TORO®

Residential Products

2009 - 2013
TITAN® ZX/MX
Service Manual

ABOUT THIS MANUAL

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

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

For service information on drive systems, please refer to the Hydro-Gear ZT-2800/ZT-3100/ZT-3400 service manual (BLN 52441). For information specific to the engines used on this unit, refer to the appropriate engine manufacturer's service and repair instructions.

TITAN® model years 2009 – 2013 are covered in this manual. The manual may also be specified for use on later model products.

The hydrostatic transaxle is a sophisticated component. 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.

If you have any questions or comments regarding this manual, please contact us at the following address:

The Toro Company
Residential and Landscape Contractor 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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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 TITAN® zero turn mowers.

The TITAN operator's manuals contain safety information and operating tips for safe operating practices. Operator's manuals are available online 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 it has been running.

Avoid fires and explosions…

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

Avoid asphyxiation…

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

Avoid injury from batteries…

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

Avoid injury due to inferior parts…

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

Avoid injury to bystanders…

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

Avoid injury due to projectiles…

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

Avoid modifications…

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

Avoid unsafe operation…

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

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2009 - 2010 TITAN ZX Specifications

Configurations	TITAN ZX5000	TITAN ZX4800	TITAN ZX5450
22 HP Kawasaki V-Twin	50” SD, 3 Blades		
23 HP Kohler Courage ‘Pro’ V-Twin		48” SD, 3 Blades	
25 HP Kohler Courage ‘Pro’ V-Twin			54” SD, 3 Blades

Power Systems	TITAN ZX5000	TITAN ZX4800	TITAN ZX5450
Clutch	Electric	Electric	Electric
Transaxles	Twin Hydro-Gear ZT2800 Hydrostatic Transaxle w/ charge pumps	Twin Hydro-Gear ZT2800 Hydrostatic Transaxle w/ charge pumps	Twin Hydro-Gear ZT2800 Hydrostatic Transaxle w/ charge pumps
Drive	Belt Drive with self-tensioning system	Belt Drive with self-tensioning system	Belt Drive with self-tensioning system
Maximum Ground Speed (Fwd/Rev)	7.5 mph/3.8 mph	7.5 mph/3.8 mph	7.5 mph/3.8 mph
Rear Drive Tires	20” x 8.5”-8 4 ply rated	20” x 8.5”-8 4 ply rated	20” x 8.5”-8 4 ply rated
Front Caster Tires	410/350 x 5” Smooth Tread 4 ply rated	410/350 x 5” Smooth Tread 4 ply rated	410/350 x 5” Smooth Tread 4 ply rated
Fuel / Capacity	5 gallons (18.9 L)	5 gallons (18.9 L)	5 gallons (18.9 L)

Mowing Deck:	TITAN ZX5000	TITAN ZX4800	TITAN ZX5450
Type	Side Discharge	Side Discharge	Side Discharge
Deck Construction/ Material	12 gauge stamped steel	10 gauge fabricated steel	10 gauge fabricated steel
Spindle Housings	Die cast aluminum	Die cast aluminum	Die cast aluminum
Spindle Shaft/Bearings	Three 17mm permanently lubed ball bearings	Three 25mm permanently lubed ball bearings	Three 25mm permanently lubed ball bearings
Blades	Three 17.5” x 2.25” x .164” heat treated steel	Three 16.5” x 2.25” x .164” heat treated steel	Three 18.75” x 2.25” x .164” heat treated steel
Blade Tip Speed	18,889 ft/min @ 3650 RPM	18,670 ft/min @ 3700 RPM	18,644 ft/min @ 3700 RPM
Cutting Height	1.5” to 4.5” (13 Positions)	1.5” to 4.5” (13 Positions)	1.5” to 4.5” (13 Positions)
Anti-Scalp Rollers	3 adjustable	3 adjustable	3 adjustable
Frame Construction	1.5” x 3” (.109 wall) Mechanical Steel Tubing	1.5” x 3” (.109 wall) Mechanical Steel Tubing	1.5” x 3” (.109 wall) Mechanical Steel Tubing

2009 - 2010 TITAN ZX Specifications cont.

Operator Zone	TITAN ZX5000	TITAN ZX4800	TITAN ZX5450
Steering Controls	Dual Wrap-Around Levers with cushion grips	Dual Wrap-Around Levers with cushion grips	Dual Wrap-Around Levers with cushion grips
Arm Rests	Standard	Standard	Standard
Beverage Holder	Standard	Standard	Standard
Hour Meter	Standard	Standard	Standard

Dimensions	TITAN ZX500	TITAN ZX4800	TITAN ZX5450
Weight	605 lbs. (estimated)	665 lbs. (estimated)	679 lbs. (estimated)
Width Outside Tires	45.3” (115.1cm)	45.3” (115.1cm)	46.3” (117.6cm)
Width Outside Deck	63.1” (160.3cm) Deflector down	61.5” (156.2cm) Deflector down	67.9” (172.5cm) Deflector down
Wheel Base	49.4” (125.5cm)	49.4” (125.5cm)	49.4” (125.5cm)
Overall Length	77.3” (196.3cm)	77.3” (196.3cm)	77.3” (196.3cm)
Height	43.4” (110.2cm)	43.4” (110.2cm)	43.4” (110.2cm)

2009 - 2010 TITAN ZX Specifications cont.

Configurations	TITAN ZX6030	TITAN ZX6050
27 HP Kohler Courage 'Pro' V-Twin	60" SD, 3 Blades	
26 HP Kawasaki V-Twin		60" SD, 3 Blades

Power Systems	TITAN ZX6030	TITAN ZX6050
Clutch	Electric	Electric
Transaxles	Twin Hydro-Gear ZT2800 Hydrostatic Transaxle w/charge pumps	Twin Hydro-Gear ZT2800 Hydrostatic Transaxle w/charge pumps
Drive	Belt Drive with self-tensioning system	Belt Drive with self-tensioning system
Maximum Ground Speed (Fwd/Rev)	7.5 mph/3.8mph	7.5 mph/3.8mph
Rear Drive Tires	20" x 10" – 8 4 ply rated	20" x 10" – 8 4 ply rated
Front Caster Tires	410/350 x 5" Smooth tread 4 ply rated	410/350 x 5" Smooth tread 4 ply rated
Fuel/Capacity	5 gallons (18.9 L)	5 gallons (18.9 L)

Mowing Deck	TITAN ZX6030	TITAN ZX6050
Type	Side Discharge	Side Discharge
Deck Construction/ Material	10 gauge fabricated steel	10 gauge fabricated steel
Spindle Housing	Die cast aluminum	Die cast aluminum
Spindle Shaft/Bearings	Three 25mm dia. permanently lubed ball bearings	Three 25mm dia. permanently lubed ball bearings
Blades	Three 20.5" x 2.25" x .164 heat-treated steel blades	Three 20.5" x 2.25" x .164 heat-treated steel blades
Blade Tip Speed	18,908 ft/min @ 3700 RPM	18,908 ft/min @ 3700 RPM
Cutting Height	1.5" to 4.5" (13 Positions)	1.5" to 4.5" (13 Positions)
Anti-Scalp Rollers	3 adjustable	3 adjustable
Frame Construction	1.5" x 3" (.109 wall) Mechanical steel tubing	1.5" x 3" (.109 wall) Mechanical steel tubing

2009 - 2010 TITAN ZX Specifications cont.

Dimensions	TITAN ZX6030	TITAN ZX6050
Weight	724 lbs (estimated)	724 lbs. (estimated)
Width Outside Deck	75.1” (190.8cm) Deflector Down	75.1” (190.8cm) Deflector Down
Width Outside Tires	46.3” (117.6cm)	46.3” (117.6cm)
Wheel Base	49.4” (125.5cm)	49.4” (125.5cm)
Overall Length	78.6” (199.6cm)	78.6 (199.6cm)
Height	43.4” (110.2cm)	43.4” (110.2cm)

Operator Zone	TITAN ZX6030	TITAN ZX6050
Steering Controls	Dual Wrap-Around levers with cushion grips	Dual Wrap-Around levers with cushion grips
Arm Rests	Standard	Standard
Beverage Holder	Standard	Standard
Hour Meter	Standard	Standard

2011 - 2013 TITAN ZX & MX Specifications

Configurations	TITAN ZX4820	TITAN ZX5420	TITAN ZX6020
21.5 HP Kawasaki V-Twin	48” SD, 3 Blades		
23 HP Kawasaki V-Twin		54” SD, 3 Blades	
24 HP Kawasaki V-Twin			60” SD, 3 Blades

Power Systems	TITAN ZX4820	TITAN ZX5420	TITAN ZX6020
Clutch	Electric	Electric	Electric
Transaxles	Twin Hydro-Gear ZT-2800 w/charge pumps	Twin Hydro-Gear ZT-2800 w/charge pumps	Twin Hydro-Gear ZT-2800 w/charge pumps
Drive	Belt Drive with self-tensioning system	Belt Drive with self-tensioning system	Belt Drive with self-tensioning system
Maximum Ground Speed	7.5 mph/3.8 mph	7.5 mph/3.8 mph	7.5 mph/3.5 mph
Rear Drive Tires	20” x 8”-8 4-ply rated	20” x 10”-8 4-ply rated	20” x 10”-8 4-ply rated
Front Caster Tires	410/350x5 smooth 4-ply rated	410/350x5 smooth 4-ply rated	410/350x5 smooth 4-ply rated
Fuel/Capacity	5 gallons (18.9 L)	5 gallons (18.9 L)	5 gallons (18.9 L)

Mowing Deck	TITAN ZX4820	TITAN ZX5420	TITAN ZX6020
Type	Side Discharge	Side Discharge	Side Discharge
Deck Construction	10 gauge fabricated steel	10 gauge fabricated steel	10 gauge fabricated steel
Spindle Housings	Die cast aluminum	Die cast aluminum	Die cast aluminum
Spindle Shaft/Bearings	Three 25mm diameter spindles in permanently lubed ball bearings	Three 25mm diameter spindles in permanently lubed ball bearings	Three 25mm diameter spindles in permanently lubed ball bearings
Blade Tip Speed	18,800 ft/min @ 3700 RPM	18,644 ft/min @ 3700 RPM	18,908 ft/min @ 3700 RPM
Cutting Height	1.5” to 4.5” 13 positions	1.5” to 4.5” 13 positions	1.5” to 4.5” 13 positions
Anti-Scalp Rollers	3 Adjustable	3 Adjustable	3 Adjustable
Frame Construction	1.5” X 3” (.109” wall) Mechanical Steel Tubing	1.5” X 3” (.109” wall) Mechanical Steel Tubing	1.5” X 3” (.109” wall) Mechanical Steel Tubing

Dimensions	TITAN ZX4820	TITAN ZX5420	TITAN ZX6020
Weight	735 lbs. (estimated)	750 lbs. (estimated)	773 lbs. (estimated)
Width Outside Tires	44.3” (117.6cm)	46.4” (117.9cm)	46.4” (117.9cm)
Overall Width	61.5” Deflector Down 52.4” Deflector Up	67.9” Deflector Down 57.7” Deflector Up	75.0” Deflector Down 63.0” Deflector Up
Wheel Base	49.4” (125.5cm)	49.4” (125.5cm)	49.4” (125.5cm)
Overall Length	77.3” (196.3cm)	77.3” (196.3cm)	77.3” (196.3cm)
Height	72.4” ROPS Up 45.6” ROPS Down	72.4” ROPS Up 45.6” ROPS Down	72.4” ROPS Up 45.6” ROPS Down

SPECIFICATIONS

2011 - 2013 TITAN ZX & MX Specifications cont.

Configurations	TITAN MX4880	TITAN MX5480	TITAN MX6080
21.5 HP Kawasaki V-Twin	48” SD, 3-Blades		
23 HP Kawasaki V-Twin		54” SD, 3-Blades	
24 HP Kawasaki V-Twin			60” SD, 3-Blades

Power Systems	TITAN MX4880	TITAN MX5480	TITAN MX6080
Clutch	Electric	Electric	Electric
Transaxles	Twin Hydro-Gear ZT-3100 with Charge Pump, Shock Valves and Heavy Duty Gears	Twin Hydro-Gear ZT-3100 with Charge Pump, Shock Valves and Heavy Duty Gears	Twin Hydro-Gear ZT-3100 with Charge Pump, Shock Valves and Heavy Duty Gears
Drive	Belt Drive self-tensioning system	Belt Drive self-tensioning system	Belt Drive self-tensioning system
Maximum Ground Speed	7.5 mph/3.8 mph	7.5 mph/3.8 mph	7.5 mph/3.8 mph
Rear Drive Tires	22”X10”-10 4 ply rated	22”X10”-10 4 ply rated	22”X10”-10 4 ply rated
Front Caster Tires	12”X6”-6 Smooth Tread	12”X6”-6 Smooth Tread	12”X6”-6 Smooth Tread
Fuel / Capacity	5 gallons (18.9 L)	5 gallons (18.9L)	5 gallons (18.9L)

Mower Decks	TITAN MX4880	TITAN MX5480	TITAN MX6080
Type	Side Discharge	Side Discharge	Side Discharge
Deck Construction Material	10 gauge fabricated steel	10 gauge fabricated steel	10 gauge fabricated steel
Spindle Housing	Die cast aluminum	Die cast aluminum	Die cast aluminum
Spindle Shaft/Bearings	Three 25mm diameter spindles in permanently lubed ball bearings	Three 25mm diameter spindles in permanently lubed ball bearings	Three 25mm diameter spindles in permanently lubed ball bearings
Blade Tip Speed	18,800 ft/min @ 3700 RPM	18,644 ft/min @ 3700 RPM	18,908 ft/min @ 3700 RPM
Cutting Height	1.5” to 4.5” 13 Positions	1.5” to 4.5” 13 Positions	1.5” to 4.5” 13 Positions
Anti-Scalp Rollers	3 Adjustable	3 Adjustable	3 Adjustable
Frame Construction	1.5” X 3” (.109” wall) Mechanical Steel Tubing	1.5” X 3” (.109” wall) Mechanical Steel Tubing	1.5” X 3” (.109” wall) Mechanical Steel Tubing

Dimensions	TITAN MX4880	TITAN MX5480	TITAN MX6080
Weight	797 lbs. (estimated)	813 lbs. (estimated)	
Width Outside Tires	47.2” (119.9cm)	47.2” (119.9cm)	47.2” (119.9cm)
Width Outside Deck	61.5” Deflector Down 52.4” Deflector Up	67.9” Deflector Down 57.7” Deflector Up	75.0” Deflector Down 63.0” Deflector Up
Wheel Base	49.2” (125.0cm)	49.2” (125.0cm)	49.2” (125.0cm)
Overall Length	77.4” (196.6cm)	77.4” (196.6cm)	77.4” (196.6cm)
Overall Height	73.4” ROPS Up 46.9” ROPS Down	73.4” ROPS Up 46.9” ROPS Down	73.4” ROPS Up 46.9” ROPS Down

2011 - 2013 TITAN ZX & MX Specifications cont.

Configurations	TITAN ZX5020
22 HP Kawasaki V-Twin	
23 HP Kohler Courage 'Pro' V-Twin	50" SD, 3 Blades
24 HP Kawasaki V-Twin	

Power Systems	TITAN ZX5020
Clutch	Electric
Transaxles	Twin Hydro-Gear ZT2800 Hydrostatic Transaxle w/ charge pumps
Drive	Belt Drive with self-tensioning system
Maximum Ground Speed (Fwd/ Rev)	7.5 mph/3.8 mph
Rear Drive Tires	20" x 10" 4 ply rated
Front Caster Tires	11 x 4
Fuel / Capacity	5 gallons (18.9 L)

Mowing Deck	TITAN ZX5020
Type	Side Discharge
Deck Construction/ Material	12 gauge stamped steel
Spindle Housings	Die cast aluminum
Spindle Shaft/Bearings	Three 17mm permanently lubed ball bearings
Blades	Three 17.5" x 2.25" x .164" heat treated steel
Blade Tip Speed	18,889 ft/min @ 3650 RPM
Cutting Height	1.5" to 4.5" (13 Positions)
Anti-Scalp Rollers	3 adjustable
Frame Construction	1.5" x 3" (.109 wall) Mechanical Steel Tubing

2011 - 2013 TITAN ZX & MX Specifications cont.

Operator Zone	TITAN ZX5020
Steering Controls	Dual Wrap-Around Levers with cushion grips
Arm Rests	Standard
Beverage Holder	Standard
Hour Meter	Standard

Dimensions	TITAN ZX5020
Weight	605 lbs. (estimated)
Width Outside Tires	45.3” (115.1cm)
Width Outside Deck	63.1” (160.3cm) Deflector down
Wheel Base	49.4” (125.5cm)
Overall Length	77.3” (196.3cm)
Height	43.4” (110.2cm)

Engine Specifications

Model #	Model	Engine Information
74820	ZX5000	Briggs & Stratton, 22hp, High Idle: 3550 ± 100 RPM
74822	ZX5400	Kohler, 23hp, High Idle: 3600 ± 75 RPM
74823	ZX6000	Kohler, 25hp, High Idle: 3600 ± 75 RPM
74824	ZX6050	Kawasaki, 26hp, High Idle: 3600 ± 75 RPM
74830	ZX4800	Kohler, 23hp, High Idle: 3600 ± 75 RPM
74832	ZX5450	Kohler, 25hp, High Idle: 3600 ± 75 RPM
74833	ZX6030	Kohler, 27hp, High Idle: 3600 ± 75 RPM
74840	ZX5020	Kohler, 23hp, High Idle: 3600 ± 75 RPM
74841	ZX4820	Kawasaki, 21.5hp, High Idle: 3600 ± 100 RPM
74842	ZX5420	Kawasaki, 23hp, High Idle: 3600 ± 100 RPM
74843	ZX6020	Kawasaki, 24hp, High Idle: 3600 ± 100 RPM
74845	ZX4820	Kawasaki, 21.5hp, High Idle: 3600 ± 100 RPM
74929	ZX6020	Kawasaki, 24hp, High Idle: 3600 ± 100 RPM
74871	MX4880	Kawasaki, 21.5hp, High Idle: 3600 ± 100 RPM
74872	MX5480	Kawasaki, 23hp, High Idle: 3600 ± 100 RPM
74873	MX6080	Kawasaki, 24hp, High Idle: 3600 ± 100 RPM
74912	ZX4800 (INTL)	Kohler, 23hp, High Idle: 3000 ± 75 RPM
74914	ZX5400 (INTL)	Kawasaki, 24hp, High Idle: 3000 ± 100 RPM
74920	ZX4820 (INTL)	Kawasaki, 24hp, High Idle: 3000 ± 100 RPM
74924	ZX5420 (INTL)	Kawasaki, 24hp, High Idle: 3000 ± 100 RPM

SPECIFICATIONS

Hydro-Gear ZT-2800 & ZT-3100 Hydrostatic Transaxles

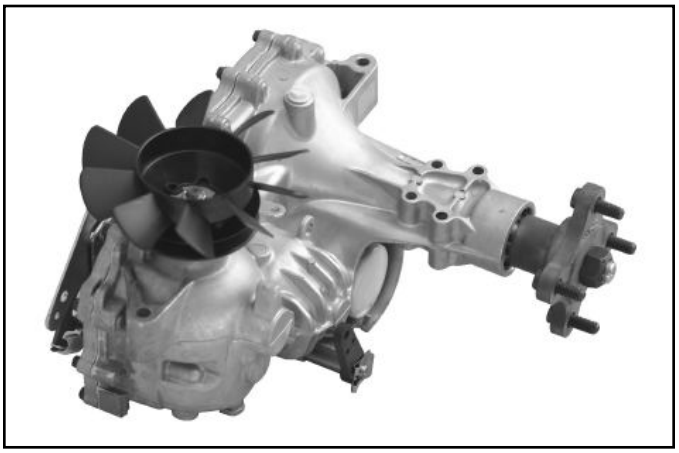


Fig. 001 PICT-1002

Lubrication	Toro HYPR-OIL 500® or 20w50 Engine Oil
Oil Capacity ZT-2800	77.23 fl. oz. (2284ml) each
Oil Level Check	Check expansion reservoir and if necessary add the specified oil to the **FULL COLD** line. See illustration below. Also see the Hydro-Gear ZT-2800 / ZT-3100 service manual (BLN-52441).
Fluid Change Interval	After the First 50 hours - change the oil and filters for the hydraulic system and bleed the system. Every 400 Hours - change the oil and filters for the hydraulic system and bleed the system.

Checking the Hydraulic Oil Level

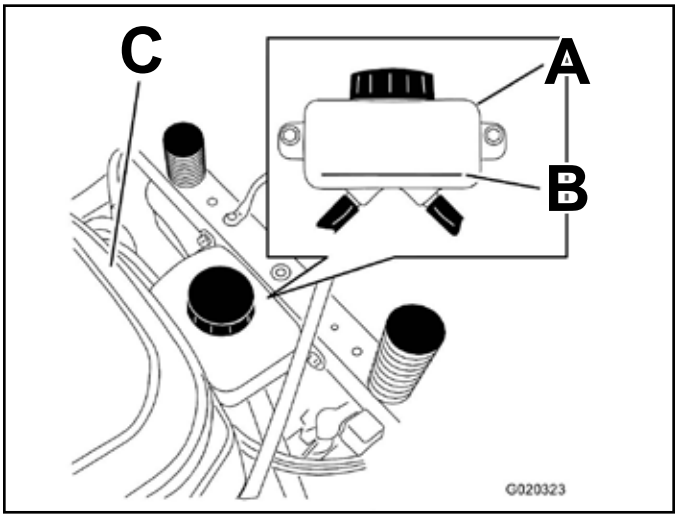


Fig. 002 fig. 51 G020323

A. Expansion reservoir
B. Full cold line
C. Engine

Torque Specifications

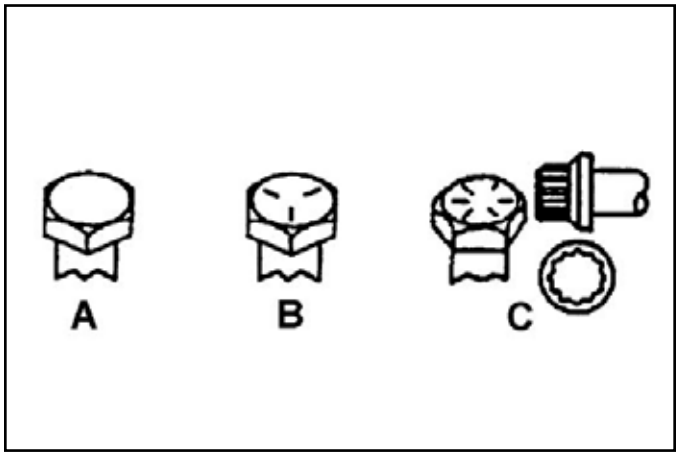
Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in the service manual.

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 (e.g. 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.

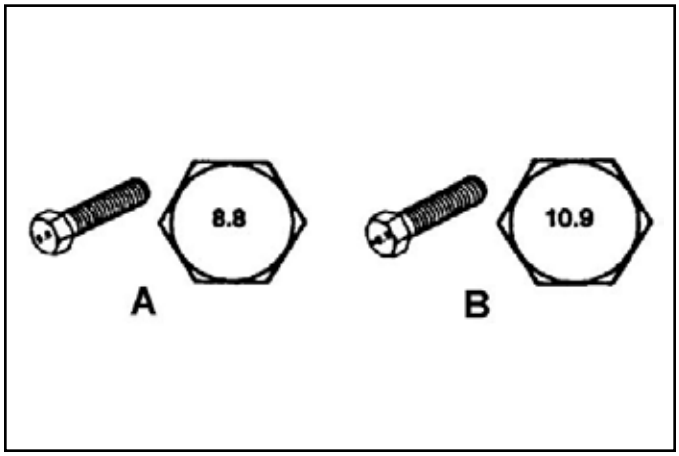
As noted in the following tables, torque values should be reduced by 25% for lubricated fasteners to achieve the similar stress as a dry fastener. Torque values may also have to be reduced when the fastener is threaded into aluminum or brass. The specific torque value should be determined based on the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



Inch Series bolts and Screws	
(A) Grade 1 & 2 (B) Grade 5	(C) Grade 8



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

SPECIFICATIONS

Standard Torque for Dry, Zinc Plated & 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	169 ± 23	23 ± 2	260 ± 34
# 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 ± 15	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 & 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	644 ± 68 N-cm	78 ± 8 in-lb	881 ± 90 N-cm
M6 X 1.0	96 ± 10 in-lb	1085 ± 113 N-cm	133 ± 14 in-lb	1503 ± 158 N-cm
M8 X 1.25	19 ± 2 ft-lb	26 ± 3 N-m	28 ± 3 ft-lb	38 ± 4 N-m
M10 X 1.5	38 ± 4 ft-lb	52 ± 5 N-m	54 ± 6 ft-lb	73 ± 8 N-m
M12 X 1.75	66 ± 7 ft-lb	90 ± 10 N-m	93 ± 10 ft-lb	126 ± 14 N-m
M16 X 2.0	166 ± 15 ft-lb	225 ± 23 N-m	229 ± 23 ft-lb	310 ± 31 N-m
M20 X 2.5	325 ± 33 ft-lb	440 ± 45 N-m	450 ± 36 ft-lb	610 ± 62 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 & Conversions

Decimal & 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

Model and Serial Number Identification

The model and serial number identification plate is located on the frame, near the engine, on the RH side of the unit (Fig. 003).

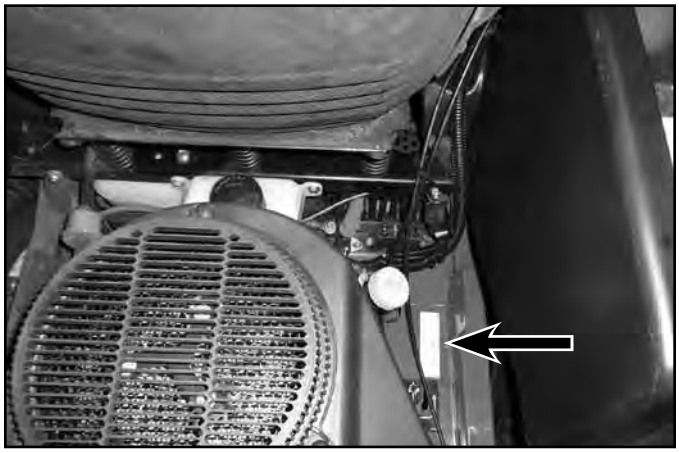


Fig. 003 PICT-2057

Grease & Lubrication Point

Grease Type – No. 2 general-purpose lithium base grease

A grease fitting is located on each of the front wheel hubs.

The front wheel hubs should be greased every 25 hrs. (Fig. 004)

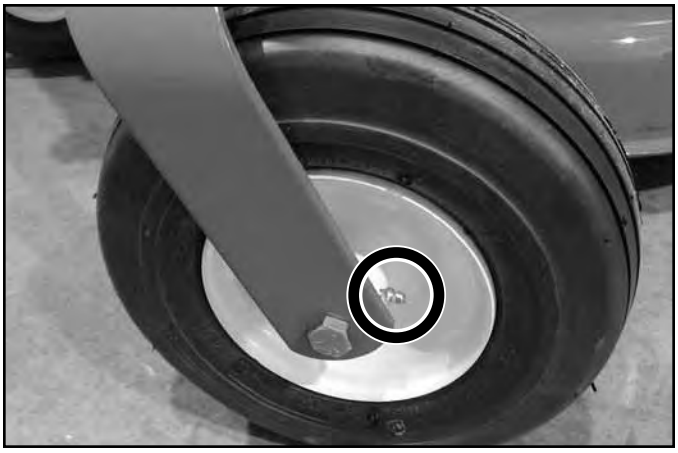


Fig. 004 PICT-1035

Front Axle / Caster Fork / Bearing Service

Front Axle / Caster Fork / Bearing Disassembly

1. Safely raise and support unit so front wheels are off the ground.
2. Support under caster wheel and remove the fastener (A).
3. Remove caster fork (B) from frame hub (C). Inspect the caster fork shaft and thrust washer (D) for excessive wear, replace if necessary.
4. Using an appropriate punch, tap out and remove the LOWER bearings from the front axle (C).
5. Using an appropriate punch, tap out and remove the UPPER bearings from the frame hub (C).
6. Properly clean and inspect the frame hub bearing area.

Front Axle / Caster Fork / Bearing Assembly

1. Using a proper bearing installation tool, install new upper and lower bearings into the frame hub making sure they are fully seated.
2. Install thrust washer (D) onto the caster fork shaft.
3. Install the caster assembly up through the bearings and hold in position.
4. Install washer (E).
5. Install fastener (A) and torque to specification - 17 ft-lbs. (23 Nm).
6. Safely lower unit and verify proper function.

(Fig. 005)

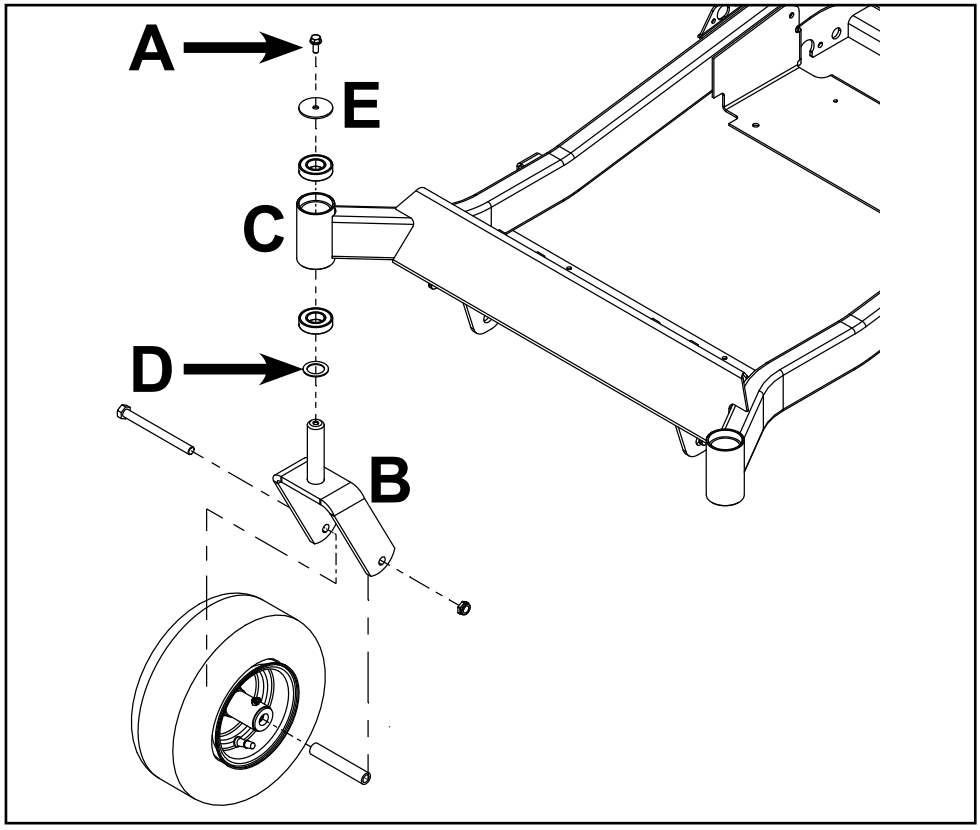


Fig. 005 PICT-2058

Caster Wheel / Bushing Service – TITAN ZX Chassis

Caster Wheel / Bushing Disassembly

1. Safely raise and support unit so front wheels are off the ground.
2. Support under caster wheel and remove the nut / bolt (A).
3. Remove and inspect wheel spanner (B). Replace if excessively worn.
4. Using an appropriate punch, remove the (2) bushings (C) from the wheel hub. Inspect bushings and replace if excessively worn.
5. Properly clean and inspect the front wheel hub area.

Caster Wheel / Bushing Assembly

1. Lightly lubricate bushings (C) and wheel spanner (B) with No. 2 general-purpose lithium base grease. Fill center of wheel hub with grease.
2. Install the (2) bushings (C) into front wheel hub, making sure they are fully seated.
3. Install wheel spanner (B) into the front wheel assembly.
4. Install front wheel assembly into the front caster.
5. Install the nut / bolt (A) and torque nut to specification - 35 ft-lbs. (47 Nm).
6. Lubricate bushings / spanner through grease fitting with No. 2 general-purpose lithium base grease.
7. Safely lower unit and verify proper function.

(Fig. 006)

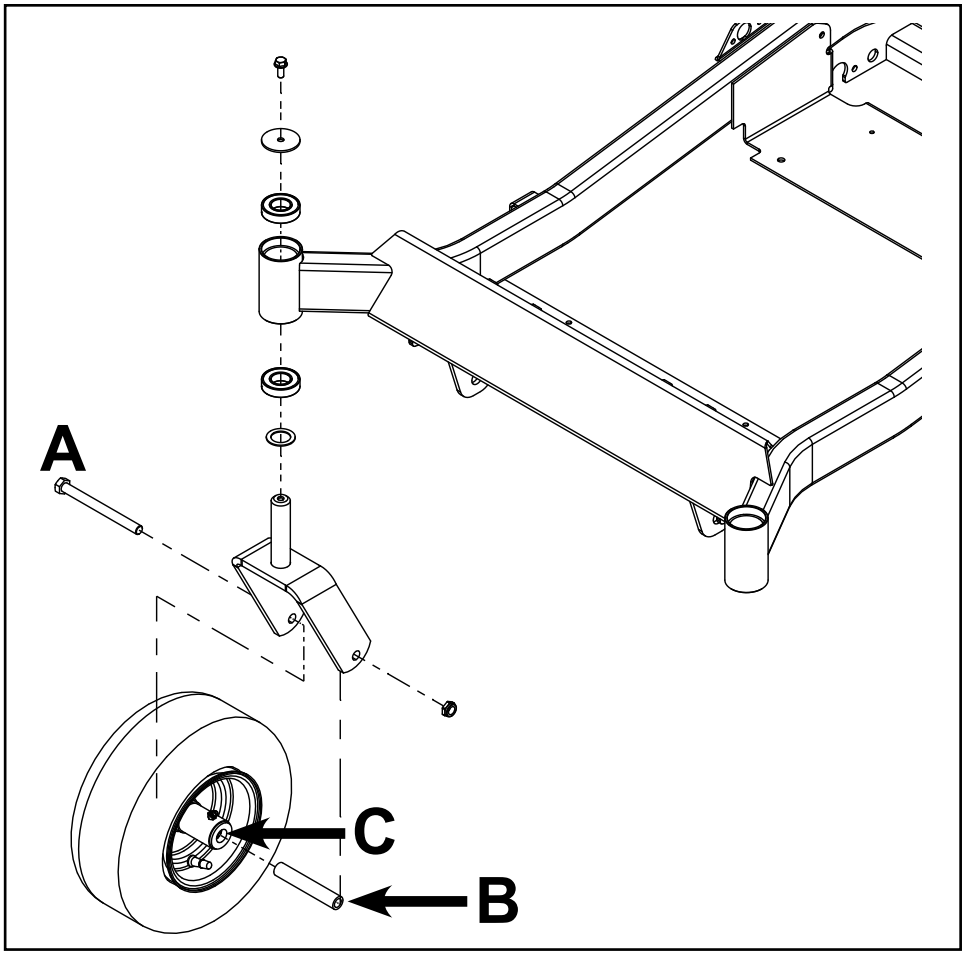


Fig. 006 PICT-2058

Caster Wheel, Bushing & Bearing Service – TITAN MX Chassis

Disassembly

1. Safely raise and support unit so front wheels are off the ground.
2. Support under caster wheel and remove the nut / bolt fastener (A).
3. Remove and inspect wheel spanner (B). Replace if excessively worn.
4. Use an appropriate punch to remove the (2) bushings (C) from the wheel hub. Inspect bushings and replace if excessively worn.
5. Remove the (2) bearings (D) from the wheel hub. Replace if excessively worn.
6. Properly clean and inspect the front wheel hub area.

Assembly

1. Lightly lubricate bearings (D), bushings (C) and wheel spanner (B) with No. 2 general-purpose lithium base grease. Fill center of wheel hub with grease.
2. Install the (2) bearings (D) and (2) bushings (C) into front wheel hub, making sure they are fully seated.
3. Install wheel spanner (B) into the front wheel assembly.
4. Install front wheel assembly into the front caster.
5. Install the nut / bolt (A) and torque nut to specification - 35 ft-lbs. (47 Nm).
6. Lubricate bushings / bearings through grease fitting with No. 2 general-purpose lithium base grease.
7. Safely lower unit and verify proper function.

(Fig. 007)

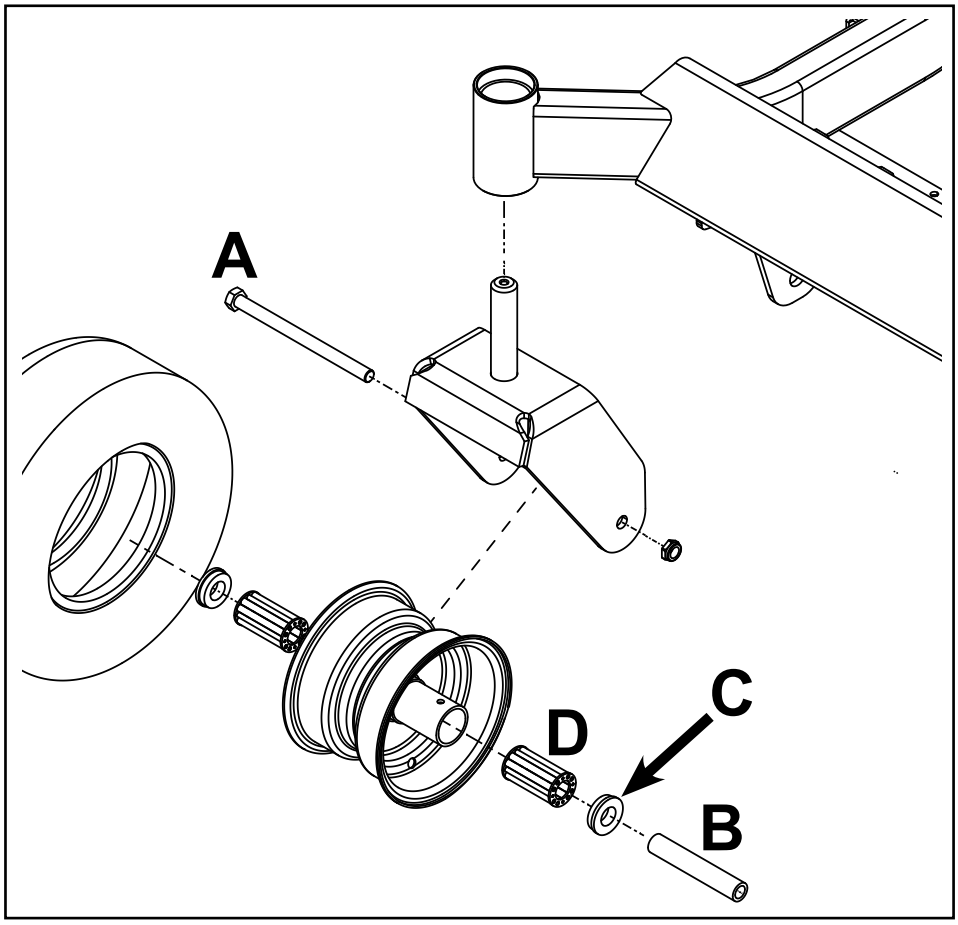


Fig. 007 PICT-2060

Pod / Fender Service

Pod / Fender Removal - RH

1. Raise seat and disconnect battery terminals.
2. Remove the (4) screws securing control panel (A) to RH fender. Move control panel inward towards the center of the unit.
3. Remove the (3) screws (B) securing the RH fender to frame.
4. Maneuver RH fender up and off frame.

Pod / Fender Installation - RH

1. Maneuver RH fender into position.
2. Install the (3) screws (B) that secure the RH fender to frame and torque to specification – 7 ft-lbs. (9 Nm).
3. Position control panel (A) back onto RH fender. Install and sufficiently tighten the (4) screws that secure the control panel to the RH fender.
4. Verify choke cable, throttle cable and wiring are properly routed.
5. Connect battery terminals and lower seat.

(Fig. 008).

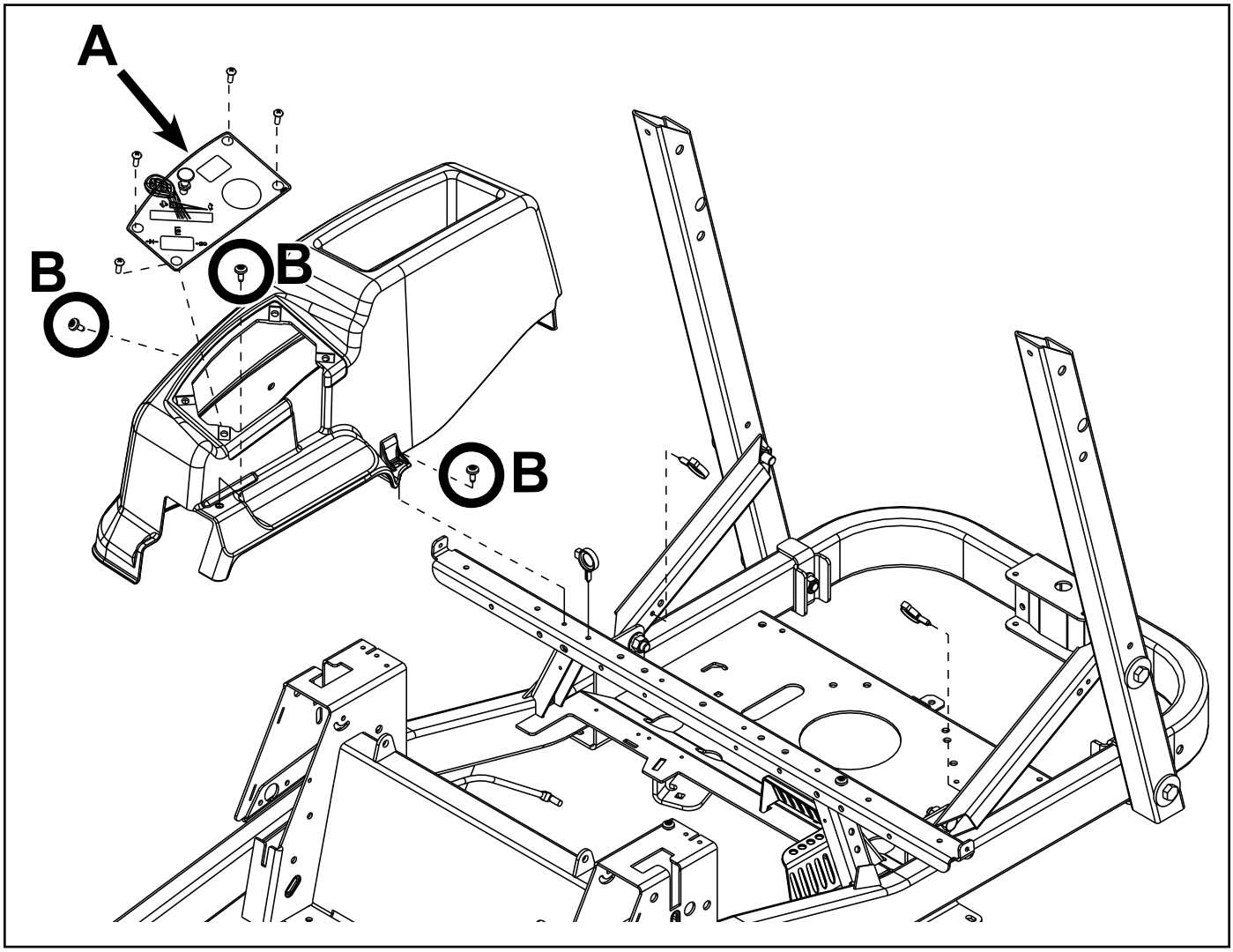


Fig. 008 PICT-2061

Pod / Fender Removal - LH

1. Raise seat and disconnect battery terminals.
2. Remove the (3) screws (A) securing the LH fender to the unit frame.
3. Lubricate rubber fuel tank neck grommet with soapy water (Fig. 009).

Fig. 009 PICT-2065

4. Remove fuel cap.
5. Lift LH fender assembly upward and off the frame. Use care while lifting fender upward as the fuel tank neck slips through the rubber grommet.
6. Reinstall fuel cap.

