



Residential and  
LCE Products

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# **30 inch Stand-On Aerator Service Manual**





# ABOUT THIS MANUAL

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This service manual was written expressly for Toro and Lawn-Boy 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 additional information on the electrical system, please refer to the Toro Electrical Demystification Guide (492-4761) and subsequent. For service information on drive systems, please refer to the Hydro-Gear BDP service manual (492-4779). For information specific to the engine used on this unit, refer to the appropriate engine manufacturer's service and repair instructions.

The Toro 30" Aerator, model year 2013, is covered in this manual. The manual may also be specified for use on later model products.

Due to the compact design, parts were removed for photographic purposes when necessary.

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

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

**The Toro Company  
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.

## **ABOUT THIS MANUAL**

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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 Toro 30" Aerator. The 30" Aerator operator's manual contains

safety information and operating tips for safe operating practices. Operator's manuals are available through your Toro parts source or:

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

## Think Safety First

### **Avoid unexpected starting of engine...**

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

### **Avoid lacerations and amputations...**

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

### **Avoid burns...**

Do not touch the engine, muffler, or other components which may increase in temperature during operation, while the unit is running or shortly after 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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# SPECIFICATIONS & MAINTENANCE

## Torque Specifications

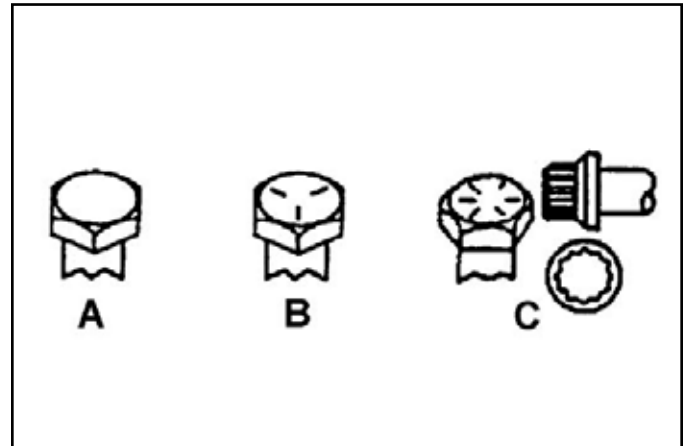
Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in the service manual.

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.

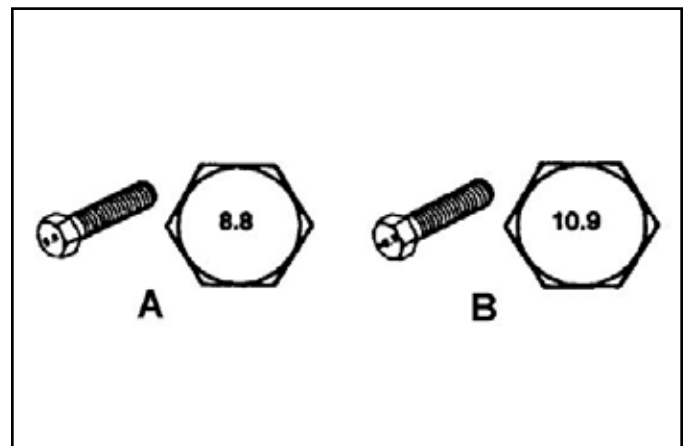
The standard method of verifying torque shall be performed by marking a line on the fastener (head or nut) and mating part, then back off fastener 1/4 of a turn. Measure the torque required to tighten the fastener until the lines match up.

## Fastener Identification



### Inch Series bolts and Screws

(A) Grade 1 & 2 (B) Grade 5	(C) Grade 8
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### Metric Bolts and Screws

(A) Class 8.8	(B) Class 10.9
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# SPECIFICATIONS & MAINTENANCE

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

2

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.



# SPECIFICATIONS & MAINTENANCE

## 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)	
<b>M5 X 0.8</b>	57 ± 5 in-lb	644 ± 68 N-cm	78 ± 8 in-lb	881 ± 90 N-cm
<b>M6 X 1.0</b>	96 ± 10 in-lb	1085 ± 113 N-cm	133 ± 14 in-lb	1503 ± 158 N-cm
<b>M8 X 1.25</b>	19 ± 2 ft-lb	26 ± 3 N-m	28 ± 3 ft-lb	38 ± 4 N-m
<b>M10 X 1.5</b>	38 ± 4 ft-lb	52 ± 5 N-m	54 ± 6 ft-lb	73 ± 8 N-m
<b>M12 X 1.75</b>	66 ± 7 ft-lb	90 ± 10 N-m	93 ± 10 ft-lb	126 ± 14 N-m
<b>M16 X 2.0</b>	166 ± 15 ft-lb	225 ± 23 N-m	229 ± 23 ft-lb	310 ± 31 N-m
<b>M20 X 2.5</b>	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.

# SPECIFICATIONS & MAINTENANCE

## 30" Aerator Specifications

	<b>30" Stand-On Aerator</b>
<b>Models:</b>	<b>23518 / 33518</b>

<b>Engines:</b>	<b>36.8 cu-in. (603cm<sup>3</sup>)</b>
<b>Make</b>	Kawasaki
<b>Model</b>	FS481 V-Twin
<b>Hi-Idle</b>	3600 RPM
<b>Low-Idle</b>	1250-1550 RPM
<b>Spark Plug</b>	BPR4ES (NKG)
<b>Spark Plug Gap</b>	.030"/.76mm
<b>Oil</b>	SAE 10W-30
<b>Oil Capacity</b>	1.8 Qt. (1.7 liters)
<b>Starter</b>	Electric Only
<b>Fuel Tank Volume</b>	5.0 US gal (18.9 L)

### Power System:

<b>Transmission</b>	Hydro-Gear ZT3400
<b>Hydraulic Fluid</b>	Toro Hydro Oil
<b>Hydraulic Fluid Capacity</b>	70.3 oz. (2.0 L) w/filter
<b>Ground Speed (fwd/rev)</b>	7.5 mph/NA
<b>Drive Tires (pneumatic)</b>	16 x 6.50 - 8
<b>Tire Pressure</b>	12-14 psi (83-97 kPa)

### Dimensional:

<b>Width (in/cm)</b>	47.75/121.3
<b>Length Operating (in/cm)</b>	64.0/162.6
<b>Length Handle Stored (in/cm)</b>	N/A
<b>Height Operating (in/cm)</b>	52.0/132.1
<b>Height Handle Stored (in/cm)</b>	N/A
<b>Weight (lb/kg)</b>	1015.0/460.0
<b>Max Operating Depth (in/cm)</b>	4.0/10.2
<b>Plugs per Sq-ft./ Sq-meter</b>	4.6/49.5

# SPECIFICATIONS & MAINTENANCE

## Recommended Maintenance Schedule

Maintenance Service	Interval Maintenance Procedure
After the first 5 hours	<ul style="list-style-type: none"> <li>• Change the engine oil.</li> </ul>
After the first 100 hours	<ul style="list-style-type: none"> <li>• Change the auxiliary hydraulic reservoir filter and fluid.</li> <li>• Change the hydraulic transmission filter and fluid.</li> </ul>
Before each use or daily	<ul style="list-style-type: none"> <li>• Check the engine oil level.</li> <li>• Check the safety interlock system.</li> <li>• Check for loose hardware.</li> <li>• Lubricate the chains.</li> <li>• Check the condition and tension of the chains.</li> <li>• Check the condition of the sprockets.</li> <li>• Check the tines.</li> <li>• Clean the engine and exhaust system area.</li> <li>• Clean the grass and debris build-up from the machine.</li> </ul>
Every 25 hours	<ul style="list-style-type: none"> <li>• Grease the jackshaft bearings.</li> <li>• Grease the wheel bearings.</li> <li>• Grease the tine shaft bearings.</li> <li>• Grease the tine assembly idlers.</li> </ul>
Every 50 hours	<ul style="list-style-type: none"> <li>• Grease the control pivots.</li> <li>• Check spark arrester (if equipped).</li> <li>• Check the tire pressures.</li> <li>• Check the condition and tension of the belts.</li> <li>• Check the auxiliary hydraulic oil level.</li> <li>• Check the hydraulic transmission oil level.</li> </ul>
Every 80 hours	<ul style="list-style-type: none"> <li>• Remove engine shrouds and clean cooling fins.</li> </ul>
Every 100 hours	<ul style="list-style-type: none"> <li>• Change the engine oil. (May need more often under severe conditions.)</li> </ul>
Every 160 hours	<ul style="list-style-type: none"> <li>• Check the spark plugs.</li> </ul>
Every 250 hours	<ul style="list-style-type: none"> <li>• Replace the primary air cleaner element - check secondary air cleaner element; replace if dirty. (May need more often under severe conditions. See the Engine manual for additional information.)</li> <li>• Change the auxiliary hydraulic reservoir filter and fluid.</li> <li>• Change the hydraulic transmission filter and fluid.</li> </ul>
Every 500 hours	<ul style="list-style-type: none"> <li>• Replace the secondary air cleaner element. (May need more often under severe conditions. See the Engine manual for additional information.)</li> </ul>
Monthly	<ul style="list-style-type: none"> <li>• Check the battery charge.</li> </ul>
Yearly	<ul style="list-style-type: none"> <li>• Grease the front caster pivots.</li> <li>• Grease the belt idler pivot.</li> <li>• Lubricate the caster wheel hubs.</li> <li>• Check the torque of the wheel hub nuts.</li> <li>• Check the torque on the wheel lug nuts.</li> <li>• Check the transmission output shaft nut torque specification.</li> </ul>
Yearly or before storage	<ul style="list-style-type: none"> <li>• Touch up chipped paint</li> </ul>

# SPECIFICATIONS & MAINTENANCE

## Premaintenance Procedures

**Note:** Shut off engine, wait for all moving parts to stop, engage parking brake, and remove key before servicing, cleaning, or making any adjustments to the unit.

2

Caution

Raising the unit for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the unit to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

## Lubrication

### Lubricate Chains

Service Interval: Before each use or daily

**Important:** Do not lubricate chains with penetrating oil or solvents. Use oil or chain lubricant.

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lift the rear of the unit and support using jack stands or equivalent support.

Caution

Raising the unit for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the unit to fall, which could cause injury.

Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

3. Start engine and move throttle control ahead to 1/2 throttle position. Disengage parking brake.

!

Warning

!

Engine must be running and drive wheels must be turning so adjustments can be performed. Contact with moving parts or hot surfaces may cause personal injury.

Keep fingers, hands, and clothing clear of rotating components and hot surfaces.

4. With the engine running, slowly move the motion control levers forward and lubricate all six chains.
5. Check the condition and tension of the chains.

# SPECIFICATIONS & MAINTENANCE

## Lubricate Grease Fittings

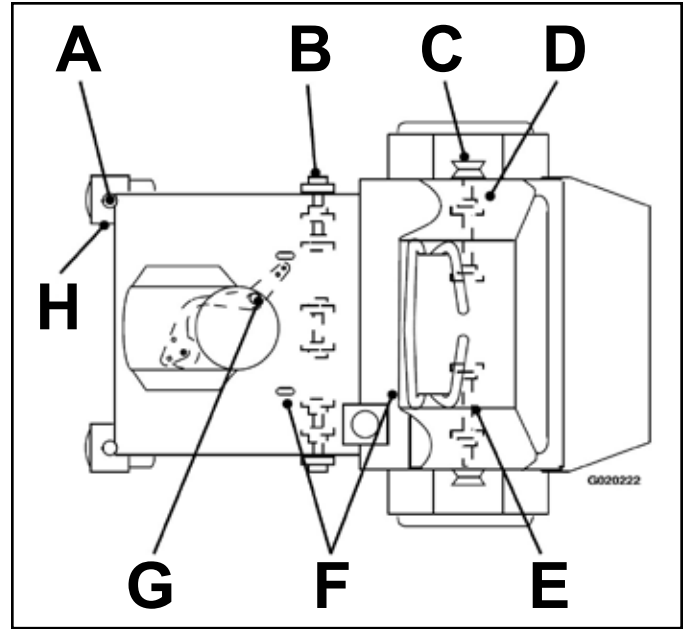
**Note:** See chart for service intervals.

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lubricate fittings with NGLI grade #2 multi-purpose gun grease.

Refer to the following chart for fitting locations and lubrication schedule.

**Lubrication Chart**

Fitting Locations	Initial Pumps	Number of Places	Service Interval
A. Front Caster Pivots	*0	2	Yearly
B. Jackshaft Bearings	1	8	25 hours
C. Wheel Bearings	1	2	25 hours
D. Tine Shaft Bearings	1	4	25 hours
E. Tine Assembly Idlers	1	2	25 hours
F. Control Pivots	1	4	50 hours
G. Belt Idler Pivot	1	1	Yearly
H. Front Caster Hubs	*0	2	Yearly



**Fig. 001**

fig. 13a G020222

- \* See step 3 for special lubrication instructions on the front caster pivots.
3. Lubricate front caster pivots once a year. Remove hex plug and cap. Thread grease fitting in hole and pump with grease until it oozes out around top bearing. Remove grease fitting and thread plug back in. Place cap back on.

# SPECIFICATIONS & MAINTENANCE

## Lubricate Caster Wheel Hubs

Service Interval: Yearly

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Remove caster wheel from caster forks.
3. Remove seal guards from the wheel hub (Fig. 002).
4. Remove one of the spacer nuts from the axle assembly in the caster wheel (Fig. 002). Note that thread locking adhesive has been applied to lock the spacer nuts to the axle. Remove the axle (with the other spacer nut still assembled to it) from the wheel assembly.

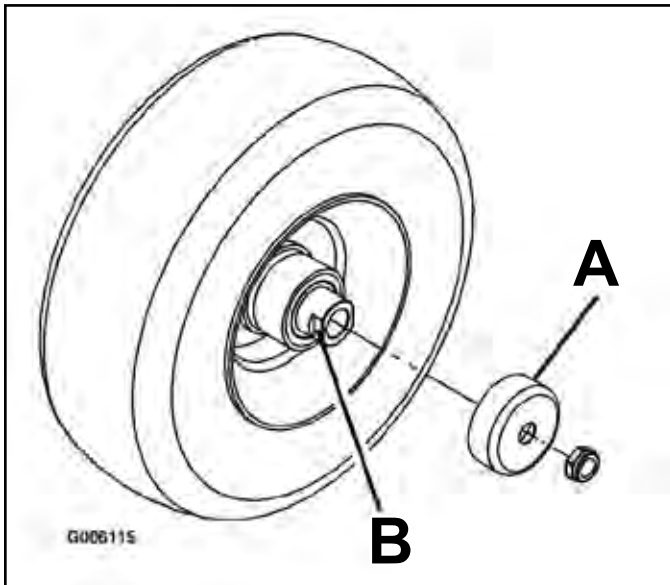


Fig. 002

fig. 14 G006115

- A. Seal guard      B. Spacer nut w/wrench flats

5. Pry out seals, and inspect bearings for wear or damage and replace if necessary.
6. Pack the bearings with a NGLI grade #1 multi-purpose grease.
7. Insert one bearing, one new seal into the wheel.

**Note: Replace the seals.**

8. If the axle assembly has had both spacer nuts removed (or broken loose), apply a thread locking adhesive to one spacer nut and thread onto the axle with the wrench flats facing outward. Do not thread spacer nut all of the way onto the end of the axle. Leave approximately 3mm (1/8") from the outer surface of the spacer nut to the end of the axle inside the nut.
9. Insert the assembled nut and axle into the wheel on the side of the wheel with the new seal and bearing.
10. With the open end of the wheel facing up, fill the area inside the wheel around the axle full of NGLI grade #1 multi-purpose grease.
11. Insert the second bearing and new seal into the wheel.
12. Apply a thread locking adhesive to the 2nd spacer nut and thread onto the axle with the wrench flats facing outward.
13. Torque the nut to 75-80 in-lbs. (8-9 Nm), loosen, then re-torque to 20-25 in-lbs. (2-3 Nm). Make sure axle does not extend beyond either nut.
14. Reinstall the seal guards over the wheel hub and insert wheel into caster fork. Reinstall caster bolt and tighten nut fully.

**Important: To prevent seal and bearing damage, check the bearing adjustment often. Spin the caster tire. The tire should not spin freely (more than 1 or 2 revolutions) or have any side play. If the wheel spins freely, adjust torque on spacer nut until there is a slight amount of drag. Reapply thread locking adhesive.**

## Engine Maintenance

### Service Air Cleaner

Service Interval: Every 250 hours - Replace the primary air cleaner element - check secondary air cleaner element; replace if dirty. (May need more often under severe conditions. See the Engine Owner's Manual for additional information.)

Every 500 hours - Replace the secondary air cleaner element. (May need more often under severe conditions. See the Engine Owner's Manual for additional information.)

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. See the Engine Owner's Manual for maintenance instructions.

### Change Engine Oil

Service Interval: After the first 5 hours

Every 100 hours (May need more often under severe conditions.)

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Drain oil while engine is warm from operation.
3. The oil drain hose assembly is located on the left side of the engine.

Place pan under machine to catch oil. Remove oil drain plug. Allow oil to drain and replace oil drain plug. Torque plug to 20-24 ft-lbs. (27-33 Nm).

4. Replace the oil filter per the Engine Owner's Manual. Clean around the oil filter and carefully remove the filter by unscrewing it. Make sure no oil drains onto the belt drives through the holes in the engine deck. Before the new filter is installed, apply a thin coating of Toro 4-Cycle Premium Engine Oil on the surface of the rubber seal. Turn filter clockwise until rubber seal contacts the filter adapter, then tighten filter an additional 2/3 to 3/4 turn.

5. Clean around oil fill cap and remove cap. Fill to specified capacity and replace cap.
6. Add 1.8 qt. (1.7 L) of Toro Premium Oil. Do not overfill. Start the engine and check for leaks. Stop engine and recheck oil level.
7. Wipe up any spilled oil from engine deck mounting surfaces.

### Check Spark Plugs

Service Interval: Every 160 hours

Remove spark plugs, check condition and reset gaps, or replace with new plugs. See the Engine Owner's Manual.

### Check Spark Arrester (if equipped)

Service Interval: Every 50 hours



#### Warning



**Hot exhaust system components may ignite gasoline vapors even after the engine is stopped. Hot particles exhausted during engine operation may ignite flammable materials. Fire may result in personal injury or property damage.**

**Do not refuel or run engine unless spark arrester is installed.**

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Wait for muffler to cool.
3. If any breaks in the screen or welds are observed, replace arrester.
4. If plugging of the screen is observed, remove arrester and shake loose particles out of the arrester and clean screen with a wire brush (soak in solvent if necessary). Reinstall arrester on exhaust outlet.

# SPECIFICATIONS & MAINTENANCE

## Fuel System Maintenance

### Change Fuel Filter

A fuel filter is installed in the fuel line between the fuel tank and the engine. Replace when necessary.

**2** **Note:** It is important to reinstall the fuel line hoses and secure in place, the same way as originally installed at the factory, to keep the fuel line away from components.

## Electrical System Maintenance

### Check Battery Charge

Service Interval: Monthly



#### Warning



#### CALIFORNIA Proposition 65 Warning

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

Allowing batteries to stand for an extended period of time without recharging them will result in reduced performance and service life. To preserve optimum battery performance and life, recharge batteries in storage when the open circuit voltage drops to 12.4 volts.

**Note:** To prevent damage due to freezing, battery should be fully charged before putting away for winter storage.

Check the voltage of the battery with a digital voltmeter. Locate the voltage reading of the battery in the table and charge the battery for the recommended time interval to bring the charge up to a full charge of 12.6 volts or greater.

**Important:** Make sure the negative battery cable is disconnected and the battery charger used for charging the battery has an output of 16 volts and 7 amps or less to avoid damaging the battery.



# SPECIFICATIONS & MAINTENANCE

## Drive System Maintenance

### Check Tire Pressures

Service Interval: Every 50 hours

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Check tire pressure in drive tires.
3. Inflate drive tires to 12-14 psi (83-97 kPa).
4. Semi-pneumatic caster tires do not need to be inflated.

### Check Wheel Hub Nuts Torque Specification

Service Interval: Yearly

Torque the wheel hub nuts to 210-260 ft-lbs. (285-350 Nm).

**Note:** Do not use anti-seize compound on the wheel hub.

### Check Wheel Lug Nuts Torque Specification

Service Interval: Yearly

Torque the wheel lug nuts to 90-95 ft-lbs. (122-129 Nm).

## Check Condition Of Chains

Service Interval: Before each use or daily

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Check the chains on both sides of the unit for proper tension. The chains should be able to move up and down 1/4"-1/2" (6-12mm).
3. If chains pop or snap see "Jackshaft Drive Chain Tension Adjustment" on page 2-12, "Drive Wheel Chain Tension Adjustment" on page 2-13, or "Tine Drive Chain Adjustment" on page 2-18.

## Check Condition Of Sprockets

Service Interval: Before each use or daily

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Inspect sprockets for wear and replace as required.

## Check Transmission Output Shaft Nut Torque Specification

Service Interval: Yearly

Torque the nut on the transmission output tapered shaft to 210-260 ft-lbs. (285-353 Nm).

# SPECIFICATIONS & MAINTENANCE

## Jackshaft Drive Chain Tension Adjustment

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lift the rear of the unit and support using jack stands or equivalent support.
3. Check the chains on both sides of the unit for proper tension. The chains should be able to move up and down 6-12mm (1/4"-1/2").
4. Loosen the nuts on the three hydro mounting bolts and the two on the adjustment bolt as shown in Figure 003. The nuts on the hydro mounting bolts must be loosened on both sides of the unit (Fig. 003).
5. Turn the adjustment bolt to move transmission adjustment plates and hydros. Tighten the nuts on both sides of the adjustment bolts when the chains are properly tensioned.
6. Tighten hydro mounting bolts.
7. Adjust motion controls as stated in the "Motion Control Linkage Adjustment" section of this chapter.

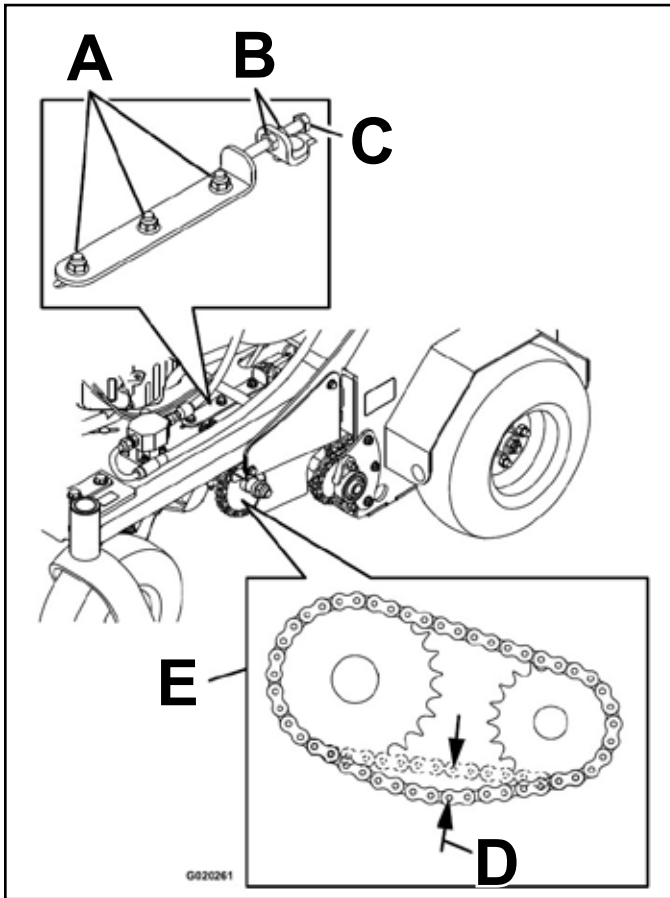


Fig. 003

fig. 16 G020261

- |                                |                              |
|--------------------------------|------------------------------|
| A. Hydro mounting bolts & nuts | D. 6-12mm (1/4"-1/2")        |
| B. Nuts                        | E. Guard removed for clarity |
| C. Adjustment bolt             |                              |

# SPECIFICATIONS & MAINTENANCE

## Drive Wheel Chain Tension Adjustment

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lift the rear of the unit and support using jack stands or equivalent support.
3. Check the chains on both sides of the unit for proper tension. The chains should be able to move up and down 1/4"-1/2" (6-12mm).
4. Adjust the idler sprockets.
5. Recheck the chain tension and tighten the idler bolt.

## Caster Pivot Bearings Pre-Load Adjustment

Remove dust cap from caster and tighten nyloc nut until washers are flat and back off 1/4 of a turn to properly set the pre-load on the bearings. If disassembled, make sure the spring disc washers are reinstalled as shown in Figure 004.

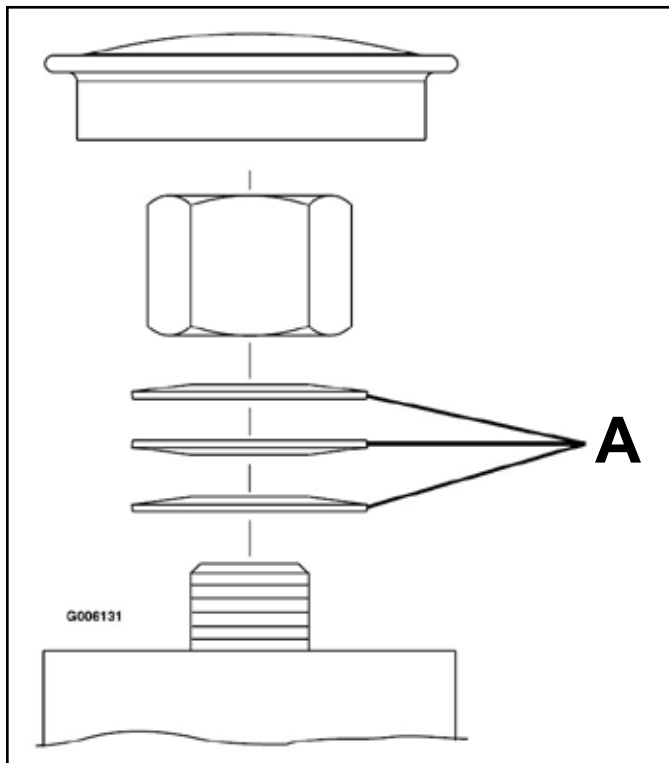


Fig. 004

fig. 17 G006131

A. Spring disc washers

## Brake Maintenance

### Adjusting the Parking Brake

If the parking brake does not hold securely, an adjustment is required.

1. Park the machine on a level surface.
2. Shut off engine and wait for all moving parts to stop.
3. Check the air pressure in the drive tires. If needed, adjust to the recommended inflation.
4. Disengage the parking brake.
5. Loosen the adjustment nut on the brake cable under the console.
6. Engage the parking brake.
7. Adjust the nut position until 3-1/8" (7.9cm) from the bottom of the link to the bottom of the spring (Fig. 005).

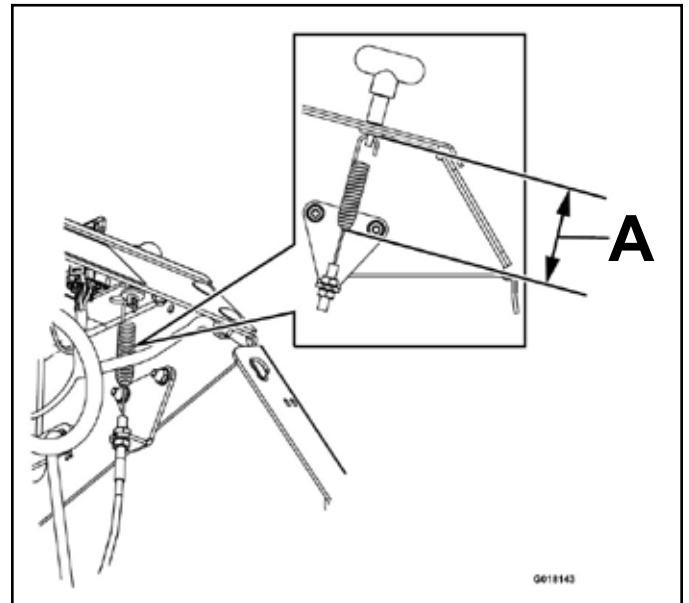


Fig. 005

fig. 18 G018143

A. 3-1/8" (7.9cm)

8. Tighten the cable adjustment nuts.
9. Check the parking brake; repeat steps 5 through 8 if necessary.

# SPECIFICATIONS & MAINTENANCE

## Adjusting the Brake Switch

1. Park the machine on a level surface.
2. Shut off the engine and wait for all moving parts to stop.
3. Prior the adjusting the brake switch ensure the parking brake is properly adjusted. See "Adjusting the Parking Brake" on page 3-13.
4. Engage the parking brake.
5. Check the distance from the parking brake switch bracket to the hydro brake arm. The distance should be 1/8" (3.2mm) (Fig. 006).

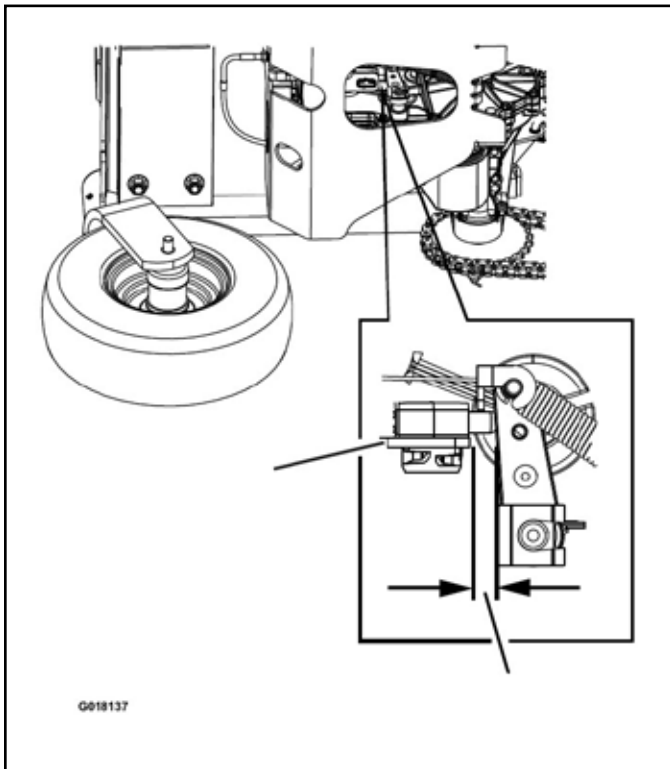


Fig. 006

fig. 19 G018137

- A. Parking brake switch bracket
  - B. 1/8" (3.2mm) gap
6. If adjustment is required, loosen the bolt holding the parking brake switch bracket and adjust the distance between the parking brake switch bracket and the hydro brake arm to be 1/8" (3.2mm).
  7. Tighten the bolt holding the parking brake bracket.

## Belt Maintenance

### Check Condition & Tension Of Belts

Service Interval: Every 50 hours

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lift the front of the unit and support using jack stands or equivalent support.
3. Check the auxiliary pump drive belt condition and tension; belt should be snug. See Auxiliary Pump Drive Belt Adjustment in this section.
4. Check condition of the transmission drive belt.

### Transmission Drive Belt Tension

**Note:** No adjustments are required for belt tension.

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Install the new belt.
3. Make sure the idler arm and pulley can move freely.

### Auxiliary Pump Drive Belt Adjustment

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. To tighten belt, loosen the 3/8" nyloc nut on auxiliary pump belt idler pulley. Slide bolt inward in slot and retighten nyloc nut.
3. When properly adjusted, the belt should have 1/2" (1.3cm) of deflection with 3 pounds of pressure on the belt midway between the auxiliary pump and engine pulley.

## Controls System Maintenance

### Motion Control Linkage Adjustment

1. Park the machine on a level surface.
2. Shut off engine and wait for all moving parts to stop.
3. Push the control levers all the way forward to the front reference bar.
  - If the control levers contact the reference bar, allow the control levers to return to neutral. Remove the spring clevis pin on the turnbuckle of the motion control linkage. Rotate the turnbuckle counterclockwise (as viewed from the top of the machine). Reinstall the spring clevis pin and move the control lever forward (Fig. 007). Repeat this step until there is a gap between the control lever and the front reference bar. Once the gap is achieved, proceed with step 4.
  - If the control levers do not contact the reference bar, then proceed to step 4.
4. Allow the control levers to return to neutral. Remove the spring clevis pin on the turnbuckle of the motion control linkage. Rotate the turnbuckle clockwise (as viewed from the top of the machine). Reinstall the spring clevis pin and move the control lever forward. Repeat this step until there is minimal gap or contact between the control lever and the front reference bar.
5. Remove the spring clevis pin, rotate the turnbuckle clockwise one more full turn.
6. Reinstall the spring clevis pin. Rotate locknut against the turnbuckle.
7. Repeat steps 3 through 6 for other motion control linkage.

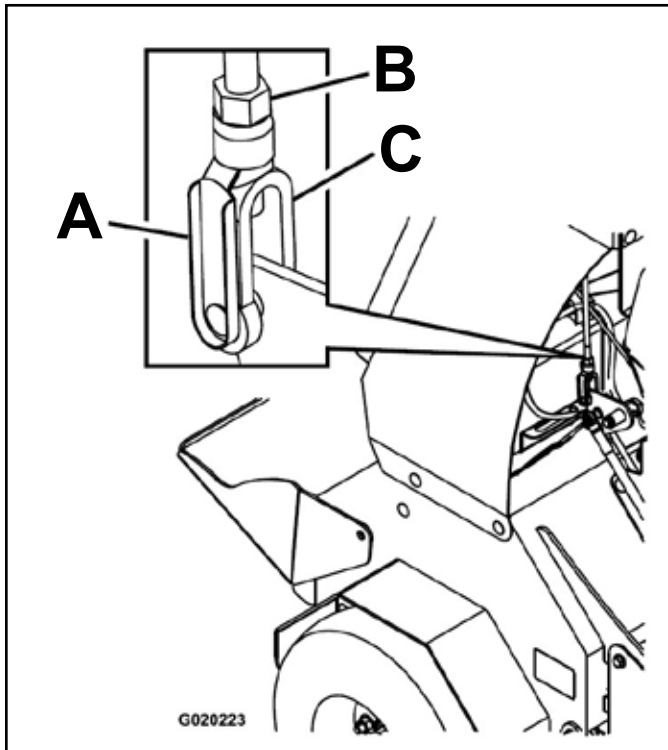


Fig. 007

fig. 20 G020223

- A. Spring clevis pin      C. Turnbuckle  
B. Locknut

# SPECIFICATIONS & MAINTENANCE

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## Hydraulic System Maintenance

### Check Auxiliary Hydraulic Oil Level

Service Interval: Every 50 hours

1. Lower the tines to the ground.
2. Stop engine and wait for all moving parts to stop, and remove key. Engage parking brake.
3. Clean area around hydraulic reservoir cap and remove cap. Oil level should be to the top of the baffle inside the tank. If not, add oil. Use Toro Hydro Oil. Replace hydraulic reservoir cap and tighten until snug. Do not over-tighten.

**Note:** The baffle is labeled Hot and Cold. The oil level varies with the temperature of the oil. The Hot level shows the level of oil when it is at 107°C (225°F). The Cold level shows the level of the oil when it is at 24°C (75°F). Fill to the appropriate level depending upon the temperature of the oil. For example: If the oil is about 65°C (150°F), fill to halfway between the Hot and Cold levels. If the oil is at room temperature (about 24°C (75°F)), fill only to the Cold level.

### Check Hydraulic Transmission Oil Level

Service Interval: Every 50 hours

1. Stop engine and wait for all moving parts to stop, and remove key. Engage parking brake.
2. With the unit cold, check the expansion tank and if necessary add Toro Hydro Oil to the Full Cold line.

### Change Auxiliary Hydraulic Reservoir Fluid and Filter

Service Interval: After the first 100 hours  
Every 250 hours thereafter

1. Stop engine, wait for all moving parts to stop, and remove key or spark plug wire(s). Engage parking brake.
2. Carefully clean area around the front of the auxiliary pump and fill cap; also clean around the filter. It is important that no dirt or contamination enter hydraulic system.
3. Unscrew the suction hose from the pump fitting, clean around the pump fitting, and allow oil to drain.
4. Unscrew the filter to remove and allow oil to drain.

**Important:** Apply a thin coat of oil on the surface of the rubber seal.

Turn filter clockwise until rubber seal contacts the filter adapter, then tighten the filter an additional 2/3 to 3/4 turn.

5. Reinstall the hose and torque to 50 Nm (37 ft-lbs.).
6. Add Toro Hydro Oil until the level reaches the cold fill line located on the reservoir tank. Start engine and raise and lower the tines. Lower the tines to the ground and refill the reservoir to the cold fill line.

# SPECIFICATIONS & MAINTENANCE

## Change Hydraulic Transmission Filters and Fluid

Service Interval: After the first 100 hours  
Every 250 hours thereafter

1. Stop engine, wait for all moving parts to stop, and remove key or spark plug wire(s). Engage parking brake.
2. Locate the two filters under the transmissions. Remove filter guards.
3. Carefully clean area around filters. It is important that no dirt or contamination enter hydraulic system.
4. Unscrew filters to remove and allow oil to drain from drive system.

**Important: Before reinstalling new filters, apply a thin coat of Toro Premium Hydro Oil on the surface of the filters rubber seal.**

Turn the filters clockwise until rubber seal contacts the filter adapter then tighten the filter an additional 3/4 to 1 full turn.

