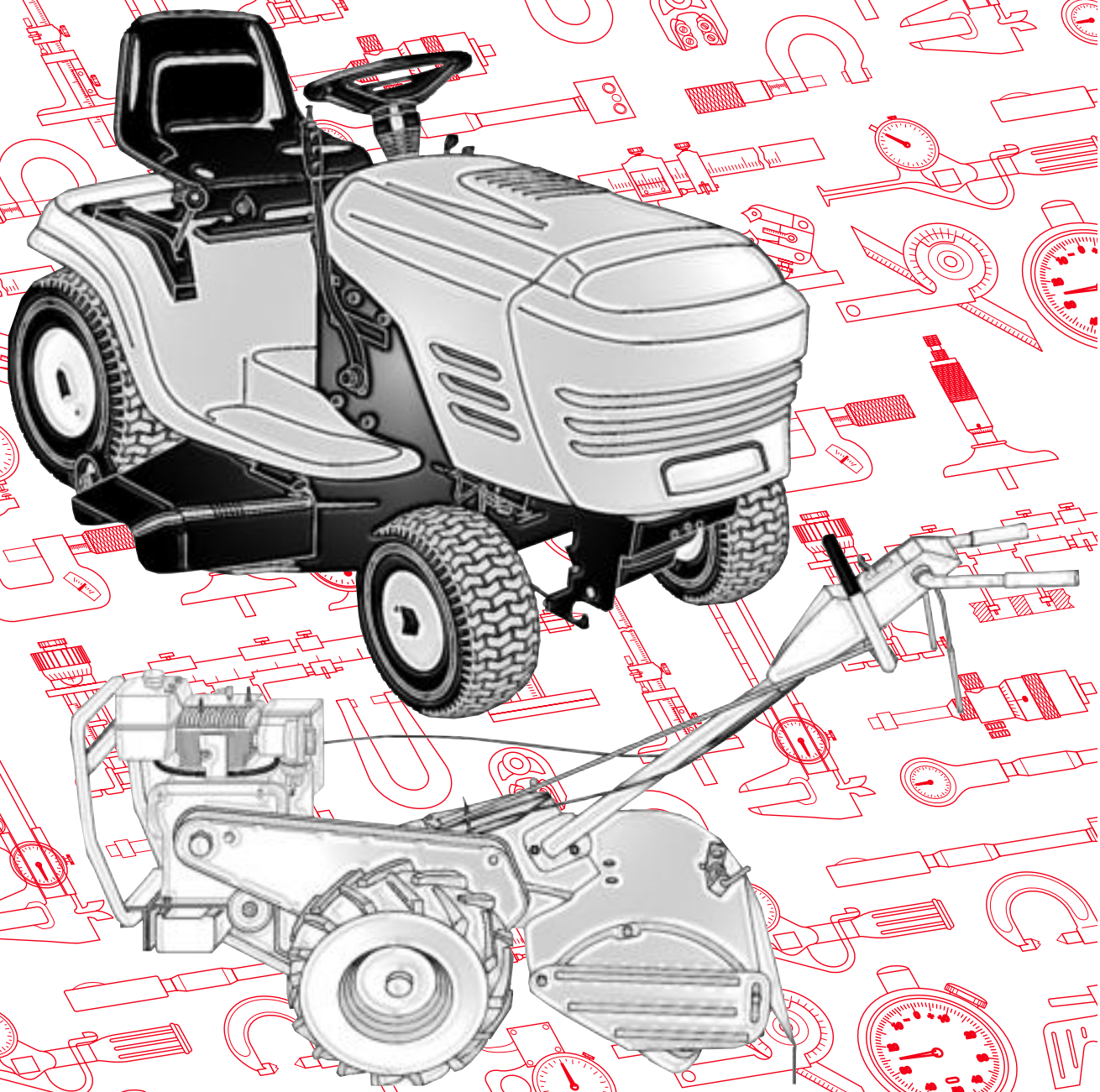
FRIGIDAIRE
HOME PRODUCTS



ONSITE SERVICE INFORMATION

TABLE OF CONTENTS

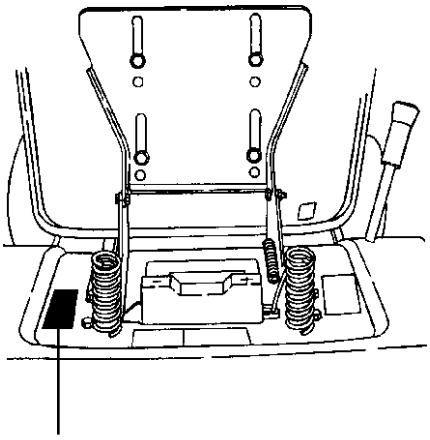
Part No. 163578 - REV 4

NOTES

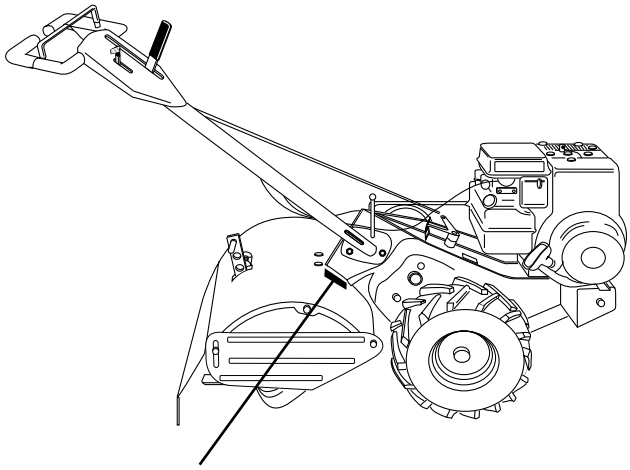
MODEL AND SERIAL NUMBER DECAL PLATE

HOW TO READ THE MODEL AND SERIAL DECAL PLATE

TO DETERMINE THE YEAR THE PRODUCT WAS PRODUCED



Model No., Serial Plate Location



Model No., Serial Plate Location

OLD (JULIAN DATE SYSTEM)

One white bar means the product has one year warranty

CONFORMS TO ANSI B71.1-1990 SAFETY STANDARDS

MODEL NO.	SERIAL NO.
917.255970	3155S 001227

FOR SERVICE AND PARTS ALWAYS GIVE THE MODEL NO.

MODEL #

917.255970

MODEL #

SOURCE

315 - Represents the 315th day of the year.

5 - Last Digit of Year 1985

S - Plat Code

1227 - Number of Units Produced

NEW 1993 (CALANDER DATE SYSTEM)

Two white bars means the product has two year warranty

CONFORMS TO ANSI B71.1-1990 SAFETY STANDARDS

MODEL NO.	SERIAL NO.
917.255970	012793A 001765

FOR SERVICE AND PARTS ALWAYS GIVE THE MODEL NO.

012793A - Calendar date of production (January 27, 1993). The Alpha character is Final Assembly Line (A, B, C, D, etc.

001765 - The last six (6) digits designate the number of the units produced for a specific model #. Each new unit will start with 001001 and will continue in consecutive order.

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RECOMMENDED PARTS STOCK TRACTOR & TILLER

DIV.	PLS.	PART #	DESCRIPTION	DIV.	PLS.	PART #	DESCRIPTION
O71	917	25034	44" STD Lift Blade	O71	917	148698	Terminal Ring
O71	917	25036	38" STD Lift Blade	O71	917	148763	Primary Deck Belt
O71	917	25321	42" STD Lift Blade	O71	917	150280	Clutch Bolt Kit
O71	917	25741	38" STD Lift Blade	O71	917	151785	Cam Roller Kit
O71	917	59904	Tube 5.3 / 4.5 X 6	O71	917	152443	46" Prem Mulch Blade
O71	917	65139	Valve Stem	O71	917	153535	Pulley
O71	917	71208	Bushing	O71	917	154963	PTO Switch
O71	917	127218	Link Front	O71	917	155106	Bushing Kit
O71	917	128774	Man Housing 38/42	O71	917	155132	Hood Repair Kit
O71	917	129895	Bearing	O71	917	156109	Belt Keeper Kit
O71	917	129963	Washer	O71	917	157353	46" Blade Hi Lift
O71	917	130171	Trunion	O71	917	157722	Screw
O71	917	130652	44" Prem Hi Lift Blade	O71	917	158818	Primary Deck Belt
O71	917	130759	Latch	O71	917	158913	Ignition Switch
O71	917	130794	Mandrel	O71	917	160793	Bagger Latch
O71	917	130968	Deflector 42"	O71	917	12000029	E-Ring
O71	917	130969	Primary Deck Belt	O71	917	12000039	E-Ring
O71	917	131006	Ground Drive Belt	O71	917	17490612	Screw
O71	917	131264	Primary Deck Belt	O71	917	17580520	Bolt
O71	917	131290	Primary Deck Belt	O71	917	71161010	Screw
O71	917	131340	Bolt shoulder	O71	917	532124029	Lens
O71	917	131494	Flat Idler	O71	917	532126938	Bumper
O71	917	131845	Brake Pad	O71	917	532132800	Knob
O71	917	132673	Pin Clevis / Shear Pin	O71	917	101342N	Belt
O71	917	133957	Gauge Wheel	O71	917	102403X	Flat Idler
O71	917	134148	38" Mulch Blade	O71	917	104239X	Bearing
O71	917	134149	42" Mulch Blade	O71	917	104418X	38"Cross Blade
O71	917	134998	38" Prem Mulch Blade	O71	917	104445X	Switch
O71	917	136321	Runner RH	O71	917	1044R	Washer
O71	917	136420	Mulch Cover	O71	917	104757X	Hub Cap
O71	917	136819	Mandrel	O71	917	105709X	Spring
O71	917	136874	Sector	O71	917	106085X	Ground Drive Belt
O71	917	136888	Baffle	O71	917	106412X	Belt
O71	917	137153	Ground Drive Belt	O71	917	106578X	Brake Mandrel
O71	917	137380	50" Prem Hi Lift Blade	O71	917	106729X	Ground Drive
O71	917	137553	Shaft 44/46/50	O71	917	106888X	Brake Spring
O71	917	137644	Bolt shoulder	O71	917	106909X	Screw
O71	917	137646	Shaft Mandrel 38/42	O71	917	106932X	Knob
O71	917	138255	Primary Deck Belt	O71	917	106933X	Knob
O71	917	138497	38" Hi Lift Blade	O71	917	108597X	Belt
O71	917	138498	42" Hi Lift Blade	O71	917	108824X	Fuse
O71	917	138971	42" Prem Hi Lift Blade	O71	917	109310X	Key Ignition
O71	917	139774	38" Prem Mulch Blade	O71	917	109553X	Switch

RECOMMENDED PARTS STOCK TRACTOR & TILLER

DIV.	PLS.	PART #	DESCRIPTION	DIV.	PLS.	PART #	DESCRIPTION
O71	917	139775	42" Prem Mulch Blade	O71	917	109808X	Hood Latch
O71	917	139868	Arm Support	O71	917	109816X	Nyliner T
O71	917	140080	Bolt	O71	917	110452X	Push Nut
O71	917	140218	Ground Drive Belt	O71	917	110485X	Bearing
O71	917	140301	Ignition Switch	O71	917	110883X	Belt
O71	917	140403	Key Ignition	O71	917	110884X	Belt
O71	917	144200	Primary Deck Belt	O71	917	120951X	Brake Puck
O71	917	144959	Primary Deck Belt	O71	917	120961X	Brake Puck
O71	917	145960	Primary Deck Belt	O71	917	121263X	38" High Lift
O71	917	145967	Belt	O71	917	121687X	Mandrel
O71	917	145956	Belt	O71	917	121748X	Washer
O71	917	146077	Bumper	O71	917	121749X	Washer
O71	917	146154	Solenoid Kit	O71	917	121798X	50" STD Lift
O71	917	146525	Wing nut	O71	917	123549X	Fuel Cap
O71	917	146682	Spring	O71	917	123713X	Spring
O71	917	123796X	Belt	O71	502	91954	Bulb
O71	917	124035X	Support	O71	502	424285	Solenoid
O71	917	124035X	Shaft	O71	502	456246	30" Blade
O71	917	125907X	Belt	O71	502	492574	Housing
O71	917	126847X	Bushing	O71	502	54390E701	Blade
O71	917	126875X	Rivet	O71	502	91742E701	Blade
O71	917	2029J	Weld Nut	O71	502	91871E701	Blade 40"
O71	917	3366R	Bearing	O71	502	92117E701	Blade
O71	917	4921H	Clip Retainer	O71	536	330278	Blade
O71	917	4921H	Retainer Ring	O71	536	339093	Belt
O71	917	6266H	Washer				
O71	917	6554J	Tine CRT				
O71	917	6555J	Tine CRT			Spark	Plugs
O71	917	6941R	Belt	O98	661	H10C	H10C/216
O71	917	7152J	Tube 18X 9.5— 8	O98	661	J17LM	J17LM/245
O71	917	7631J	Runner	O98	661	PM-4	J19LM/458
O71	917	7662J	Bulb	O98	661	RC12YC	PLUG
O71	917	8134H	Tube 16 X 6.5 / 7.5 —8	O98	661	RJ12C	RJ12C/308
O71	917	9040H	Bearing Wheel	O98	661	RJ12YC	RJ12YC/85
O71	917	9180R	Belt	O98	661	RL86C	L86C/RL86C
O71	O71	24101	Belt	O98	661	DP26	RV154C
O71	O71	24102	Belt	O98	661	N4C	PLUG
O71	O71	24103	Belt	O98	661	RJ19LM	PLUG
O71	O71	24655	Blade Prem	O98	661	RV17YC	PLUG
O71	O71	24694	Belt				
O71	O71	33500	Fuel Stabil			Standard	Parts
O71	O71	96145	Battery	O98	980	STD365402	Switch
O71	143	34279B	Filter	O98	980	STD624010	Hitch Pin
O71	143	35403	Air Cleaner	O98	980	STD560907	PIN 8 PK
O71	143	35404	Filter				

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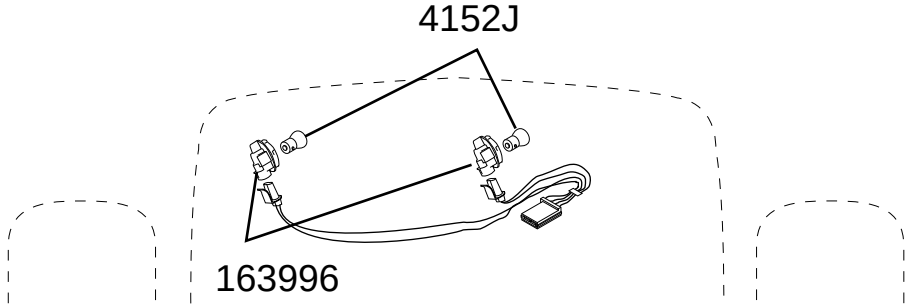
RECOMMENDED PARTS STOCK TRACTOR & TILLER

DIV.	PLS.	PART #	DESCRIPTION
O71	143	632633	Inlet Assy
O71	143	799021	Brake Pads
O71	247	736-0242	Washer
O71	500	222698	Key
O71	500	270843	Air Filter
O71	500	271962	Air Filter
O71	500	272403	Filter
O71	500	272490	Air Filter
O71	500	280104	Gear Starter
O71	500	291675	Seal Oil
O71	500	394018	Cartridge
O71	500	394019	Cartridge
O71	500	399806	Cartridge
O71	500	491588	Filter
O71	500	495878	Drive
O71	500	496894	Air Filter
O71	501	12-050-01	Oil Filter
O71	501	12-083-05	Air Filter
O71	501	12-083-08	Precleaner
O71	501	25-050-02	Fuel Filter
O71	501	45-083-01	Precleaner
O71	501	45-083-02	Air Filter
O71	501	47-083-03	Filter
O71	501	52-050-02	Oil Filter
O71	502	54211	Adapter
O71	502	55547	Flange
O71	502	91178	Pulley
O71	502	91334	Bearing Wheel

DIV.	PLS.	PART #	DESCRIPTION
	Recommended		Supplies
*O92	192	730301	48 OZ. SAE 30 OIL
*O92	192	25-357-06	10W30 Kohler Oil 32 OZ.
O92	192	144335	Tire Sealant 5 Gal Pail
O92	192	100035	Pump for Tire Sealant
*O92	Or	buy oil	Locally in bulk
Recommended Tools			
O92	150	DS-100	Deck Straightening tool
O92	150	19435	Starter Drive install tool
O92	150	19436	Starter Drive tool for Briggs
O92	150	25-761-18	Starter Drive tool for Kholer
Service Kit for Current Service Flashes			
O71	917	158739	Debris Guard (SF71-364)
O71	917	159258	Washer Kit (SF71-365)
O71	917	139573	V Belt (SF71-366)
O71	917	159717	Belt Kit (SF71-378)
Special 46" Blades for Bahia, Field or Pasture type Grass			
O71	917	157033	46" Blade (SF71-390)
O71	917	159705	46" Bahia Blade (SF71-390)
Service Kits For High Volume Rough Service Markets			
O71	917	137797	Frame Kit (SF71-243)
O71	917	140342	Bushing Kit 96 Update Book
O71	917	149681	Kit Steering (SF71-297)
O71	917	149684	Kit Steering (SF71-297)
071	917	151786	Ring Kit

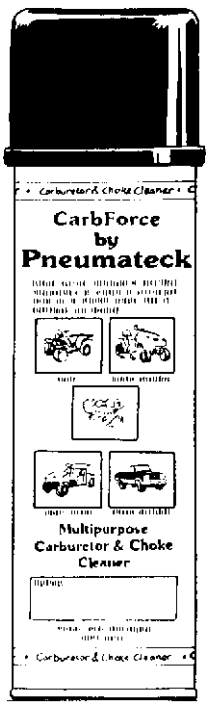
SEARS STEALTH HOOD TRACTOR MANUALS IN 1998
OMITTED THE HEADLIGHT SOCKET 71/917/163996

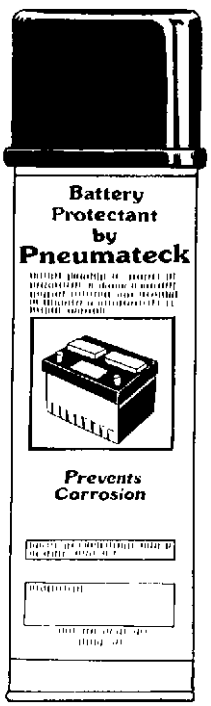


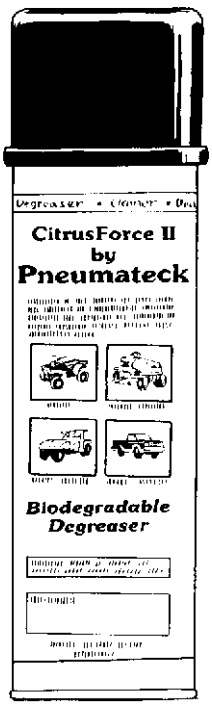
Cleaners and Lubricants

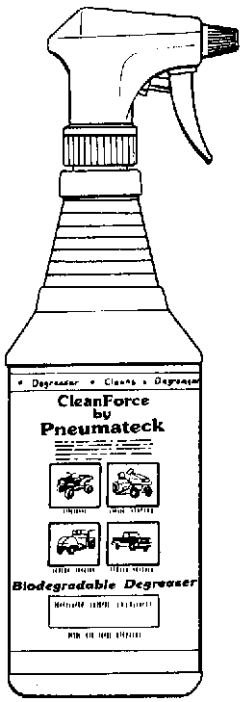
Sold in Case Lots Only

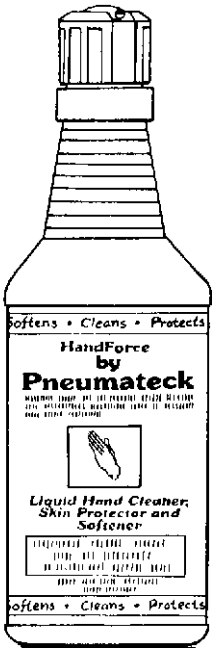
DIV.	PLS	PART #	DESCRIPTION	SIZE	CASE SIZE
O92	192	81010C	Multi-Purpose Cleaners & Degreaser Biodegradable Citrus Force	14oz can	12 cans
O92	192	84010C	Multi-Purpose Penetrant, Lubricant, Corrosion Preventive & Moisture Displacer Fourway Force Case	15oz can	12 cans
O92	192	85010C	Multi-Purpose White Lithium Grease Lithium Force	14oz can	12 cans
O92	192	87010C	'Multi-Purpose Carburetor & Choke Cleaner Carb Force	15oz can	12 cans
O92	192	88010C	'Multi-Purpose Battery Spray Protection Battery Protection	14oz can	12 cans
O92	192	89010C	Contact Cleaners (Elec. Components) Refrigeration	14oz can	12 cans
O92	192	81410C	Dry Teflon, Lubricant	10oz can	12 can
O92	192	82010C	Multi-Purpose Cleaner and Degreaser Clean Force	32oz bottle	12 bottles
O92	192	86010C	Multi-Purpose Hand Cleaner and Skin Softener Hand Force	16oz bottle	12 bottles











TECHNICAL TRAINING and SERVICE INFORMATION BOOKS

Part Number	Description
	from F.H.P. Source 917 order from D92/192
163578	Tractor & CRT Tiller Service Information Book
169291	1999 Craftsman & Wizzard Tractor, Mowers, Tiller Accessories Book
169418	1999 Craftsman & Wizard Tractor Wiring Schematics Book
168830	1999 Service Update Information Book
158222	1997 FHP Tractor Quick Reference Book
158223	1997 FHP Mowers / Tillers Quick Reference Book
158224	1997 FHP Tractor Wiring Schematics Book
168695	Deck Leveling Video
169287	Automatic Transmission/Drive System Video
139132	Electrical & Charging Systems Book
BLN-50432	HYDRO GEAR LT Hydro IHT Service & Repair Manual
BLN-50334	HYDRO GEAR GT Hydro 3010L Service & Repair Manual
99924-2041-01	KAWASAKI Engine Model FD590V 18HP Service Manual

Part Number	Description
	from BRIGGS & STRATTON Training & Ref. Mtl. (D92/192)
MS-8518	Troubleshooting Magnetron Ignition Systems (1985 Update)
MS-8798	Quick Check, an Effective Troubleshooting Tool (1986 Update)
MS-9152	Systematically Troubleshooting Ignition, Carbureton and Compression
MS-9557	Troubleshooting Carburetion Systems (1988 Update)
MS-9884	Troubleshooting Ignition, Starting, and Charging Systems (1991Update)
MS-2285	Carburetor Problem Solving Chart, page 10 (1991Update)
MS-2857	Troubleshooting Governor Systems (1993 Update)
MS-0279	Float Style Carburetor Leakage, page 27 (1994 Update)
MS-0575	Troubleshooting - Ignition Tester, DC Shunt, Leakdown Tester (1995 Update)
MS-0981	Troubleshooting Carburetors (1996 Update)
MS-0709	OHV Gasket Chart
MS-0710	V-Twin OHV Gasket Chart
MS-2288	Alternator Chart
MS-3957	Air Filter Charts (2)
MS-3992	Handy Repair Check Chart
MS-5437	Single Cylinder L-Head Gasket Chart
MS-5441	Opposed Twin Gasket Chart
270962	Single Cylinder L-Head Engine MANUAL
271172	Opposed Twin Engine MANUAL

Part Number	Description
	from TECUMSEH Source 143 Training & Ref. Mtl. order D92/192
692509	3 to 10 HP 4 Cycle "L" Head Engine MANUAL
691462A	8 to 18 HP Cast iron Engine MANUAL
691218	PEERLESS PowerTrain Components MANUAL
695244A	4 Cycle Overhead Valve Engines MANUAL
695907	Carburetor Troubleshooting Booklet
695590	4 Cycle Engine Failure Analysis Booklet
695933	Quick Reference Chart / Booklet
694862	Special Tools Booklet

Part Number	Description
	from KOHLER Source 501 Training & Ref. Mti. order D92/192
TP-2339	Command Single Cylinder CV11-CV16 Service Manual
TP-2450	Command Twin Cylinder CV18-CV25 Service Manual
TP-2289	Magnum Twin Cylinder MV18-MV20 Service Manual
TP-2131	Troubleshooting Flow Chart & Guidebook
ES-103	General Maintenance Video An Ounce of Prevention
ES-2007	Product Specifications; Sales Brochure on Models
TP-2372	Specifications & Tollerances Wallchart
ENS-967	Gaskets Wallchart
TP-2067	Air Cleaner Elements Wallchart

IMPORTANT BOLT TORQUES

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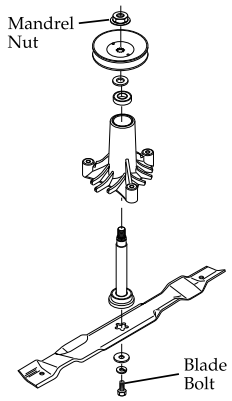
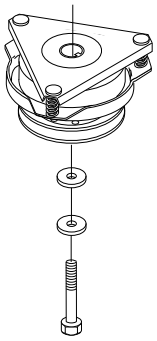
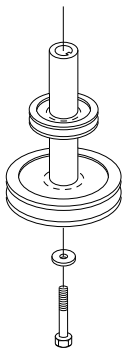
TRACTORS:



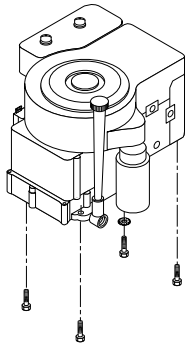
Blade Bolt / Mandrel Nut
Blade Bolt to 30-35 Ft. Lbs.
Mandrel Nut to 55-65 Ft.



Electric Clutch Bolt
Grade 5 Bolt
Torque to 50 Ft. Lbs.



Mechanical Clutch Bolt
Grade 5 Bolt
Torque to 35 Ft. Lbs.



Engine Mounting Bolts
Grade 5 Bolts
Torque to 35 Ft. Lbs.

STANDARD TORQUE VALUES

BOLTS, SCREWS, NUTS, AND FASTENERS
ASSEMBLED INTO CAST IRON OR STEEL.

SIZE	Grade 2	Grade 5	Grade 8
# 8-32	20 in. lb.	25 in. lb.	
#10-24	32 in. lb.	40 in. lb.	
#10-32	32 in. lb.	40 in. lb.	
1/4-20	70 in. lb.	115 in. lb.	165 in. lb.
1/4-28	85 in. lb.	140 in. lb.	200 in. lb.
5/16-18	150 in. lb.	250 in. lb.	350 in. lb.
5/16-24	165 in. lb.	270 in. lb.	30 ft. lb.
3/8-16	260 in. lb.	35 ft. lb.	50 ft. lb.
3/8-24	300 in. lb.	40 ft. lb.	60 ft. lb.
7/16-14	35 ft. lb.	55 ft. lb.	80 ft. lb.
7/16-20	45 ft. lb.	75 ft. lb.	105 ft. lb.
1/2-13	50 ft. lb.	80 ft. lb.	115 ft. lb.
1/2-20	70 ft. lb.	105 ft. lb.	165 ft. lb.
9/16-12	75 ft. lb.	125 ft. lb.	175 ft. lb.
9/16-18	100 ft. lb.	165 ft. lb.	230 ft. lb.
5/8-11	110 ft. lb.	180 ft. lb.	260 ft. lb.
5/8-18	140 ft. lb.	230 ft. lb.	330 ft. lb.
3/4-10	150 ft. lb.	245 ft. lb.	350 ft. lb.
3/4-16	200 ft. lb.	325 ft. lb.	470 ft. lb.

Notes on Engine Pulley Bolts for KOHLER Command Single Cylinder Engines

Replacement engines use metric engine pulley bolts.
Original engines from AYP have SAE engine pulley bolts.

LT with manual deck engagement
M747810100 Bolt 1.5THD x 100mm.GR 10.9
71170764 Bolt 7/16-20 UNC x 4" GR 5

LT with electric clutch deck engagement
M747810110 Bolt 1.5THD x 110mm.GR 10.9
71170768 Bolt 7/16-20 UNC x 4 1/4" GR5

Lawn Rider
M747810075 Bolt 1.5THD 75mm.GR 10.9
71170775 Bolt 7/16-20 UNC x 2 3/4"GR5

Bolts, Screws, Nuts, and Fasteners Assembled into Aluminum

SIZE	Grade 2	Grade 5	Grade 8
# 8-32	20 in. lb.	20 in. lb.	20 in. lb.
#10-24	32 in. lb.	32 in. lb.	32 in. lb.
1/4-20	70 in. lb.	70 in. lb.	70 in. lb.
5/16-18	150 in. lb.	150 in. lb.	150 in. lb.

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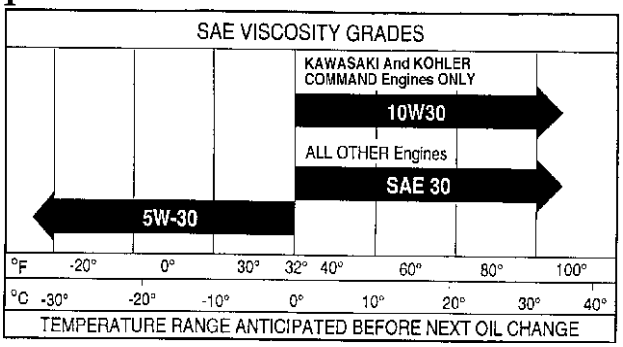
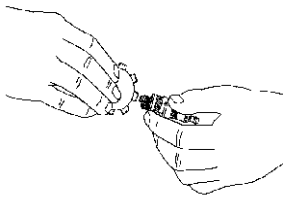




TECUMSEH ENGINES	OEM PLUG#	GAP	STD PLUG#	OIL GRADE	OIL CAPACITY
3HP thru 6.2HP, L Head and HTL Rotary	RJ19LM	.030	PM4	30W	20.OZ
5HP thru 6.6HP Hi Torque w/Extruded Carb.	RJ19LM	.030	PM4	30W	27.OZ
4HP, 5HP, OHV Rotary 6HP OHV Slant Horizontal	RN4C	.030	NONE	30W	20.OZ
8HP, 10HP Vertical L Head	RJ17LM	.030	NONE	30W	32.OZ
12HP, 12.5HP Vertical w/Stationary Cooling Air Inlet Screen	RL86C	.030	NONE	30W	32.OZ
12HP, 12.5HP, 16.5HP OHV Vertical w/Rotating Cooling Air Inlet Screen	NC4	.030	NONE	30W	32.OZ
BRIGGS AND STRATTON					
3HP, 3.5HP, Classic 4HP, 5HP, Quantum	RJ19LM	.030	PM4	30W	20.OZ
5HP Horizontal L Head	RJ19LM	.030	PM4	30W	20.OZ
8HP Horizontal L Head	RJ19LM	.030	PM4	30W	44.OZ
12HP, 12.5HP, 13HP Singles Cyl.	RJ19LM	.030	PM4	30W	48.OZ
15HP, 15.5HP OHV	RC12YC	.030	NONE	30W	48.OZ
14HP, 16HP, 18HP, 19HP, Opposed Twins	RJ19LM	.030	PM4	30W	48.OZ
20HP Opposed Twin w/Filter	RJ19LM	.030	PM4	30W	56.OZ
13HP, 14HP, 15HP, 16HP, 17HP Vanguard Single OHV + Intek/V	RC12YC	.030	NONE	30W	56.OZ
14HP, 16HP, 18HP, 20HP, 22HP Vanguard Twin OHV+ Intek/V	RC12YC	.030	NONE	30W	56.OZ
KOHLER ENGINES					
CV 12.5HP, 14HP, 14.5HP, 15HP, 15.5HP	RC12YC	.040	NONE	10W30	64.OZ
CV 20.5HP, 22HP 22.5HP, 25HP	RC12YC	.030	NONE	10W30	64.OZ
M18HP, 20HP, MV18HP, 18.5HP, 19HP, 20HP	RV17YC	.035	NONE	30W	56.OZ
HONDA ENGINE					
5HP GXV140 NGK Brand	NGKBPR5ES	.030	NONE	30W	20.OZ
ONAN ENGINES					
20HP	RS14YC	.025	NONE	30W	56.OZ
KAWASAKI 18HP NGK	BPMRGA	.025	CJ8	10W30	70.OZ

NOTE: Make sure the correct engine spark plug is used with (correct reach and heat range), as the use of a incorrect spark plug will cause damage to the customer engine.
Tractor 1992 and newer with vented decks 3350 RPM + or - 50 RPM
Tractor 1991 and older with standard decks 3550 RPM + or - 50 RPM
Tractor low RPM single cylinder 1800 RPM
Tractor low RPM twin cylinder 1400 RPM
Rotary mower high RPM 3200 fast
Rotary mower low RPM 2600 slow

MAINTENANCE (M/A) CHECK

1

Tractor / Riding Mowers

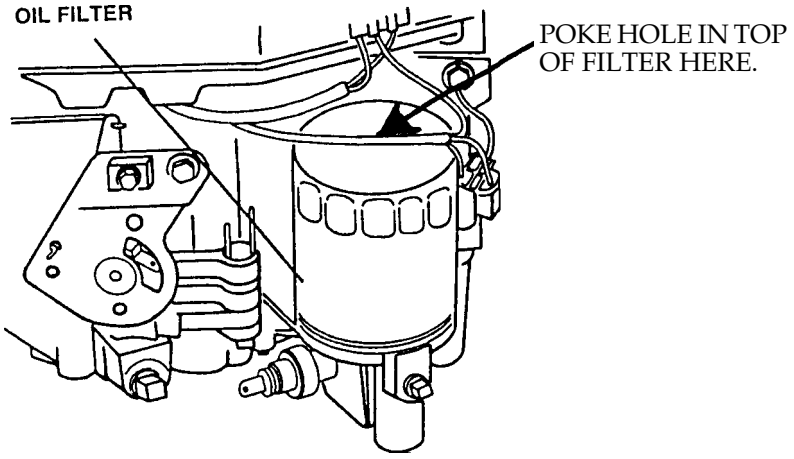
- Tune engine, Check: rpm engine speed ,charging system , ignition, spark plug, throttle & choke controls, clean engine cooling fins, replace air filter, change oil, oil filter, and fuel filter.
- Check & adjust tires for proper inflation.
- Lubricate moving parts, steering, linkage, and grease all fittings.
- Test overall operation of equipment and ensure that all safety features are operating properly.
- Check electrical system and clean battery terminals.
- Sharpen or replace cutting blades.
- Check blade mounting bolt Torque with Torque wrench (30 to 35 ft lbs).
- Check and adjust brakes & do brake test. See brake adjustment section for brake test.
- Compliance check operator present system and blade brake system, blades stop within 5 seconds when disengaged.
- Check belts & pulleys.
- Adjust guage wheels, (off of ground).
- Check deck rake and level.

Tillers

- Remove fuel from tank & bowl.
- Tune engine , Check: rpm engine speed, Ignition, carburetor, clean or replace air filter and change oil.
- Lubricate moving parts, pivot point and cable.
- Inspect, adjust or replace as needed all belts and chains as applicable.
- Test overall operation of equipment and ensure that all safety features are fully operational.

Snow Throwers

- Tune engine , Check: rpm engine speed , Ignition system, carburetor, battery, replace spark plug and change oil winter weight only.
- Lubricate moving parts: pivot point, cables, auger shaft, grease zerk, and chains.
- Inspect, adjust or replace (as needed) all drive belts, belt guides.
- Check manual starter and electric starter if so equipped.
- Check and adjust disk drive assembly and auger cable.
- Check chute control rod and deflector.
- Test overall operation of the snow thrower.
- Check for proper operation of all safety features.



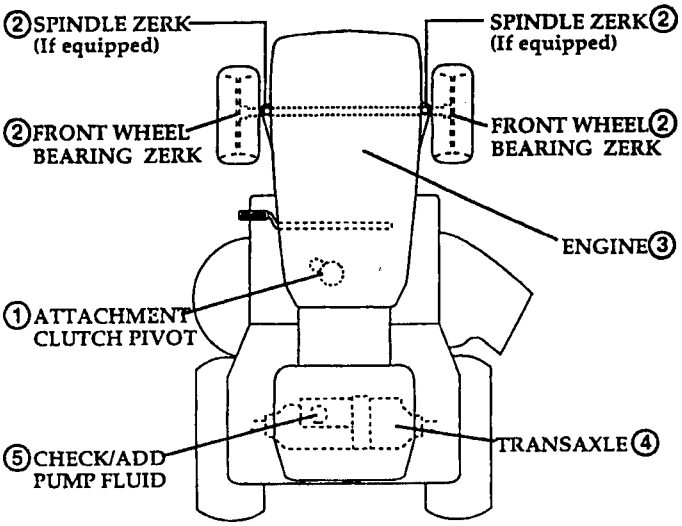
PREVENT OIL FROM SPILLING ALL OVER THE WHEN CHANGING FILTER. POKING A HOLE IN THE TOP OF THE FILTER WILL VENT SYSTEM AND ALLOW OIL TO DRAIN OUT THROUGH ENGINE SUMP.

1

TRACTOR LUBRICATION

Important: do not oil or grease the pivot points which have special nylon bearings. Viscous lubricants will attract dust and dirt that will shorten the life of the self-lubricating bearings. If you feel they must be lubricated, use only a dry, powdered graphite type lubricant sparingly.

HYDRO LUBRICATION CHART

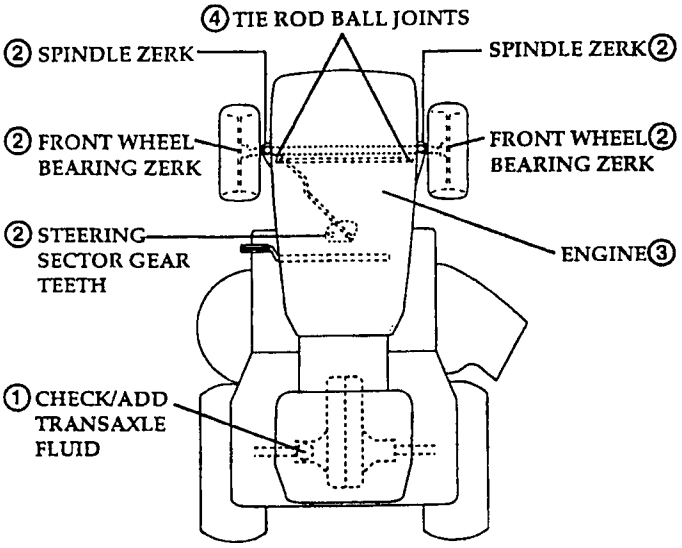


1. SAE 10W30 Motor Oil API-SG
2. General purpose grease
3. Refer to customer responsibilities "Engine" section in owners manual.
4. Grease shell dorina type 0 20 oz.
5. SAE 20W50 Motor Oil API SG/CD

Lawn Tractor:
310-500, 310-650, 310-750 IHT Hydro transmission holds approximately 80 oz. 20W50 motor oil.

Garden Tractor:
210-3010L GT Hydro transmission holds approximately 60 oz. 20W50 motor oil or 10W40 or 15W50 Mobil 1 synthetic motor oil.

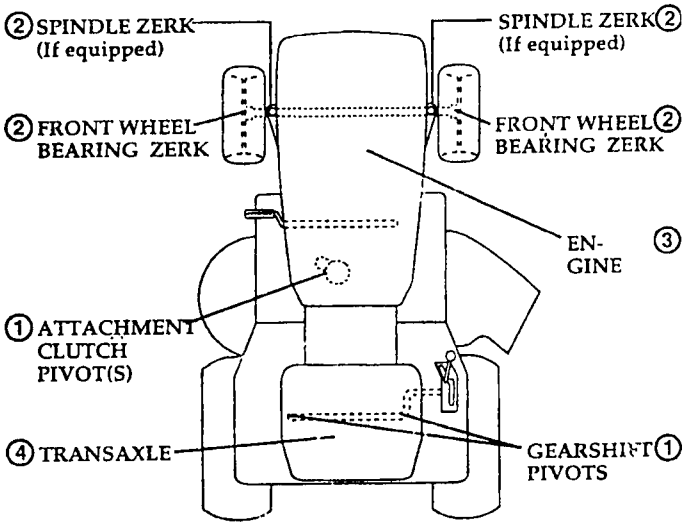
GARDEN TRACTOR LUBRICATION CHART



1. SAE 30 Motor Oil API-SF/SG holds 128 oz.
2. General purpose grease.
3. Refer to customer responsibilities "Engine" section.
4. Spray silicone lubricant (move boots to lubricate)

NOTE: HYDRO TRANSAXLE FLUID
Typically, a 20W-50 engine oil with an API classification of SH/CD is recommended for most normal operating conditions. In some cases, such as northern climates where temperatures commonly drop below 20°F it may be necessary to perform seasonal oil and filter changes to achieve the proper performance levels expected from a hydrostatic transmission. The recommended "winter" fluid would then become a 10W-40 engine oil. An alternative to seasonal fluid and filter changes would be to use a synthetice engine oil such as 15W-50 Mobil 1. This choice offers not only better cold weather performance, but also improves high temperature protection over both of the previously mentioned fluids. The volume of fluid required to refill a transaxle is approximately 2-1/2 quarts.

LAWN TRACTOR LUBRICATION CHART



1. SAE 30 or 10W30 Motor oil API - SG
2. General purpose grease
3. Refer to customer responsibilities "Engine" section in owner's manual
4. Dana transaxle 16 oz. Shell dorina type 0 grease. Part number 120416X

Peerless transaxle: 30 oz. Bentonite grease.

NOTE: on transaxle with grease, only change or add grease when making repairs to the inside of transaxle.

IMPORTANT: do not oil or grease the Pivot points which have special nylon bearings. Viscous lubricants will attract dust and dirt that will shorten the life of the self-lubricating bearings. If you feel they must be lubricated use only a dry, powdered graphite type lubricant sparingly.

SERVICE ORDER DOCUMENTATION

1

It's important to always document the reason for failure on the service order. On an in-warranty product, do not close the service orders as in-warranty, if the failure is due to customer abuse, neglect or even accident. Verify and document as much information as possible about a service call on the service order. Especially when a major component has been replaced, here are a few examples of acceptable and not acceptable service orders.

1 - NOT ACCEPTABLE

A. Service Requested: Won't Run
B. Tech Comments: Replaced Engine

2 - ACCEPTABLE

A. Service Requested: Won't Run
B. Tech Comments: Found black, dirty oil in pump, connecting rod broken. Customer abuse, changed engine, tested for safety compliance and charged customer.
C. Call closed as collect

3 - ACCEPTABLE

A. Service Requested: Won't Run
B. Tech Comments: Found engine locked. Oil normal, no external causes found. Internal component failed. Replaced engine and tested.
C. Call closed as in-warranty

Note: The cost of an engine replacement must be supported by what you have determined caused the failure.

Engine Replacement

Other than catastrophic internal engine failures, ordering a replacement engine is not always the solution. Many perfectly good engines have been received and inspected at the Dallas Rebuilding facility. Before replacing an engine check the following items first:

Complaint:

Noisy

- Disconnect belt(s), run engine with no load.
- If an engine is noisy, determine where noise is coming from. If engine runs normally but has a knock, pull head(s) and check for carbon buildup.

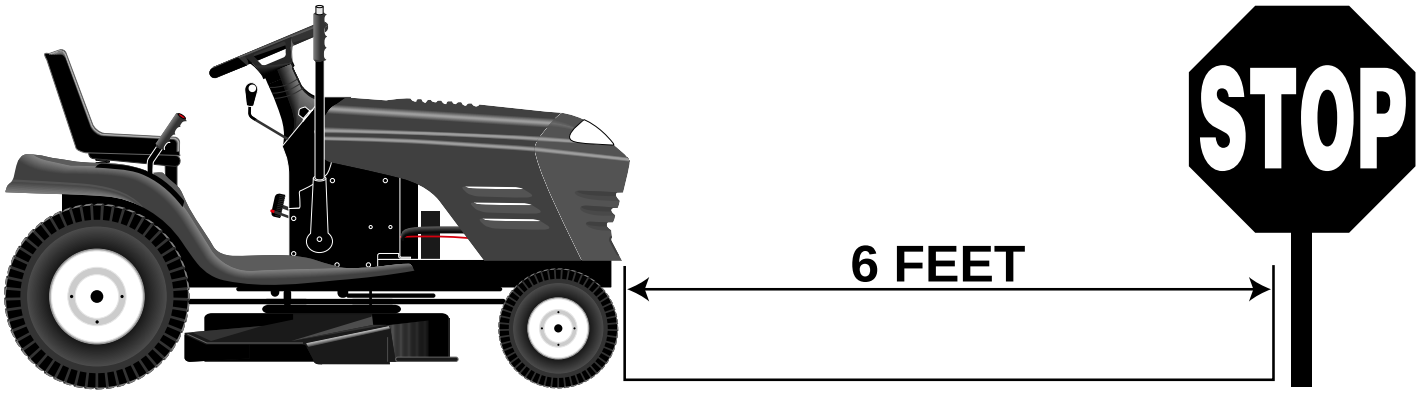
High Oil Consumption

- Is it leaking or burning oil?
- Check integrity of all seals and gaskets (as described in the Troubleshooting section of this manual).
- Ensure breather is operating properly.
- Check condition of spark plug. An oil-fouled plug will indicate engine is burning oil.
- Check oil type, quality and quantity.
- Does the engine smoke? If so, is the smoke black, white or blue?

Won't Run / Locked Up

- Disconnect belt(s), run engine with no load.
- Check external causes.
- Check starter drive to ensure it is not jammed in the flywheel.

2 BRAKE ADJUSTMENTS



BRAKE TEST

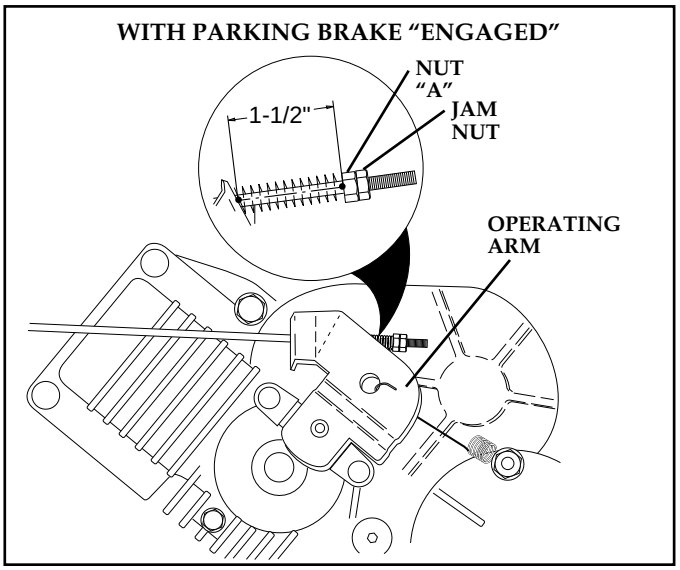
A brake test should be performed whenever Service work is performed on a tractor. Tractor traveling at high speed in highest gear must stop within 6 feet when the brakes are applied. If tractor requires more than 6 feet to stop, a brake adjustment should be made before returning tractor to the customer.

TO ADJUST BRAKE

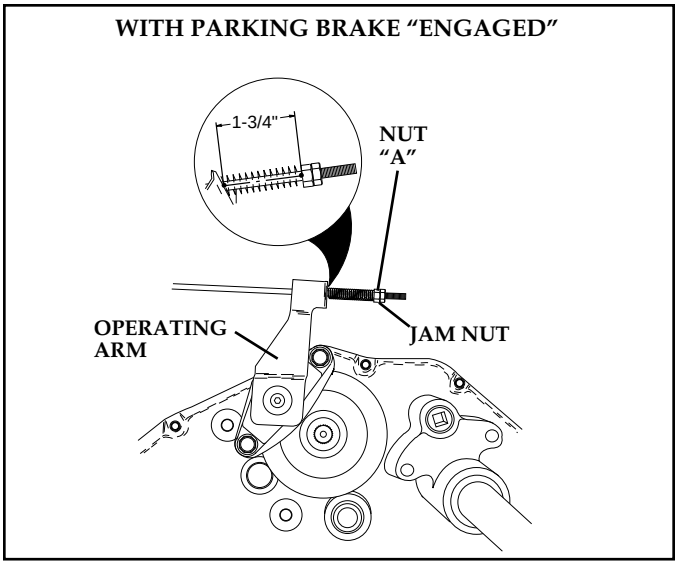
Your tractor is equipped with an adjustable brake system which is mounted on the side of the transaxle.

