSC-2983

3. Install the mower drive belt around the electric PTO clutch, refer to Replacing the Mower Belt page 7-24.

4. Plug the electric PTO clutch harness into the clutch (Fig. 193). Secure the clutch wire to the PTO stop rod with a tie strap.

Fig 193 DSC-2977

5. Connect the three wires going from the main harness to the engine (Fig. 194).
   - Violet wire to the Regulator/Rectifier
   - White wire to the Engine Magneto wire
   - Pink wire to the Fuel Solenoid

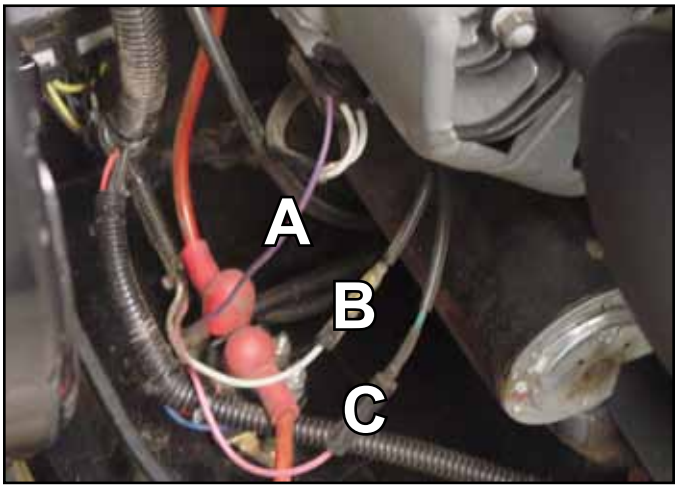

Fig 194 DSC-2980

A. Violet Wire
B. White Wire
C. Pink Wire

6. Install the red heavy gauge wire from the solenoid to the engine starter (Fig. 195).

Fig 195 DSC-2978

7. Install the fuel line to the engine and tighten the hose clamp. Turn the fuel shut off valve ON (Fig. 196).

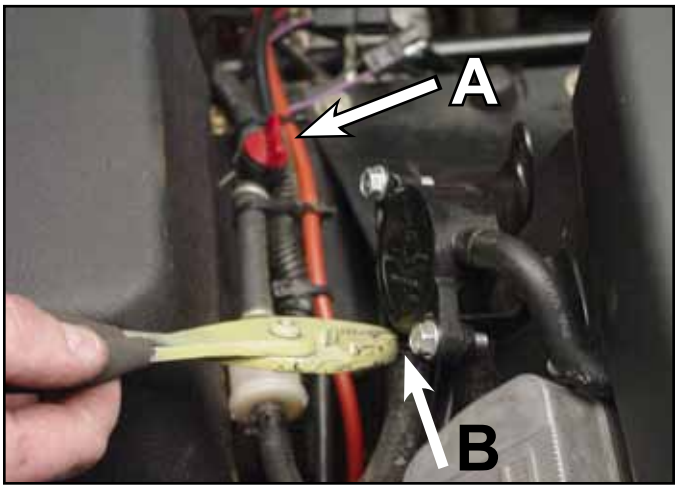

Fig 196 DSC-2985

A Fuel Valve B Fuel Line Clamp

8. Plug the wire into the oil pressure sending unit located next to the engine oil filter (Fig. 197).

Fig 197 DSC-2976

9. Connect the throttle and choke cables to the engine control linkage. Position the throttle control in the idle position. Make sure the choke lever is pushed down to the “Off” position when connecting the cable. Tighten both cable clamps (Fig. 198).

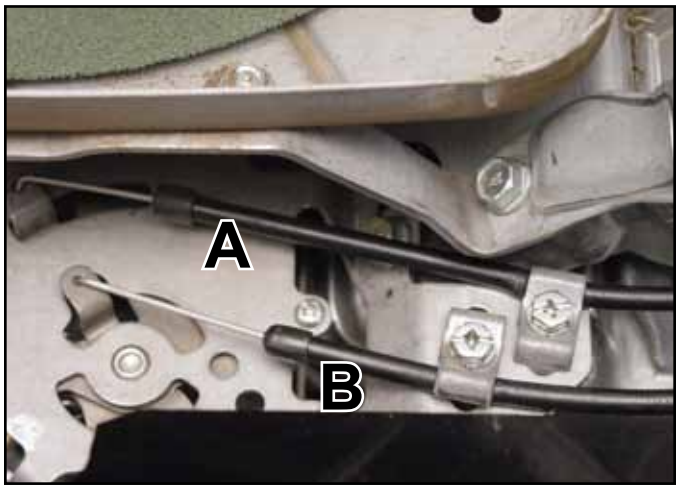

Fig 198 DSC-2975

A Choke Cable B Throttle Cable

10. Install the hydrostatic pump drive belt, using a pry bar to release the tension on the spring loaded idler pulley (Fig. 199).

Fig 199 DSC-2982

11. Install the engine air cleaner cover on the engine Fig. 200).

Note: This unit has a standard air cleaner assembly.

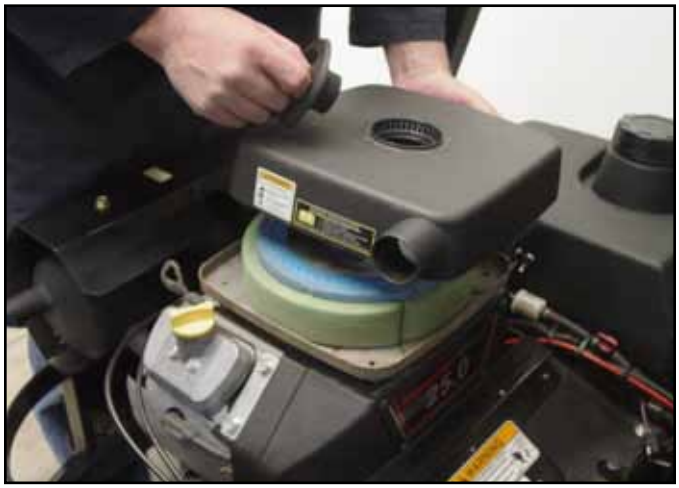

Fig 200 DSC-2973

12. Install the battery negative cable to the battery.

13. Test operate engine; adjust choke and throttle cables as required. Check engine low and high idle are to specification.

28 HP Kohler EFI Air-Cooled Engine Removal

Note: If welding on an EFI equipped machine, be sure to disconnect the negative ground cable on the battery and disconnect the ECU.

1. Disconnect the negative battery cable from the battery.

2. Loosen the hose clamp on the air intake hose (Fig. 201).

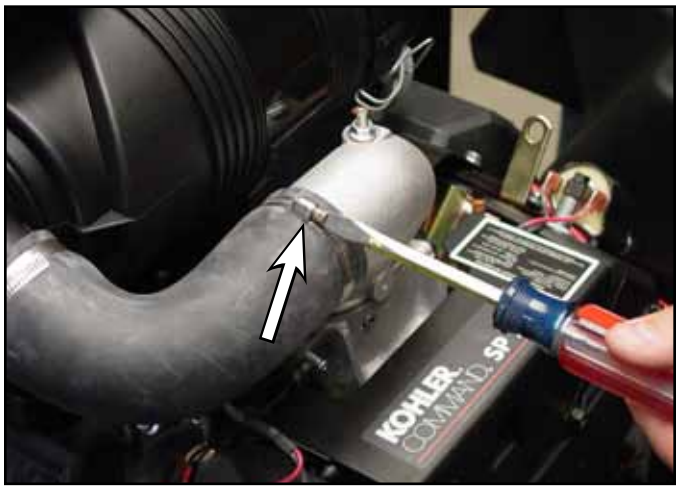

Fig 201 DSC-2883

3. Loosen and remove the bolt, spacer, spring, and nut retaining the air cleaner assembly to the air cleaner bracket (Fig. 202).

Fig 202 DSC-2884

4. Remove the air cleaner cap and slide the air cleaner assembly out of the air cleaner bracket (Fig. 203).

Fig 203 DSC-2885

5. Remove the fuel line clamp located on the engine fuel rail and remove hose (Fig. 204).

Fig 204 DSC-2886

6. Remove the tie strap securing the throttle cable to the bracket on the valve cover (Fig. 205).

Fig 205 DSC-2887

7. Remove the throttle cable from the engine throttle linkage (Fig. 206).

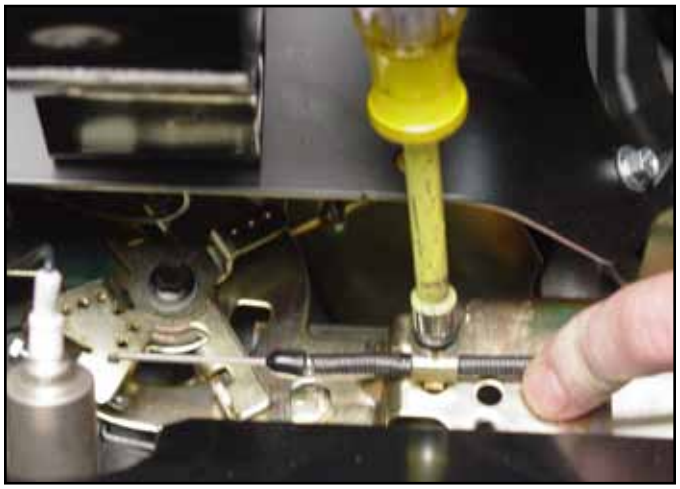

Fig 206 DSC-2888

8. Remove the tie strap securing the fuel pump and electric clutch harness to the AC voltage wires coming from the stator (Fig. 207).

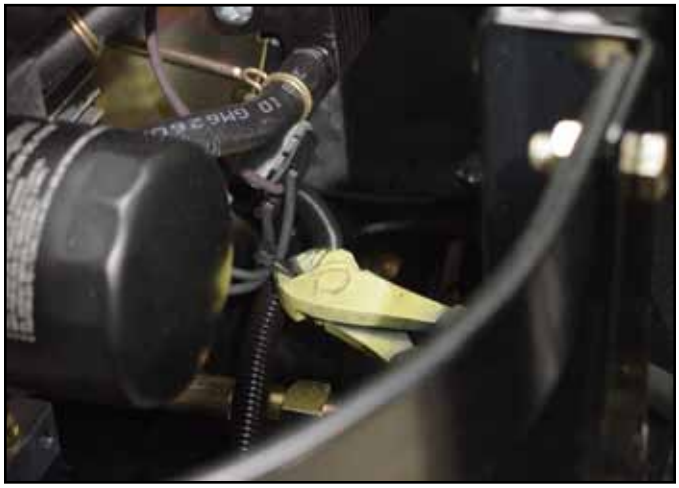

Fig 207 DSC-2889

9. Unplug the electric clutch harness from the electric clutch (Fig. 208).

Fig 208 DSC-2891

10. Remove the tie strap securing the electric PTO wires to the electric PTO clutch stop (Fig. 209).

Fig 209 DSC-2909

11. Remove the mower deck drive belt.

Note: Refer to Mower Deck Removal page 7-8.

12. Using a pry bar, release tension on the Hydro pump drive belt. Remove the hydro drive pump belt (Fig. 210).

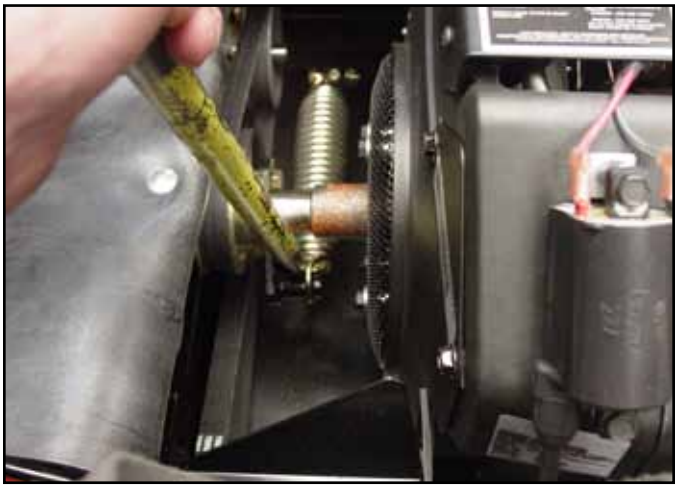

Fig 210 DSC-2892

13. Remove the 3 red wires located at the starter solenoid (Fig. 211).

Fig 211 DSC-2894

14. Remove the blue wire from the starter solenoid (Fig. 212).

Fig 212 DSC-2895

15. Remove the ground cables located on the lower left side of the base of the engine (Fig. 213). One bolt goes into the side of the engine block and the other is the engine mounting bolt and nut.

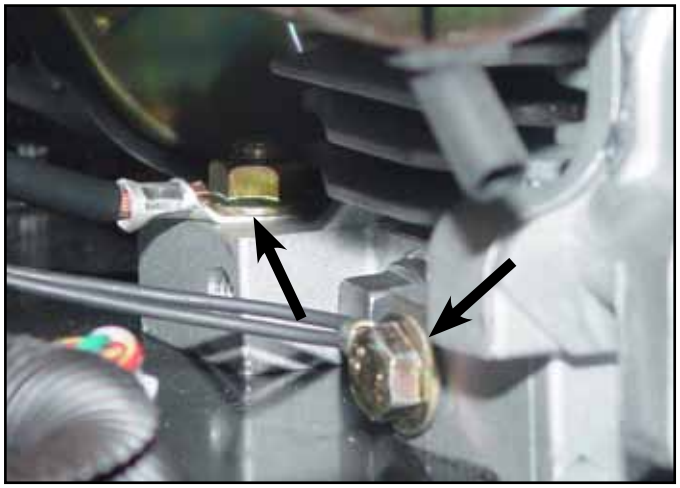

Fig 213 DSC-2901

16. Disconnect the engine harness connector from the main wiring harness (Fig. 214).

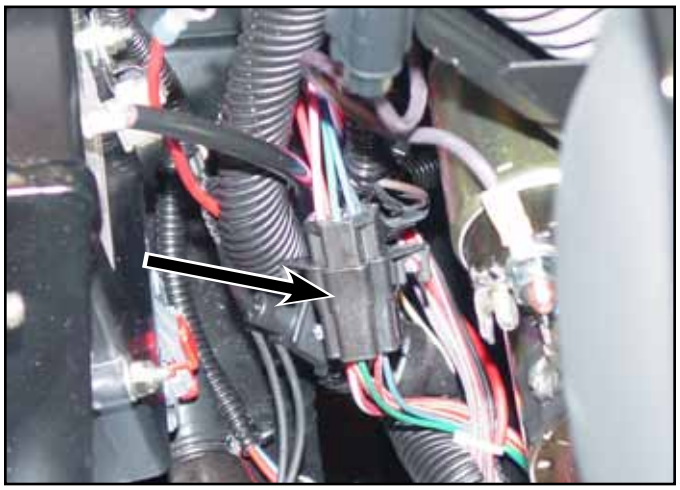

Fig 214 DSC-2903

17. Remove the wire clamp bolted to the frame, located on the left side of the engine (Fig. 215).

Fig 215 DSC-2904

18. Remove the wire connector located at the bottom of the ECU (Electronic Control Unit). First, remove the red retainer clip (Fig. 216).

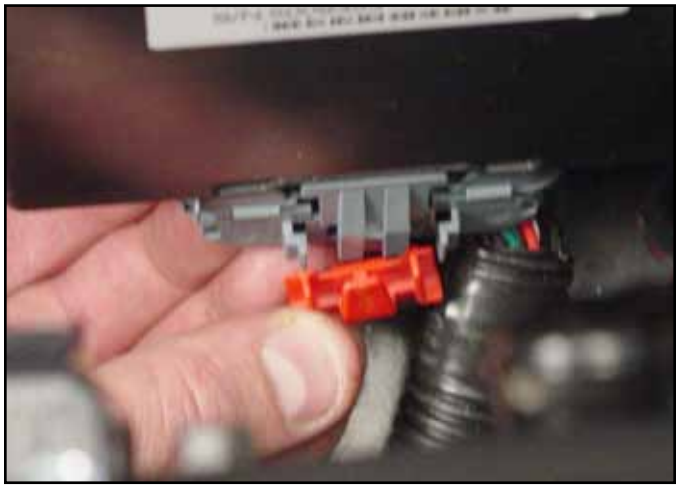

Fig 216 DSC-2907

Next, remove the multi-pin connector from the ECU (Fig. 217).

Fig 217 DSC-2908

19. Remove the wire clip located on the side of the ECU that retains the test plug connector (Fig. 218).

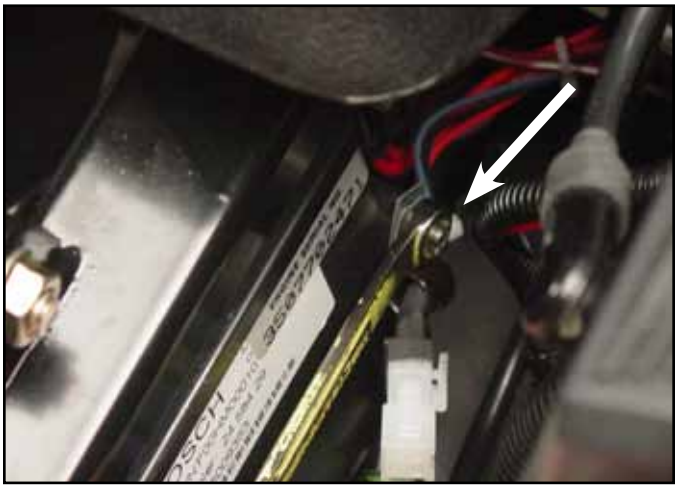

Fig 218 DSC-2910

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20. Remove the two fuse holders, located in front of the ECU unit (Fig. 219).

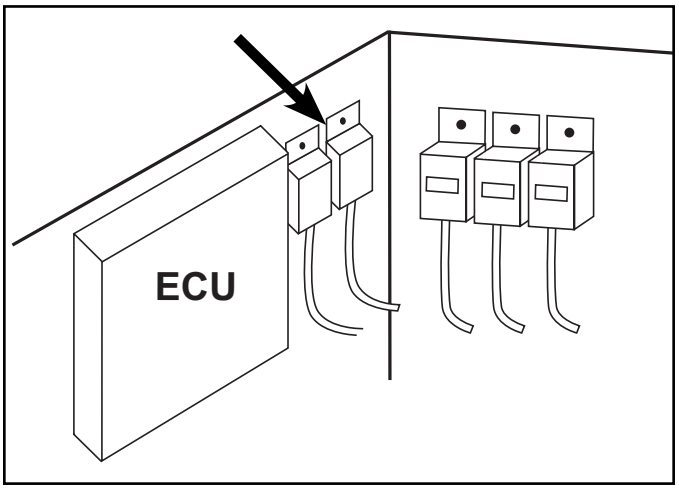

Fig 219 hidden fuses

21. Unplug the left and center relay from their connectors. Remove 2 bolts and nuts retaining the connectors to the frame (Fig. 220).

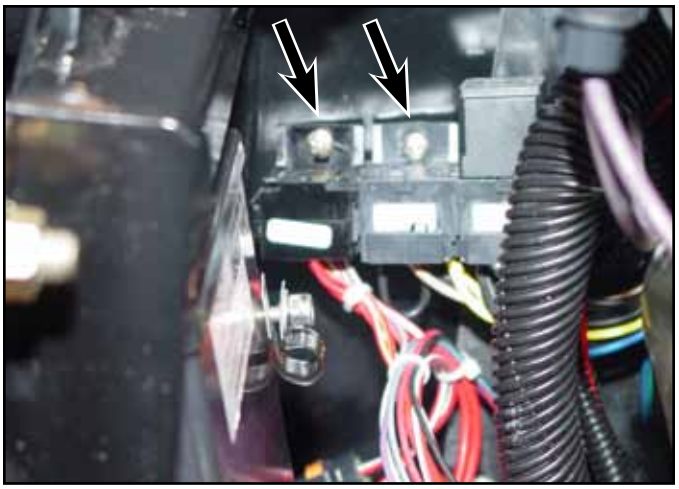

Fig 220 DSC-2912

22. Unplug the tan wire connector (Fig. 221).

Fig 221 DSC-2915

23. Remove the remaining 3 bolts, washer, and nuts retaining the engine to the frame (Fig. 222). Raise the engine out of the frame.

Fig 222 DSC-2916

28 HP Kohler EFI Air-Cooled Engine Installation

1. Lower the engine to the frame. Install 2 bolts, washers, and nuts on the right side of the engine. On the left side, mount only the bolt, washer, and nut to the rear engine mount. Tighten the bolts.

2. Connect the two tan wires, one from the engine harness and the other from the main harness (Fig. 223).

Fig 223 DSC-2915

3. Install the two left relays to the frame using two bolts and washers (Fig. 224). Plug the remaining two relays into the harness.

Fig 224 DSC-2912

4. Install the two fuse holders in front of the ECU control box (Fig. 225).

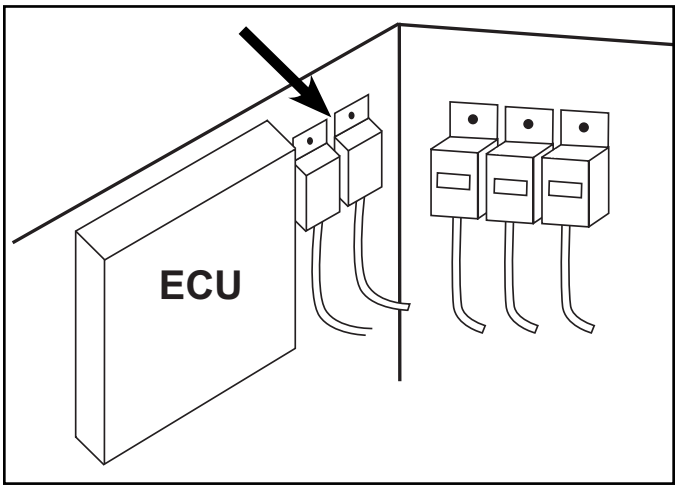

Fig 225 hidden fuses

5. Install the clamp holding the test plug connector to the side of the ECU control (Fig. 226).

Fig 226 DSC-2910

6. Install a tie strap around the electric PTO harness and the PTO electric clutch stop rod (Fig. 227).

Fig 227 DSC-2917

7. Install the wire connector to the bottom of the ECU (Fig. 228).

Fig 228 DSC-2908

Install the red retainer clip on the wire connector (Fig. 229).