5. Remove the vent plug on each transmission and fill through expansion reservoir, when oil comes out of vent reinstall plug.

Toro Premium Hydro Oil is recommended. Refer to the chart for an acceptable alternative:

Hydro Oil	Change Interval
Toro Premium Hydro Oil (Preferred)	500 Hours
Mobil 1 15W50	250 Hours

Torque plugs to 20 Nm (180 in-lbs.). Continue to add Toro Premium Hydro Oil until it reaches the full cold line on the expansion reservoir.

6. Raise the rear of machine up and support with jack stands (or equivalent support) just high enough to allow drive wheels to turn freely.

### Caution

**Raising the unit for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the unit to fall, which could cause injury.**

**Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.**

7. Start engine and move throttle control ahead to 1/2 throttle position. Disengage parking brake.



### Warning



**Engine must be running and drive wheels must be turning so motion control adjustment can be performed. Contact with moving parts or hot surfaces may cause personal injury.**

**Keep fingers, hands, and clothing clear of rotating components and hot surfaces.**

- A. With the engine running, slowly move the directional control in both forward and reverse directions (5 to 6 times). Check the oil level, and add oil as required after stopping the engine.
- B. It may be necessary to repeat step A until all the air is completely purged from the system. When the transaxle operates at normal noise levels and moves smoothly forward and reverse at normal speeds, then the transaxle is considered purged.

**Note: Do not change the hydraulic system oil (except for what can be drained when changing filter), unless it is felt the oil has been contaminated or been extremely hot. Changing oil unnecessarily could damage hydraulic system by introducing contaminants into the system.**

# SPECIFICATIONS & MAINTENANCE

---

## Tine Maintenance

### Check Tines

Service Interval: Before each use or daily

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lift the rear of the unit and support using jack stands or equivalent support.

### Caution

**Raising the unit for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the unit to fall, which could cause injury.**

**Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.**

3. Remove and retain the two bolts from the rear cover panel.
4. Remove rocks and other debris from the tines.
5. Inspect the tines and replace as required.

### Tine Drive Chain Adjustment

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Lift the rear of the unit and support using jack stands or equivalent support.
3. Check the chains on both sides of the unit for proper tension. The chains should be able to move up and down 1/4-1/2" (6-12mm).
4. Adjust the idler sprocket.
5. Recheck the chain tension and tighten the idler bolt.



## Chassis

### Exploded View - Mainframe

(Fig. 008)

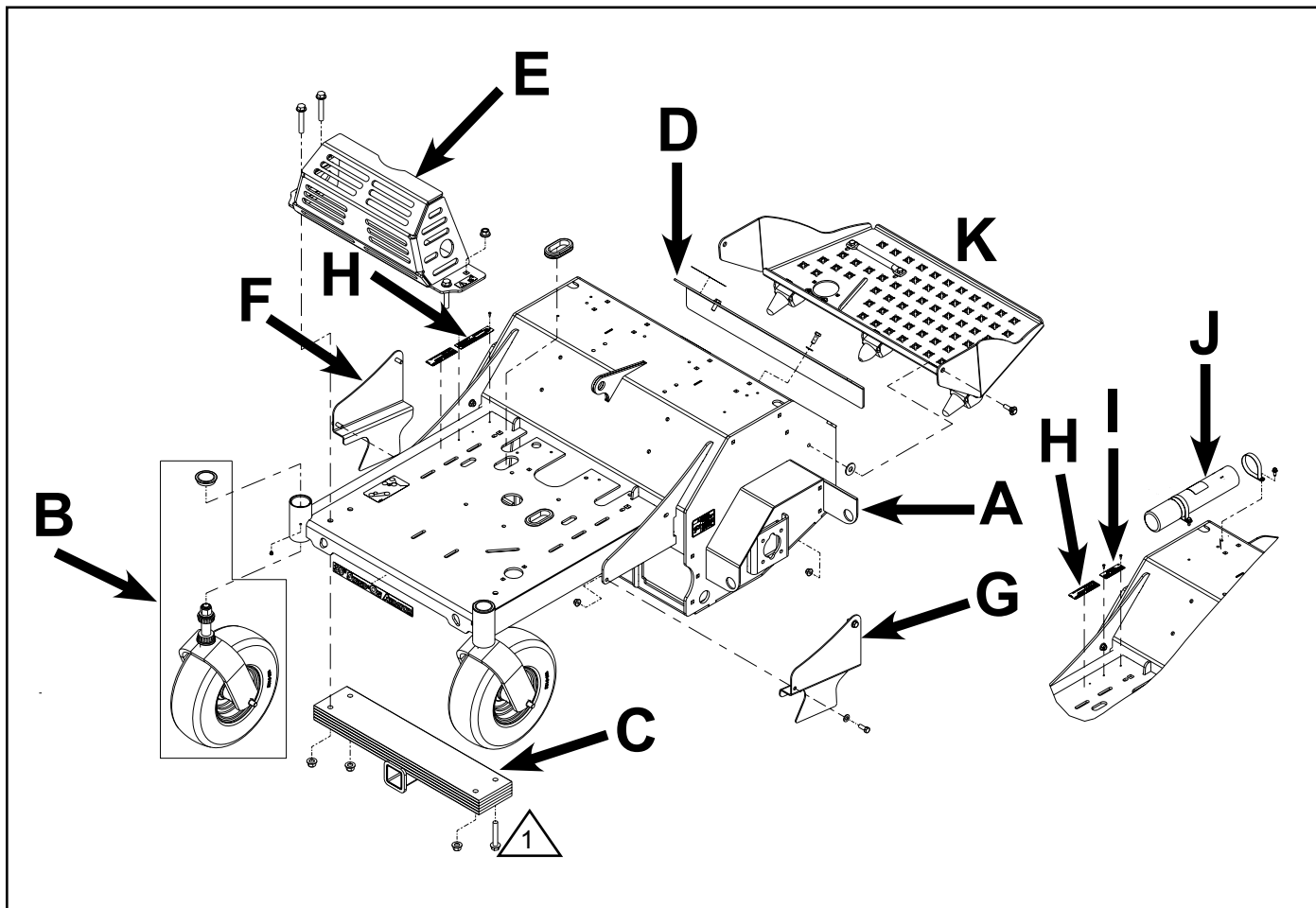


Fig. 008 subsystem mainframe\_smr

- |                          |                            |                               |
|--------------------------|----------------------------|-------------------------------|
| A. Main frame assembly   | E. Muffler guard           | I. Plate, serial no. (1x2.88) |
| B. Front caster assembly | F. Guard - chain, RH       | J. Tube, manual               |
| C. Weight                | G. Guard - chain, LH       | K. Platform assembly          |
| D. Access cover          | H. Plate, serial no. (1x5) |                               |

1 Bolt installed from the bottom in this location only.

# CHASSIS

## Lubricate Caster Wheel Hubs

1. Stop engine, wait for all moving parts to stop, and remove key. Engage parking brake.
2. Remove caster wheel from caster forks.
3. Remove seal guards from the wheel hub (Fig. 009).

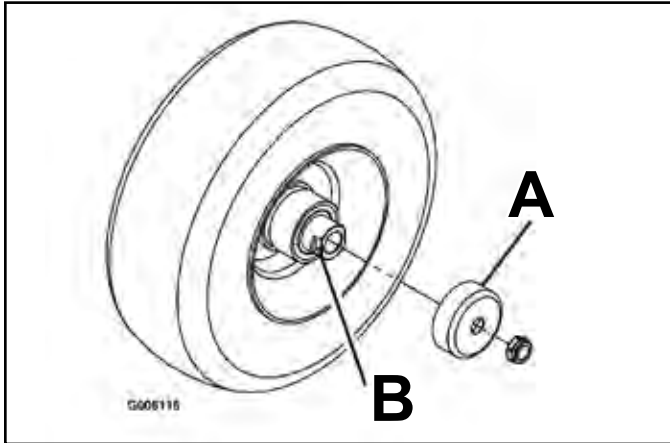


Fig. 009

fig. 14 G006115

- A. Seal guard
  - B. Spacer nut with wrench flats
4. Remove one of the spacer nuts from the axle assembly in the caster wheel. Note that thread locking adhesive has been applied to lock the spacer nuts to the axle. Remove the axle (with the other spacer nut still assembled to it) from the wheel assembly.
  5. Pry out seals, and inspect bearings for wear or damage and replace if necessary.
  6. Pack the bearings with a NGLI grade #1 multi-purpose grease.
  7. Insert one bearing, one new seal into the wheel.

**Note:** Replace the seals.

8. If the axle assembly has had both spacer nuts removed (or broken loose), apply a thread locking adhesive to one spacer nut and thread onto the axle with the wrench flats facing outward. Do not thread spacer nut all of the way onto the end of the axle. Leave approximately 3mm (1/8") from the outer surface of the spacer nut to the end of the axle inside the nut.
9. Insert the assembled nut and axle into the wheel on the side of the wheel with the new seal and bearing.
10. With the open end of the wheel facing up, fill the area inside the wheel around the axle full of NGLI grade #1 multi-purpose grease.
11. Insert the second bearing and new seal into the wheel.
12. Apply a thread locking adhesive to the 2nd spacer nut and thread onto the axle with the wrench flats facing outward.
13. Torque the nut to 8-9 Nm (75-80 in-lbs.); loosen, then re-torque to 2-3 Nm (20-25 in-lbs.). Make sure axle does not extend beyond either nut.
14. Reinstall the seal guards over the wheel hub and insert wheel into caster fork. Reinstall caster bolt and tighten nut fully.

**Important:** To prevent seal and bearing damage, check the bearing adjustment often. Spin the caster tire. The tire should not spin freely (more than 1 or 2 revolutions) or have any side play. If the wheel spins freely, adjust torque on spacer nut until there is a slight amount of drag. Reapply thread locking adhesive.

## Caster Wheel Assembly Replacement

### Caster Wheel Assembly Removal

1. Remove the grease cap from the top of the caster wheel pivot tube (Fig. 010).



Fig. 010

DSC-00139

2. Remove the nut from the caster fork shaft (Fig. 011).



Fig. 011

DSC-00140

3. Remove the caster fork and wheel assembly.
4. Remove the three Belleville washers from the caster wheel pivot tube (Fig. 012).



Fig. 012

DSC-00142

5. Remove the upper tapered roller bearing from the caster wheel pivot tube (Fig. 013).



Fig. 013

DSC-00144

# CHASSIS

6. Remove the grease seal from the bottom of the caster wheel pivot tube (Fig. 014).



Fig. 014

DSC-00146a

8. If replacing the wheel bearings, use a blunt punch to remove the upper and lower bearing cups from the caster wheel pivot tube (Fig. 016).



Fig. 016

DSC-00152

7. Remove the lower tapered roller bearing (Fig. 015).



Fig. 015

DSC-00149

9. Remove the nut securing the caster wheel axle bolt, then remove the axle bolt (Fig. 017).



Fig. 017

DSCN-0376a

10. Remove the caster wheel assembly from the caster fork.

11. Remove the seal guard from both sides of the wheel hub (Fig. 018).



Fig. 018

DSCN-0377a

12. Remove the spacer nut from the caster axle (Fig. 019).



Fig. 019

DSCN-0379a

**Note:** The spacer nuts are both threaded onto the caster axle. One of the spacer nuts will need to be removed after it has been removed from the caster wheel (Fig. 020).

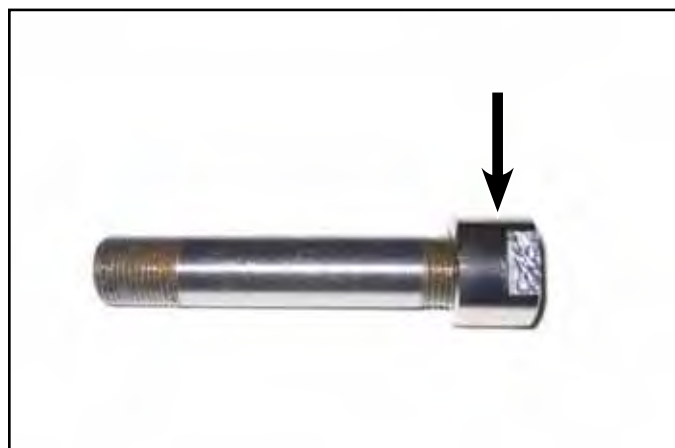


Fig. 020

DSCN-0383a



# CHASSIS

13. Remove the grease seal from both sides of the caster wheel (Fig. 021).



Fig. 021

DSCN-0387a

14. Remove the LH and RH tapered bearings (Fig. 022).



Fig. 022

DSCN-0389a

## Caster Wheel Assembly Installation

1. Pack the caster wheel tapered roller bearing with high temperature grease (Fig. 023).



Fig. 023

DSCN-0407a

2. Install the bearing into the wheel hub (Fig. 024).



Fig. 024

DSCN-0389a

3. Install grease seal into the wheel hub (Fig. 025).



Fig. 025

DSCN-0393a

6. Position the caster axle through the bearing and seal assembly (Fig. 027).



Fig. 027

DSCN-0398a

4. Repeat steps 1, 2, and 3 on the other side of the caster wheel.
5. Fill the center of the wheel hub with high temperature grease (Fig. 026).



Fig. 026

DSCN-0406a

7. Install a spacer nut onto both ends of the caster axle (Fig. 028).

**Note:** There should be approximately 3 internal spacer nut threads visible on both sides, indicating the axle is centered.



Fig. 028

DSCN-0379a

# CHASSIS

8. Position the seal guard onto both sides of the caster wheel hub (Fig. 029).



Fig. 029

DSCN-0377a

10. Install the upper and lower bearing cups into the pivot tube (Fig. 031).



Fig. 031

DSCN-0410a

9. Secure the caster wheel assembly to the caster fork using the axle bolt and nut (Fig. 030).



Fig. 030

DSCN-0376a

- Note: A socket can be used as a driver. Take care not to scar the race surface (Fig. 032).**



Fig. 032

hammer



11. Pack the pivot tube tapered roller bearings with high temperature grease (Fig. 033).



**Fig. 033**

DSCN-0407a

13. Install grease seal into the base of the pivot tube (Fig. 035).



**Fig. 035**

DSCN-0414a

12. Install the lower bearing into the pivot tube (Fig. 034).



**Fig. 034**

DSCN-0416a

14. Install the upper bearing into the pivot tube (Fig. 036).



**Fig. 036**

DSCN-0418a

# CHASSIS

15. Install the 3 Belleville washers into the pivot tube (Fig. 037).



Fig. 037 washers

16. Insert the caster wheel and fork assembly through the pivot hub (Fig. 039).



Fig. 039 insert wheel

**Note:** Bottom: Crown Up / Middle: Crown Down / Top: Crown up (Fig. 038).



Fig. 038 DSCN-0423a

17. Secure the caster wheel and fork assembly with the nut (Fig. 040).

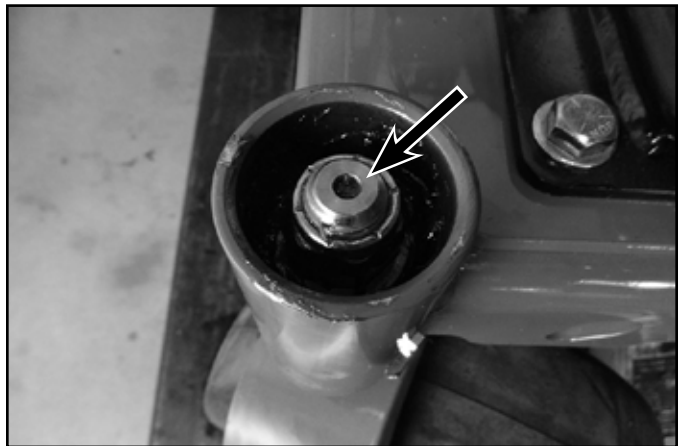


Fig. 040 nut

18. Tighten locknut until spring washers are flat (15 ft-lbs./20 Nm) and then back off a 1/4 turn to properly set the pre-load on the bearings.

19. Remove the plug from the side of the pivot hub (Fig. 041).



Fig. 041

DSCN-0436a

20. Install a grease zerk into the port on the side of the pivot hub (Fig. 042).

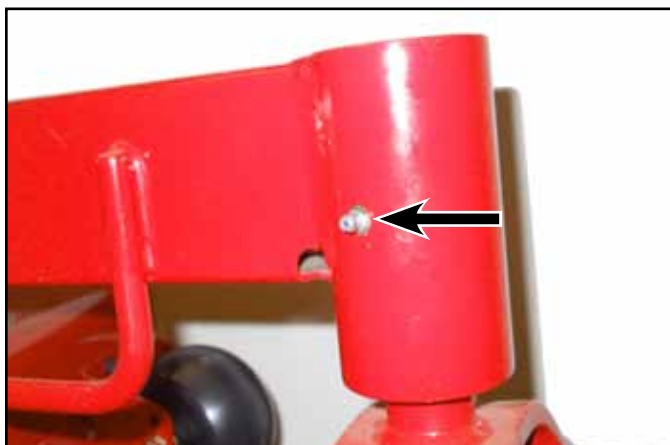


Fig. 042

DSCN-0434a

21. Fill the pivot hub cavity until grease is purging out through the upper bearing (Fig. 043).



Fig. 043

DSCN-0438a

22. Replace the grease zerk with the plug (Fig. 044).



Fig. 044

DSCN-0436a

23. Install the grease cap onto the top of the pivot hub (Fig. 045).



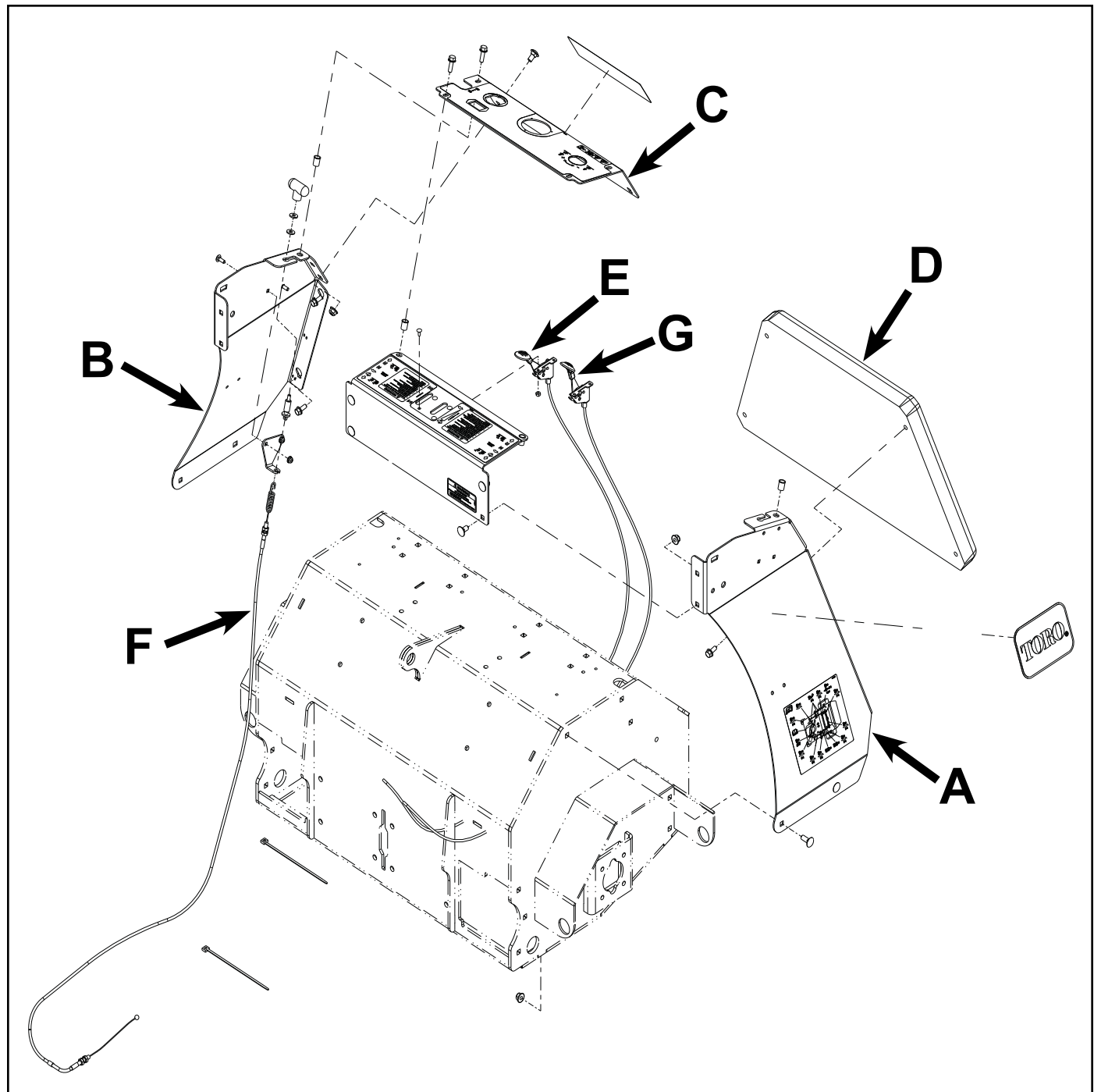
Fig. 045

DSC-00139a

# CHASSIS

## Exploded View – Tower

(Fig. 046)



**Fig. 046**

subsystem tower

- |                           |                       |
|---------------------------|-----------------------|
| A. LH side panel assembly | E. Control - choke    |
| B. RH side panel assembly | F. Cable - brake      |
| C. Assembly - console     | G. Control - throttle |
| D. Cushion                |                       |

## Adjusting the Parking Brake

If the parking brake does not hold securely, an adjustment is required.

1. Park the machine on a level surface.
2. Shut off engine and wait for all moving parts to stop.
3. Check the air pressure in the drive tires. If needed, adjust to the recommended inflation.
4. Disengage the parking brake.
5. Loosen the adjustment nut on the brake cable under the console.
6. Engage the parking brake.
7. Adjust the nut position until 3-1/8" (7.9cm) from the bottom of the link to the bottom of the spring (Fig. 047).

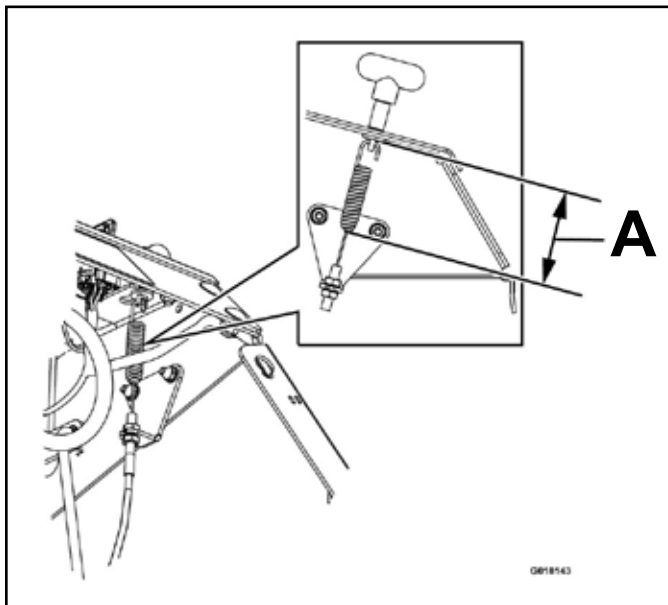


Fig. 047

fig. 18 G018143

- A. With park brake engaged, spring length should be 3-1/8" long (7.9cm).
8. Tighten the cable adjustment nuts.
9. Check the parking brake; repeat steps 5 through 8 if necessary.

## Adjusting the Brake Switch

1. Park the machine on a level surface.
2. Shut off the engine and wait for all moving parts to stop.
3. Prior to adjusting the brake switch, ensure the parking brake is properly adjusted.
4. Engage the parking brake.
5. Check the distance from the parking brake switch-bracket to the hydro brake arm. The distance should be 1/8" (3.2mm) (Fig. 048).

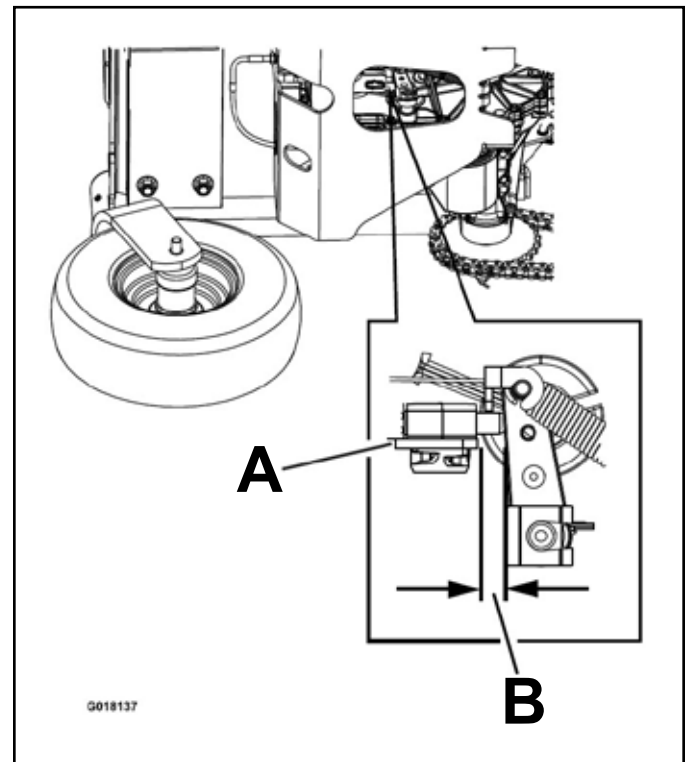


Fig. 048

fig. 19 G018137

- A. Parking brake switch bracket
- B. 1/8" (3.2mm) gap
6. If adjustment is required, loosen the bolt holding the parking brake switch-bracket and adjust the distance between the parking brake switch bracket and the hydro brake arm to be 3.2mm (1/8").
7. Tighten the bolt holding the parking brake bracket.

# CHASSIS

## Fuel System

(Fig. 049)

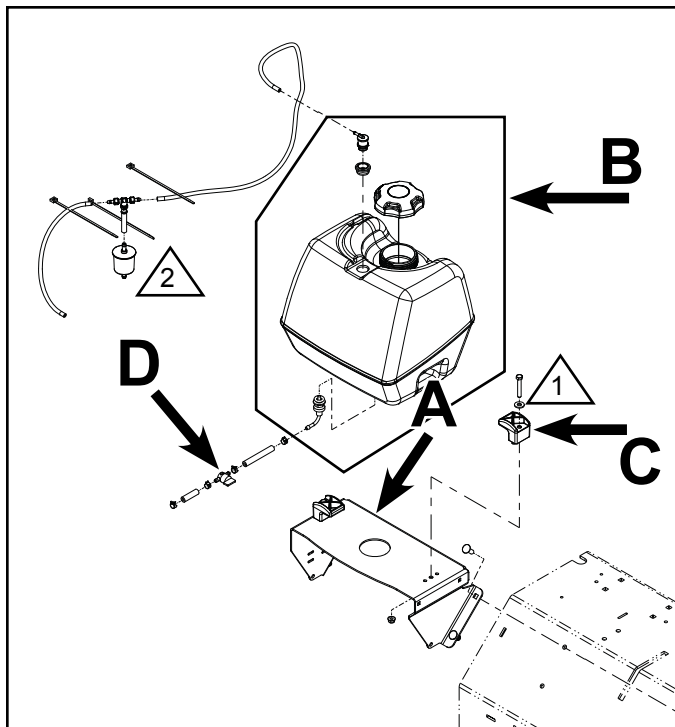


Fig. 049

fuel tank

- A. Support, fuel tank  
B. Fuel tank assembly  
C. Clamp  
D. Valve, fuel

1 Torque fuel tank clamp bolts to  $200 \pm 25$  in-lbs.  
( $27.5 \pm 2.8$  Nm).

2 Install filter matching flow direction ( $\uparrow$ ).

## Engine Fuel Line Routing

(Fig. 050)

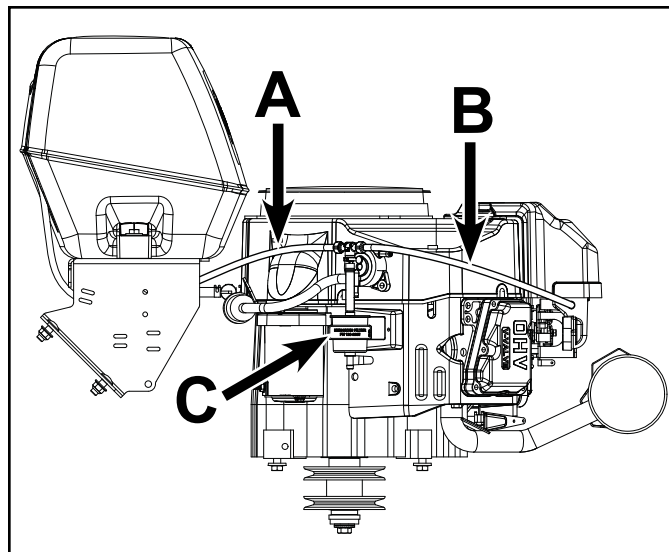


Fig. 050

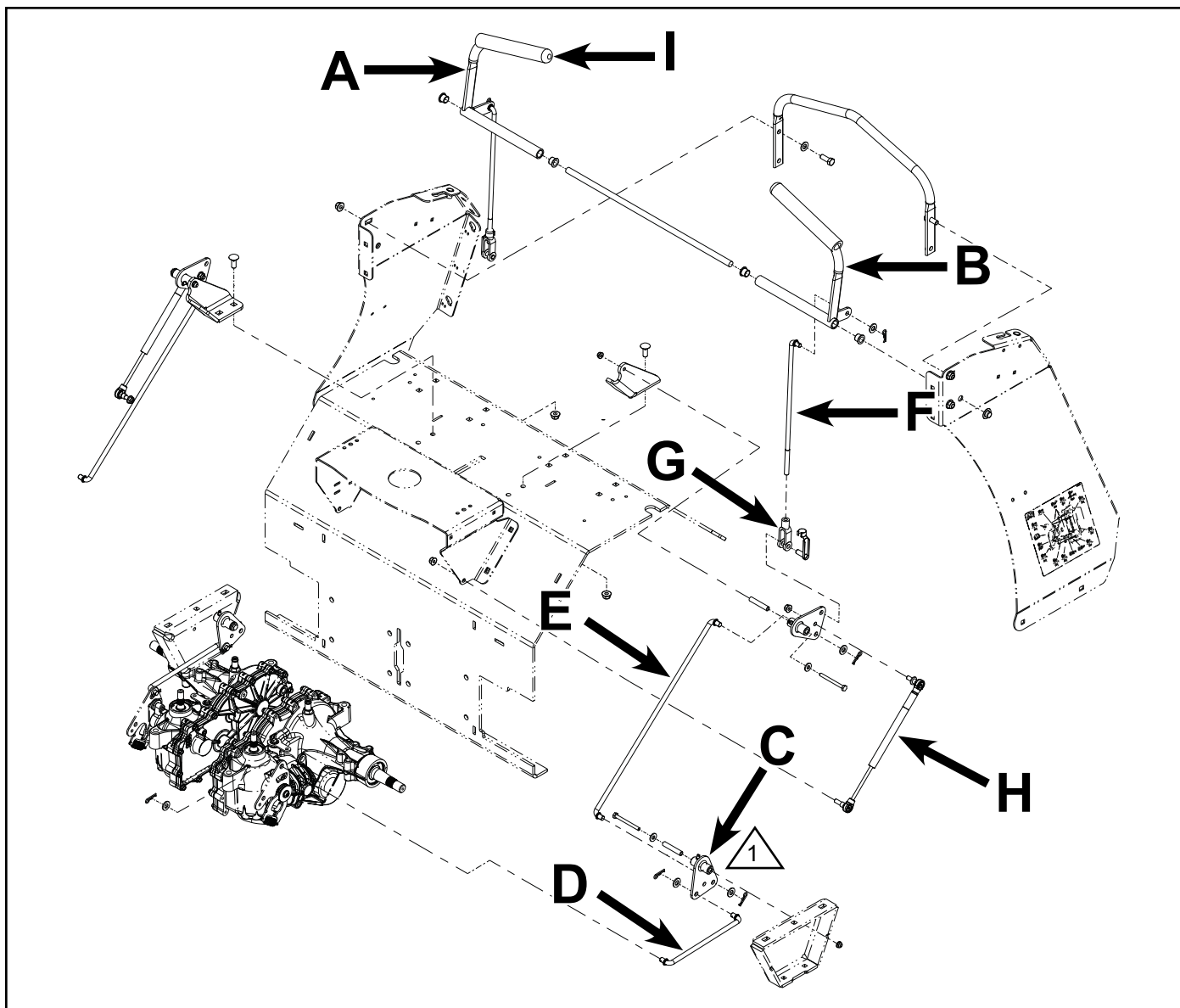
subsystem fuel

- A. Emissions hose  
B. Fuel hose  
C. Emissions filter



## Motion Control System

(Fig. 051)



3

Fig. 051 subsystem motion control

- A. RH control handle assembly
- B. LH control handle assembly
- C. Bell crank with arm

- D. Link, hydro control
- E. Link, bell crank control
- F. Link, bell crank control

- G. Yoke, linkage, brake
- H. Damper, control, motion
- I. Grip, lever, control

1 Apply grease to bell crank. **Note: use Mobil™ high temperature XHP 222 grease (or equivalent).**

# CHASSIS

## Motion Control Linkage Adjustment

1. Park the machine on a level surface.
2. Shut off engine and wait for all moving parts to stop.
3. Push the control levers all the way forward to the front reference bar (Fig. 052).
4. Once there is a minimal gap or contact between the control lever and front reference bar, remove clevis spring and rotate the turnbuckle clockwise (as viewed from the top of the machine) one full turn.
5. Reinstall the spring clevis pin and rotate the locknut against the turnbuckle.



Fig. 052

012

**Note:** If the control levers contact the reference bar, return the control levers to neutral and remove the spring clevis pin on the turnbuckle of the motion control linkage. Rotate the turnbuckle counterclockwise (as viewed from the top of the machine) (Fig. 053). Repeat this step until there is a gap between the control lever and the front reference bar.

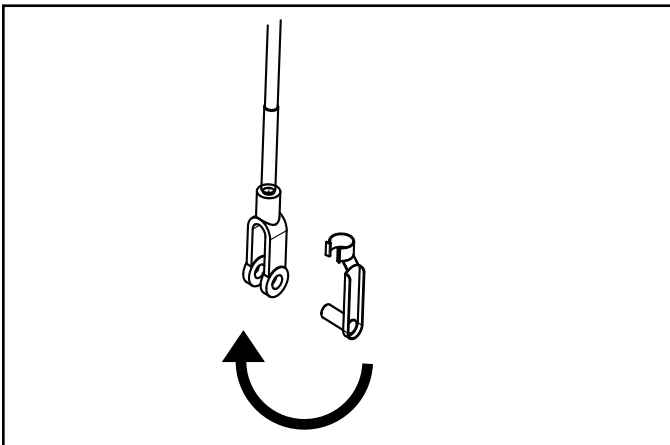


Fig. 053

clevis pin



## Axle Bearing Assembly Replacement

### Axle Bearing Assembly Removal

1. Position the unit in the work area, raise and secure the back of the unit as high as possible using two jack stands to support the unit (Fig. 054).



Fig. 054

IMG-1044

2. Remove the drive tire on the side you are working on.
3. Remove the lock nut securing the hub to the axle shaft (Fig. 055). Remove the hub.



Fig. 055

IMG-1045a

4. Remove the four nuts securing the axle sub assembly to the frame (Fig. 056).

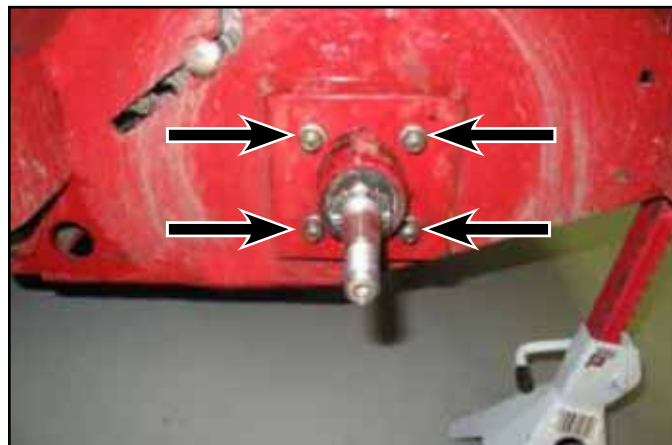


Fig. 056

IMG-1048a

5. On the underside of the unit, loosen the nut for the chain tensioner and slide the tensioner to the top of the slot (Fig. 057).



Fig. 057

IMG-1052

# CHASSIS

6. Remove two tines from the outside spider that are in-line to each other (Fig. 058). It is not necessary to remove the connector link from the chain if it is not being replaced. Work the chain off the sprocket and let it drop down.