Pod / Fender Installation - LH

1. Lubricate rubber fuel tank neck grommet with soapy water.
2. Remove fuel cap from fuel tank.
3. Install LH fender assembly onto unit frame. Use care while installing LH fender as the fuel tank neck slips through the grommet.
4. Install fuel cap.
5. Install the (3) screws (A) that secure the fender to the unit frame and torque to specifications - 7 ft-lbs. (9 Nm).
6. Connect battery terminals and lower seat.

(Fig. 010)

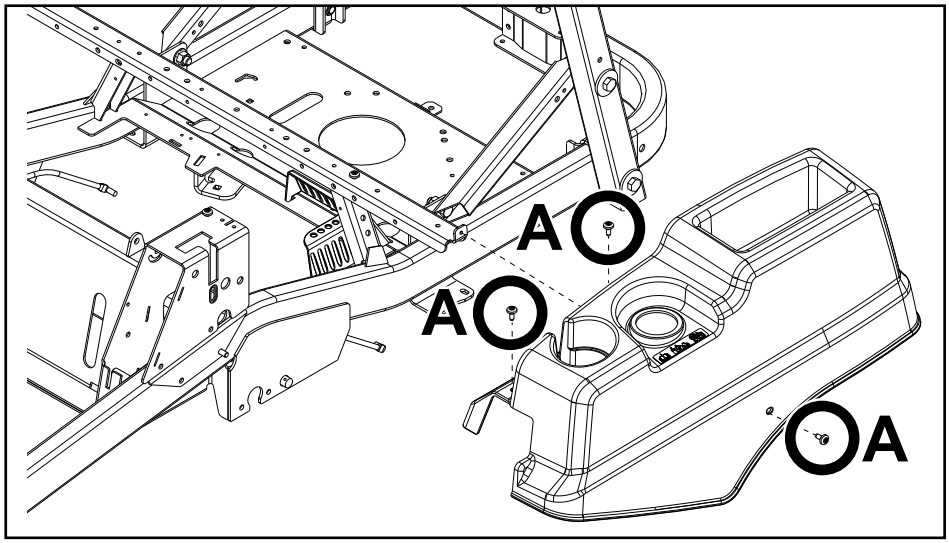


Fig. 010 PICT-2064

Fuel Tank Service

Fuel Tank Removal

1. Raise seat and disconnect battery terminals.
2. Remove LH pod / fender as shown in this chapter.
3. Remove the (2) bolts that secure the hydro expansion tank (A) to the seat support. Move the tank rearward for fuel tank removal clearance.
4. Remove the (1) fastener securing the fuel tank retaining rod (B) and remove it from the chassis.
5. Remove the (2) thread-forming bolts that secure the rear guard tube (C) to the seat support (E). OR Remove the bolts / nuts securing the rear engine guard to the ROPS frame (D).

(Fig. 011)

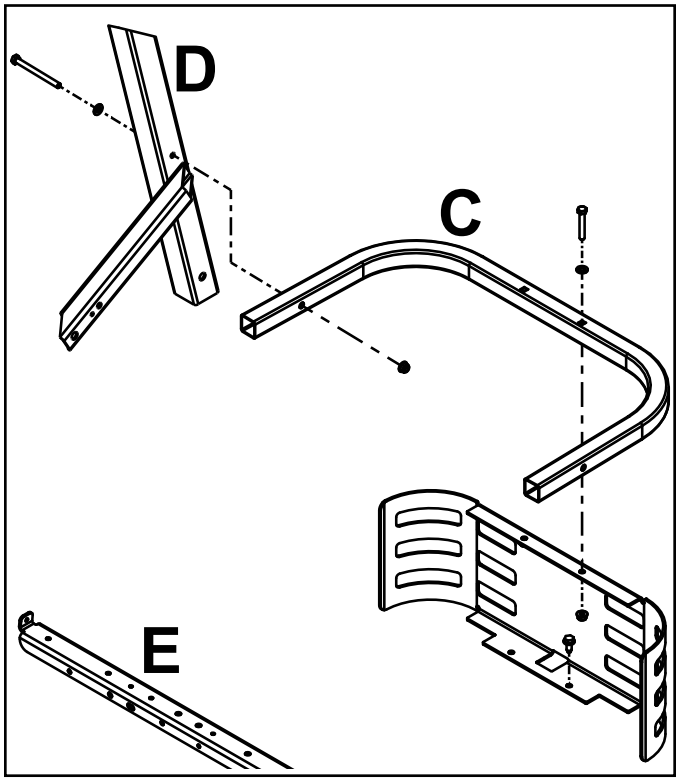


Fig. 011 PICT-2070

6. Remove the (2) bolts and nuts that secure the seat support (E) to the frame brackets.
7. Note the location of and remove any cable ties / loom clamps that secure wiring / cables to the seat support bar (E).
8. Remove the seat support bar from the frame.
9. Disconnect and properly secure the fuel / vent line(s) from the top of the fuel tank assembly.
10. The fuel tank is now loose and can be removed by from the unit frame (Fig. 012).

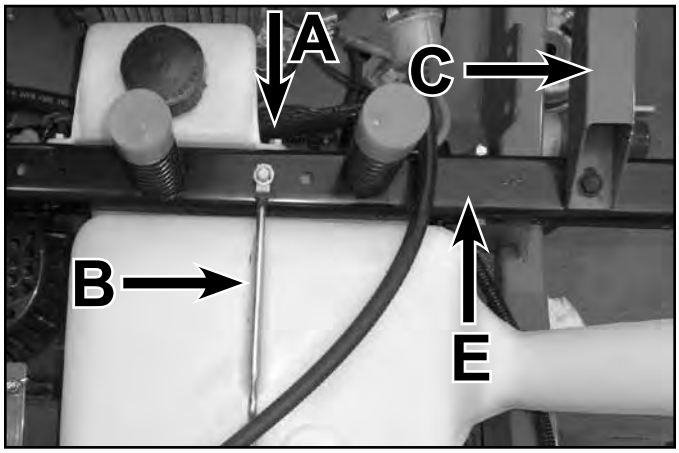


Fig. 012 PICT-2066

Fuel Tank Installation

1. Position the fuel tank assembly into the unit frame.
2. Install the (2) bolts and nuts that secure the seat support (E) to the frame brackets and torque to specification – 17 ft-lbs. (23 Nm).
3. Install the fuel tank retaining rod (B) and torque retaining bolt to specification – 8 ft-lbs. (11 Nm). Be sure the front rod end is engaged into the control box assembly (Fig. 013).

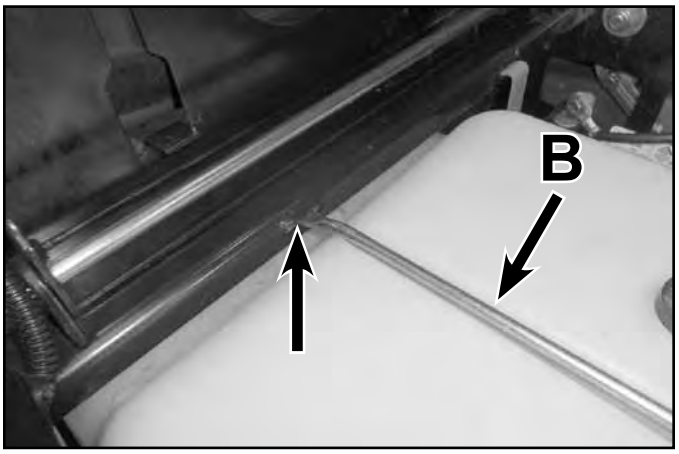


Fig. 013 PICT-2069

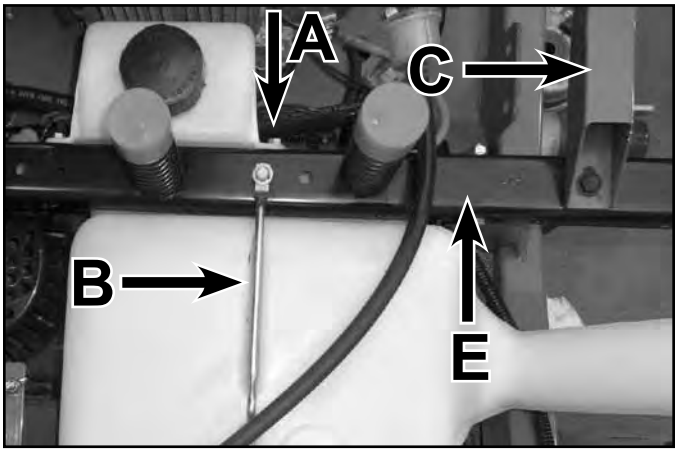


Fig. 014 PICT-2066

4. Install and sufficiently tighten the (2) thread forming bolts that secure the rear guard tube (C) to the seat support (E). OR Install the bolts / nuts securing the rear engine guard to the ROPS frame (D).

(Fig. 015)

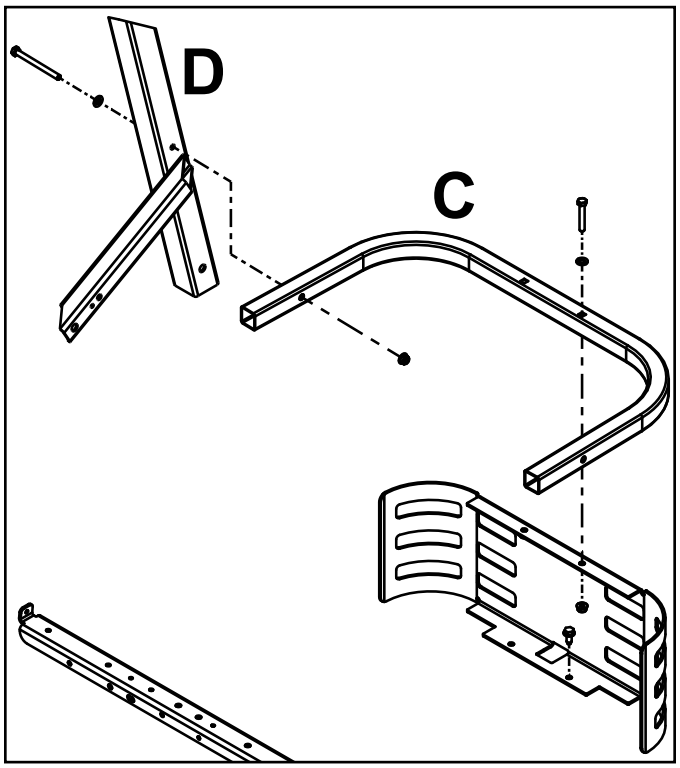


Fig. 015 PICT-2070

5. Install the (2) bolts that secure the hydro expansion tank (A) to the seat support and torque to specification – 5 ft-lbs (7 Nm).
6. Properly route cables / wiring and reinstall cable ties / loom clams to secure them to the seat support.
7. Install LH pod / fender as outlined in this chapter.
8. Connect the battery cables and lower seat.
9. Verify proper function.

Motion Control Damper Service

Motion Control Damper Removal

1. Tilt seat forward and disconnect the battery.
2. Remove the appropriate fender / pod as shown in this chapter.
3. Remove the (1) shoulder bolt (A) and washer that secures the upper motion control damper eyelet to the actuator arm.
4. Remove the nut and bolt (B) that secure the lower motion control damper eyelet to the control box (Fig. 016).

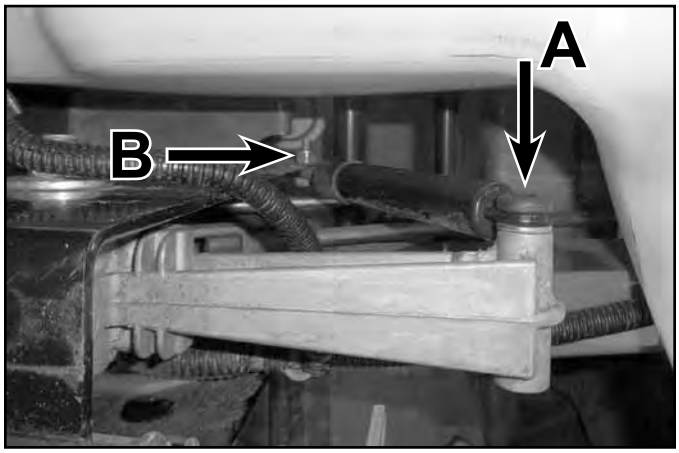


Fig. 016 PICT-2071

5. Remove the motion control damper from the unit.

Motion Control Damper Installation

1. Install the washer and upper damper eyelet to the actuator arm and torque the shoulder bolt (A) to specification – 7.5 ft-lbs. (10 Nm).
2. Install the lower damper eyelet to the Control Box and torque the nut (B) to specification – 7.5 ft-lbs. (10 Nm).
3. Install the fender / pod as shown in this chapter.
4. Check the motion control system for proper function. (Fig. 017)

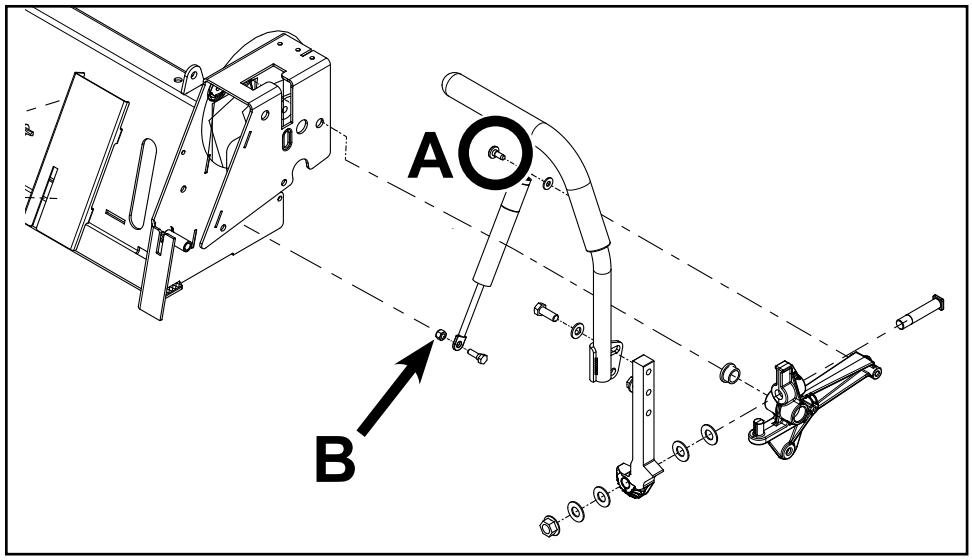


Fig. 017 PICT-2072

Motion Control Box / Seat Pivot Service

Note: The entire Control Box / Motion Control assembly does not need to be removed to service the Actuator Arm assembly. The Control Box is shown removed from the frame for clarity and ease of service.

Motion Control Box / Seat Pivot Removal

1. Raise seat, disconnect battery terminals and remove the battery from the unit.
2. Remove the (2) control handles.
3. Disconnect the seat switch harness connection and remove seat switch harness from the routing clip on the Motion Control Box.
4. Remove the operator's seat:

Seat Style 1 - Remove the (2) retaining clips (A), seat pivot rod (B), and seat from the unit (Fig. 018).

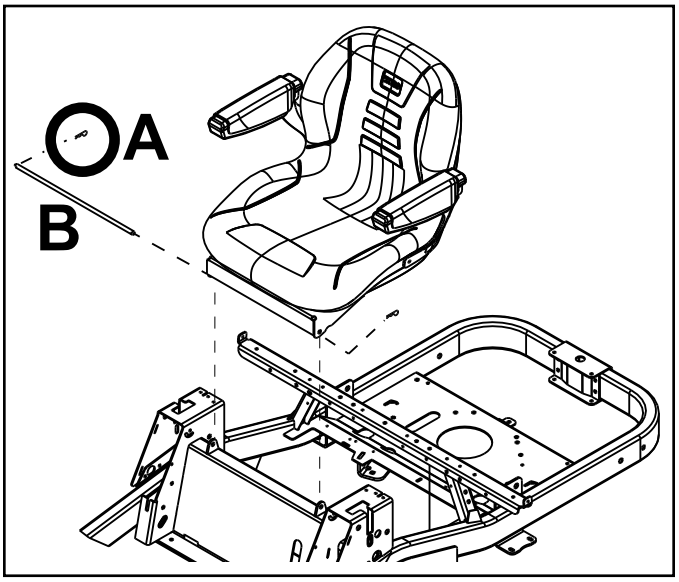


Fig. 018 PICT-2073

Seat Style 2 – Remove the (4) bolts and washers (C) that attach the seat base to the rubber mounts (D) (Fig. 019).

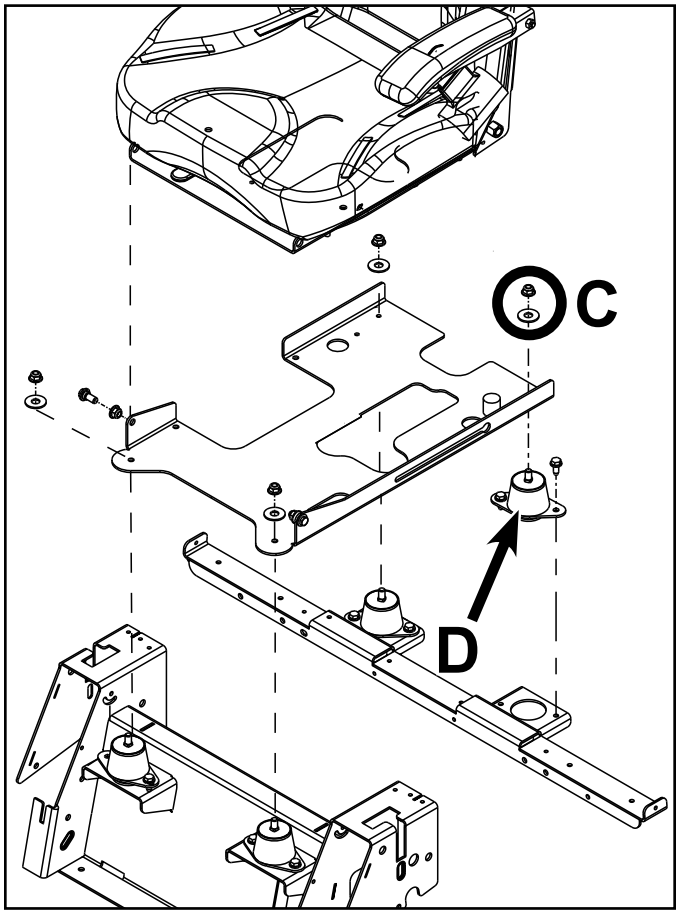


Fig. 019 PICT-2074

5. Remove the RH and LH fenders as shown in this chapter.
6. Safely remove the fuel tank as shown in this chapter.

7. Remove the (2) control covers (E) (Fig. 020).

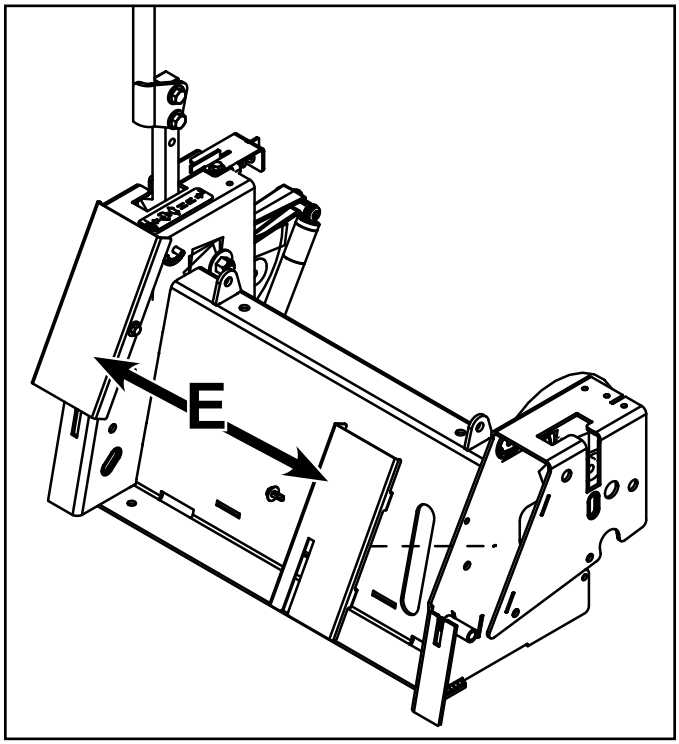


Fig. 020 PICT-2010

8. Make note of wire harness routing. Disconnect the RH and LH neutral switches and the parking brake switch. Open the loom routing clip and completely remove harness from the Control Box.

9. Remove the motion control rod clips and pins (F) (Fig. 021).

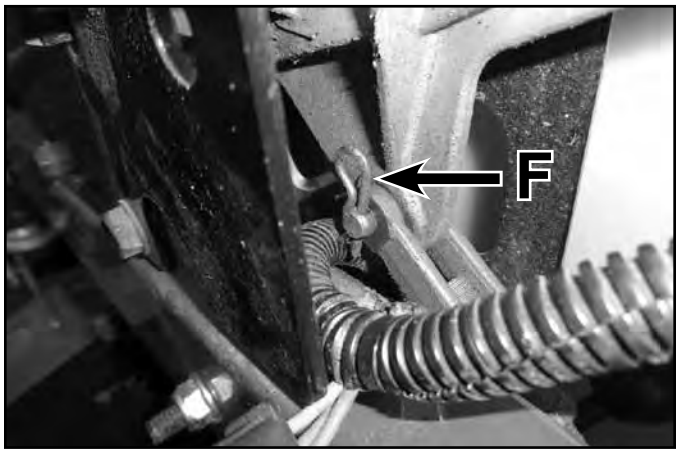


Fig. 021 PICT-2075

10. Remove the parking brake pin and washer (G). Remove the parking brake link from the handle stud (Fig. 022).

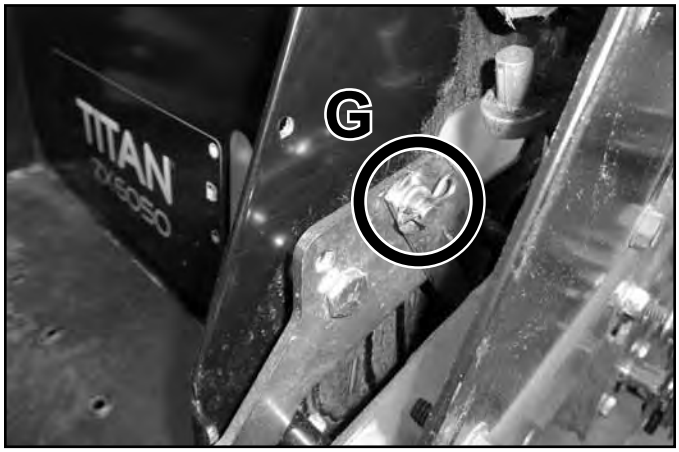


Fig. 022 PICT-2076

11. Remove the (4) fasteners (H) that secure the Control Box to the frame (Fig. 023).

12. Remove the (2) nuts and (2) carriage bolts (I) that secure the Control Box to the frame (Fig. 023).

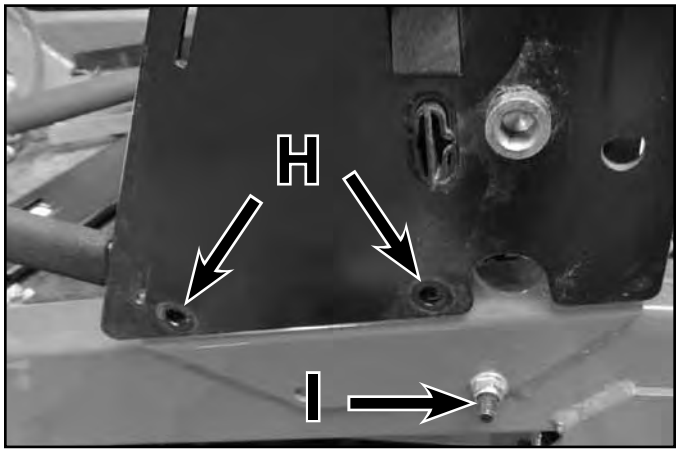


Fig. 023 PICT-2084

13. Remove the (2) bolts/nuts (J) that secure the front motion control box to the frame (Fig. 024).

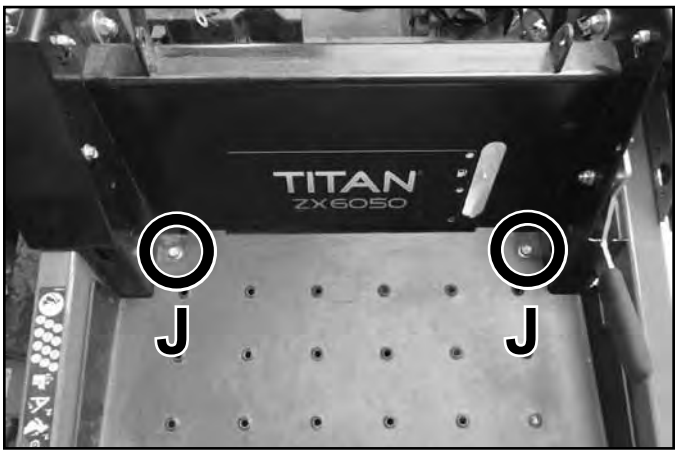


Fig. 024 PICT-2088

14. Remove the (2) fasteners that secure the floor pan to the frame. Remove the floor pan.

15. The Motion Control Box is now loose and can be removed from the frame.

Motion Control Box / Seat Pivot Installation

1. Install the control box / motion control assembly onto the frame.

2. Install the (6) fasteners securing the control box assembly to the frame and torque to specification:

   - (H) (4) Bolts- 6 ft-lbs. (8 Nm)
   - (I) (2) Carriage Bolt Fasteners - 17 ft-lbs. (23 Nm)

(Fig. 025)

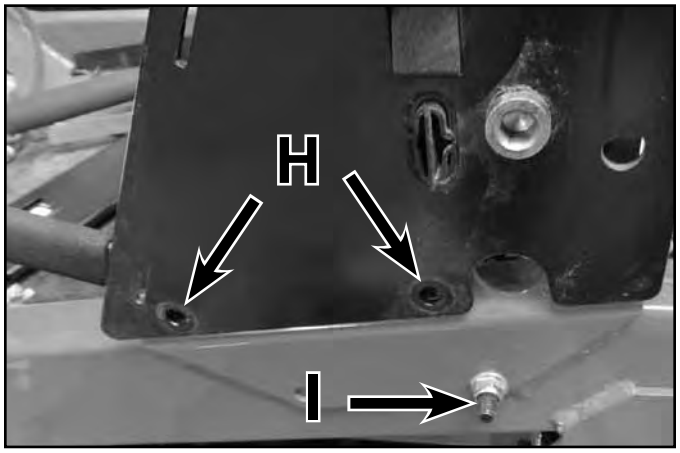


Fig. 025 PICT-2084

3. Install the (2) bolts/nuts (J) that secure the front motion control bolt to the frame and torque to specification - 17 ft-lbs. (23 Nm) (Fig. 026).

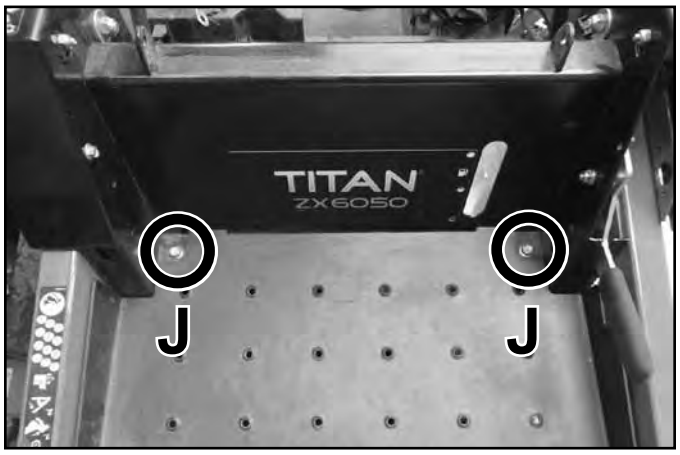


Fig. 026 PICT-2088

4. Install the floor pan and torque the (2) fasteners to specification - 7 ft-lbs. (10 Nm).

5. Install the motion control rod and clips and pins (F) (Fig. 027).

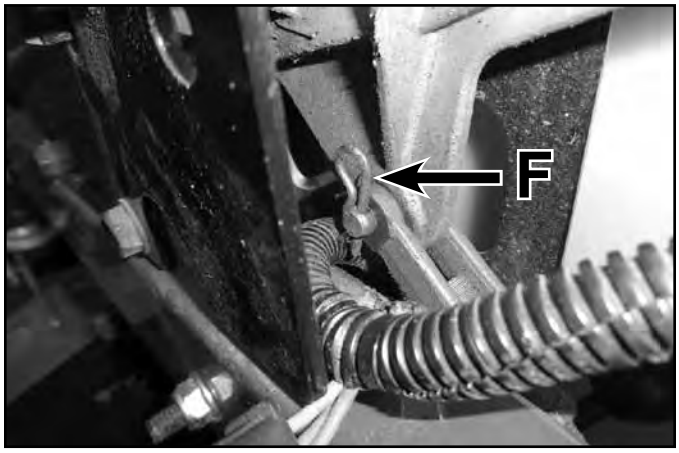


Fig. 027 PICT-2075

6. Install the parking brake linkage, washer and pin and (G) (Fig. 028).

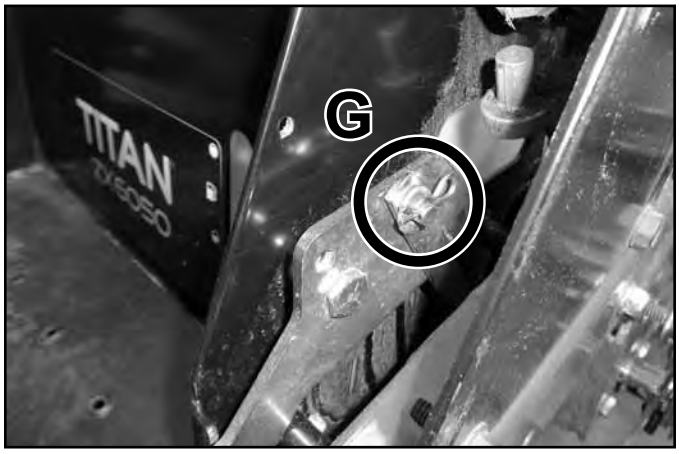


Fig. 028 PICT-2076

7. Properly route the wire harness and connect the RH and LH neutral switches, and parking brake switch.

8. Install the control covers and torque the fasteners to specification – 5 ft-lbs. (7 Nm).

9. Safely install the fuel tank as shown in this chapter.

10. Install the RH and LH fenders as shown in this chapter.

11. Install the seat assembly.

12. Install the seat switch harness connection and verify proper harness routing.

13. Install the (2) control handles and torque the (4) fasteners to specification - 30 ft-lbs. (40 Nm).

14. Install the battery and battery cables.

15. Verify proper function.

Motion Control / Actuator Arm Service

Note: The entire Control Box / Motion control assembly does not need to be removed from the frame to service the Actuator Arm assembly. The fenders and control box are shown removed from the frame for clarity and ease of service.

Motion Control Disassembly (LH Side Shown)

1. Remove the control lever.
2. Remove the upper damper shoulder bolt and washer (A).
3. Note orientation, then remove the eccentric fastener (B) and eccentric from the control box (Fig. 029).

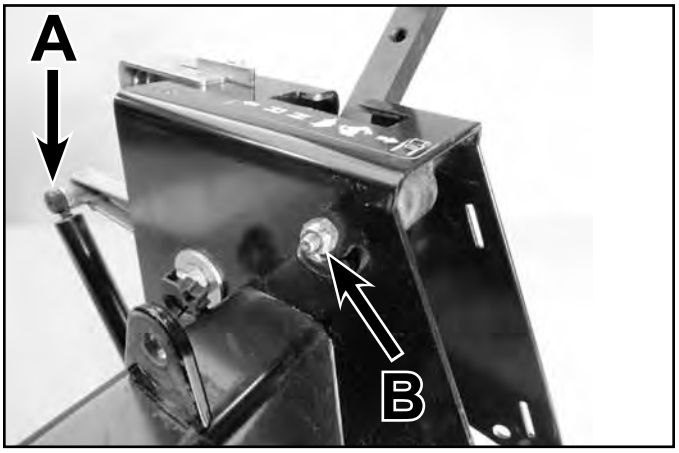


Fig. 029 PICT-2079

4. Remove the actuator arm nut (C) and (2) washers (Fig. 030).
5. Remove the shoulder bolt (D), actuator arm (E) and the (2) washers from the activator arm (F) (Fig. 030).

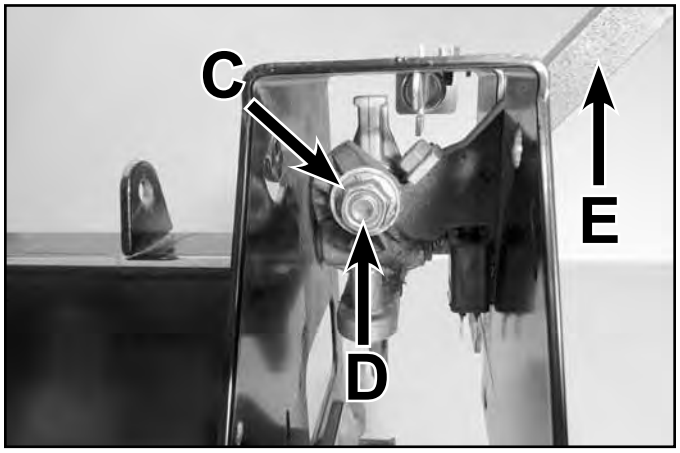


Fig. 030 PICT-2082

6. Remove the activator arm pivot bolt and nut (G) and the activator arm assembly (F) from the control box (Fig. 031).

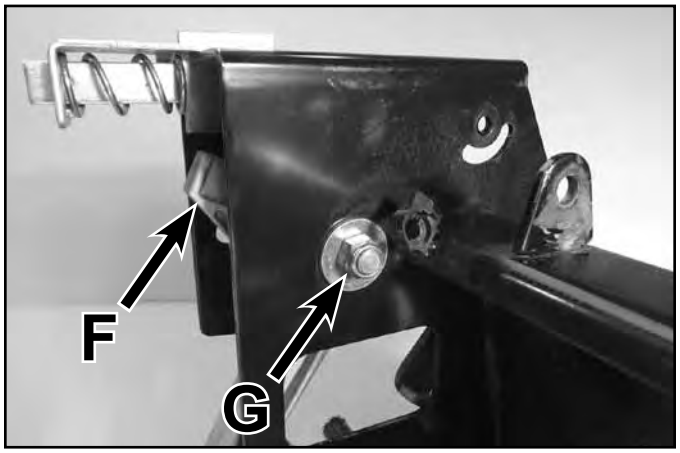


Fig. 031 PICT-2081

7. Inspect the pivot bolts, washers, nylon washers and bushings for excessive wear, replace if necessary.

Motion Control Assembly

1. Install the activator arm assembly (F) into the control box and torque the pivot bolt (G) to specification – 30 ft-lbs. (40 Nm). **Do not apply lubrication to the activator arm pivot bolt (G).**

2. Apply anti-seize compound to the actuator arm shoulder bolt (D) and the (4) washers. Install the pivot bolt (D) through the activator arm (F).

3. Install the actuator arm pivot bolt (D) and (4) washers to the activator arm assembly.

   Be sure the (4) washers are positioned correctly:
   - Washer 1: Standard Pivot Washer
   - Washer 2: Standard Pivot Washer
   - Washer 3: Standard Pivot Washer
   - Washer 4: Teflon Washer

(Fig. 032)

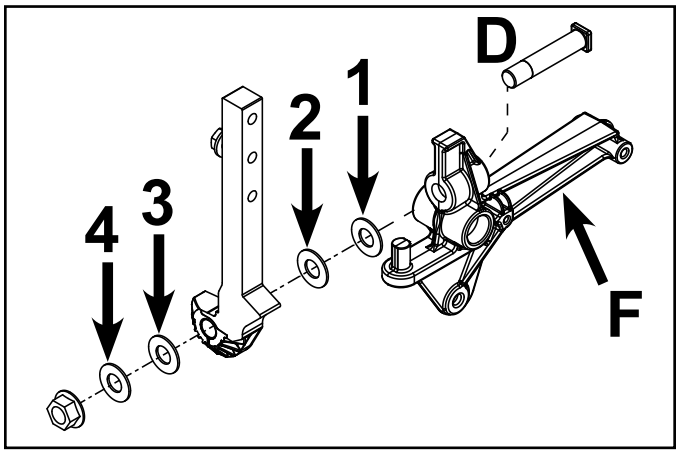


Fig. 032 PICT-2085

4. Apply Loctite® 242 to the actuator arm pivot bolt threads (D).

5. Tighten nut (C) until the control lever has an acceptable and safe resistance feel when moved from stop to stop.

   - Over tightening nut (C) may damage the Teflon washer and cause excessive resistance.

   - Under tightening nut (C) may cause the actuator arm to feel loose.

(Fig. 033)

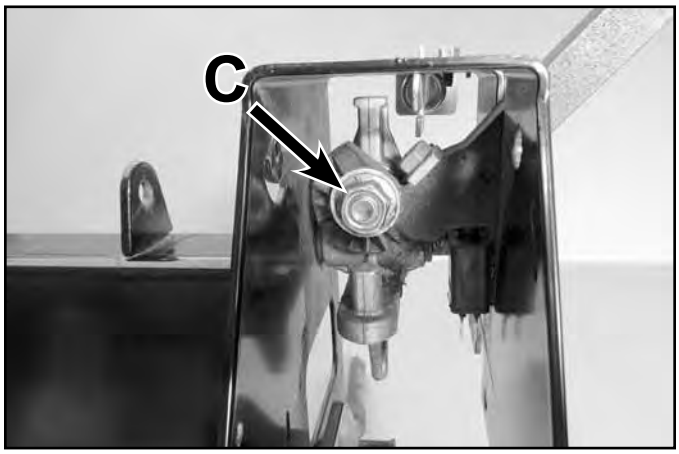


Fig. 033 PICT-2082

6. Install the upper motion control damper washer and shoulder bolt (A) to the activator arm (F) and torque to specification - 7.5 ft-lbs. (10 Nm).

7. Index and install the eccentric and fastener (B). Torque nut to specification – 8ft-lbs. (11 Nm).

8. If needed, install the control box back onto the frame as outlined in this chapter.

9. Install the control lever and torque the fasteners to specification - 30 ft-lbs. (40 Nm).

10. Perform the “Neutral Adjustment” and “Tracking Adjustment” procedures on pages 5-4 and 5-6.

(Fig. 034)

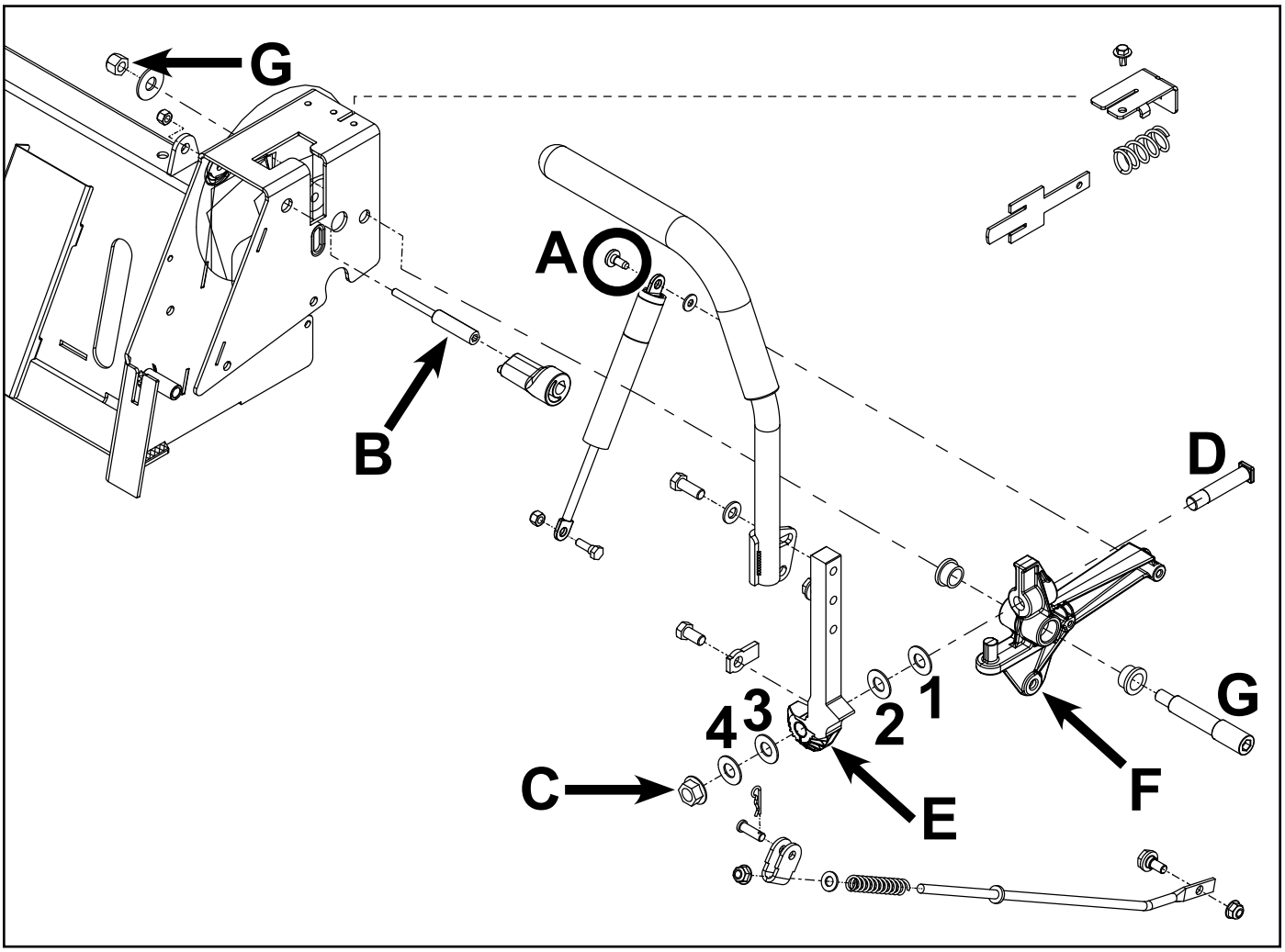


Fig. 034 PICT-2080

Washer 1 - Standard pivot washer
Washer 2 - Standard pivot washer
Washer 3 - Standard pivot washer
Washer 4 - Teflon washer

Seat Support / Fender Support Service

Seat Support Removal

1. Raise seat and disconnect battery terminals.
2. Remove RH and LH pod / fender as shown in this chapter.
3. Remove the (2) bolts that secure the hydro expansion tank (A) to the seat support.
4. Remove the (1) fastener securing the fuel tank retaining rod (B) to the seat support.
5. Remove the (2) thread-forming bolts that secure the rear guard tube (C) to the seat support (E). OR Remove the bolts / nuts securing the rear engine guard to the ROPS frame (D) (Fig. 035).