Fig 229 DSC-2907

8. Install the wire clamp to the frame on the left side of the engine (Fig. 230).

Fig 230 DSC-2904

9. Connect the engine harness connector to the main harness (Fig. 231).

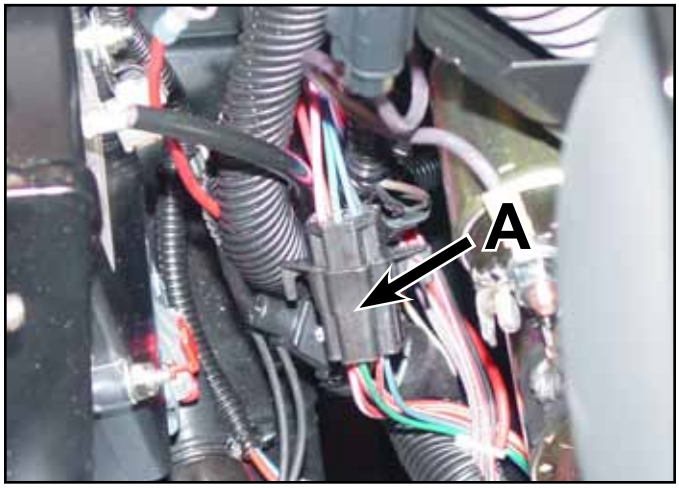

Fig 231 DSC-2903

A. Main harness to engine connector

10. Install the two sets of ground wires on the left side of the engine as shown (Fig. 232).

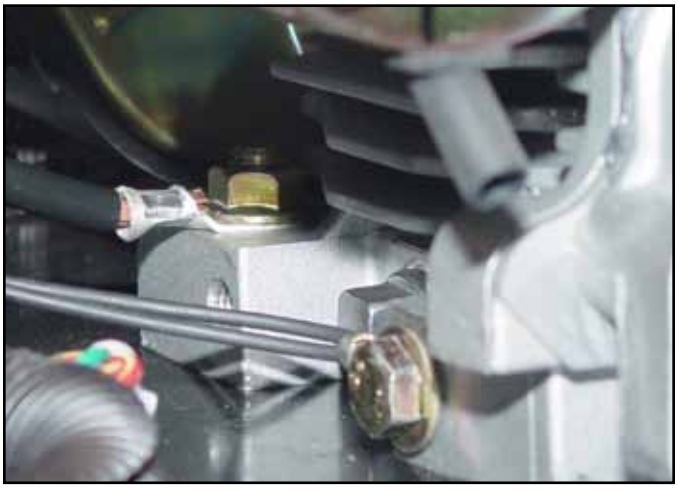

Fig 232 DSC-2901

11. Install the blue wire to the starter solenoid terminal (Fig. 233).

Fig 233 DSC-2895

12. Install three red wires to the starter solenoid stud (Fig. 234).

Fig 234 DSC-2894

13. Install the hydro pump drive belt, using a pry bar to relieve the spring tension on the idler pulley (Fig. 235).

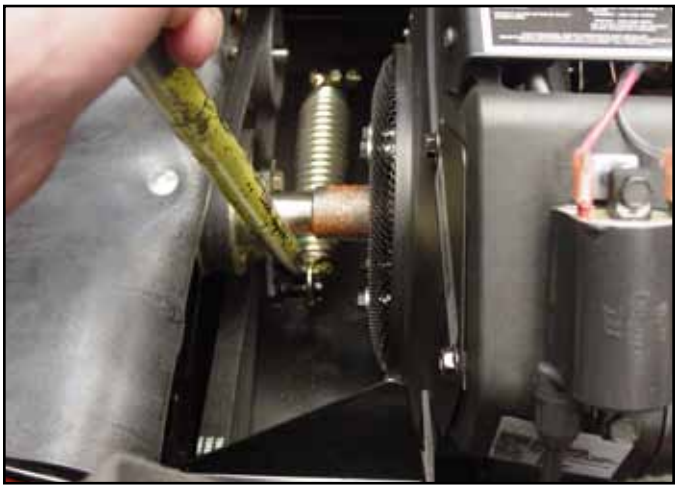

Fig 235 DSC-2892

14. Install the mower deck drive belt around the electric PTO clutch. Refer to Replacing the Mower Belt page 7-24.

15. Install the PTO clutch harness to the PTO clutch (Fig. 236).

Fig 236 DSC-2891

16. Secure the fuel pump and the electric clutch harness to the AC voltage wires coming from the stator with a tie strap (Fig. 237).

Fig 237 DSC-2918

17. Install the throttle cable to the engine throttle linkage. Make sure the throttle contacts the stop with the throttle control lever in the full speed position. Tighten throttle housing clamp (Fig. 238).

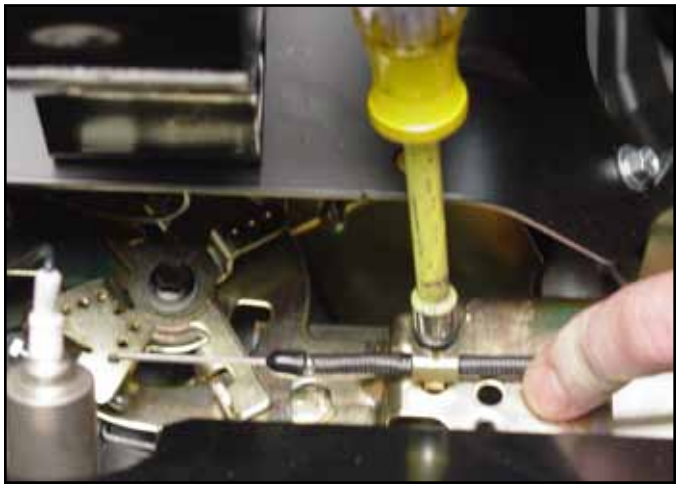

Fig 238 DSC-2888

18. Fasten the throttle cable to the engine lift bracket using a tie strap (Fig. 239).

Fig 239 DSC-2919

19. Install the fuel line to the engine fuel rail. Tighten the fuel line clamp (Fig. 240).

Fig 240 DSC-2920

20. Slide the air cleaner assembly into the air cleaner bracket (Fig. 241).

Fig 241 DSC-2885

5

21. Install the air cleaner assembly and air cleaner cap. Install the bolt, spacer, spring and nut to the air filter bracket. Tighten the bolt (Fig. 242).

Fig 242 DSC-2884

22. Install the air intake hose and tighten the hose clamp (Fig. 243).

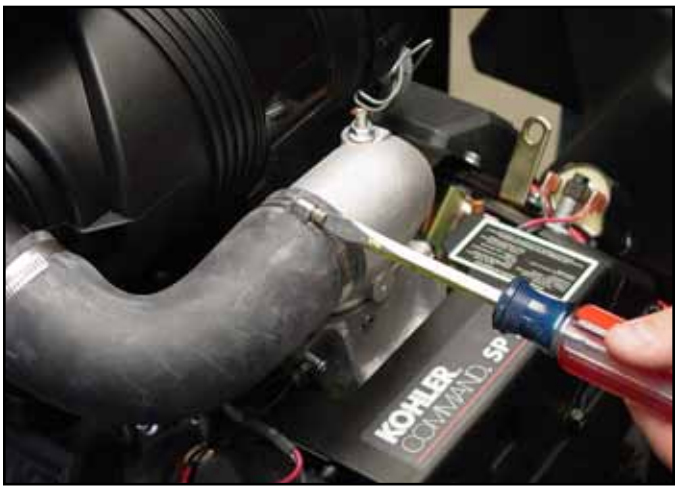

Fig 243 DSC-2883

23. Install the battery negative cable on the battery.

24. Test operate engine; adjust throttle cable as required. Check engine low and high idle are to specification.

Kohler Electronic Fuel Injection (EFI) Models

EFI Fuel System

For engine specific service or diagnostics procedures, consult the engine manufacture's service manual.

The following are the locations of components which are EFI related but mounted to the unit's chassis.

1. The fuel pressure regulator and fuel pump are located in the back of the unit, under the right side of the chassis, next to the mower idler pulleys (Fig. 244).

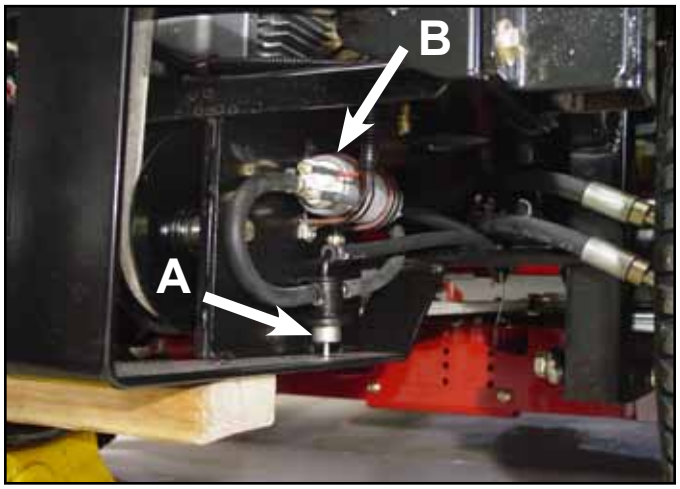

Fig 244 DSC-2948

A. Fuel Pressure Regulator
B. Fuel Pump

2. High pressure fuel filter is located under the seat behind the hydraulic reservoir (Fig. 245).

Fig 245 DSC-2951

3. Dual flow fuel valve is located under the seat, mounted to the frame (Fig. 246).

Fig 246 DSC-2952

EFI Electrical System

1. The electronic control unit (ECU) is located next to the engine starter, on the left rear side, mounted to the frame (Fig. 247).

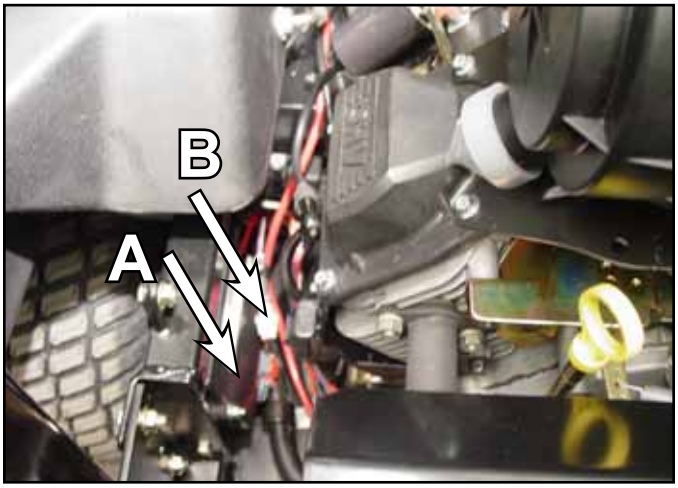

Fig 247 DSC-2950

A. ECU unit B. ECU test plug

2. The Transient Voltage Supression (TVS) diode is located on the left side of the engine, next to the starter. (Fig. 248).

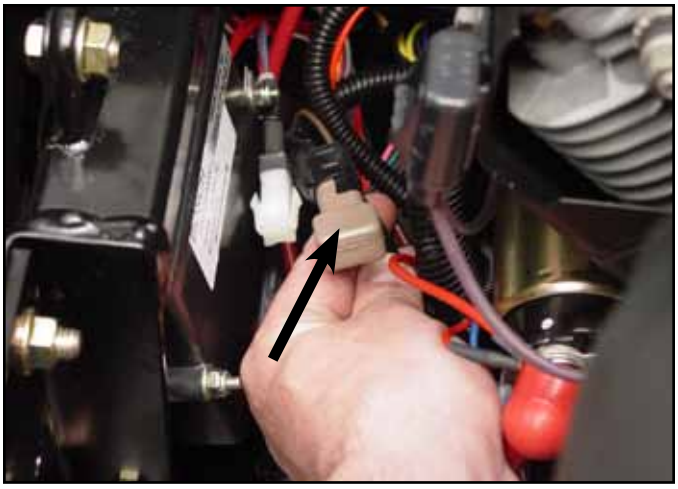

Fig 248 DSC-2953

5

The purpose of the TVS diode is to protect the ECU unit from any high voltage spikes in the electrical system, typically associated with the engagement and disengagement of the PTO clutch (Fig. 249).

Fig 249 DSC-2955

27 HP Kawasaki Liquid-Cooled Engine Removal

1. Disconnect the negative and then the positive battery cable and remove the battery from the unit.

2. Unlatch and open the engine hood. Remove the bumper guard from the frame (Fig. 250).

Fig 250 DSC-2800

3. Remove the right and left hair pins, washers and clevis pins securing the hood. Remove the hood assembly (Fig. 251).

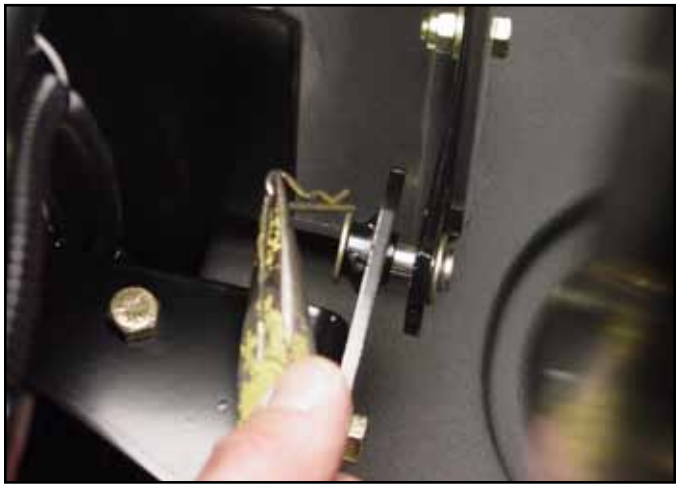

Fig 251 DSC-2802

4. Remove 4 bolts, washers, and nuts retaining the engine shield. Remove the engine shield (Fig. 252).

Fig 252 DSC-2803

5. Remove the air deflector (Fig. 253).

Fig 253 DSC-2804

6. Using a pry bar, relieve the idler pulley spring tension and remove the pump drive belt (Fig. 254).

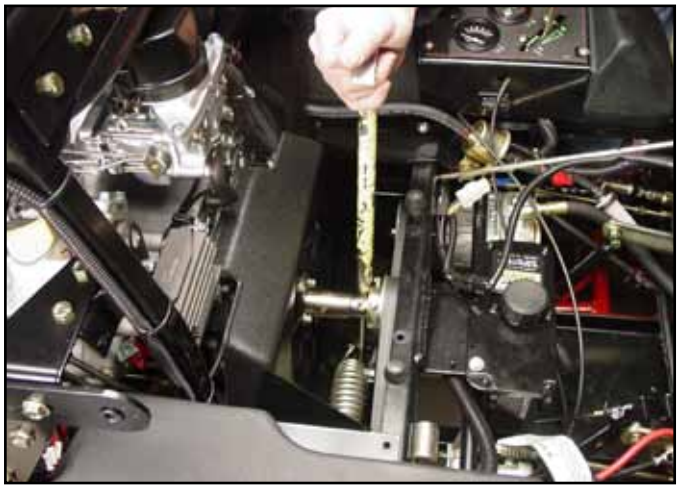

Fig 254 DSC-2805

7. Drain the engine coolant through the engine drain port, located on the engine block, next to the engine oil filter (Fig. 255).

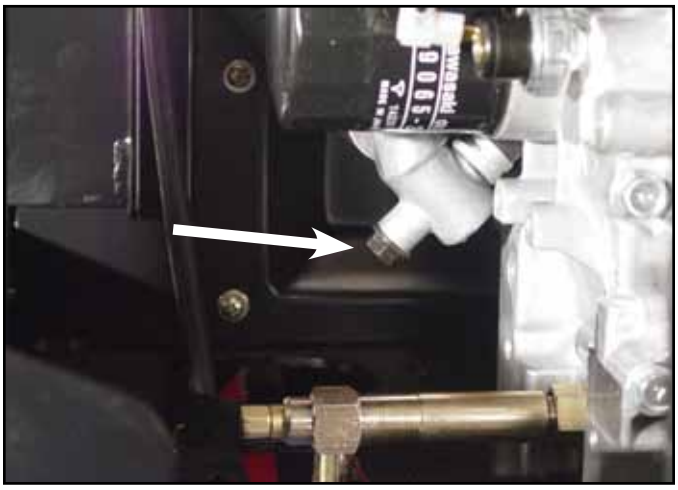

Fig 255 DSC-2806

8. Remove the tie strap from the overflow hose located next to the radiator cap (Fig. 256).

Fig 256 DSC-2807

9. Remove the radiator inlet hose located on the right side of the radiator (Fig. 257).

Fig 257 DSC-2808

10. Remove the radiator outlet hose, located on the left rear of the radiator (Fig. 258).

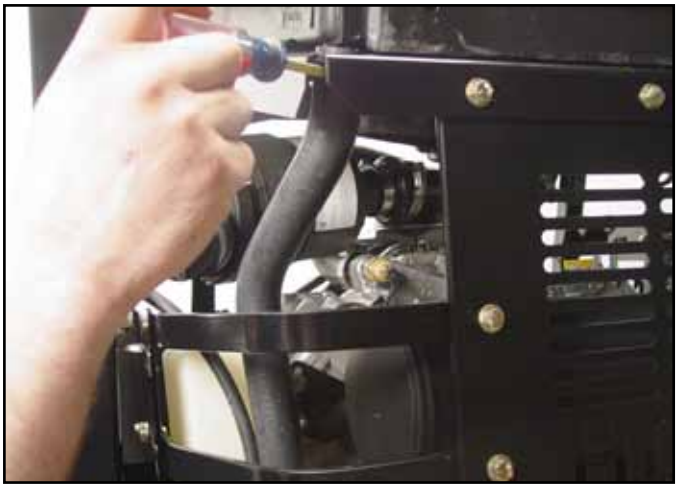

Fig 258 DSC-2809

11. Unplug the wire connector for the cooling fan (Fig. 259).

Fig 259 DSC-2812

12. Remove the 3 bolts, washers, and nuts retaining the fan mounting plate (Fig. 260).

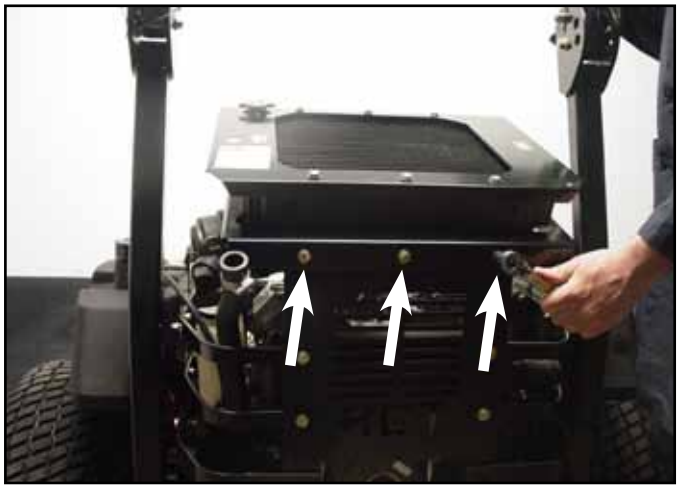

Fig 260 DSC-2810

13. Remove the 2 bolts, washers, and nuts on the right and left side of the fan mounting plate (Fig. 261).

Fig 261 DSC-2813

14. Remove the fan mounting plate and radiator (Fig. 262).

Fig 262 DSC-2814

15. Remove the hose clamp from the air cleaner assembly (Fig. 263).

Fig 263 DSC-2815

16. Remove two bolts, washers, and nuts retaining the air cleaner assembly to the left side radiator brace (Fig. 264).

Note: This allows better access to the battery bolt and nut.

Fig 264 DSC-2817

17. Unplug the two relays from the relay connectors. Remove the two bolts and nuts retaining the connectors to the right hand side plate (Fig. 265).

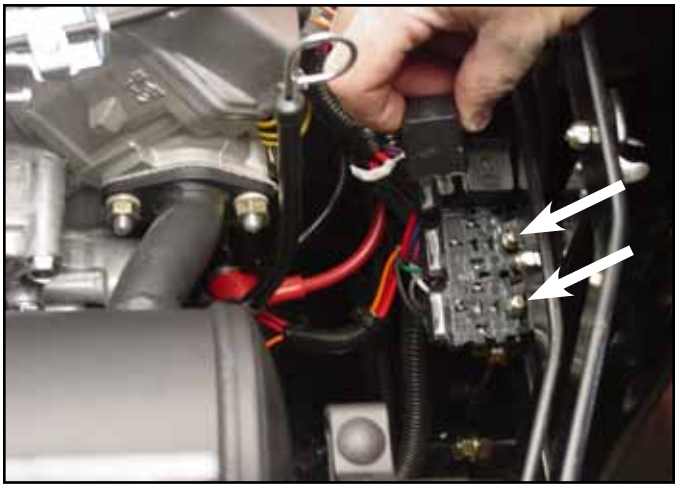

Fig 265 DSC-2818

18. Remove the clamp and hose, located under the coolant overflow tank (Fig. 266).

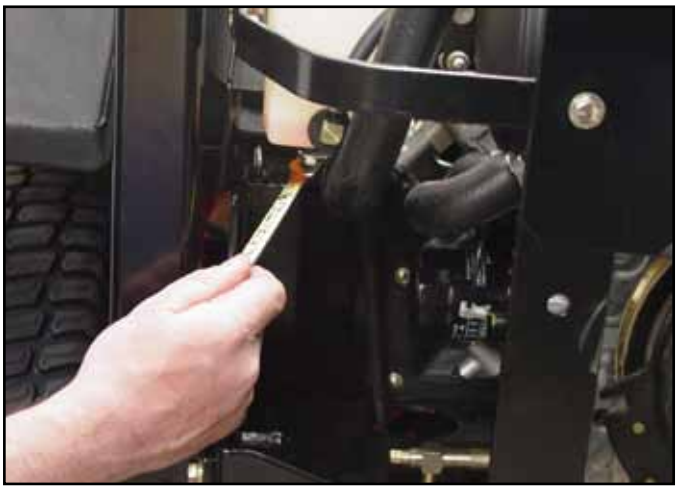

Fig 266 DSC-2825

19. Remove the two bolts and nuts on the right side of the machine used to hold the top rib to the right side radiator brace (Fig. 267). Remove the corresponding bolts and nuts on the left hand side.