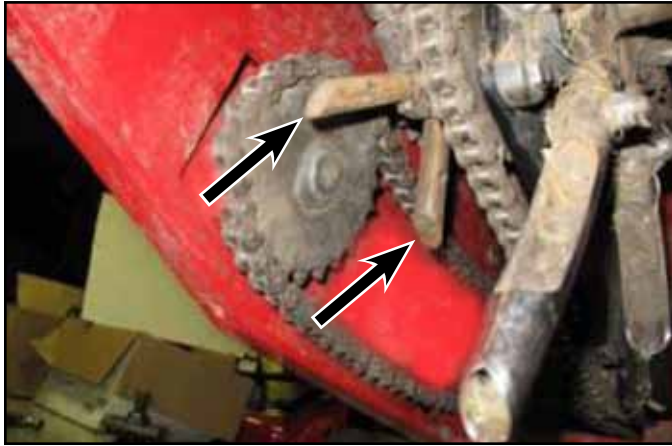


Fig. 058

IMG-1056a

7. Slide the axle sub assembly outward (it will be necessary to cock the unit at an angle to get the rear-tine stub shaft hooked behind the sprocket). As you rotate the shaft counterclockwise using one of the tines on the next set of tines, the unit can be removed (Fig. 059).



Fig. 059

IMG-1059

## Axle Bearing Assembly Installation

1. If installing an axle and bearing assembly, proceed to step 3. Replacing a damaged wheel axle first remove it from the wheel bearing mount. Check to make sure the grease seals are not damaged. You will notice the grease seals are installed backwards to allow grease to be purged when greasing the unit. If either of these are damaged it will need to be replaced. Mount a spacer, the bearing mount, another spacer, and then install the castle nut and cotter pin using the instructions in the next step (Fig. 060).

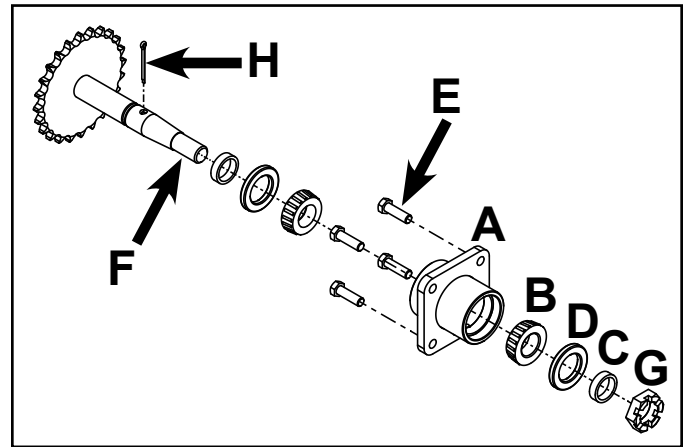


Fig. 060

axle & bearing asm

- |                           |               |
|---------------------------|---------------|
| A. Steel bearing mount    | E. Screw      |
| B. Tapered roller bearing | F. Wheel axle |
| C. Spacer                 | G. Castle nut |
| D. Grease seal            | H. Cotter pin |
2. Install the castle nut and tighten it to 83 ft-lbs. (112.5 Nm) while turning the hub, loosen it, then re-torque to 14 ft-lbs. (19.0 Nm). Loosen the castle nut to the first available slot that allows the cotter pin to be inserted and bent open.

3. Slide the axle assembly inward (it will be necessary to cock the unit at an angle to get the rear tine stub shaft hooked behind the sprocket). As you rotate the tines clockwise to install the unit (Fig. 061).



**Fig. 061**

IMG-1059

4. Reinstall the chain onto the sprocket and replace the two tines that were previously removed (Fig. 062).



**Fig. 062**

IMG-1056a

5. Install the four screws securing the axle assembly back in position, install the four nuts and tighten securely (Fig 063).



**Fig. 063**

IMG-1048

6. Slide the chain tensioner onto the top of the chain and re-tighten with very little play in the chain. (Fig 064).



**Fig. 064**

IMG-1052a

# CHASSIS

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7. Re-install the wheel hub to the axle and torque the lock nut to 310-325 ft-lbs. (420-440 Nm) (Fig 065).



**Fig. 065**

IMG-1045a

8. Install the tire and torque the lug nuts to 125-130 ft-lbs. (169-176 Nm).
9. Lower the unit to the ground, test drive and re-check the chain tension.



# HYDRAULICS & ENGINE MOUNTING

## Hydraulics

(Fig. 066)

## Hydraulic Subsystem

See engine "Hydraulic Pump Belt Removal and Installation" as shown in this chapter.

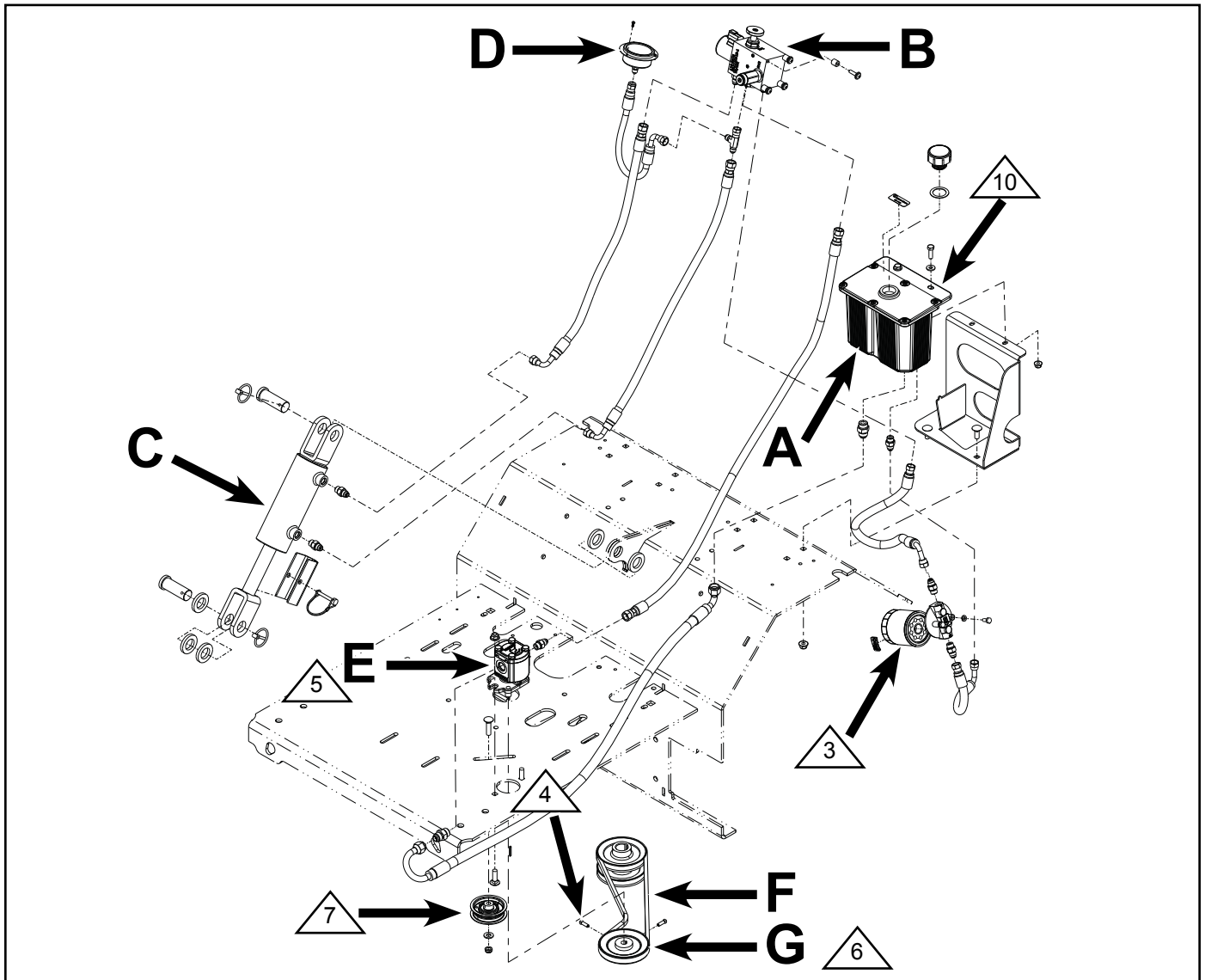


Fig. 066

subsystem hydraulic

### Bottom view engine pump pulley & idler

- |                                       |                    |
|---------------------------------------|--------------------|
| A. Reservoir assembly                 | E. Pump, hydraulic |
| B. Valve manifold with check & relief | F. Belt            |
| C. Hyd cylinder assembly              | G. Pulley          |
| D. Gauge, pressure                    | H. Filter          |

3 Apply film of hydraulic oil to hydraulic oil gasket prior to installation.

4 Apply Loctite® (202) to set screws. Torque to 105 ± 10 in-lbs. (12 ± 1 Nm)

5 Pump to be oriented so that the body is offset to the outside of the unit.

6 Bottom of hub to be flush with bottom of pump shaft

7 Idler to be pushed into belt hand-tight (minimum 15 lbs. or 6.6kg) when fastener is tightened.

10 Hydraulic oil fill level to be between "COLD" baffle and down a 1/4" below. Check with the aerator tines down (resting on the ground) and fluid temperature at 71° ± 10°F (21.6 ± 6.6°C).

# HYDRAULICS & ENGINE MOUNTING

## Valve Manifold

Bottom view engine pump pulley and idler (Fig. 067)

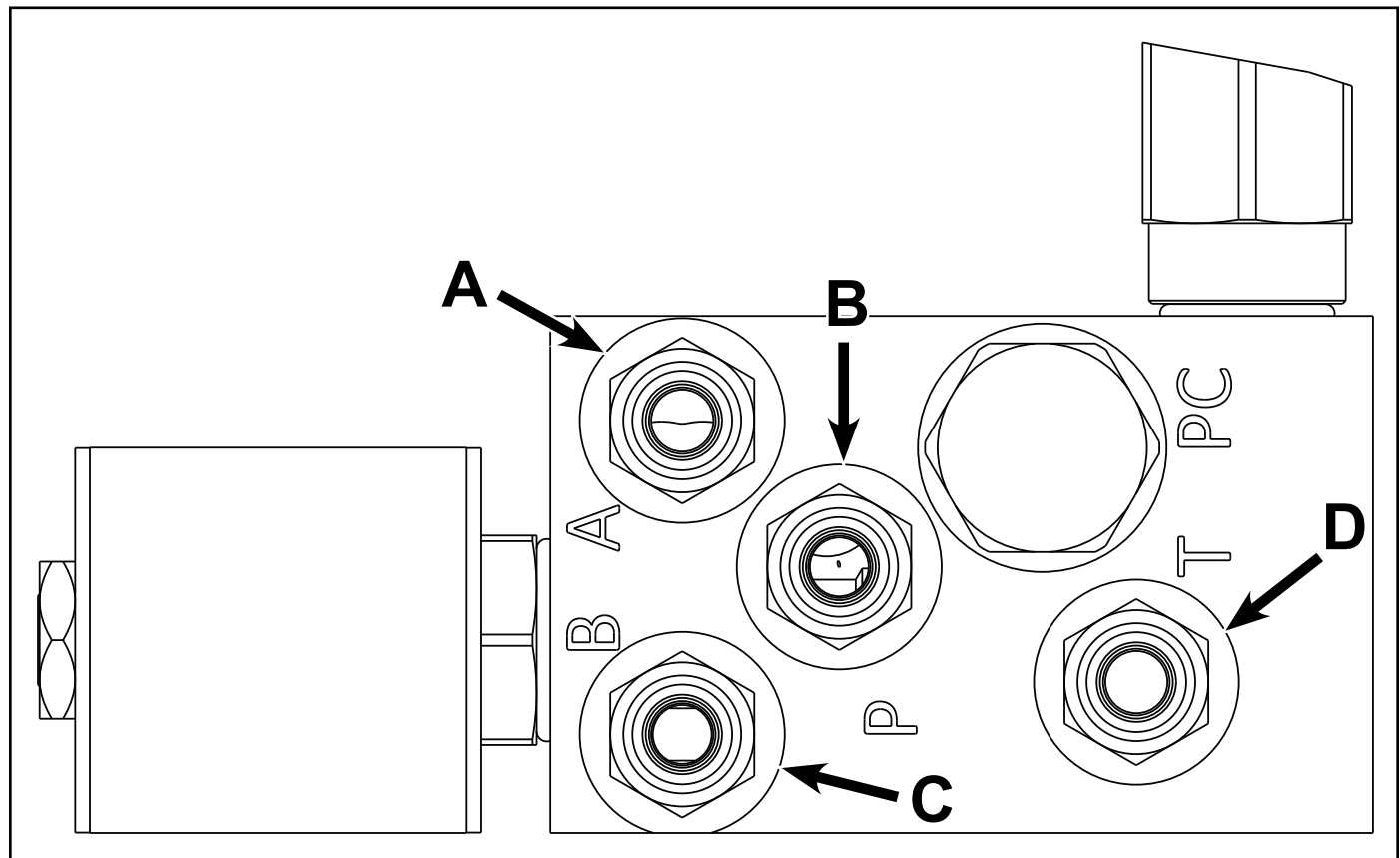


Fig. 067

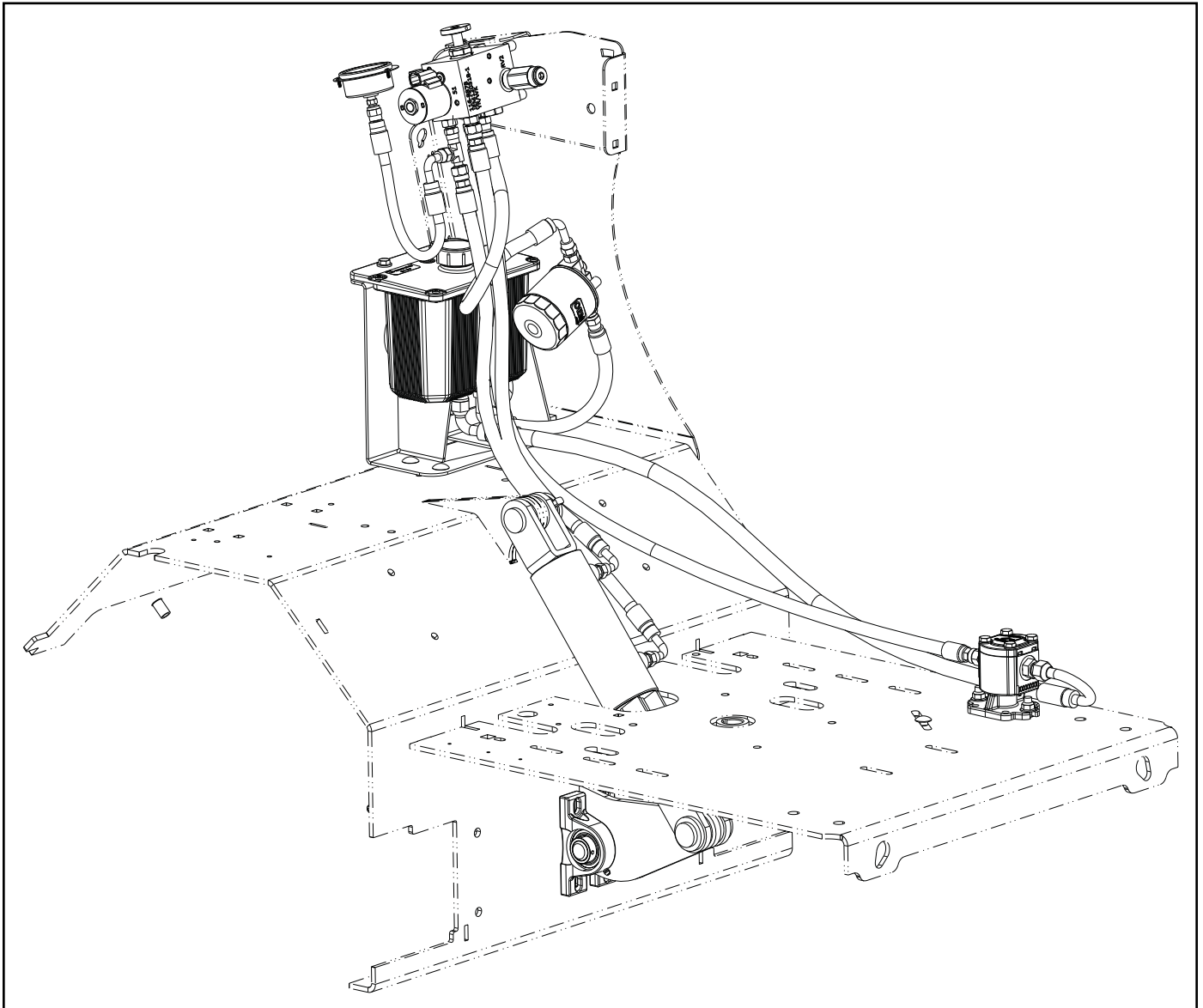
valve manifold

- A. Connect "A" with blind end of cylinder with hose
- B. Connect "P" to pressure side of pump with hose
- C. Connect "B" to rod end of cylinder
- D. Connect "T" to oil filter using hose

# HYDRAULICS & ENGINE MOUNTING

## Auxiliary Hydraulic Subsystem

(Fig. 068)



**Fig. 068** subsystem aux hydraulic 2

4

# HYDRAULICS & ENGINE MOUNTING

## Checking the Transmission Expansion Tank Hydraulic Oil

Service Interval: Every 50 hours

1. Run the machine for approximately 15 minutes to allow any extra air to purge out of the hydraulic system.
2. Let the unit cool. With the unit cold, check the expansion tank and if necessary add Toro Hydro Oil to the Full Cold line. DO NOT OVERFILL.
3. Replace the hydraulic reservoir cap and tighten until snug. DO NOT OVERTIGHTEN (Fig. 069).

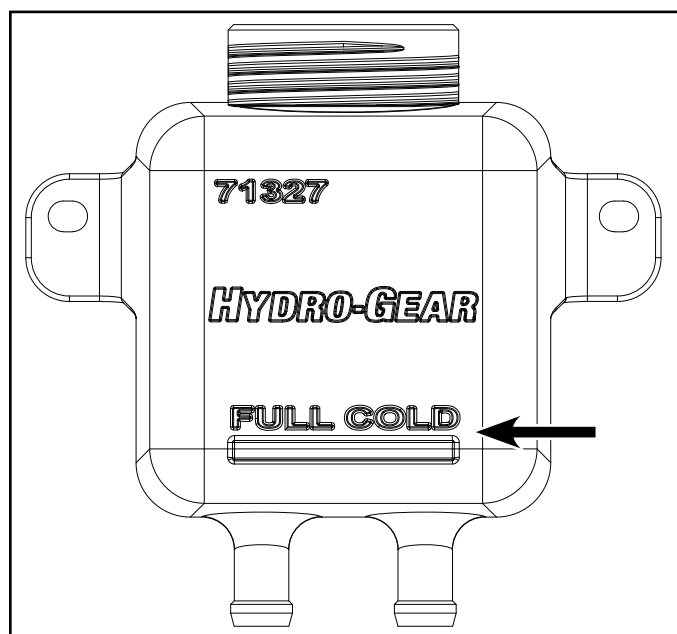


Fig. 069

expansion tank

## Servicing the Auxiliary Hydraulic Oil

Service Interval: Every 50 hours

1. Run the machine for approximately 15 minutes to allow any extra air to purge out of the hydraulic system.
2. With the engine running, raise and lower the tines three times to purge the air.
3. Loosen the four (4) bolts inside the frame securing the rear pad to the unit. Lift the pad up and back to remove it (Fig. 070).

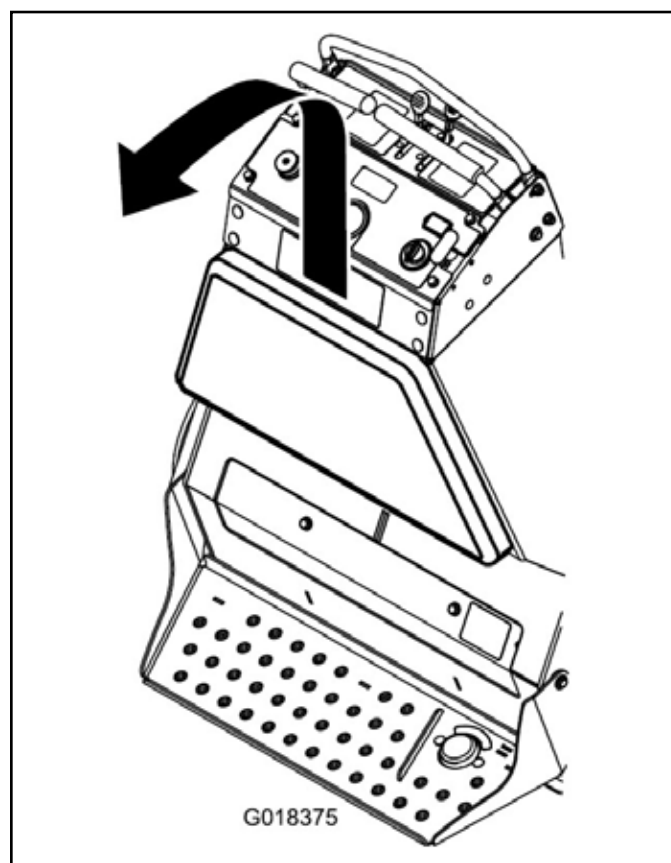


Fig. 070

fig. 5 G018375\_a



# HYDRAULICS & ENGINE MOUNTING

4. Check the hydraulic reservoir and if necessary fill the reservoir to the appropriate level with Toro Hydro Oil (Fig. 071).
5. Replace the hydraulic reservoir cap and tighten until snug. DO NOT OVERTIGHTEN.
6. Install the previously removed rear pad and tighten the bolts, securing it to the frame.

**Note:** Hydraulic oil fill level to be between “COLD” baffle and down a 1/4” below. Check with the aerator tines down (resting on the ground) and fluid temperature at  $71^{\circ} \pm 10^{\circ}\text{F}$  ( $21.6 \pm 6.6^{\circ}\text{C}$ ).

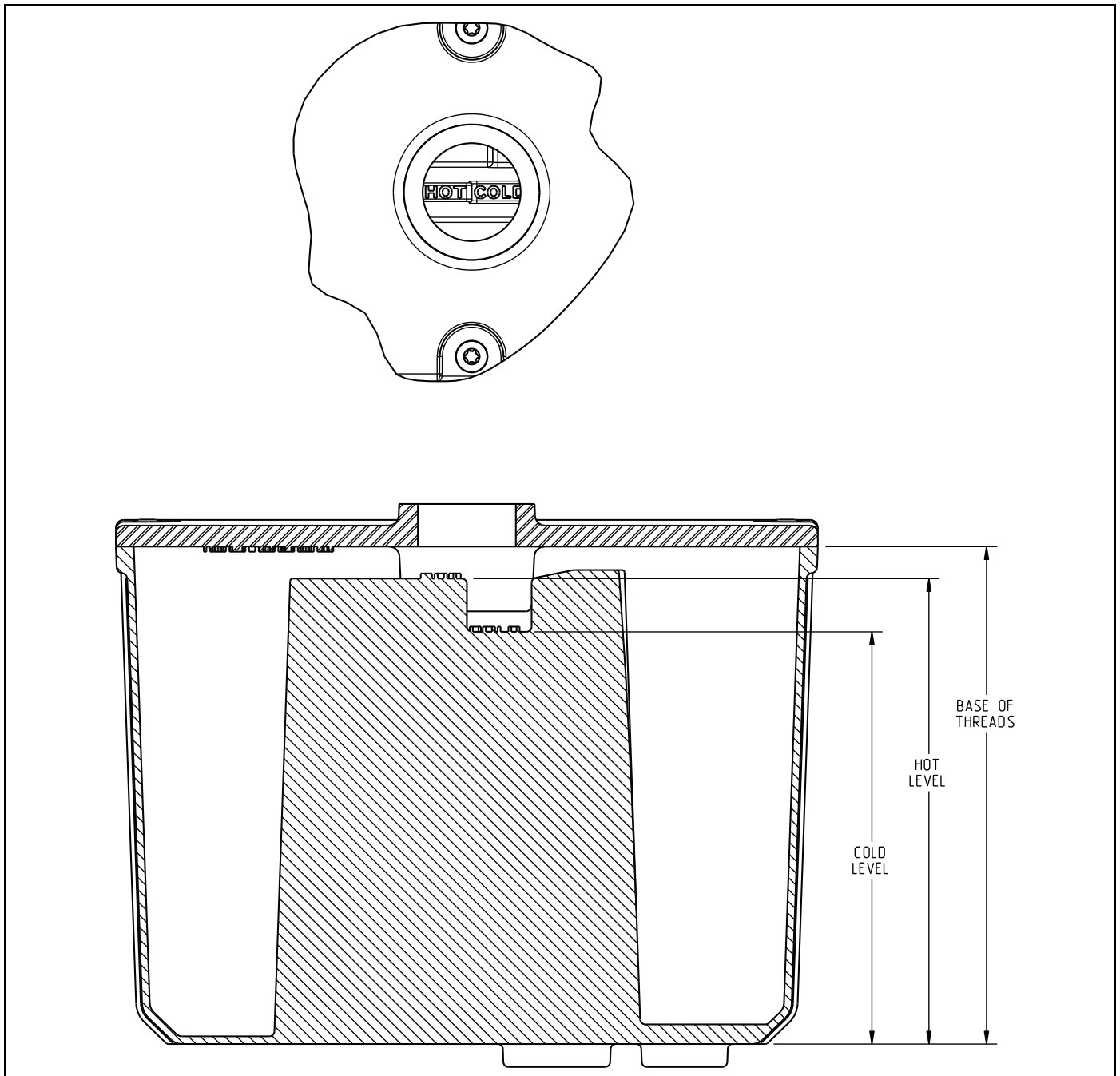


Fig. 071

hyd reservoir tank

# HYDRAULICS & ENGINE MOUNTING

## Changing Auxiliary Hydraulic Reservoir Fluid and Filter

Service Interval: After the first 100 hours, every 250 hours thereafter

1. Stop engine, wait for all moving parts to stop. Remove key and spark plug wires. Engage parking brake.
2. Carefully clean area around the front of the auxiliary pump and fill cap, and around the filter (Fig. 072).

**Note:** It is important that no dirt or contamination enter hydraulic system.



Fig. 072 aux hydraulic filter

3. Unscrew the suction hose from the pump fitting, clean around the pump fitting and allow oil to drain (Fig. 073).

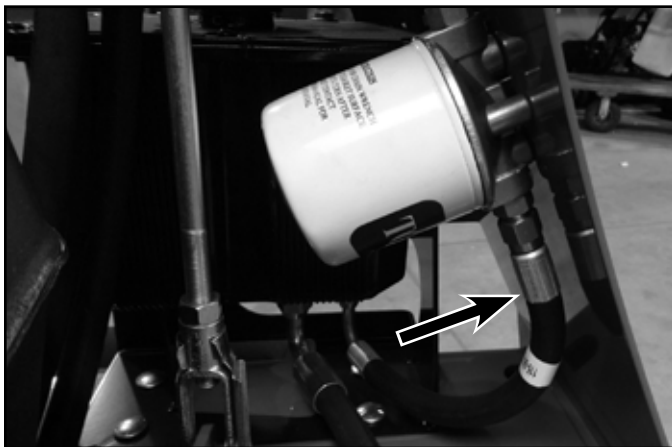


Fig. 073 aux filter 2

4. Unscrew the filter to remove and allow oil to drain.
5. Apply a thin coat of Toro Hydro Oil to the surface of the rubber seal on the new oil filter. Turn the filter clockwise until the rubber seal contacts the filter adapter, then tighten the filter an additional 2/3 to 3/4 turn.
6. Reinstall the hose and torque (Fig. 074).

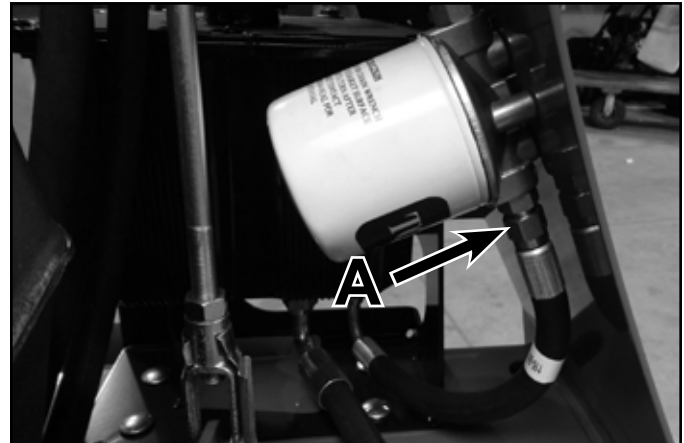


Fig. 074 aux filter 2

- A. Torque to 37 ft.-lbs. (50 Nm)

7. Add Toro Hydro Oil until the level reaches the cold fill line located on the reservoir tank. Start engine and raise and lower the tines 3-4 times. Lower the tines to the ground and refill the reservoir to the cold fill line.

**Note:** Hydraulic oil fill level to be between “COLD” baffle and down a 1/4” below. Check with the aerator tines down (resting on the ground) and fluid temperature at  $71^{\circ} \pm 10^{\circ}\text{F}$  ( $21.6 \pm 6.6^{\circ}\text{C}$ ).

# HYDRAULICS & ENGINE MOUNTING

## Changing Hydraulic Transmission Filters and Fluid

Service Interval: After the first 100 hours, every 250 hours thereafter

### Hydraulic Transmission Filter Removal

1. Stop engine, wait for all moving parts to stop. Remove key and spark plug wires. Engage parking brake.
2. Locate the two filters under the transmissions. Remove filter guards (Fig. 075).

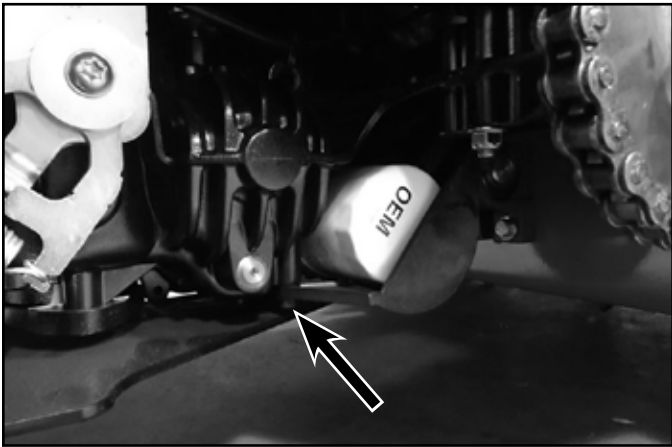


Fig. 075 hyd filter

3. Carefully clean area around filters. It is important that no dirt or contamination enter hydraulic system and remove the filters.

### Hydraulic Transmission Filter Installation

1. Apply a thin coat of Hydro Oil to the surface of the rubber seal on the new oil filter. Turn the filter clockwise until the rubber seal contacts the filter adapter, then tighten the filter an additional 3/4 to 1 full turn.
2. Fill through EXPANSION TANK (Fig. 076).



Fig. 076 expansion tank

Toro Premium Hydro Oil s recommended. Refer to the chart for an acceptable alternative:

Hydro Oil	Change Interval
Toro Premium Hydro Oil (Preferred)	500 Hours
Mobil 1 15W50	250 Hours

3. Continue to add oil until it reaches the full cold line on the expansion reservoir.

# HYDRAULICS & ENGINE MOUNTING

4. Raise the rear of the machine up and support with jack stands (or equivalent support). Raise just high enough to allow the drive wheels to turn freely.

## CAUTION

Raising the unit for service or maintenance relying solely on mechanical or hydraulic jacks could be dangerous. The mechanical or hydraulic jacks may not be enough support or may malfunction allowing the unit to fall, which could cause injury. Do not rely solely on mechanical or hydraulic jacks for support. Use adequate jack stands or equivalent support.

5. Install the spark plug wire and key. Start the engine and move the throttle control ahead to 1/2 throttle position. Disengage the parking brake.



## WARNING



Engine must be running and drive wheels must be turning so motion control adjustment can be performed. Contact with moving parts or hot surfaces may cause personal injury. Keep fingers, hands, and clothing clear of rotating components and hot surfaces.

6. With the engine running, slowly move the directional control in both forward and reverse directions 5 to 6 times. Stop the engine and check the oil. Add oil if necessary to the expansion reservoir.

**Note:** If may be necessary to repeat step 9 until all the air is completely purged from the system. When the transaxle operates at a normal noise levels and moves smoothly forward and reverse at normal speeds, then the transaxle is considered purged.

**Note:** Do not change the hydraulic system oil (except for what can be drained when changing filters) unless it is felt the oil has been contaminated or has been extremely hot. Changing the oil unnecessarily could damage the hydraulic system by introducing contaminants into the system.

## Transmission Belt Replacement

### Transmission Belt Removal

1. Blow dirt and debris off unit especially in the drive belt area.
2. Position unit in work area, remove key and engage the parking brake.
3. Raise the front of the unit and support with jack stands (Fig. 077).



Fig. 077

IMG-0004

4. Loosen the nut on the belt tensioner (LH side) until only two or three threads are left engaged (Fig. 078).



Fig. 078

IMG-0005

# HYDRAULICS & ENGINE MOUNTING

5. Remove the stationary idler on the RH side of the unit completely and set aside (Fig. 079 and Fig. 080).

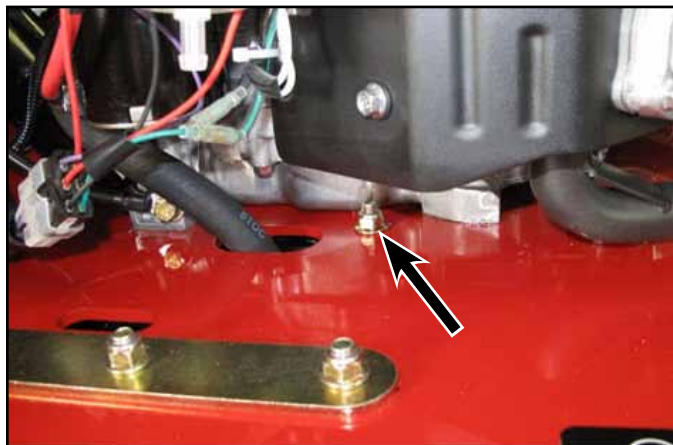


Fig. 079

IMG-0012

6. Remove the front two transmission support plate bolts. Install the two nuts, finger tight (Fig. 081 and Fig. 082).

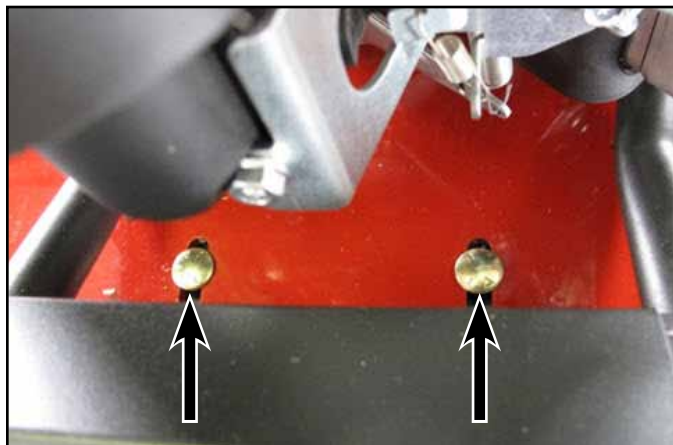


Fig. 081

IMG-0017

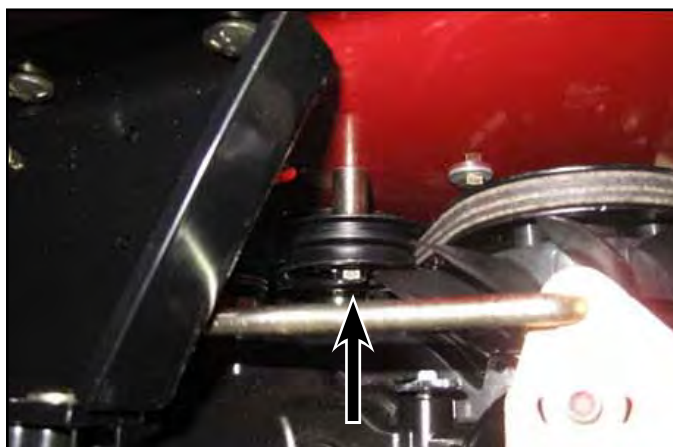


Fig. 080

IMG-0011

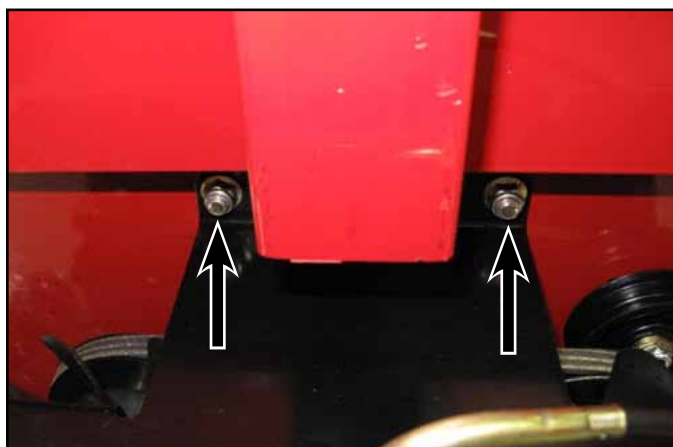


Fig. 082

IMG-0014

4



# HYDRAULICS & ENGINE MOUNTING

7. Position the floor jack under the front of the transmission skid plate and apply slight upward pressure (Fig. 083).

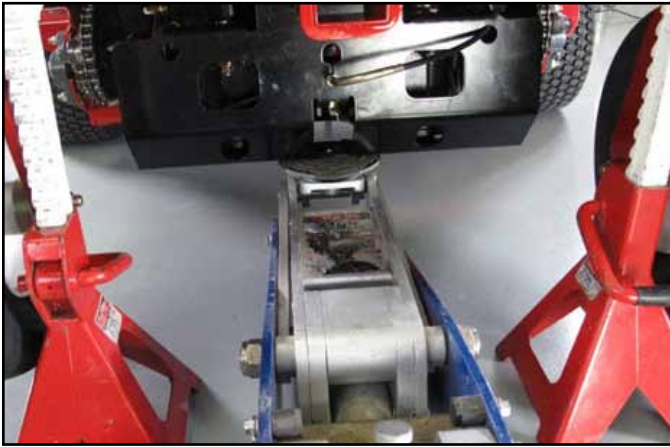


Fig. 083

IMG-0019

8. Remove the tension on the drive chains on both sides (Fig. 084 and Fig. 085).

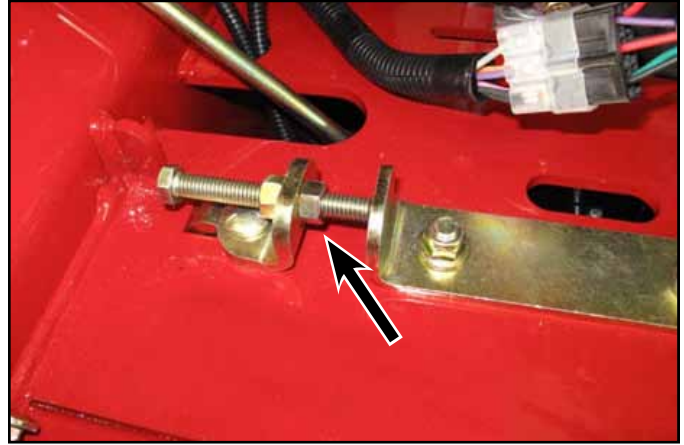


Fig. 084

IMG-0020a

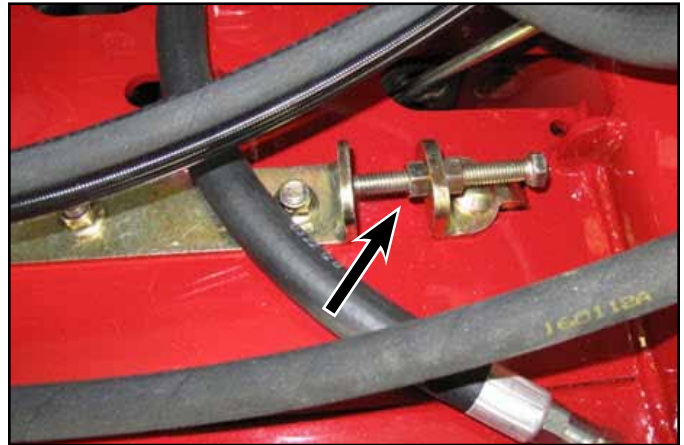


Fig. 085

IMG-0021

# HYDRAULICS & ENGINE MOUNTING

9. Remove the front two nuts on each of the chain tensioner plates on the top side and loosen the back one until the nut is free from the nyloc portion (Fig. 086).