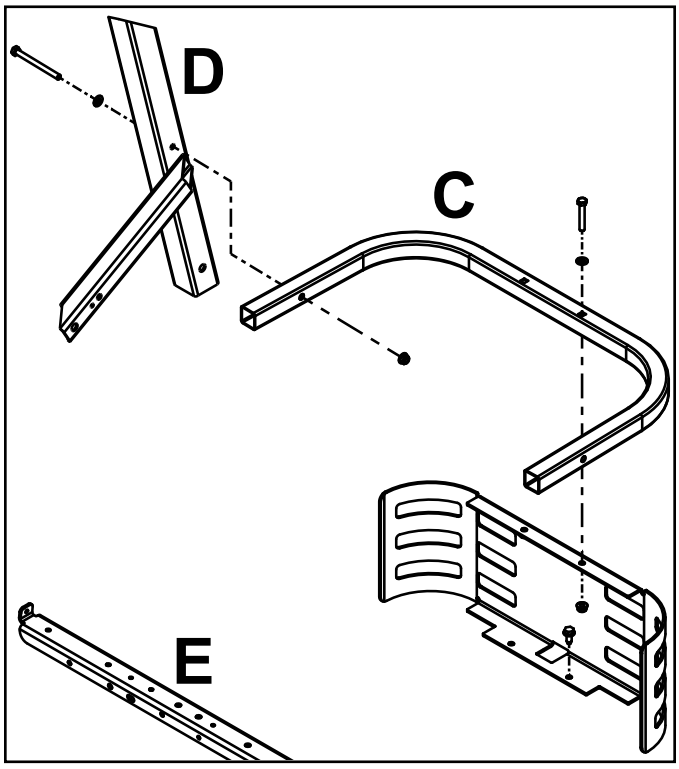


Fig. 035 PICT-2070

6. Remove the (2) bolts and nuts that secure the seat support (E) to the frame brackets.
7. Note the location of and remove any cable ties / loom clamps securing wiring / cables to the seat support bar (E).
8. Remove the seat support bar from the frame. (Fig. 036)

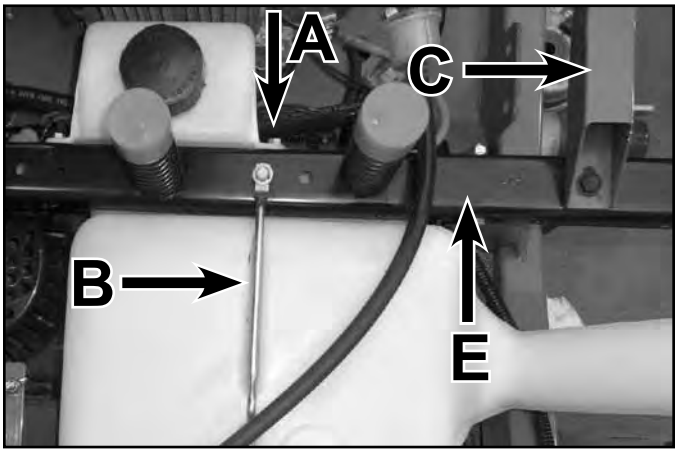


Fig. 036 PICT-2066

Seat Support Installation

1. Position the Seat Support assembly into the unit frame.

2. Install the (2) bolts and nuts that secure the seat support (E) to the frame brackets and torque to specification – 17 ft-lbs. (23 Nm).

3. Install the fuel tank retaining rod (B) and torque retaining bolt to specification – 8 ft-lbs. (11 Nm). Be sure the front rod end is engaged into the control box assembly (Fig. 037).

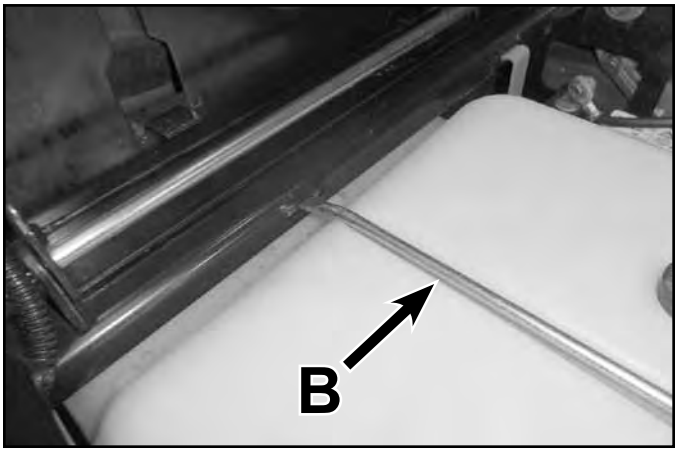


Fig. 037 PICT-2069

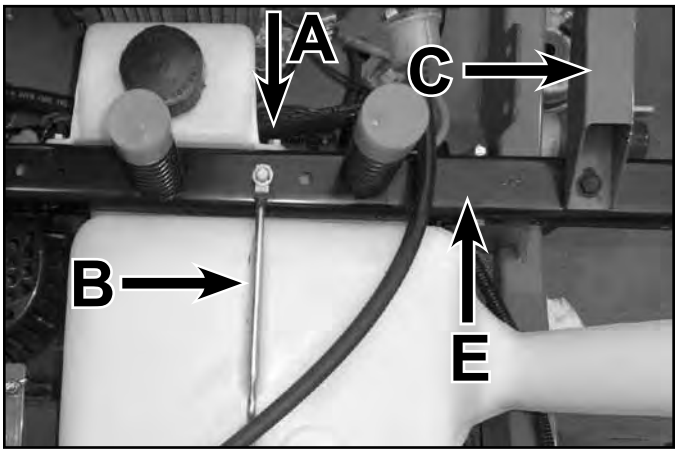


Fig. 038 PICT-2066

9. Install and sufficiently tighten the (2) thread forming bolts that secure the rear guard tube (C) to the seat support (E). OR Install the bolts / nuts securing the rear engine guard to the ROPS frame (F) (Fig. 039).

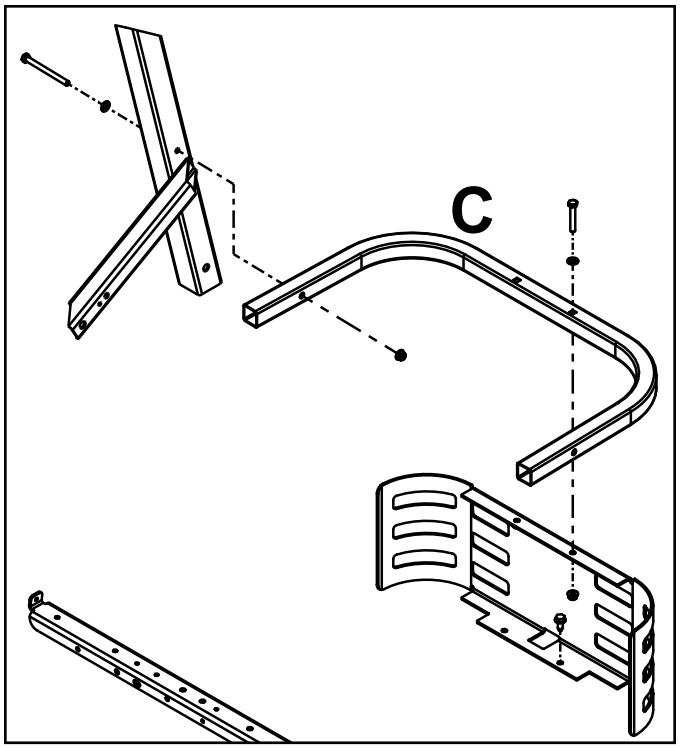


Fig. 039 PICT-2070

4. Install the (2) bolts that secure the hydro expansion tank (A) to the seat support and torque to specification – 5 ft-lbs. (7 Nm).

5. Properly route cables / wiring and reinstall cable ties / loom clams to secure them to the seat support.

6. Install RH and LH pod / fender as outlined in this chapter.

7. Connect the battery cables and lower seat.

8. Verify proper function.

Deck Lift Service

Deck Lift Removal

Note: Exploded view shown on next page, 3-20.

1. Remove the PTO belt tensioner spring, then remove the PTO belt from the PTO clutch as shown in chapter 6, page 6-5 - 6-8.
2. Remove the deck from the frame as shown in Chapter 6, page 6-9 - 6-12.
3. Remove the deck lift foot petal center bolt, nut, and spacer (A).
4. Remove the HOC lever pivot fastener and spacer (B).
5. Remove the rear HOC arm fastener (C).
6. Remove the HOC plate and foot lift assembly from the chassis.
7. 54 and 60 Inch Units Only - Remove the front lift pan (D), spring, and mounting fasteners.
8. Support under the front foot lift pivot rod (E).Remove the (4) fasteners (F) that retain the pivot bushings. Remove the pivot rod from the frame. Inspect the (2) bushings for wear and replace if necessary.
9. Support under the rear pivot rod (G). Remove the (4) fasteners (H) that retain the pivot bushings. Remove the pivot rod from the frame. Inspect the (2) bushings for wear and replace if necessary.
10. Inspect the front lift pan (D), the front pivot rod (E), the rear pivot rod (G) and all wear / pivot area for excessive wear, bends and cracks. Replace if necessary.

Deck Lift Installation

1. Install the front and rear pivot rods (E and G) into the frame slots and support in position.
2. Install the (4) pivot bushings, (4) gusset plates and (8) fasteners that secure the pivot rods to the frame. Torque the (8) fasteners to specification – 5 ft-lbs. (7 Nm) (Fig. 040).

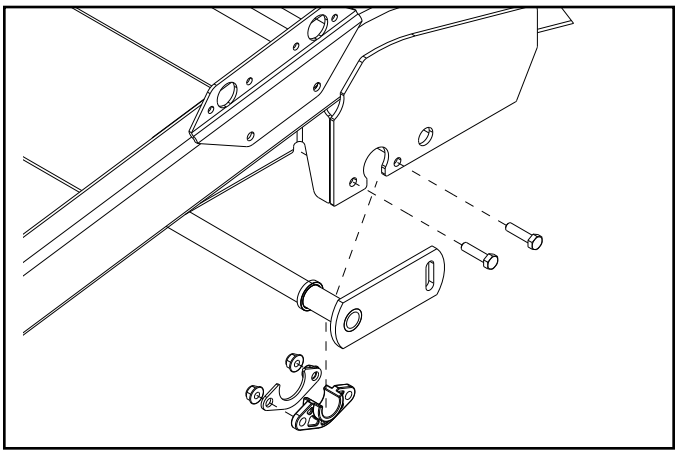


Fig. 040 PICT-2087

3. 54 and 60 Inch Units Only - Install the front lift pan (D) and spring to the frame and torque fasteners to specification - 50 ft-lbs. (69 Nm).
4. Install the rear HOC arm fastener (C). Do not tighten at this time.
5. Install the HOC lever pivot fastener and spacer (B). Do not tighten at this time.
6. Install the deck lift foot petal center bolt, nut, and spacer (A).
7. Torque fasteners A, B and C to specification - 30 ft-lbs. (40 Nm).
8. Install and level the deck as shown in Chapter 6.
9. Install and properly route the PTO belt, then install the PTO belt tensioner spring.

(Fig. 041, next page)

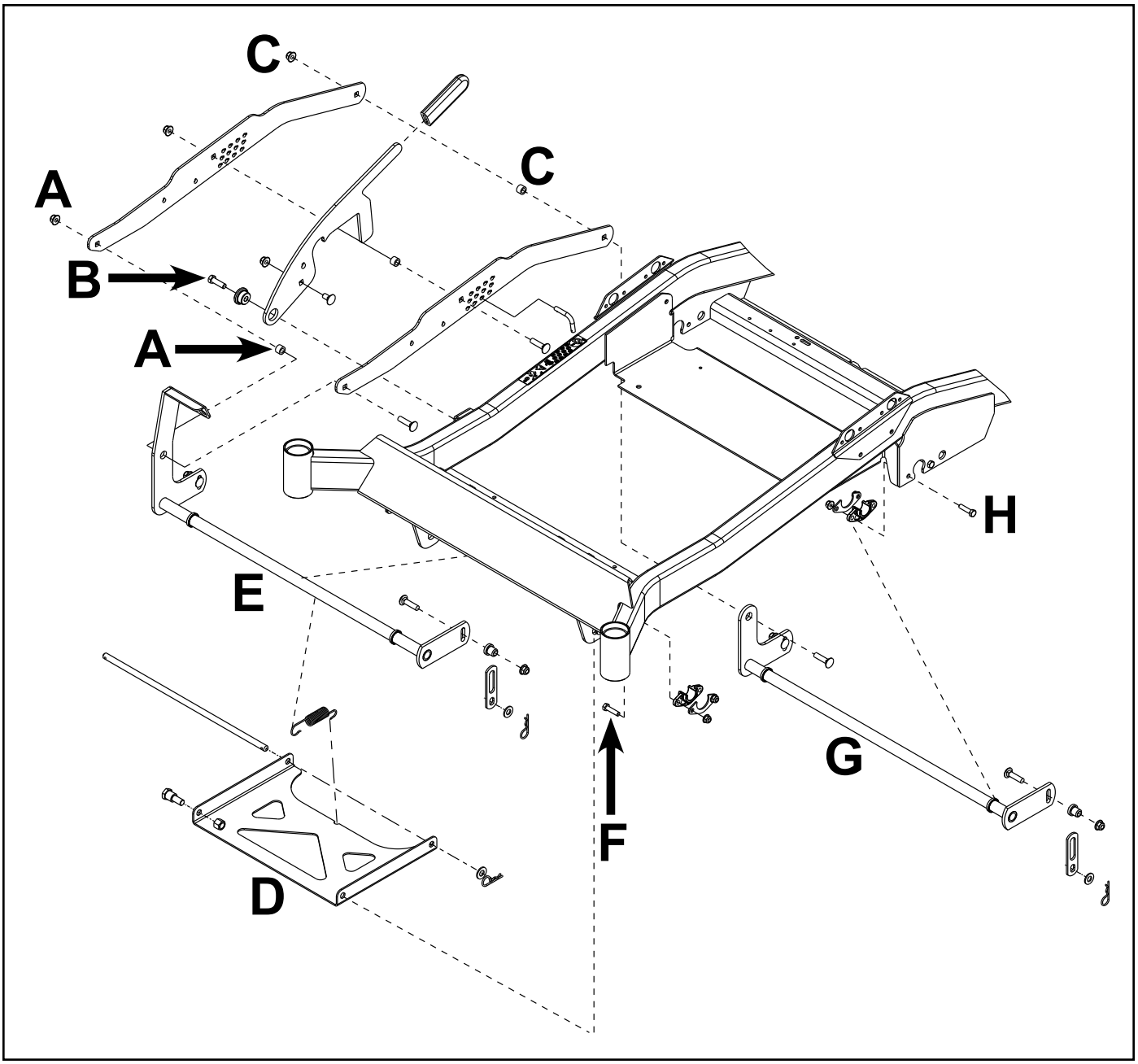


Fig. 041 PICT-2068

Parking Brake & Linkage Service

Parking Brake & Linkage Removal

1. Tilt seat forward, disconnect and remove the battery.
2. Remove the LH control cover to access the parking brake handle area.
3. Remove the parking brake pin and washer (A). Remove the parking brake link from the handle stud (Fig. 042).
4. Remove fastener (B) that secures the parking brake handle to the control box assembly. Remove the handle from the unit (Fig. 042).

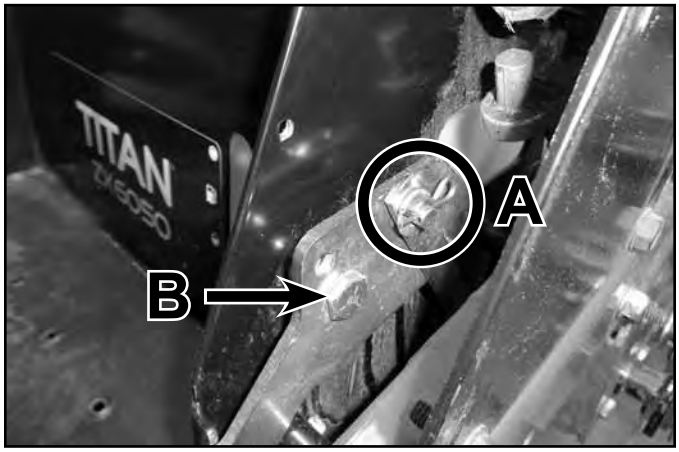


Fig. 042 PICT-2076

5. Remove the brake return spring (C) and the clip and washer (D) from the brake rod on the hydro (Fig. 043).

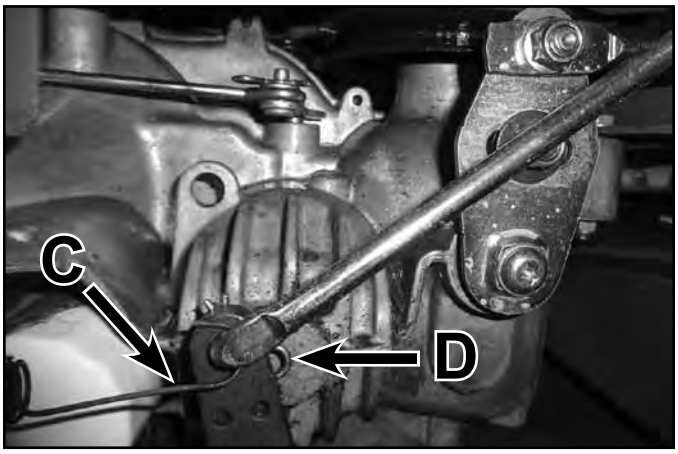


Fig. 043 PICT-2046

6. Remove all of the clips and washers (E), then remove the (3) linkage rods from the chassis.
7. Remove the (2) cotter pins (F), (2) washers and (2) bushings (G) from the brake bell crank (H) (Fig. 044).

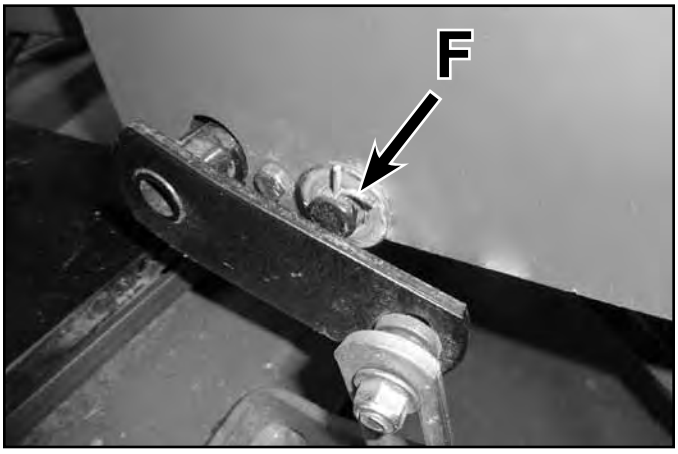


Fig. 044 PICT-2083

8. Slide the brake bell crank (H) to one side and remove the bell crank from the frame.
9. Inspect all linkage rods, pivot points and bushings for excessive wear, replace if necessary.

Parking Brake & Linkage Installation

1. Position the brake bell crank (H) into the frame pivot holes.
2. Install the pivot bushings (G), washers and cotter pins to secure the bell crank into the frame.
3. Install the (3) linkage rods to the bell crank and install retaining washers and clips (E), and (D).
4. Install the brake return spring (c) (Fig. 045).

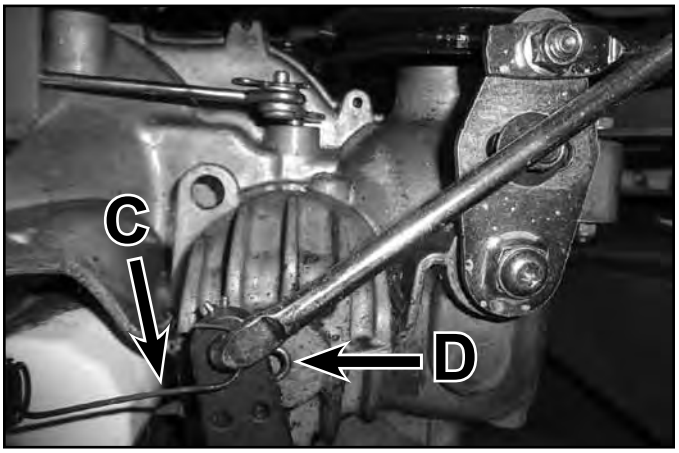


Fig. 045 PICT-2046

5. Lubricate the brake handle pivot bolt (B) friction surface with a light coating of engine assembly lube.
6. Install the parking brake handle into the motion control box and torque the mounting fastener (B) to specification – 17 ft-lbs. (23 Nm).
7. Install the parking brake linkage rod to the handle stud using the washer and clip (A).
8. Install the LH control cover and torque the (1) mounting fastener to specification - 5 ft-lbs. (7 Nm).
9. Install and connect the battery.
10. Inspect for proper brake function.
11. Verify proper parking brake function.

(Fig. 046)

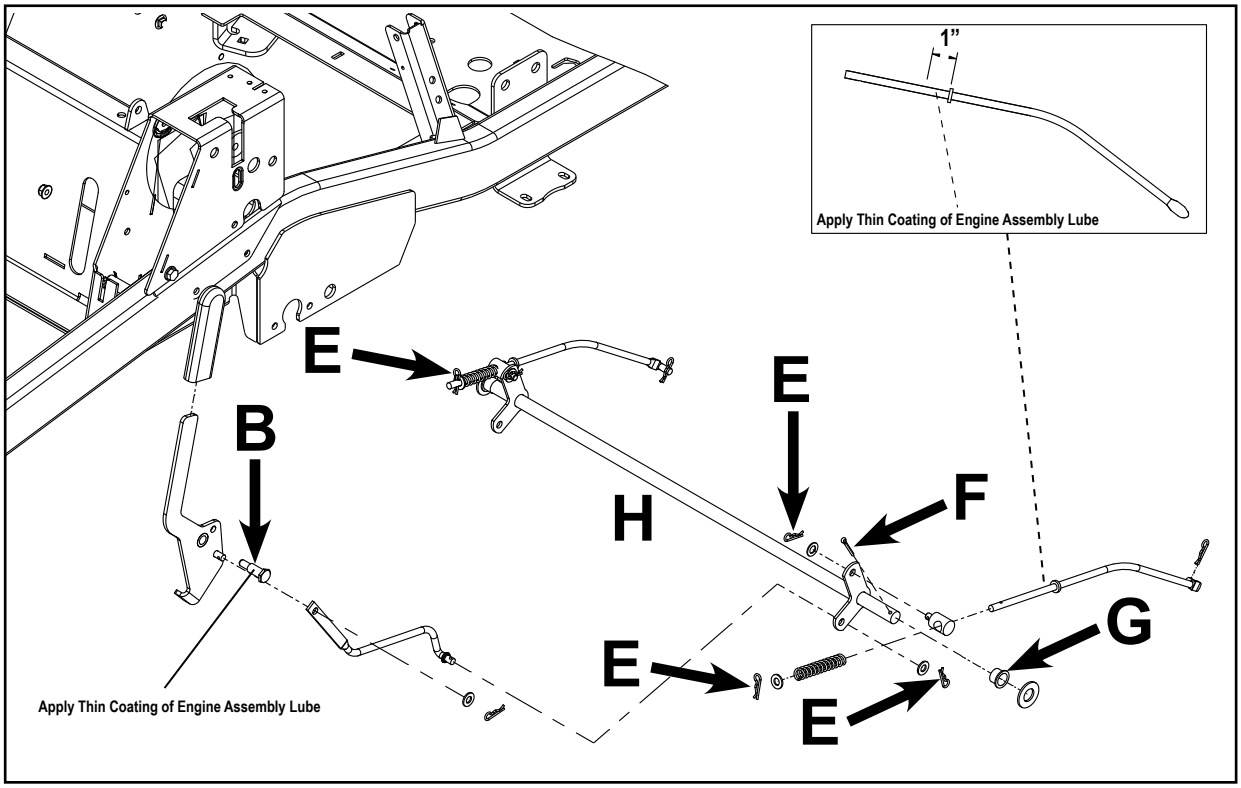


Fig. 046 PICT-2078

ROPS Exploded View & Torque Values

(Fig. 047)

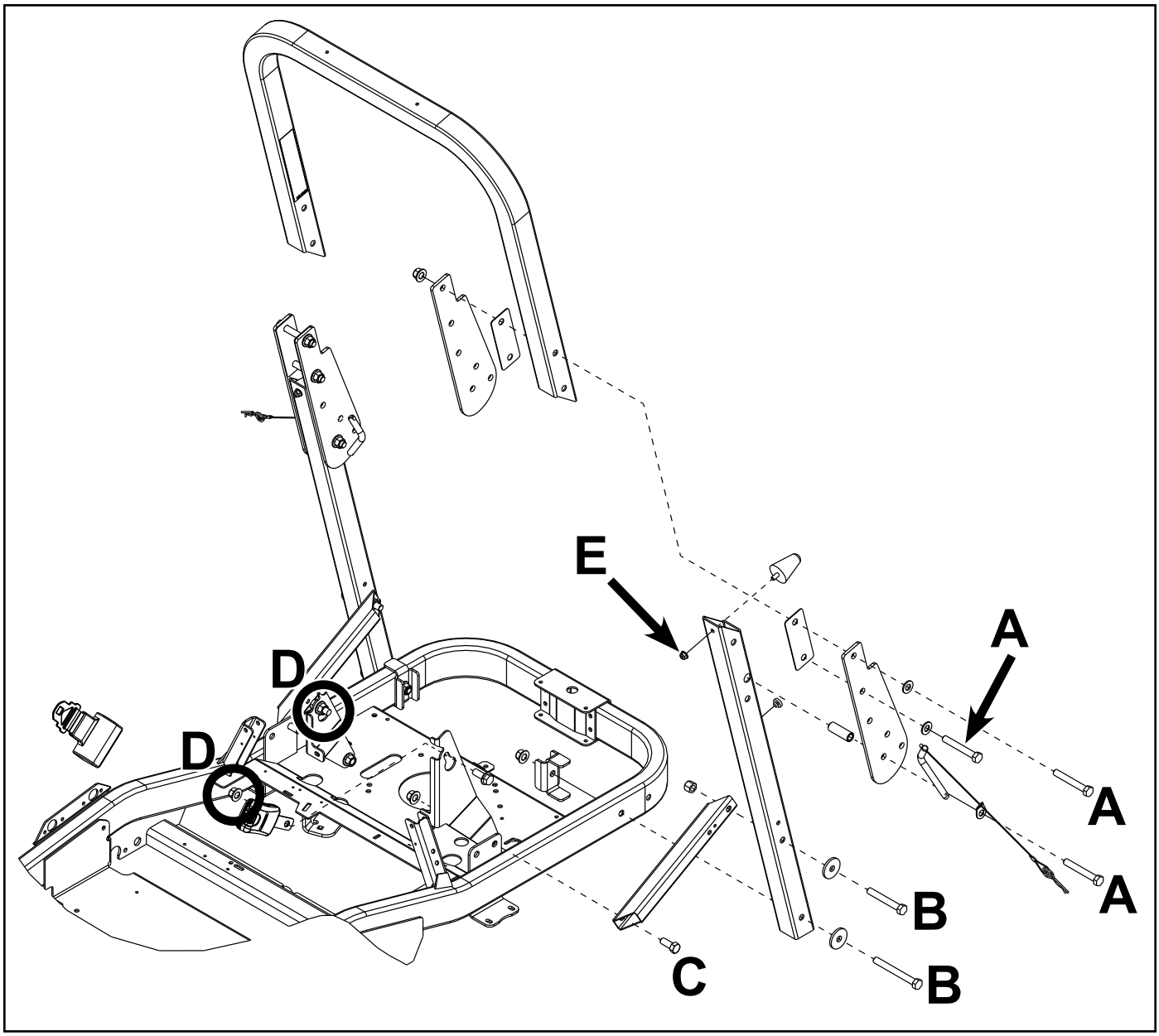


Fig. 047 PICT-2067

ROPS mounting torque sequence:

1. Install, but do not tighten all ROPS mounting fasteners
2. Torque the (6) bolts (A) to specification – 35 ft-lbs. (47 Nm)
3. Torque the (4) bolts (B) to specification – 25 ft-lbs. (34 Nm)
4. Torque the (2) bolts (C) to specification – 75 ft-lbs. (101 Nm)

Torque values:

D. Seat Belt Mounting Fasteners – 75 ft-lbs. (101 Nm)
E. Rubber Bumper Mounting Fastener - 17 ft-lbs. (23 Nm)

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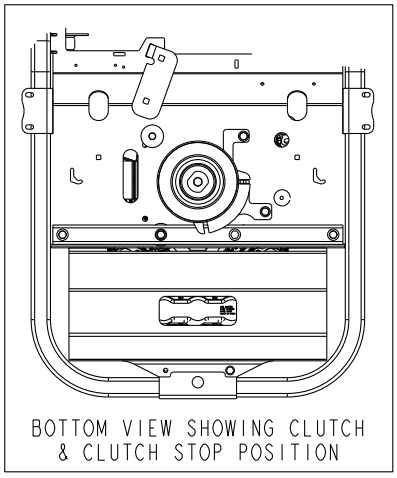
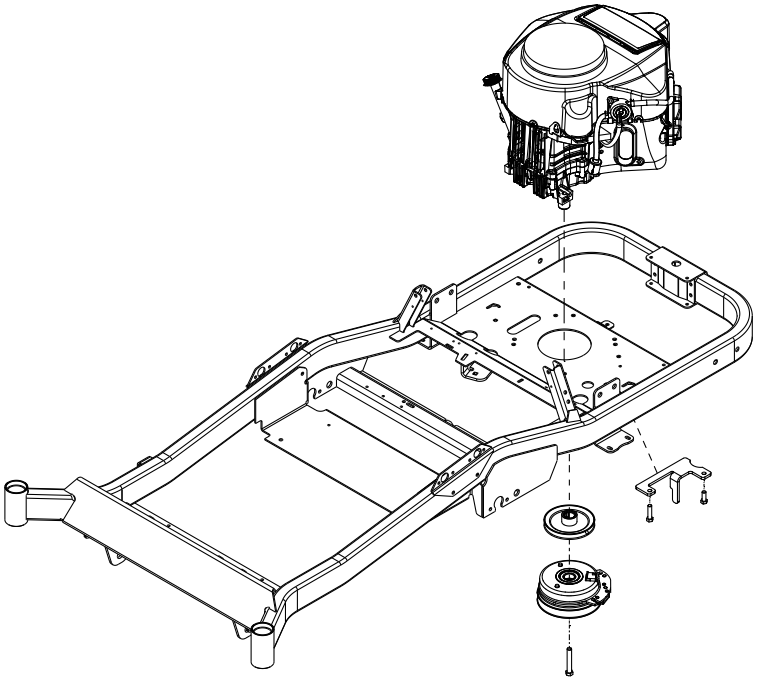
Engine Replacement

PTO Clutch & Clutch Stop Mounting (All Models)

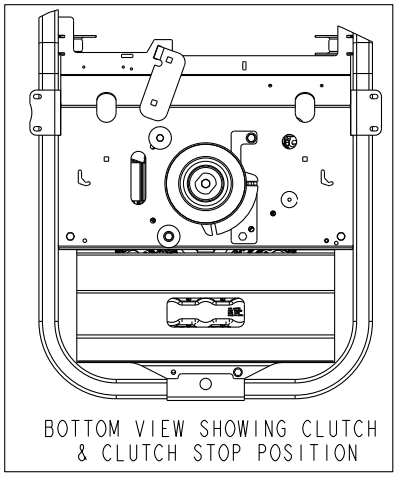
(Fig. 048)

Kawasaki Clutch / Clutch Stop Location





Kohler / Briggs and Stratton Clutch / Clutch Stop Location



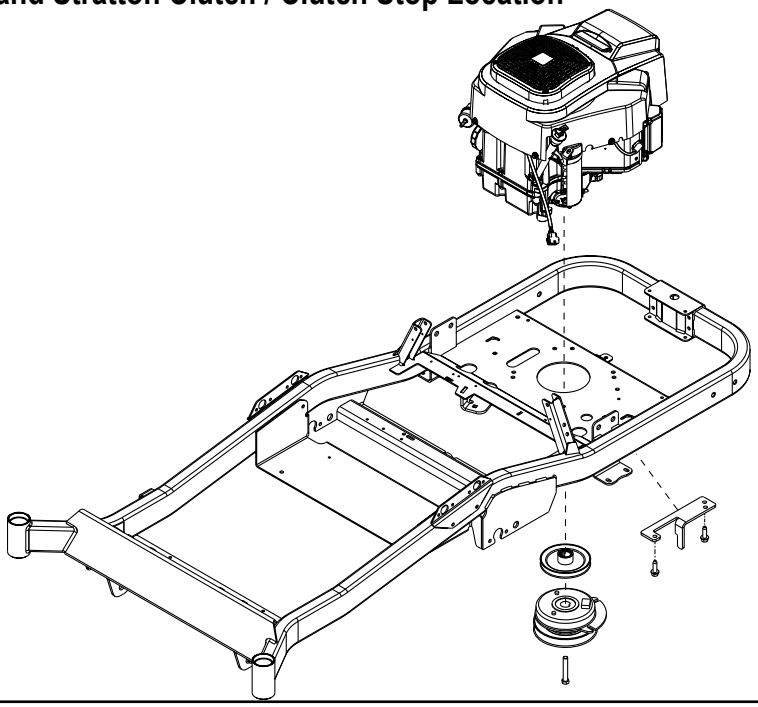


Fig. 048 PICT-2027

Engine Mounting Exploded Views

Engine Mounting – Kawasaki Engine
(Fig. 049)

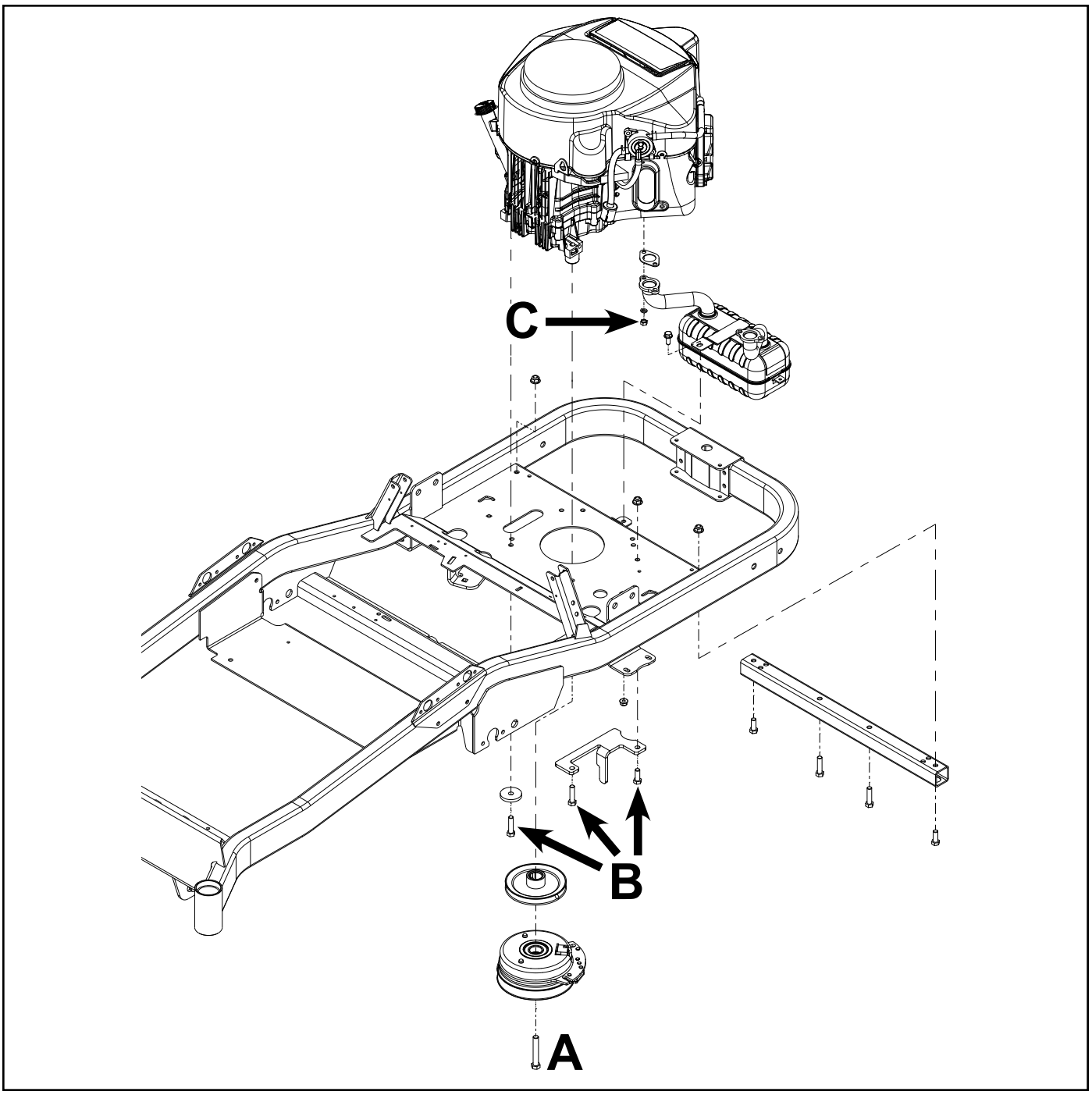


Fig. 049 PICT-2052

A. PTO clutch bolt - apply Loctite® 242 - 55 ft-lbs. (76 Nm)
B. Engine/clutch stop mounting bolts - Loctite 242 - 33 ft-lbs. (44 Nm)
C. Muffler to engine fastener - 13 ft-lbs. (17.5 Nm)

Engine Mounting – Kohler Engine

(Fig. 050)

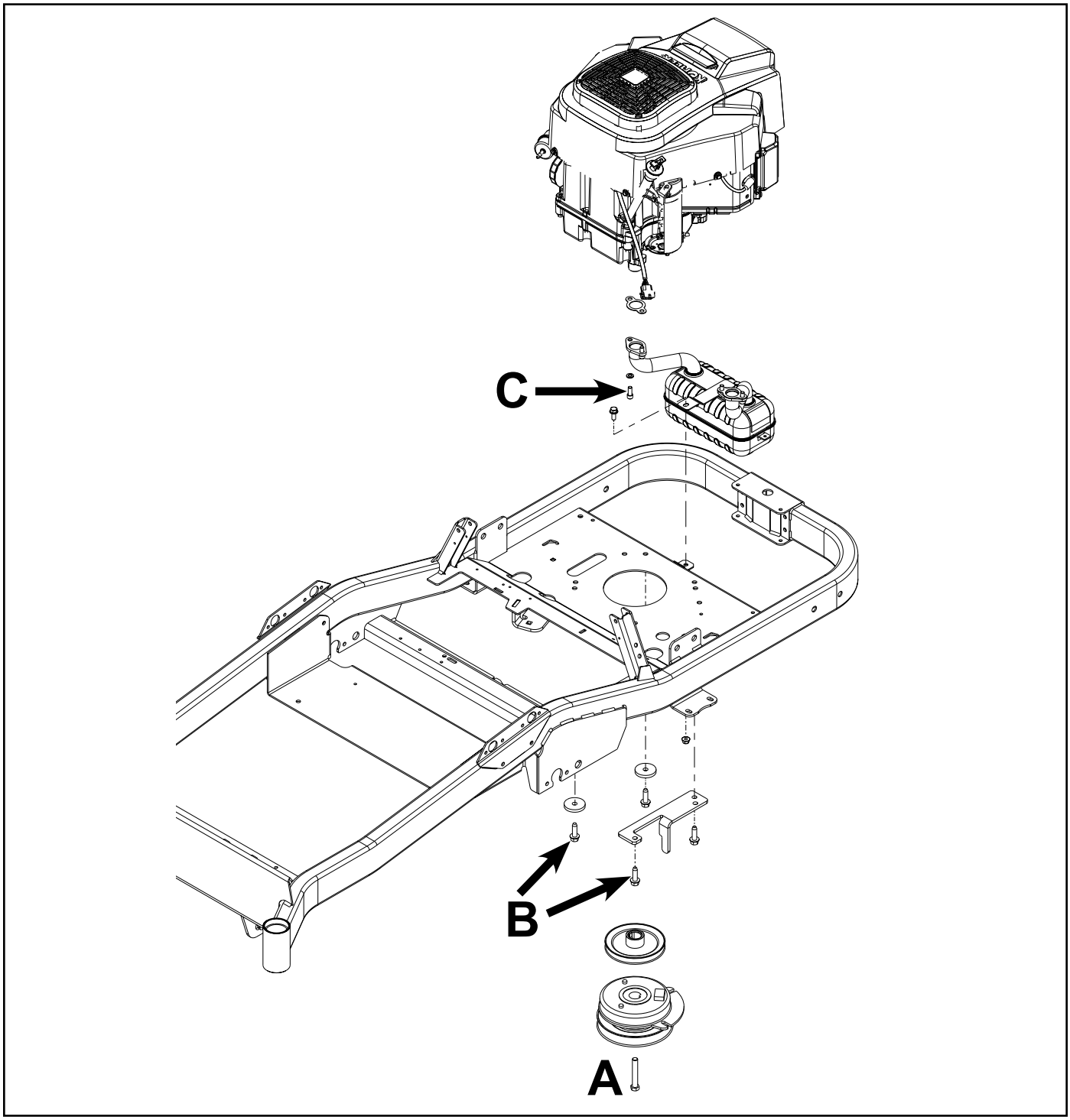


Fig. 050 PICT-2053

A. PTO clutch bolt - apply Loctite® 242 - 55 ft-lbs. (76 Nm)
B. Engine/clutch stop mounting bolts - Loctite 242 - 33 ft-lbs. (44 Nm)
C. Muffler to engine fastener - 13 ft-lbs. (17.5 Nm)

Engine Mounting – Briggs & Stratton Engine
(Fig. 051)

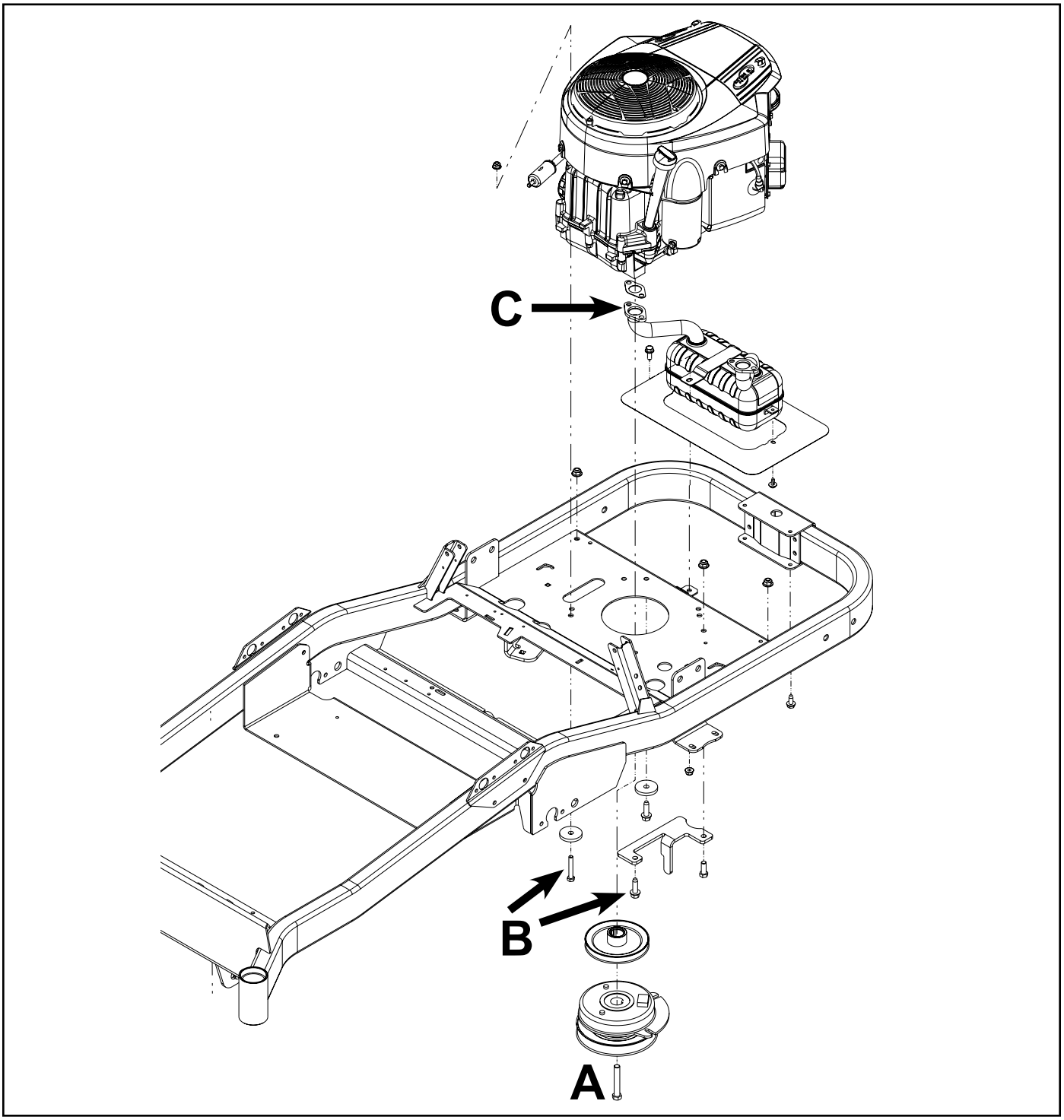


Fig. 051 PICT-2054

A. PTO clutch bolt - apply Loctite® 242 - 55 ft-lbs. (76 Nm)
B. Engine/clutch stop mounting bolts - Loctite 242 - 33 ft-lbs. (44 Nm)
C. Muffler to engine fastener - 13 ft-lbs. (17.5 Nm)

Engine Removal

1. Raise seat and disconnect battery terminals.

2. Safely raise and support rear of unit so rear wheels are off the ground.

3. Remove PTO belt tensioner spring (A) from the deck to relieve PTO belt tension as shown in chapter 6 (Fig. 052).

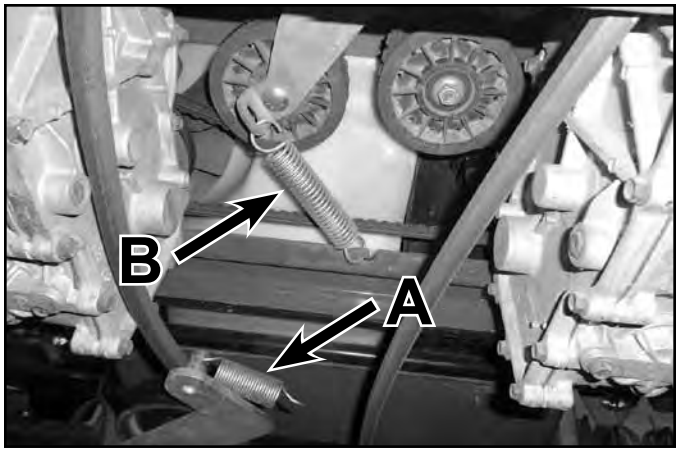


Fig. 052 PICT-2041

4. Remove PTO belt from PTO clutch.

5. Disconnect the wire harness connection to the PTO clutch.

6. Remove the PTO clutch bolt and then remove the clutch from the engine crankshaft.

7. Remove the drive belt tensioner spring (B) (Fig. 052).

8. Remove the belt from around the crankshaft drive pulley and remove the drive pulley from the engine crankshaft. Make note of pulley orientation for assembly.