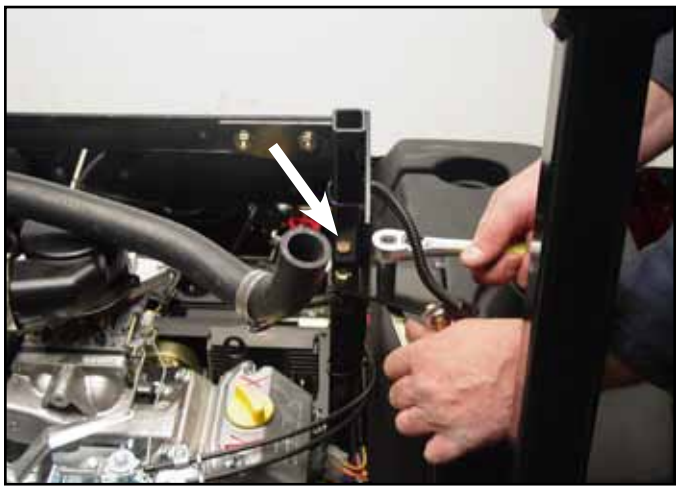

Fig 267 DSC-2819

20. Remove two bolts and nuts retaining the top and bottom ribs and the bottom strap guard located on the right side (Fig. 268). Remove the corresponding bolts and nuts on the left hand side.

Fig 268 DSC-2823

21. Remove the two bolts and nuts retaining the rear radiator mount to the frame (Fig. 269).

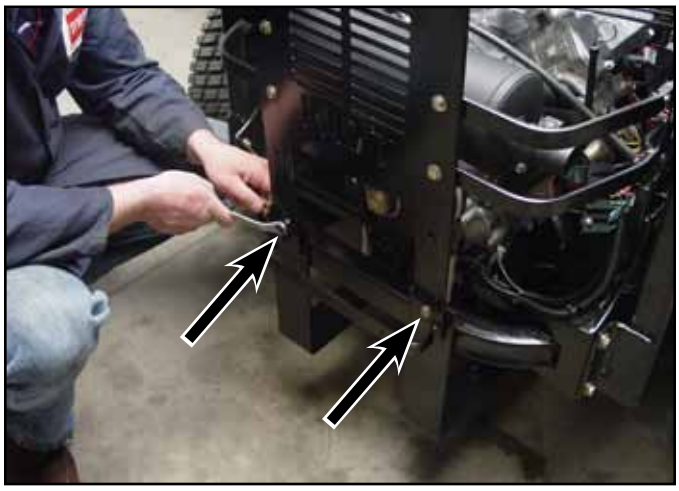

Fig 269 DSC-2824

22. Remove the rear support assembly from the frame (Fig. 270).

Fig 270 DSC-2826

23. Loosen the clamps and remove the choke and throttle cables from the engine linkage (Fig. 271).

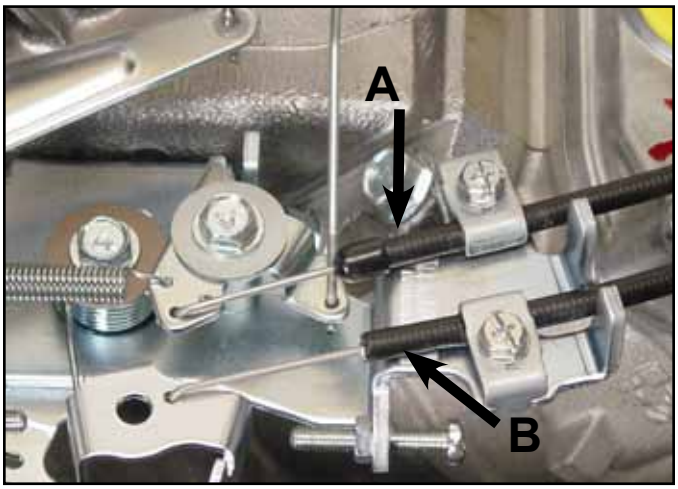

Fig 271 DSC-2827

A. Choke Cable B. Throttle Cable

24. Release the belt tension on the mower drive belt and remove belt around the electric PTO clutch, follow procedures for Replacing the Mower Belt page 7-24.

25. Disconnect the plug for the electric PTO clutch (Fig. 272).

Fig 272 DSC-2828

26. Remove the three engine ground cables located on the lower right rear of the engine (Fig. 273).

Fig 273 DSC-2829

27. Unplug the orange/black wire to the starter solenoid (Fig. 274).

Fig 274 DSC-3163

28. Remove the 3 red wires from the starter solenoid (Fig. 275).

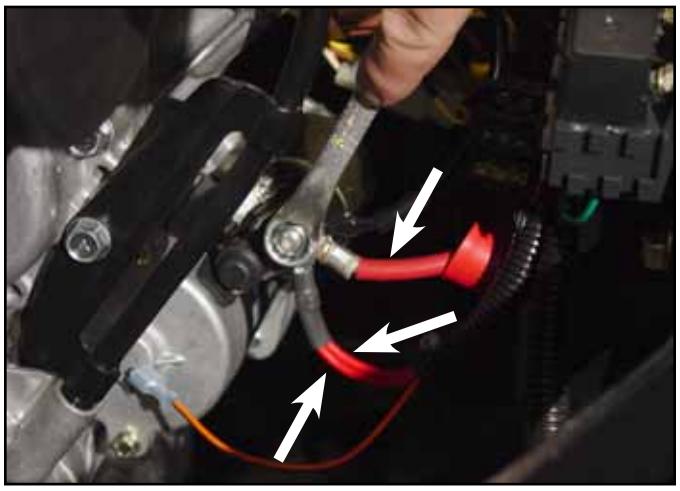

Fig 275 DSC-3164

29. Unplug the black and white wiring connector from the wiring harness located on the right front side of the engine (Fig. 276).

Note: The other two wiring connectors do not need to be disconnected.

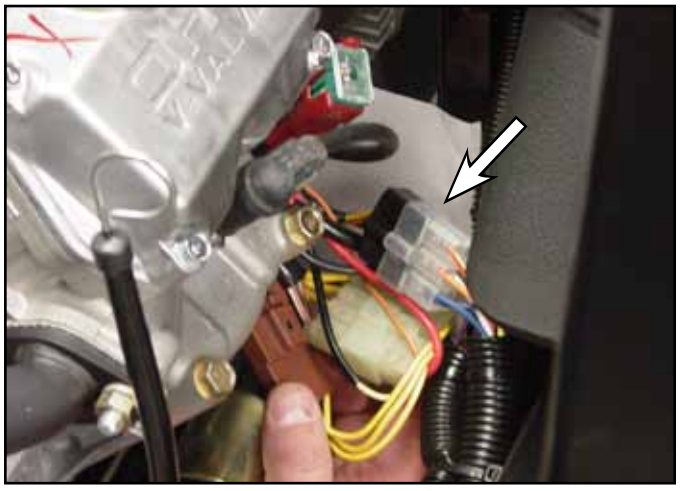

Fig 276 DSC-2832

30. Turn the fuel shut-off valve to the OFF position.

31. Move the hose clamp and disconnect the fuel line on top of the engine (Fig. 277).

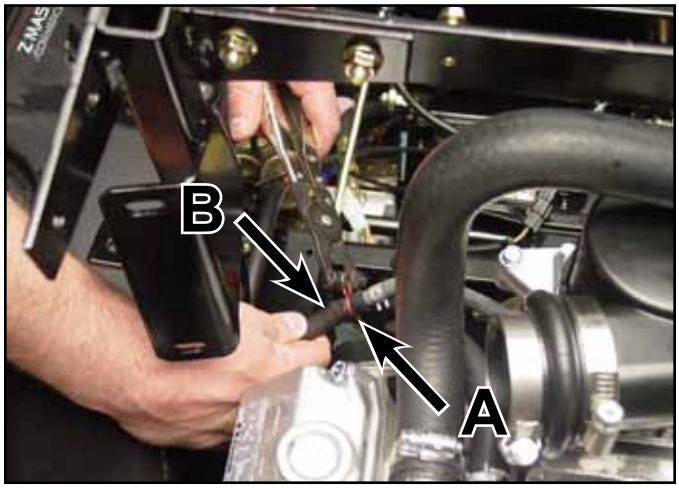

Fig 277 DSC-2833

A. Hose clamp B. Fuel line

32. Remove the 4 bolts and spring washers retaining the engine to the frame. The engine mounting bolts are located under the engine in tapped holes in the engine block.

33. Remove the engine from the frame (Fig. 278).

Fig 278 DSC-2836

27 HP Kawasaki Liquid-Cooled Engine Installation

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

2. Connect the gas line on top of the engine and install the hose clamp (Fig. 279).

Fig 279 DSC-2833

3. Turn the fuel shut-off valve to the ON position.

4. Reconnect the black and white wiring connector located on the right front side of the engine (Fig. 280).

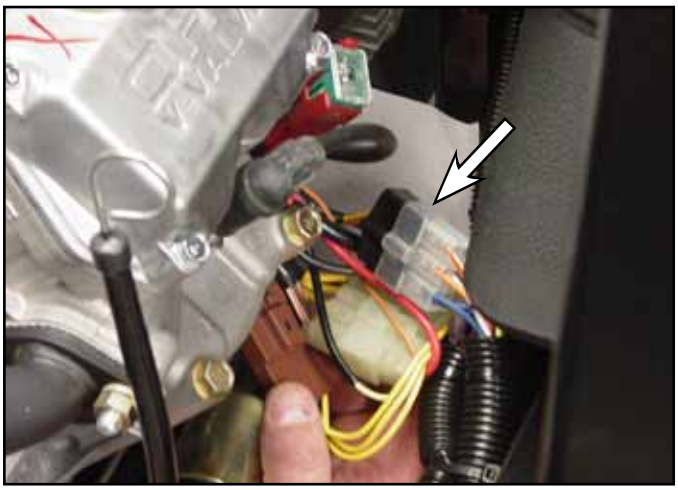

Fig 280 DSC-2832

5. Install the 3 red wires to the starter solenoid post and tighten (Fig. 281).

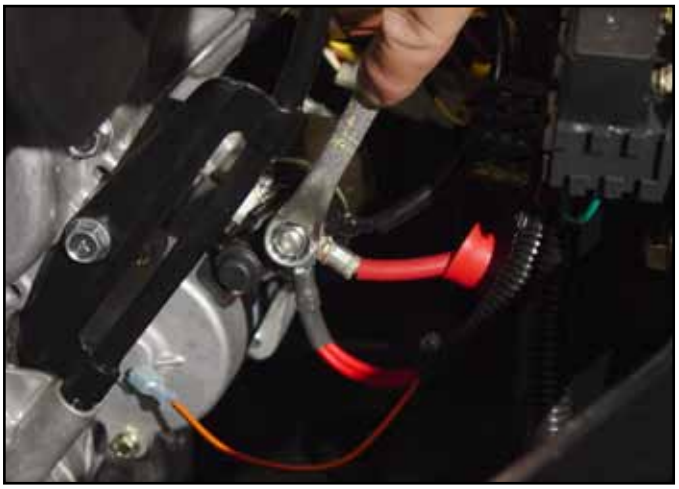

Fig 281 DSC-3164

6. Plug the orange/black wire to the starter solenoid (Fig. 282).

Fig 282 DSC-3163

7. Install the 3 ground wires to the lower rear of the engine (Fig. 283).

Fig 283 DSC-2829

8. Plug the wiring connector to the electric PTO clutch (Fig. 284).

Fig 284 DSC-2828

9. Install the mower drive belt around the electric PTO clutch; follow the procedures for Replacing the Mower Belt page 7-24.

10. Install the choke cable to the engine linkage; make sure the choke knob is pushed all the way in before tightening down the clamp (Fig. 285). Tighten the choke cable clamp.

Fig 285 DSC-2838

11. Install the throttle cable to the engine linkage. Make sure the throttle is all the way back to the idle position. Tighten the throttle clamp (Fig. 286).

Fig 286 DSC-2839

12. Install the rear support assembly to the frame (Fig. 287).

Fig 287 DSC-2826

13. Install two bolts and nuts connecting the rear radiator mount to the frame (Fig. 288).

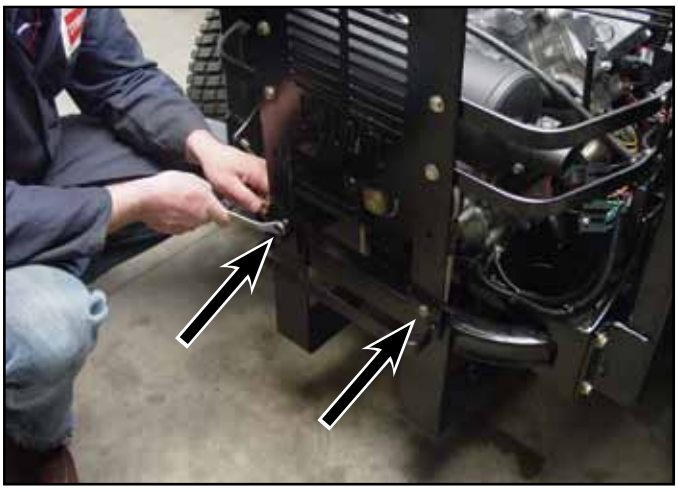

Fig 288 DSC-2824

14. Install the two bolts and nuts retaining the top and bottom strap guard located on the right side (Fig. 289). Install the corresponding bolts and nuts on the left side.

Fig 289 DSC-2823

15. Install the two bolts and nuts located on the right side holding the top rib to the right side radiator brace (Fig. 290). Install the corresponding bolts and nuts on the left hand side. Tighten all of the bolts and nuts.

Fig 290 DSC-2819

16. Install the hose and clamp, located under the coolant overflow tank (Fig. 291).

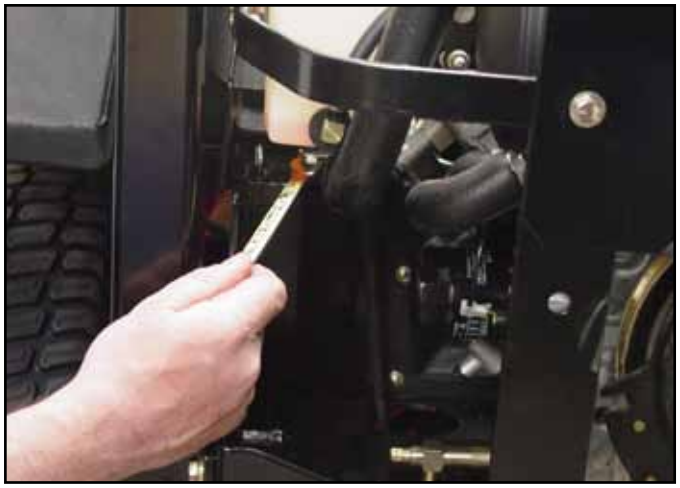

Fig 291 DSC-2825

17. Install two bolts and nuts securing the relays connectors to the right side plate (Fig. 292). Plug the two relays into the connectors.

Fig 292 DSC-2818

18. Install two bolts, washers, and nuts retaining the air cleaner assembly to the left side radiator brace (Fig. 293).

Note: Leave the air filter and air cleaner cover off until after you fill the coolant reservoir bottle.

Fig 293 DSC-2817

19. Install the hose clamp on the air cleaner assembly (shown with air filter cover on) (Fig. 294).

Fig 294 DSC-2815

20. Install the fan mounting plate and radiator (Fig. 295).

Fig 295 DSC-2814

21. Install the 2 bolts and washers on the right and left side of the fan mounting plate (Fig. 296).

Fig 296 DSC-2840

22. Install 3 bolts, washers, and nuts to the rear of the fan mounting plate (Fig. 297). Tighten all 7 bolts and nuts.

Fig 297 DSC-2841

23. Connect the wiring for the cooling fan (Fig. 298).

Fig 298 DSC-2812

24. Install the radiator outlet hose clamp located on the left rear of the radiator (Fig. 299).

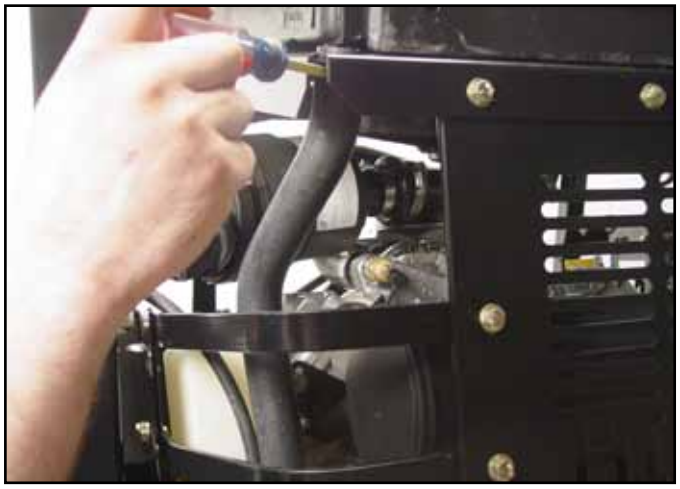

Fig 299 DSC-2809

25. Install the radiator inlet hose and clamp located on the right side of the radiator (Fig. 300).

Fig 300 DSC-2808

26. Install the overflow hose next to the radiator cap with a tie strap (Fig. 301).

Fig 301 DSC-2853

27. Add a 50-50 mix of water and coolant to the radiator (Fig. 302) and the overflow bottle (Fig. 303). Fill to the line indicator of the overflow bottle.

Fig 302 DSC-2854

Fig 303 DSC-2855

28. Install the air filter and air cleaner cover.

29. With a suitable pry bar, relieve the spring tension on the idler pulley spring and install the hydraulic pump drive belt (Fig. 304).

Fig 304 DSC-2805

30. Install the air deflector (Fig. 305).

Fig 305 DSC-2804

31. Install the engine shield with 4 bolts, washers, and nuts and tighten (Fig. 306).

Fig 306 DSC-2803

32. Install the engine hood assembly with 2 clevis pins, washers, and hair pins (Fig. 307).

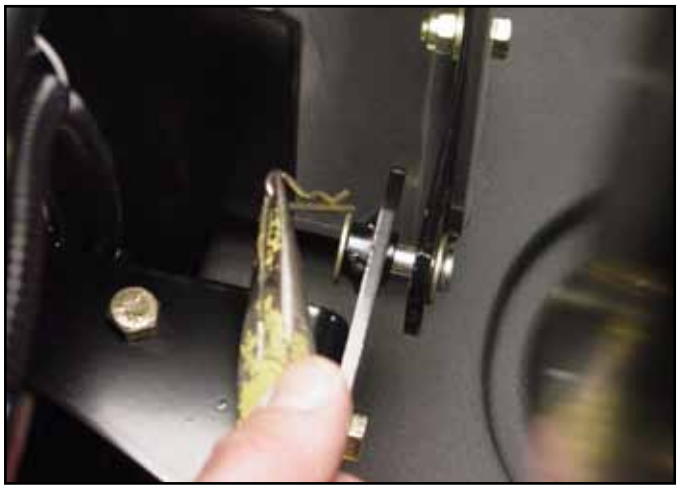

Fig 307 DSC-2802

33. Install the rear bumper guard (Fig. 308).

Fig 308 DSC-2800

34. Install the battery and connect the positive and then the negative battery cable.

35. Test operate engine; adjust choke and throttle cables as required. Check engine low and high idle are to specification. Add coolant as needed; check system for leaks.

Cooling Fan Assembly Removal - 27 HP Kawasaki Liquid-Cooled Engine

1. Disconnect the negative battery cable.

2. Unlatch and open the engine hood. Remove the right and left hair pins located on the hood. Remove the hood assembly (Fig. 309).

Fig 309 DSC-2800

3. Remove four bolts, washers, and nuts retaining the rear engine shield. Remove the engine shield (Fig. 310).

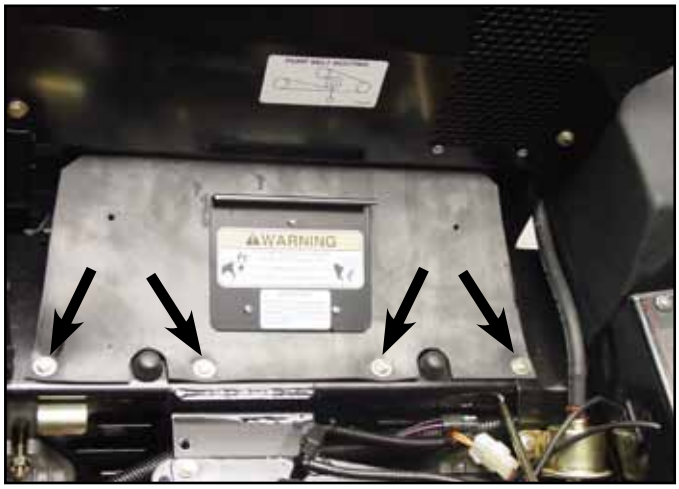

Fig 310 DSC-2803

4. Remove the crossbar located across the front of the radiator (Fig. 311).

Fig 311 DSC-2844

A. Crossbar support

5. Unplug the wire connector for the cooling fan (Fig. 312).

Fig 312 DSC-2812

5

6. Drain the engine coolant through the engine drain bolt located on the engine block next to the engine oil filter (Fig. 313).