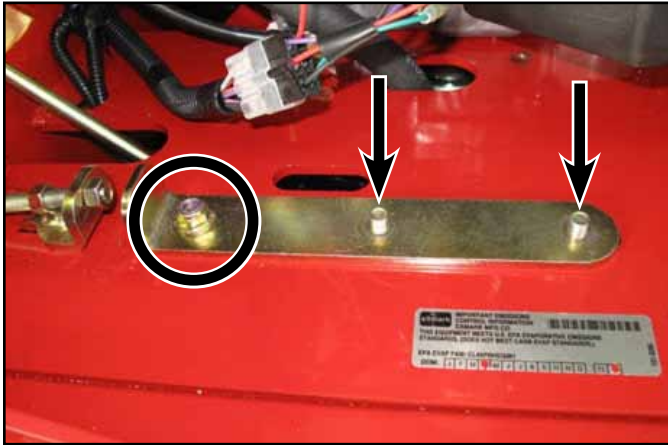


Fig. 086

IMG-0022a

10. Lower the jack and the drive units will pivot downward.
11. From the RH side remove the old belt. Notice how the belt stays hooked on the tensioning idler (Fig. 087).



Fig. 087

IMG-0024

## Transmission Belt Installation

1. Install the new belt around the engine and LH pump drive sheave and hook it on the lip of the idler arm pulley. Slowly raise the floor jack. The last pulley the belt will slip on, is the RH pump drive sheave (Fig. 088).

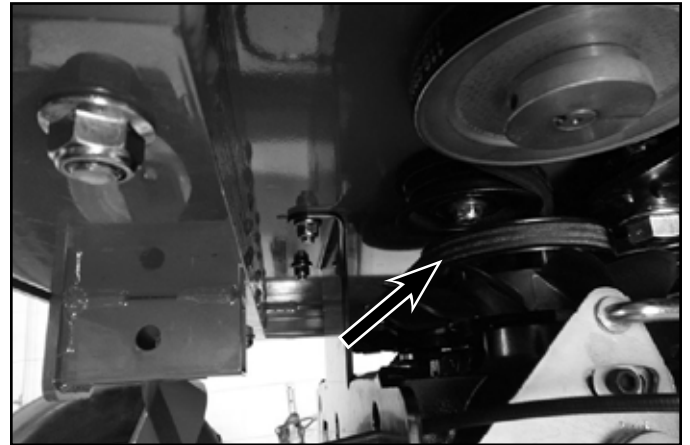


Fig. 088

front mount bolts

2. Slowly finish jacking the unit back into position using the floor jack making sure the belt stays in the proper position.
3. Start the four nuts on the chain tensioner brackets removed in step 9. Tighten all six nuts (three on each side) and then back off one turn each to allow chain tension adjustment later. Remove the floor jack (Fig. 089).



Fig. 089

IMG-0022a

4

# HYDRAULICS & ENGINE MOUNTING

4. Reinstall the stationary idler (Fig. 090).

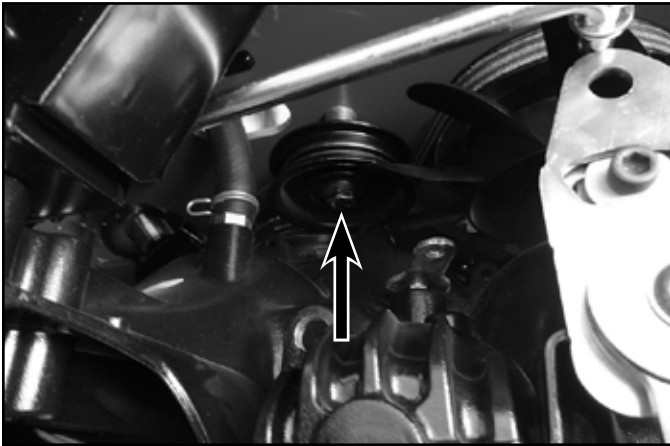


Fig. 090

idler

5. Tighten the front carriage bolts then back them off one turn (Fig. 091).

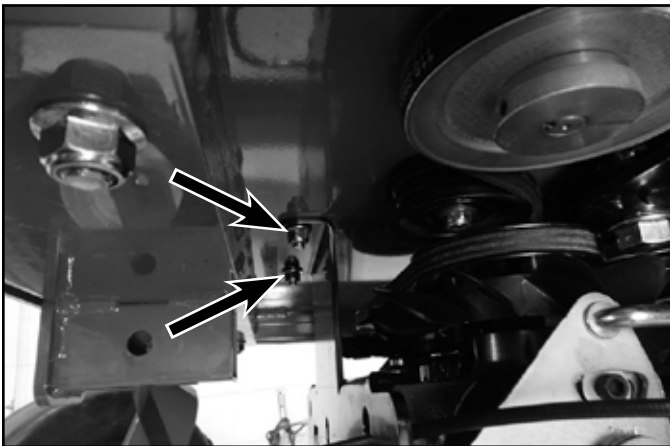


Fig. 091

front mount bolts

6. Adjust the chain tension on both sides with the tensioner so chains have 1/4 - 1/2\"/>
7. Recheck chains one more time and set the jam nuts on the tensioners.
8. Tighten the compression spring for the belt tensioner until the spring measures 2-3/8\"/>

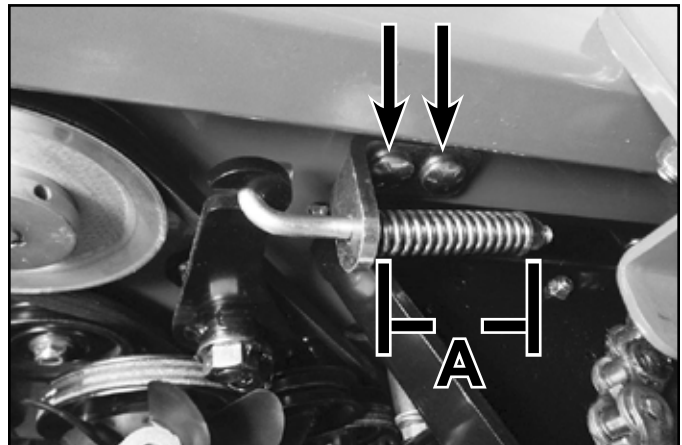


Fig. 092

tensioner

A. 2-3/8"

9. Verify all hardware is tight and use the floor jack to remove the jack stands and lower the unit to the ground.



# HYDRAULICS & ENGINE MOUNTING

## Transmission Replacement

### Transmission Removal

1. Raise the front of the unit and support with jack stands (Fig. 093).



Fig. 093

IMG-0004

2. Remove the parking brake cable by loosening the jam nuts and feeding cable through opening (Fig. 094).

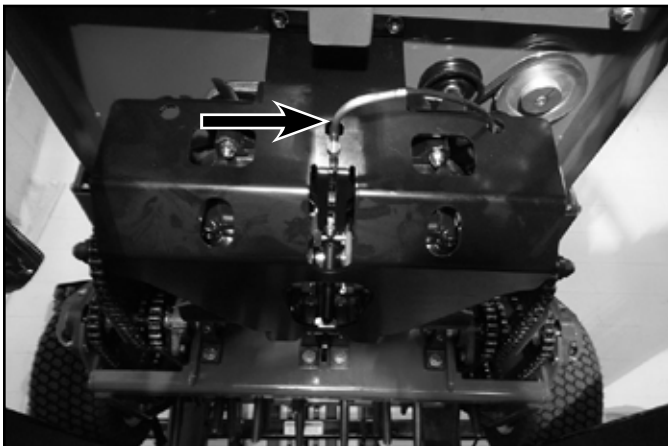


Fig. 094

park brake

3. Loosen the two transmission support plate bolts at the front of the machine (Fig. 095).

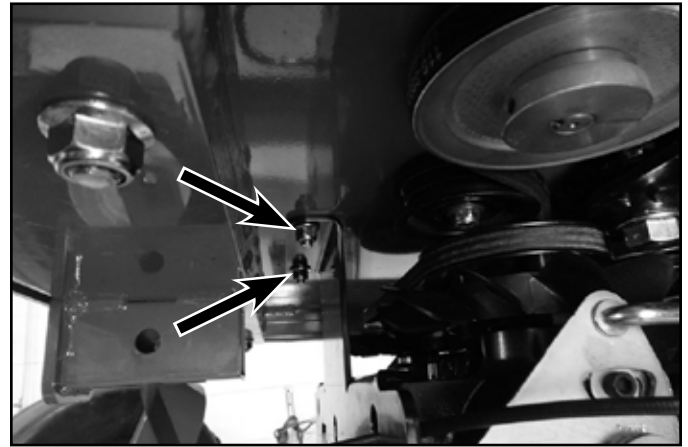


Fig. 095

front mount bolts

4. Loosen the chain tensioners on both sides of the machine.
  - a. Loosen the jam nuts (A), then loosen the tightening bolt (B) (Fig. 096).

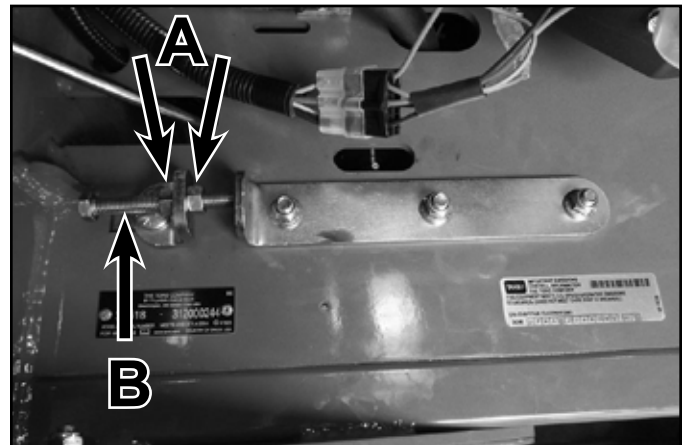


Fig. 096

tightener bolt

4

# HYDRAULICS & ENGINE MOUNTING

- b. Loosen the three mounting bolts on each side of the machine (Fig. 097).

**IMPORTANT:** Do not remove the bolts at this time.

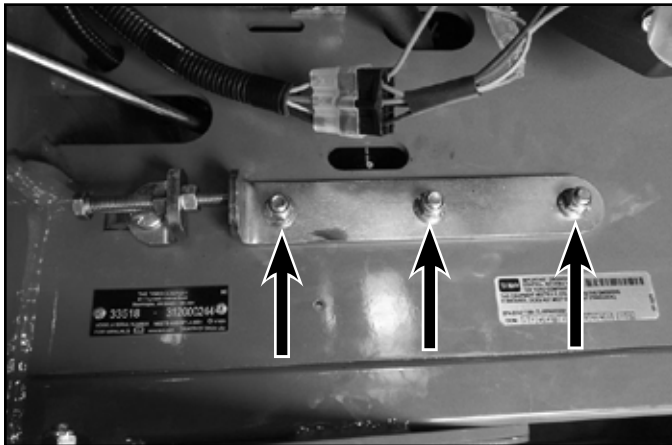


Fig. 097

tightener bolt

6. Rotate the rear wheels until the transaxle chain master link is accessible (Fig. 099).

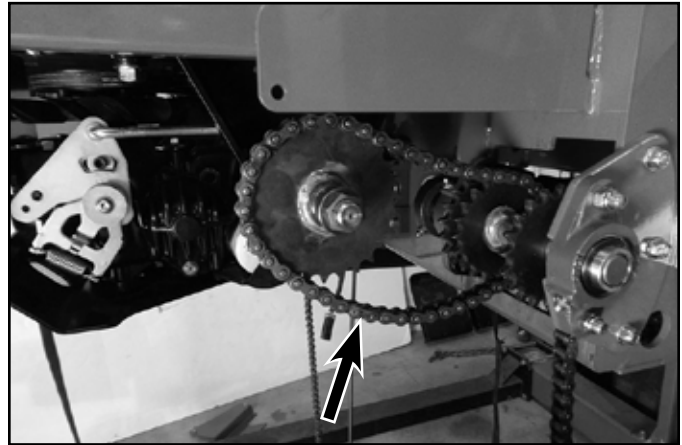


Fig. 099

chain install

5. Remove the right and left side chain guards (Fig. 098).

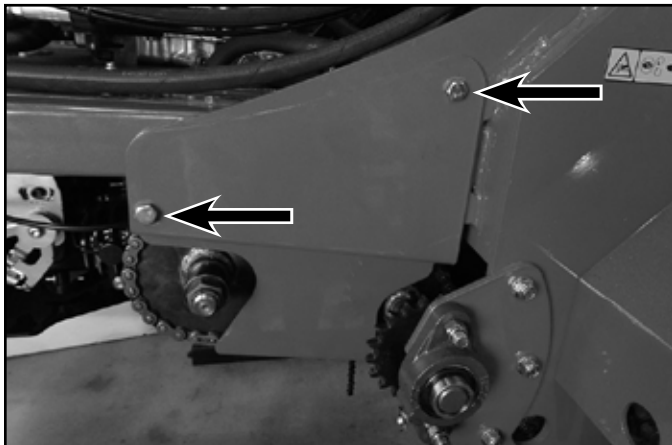


Fig. 098

chain guard

7. Remove the master link and remove chain. Repeat for the opposite side of the machine.
8. Disconnect the bell crank control links from the bell cranks (Fig. 100).



Fig. 100

linkage removal

# HYDRAULICS & ENGINE MOUNTING

9. Remove the two bolts securing the pivot arm tensioner and remove tensioner and spring (Fig. 101).

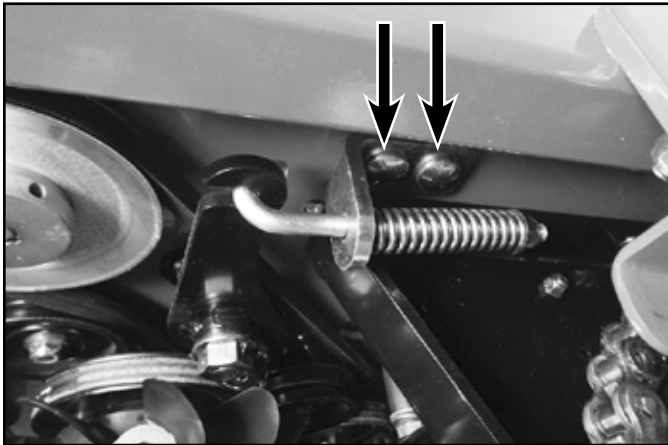


Fig. 101

tensioner

11. Disconnect hydro hoses from the overflow tank and plug the openings (Fig. 103). Ensure shop towels or rags are available to wipe up any fluid spills. Dispose of used towels properly (Fig. 104).



Fig. 103

hose

10. Remove the stationary idler on the RH side of the unit (Fig. 102).

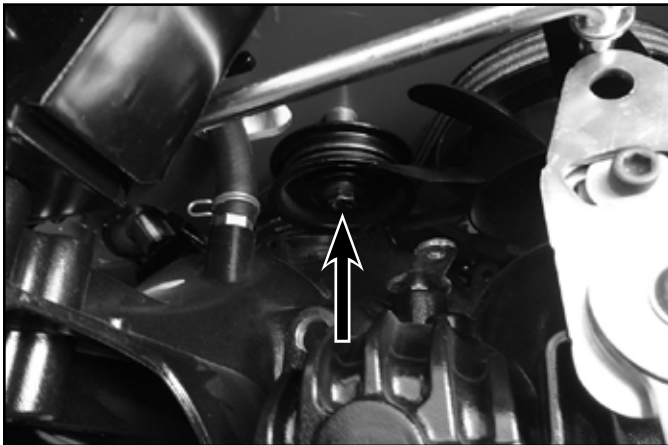


Fig. 102

idler



Fig. 104

towel

# HYDRAULICS & ENGINE MOUNTING

12. Disconnect the parking brake switch wire connector (Fig. 105).

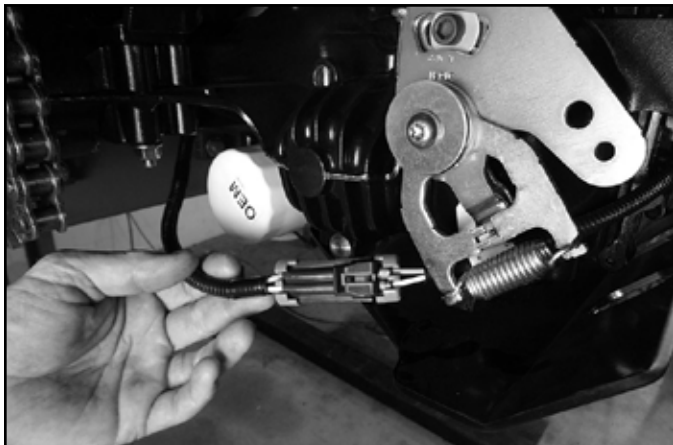


Fig. 105 connector

14. Remove the two front mount bolts and the three mounting bolts on each side of the machine (Fig. 107).

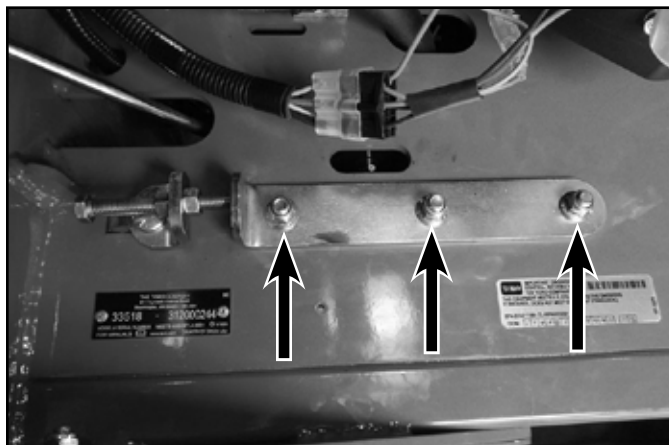


Fig. 107 tightener bolt

- 4 13. Support transaxle with a jack (Fig. 106).



Fig. 106 IMG-0019

15. Slowly lower the jack to gain access to the drive belt. While lowering, work the belt off the PTO shaft of the engine (Fig. 108). Once the belt is off, lower the transaxle out of the chassis.

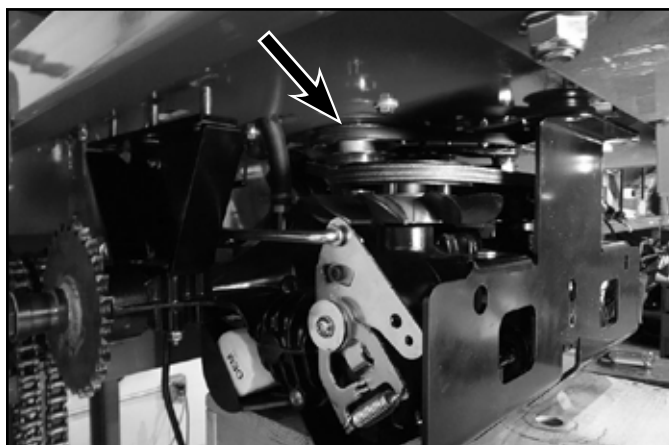


Fig. 108 belt

# HYDRAULICS & ENGINE MOUNTING

## Transmission Installation

1. Place transaxle on a floor jack and position it under the frame so that the bolts line up through the slotted mounting holes (Fig. 109).



Fig. 109

IMG-0019

2. Slowly raise the transaxle until the bolts are almost to the frame. Install the drive belt over the PTO clutch (Fig. 110).

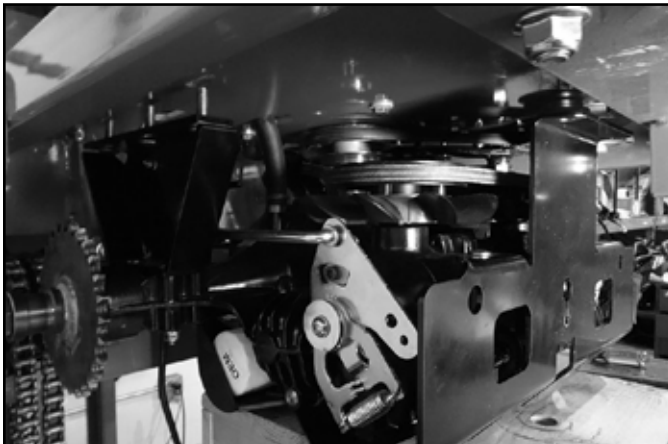


Fig. 110

belt

3. Raise the transaxle up through the mounting holes. Install the front mounting bolts, the transmission adjuster plates, bolts and nuts. Tighten the bolts finger tight (Fig. 111).

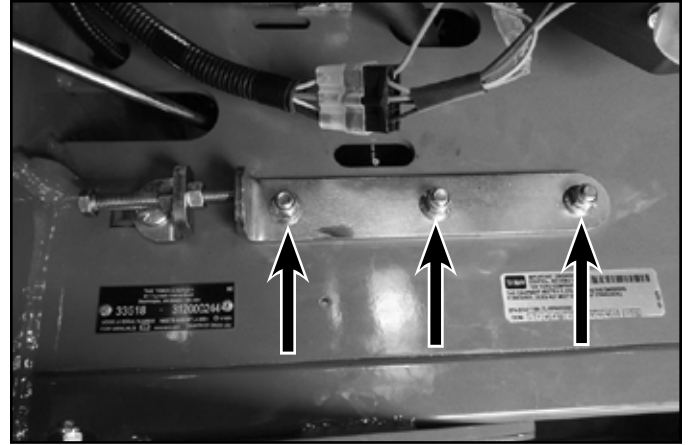


Fig. 111

tightener bolt

4. Install the stationary idler on the RH side of the unit (Fig. 112). Torque bolt to 30 ft-lbs. (41 Nm).

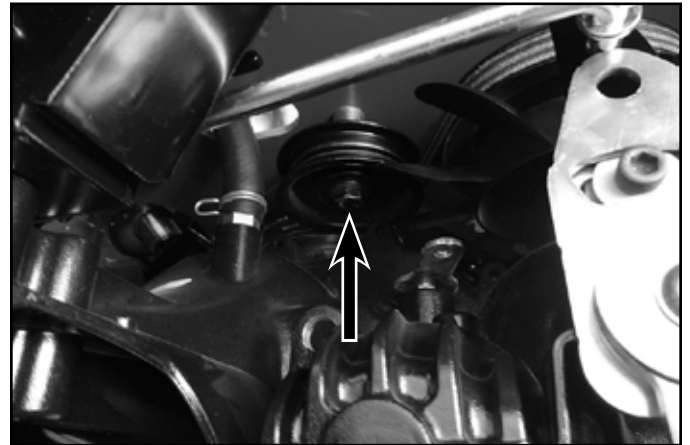


Fig. 112

idler

4



# HYDRAULICS & ENGINE MOUNTING

5. Install the pivot arm tensioner (Fig. 113). Torque bolts to 20 ft-lbs. (27 Nm). Tighten the compression spring until the spring measures 2-3/8" with a new belt. After run-in, recheck the spring and it should not be more than 2-5/8".

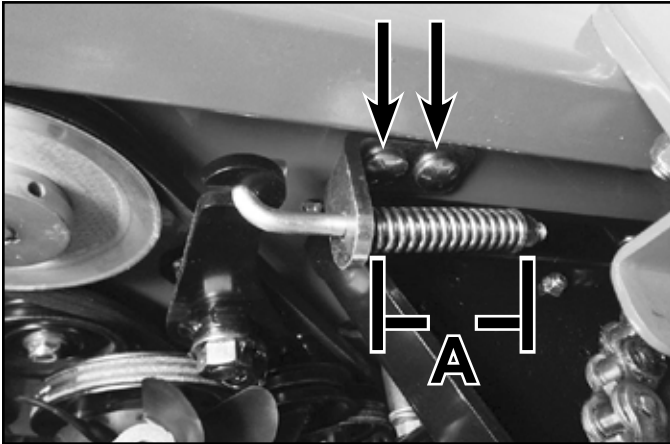


Fig. 113 tensioner

A. 2-3/8"

6. Reconnect the bell crank control links to the bell cranks (Fig. 114).



Fig. 114 linkage removal

7. Install the park brake cable (Fig. 115).

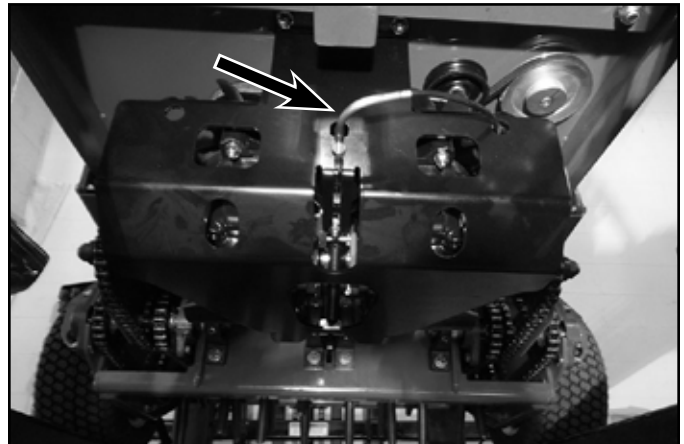


Fig. 115 park brake

8. Insert the ball of the park brake cable through the park brake yoke and install yoke as shown between the two transaxles (Fig. 116).

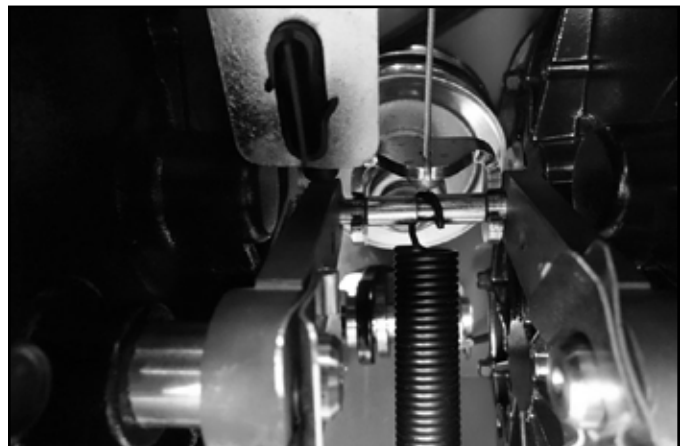


Fig. 116 yoke

# HYDRAULICS & ENGINE MOUNTING

9. Reconnect the parking brake switch wire connector (Fig. 117).

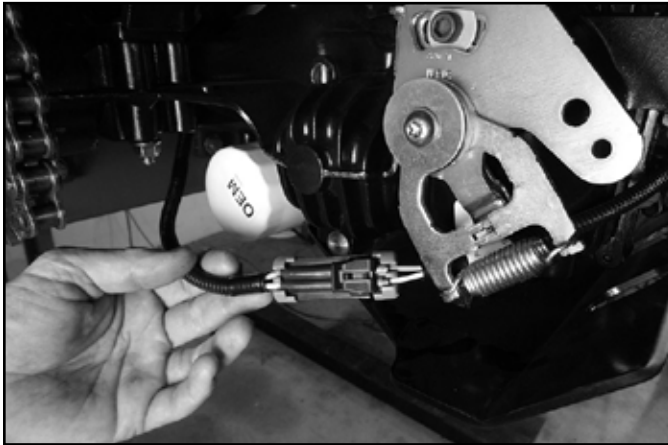


Fig. 117

connector

10. Reconnect the hydro hoses to the overflow tank (Fig. 118).



Fig. 118

hose

11. Install both chains. Install the connecting link so the cover plate and spring clip are to the OUTSIDE of the machine. The split end of the chain clasp MUST be oriented AWAY from the forward direction of chain travel (Fig. 119).

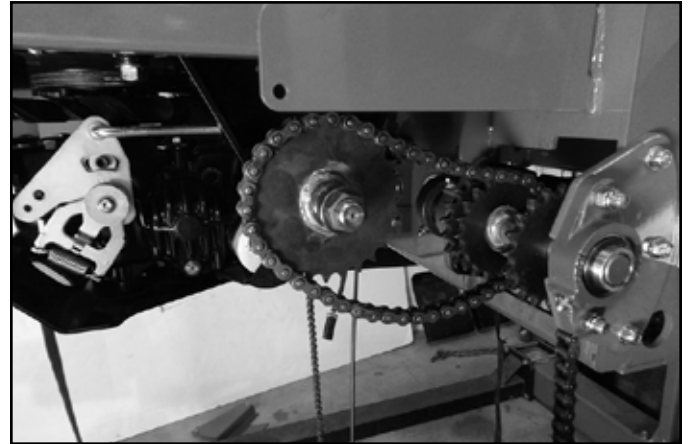


Fig. 119

chain install

(Fig. 120)

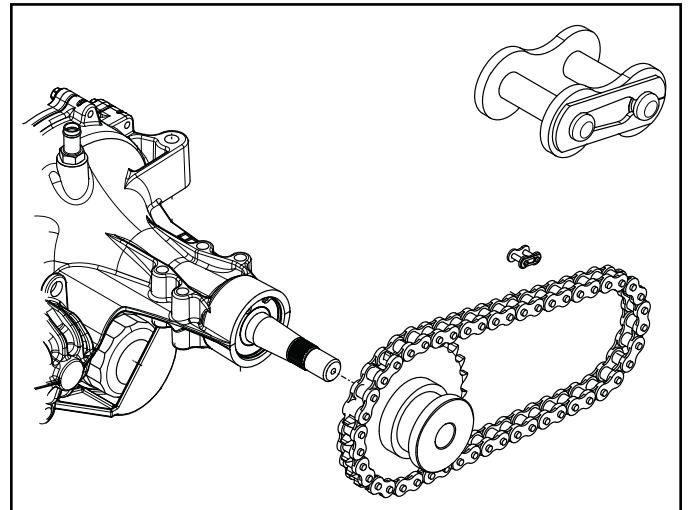


Fig. 120 outside connect link transaxle

# HYDRAULICS & ENGINE MOUNTING

## Transaxle Chain Tensioning

1. Tighten the front mounting bolts and the transmission adjustment plate bolts on both sides of the unit tight, then loosen them one turn.
2. Turn the adjustment bolt to move the transmission adjustment plates and hydros (Fig. 121).

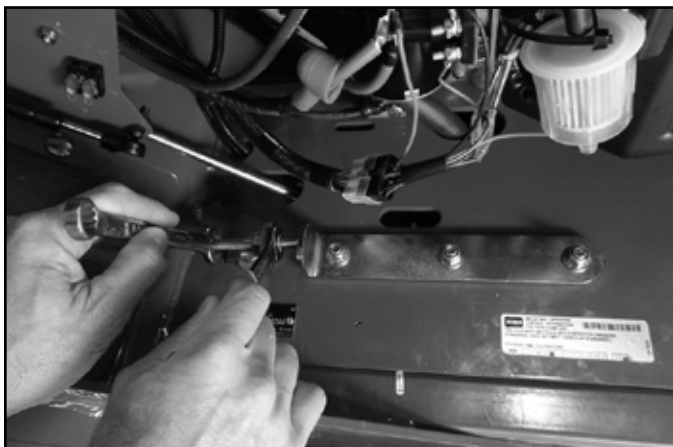


Fig. 121

trans adj plate

3. Tighten until the chain has between 1/4" and 1/2" deflection (Fig. 122).

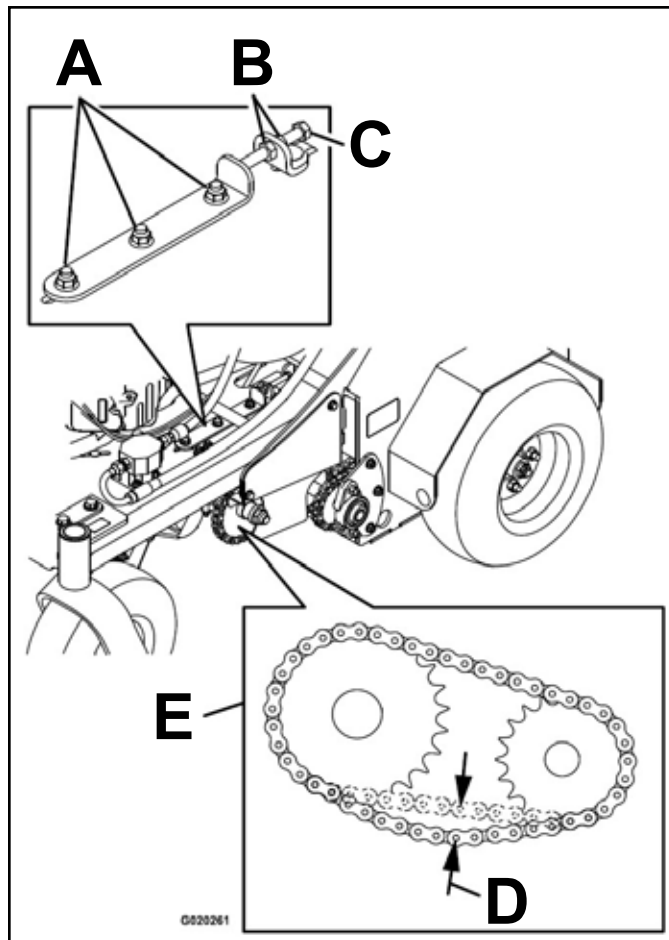


Fig. 122

fig. 16 G020261

- |                                |                              |
|--------------------------------|------------------------------|
| A. Hydro mounting bolts & nuts | D. 6-12mm (1/4"-1/2")        |
| B. Nuts                        | E. Guard removed for clarity |
| C. Adjustment bolt             |                              |



# HYDRAULICS & ENGINE MOUNTING

4. When the correct deflection is achieved, tighten the front mounting bolts and transmission adjustment plate bolts on both sides to 35 ft-lbs. (48 Nm).
5. Check the deflection on the chains again. If they are too tight, loosen the mounting bolts one turn and loosen the chains using the adjustment bolt. Re-torque the mounting bolts to 35 ft-lbs. (48 Nm) and check deflection again.
6. Test drive the unit and re-check deflection. If it is out-of-spec, re-set the deflection again.
7. Install the right and left side chain guards (Fig. 123). Torque bolts to 20 ft-lbs. (27 Nm).