9. If necessary, remove rear engine guard.

10. Remove the fasteners that secure the heat shield to the muffler and frame and remove the heat shield. If necessary, remove the muffler from the engine.

11. Remove the (4) engine to frame mounting bolts. Make note of clutch stop bracket (C) mounting and orientation (Fig. 053).

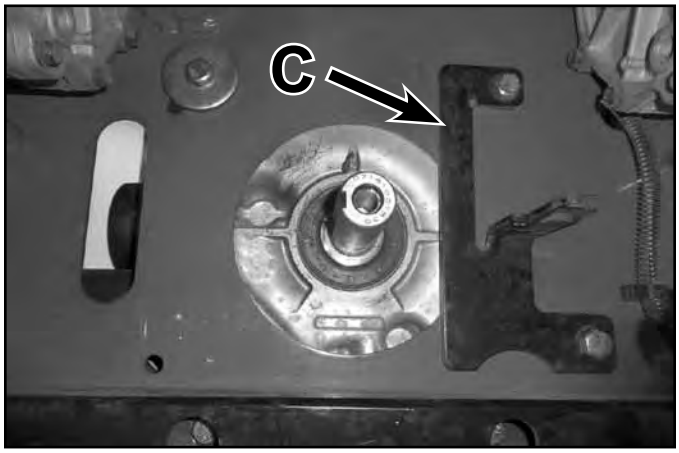


Fig. 053 PICT-2055

12. Safely disconnect the fuel and vent lines from engine.

13. Remove the throttle and choke cable from carburetor linkage.

14. Disconnect the chassis-to-engine electrical connection (D).

15. Disconnect the ground wires from the engine block (E)

16. Disconnect the positive battery cable (F) from the starter motor (Fig. 054).

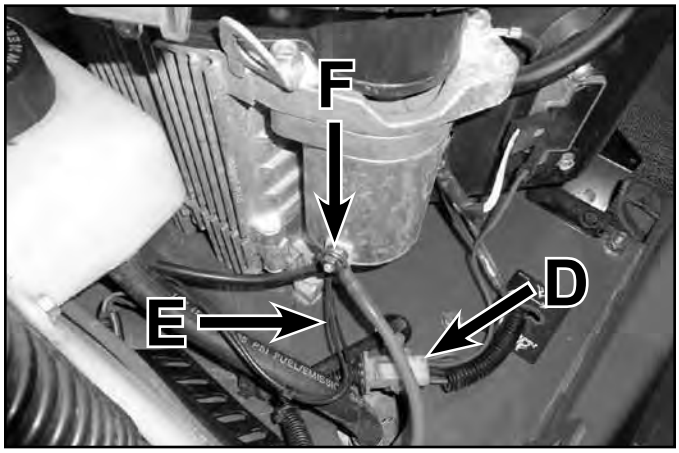


Fig. 054 PICT-2056

17. The engine can now be lifted vertically from the frame.

Engine Installation

1. Position the engine onto the frame.
2. Connect the battery ground wires (E) to the engine block, and connect the positive battery wire (F) to the engine starter motor.
3. Connect the chassis to engine harness connector (D) (Fig. 055).

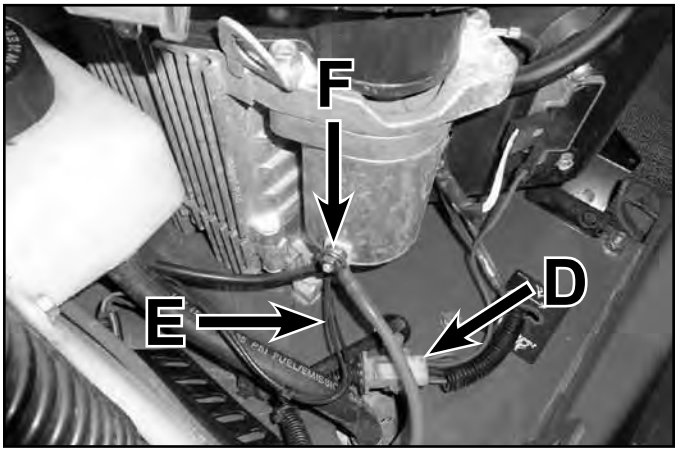


Fig. 055 PICT-2056

4. Install the fuel and vent lines to the engine.
5. Install the throttle and choke cables to carburetor linkage.
6. Apply Loctite® 242 to the (4) engine mounting bolts.
7. By hand, install the (4) engine mounting bolts.

Note: Some of the engine mounting bolts also secure the clutch stop bracket and stiffener tube to the frame. See the exploded views for application and mounting location.

8. In a cross pattern, torque the (4) engine mounting bolts to specification - 33 ft-lbs. (44 Nm).
9. Install muffler and new muffler gaskets, if necessary, to the engine and torque muffler fasteners to specification - 13 ft-lbs. (17.5 Nm).
10. Install heat shield to the muffler mounting screws and torque to specification - 5 ft-lbs. (7 Nm).
11. Install the heat shield and muffler to frame mounting screws and torque to specification - 17 ft-lbs. (23 Nm).
12. Apply anti-seize to the engine crankshaft and the ends of the drive pulley shaft.
13. Install the drive pulley onto the crankshaft and hold in position.

Note: The drive pulley is marked “CLUTCH SIDE” for proper installation (Fig. 056).

Fig. 056 PICT-2044

14. Install the drive belt around the drive pulley.
15. Install the drive belt tensioner spring as oriented below (Fig. 057).

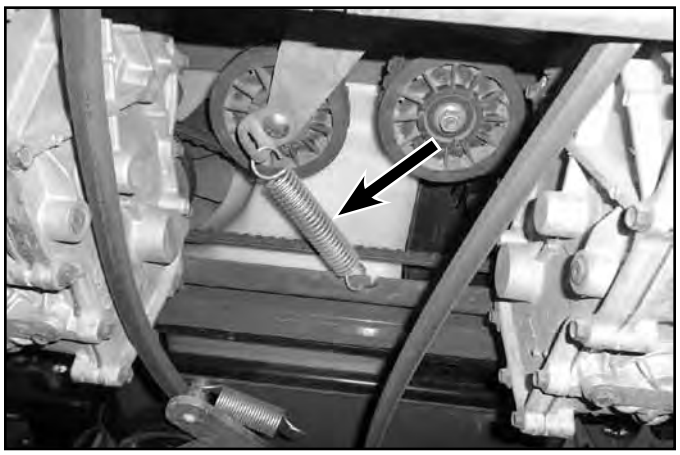


Fig. 057 PICT-2041

16. Apply Loctite® 242 to the PTO clutch bolt threads.

17. Install the PTO clutch onto crankshaft. Be sure PTO clutch engages with the clutch stop bracket.

18. Install and torque the PTO clutch bolt to specification – 55 ft-lbs. (76 Nm).

19. Install PTO belt onto PTO clutch. Verify proper PTO belt routing; see PTO Belt Replacement and Belt Routing” on page 6-5. Install the PTO belt tensioner spring to the deck.

20. Connect battery cables and verify engine oil level.

21. Safely start engine and verify proper operation.

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Hydrostatic Drive Exploded Views

(Fig. 058)

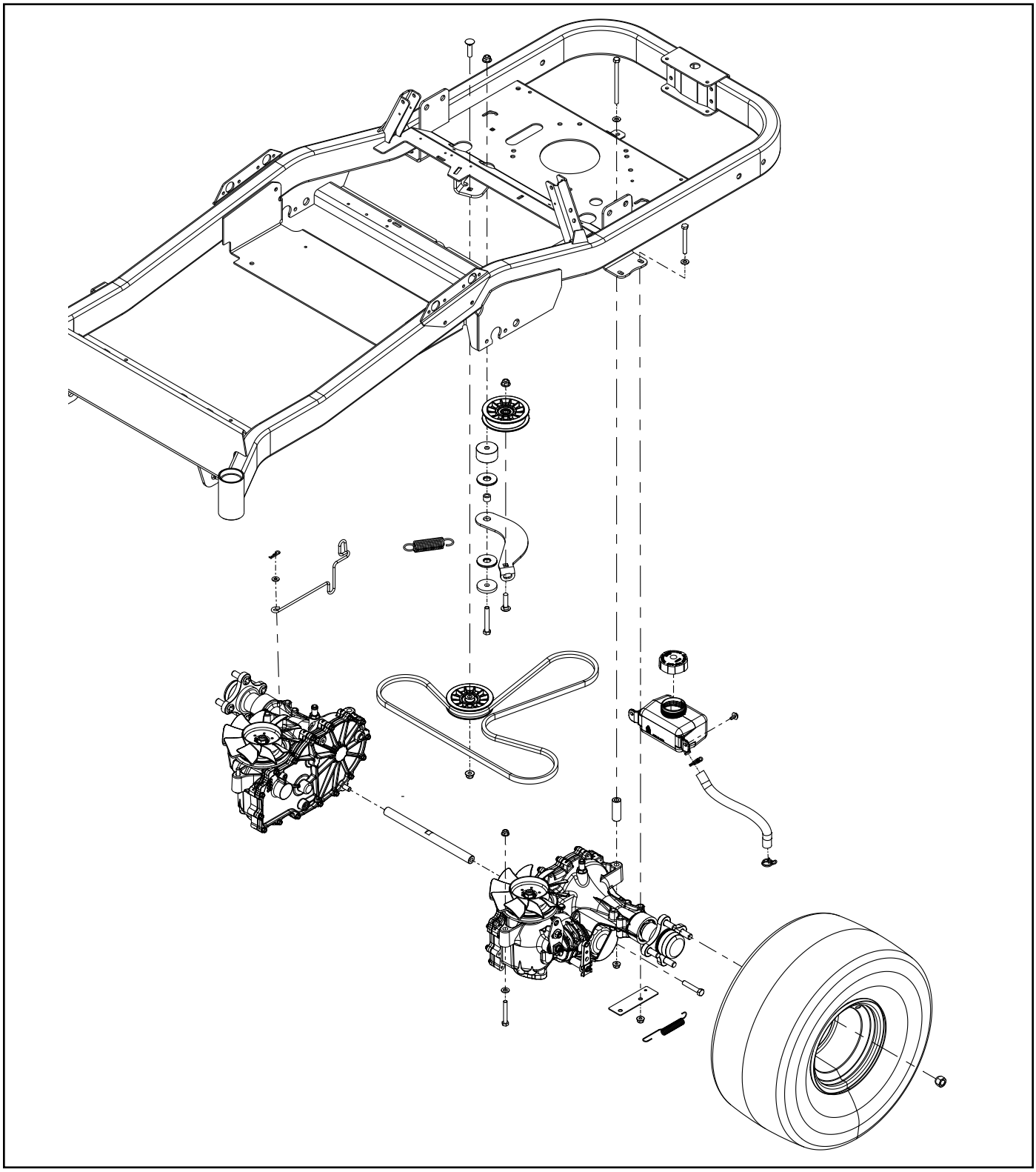
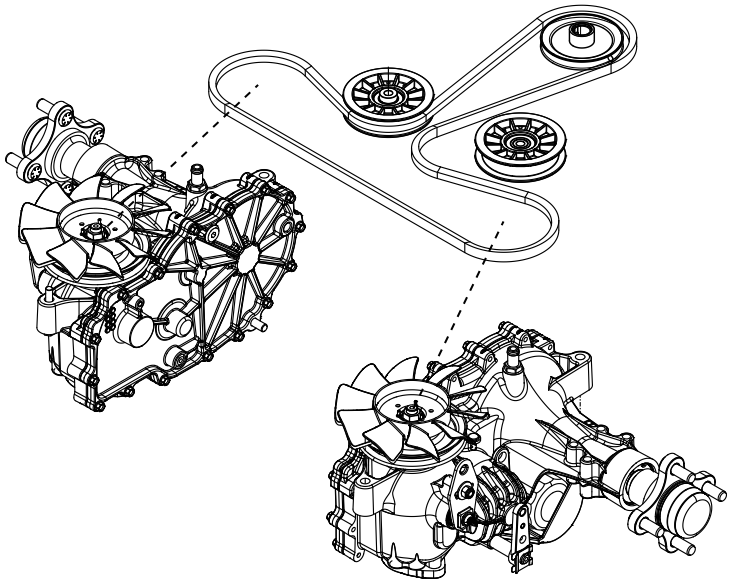
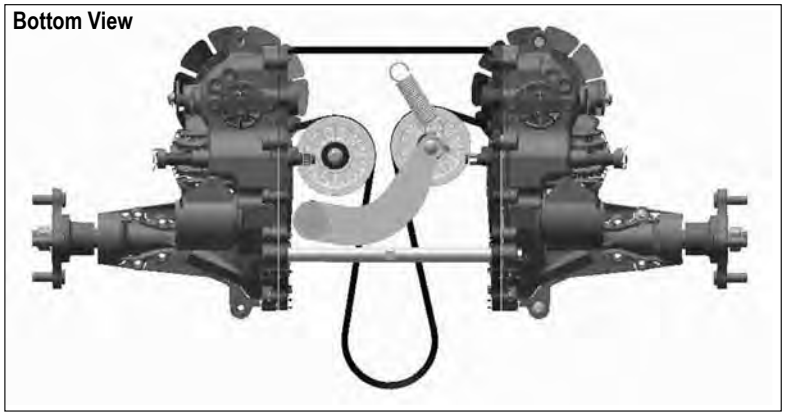


Fig. 058 PICT-2038

Hydrostatic Drive Belt Routing

(Fig. 059)





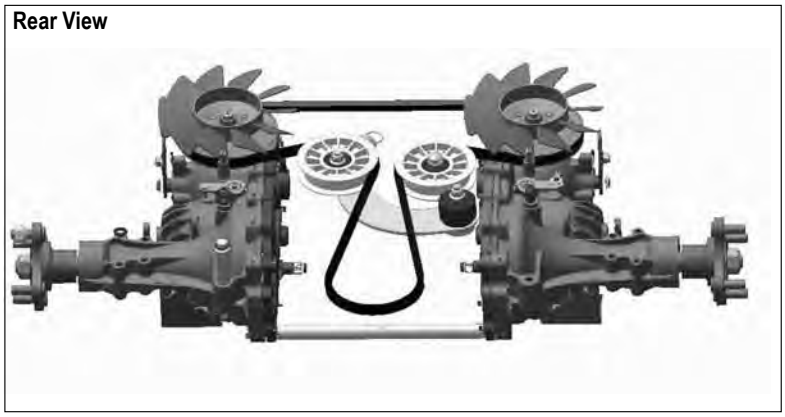


Fig. 059 PICT-2039

Hydro-Gear ZT-2800 & ZT-3100 Hydrostatic Transaxles

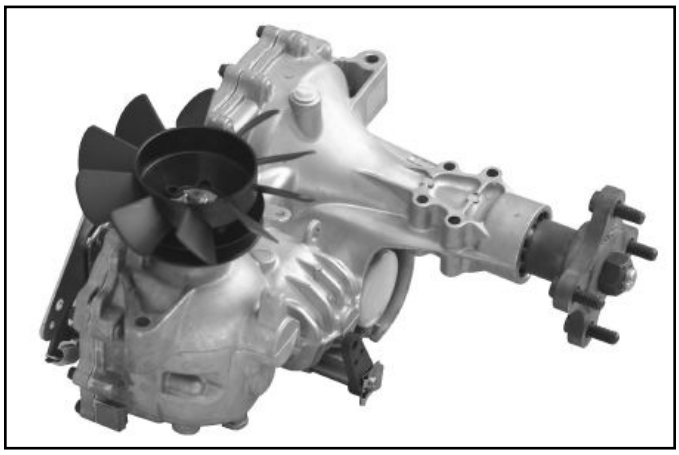
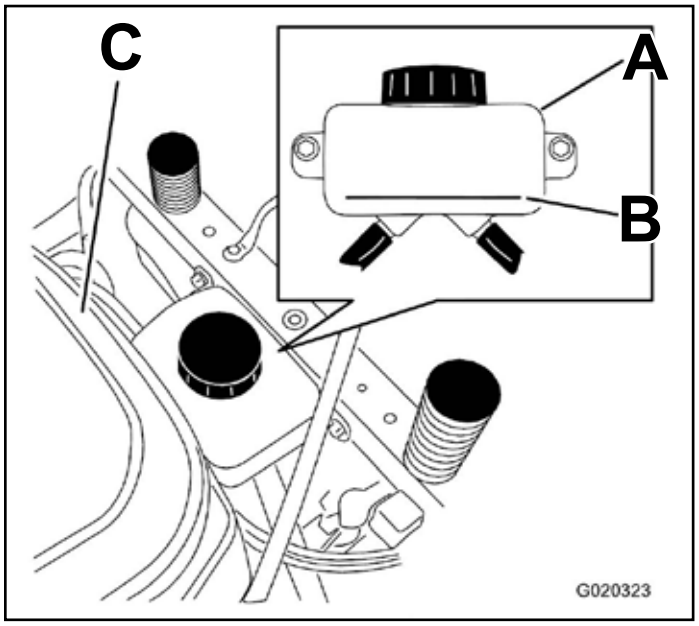


Fig. 060 PICT-1002

Lubrication	Toro HYPR-OIL® 500 or 20w50 Engine Oil
Oil Capacity ZT-2800	77.23 fl. oz. (2284ml) each
Oil Level Check	Check expansion reservoir and if necessary add the specified oil to the **FULL COLD** line. See illustration below. Also see the Hydro-Gear ZT-2800 / ZT-3100 service manual (BLN-52441).
Fluid Change Interval	After the First 50 hours - change the oil and filters for the hydraulic system and bleed the system. Every 400 Hours - change the oil and filters for the hydraulic system and bleed the system.

5

Checking the Hydraulic Oil Level



A. Expansion tank
B. Full cold line
C. Engine

Fig. 061 fig. 51 G020323

Neutral Adjustment

Note: Do not make neutral adjustments on cold hydrostatic drive systems. Safely warm the drive system before making adjustments.

1. Safely raise and support unit so rear wheels are off the ground.

2. Unplug the seat switch and install a jumper wire across the harness terminals.

Note: Jumping the seat switch is for testing / adjustment procedures only.
(Fig. 062)

Fig. 062 PICT-6459a

3. Start the engine and run at full RPM.

4. Verify the motion control handles are in the outward neutral position.

5. Release the parking brake and observe rear tire movement. If the tire is creeping in either forward or reverse, a neutral adjustment is required.

Note: A slight amount of reverse creep is acceptable.
(Fig. 063)

Fig. 063 PICT-6486a

6. Turn engine off.

7. Remove the fender / pod assembly / control panel of the side that needs neutral adjustment as shown in chapter 3.
(Fig. 064)

Fig. 064 PICT-6483

8. Remove the hairpin and clevis from the adjustable yoke (Fig. 065).

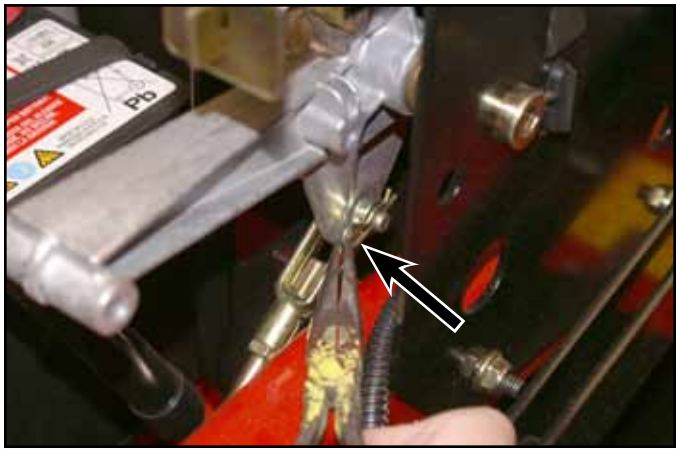


Fig. 065 PICT-6471a

9. Loosen the jam nut on the hydro linkage rod (Fig. 066).

Fig. 066 PICT-6474a

10. Turn the yoke assembly to lengthen / shorten the control rod as needed to achieve proper neutral adjustment (Fig. 067).

Fig. 067 PICT-6478a

11. Install the clevis pin and hairpin back into the yoke assembly.

12. Start the engine and run it at full RPM.

13. Stroke the control handles in forward and reverse. Move the control into the neutral position and verify the rear wheels do not rotate forward or reverse.

Note: A slight amount of reverse creep is acceptable.

14. Turn engine off.

15. Readjust neutral setting if required.

16. Install the fender / pod assembly / control panel assembly as shown in chapter 3.

17. Remove the seat switch bypass jumper wire and reconnect the seat switch harness connection.

18. Safely lower the unit and verify proper drive system function.

Tracking Adjustment

Note: Do not make tracking adjustments on cold hydrostatic drive systems. Safely warm the drive system before making adjustments.

- Adjust the eccentric on the LEFT side if the unit pulls to the RIGHT

- Adjust the eccentric on the RIGHT side in the unit pulls to the LEFT.

1. Remove the (1) bolt that secures the control panel cover to access the adjustment eccentric (Fig. 068). (RH side shown)

Fig. 068 PICT-2040

2. Hold the pivot bolt in position with a 1/4” hex wrench, and then slightly loosen the eccentric pivot nut (A) (Fig. 069).

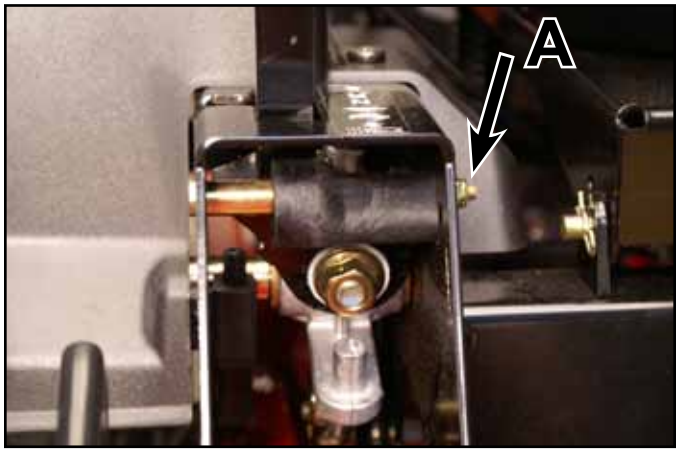


Fig. 069 PICT-6488

3. Use a 1/4” hex wrench to adjust the eccentric pivot bolt until the unit tracks straight (Fig. 070).

Fig. 070 PICT-6495

4. After proper tracking has been achieved, hold the pivot bolt in position with a 1/4” hex wrench, and then torque the eccentric pivot nut (A) to specification – 8 ft-lbs. (11 Nm).

5. Install the control panel cover, then torque the retaining bolt to specification – 4.5 ft-lbs. (6 Nm).

6. Verify proper drive system function.

Purging Procedure

Due to the effects air has on efficiency in hydrostatic drive applications, it is critical that it is purged from the system.

This purge procedure should be implemented any time a hydrostatic system has been opened to facilitate maintenance, any additional oil has been added to the system, or a replacement transaxle has been installed.

Air creates inefficiency because its compression and expansion rate is higher than that of the oil in hydrostatic drive systems.

The resulting symptoms of air in hydrostatic systems may be:

- Noisy operation
- Lack of power or drive after short term operation.
- High operation temperature and excessive expansion of “oil”; in the latter case, oil may overflow.

The following procedure should be performed with the drive wheels off the ground and then repeated under operating conditions.

1. With the bypass valve open (push position) and the engine running, slowly move the control handles (forward/reverse levers) in both forward and reverse directions 5 to 6 times; as air is purged from the transaxles, the oil level will drop.
2. With the bypass valves in the closed position (drive position) and the engine running, slowly move the control handles in both forward and reverse directions 5 to 6 times.
3. It may be necessary to repeat steps 1 and 2 until all air is completely purged from the transaxles. When the transaxles move forward at normal speed, purging is complete.

Hydrostatic Drive Belt Replacement

Hydrostatic Drive Belt Removal

1. Safely raise and support unit so rear wheels are off the ground.

2. Remove PTO belt tensioner spring (A) from the deck to relieve PTO belt tension as shown in chapter 6 (Fig. 071).

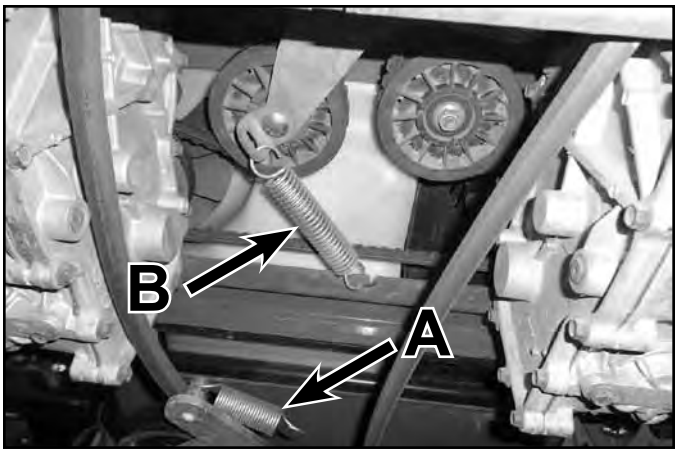


Fig. 071 PICT-2041

3. Remove PTO belt from PTO clutch.

4. Disconnect the wire harness connection to the PTO clutch.

5. Remove the PTO clutch bolt and then remove the clutch from the engine crankshaft.

6. Remove the drive belt tensioner spring (B) (Fig. 071).

7. Remove the belt from around the crankshaft drive pulley then remove the drive pulley from the engine crankshaft. Make note of pulley orientation for assembly.

8. Disengage the drive belt from the tensioner pulley and idler pulley.

9. Remove the belt from around both hydro input pulleys. Do not bend or damage the hydro cooling fans while walking the belt upward off the input pulleys.

10. Remove the belt from the unit and inspect. Replace if necessary.

11. Inspect the idler arm / tensioner pivot and pulley bearings for excessive wear and replace if necessary (Fig. 072).

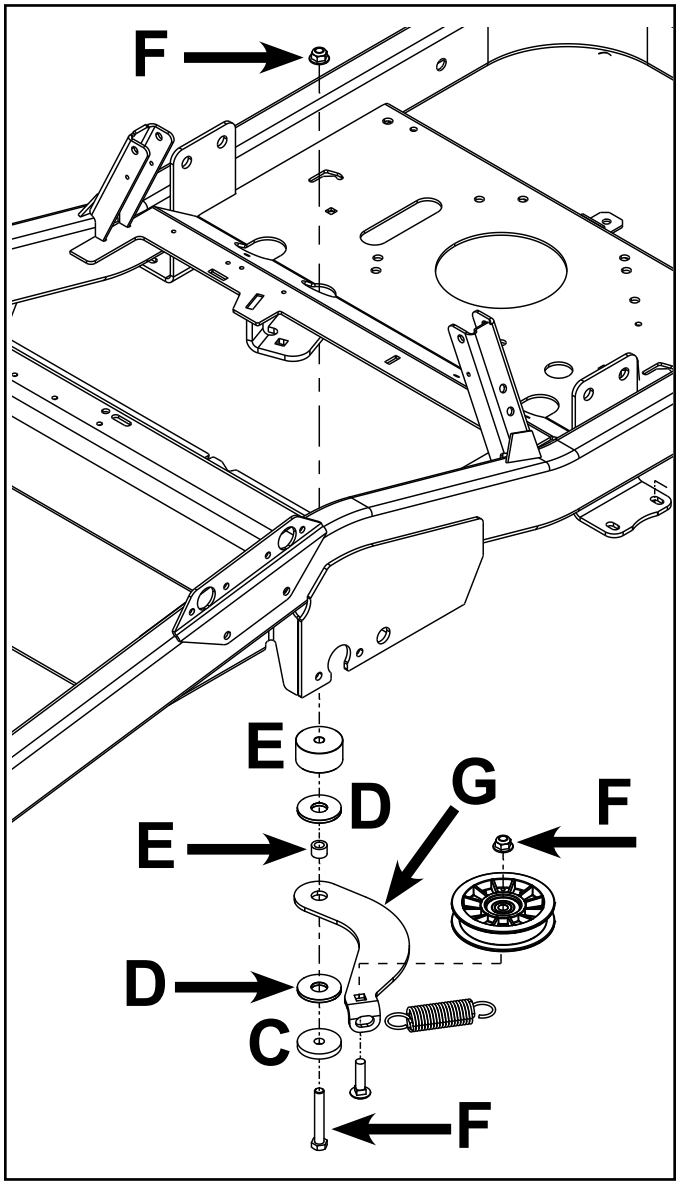


Fig. 072 PICT-2042

C. Washer
D. Friction washer - composite
E. Spacer
F. 30 ft-lbs. (40 Nm)
G. Arm

Hydrostatic Drive Belt Installation

1. Properly route the belt around the (2) hydro input pulleys, and (2) tensioner / idler pulleys (Fig. 073).

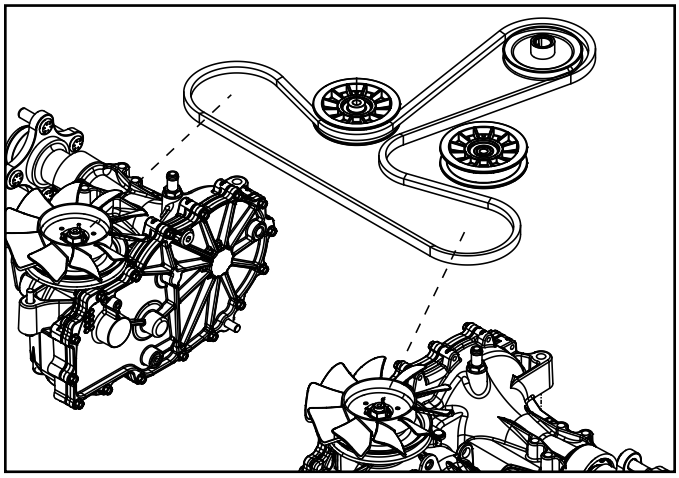


Fig. 073 PICT-2043

2. Install the drive pulley onto the crankshaft and hold in position.

Note: The drive pulley is marked "CLUTCH SIDE" for proper installation (Fig. 074).

Fig. 074 PICT-2044

3. Install the drive belt around the drive pulley.

4. Install the drive belt tensioner spring as oriented below (Fig. 075).

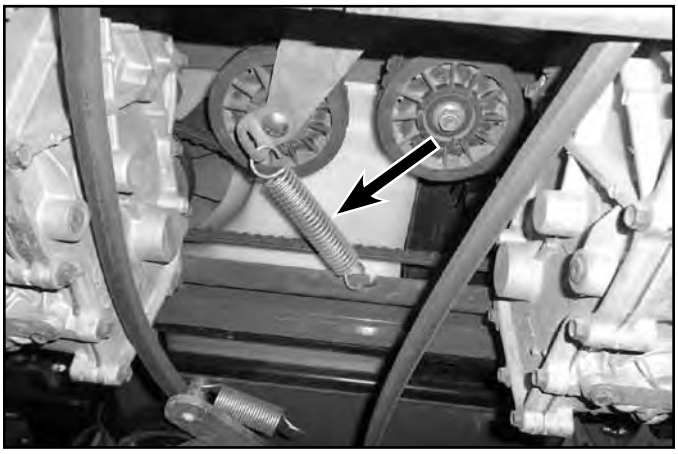


Fig. 075 PICT-2041

5. Apply Loctite® 242 to the PTO clutch bolt threads.

6. Install the PTO clutch. Be sure the PTO clutch stop bracket is properly engaged into the clutch slot (Fig. 076).

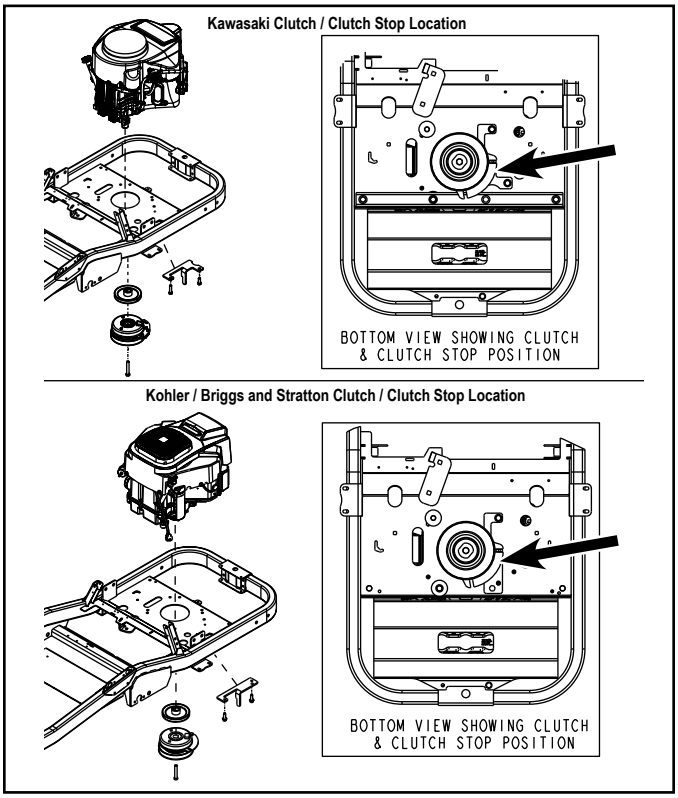


Fig. 076 PICT-2045

7. Torque the clutch bolt to specification - 55 ft-lbs. (75 Nm).

8. Install the PTO belt around the PTO clutch pulley.

9. Verify proper PTO belt routing and then install the PTO belt tensioner spring to the deck. See PTO Belt Replacement and Belt Routing on page 6-5.

10. Safely lower unit and verify proper drive system function.

Transaxle Replacement

Transaxle Removal – RH Side Shown

1. Disconnect the battery terminals.

2. Safely raise and support rear of unit so rear wheels are off the ground.

3. Remove the rear wheels.

4. Remove the parking brake return spring (A) from the rod and spring plate.

5. Remove the retaining pin (B) from the brake linkage then remove the brake rod from the hydro arm.

6. Remove the hydro bypass rod (C), retaining clip, and washer then remove the rod from the unit.

7. Remove the hydro control rod nut and bolt (D) (Fig. 077).

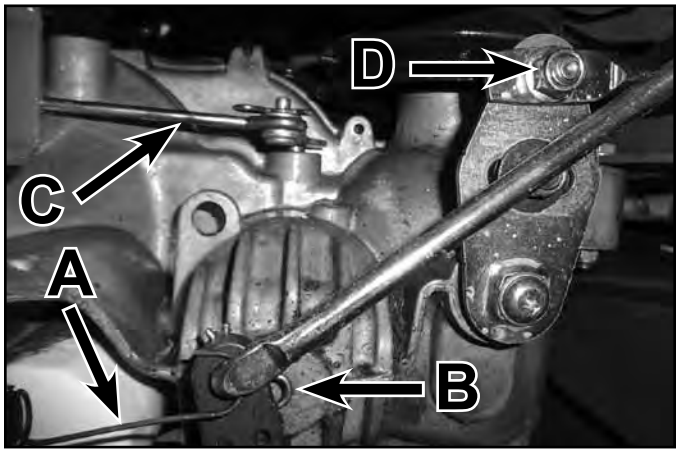


Fig. 077 PICT-2046

8. Remove the drive belt tensioner spring (Fig. 078).

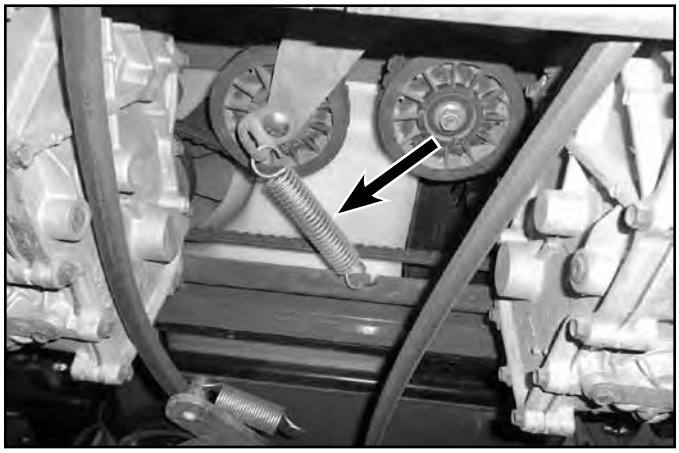


Fig. 078 PICT-2041

9. Slip the drive belt off the idler / tensioner pulleys, then off the appropriate hydro input pulley.

10. Disconnect and plug the hydro reservoir hoses at the hydro fitting. Be sure to capture and dispose of fluid and shop towels properly (Fig. 079).

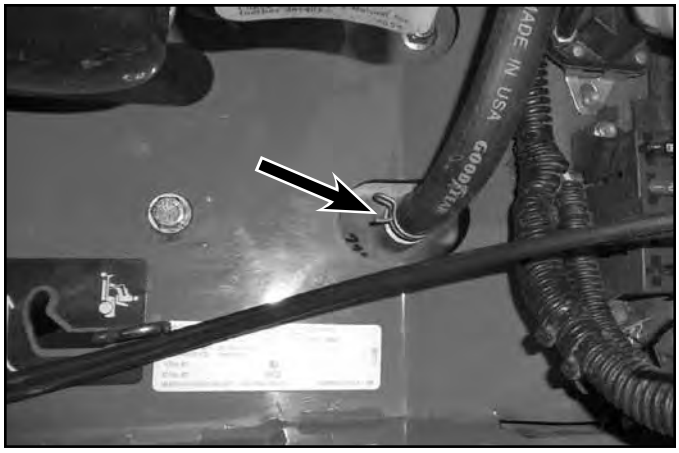


Fig. 079 PICT-2047

11. Remove the (2) bolts that secure hydro center support. Remove support from the unit (Fig. 080).

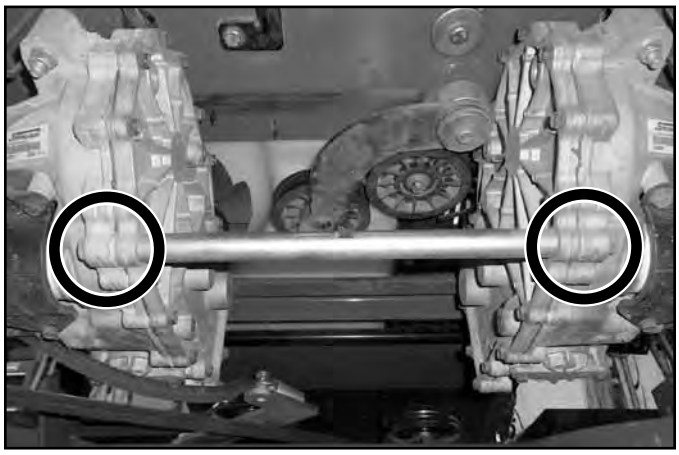


Fig. 080 PICT-2048

12. Safely support hydro assembly in current position using a hydraulic floor jack. Remove the (2) outer hydro mounting fasteners (Fig. 081).

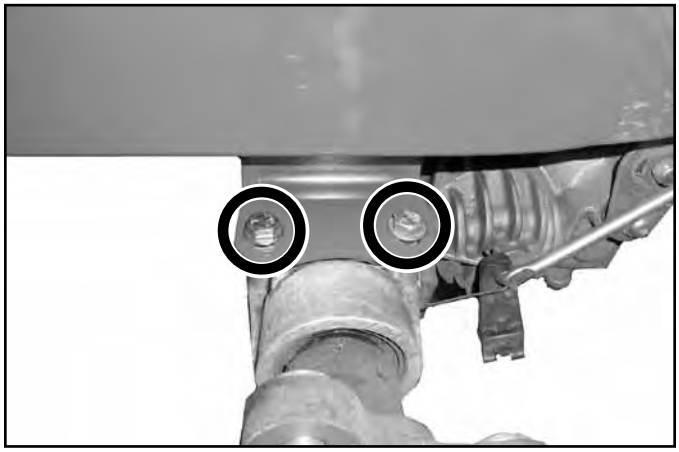


Fig. 081 PICT-2049

5

13. Remove the (1) front hydro mount fastener (Fig. 082).

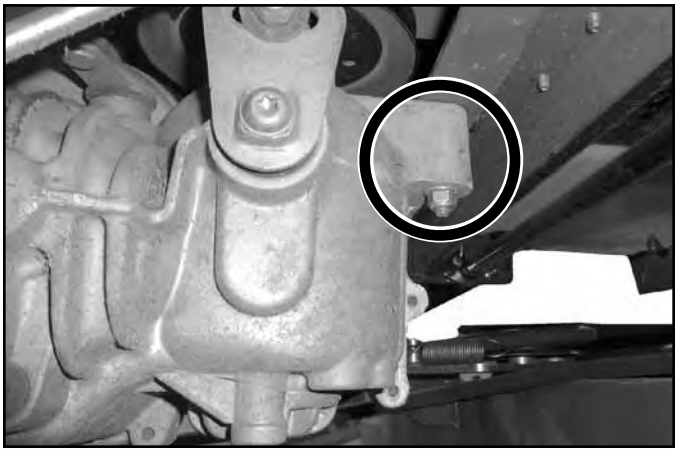


Fig. 082 PICT-2050

14. Remove the (1) rear hydro mounting fastener (Fig. 083).

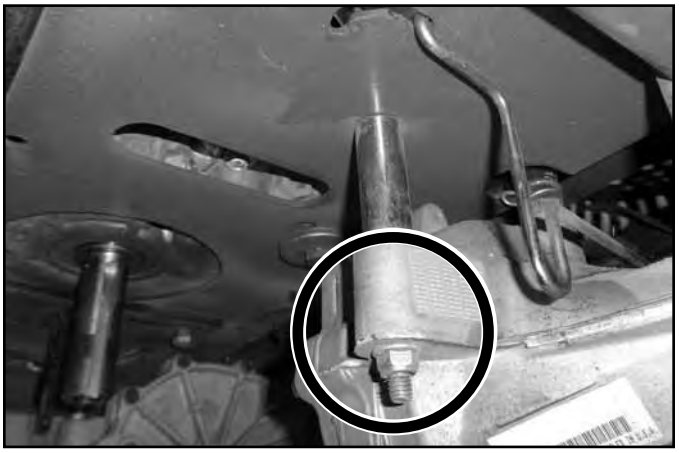


Fig. 083 PICT-2051

15. Lower the hydro assembly then remove it from the frame.

Transaxle Installation

1. Position the hydro assembly up into the unit frame and align mounting points.

2. Apply Loctite® 242 to the (2) hydro center support bolts.

3. Loosely install **ALL** hydro mounting spacers, fasteners and center support bolts. Do not fully tighten at this time.

4. Torque hydro mounting fasteners in sequence to specification and shown:

   1st – Apply Loctite 242 to the hydro center support bolts. Torque bolts to specification – 17 ft-lbs. (23 Nm) (Fig. 084).