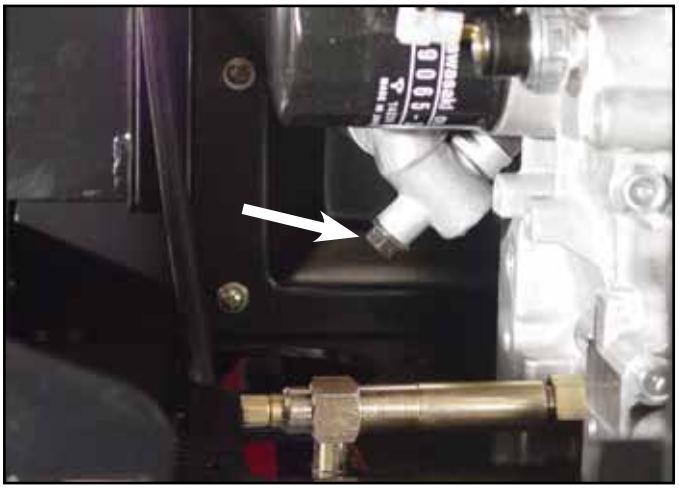

Fig 313 DSC-2806

7. Remove the tie strap around the overflow hose located next to the radiator cap (Fig. 314).

Fig 314 DSC-2807

8. Remove the radiator inlet hose, located on the right side of the radiator (Fig. 315).

Fig 315 DSC-2808

9. Remove the radiator outlet hose, located on the left rear of the radiator (Fig. 316).

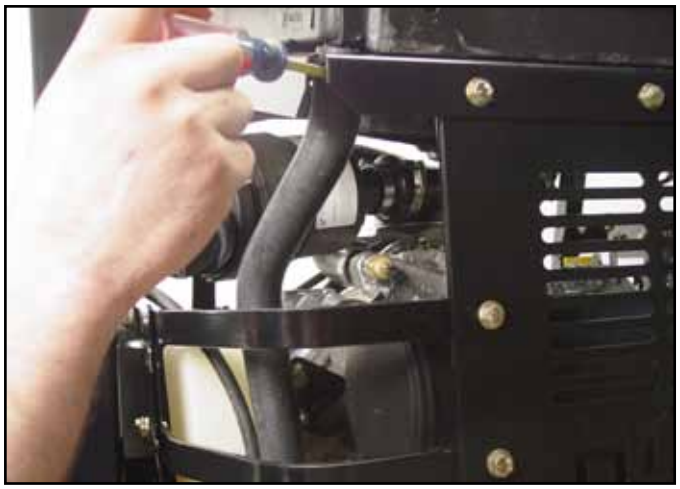

Fig 316 DSC-2809

10. There are 6 bolts and washers located under the radiator retaining the radiator to the fan mounting plate. Remove all 6 bolts and washers. Remove the radiator (Fig. 317).

Fig 317 DSC-2845

11. Remove the 4 bolts, washers, and nuts retaining the fan assembly to the fan mounting plate assembly (Fig. 318).

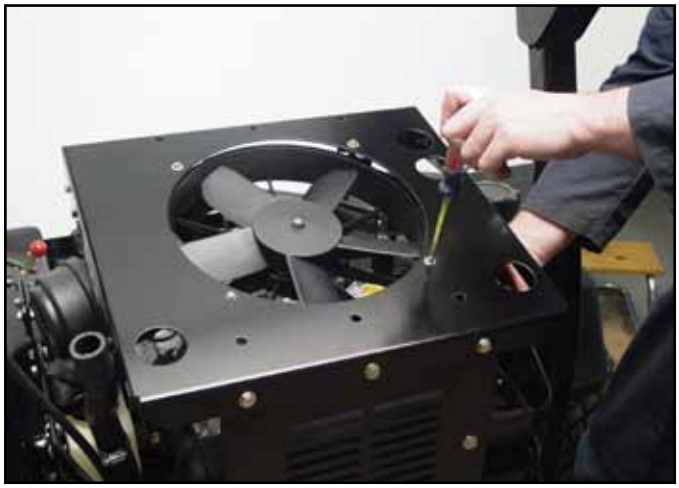

Fig 318 DSC-2847

12. Before removing the fan assembly, remove two clamps located on the upper engine air duct. Remove the engine air intake duct (Fig. 319).

Fig 319 DSC-2848

Note: Fan removed for clarity.

13. Remove the fan assembly through the front opening of the radiator support (Fig. 320).

Fig 320 DSC-2849

Cooling Fan Assembly Installation

Reverse the order of removal.

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ELECTRICAL

GENERAL

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

RELAYS

Purpose

There are as many as three relays in a Z500 air-cooled or liquid cooled gas machine depending on model.

Relays have 4 functions in the Z500 gas machine:

1. Start Relay
2. Kill Relay
3. Fan Relay (liquid cooled gas only)
4. Fuel Pump Relay (Kohler EFI engine)

1. **Start Relay:** If all conditions of the safety system are met, the start relay will activate allowing current to flow to the starter solenoid when the ignition is in the “start” position.

2. **Kill Relay:** If any of the conditions of the safety circuit are not met during operation the kill relay is de-energized which will ground the ignition coil.

3. **Fan Relay:** Activates when the ignition switch is in the “run” position, energizing the cooling fan (Liquid cooled machines only).

4. **Fuel Pump Relay:** (Kohler EFI engine): Activates when the ignition switch is in the “run” position, providing 12VDC to the fuel pump, fuel injectors and ignition coils.

   The Fuel Pump Relay is part of the Kohler engine electrical system. Refer tot he Kohler engine service manual for more detailed service information.

   For reference purposes, Fuel Pump Relay wiring terminal connections are listed below.

Terminal #	Connection
30	Battery Voltage
85	Ignition Switch Voltage
86	ECU-Controlled Ground
87	Feed to Ignition Coils, Fuel Pump and Injectors
87a	Not Used

Location

Air-Cooled Engine Models: Two relays located on the left side of the unit, between the engine and the frame (Fig. 321).

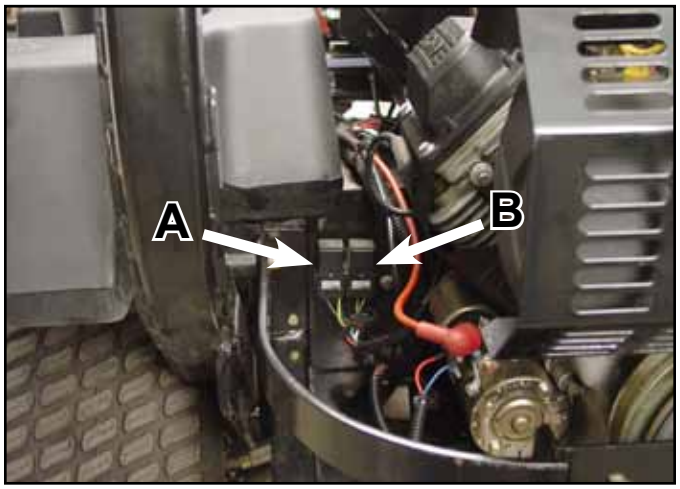


Fig 321 DSC-3159

A. Start Relay (left) B. Kill Relay (right)

Air-Cooled EFI Engine Model: Three relays located on the left side of the unit, between the engine and the frame (Fig. 322).

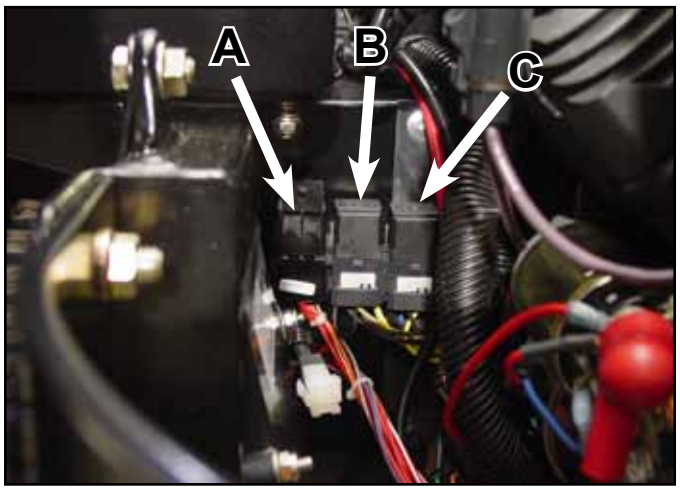


Fig 322 DSC-3161

A. Fuel Pump Relay (left) C. Start Relay (right)
B. Kill/Safety Relay (middle)

Liquid-Cooled Engine Model: Three relays located on the right rear radiator support arms, next to the ROPS (Fig. 323).

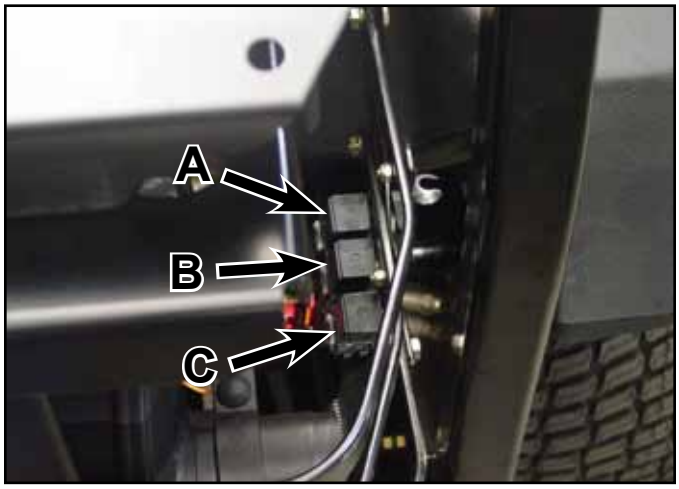


Fig 323 DSC-3162

A. Fan Relay (toward front)
B. Start Relay (middle)
C. Kill Relay (back)

How It Works

A relay is an electrically actuated switch (Fig. 324).

Fig 324 DSC-2517

1. Coil: Terminals 85 and 86 are connected to an internal coil. Applying 12 volts to either terminal 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 terminals 30 and 87a are connected when the relay is not energized. When the relay is energized, the magnetic field overcomes the spring loaded switch and connects terminals 30 and 87 (Fig 325).

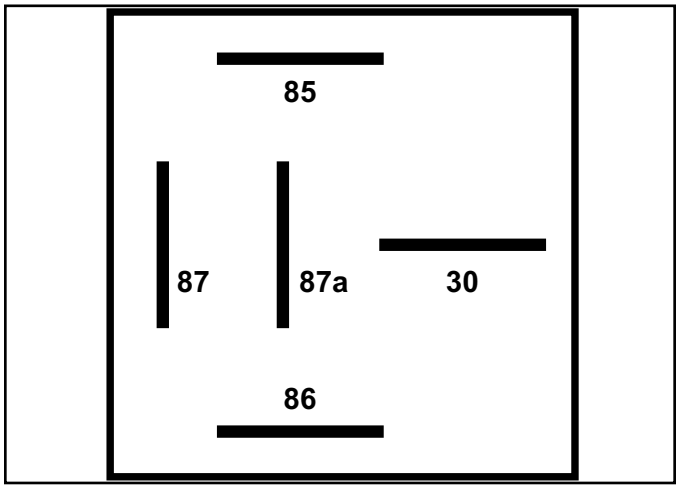


Fig 325 relay pin diagram

Testing

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 (Fig. 326).

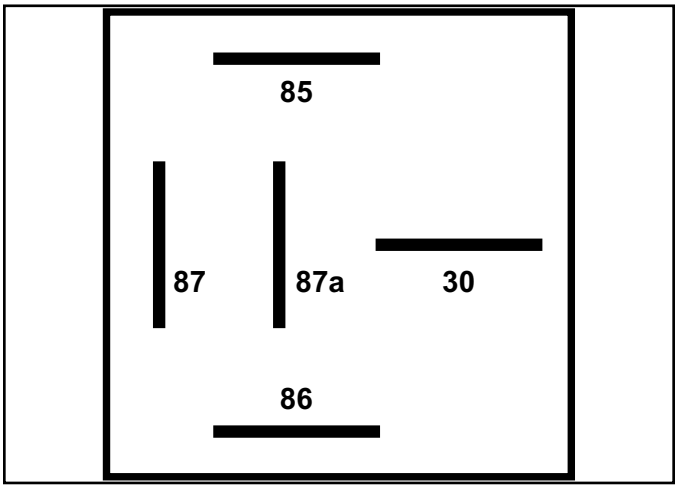


Fig 326 relay pin diagram

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. 327).

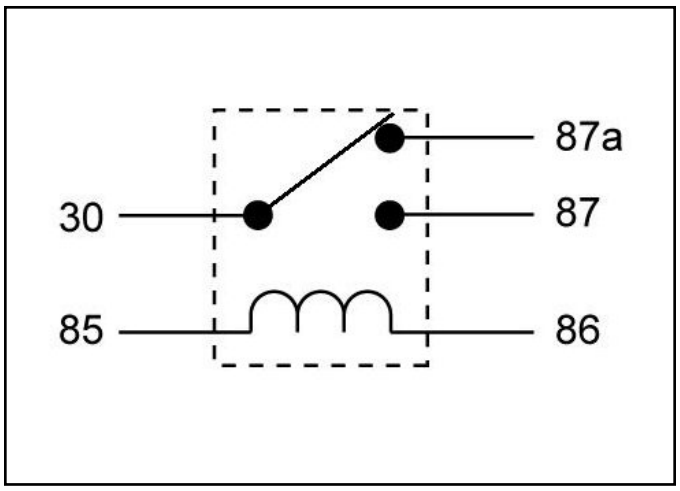


Fig 327 xl relay

Relay not energized.

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 in the control panel on the left side of the operator (Fig. 328).

Fig 328 DSC-3150

How It Works

When the PTO switch is activated, mechanical connections are made between various terminals. One terminal is connected to the wire that goes directly to the electric clutch. When the PTO is pulled out to the “ON” position, voltage flows to the electric clutch which causes it to engage. When the switch is pushed in to the “OFF” position, current flows through the PTO switch to the Park Brake switch to complete the safety circuit to start the unit.

Testing

1. Disengage the PTO, set the parking brake, and turn the ignition to the “OFF” position. 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. 329).

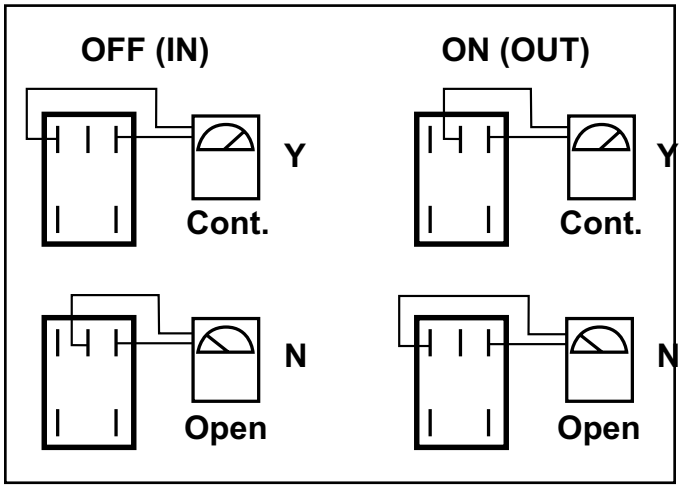


Fig 329 PTO switch test gas

Continuity? Y = Yes N = No

6. Replace the switch if your test results do not correspond with those given in Figure 329, above.
7. Mount the PTO switch back into the control panel and reinstall the wiring harness.

IGNITION SWITCH

Purpose

The ignition switch provides the proper switching 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. 330).

Fig 330 DSC-3150

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. 331).

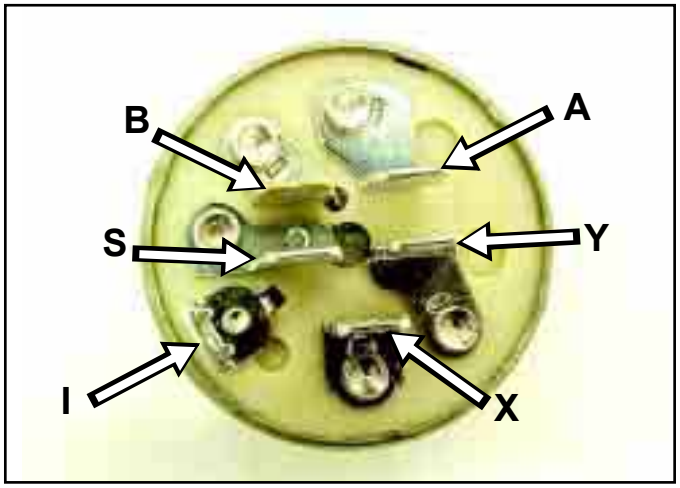


Fig 331 mvc-166

Ignition Switch

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

Testing

1. Disconnect the switch from the wiring harness

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

OFF	No continuity between terminals
RUN	Continuity – B I A and 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 in the out position).

Location

To gain access to the neutral safety switches, the front pocket has to be removed. There are 2 neutral switches, one for the right motion control handle and one for the left motion control handle (Fig. 332).

Fig 332 DSC-2524

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. 333).

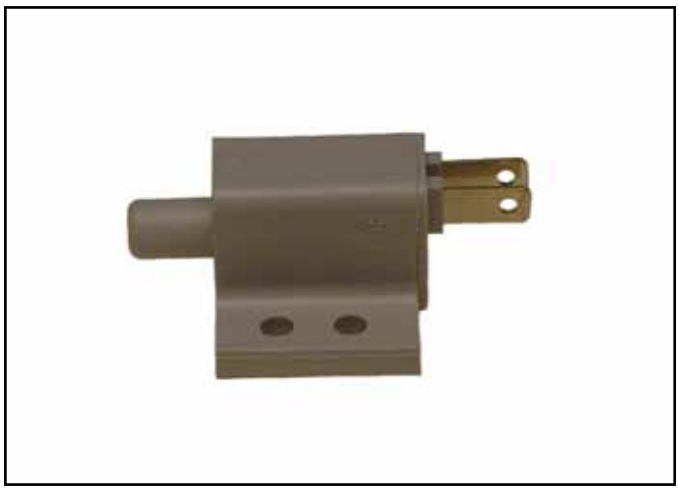


Fig 333 DSC-2527

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 on the left side of the operators below the left motion control handle (Fig. 334).

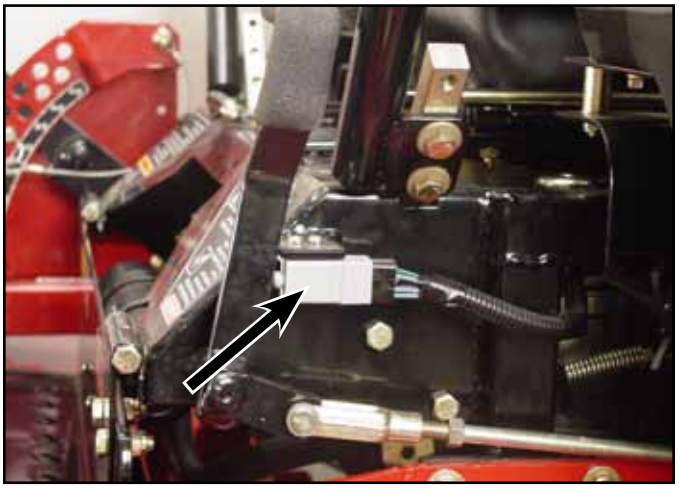


Fig 334 DSC-2525

How It Works

In the start position it is used to ensure the park brake is “ON”. At the same time it allows current to flow through for the safety circuit. When the park brake is released in the “OFF” position it bypasses both neutral switches as long as the operator is in the seat thereby maintaining current for the safety circuit (Fig. 335).

Fig 335 DSC-2528

Testing

1. Disconnect the switch from the wiring harness.

2. Using a multimeter, follow the procedures listed below (Fig. 336).

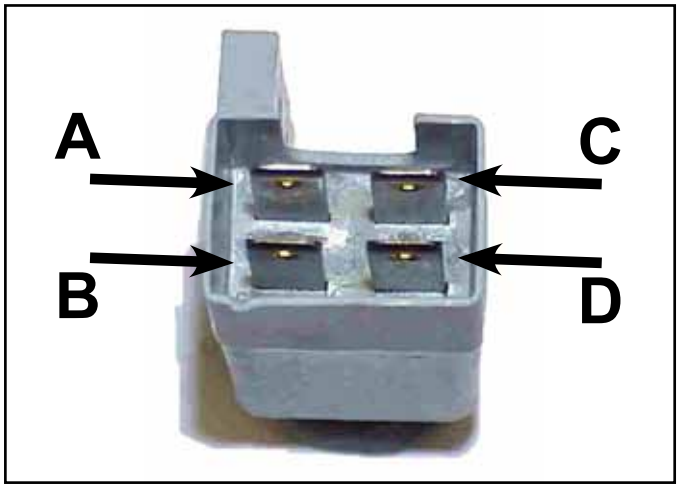


Fig 336 brake switch

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 off, the engine will shut down.

Note: With 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 fastened to the bottom of seat base on all models equipped with deluxe suspension seats (Fig. 337).