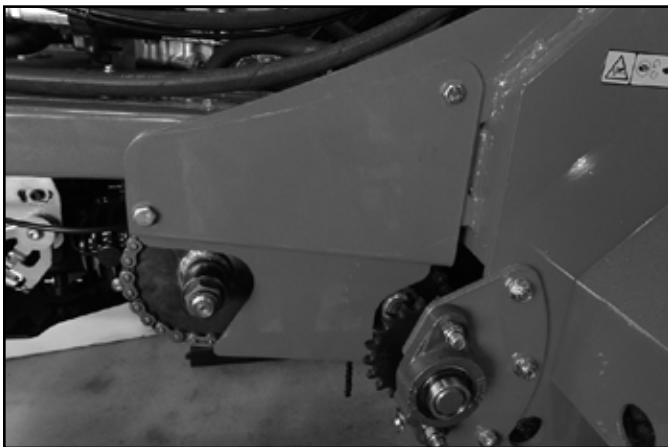


Fig. 123 chain guard

## Hydraulic Pump Belt Removal & Installation

1. Lower the transaxle as outlined in the "Transmission Belt Replacement" section of this chapter.
2. Once the transaxle is lowered, remove the fixed idler (Fig. 124).

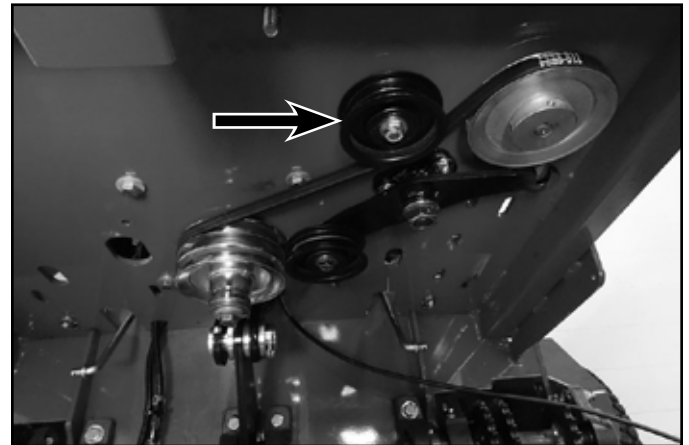


Fig. 124 tension idler

3. Work the old belt off of the pump pulley.
4. Place the new belt over the PTO pulley and work the new belt around the pump pulley (Fig. 125).

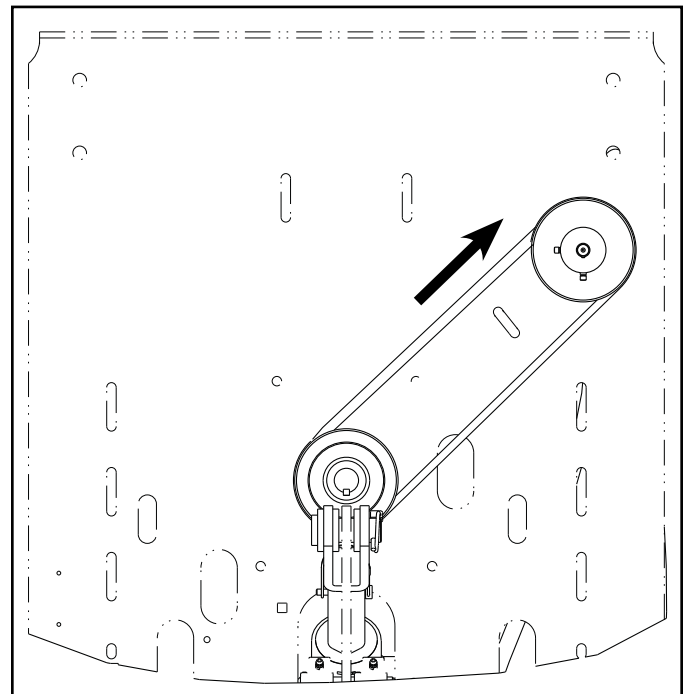
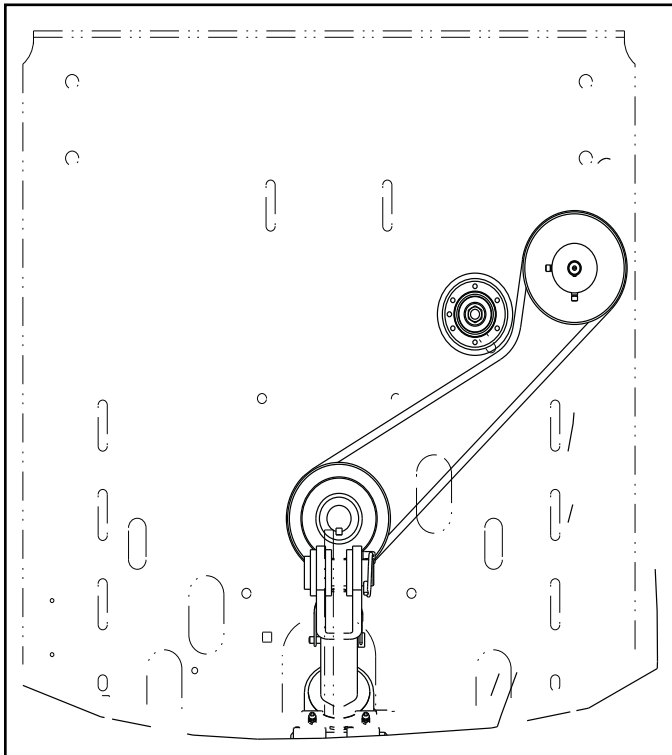


Fig. 125 pump belt install

# HYDRAULICS & ENGINE MOUNTING

5. Reinstall the fixed idler. The idler needs to be pushed into the belt hand tight when the fastener is tightened (minimum 15 lbs.) (Fig. 126). (bottom view)

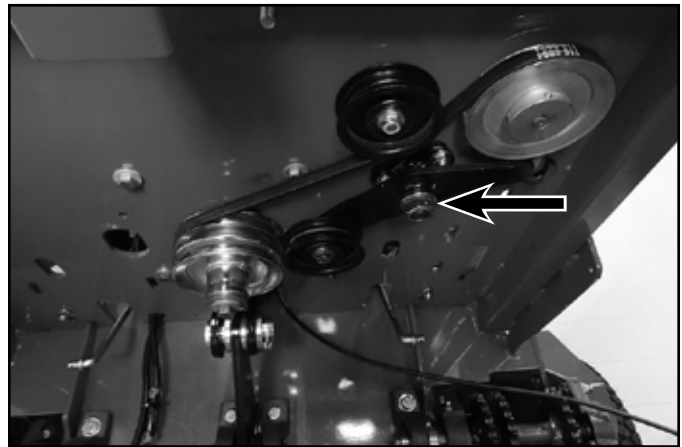


**Fig. 126** engine pump pulley & idler

## Idler Arm Removal & Installation

1. Lower the transaxle as outlined in the "Transmission Belt Replacement" section of this chapter.
2. Remove the idler arm mounting nut (Fig. 127).

**Note:** The transaxle has been removed for picture clarity.



**Fig. 127**

tensioner idler

3. Install new idler arm. Torque nut to 20 ft. lbs. (27 Nm).

6. Tighten the idler bolt to 20 ft-lbs. (27 Nm).

# HYDRAULICS & ENGINE MOUNTING

## Return to Neutral Setting



### WARNING



#### Potential for Serious Injury

Inattention to proper safety, operation, or maintenance procedures could result in personal injury, or damage to the equipment. Before servicing or repairing the transaxle, fully read and understand the safety precautions described in this section.

The return to neutral mechanism on the transaxle is designed to set the directional control into a neutral position when the operator releases the vehicle hand control. Follow the procedures below to properly adjust the return to neutral mechanism on the transaxle:

1. Confirm the transaxle is in the operating mode (bypass disengaged). Raise the vehicle's drive tires off the ground to allow free rotation.

**Note:** It may be necessary to remove the drive tire from the axle hub to access the linkage control and the transaxle return arm. Remove the wheel by removing the lug nuts. Do not remove the axle/hub nut.

2. Remove the Original Equipment Manufacturer's (OEM's) control linkage at the control arm.



### WARNING



Do not attempt any servicing or adjustments with the engine running. Use extreme caution while inspecting the drive belt assembly and all vehicle linkage!

Follow all safety procedures outlined in the vehicle owner's manual.

3. Start the engine and increase the throttle to full engine speed.
4. Check for axle rotation. If the axle does not rotate, go to Step 5. If the axle rotates, go to Step 6.
5. Stop the vehicle's engine. Reattach and adjust the vehicle's linkage according to the vehicle owner's manual.
6. Note the axle directional movement. Stop the vehicle engine. Loosen the RTN adjustment screw until the control arm can be rotated. Rotate the control arm in the opposite direction of the axle rotation in 5 degree increments. Tighten the RTN adjustment screw. Recheck according to steps 3 and 4. Refer to Figure 128.

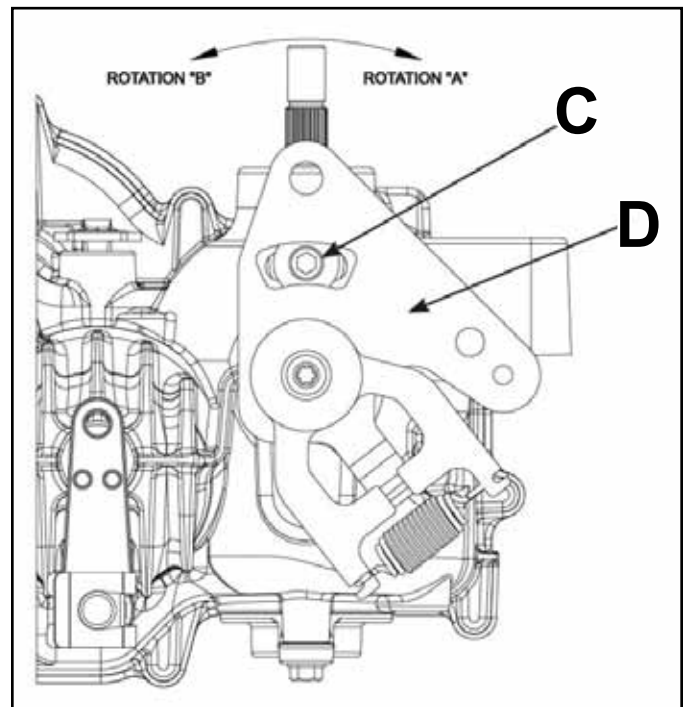


Fig. 128

return to neutral\_a

- C. RTN adjusting screw      D. Speed & direction control arm

# HYDRAULICS & ENGINE MOUNTING

## Hydraulic Pump Rebuild

(Fig. 129)

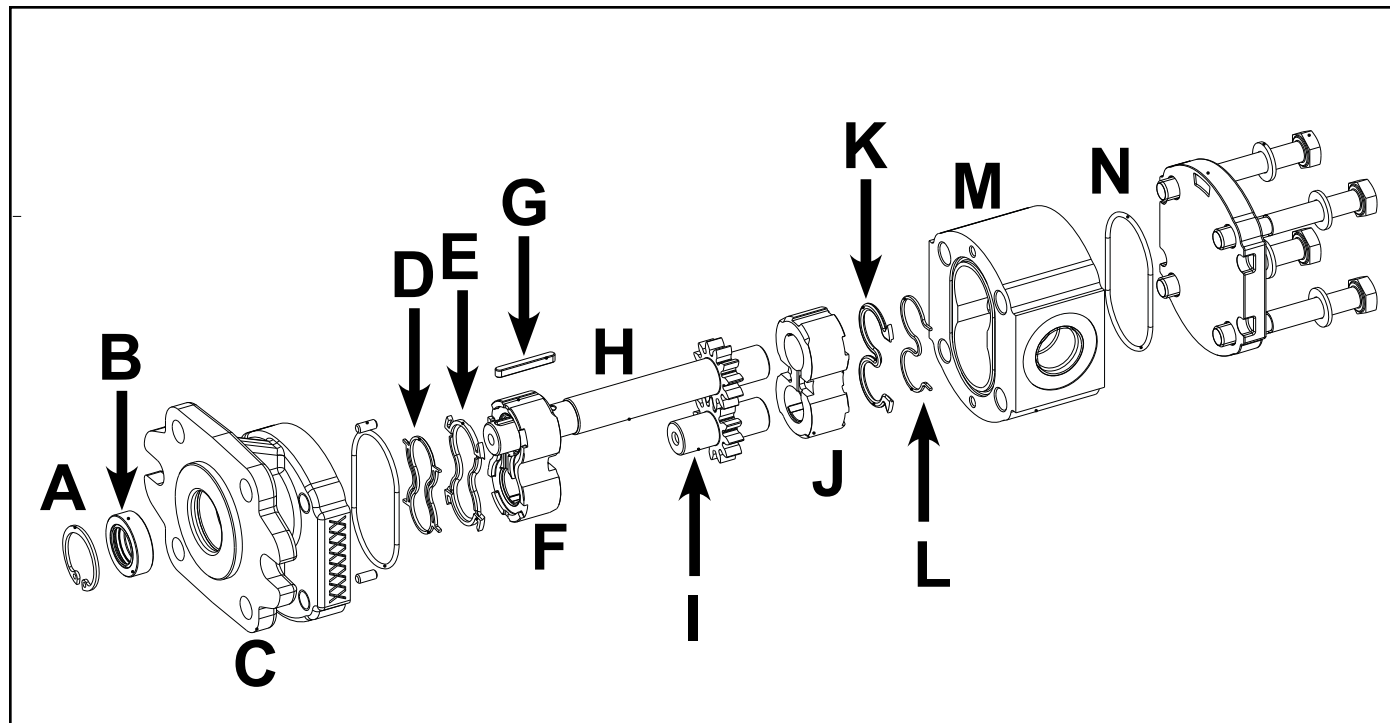


Fig. 129

hyd pump asm

- |                  |                 |                  |                |
|------------------|-----------------|------------------|----------------|
| A. Snap ring     | E. Upper seal   | I. Driven gear   | M. Body        |
| B. Shaft seal    | F. Thrust plate | J. Thrust plate  | N. O-ring seal |
| C. Front cover   | G. Key          | K. Seal          |                |
| D. Antiextrusion | H. Drive shaft  | L. Antiextrusion |                |

# HYDRAULICS & ENGINE MOUNTING

1. Ensure you have all the parts necessary to rebuild pump (Fig. 130).



Fig. 130

0001\_a

3. Remove the body and thrust plate assembly (Fig. 132).

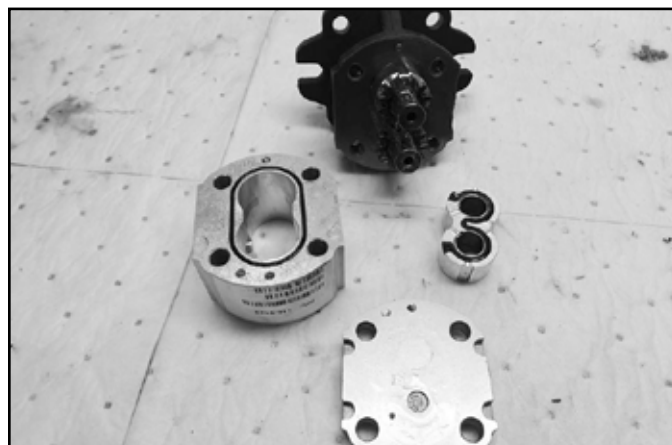


Fig. 132

0003\_a

2. Remove the rear cover (Fig. 131).

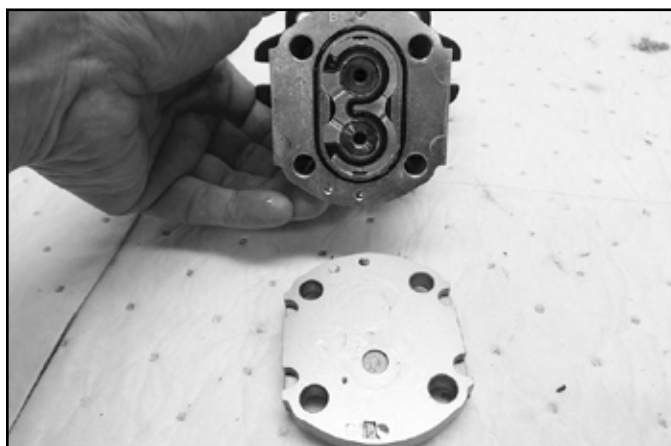


Fig. 131

0002\_a

4. Remove the O-ring from one side of the body (Fig. 133).



Fig. 133

0004a\_a

4

# HYDRAULICS & ENGINE MOUNTING

5. Replace the O-ring with new (Fig. 134).

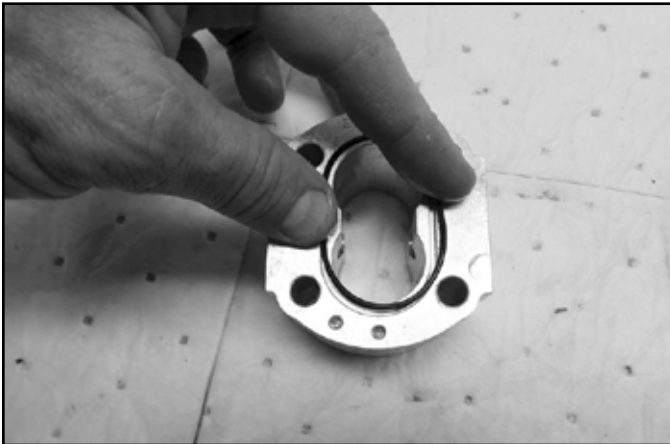


Fig. 134

0005\_a

8. Replace with new seal and antiestrusion (Fig. 136).



Fig. 136

0007\_a

4 6. Remove and replace the O-ring on opposite side.

7. Remove the seal and antiestrusion from the thrust plate assembly (Fig. 135).

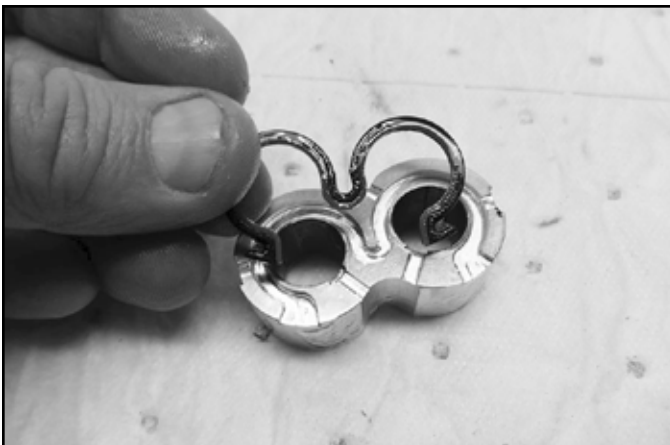


Fig. 135

0006\_a

9. Remove the key from the drive shaft and remove drive shaft and thrust plate from the front cover (Fig. 137).



Fig. 137

0008\_a

# HYDRAULICS & ENGINE MOUNTING

10. Remove the upper seal and antiextrusion and replace with new (Fig. 138).



Fig. 138

0009\_a

12. Remove the seal (Fig. 140).



Fig. 140

0011\_a

11. Remove the snap ring (Fig. 139).



Fig. 139

0010\_a

13. Install new seal (Fig. 141).



Fig. 141

0012\_a

4

# HYDRAULICS & ENGINE MOUNTING

14. Install the snap ring (Fig. 142).

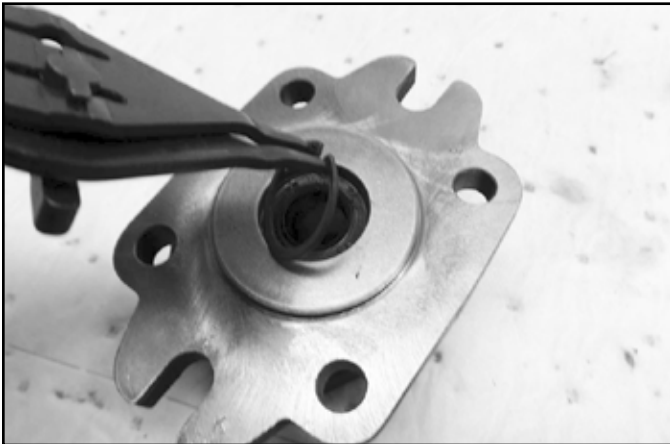


Fig. 142

0010\_a

4

15. Reassemble pump.

## Hydraulic Pump Assembly

(Fig. 143)

Torque bolts to 14-18 ft-lbs. (19-25 Nm).

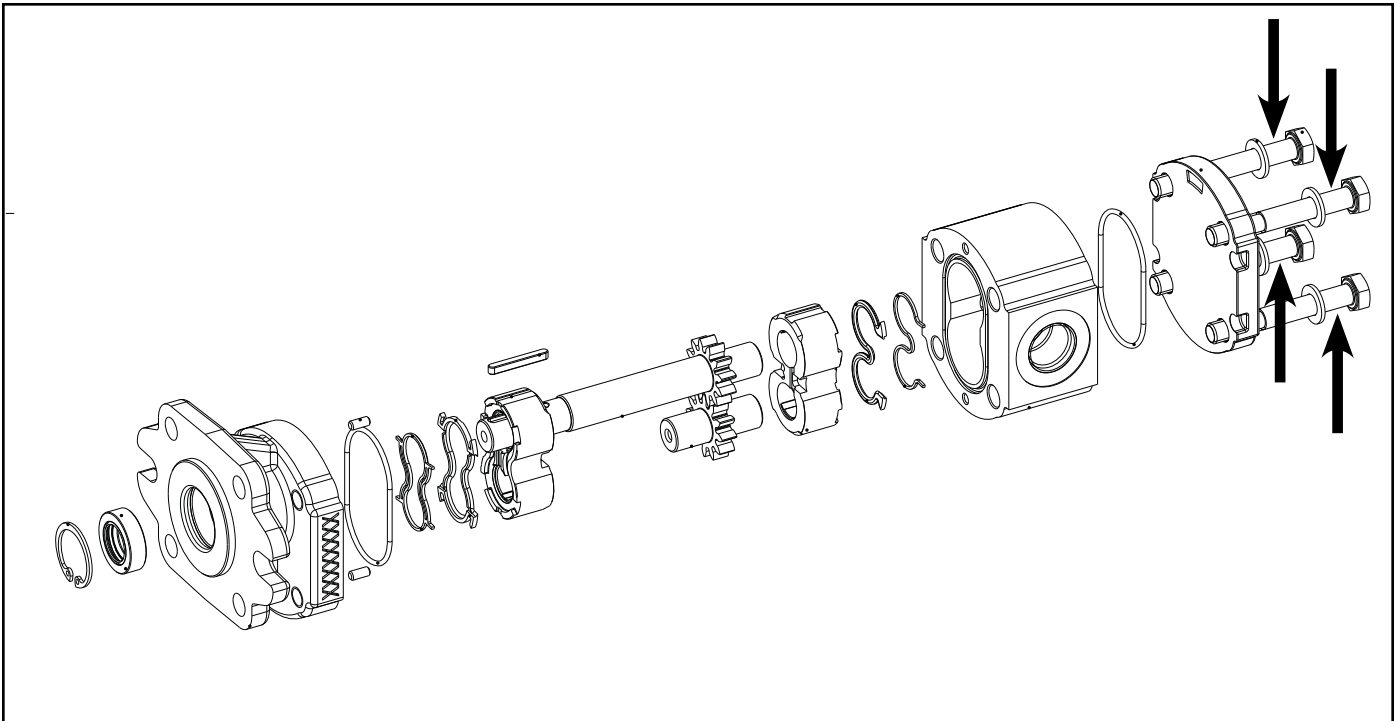


Fig. 143

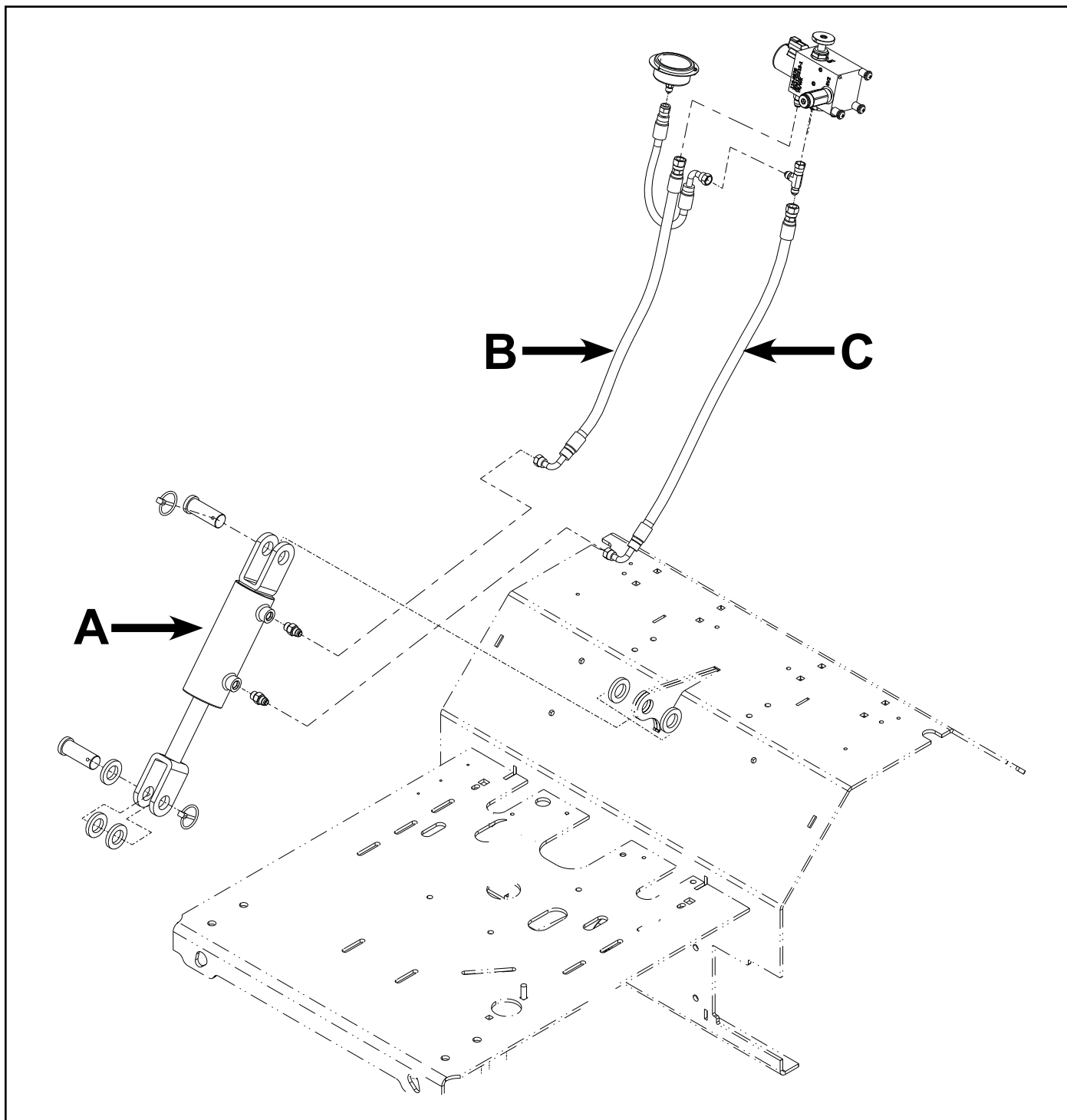
hyd pump asm



# HYDRAULICS & ENGINE MOUNTING

## Hydraulic Cylinder Rebuild

(Fig. 144)



**Fig. 144**

Hyd cyl removal

- A. Hydraulic cylinder assembly
- B. Assembly, hydraulic hose
- C. Assembly, hydraulic hose

# HYDRAULICS & ENGINE MOUNTING

1. Remove the hydraulic cylinder from the chassis. Make sure to wipe up any hydraulic oil spills with towels and dispose of them properly. Plug the hydraulic hoses to keep them free of dirt and debris. Drain the oil from the cylinder into an approved container.
2. Put the cylinder in a vise. Insert the tabs of a spanner wrench into the holes on the top cover of the cylinder. Turn the cover until the retaining ring comes completely out (Fig. 145).



Fig. 145

spanner 1\_a

3. Remove the piston assembly from the cylinder (Fig. 146).



Fig. 146

piston\_a

4. Put the yoke of the piston assembly in a vise. Remove the retaining nut (Fig. 147).



Fig. 147

nut\_a

5. Remove the piston stack from the piston shaft. Make sure you have all the replacement parts needed (Fig. 148).



Fig. 148

parts\_a

# HYDRAULICS & ENGINE MOUNTING

6. With a pick, remove and replace the inner shaft O-ring (Fig. 149).



Fig. 149

o-ring\_a

8. Remove and replace the large O-ring and flat O-ring (Fig. 151).



Fig. 151

large o-ring\_a

7. Remove and replace the yellow outer band and the black inner band (Fig. 150).

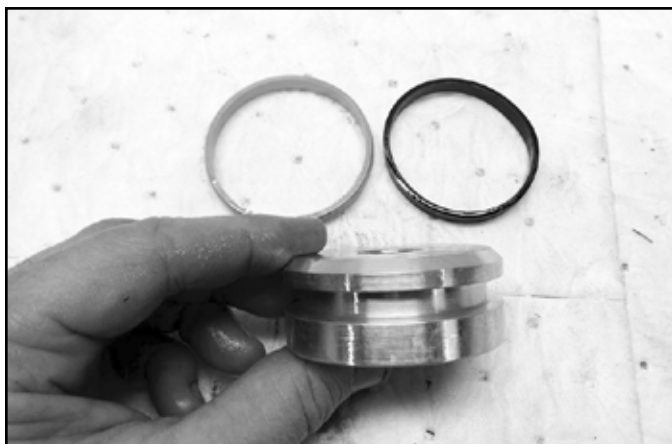


Fig. 150

bands\_a

9. Remove and replace the inner wiper (Fig. 152).

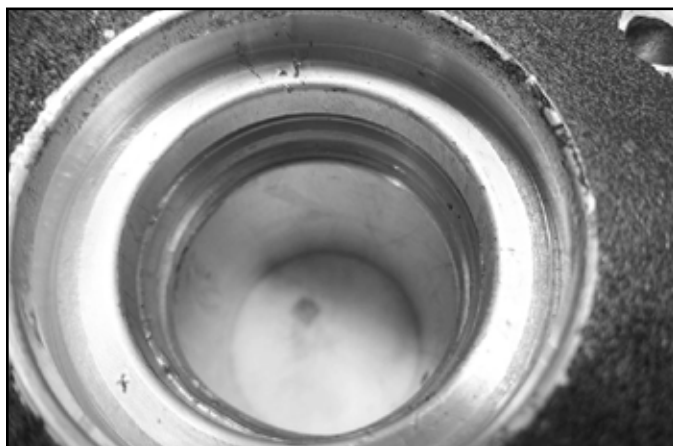


Fig. 152

wiper\_a

4

# HYDRAULICS & ENGINE MOUNTING

10. Remove and replace the top seal (Fig. 153).

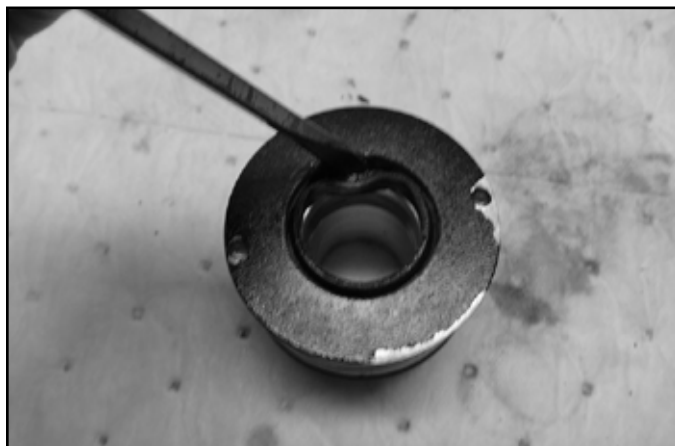


Fig. 153

top seal\_a

12. Install the piston assembly into the cylinder. Align the retaining ring catch hole with the retaining ring slot on the side of the cylinder and push down on piston cover until flush with the top of the cylinder slot (Fig. 155).



Fig. 155

slot\_a

4 11. Install the piston stack onto the piston shaft. Install the nut and torque the nut to 50 ft-lbs (69 Nm) (Fig. 154).



Fig. 154

piston stack\_a

13. Insert the retaining ring in the slot making sure it catches in the catch hole (Fig. 156).



Fig. 156

insert ring\_a

# HYDRAULICS & ENGINE MOUNTING

14. Using the spanner wrench, turn the the top cover of the cylinder until the retaining ring is fully seated into the slot (Fig. 157).



**Fig. 157**

spanner 1\_a

15. Install cylinder into chassis. Connect the hoses and fill the hydraulic reservoir with oil. Start the unit and purge the system of any air. Check for leaks.