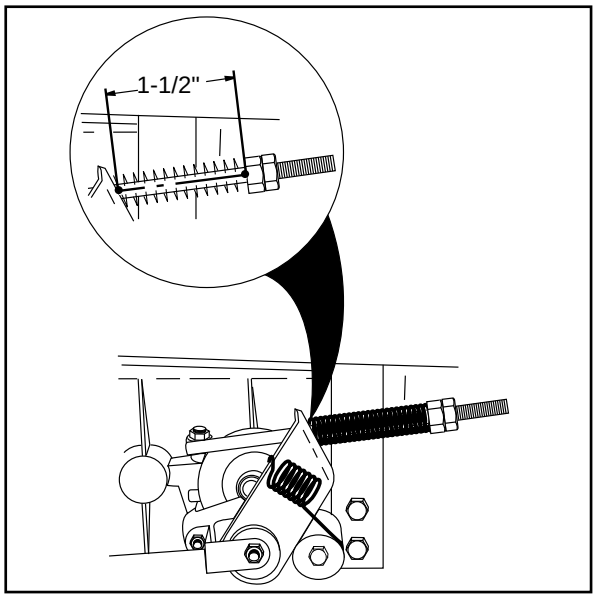
- Depress clutch/brake pedal and engage parking brake.
- Measure distance between brake operating arm and nut "A" on brake rod.
- If distance is other than dimension shown for your type tractor, loosen jam nut and turn nut "A" until correct distance is reached. Retighten jam nut against nut "A".

VGT HYDRO TRANSAXLE



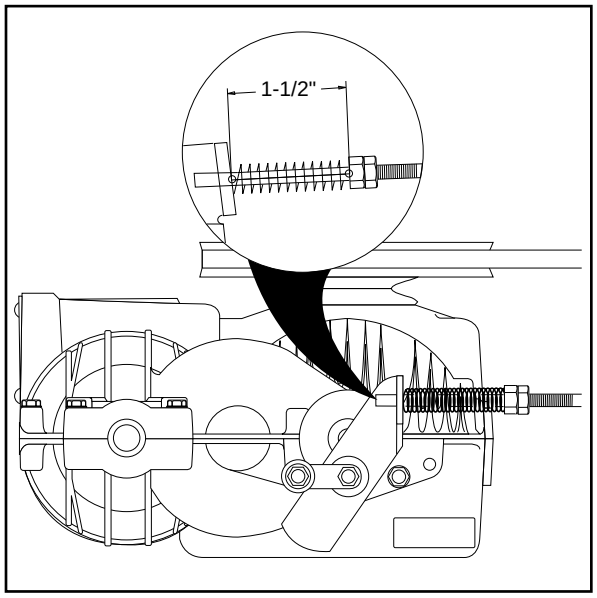
AYP DISC BRAKE TRANSAXLE





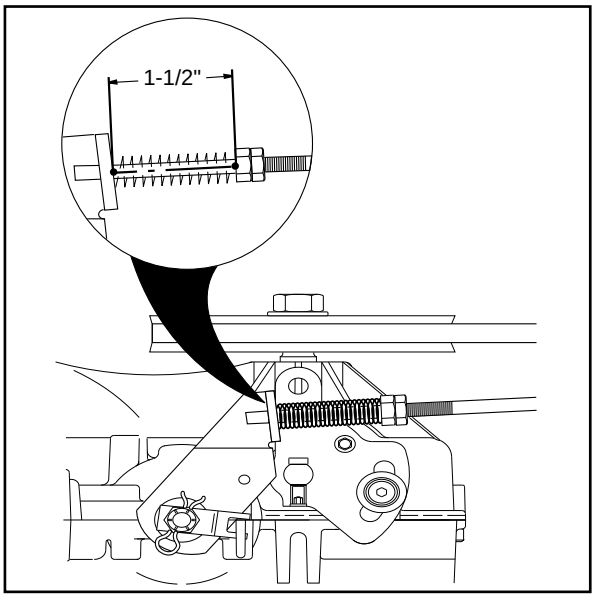
LAWN RIDER

Brake adjustments



PEERLESS HYDRO

Brake adjustments



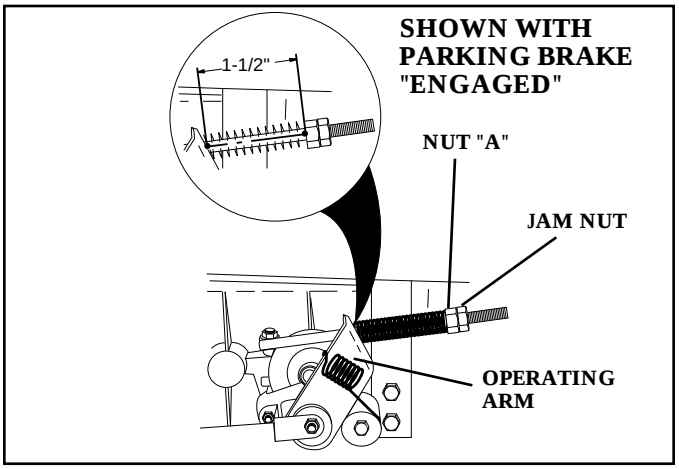
HYDRO GEAR 3000

Brake adjustments

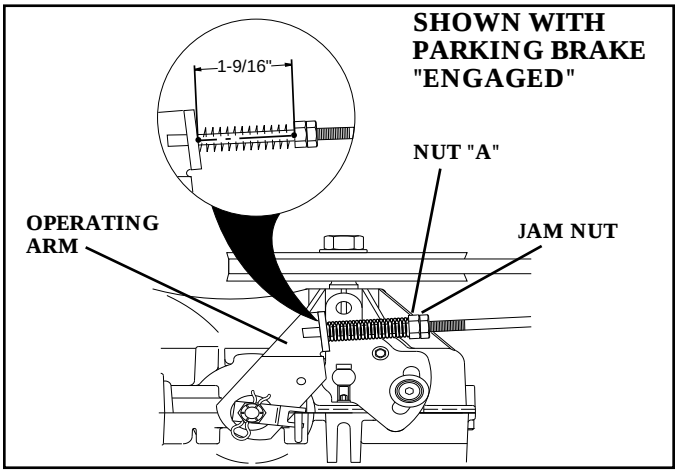
2

BRAKE ADJUSTMENT

STEP-THRU LT/YT GEAR DRIVE TRANSAXLES PEERLESS + DANA



STEP-THRU LT/YT HYDROGEAR 0500/0650

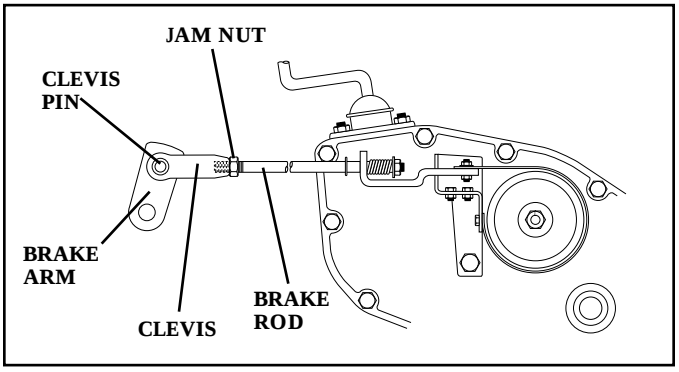


GT BRAKE BAUD BRAKE ADJUSTMENT

IMPORTANT: DO NOT OVER TIGHTEN BRAKE. WHEN DEPRESSING CLUTCH BRAKE PEDAL, THE MOTION DRIVE BELT MUST STOP MOVING (DECLUTCH FROM ENGINE PULLEY) BEFORE BRAKE ENGAGES. IMPROPER ADJUSTMENT WILL CAUSE HARD SHIFTING AND EXCESSIVE WEAR TO BRAKE LINING.

- Park and turn off the tractor on a level surface. Place gear shift lever in neutral (N) position. Disengage parking brake and be sure tractor does not roll in either direction.
- Lower mower deck (if installed on tractor).
- Snap out access hole cover on left side of tractor above footrest.
- Loosen jam nut at clevis which will allow brake rod to be rotated.
- With pliers, from underside of frame, unscrew brake rod from clevis four (4) to six (6) full turns.
- Start tractor with gear shift lever in neutral (N) position.
- Slowly depress clutch/brake pedal to the point where the motion drive belt stops moving. Hold clutch/brake pedal in this position and engage parking brake. If belt begins to move after engaging parking brake, reset parking brake by depressing clutch/brake pedal slightly to next notch on parking brake.
- Stop engine. Screw brake rod back into clevis until clevis pin is against rear edge of slot in brake arm. Do not over tighten (see "IMPORTANT" above).
- Tighten jam nut against clevis.
- Replace access hole cover.
- Road test tractor for proper stopping distance and declutching as stated above. Readjust if necessary. If proper adjustment cannot be attained, replace brake band.

GT BAND BRAKE TRANSAXLE



TRANSAXLES

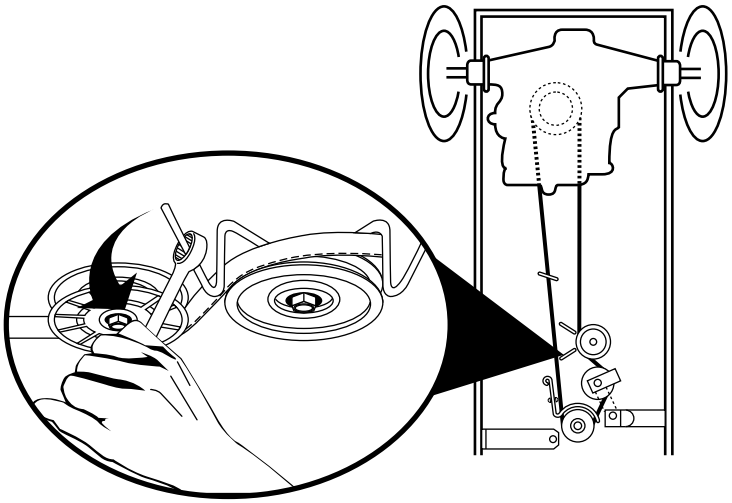
WHAT YOU SHOULD CHECK BEFORE YOU REPLACE THE TRANSAXLE

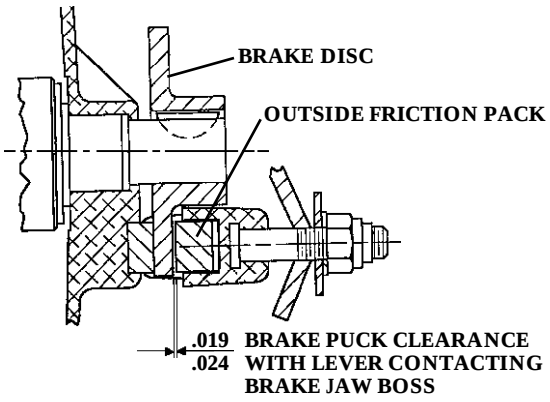
Symptom: Hard Shifting / Transaxle locked up.

Eliminate all customer issues: Make sure customer is not shifting on the go or is trying to shift on a hill. Shifting on the go will damage transaxle, shifting on a hill is incorrect due to the gear load.
Jerking is caused by clutch misuse. Do not replace transaxle, instruct customer how to use clutch.
Surging happens when a tractor goes down hill and momentarily picks up speed (this is normal).
Remember you cannot fix something on a transaxle that is normal (not broken).

1. Place tractor on level ground.
2. Remove drive belt from transaxle input pulley.
3. If transaxle shifts OK. Tractor has a belt guide out of adjustment or belt guide is missing.
4. Verify that both square axle keys are installed in each wheel hub.
5. Verify shift lever linkage is secure (all fasteners are tight).
6. Check brakes/clutch dwell setting for proper adjustment (verify brake return spring is installed).
7. If transaxle is still locked up you have a internal problem in the transaxle, repair or replace.
8. **Note**: 30% of all transaxles returned to the rebuild center have nothing wrong with them.
Set Parking Brake: Check the brake clearance it should be. 019"/.024" between the brake disc and the outside friction puck while the brake lever contacts the brake jaw.

Compliance brake test: tractor on level ground at full speed in highest gear must stop within six (6) feet or less. If unit fails, follow brake adjustment procedures on page 16, 17 and 18 of this manual.





DRIVE BELT DISENGAGED
CLUTCH/BRAKE PEDAL DEPRESSED

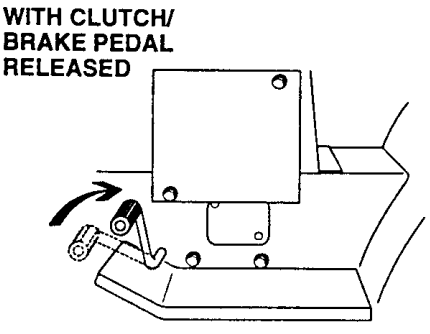


FIG. 1

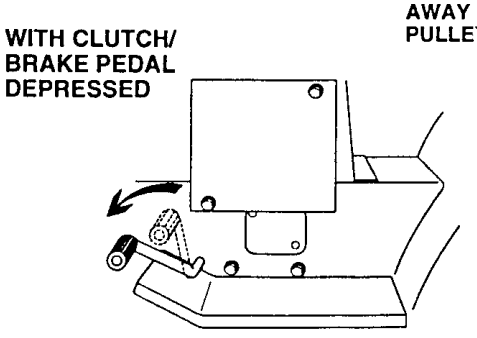
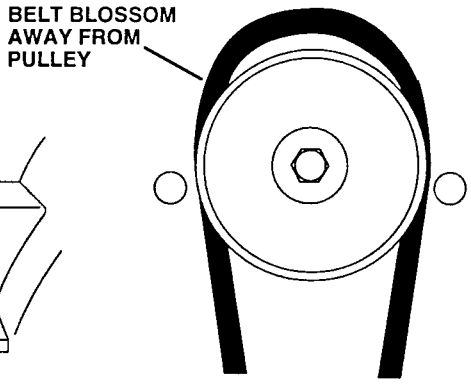


FIG. 2



3 HYDRO TRANSAXLES - GT OIL/FILTER CHANGE

Oil and filter change should occur approximately every 200 hours of operation or when oil condition results in loss of power. More frequent oil and filter changes are recommended if operation conditions are severe or adverse, such as pulling a plow or a tiller for an extended period, or operating in very dusty conditions.

- Run tractor to heat up oil **(Warm oil will drain more freely).**
- Be sure tractor is on level surface and catch oil in a suitable container.

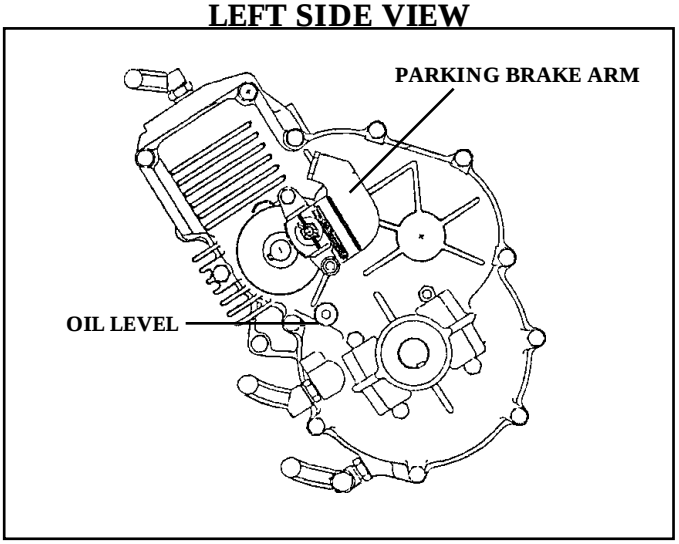
Lift tractor off the ground with lift at the drawbar of the tractor or block up tractor so the left rear wheel is just off the ground and remove left rear tire **(Be sure to keep tractor as level as possible).**

(#1) Remove oil filter.
(#2) Remove hose from end of swivel fitting at oil drain location.
(#3) After oil has drained completely, replace hose end to swivel fitting and tighten securely
(#4) Put a small amount of oil on the filter rubber seal before installing. Install the new filter and tighten 3/4 of one turn after the filter seal touches the filter mounting base, to prevent an air leak. Order the proper replacement filter from AYP.
(#5) Remove oil level port plug.
(#6) Remove vent cap from end of oil fill tube and refill transaxle with about 45 ounces of 15w50 Synthetic Mobil one engine oil . Fill oil through the oil fill breather vent hose until just before the oil starts to come out of the oil level port hole. **Pour slowly do not overfill, let excess oil drain out of oil level port hole.**. Note the system holds 60 ounce of oil but you will only get out about 75% during a oil change. About 25% of the oil will remain in the pump for a prime to restart the system after the oil change.
(#7) Replace oil level plug and purge transaxle as follows:

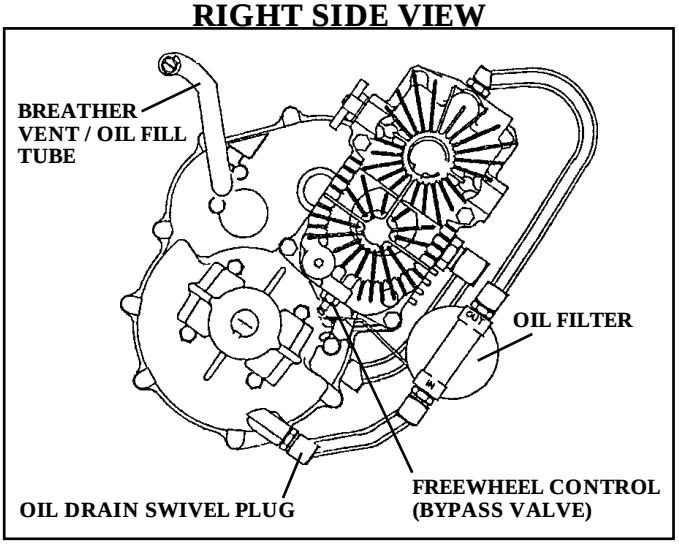
- Engage parking brake and place freewheel control in “freewheel” position.
- Sit in seat, start engine and move throttle control to “slow” position.
- Put motion control lever in neutral (**N**) and slowly disengage clutch/brake pedal.
- Move motion control lever to full forward position and hold for five (5) seconds.
  Move lever to full reverse position and hold for five (5) seconds.
  Repeat this procedure three (3) times.

(#8) After purging the system of air andonce tractor has been running for one minute, the oil level should be rechecked. Remove oil drain port hole plug and add 2 to 4 ounces or more oil if needed. Reinstall oil drain port hole plug and the vent cap to oil fill tube. Refer to step#6.

LEFT SIDE VIEW



RIGHT SIDE VIEW



HYDRO TRANSAXLES - GT TROUBLESHOOTING

Symptom: Hydro Garden Tractor Won't Drive.

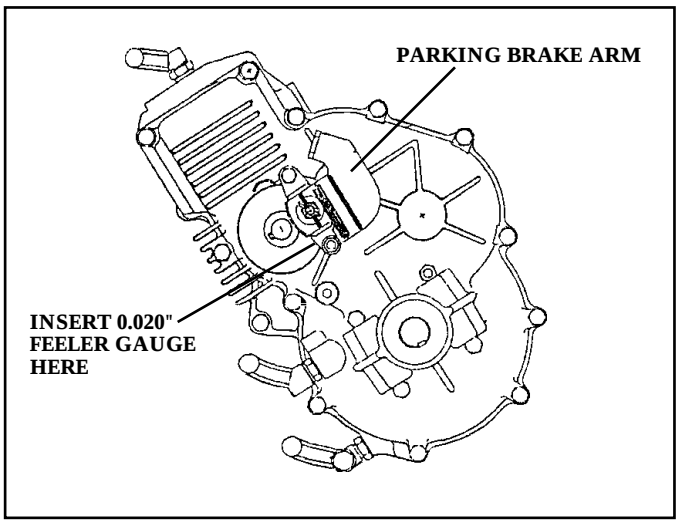
Trouble shooting Cold starting for hydro (below 40 degrees F) after starting engine and before driving , let the transmission warm up for (1) minute by placing the motion control lever in neutral (N) position and releasing clutch/brake pedal.

1. Follow purge procedures described in step #7 on page 20 of this manual.
2. Place free wheel control in the drive position.
3. Check for proper installation and function of motion drive belt.
4. Verify that the axle engagement key is in place in both rear wheel hubs..
5. Verify motion control linkage is secure (all fastener are tight).
6. Verify proper oil level in transmission, remove oil level port plug and check oil level. Oil should be at the bottom of the plug hole, but not running out.
7. Verify parking brake arm releases..
8. Test for system leaks (fitting, hoses, seals, ect) see test procedures.

PARKING BRAKE

The brake was factory set for specific running clearance between the disc and pucks of 0.020". Place a feeler gage between the disc and one puck, if the clearance is not set properly remove the cotter pin retaining the castle nut and set the correct clearance by adjusting the castle nut accordingly. Reinstall the cotter pin. **Compliance brake test: Check Brakes operation, tractor at full speed in high gear must stop within six (6) feet or less on level ground.**

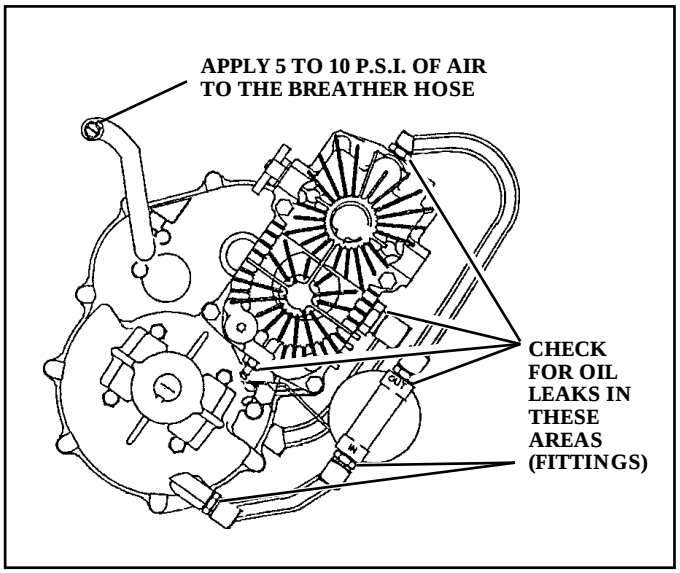
LEFT SIDE VIEW



Test Procedure for System Leaks:

1. Remove vent from breather hose (located at the rear tractor on top of the hydro transaxle).
2. Apply (5) to a maximum of (10) psi air pressure to the hose.
3. If a leak is present, a puddle of oil should begin to form under the transmission in less then (2) minutes. Determine the origin of the leak.
4. If no leaks are found, change filter and oil.
5. If leak is found repair or replace defective components.
6. Check level and top off with recommended oil.
7. Follow purge procedures as described in step #7 on previous page of this manual.
8. If tractor functions properly, check oil level and top off with recommended oil if needed.
9. If tractor still won't drive replace hydro/pump (or) defective component) and follow recommended start up purge procedures.

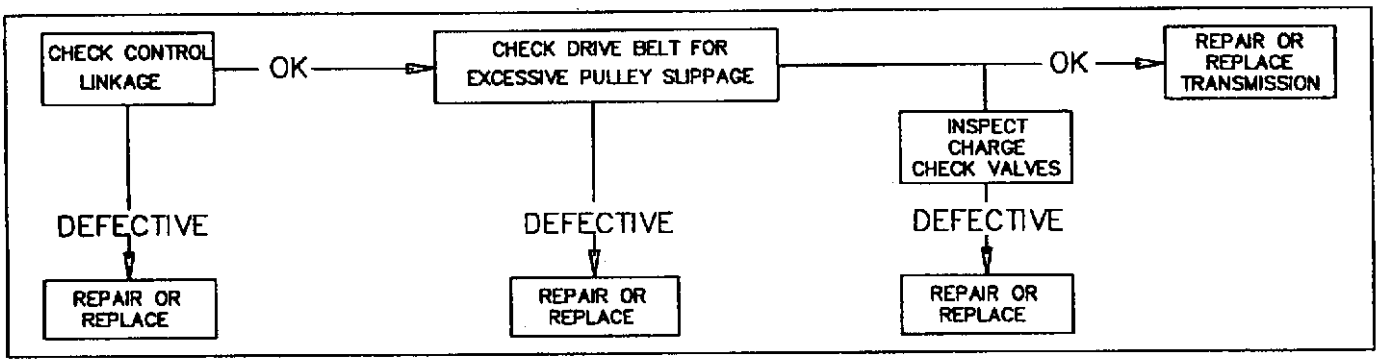
RIGHT SIDE VIEW



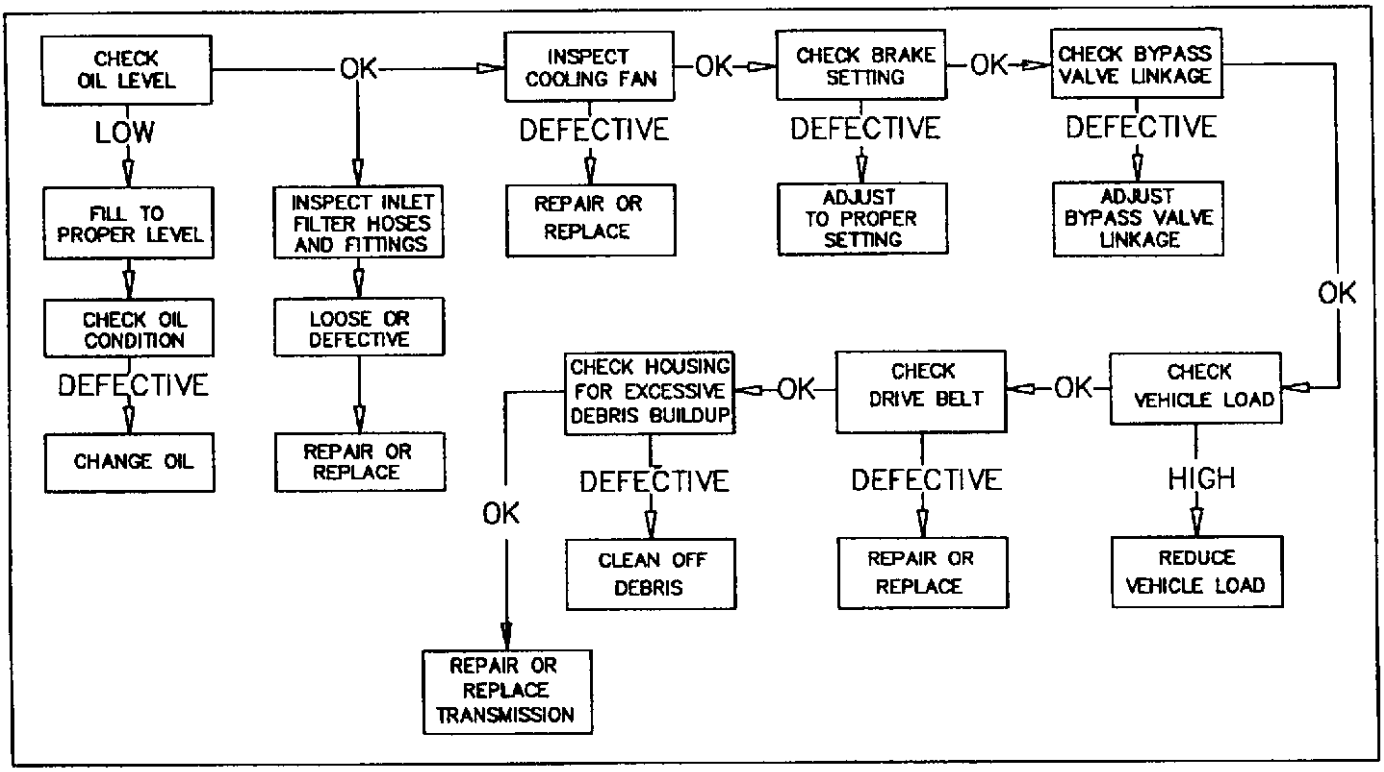
3

TROUBLESHOOTING CHART
GARDEN TRACTOR WITH HYDRO GEAR TRANSAXLE

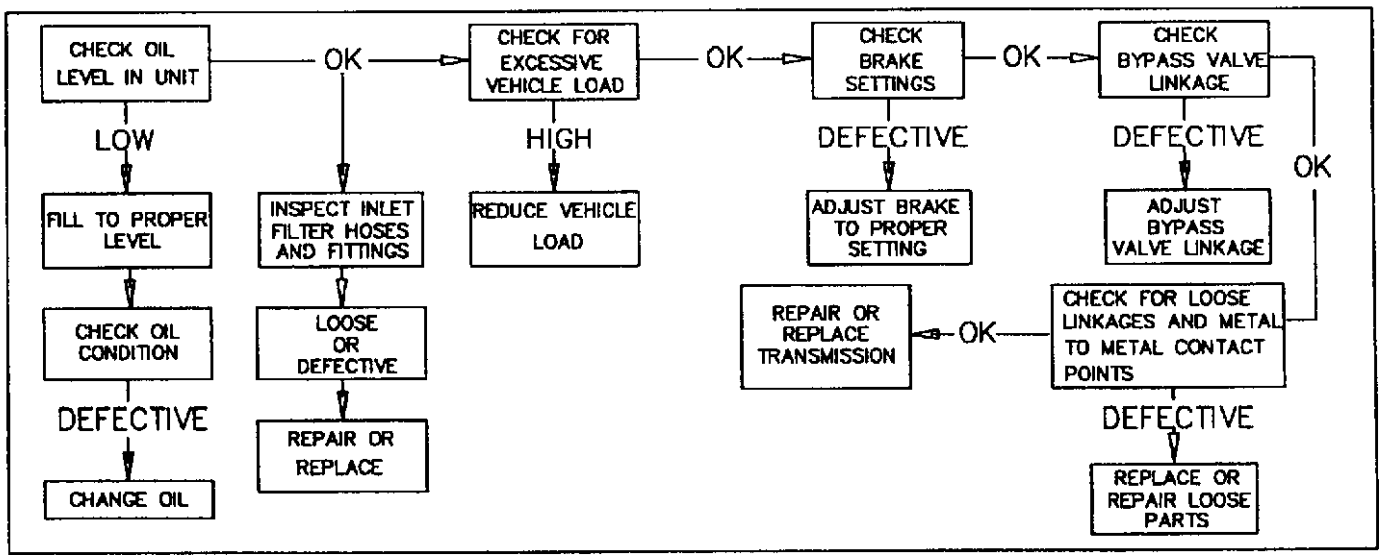
OPERATES IN ONE DIRECTION ONLY



OPERATING HOT/LOSING POWER



NOISY UNDER LOAD



HYDRO TRANSAXLES - LT REPLACEMENT

WHAT YOU SHOULD CHECK BEFORE YOU REPLACE THE TRANSAXLE

Symptom: Tractor has loss of drive. No forward / reverse motion.

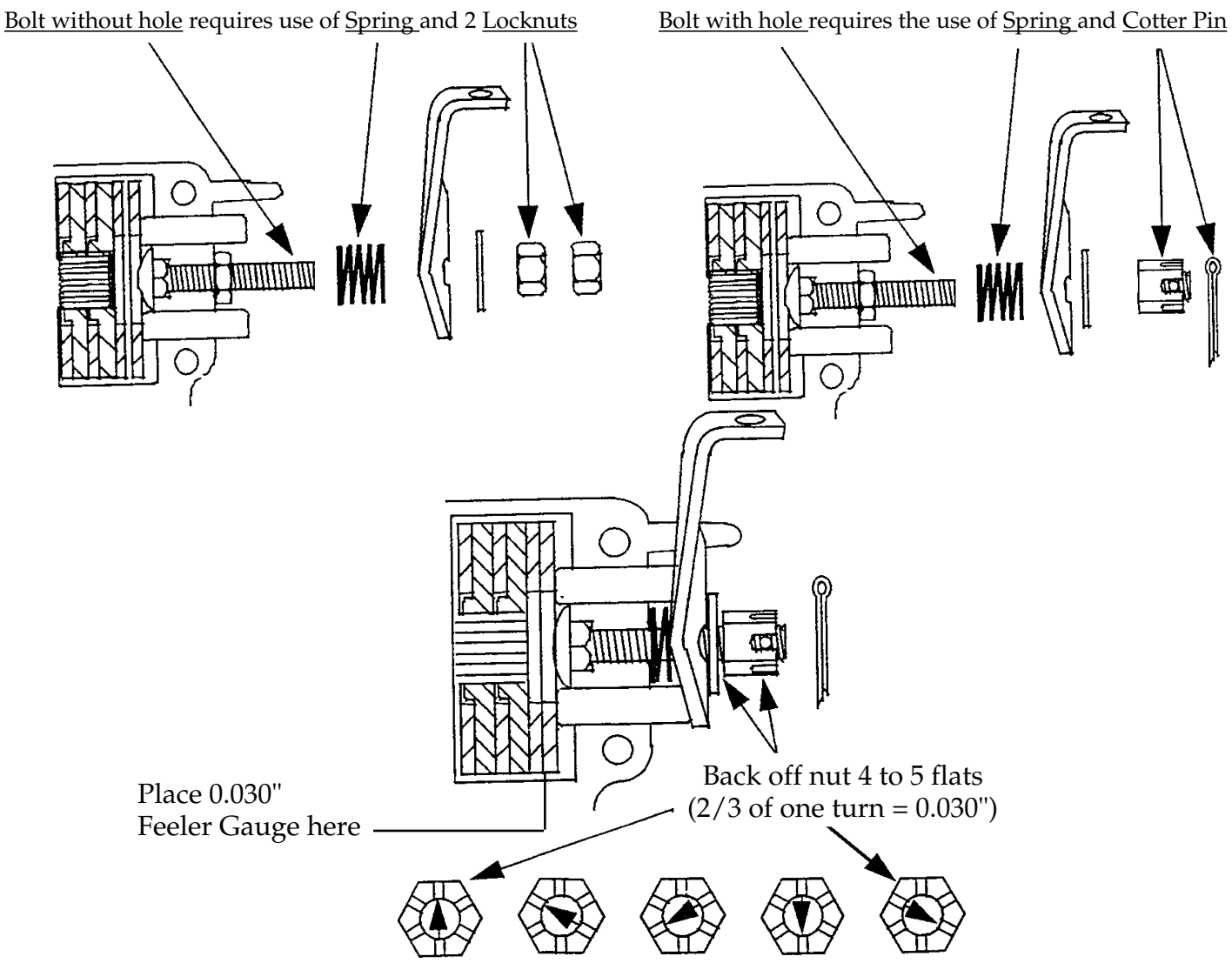
1. Check to see that the freeweel control is **"DISENGAGED"** position.
2. Make sure the motion drive belt is not worn , damaged or broken.
3. Vehicle should be on level ground before performing adjustments.
4. Verify that square axle key are installed in each wheel hub.
5. Was air trapped in hydro transaxle during shipment? **(PURGE TRANSAXLE.)**
6. Adjust the neutral position. Make sure shift lever linkage is tight.
7. Does hydro transaxle have enough oil ? Check oil level and add if needed..
8. Check the parking brake setting.

Set Parking Brake :

1. Adjust the nut onto brake bolt until tight or until the brake arm will not move.

CAUTION! do not over tighten the nut or damage may occur to the brake assembly.

2. Back nut off 2/3 turn (4 to 5 flats); place a 0.030" feeler gauge between the two outer discs to set air gap.
3. Reinstall the cotter pin or second new nylon insert locking nut to **lock the brake setting.**



3 HYDRO TRANSAXLES - TROUBLESHOOTING

SYMPTOM: TRANSAXLE NOISY

Note: The average Hydro-transaxle has a different sound level.

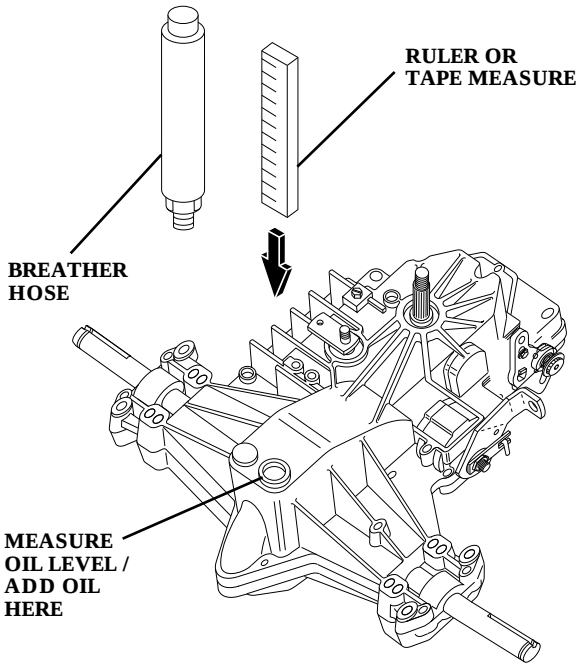
1. Check oil level as previously described, using a ruler for LT tractor and oil level port for GT.
2. Check cooling fan (if applicable) for obstruction and/or broken fins, if fan blade is broken, replace, to keep the transaxle running at optimum performance keep the area clean. It's recommended to use air to clean off debris. Although, using a garden hose (low pressure) with water is acceptable as long as the transaxle is completely cooled down, for example clean with water before the customer cuts the grass or after, as long as the tractor has sufficient time to cool down.
3. Check brake setting to ensure that it has the proper clearance and that the puck is not giving resistance during freewheel. To check brake clearance; place a feeler gauge between the two outer discs, if the clearance is out of range (.020"-.040" for LT tractor and .020"-.025" for GT tractors), adjust the break retainer as needed to bring clearance into this range.
4. Check bypass valve linkage to insure that the bypass valve is fully opening and closing when the actuator is activated.
5. Verify axle key is in place and in one piece.

HYDRO TRANSAXLES - LT TROUBLESHOOTING

SYMPTOM: ENGINE RUNS, TRACTOR WON'T DRIVE

1. Check bypass actuator to insure that it is in the "Drive" position.
2. Check belt integrity and that there is not excessive slippage on the input pulley. If the belt is worn, dry rotten, broken, etc., replace and adjust.
3. Check oil level, the 310-0500 and 310-0750 holds approximately 80 ounces of 20W50 SG/CD grade oil (or in cold weather 15W50 Mobil One synthetic oil is recommended) To check oil level: remove vent hose and fitting. Put tape measure inside vent hole and measure oil level
On model 310-0500: the oil should be between 1.25" and 2.00" from top of housing.
On model 310-0650/0750: the oil should be between 1.00" and 1.75" from top of housing.

To add oil, remove vent hose and fitting. Add oil until proper oil level for either type transaxle is reached. **Note:** If oil level is found low, find the cause of the problem, check the input seals, bypass seals, and axle key. If needed, perform the pressure test to find the leak.
4. If tractor still does not move, check shift linkage to be sure the shift lever is fully actuated.
5. Check brake and verify that the brake is adjusted properly and the tractor freewheels when the transaxle is in the transport position.
TO ADD OIL: Remove breather hose and fitting. Add oil until proper oil level for transaxle type is reached.



The motion control lever has been preset at the factory and adjustment should not be necessary.

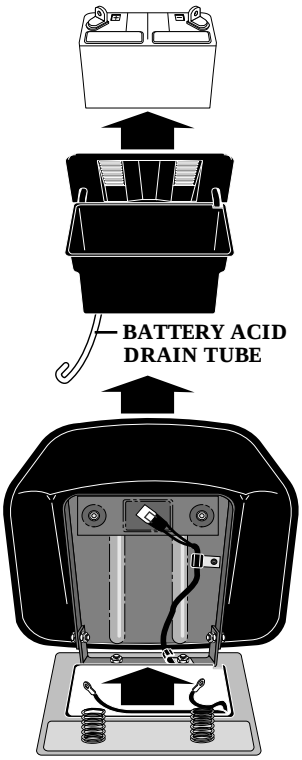
If for any reason the motion control lever will not hold its position while at a selected speed, it may be adjusted as follows:

- Park tractor on a level surface. Stop tractor by turning key to "OFF" ` position and engage parking brake.

NOTE: Transmission should not be warm when making this adjustment. Allow transmission to cool to airtemperature before making this adjustment.

To access the transmission adjustment, it will be necessary to remove the battery and the battery box from tractor.

- Raise seat and open battery box door. Disconnect BLACK battery cable first, then the RED cable.
- Remove battery and battery box from tractoras shown.

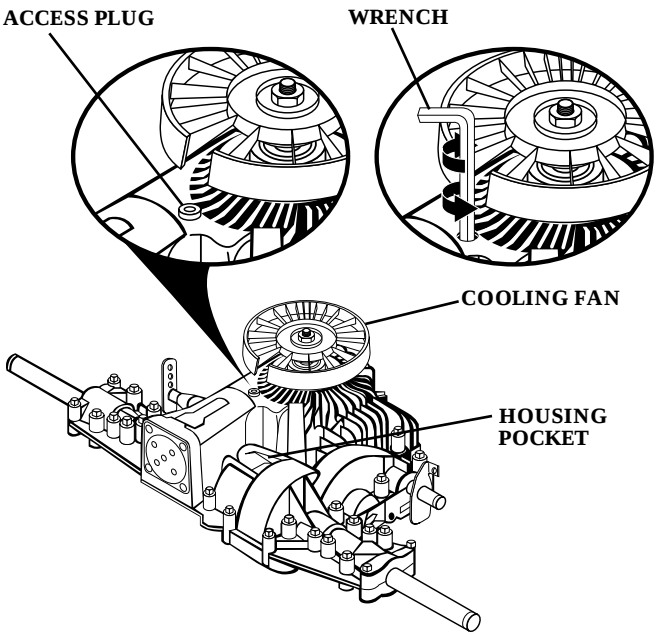


NOTE: When reinstalling battery box, ensure that battery acid drain tube is routed toward the rear and is clear of the cooling fan.

- Locate the access plug underthe cooling fan. This plug and surrounding area must be cleaned to prevent contamination of internal parts during this procedure. Before removing the plug, pack a cloth in the housing pocket to absorb excess oil.
- Using needle nose pliers, remove the access plug described above. When the plug is removed, a small quantity of oii will flow out of the transmission. This is normal and will not effect-transmission function.
- Insert a #30 torx or 5/32 alien wrench into the access hole and locate the adjustment screw. Adjust the screw clockwise 1/4 turn at a time to increase motion control effort. An effort of 15-18 Ibs. at the motion control lever knob is nommal.

NOTE: If for any reason the effort to move the motion control lever becomes too excessive, reverse the above procedure by turning the adjustment screw counterclockwise 1/4 turn.

- Clean the access plug and insert it into position using the torx or alien wrench.
- Clean spilled oil from transmission and reinstall battery box and battery into tractor. When connecting battery be sure to connect the RED bat tery cable first. Road test tractor after adjustment and repeat procedure if necessary.



SECTION 11. VST TROUBLESHOOTING

The information on the following pages has been provided to help understand the internal operation of the VST. Do not use this information to attempt any internal repairs. Tecumseh's current policy on hydrostatic transaxles that have internal failures is to replace the complete unit. This has not changed. However, Tecumseh would like to provide a failure checklist to assist in making an accurate evaluation of the complete tractor to eliminate any unnecessary replacements. Here is a list of items to check and corrective actions to take.

To properly test the unit for power loss.

1. Allow the unit to cool before trying the following steps.
2. Put the shift lever in a position that is 1/2 of the travel distance from neutral to forward.
3. Place the tractor on a 17 degree grade.
4. Drive the tractor up the grade (without the mower deck engaged). The loss of power experienced should be approximately 20%. This is considered normal. If the loss of power is approximately 50%, this would be considered excessive.
5. Bring the unit to neutral, shift into forward and note the response. Care should be taken to move the lever slowly to avoid an abrupt wheel lift.

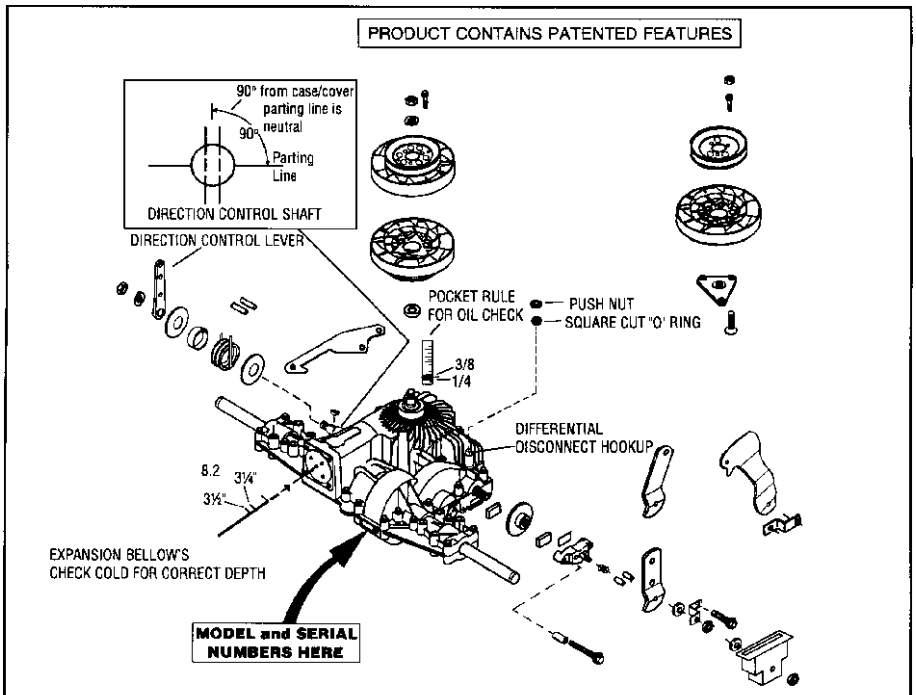
To detemmine if the problem is with the hydro unit, all external problem possibilities must be eliminated. Here are some potential problem areas.

1. Overheating: Heat can cause a breakdown in the viscosity of the oil which reduces the pressure used to move the motor. Remove any grass, debris, or dirt buildup on the transaxle cover and / or between the cooling fins and fan. Buildup of material will reduce the cooling efficiency.
2. Belt slippage: A belt that is worn, stretched, or the wrong belt (too large or wide) can cause belt slippage. This condition may have the same loss of power symptom as overheating. Typically, the unit which has a slipping belt will exhibit a pulsatina type motion of the mower. This can be verified visually by watching the beTt and pulley relationship. It the belt is slipping, the belt will chatter or jump on the pulley. If the belt is good, a smooth rotation will be seen. Replace the belt and inspect the pulley for damage.

3. Leakage: The VST and 1800 Series have two oil reservoirs which can be checked for diagnostic purposes. The first is the pump and motor expansion bellows, With a small diameter blunt or round nose probe, check the bellows depth through the center vent hole. Proper depth from the edge of that hole is 3-1/4 - 3-1/2 inches (8.25 - 8.9 cm).
The second chamber is for the output gears including the differential. FIRST make sure the tractor is level, then remove the drain/fill plug. NOTE: Some units that do not have differential disconnect will have two plugs. We recommend using only the primary plug. With a small pocket rule insert until you touch bottom of case. You can then remove it and check for 1/4 - 3/8 inches (6.5 - 9.5 mm) contact. This is full at its 8 oz. capacity of SAE EP 80W90 oil.

4. Low ground speed: If the linkage is not synchronized to absolute neutral, or the shift lever is not properly fastened to the tapered control shaft, full forward travel may not be achieved. This may cause a false reading and be misdiagnosed as a low power condition. This also could be caused by the brake not releasing.
To detemmine absolute neutral, the hole in the tapered control shaft must face straight up and down, at this point make sure the OEM linkage is in neutral. To properly fasten the control lever to the shaft, torque the nut to 25-35 ft. Ibs. (34 - 48.3 NM) of torque with the shaft and the lever in neutral.
When attaching the shifter arm to the shaft you must prevent any rotation during torquing. This can be done by placing a long 5/16 bolt in the hole as shown in Illustration. Hold the bolt until the tapers are locked and the nut torque is correct.
To make sure that the brake is not binding, drive the unit up a slight grade. Position the speed control lever into neutral. The unit should coast backwards. If the unit does not coast back slowly, the brake is not released from the brake disk. Adjust the brake linkage to release the brake completely when the foot pedal is released.