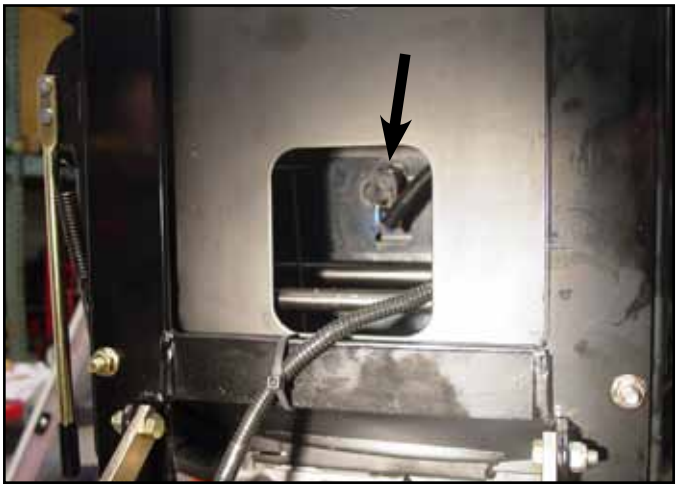


Fig 337 DSC-2555

For all models equipped with a standard seat, the seat switch is located between the frame cross-member and the rear of the hydraulic oil tank (Fig. 338).

Fig 338 DSC-3151

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. (Deluxe suspension seat switch shown) (Fig. 339).

Fig 339 DSC-2556

(Standard seat switch shown.) (Fig. 340)

Fig 340 DSC-3154

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.

Note: This procedure applies to both standard seat and deluxe suspension seat switches.

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 control console behind the console pocket (Fig. 341).

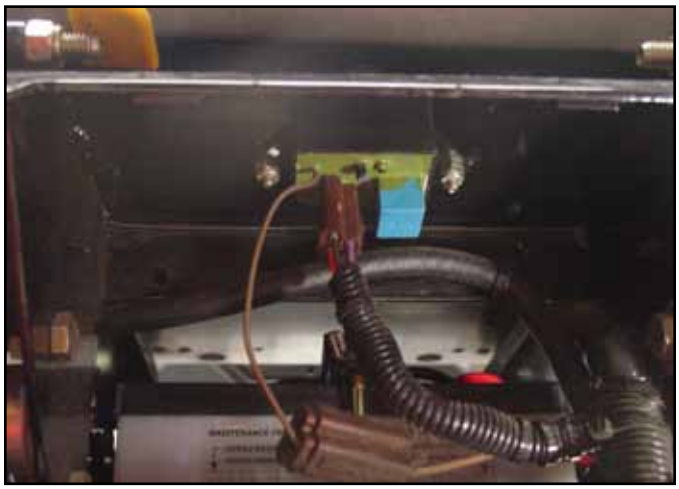


Fig 341 DSC-3156

How It Works

The seat delay module circuit board is made up with several different electrical components such as transient voltage suppressor, capacitor, transistors, carbon film resistors, diodes and a relay. The components work together to allow any short term voltage interruption in the seat switch and supplies temporary voltage to the safety circuit to keep the engine running (Fig. 342).

Fig 342 DSC-2532

Testing

1. Raise the seat and disconnect the seat switch. Install a jumper wire in place of the seat switch (Fig. 343).

Fig 343 DSC-3157

2. Remove the 4 bolts to the pocket. Remove the pocket.

3. Connect a VOM positive lead to the violet wires on the module (Fig. 344). Connect the negative lead to the battery negative terminal.

Fig 344 DSC-3158

4. While sitting in the seat, follow the procedure below to test the delay module function.
   1. Disengage the parking brake.
   2. Pull the right and left motion control levers out of the neutral position.
   3. Turn the ignition key to the RUN position.
   4. The meter should read approximately 12 volts DC.
   5. 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:
   1. 12VDC at the Tan wire terminal.
   2. 12VDC at the Brown wire terminal.
   3. 0 VDC at the Gray wire terminal.
   4. If all these conditions are met, replace the seat delay module.

TEMPERATURE GAUGE
Liquid-Cooled Engine Only

Purpose

The purpose of the temperature gauge is to monitor the engine coolant temperature.

Location

The temperature gauge is located on the left side of the operator on the control panel (Fig. 345).

Fig 345 DSC-2550

How It Works

When the engine coolant temperature increases the sending unit resistance decreases, which causes the needle on the water temperature gauge to increase (Fig. 346).

Fig 346 DSC-2549

Testing

Time-efficient testing is not possible. See information under Temperature Sender, page 6-14.

Back side of the Temperature Gauge with terminal and wire locations (Fig. 347).

S Terminal – Yellow/Red Wire (to the Temperature Sender)
G Terminal – Black Wire (Ground)
I Terminal – Orange Wire (I Terminal of the Ignition Switch)

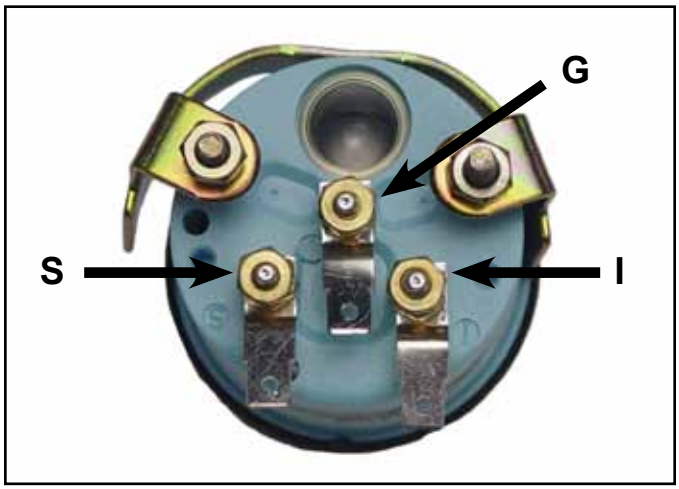


Fig 347 DSC-2551

6

TEMPERATURE SENDER

Purpose

The temperature sender is a temperature-dependent variable resistor. As the coolant temperature increases the internal resistance decreases. This causes a change in voltage applied to the water temperature gauge, which indicates a higher temperature.

Location

The temperature sender is located on the right side of the engine, just below the exhaust header pipe to the muffler.

How It Works

When the water temperature increases the internal resistance decreases which will cause the water temperature gauge to increase (Fig. 348).

Fig 348 DSC-2548

Testing

It is not practical to test the sender in a shop environment. If the gauge is not reading at all, temporarily ground the lead at the sender. If the meter reads full scale, the ground wire and gauge are OK and the sender is bad. If the gauge does not respond, check for 12 VDC at gauge and continuity of the ground lead. If OK, the gauge is bad. Erratic readings can be either the gauge or sender. Replace the sender first, when diagnosing.

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

Raise the seat; the hour meter is located on the left side of the operator on the lower portion of the control panel (Fig. 349).

Fig 349 DSC-2559

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. 350).

Fig 350 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.

VOLTMETER GAUGE

Purpose

This gauge indicates the voltage across the battery.

Location

The voltmeter is located to the left side of the operator, on the control panel (Fig. 351).

Fig 351 DSC-2563

How It Works

The meter movement is proportional to the voltage level across the two terminals of the battery. This is accomplished by placing a resistor in parallel with the meter.

Testing

1. Remove the control panel from the tank by removing 4 screws.
2. With a VOM, place the negative probe to the battery negative cable. Turn the ignition key to the RUN position.
3. Place the positive probe of the meter to the I (orange wire) terminal. You should read the DC battery voltage level on the meter.
4. Move the positive probe of the meter to the G (black wire) terminal. You should get 0 volts DC on the meter.
5. If you DO NOT get the above readings, replace the voltmeter.

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 (Fig. 352).

Fig 352 DSC-2552

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 wire.
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. 353).

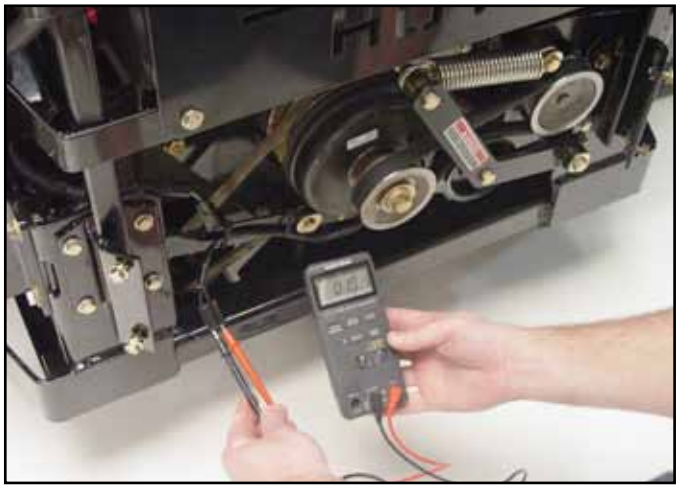


Fig 353 DSC-2553

5. The meter should read between approximately 2-4 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. Loosen 4 bolts and remove the rear bumper plate loosening 4 bolts.
3. Disconnect the electric PTO clutch wire connector.
4. Set the multi meter to check amps (10 amp scale).
5. Connect the positive meter lead to the tractor terminal (1) of the clutch harness (Fig. 354).

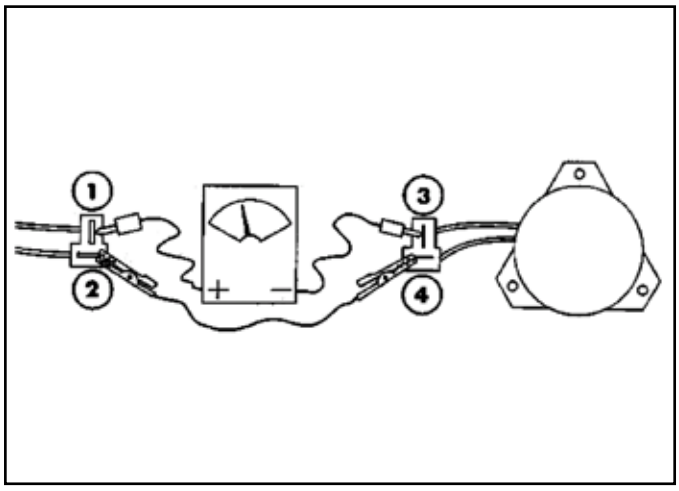
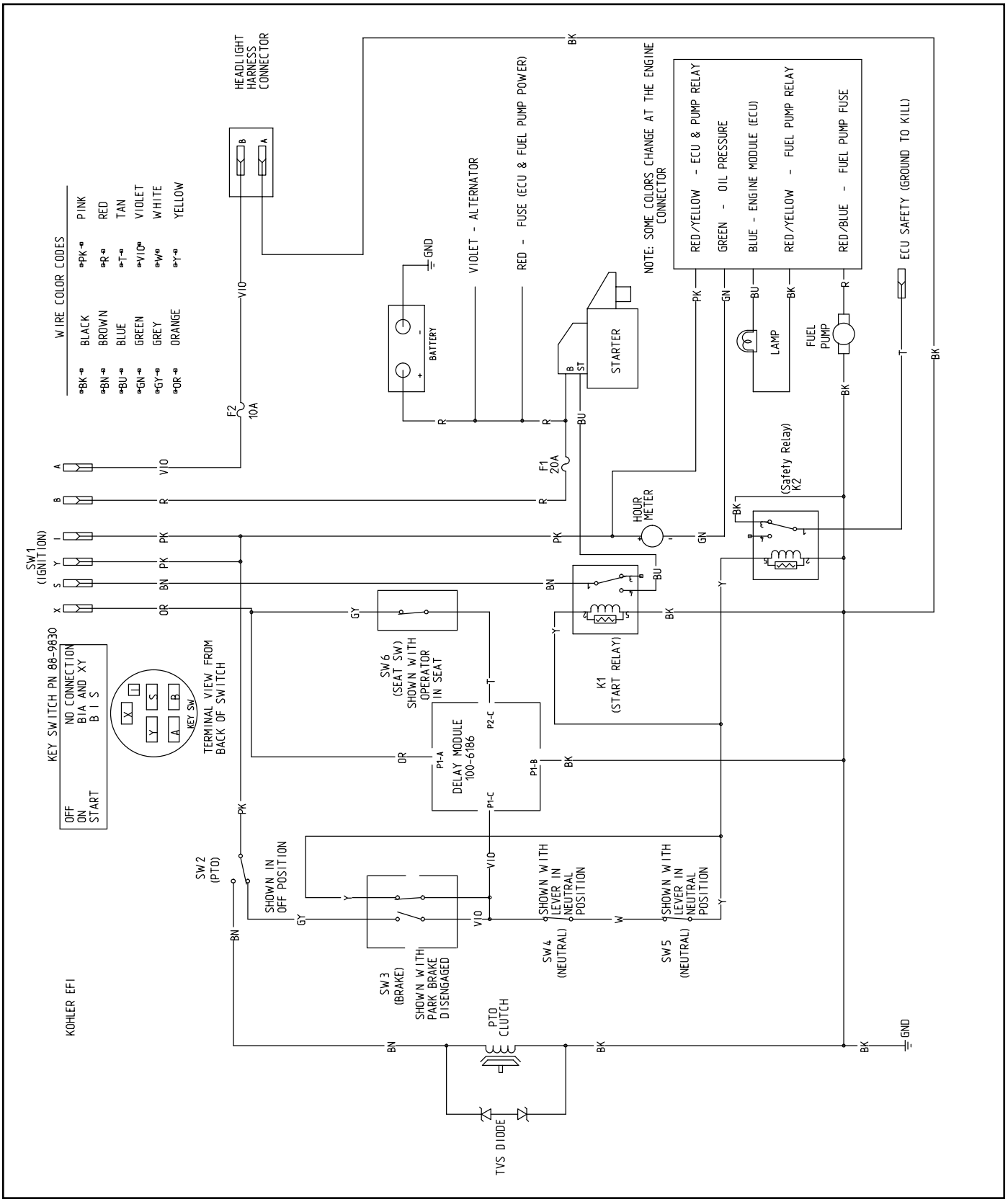


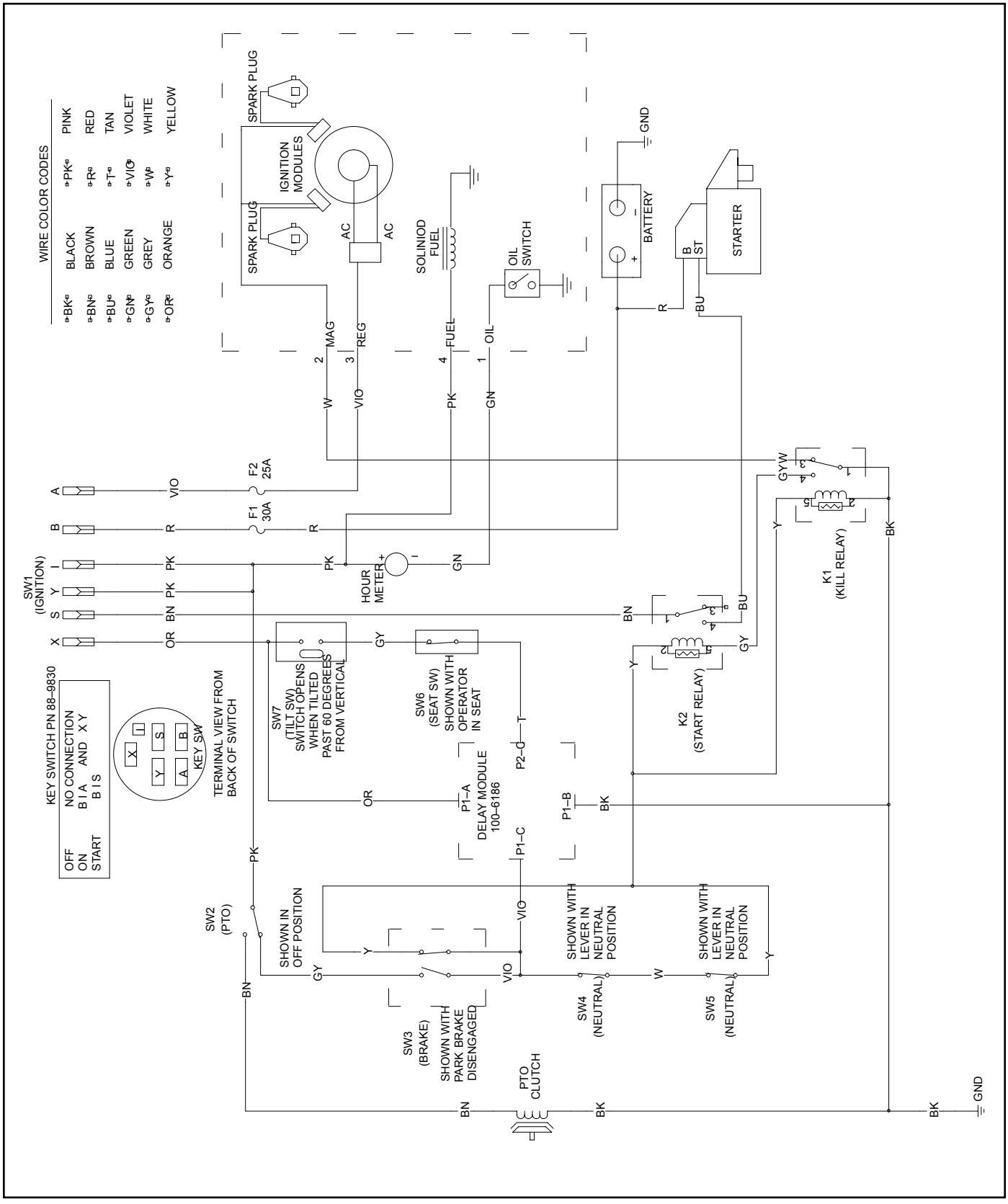
Fig 354 diag 3-7

6. Connect the negative meter lead to the corresponding wire terminal (3) (Fig. 354, above).
7. Connect a short jumper lead from terminal (2) to terminal (4) (Fig. 354, above).
8. Turn the ignition switch to the “RUN” position. Turn the PTO switch to the “ON” position.
9. If the meter is 3.5 amps or above, the system is functioning properly. If the meter reading is below 3.5 amps, check the electrical system for problems (i.e., the battery, ignition switch. PTO switch, or wiring harness may be malfunctioning).

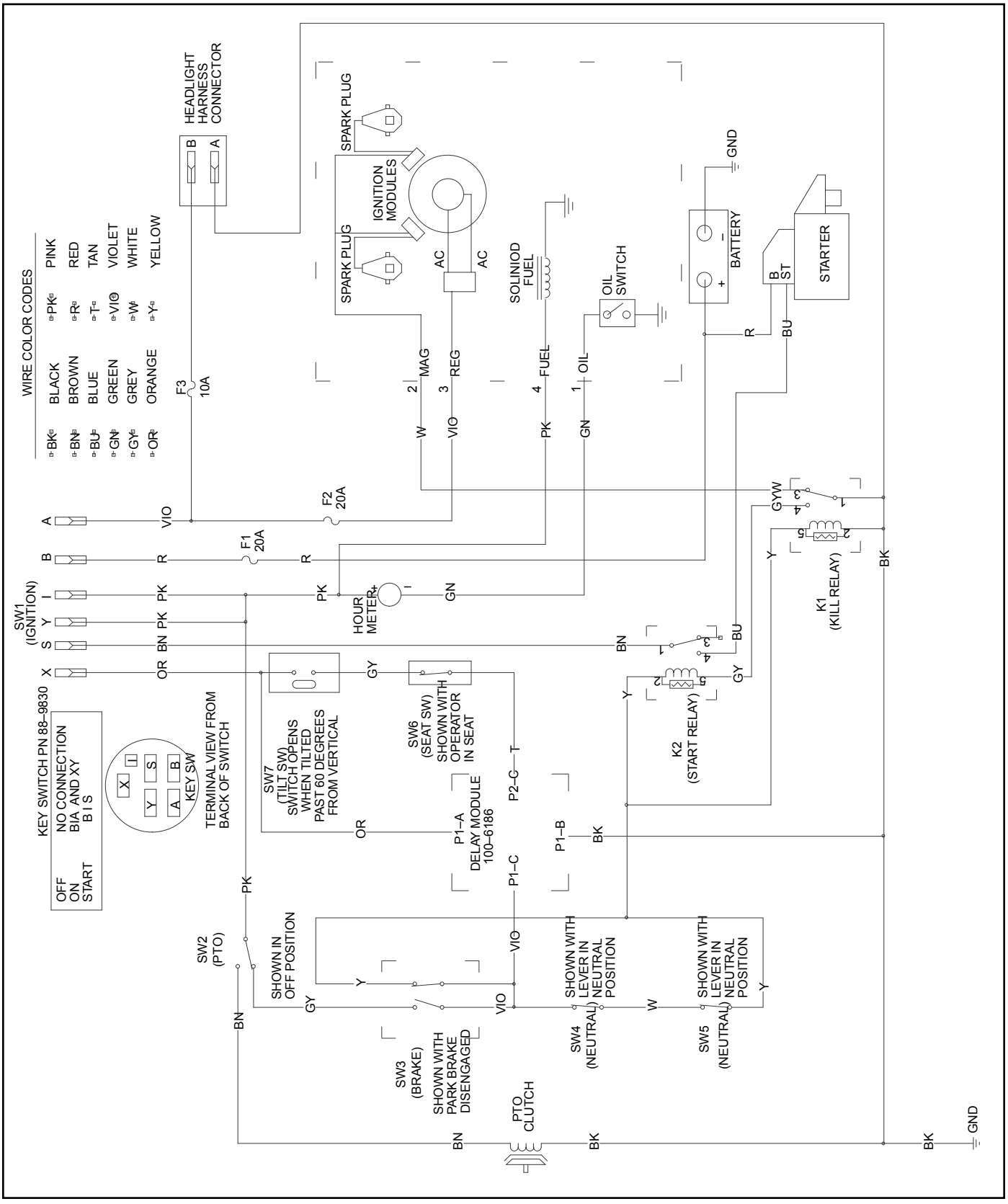
Kohler EFI (Electric Fuel Injection)