# HYDRAULICS & ENGINE MOUNTING

## Engine

### Engine Mounting

(Fig. 158)

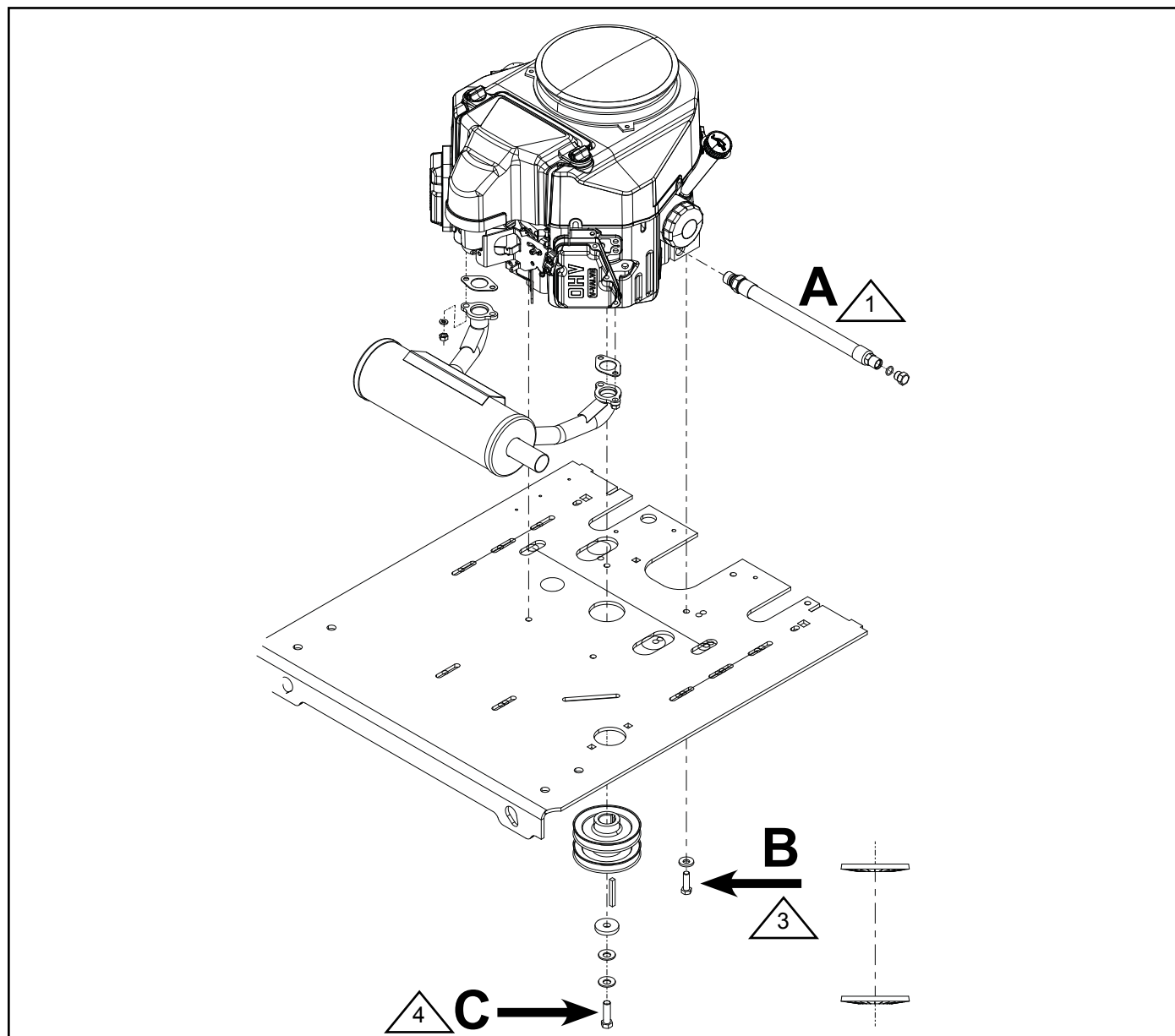


Fig. 158

engine mounting

- A. Engine oil drain hose assembly with plug
- B. Screw - engine mount
- C. Screw - pulley

1 Torque  $26 \pm 3$  in-lbs. (3 Nm)

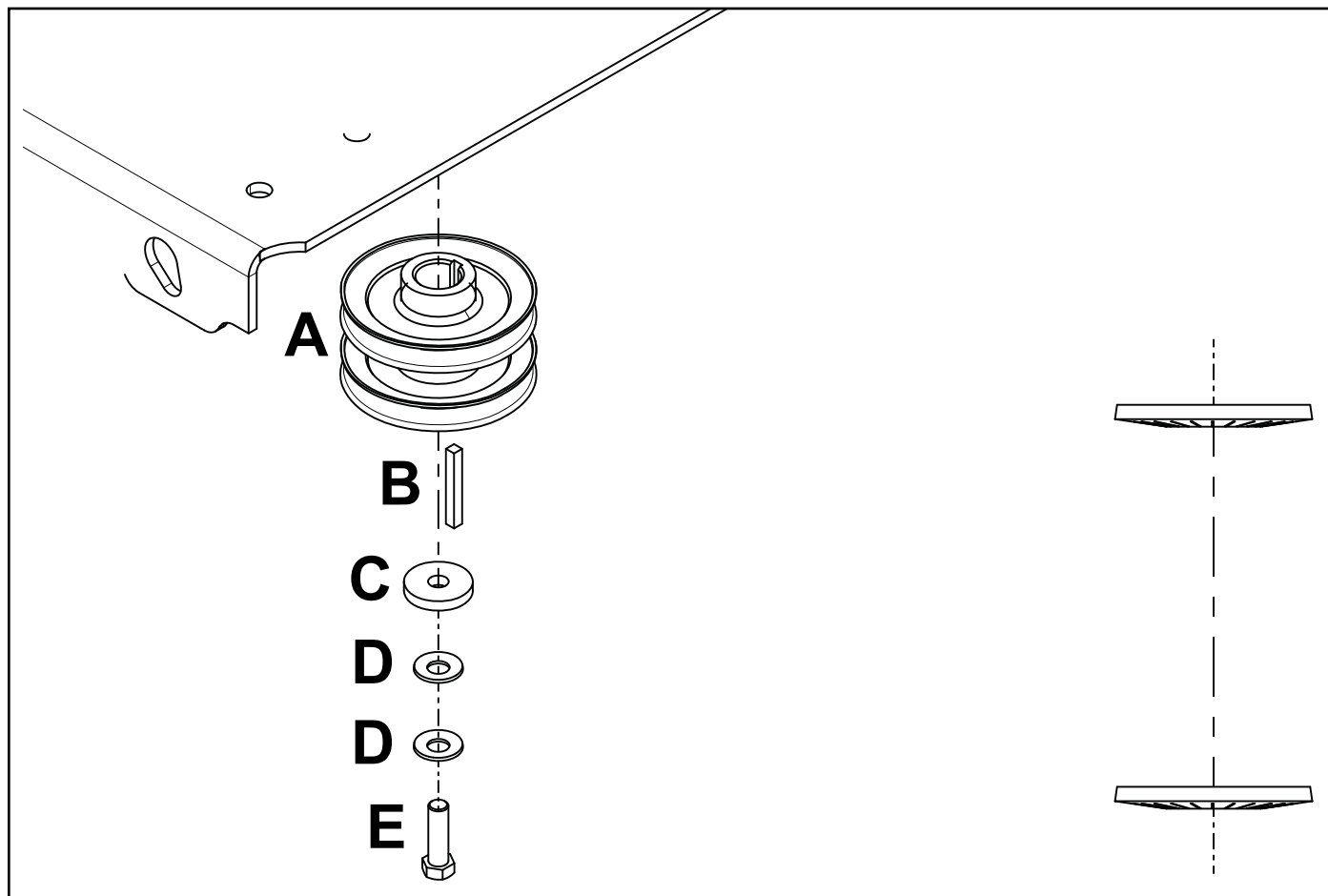
2 Adjust high idle  $3600 \pm 50$

3 Torque to 17 - 23 ft-lbs. (23 - 31 Nm)

4 Torque to  $55 \pm 6$  ft-lbs. ( $76 \pm 8$  Nm)

## Engine Pulley

(Fig. 159)



**Fig. 159**

engine pulley

- A. Pulley
- B. Key
- C. Washer, clutch
- D. Washer, spring (2)
- E. Screw

# HYDRAULICS & ENGINE MOUNTING

## Engine Replacement

### Engine Removal

1. Remove positive (+) and negative (-) cables from battery (Fig. 160).



Fig. 160

pos cable

2. Turn off fuel valve (Fig. 161).



Fig. 161

fuel valve

3. Disconnect the fuel line and the emissions line from the engine (Fig. 162).

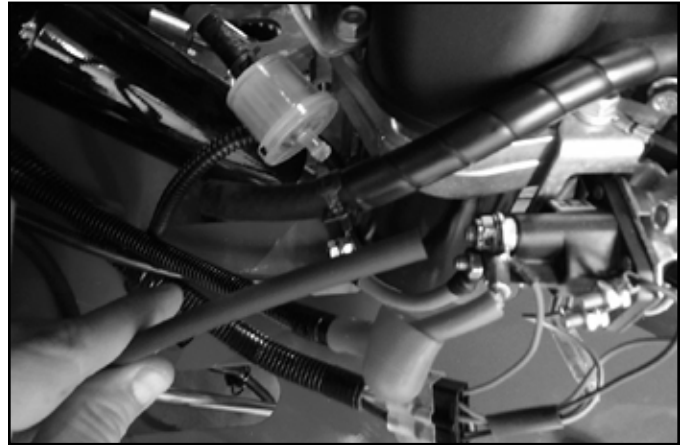


Fig. 162

lines

4. Disconnect the positive (+) wires from the starter solenoid and secure out of the way (Fig. 163).



Fig. 163

battery cable



# HYDRAULICS & ENGINE MOUNTING

5. Disconnect the engine wiring harness from the main wiring harness (Fig. 164).

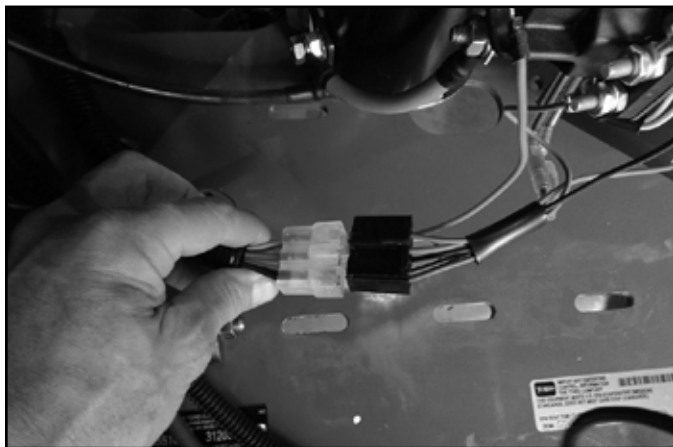


Fig. 164

harness

7. Remove the throttle and choke cables from the engine. Mark the wires with tape or a marker to ensure they get reinstalled correctly (Fig. 166).

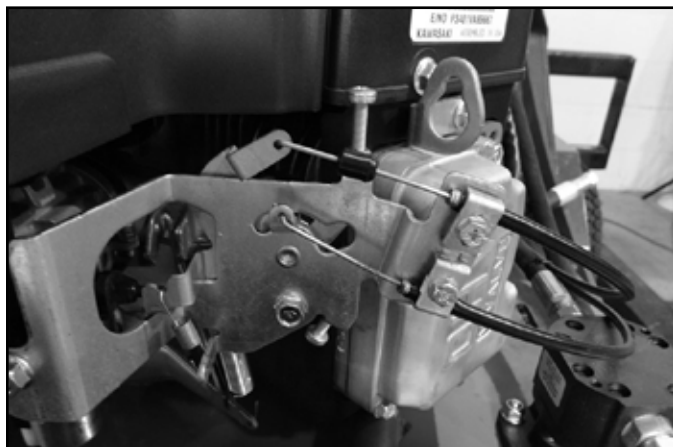


Fig. 166

cables

6. Disconnect the ground wires from the engine block (Fig. 165).

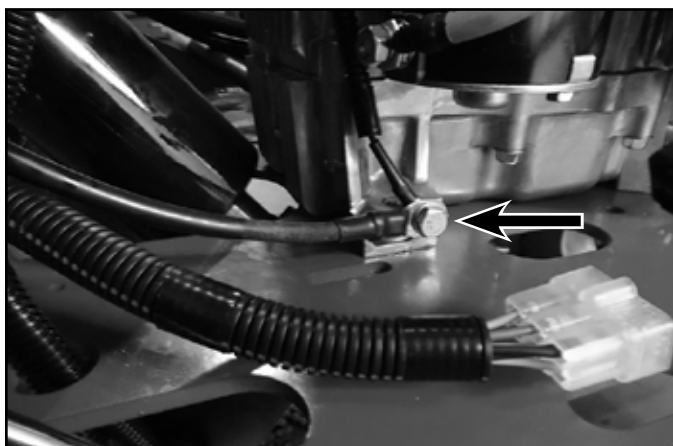


Fig. 165

ground wires

# HYDRAULICS & ENGINE MOUNTING

8. Remove the transaxle as outlined in the "Transmission Removal" section of this chapter.
9. Remove the hydraulic pump belt as outlined in the "Hydraulic Pump Belt Removal & Installation" section of this chapter.
10. Remove the bolt securing the PTO pulley and remove pulley. Make sure to secure the key (Fig. 167).

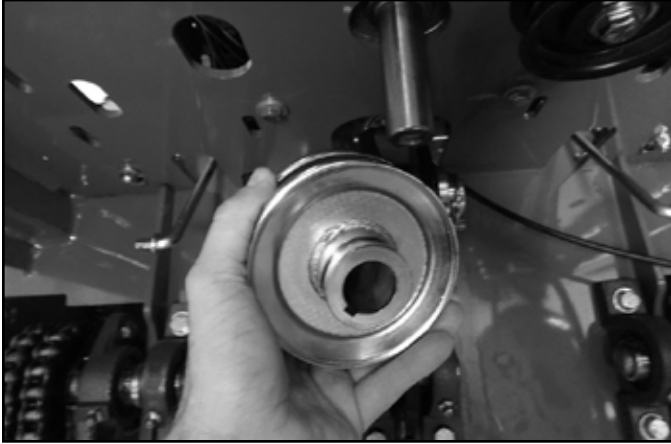


Fig. 167

PTO pulley

11. Remove the four mounting bolts securing the engine (Fig. 168).

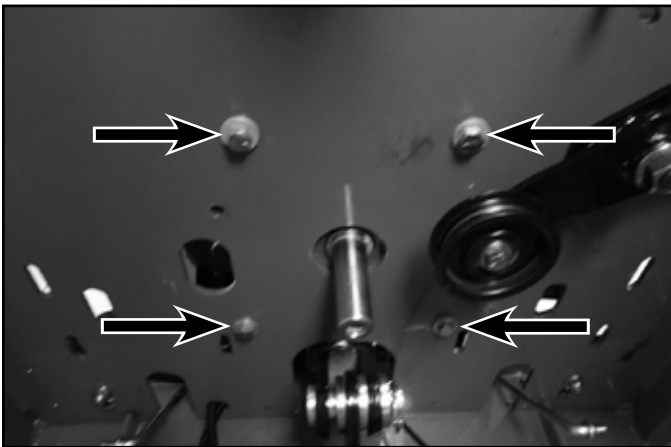


Fig. 168

eng mt bolts

12. Remove engine.

## Engine Installation

1. Line up mounting bolt holes on the engine to the holes on the deck. Install mounting bolts. Torque bolts to 17-23 ft-lbs. (23-31 Nm) (Fig. 169).

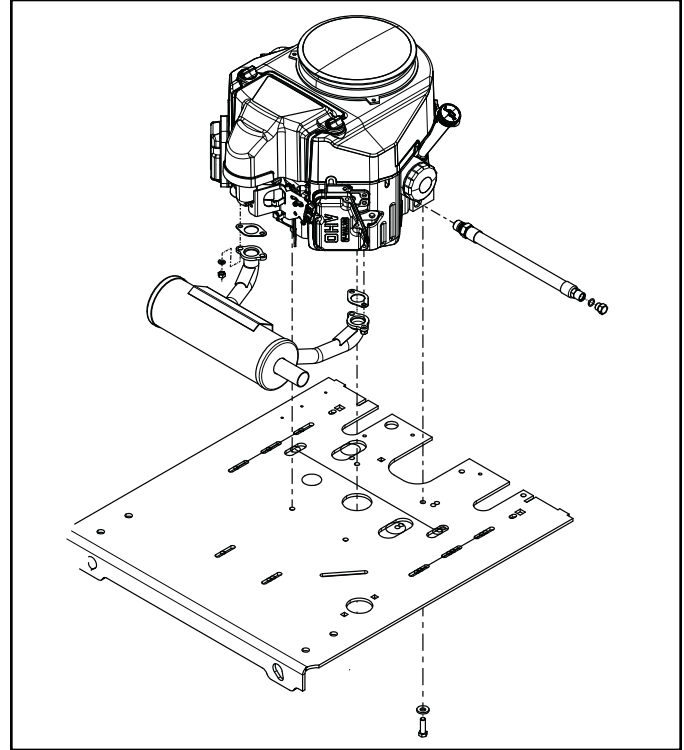


Fig. 169

eng mt

2. Install the PTO pulley. Torque to  $56 \pm 6$  ft-lbs. ( $76 \pm 8$  Nm) (Fig. 170).

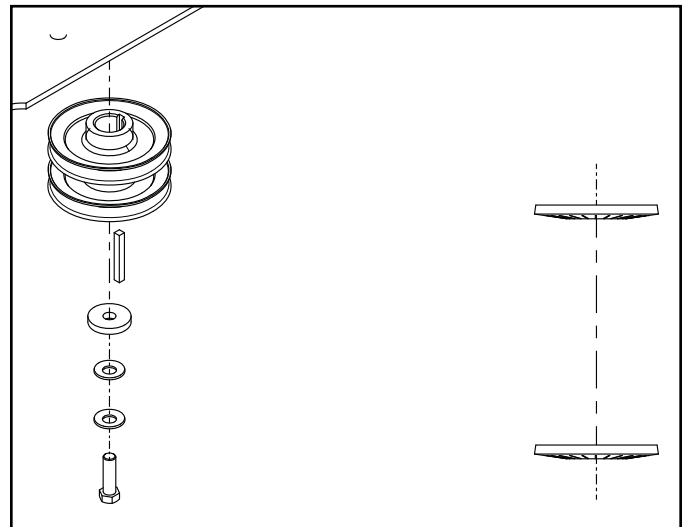


Fig. 170

engine pulley

# HYDRAULICS & ENGINE MOUNTING

3. Install the hydraulic pump belt as outlined in the "Hydraulic Pump Belt Removal & Installation" section of this chapter.
4. Install the transaxle as outlined in the "Transmission Installation" section of this chapter.
5. Install the throttle and choke cables (Fig. 171).

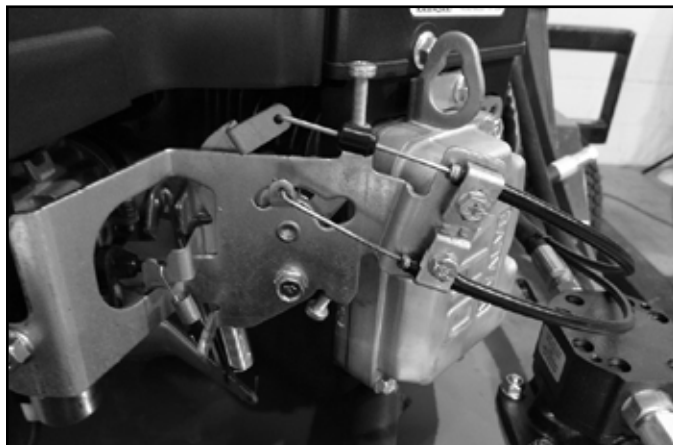


Fig. 171

cables

7. Connect the engine wiring harness to the main wiring harness (Fig. 173).

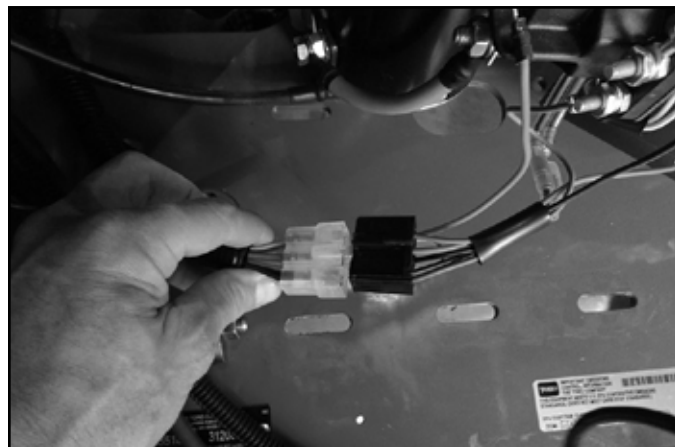


Fig. 173

harness

8. Connect the fuel line and emissions line to the engine (Fig. 174).

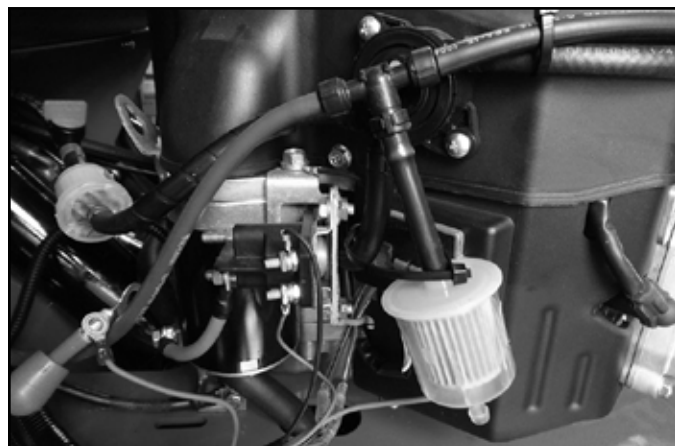


Fig. 174

lines new

6. Install the ground wires (Fig. 172).



Fig. 172

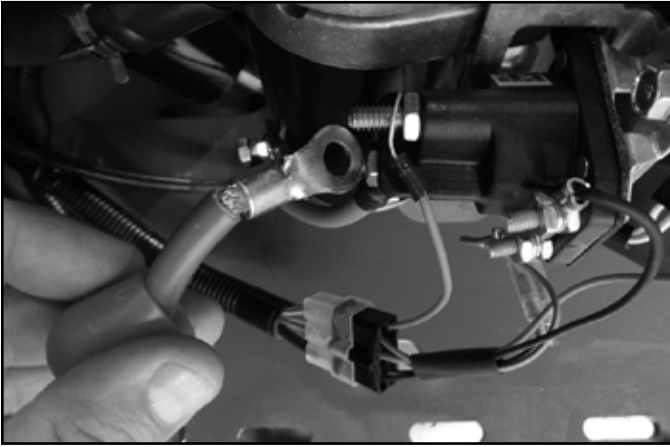
ground wires

4

# HYDRAULICS & ENGINE MOUNTING

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9. Turn on fuel valve.
10. Connect positive (+) wires to the starter solenoid (Fig. 175).



**Fig. 175**

battery cable

11. Connect positive and negative wires to the battery (Fig. 176).



**Fig. 176**

pos cable

## Ground Drive

### Subsystem Ground Drive

(Fig. 177)

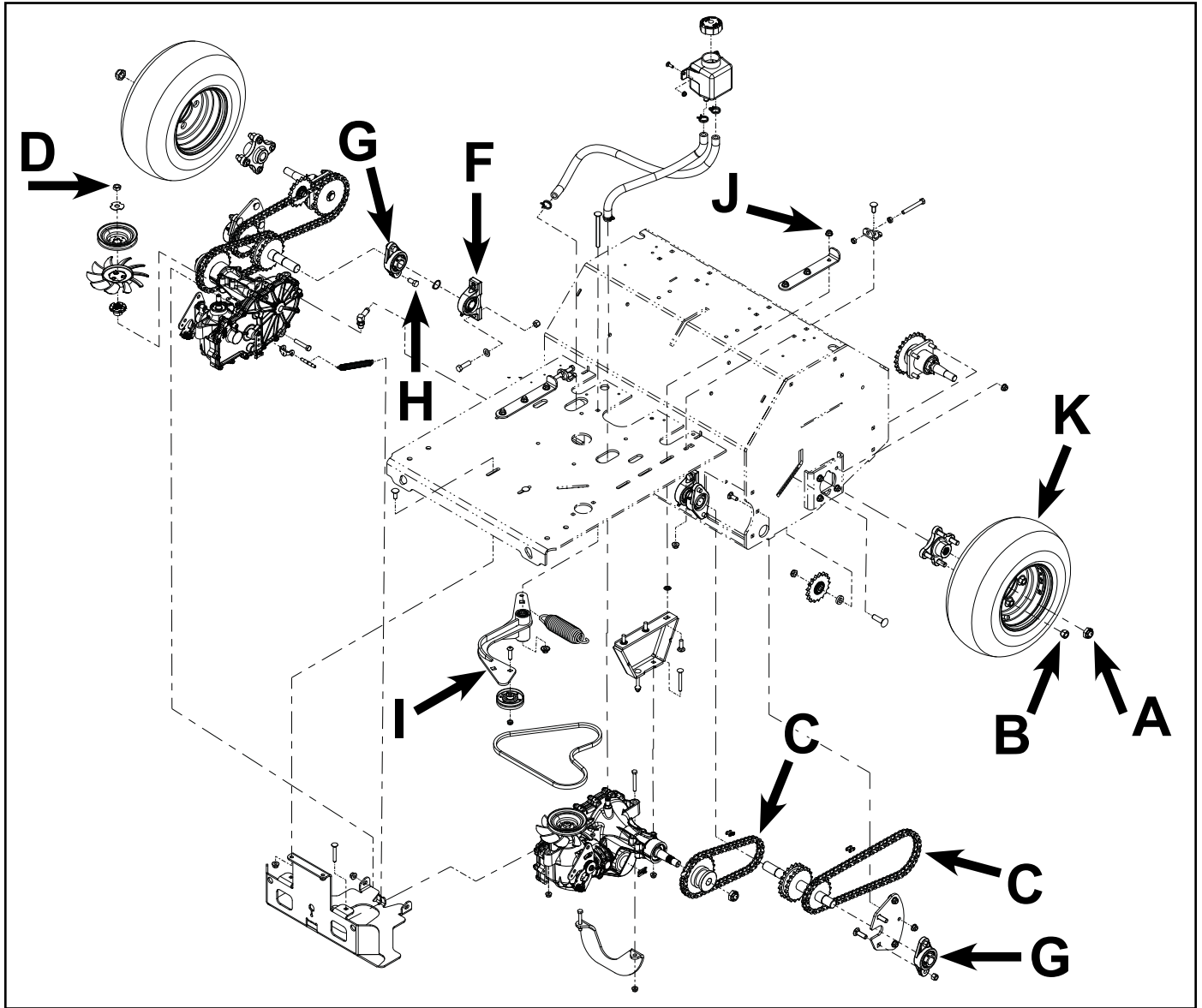


Fig. 177 subsystem ground drive

- A. When tightening the slotted nut on the wheel motor tapered shaft: torque the slotted nut to  $235 \pm 35$  ft.-lbs. ( $325 \pm 48$  Nm). Note: Do not use anti-seize on wheel hub.
- B. Snug all nuts in alternating pattern on wheel then torque in alternating pattern to 77-95 ft.-lbs. (105-130 Nm).
- C. Chains should have  $1/4$ "- $1/2$ " deflection half-way between sprockets.
- D. Torque to 45-55 ft.-lbs. (62-76 Nm).
- E. Route transmission expansion hoses over the auxiliary hydraulic hose to keep hoses away from linkage.
- F. Zerks on the jackshaft pillow block bearings must face down away from engine mounting plate.
- G. Zerks on flange bearings must face forward away from tine body.
- H. Apply Loctite® 505 to flange bearing bolts.
- I. Use  $1-1/4$ " spacer block under pulley end of idler arm assembly as idler bolt and nut are tightened.
- J. Torque to  $32 \pm 3$  ft.-lbs. ( $44 \pm 4$  Nm).
- K. Inflate tire to 12-14 psi (83-97kPa).

# GROUND DRIVE & TINE SYSTEMS

## Chains

(Fig. 178)

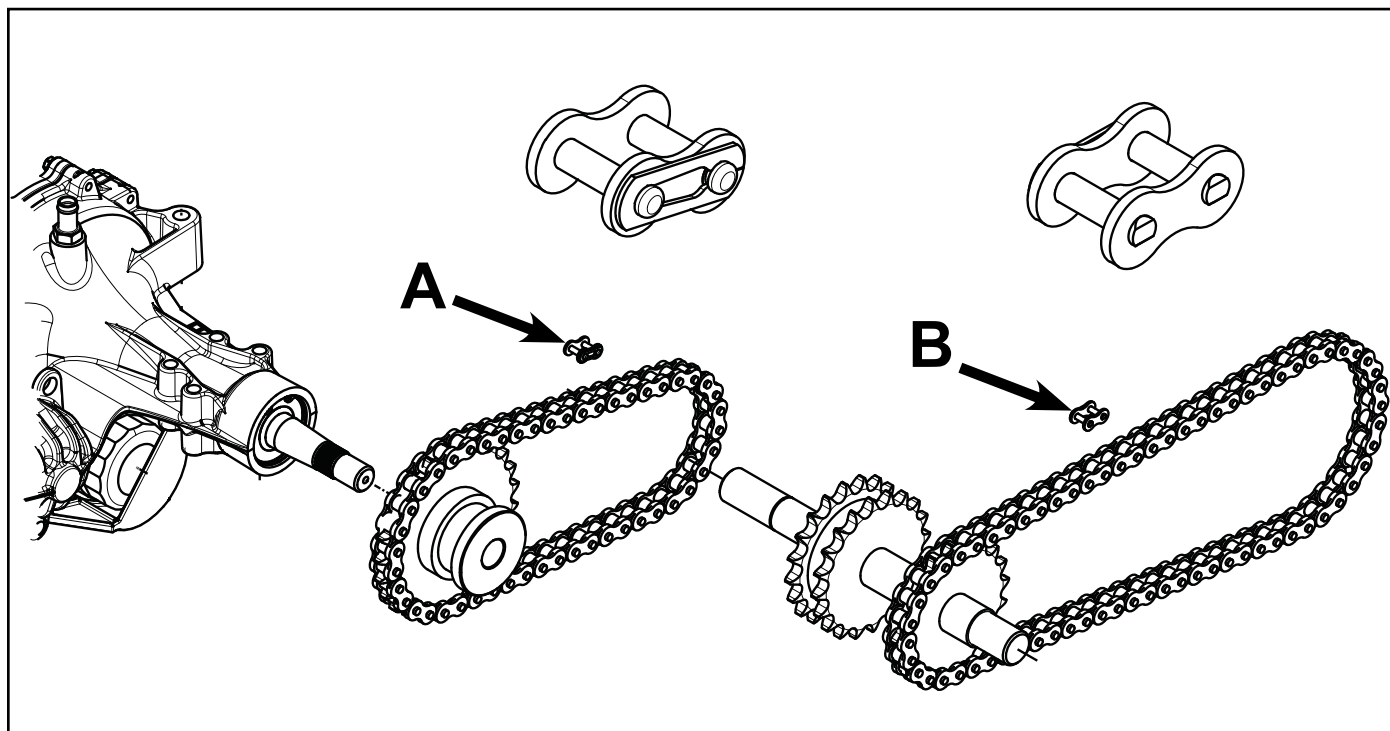


Fig. 178

chains

### Transmission Chains

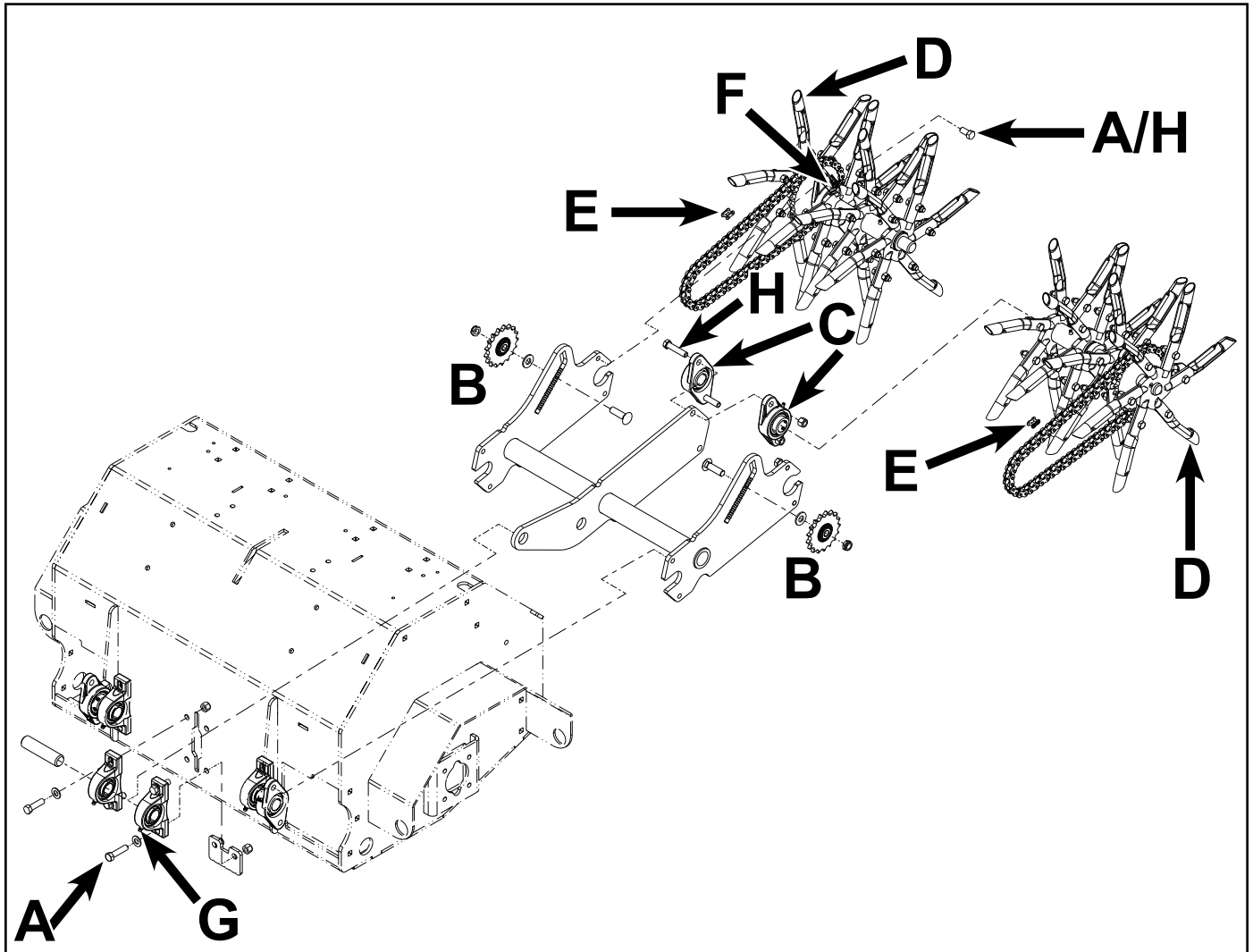
- A. Install the connecting link so the cover plate and spring clip are to the **outside** of the machine. Split end of chain clasp must be oriented away from the forward direction of chain travel.

### Drive Chains

- B. Install the connecting link so the cover plate and spring clip are to the **inside** of the machine. Split end of chain clasp must be oriented away from the forward direction of chain travel.

## Aerator Assembly

(Fig. 179)



**Fig. 179** subsystem aerator asm

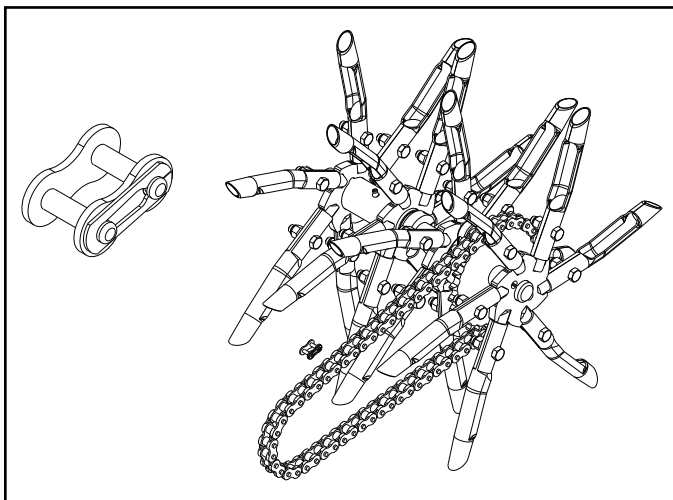
- A. Apply Loctite® 242 to setscrews (4) and screws (4) and tighten to  $27 \pm 3$  ft-lbs. ( $37 \pm 4$  Nm).
- B. Adjust idler position to allow a maximum of  $3/8$ " of chain movement.
- C. Zerk on tine shaft bearings must face rear of unit.
- D. Adjust tine shaft outward until the spyder contacts the outer tine shaft bearings. Slide locking collar up to the tine idler and slide tine idler up to center tine shaft bearing. Use Loctite 243 for lock collar screws. Tighten locking collar to tine shaft. Torque to 12-14 ft-lbs. (16-19 Nm). Tine idler must turn freely.
- E. Install the connecting links so the cover plate and spring clip are to the outside of the machine. Install spring clip so opening is away from forward direction of rotation.
- F. Grease location.
- G. Zerk on trail arm pivot bearings must face down away from the engine mounting plate.
- H. Torque to  $27 \pm 3$  ft-lbs. ( $37 \pm 4$  Nm)



# GROUND DRIVE & TINE SYSTEMS

## Tinebar Chain Assembly

Install the connecting links so the cover plate and spring clip are to the OUTSIDE of the machine. Install spring clip so opening is away from forward direction of rotation (Fig. 180).

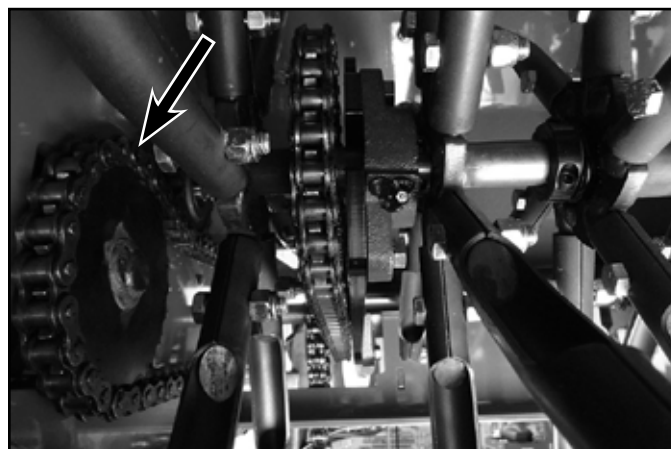


**Fig. 180** tine chain connector link

## Tine Shaft Replacement

### Tine Shaft Removal

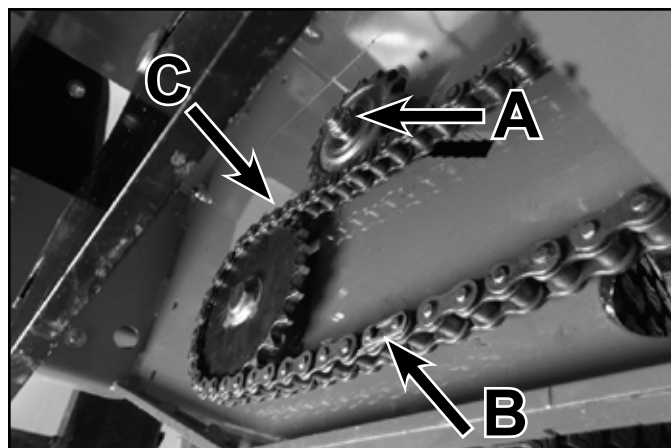
1. Rotate the wheels until the master links on the drive chains are in a position to be removed (Fig. 181).



**Fig. 181**

drive chains

2. Loosen the drive wheel tensioners (A) and remove the spring clips, cover plates, master links (B) and chains (C) (Fig. 182).