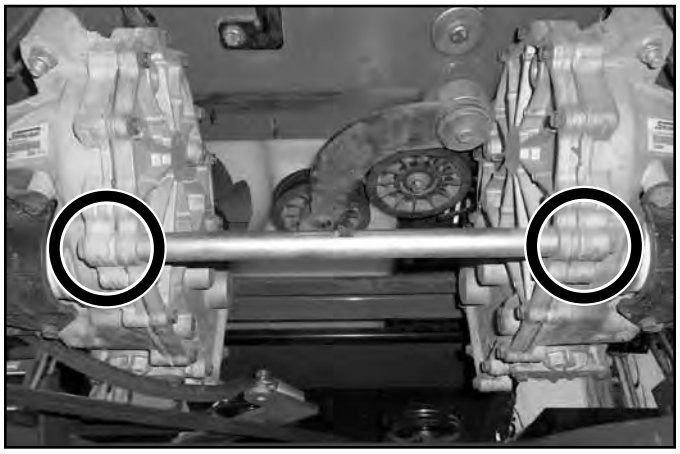


Fig. 084 PICT-2048

2nd - Torque the (1) front hydro mount fastener to specification – 17 ft-lbs. (23 Nm) (Fig. 085).

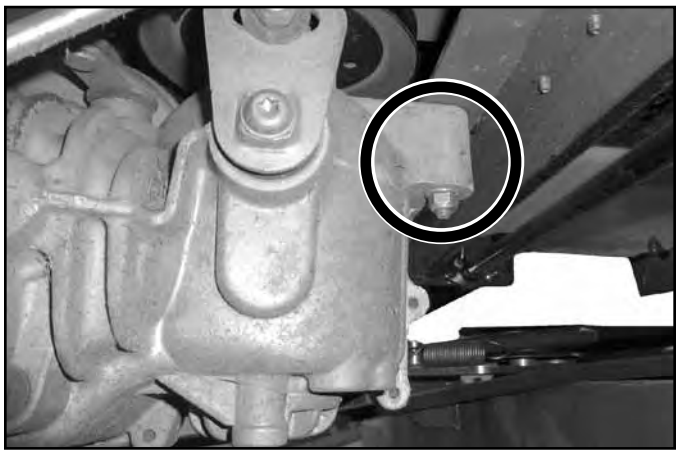


Fig. 085 PICT-2050

3rd – Torque the (1) rear hydro mount fastener to specification – 17 ft-lbs. (23 Nm) (Fig. 086).

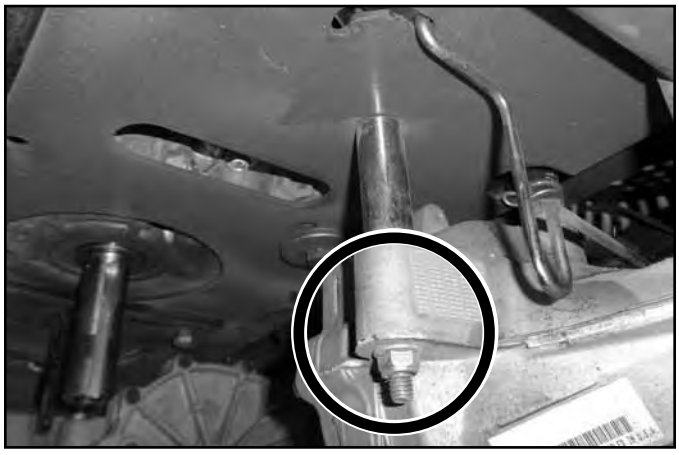


Fig. 086 PICT-2051

4th – Torque the (2) outside hydro mount fasteners to specification – 17 ft-lbs. (23 Nm) (Fig. 087).

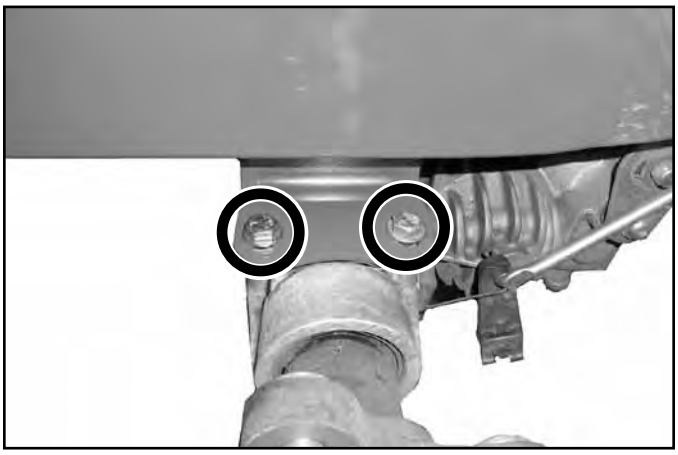


Fig. 087 PICT-2049

5. Connect the hydro reservoir hoses at the hydro fitting (Fig. 088).

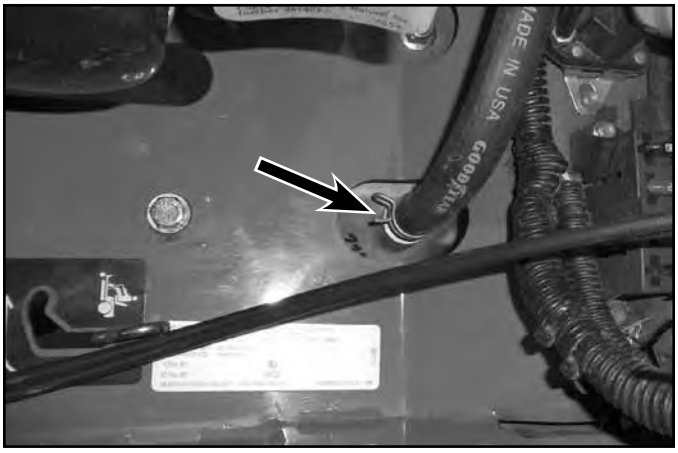


Fig. 088 PICT-2047

5

6. Install the hydro drive belt and verify proper routing (Fig. 089).

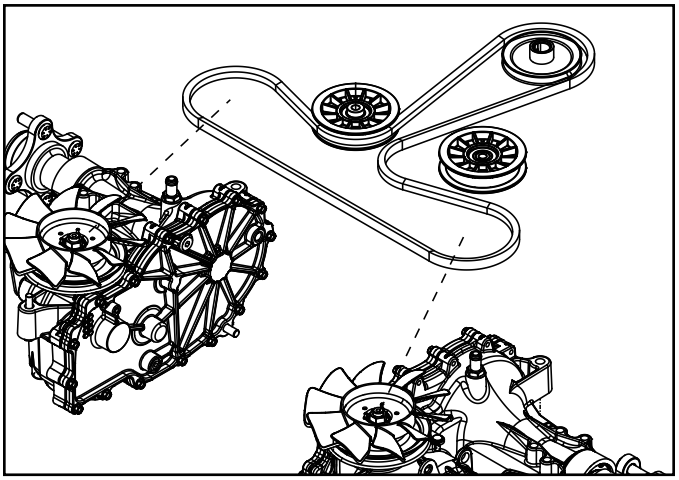


Fig. 089 PICT-2043

7. Install and orient the drive belt tensioner spring as shown (Fig. 090).

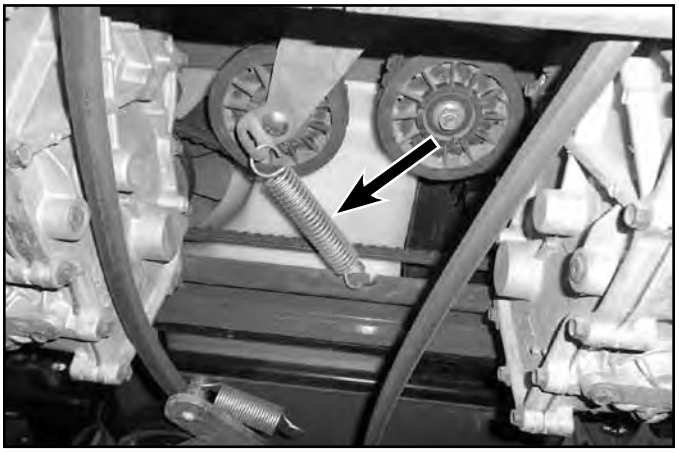


Fig. 090 PICT-2041

8. Install the parking brake return spring (A).

9. Install the brake rod into the hydro arm and insert the retaining pin (B).

10. Install the hydro bypass rod, washer and retaining clip (C).

11. Install the hydro control rod nut and bolt (D) and torque to specification - 17 ft-lbs. (23 Nm) (Fig. 091).

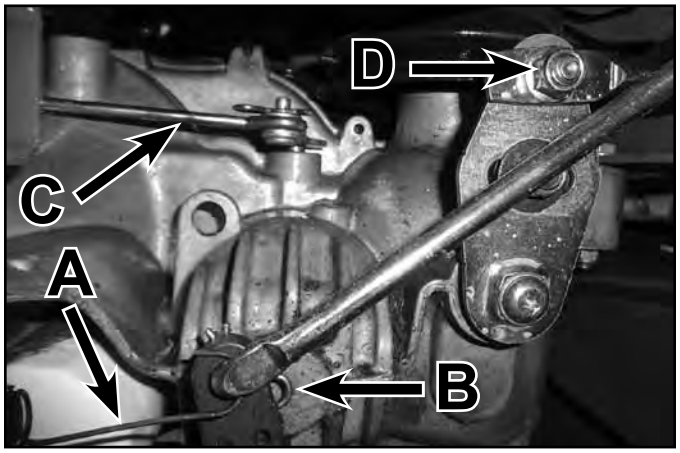


Fig. 091 PICT-2046

12. Install the rear wheels and torque lug nuts to specification – 80 ft-lbs. (108 Nm).

13. Connect battery terminals.

14. Safely lower unit.

15. Add 20w50 engine oil or Toro HYPR-OIL® 500 to the hydro reservoir FULL COLD mark.

16. Perform the purging procedure as shown in this chapter.

17. Perform the neutral and tracking adjustment procedures as shown in this chapter.

18. Verify proper unit oil levels and function.

Mower Deck Exploded Views

48 Inch Deck

(Fig. 092)

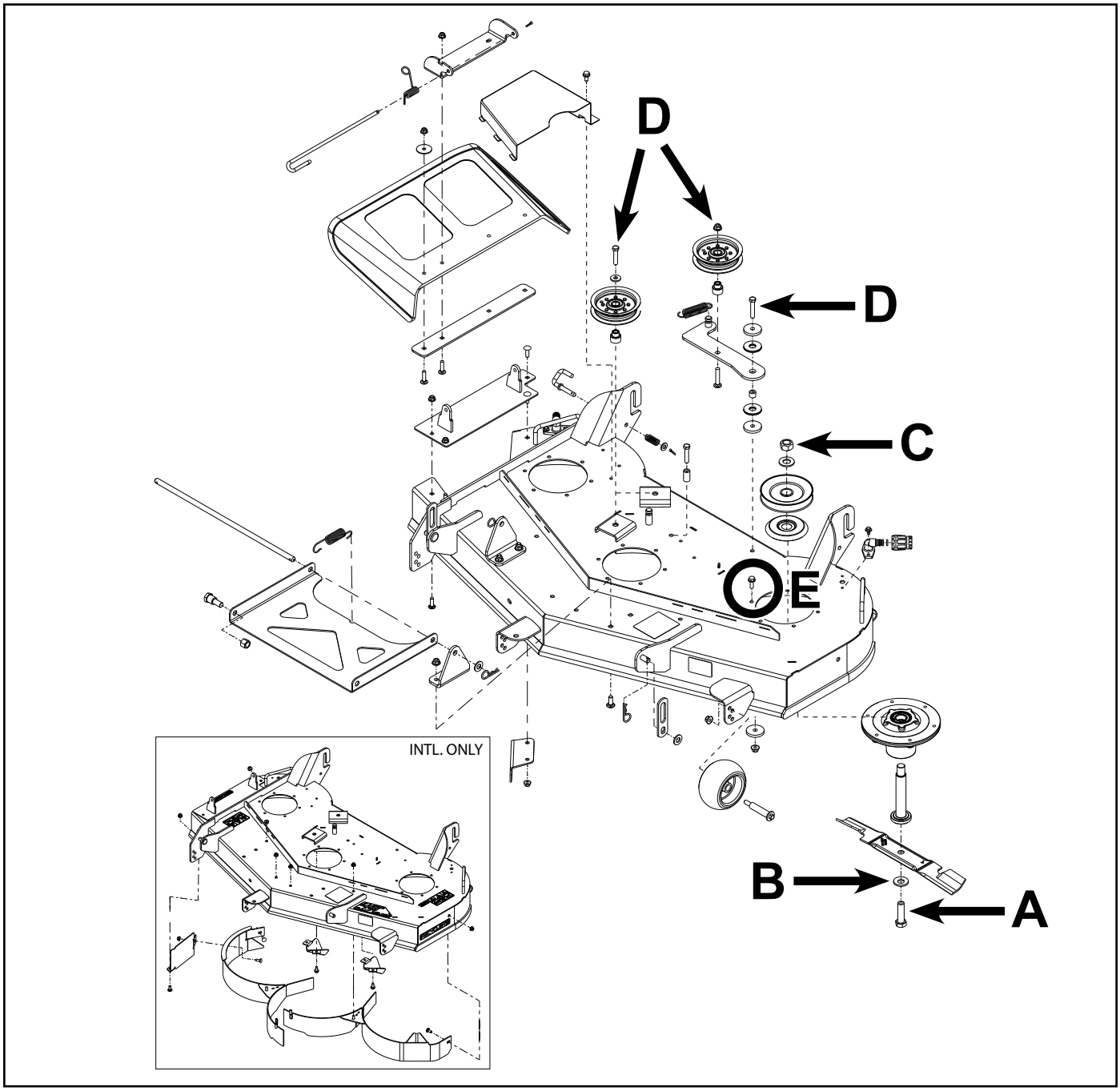


Fig. 092 PICT-2028 48

A. Blade bolt - 105 ft-lbs. (143 Nm)
B. Washer - concave side towards blade
C. Pulley Nut - 105 ft-lbs. (143 Nm)
D. 30 ft-lbs. (40 Nm)
E. Spindle housing-to-deck bolts - 14 ft-lbs. (19 Nm)

50 Inch Deck
(Fig. 093)

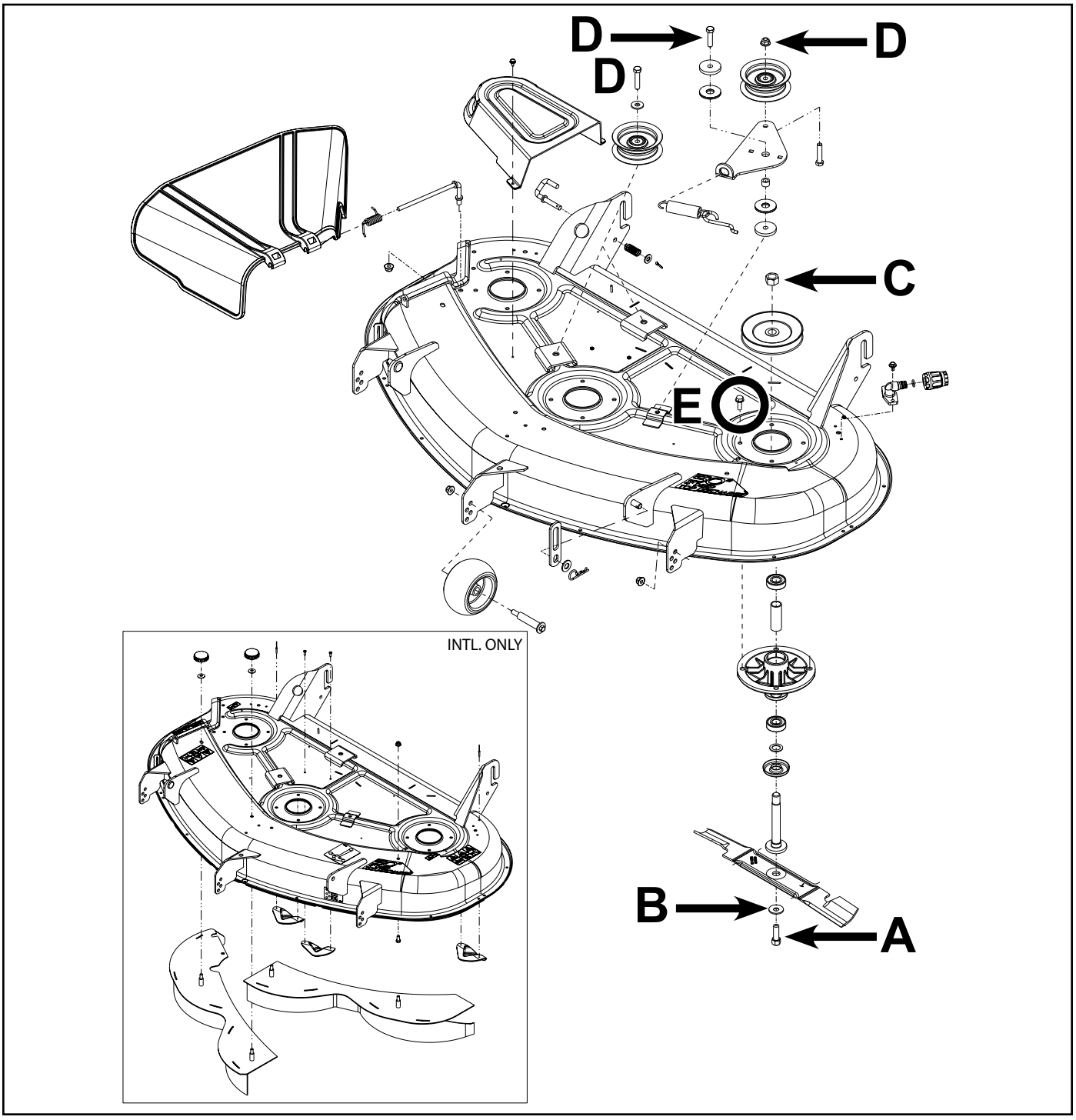


Fig. 093 PICT-2028 50

A. Blade bolt - 55 ft-lbs. (76 Nm)
B. Washer - concave side towards blade
C. Pulley Nut - 55 ft-lbs. (76 Nm)
D. 30 ft-lbs. (40 Nm)
E. Spindle housing-to-deck bolts - 17 ft-lbs. (23 Nm)

54 Inch Deck
(Fig. 094)

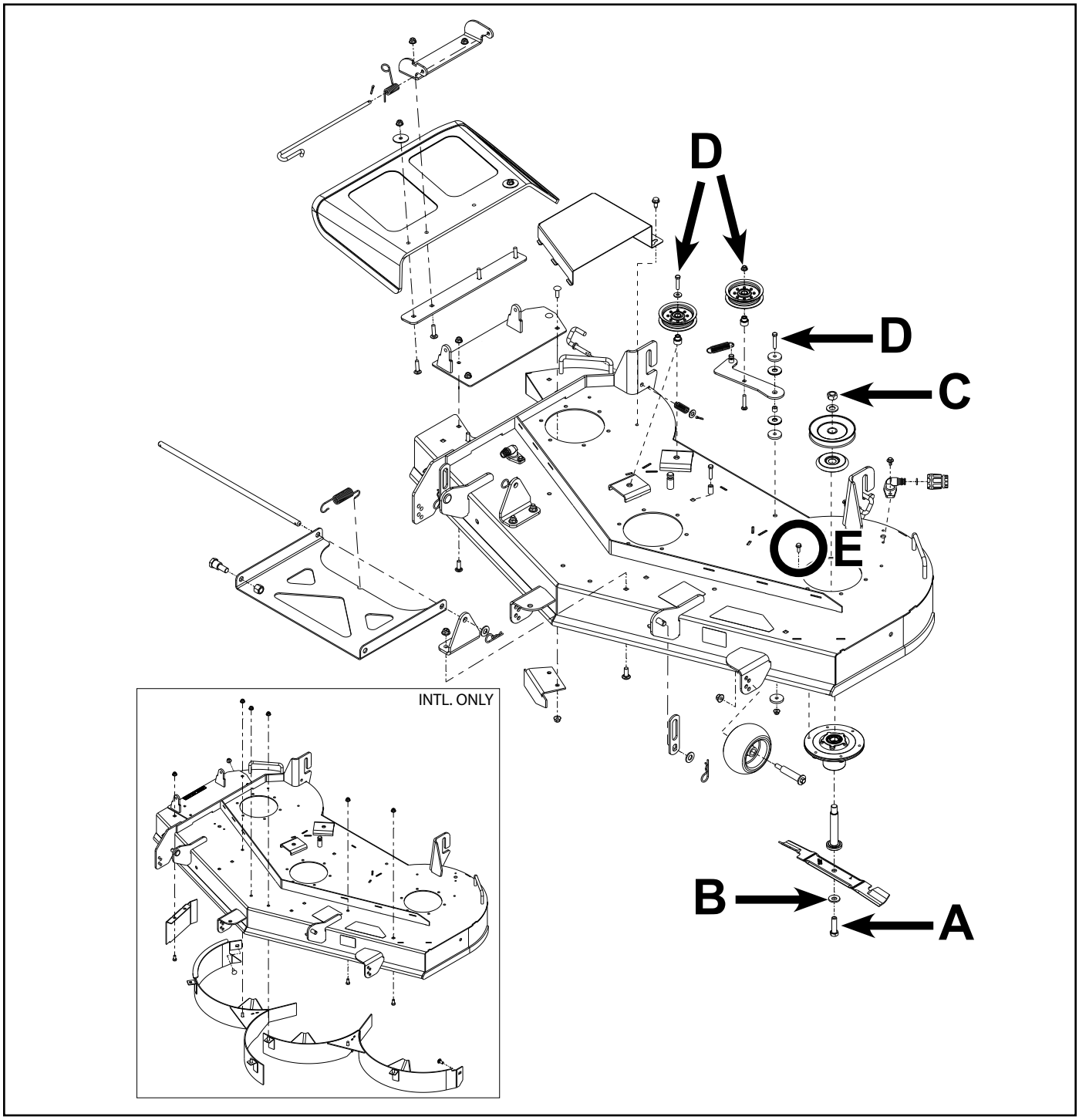


Fig. 094 PICT-2028 54

A. Blade bolt - 105 ft-lbs. (143 Nm)
B. Washer - concave side towards blade
C. Pulley Nut - 105 ft-lbs. (143 Nm)
D. 30 ft-lbs. (40 Nm)
E. Spindle housing-to-deck bolts - 14 ft-lbs. (19 Nm)

60 Inch Deck
(Fig. 095)

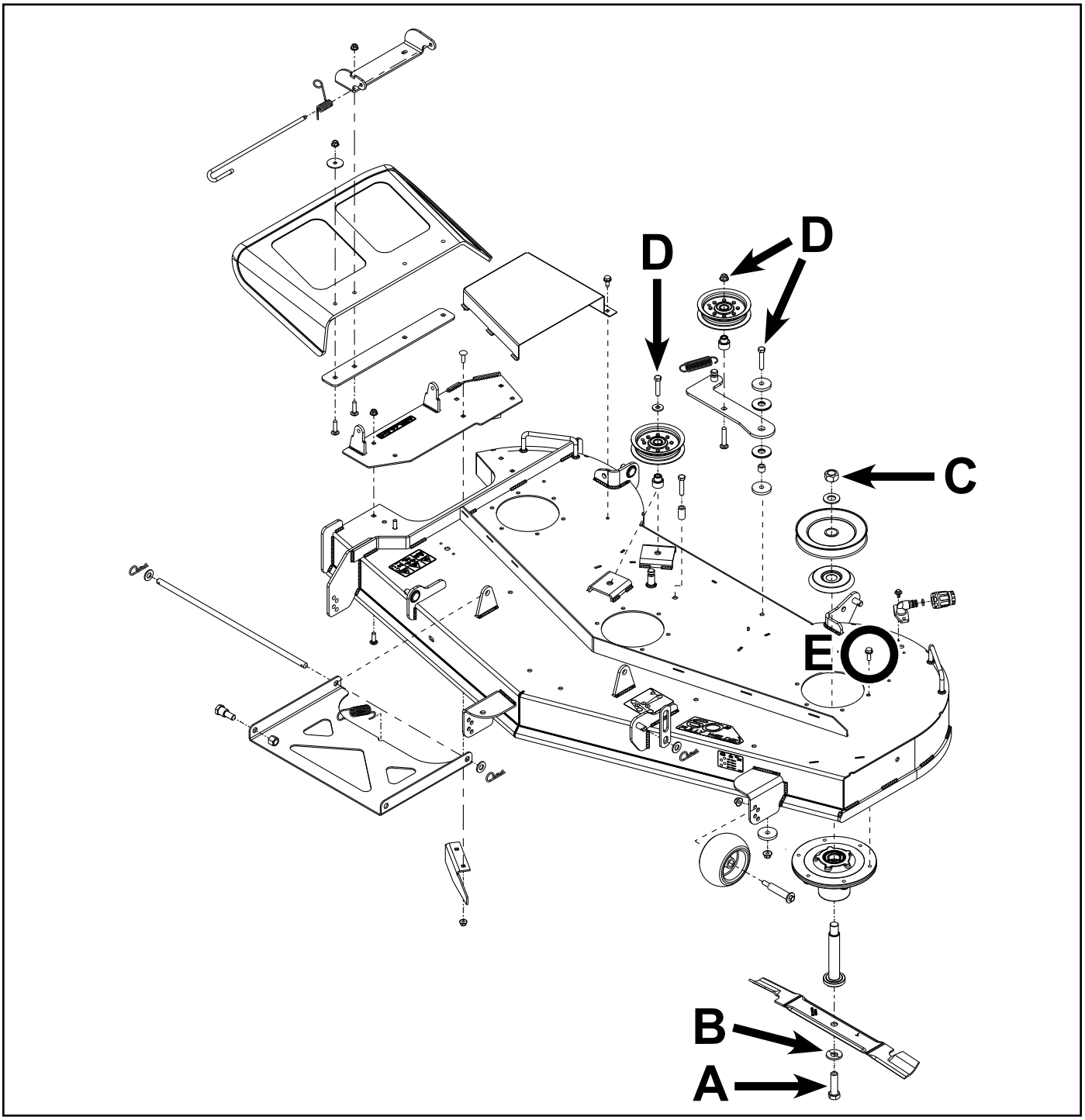


Fig. 095 PICT-2028 60

A. Blade bolt - 105 ft-lbs. (143 Nm)
B. Washer - concave side towards blade
C. Pulley Nut - 105 ft-lbs. (143 Nm)
D. 30 ft-lbs. (40 Nm)
E. Spindle housing-to-deck bolts - 14 ft-lbs. (19 Nm)

PTO Belt Replacement and Belt Routing

48, 54, 60 Inch Deck Idler / Tensioner Pulley
(Fig. 096)

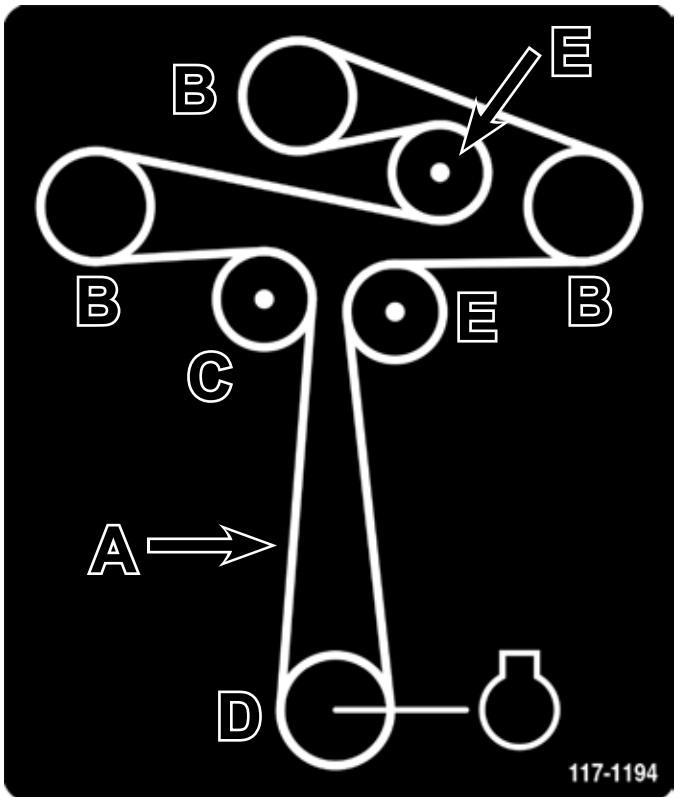


Fig. 096 PICT-2030

A. PTO Belt
B. Spindle Pulley
C. PTO Belt Tensioner
D. PTO Clutch Pulley
E. Idler

50 Inch Deck Idler / Tensioner Pulley
(Fig. 097)

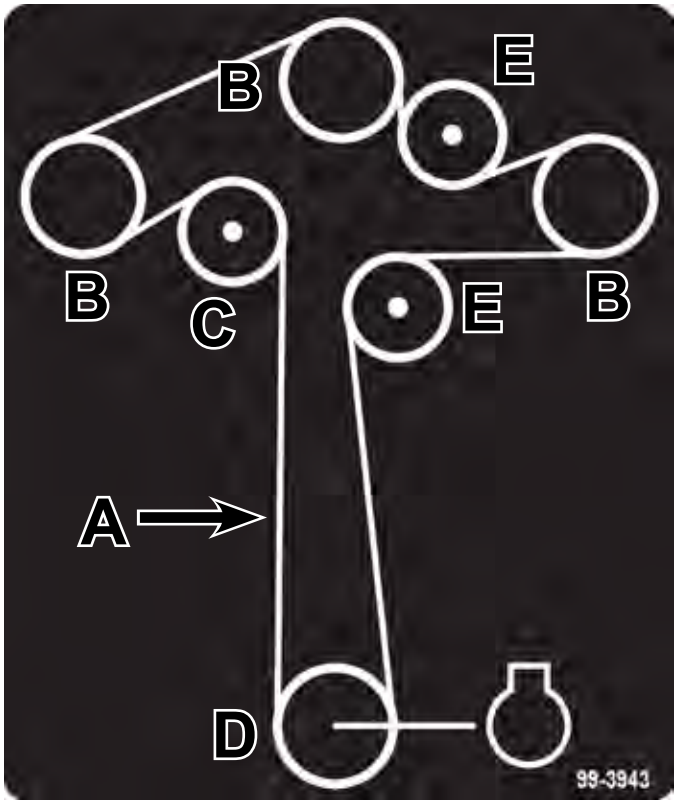


Fig. 097 PICT-2031

A. PTO Belt
B. Spindle Pulley
C. PTO Belt Tensioner
D. PTO Clutch Pulley
E. Idler

6

Inspecting the Belts

Service Interval: Every 25 hours – Check the belts for wear.

Check the belts for cracks, frayed edges, burn marks or any other damage. Replace damaged belts.

PTO Belt Replacement - 48, 54 and 60 Inch Deck

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 switch, 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. Lower the mower to the 3 inch (76mm) height-of-cut position.

4. Remove the belt covers (Fig. 098).

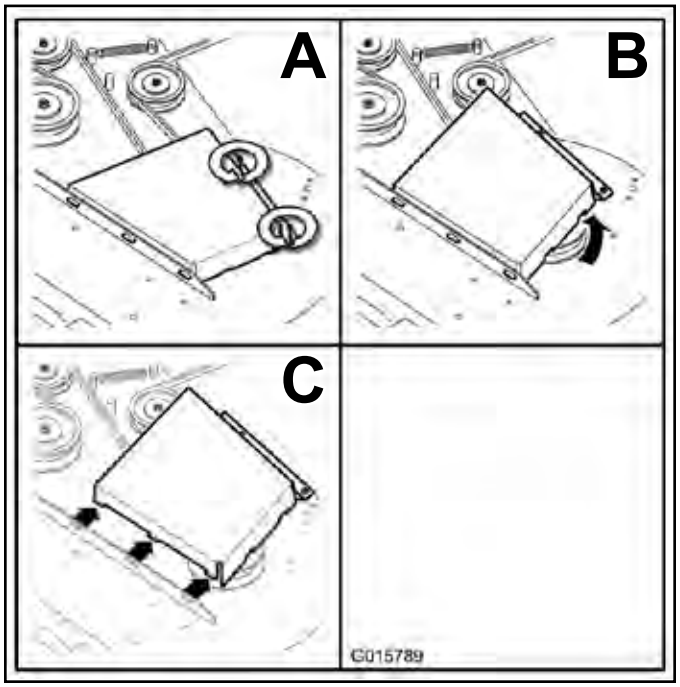


Fig. 098 fig. 67 G015789

A. Loosen the screws
B. Pivot the belt cover up
C. Remove belt cover

5. Using a spring tool, (Toro part no. 92-5771), remove the idler spring from the deck post to remove tension on the idler pulley (Fig. 099).

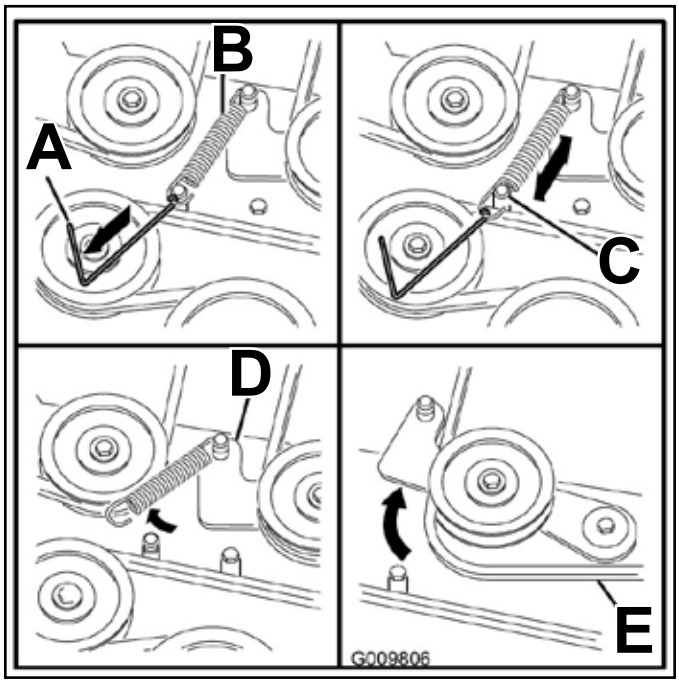


Fig. 099 fig. 68 G009806

A. Spring tool
B. Idler/Tensioner spring
C. Deck spring post
D. Idler/Tensioner arm
E. PTO belt

6. Lower the mower to the lowest height-of-cut. Place the height-of-cut pin in the lock position for lowest height-of-cut.

7. Remove the belt from the spindle pulleys and PTO clutch.

8. Install the new belt around the spindle pulleys and the PTO clutch pulley under the engine (Fig. 099).

WARNING

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

Be careful when removing the belt.

9. Using a spring tool, (Toro part no. 92-5771), install the idler spring over the deck post and placing tension on the idler pulley and mower belt (Fig. 099).

10. Ensure that the belt is properly seated in all pulleys.

11. Install the belt covers (Fig. 100).

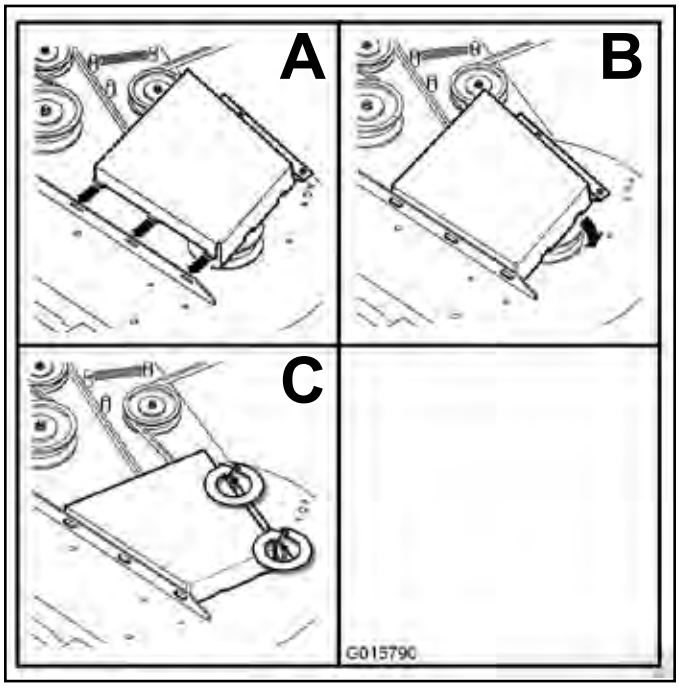


Fig. 100 fig. 69 G015790

A. Position the belt cover, ensure the tabs seat
B. Pivot the belt cover down
C. Tighten the screws

PTO Belt Replacement - 50 Inch Deck

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 PTO belt if any of these conditions are evident.

1. Park the machine on a level surface and disengage the blade control switch.
2. Move the motion control levers outward to the neutral lock position, set the parking brake, stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Lower the mower to the 3 inch (76 mm) height-of-cut.
4. Remove the belt covers over the outside spindles.
5. If necessary, remove the floor pan to access the idler pulley.
6. Using a spring tool, (Toro part no. 92-5771), remove the idler spring from the deck hook to remove tension on the idler pulley and roll the belt off of the pulleys (Fig. 101).

WARNING

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

Be careful when removing the belt.

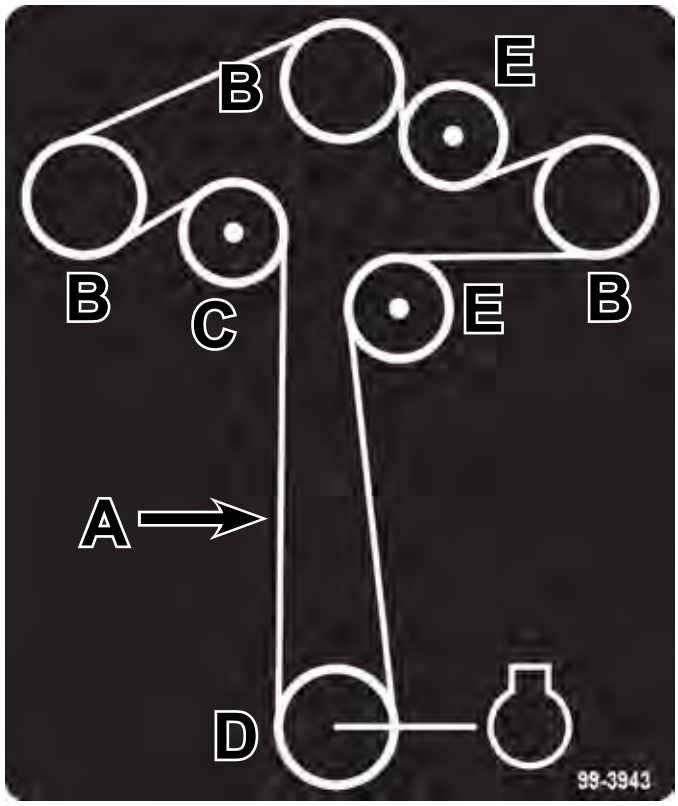


Fig. 101 PICT-2031

A. PTO Belt
B. Spindle Pulley
C. PTO Belt Tensioner
D. PTO Clutch Pulley
E. Idler

7. Route the new belt around the engine PTO pulley and spindle pulleys (Fig. 101).
8. Using a spring tool, (Toro part no. 92-5771), install the idler spring over the deck hook and placing tension on the idler pulley and mower belt route the belt onto the idler pulley (Fig. 101).
9. Ensure that the belt is properly seated in all pulleys.
10. Install the belt covers over the outside spindles.

Mower Deck Replacement

Mower Deck Removal - 48 and 54 Inch Deck

1. Park the machine on a level surface and disengage PTO switch.
2. Move the motion control levers outward to the neutral position and engage parking brake.
3. Stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
4. Lower the mower to the 3 inch (76mm) height-of-cut position.
5. Remove the PTO belt tensioner spring and remove the PTO belt from the engine pulley.
6. Lower the mower to the lowest height-of-cut.
7. Move the spring loaded J-hooks out of the slot in the rear hanger brackets on both sides of the deck (Fig. 102).

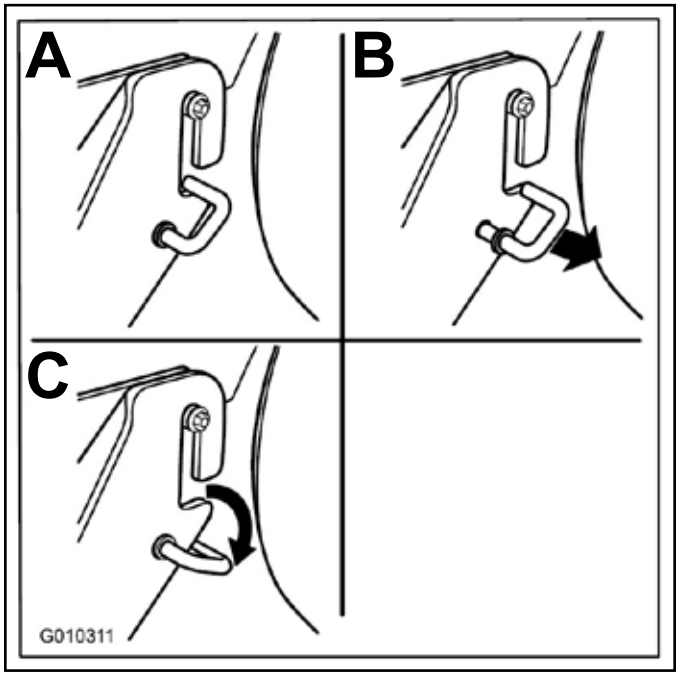


Fig. 102 fig. 70 G010311

8. Remove the hardware from the front deck hangers on both sides of the deck (Fig. 103).

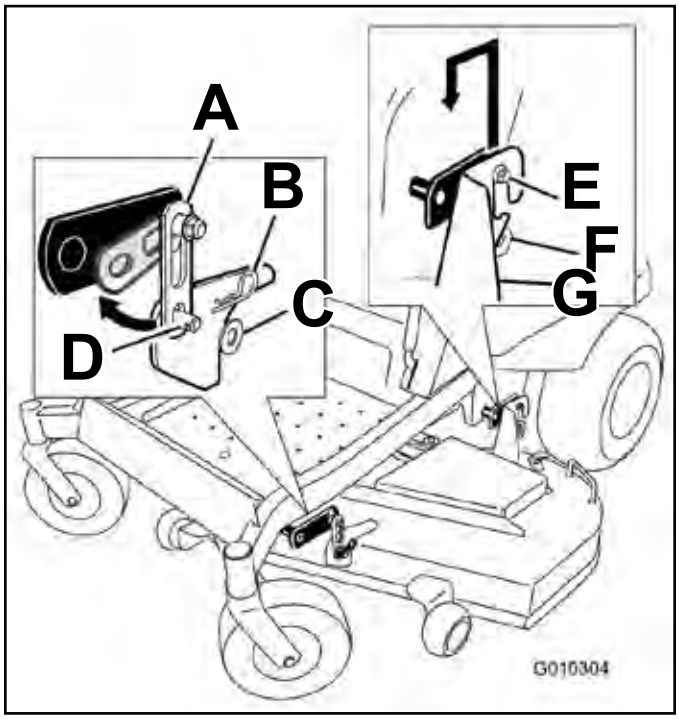


Fig. 103 fig. 71 G010304

A. Deck hanger
B. Hairpin
C. Washer
D. Welded post on deck
E. Rear hanger bolts
F. J-hook
G. Rear deck hanger bracket

9. Carefully lift the deck off the rear hanger bolts and lower the front of the mower deck to the ground.
10. Raise the height-of-cut to the transport position.
11. Slide the mower out from underneath the machine.

Mower Deck Installation - 48 and 54 Inch Deck

1. Slide the deck under the machine.
2. Lower the height-of-cut lever to the lowest position. Place the height-of-cut pin in the lock position for lowest height-of-cut.
3. Lift the rear of the mower deck and guide the hanger brackets over the rear hanger bolts.
4. Attach the front support on the mower deck to the front deck hangers and secure them with a washer and hairpin (Fig. 104).