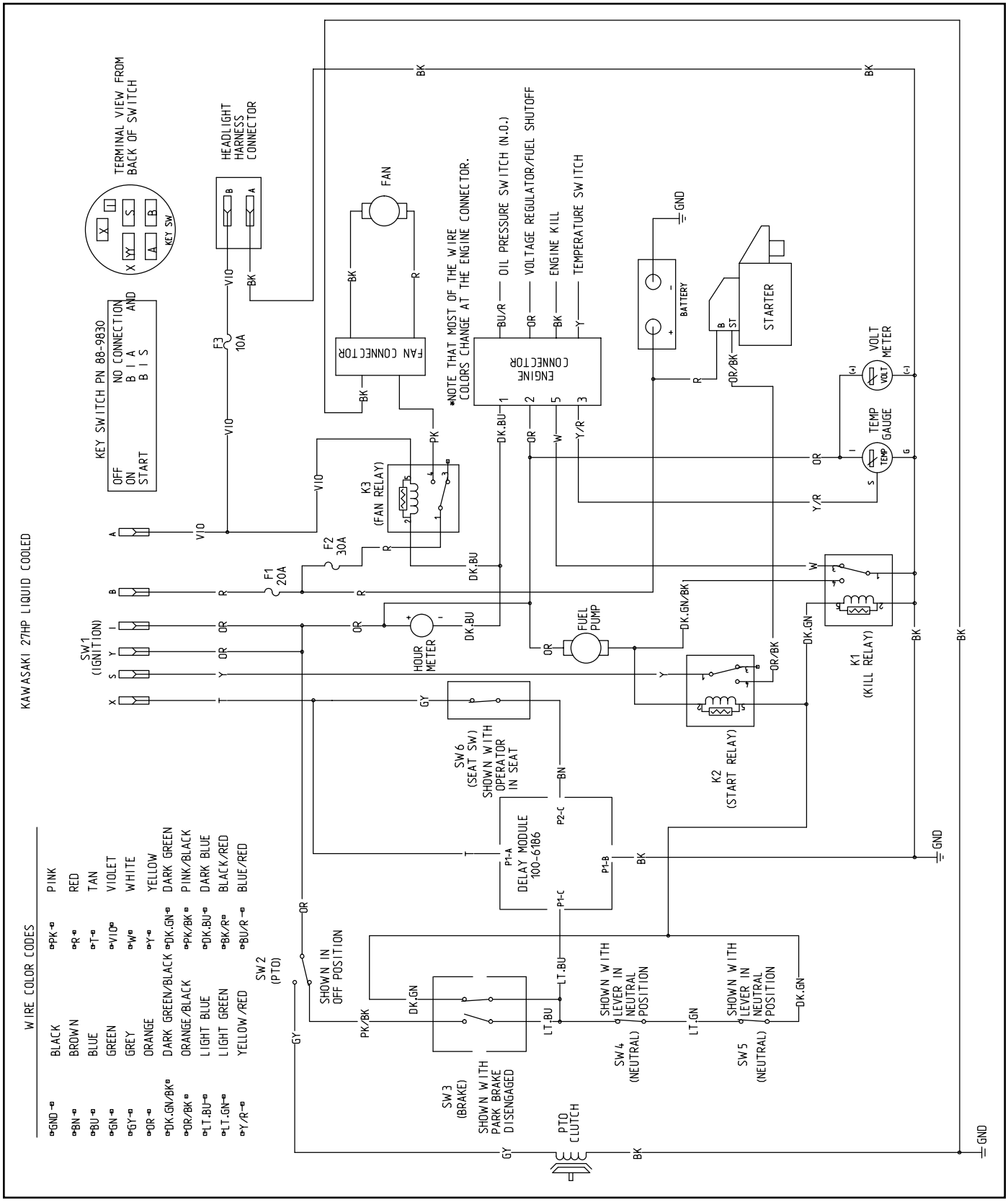
Kohler A/C (Air Cooled)



Kawasaki A/C (Air Cooled)



Kawasaki L/C (Liquid Cooled)



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Electric PTO Clutch Removal

The electric PTO clutch removal and installation are similar on both the air cooled engine models and the liquid cooled model. The only difference is the clutch guard removal. The figure below points to the bolts that need to be removed in both units (Fig. 355). The procedure shows an air-cooled unit.

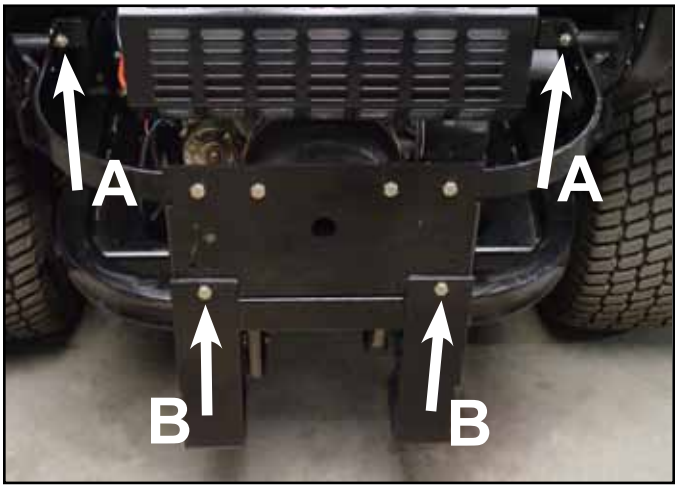

Fig 355 DSC-3131

A. Top strap bolts B. Clutch guard bolts

On the Kawasaki liquid cooled models, remove 6 bolts to access the clutch (Fig. 356).

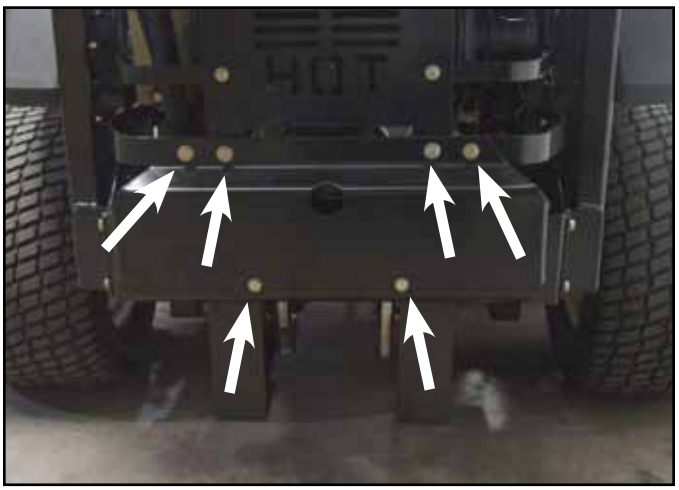

Fig 356 DSC-3794

This procedure is on the Air Cooled Engine Models and follows the same procedure for the Liquid Cooled Engine Model.

1. Loosen and remove 2 bolts and nuts located on the clutch guard (Fig. 357).

Fig 357 DSC-3131

2. Remove the right and left top bolt and nut on the top strap guards to remove the clutch guard from the unit (Fig. 358).

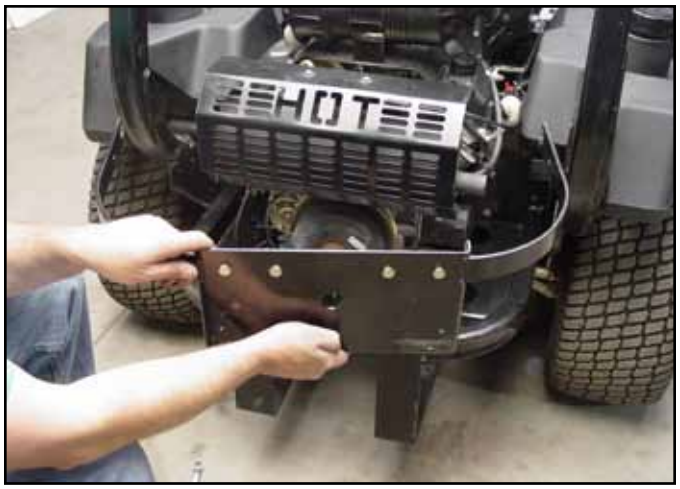

Fig 358 DSC-3134

7

3. Disconnect the electric PTO clutch connector from the clutch (Fig. 359).

Fig 359 DSC-3135

4. Lift the floor pan and remove the right side mower belt cover (Fig. 360).

Fig 360 DSC-3136

5. Loosen the two nuts located on the idler plate to relieve tension on the belt (Fig. 361).

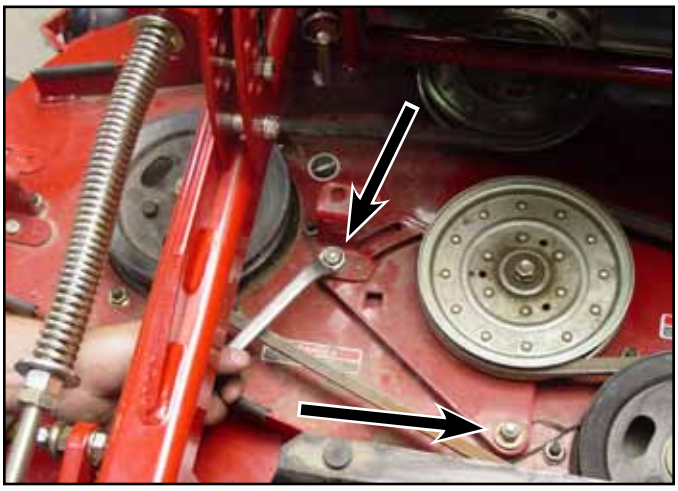

Fig 361 DSC-3137

6. Slip the mower drive belt off the right mower spindle pulley (Fig. 362).

Fig 362 DSC-3138

7

7. Remove the belt from the electric PTO clutch (Fig. 363).

Fig 363 DSC-3139

8. Remove the electric PTO clutch bolt (Fig. 364).

Fig 364 DSC-3140

9. Remove the electric PTO clutch from the engine crankshaft (Fig. 365).

Fig 365 DSC-3141

Electric PTO Clutch Installation

1. Apply anti-seize compound to the engine crankshaft (Fig. 366).

Fig 366 DSC-3142

2. Install the electric PTO clutch to the engine crankshaft (Fig. 367).

Fig 367 DSC-3141

3. Apply medium strength threadlocking material to the bolt. Install the bolt and two spring washers to the crankshaft. Torque the bolt to 65 ft. lbs (88.13 Nm) (Fig. 368).

Fig 368 DSC-3143

4. Install the mower drive belt around the electric PTO clutch pulley (Fig. 369).

Fig 369 DSC-3144

5. Check and make sure the mower drive belt is in the groves of the two idler pulleys located under the electric PTO clutch (Fig. 370).

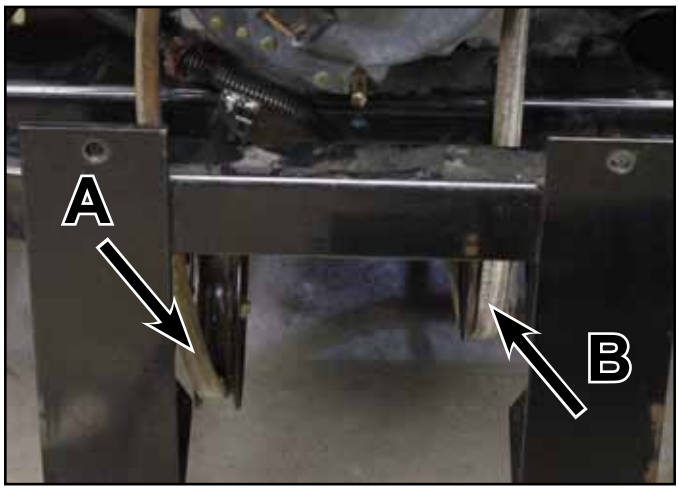

Fig 370 DSC-3145

A. Idler pulley B. Stationary idler

7

6. Route the belt around all of the mower deck pulleys and install the belt around the right side mower spindle pulley (Fig. 371).

Fig 371 DSC-3146

Important: Check the amount of twist in the belt between the pulleys. Make sure it is only what is specified in Figure 372.

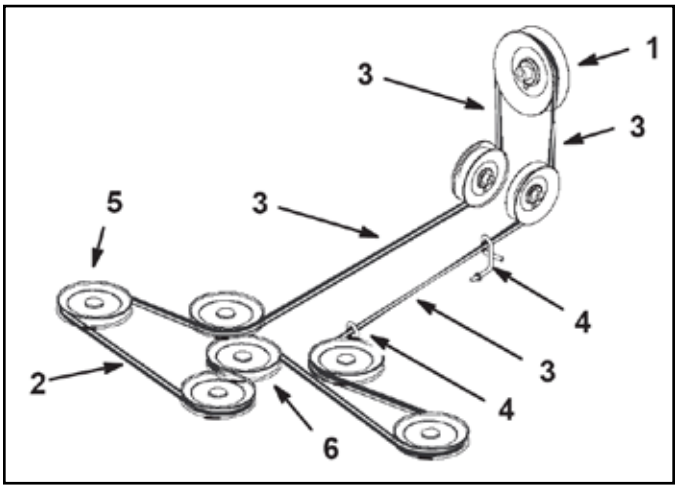

Fig 372 fig. 70 m-6825

1. Clutch
2. Mower belt
3. 1/4 turn belt twist
4. Belt guide
5. Mower spindle pulley
6. Mower idler pulley

7. Install a 1/2” ratchet and extension, into the square hole in the idler plate (Fig. 373).

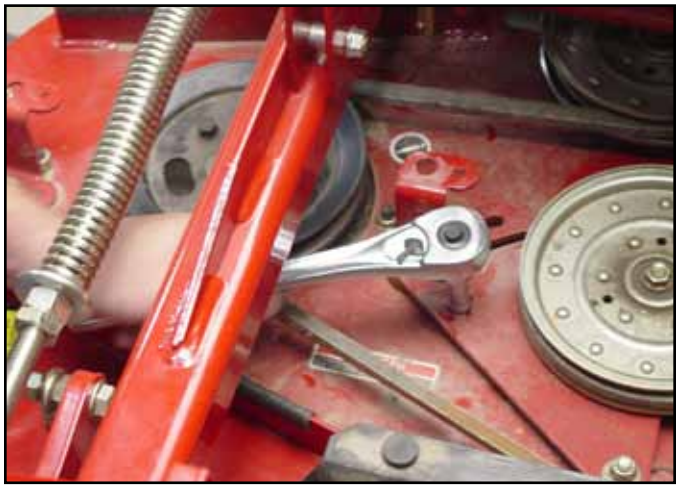

Fig 373 DSC-3147

8. Rotate the mower idler plate toward the front of the mower deck until light contact is made between the rear idler arm and the rubber stop (Fig. 374).

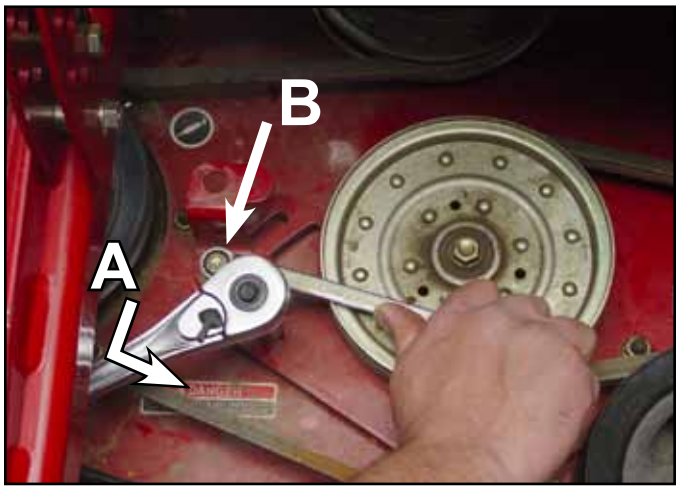

Fig 374 DSC-3148

8. Direction to rotate idler plate
B. Idler plate nut

7

9. Tighten the pivot bolt on the idler plate once the adjustment is achieved (Fig. 375).

Fig 375 DSC-3149

10. Connect the PTO clutch connector to the clutch (Fig. 376).

Fig 376 DSC-3135

11. Install the right belt cover on the mower deck.

12. Install the right and left top strap guards, with the clutch guard to the unit (Fig. 377).

Fig 377 DSC-3134

13. Install and tighten the two bolts and nuts on the top strap guards and the two bolts in the clutch guard (Fig. 378).

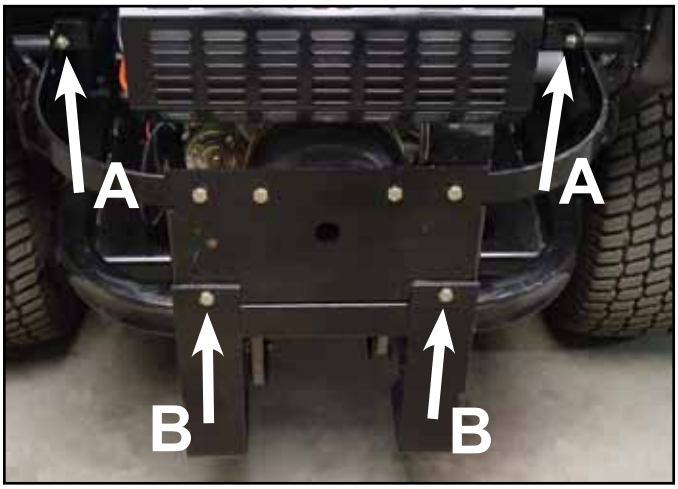

Fig 378 DSC-3131

A. Top strap bolts B. Clutch guard bolts

7

Mower Deck Removal (52, 60, 72”)

1. Lift the floor pan and remove the right hand belt cover (Fig. 379).

Fig 379 DSC-3136

2. Loosen the two nuts located on the idler plate to relieve tension on the mower drive belt (Fig. 380).

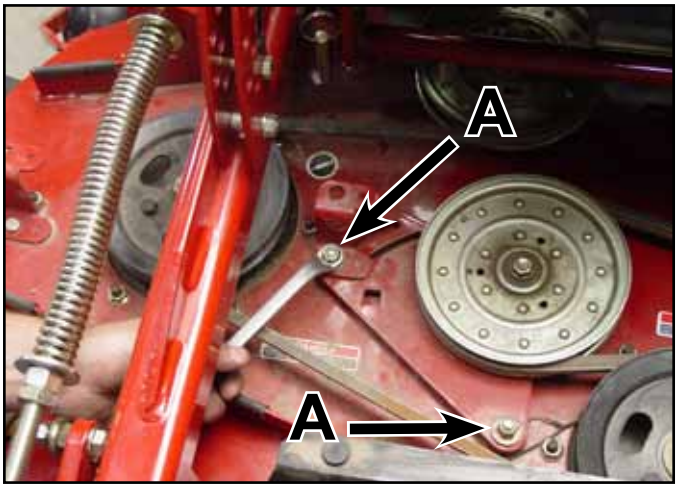

Fig 380 DSC-3137

A. Idler plate bolt

3. Slip the mower drive belt off the right mower spindle pulley (Fig. 381).

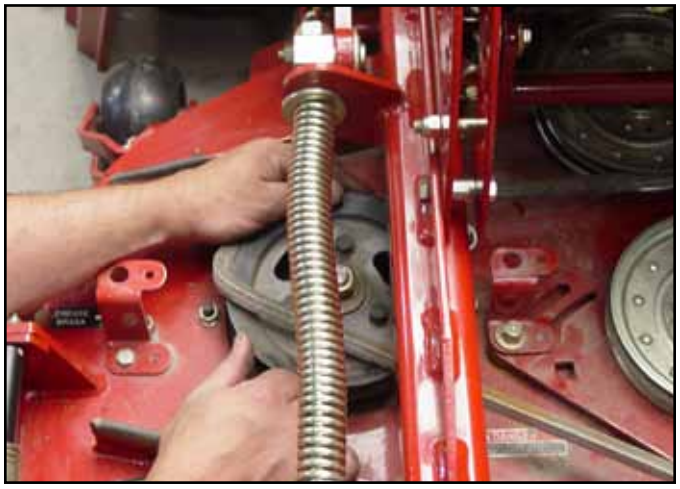

Fig 381 DSC-3138

4. Remove the belt around the electric PTO clutch pulley and the two rear idler pulleys (Fig. 382).

Fig 382 DSC-3139

Note: Clutch guard removed for clarity.

5. Raise the mower deck to the transport position. Install a 4 x 4 wood block under the right side of the mower deck. Lower the deck to relieve tension on the lift chains on the right side (Fig. 383).

Fig 383 DSC-2623

6. Remove the front and rear lift chains from the mower deck (Fig. 384).

Fig 384 DSC-2631

7. Remove the bolt and nut holding the right rear strut pin into the strut assembly (Fig. 385).

Fig 385 DSC-2632

8. Remove the strut pin from the strut assembly and remove the assembly from the mower deck (Fig. 386).

Fig 386 DSC-2633

7

Tie strap the strut assembly up so it will be out of the way of the mower deck when sliding it out under the frame. Remove the 4 x 4 block of wood from the right side of the deck and allow the deck to rest on the floor.

9. Raise the deck to transport position. Install a 4 x 4 wood block under the left side of the mower deck. Lower the mower deck until it rests on the block of wood to relieve tension on the lift chains (Fig. 387).