5. Hard to shift: Typically hard to shift symptoms are not caused by the hydrostatic unit. The shift arm should move with relative ease. Approximately 40-50 inch Ibs. (4.48 - 5.6 NM) at the transaxle for foot pedal units or 150-200 inch Ibs. (16.8 - 22.4 NM) for hand operated units. This varies depending on the type of linkage. Binding may occur in the linkage connections due to rust or moisture. Lubricating these connections and checking for bent or damaged parts should resolve hard shifting.



NOTE: The above illustration is of a foot control unit with differential disconnect. Consult your parts list by model and specification number to get correct parts for your unit. ALL PARTS SHOWN MAY NOT BE ON YOUR UNIT.

3

FRICTION PACK KIT INSTALLATION 71/143 799026

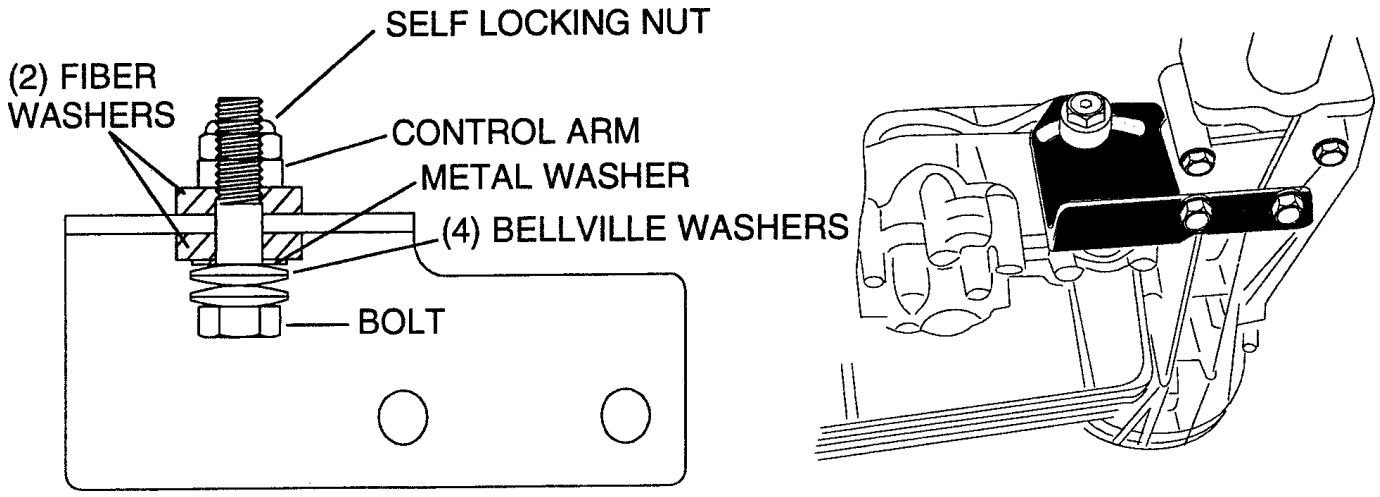
To install the friction pack kit first take these precautions. 1) Park the mower on a level surface. 2) Make sure the parking brake has been set.

Raise the rear of the mower off of the ground and rest it on a stable support. Block the front wheels to prevent the mower from rolling off the support. Remove the left rear wheel (in the operators position) to expose the shifting linkage. Disconnect the turnbuckle shifting linkage at the pivot point of the control arm and turn the control arm counter clockwise until it stops. To help accomplish this it may be necessary to place a 5/16 pin punch in the hole in the shifter shaft just behind the control arm. Putting the punch in from the bottom side will provide increased leverage.

To mount the kit on the transaxle, angle the bracket so that it will clear the opening in the bracket for the nut on the shifter shaft. Align the two bracket mounting holes up with the axle housing thru holes. Fasten the bracket to the housing securing it with the two (2) 3/8" diameter self threading bolts included in your kit.

Place the four (4) belleville washers on the remaining bolt so that the cupped sides face each other, followed by a metal washer and a fiber washer. Place this assembly through the arced slot in the bracket and the second fiber washer and the control arm securing the entire assembly with the compression nut. Return the control arm to the neutral position and connect the shifting linkage.

Adjust the friction kit by using a torque wrench (beam style or needle style) on the shifter shaft nut. The torque required to move the shaft should be between 150 - 200 inch pounds. If the shaft moves at less then this setting tighten the nut on the friction kit accordingly or so that the shift lever stays in position when driving up an incline. CAUTION: For safety reasons never operate equipment on inclines greater then 15 deg rees .



HYDRO TRANSAXLES - ADJUSTMENT

TO ADJUST MOTION CONTROL LEVER

The motion control lever has been preset at the factory and adjustment should not be necessary.

If for any reason the motion control lever will not hold its position while at a selected speed, it may be adjusted at the friction pack located on the right side of transmission.

- Park tractor on level surface. Stop tractor by turning ignition key to "OFF" position, and engage parking brake.

LT (See Fig. 2):

•Adjust motion control lever by tightening adjustment locknut one half (1/2) turn.

GT (See Fig. 1):

•Place motion control lever in neutral (N) position.

•While holding locknut, loosen jam nut.

•Tighten locknut 1/4 turn.

•While holding locknut, tighten jam nut securely.

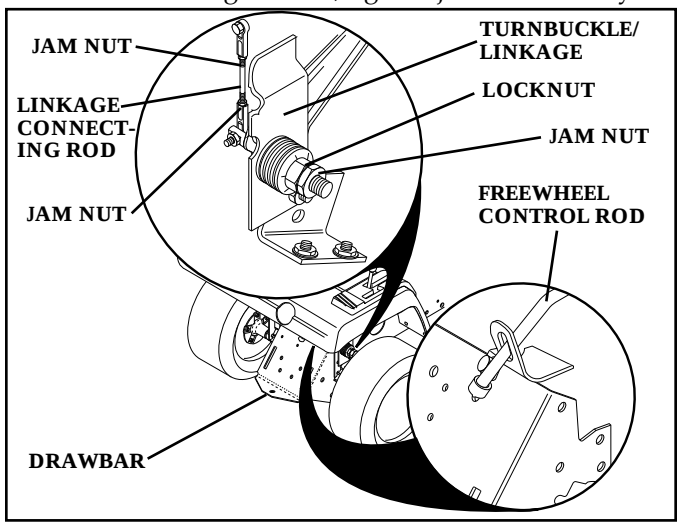


FIG. 1

NOTE: If for any reason the effort to move the motion control lever becomes too excessive, reverse the above adjustment procedure by loosening locknut 1/4 to 1/2 turn.

Road test tractor after adjustment and repeat procedure if necessary.

TO ADJUST NEUTRAL POSITION

The Neutral (N) position of the motion control lever has been preset at the factory and adjustment should not be necessary.

If your tractor tends to "creep" when the motion control lever is in the neutral (N) position, adjust the neutral lever position as follows.

LT (See Fig. 2):

•Sit on the tractor in the normal operators position. Start the engine and disengage the parking brake so that the foot pedal is in the full up position.

•Move the motion control lever until the tractor no longer moves forward or backwards. Stop the engine and remove the key.

•Loosen the jam nuts on balljoint shift linkage and twist connecting rod clockwise or counterclockwise until motion control lever falls into the neutral slot. Tighten jam nuts and retest.

GT (See Fig. 1):

•Place motion control lever in neutral position.

•Locate turnbuckle/linkage at top right corner of drawbar and loosen jam nuts.

•Place concrete block under drawbar to lift rear wheels off ground. Start engine and turn linkage connecting rod clockwise or counterclockwise until the rear tires stop turning.

•Stop the engine and remove the key. Tighten jam nuts and retest for creeping with fastest engine rpm from both forward and reverse.

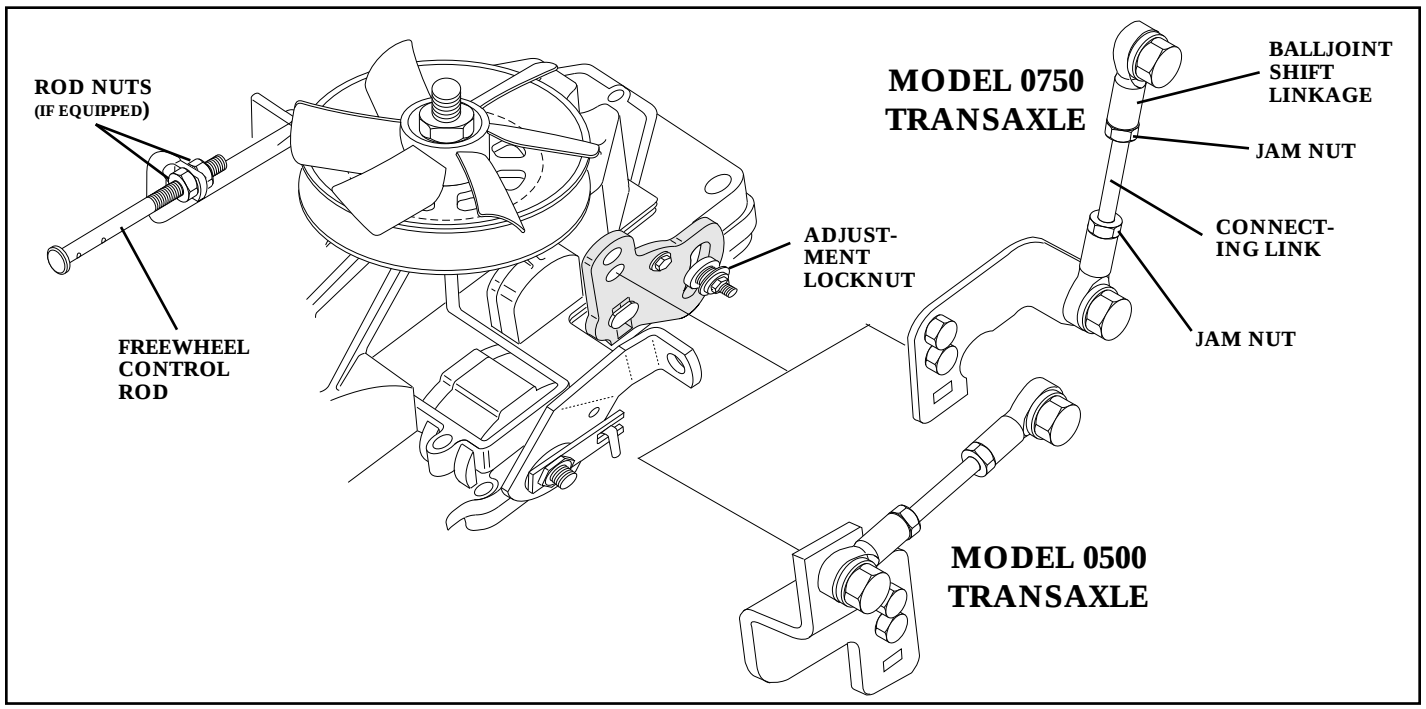


FIG. 2

3

NEUTRAL ADJUSTMENT FOR AUTOMATIC DRIVE CONTROL LEVER

1. Place the tractor on a smooth paved level surface.

2. Loosen Adjustment Bolt in front of the right rear wheel, and lightly tighten using a 1/2" wrench.

3. Start Engine and move Lever until tractor does not move forward or backward. Hold Control Lever in that position and do not move. Turn the engine off.

4. While holding the Control Lever to keep it from moving, loosen theAdjustment Bolt . Move the Control Lever to the position indicated for Neutral on the fender. Tighten Adjustment Bolt securely.

FINE TUNE THE NEUTRAL ADJUSTMENT ON AUTOMATIC DRIVE

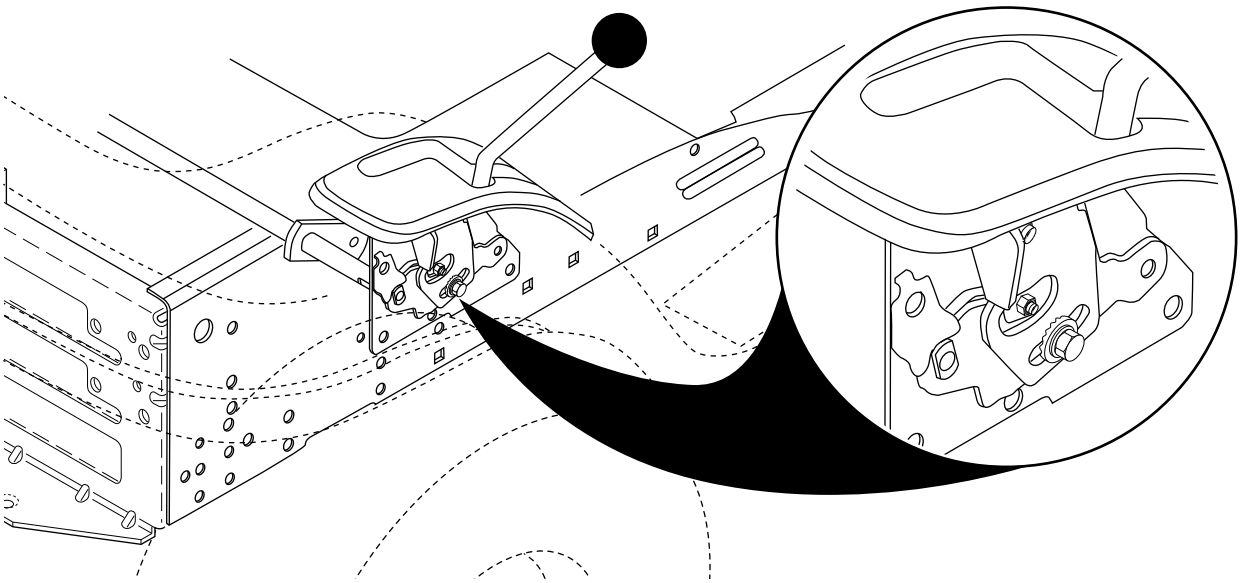
1. Place the tractor on a smooth paved level surface.

2. Loosen the Adjustment Bolt using a 1/2" wrench. If the tractor is creeping forward, move the Control Lever forward 1/4 to 1/2 inch. Move the Control Lever rearward 1/4 to 1/2 inch if the tractor is creeping backwards. Tighten the Adjustment Bolt securely.

3. Start engine and test from both forward and reverse.

4. If tractor still creeps, repeat step # 2 until satisfied.

NOTE: If additional clearance is needed to get to adjustment bolt, move mower deck height to the lowest position.



NEUTRAL ADJUSTMENT FOR GEAR DRIVE SHIFT LEVER

1. Place the tractor on a level surface.

2. With the engine off and the parking brake disengaged, push the tractor from behind while shifting gears.When the tractor rear wheels move freely, the transaxle is in neutral. Leave in this position.

3. Loosen Adjustment Bolt in front of the right rear wheel,using a 1/2" wrench. Position the Lever in the position indicated for Neutral.Tighten Adjustment Bolt securely.

NOTE: If additional clearance is needed to get to adjustment bolt, move mower deck height to the lowest position.

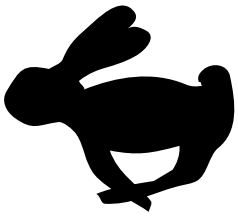
4 TRACTOR MOWER DECK LEVELING PROCEDURE COMMENTS FOR QUALITY OF CUT

PROPER ADJUSTMENTS TO MOWER DECK LEVELNESS AND ENGINE RPM ARE IMPORTANT FOR OPTIMUM MOWER PERFORMANCE AND QUALITY OF CUT.
(WATCH OUR NEW DESK LEVELING VIDEO PART# 168695)

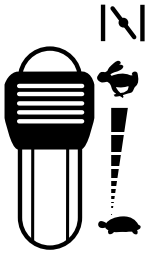
*Customers should be instructed to always mow at full engine speed. There is a detent in the throttle control that marks this position. The throttle and carburetor should be properly adjusted to provide maximum allowable full engine speed when mowing. The correct allowable full engine speed setting are as follows.

On tractor 1992 and newer **with a vented deck,** 3350 RPM + or - 50 RPM.

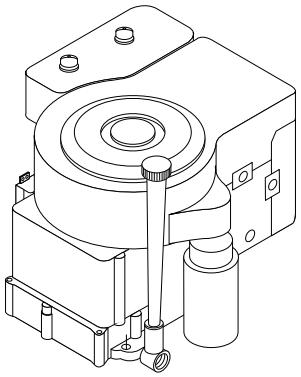
On tractor 1991 and older with a standard deck, 3550 RPM + or - 50 RPM.



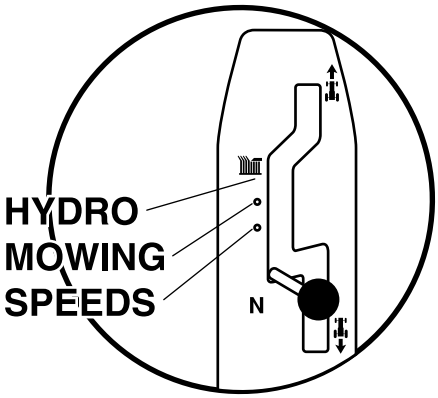
FAST

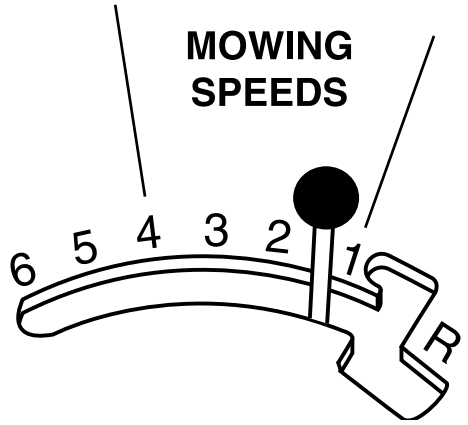


FULL ENGINE SPEED IN DETENT



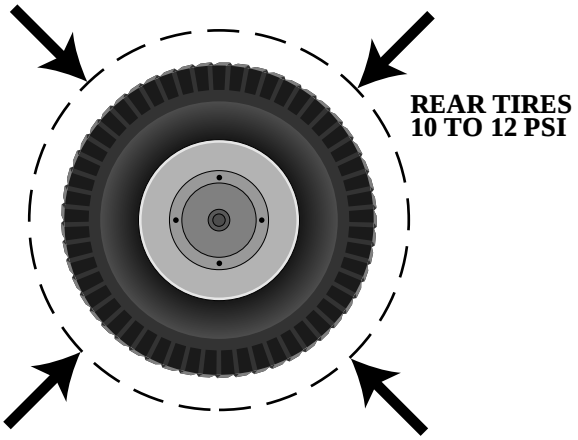
* Ground speed: Customer should select proper travel speed for mowing conditions and shift transaxle down to a slower ground speed if necessary to achieve a desired quality of cut.



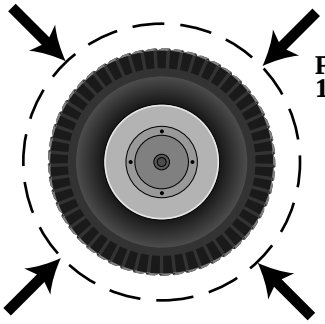


* Be sure tires are properly inflated before making any adjustment to mower. Inflate tires to operating PSI shown on sidewall of tires or, to specification in product owners manual.

CHECK TIRE PRESSURE

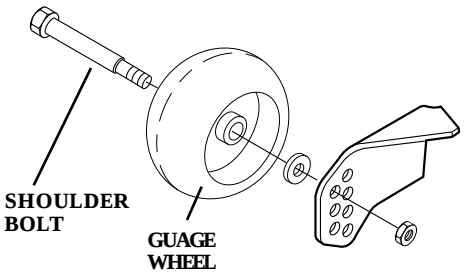


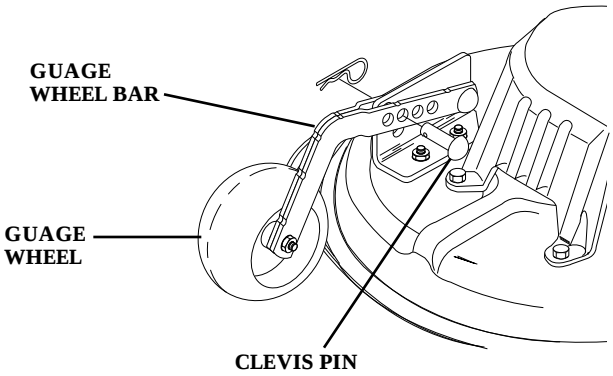
REAR TIRES 10 TO 12 PSI



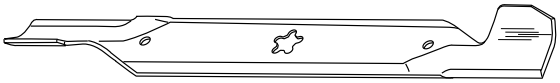
FRONT TIRES 14 PSI

* Gauge wheels should be assembled so they are slightly off the ground when mowing. Gauge wheel should not be rolling on the ground continuously when mowing on level ground. Gauge wheels adjusted too low will cause excessive rake.



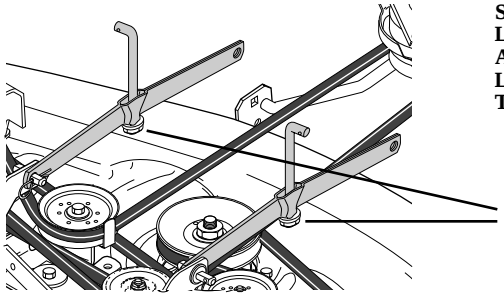


* Replace worn or bent blades. Check blades to be sure they are straight and have a sharp edge.



* If bottom edge of mower deck is worn or damaged, making measurements difficult, make all adjustments and measurements at the tip of the blades. Be sure blades tips are positioned appropriately for each adjustment check (towards outside for side-to-side check and front-to-back when checking rake).

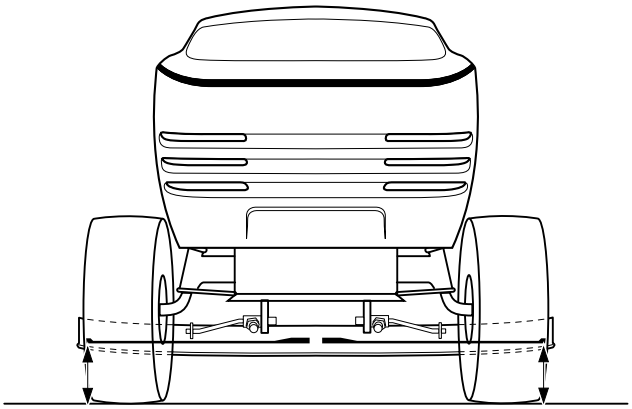
* Mower should be level side-to-side or within 1/8" of each other and have a slight rake angle front-to-back 1/8" to 1/2" lower in the front than in the rear, optimum setting at 1/4". Make mower adjustment in the high cut position.



NOTE: DECK SHOULD NOT GO LOWER THAN 1 1/2" AT BLADE TIPS IN LOW CUT POSITION.

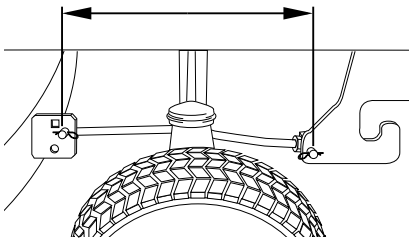
ADJUST THESE NUTS FOR SIDE-TO-SIDE LEVEL OF DECK.

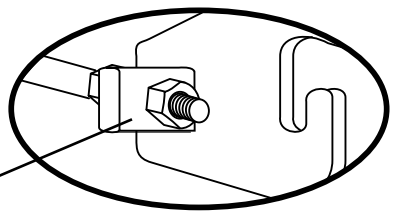
LEVEL DECK SIDE-TO-SIDE



SIDE-TO-SIDE SHOULD BE SET LEVEL OR WITHIN 1/8" OF EACH OTHER.

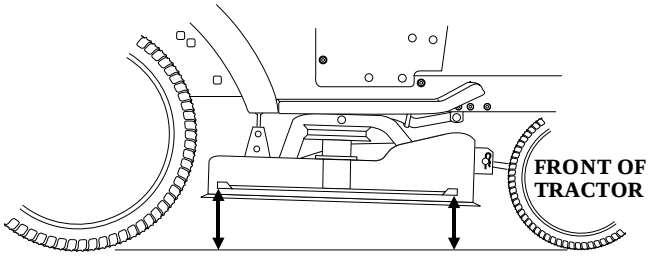
BOTH FRONT LINKS MUST BE EQUAL IN LENGTH.





- **ADJUSTING LINKS TO SHORTER LENGTH REDUCES DECK RAKE.**
- **ADJUSTING LINKS TO LONGER LENGTH INCREASES DECK RAKE.**

SLIGHT RAKE ANGLE FRONT-TO-BACK



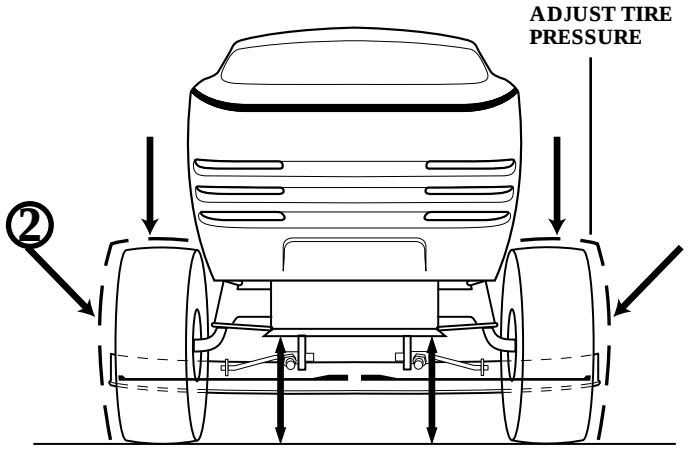
SET RAKE AT 1/8" TO 1/2" WITH OPTIMUM SETTING AT 1/4". NOTE: EXCESSIVE DECK RAKE MAY CAUSE PREMATURE BELT FAILURE. ALWAYS CHECK DECK RAKE WHEN REPLACING THE MOWER DRIVE BELT OR WHEN LEVELING THE DECK.

4 DIFFICULT TO LEVEL MOWER DECKS.

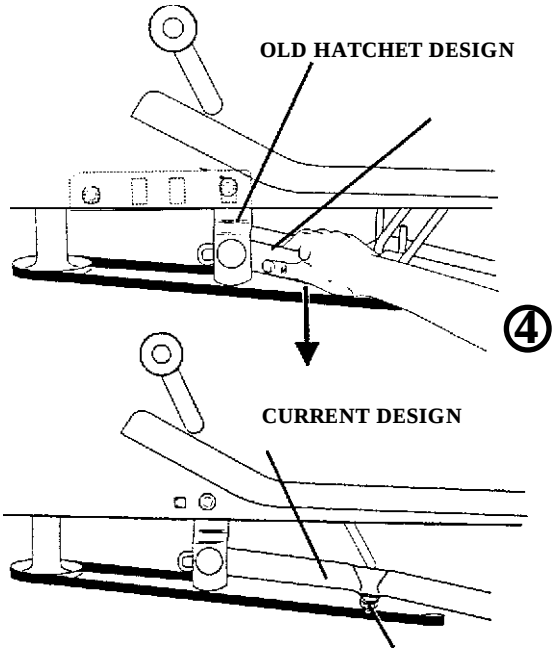
1. Verify tractor frame is level by measuring the distance from frame to the ground on level flat surface. Frame should measure the same or be within 1/8" of each other. If frame measures more than 1/8" try the following.

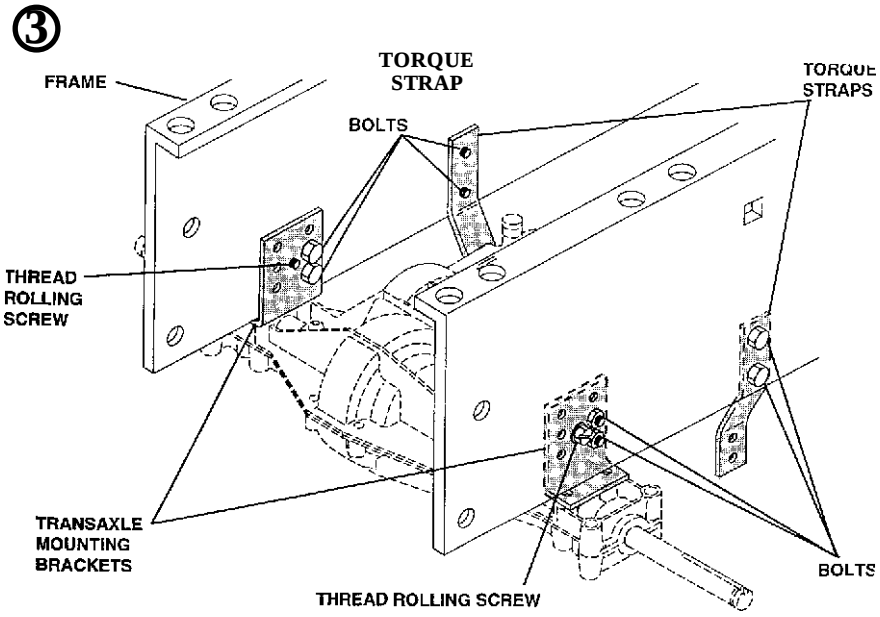
2. Reduce tire pressure to correct PSI rating on tires. 14 lb front, 10 to 12 lb rear.

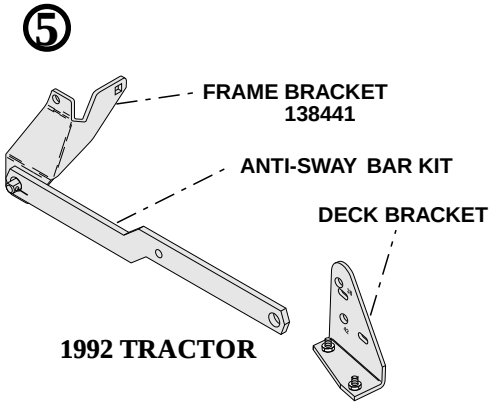
3. Level the tractor frame: Loosen (do not remove) the thread rolling screws and the two bolts on each "L" shaped transaxle mounting bracket where the bracket mounts to the tractor frame. Loosen (do not remove) the two bolts on each torque strap where torque strap mounts to the tractor frame. Lift the rear of the tractor up and down until tractor sits level. Retighten thread rolling screws and all bolts previously loosened.



CHECK LEVEL OF TRACTOR FRAME. FRAME SHOULD MEASURE SAME OR BE WITHIN 1/8" OF EACH OTHER.







LEVEL THE TRACTOR FRAME

4. Lawn tractor built 1992 and 1993 with the old style hatchet design suspension system can make side-to-side leveling difficult. Suspension kit #152287 (71/917) can be installed to make side-to-side leveling adjustment easier by turning two adjusting nuts.

5. 38" and 42" mower decks built in 1992 can sway side-to-side when cutting. This can be corrected by installing Anti-Sway kit #138441 (71/917).

WHAT TO REMEMBER WHEN REPLACING A BELT

Any time you are replacing a broken belt, try to determine the root cause of the belt failure. Failure to determine the root cause of the belt failure and correcting it, may cause repeated service calls.

* Are you installing the correct belt number for the model you are working on ?

* Is there grass build up, sticks, or trash on top of the mower deck that is causing the belt to jump off the pulley or break? Instruct the customer to keep the deck top free from build up of debris.

* Are the Mandrel or Idler pulleys Damaged or Worn? Inspect the Mandrel pulleys to make sure the pulley grooves are not bent or damaged. Inspect all Idler pulleys to be sure they are not damaged or the idler bearings are not bad or frozen up and need to be replaced.

* The mower drive belt is stretched and slipping when mowing. Each deck has an adjust trunion on the mower deck engagement lever that can be adjusted to extend the belt life on a stretched belt.

* Is the Mower Deck set with excessive deck rake that is causing short mower belt life?. Excessive Deck rake on a mower will cause the belt to run at much higher than normal belt angles, which will cause the belt to wear out or fail prematurely. All Decks should have a slight rake angle front-to-back 1/8" to 1/2" lower at the front blade tip than at the rear of the blade, with an optimum or best setting at 1/4" rake.

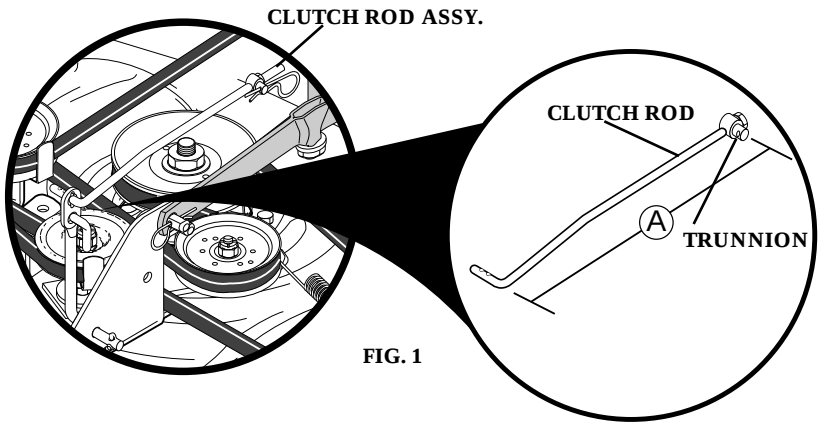
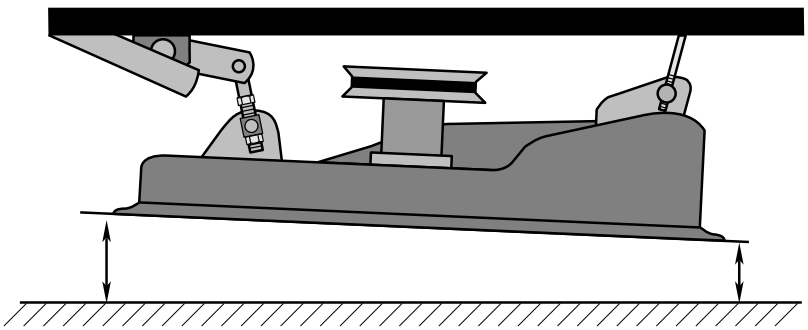


FIG. 1

To loosen a tight belt turn the clutch rod trunion in clockwise.

To tighten a loose belt, turn the clutch rod trunion out counter clockwise.

(A) Clutch Rod Length
38" clutch rod 10.00"
42" clutch rod 10.40"
46" clutch rod 9.38"



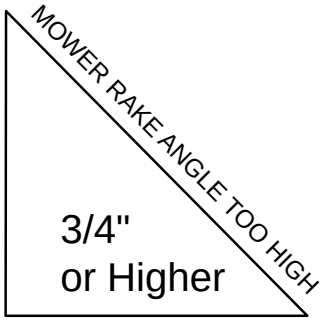
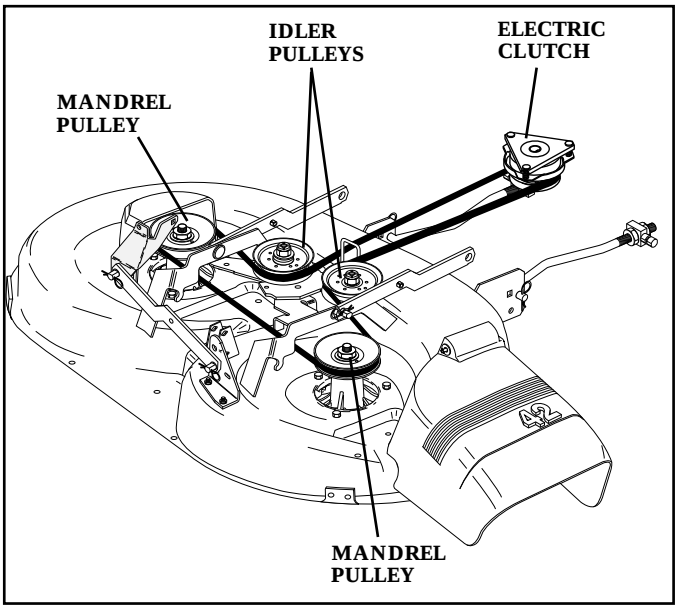
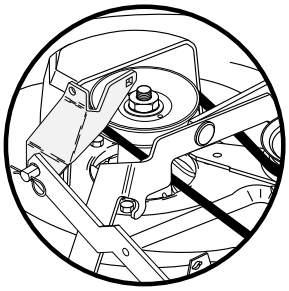


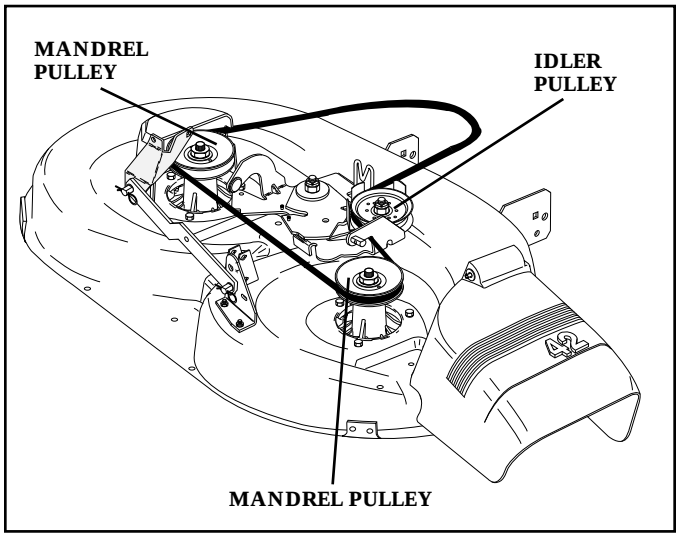
FIG. 2

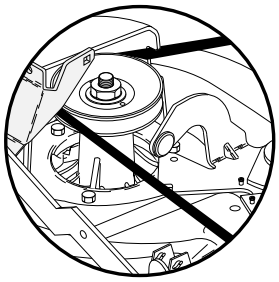
4



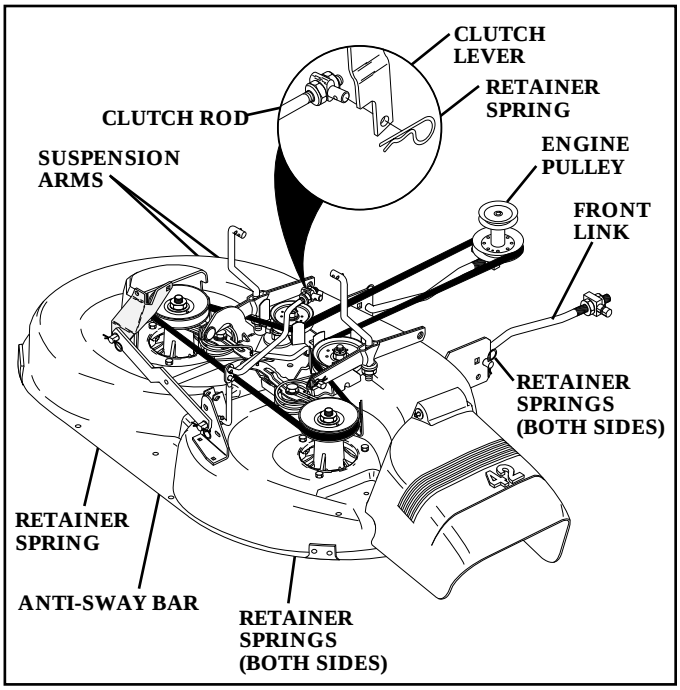


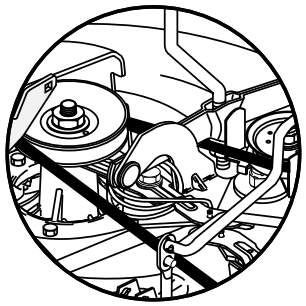
42" mower deck 1992 TO 1993
OLD STYLE ARCH SUSPENSION
TEE PATH BELT ROUTE WITH
TWO IDLER PULLEY. USE DECK
BELT 71/917 #130969
SIZE 1/2 X 11/32 X 92.41





42" mower deck 1994 NEW STYLE SUSPEN-
SION TRI-PATH BELT ROUTE WITH ONLY
ONE IDLER PULLEY. USE DECK BELT
71/917 #140067
SIZE 1/2 X 11/32 X 86.62



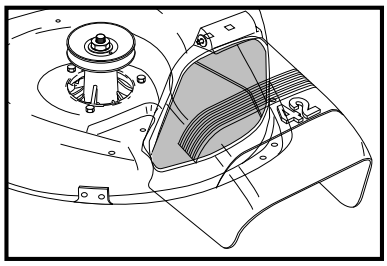


42" mower deck 1995 to 1998 NEW STYLE
SUSPENSION TEE PATH BELT ROUTE WITH
TWO IDLER PULLEY. USE DECK BELT
71/917 #144200
SIZE 1/2 X 3/8 X 88.38

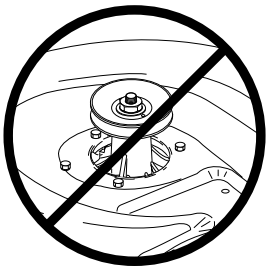
TRACTOR WITH 42" DECK BUILT FROM
1992 THRU 1994, THAT REQUIRE THE DECK
HOUSING TO BE REPLACED, WILL BE
UPDATED WITH OUR CURRENT 42" BELT
#144200, WHICH IS SUPPLIED IN THE
HOUSING KIT.

. Be sure ALL safety devices, belt guards, mower deflector shields, mower mandrel guards, the Operator Presence System, electrical harnesses and interlock switches are in place and functional when you are done working on the customers product. Parts which are worn, modified, or damaged should be repaired; or the product should be made non-functional until repairs are completed.

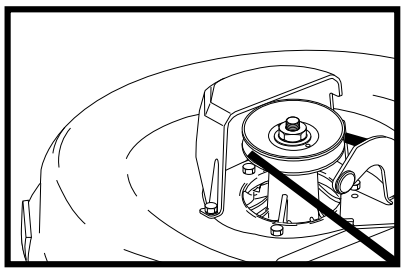
CAUTION: Do not allow the customer to operate the mower with the safety discharge guard removed.



Always mow or mulch grass with the discharge guard attached to the mower deck.



CAUTION: Do not allow the customer to operate a mower with any Mandrel safety guards removed.



Always mow grass with all safety guards required installed on the mower deck.

Primary V-Belt Kit for 46” Deck With Electric Clutch
Kit #166109

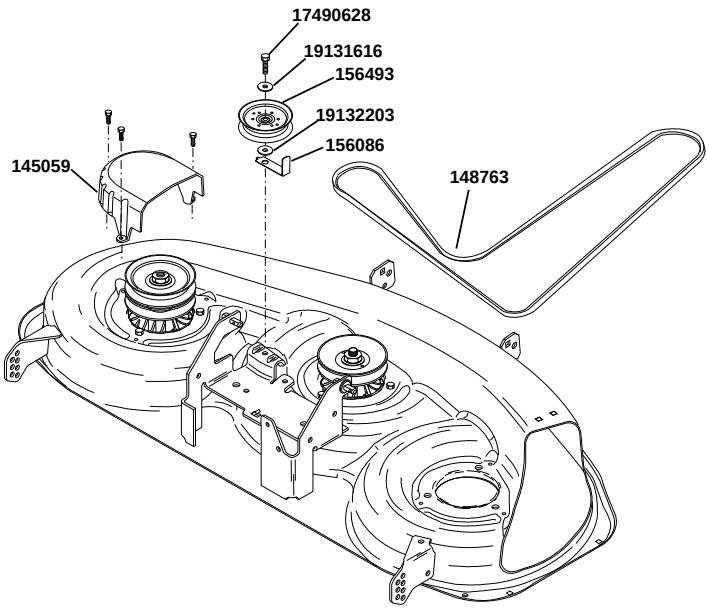
1. Remove the LH Deck Mandrel Cover, 145059 and the current Primary Mower V-Belt, 139573 from the deck. Discard the v-belt.

2. Remove the primary Drive Idler Pulley, 156493 and the Threadroll Screw, 17490628.

3. Install the Spacer Washer, 19132203, between the Primary Drive Idler Pulley, 156493, and the Idler Belt Keeper, 156086. Hold belt keeper in place as Threadroll Screw, 17490628 is tightened to ensure correct orientation of the belt keeper.

4. Route the new Primary Mower V-Belt, 148763, in the same path as the old Primary Mower V-Belt, 139573.

5. Install the LH Deck Mandrel Cover, 145059 back on the deck with the original hardware. Installation is complete.



NOTE: 46” manual engagement mower deck uses primary belt #158818.

4 WEAR-RESISTANT LINERS FOR 38", 42", AND 46" MOWER DECKS

* Wear resistant deck liners have been developed for those customers who are using their mower deck under harsh, sandy conditions.

* Wear resistant deck liners help:
  * Make the mower deck housing more resistant to sand erosion.
  * Reduce buildup of materials that stick to the under side of the mower deck.

38" standard and QC decks built from 1985 to 1997 - use deck liner kit #**151881** (71/917).
42" QC decks built from 1992 to 1997 - use deck liner kit #**151882** (71/917).
46" QC decks use deck liner kit #**157463** (71/917).

1. Remove deck from tractor.
2. Remove blades.
3. Thoroughly clean underside of deck using soap and water.
4. Allow deck to dry.
5. Using liner as a template drill 12 ea. 7/32 inch diameter holes in deck.
6. Remove liner and clean it and deck of any drill shavings.
7. Apply beads of sealant on liner 1/4 inch outside of both circle cutouts, (if deck has teardrop stripper instead of round, cut out section indicated on liner using scissors or tin snips, then apply sealant to this new shape 1/4 inch all around). See FIG. 1.
8. Press liner firmly in deck, ensuring a good seal and that the drilled holes are lined up.
9. Turn deck on its side and install steel rivets and washers provided using a standard rivet gun. See FIG. 2.
10. Apply a bead of sealant all around the liner outer lip per illustration. See FIG 3.
11. Reinstall blades.
12. Reinstall deck.
13. After installing liner instruct customer to wait 2 hours for the sealant to completely dry before use.