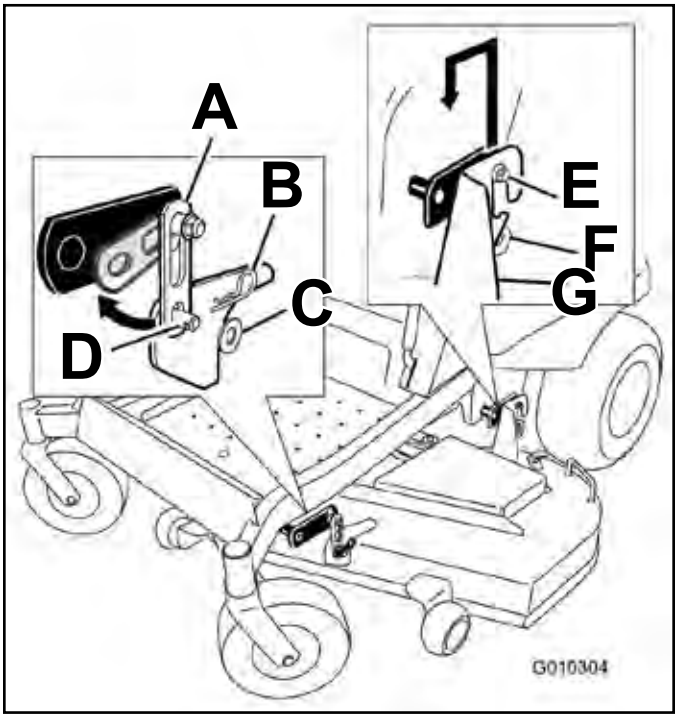


Fig. 104 fig. 71 G010304

A. Deck hanger
B. Hairpin
C. Washer
D. Welded post on deck
E. Rear hanger bolts
F. J-hook
G. Rear deck hanger bracket

5. Properly route and install the PTO belt and tensioner spring.

Mower Deck Removal - 60 Inch Deck

1. Park the machine on a level surface and disengage PTO switch.
2. Move the motion control levers outward to the neutral position and engage parking brake.
3. Stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
4. Lower the mower to the 3 inch (76mm) height-of-cut position.
5. Remove the PTO belt tensioner spring and remove the PTO belt from the engine pulley.
6. Remove the hairpin and washer securing the long, link bar to the frame and deck; remove the link bar (Fig. 105).

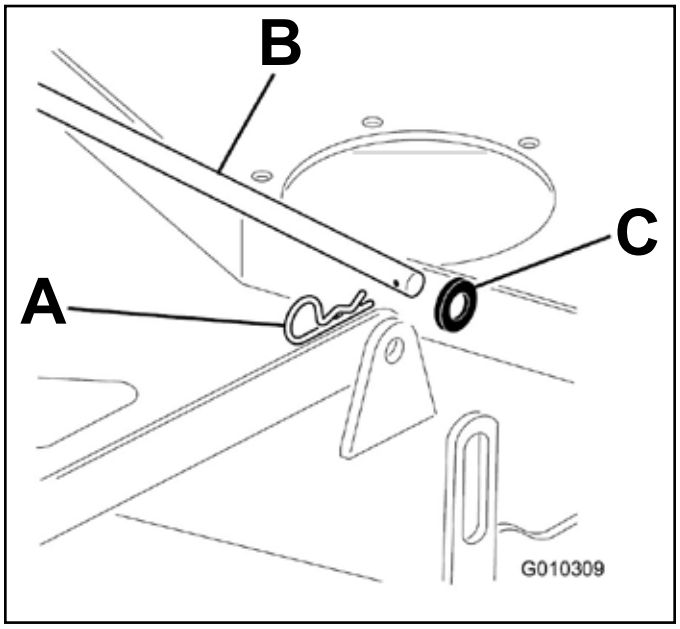


Fig. 105 fig. 72 G010309

A. Hairpin
B. Link bar
C. Washer

7. Remove the hardware from the front and rear deck hangers on both sides of the deck (Fig. 106).

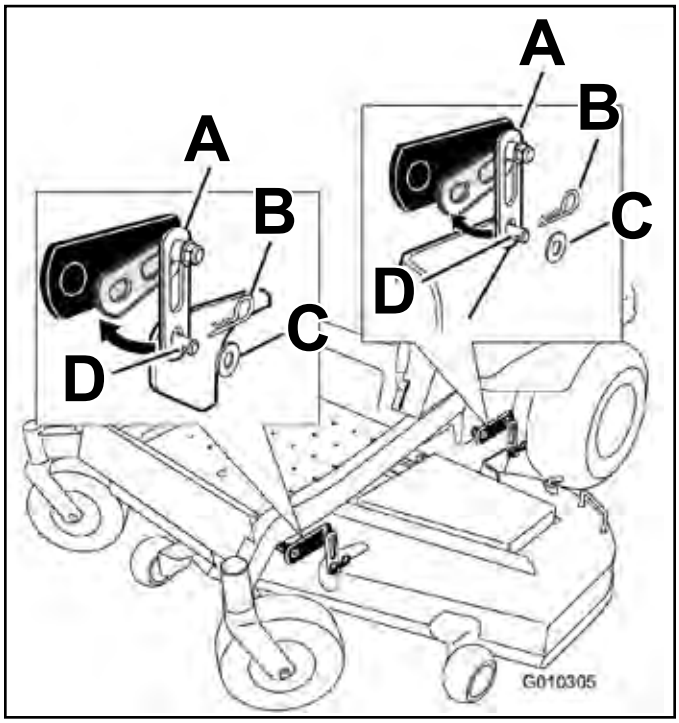


Fig. 106 fig. 73 G010305

A. Deck hanger
B. Hairpin
C. Washer
D. Welded post on deck

8. Raise the height-of-cut to the transport position.

9. Slide the mower out from underneath the machine.

Mower Deck Installation - 60 Inch Deck

1. Slide the mower under the machine.

2. Lower the height-of-cut lever to the lowest position. Place the height-of-cut pin in the lock position for lowest height-of-cut.

3. Lift the rear of the mower deck and attach the rear support on the mower deck to the rear deck hangers. Secure them with a washer and hairpin.

4. Attach the front support on the mower deck to the front deck hangers and secure them with a washer and hairpin (Fig. 106).

5. Install the long, link bar through the frame hanger and deck. Secure the link bar with the hairpin and washers removed previously (Fig. 107).

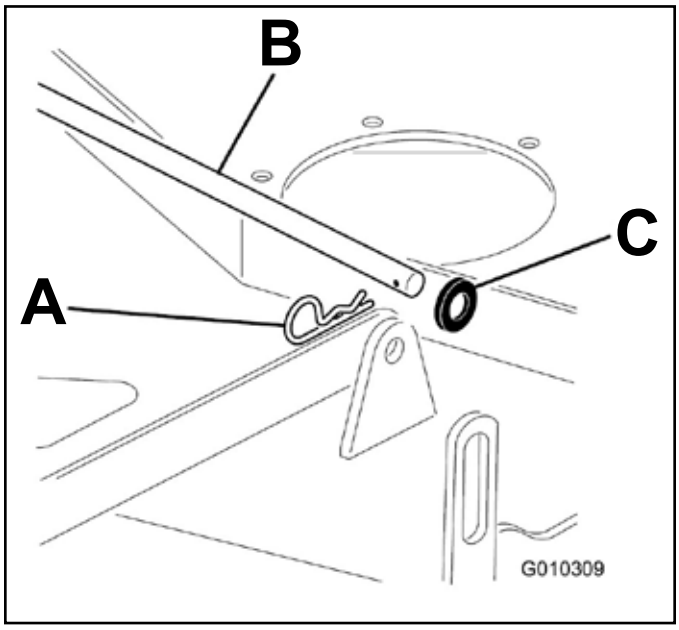


Fig. 107 fig. 72 G010309

A. Hairpin
B. Link bar
C. Washer

6. Properly route and install the PTO belt, then install tensioner spring.

Mower Deck Removal - 50 Inch Deck

1. Park the machine on a level surface and disengage the blade control switch.
2. Move the motion control levers outward to the neutral position, engage parking brake, stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.
3. Lower the mower to the 3 inch (76mm) height-of-cut position.
4. Remove the PTO belt tensioner spring, then remove PTO belt from PTO clutch.
5. Lower the height-of-cut lever to the lowest position.
6. Move the spring loaded J-hooks out of the slot in the rear hanger brackets on both sides of the deck (Fig. 108).

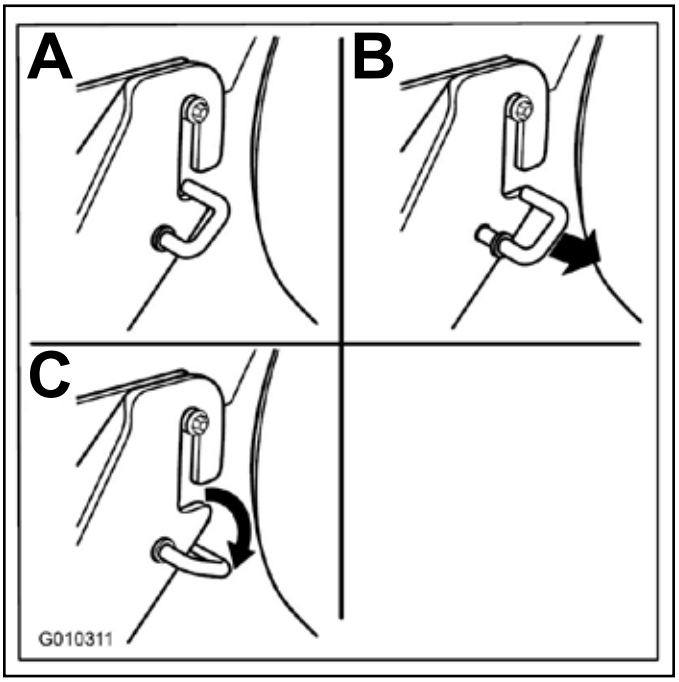


Fig. 108 fig. 70 G010311

7. Remove the hardware from the front deck hangers on both sides of the deck (Fig. 109).

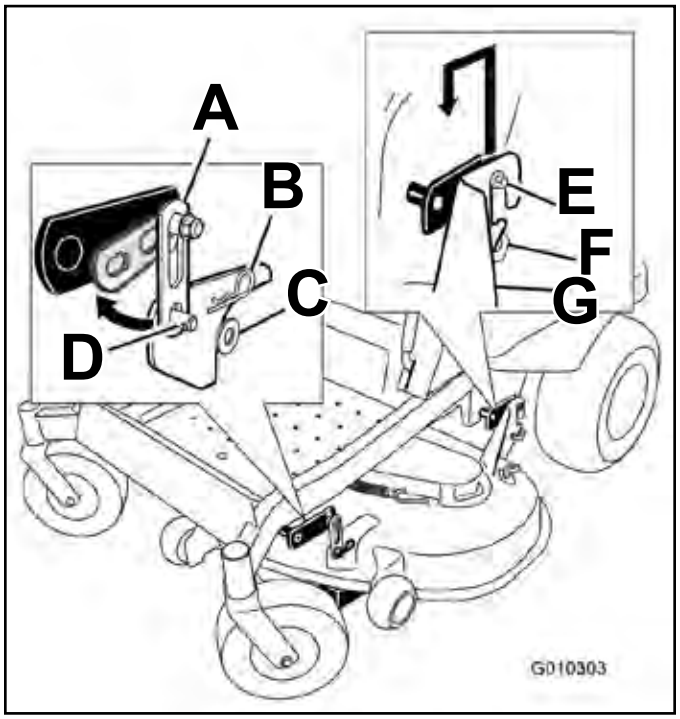


Fig. 109 fig. 67 G010303

A. Deck hanger
B. Hairpin
C. Washer
D. Welded post on deck
E. Rear hanger bolts
F. J-hook
G. Rear deck hanger bracket

8. Carefully lift the deck off the rear hanger bolts and lower the front of the mower deck to the ground (Fig. 109).
9. Raise the height-of-cut to the transport position
10. Slide the mower out from underneath the machine.

Mower Deck Installation - 50 Inch Deck

1. Slide the mower under the machine.

2. Lower the height-of-cut lever to the lowest position. Place the height-of-cut pin in the lock position for lowest height-of-cut.

3. Lift the rear of the mower deck and guide the hanger brackets over the rear hanger bolts (Fig. 110).

4. Attach the front support on the mower deck to the front deck hangers and secure them with a clevis pin and hairpin (Fig. 110).

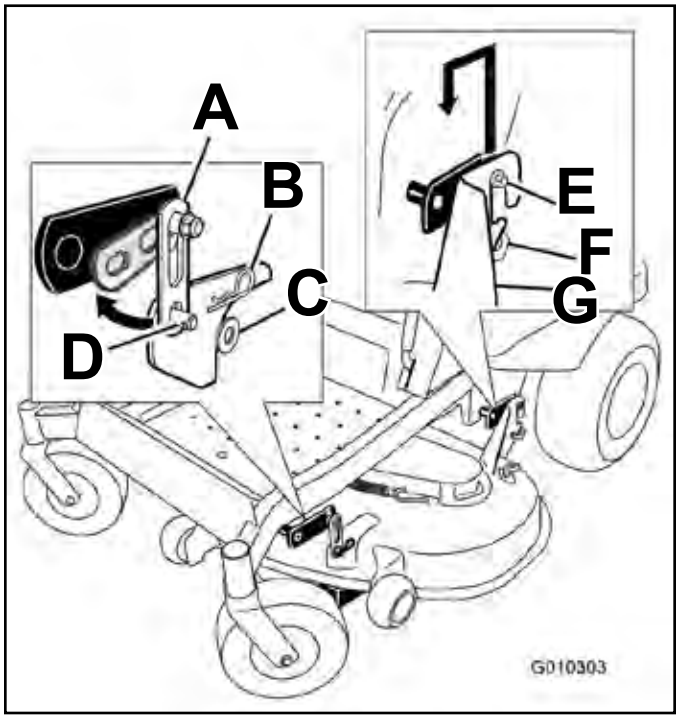


Fig. 110 fig. 67 G010303

A. Deck hanger
B. Hairpin
C. Washer
D. Welded post on deck
E. Rear hanger bolts
F. J-hook
G. Rear deck hanger bracket

5. Properly route PTO belt around deck pulleys and PTO clutch, then install the idler/tensioner spring.

Spindle Service

Spindle Removal

1. If necessary, remove deck from chassis as outlined in this chapter.
2. Remove belt cover(s) from deck.
3. Remove the PTO belt tensioner spring and disengage the PTO belt from the spindle pulley(s).
4. Safely hold the blade in position and remove the spindle pulley nut (A). Inspect the pulley and spindle shaft for excessive wear and replace if necessary.
5. Remove the fasteners that secure spindle housing to deck shell.
   - 48, 54 and 60 inch decks use (6) thread forming bolts for spindle mounting
   - 50 inch decks use (4) thread forming bolts for spindle mounting
6. Remove spindle assembly from deck.
7. Remove blade bolt (B) and washer.
8. Remove blade.

Spindle Installation

1. Install blade and washer onto spindle shaft. Install and torque blade bolt to specification:

Note: Install blade washer so concave surface is towards blade.

   - 48, 54 and 60 inch decks – 105 ft-lbs. (143 Nm)
   - 50 inch decks - 55 ft-lbs (76 Nm)

2. Install spindle assembly onto the deck shell and torque fasteners (C) to specification:
   - 48, 54 and 60 inch decks - 14 ft-lbs. (19 Nm)
   - 50 inch decks - 17 ft-lbs. (23 Nm)
3. Safely hold blade in position.
4. Install spindle pulley onto the spindle shaft and torque pulley nut (A) to specification:
   - 48, 54 and 60 inch decks – 105 ft-lbs. (143 Nm)
   - 50 inch decks - 55 ft-lbs. (76 Nm)
5. If necessary, install deck onto the chassis.
6. Properly route PTO belt, then install the PTO belt tensioner spring.
7. Install belt cover(s) onto deck and sufficiently tighten mounting bolts.
8. Safely verify proper function.

(Fig. 111)

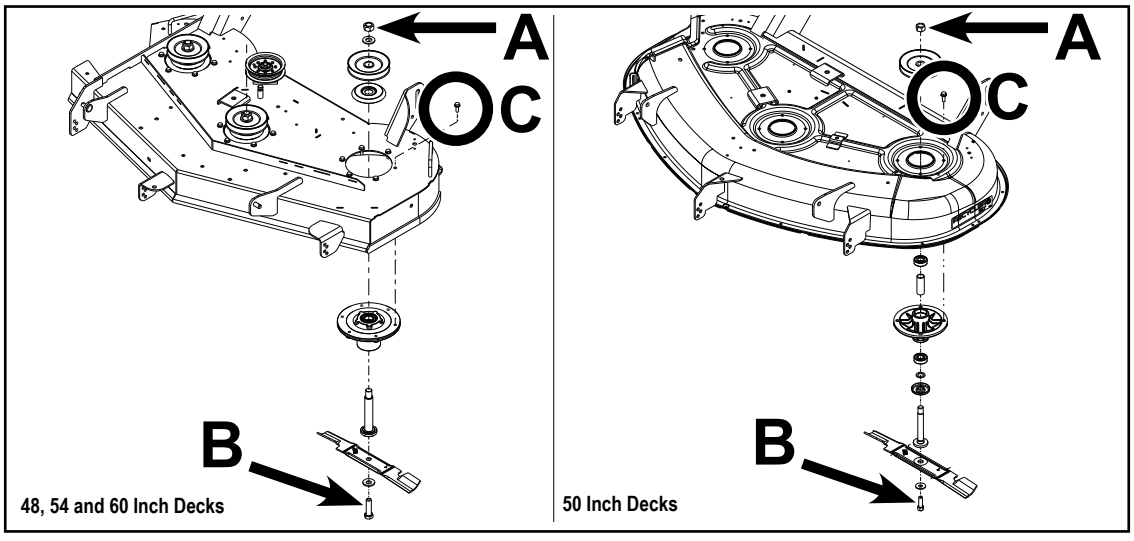


Fig. 111 PICT-2034

Spindle Exploded Views

Spindle Assembly - 48, 54 and 60 Inch Deck
(Fig. 112)

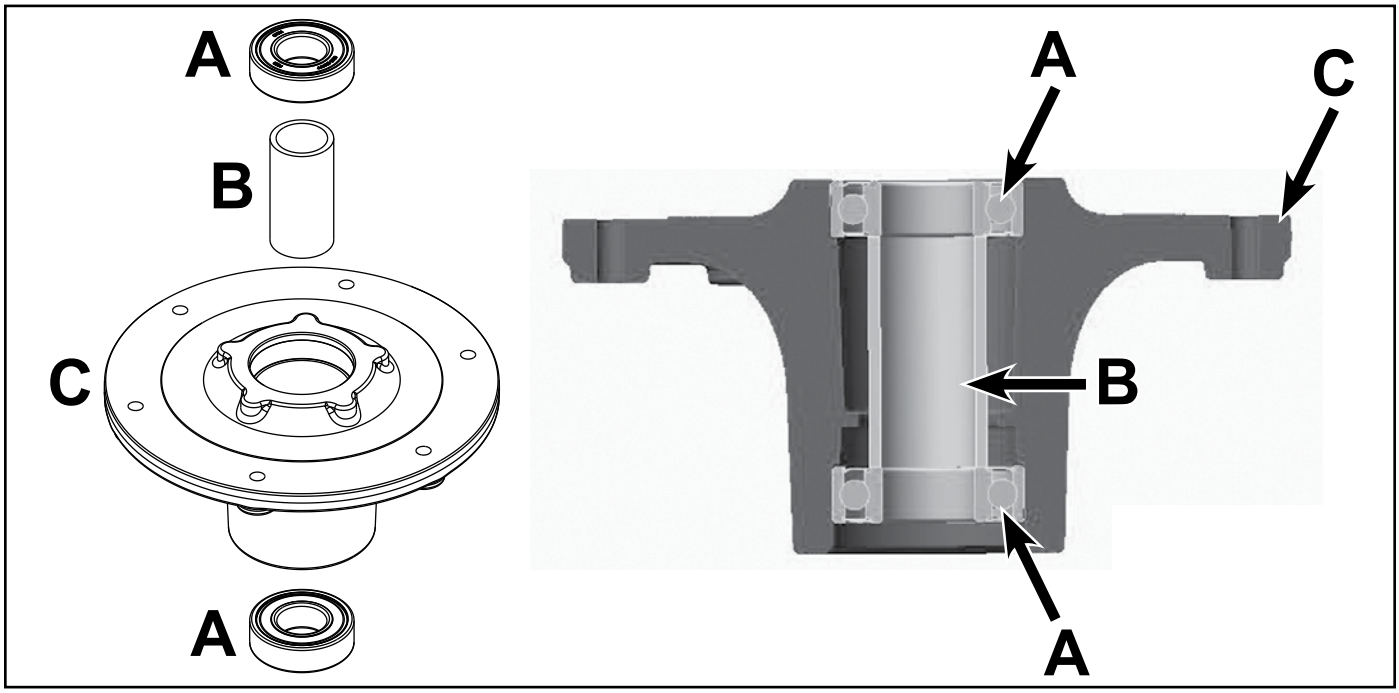


Fig. 112 PICT-2033

Spindle Assembly - 50 Inch Deck
(Fig. 113)

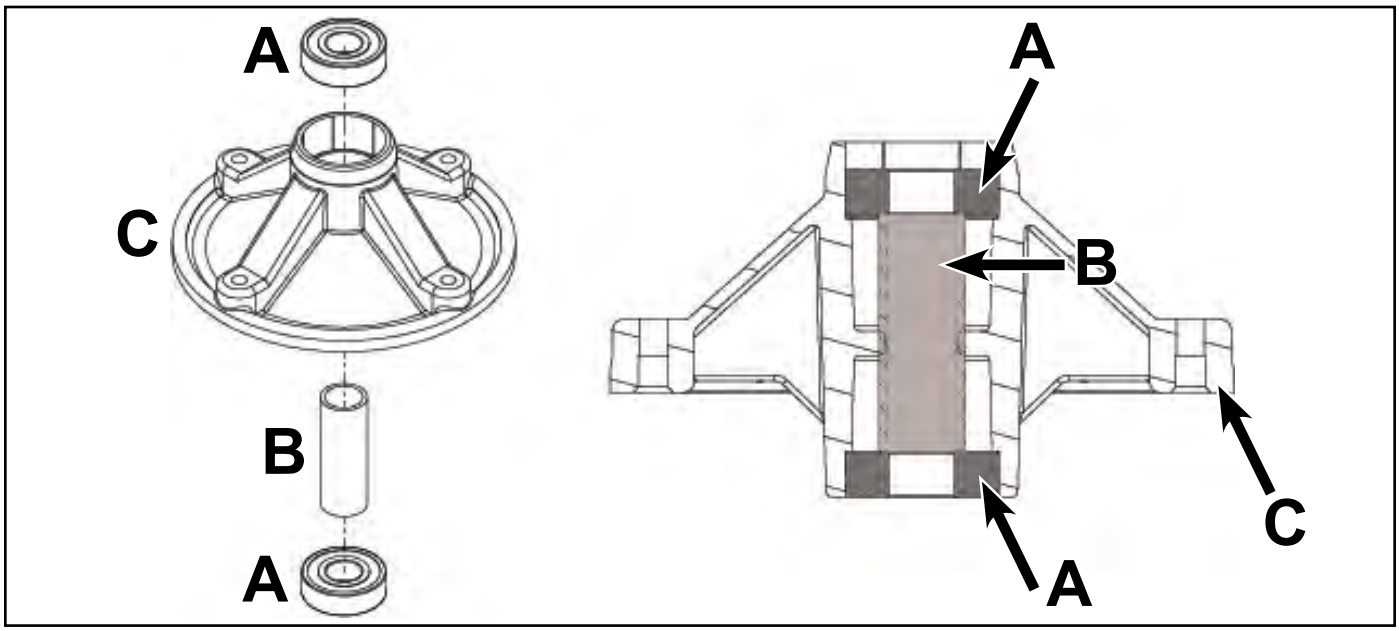


Fig. 113 PICT-2032a

A. Bearing
B. Bearing spacer
C. Spindle housing

Spindle Disassembly

1. If necessary, remove deck from the frame as shown in this chapter.
2. Remove spindle assembly from deck as outlined in this chapter.
3. Remove spindle shaft (D) from spindle assembly. Inspect for excessive wear and replace if necessary (Fig. 114).
4. Use an appropriate punch or bearing extractor to remove the (2) bearings (A) from the spindle housing.
5. Inspect bearing spacer (B) for wear and replace if necessary.
6. Clean and inspect spindle housing (C) bearing bores for excessive wear and replace if necessary.

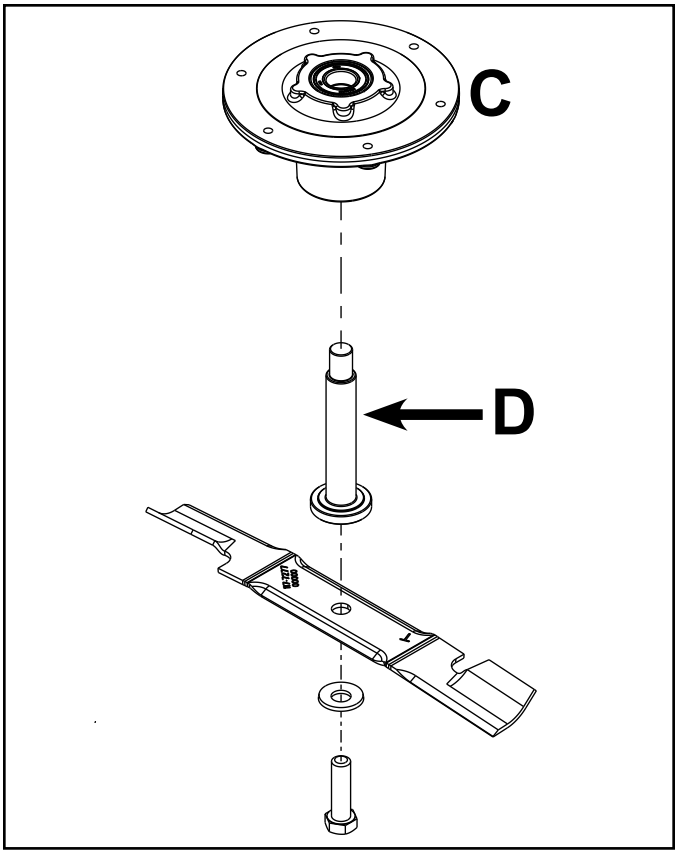


Fig. 114 PICT-2035

Spindle Assembly

1. Fully seat a new UPPER bearing (pulley side) into spindle housing until it contacts the bearing bore shoulder. Be sure to press equally on inner and outer race while installing bearing.
2. Turn spindle housing over.
3. Install the bearing spacer (B) into spindle housing (C).
4. Install a new LOWER bearing (blade side) into spindle housing until it contacts bearing spacer and/or bore shoulder. Be sure to press equally on the inner and outer race while installing bearing.

Note: While installing lower bearing, align center bore of the bearing spacer(s) with center bore of the bearings.

5. Install spindle shaft (D) into spindle housing.
6. Install spindle assembly to the deck as outlined in this chapter.
7. If necessary, install the deck onto the frame. (Fig. 115)

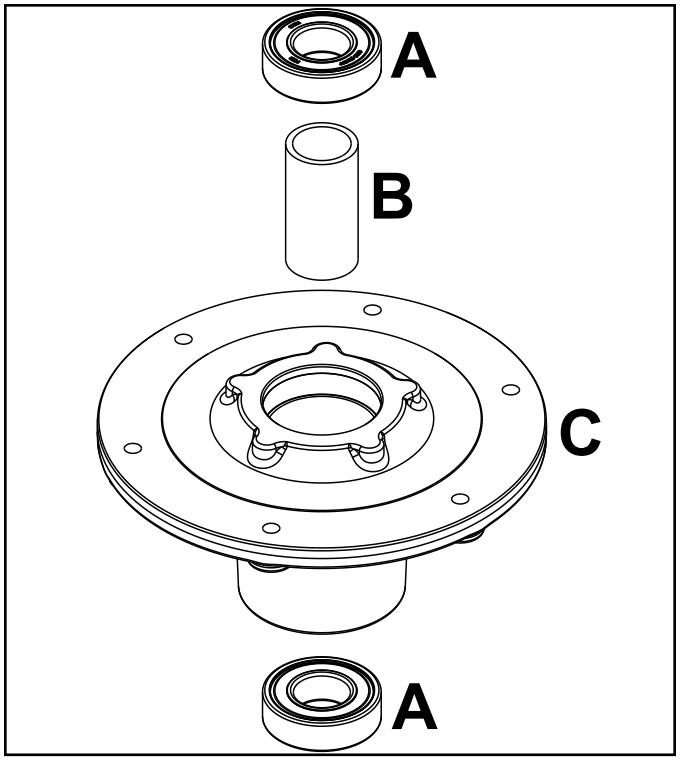


Fig. 115 PICT-2063

Idler Arm / Deck Belt Tensioner Service

Idler Arm / Tensioner Exploded Views

Idler Arm / Tensioner - 48, 54, 60 Inch Deck

(Fig. 116)

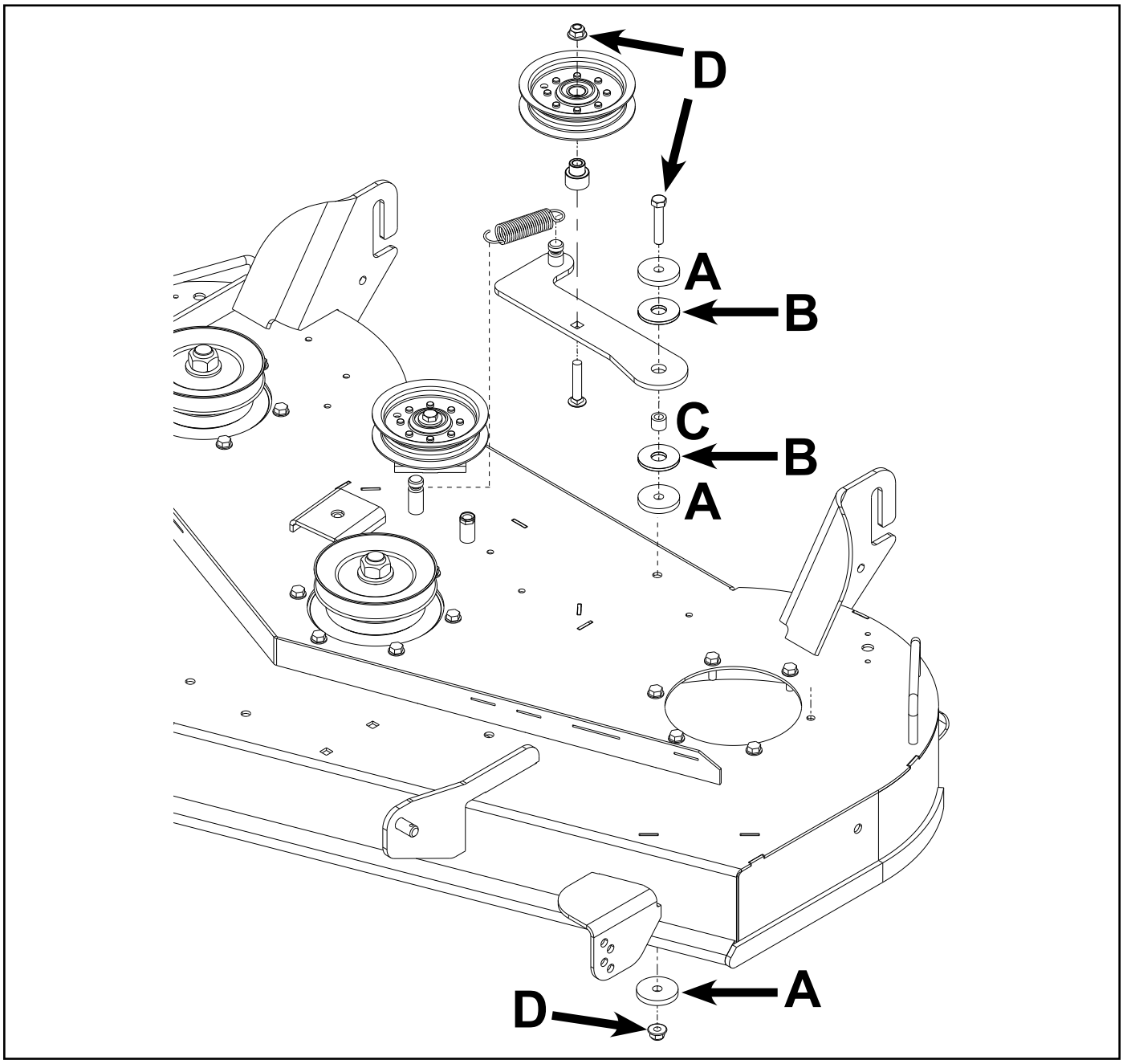


Fig. 116 PICT-2037

A. Washer
B. Friction washer - (composite)
C. Spacer
D. 30 ft-lbs. (40 Nm)

Idler Arm / Tensioner - 50 Inch Deck

(Fig. 117)

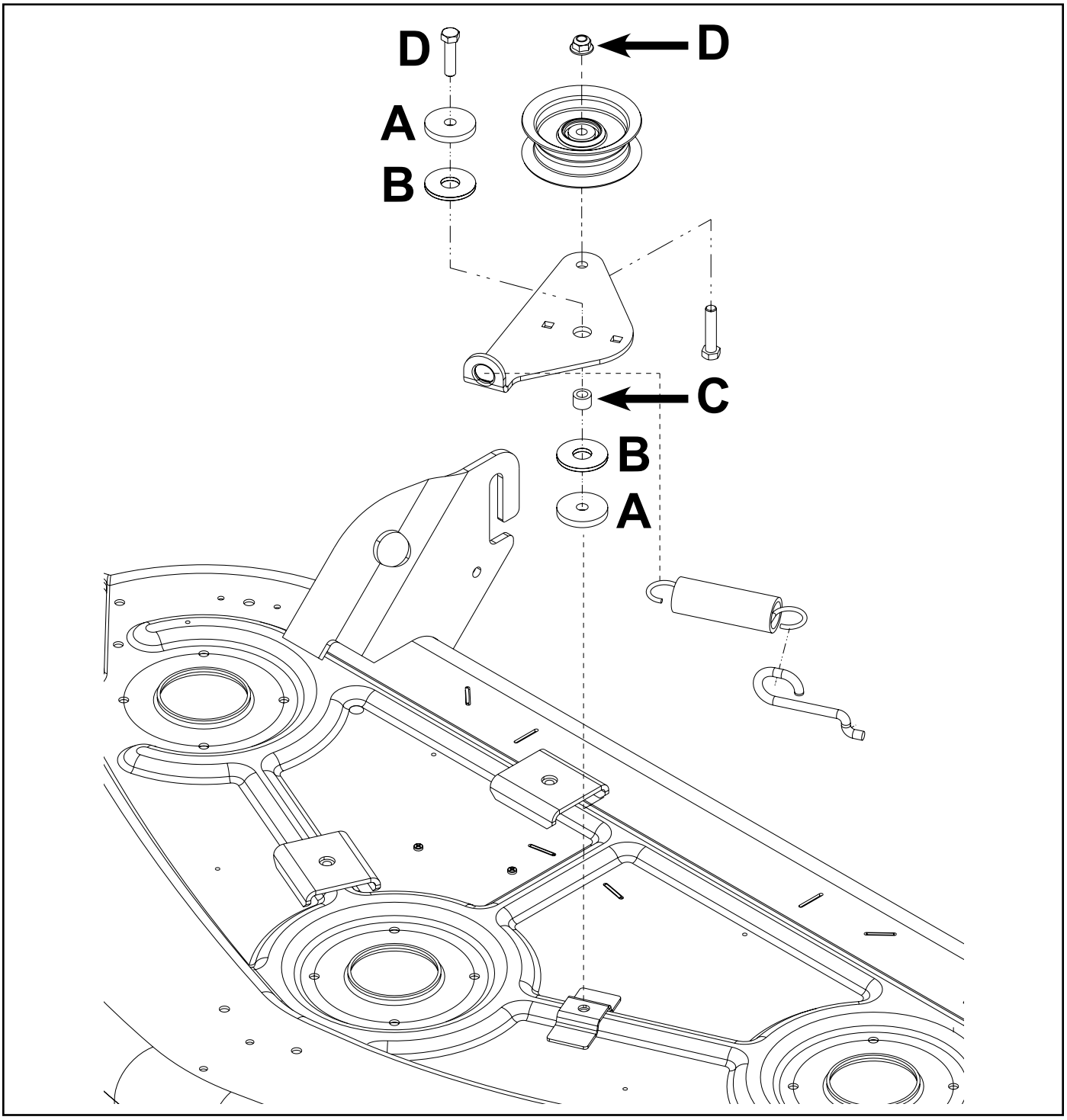


Fig. 117 PICT-2036

A. Washer
B. Friction washer - (composite)
C. Spacer
D. 30 ft-lbs. (40 Nm)

Idler Arm Inspection

1. Remove deck belt as shown in this chapter.
2. Remove deck if necessary, as outlined in this chapter.
3. Rotate idler arm by hand. The idler arm should not pivot freely, it should take some force to rotate the idler arm.
   - If the idler arm rotates easily and / or rocks excessively side-to-side, replace mounting hardware, spacers and all washers.
4. Inspect idler arm pulley bearing and replace if necessary.

Idler Arm Removal

1. Remove deck belt as shown in this chapter.
2. Remove deck if necessary.
3. Remove idler arm/tensioner spring from idler arm. Inspect spring and replace if necessary.
4. Remove the (1) fastener that secures idler arm assembly to deck.
5. Inspect pivot bolt, friction washers, standard washers, spacers and replace if necessary.
6. Remove the fastener that secures idler pulley to the idler bracket. Inspect pulley bearing and replace if necessary.

Idler Arm Installation

1. Install idler pulley to the idler arm and torque mounting bolt to specification - 30 ft-lbs. (40 Nm).
2. Assemble the idler arm pivot washers, spacers and bolts. Verify proper component order according the exploded views.
3. Install idler arm assembly and pivot bolt onto the deck and torque to specification – 30 ft-lbs. (40 Nm).
4. Install deck to the frame if needed.
5. Fully install deck belt and tensioner spring to idler arm.
6. Safely operate unit and check for proper function.

Checking for Bent Blades

Note: The machine must be on a level surface for the following procedure.

1. Raise deck to the highest height-of-cut position.

2. While wearing thickly padded gloves or other adequate hand protection slowly rotate blade to be measured into a position that allows effective measurement of the distance between the cutting edge and the level surface the unit is on (Fig. 118).

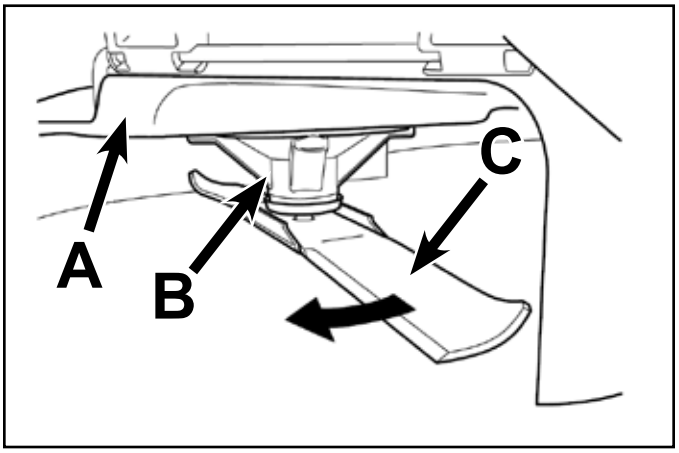


Fig. 118 fig. 39 G009679

A. Deck
B. Spindle housing
C. Blade

3. Measure from the tip of the blade to the level surface (Fig. 119).

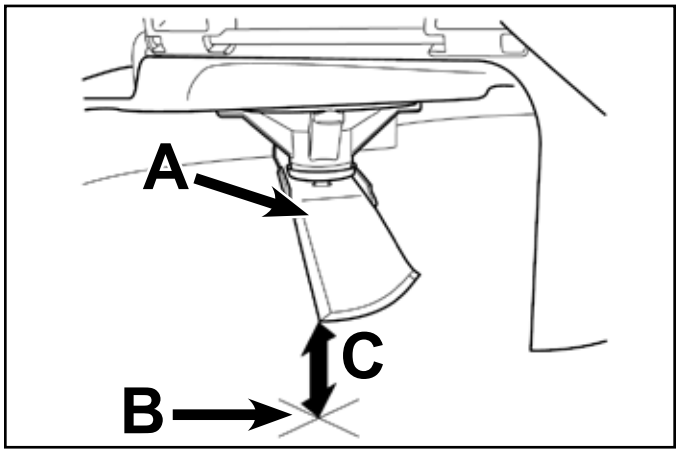


Fig. 119 fig. 40 G009680

A. Blade, in position for measuring
B. Level surface
C. Measure from blade tip to level surface

4. Rotate the same blade 180 degrees so that the opposing cutting edge is now in the same position (Fig. 120).

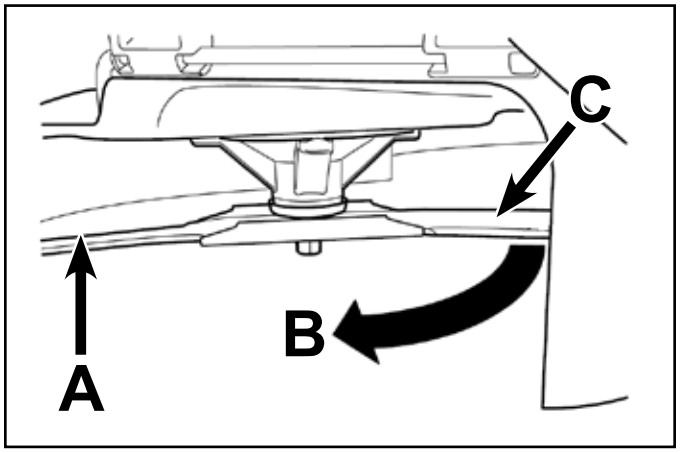


Fig. 120 fig. 41 G009681

A. Blade, side previously measured
B. Measurement position used previously
C. Opposing side of blade being moved into measurement position

5. Measure from the tip of the blade to the level surface. The variance should be no more than 1/8” (3mm) (Fig. 121).

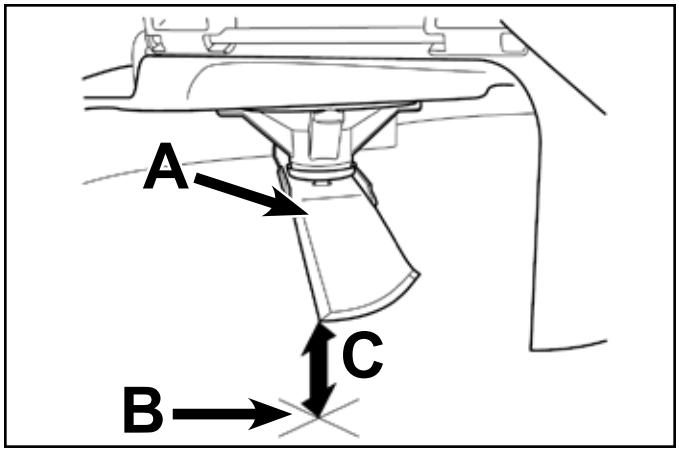


Fig. 121 fig. 40 G009680

A. Blade, in position for measuring
B. Level surface
C. Measured distance between blade & surface (A)

A blade that is bent or damaged could break apart and could seriously injure or kill you or bystanders.

- Always replace bent or damaged blade with a new blade
- Never file or create sharp notches in the edges or surfaces of blade

a. If the difference between A and B is greater than 1/8” (3mm) replace the blade with a new blade as outlined in this chapter.

- Recheck, starting at step 1.

Note: If a bent blade is replaced with a new one and the dimension obtained continues to exceed 1/8” (3mm), the blade spindle shaft could be bent.

b. If the variance is within constraints, move to the next blade.

Repeat this procedure on each blade.

Leveling Mower Deck - 48, 54, 60 Inch Deck

Check to ensure the mower deck is level any time you install the mower or when you see an uneven cut.

The mower deck must be checked for bent blades prior to leveling; any bent blades must be removed and replaced. Refer to the Checking for Bent Blades procedure before continuing.

The mower deck must be leveled side-to-side first then the front to rear slope can be adjusted.

Requirements:

- The machine must be on a level surface.
- All four tires must be properly inflated.

Checking Side-to-Side Level

The mower blades must be level from side to side. Check the side-to-side level any time you install the mower or when you see an uneven cut.

1. Park the machine on a level surface and disengage the blade control switch.
2. Move the motion control levers outward to the neutral lock position, stop the engine, remove the key, set the parking brake and wait for all moving parts to stop before leaving the operating position.
3. Carefully rotate the blades side to side.

4. Measure between the outside cutting edges and the flat surface (Fig. 122). If both measurements are not within 3/16 inch (5mm), an adjustment is required; continue to the Leveling procedure.