**Fig. 182**

drive tensioner



# GROUND DRIVE & TINE SYSTEMS

3. Remove tine chains by rotating the tines until the master links are in a position to be removed (Fig. 183).

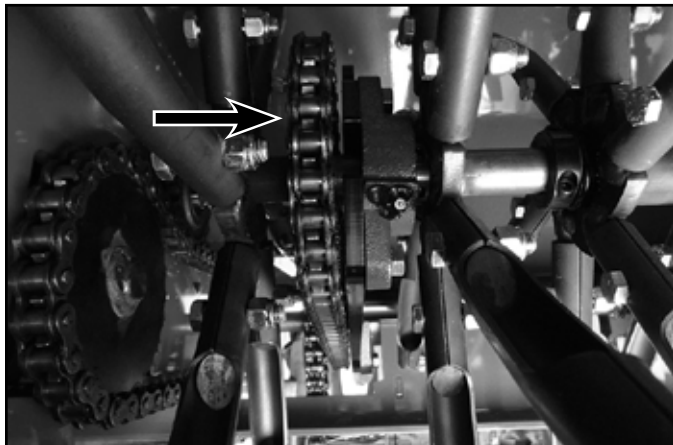


Fig. 183 drive chains

4. Loosen the tensioners and remove the spring clips, cover plates, master links and chains (Fig. 184).



Fig. 184 idler sprocket

5. Loosen the lock collars (Fig. 185).

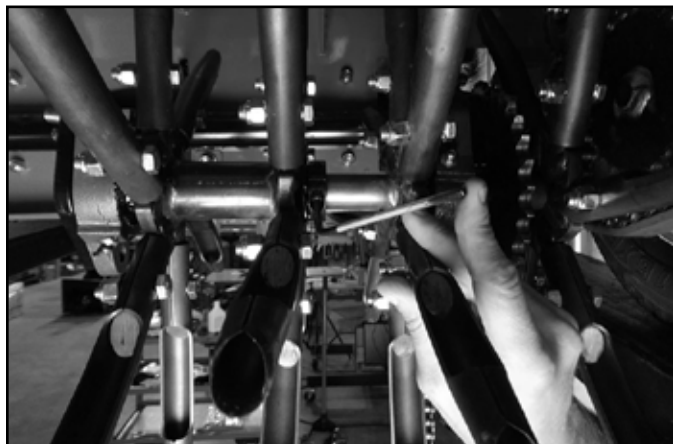


Fig. 185 lock collar

6. Slide the inner tines and lock collar to the outside of the machine (Fig. 186).



Fig. 186 slide tines

5

# GROUND DRIVE & TINE SYSTEMS

7. Remove the bolts holding the outer flange bearings (Fig. 187).

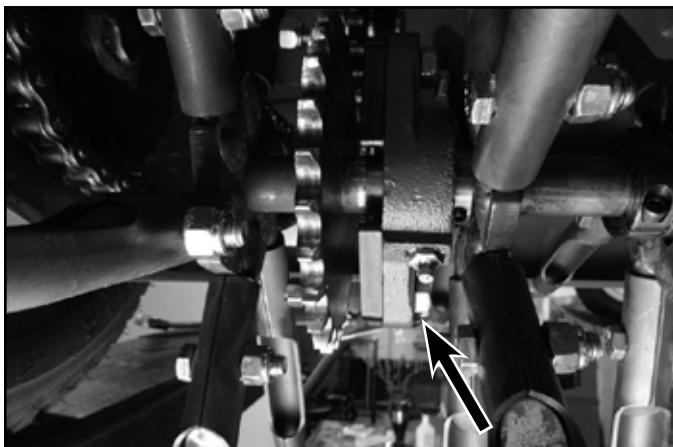


Fig. 187 outer flange brgs

8. Loosen the bolts holding the inner flange bearings (Fig. 188).

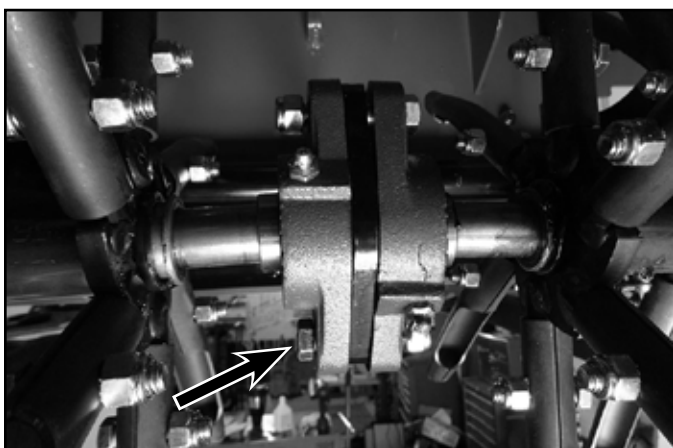


Fig. 188 inner flange brgs

9. Remove bolts holding the inner flange bearings while supporting the tine axles.

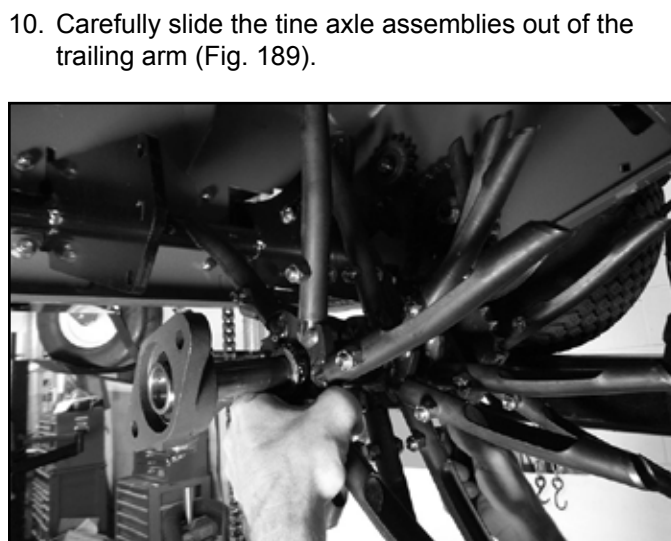


Fig. 189 tine asm

## Tine Wheel Assembly (left side shown) (Fig. 190)

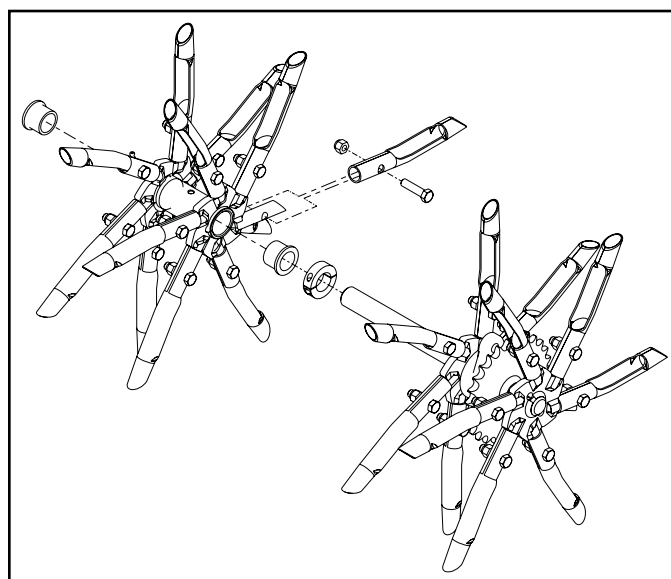


Fig. 190 tine wheel LH

# GROUND DRIVE & TINE SYSTEMS

## Coring Tine Removal & Replacement

1. Remove the bolt holding the tine to the shaft (Fig. 191).

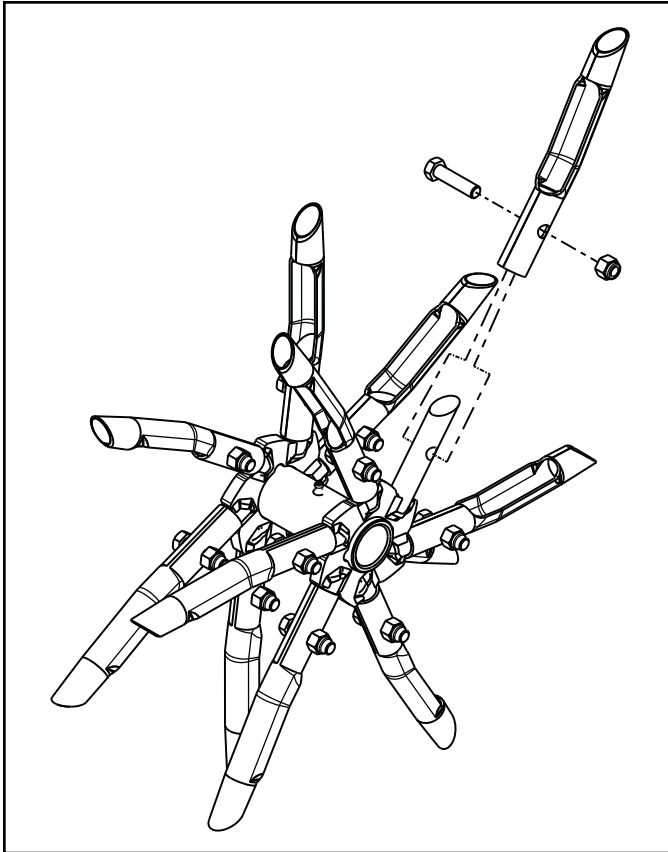


Fig. 191

tine R&R

2. Replace tine. Torque bolt to 20 ft-lbs. (27 Nm)

## Tine Shaft Installation

1. Slide the tine axle assemblies into the trailing arm (Fig. 192).

**Note:** Chains on in picture for orientation purposes only.

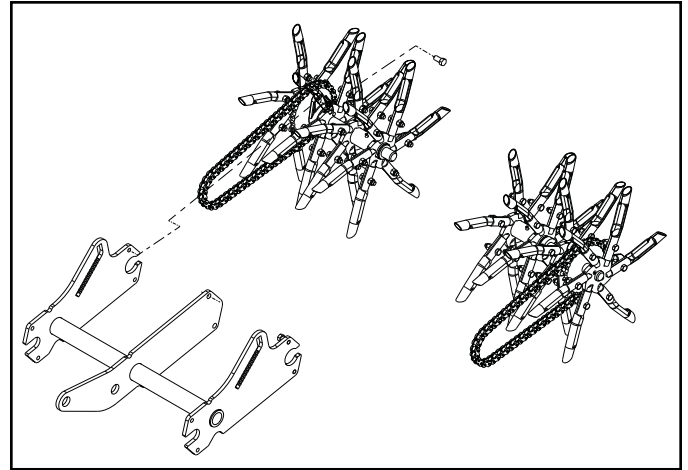


Fig. 192

trailing arm

2. Apply Loctite® 242 to the inner flange bearing bolts and install the bolts through the inner flange bearings. Make sure the grease fittings on the bearings face the rear of the unit. Torque bolts to 27 ft-lbs. (37 Nm) (Fig. 193).

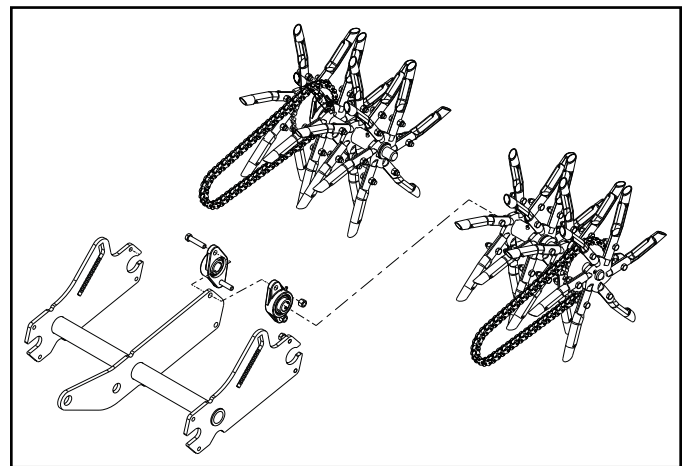
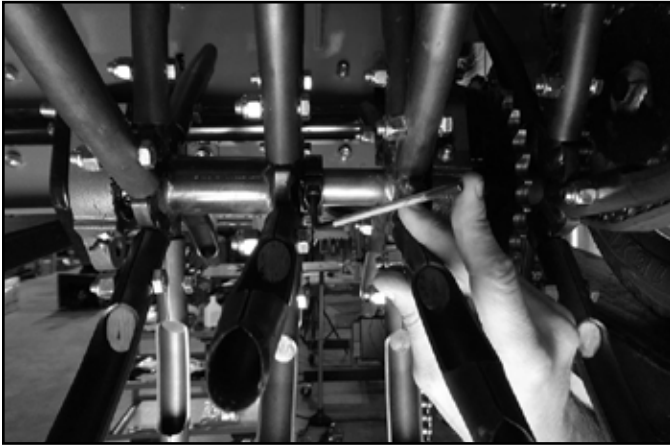


Fig. 193

inner flange brg bolt install

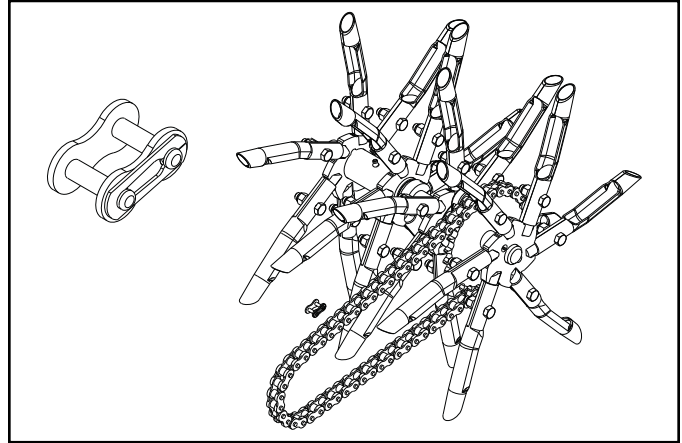
# GROUND DRIVE & TINE SYSTEMS

- Slide the inner tines and lock collars to the inside of the machine. Adjust the tine shafts outward until the spyder contacts the outer tine shaft bearings. Slide lock collars up to the tine idler. Apply Loctite® 243 to the lock collar screws. Tighten the lock collars to 12-14 ft-lbs. (16-19 Nm). Make sure tine idler turns freely (Fig. 194).



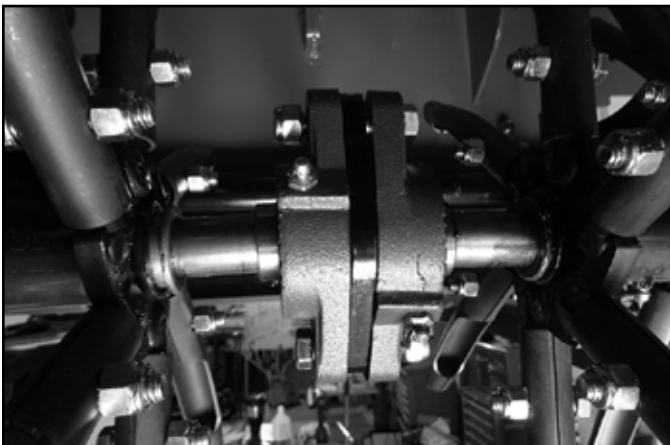
**Fig. 194** lock collar

- Reinstall the tine chains. Ensure that the cover plate and spring clip are to the OUTSIDE of the machine. Install spring clip so opening is away from forward direction of rotation (Fig. 196).



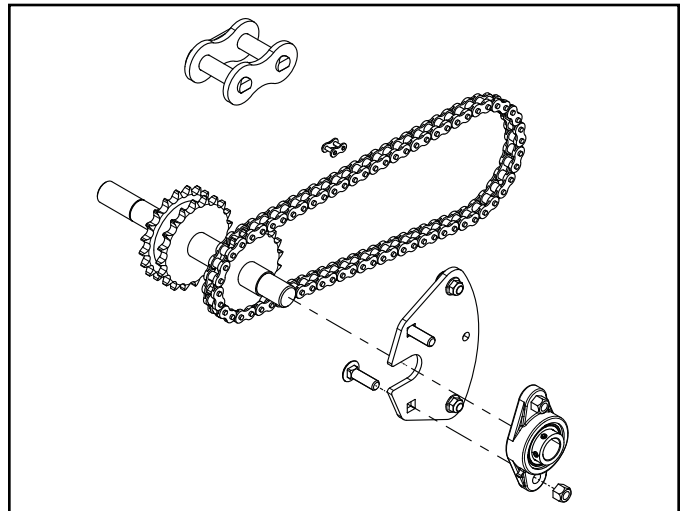
**Fig. 196** tine chain connector link

- Apply Loctite 242 to the outer flange bearing bolts and install the bolts into the outer flange bearings. Make sure the grease fittings on the bearings face the rear of the unit. Torque bolts to 27 ft-lbs. (37 Nm) (Fig. 195).



**Fig. 195** inner flange brgs

- Reinstall drive chains. Ensure that the cover plate and spring clip are to the INSIDE of the machine. Install spring clip so opening is away from forward direction of rotation (Fig. 197).



**Fig. 197** inside chain

# GROUND DRIVE & TINE SYSTEMS

7. Place the idler sprocket on the tine chain. Adjust idler position to allow a maximum of 3/8" of chain movement. Torque nut to 50 ft-lbs. (69 Nm) (Fig. 198).

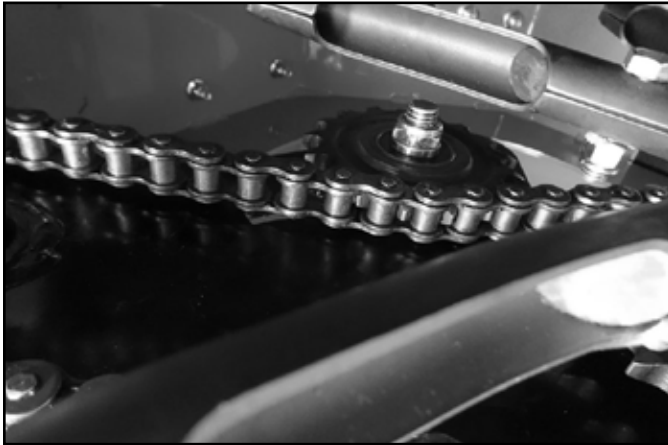


Fig. 198 idler sprocket

8. Place the idler sprocket on the drive chain. Adjust idler position to allow a maximum of 3/8" of chain movement. Torque nut to 50 ft-lbs. (69 Nm) (Fig. 199).

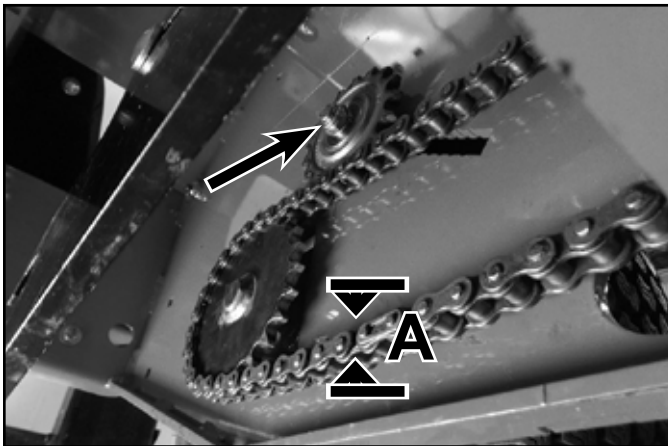


Fig. 199 drive tensioner

A. 3/8" movement

## Jackshaft Replacement

### Jackshaft Removal

1. Remove the two bolts and nuts holding the chain guard (Fig. 200).

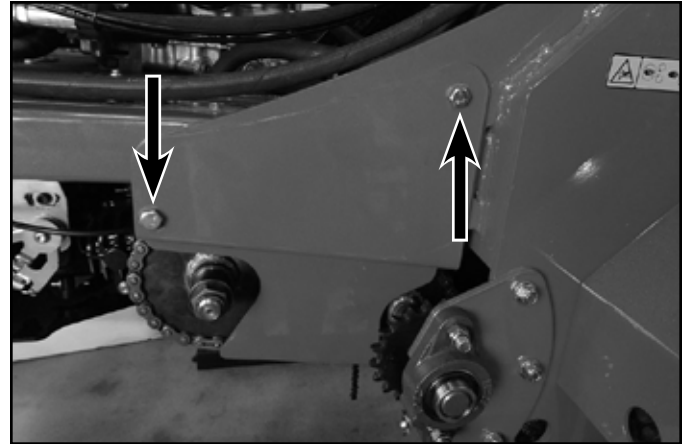


Fig. 200 chain guard

2. Remove the tension on the drive chains for both sides.
3. Loosen the three nuts on each of the chain tensioner plates on the top side until the nut is free from the nyloc portion (Fig. 201).

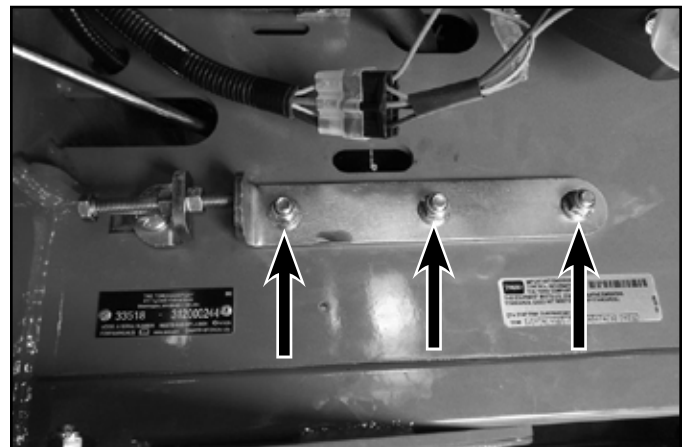
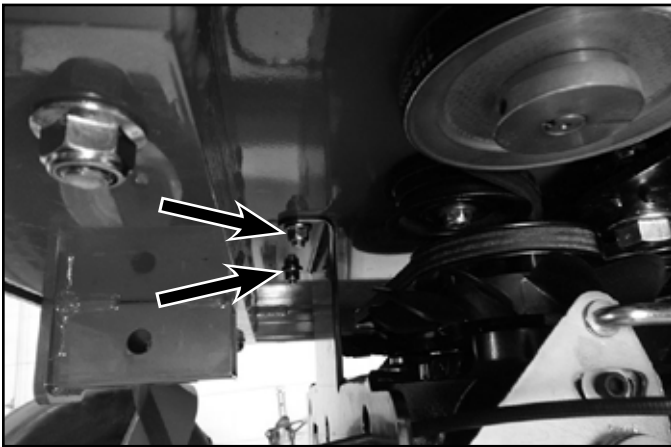


Fig. 201 tightener bolt

5

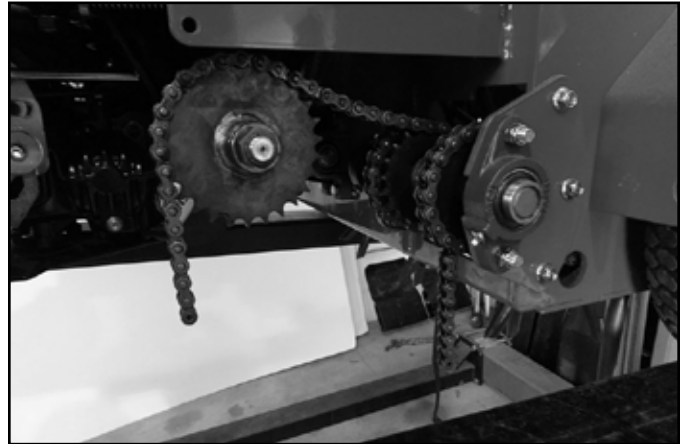
# GROUND DRIVE & TINE SYSTEMS

4. Loosen the two transmission support plate bolts located at the front of the unit under the muffler (Fig. 202).



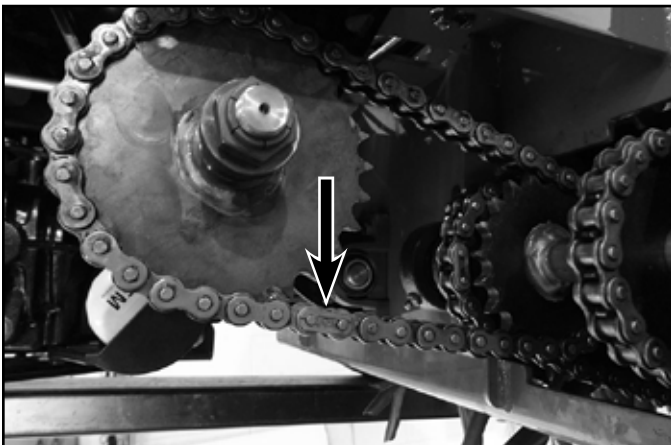
**Fig. 202** front mount bolts

6. Remove the chain (Fig. 204).



**Fig. 204** chain removal

5. Jack up the rear of the unit. Turn the rear wheel until the master link is accessible on the transmission chain. Remove the master link, cover plate, and spring clip (Fig. 203).



**Fig. 203** master links

7. Loosen the tine chain tensioner (Fig. 205).



**Fig. 205** idler sprocket



# GROUND DRIVE & TINE SYSTEMS

8. Rotate the rear wheel until the master link is accessible. Remove the master link, cover plate, and spring clip. Remove the chain.

9. Loosen the tensioner for the drive wheel chain (Fig. 206).

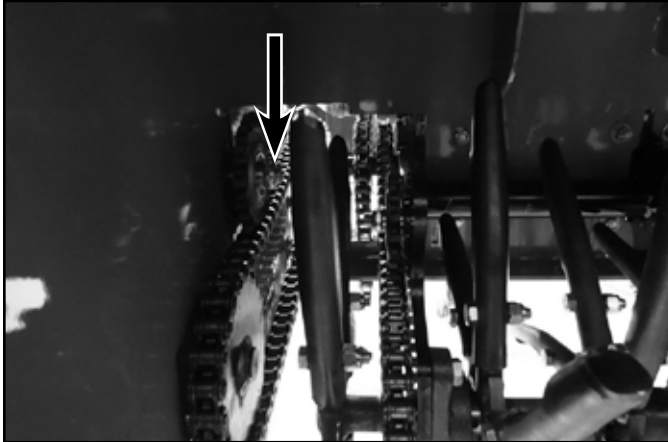


Fig. 206 drive chn tensioner

10. Rotate the rear wheel until the master link is accessible. Remove the master link, cover plate, and spring clip. Remove the chain

11. Loosen the set screws on all three flange bearing assemblies.

**Note: There are two set screws per flange bearing (Fig. 207).**

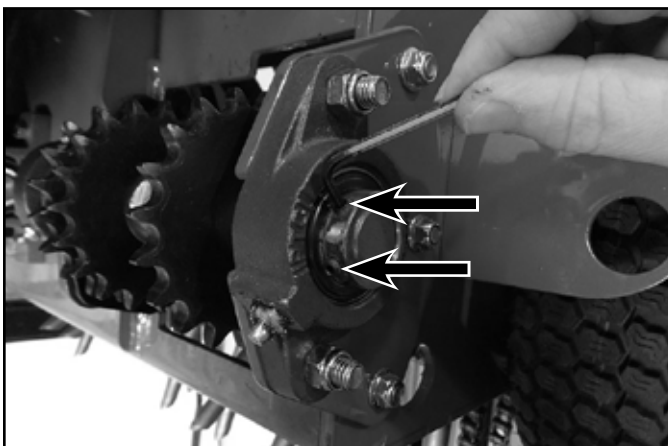


Fig. 207 set screws

12. Remove the three nuts and bolts that secure the jack shaft plate (Fig. 208).

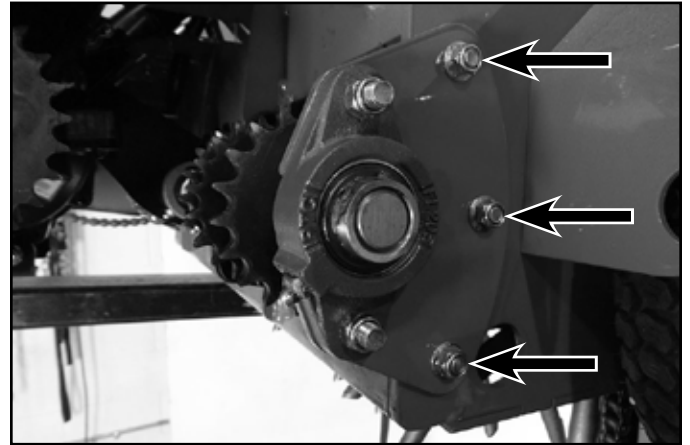


Fig. 208 jackshaft plate

13. Slide the bearing and plate off the jack shaft (Fig. 209).

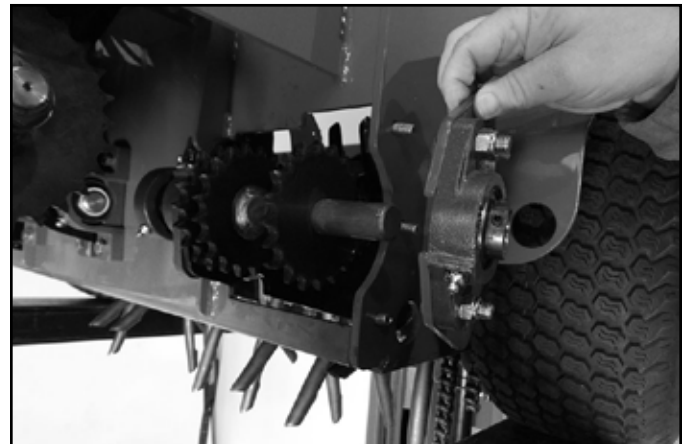


Fig. 209 brg & plate



# GROUND DRIVE & TINE SYSTEMS

14. Slide the jack shaft out of the remaining bearings (Fig. 210).

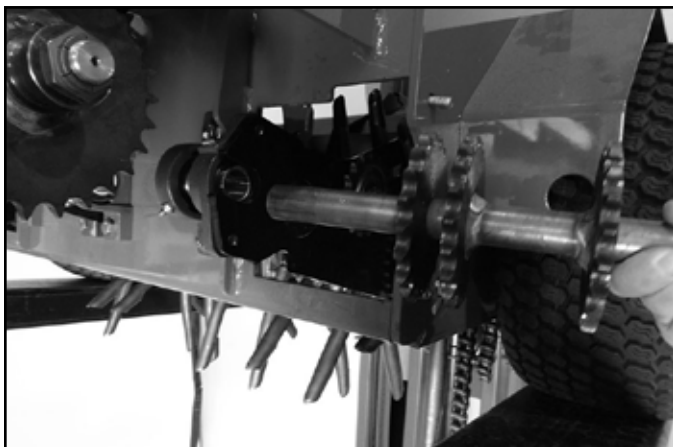


Fig. 210

jackshaft

## Jackshaft Installation

1. Reinstall the shaft into the two bearings on the chassis. Be sure to include any spacers (A) that were included (Fig. 211).

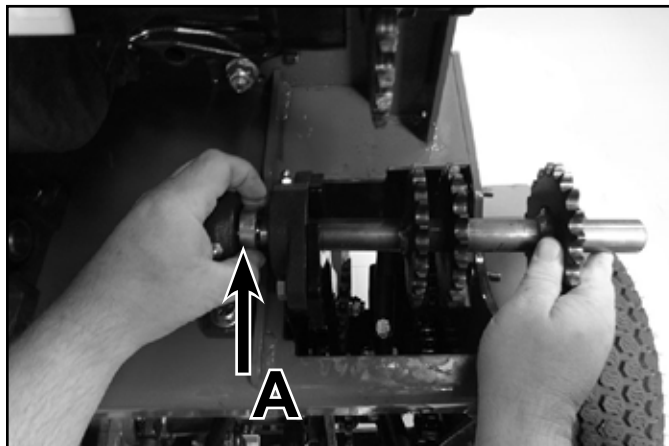


Fig. 211

shaft install

2. Install the outer flange bearing and jack shaft plate. Re-install the bolts and tighten them to 30 ft-lbs (41 Nm) (Fig. 212).

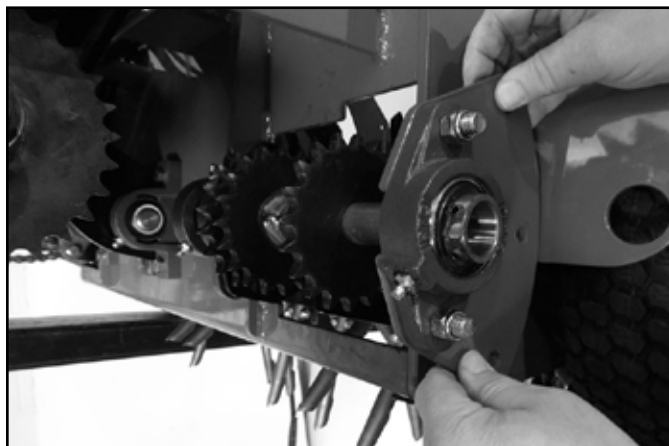


Fig. 212

brg & plate inst

# GROUND DRIVE & TINE SYSTEMS

3. The end of the jackshaft should be flush with the end of the lock collar on the bearing. If not, tap the jack shaft one way or the other with a hammer to get the shaft flush with the end of the lock collar. Do NOT tighten the bearing collar set screws at this time (Fig. 213).



Fig. 213

shaft inst

4. Install the drive wheel chain. Ensure that the cover plate and spring clip are to the INSIDE of the machine. Install spring clip so the opening is away from forward direction of rotation (Fig. 214).

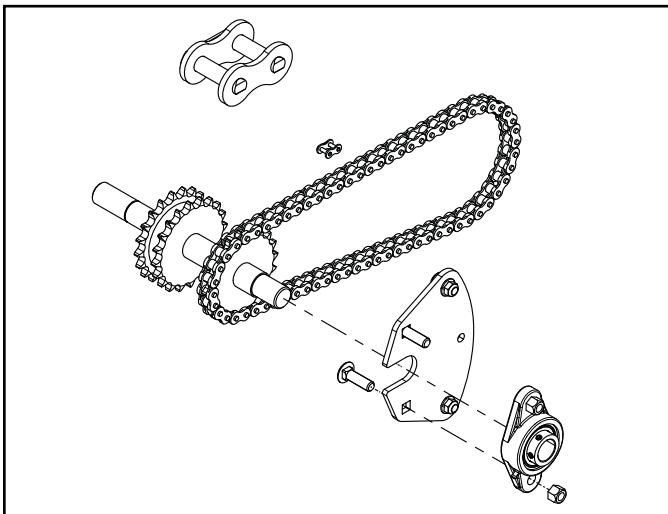


Fig. 214

inside chain

5. Place the idler sprocket on the drive wheel chain. Adjust idler position to allow a maximum of 3/8" of chain movement (A). Torque nut to 50 ft-lbs. (69 Nm) (Fig. 215).

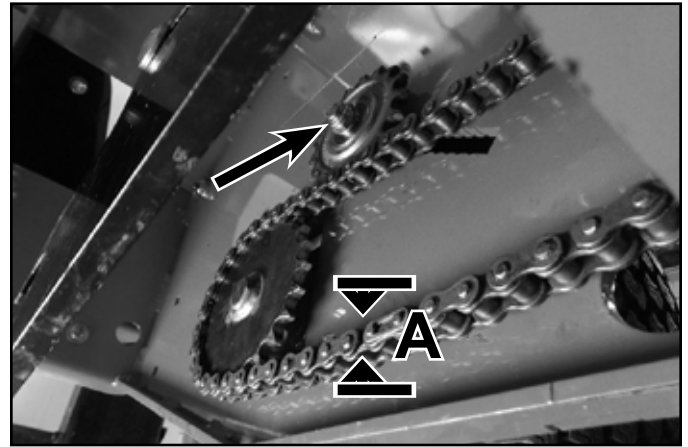


Fig. 215

drive tensioner

6. Install the tine chain. Ensure that the cover plate and spring clip are to the OUTSIDE of the machine. Install the spring clip so the opening is away from forward direction of rotation (Fig. 216).

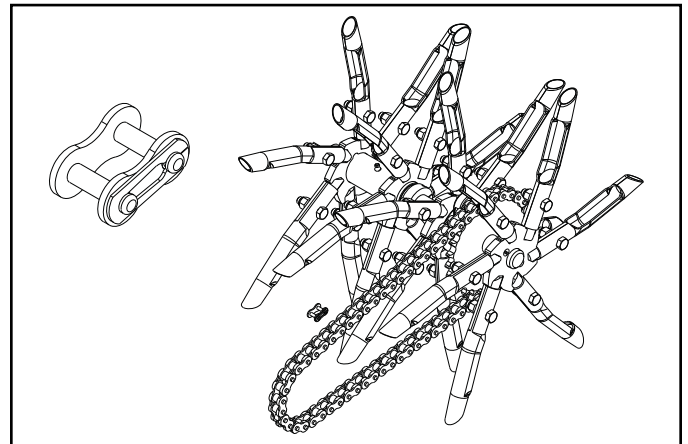


Fig. 216

tine chain connector link

# GROUND DRIVE & TINE SYSTEMS

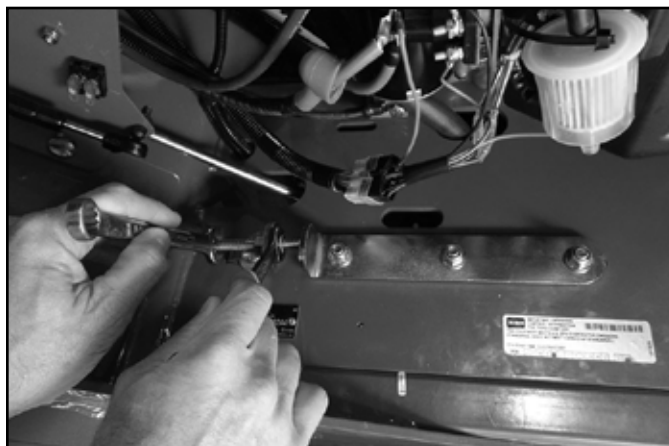
7. Place the idler sprocket on the tine chain. Adjust idler position to allow a maximum of 3/8" of chain movement. Torque nut to 50 ft-lbs. (69 Nm) (Fig. 217).



**Fig. 217**

idler sprocket

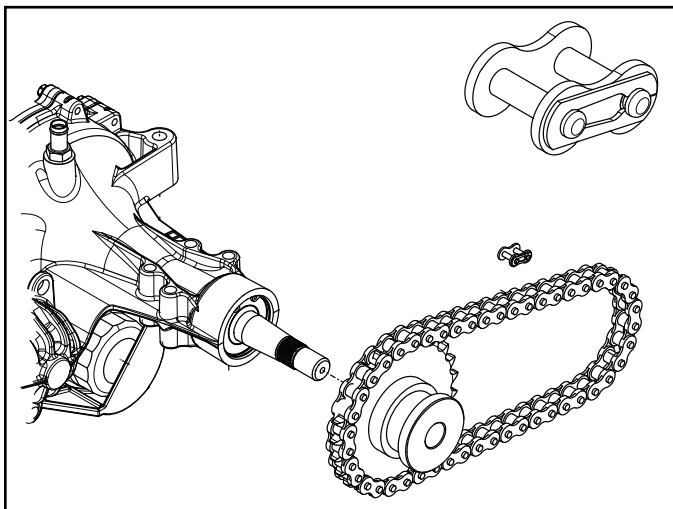
9. Tighten the front mounting bolts and the transmission adjustment plate bolts on both sides of the unit tight, then loosen them one turn.
10. Turn the adjustment bolt to move the transmission adjustment plates and hydros (Fig. 219).