PATENT PENDING

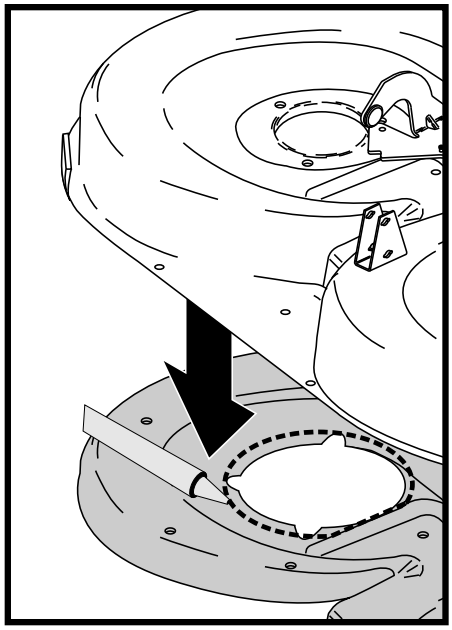


FIG. 1

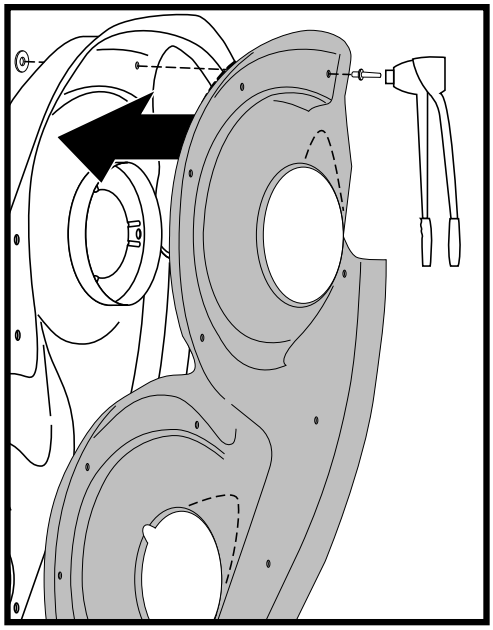


FIG. 2

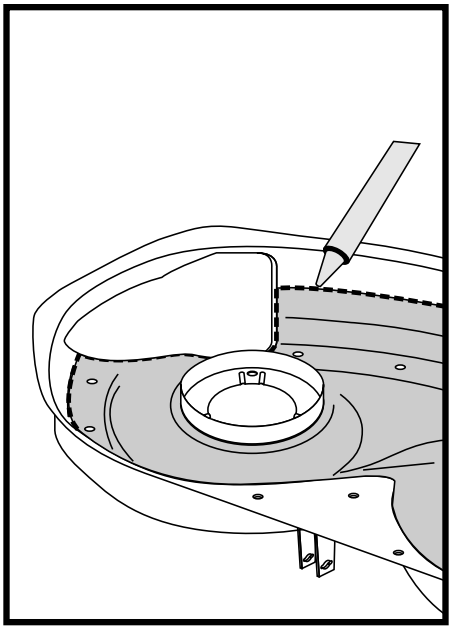


FIG. 3

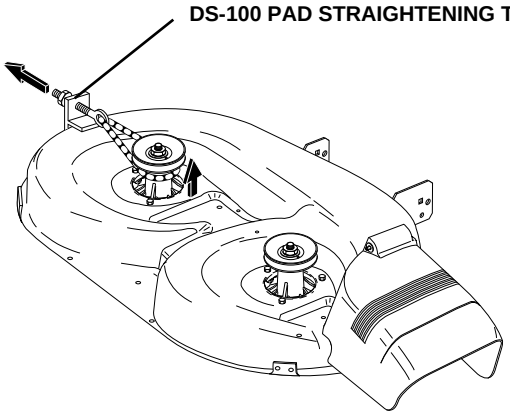
42" DECK MANDREL PAD REINFORCEMENT RING

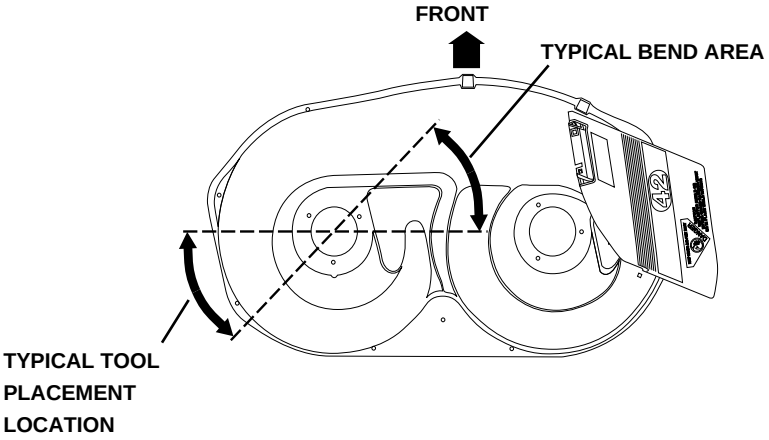
KIT NO. 151786

Before installing this mandrel pad reinforcement ring, the mandrel pad should be checked to see if it is bent. NOTE: Blades must be checked for straightness before checking to see if the mandrel pad is bent. Straighten or replace bent blades. To check for bent mandrel pad, rotate the blade tips around to check all four blade tips at the center of the deck. There should be no more than 1/8" difference between the tips. If there is more than 1/8" difference, check to see if the left hand mandrel pad is bent inward toward the center of the deck. If housing pad is bent, you should use the deck straightening tool DS-100 to straighten the housing pad.

How to use the mower housing mandrel pad straightening tool Part Number DS-100 (92/150).

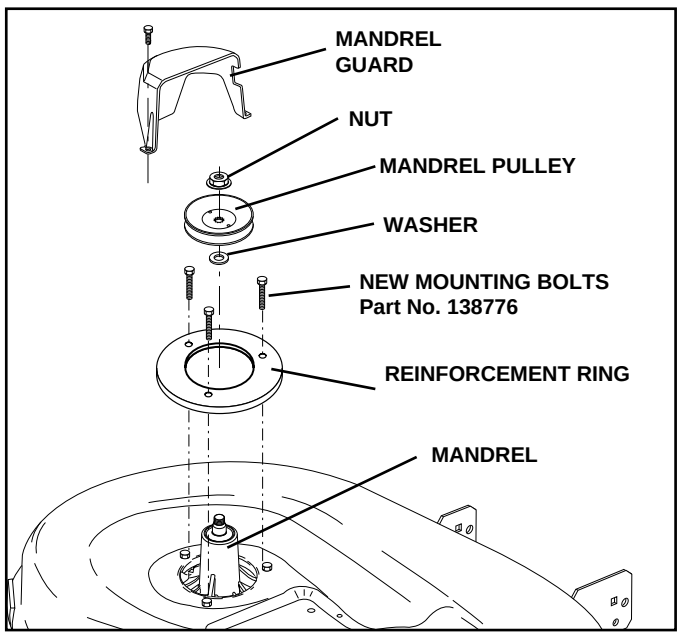
- Before attempting to use this tool, be sure the mower blades are straight.
- Note the direction that the housing mandrel pad bent when the mower blade hit an object and line up the straightening tool to pull back in the opposite direction. The deck will most likely be bent in the direction that the belt was pulling, toward the idler pulley, when the blade hit something and came to sudden stop.
- Wrap the chain around the mandrel housing shaft and fasten them together.
- Turn the nut on the eyebolt and watch the mandrel and blade move until the blades are even.
- It may be necessary to pull the mandrel pad past level to compensate for any spring back.
- Be careful not to pull the mandrel pad too far past level.
- The mandrel pad reinforcement ring should be installed to help prevent future bending.





To Install Mandrel Pad Reinforcement Ring

- Remove mandrel guard.
- Remove belt from mandrel pulley.
- Remove mandrel pulley nut and pulley.
- Remove and discard the three (3) mandrel mounting bolts.
- Position reinforcement ring over mandrel pad and install new mounting bolts supplied with this kit. Tighten all bolts securely.
- Reinstall mandrel pulley and nut. Tighten securely to 55-65 ft. lbs. torque.
- Reinstall mandrel guard and V-belt around pulley.
- Make sure belt is in all pulley grooves and inside all belt keepers.



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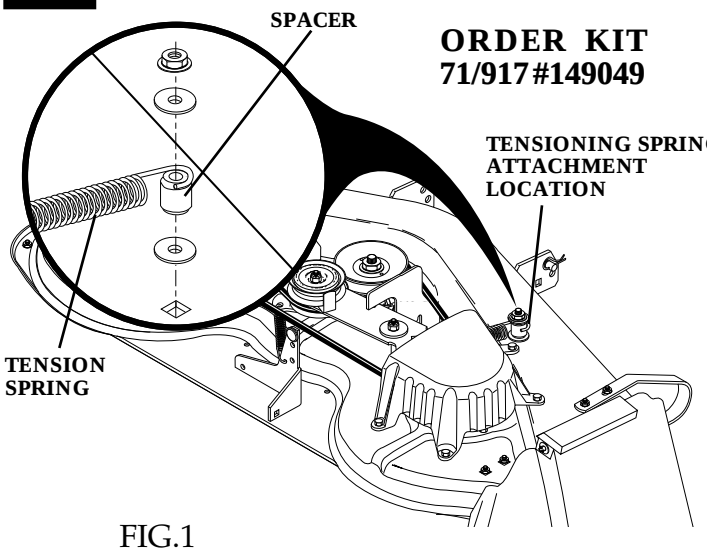


FIG.1

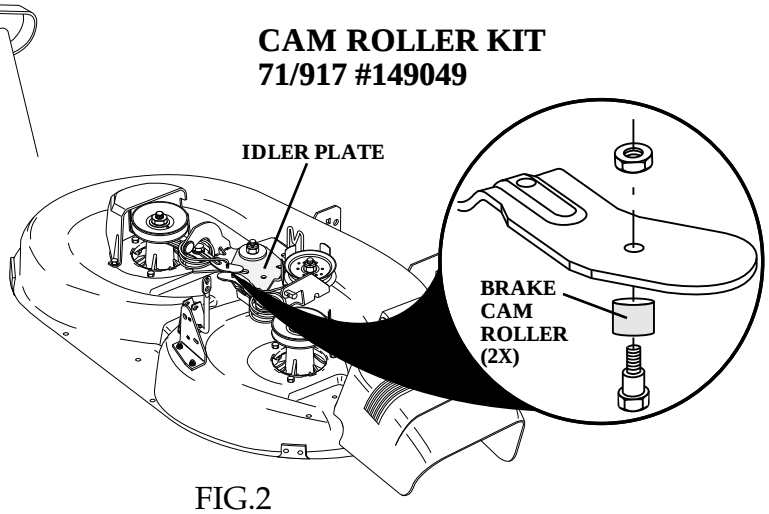


FIG.2

FIG. 1 - Tensioning spring on electric clutch 44"/50" decks break - Solution - order kit 71/917 #149049

FIG. 2 - Mower engagement lever binding and/or not completely disengaging on mechanical clutch 42" decks - Solution - install brake cam roller kit 71/917 #151785.

FIG. 3 - Idler suspension bracket breaks. Avoid replacing 44" & 50" mower housing order kit 71/917 #150021.

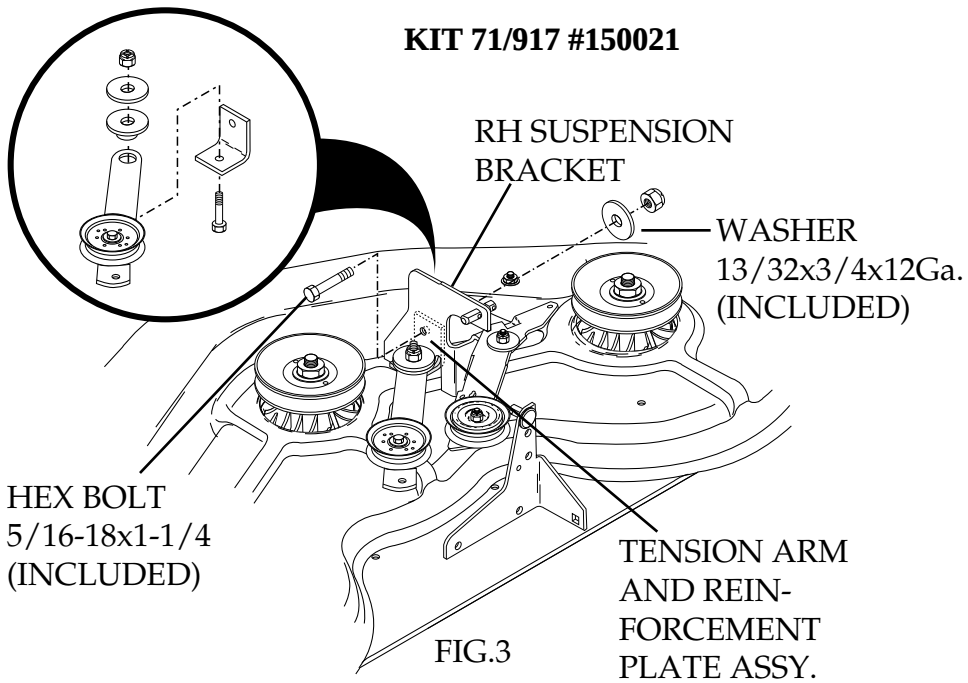


FIG.3

4

36" THRU 50" BLADE LISTING

BY RETAINER HOLE CHARACTERISTICS

PART NUMBER	DECK SIZE	CONSTRUC-TION	TYPE	DECK TYPE	HOLE(S)	BLADE BOLT(S)	RETAIL NUMBER
25645	36"	REGULAR	STANDARD		1	1	
138970	38"	PREMIUM	HI LIFT		STAR	1	**71-24651**
138497	38"	REGULAR	HI LIFT		STAR	1	**71-24671**
139774	38"	PREMIUM	MULCH		STAR	1	**71-24654**
134148	38"	REGULAR	MULCH		STAR	1	**71-24692**
121263X	38"	REGULAR	BAGGER		1	1	71-24673
25036	38"	REGULAR	STANDARD		1	1	71-24691
104418X	38"	REGULAR	CROSS/BAGGER		1	1	
25741	38"	REGULAR	STANDARD		3	2	
134998	38"	REGULAR	MULCH		1	1	
138971	42"	PREMIUM	HI LIFT		STAR	1	**71-24652**
138498	42"	REGULAR	HI LIFT		STAR	1	
139775	42"	PREMIUM	MULCH		STAR	1	**71-24655**
134149	42"	REGULAR	MULCH		STAR	1	**71-24676**
130652	44"	PREMIUM	STANDARD		STAR	1	71-24678
25034	44"	REGULAR	STANDARD		1	1	71-24677
25742	44"	REGULAR	STANDARD		3	2	
25321	42"	REGULAR	STANDARD		3	2	
25322	48"	REGULAR	STANDARD		3	2	
163819	46"	PREMIUM	MULCH		STAR	1	**71-24004**
157033	46"	PREMIUM	HI LIFT		STAR	1	**71-24006**
159705	46"	PREMIUM	BAHIA		STAR	1	
137380	50"	PREMIUM	STANDARD		STAR	1	71-24005
156468	50"	PREMIUM	STANDARD-THICK		STAR	1	
121798X	50"	REGULAR	STANDARD		1	1	
25743	50"	REGULAR	STANDARD		3	2	

BLADE PART NUMBERS WITHIN SHADED AREAS ARE INTERCHANGABLE.

CONSTRUCTION - BLADES INDICATED AS PREMIUM ARE MADE OF BETTER STEEL WITH A BETTER HEAT TREAT PROCESS TO RESIST SAND ABRASION

4 OPTIONAL TRACTOR MOWING BLADES THAT CAN BE USED IN PLACE OF ORIGINAL EQUIPPED BLADES TO IMPROVE QUALITY OF CUT UNDER DIFFERENT MOWING CONDITIONS.

HI LIFT BLADE

3 IN 1 MULCHING BLADE

38″ BLADE *** Part Number 134148 Original Equipped 38” Standard 3 in one mulch blade.**
1. Use 139774 Premium 3 in one mulching blade for better wear when mulching.
2. Use 138497 Standard Hi lift blade for better bagging , especially in wet conditions.
3. Use 138970 Premium Hi lift blade for better wear when bagging in heavy or wet condition.

42″ BLADE *** Part number 134149 Original Equipped 42” Standard 3 in one MULCH blade.**
1. Use 139775 Premium 3 in one Mulching for better wear when mulching.
2. Use 138498 Standard Hi lift blade for better bagging , especially in wet condition.
3. Use 138971 Premium Hi lift blade for better wear when bagging in heavy or wet condition.

46″ Blade *** Part Number 152443 Original Equipped 46” Premium 3 in one MULCHING blade.**
1. Use 157033 Premium Hi lift blade for better bagging , especially in wet conditions.
2. Use 159705 Bahia blade for better quality of cut on pasture type grassES OR Bahia GRASS.

50″ Blade *** Part number 137380 Original Equipped 50” Premium Hi lift blade.**
1. Use 156468 Premium Hi lift thick blade FOR BETTER WEAR.

Why use O.E.M. v-belts?

O.E.M. stands for ***Original Equipment Manufacturer.*** This is the company that made the product, in this case with the v-belt drive. O.E.M. v-belts are designed for the characteristics of the individual drive system. This means the v-belt will last longer and work properly. OEM v-belts should be used only in the drive for which the v-belt was designed.

Aftermarket V-belts fall into four categories: auto parts v-belts, fractional horsepower electric motor v-belts, lawn and garden v-belts, and agricultural replacement v-belts.

Auto parts V-belts are designed specifically for cars and trucks. These v-belts have polyester cords which are designed to shrink when the v-belt gets hot as it starts to slip. These v-belts have minimal covers and only a few cords. They are designed for low horsepower at high RPM with **NO** misalignment of pulleys.

Fractional Horsepower Electric Motor v-belts usually have designations like 4L or 3L. The 'L' is for light duty. Normally this v-belt is for one (1) horsepower or less and has polyester cords.

Lawn and Garden aftermarket replacement v-belts normally have kevlar cords and an aggressive v-belt cover. These v-belts may or may not give a good service life. The aggressive v-belt cover will usually grab in the drive system. This may result in front end lift off (wheelies) or may result in the drive pulley burning a section of the drive cover off. The aftermarket v-belts are normally found in one inch increments. If a v-belt is too long, it's life is shortened.
If the aftermarket v-belt is too short, the v-belt may not declutch when needed.

Agricultural aftermarket replacement v-belts are similar to the Lawn and Garden replacement v-belts but with larger cross section and are designed for larger pulley diameters.

F.H.P. uses only OEM v-belts which have the correct length, v-belt cover, and cord construction. The correct length maximizes the service life of the v-belt. The v-belt cover specified gives the slippage or traction required for the drive. The v-belt cords are appropriate for the force the v-belt will transfer and the shock loads expected.

How are OEM v-belts customized?

OEM v-belts are designed for that specific drive application. Many things can be changed.
The v-belt is a wedge. The power is transmitted through the angled sides of the v-belt.
The angle of the side walls is different on some OEM v-belts. This is done to achieve a desired drive characteristic. For this reason, it is not a good idea to use an OEM v-belt in a place other than its designated application.

There are different belt cords that can be used. The is cord selected for the load or force the v-belt will transfer in a specific application.

Kevlar is the strongest cord which will normally be a Yellow color. Kevlar is by weight stronger than steel and will not stretch. It is widely used in products that require strength and light weight such as bullet proof vests.

Fiberglass cord may be used where the maximum strength will not be needed but without stretch. The fiberglass cord will be a reddish brown on source 917 tractors.

Polyester filament cord may be used where there should be a moderate force. The Polyester filament is dyed and may be different colors from different manufacturers. On source 917 tractors and tillers, the Polyester filament is a cream/white color. Polyester filament cords will shrink if they get hot and can stretch. Polyester is a good shock absorber and may be used in applications where there are high shock loads and length stability is not critical.

Polyester staple cord or rayon cord are used in lesser quality v-belts and are often found in aftermarket belts. These cords are not used on source 917 tractors.

The v-belt cover must also be matched to the application.

A White Cover is specified for increased slippage or less front end lift off (wheelies). The White Cover v-belt is a cotton/polyester blend. If you find one of these v-belts failed with a hard black residue in the engine pulley, remove the residue or replace the pulley. Never replace a white cover v-belt with a black cover v-belt. CRT tillers must have a white cover v-belt to allow the v-belt drive to slip when the tines hit obstructions. On CRT tillers, the White Cover v-belt also eliminates tine creep and wheel creep.

A Salt & Pepper Cover is used when increased v-belt traction is needed.

A Black Cover is used on v-belt drives requiring even higher traction for mower drives and tillers. In operation this v-belt is black and sticky from rubber in the canvas v-belt cover. Most aftermarket v-belts have this type of cover.

A Cut Side V-belt with no cover may be used in some applications. A cut side v-belt is very aggressive engaging the pulley.

What to check when a v-belt is replaced.

There are many reasons that a v-belt fails. If a problem caused the failure of one v-belt, that problem must be corrected or the new v-belt will also fail in a short period of time.
Check v-belt alignment in the drive - add "pulley".
Check mower rake to determine proper mower v-belt alignment
Check for a bent mower deck causing improper alignment
Check for bent idler pulley brackets
Check for binding idler pulleys
Check mandrel shaft for bearing wear or binding
Check pulleys for wear and for deformation
Check v-belt guards and v-belt guides for worn spots against v-belt
Check for obstructions in mower decks (including grass buildup)

Check the failed v-belt for:
Wear patterns
Deformation
Cuts
Burned section
Oil saturation of v-belt cover
V-belt pulled apart

ILLUSTRATIONS of FAILED V-BELTS:

Excessive Oil causes V-belt Cover to swell Belt looks normal, but belt feels sticky or spongy. Replace v-belt and correct the reason for the oil problem.

V-belt Slippage
V-belt drive lacks proper tension or v-belt is worn out. The belt may show glazing on the sidewalls, excessive heat, fabric worn from belt sidewalls, or sidewall fabric polished smooth. Measure v-belt length and compare to dimension in newest accessories book.

Rupture
A ruptured belt is caused by an obstruction coming between the belt and the v-pulley putting excessive pressure on the cords. The cords will fracture inside the belt and the belt will separate. Unlike a shock load, the cords will be frayed and fuzzy on both ends.

V-belt Cut from installation by Prying v-belt over pulley Replace v-belt with correct installation procedure.

V-belt bottoms out in Pulley or Wear from rough Pulley V-belt worn away at the sides of the 'v'. Check pulley grove and v-belt width. Also check the v-belt pulleys or small rock wedged into the pulley. Worn v-belt sidewalls, v-belt rides at bottom of the pulley grove, replace v-belt and replace damaged 'V' pulley. The pulley groove should not be rough, rusty, or worn.

V-belt Abrasion from idler locked up The v-belt will be worn across the width of the belt. The material will be carbonized and show cracks.

5

Spin Burn section of v-belt
The V-belt is tightly held by pulleys and idler spring tension when engaged against the engine pulley. A mower in tall grass in a lowered position may experience a spin burn when the v-belt is engaged. Or check for a long v-belt. If a newly installed v-belt is too short, it may spin burn when disengaged.

V-belt turned in drive
The entire v-belt can be deformed when the belt turns in a drive. The belt cross section will appear deformed and instead of the belt being an oval it will be like a 'potato chip'. If this belt is reinstalled, it will quickly turn in the drive again.

Shock Load fracture of V-belt
The v-belt is 'broken' or pulled apart. It is not a smooth cut that you might get from a v-belt guide. The material fracture is rough and cords may be hanging out of one or both ends. The cords are well defined.

V-belt Rubbing on a v-belt guide
A v-belt worn on one side will usually be caused by a v-belt guard or too close to the v-belt. This can also be caused by a stick or rock in a v-belt guide. In some cases the fabric cover way be frayed.

Vibration in v-belt drive system
If there is vibration in the drive system, footpedal motion, or mower deck motion, check the v-pulleys. A pulley can cause vibration from a 'cam' action if it is deformed wider or narrower at one point. This can also happen if the sides of the pulley are separating from the hub of the pulley. It may not be noticeable unless the drive system is engaged with the engine off.

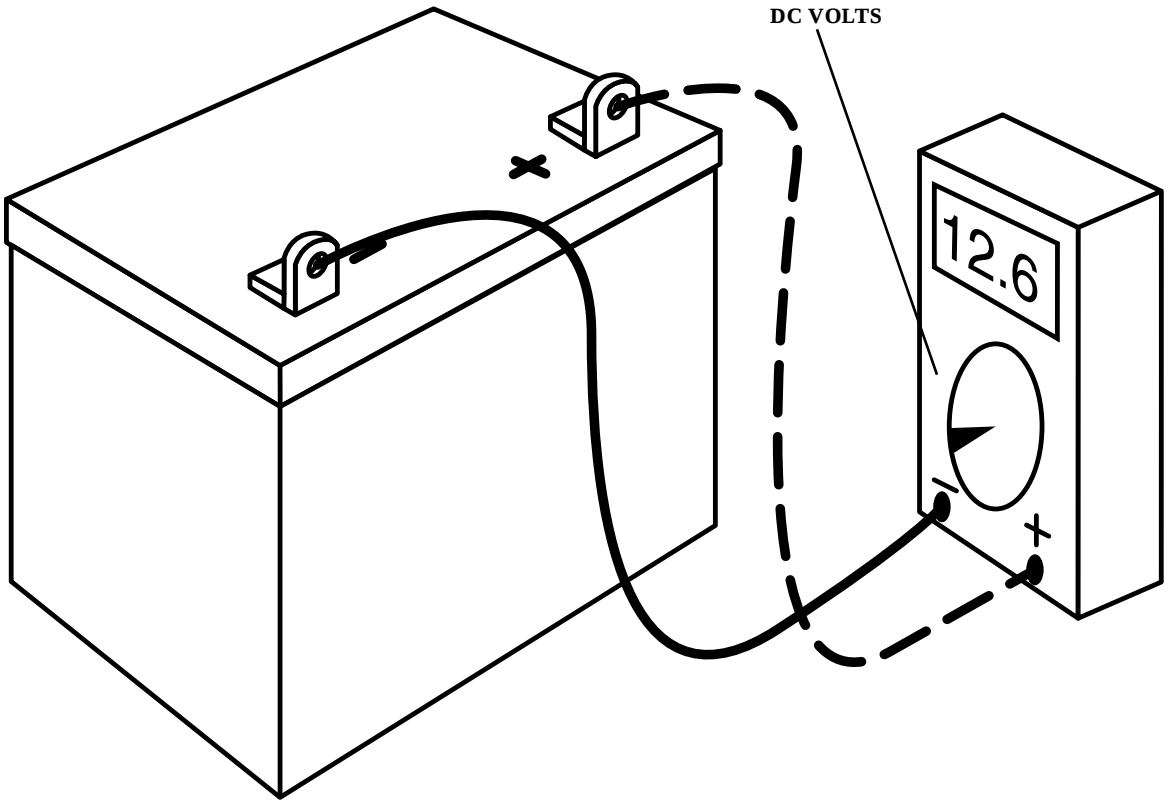
BATTERY SECTION ON
BATTERY FAILURE DETERMINATION AND TESTING

When a battery is replaced, we need to determine the reason the old battery failed. **The battery is often the symptom, not the problem. There will be additional service calls until the real problem is found.** And until then, batteries will be unnecessarily replaced. 50 percent of all replaced batteries can be charged, tested, and reused.

Reasons for battery replacement include: bad electrical ground, battery cable connections corroded, battery internal problem, engine hydraulic lock, improper operation of the engine compression release, electrical drain or short in wiring harness or component, engine charging system problem, engine RPM to slow during operation, or the battery was not fully charged when installed. **All storage batteries discharge when not being charged and the discharge rate increases as the temperature rises. Batteries in storage for more than 6 months will need charging before use.**

Open Circuit Voltage Test

The Open Circuit Voltage Test will tell the state of charge of the battery. A battery should have a state of charge of 50 percent (12.20 Volts) for accurate troubleshooting. Select the meter scale for DC Volts. Connect the negative meter lead to the negative battery terminal; and the positive lead to the positive battery terminal.



* If 11.7 Volts or less; extensive charging required to recycle this battery—replace battery.
* If 12.2 Volts or less, the battery charge is marginal, charge at 6 to 10 amps or exchange the battery and save for recycling.
* If 12.2 to 12.5 Volts, battery is good, additional charge helps
* If 12.6 Volts or above the battery is fully charged

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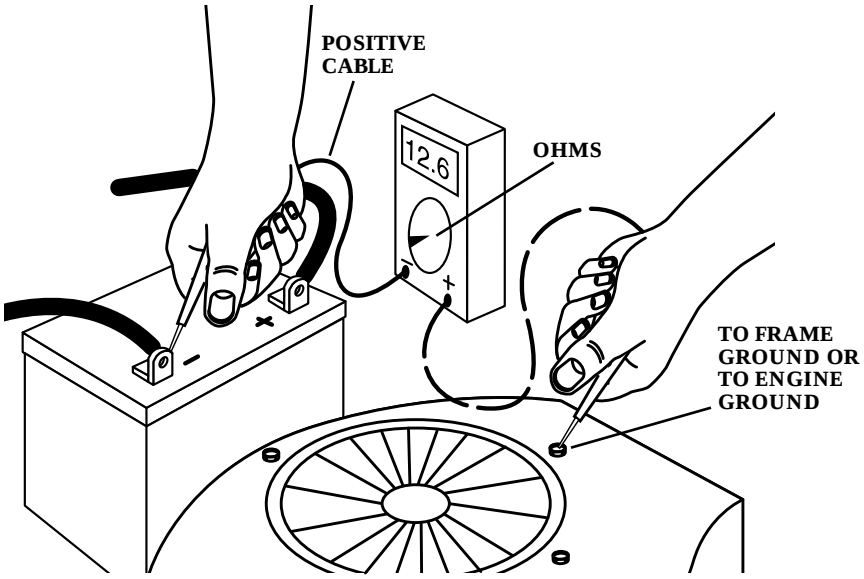
CHECK BATTERY GROUND

The battery must be grounded to the frame and the engine for electrical components and charging to work. Place the ignition switch in off position. Use a continuity tester or Meter on OHMs scale.

* Test for the ground to frame. Place one meter lead on negative battery terminal and the other on a known good ground to the frame. If no continuity, correct before proceeding
* Test for ground to engine. Place one meter lead on negative battery terminal and the other on a good ground on the engine. If no continuity, correct before proceeding.
* clean battery terminals and battery cable ends until metal is bright. Coat terminals with a non-metalic grease or commercially available battery terminal protection product.



SITE TECHNICIAN LOAD TEST

* The battery must pass Open Circuit Voltage Test at 12.5 volts or higher.
* Remove spark plug wire from spark plugs
* Put meter on D.C. voltage scale larger than 15 volts.
* Attach meter test leads to battery terminals. Like Open Circuit Voltage Test.
* Watch meter while cranking the engine for 10-15 seconds.
* If the battery voltage drops below 7.2 volts while cranking, the battery requires charging or is defective
* If the battery holds 8.5 volts at the end of 10-15 seconds, the battery is good.
* Reattach spark plug wire to Spark Plugs

CHECK FOR PROBLEMS WITH ENGINE COMPRESSION RELEASE OR CYLINDER HYDRAULIC LOCK

The symptoms include:

* The battery may only spin the engine fast enough to start when fully charged
* The battery may not turn the engine starter motor

This may result in:

* Batteries not fully charged will be unnecessarily replaced
* There will be multiple service calls resulting in unneeded battery replacement
* Starter Motors may also be unnecessarily replaced

CHECK FOR CYLINDER HYDRAULIC LOCK FIRST

* Engine Starter Motor will not crank over the engine
* Remove engine Spark Plug.
* If fluid comes out of spark plug opening

  The fluid would not allow the piston to go to the top of the cylinder

  Check dipstick for crankcase level, if high, change oil and spark plug.

  If oil smells of fuel, check carburetor float, needle, and seat.

  If will not start, proceed with Compression Release Test.

COMPRESSION RELEASE TEST

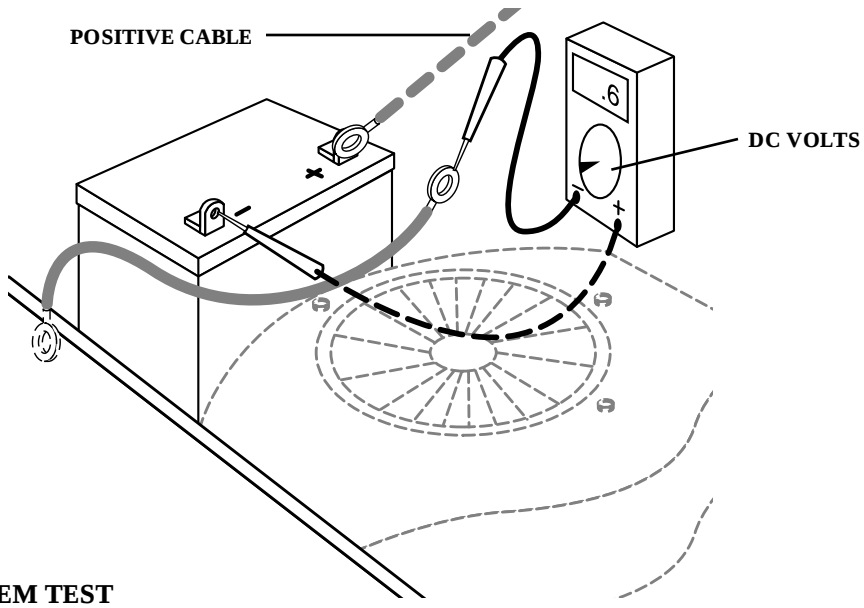
* The battery must pass Open Circuit Voltage Test at 12.2 volts or higher.
* Remove engine Spark Plug.
* Place a rag over the spark plug opening
* If engine turns over without the spark plug installed, check for proper valve clearance before you replace or repair the compression release

SYMPTOMS OF WIRE HARNESS OR SWITCH ELECTRICAL CURRENT LEAKAGE PROBLEM

* components or wiring leak electrical current allowing the battery to discharge
* a discharged battery is a problem when tractor has not been used for several days.
* multiple battery replacements due to a discharged condition

ELECTRICAL LEAKAGE TEST

* Place meter on DC volts scale.
* Place the tractor ignition switch in off position.
* Place meter test leads at black battery cable and negative battery terminal.
* If more than 1.0 volts DC shows on the meter, find and repair the source of the voltage leak to ground.



CHARGING SYSTEM TEST

* The battery must pass Open Circuit Voltage Test at 12.20 volts or higher.
* Start Engine
* Place at full throttle and check engine R.P.M.s with a tachometer (3500)
* Place meter on D.C. Voltage scale 15 volts or higher.
* Attach the meter test leads to the battery, like in Open Circuit Voltage Test.
* If voltage when the engine is running at full speed exceeds voltage when the engine is off (Open Circuit Voltage); and if the voltage exceeds 12.6 and is rising after 1 minute, the charging system is good.
* Additional diagnostic information on engine charging systems is in last years book, 'BACK TO BASICS' I.

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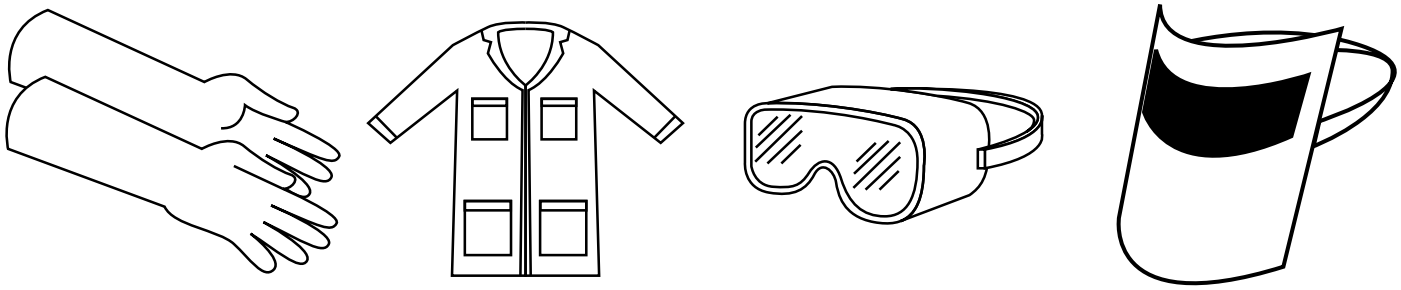
BATTERY RECYCLING

Why Recycle batteries? Many batteries are replaced so the service call can be completed. Most replaced batteries are only discharged, and only need a good charging to be serviceable. Why throw away functional parts that can be recycled? Recycled batteries can be used on MA calls and can reduce parts costs to your service center.

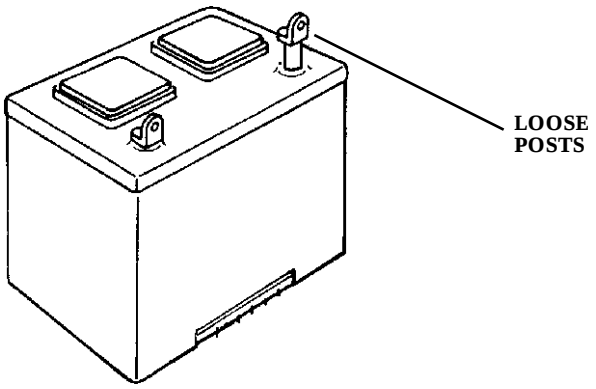
Battery plates are made from lead-alloy. Lead is toxic. Recycling batteries reduces environmental pollution.

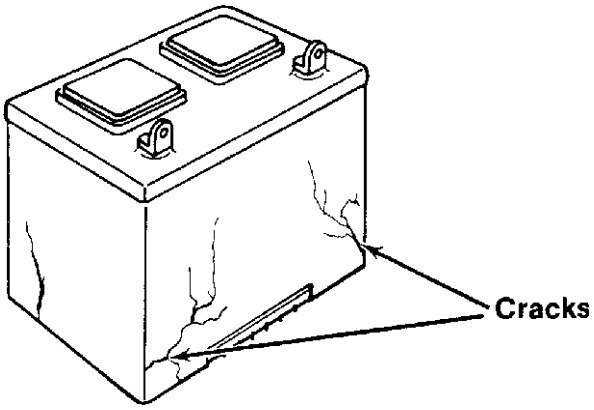
PROCEDURES FOR RECYCLING BATTERIES.

Wear protective equipment when working with batteries. Goggles or glasses with face shield should be used to protect eyes anytime you are handling batteries. A plastic apron or lab coat will protect your clothes. Rubber gloves should be worn when handling batteries.

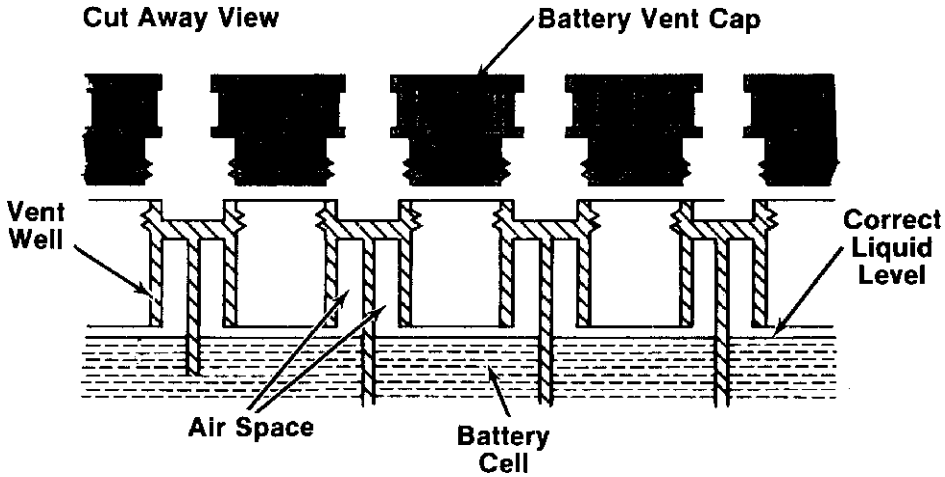


Do a visual check of the battery case and the battery terminals for damage. If damage is found, dispose of the battery following E.P.A. regulations.





Check the electrolyte level. If the cell at negative post of the battery has less than 3 inches of electrolyte, dispose of battery properly. If electrolyte is not 1/4 inch over battery plates in any cell of the battery, add water to the proper level.



NOTE: Checking the electrolyte is not possible with Maintenance Free Sealed Batteries. If vent plugs are not easily removable, skip this step.

Clean the battery exterior. Use a solution of one cup baking soda to 1 gallon of water, and stir. Do not get cleaning solution in the battery cells. Use disposable wipes to clean and dry battery.

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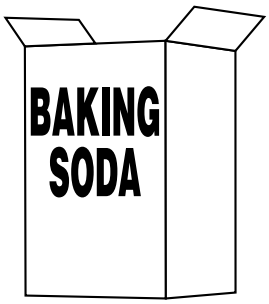
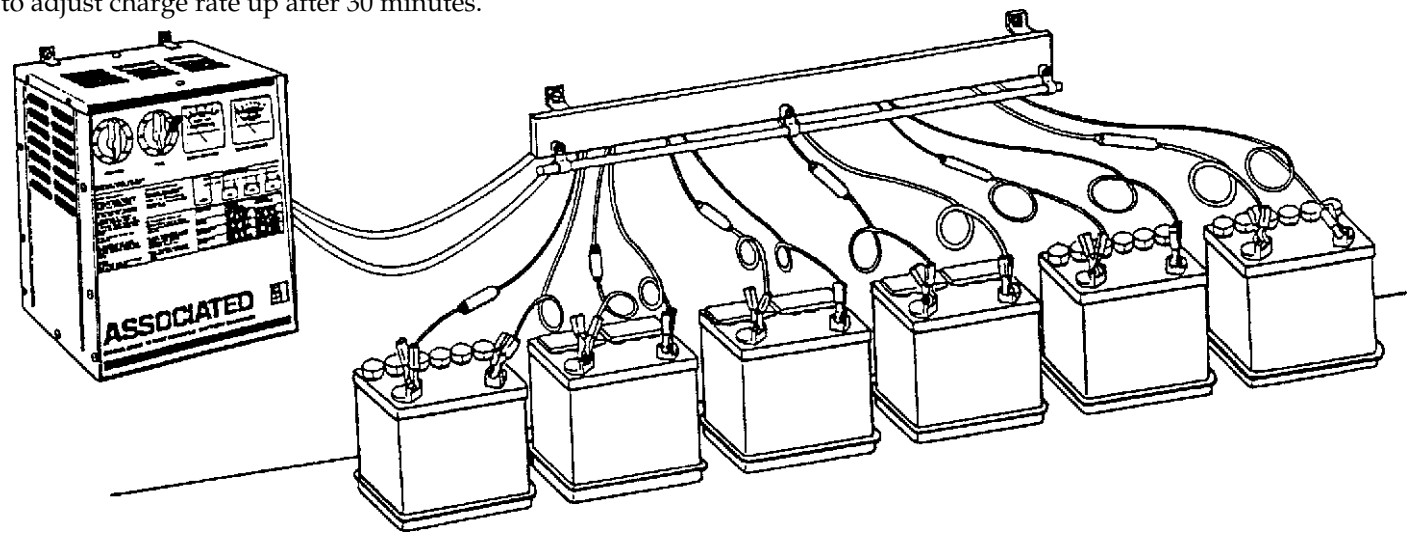


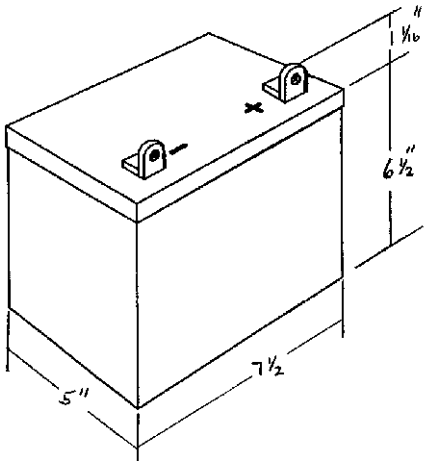
Charge the batteries. Use a CONSTANT CURRENT CHARGER set at 8 to 10 amps for 2 to 4 hours. It may be necessary to adjust charge rate up after 30 minutes.

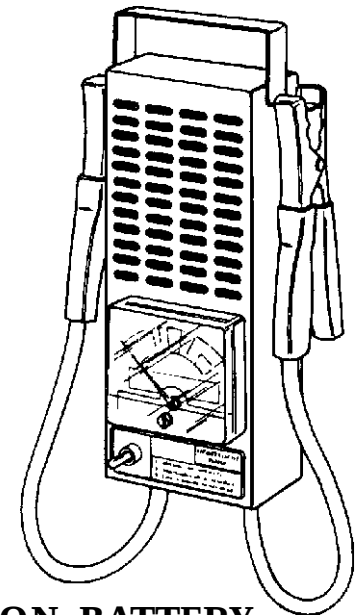


Test the batteries with a Load Tester like the MILTON BT1260 Connect the Test Leads to the appropriate battery terminals. Actuate the Load for 2-3 seconds to eliminate any surface charge If voltage drops below 7.2 volts, discontinue test immediately and properly dispose of battery for internal failure. Note the Open Circuit Voltage for the battery state of charge. Actuate the load for 15 seconds and note the voltage at the end. Testers are designed for automobiles and trucks with larger capacity batteries. Lawn and garden tractor batteries are smaller capacity than automotive batteries. At the end of the 10 second load test, 8.5 volts is acceptable for Lawn & Garden Batteries. If below 7.2 volts on the load test, discard the battery for an internal problem. If the Load Test is below 8.5 volts and the Open Circuit voltage is below 12.5 volts, charge the battery for 2 or more hours and retest the battery.

BATTERY REPLACEMENT CHART

AMP/HR RATING	MIN CCA	CASE SIZE	ACME DRY P/N	ACME WET P/N	EAST PENN WET P/N
20	130	U1R	121310X	146138	144924
25	190	U1R	121265X	146139	144925
30	240	U1R	121537X	146140	144926
35	280	U1R	125603X	146141	144927
40	340	U1R		146142	145425





MILTON BATTERY TESTER

092/150 BT1260

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Label batteries during testing. Label failed batteries as 'Bad' to keep from charging and testing these batteries again unnecessarily. Label batteries passing Load Test as 'GOOD' and with date tested. This will keep from mixing batteries and unnecessary work.

NOTES:

Do Not Mix Batteries on charger. Batteries that have been charged and tested good should not be charged at the same time as batteries that have not been charged.

The charging system and batteries should be located in a well ventilated area. When testing a battery, remove it from the charging rack and away from other batteries.

Materials used to clean battery exterior can be disposed of normally as there is no lead content from electrolyte. To neutralize acid, add baking soda to water and stir until there is no reaction.

NEW TRACTOR BATTERIES

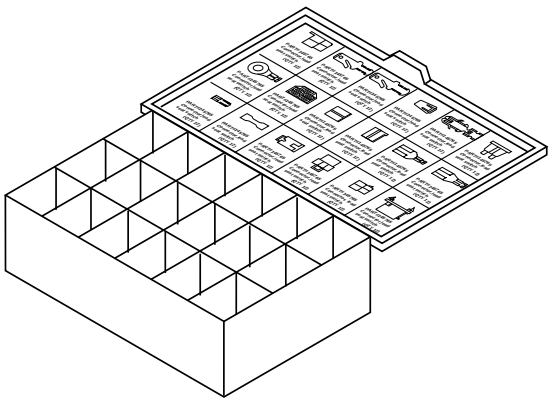
Beginning in 1995, new tractors are shipped from the factory with Maintenance free batteries. This eliminates the need for setup people to fill the battery with acid. There is a decal on top of these batteries with a recharge date. Before or during that month it is not necessary for the battery to be charged during setup. After the date on decal, the battery must have a 6-10 Amp charge for a minimum of one hour. Tractors with batteries that are delivered without an adequate charge will cause in-warranty service calls.

It is expected the setup person will charge the battery if necessary, attach the battery cables, and properly install the battery hold-down.

KIT: CONNECTOR / TERMINAL

ENTIRE KIT PART # 148691

DIV. 92 PLS 192



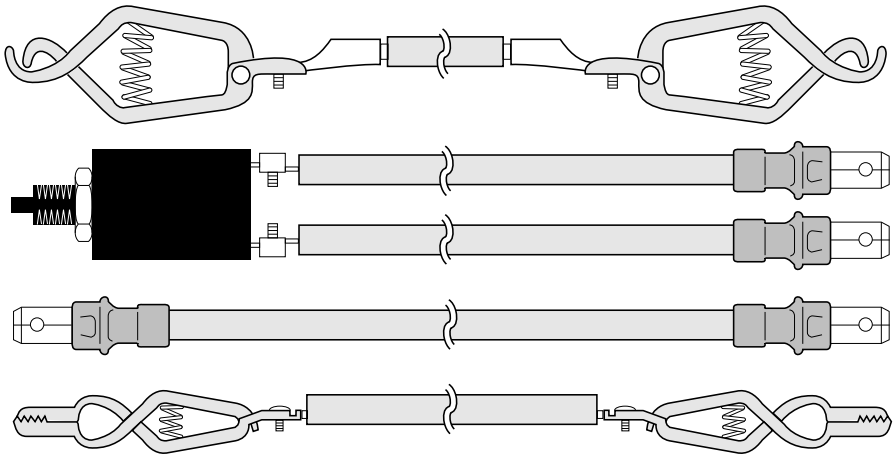
DIV. 71 PLS 917

ORDER PART # 148692 CONNECTOR, ELEC. CLUTCH (TRACTOR SIDE)	**ORDER PART # 148701** CONNECTOR, INTERLOCK SINGLE POLE
ORDER PART # 148693 TERMINAL, MALE BLADE SINGLE LEAD	**ORDER PART # 148702** TERMINAL, .250 SINGLE LEAD
ORDER PART # 148694 TERMINAL, MALE BLADE DOUBLE LEAD	**ORDER PART # 148703** TERMINAL, .250 DOUBLE LEAD
ORDER PART # 148695 CONNECTOR FUSEHOLDER	**ORDER PART # 148704** TERMINAL, .187 PUSH-ON
ORDER PART # 148696 TERMINAL, FUSEHOLDER	**ORDER PART # 148705** SPLICE, BUTT 16 GAGE
ORDER PART # 148697 FUSE AUTOMOTIVE TYPE 30 AMP.	**ORDER PART # 148706** CONNECTOR SEAT SWITCH
ORDER PART # 148698 TERMINAL, RING 6 - GAGE	**ORDER PART # 148707** CONNECTOR, MAIN COMM. HARNESS
ORDER PART # 148699 CONNECTOR, IGNITION SWITCH	**ORDER PART # 148708** CONNECTOR, ELEC. CLUTCH (CLUTCH SIDE)
ORDER PART # 148700 CONNECTOR, INTERLOCK DOUBLE POLE	**ORDER PART # 148709** LIGHT SOCKET SNAP-IN

USE OF THE 150834 JUMPER DIAGNOSIS KIT -

PURPOSE

Instructions on use of the 150834 Jumper Diagnosis Kit for simple troubleshooting of the circuits for starting the tractor.