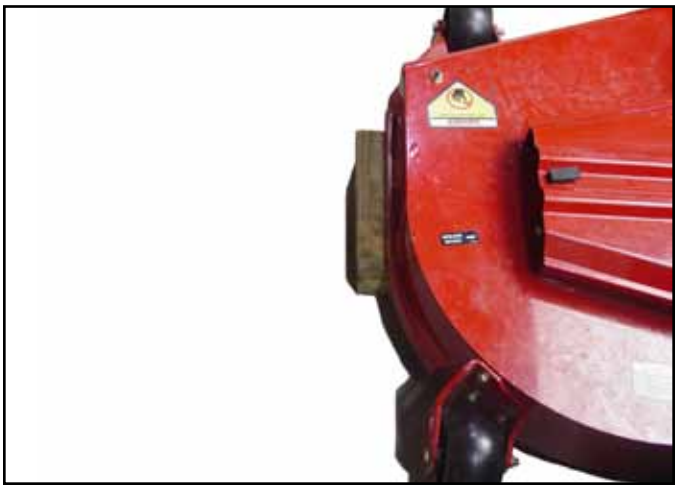

Fig 387 DSC-2635

10. Push the lift handle to the lowest HOC position to overcome the tension of the lift assist springs. Use the hitch pin above the lift handle to lock the handle in the down position (Fig. 388).

Fig 388 DSC-2636

11. Follow steps 5 through 8 on the left side of the mower deck.

12. Remove the 4 x 4 wood block from under the left side of the mower deck and lower the deck to the floor.

13. Turn the right front wheel so the caster fork is angled forward. This will allow more clearance to slide the mower deck from under the frame (Fig. 389).

Fig 389 DSC-2637

14. Slide the mower out the right side of the unit (Fig. 390).

Fig 390 DSC-2638

Mower Deck Installation (52, 60, 72”)

1. Slide the mower deck under the unit.

2. Install a 4 x 4 block of wood under the left side of the mower deck (Fig. 391).

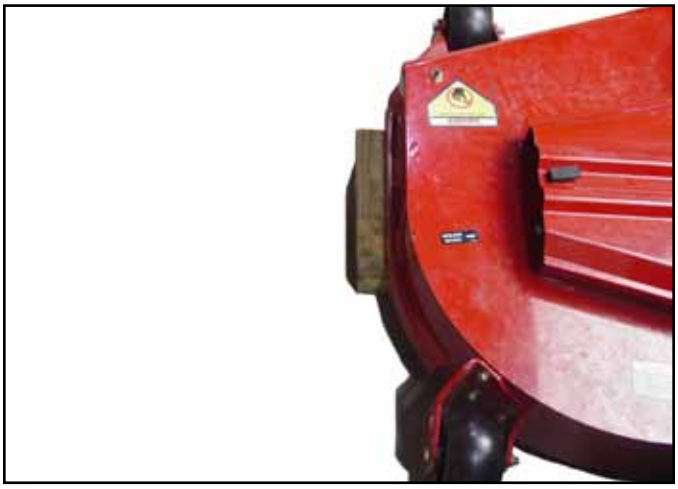

Fig 391 DSC-2635

3. Install the strut pin through the strut assembly. Install the bolt and nut retaining the strut pin (Fig. 392).

Fig 392 DSC-2639

4. Install the rear and front chains to the mower deck (Fig. 393).

Fig 393 DSC-2640

5. Remove the hitch pin on the lift handle and raise the mower in the transport position.

6. Install a 4 x 4 wood block under the right side of the mower deck.

7. Lower the mower deck down on the wood block.

8. Install the strut pin in the strut assembly. Install and tighten the bolt and nut.

9. Install the rear and front lift chains to the mower.

10. Raise the mower deck and remove the wood block.

11. Install the belt around the electric PTO clutch pulley (Fig. 394).

Fig 394 DSC-3139

Note: Clutch guard removed for clarity.

12. Check and make sure the mower drive belt is in the grooves of the two idler pulleys located under the electric PTO clutch (Fig. 395).

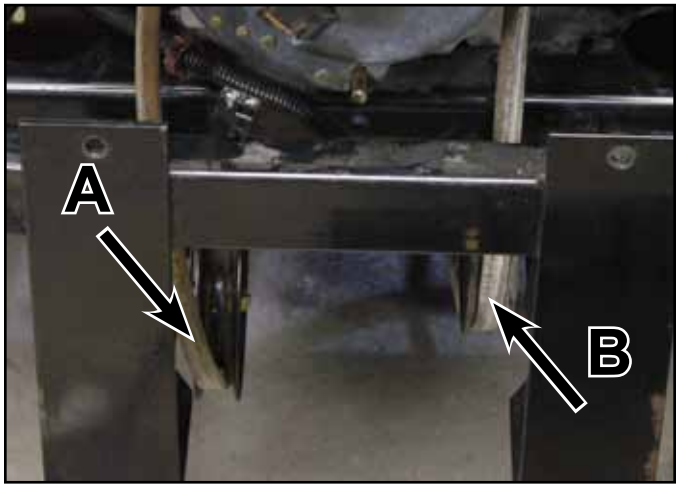

Fig 395 DSC-3145

A. Idler pulley B. Stationary idler

13. Route the belt around all of the mower deck pulleys and install the belt around the right side mower spindle pulley (Fig. 396).

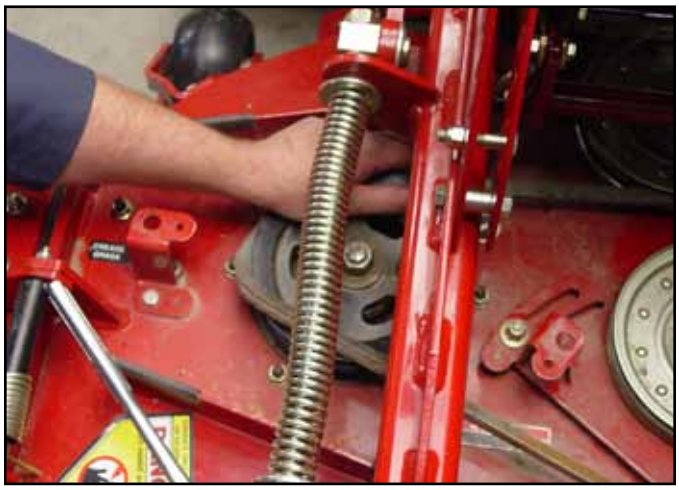

Fig 396 DSC-3146

Important: Check the amount of twist in the belt between the pulleys. Make sure it is only what is specified in Fig. 397 below.

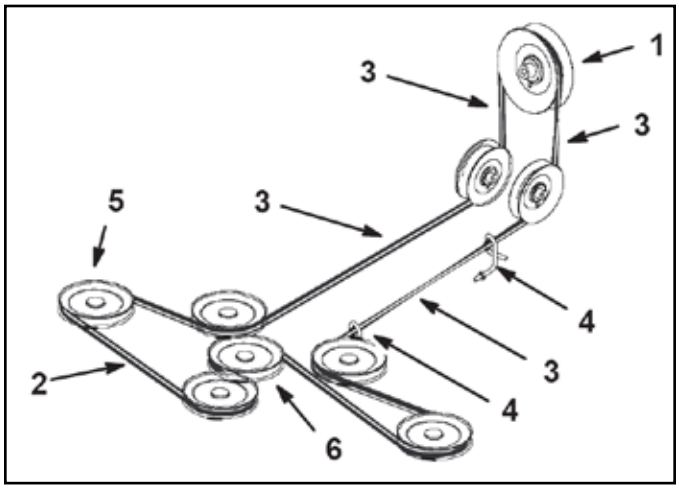

Fig 397 fig. 70 m-6825

1. Clutch
2. Mower belt
3. 1/4 turn belt twist
4. Belt guide
5. Mower spindle pulley
6. Mower idler pulley

14. Install a 1/2” socket ratchet and extension, in the square hole in the idler plate (Fig. 398).

Fig 398 DSC-3147

15. Rotate the mower idler plate toward the front of the mower deck until light contact is made between the idler arm and the rubber stop (Fig. 399).

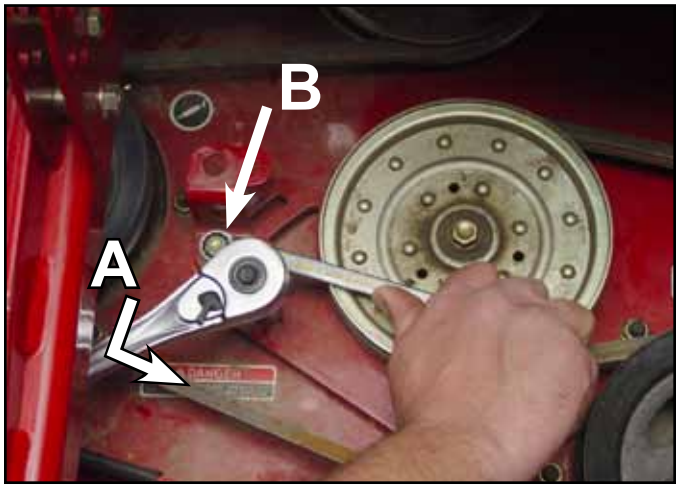

Fig 399 DSC-3148

8. Direction to rotate idler plate
B. Idler plate nut

7

16. Tighten the pivot bolt on the idler plate once the adjustment is achieved (Fig. 400).

Fig 400 DSC-3149

17. Install the right belt cover on the mower deck.

Mower Spindle Removal

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

1. Either 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. 401).

Fig 401 DSC-3136

6. Loosen the two nuts located on the idler plate to relieve tension on the belt (Fig. 402).

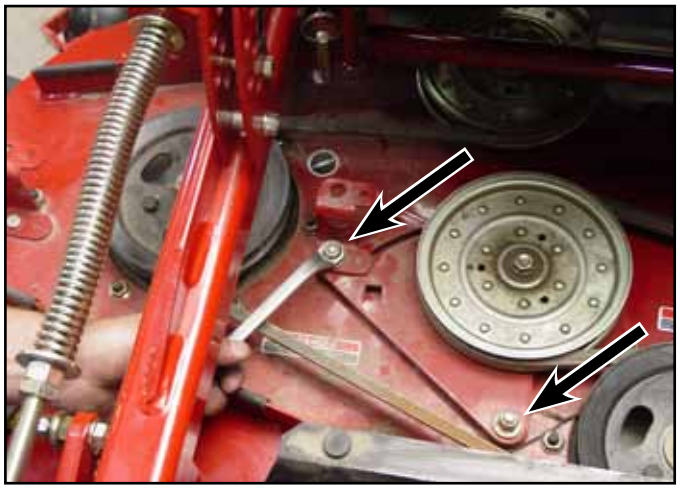

Fig 402 DSC-3137

7. Slip the mower drive belt off the left mower spindle pulley (Fig. 403).

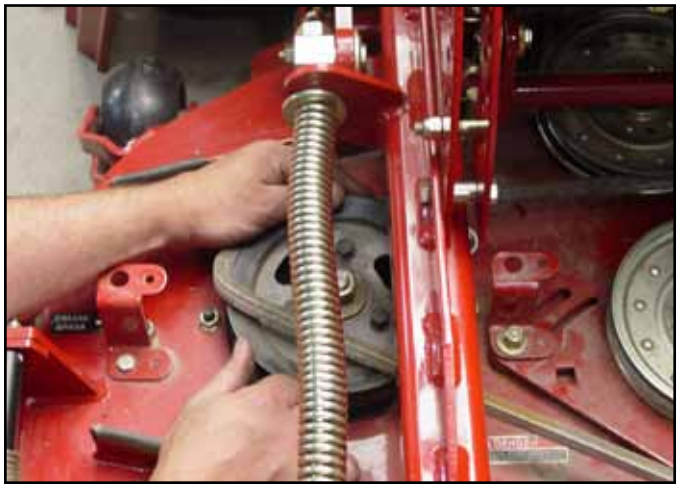

Fig 403 DSC-3138

8. Remove three bolts retaining the pulley to the pulley hub (Fig. 404).

Fig 404 DSC-2662

9. Raise the mower deck to the transport position.

10. Remove the mower blade from the spindle assembly.

11. Remove the 6 bolts and nuts from the spindle assembly. Remove the spindle assembly (Fig. 405).

Fig 405 DSC-2666

Mower Spindle Installation

Reverse the order of mower spindle removal.

Mower Spindle Disassembly

1. Remove the nut and washer (Fig. 406).

Fig 406 DSC-2669

2. Remove the pulley hub and square key (Fig. 407).

Fig 407 DSC-2670

3. Remove the bearing shield (Fig. 408).

Fig 408 DSC-2671

4. Remove the spindle housing from the spindle shaft assembly (Fig. 409).

Fig 409 DSC-2672

5. Remove the seal spacer from the top of the spindle housing (Fig. 410).

Fig 410 DSC-2673

6. Remove the seal spacer from the bottom of the spindle housing (Fig. 411).

Fig 411 DSC-2674

7. Remove the top oil seal from the spindle housing (Fig. 412).

Fig 412 DSC-2675

8. Remove the tapered roller bearing from the top of the spindle housing (Fig. 413).

Fig 413 DSC-2676

9. Remove the spindle spacer (Fig. 414).

Fig 414 DSC-2677

10. Remove the split ring (Fig. 415).

Fig 415 DSC-2678

11. Turn the spindle housing over and remove the oil seal from the bottom of the spindle housing (Fig. 416). Note the orientation of the lower oil seal. The open end of the seal faces outwards to help relieve pressure from over-greasing the spindle assembly.

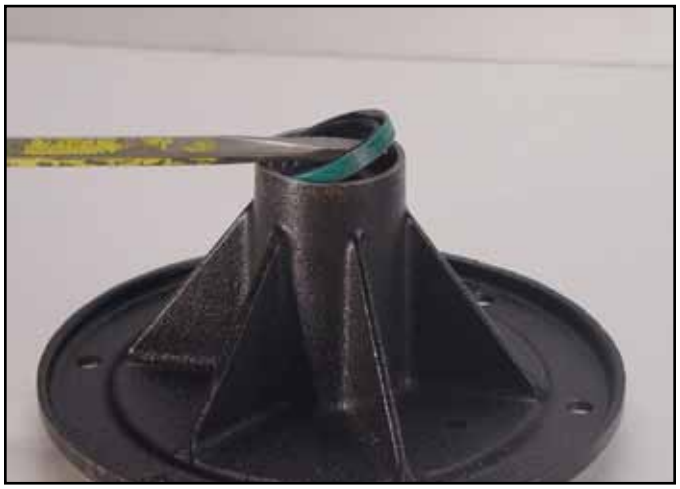

Fig 416 DSC-2679

12. Remove the tapered roller bearing from the bottom of the spindle assembly (Fig. 417).

Fig 417 DSC-2680

13. Using a hammer and a driver with a square edge, drive both the top and bottom bearing races out of the spindle housing (Fig. 418).

Fig 418 DSC-2681

14. Remove the large spacer in the spindle housing (Fig. 419).

Fig 419 DSC-2682

15. This view shows the 2 bearing races and the large spacer in the spindle housing (Fig. 420). Note the internal snap ring in the housing, it is not necessary to remove when installing new bearing races and the spacer.

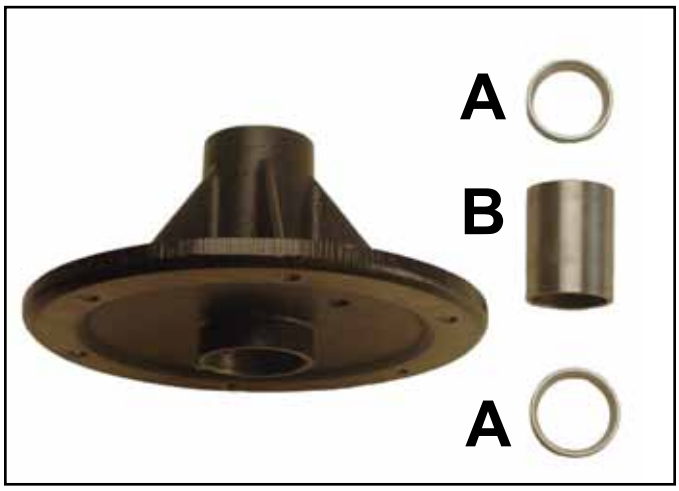

Fig 420 DSC-2684

A. Bearing race B. Spacer

Mower Spindle Assembly

1. Install the spacer through the top of the spindle housing (Fig. 421).

Fig 421 DSC-2688

2. Using a press, install the upper bearing race into the spindle housing (Fig. 422).

Note: The wider inside diameter of the bearing race should be facing up to accept the tapered bearing.

Fig 422 DSC-2689

3. Turn the spindle housing over and install the lower bearing race with a press (Fig. 423).

Note: The wider inside diameter of the bearing race should be facing up to accept the tapered bearing.

Fig 423 DSC-2690

4. Pack the tapered bearing with #2 grease and install the tapered bearing (Fig. 424).

Fig 424 DSC-2691

5. Install the lower seal (Fig. 425).

Note: The open lip of the seal should be facing outward.

Fig 425 DSC-2692

6. Using a seal driver, drive or press the seal on the lower end of the spindle housing until the seal is flush with the outer edge of the housing (Fig. 426).

Fig 426 DSC-2693

7. Turn the spindle assembly over and install the split ring spacer (Fig. 427).

Fig 427 DSC-2699

8. Install the inner spacer to the spindle assembly (Fig. 428).

Fig 428 DSC-2700

9. Pack the tapered bearing with #2 grease and install the tapered bearing (Fig. 429).

Fig 429 DSC-2694

10. Install the seal. Press it flush with the top of the housing (Fig. 430).

Note: The open lip of the seal faces inward.

Fig 430 DSC-2696

11. Install the bearing shield and the seal spacer onto the spindle shaft (Fig. 431).

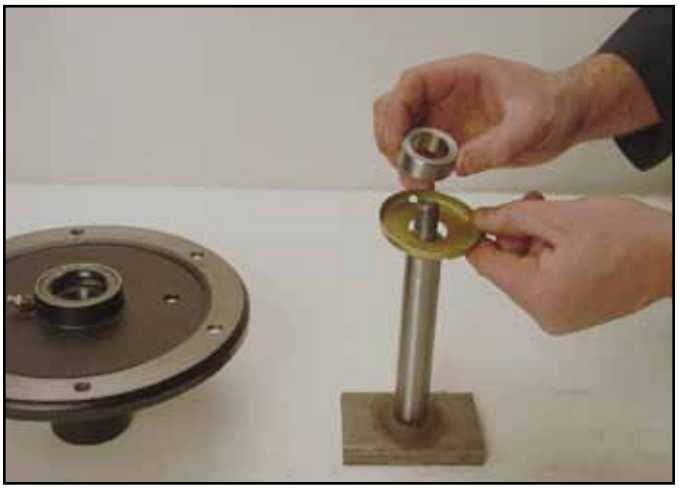

Fig 431 DSC-2702

12. Lower the spindle housing over the spindle shaft (Fig. 432).

Fig 432 DSC-2703

13. Install the seal spacer on the top of the spindle housing (Fig. 433).

Fig 433 DSC-2704

14. Install the bearing shield (Fig. 434).

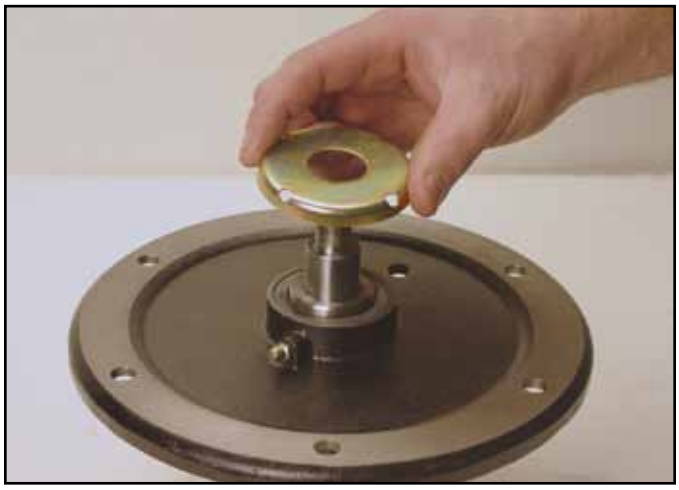

Fig 434 DSC-2705

15. Install the square key onto the spindle shaft (Fig. 435).

Fig 435 DSC-2706

16. Install the pulley hub on the spindle shaft (Fig. 436).

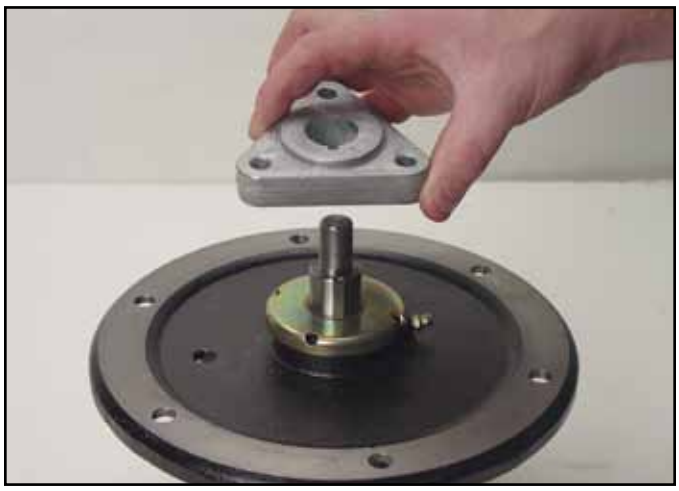

Fig 436 DSC-2707

17. Install the heavy washer and nut on the top of the spindle shaft (Fig. 437).

Note: The cup side of the washer should be facing down toward the pulley hub.