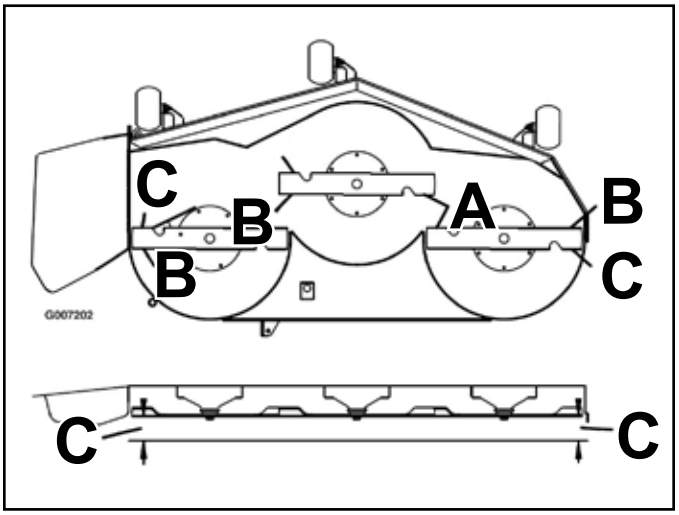


Fig. 122 fig. 62 G007202

A. Blades side-to-side
B. Outside cutting edges
C. Measure from the tip of the blade to the flat surface here

Checking the Front-to-Rear Blade Slope

Check the front-to-rear blade level any time you install the mower. If the front of the mower is more than 5/16 inch (7.9mm) lower than the rear of the mower, adjust the blade level using the following instructions:

1. Park the machine on a level surface and disengage the blade control switch.

2. Move the motion control levers outward to the neutral position, engage the parking brake, stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.

3. Carefully rotate the blades so they are facing front to rear (Fig. 123).

4. Measure from the tip of the front blade to the flat surface and the tip of the rear blade to the flat surface (Fig. 123). If the front blade tip is not 1/16-5/16 inch (1.6-7.9mm) lower than the rear blade tip, continue to the “Leveling the Mower Deck” procedure.

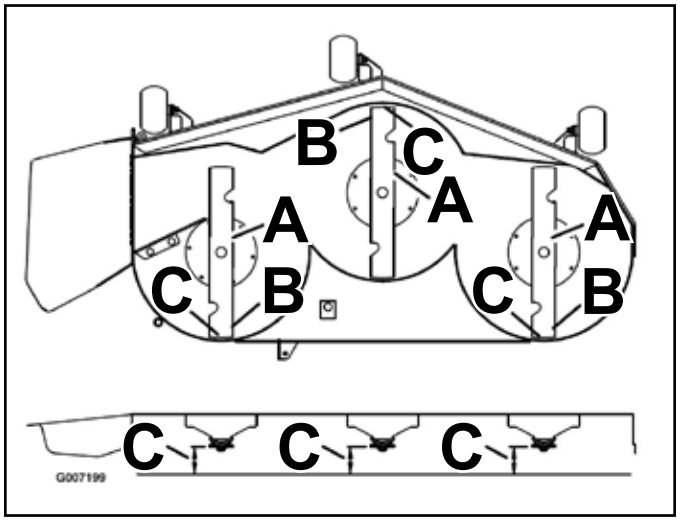


Fig. 123 fig. 63 G007199

A. Blades front-to-rear
B. Outside cutting edges
C. Measure from the tip of the blade to the flat surface here

Leveling the Mower Deck

1. Set anti-scalp rollers to top holes or remove completely for this procedure.

2. Set the height-of-cut lever to the 3 inch (76mm) position.

3. Place two 2-5/8 inch (6.66cm) blocks under each side of the front edge of the deck, but not under the anti-scalp roller brackets. Place two 2-7/8 inch (7.30cm) thick blocks under the rear edge of the cutting deck skirt; one on each side of the cutting deck (Fig. 124).

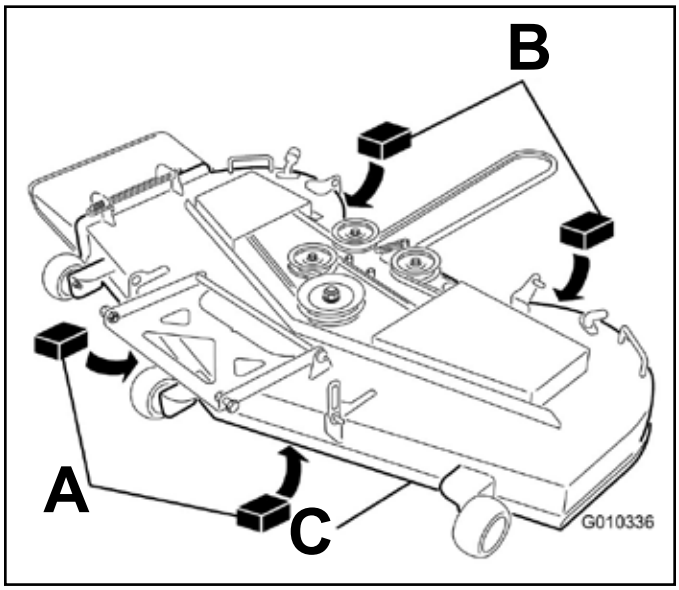


Fig. 124 fig. 64 G010336

A. Wood block, 2-5/8” (6.66cm) thick
B. Wood block, 2-7/8” (7.30cm) thick
C. Front edge

4. Loosen the leveling adjust locking nuts (C) on all four corners so that the deck is sitting securely on all four blocks. Make sure that the deck hangers are all the way down (at the top of the slot) and the deck lift foot lever is pushed back against the stop, then tighten the four leveling adjust locking nuts (C) (Fig. 125 and Fig. 126).

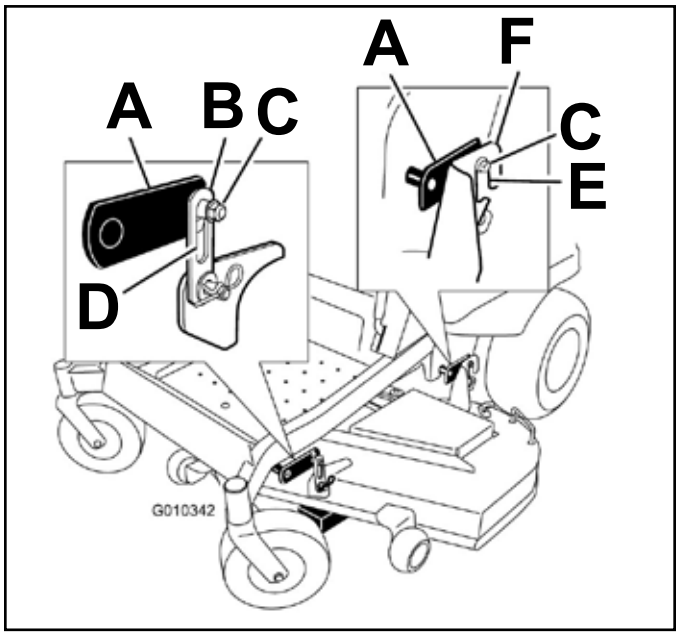


Fig. 125 fig. 65 G010342

48 and 54 inch mower decks

A. Deck lift arm
B. Deck hanger
C. Leveling adjust locking nut
D. Slot in deck hanger
E. Slot in rear deck hanger bracket
F. Rear deck hanger bracket

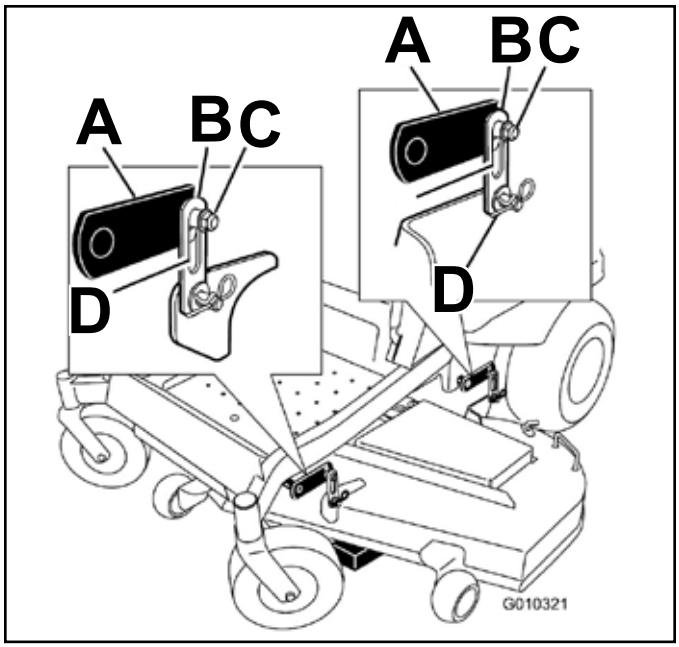


Fig. 126 fig. 66 G010321

60 inch mower decks

A. Deck lift arm
B. Deck hanger
C. Leveling adjust locking nut
D. Slot in deck hanger

5. Recheck that blocks fit just snugly under the deck skirt. Make sure all attachment bolts are tight.

6. Verify the deck is level by checking the side-to-side level and front-to-rear blade slope; repeat deck leveling procedure if necessary.

Leveling Mower Deck - 50 Inch Deck

Check to ensure the mower deck is level any time you install the mower or when you see an uneven cut.

The mower deck must be checked for bent blades prior to leveling; any bent blades must be removed and replaced. Refer to “Checking for Bent Blades” on page 6-20 before continuing.

The mower deck must be leveled side-to-side first then the front to rear slope can be adjusted.

Requirements:

- The machine must be on a level surface.
- All four tire must be properly inflated.

Checking Side-to-Side Level

The mower blades must be level from side to side. Check the side-to-side level any time you install the mower or when you see an uneven cut on your lawn.

1. Park the machine on a level surface and disengage the blade control switch.

2. Move the motion control levers outward to the neutral lock position, stop the engine, remove the key, set the parking brake and wait for all moving parts to stop before leaving the operating position.

3. Carefully rotate the blades side to side.

4. Measure between the outside cutting edges and the flat surface (Fig. 127). If both measurements are not within 3/16 inch (5mm), an adjustment is required; continue to the Leveling procedure.

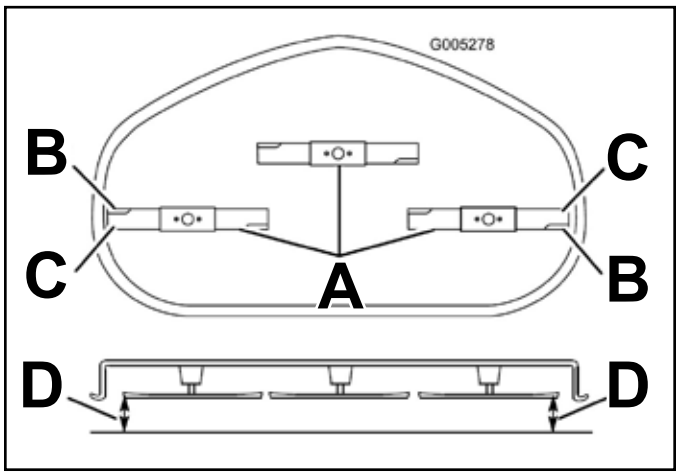


Fig. 127 fig. 61 G005278

A. Blades side-to-side
B. Outside cutting edges
C. Sail area of blade
D. Measure from the tip of the blade to the flat surface here

Checking the Front-to-Rear Blade Slope

Check the front-to-rear blade level any time you install the mower. If the front of the mower is more than 5/16 inch (7.9mm) lower than the rear of the mower, adjust the blade level using the following instructions:

1. Park the machine on a level surface and disengage the blade control switch.

2. Move the motion control levers outward to the neutral position, engage the parking brake, stop the engine, remove the key, and wait for all moving parts to stop before leaving the operating position.

3. Carefully rotate the blades so they are facing front to rear (Fig. 128).

4. Measure from the tip of the front blade to the flat surface, and the tip of the rear blade to the flat surface (Fig. 128). If the front blade tip is not 1/16-5/16 inch (1.6-7.9mm) lower than the rear blade tip, continue to “Leveling the Mower Deck” on the next page.

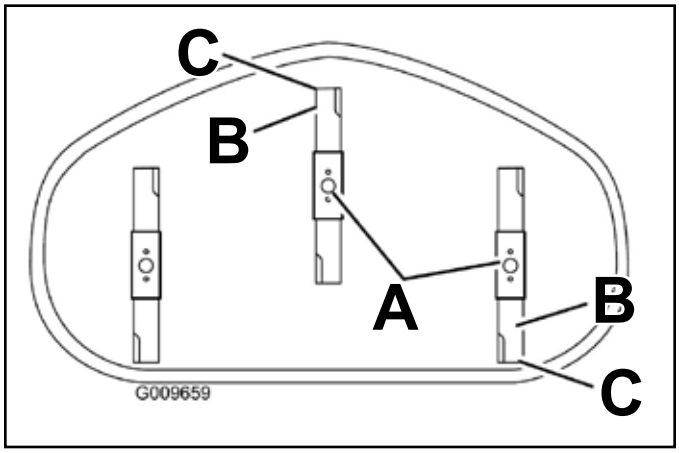


Fig. 128 fig. 62 G009659

A. Blades front-to-rear
B. Outside cutting edges
C. Measure from the tip of the blade to the flat surface here

Leveling the Mower Deck

1. Set anti-scalp rollers to top holes or remove completely for this procedure.

2. Set the height-of-cut lever to the 3 inch (76mm) position.

3. Place two 2-5/8 inch (6.66 cm) blocks under each side of the front edge of the deck, but not under the anti-scalp roller brackets. Place two 2-7/8 inch (7.30cm) thick blocks under the rear edge of the cutting deck skirt; one on each side of the cutting deck (Fig. 129).

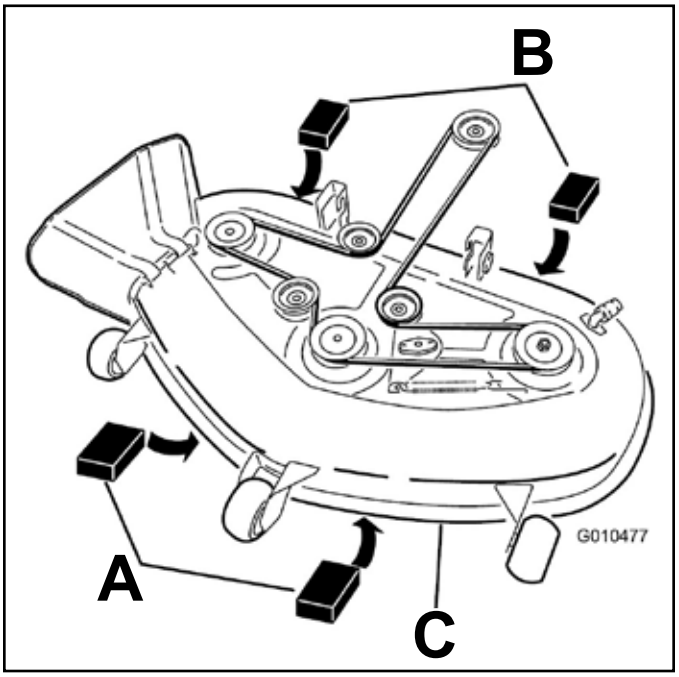


Fig. 129 fig. 63 G010477

A. Wood block, 2-5/8” (6.66cm) thick
B. Wood block, 2-7/8” (7.30cm) thick
C. Front edge

4. Loosen the leveling adjust locking nuts (item 3) on all four corners so that the deck is sitting securely on all four blocks. Make sure that the deck hangers are all the way down (at the top of the slot) and the deck lift foot lever is pushed back against the stop, then tighten the four leveling adjust locking nuts (Fig. 130).

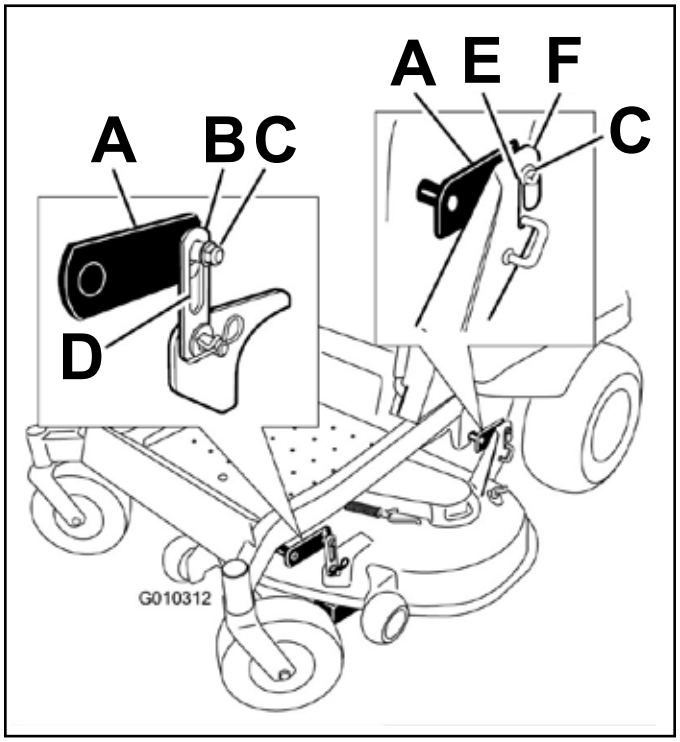


Fig. 130 fig. 64 G010312

A. Deck lift arm
B. Deck hanger
C. Leveling adjust locking nut
D. Slot in deck hanger
E. Slot in rear deck hanger bracket
F. Rear deck hanger bracket

5. Recheck that blocks fit just snugly under the deck skirt. Make sure all attachment bolts are tight.

6. Verify the deck is level by checking the side-to-side level and front-to-rear blade slope; repeat deck leveling procedure if necessary.

Chassis Switches

Key/Ignition Switch

Purpose

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

Location

The ignition switch is located on the control panel, on the right fender (Fig. 131).

Fig. 131 PICT-2001

How It Works

Detents inside the switch give it 3 positions: OFF, RUN, and START. The START position is spring loaded so the key automatically returns to RUN when released (Fig. 132).

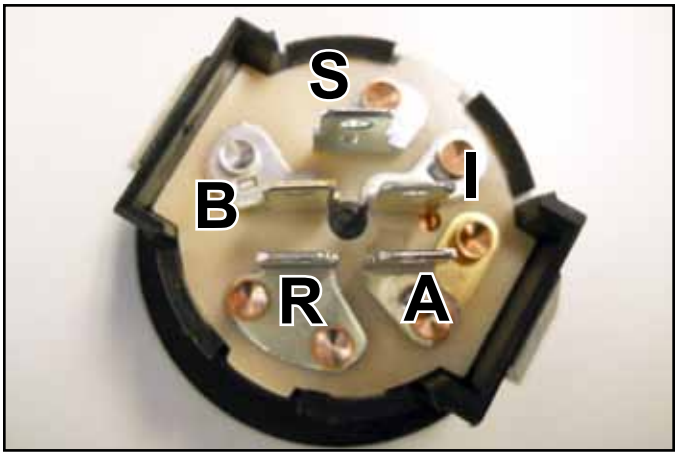


Fig. 132 DSCN-0173a

Ignition Switch Wiring Connections

B - Battery voltage IN
S - Starting Circuit
I - PTO Switch, Safety Interlock Switches, Fuel Solenoid
A - Seat Switch, Safety Interlock Switches
R - Regulator, Charging Circuit

Testing

1. Disconnect switch from wiring harness.
2. Verify that continuity exists between the terminals listed for the switch position.
3. Verify there is NO continuity between terminals not listed for the position.

Key Switch Continuity Table	
OFF	No continuity between any terminals
RUN	Continuity – B R I A only
START	Continuity – B R I S only

PTO Switch

Purpose

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

Location

The PTO switch is located on the control panel, on the right fender (Fig. 133).

Fig. 133 PICT-2001

How It Works

- **PTO Switch ON (Switch Pulled Up)**

The PTO Switch provides battery voltage from the key switch to the PTO clutch.

The PTO Switch provides battery voltage from the key switch to the hour meter.

As a part of the safety interlock system, the PTO switch will prevent the engine from cranking/starting when in the ON position by preventing the starter solenoid from grounding through the kill relay.

Note: The engine will not crank over to start when the PTO switch is ON.

- **PTO Switch OFF (Switch Pushed Down)**

The PTO Switch will not supply battery voltage to the PTO clutch.

The PTO Switch provides battery voltage from the key switch to the parking brake switch and neutral switches as a part of the Safety Interlock System to allow the unit to crank / start (Fig. 134).

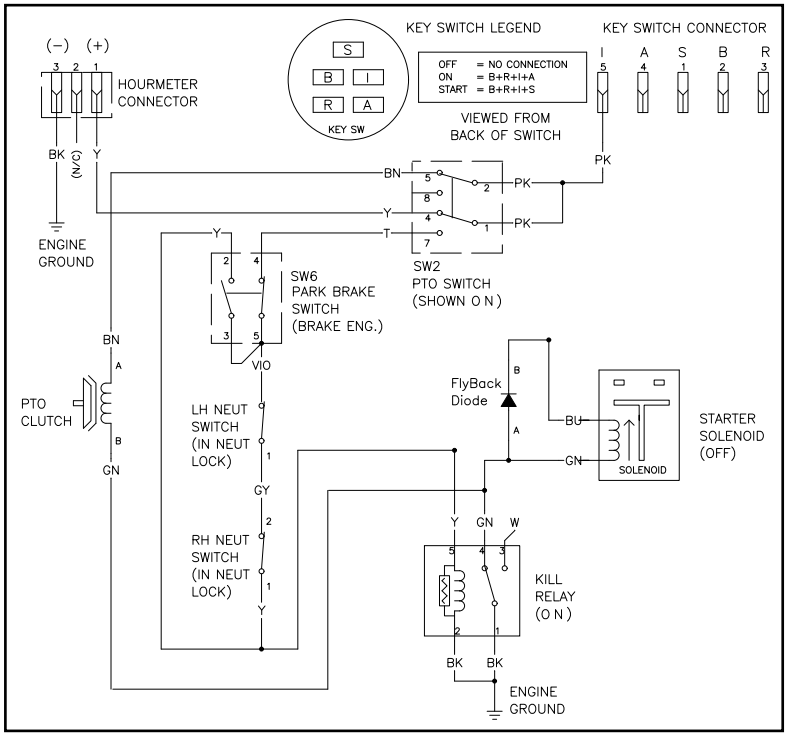


Fig. 134 PICT-2002

Continuity Testing

Terminals viewed from the back of the switch.

With the Switch “ON” (Button pulled OUT):
- Pin 2 and 5 should have continuity (closed - circled below)
- Pin 1 and 4 should have continuity (closed - circled below)
- Pin 1 and 7 should not have continuity (open)
- Pin 2 and 8 should not have continutiy (open)

(Fig. 135 and Fig. 136)

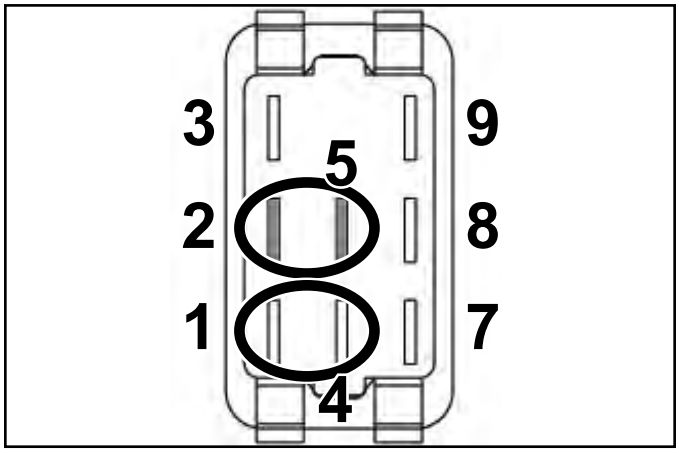


Fig. 135 PICT-1005

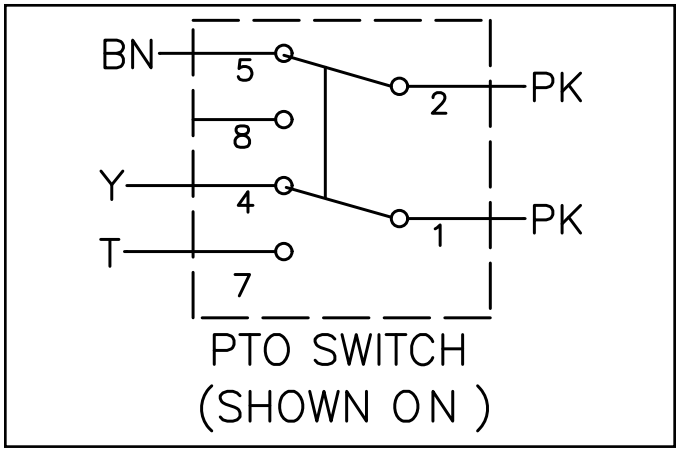


Fig. 136 PICT-2004

With the Switch “OFF” (Button pushed IN):
- Pin 1 and 7 should have continuity (closed - circled below)
- Pin 2 and 8 should have continuity (closed - circled below)
- Pin 2 and 5 should not have continuity (open)
- Pin 1 and 4 should not have continuity (open)

(Fig. 137 and Fig. 138)

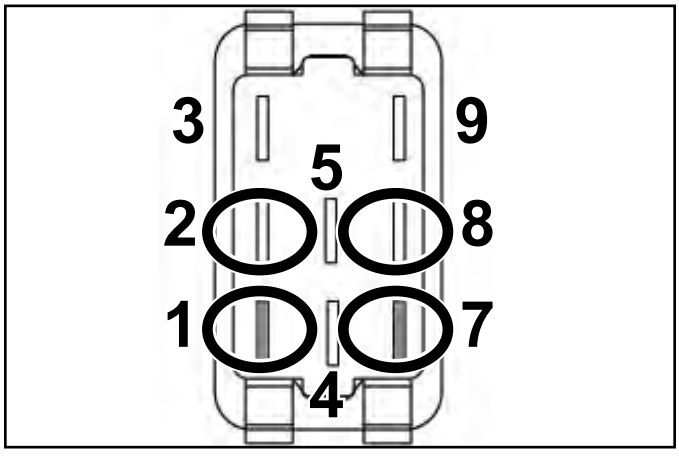


Fig. 137 PICT-1006

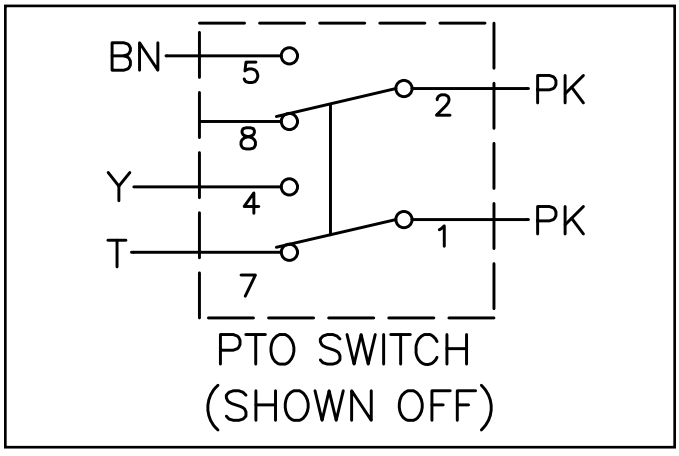


Fig. 138 PICT-2003

Note: Switch pins 3 and 9 are not used.

Seat Switch

Purpose

The seat switch is a part of the safety interlock system. If the engine is running and the operator vacates the seat with the PTO engaged and/or the handles pulled IN, the engine will shut off.

Location

The seat switch is attached to the seat base, accessible by flipping the seat up into the service position.

To remove the seat switch, first disconnect the harness connection from the switch. Then rotate the switch counterclockwise and remove switch from the seat base (Fig. 139).

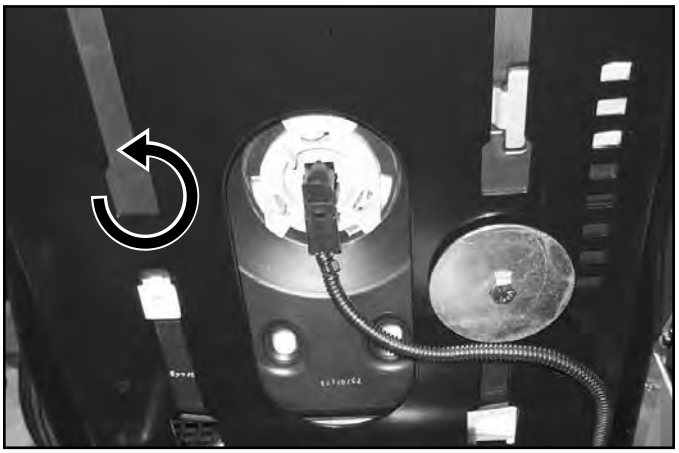


Fig. 139 PICT-1009

How It Works

With the ignition switch ON, and the seat switch closed, it supplies battery voltage to the neutral switches.

Testing

1. Disconnect the harness connection from the seat switch.

2. With a multimeter set to the Ohm or Continuity setting, check the continuity between the two switch terminals:

   - When the seat is vacated, the switch should be OPEN and there should be NO continuity between the two switch terminals.

   - When the seat is occupied, the switch CLOSES and there should be continuity between the two switch terminals.

(Fig. 140)

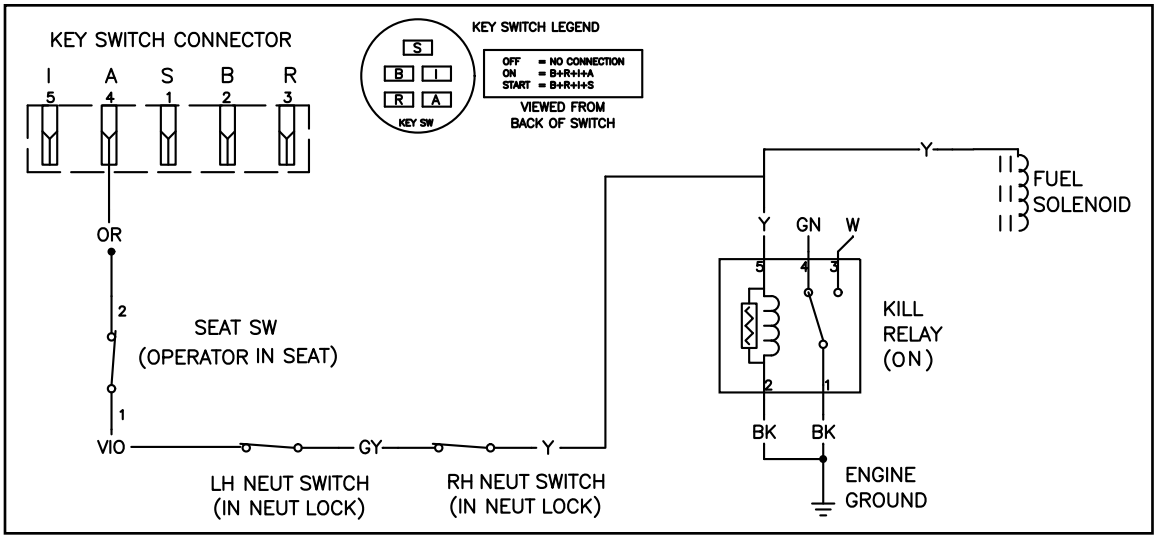


Fig. 140 PICT-2005

RH and LH Neutral Switch

Purpose

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

Location

The RH and LH Neutral Switches are located in the fender/control arm pivot area. The RH and LH switches are serviceable by removing the control cover fastener and the control cover (A) (Fig. 141 and Fig. 142).

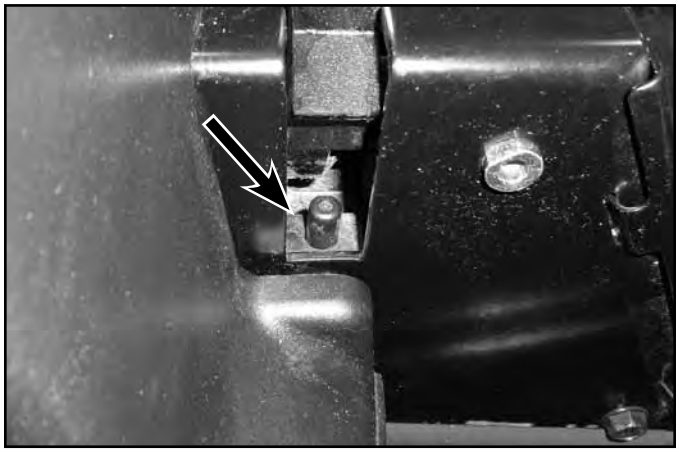


Fig. 141 PICT-2006

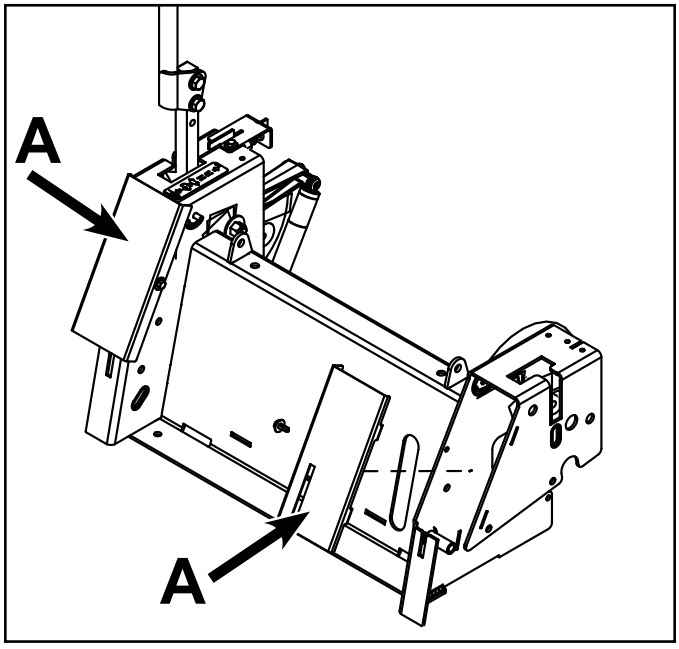


Fig. 142 PICT-2010

How it Works

This single pole plunger (normally open) type switch has two terminals. When the motion control handles are in the neutral position (handles in the OUT position), it pushes on the plunger, closing the contact and connecting the terminals (Fig. 143).

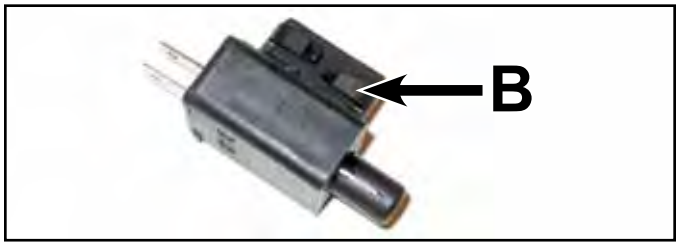


Fig. 143 DSCN-0150a

When the key is ON, the RH and LH Neutral Switches get battery voltage from the Parking Brake Switch and/or the Seat Switch.

When both of the Neutral Switches are CLOSED, battery voltage is provided to the Kill Relay and the Fuel Solenoid (Fig. 144).

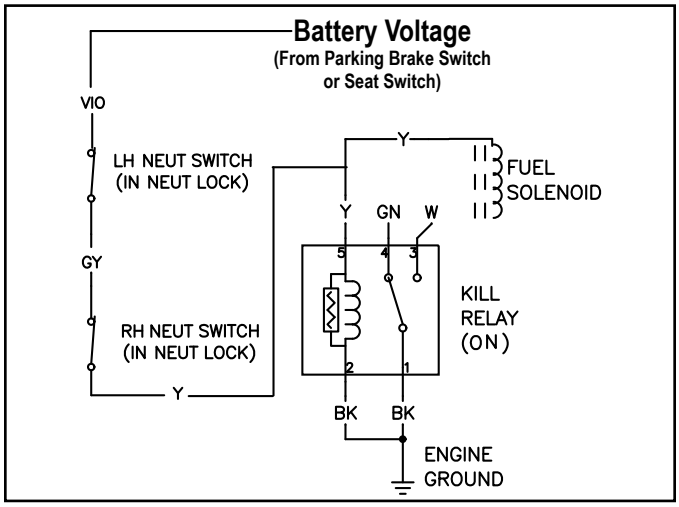


Fig. 144 PICT-2007

Testing

1. Disconnect the switch from the wiring harness.
2. With a multimeter set to the Ohm or Continuity setting, check the continuity between the two switch terminals.
3. With the plunger pushed in, there should be continuity between the terminals. With the plunger pulled out, there should not be continuity between the terminals.

Parking Brake Switch

Purpose

The Parking Brake Switch is part of the safety interlock system.

The parking brake switch circuit can:

- Prevent the engine from cranking if parking brake is not engaged.
- Prevent the engine from cranking if a control handle is not in the neutral position.
- Turn the engine OFF if a control handle is moved out of neutral with the brake engaged.

Location

The Parking Brake Switch is located in the control box assembly, near the parking brake lever. Remove LH control cover (A) for better access (Fig. 145 and Fig. 146).

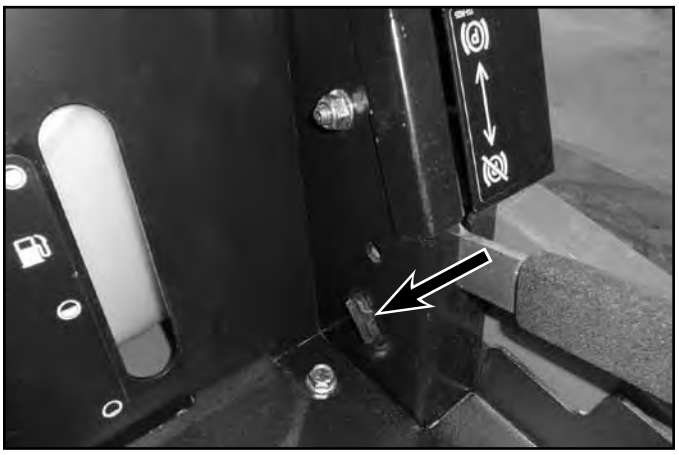


Fig. 145 PICT-2008

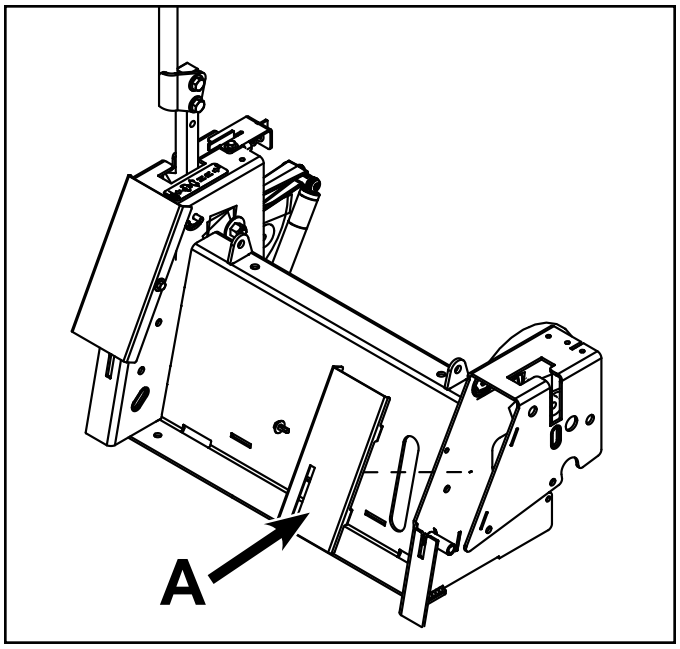


Fig. 146 PICT-2010

How it Works

This double pole plunger type switch has four terminals. For engine START, it is used to ensure the park brake is in the ON position. At the same time it allows battery voltage to flow through the safety circuit.

When the park brake is released, it bypasses both the neutral switches, as long as the operator is sitting in the seat to maintain current for the safety circuit.

Park Brake ON:

- Normally Open contacts are closed – Battery voltage to kill relay coil and fuel solenoid, through motion control neutral switches.
- Operator must be in seat.

Park Brake OFF (engine running):

- Normally closed contacts are closed – Battery voltage directly to kill relay coil and fuel solenoid, neutral switches NOT in circuit.
- Operator must be in seat.

Testing

1. Remove the LH control cover (A).
2. Press inward on the locking taps and push the switch out of the mounting slot.
3. Pull the switch and harness downward, in-between the frame and deck assembly.
4. Disconnect the harness connection to switch and remove the switch from the unit.
5. Use a ohm meter to test the switch continuity as shown below:

View From Back of Switch (Fig. 147)

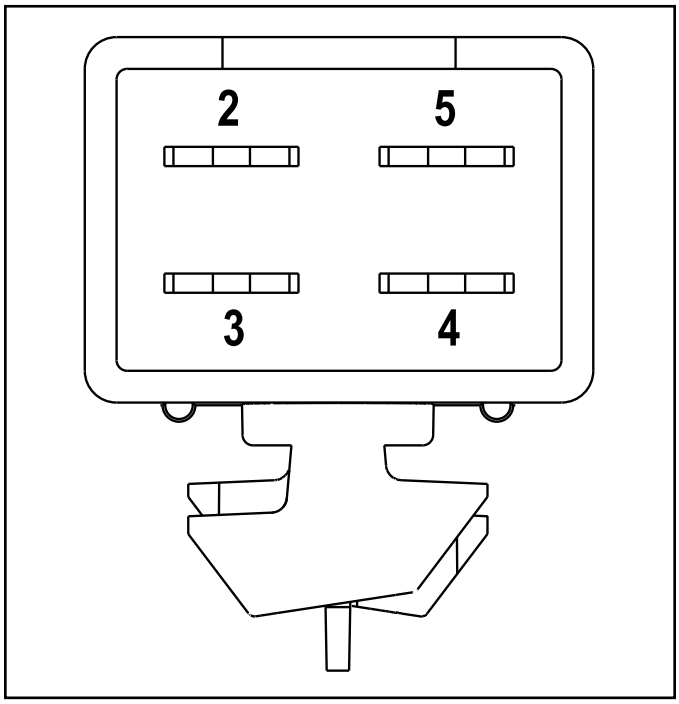


Fig. 147 PICT-2012

Switch Plunger NOT Depressed:
Pin 2 and 3 – CLOSED, continuity between the pins
Pin 4 and 5 – OPEN, NO continuity between the pins

Switch Plunger Depressed:
Pin 2 and 3 – OPEN, NO continuity between the pins
Pin 4 and 5 – CLOSED, continuity between the pins

Parking Brake Circuit
(Fig. 148)

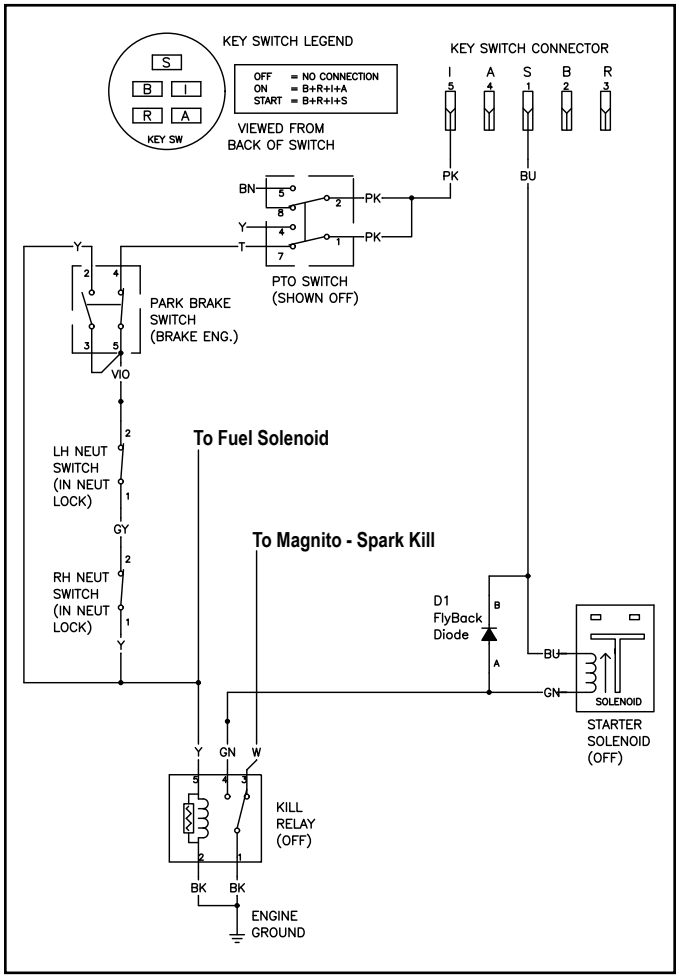


Fig. 148 PICT-2011

Starter Solenoid & Starting System

Purpose

The solenoid's purpose is a remote switch to connect the battery to the starter motor on the engine when the ignition switch is turned to "START". The solenoid is used to protect the ignition switch from the high current drawn by the starter motor.