KIT CONTAINS 1 EACH OF:

Battery Ground / Solenoid Bypass Cable

Circuit Breaker Test Unit

Flat Blade Bypass Jumper

Alligator Clip Bypass Jumper

INFORMATION

It is IMPORTANT before attempting any tests described to do the following:

1. Lock the Clutch/Brake Pedal in the "PARK" position.
2. Verify the mower Blade Engagement is "OFF".
3. Verify the battery is good and charged at 12.2 DC Volts or higher or for testing install a known good battery that is charged.
4. Place the Ignition Switch in the "ON" or "Run" position.
5. Tractors equipped with a carburetor solenoid may not run during these procedures. If the engine turns over ("cranks") the purpose of the test has been completed.
6. This Schematic will help you trace the circuits as we go through the procedures.

PROCEDURE:

1. Check the fuse.

Remove it from the holder and check visually. If the fuse is bad, replace the 30 Amp Fuse and test crank the engine.

If the engine fails to crank or the fuse was good, replace it with **the CIRCUIT BREAKER TEST UNIT** in the fuse holder, as shown in Figure 1.

2. Test the Engine Starter Motor

Install the heavy duty **Battery Ground/Solenoid By-Pass Cable** from the engine Starter Motor Electrical Post to the 'HOT' post of the Solenoid. If the starter motor 'cranks', we know the starter motor is good for this test.

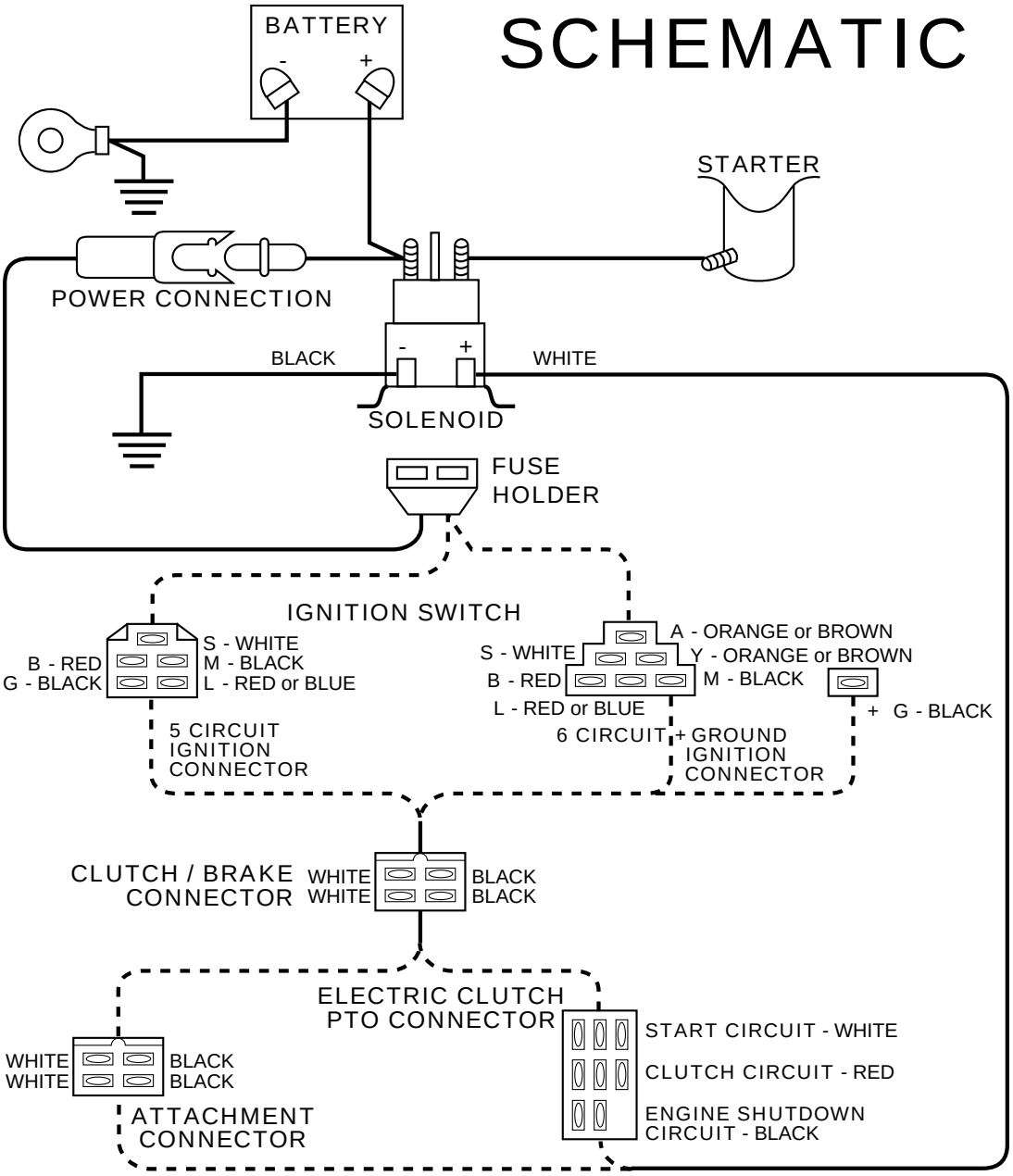
If the Starter Motor does not 'crank', install the Battery Ground/Solenoid By-Pass Cable from the engine Starter Motor Electrical Post and the Positive '+' Post of the Battery.

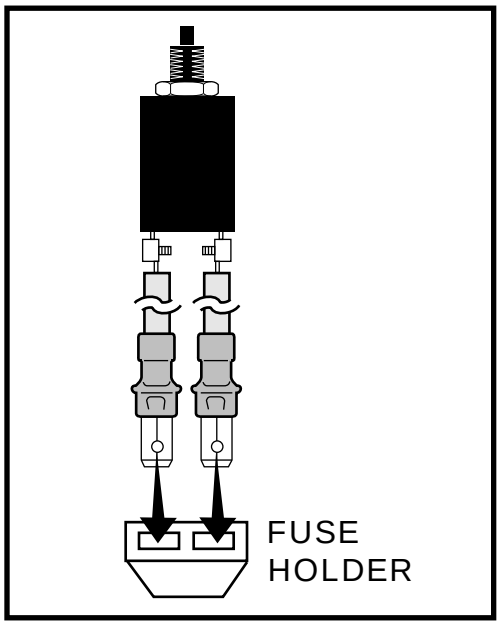
If it still does not work, remove the spark plug and cover the hole, actuate the starter motor as before.

If it does not work, check the Battery Ground and the Battery.

The Starter Motor must work before going to Procedure # 3.

SCHEMATIC





3. Test the Solenoid operation.
Using the **Alligator Clip Bypass Jumper**, clip across the solenoid from the battery cable side to the positive "+" coil terminal (White Wire), as shown in Figure 2. If the engine turns over (or "cranks") the Solenoid is good, then go procedure 4.
If the engine will not turn over (or "crank"), remove the **Alligator Clip Bypass Jumper** and install it across the negative "-" coil terminal (black wire) and the **Battery Chassis Ground**. .This is shown in Figure 3 (to chassis attachment point for the black battery cable). Try to turn over (or "crank") the engine. If the engine turns over (or "cranks"), repair or establish a good Ground for the Solenoid.
If the engine will not turn over (or "crank"), remove the **Alligator Clip Bypass Jumper.**
Install the heavy duty **Battery Ground/Solenoid By-Pass Cable** across the Solenoids large copper studs. If the engine turns over (or "cranks") go to procedure 4.
Install the heavy duty **Battery Ground/Solenoid By-Pass Cable** from the negative "-" battery terminal to the Chassis ground, as shown in Figure 5. Turn the ignition key to "start". If the engine turns over (or "cranks") repair the battery ground. If not, go to procedure 4.

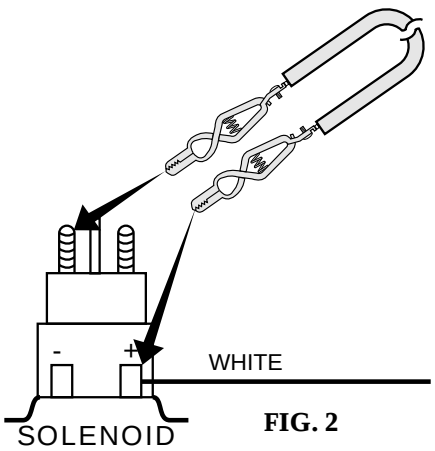


FIG. 2

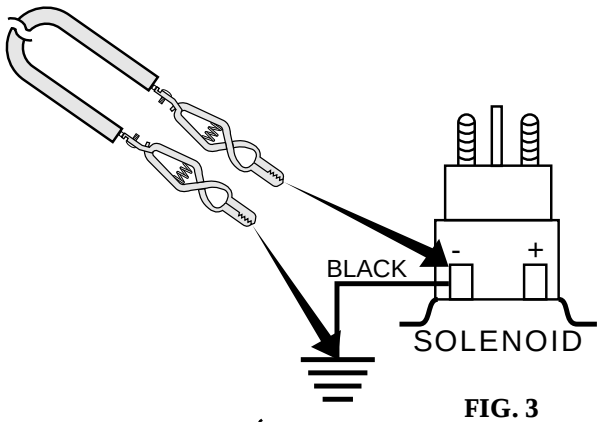


FIG. 3

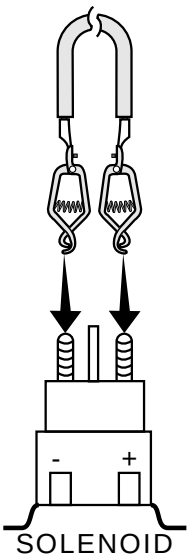


FIG. 4

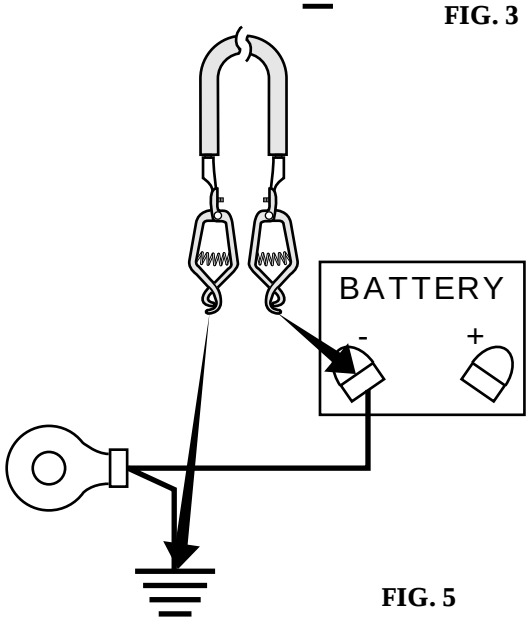


FIG. 5

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4. Check the Attachment or PTO Switch
Disconnect the Attachment switch connector, or the PTO connector if the tractor has an electric clutch.
Place a **Flat Blade By-Pass Jumper** across terminals holding White wires, as shown in Figure 6. Turn the ignition key to "start". If the engine turns over (or "cranks") replace the switch. If not, remove the **Flat Blade By-Pass Jumper**, replace the connector on the Attachment switch or PTO switch, and go to procedure 5.

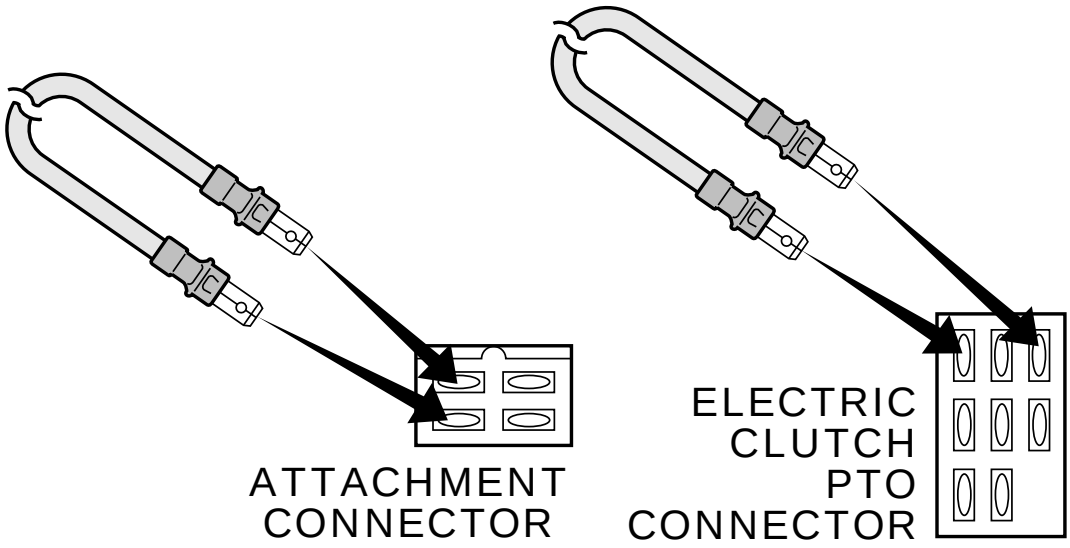


FIG. 6

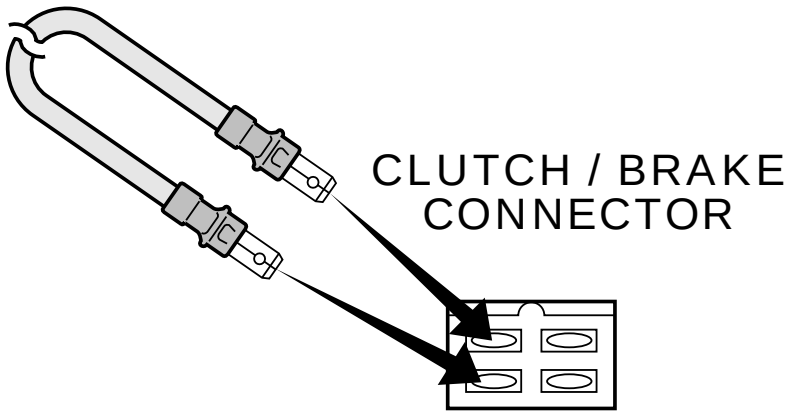


FIG. 7

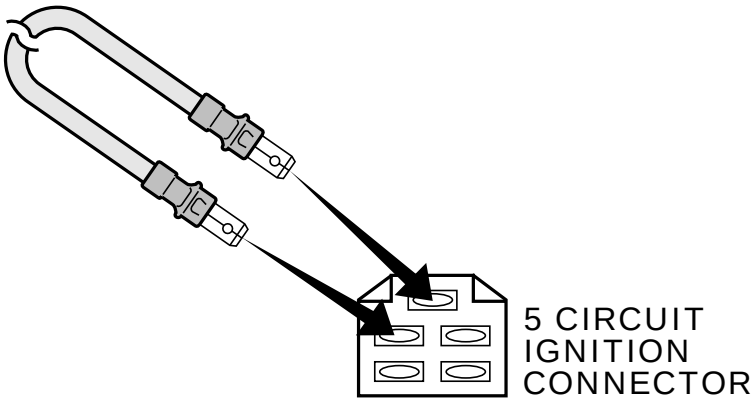
5. Check the Clutch/Brake Switch
Disconnect the Clutch/Brake Switch Connector from the switch.
Place a **Flat Blade By-Pass Jumper** across terminals holding White wires, as shown in Figure 7. Turn the ignition key to "start". If the engine turns over (or "cranks") replace the switch. If not, remove the **Flat Blade By-Pass Jumper**, replace the connector on the Clutch/Brake Switch and go to procedure 6.

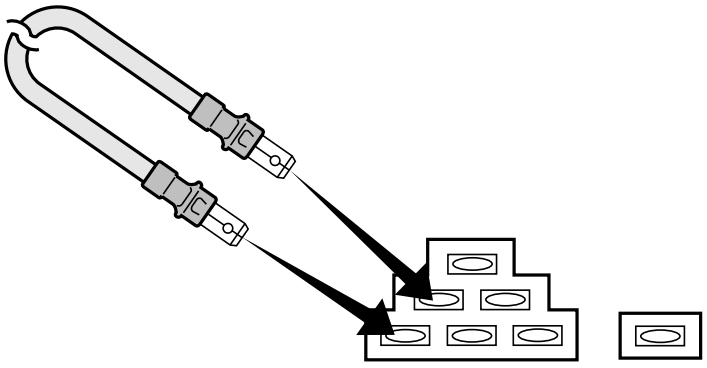
6. Check the Ignition Switch

Disconnect the Ignition Switch Connector from the switch.

Place a **Flat Blade By-Pass Jumper** across terminals holding Red wire ("B" from battery) and White wire ("S" to starter).

If the engine turns over (or "cranks") replace the switch. If not, remove the **Flat Blade By-Pass Jumper**, and replace the connector on the Ignition Switch.





7. If the above tests have not identified the problem, the problem is somewhere other than the starting circuits. To check the following items, a Volt/Ohm Meter (VOM) may be required.

Re-check the battery, a fully charged battery will have a D.C. VOLTS reading of 12.6 or more.

Remove the white wire from the solenoid, check for Battery voltage when the ignition switch is in the "Start" position. If voltage is 0, go to procedure 4. If 12 D.C. Volts, **check resistance of solenoid coil**. Set the meter at (R x 1) scale. Touch meter probes to the terminals on the side of the solenoid. The proper resistance is 5 to 6 OHMS. If the resistance is significantly higher or lower, replace the solenoid.

Insure all normal starting components are functional. The Clutch/Brake Pedal fully depresses the Clutch/Brake Switch, and all switch Terminals are intact with the wires and the connectors.

Check for pinched or broken wires which could be located between the switches tested.

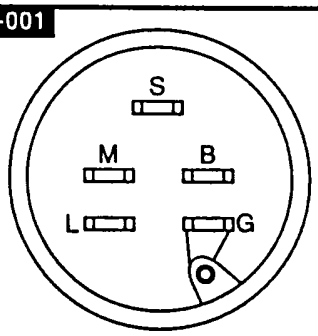
Insure the engine is grounded to the chaises.

Use the **Battery Ground / Solenoid By-Pass Cable** for this test.

8. UPON COMPLETION OF TROUBLESHOOTING, remove all test jumper wires, and replace the tractor 30 AMP fuse.

6 IGNITION SWITCH IDENTIFICATION CHART

SCH-001

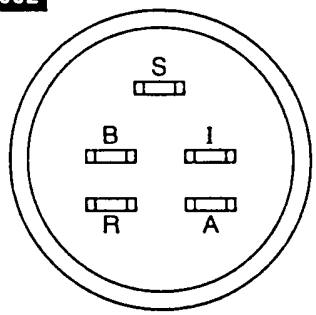


IGNITION SWITCH

POSITION	CIRCUIT
OFF	M + G
ON	B + L
START	B + S + L

METAL
GRAY BACK
71/917 158913
REPLACEMENT SWITCH
FOR PLASTIC SWITCHING

SCH-002

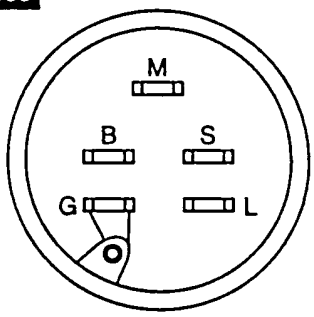


IGNITION SWITCH

POSITION	CIRCUIT
OFF	
ON	B + I + R + A
START	B + I + R + S

METAL
WHITE BACK
71/917 2683R
USED WITH
ONAN ENGINE
ONLY

SCH-003

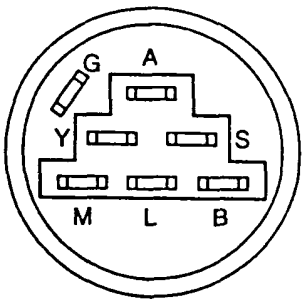


IGNITION SWITCH

POSITION	CIRCUIT
OFF	M + G
ON	B + L
START	B + S

METAL
WHITE BACK
4406R
98/980 STD365402
BRIGGS AND
TECUMSEH ENGINES UP TO
1993

SCH-041



IGNITION SWITCH

POSITION	CIRCUIT	"MAKE"
OFF	G + M + L	NONE
RUN/LIGHT	B + L	A + Y
RUN	B + L	NONE
START	B + L + S	NONE

METAL
WHITE BACK
71/917 140301
CHRISTMAS TREE HEAD-
LIGHT IN IGNITION
SWITCH

Symptom: Electric Clutch Doesn't Engage, Engages Intermittently, Drains Battery, Blows Fuses

Talk to the customer

* Get a complete description of the problem.
* Let the customer help you to isolate the problem by describing the symptom.

Verify the symptom

* Operate the product to verify complaint.
* Determine what is already known about the problem from past experience, service flashes, etc.

Verify all controls are in the proper position.

* PTO switch
* Ignition switch

Checking clutch electrically

Check fuse condition

* Remove fuse and verify the fuse is good. Insert circuit breaker from test kit #150834 into fuse holder end for testing purposes. Look for cut or loose wires around the clutch wiring and connector. If a bad connection or loose wire is found repair using terminal kit number 148691. Note: Be certain the 2 pin Molex lug is and connector are securely connected.

Check for 12 volts at battery

* Check for 12 volts at the battery and at the plug to verify the clutch PTO switch is good or bypass the switch, connect jumper wire from red to red at the PTO switch connector. If clutch engages, replace switch. If not, check for 12 volts at the clutch plug.

Voltage at clutch plug

* If 12 volts is present at the clutch plug, then you can assume the switch and battery voltage is good. If the clutch still does not engage insert meter leads into the clutch end of the connector and take an ohm's reading. If the reading is between 2.40 and 2.90 ohms clutch windings are OK. Note: When checking amperage the electric clutch should not draw more than 4 amps, if it does air gap MUST be checked.

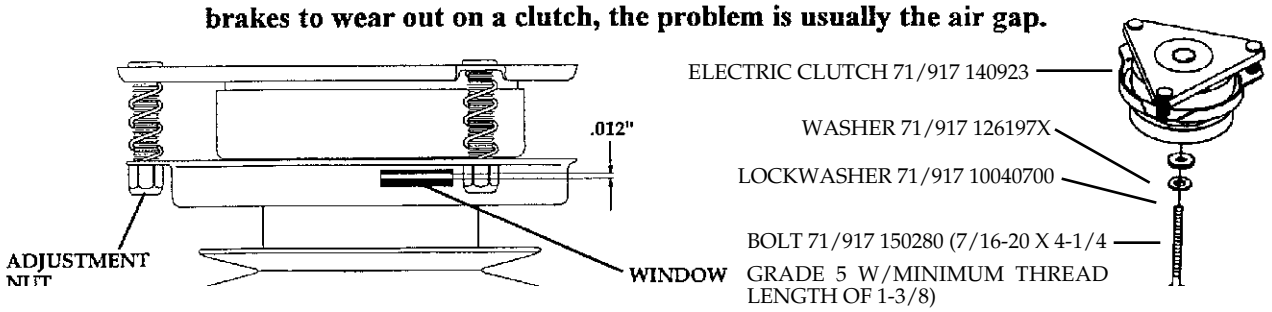
Checking clutch mechanically

Check air gap

* If ohm reading is good clutch air gap must be checked. Turn ignition switch and PTO switch off, unplug the spark plug. Use TECUMSEH air gap gauge part number 670297 and cut into 3 strips (or use a 0.12" feeler gauge). Insert into each window and tighten the three adjustments nuts one at a time (rotating) until the air gap gauges (feeler gauges) slide out of each window with a little resistance. Note: This is the preferred method. The clutch can also be adjusted by doing one window at a time.

Check compliance

* **Check to be sure that the mower blades stop within 5 seconds after the PTO switch has been disengaged. If the blades do not stop within 5 seconds, recheck air gap. If they still do not stop, replace clutch. Note: It's not common for the brakes to wear out on a clutch, the problem is usually the air gap.**



USE LOCKTITE ON THE BOLT
TORQUE BOLT TO 50 FT. LB.

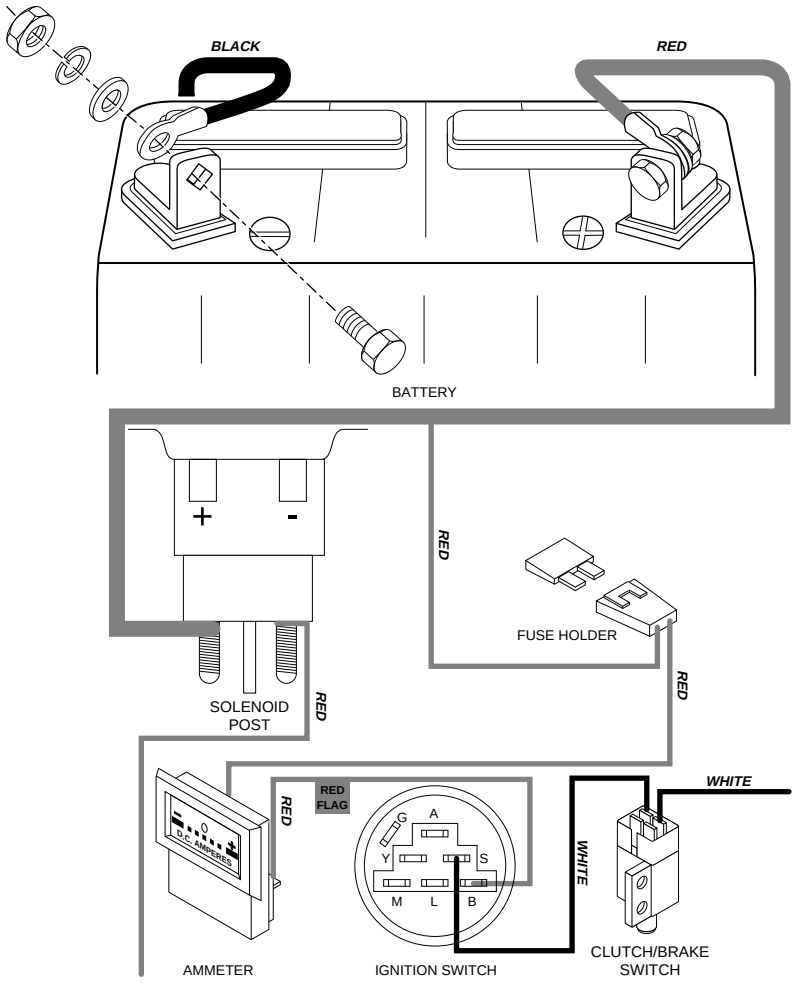
6 THE TRACTOR SYSTEM for ENGINE STARTING

When the tractor starting circuit is energized, the engine starter motor will turn.

For the engine to crank:

1. the clutch/brake pedal must be depressed (down)
2. the mower engagement lever or PTO switch must be in the disengaged or off position
3. the battery should test at 12.2 DC Volts or more
4. the ignition switch must be turned to the start position

The electrical circuit through these components is described in order. Follow the components along the right column.



Battery Ground

The Black Battery Cable goes from a ground on the chassis to the negative (-) post of the battery. If there is not a good ground, the electricity in the battery will not power anything. Be sure you have a good ground for the battery *and the engine.*

The Battery

The battery is a device that chemically stores electrical energy in cells. The batteries used on tractors have 6 cells with 2.1 Volts DC each. The primary purpose of the battery is to provide the electrical power to start the tractor engine. If electrically powered items need more power than the charging system provides, the battery makes up the difference until it is discharged.

Solenoid Post

Current flows from the Red Battery Cable to the 'HOT' post of the Solenoid. A wire branches off to supply electricity to the rest of the tractor.

CONTINUED ON PAGE 66...

Fuse Holder

The low control current flows through the Fuse, check for a good fuse.

Ammeter (if so equipped)

The low control current flows through the Ammeter. Check to see if both wires are hooked up to the Ammeter. If the Ammeter is known to operate backwards, reverse the wires on the back.

Ignition Switch (in 'Start' position)

In the 'Start' position, the ignition switch will send current out the 'S' terminal and depending on the model, 'L' terminal. The Ignition Switch can be tested for continuity or for resistance. In the Start position, check continuity between contacts 'B', 'S', and 'L'. (Check legend of the ignition switch on the electrical schematic for the correct path.)

Clutch / Brake Switch

This switch is closed when the foot pedal is depressed to complete its portion of the start circuit.

Attachment Interlock or PTO Switch

The Attachment Interlock Switch on manual engagement models, and the PTO Switch on electric clutch models will only be closed to complete the start circuit if the mower is disengaged.

Solenoid

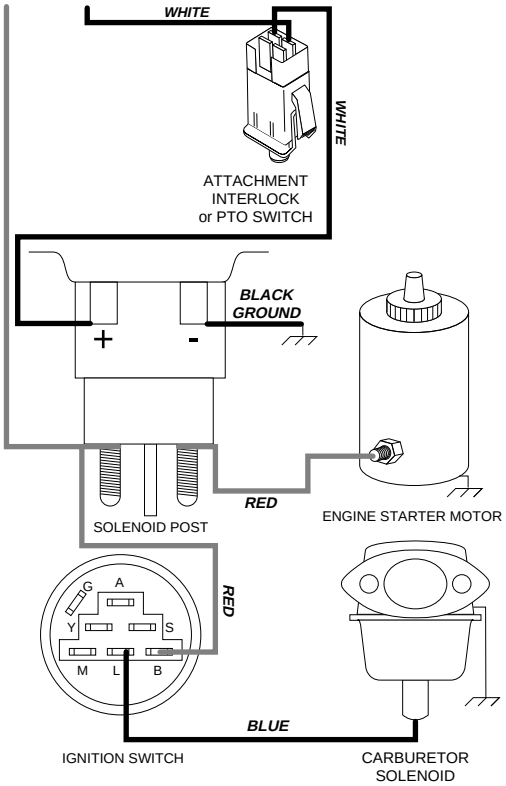
If all the above connections are made, the solenoid is now actuated. This closes the contacts between the posts on the solenoid for the heavy current to pass to the engine starter motor.

Engine Starter Motor

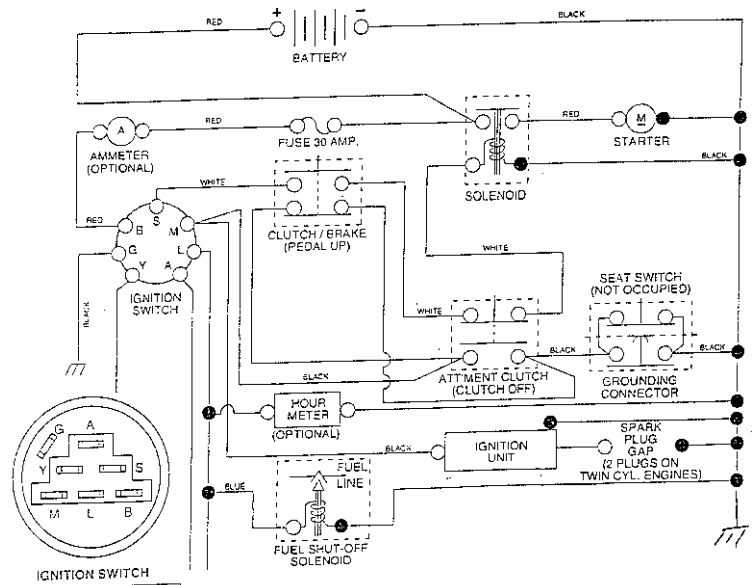
The Engine Starter Motor needs to spin the crankshaft at more than 400 rpm to generate enough voltage or current through the magneto coil to fire the spark plugs. A battery that is low on charge may not allow the engine to spin fast enough for the ignition to work. When the operator releases the ignition switch back to the 'Run' position, the solenoid de-activates, and the current flow to the Starter stops.

Carburetor Solenoid

Some tractors have a solenoid on the carburetor. This solenoid has a plunger that goes into the fixed main jet to stop the flow of fuel when the engine is turned off. This plunger is retracted when the carburetor solenoid is energized to let fuel pass into the venturi. It is activated when the ignition switch is in the 'Start' and 'On' positions on the tractors that have this feature. Also read in the ENGINE section about Reduce Engine Afterfire.



...CONTINUED FROM PAGE 65



POSITION	CIRCUIT	"MAKE"
OFF	G - M - L	NONE
RUN/LIGHT	B - L	A - Y
RUN	B - L	NONE
START	B - L - S	NONE

6

NEW OPERATOR PRESENCE SYSTEMS for 1998

The Operator Presence System is designed to protect the operator of the tractor. This system will short the engine ignition for the engine to die and the mower blades to stop when the operator is off the seat and the mower or ground drive is engaged. When the operator is in the safe position the tractor and mower will work. The operator presence standards define the 'safe' position as the operator in the tractor seat. The operator presence will be disengaged and the engine ignition system will function when:

- The mower Engagement Lever must be disengaged or the mower PTO Switch must be off.
- The Clutch/Brake Pedal must be down.
- The Ignition Switch should be in the 'Start' or 'Run' positions.

Be sure <u>ALL safety devices</u>, the Operator Presence System, electrical harnesses and interlock switches are in place and functional when you are done working on the customers product. Parts which are worn, modified, or damaged should be repaired or replaced; or the product should be made non-functional until repairs are completed.

New ANSI standards went into effect on July 1, 1997 that make it <u>mandatory</u> for the operator presence system **to stop mower blade in five (5) seconds or less.** For clarity in this discussion, we will label these systems with letters.

System 'A' will be used on tractors with a manual mower clutch unless that tractor has a Kohler Command Single cylinder engine. System 'A' is the same system all Source 917 tractors have had since January 1995. This system similar to the Operator Presence Systems back to 1987.

System 'B' will be used on most Source 917 tractors with an Electric Clutch for mower engagement and a Magneto Ignition. This system will have one (1) relay in the operator presence circuit.

System 'C' will be used on tractors with a Kohler Command Single Cylinder engine and manual mower engagement. This system will have two (2) relays. The Kohler Command Single Cylinder engine may have a STATOR BRAKE.

There will also be a System 'D' and a System 'E'. System 'E' will be used when engines have a BATTERY IGNITION.

Chart for Operator Presence Systems

	System 'A'	System 'B'	System 'C'	System 'D'	System 'E'
Magneto Ignition	- Yes -	- Yes -	- Yes -	- Yes -	
Battery Ignition					- Yes -
Manual Engagement	- Yes -		- Yes -	- Yes -	
Electric Clutch		- Yes -			- Yes -
KOHLER Command Single		- Yes -	- Yes -	- Yes -	
Stator Brake			- Yes -		
Man. Engage 46" Mower Deck	- Yes -			- Yes -	

There will be different interlock switches in these systems. You will need to be aware of color, which will indicate the switch is functionally different. The new seat switch will be Olive Green and the color of the connector should match the switch. If the interlock switch is gray and the cap on one end of the interlock switch is black, it is different from a switch that is all gray.

OPERATOR PRESENCE SYSTEM

The Operator Presence System is designed to protect the operator of the tractor. This system will short the ignition system for the engine to die and the mower blades to stop. When the operator is in the 'safe' position the tractor and mower will work.

Tractors have had an Operator Presence System since 1987. New ANSI standards went into effect on July 1, 1997 that makes it **mandatory for the engine and mower blade to stop in five (5) seconds** or less. For clarity in this discussion, we will label these systems with letters.

System 'B' will be used on most Source 917 tractors with an Electric Clutch for mower engagement and a Magneto Ignition. This system will have one (1) relay in the operator presence circuit.

There have been changes to System 'C' during 1998. Below find a rewritten explanation for System 'C' along with a new schematic and new harness print for Ignition Harness # 163845. For the complete explanation of all 5 Operator Presence Systems, see the 1998 FHP On-Site Manual number 163578.

OPERATOR PRESENCE SYSTEM 'C'

System 'C' will be used on Source 917 tractors with a Kohler Command Single Cylinder engine and manual mower engagement on a 42" Mower deck.

In this system electrical current flows from the Ignition Switch through either the Seat Switch (NO) or the Clutch/Brake and Attachment Switches to energize two Operator Presence Relays. Operator Presence Relay #1 when de-energized grounds the ignition to stop the engine. Operator Presence Relay #2 when de-energized connects to short-circuit the engine alternator stator. The shorted stator creates the maximum potential opposition to the charging magnets. The increased drag of the charging system helps oppose the flywheel momentum and stop the engine faster. This is a Stator Brake.

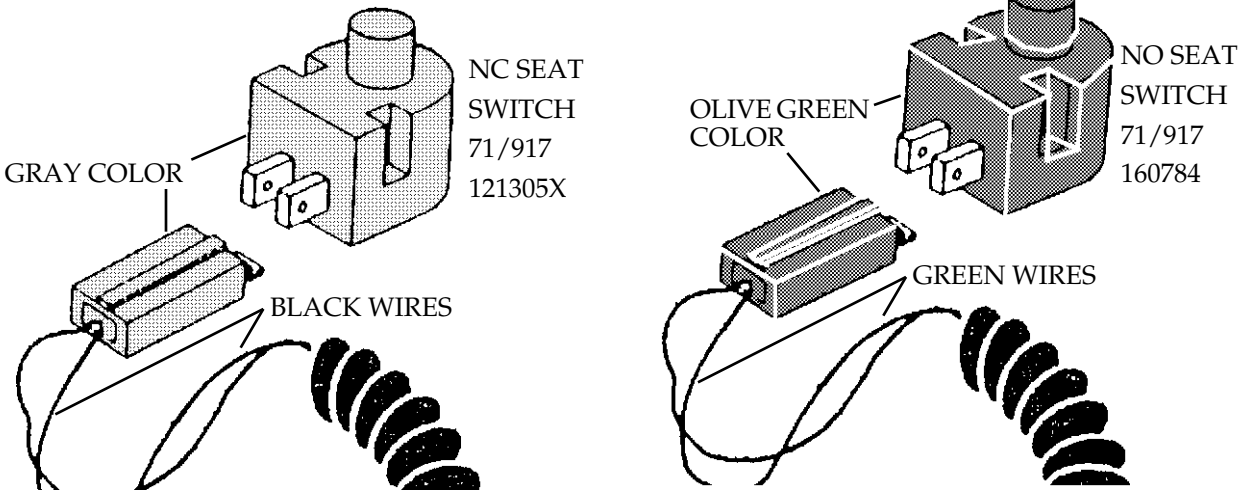
There is a Stator Brake with the 5 Amp charging system with two relays in the harness. There is a different Stator Brake with the 15 Amp charging system with three relays in the harness. With the 15 Amp system, Relay #3 disconnects the charging system from the tractor. This directs all the current from the alternator to the Stator Brake.

In this system the Seat Switch is Olive Green and normally open when the operator is off the seat. The operator may actuate the Operator Presence Relay two ways:

- Both the Clutch/Brake and Attachment Interlock Switches are closed in the safe position,
- The operator is on the seat closing the Seat Switch.

When either of these conditions are met and the Ignition Switch is in the 'Start', 'Run', or the 'Run and Lights' position:

- Operator Presence Relay #1 is energized opening the contacts that otherwise would "kill" the ignition,
- Operator Presence Relay #2 is energized opening the contact that normally engages the "Stator Brake",
- The Stator Brake, a magnetic field brake, is actuated.
- The Fuel Shut-off Solenoid is energized letting fuel into the carburetor. This circuit also supplies current to the S.A.M. on Kohler Command Engines with this ignition system.
  Operator Presence Relay # 3 disconnects the engine charging system from the tractor.



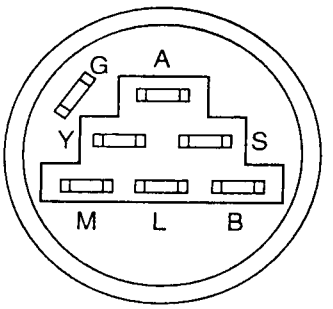
Gray Interlock Switch - 71/917 153664 (NO/NO)
Black/Gray Interlock Switch - 71/917 161343 (NO/NO

TURNING OFF THE ENGINE and THE OPERATOR PRESENCE SYSTEM

To understand how operator presence works, we start with how the engine stops running.

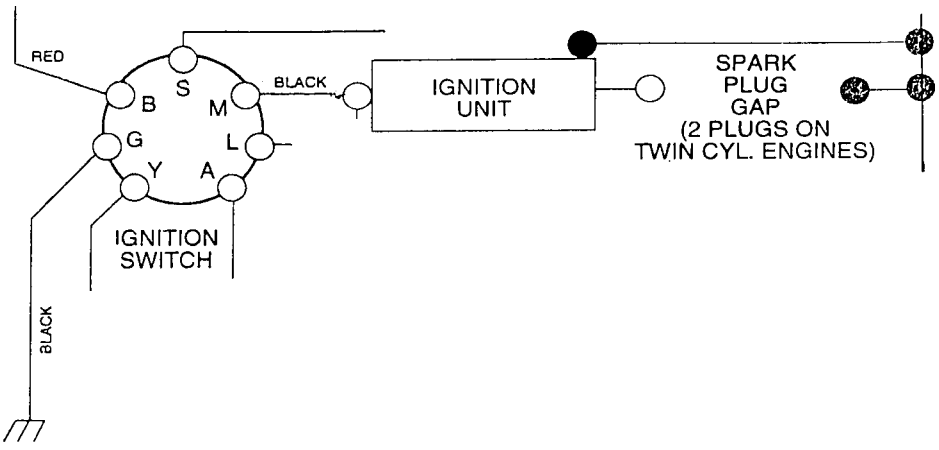
The engines we use from Briggs & Stratton, Kohler, and Tecumseh have a MAGNETO IGNITION SYSTEM. This system has an armature assembly next to the flywheel. When the magnet on the flywheel moves past the armature, current flow is created and at the specified moment a switch closes and the spark plug fires.

To "turn off" the engine the ignition must be "killed". To "kill" the ignition you close switches that ground out the armature. Electrical current is taken to ground, the spark plugs will not fire, and the engine slows to a stop. One way this happens is to turn the Ignition Switch to the "OFF" position. The operator presence systems we will discuss next will also "kill" the engine ignition. Have someone explain the electrical schematic below.



IGNITION SWITCH

POSITION	CIRCUIT	"MAKE"
OFF	G + M + L	NONE
RUN/LIGHT	B + L	A + Y
RUN	B + L	NONE
START	B + L + S	NONE



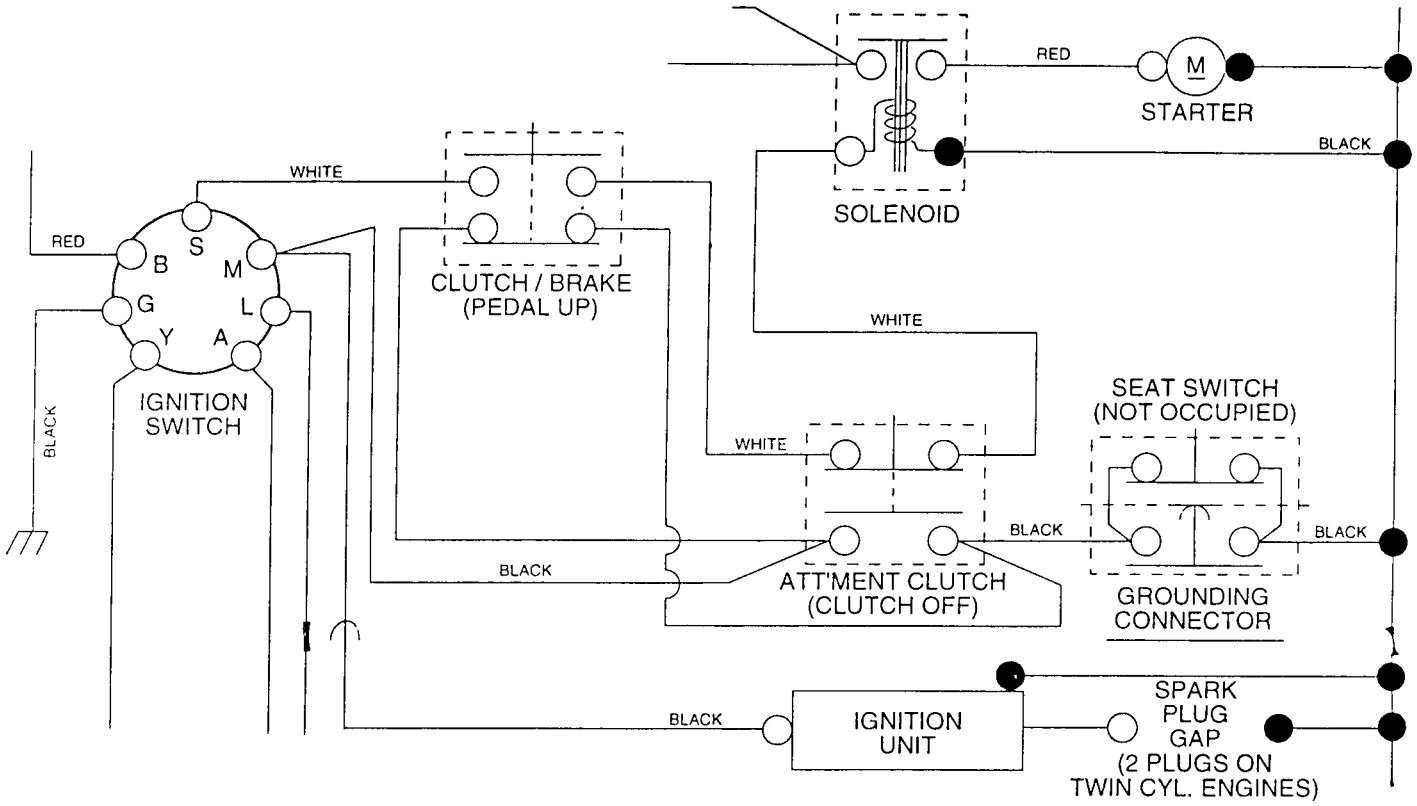
6

OPERATOR PRESENCE SYSTEM 'A'

System 'A' will be used on tractors with a manual engagement mower clutch unless that tractor has a Kohler Command Single cylinder engine.

System 'A' will ground out the engine ignition through the interlock switches. This is the type of operator presence system we have had for years. The Seat Switch is Normally Closed when the operator is not in the seat. The Seat Switch must be closed at the same time as one of the other interlock switches is closed to 'kill' the engine ignition. This system does not have a relay. The Seat Switch is gray and on 1998 tractors so is the connector. The wires to the connector are black. On Source 917 tractors black wires are used for ground wires.

Trace through the schematic. If the operator is off the seat and the mower is engaged, both the Seat Switch and the Attachment Switch are in the closed position. Trace the completed circuit through both switches, to the black wire to the 'M' Terminal of the Ignition Switch then to the Engine Ignition Unit. This grounds out the engine ignition. Now trace through the schematic for the foot pedal up, or drive belt engaged (Clutch/Brake switch closed). Only the items needed for operator presence are in the schematics.