Fig 437 DSC-2708

18. Torque the top nut to 100 to 120 ft. lbs. (Fig. 438).

Fig 438 DSC-2709

Replacing the Mower Belt

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

3. Remove the belt covers (Fig. 439).

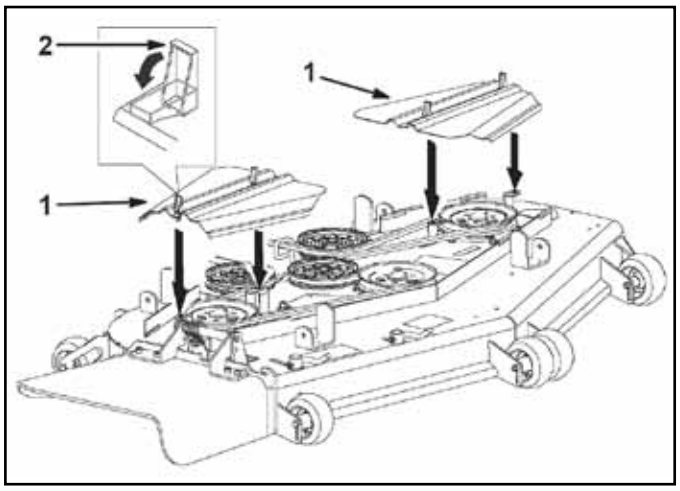

Fig 439 fig. 71 m-6824

1. Belt cover
2. Latch

4. Loosen the nut securing the idler plate and move the idler plate to relieve the belt tension on the idler pulley, then remove the worn mower belt (Fig. 440).

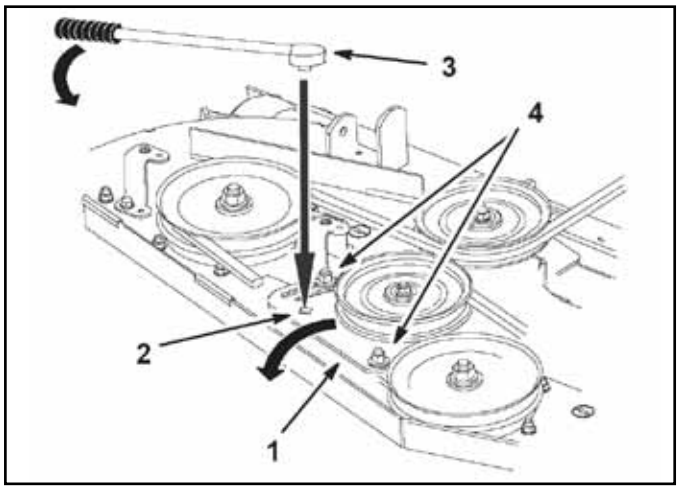

Fig 440 fig. 73 m-6826

1. Mower idler plate
2. Square hole
3. Ratchet or breaker bar
4. Idler plate bolt

5. Install the new mower belt around the mower spindle pulleys, mower idler pulley, into the belt guides, into rear idler arm assembly, and the clutch (Fig. 441).

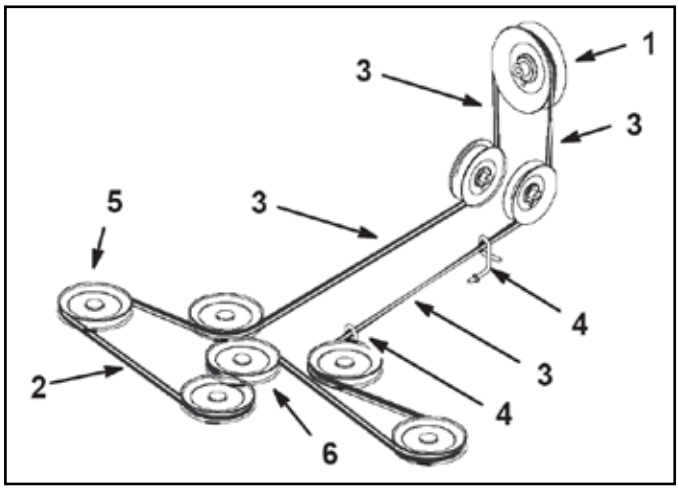

Fig 441 fig. 70 m-6825

1. Clutch
2. Mower belt
3. 1/4 turn belt twist
4. Belt guide
5. Mower spindle pulley
6. Mower idler pulley

Important: Check the amount of twist in the belt between the pulleys. Make sure it is only what is specified in Figure 441.

6. Adjust the belt tension, refer to Adjusting the Mower Belt Tension, page 7-25.

7. Install the belt covers and close the latches (Fig. 439).

Adjusting the Mower Belt Tension

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. Raise the mower to the transport position.

Important: Check the amount of twist in the belt between the pulleys. Make sure it is only what is specified (Fig. 441).

Important: Check and make sure the belt is installed into both the front and rear belt guides (Fig. 442).

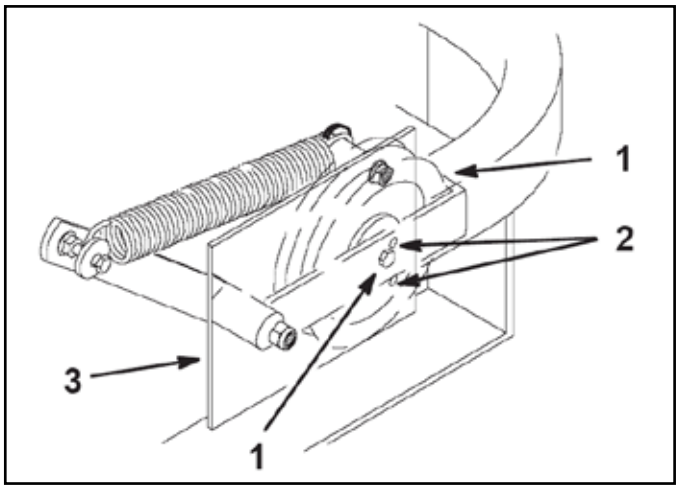

Fig 442 fig. 72 m-4417

1. Center bolt
2. Alignment hole
3. Left support plate
4. Spring loaded idler

7

4. Check the belt tension. The spring loaded idler center bolt needs to be near the top alignment hole in left support plate (light contact with the rubber stop) (Fig. 443).

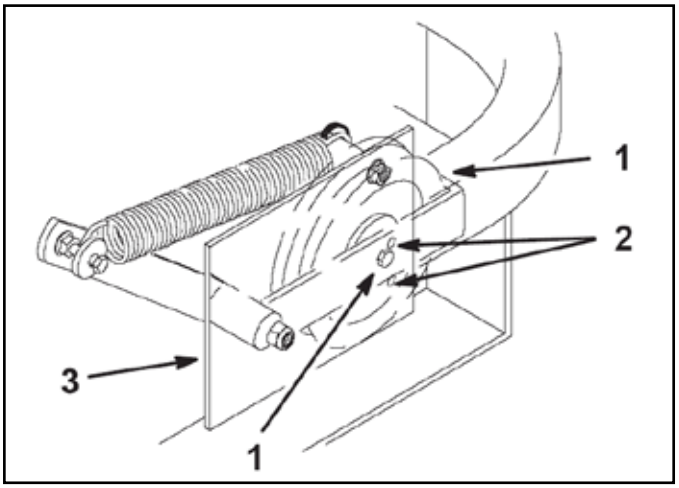

Fig 443 fig. 72 m-4417

1. Center bolt
2. Alignment hole
3. Left support plate
4. Spring loaded idler

5. If adjustment is required, loosen the mower idler plate and adjust it (Fig. 440).

6. Insert a ratchet or breaker bar into the square hole in the mower idler plate to adjust the tension (Fig. 440).

7. To increase belt tension, rotate the mower idler plate until resistance is felt and rotation stops. Do not go past when it stops (Fig. 440).

8. Tighten the idler plate bolts (Fig. 440).

9. Check the distance from the rubber stop and the arm of the spring loaded idler pulley when the idler plate is tightened. Light contact should be made between the idler arm and the rubber stop (Fig. 444).

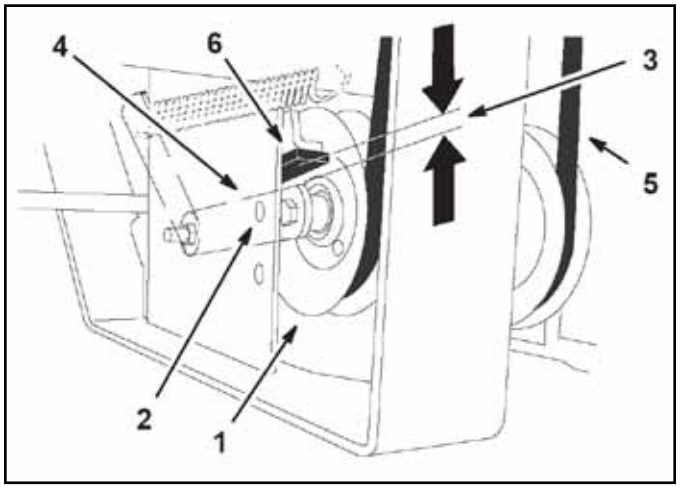

Fig 444 fig. 74 m-6825

1. Spring loaded idler pulley
2. Top alignment hole
3. 0 to 1/4 in. gap (0 to 6mm)
4. Idler pulley arm
5. Belt
6. Rubber bumper

10. Adjust the belt tension and the idler plate, if necessary, and tighten all hardware securely (Fig. 445).

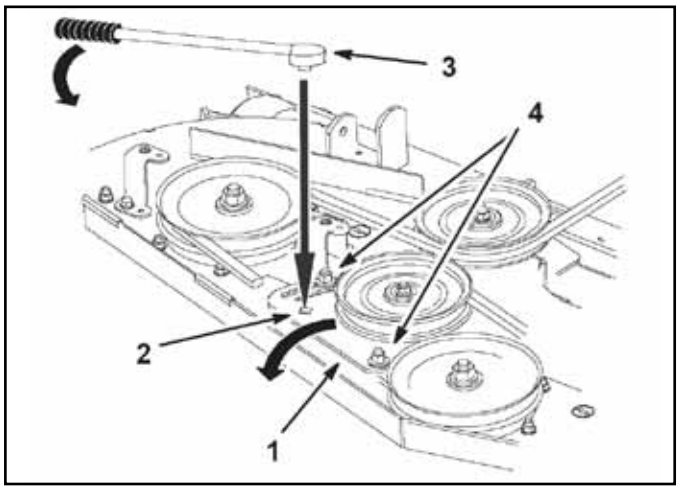

Fig 445 fig. 73 m-6826

1. Mower idler plate
2. Square hole
3. Ratchet or breaker bar
4. Idler plate bolt

11. If the mower idler plate contacts the end of the adjustment slot and more belt tension is required, a small change to the right side fixed idler can create more belt tension adjustment (Fig. 446).

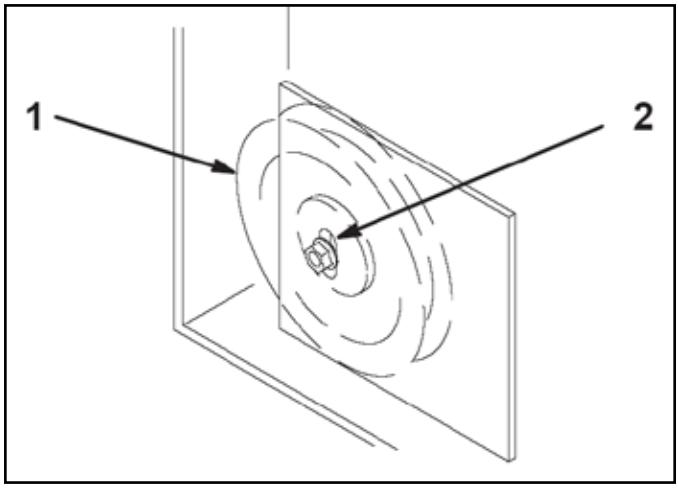

Fig 446 fig. 75 m-3746

1. Fixed idler
2. Adjustment slot

Leveling the Mower

Setting up the Machine

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 the tire pressure of all four tires. If needed, adjust to 13 psi (90 kPa).
5. Lower the mower to the 3 inch (76mm) height-of-cut position.
6. Inspect the four chains. The chains need to have tension.
   - 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 on page 7-29.
   - If one front chain is loose, raise (tighten) the front support arm for that chain. Refer to Front-to-Rear Mower Pitch on page 7-29.

Leveling the Mower Side-to-Side

1. Position the right blade side-to-side (Fig. 447).

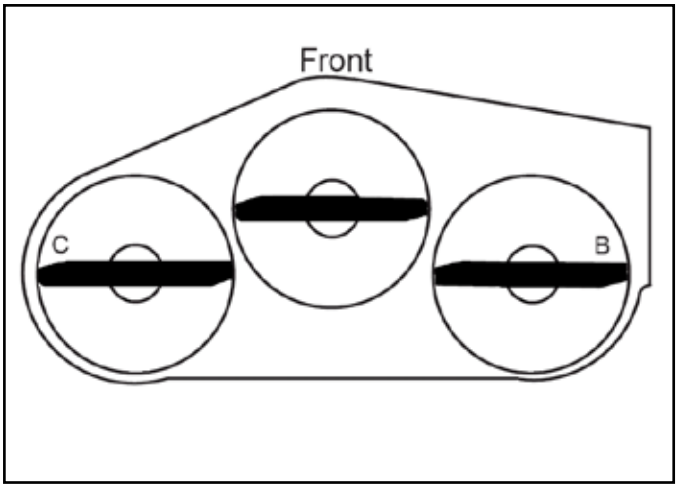

Fig 447 fig. 65 m-1078

2. Measure the right blade at the B location (Fig. 447), from a level surface to the cutting edge of the blade tips (Fig. 448).

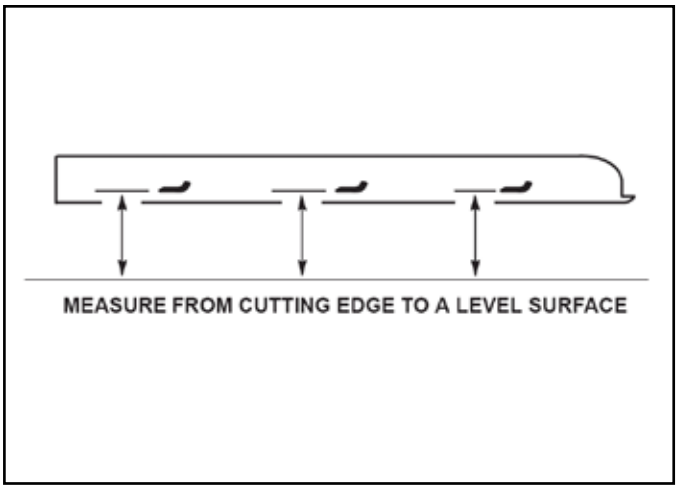

Fig 448 fig. 66 m-2539

3. Record this measurement. This measurement needs to be 3-1/8 to 3-1/4 inches (7.9 to 8.3cm).

4. Position the left blade side-to-side refer to Fig. 447.

5. Measure the left blade at the C location (Fig. 447) from level surface to cutting edge of the blade tips (Fig. 448).

6. Record this measurement. The measurement needs to be 3-1/8 to 3-1/4 inches (7.9 to 8.3cm).

7. If the measurement at positions B or C are not correct, loosen the bolt attaching the rear chain support arm (Fig. 449).

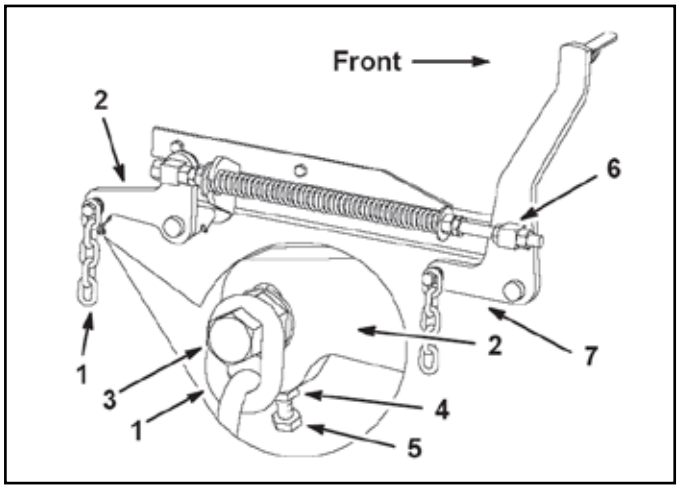

Fig 449 fig. 67 m-6830

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 adjust the adjustment bolt to get a measurement of 3-1/8 to 3-1/4 inches (7.9 to 8.3cm).

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.

Adjusting the Front-to-Rear Mower Pitch

1. Position the right blade front-to-rear (Fig. 450).

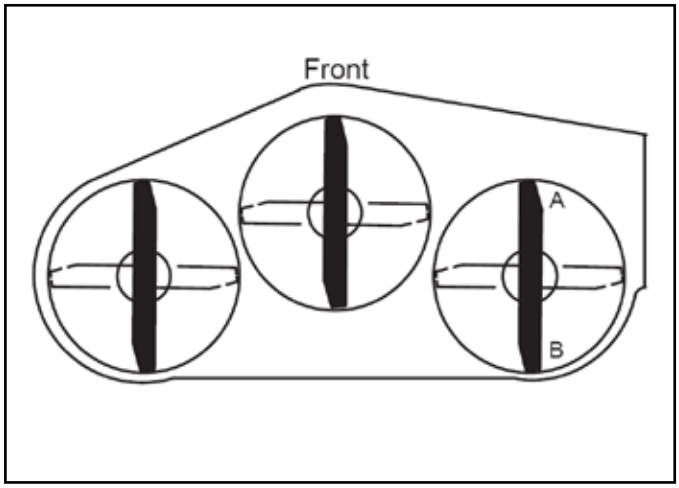

Fig 450 fig. 68 m-1078

2. Measure the right blade at the A location (Fig. 450) from a level surface to the cutting edge of the blade tip (Fig. 451).

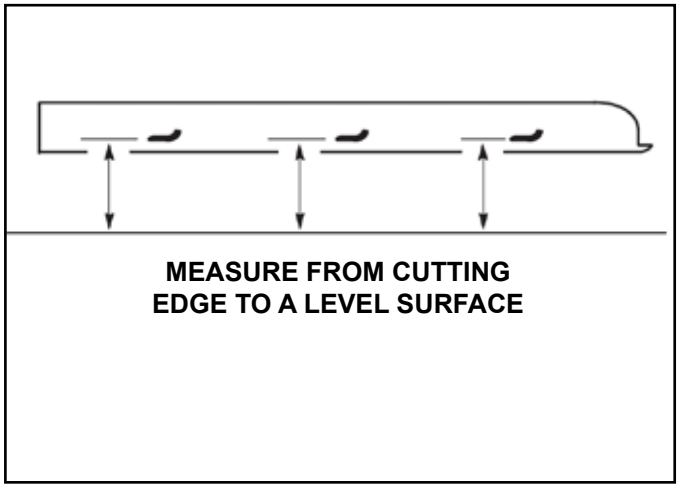

Fig 451 fig. 69 m-2539

3. Record the measurement.
4. Measure the right blade at the B location (Fig. 450), from a level surface to the cutting edge of the blade tip (Fig. 451).
5. Record this measurement.
6. The mower blade should be a 1/4 to 3/8 inch (6 to 10mm) lower at position A than at position B (Fig. 450). 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.

7. Loosen the front swivel jam nuts, at the front of the right and left swivels, approximately a 1/2 inch (13mm) (Fig. 452).

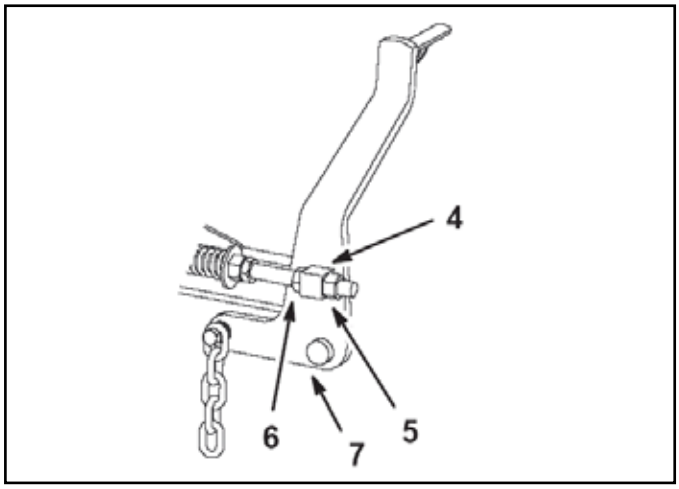

Fig 452 fig. 70 m-6831 rev

4. Front swivel
5. Swivel jam nut
6. Lift nut
7. Front support arm

7

Z Master 500 Series

Gasoline Engine Models

Service Manual

Form No. 492-9151

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 A than in the rear at B (Fig. 453).

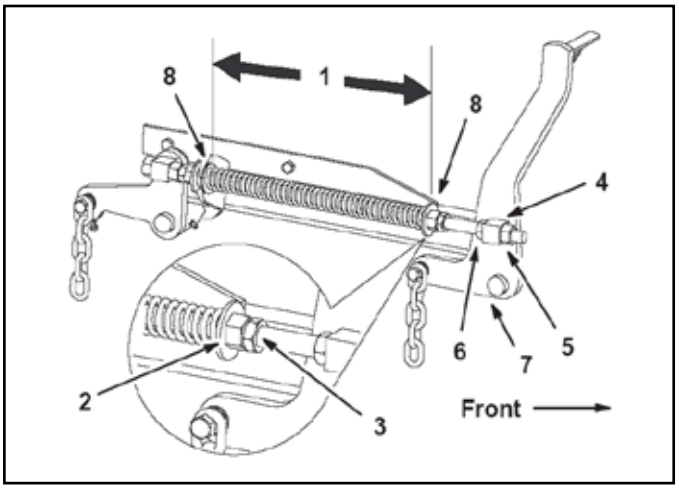

Fig 453 fig. 70 m-6831

1. 11-1/2” (29.2cm) between the large washers
2. Front nut
3. Spring jam nut
4. Front swivel
5. Swivel jam nut
6. Lift nut
7. Front support arm
8. Large washer

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

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