Location

The starter solenoid is located behind the operator's seat, near the fuse block (Fig. 149).

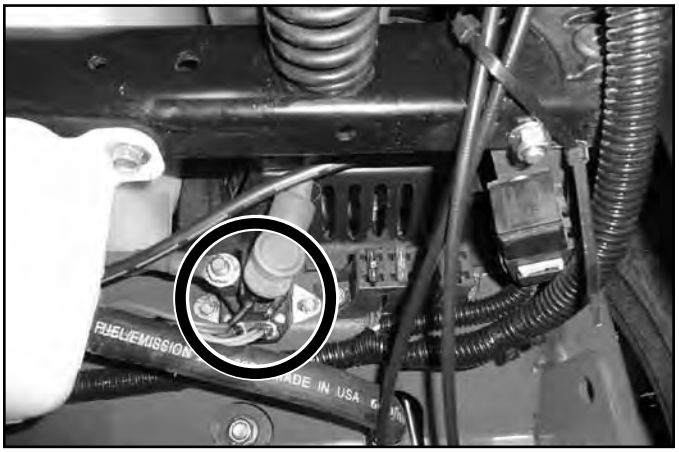


Fig. 149 PICT-2013

How It Works (solenoid only)

The solenoid has two primary parts. One, a coil of wire is wrapped around an iron core. Whenever 12 volts is applied to the coil, it becomes a magnet. The other part is a bar type switch. Because it has a large contact area with the contact terminals, it can easily handle the high current loads required by the starter motor of the engine.

When 12 volts is applied to the coil, it becomes an electromagnet. This quickly pulls the contact bar toward the contacts and closes the switch. When power is removed from the coil, the spring loaded bar returns to its "normally open" position. The solenoid closes and opens the switch very quickly. This minimizes the "arcing" that can damage other types of switches.

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

Starter Solenoid Testing (solenoid only)

1. Disconnect solenoid from the wiring harness.
2. With a multimeter (ohms setting), check to ensure that terminals "c" and "d" are open (no continuity).
3. Apply +12 VDC to terminal "a" and ground terminal "b". Terminals "c" and "d" should now be closed (continuity) (Fig. 150).

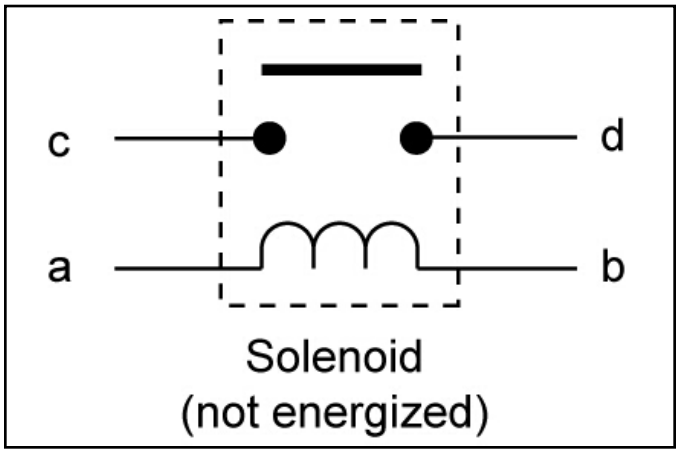


Fig. 150 xl solenoid

Starter Solenoid Circuit & Operation

The starter solenoid B+ (battery positive) input is controlled by the ignition switch when in the START position. The starter solenoid B- (battery negative) is controlled by the Kill Relay.

The Kill Relay will only ground and activate the starter solenoid and allow the engine to start when:

- The key is in the start position.
- Proper battery voltage is present at the key switch, kill relay, and starter solenoid
- Proper ground is present at the battery, chassis, and kill relay.
- The PTO switch is OFF, supplying battery voltage to the Park Brake Switch.
- Both handles are in the neutral position and both neutral switches are CLOSED, supplying battery voltage to the control side of the kill relay.

Note: The engine will not crank over to start when the PTO switch is ON.

(Fig. 151)

Starting System Schematic

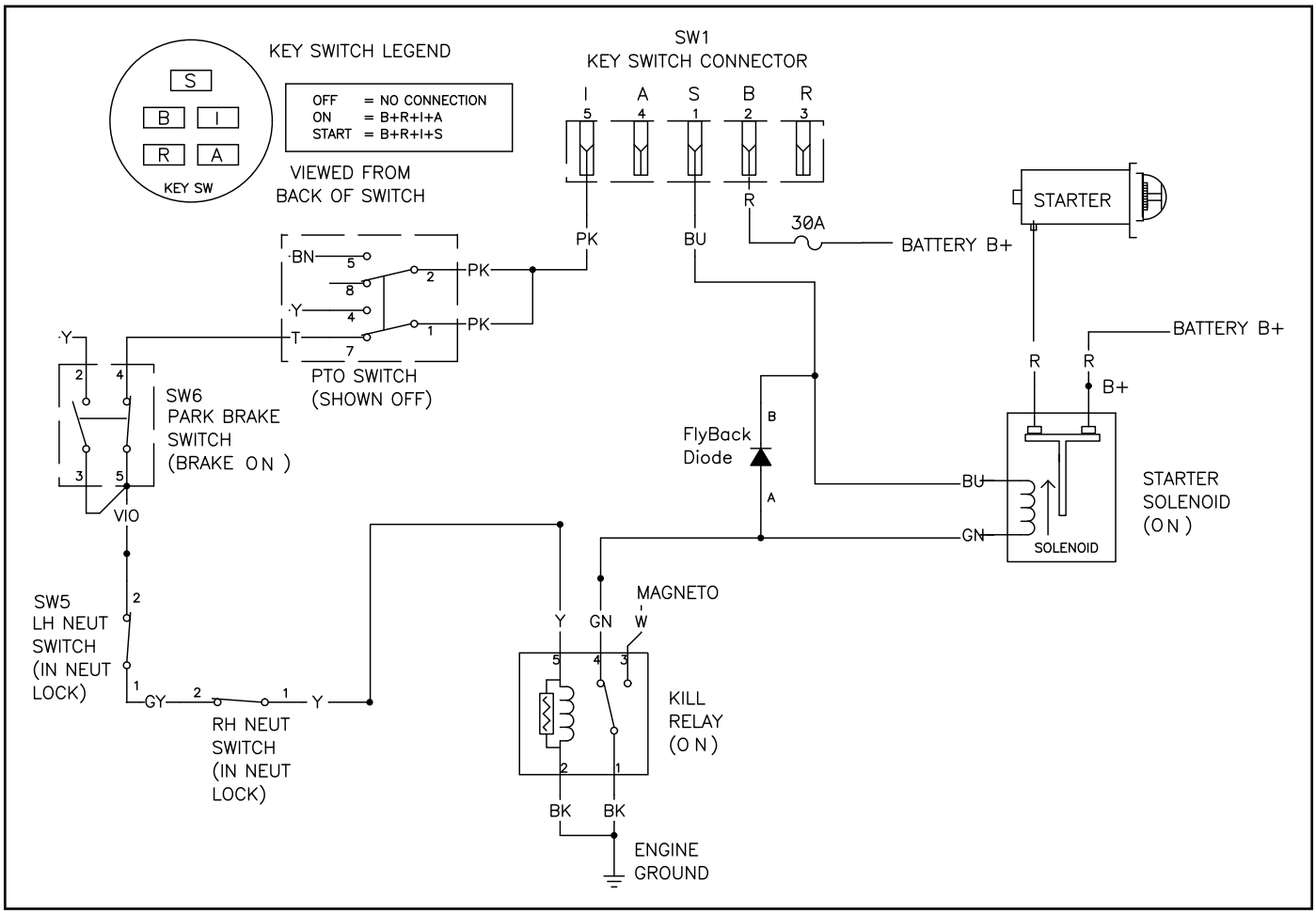


Fig. 151 PICT-2014

Electric PTO Clutch

Purpose

The clutch electrically controls the engagement and disengagement of the PTO pulley.

Location

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

How It works

The PTO clutch is composed of three major components; the field, clutch plate, and friction plate. The clutch plate always turns with the engine. The field is a coil of wire on an iron core, which becomes an electromagnet when power is applied.

The friction plate is the only piece that can slide up and down on the crankshaft axis. It is normally spring-loaded so that it is not in contact with the clutch plate and is pressed against the brake material opposite the clutch. When power is applied, the friction plate is drawn toward the clutch plate and the two rotate as one.

Testing

If the electric PTO clutch is not engaging or is suspected as a cause of electrical problems, use the troubleshooting steps. These procedures will help you determine if the clutch has failed or is the cause of the electrical problem.

Coil Resistance Measurement

1. Disengage the PTO switch, turn ignition off and remove key.
2. Disconnect clutch wire connector.
3. Set the multimeter to check resistance (ohms).
4. Connect the meter lead wires to the terminals in the clutch connector (Fig. 152).

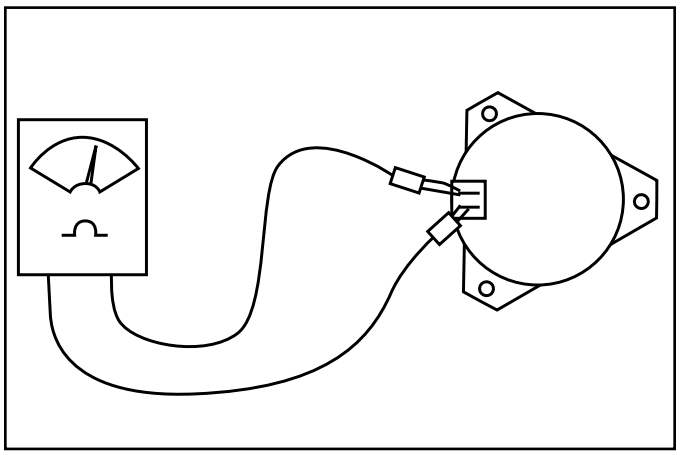


Fig. 152 coil resist msmt_v2

5. See the PTO Clutch Electrical Specifications chart.

PTO Clutch Electrical Specifications

Ohms Specification	Amp Draw Specification	Continuity to Ground
2.84 ± 15%	4.23A ± 15%	OPEN

PTO Clutch Continuity to Ground Check

1. Disengage PTO switch, turn ignition off and remove key.
2. Disconnect clutch wire connector.
3. Set the multimeter to check resistance (ohms).
4. Connect one meter lead to the engine, chassis or battery ground. Connect the other meter lead to each of the PTO clutch terminals.
5. The two PTO terminals should never have continuity to ground and should be OPEN at all times. If continuity is found between the clutch wires and ground, the clutch and PTO switch must be replaced.

Measuring Clutch Current Draw

Note: Do not measure current draw if clutch has shorted to ground or if the resistance measurement is out of specification.

1. Disengage PTO switch, turn ignition off and remove key.
2. Disconnect clutch wire connector.
3. Set the multimeter to check amps (10 amp scale).
4. Connect the positive meter lead to the chassis harness terminal A (brown wire) (Fig. 153).
5. Connect the negative meter lead to the corresponding wire terminal B (Fig. 153).
6. Connect a short jumper lead from terminal C to terminal D (Fig. 153).
7. Turn the ignition key in the switch to “RUN” position and the PTO switch to the “ON” position.
8. See the PTO Clutch Electrical Specifications chart.

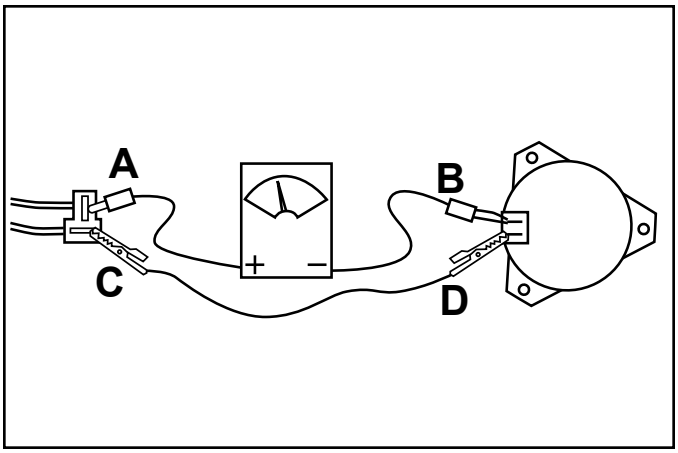


Fig. 153 clutch current msmt_v2

PTO Clutch Electrical Specifications

Ohms Specification	Amp Draw Specification	Continuity to Ground
2.84 ± 15%	4.23A ± 15%	OPEN

PTO Circuit & Operation

The The PTO clutch is powered by the PTO Switch and grounded through the kill relay.

The PTO Clutch will only ground and engage when:

- The ignition switch is in the ON position.
- The PTO switch is in the ON position.
- Proper battery voltage is present at the key switch kill relay.
- Proper ground is present at the battery, chassis and kill relay.
- An operator is in the seat.
- The parking brake is ON and the handles are in the outward neutral position.
- The parking brake is OFF and the handles in any position.

Note: The engine will not crank over to start when the PTO switch is ON.

(Fig. 154, next page)

PTO Circuit Schematic

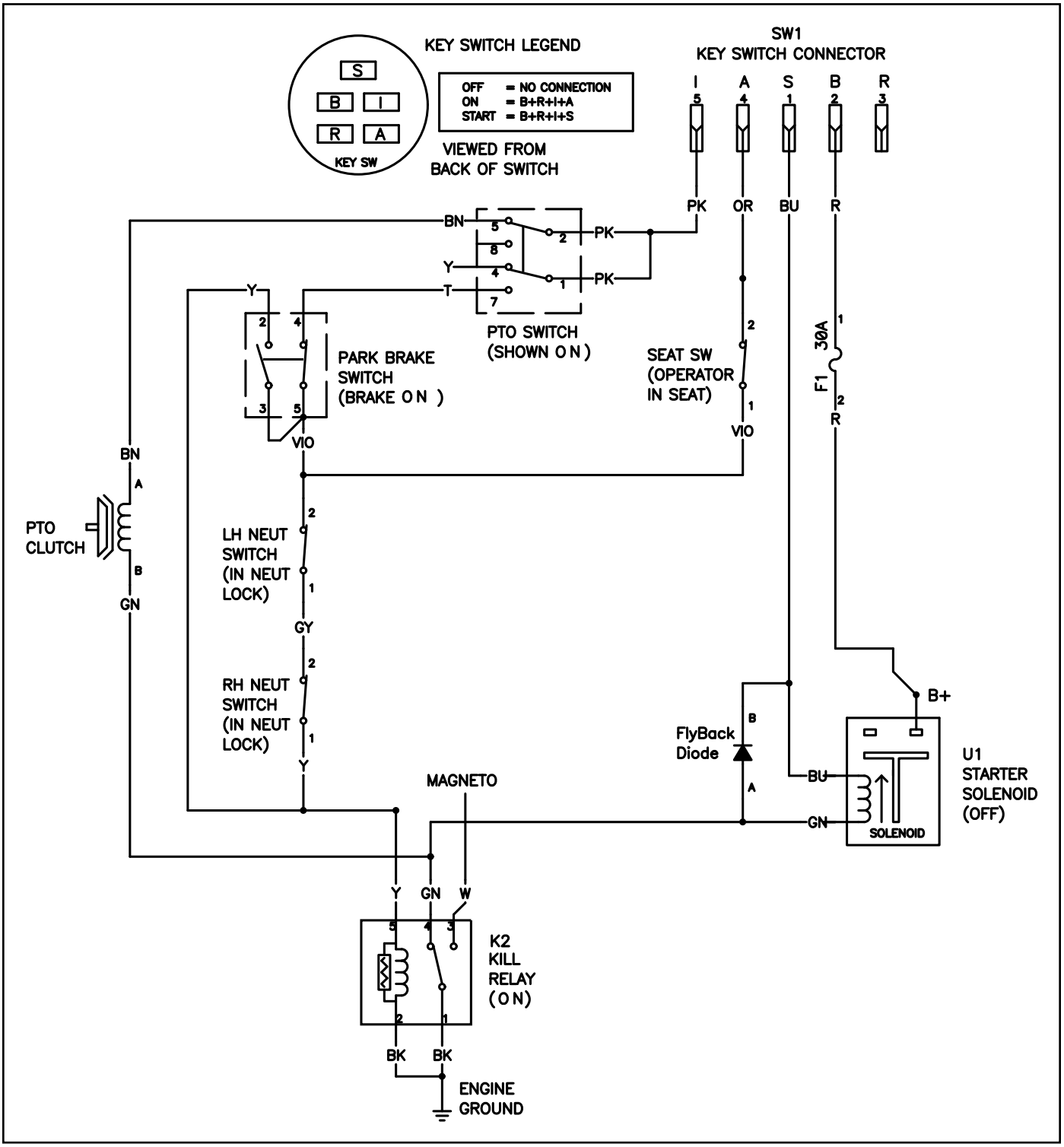


Fig. 154 PICT-2015

PTO Clutch Replacement

PTO Clutch Removal

1. Remove the PTO belt tensioner spring from the deck, then remove the PTO belt from the PTO clutch.
2. If necessary, safely raise and support unit.
3. Disconnect harness connection to PTO clutch.
4. Remove the PTO clutch bolt (A).
5. Remove PTO clutch (B) from the engine crankshaft.

PTO Clutch Installation

1. Clean engine crankshaft.
2. Apply anti-seize to engine crankshaft.
3. Install PTO clutch onto engine crankshaft. Be sure anti–rotation bracket is properly aligned.
4. Apply Loctite® 242 to PTO clutch bolt.
5. Torque the PTO clutch mounting bolt to 55 ft-lbs. (75 Nm).
6. Connect harness connection to PTO clutch.
7. Install PTO belt, then tensioner spring.
8. Safely lower unit.
9. Verify proper function.

(Fig. 155)

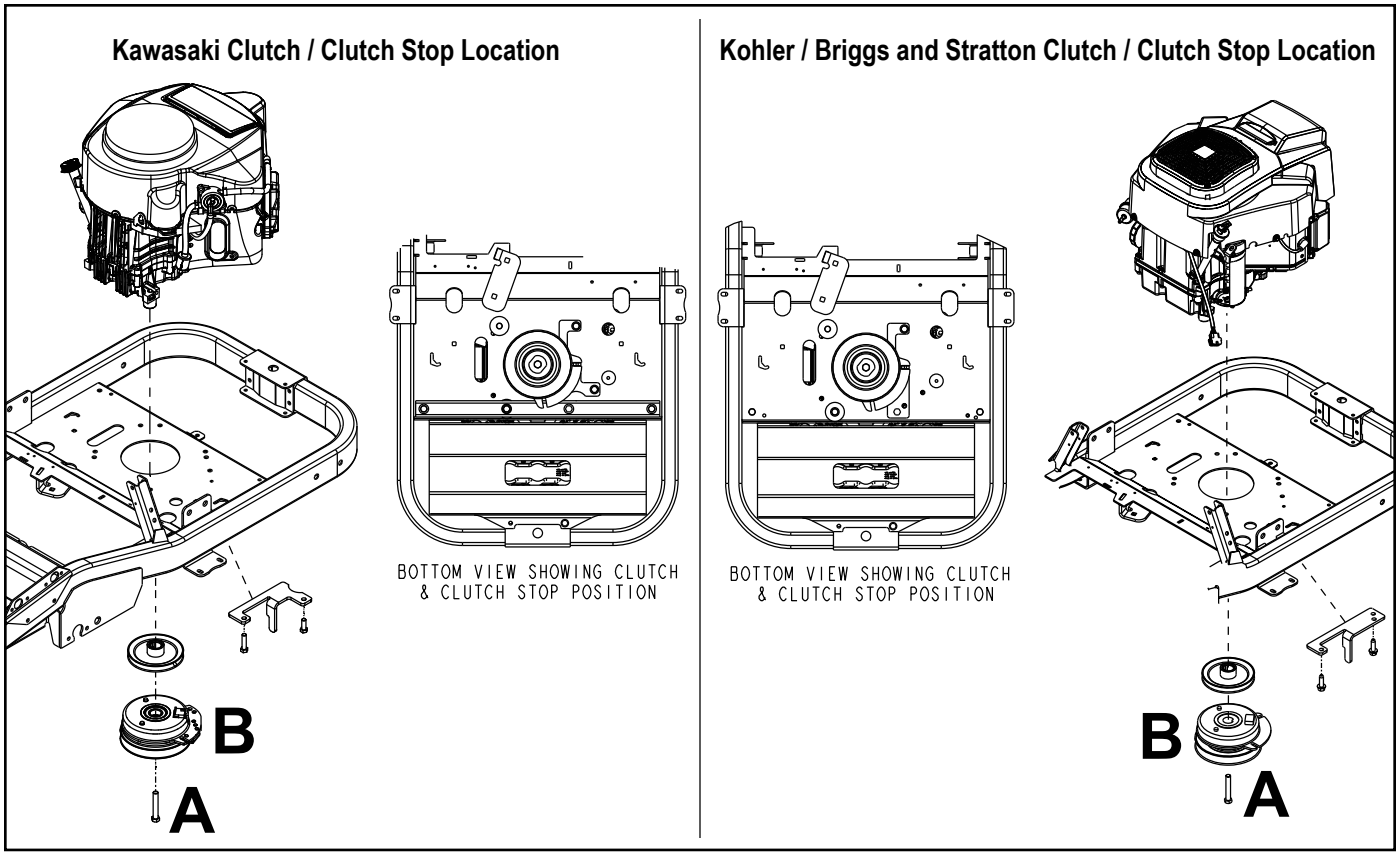


Fig. 155 PICT-2062

Hour Meter

Purpose

The hour meter records hours of operation when:

- The Ignition key is ON
- The PTO switch is ON

Location

The hour meter is located on the RH control panel (Fig. 156).

Fig. 156 PICT-2001

How It Works

When they key is ON, a closed PTO switch supplies battery voltage to the hour meter.

The electric/LCD style hour meter has an internal battery the keeps the hour meter display illuminated at all times.

Testing

With the key ON and PTO switch CLOSED, verify battery voltage and ground are present at the hour meter (Fig. 157).

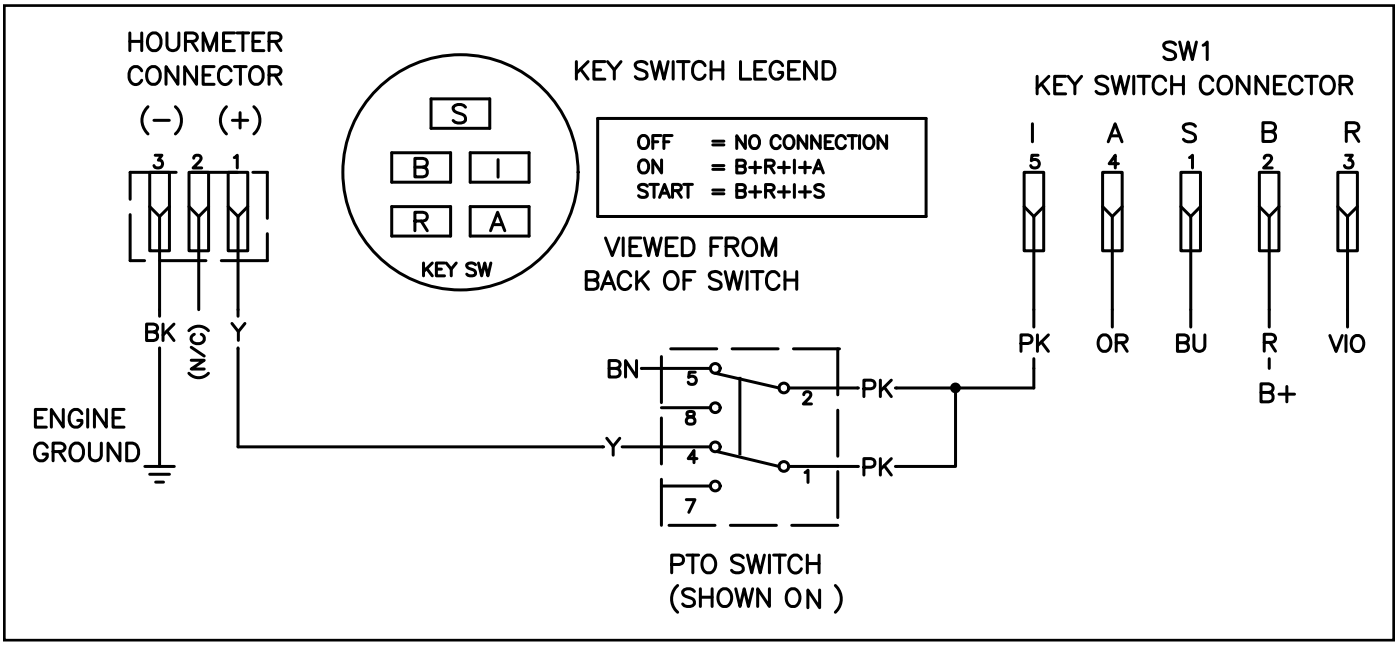


Fig. 157 PICT-2016

Fuse Block & Fuses

Purpose

The fuse block houses the electrical system fuses.

Location

The fuse block is located behind the operator's seat, near the starter solenoid on the RH side of the unit (Fig. 158).

Fig. 158 PICT-2013

How It Works

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

Testing

- With a multimeter set to OHM of continuity setting, check the continuity between the fuse blades. If the fuse is OPEN, replace it and test the circuit.
- The fuses used in this application can also be visually inspected. A failed fuse can be identified by the broken/melted element inside the fuse cover or a damaged spade (Fig. 159 and Fig. 160).

Fig. 159 IMG-1214a

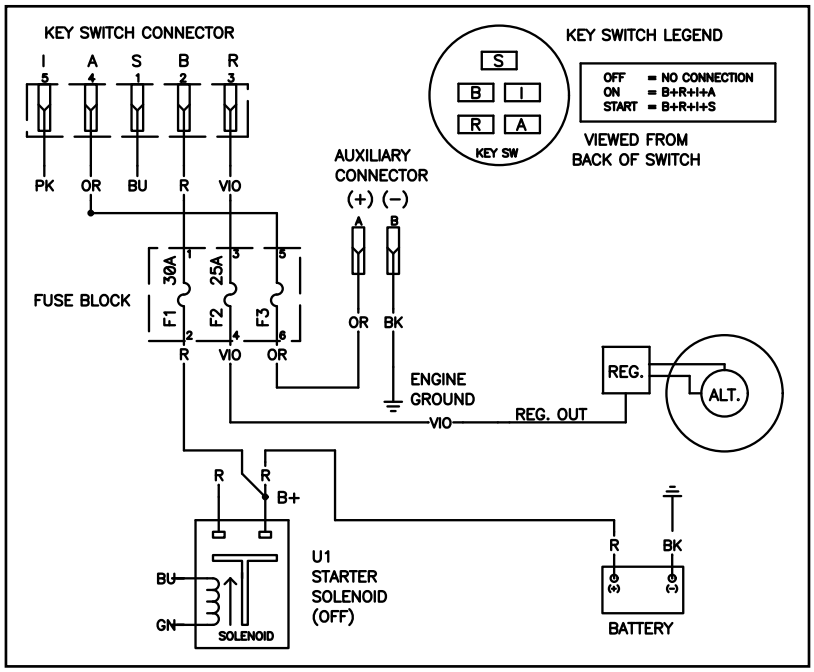


Fig. 160 PICT-2017

7

FlyBack Diode

Purpose

The flyback diode protects the electrical system from current surges caused by PTO engagement and disengagement (Fig. 161).

Fig. 161 DSCN-0149a

Location

The flyback diode is located just in front of the engine, near the hydro expansion tank. The diode is cable tied to the main wire harness (Fig. 162 and Fig 163).

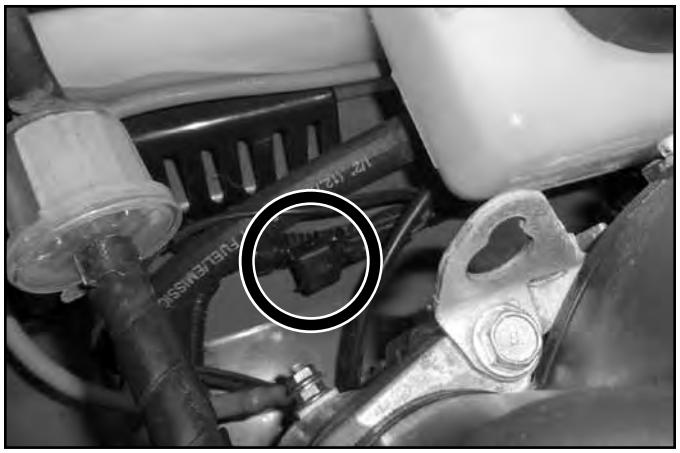


Fig. 162 PICT-2021

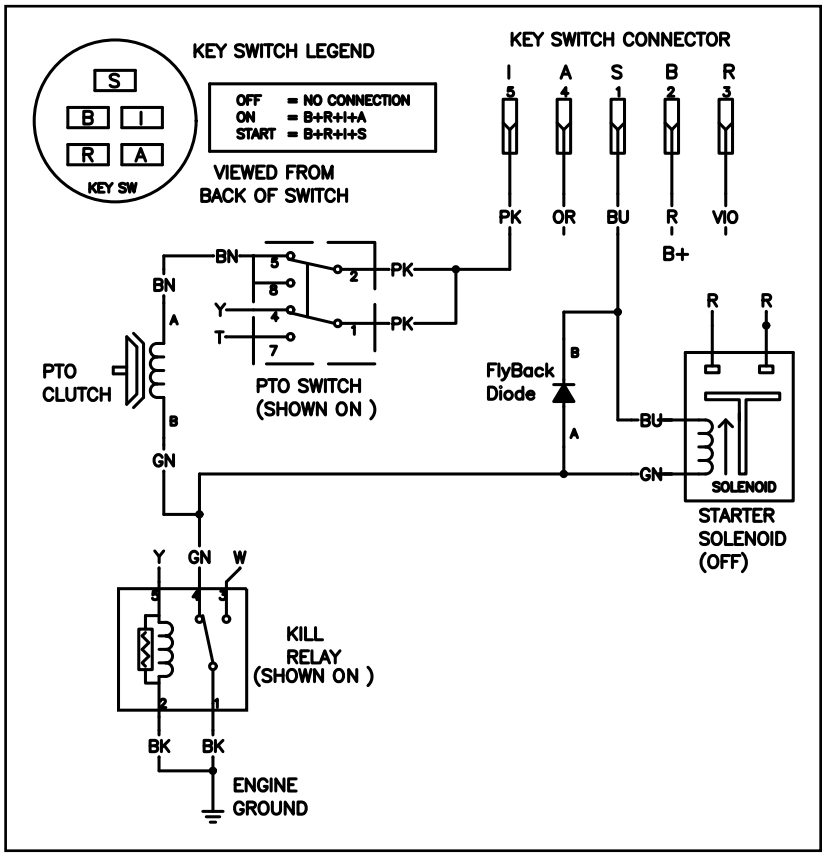


Fig. 163 PICT-2024

Testing

1. Remove the diode from the harness connection.
2. Use a volt / ohm meter set to the ohm or diode setting to test the diode.
3. Measure the diode resistance, record the value.
4. Reverse the ohm meter leads on the diode terminals and measure the diode resistance again, record this value.
   - If the resistance value is the same in steps 3 and 4, the diode is shorted or open – replace the diode.

Note: If the flyback diode tests shorted or open, also test the PTO clutch as shown in this chapter.

- A properly functioning diode will be open in one direction and have an ohms resistance value when the meter leads are reversed as shown:

(Fig. 164 and Fig. 165)

Fig. 164 PICT-2022

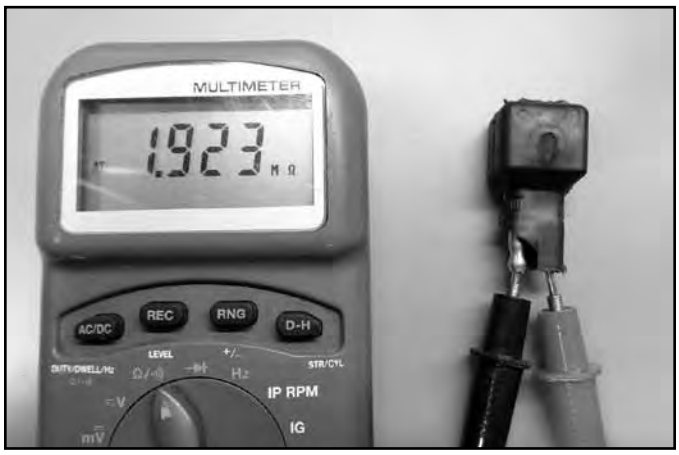


Fig. 165 PICT-2023

7

Wire Harness 1 of 3

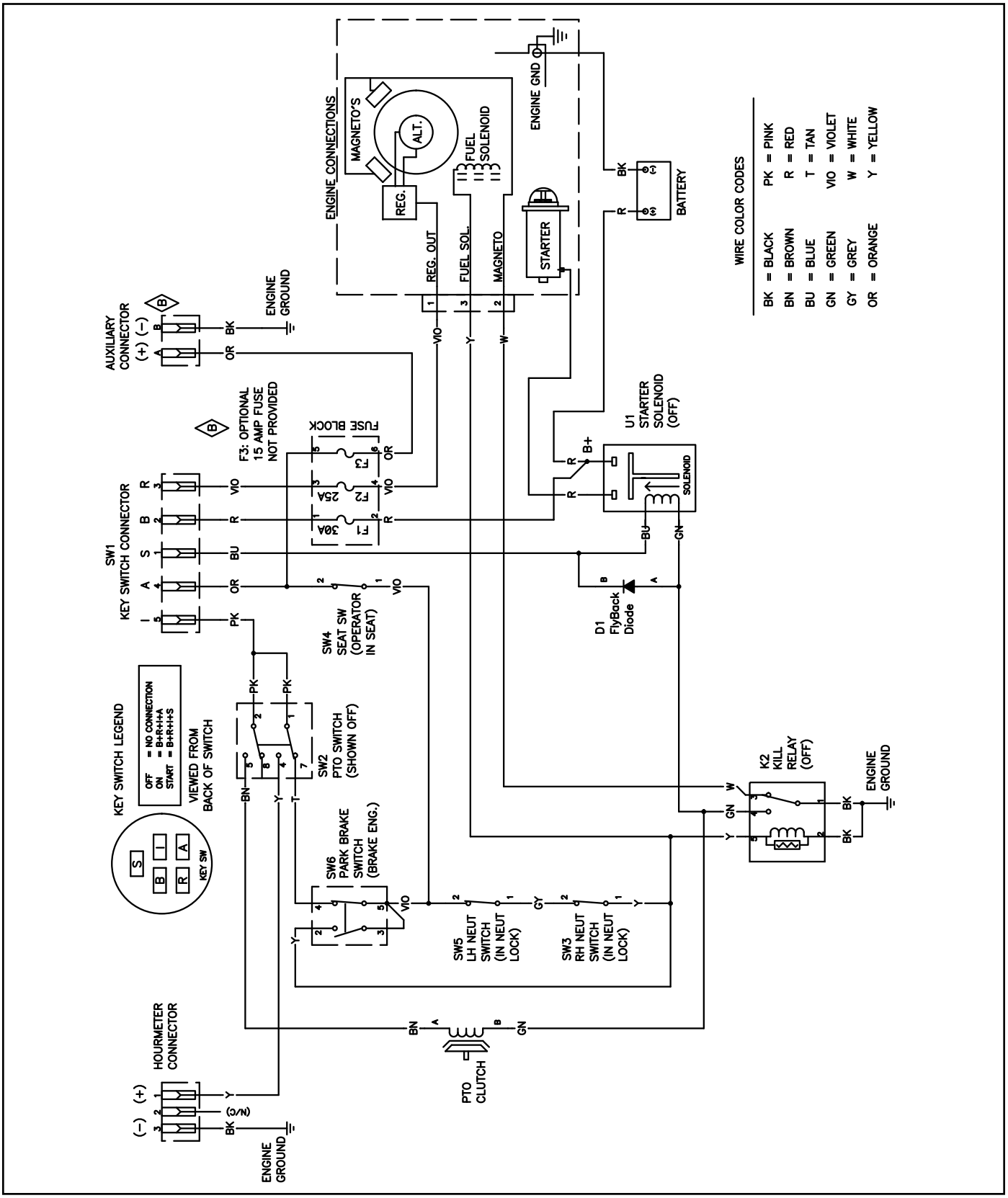


Fig. 166 PICT-2018

Wire Harness 2 of 3

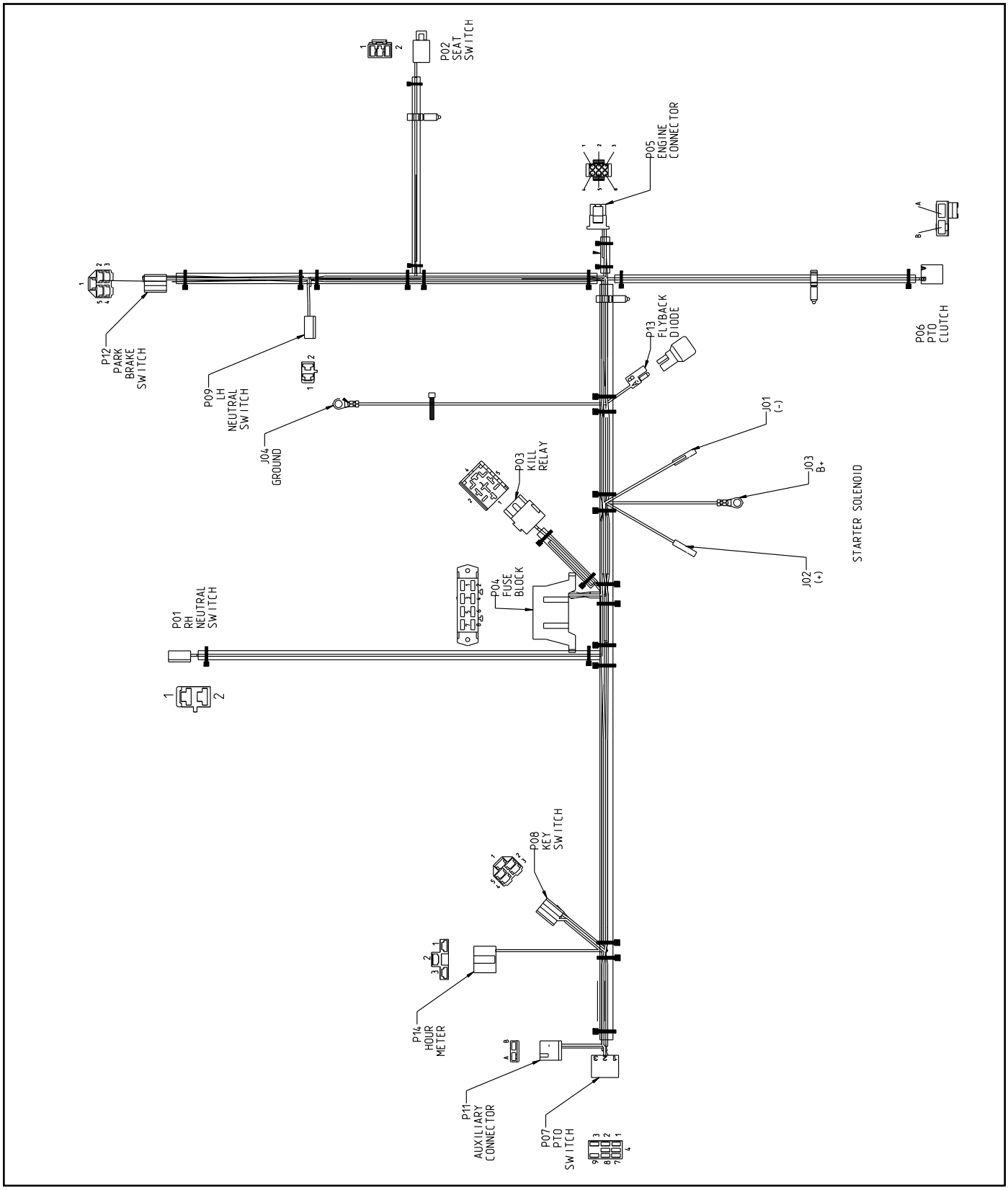


Fig. 167 PICT-2019

Wire Harness 3 of 3

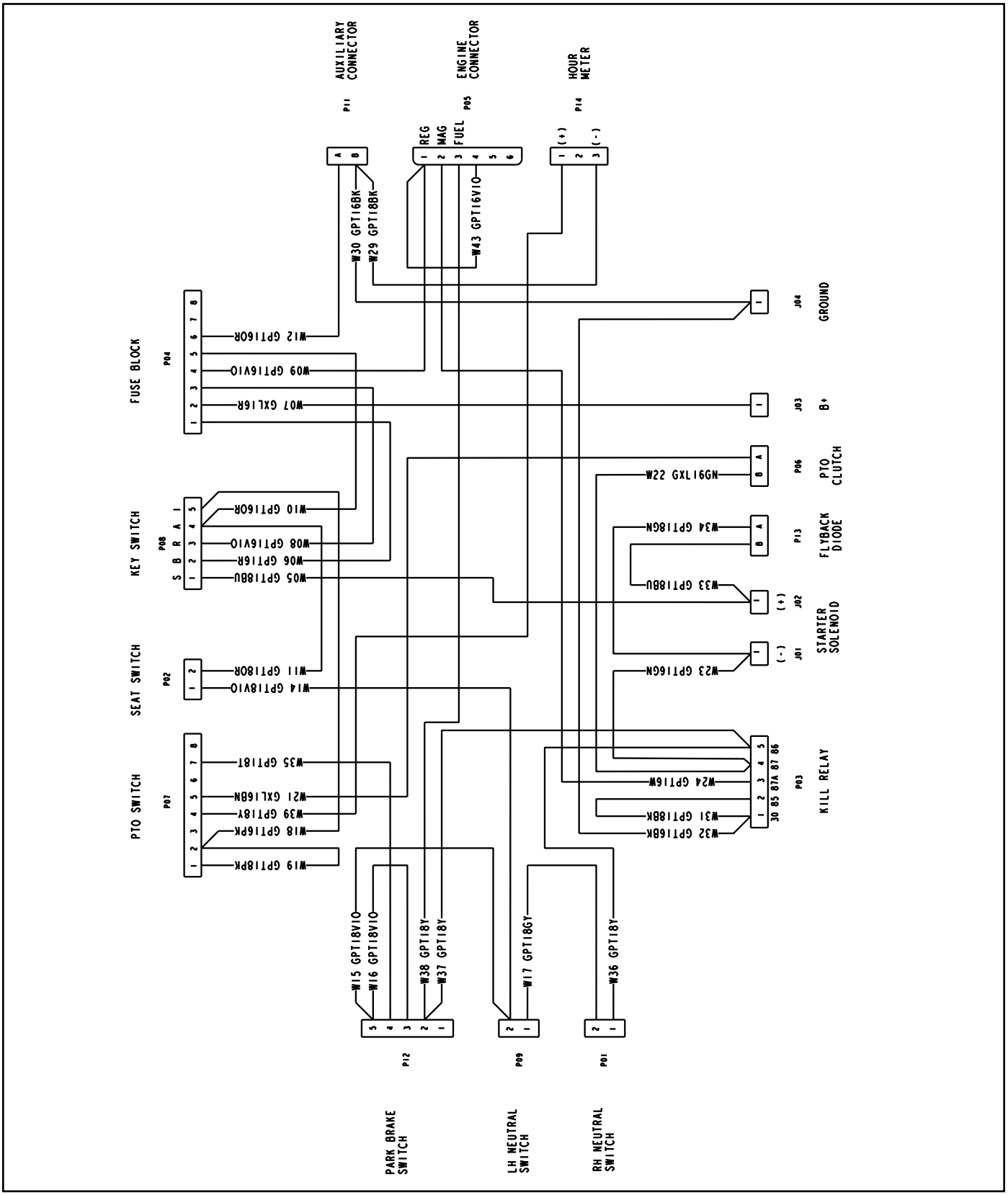


Fig. 168 PICT-2020

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TITAN® ZX/MX
Service Manual

Form Number 492-9336