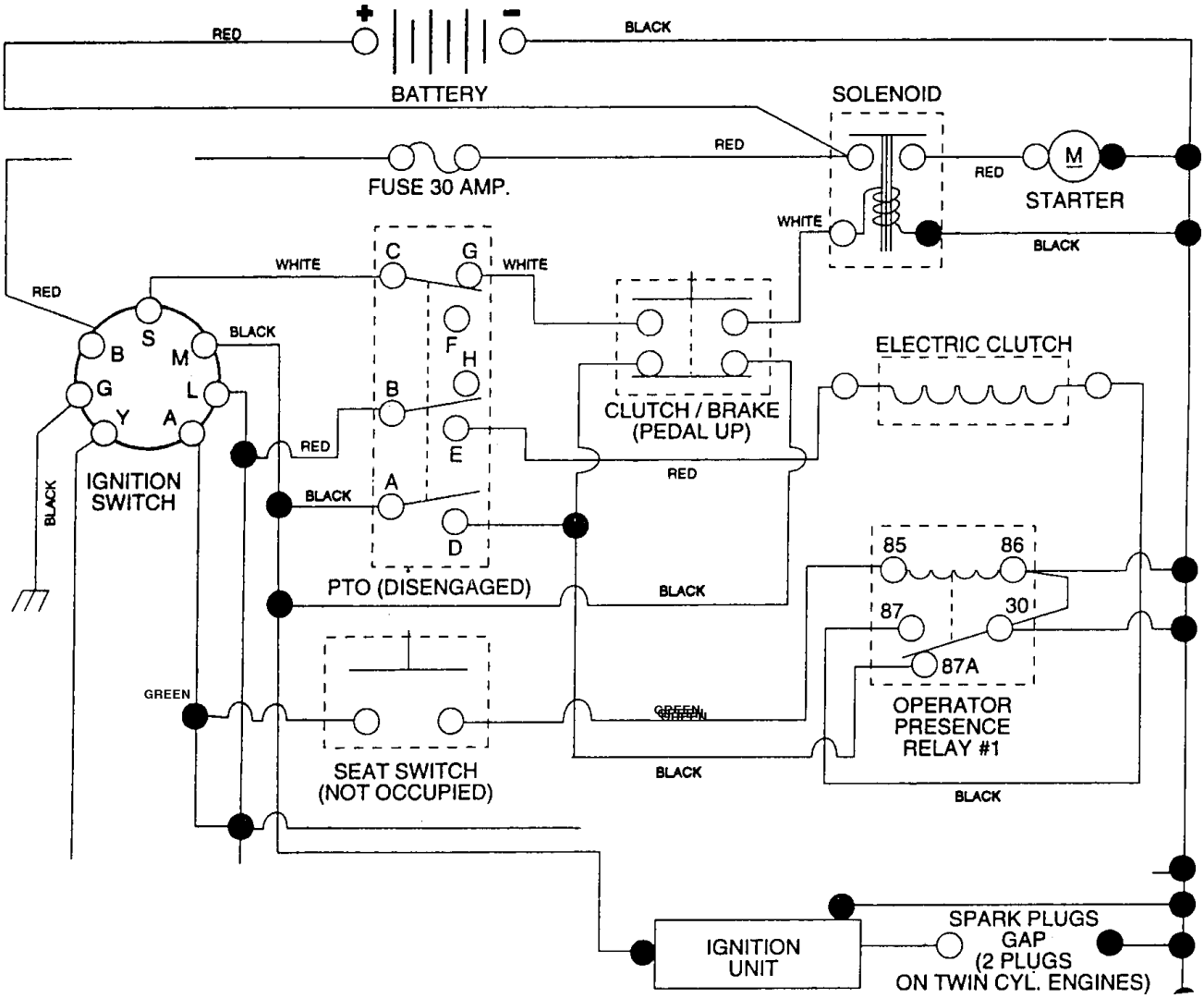


OPERATOR PRESENCE SYSTEM 'B'

System 'B' will be used on all Source 917 tractors with Electric Clutch mower engagement.

In this system the Seat Switch does NOT ground the ignition to 'Kill' the engine. Current flows from the Ignition Switch through the Seat switch to energize a relay. When the Operator Presence Relay is energized, the engine ignition 'fires'. When the Operator Presence Relay disengages, contacts are made to ground out the ignition, stopping the engine. In this system the Seat Switch is Normally Open when the operator is off the seat. When the operator gets on the seat, the switch closes. This seat switch is Olive Green. The wires going to the seat switch in this system are green.

Trace through the schematic. In the 'Run' position the Ignition Switch connects terminals 'B' from the battery to 'L' for the light and charging circuit. In some harnesses the circuit from the 'L' terminal is tied to the circuit from the 'A' terminal. Current flows from the Ignition Switch to the Seat Switch. When the seat switch is closed the Operator Presence Relay is energized. In this position the Electric Clutch circuit is completed from Terminals 87 to 30 in the relay. When the operator gets off the seat, the Operator Presence Relay is disengaged connecting Terminals 87A to 30. When 87A is connected to 30, the engine ignition can be grounded through either the Clutch/ Brake Switch or the PTO Switch for the mower deck. The engine and blades stop within 5 seconds.



6

OPERATOR PRESENCE SYSTEM 'C'

System 'C' will be used on Source 917 tractors with a Kohler Command Single Cylinder engine and manual mower engagement on a 42" Mower deck.

In this system electrical current flows from the Ignition Switch through either the Seat Switch (NO) or the Clutch/Brake and Attachment Switches to energize two Operator Presence Relays. Operator Presence Relay #1 when de-energized grounds the ignition to stop the engine. Operator Presence Relay #2 when de-energized connects to short-circuit the engine alternator stator. The shorted stator creates the maximum potential opposition to the charging magnets. The increased drag of the charging system helps oppose the flywheel momentum and stop the engine faster. This is a Stator Brake.

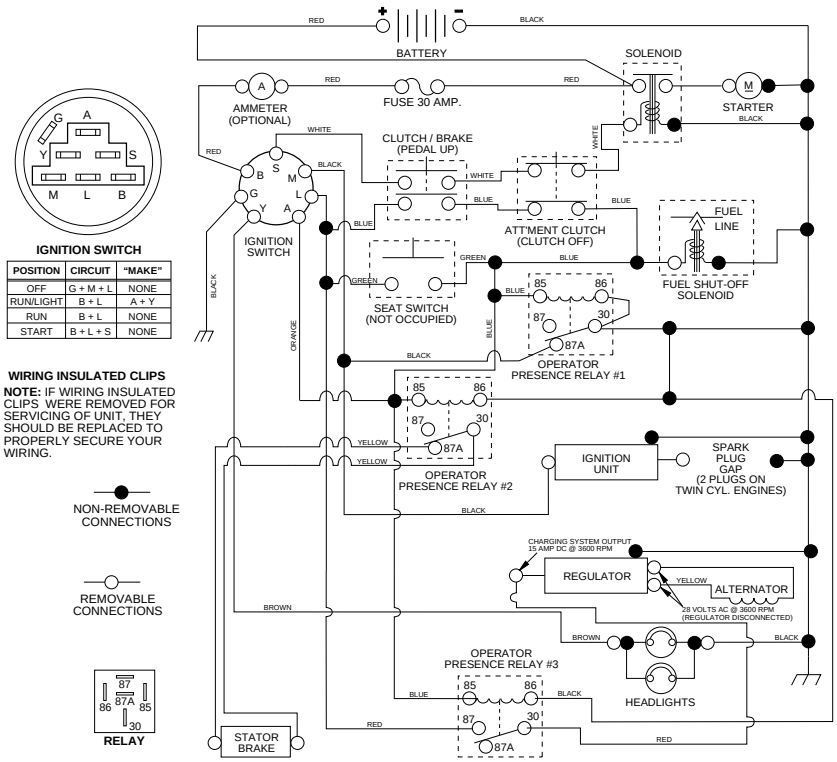
There is a Stator Brake with the 5 Amp charging system with two relays in the harness.
There is a different Stator Brake with the 15 Amp charging system with three relays in the harness.
With the 15 Amp system, Relay #3 disconnects the charging system from the tractor.
This directs all the current from the alternator to the Stator Brake.

In this system the Seat Switch is Olive Green and normally open when the operator is off the seat. The operator may actuate the Operator Presence Relay two ways:

- Both the Clutch/Brake and Attachment Interlock Switches are closed in the safe position,
- The operator is on the seat closing the Seat Switch.

When either of these conditions are met and the Ignition Switch is in the 'Start', 'Run', or the 'Run and Lights' position:

- Operator Presence Relay #1 is energized opening the contact that would "kill" the ignition,
- Operator Presence Relay #2 is energized opening the contact that engages the "Stator Brake",
- The Stator Brake, a magnetic field brake, is actuated. [See page # 77]
- The Fuel Shut-off Solenoid is energized letting fuel into the carburetor. This circuit also supplies current to the S.A.M. on Kohler Command Engines with this ignition system.



OPERATOR PRESENCE SYSTEM 'D'

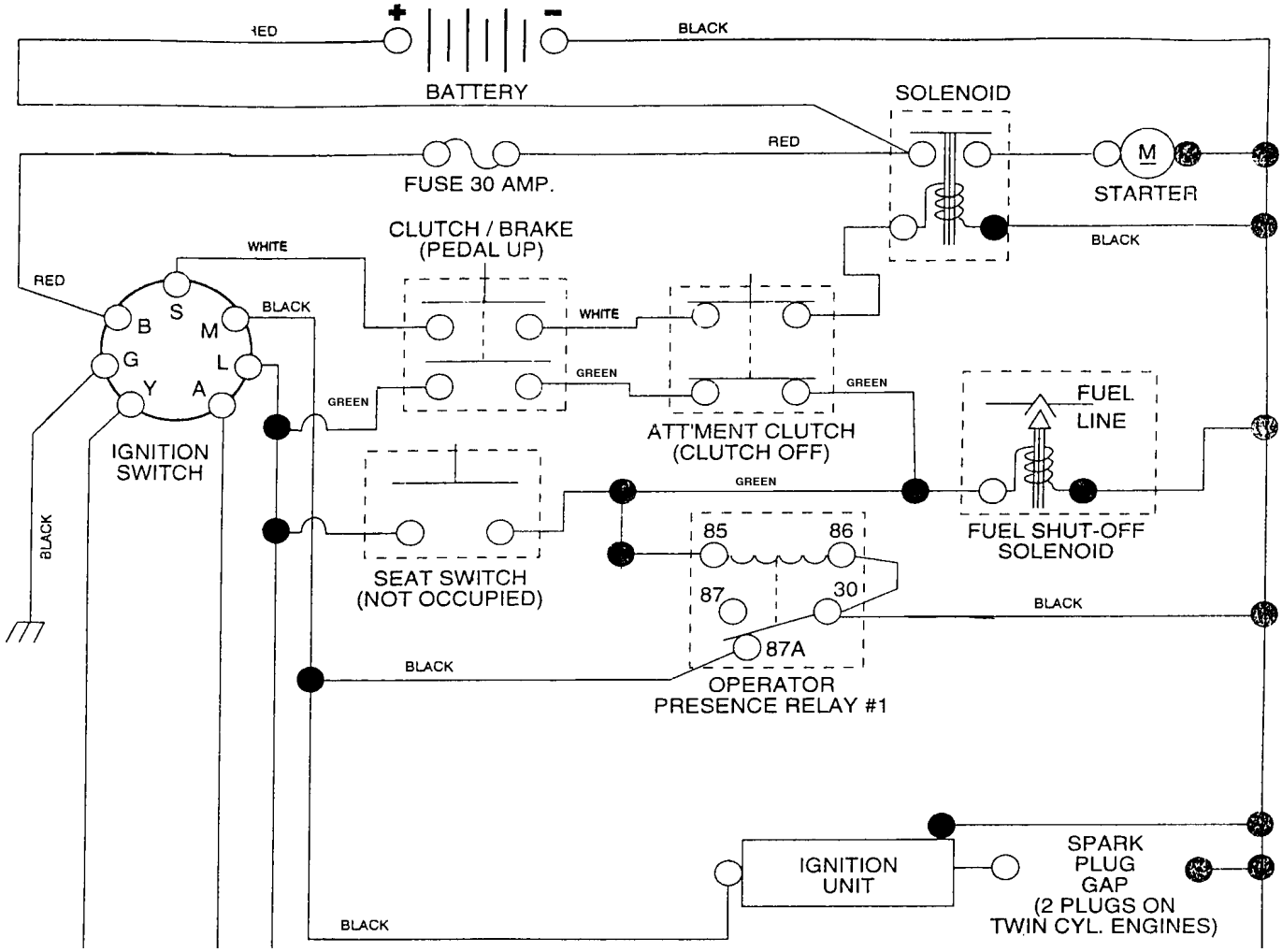
System 'D' will be used on Source 917 tractors with a Kohler Command Single Cylinder engine and a 46" Mower with manual engagement deck. It is similar to System 'C' except it does not have Operator Presence Relay #2, and does NOT have the engine Stator Brake.

In this system electrical current flows from the Ignition Switch through either the Seat Switch (NO) or the Clutch / Brake and Attachment Switches to energize two Operator Presence Relays. The Operator Presence Relay when de-energized grounds the ignition to stop the engine.

In this system the Seat Switch is Olive Green and normally open when the operator is off the seat. The operator actuates the Operator Presence Relay when: Both the Clutch/Brake and Attachment Interlock Switches are closed in the safe position, the operator is on the seat closing the Seat Switch.

When either of these conditions are met and the Ignition Switch is in the 'Start', 'Run', or 'Run and Lights' position:

- The Operator Presence Relay is energized opening the contacts that otherwise would "kill" the engine ignition system,
- The Fuel Shut-off Solenoid is energized letting fuel into the carburetor.



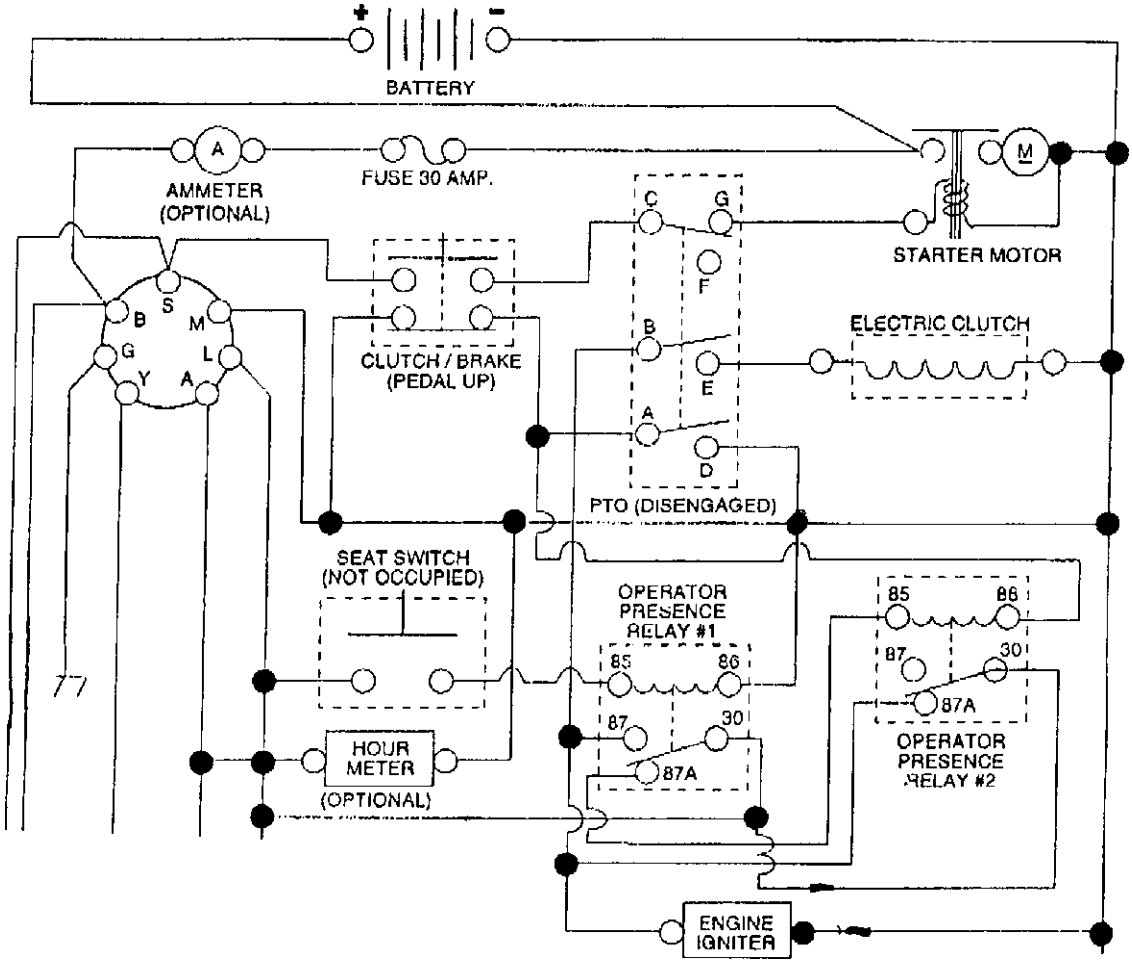
6

OPERATOR PRESENCE SYSTEM 'E'

System 'E' will be used on Source 917 tractors with a Battery Ignition engine, like a car engine ignition. Currently a tractor with a Kawasaki 18 HP Liquid Cooled Engine will be available.

This engine has a Positive BATTERY IGNITION instead of a magneto ignition. Electrical current from the battery powers a battery ignition. To stop an engine with Battery Ignition, a contact is broken that supplies current from the battery to the ignition system. In the past we had a different Ignition Switch that was open in the 'Off' position. With this system we use the same ignition switch we use on the tractors with magneto ignition. This is possible by using Operator Presence RELAYS to make and break electrical contacts for the electrical current powering the engine positive battery ignition.

In this system electrical current flows from the Ignition Switch through the Olive Green Seat Switch (NO), when the operator is on the seat, to energize Operator Presence Relay #1 and contact is made to supply electrical current to power the engine ignition system. Operator Presence Relay #1 when de-energized closes to make contact to supply power to actuate Operator Presence Relay #2. Relay #2 is energized when either the Clutch / Brake Pedal is in the up position to close that interlock switch, or when the mower PTO Switch is engaged. When Operator Presence Relay #2 is energized, contact is broken for power to the battery ignition. Operator Presence Relay #2 when de-energized connects electrical current to operate the engine battery ignition. There may be additional relays on the tractors for a Temperature Light or a Low Oil Light.

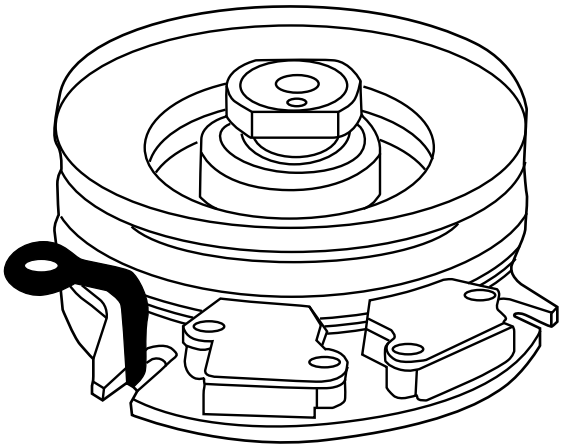


ELECTRICAL HARNESS WIRE COLORS for SOURCE 917 TRACTORS

RED	may be HOT whether or not the key is in 'ON' position
WHITE	wires in the starting circuit
BLACK	to Ground, they are often in circuits that 'ground' engine ignition
GREEN	hot wires to Seat Switch in operator presence circuit with relay
BLU E	wires to Carburetor Solenoid, Hourmeter, or switched accessories
ORANGE	power wire to Headlight Switch
BROWN	power wire from Headlight Switch to the Headlights or Taillights
YELLOW	from Engine Alternator to Regulator, Relay to Stator Brake

Use this chart as a general guide on current tractors. Wire colors on older tractors may vary where they are now Blue or Yellow.

EVX Electric Clutch for Lawn Tractors



F.H.P. Part Number	Engine	Clutch Model	Resistance
145028	Single Cylinder	EVX - 60	6.46 - 7.10 Ohms
160899	Twin Cylinder	EVX - 80	4.35 - 4.75 Ohms

1. Check resistance of windings.
2. Check to see if windings are grounded.
3. Check for 12 Volts DC at clutch connector.
4. Use Burnishing Procedure on new or replaced electric clutch.

Burnishing Procedure

This procedure should be performed with the mower or snowthrower attached.
NOTE: *Do not add additional load (e.g. cutting grass or blowing snow).*
1. Run engine at full throttle and engage load bringing load to full speed then disengage clutch.
2. Let load come to a full stop then engage again.
3. Repeat this (1 and 2) 10 times.
After burnishing procedure is complete, to maximize life of the clutch and the attachment belt, always engage clutch at half throttle before raising to full engine speed.

Electrical System Diagnosis

The most common electrical problem is to not have a ground. If the battery is not grounded, electricity will not be supplied to any component. If the component is not grounded, other electrical items will work but not that component.

Test the Battery Ground before doing the Component Ground Test. Examples of Electrical Schematics each with an accompanied Wire Harness Layout can be found the next few pages. Each schematic will be for a different operator presence system.

Battery Ground Test

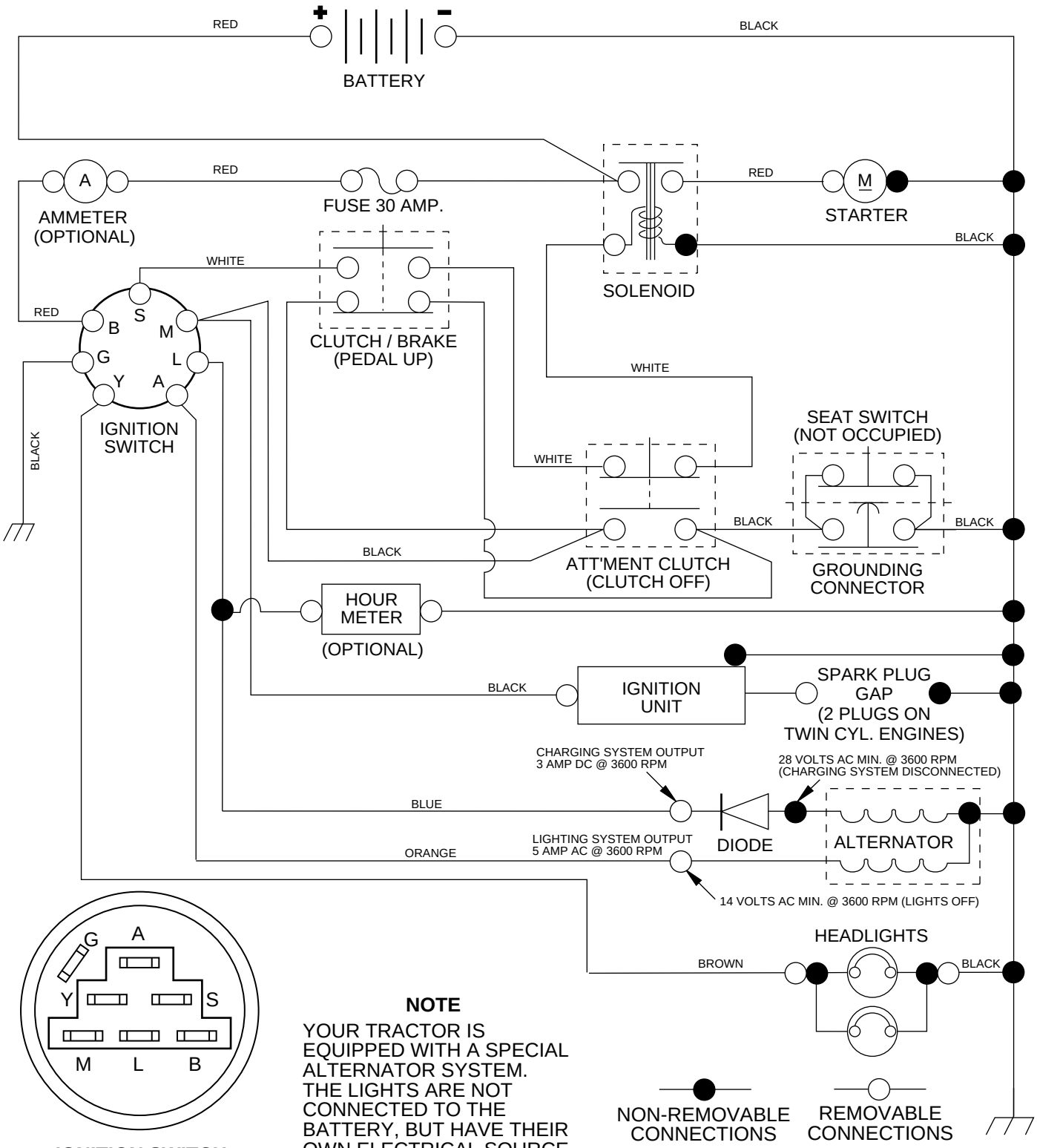
- Check voltage between battery posts, it must be over 12.2 D.C. Volts.
- Remove black battery cable from battery terminal and clean both the battery cable end and the battery terminal.
- Turn the Ignition Switch to the 'Run' or 'On' position and turn the headlights on.
- Place one probe from the meter on the battery terminal and the other probe on the black battery cable end.
- The battery cable ground is good if the Voltage reading is close to the battery voltage reading taken earlier.
- The battery is not grounded to the frame if no voltage is noted on the meter. Repair the connection between the black battery cable and the chassis and re-test until a voltage reading is acceptable.

Component Ground Test

- Put meter on R x 1 resistance scale
- Connect meter negative or black Lead Probe to the Negative (-) Battery Terminal.
- Turn the Ignition Switch and other switches to 'OFF' position, so that the component being tested has NO electrical power.
- Touch the positive or red Lead Probe to the Ground or Ground Terminal of the component being tested.
- If resistance is over 0. 7 Ohms, the ground to this component must be repaired and re-tested.
- If resistance is 0. 7 Ohms or below, the component is grounded.

Use electrical schematics and wire harness layouts on the next few pages to find component grounds. The number for the newest electrical schematics book for Source 917 tractors can be found on the page for Service Information Books.

HARNESS #156442 OPERATOR PRESENCE SYSTEM "A"



IGNITION SWITCH

POSITION	CIRCUIT	"MAKE"
OFF	G + M + L	NONE
RUN/LIGHT	B + L	A + Y
RUN	B + L	NONE
START	B + L + S	NONE

NOTE

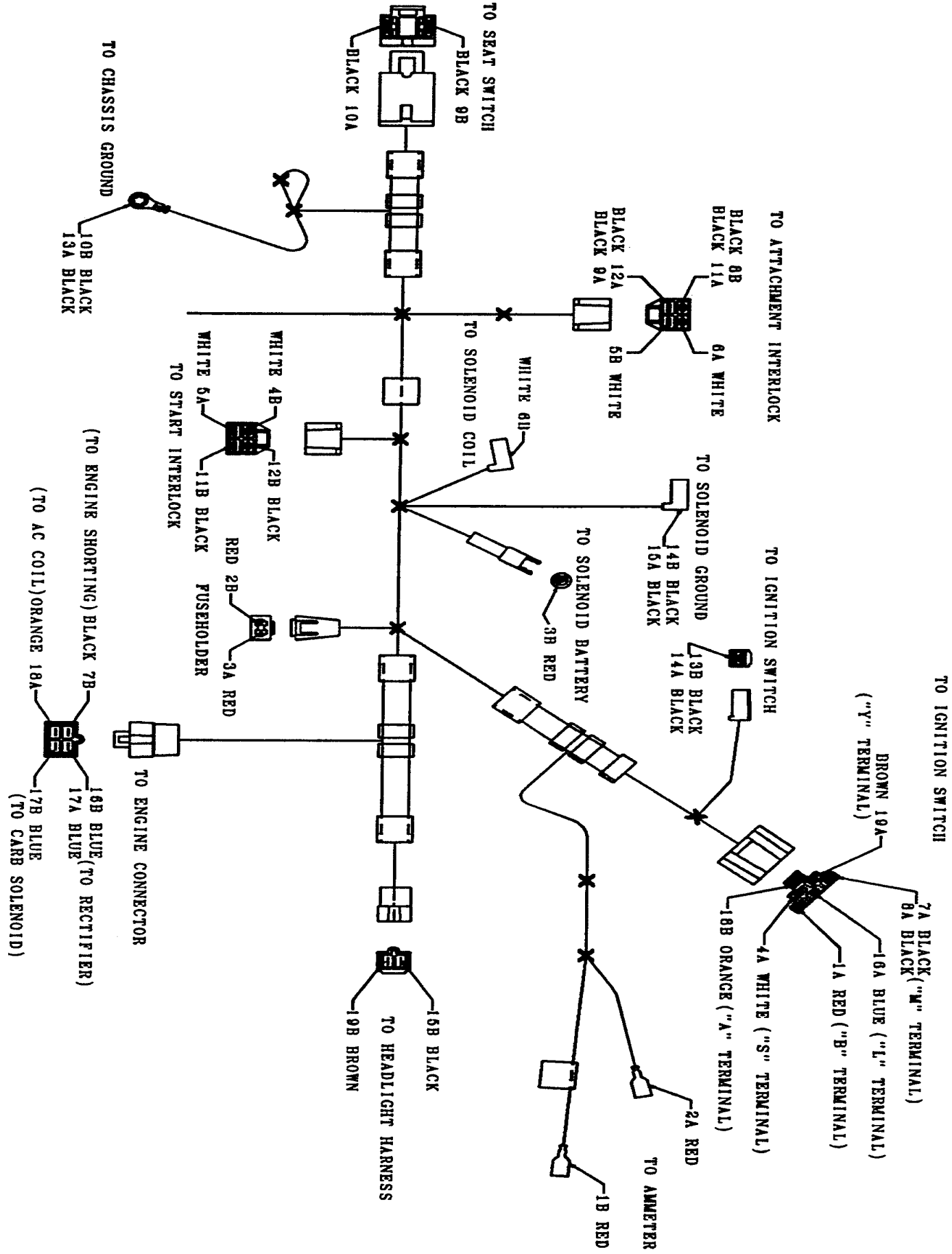
YOUR TRACTOR IS EQUIPPED WITH A SPECIAL ALTERNATOR SYSTEM. THE LIGHTS ARE NOT CONNECTED TO THE BATTERY, BUT HAVE THEIR OWN ELECTRICAL SOURCE. BECAUSE OF THIS, THE BRIGHTNESS OF THE LIGHTS WILL CHANGE WITH ENGINE SPEED. AT IDLE THE LIGHTS WILL DIM. AS THE ENGINE IS SPEEDED UP, THE LIGHTS WILL BECOME THEIR BRIGHTEST.

WIRING INSULATED CLIPS

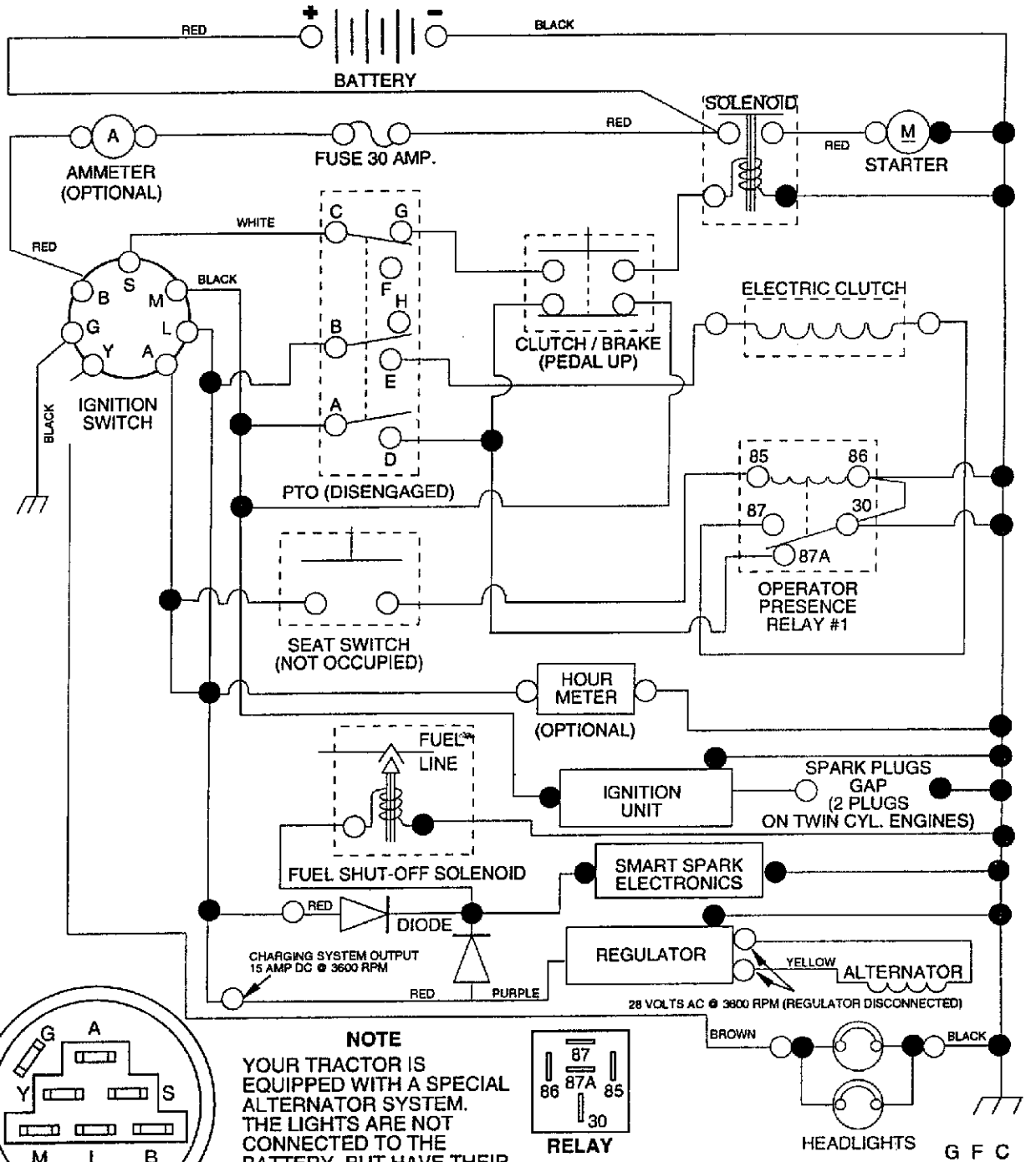
NOTE: IF WIRING INSULATED CLIPS WERE REMOVED FOR SERVICING OF UNIT, THEY SHOULD BE REPLACED TO PROPERLY SECURE YOUR WIRING.

6

HARNESS #156442 OPERATOR PRESENCE SYSTEM "A"



HARNESS #160732 OPERATOR PRESENCE SYSTEM "B"



NOTE

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IGNITION SWITCH

POSITION	CIRCUIT	"MAKE"
OFF	G + M + L	NONE
RUN/LIGHT	B + L	A + Y
RUN	B + L	NONE
START	B + L + S	NONE

PTO SWITCH

POSITION	CIRCUIT
OFF	C + G, B + H
ON	C + F, B + E, A + D

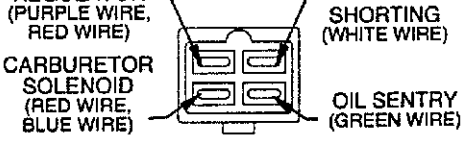
REMOVABLE CONNECTIONS

NON-REMOVABLE CONNECTIONS

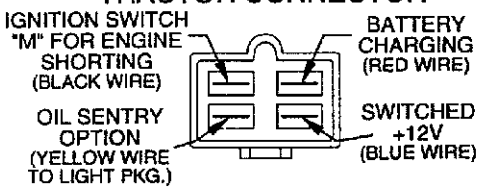
WIRING INSULATED CLIPS

NOTE: IF WIRING INSULATED CLIPS WERE REMOVED FOR SERVICING OF UNIT, THEY SHOULD BE REPLACED TO PROPERLY SECURE YOUR WIRING.

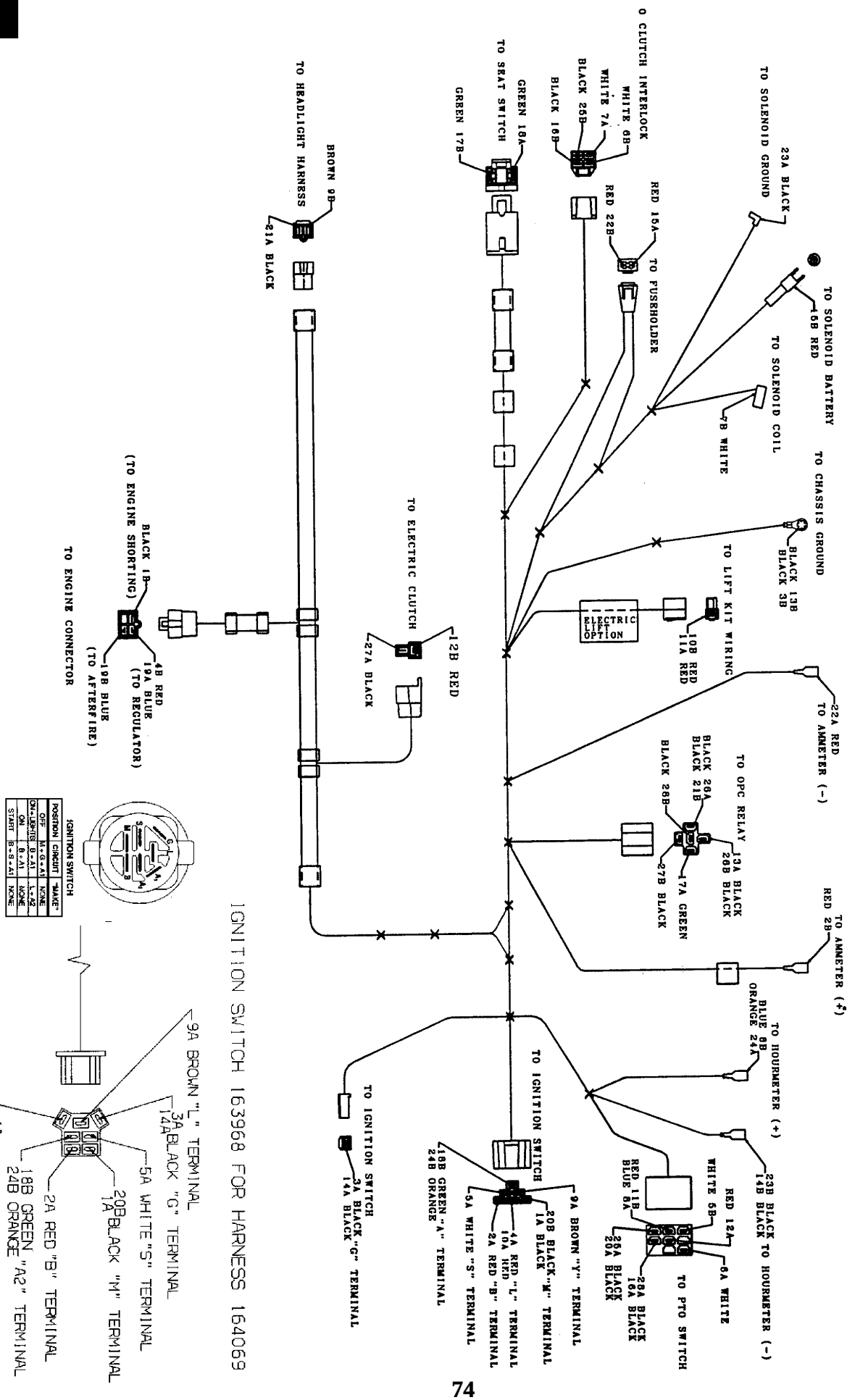
ENGINE CONNECTOR



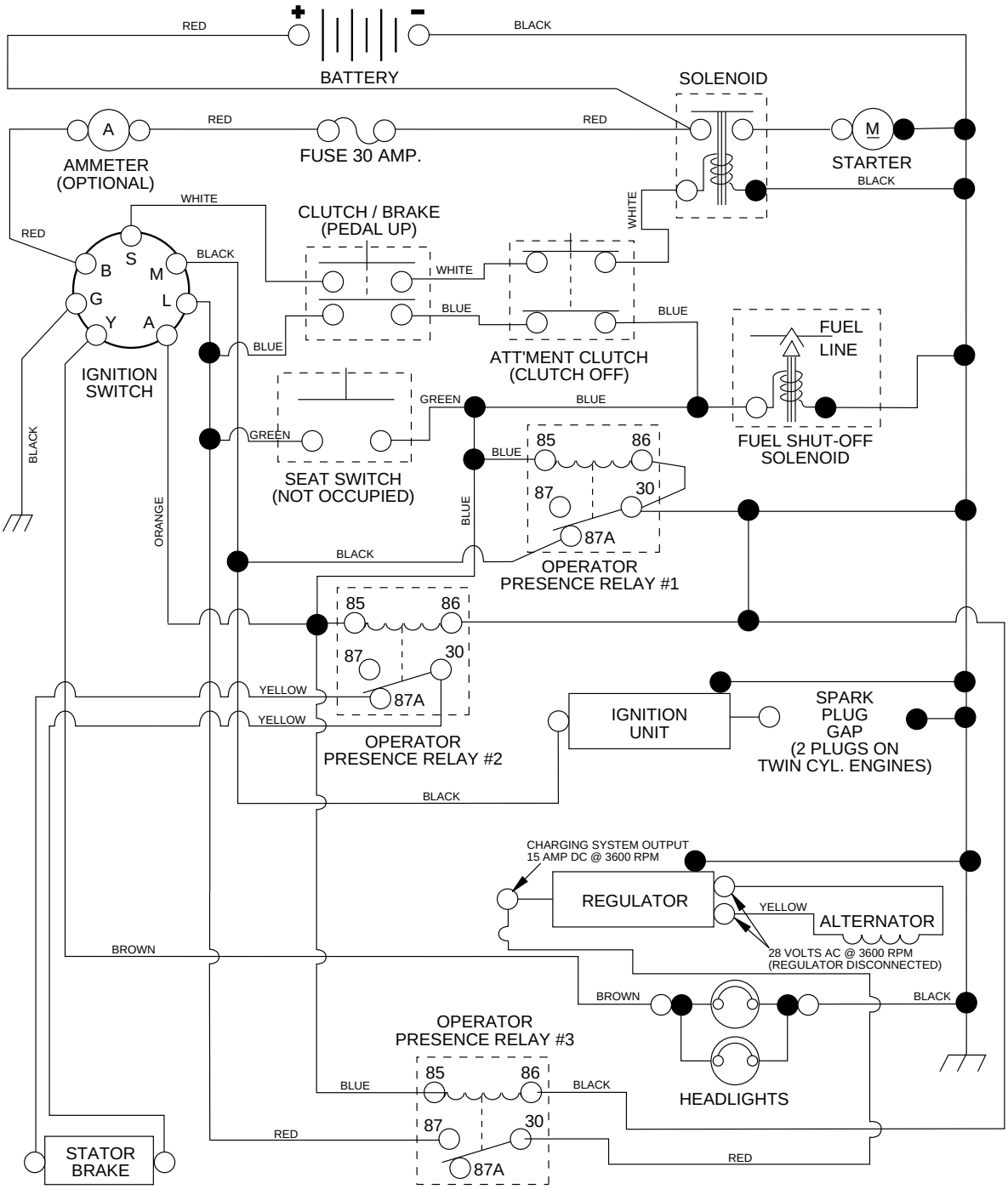
TRACTOR CONNECTOR

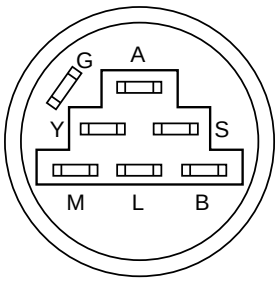


HARNESS #160732 OPERATOR PRESENCE SYSTEM "B"



HARNESS #163845 OPERATOR PRESENCE SYSTEM "C"





IGNITION SWITCH

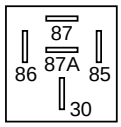
POSITION	CIRCUIT	"MAKE"
OFF	G + M + L	NONE
RUN/LIGHT	B + L	A + Y
RUN	B + L	NONE
START	B + L + S	NONE

WIRING INSULATED CLIPS

NOTE: IF WIRING INSULATED CLIPS WERE REMOVED FOR SERVICING OF UNIT, THEY SHOULD BE REPLACED TO PROPERLY SECURE YOUR WIRING.