**Fig. 219**

trans adj plate

8. Install the transmission chain. Ensure that the cover plate and spring clip are to the OUTSIDE of the machine. Install the spring clip so the opening is away from forward direction of rotation (Fig. 218).



**Fig. 218** outside connect link transaxle

# GROUND DRIVE & TINE SYSTEMS

11. Tighten until the chain has between 1/4" and 1/2" deflection (Fig. 220).

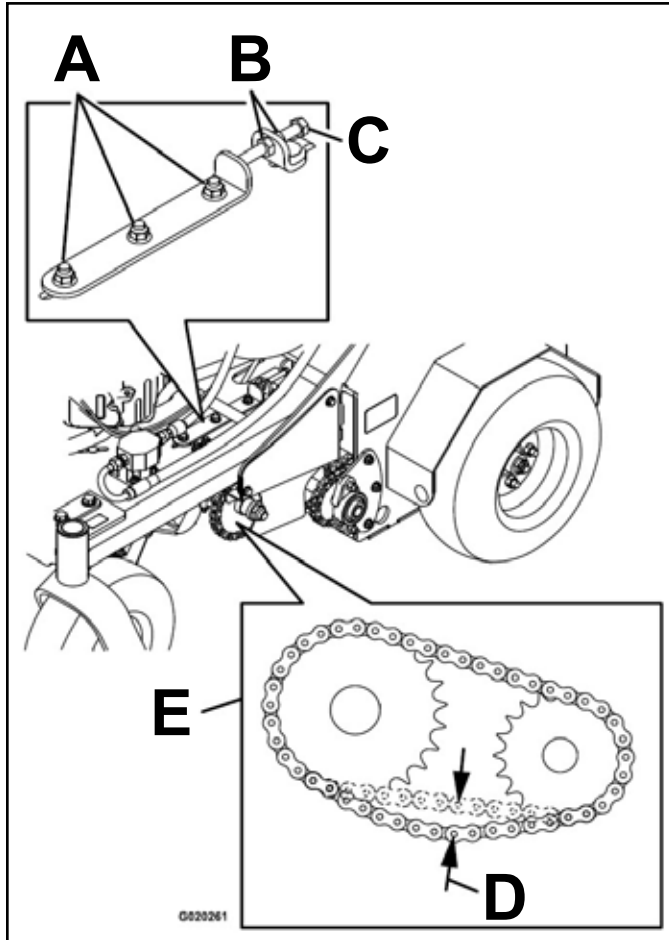


Fig. 220

fig. 16 G020261

- |                                |                              |
|--------------------------------|------------------------------|
| A. Hydro mounting bolts & nuts | D. 6-12mm (1/4"-1/2")        |
| B. Nuts                        | E. Guard removed for clarity |
| C. Adjustment bolt             |                              |

12. When the correct deflection is achieved, tighten the front mounting bolts and transmission adjustment plate bolts on both sides to 35 ft-lbs. (48 Nm).

13. Check the deflection on the chains again. If they are too tight, loosen the mounting bolts one turn and loosen the chains using the adjustment bolt. Retorque the mounting bolts to 35 ft-lbs. (48 Nm) and check deflection again.

14. Check the alignment of the chains. The chains should run straight on their sprockets. If the alignment is off, tap the jackshaft left or right with a hammer to align the chains.

15. Once alignment is met, apply Loctite® 505 to the set screws and tighten them to 12-14 ft-lbs. (16-19 Nm) (Fig. 221).

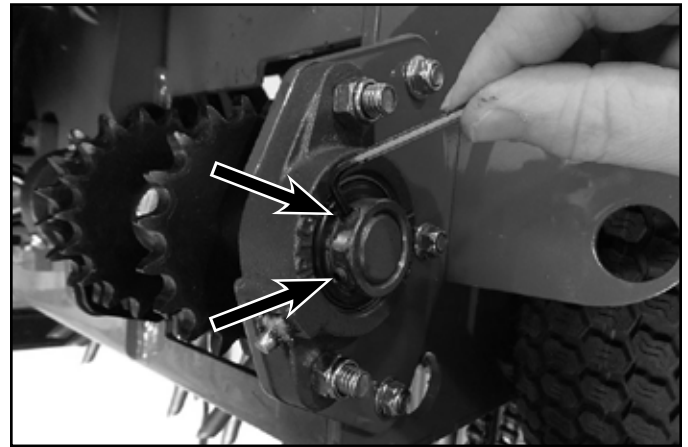


Fig. 221

set screws

# GROUND DRIVE & TINE SYSTEMS

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16. Install chain guard. Torque bolts to 20 ft-lbs. (27 Nm) (Fig. 222).

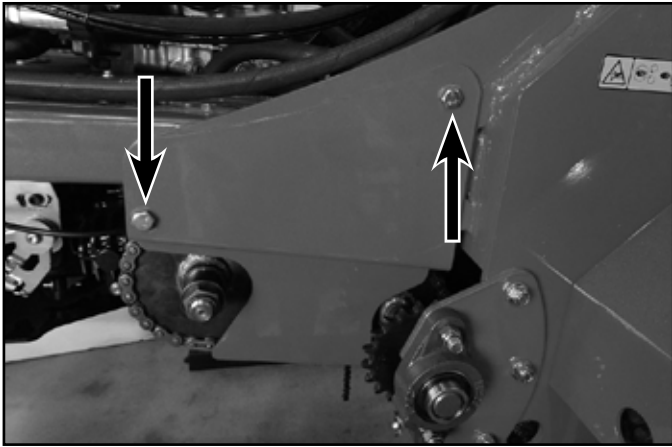


Fig. 222

chain guard

17. Test drive unit and re-check chain tension. If too loose or too tight, readjust tension.

CAUTION

Before performing any tests with a continuity light or ohmmeter, disconnect the component from the wire harness. This ensures you are testing the component rather than another circuit.

Ignition Switch

Purpose

The ignition switch provides the proper switching for the starter, ignition, accessories, and safety circuits.

Location

The ignition switch is located on the control panel (Fig. 223).

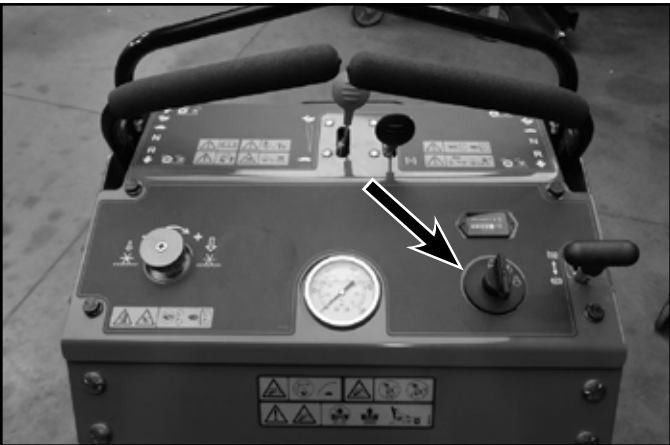


Fig. 223 control panel

How It Works

Detents inside the switch gives it 3 positions: OFF, RUN, and START. The START position is spring loaded so the cylinder automatically returns to RUN once the key is released (Fig. 224).

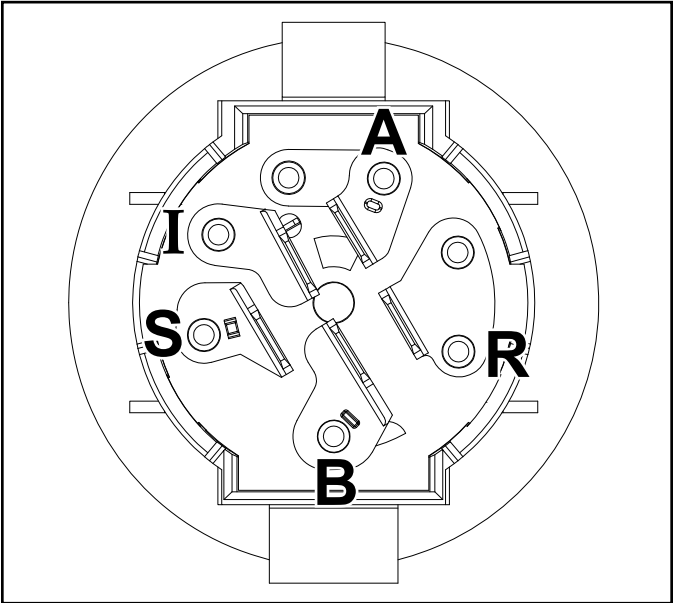


Fig. 224 ignition switch

Terminal	Component
A	Accessory
R	Rectifier
B	Battery
S	Start
I	Ignition

Testing

1. Disconnect the switch from the wiring harness.
2. Verify that continuity exists between the terminals listed for the switch positions (see table). Verify that there is NO continuity between the terminals not listed for the switch position (see table).

Position	Circuit “Make”
1. OFF	None
2. RUN	B + R + I + A
3. START	B + R + I + S

# ELECTRICAL

## Foot Switch

### Purpose

The foot switch engages the hydraulic valve which allows fluid to flow to the hydraulic cylinder and lowers the aeration tines for use. It returns the hydraulic cylinder to the transport position when aerator tines are not needed.

### Location

The foot switch is located on the platform assembly nearest your right foot when standing on platform (Fig. 225).

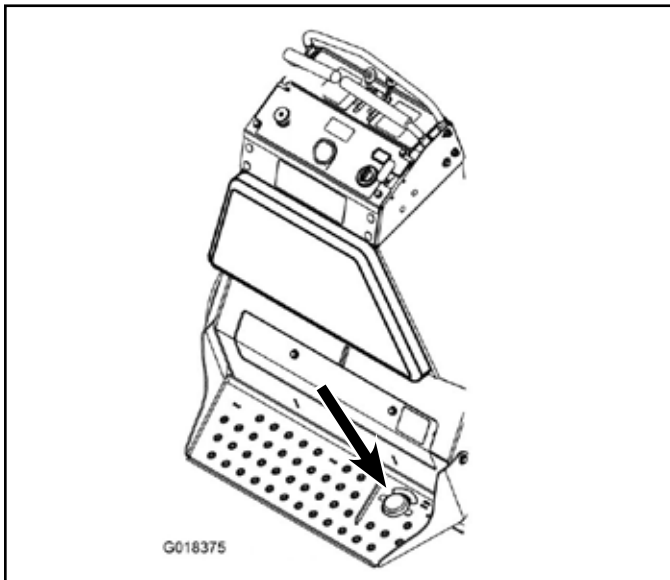


Fig. 225

fig. 5 G018375

### How It Works

Pressing the foot switch sends electrical current through it to the hydraulic valve. The valves inside open so that fluid flows to the hydraulic cylinder causing it to lower the tines. Releasing the switch causes fluid to run in reverse order pulling the tines from the turf and back into the transport position.

### Testing

1. Disconnect the switch from the wiring harness.
2. With the button pushed there should be continuity between the two connectors. With the button not pushed there should be no continuity.

## Starter Solenoid

### Purpose

The purpose of the solenoid is 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 from by the starter motor (Fig. 226).



Fig. 226

IMG-1198a

### Location

The solenoid is mounted on the right hand side of the engine, from the operator position (Fig. 227).



Fig. 227

starter solenoid

### How It Works

The solenoid has two primary parts. One, a coil 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 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 "normal open" position. The solenoid closes and opens the switch very quickly. This minimizes the "arcing" that can damage other kinds of switches.

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

### Testing

1. Disconnect the solenoid from the wire harness.
2. With a multimeter set to the 'ohms' setting, ensure 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. 228).
4. You should be able to hear the solenoid switch "click" when you make the connection (Fig. 228).

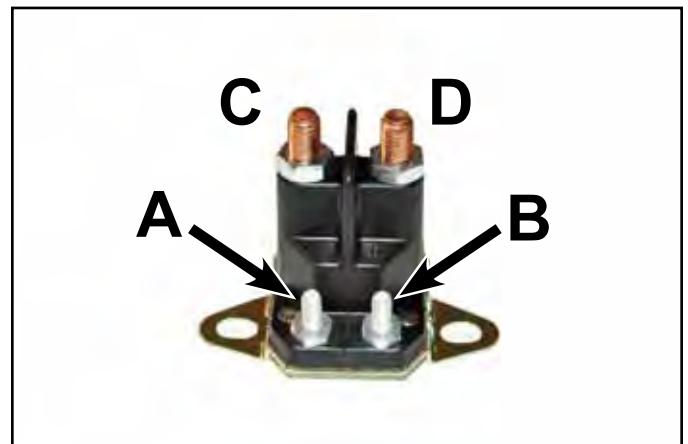


Fig. 228

IMG-1198a

A & B Coil Terminals

C & D Contact Terminals



# ELECTRICAL

## Parking Brake Switch

### Purpose

The parking brake switch is part of the safety circuit. The switch is used to ensure the parking brake is engaged allowing the machine to start (Fig. 229).



Fig. 229

IMG-0001a

### Location

The parking brake switch (A) is located between the two hydro pumps mounted to the transmission guard. It is connected to a slide bracket, which is used to adjust the switch (Fig. 230).

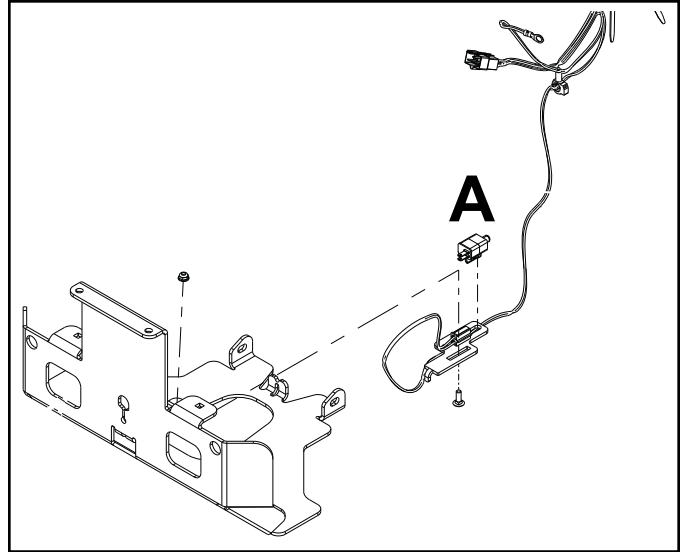


Fig. 230

neutral switch

### How It Works

This is a “normally open (NO)” switch. When the parking brake is engaged, the switch is closed and there is continuity between the switch terminals.

### Testing

1. Disconnect the switch from the wiring harness.
2. With a multimeter set to the “Ohms” setting or use a continuity light. Verify that there is continuity between the terminals (plunger in).
3. With the plunger out, there should be NO continuity between the terminals.

## Fuse Block & Fuses

### Purpose

The fuse block houses the electrical system fuses.

### Location

The fuse block is located on the right hand side of the unit, from the operator position, near the fuel tank (Fig. 231).



Fig. 231

fuse block

### How It Works

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

### Testing

The fuses used in this application can be visually inspected. A failed fuse can be identified by the broken/melted element inside the fuse cover or a damaged spade (Fig. 232).



Fig. 232

IMG-1214a

# ELECTRICAL

## Hour Meter

### Purpose

The hour meter keeps track of the actual running hours of the engine.

### Location

The hour meter is located on the control panel (Fig. 233).

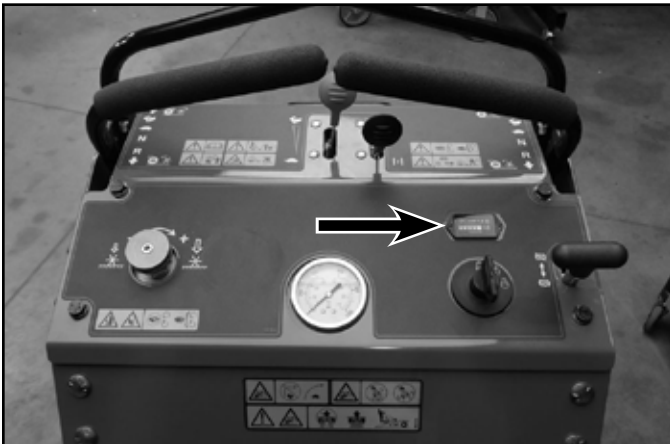


Fig. 233

control panel

### How It Works

6

Hours are accumulated when the key is in the on/run position or the start position.

### Testing

If the hour meter isn't working, disconnect the hour meter positive wire. Turn the key to on/run and check for voltage to the positive wire. If voltage is present, the meter is faulty.

## Relay

### Purpose

There are two relays on this machine.

1. **Start Relay:** Functions as an electronic switch. Once the safety connections are met, the relay will activate completing the circuit to the starter solenoid.
2. **Stop Relay:** Functions as an electronic switch. Once the safety connections are met, the relay will activate completing the circuit to the MAG KILL and the fuel solenoid, which stops the engine and stops fuel flow.

### Location

The relays are located on the frame, right side of the engine, under the fuel tank (Fig. 234).

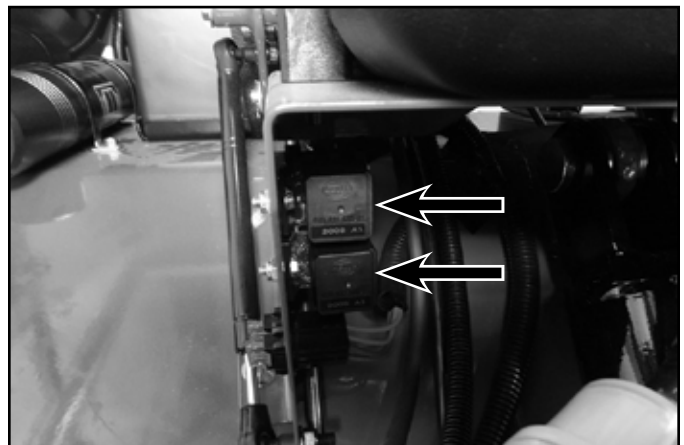


Fig. 234

002

## How It Works

A relay is an electrically actuated switch.

1. **Coil:** Terminals 85 and 86 are connected to a coil. Applying 12 volts to these terminals energizes the coil turning it into an electromagnet.
2. **Switch:** Terminals 30, 87 and 87a are actually part of a single pole, double throw (SPDT) switch. Terminal 30 is the common lead. The switch is spring loaded so that 30 and 87a are connected when the coil is not energized. When the coil is energized, the switch is "thrown" and terminals 30 and 87 are connected (Fig. 235).



Fig. 235

DSC-2517a

## Testing

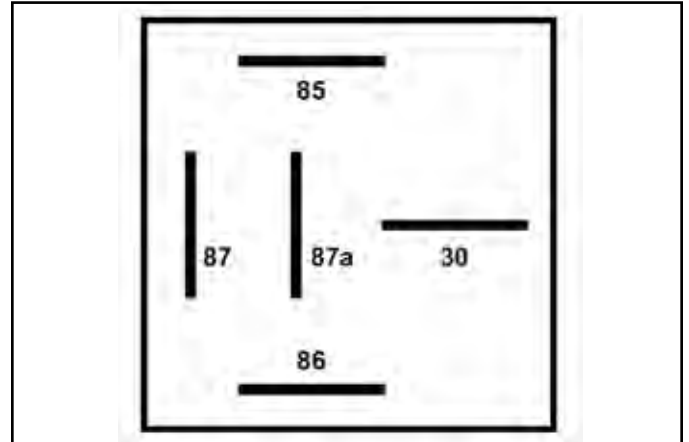


Fig. 236

relay pin diagram

1. Disconnect the relay from the harness.
2. Verify the coil resistance between terminals 85 and 86 with a multimeter (ohms setting). Resistance should be from 70 to 90 ohms. There should be continuity between terminals 87a and 30.
3. Connect multimeter (ohms setting) leads to relay terminals 30 and 87. Ground terminal 86 and apply +12 VDC to 85. The relay should make and break continuity between terminals 30 and 87 when 12 VDC is applied and removed from terminal 85.
4. Connect multimeter (ohms setting) leads to relay terminals 30 and 87a. Apply +12 VDC to terminal 85. With terminal 86 still grounded, the relay should break and make continuity between terminals 30 and 87a as 12 VDC is applied and removed from terminal.

# ELECTRICAL

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5. Disconnect voltage and multimeter leads from relay terminals (Fig. 237).

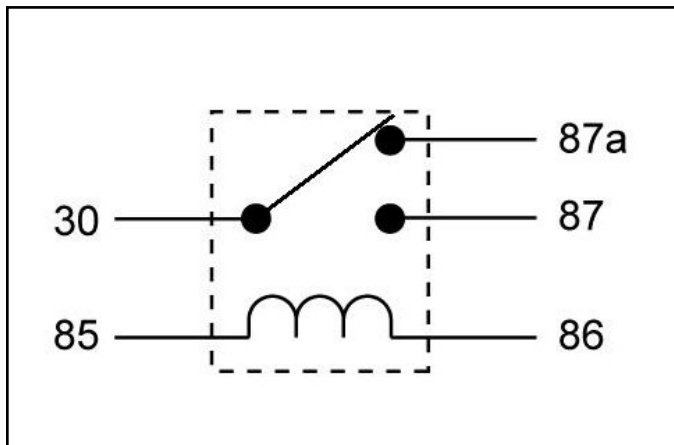


Fig. 237

xl relay

## Subsystem Electrical Diagram

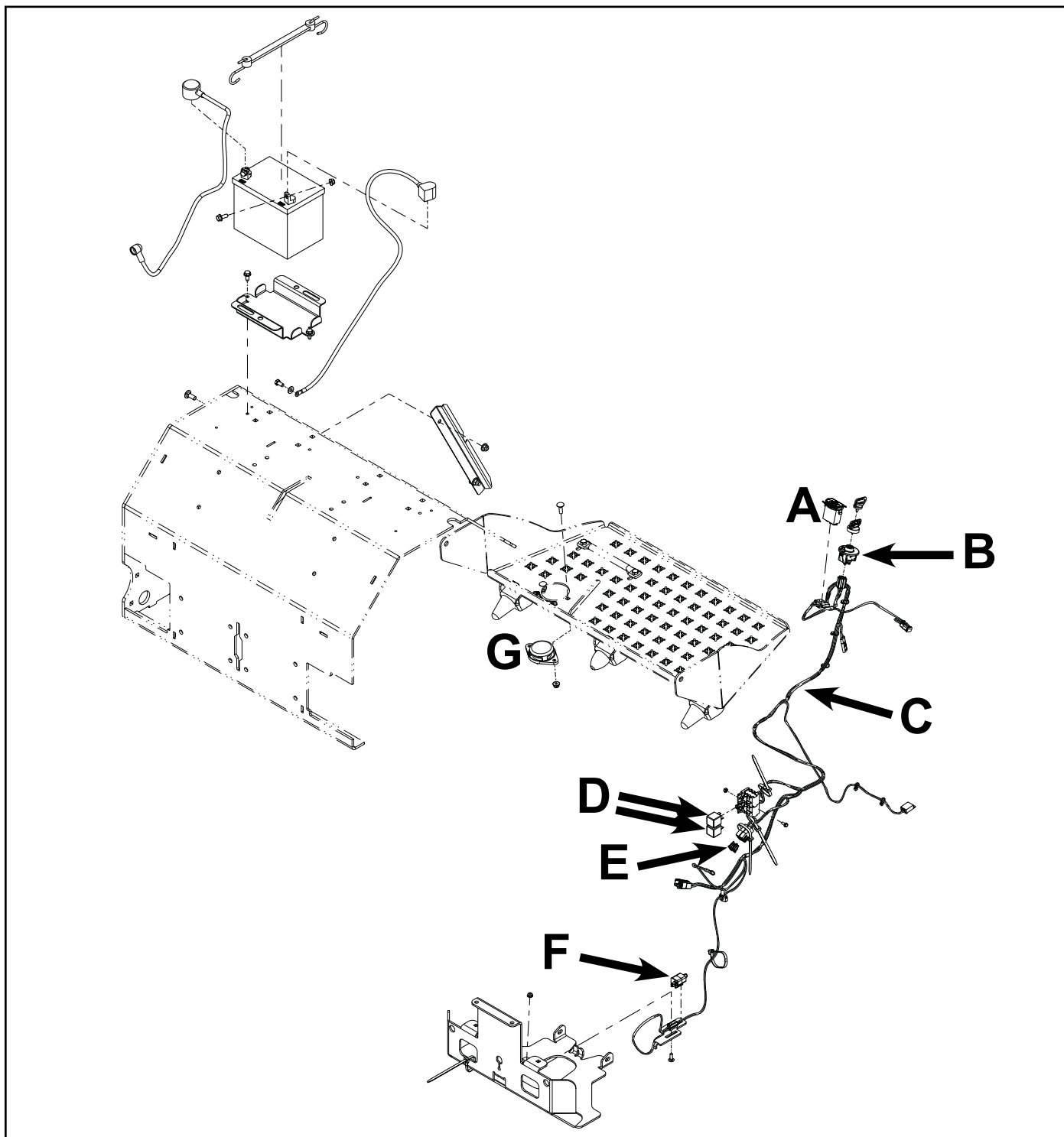


Fig. 238 subsystem electrical 1

- A. Hour meter
- B. Switch, ignition
- C. Wiring harness

- D. Relay, 12 VDC-40 Amp
- E. Fuses, 20 Amp

- F. Switch, single pole normally open
- G. Switch, foot

# ELECTRICAL

## Wiring Harness Diagram

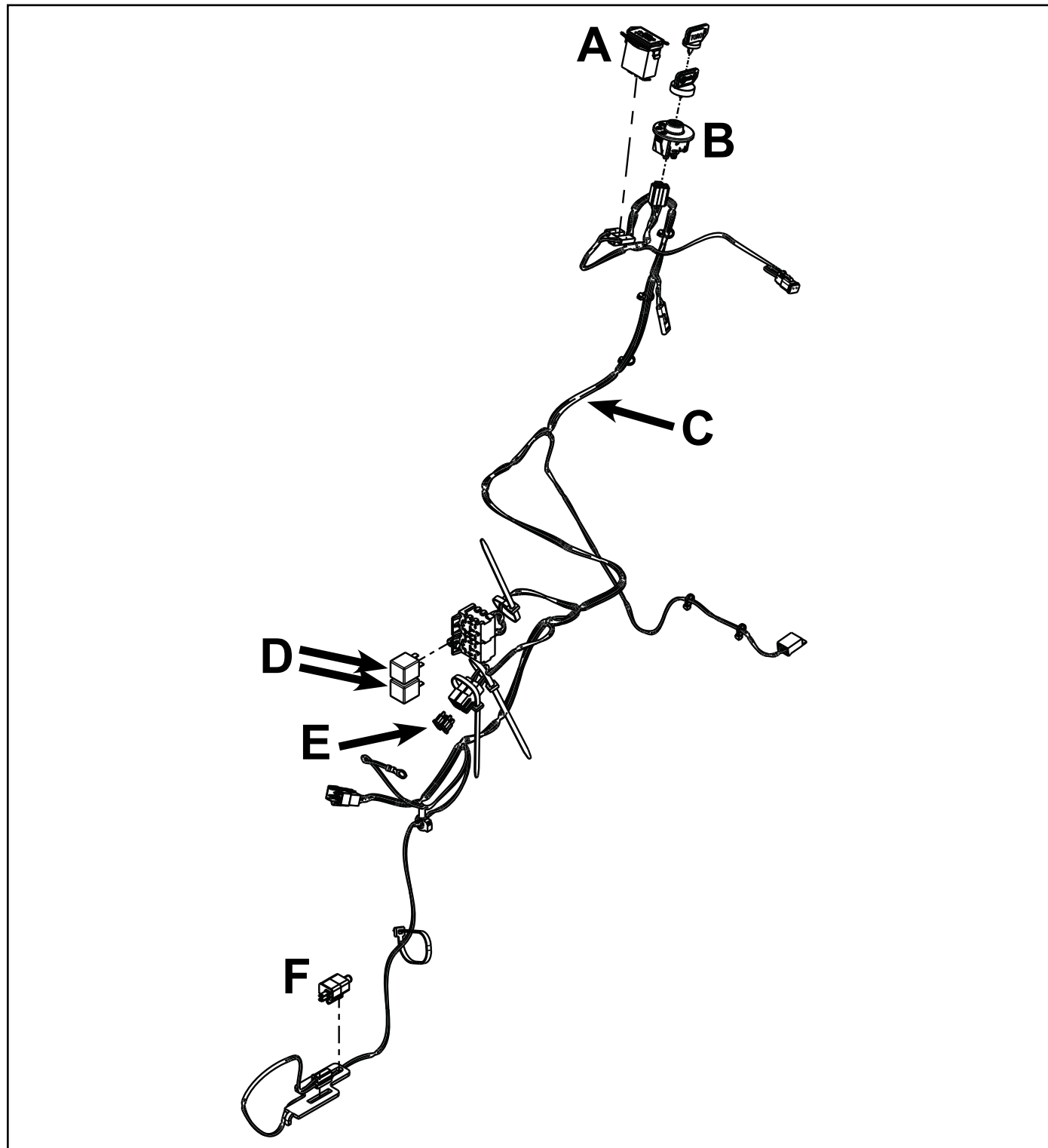


Fig. 239

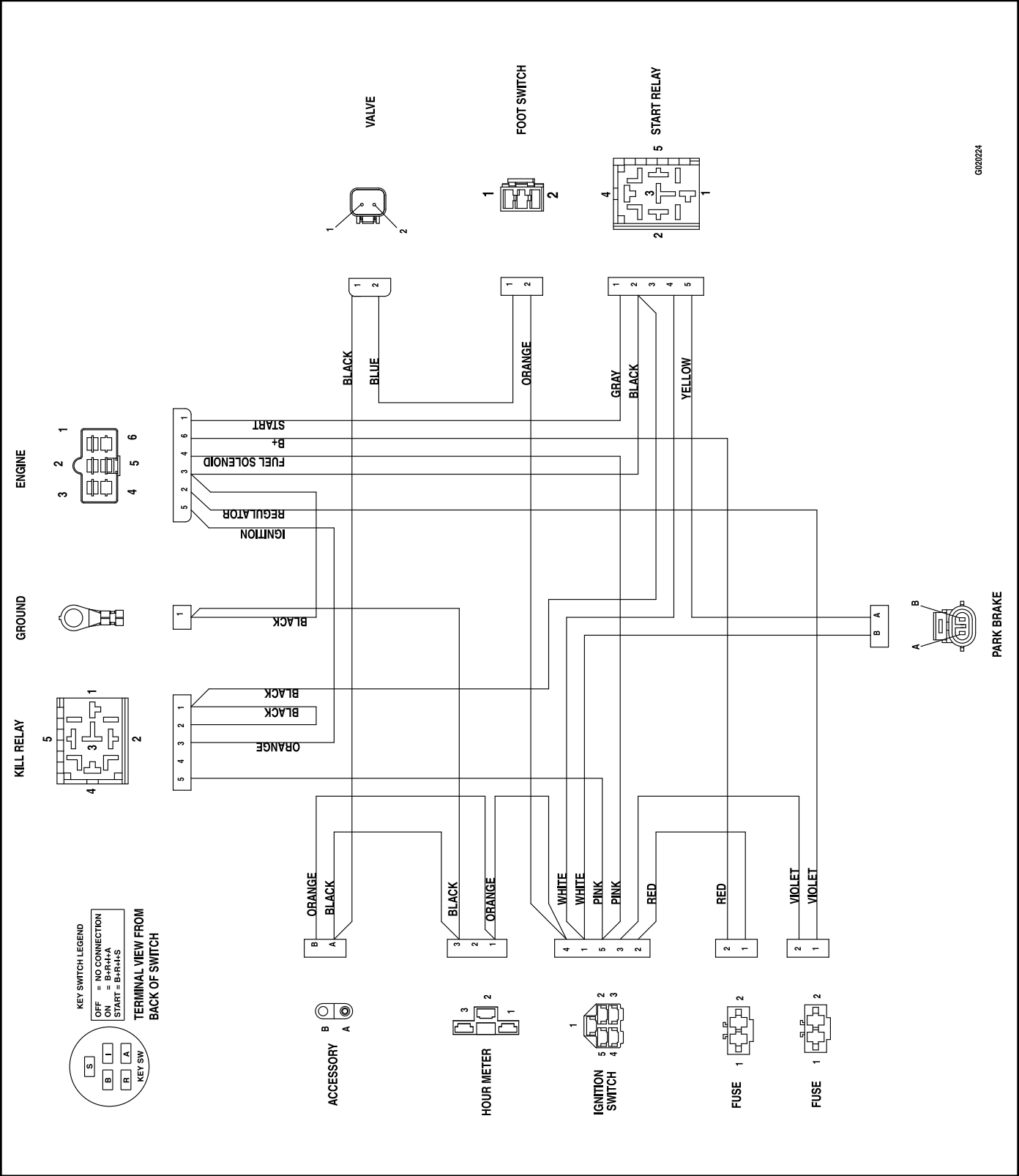
wiring harness

A. Hour meter  
B. Switch, ignition

C. Wiring harness  
D. Relay, 12 VDC-40 Amp

E. Fuses, 20 Amp  
F. Switch, single pole normally open

Electrical Diagram



G3020224

Fig. 240

elec diag\_1



# ELECTRICAL

## Electrical Schematic

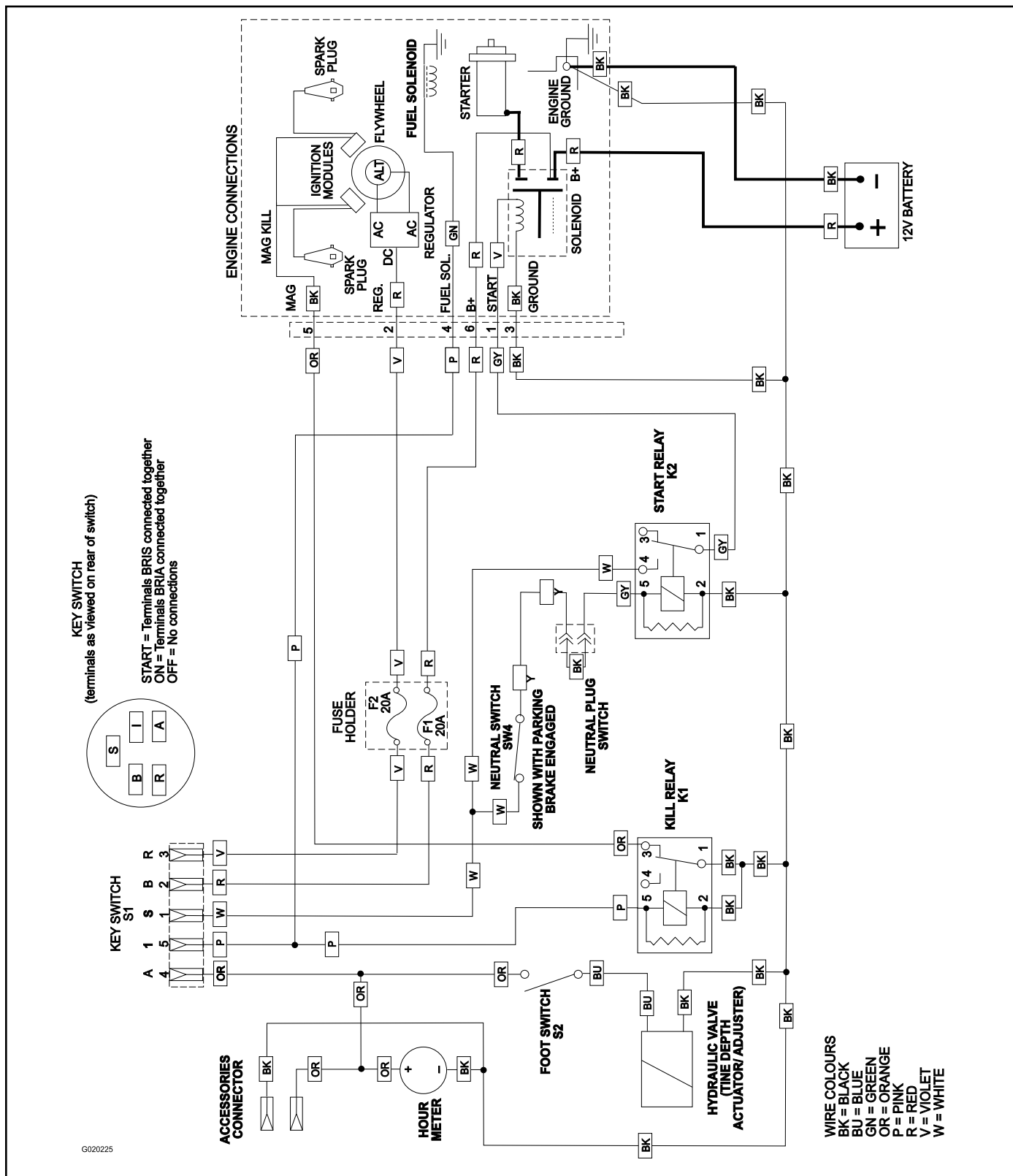


Fig. 241

elec scheme\_1



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# **30 inch Stand-On Aerator Service Manual**