NON-REMOVABLE CONNECTIONS

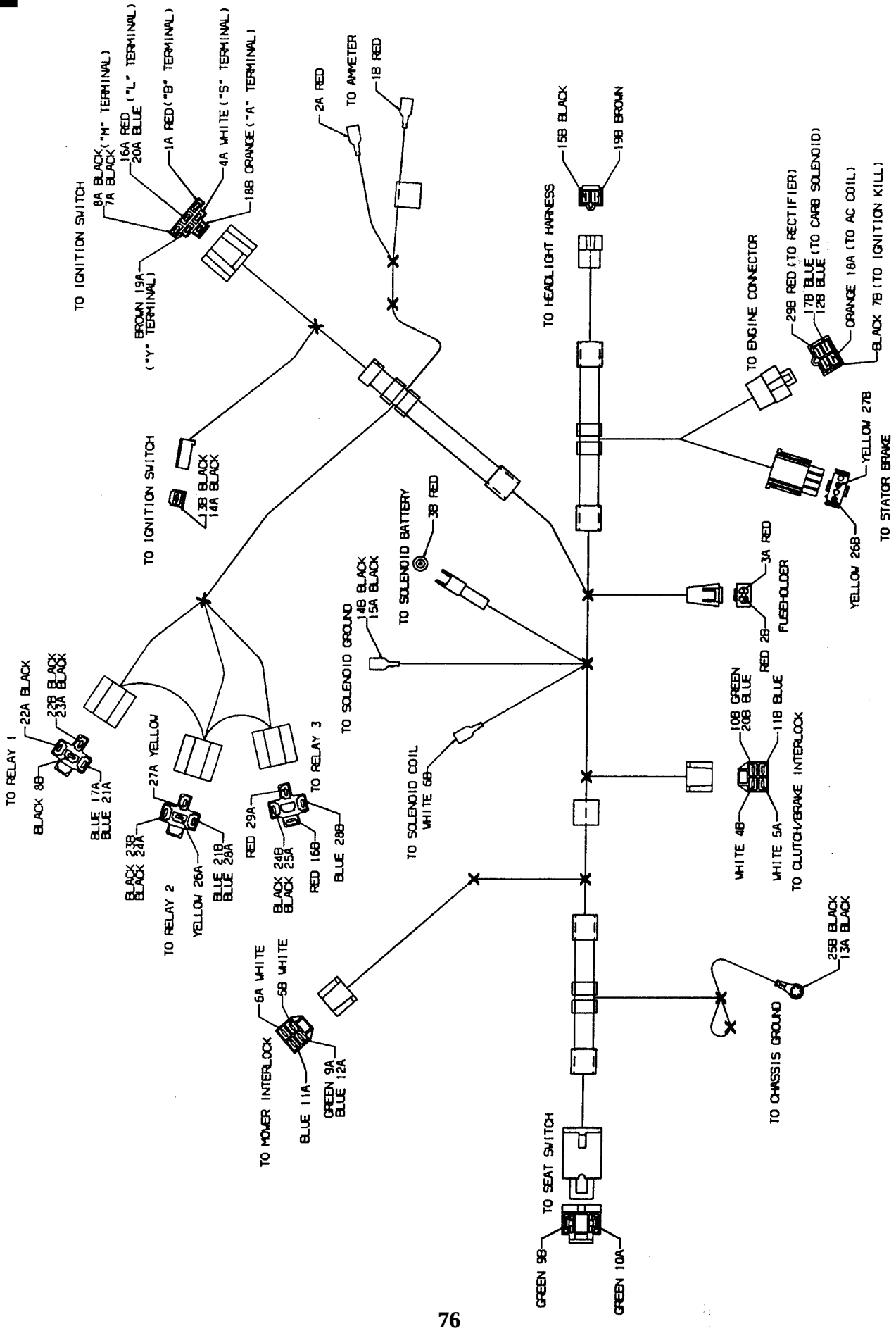
REMOVABLE CONNECTIONS



RELAY

6

HARNESS #163845 OPERATOR PRESENCE SYSTEM "C"



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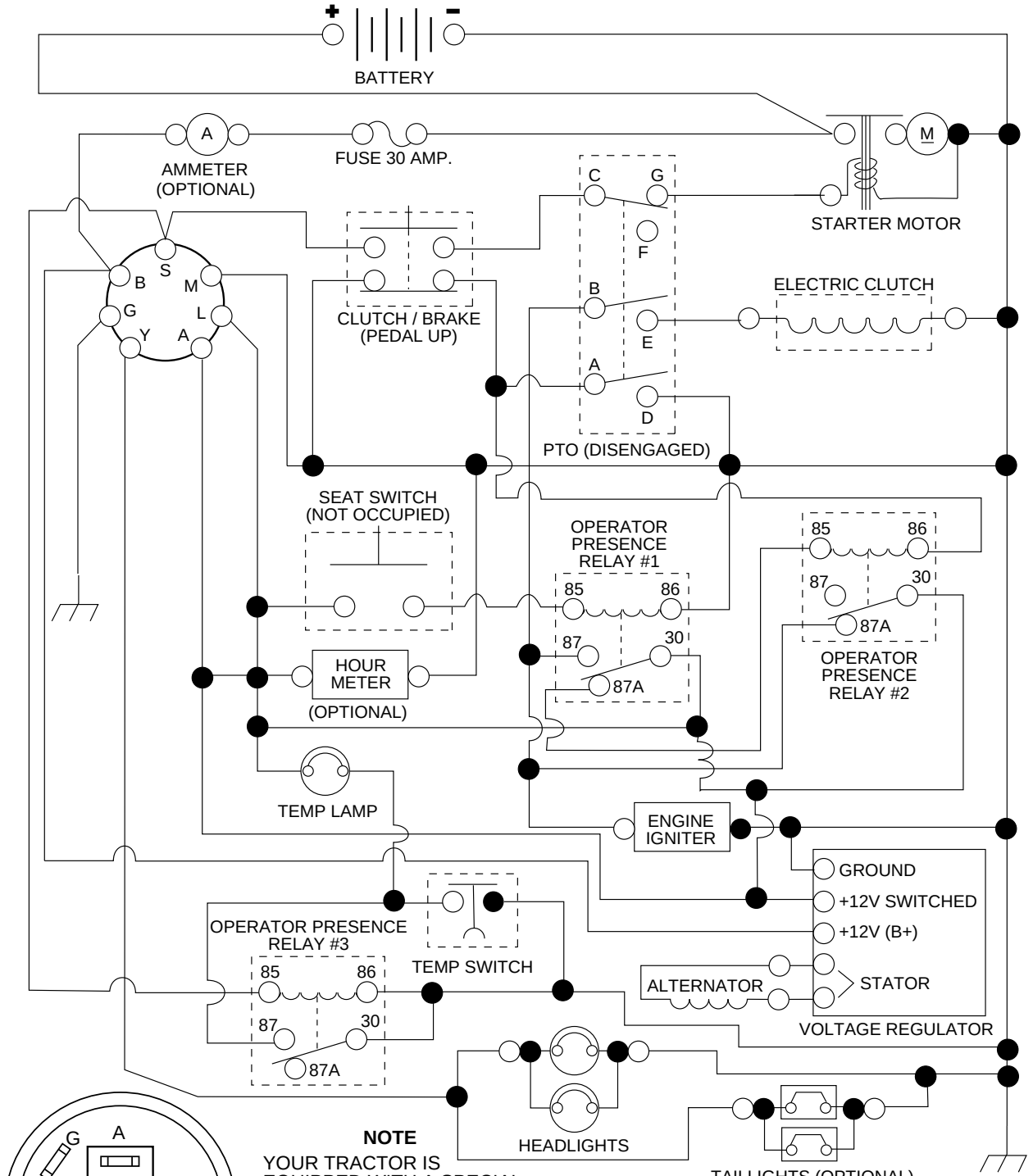
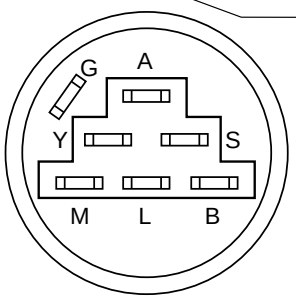


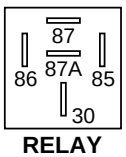


IGNITION SWITCH

POSITION	CIRCUIT	"MAKE"
OFF	G + M + L	NONE
RUN/LIGHT	B + L	A + Y
RUN	B + L	NONE
START	B + L + S	NONE

NOTE

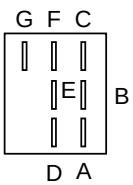
YOUR TRACTOR IS EQUIPPED WITH A SPECIAL ALTERNATOR SYSTEM. THE LIGHTS ARE NOT CONNECTED TO THE BATTERY, BUT HAVE THEIR OWN ELECTRICAL SOURCE. BECAUSE OF THIS, THE BRIGHTNESS OF THE LIGHTS WILL CHANGE WITH ENGINE SPEED. AT IDLE THE LIGHTS WILL DIM. AS THE ENGINE IS SPEEDED UP, THE LIGHTS WILL BECOME THEIR BRIGHTEST.



RELAY

PTO SWITCH

POSITION	CIRCUIT
OFF	C + G, B + H
ON	C + F, B + E, A + D



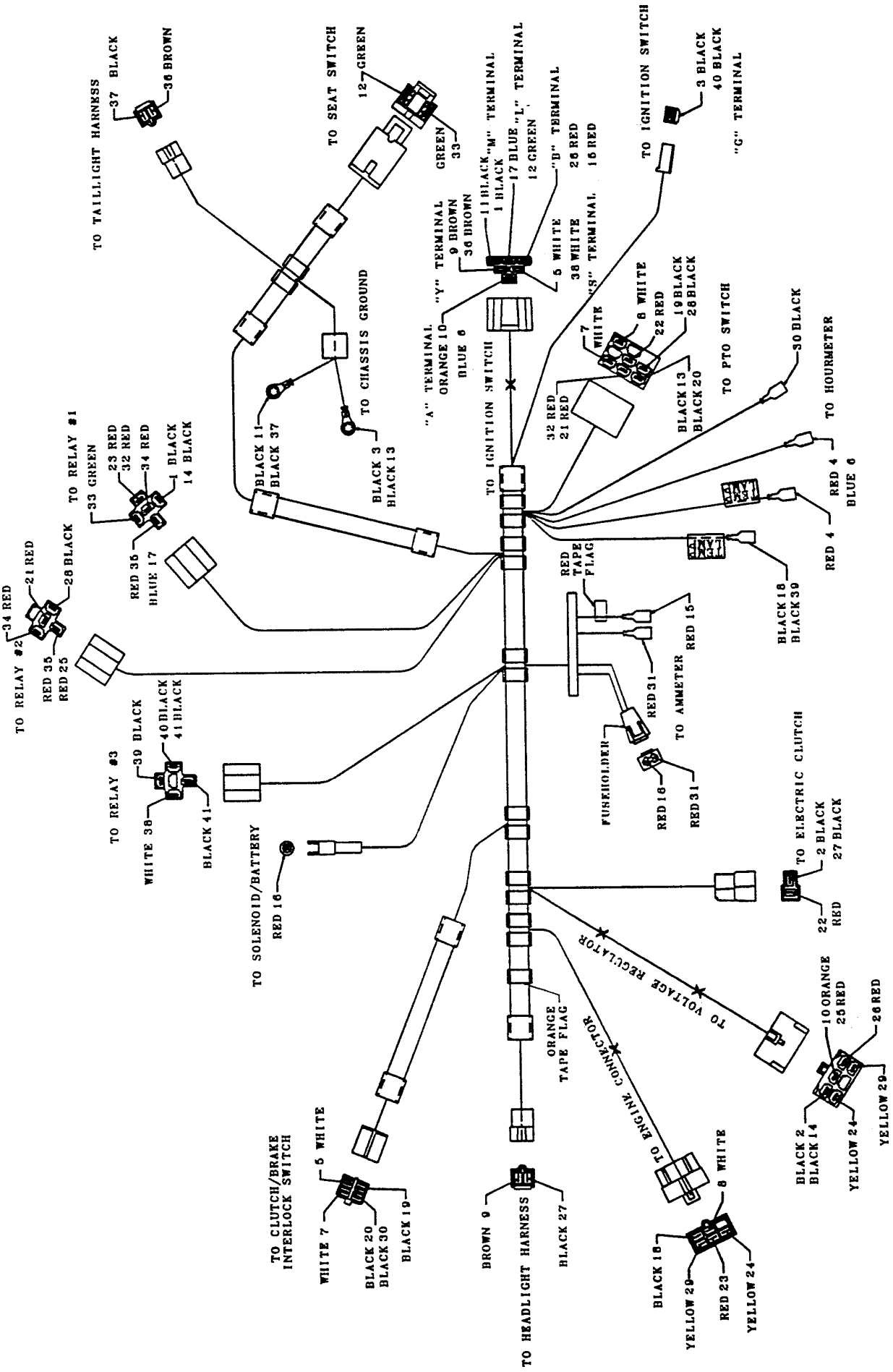
REMOVABLE CONNECTIONS

NON-REMOVABLE CONNECTIONS

WIRING INSULATED CLIPS

NOTE: IF WIRING INSULATED CLIPS WERE REMOVED FOR SERVICING OF UNIT, THEY SHOULD BE REPLACED TO PROPERLY SECURE YOUR WIRING.

HARNESS #160735 OPERATOR PRESENCE SYSTEM "E"

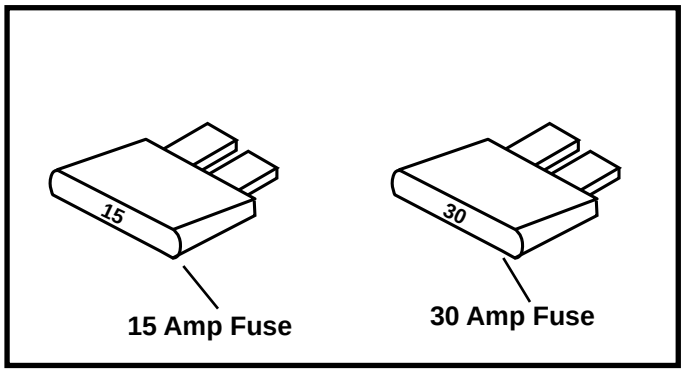


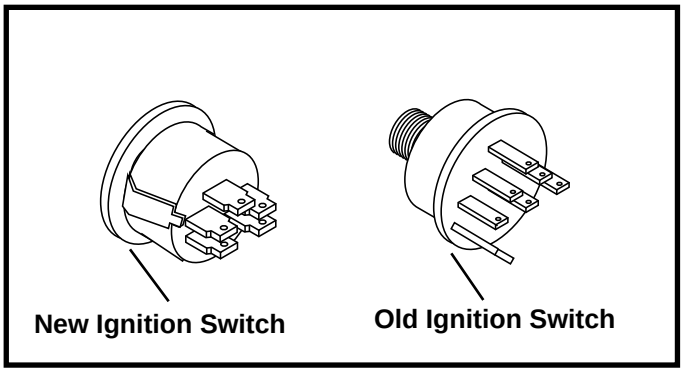
Changes for Tractor Electrical Systems

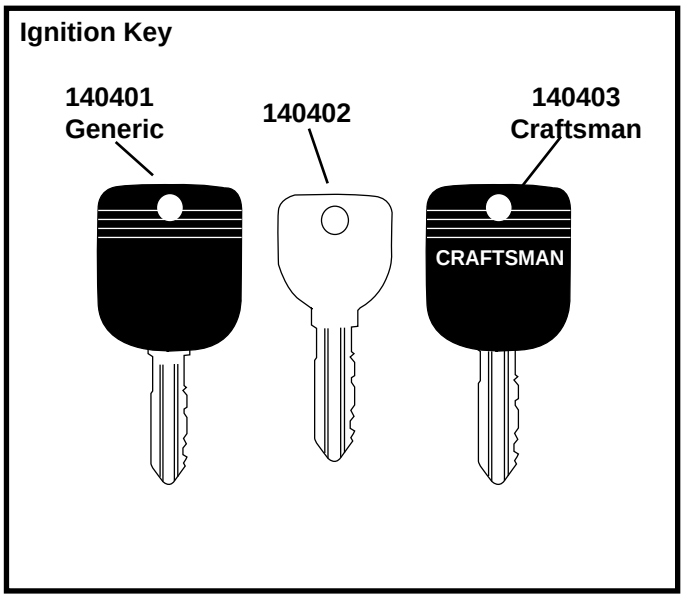
A 15 Amp Fuse is used on 1999 Lawn Tractors. Lawn Tractors made before 1999 can use either the 15 Amp or 30 Amp fuse. All Garden Tractors should use the 30 Amp fuse.

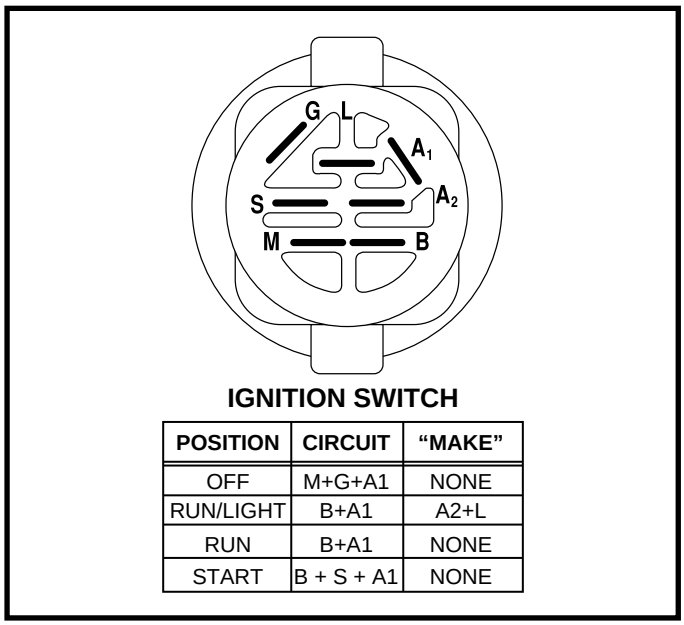
A new snap in ignition switch # 163968 came into use during 1998 production. It was first used with the new GT Stealth aesthetic package. This ignition switch will be added to other aesthetic packages and on most FHP tractors by the year 2000.

When the snap in ignition switch is used the longer ignition key must be used.





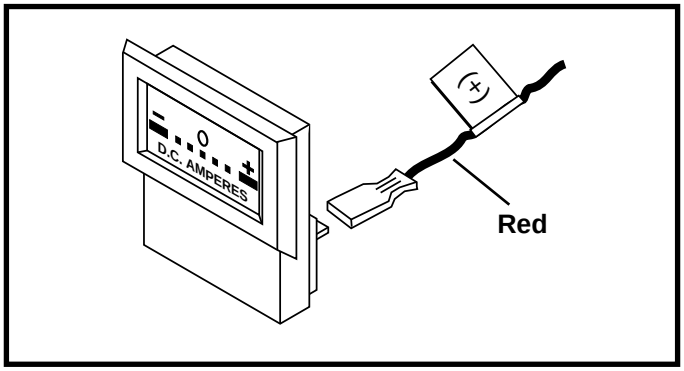




IGNITION SWITCH

POSITION	CIRCUIT	"MAKE"
OFF	M+G+A1	NONE
RUN/LIGHT	B+A1	A2+L
RUN	B+A1	NONE
START	B + S + A1	NONE

FHP wire harnesses have had red tape on the red wire from the battery. In 1999 this will change to a white tape with a red (+). This will make the wire easier to find and will better explain the purpose of the tape. If the wires to the ammeter are reversed it will read in reverse (discharging when charging).

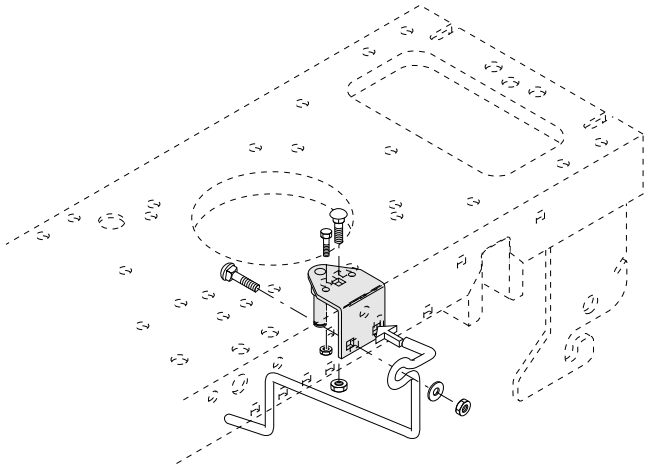


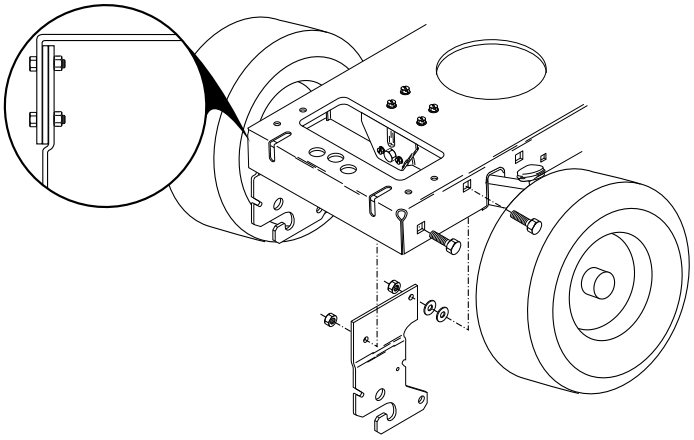
TRACTOR FRAME SECTION

CLUTCH BRAKE KIT, FRONT SUSPENSION KIT, FRAME KIT

Clutch bracket replacement kit # 71/917 137329

Front suspension bracket repair kit no. 71/917 140243 for LT and YT Tractors

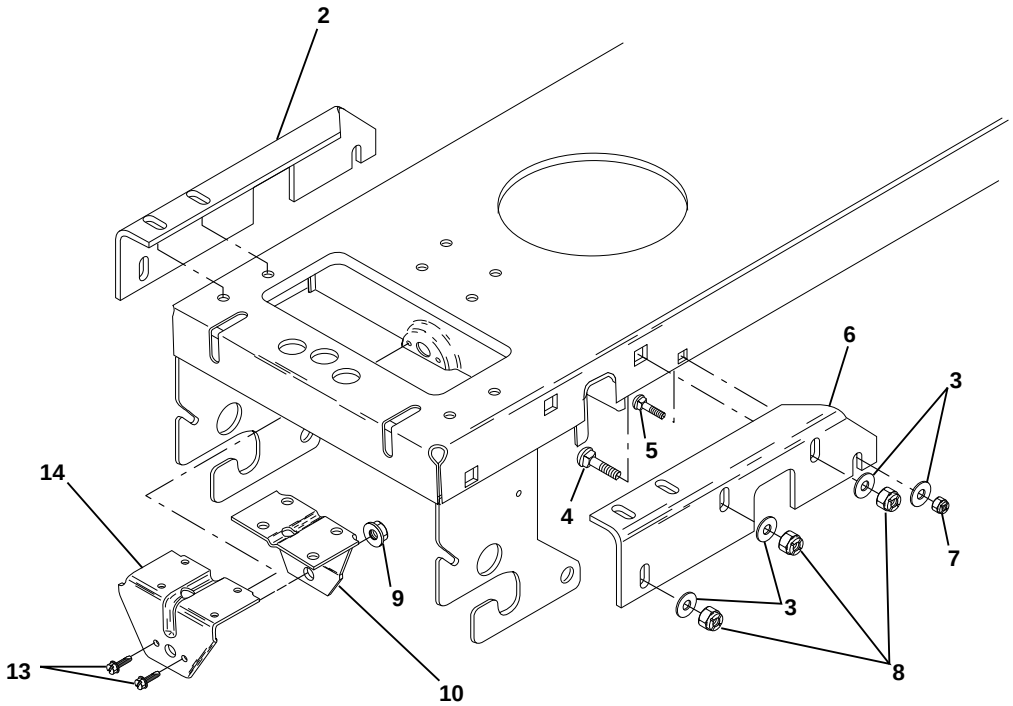




1. LT. tractors - the tractor clutch pedal gets hung up halfway and will not release, causing customer to pull foot pedal back with his toe of shoe to engage drive belt - Solution - drop the tractor motion drive clutch idler assembly and lubricate the idler pin with grease. If the welded pin is rust pitted, you can replace with clutch bracket kit 71/917 #137329

2. LT. front suspension bracket that is welded to the front of the tractor frame gets twisted or bent from the customer hitting things - Solution - cut off welded front suspension brackets with a hack-saw and install suspension bracket kit 71/917 #140243

Condition: LT frame cracked behind the axle saddle, nose of tractor frame bent down. Solution, install kit 71/917 #137797.

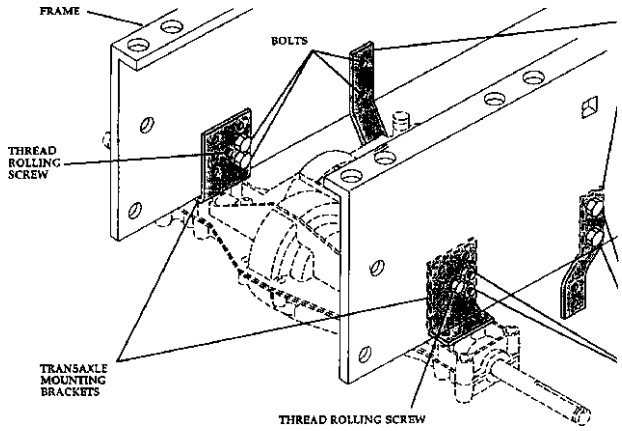


7

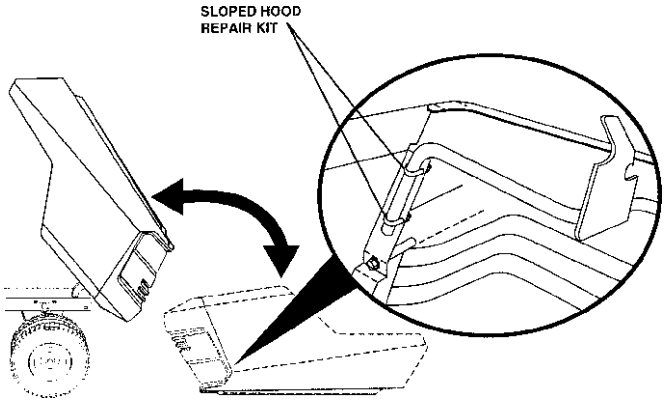
TRACTOR FRAME SECTION

LEVEL FRAME, HOOD KIT, FOOT/BRAKE PEDAL SHAFT BINDING

Level tractor frame



Hood weld breaks

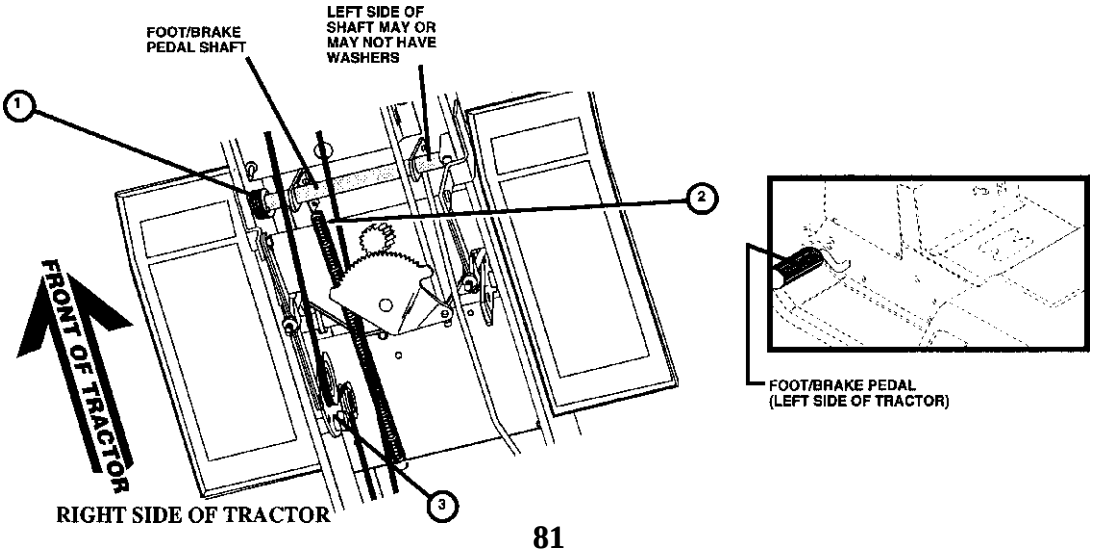


Hood not level on lawn tractor because frame is not level. Solution loosen bolts on transaxle L shape mounting brackets, lift rear of tractor up and down until tractor sits level, retighten bolts.

1. FOOT/BRAKE PEDAL SHAFT SHOULD HAVE A TOTAL OF FOUR (4) WASHERS. THE WASHERS MAY BE ON EITHER END OF SHAFT. IF THERE ARE MORE THAN FOUR TOTAL WASHERS, REMOVE NECESSARY WASHERS FROM THE RIGHT SIDE ONLY.
2. REPLACE THE GROUND DRIVE SPRING PART #138364 WITH NEW HIGHER TENSION SPRING PART 71/917 #149412.
3. REMOVE CLUTCH ARM AND LUBRICATE THE IDLER BEARING PART 71/917 #105706X WITH ANTI-SEIZE. REASSEMBLE AND VERIFY CLUTCH ARM IS MOVING FREELY.

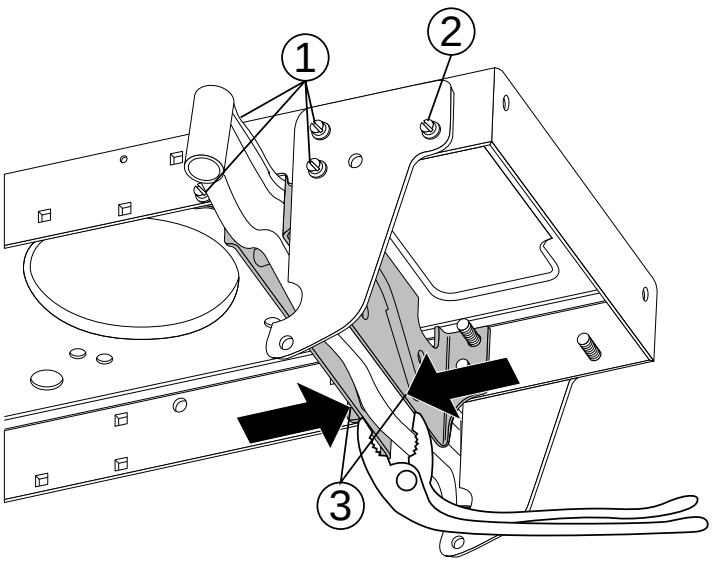
IF STEPS 1 THROUGH 3 DO NOT CORRECT THE INSUFFICIENT GROUND DRIVE CONDITION.
REFER TO SERVICE FLASH ON GT HYDRO TRANSAXLE OIL/FILTER CHANGE.
CHANGE OIL WITH SYNTHETIC 1 15W50 MOBIL 1 ENGINE OIL.
NOTE: TRACTORS OPERATING IN COLD CONDITIONS (BELOW 10 F), CHANGE OIL USING SYNTHETIC 5W30 MOBIL 1 ENGINE OIL.

GT. Hydro's foot/brake pedal shaft binding on unit built before July 31,1995 - Solution - Foot/brake pedal shaft should have a total of 4 washers only. The washer may be on either end of shaft. Remove excess washer from right side of shaft. Install tension spring 149412.



TRACTOR FRAME SECTION

CLUTCH BRAKE KIT, FRONT SUSPENSION KIT, FRAME KIT



1. LOOSEN FOUR BOLTS HOLDING THE FRONT AXLE BRACES ON RIGHT HAND SIDE OF THE TRACTOR, (ITEM 1), DO NOT LOOSEN BOLT, (ITEM 2).
2. USING CHANNEL LOCKS SQUEEZE THE AXLE BRACES, (ITEM 3), TOGETHER AS SHOWN IN FIG. 1.
3. WHILE HOLDING AND SQUEEZING THE AXLE BRACES TOGETHER RETIGHTEN ALL FOUR AXLE BRACE BOLTS, (ITEM 1).
4. REPEAT THIS PROCEDURE ON LEFT HAND SIDE.

Steering bellcrank bushing kit 71/917 #140342

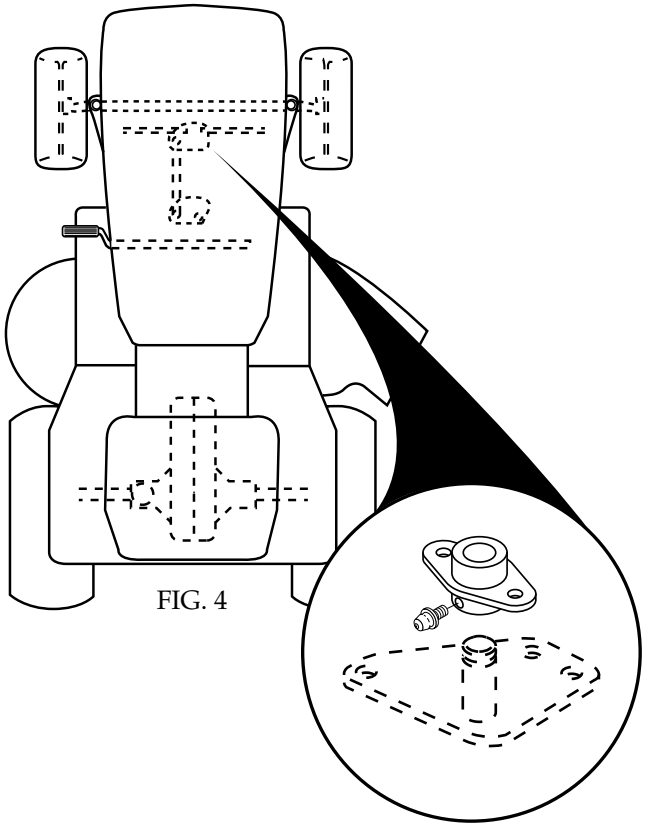


FIG. 4

GT. steering on garden tractors with horizontal engine becomes very hard to turn or freezes up - Solution - remove steering bell crank and lubricate the bell crank shaft. Replace bell crank assembly

VGTH GROUND DRIVE BELT KEEPER KIT 71/917 #156109

Gt. Hydro's main drive V-Belt comes off to the inside of the input pulley between the pulley and the hydro transaxle. Solution install bolt belt keeper kit number 71/917 156109.

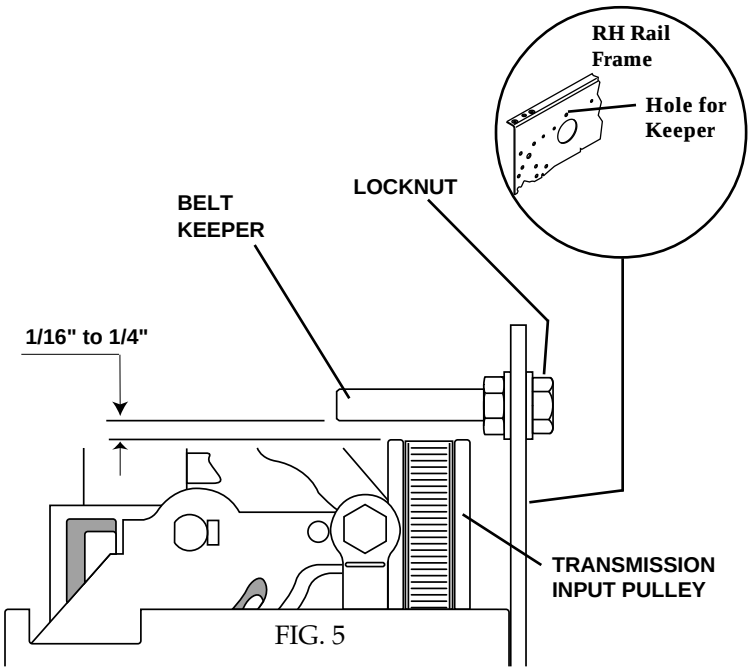


FIG. 5

Customer reports side to side play in the steering wheel..

1. Make sure the steering shaft extension adapter nut and bolt were tighten securely during tractor set up to 18-22 FT LBS, (SEE FIG.1).

2. Check to see if the steering assembly needs to be repaired by watching the small pinion gear as the steering shaft is turned . If the small pinion gear and large sector gear turn at the same time when rotating the steering shaft the unit is ok. If the small pinion gear moves before the larger sector gear the steering assembly needs to have shim washer added. Tractor should have from 3 to 5. Shim washer's on the pittman shaft before the klip ring.

3. To repair remove the fuel tank or the battery and battery support tray which ever is applicable, for ease of access to the steering assembly.

4. Rotate the klip ring on the end of the pittman shaft assembly as shown in FIG. 2, for ease of removing the klip ring. With the klip ring rotated, use a long screw driver and push the klip ring off..

5. Place a pry bar in the slotted part of the frame and push the welded end of the pittman arm over to allow you to add additional washers to the shaft as required, (SEE FIG.2).

6. Install 3 to 5 shim washers as required to tighten steering assembly and reinstall klip ring. shim washer kit 71/917 #159258.

7. Reinstall the fuel tank or the battery and battery support tray which ever is applicable.

Time required to make this repair is approximately 20 minutes.

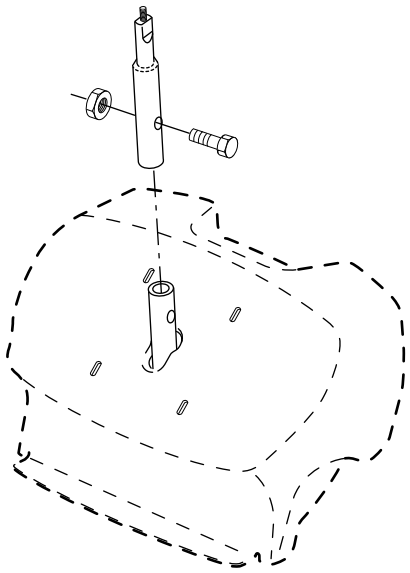


FIG. 1

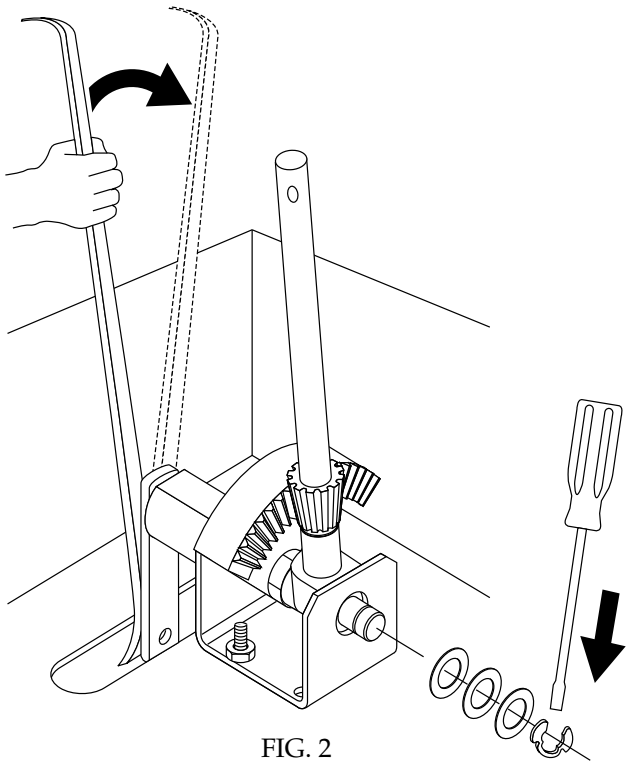


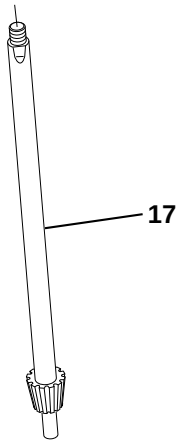
FIG. 2

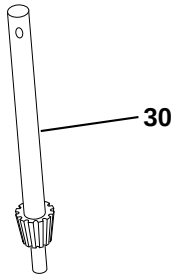
7

COMPLETE STEERING ASSEMBLY KITS

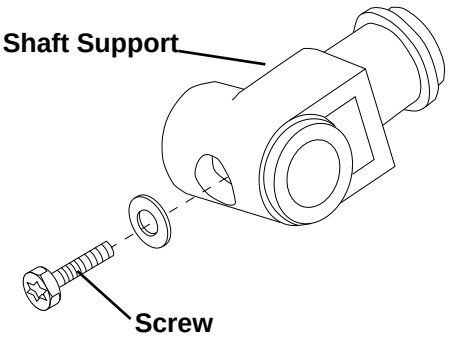
FITS LAWN AND YARD TRACTORS BUILT AFTER 1992

Key #	Part #	Shaft Size	Shaft Length	Steering Nut	Steering Kit Assembly #
17	128755	3/4	20.21"	1/2—20	71/917 158718
17	128758	3/4	20.83"	1/2—20	71/917 156595
17	128762	3/4	22.93"	1/2—20	71/917 156596
17	132614	5/8	17.71"	3/8—24	71/917 156593
30	140176	5/8	15.21"	Bolt	71/917 156594

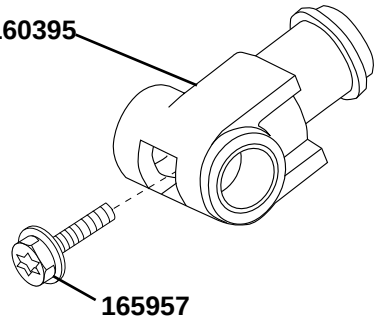




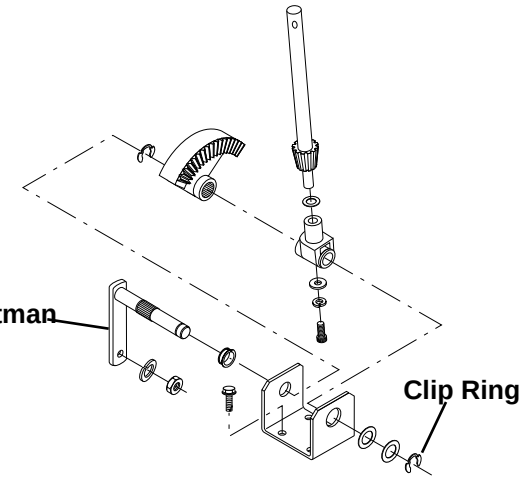
1989-1998 Steering Shaft Support



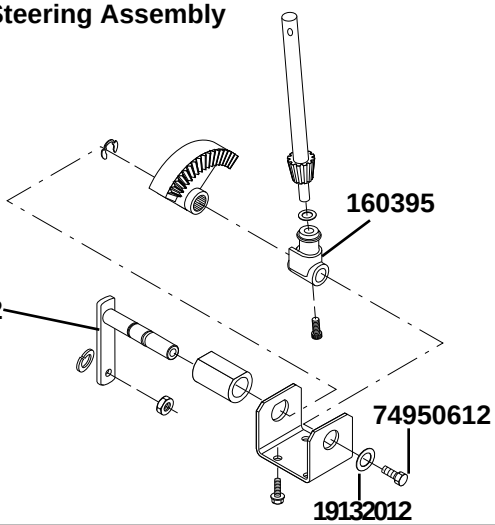
1999 Steering Shaft Support



Steering Assembly 1989 - 1998



1999 Steering Assembly



At the end of the pittman shaft, a bolt and washer replace the clip ring.

8 1997 FEDERAL EMISSIONS REGULATIONS AND NEW FEDERAL (E.P.A) EMISSIONS CERTIFIED ENGINE WARRANTY STATEMENT ON PRODUCTS SOLD IN USA

MODEL NUMBERS:
All engines produced after August 1, 1997 and sold in U.S.A. are to be in compliance.

ISSUE:
New utility, lawn & garden equipment engines built after August 1, 1997 must be designed, built and equipped to meet the Environmental Protection Agency (EPA) emission standards. The following parts and warranty considerations are part of this new law.

PARTS:
Emission related parts as defined below, are covered for 2 years parts and labor (terminology varies by engine manufacturer-refer to emission Warranty statement for specifics):

1-Fuel Metering System
- Carburetor assembly and internal components
- Cold start enrichment system (primer/choke)
- Fuel Pump
- Fuel filter
- Carburetor Gaskets
- Intake pipe

2-Air Induction System
- Air cleaner/filter element

3-Ignition System
- Spark plug
- Ignition module
- Flywheel assembly

4-Catalytic Muffler (if so equipped)
- Exhaust manifold
- Muffler gasket
- Air injection system or pulse valve

5-Crankcase Breather assembly & its components
- Breather connection tube

6-Miscellaneous Items Used in Above Systems
- Vacuum, temperature, position, time sensitive valves and switches
- Connectors and assemblies

SERVICE TECHNICIAN'S RESPONSIBILITIES:

The technician is required by Federal law to use ORIGINAL or APPROVED replacement parts any time emission related parts need to be replaced to assure that the engine will continue to meet the EPA emission standards. The technician is required under Federal law to use unleaded regular or reformulated fuel only. This is the same as required by auto regulations. The engines are designed to meet the emission standards using these fuels only.

UN-APPROVED add-on or modified parts may not be used to modify or repair an emission compliant engine. **Any deviation from "as built" production parts will be a direct violation of Federal Law and is subject to fine.**

EMISSION COMPLIANT ENGINE IDENTIFICATION:
All engines built for use in the U.S.A. after September, 1997 meeting the Federal EPA emission standards must be identified as such by the engine identification label.
This label is on the ENGINE on equipment such as rotary lawn mowers, edgers, and tillers. On equipment that has an enclosed engine such as a lawn tractor, the ID label will be on the engine but also an identification label outside the engine compartment if the engine label is not visible when the hood is opened.

CUSTOMER RESPONSIBILITIES:
The customer is responsible for bringing the engine (product) to Sears Service for repair (SHOP WARRANTY) as soon as a problem exists.

The customer is responsible for normal maintenance as specified in the owner's manual such as air filter/spark plug replacement, oil level checks or oil changes, etc.

The customer is required by Federal Law to use ORIGINAL or APPROVED replacement parts any time emission related parts need to be replaced to assure that the engine will continue to meet the EPA emission standards.

The customer is required under Federal law to use unleaded regular or reformulated fuel. This is the same as required by auto regulations. The engines are designed to meet the emission standards using these fuels only.

UN-APPROVED add-on or modified parts may not be used to modify or repair an emission compliant engine. Any deviation from "as built" or approved replacement production parts will be a direct violation of Federal law.

COMMON QUESTIONS ASKED BY SEARS TECHNICIANS ABOUT THE FEDERAL EPA EMISSION WARRANTY STATEMENT, THE EPA EMISSION REGULATIONS, AND SERVICE PROCEDURES

Q1- Do I need to check the emissions output on an engine that I've just repaired?
A1- No. There is no provision in the EPA regulations for testing emission levels of engines already sold. The requirements for emission certification are the responsibility of the engine manufacturer. Your responsibility as a service technician is to repair with approved parts and procedures.

Q2- What do I have to do as a service technician to stay in compliance with EPA emission regulations?
A2- Just make sure you use the original engine manufacturer's approved component parts and repair procedures. . . such as ordering the parts by product and engine model number, and making adjustments as stated in service literature for the engine you're working on . . . just as you should already be doing now.

Q3- I noticed that air filters are covered under the emissions warranty, does this mean that I have to replace clogged air filters under warranty?
A3- No. The only time an air filter or other emissions related part (from the list above) is repaired or replaced under the emissions system warranty is if it is defective in material or workmanship during the warranty period.

Q**4- Are parts covered that are not on the list? Such as valves, piston rings, head gaskets, etc.. since if these parts fail, they can cause emission levels to change?**
A4- No. Other parts needed to complete a warranty repair may be covered under the normal engine warranty.

Q5- If parts are covered for two years, but require replacement during normal maintenance by the customer, are these replaced at no charge?

A5- No. The owner's manual states that parts that wear during normal use are the owner's responsibility. For example, an air filter that becomes clogged is the customer's responsibility.

Q6- How do I close the service order when I replace an emission warranted part?

A6- With the appropriate in-warranty call close code as you do now for other in-warranty repairs. You must get the serial number of the product, and be precise in your written comment on the service order. This is no different than how you should be filling out service orders now. Remember, in many cases, the service order is the only document that gives us the information about what you did . . . and what parts have failed. This helps recover in-warranty costs from the manufacturer and also helps us track any quality issues.

CLOSING THE SERVICE ORDER WITH GOOD COMMENTS

For, example, if a carburetor had to be replaced because of a casting flaw that caused the air-fuel ratio to be incorrect, and you correctly diagnosed and replaced the carburetor, but the service order had the following statement in the "technician's comment" section:

INCOMPLETE TECHNICIAN COMMENT:

"REPLACED CARB AND TESTED" . . . Not descriptive enough if you had to work with the vendor to decide WHY the carburetor needed to be replaced. With just a little more detail, the following statement from you would tell us clearly what you found and why you replaced the carburetor:

GOOD, COMPLETE TECHNICIAN COMMENT:

"FOUND CARB CASTING DEFECT AT IDLE AIR BLEED, REPLACED, AND TESTED". . .
Just 7 more words make it clear to us and the vendor what you found. This example is just one of many that helps all of us. Realizing that productivity is key to our success, we aren't asking that you write an extensive description, just why you did what you did.

Q7- **The Emissions warranty states that the diagnosis, parts and labor are covered for two years. Does this include only the diagnosis needed to find a failed emissions related part (from the list) or does this include all diagnosis for the entire engine/product?**

A7- Only the diagnosis to find the failed emission warranted part is included in the emission warranty. Other diagnosis is separate and should be handled just as you do now.

Q8- Can the customer request that a part be sent to their home for self installation under the emission warranty, or can the customer receive a free part over the counter?

A8- No. The product must be diagnosed and repaired by a technician to be covered under the emission warranty.

Q9- If a service bulletin or service flash states to replace an emissions part with another part number not originally found on the product, what is the right thing to do?

A9- It is Sears policy to follow manufacturer's recommendations for repair procedures. By following the manufacturer's bulletin or issuing our service flash, we are following their recommended repair procedure, including part substitutions approved by the engine manufacturer.

SERVICE TIP - IGNITION SYSTEM TESTING

8

In the early 1980s, when Solid State Ignition replaced the breaker point style ignition systems in air cooled engines, the subject of ignition gained an air of mystery. The working reality is anything but mysterious. It's easier to understand once you have a few handy tips, plus a bit of background on the topic.

First the background. In a point style system, the flywheel magnets rotate past the legs of the ignition armature. The armature itself is made up of two separate windings of copper wire - the primary and secondary - one wound on top of the other. Add a set of breaker points and a condenser to the primary circuit and you've got the whole ball of wax. Basic physics tells us that when a magnetic field (flywheel magnet) cuts through (moves past) a conductor (copper wire), a flow of electrons (electricity) is created. However, electron flow only occurs when we have a complete circuit. This means that the points must be closed. It's also a fact that the faster the movement between the field and the conductor, the greater the output.

Remember science class in grade school? At one point in your school career, an enterprising teacher wrapped a length of copper wire around a nail and hooked the wire ends to a drycell battery. A handful of paper clips was instantly attracted to the nail and fell away when the battery was disconnected. Electron flow through a conductor then, causes a magnetic field. When the points are closed, electron flow through the primary causes a magnetic field to be created around it. This field also envelopes the secondary. As the points open, the circuit breaks and collapses the field back to the primary. The field caving in on itself is movement, just like the rotating magnetic field of the flywheel. This movement is at speeds much greater than the flywheel could spin - near the speed of light. The rapidly collapsing field tears through the secondary winding which has sixty turns of wire for every one turn of the primary - effectively generating 60 times the voltage created in the primary. The sum total of this is that the secondary winding can create up to 25,000 volts which is used to jump the gap of the spark plug and ignite the fuel/air mixture in the combustion chamber.

So what's different about the Solid State Ignition system? Most of what you know from point style systems still applies. Solid state ignition armatures, in essence, replace the mechanical breaker points with a transistor contained within the armature body. That is, we replace a mechanical switch with an electronic one - no moving parts, no arcing, no adjustments and the reliability of solid state circuitry.

Now that we've got an idea of how it all works, let's look at what is required to create a good spark.

Flywheel: The flywheel magnet must have a suffficient magnetic field to start the chain of events in motion. A fair test is to hold the flywheel on edge with the magnet facing up. Place the blade of a 10" #3 (1/4") straight blade screw driver against the magnet. Release the screwdriver. The magnet should have enough strength to hold the screwdriver straight out. If we pass this test, assume the magnet is OK.

Rotational speed: Remember speed is a factor. The engine must be pulled over at a minimum speed of 250 RPM before the coil will even think about firing. Thick oil on a winter day or a heavy parasitic load may cause problems. Customers come into play here as well. Shorter or elderly individuals may not have the leverage or strength required to reach the RPM necessary to activate the Solid State's electronics.

Spark Plug: The spark plug is a major element of the equation. A new spark plug may require around 10,000 volts to jump a .030" gap when the engine is cold. This drops to just 4,000 when the engine is hot as electrons are more easily emitted from a hot surface. That's one of the reasons the old vacuum tubes in radios had to warm up before the radio would work. Electrons are also more easily emitted from a sharp edge than a round one. A spark plug begins to require more and more voltage as normal wear causes the edge of the center electrode to become less defined. And finally, an internal short or carbon/oil fouled plug simply shunts the high voltage burst straight to ground, resulting in insufficient spark or no spark at all.

Ignition Coil: The ignition coil is probably the easiest thing to check and therefore the first thing to check when embarking upon ignition system troubleshooting. Install the spark tester between the high tension lead and a good engine ground. Spin the engine over (at least 250 RPM) and watch for spark in the tester window. As simple as it seems, this is a fairly comprehensive test. The tester electrode gap is .166" wide. Those wise in the way of electrons have calculated that it takes around 13,000 volts to jump this gap. We need 10,000 to jump the gap on a cold spark plug. Add it all up and we have voltage to spare. Engine quits while running? Hook the tester up in line with the spark plug and start the engine. When the engine quits, monitor the window. If spark is present, the problem is not in your ignition coil. By the way, this test stresses the coil well beyond the demand it would see in operation. Think about it. We're asking the coil to build enough voltage to jump TWO gaps - the tester as well as the plug. If your engine starts and runs OK cold and hot, you've got a healthy ignition coil. Note: because Solid State Ignition coils depend on the flywheel magnets to operate, they will function even if the flywheel key is sheared - unlike breaker point systems.

One additional test you can perform: check the impedance (resistance) of the secondary circuit at room temperature. Hook an ohmmeter test lead to the spark plug terminal of the high tension lead and another to the lamination stack (ground). Your resistance reading should range between 2,500 and 5,000 ohms. If infinite (no continuity), an internal open circuit exists. Replace the coil. If infinite but the engine runs, your problem is an internal break of the high tension lead, a poor attachment of the spark plug terminal or improper mating of the high tension lead to the coil. The lead is skewered by a pin within the coil body. If the pin does not contact the wire core, there will be no continuity. The coil will often have enough available voltage to jump the gap, so you see spark. The internal arcing that occurs within the high tension lead will eventually create enough resistance that ignition system performance will suffer. If your resistance reading is much lower than 2,500 ohms, an internal short exists. Replace the coil.

Now, how about some of those old wives tales that just aren't true.

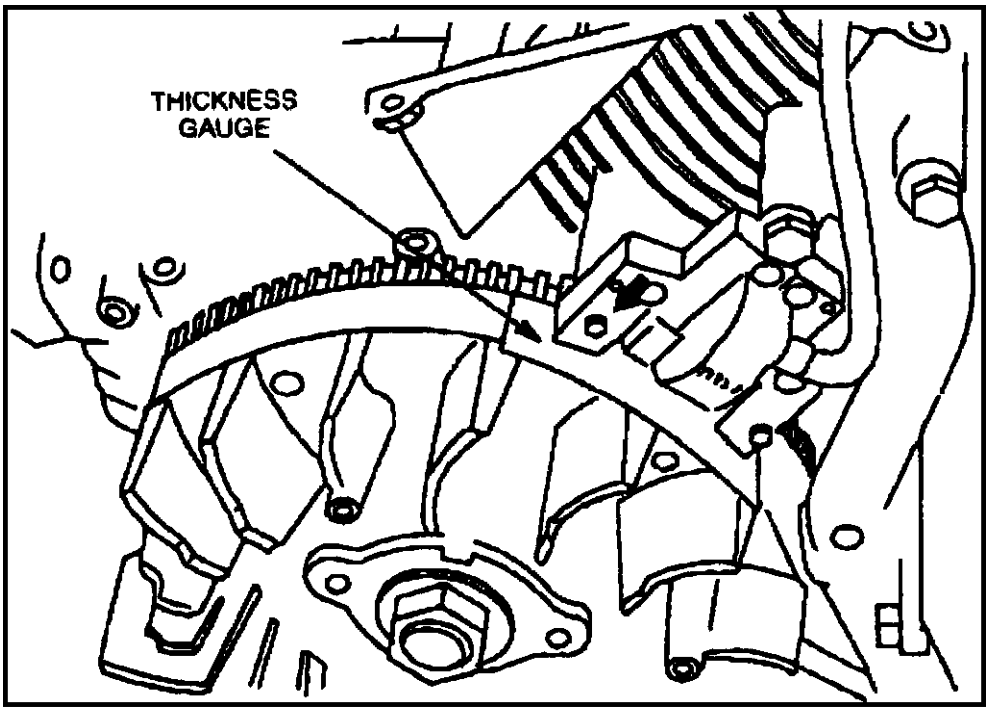
• Rust on the flywheel magnets causes a loss of spark. **Not true.** A magnetic field does not care about rust. It has no effect on it.

• A bright blue spark is best. A yellow/orange spark signifies weak ignition. **Not true.** Spark color determines virtually nothing. The hottest spark is ultraviolet which we can't see. Blue spark is cold in comparison to ultraviolet. Orange and yellow come from particles of sodium in the air ionizing in the high energy of the spark gap.

• Ignition coil output can be adequately tested by laying the spark plug against the block and pulling the engine over. **Not true.** The ignition coil will only generate enough output to jump the gap of the plug. When under compression, the plug requires twice the voltage to fire. This check is not an accurate test of the coil and can be misleading.

• An armature air gap that is too wide will prevent spark. **Not true.** Well, sort of not true. Air gaps can not be made too wide to prevent spark providing the coil is healthy and the engine is spun over fast enough. A wide air gap, say .030" will ever so slightly retard the ignition timing as the magnetic field takes longer to build within the coil windings.

A few final words. Solid State Ignition coils **rarely** fail. If one is suspect, perform the outlined checks exactly as mentioned. MOST IMPORTANT: Be sure to **isolate** the coil from the equipment wiring harness as well as the engine's wiring harness. That's right, unhook the ignition grounding lead from the coil itself and use the spark tester. Many a technician is fooled into replacing a good coil because the coil grounding lead was shorting out against a piece of sheet metal. DO NOT attach the tester to the spark plug for this test. The engine may start. Without the grounding lead installed, you won't be able to turn it off. If the coil is properly grounded to the engine block, engine speed is at least 250 RPM and the flywheel magnets are OK, there should be spark present in the window of the tester. If not, repeat the test double checking your procedure. Still no spark? Then and only then, replace the coil.



- Adjusting Air Gap

TESTING OF SMART SPARK™ IGNITION SYSTEMS ON COMMAND 22 & 25 HP ENGINES

The following procedures are provided for troubleshooting ignition problems on Command 22 & 25 HP engines. They will allow you to isolate and pinpoint the failed components .

Three types of ignition problems have been identified

1. No fire
2. Intermittent fire
3 Incorrect timing or advance.

Separate troubleshooting procedures are provided for each type of problem **Perform the preliminary test first, then follow the procedure that matches the symptoms.**

Special Tools Required:

- Hand Tachometer
- Tester 92/150 24-455-02*
- Automotive timing light
- Multi-meter (digital)

Specifications Required:

- Spark plug gap .030"
- Ignition module air gap .008-.012" (.010" nominal)

* NOTE: Ignition tester 92/150 24-455-02 must be used to test ignition on 22-25 HP engines Use of any other tester can result in inaccurate findings. Battery on unit **must** be fully charged and properly connected before making any of these tests (a battery that is hooked up or charged backward will crank the engine, but it won't have spark). Be sure drive is in neutral and all external loads are disconnected .

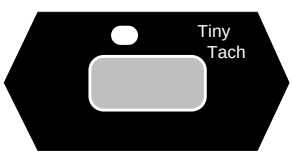
PRELIMINARY TEST

To be certain the reported problem is in the engine ignition system, it should be isolated from the unit.

1. Locate the plug connectors where the wiring harnesses from the engine and unit are joined. Separate the connectors and remove the white "kill" lead from the engine connector Rejoin the connectors and position or insulate the kill lead terminal so it cannot touch ground Try to start the engine to verify whether the reported problem is still present.

a. If the problem is gone, the electrical system on the unit is suspect. Check the key switch, wires, connections, safety interlocks, etc.

b. If the problem persists, follow the procedure that corresponds to the observed condition. Leave the kill lead isolated until all testing is completed.



DECARBONING ENGINE COMBUSTION CHAMBERS

Why do engines need to have the combustion chambers cleaned on a regular basis?

a. Carbon on the top of the piston and valves will hit the cylinder head.
b. Build up of carbon reduces the amount of fuel and air that can enter the combustion chamber reducing power.
c. Reduced engine life from carbon damaging pistons, rings, valves and cylinder(s).
d. By design OHV engines need to be decarboned less than side-valve engines.

Carbon is a by-product of burned fuel. How quickly it needs to be removed from the combustion chamber depends on several factors:

a. Adjustment of carburetor mixture; richer needle settings and dirty air cleaner elements.
b. Engines with higher than normal oil consumption (over 1 ounce/hour).
c. Engines that run at constant speed and load.
d. Engines that run with light loads and cooler combustion chamber temperatures.
e. Quality of fuel and additives.
f. Not running the engine at correct throttle speed.

How to clean the combustion chamber.

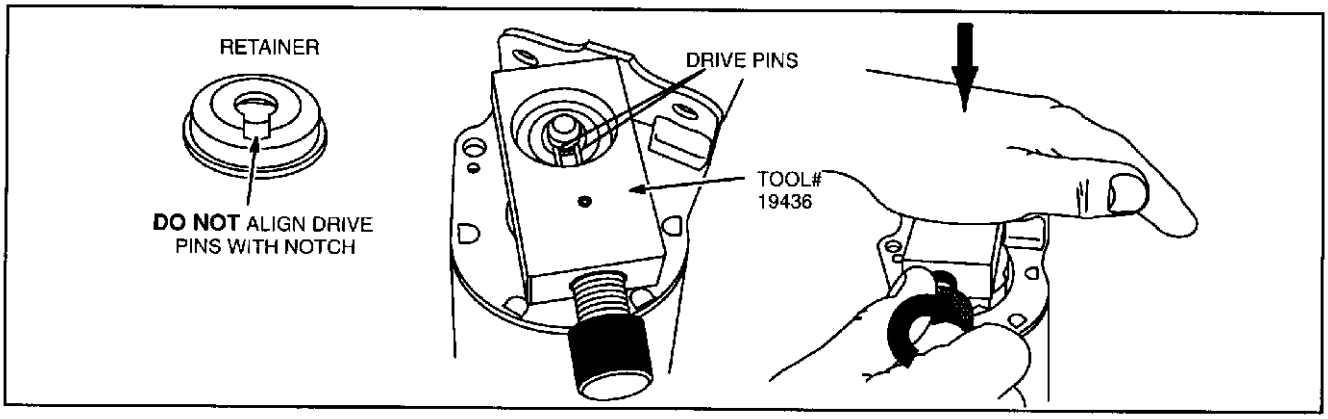
a. Spraying chemicals into the carburetor is not recommended. Loose carbon in a running engine can cause major damage in a few seconds.
b. Clean the outside of the engine as best as possible.
c. Remove the shields to expose the cylinder head and bolts.
d. Remove the cylinder bolts evenly.
e. Use a wooden or plastic scrapper to remove the carbon from the top of the piston, cylinder, valves, top of the bore and cylinder head. Soaking the head in household ammonia cleaner and water will soften the carbon.
f. Clean all loose carbon particles from the combustion chamber and use aerosol carb cleaner to flush. Do not try to remove all the brown stains.
g. Install new gaskets, old gaskets are compressed and will not seal properly. Torque head bolts in proper sequence to the recommended range. Aluminum heads and cylinders will not seal if over or under torqued. Lube threads with light-weight grease or heavy oil.
h. Install shields and air guides.
i. This is not considered warranty.

Instructions For Removing C-Ring – Tool 92/150 #19436

1. Place counterbore side of tool over retainer and align drive pins with open end of C-ring.

Important: If retainer has a notch as shown, **DO NOT** align drive pins with notch. If necessary, rotate notch away from open end of C-ring.

2. Place palm of hand over tool and push down evenly on tool to compress spring washer.
3. While applying pressure, turn knurled knob clockwise until C-ring pops off. Discard C-ring.
4. Use Tool #19435 to install new C-ring.



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Milwaukee, Wisconsin 53201

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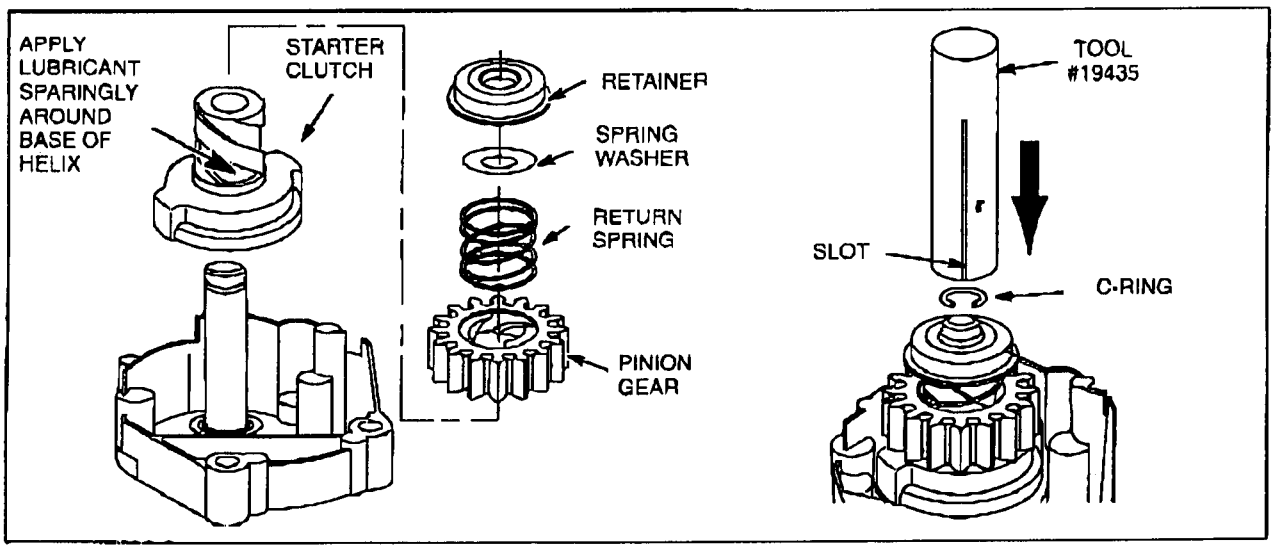
FORM MS-0947-10/96

INSTALLING C-RING – TOOL 92/150 #19435

1. Assemble starter clutch to starter shaft and rotate clutch until it drops into place.
2. Apply a lithium base lubricant sparingly around base of helix, then install starter gear with beveled side of teeth up. Then install return spring making sure spring is in recess of starter gear.

Note: Do not use silicon or mineral spirit based lubricants to lubricate helix.

3. Install spring washer with concave side up. Install retainer.
4. Place C-ring over chamfered end of shaft. Align one of the slots of C-ring installer with open end of C-ring.
5. Press or drive C-ring on until it snaps into groove in shaft.



BRIGGS & STRATTON CORPORATION
Distribution Sales & Service Division

8

Starter Drive Retaining Ring Removal Tool

The inertia drive electric starters used on current production engines have a retaining ring in a groove near the end of the armature shaft to retain the drive components. This tool is used for easy, safe removal and reinstallation of the retaining ring when servicing or replacing the starter drive.

To Use The Tool - Retaining Ring Removal

1. The rubber dust cover has a molded lip on the inside that snaps into a groove in the dust cover spacer (See Figure 1). Turn the drive pinion clockwise until it reaches the fully extended position. While holding it in the extended position, grasp the tip of the dust cover with a pliers or vise grip and pull it free from the spacer.

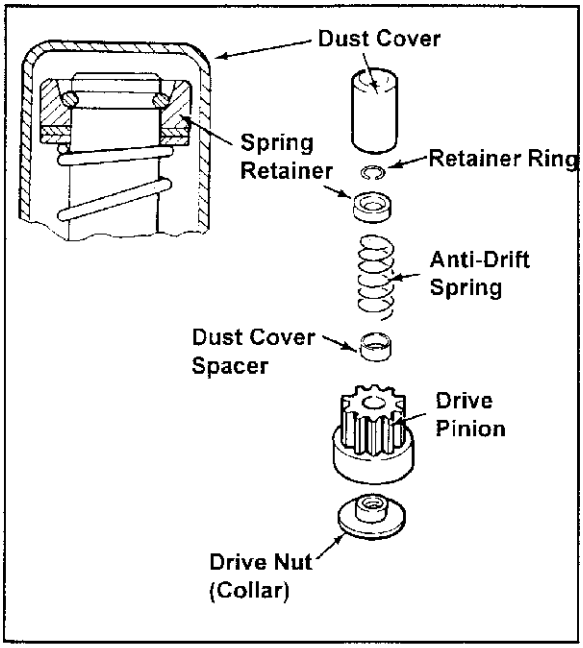


Figure 1. Drive Components, UTE "Bonded" Inertia Drive Starter.

2. Disassemble the removal tool by loosening the center screw one or two turns and removing the outer collar.

3. Again referring to Figure 1, grasp the spring retainer and push it toward the starter, compressing the anti-drift spring and exposing the retaining ring.

4. Holding the spring retainer in the retracted position, assemble the inner halves of the removal tool around the armature shaft with the retaining ring in the inner groove (See Figure 2). Slide the collar over the inner halves to hold them in position.

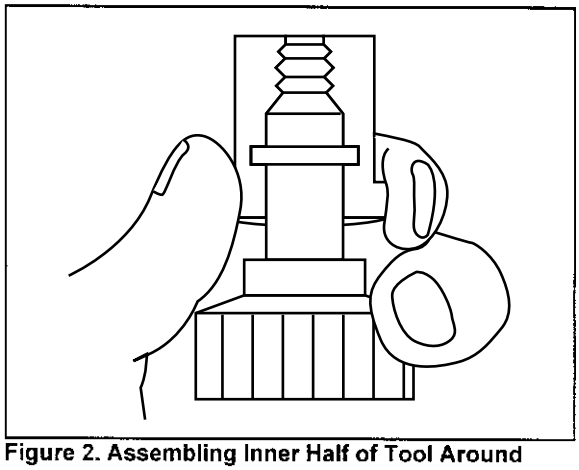
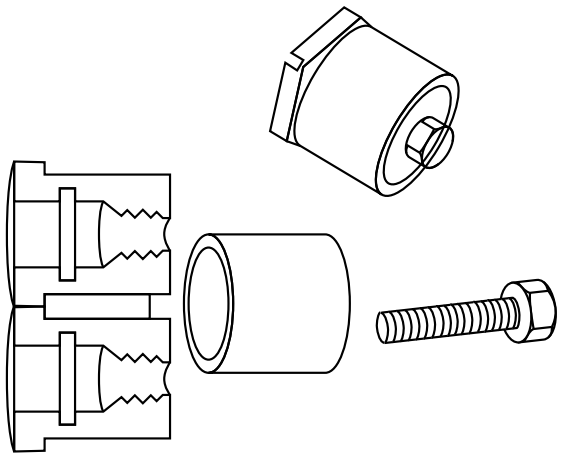


Figure 2. Assembling Inner Half of Tool Around Armature Shaft and Retaining Ring.

"Tool of the Year"

Starter Snap Ring Kit 92/150 25-761-18



The drive components on the current inertia drive starters are held in position by a snap ring that fits in a groove near the end of the armature shaft. Because the ring is partially recessed in the groove, removal and reinstallation can be tricky and even hazardous. Our "Tool of the Year" is a small kit that will do the job quickly, easily, and safely.

The snap ring is enclosed within the tool during removal and/or installation, so there is no chance of it flying off and hitting someone or getting lost.

5. Thread the center screw into the removal tool until you feel resistance. Use a wrench (1" or adjustable) to hold the base of the removal tool. Use another wrench or socket (1/2" or 13 mm) to turn the center screw clockwise (see Figure 3). The resistance against the center screw will tell you when the retaining ring has popped out of the groove in the armature shaft.

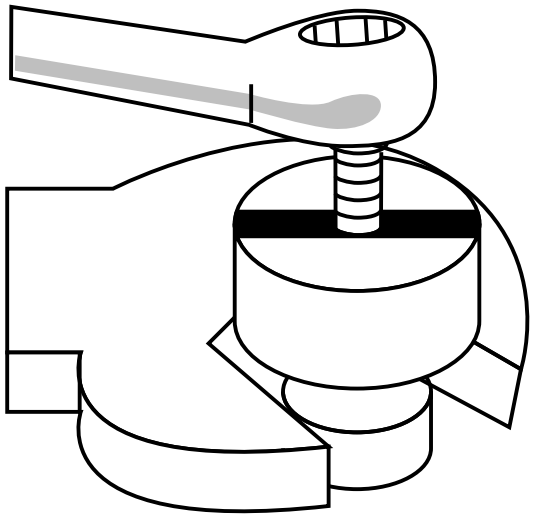


Figure 3. Holding Tool and Turning Center Screw (Clockwise) to Remove Retaining Ring.

6. Remove the drive components from the armature shaft, paying attention to the sequence. If the splines are dirty, clean them with solvent.

7. The splines should have a light film of lubricant. Relubricate as necessary with Kohler bendix starter lubricant (**92/192 52-357-01**). Reinstall or replace the drive components, assembling them in the same sequence as they were removed.

Retaining Ring Installation

1. Position the retaining ring in the groove in one of the inner halves. Assemble the other half over the top and slide on the outer collar.

2. Be certain the drive components are installed in correct sequence onto the armature shaft.

3. Slip the tool over the end of the armature shaft, so the retaining ring inside is resting on the end of the shaft. Hold the tool with one hand, exerting slight pressure toward the starter. Tap the top of the tool with a hammer until you feel the retaining ring snap into the groove. Disassemble and remove the tool.

4. Pinch the retaining ring with a pliers to compress it in the groove.

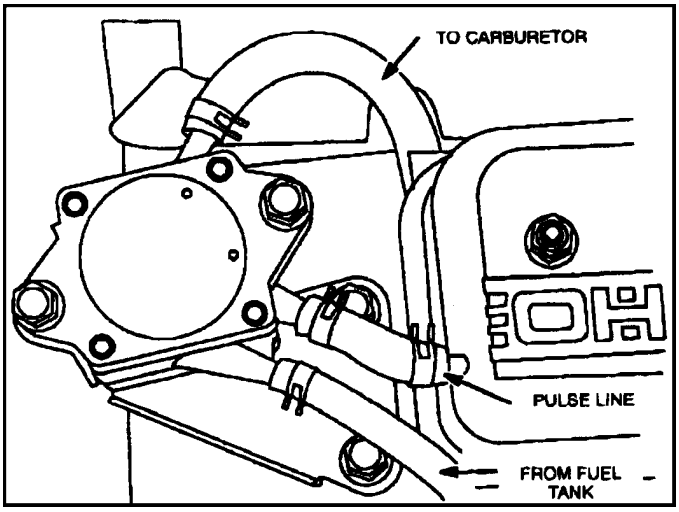
5. Pull the spring retainer up around the retaining ring so the ring is seated in the recess in the top of the retainer (see Figure 1, sectional inset).

6. Reinstall the dust cover.

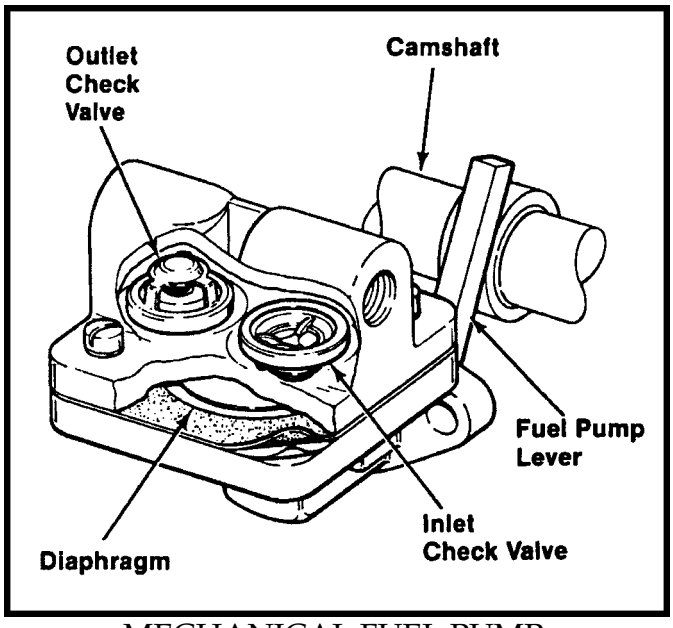
TESTING FUEL PUMPS

Test for fuel delivery to the pump. Before proceeding be sure the fuel tank has clean, fresh fuel and fuel cap vent is open.

TEST	RESULT
1) Check for fuel flow to the pump. A) Remove fuel line fuel pump inlet. B) Use 590-1 Primer bulb and connect to fuel line at the fuel pump inlet side.	1) If fuel flows freely go to step 2. 2) If fuel does not flow check the following: a. Fuel filter. b. Kinked fuel line. c. Fuel tank outlet restricted.
1) Check for fuel pump operation. A) Connect can (i.e. coffee can) to catch fuel to fuel pump outlet. Place can on front tire. B) Crank engine 15 seconds.	1) Volume of fuel exceeds capacity of carb float bowl. (Pump is OK) 2) Little or no fuel. a. Mechanical pump, replace pump. b. Pulse pump, Check pulse line if OK change pump.



PULSE FUEL PUMP



MECHANICAL FUEL PUMP

TROUBLESHOOTING BASICS

The definition of a competent technician is one that can identify a problem quickly and accurately with efficient use of both time and parts. This trouble shooting process when applied properly is the most valuable tool you possess.

The following process will help in quickly diagnosing a failed component:

1. Talk to the customer (if present):
- Get a complete description of the complaint
- Many times the customers description will lead to the area of the failed component.

2. Verify the symptom - Operate the product to observe failure

3. Isolate the problem:
- Use 4 of your 5 senses; sight, smell, sound, and touch (taste not recommended)
- Use available tools and test equipment

4. Replace or repair failed component.

5. Verify proper operation .... and you're done!

Troubleshooting is a systematic approach to problem solving that requires the technician to have a set process in mind. By using this approach on every service call, the chances of the technician overlooking a valuable piece of information is greatly reduced.

SYMPTOM: ENGINE WILL NOT TURN OVER ("CRANK")

1. Talk to the Customer:
- Get a complete description of the problem
- Let the customer help you isolate the problem by describing the symptom

2. Verify the symptom:
- Operate the product (if possible) to verify complaint
- Determine what may already be known about the problem from past experience, service flashes, etc.

3. Verify all controls are in the proper position for starting:
- Clutch pedal
- PTO switch
- Ignition switch

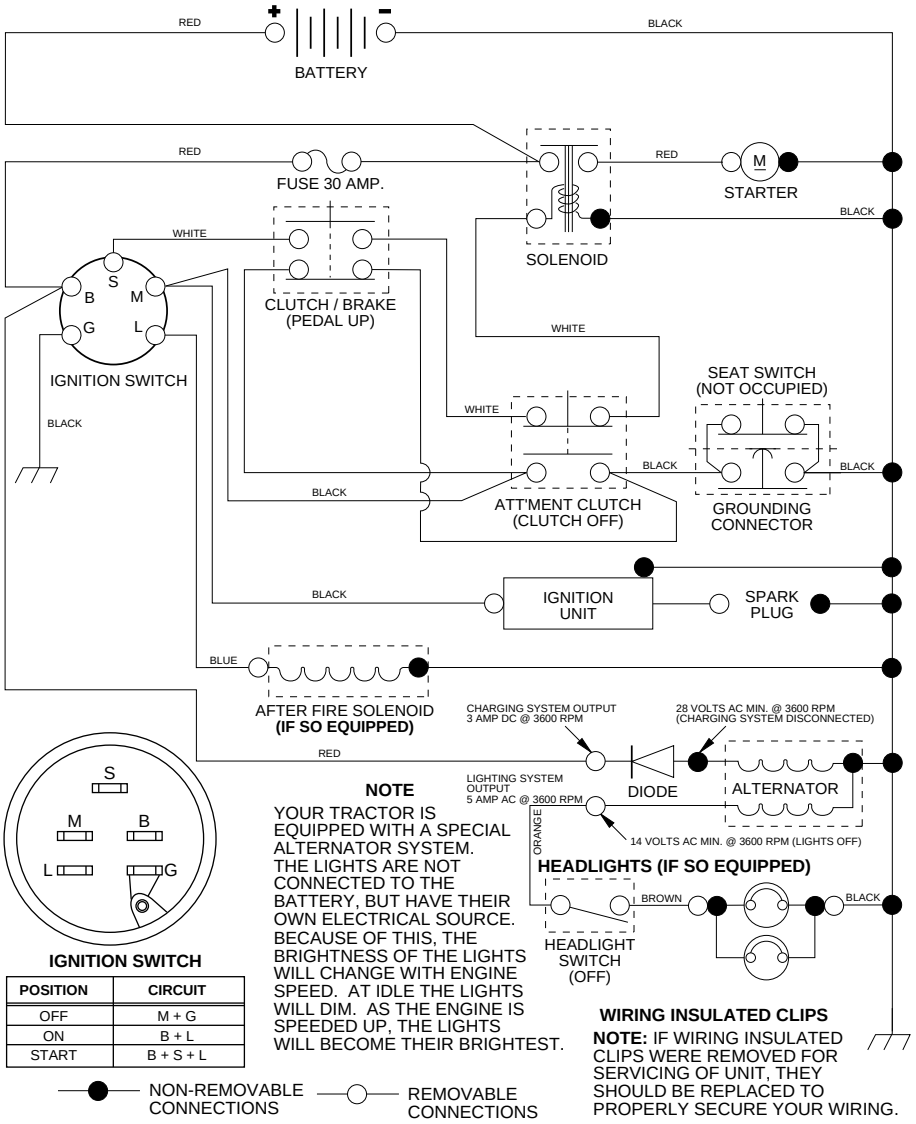
4. If engine still does not crank:
- Listen for audible click of the starter solenoid closing
- Manually turn the engine by hand to verify that the engine turns free to eliminate the possibility of the starter drive jammed into the flywheel

5. If the engine does not turn over by hand
- Check for starter drive jammed into the flywheel
- Check oil level, if overfilled, remove spark plug(s), clean oil from cylinder(s), drain crankcase and refill with correct amount of oil, to insure the engine is not experiencing a hydraulic lock
- Check for a seized engine

After eliminating or correcting the above mechanical reasons for no crank condition and if engine does turn over freely by hand, follow the test procedures found on the following pages.

8 SYMPTOM: ENGINE TURNS OVER BUT WON'T START

1. **Talk to the Customer:**
   - Get a complete description of the problem
   - Let the customer help you isolate the problem by describing the symptom
2. **Verify the symptom:**
   - Operate the product (if possible) to verify complaint
   - Determine what may already be known about the problem from past experience, service flashes, etc.
3. **Verify all controls are in the proper position for starting:**
   - Clutch pedal
   - PTO switch
   - Ignition switch
4. **If engine still does not start check fuel:**
   - Check the quality and quantity of fuel, eliminate bad fuel as a factor by using the smell and volatility tests. A "varnish" odor indicates that the fuel has deteiorated and should be replaced (an inspection and cleaning of the fuel system may be necessary). The volatility test will determine the combustibility of the fuel. Wet your finger with fuel from the fuel tank, then,wave your finger in the air. If the fuel is good it will evaporate quickly and feel "cool" on your finger; which indicates that the fuel has a good amount of volatility. If bad fuel is found replace with fresh fuel and try to start tractor. **NOTE:** Fuel can be stale and make an engine hard to start after only 30 days of storage!
   - Verify that choke is operating properly.
5. **Good Fuel, still won't start:**
   - Check fuel delivery system to ensure fuel is making it to the carburetor. Clamp off fuel line and check for clogged fuel lines, no air getting into tank, plugged fuel filter, plugged or restricted fuel tank screen, etc.
   - Listen for audible click of afterfire solenoid (if equipped) opening and closing when ignition is turned on and off. If no click is heard remove solenoid from carburetor and clean plunger with carb cleaner by spraying while moving plunger up and down. Make sure solenoid is grounded and check for 12 volts (7-9 volts minimum for Kohler engines). If solenoid is still inoperative replace solenoid.
6. **Fuel to carburetor, still won't start:**
   - Remove air filter and spray WD40 into the air intake of the carburetor. Reinstall air filter and try to start. If engine runs for a short time and then dies, remove and inspect the carburetor bowl. If you find brown, gummy deposits, oil, or water clean the carburetor. If green particles or white deposits are found; or if bowl is heavily gummed up, replace the carburetor.
7. **Dirty Air Filter:**
   - Clean foam element of air cleaner (if equipped) by washing it with soap and water. Dry off element and add one tablespoon of 30 weight motor oil to the element. A small amount of oil on the foam element will trap dirt before it gets to the paper air filter.
8. **Check Spark:**
   - Verify ignition system is operating properly, using Spark Tester #19368. Inspect spark plug (wet, dry, carboned) or use a known good plug. Remove the high tension lead or wire attached to the spark plug terminal, insert the spark tester and ground the other end. If you have spark reconnect and try to start tractor.
   - If there still is no spark disconnet the electrical as close to the ignition module as possible. Try to start tractor again. If you have spark after disconnecting the switches then one of the switches (clutch/brake, PTO or Ignition) is grounding out the ignition module and it must be checked. See the sample schematic on the following page.



9. Verify Switch operation:

- Begin testing these switches by disconnecting the ignition, then the clutch/brake switch (and run a jumper from WHITE to WHITE). If engine starts or you now get spark replace switch. If tractor still will not start or spark, replace the switch and perform the same procedure for the PTO switch.

10. Inspect flywheel key:

- The flywheel key should be inspected to determine if it has been sheared or damaged. As sheared or fractured key will cause the magnets to move away from the optimal alignment, and the voltage produced may not be sufficient to jump the spark plug's gap. A slightly damaged key will produce a good spark, but an "out of kilter" timing will cause the engine to run rough or not start at all.

11. Test ignition module:

- Disconect the kill tab from ground on the ignition module. If you still get no spark, replace the ignition module. See pages 39-40

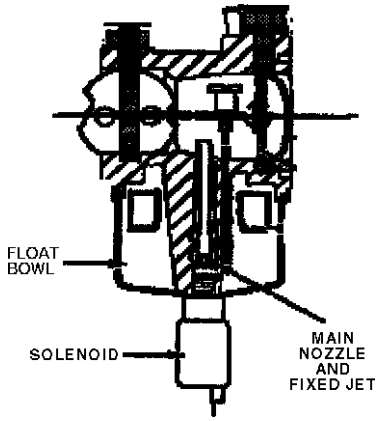
12. Test ignition module on Kohler engines:

- The ignition system on the Kohler Command 22 - 25 HP will not operate properly without at least 7 volts and will not operate at all with no voltage. If you have proper voltage and tight connections; and both spark plugs fail to fire, then replace the S.A.M. (Speed Advanced Module). If just one spark plug fails to fire then replace that coil only. IMPORTANT: Cranking the Command 22 - 25 HP engines without grounding the spark plug will damage the module and or S.A.M. in a very short time. Seepages 40-41

HOW TO REDUCE ENGINE AFTERFIRE

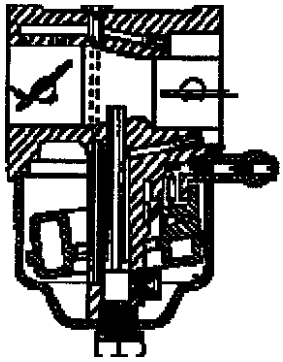
Afterfire occurs when the ignition switch is turned to the off position and the engine is coasting to a stop. During this coasting time air and fuel are drawn into the combustion chamber. Because there is no ignition to burn this charge, it is pushed into the muffler. The high temperature of the muffler may ignite this charge causing a loud noise. Some carburetors have a anti-afterfire solenoid and others do not, each system has a different procedure to stop the engine and reduce the chance of afterfire.

Engines With Anti-Afterfire Solenoids:



This type of Anti-Afterfire system works by shutting off fuel flow through the main jet. The solenoid is energized when the ignition switch is turned to the on position, when the switch is turned to the off position the spring loaded plunger is pushed into the jet. This system works best when the throttle control is in the mid to full position. This reduces the amount of fuel in the idle circuit of the carburetor. Very little fuel will be available to burn in the muffler and afterfire.

Engines Without Anti-Afterfire Solenoids:



Before shutting the engine off, move the throttle to the slow position for 30-45 seconds. This allows the engine to coast the least amount of time and muffler to cool internally.

Hunting and Surging at True Idle.

Engine hunting and surging at true idle is caused by a fuel delivery problem or an air leak. True idle is the carburetor setting when the throttle plate linkage is against the idle speed adjusting screw after idle mixture adjustment. Because the throttle plate is held stationary during true idle, hunting and surging must be caused by an improper air-fuel mixture related to an air leak or an obstruction in the idle circuit. At true idle, the governor spring applies no force on the throttle plate and has no effect on the idle characteristics of the engine.

Hunting and Surging at Governed Idle.

An engine hunting and surging only at governed idle and equipped with an idle mixture adjustment has a governor system or carburetor problem. The idle mixture must be adjusted correctly. Hold the throttle plate linkage against the idle speed adjusting screw and increase the idle speed to the specified governed idle speed. If the engine operates without hunting or surging, the problem is the governed idle spring or linkage. If the engine continues to hunt and surge, the problem is in the carburetor. After testing, return the engine to the correct idle speed.

Hunting and Surging at Top No-Load Speed.

Troubleshoot hunting and surging at top no-load speed using the same sequential steps used to isolate a governor system or carburetor problem during true idle and governed idle. Once the idle mixture is adjusted and the engine idles smoothly, increase the engine speed using the idle speed adjusting screw. Hold the throttle plate linkage against the idle speed adjusting screw until the engine reaches the specified top no-load speed. Without any appreciable load, fuel is provided by the idle circuit.

If the engine continues to hunt and surge, the carburetor is the probable cause. In this test condition, the governor system has no effect on engine speed. The idle speed adjusting screw controls the throttle plate position, which affects engine speed. If the engine operates properly when controlled by the idle speed adjusting screw but hunts and surges when controlled by the governor spring, the governor system is suspect. Check the governor linkage for resistance and binding, and replace the governed idle spring and the main governor spring.

Hunting and Surging Under Load.

Hunting and surging under load usually indicates a carburetor or fuel delivery system problem rather than a governor system problem. Fuel fed under load is primarily fed through the main jet and emulsion tube. Most loads are constant enough to maintain the rpm of the engine. The governor system has very little additional effect on the performance of an engine under load except for applications with sizable varying loads such as a generator.

Poor Performance Under Load.

Poor performance under load requires first eliminating compression component problems. If the problem is isolated to the fuel system, the cause is usually debris in the main jet or air bleeds. To isolate the problem component, examine the exhaust gas when the engine is under load. If black smoke is present, there is an excess of fuel. This condition may be caused by an incorrect float level setting, a partially clogged main air bleed, or debris lodged between the needle and the seat. If black smoke is not present, and there is no black residue on the muffler deflector, the main air bleed or main jet is probably obstructed.

A primer bulb system or choke can also be used to quickly troubleshoot carburetor problems related to a lean or rich condition. After making carburetor adjustments, slowly close the choke plate when the engine is operating poorly. If performance improves, the air-fuel mixture is too lean. If performance worsens, the air-fuel mixture is too rich. A primer bulb system can also be used to test for a lean or rich condition. Depressing the primer bulb injects extra gas into the carburetor. If the engine air-fuel mixture is too lean, the injection of the extra fuel should improve engine performance. If the engine air-fuel mixture is too rich, the injection of the extra fuel should worsen engine performance.

Fuel Pump Vacuum Line Freeze

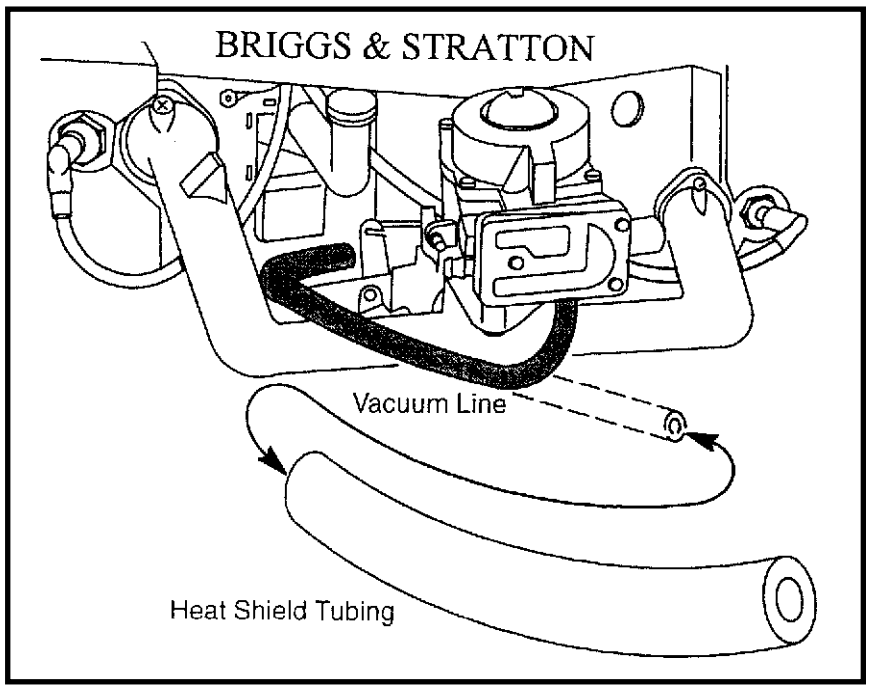
Model Series: Vertical Crankshaft Opposed Twins Under certain climatic conditions, condensation forming in the fuel pump vacuum line can freeze, causing the engine to stop. To prevent this from occuring, insulate the pulse line with heat shield tubing, part 71/500 #280866. See procedure below.

1. Cut section of heat shield tubing approximately 11- 1/2" long (292 mm).

2. Remove clamp and vacuum line at carburetor.

3. Install tubing over vacuum line. Push tubing over vacuum line until it contacts cylinder. Note: Be sure heat shield tubing does not interfere with governed idle spring.

4. Reinstall vacuum line and clamp at carburetor.



KOHLER CV18-25HP
BREATHER ANTI-ICING KIT
PART NUMBER 71/501 54-755-17

During the winter of 1996-97, we received some reports of icing in the breather hose on CV18-25 engines. A new anti-icing kit, 71/501 54-755-17 has been developed to alleviate the problem. The kit includes a manual, two way valve for rerouting the breather in cold weather.

New Products - KOHLER

Breather Anti-Icing Kit, CV18-25

During the winter of 1996-97, we received some reports of icing in the breather hose on CV18-25 engines. A new anti-icing kit, 54 755 17, has been developed to alleviate the problem. The kit includes a manual, two-way valve for rerouting the breather in cold weather. The installation instructions **are included elsewhere in this manual.**

Hydraulic Lifters – Update

KOHLER has been using hydraulic lifters in the Command engines since they were introduced in 1988. The lifters have proven themselves under field conditions in thousands of engines for millions of hours. Occasionally, however, we get a report of noisy lifters where the problem is persistent or reappears following corrective action.

A task force has been formed to study any recurrent reports and determine if there is any remedial action that can be taken. The task force is still meeting, and we anticipate further results, but their research has already uncovered some significant findings.

A. Priming

Based on information supplied by the lifter supplier we have been recommending that new replacement lifters or lifters that had been removed for service or cleaning should be manually primed with engine oil before being installed. The task force has determined that this procedure is not worth the effort. In timed tests, there was no significant difference in ''pump-up'' time between lifters which had been pre-primed and those that had not. As a result, KOHLER will remove the priming procedure from service literature as it comes up for revision.

B. "Pump-Up" Time

When an engine is started, it usually takes just one or two minutes for the lifters to pump up. If it was out of service for some time, and the lifter chamber is full of air, or replacement or serviced lifters have been installed, that time may be extended while the air is being purged. Originally, we believed 20-30 minutes of running was adequate time to allow for purging any trapped air. The timed tests conducted by the task force indicated it could take 30-60 minutes before the lifters finally quieted down.

If you get a report of lifters that are noisy after start-up, tell the customer to make sure the oil level is in the proper operating range. Also check that he is using the **multi-viscosity** oil. Although the lifters may be noisy, it doesn't harm the engine in any way. Usually within 15 minutes the noise will disappear. If it is still noisy after an hour of running, make arrangements to get the engine/unit in for further diagnosis.

C. Quick Purge Lifter

When the task force began analyzing and tracking reports of noisy lifters, they realized that most of the complaints were on CV18-25 engines. Investigation revealed that, when the engine is stopped, the oil gradually drains out of the pressure chamber that feeds the lifters and is replaced by air. When the engine is restarted, the air is forced into the lifters. Until it gets purged back out, the lifters, especially #1 intake, will be spongy and possibly noisy.

To help reduce the problem, we are now using quick purge lifters which have a bit more clearance between the plunger and body. The extra clearance allows any air to bleed off more quickly, so the lifter will pump up with oil and return to quiet operation.

The quick purge lifter will be used on most 1998 Command engines.

Starting And Stopping Procedures

All of our current production engines are designed to start with the throttle set anywhere between half and full throttle. For customer convenience, we had been recommending mid-throttle for shut-down also, so the lever would already be in the correct position for restarting. The convenience has a downside, however.

An engine that is shut down at mid-throttle pumps through more unburned fuel, increasing the possibility of afterfire or afterboom in the exhaust system.

Customers tend to get more upset about afterboom and a case of ''brown short syndrome'' than repositioning the throttle lever, so KOHLER engineers have revised the recommended shutdown procedure to one that will not contribute to any afterfire. As a review, we are including the recommended starting procedure along with the revised stopping procedure.

Engine Starting

1. Place the throttle control **midway** between the **''slow''** and **''fast''** positions. Place the choke control into the **''on''** position.
2. Start the engine, activate the starter switch. Release the switch as soon as the engine starts.

NOTE: Do not crank the engine continuously for more than 10 seconds at a time. If the engine does not start, allow a 60-second cool-down period between starting attempts. Failure to follow these guidelines can burn out the starter motor.

NOTE: Upon start up a metallic ticking may occur. This is caused by the hydraulic lifter leakdown during storage. Run the engine for 5 minutes. The noise will normally cease in the first minute. If noise continues, run the engine at mid-throttle for at least 30 minutes. If noise persists, a trained service technician should diagnose the engine.

NOTE: If the engine develops sufficient speed to disengage the starter but does not keep running (a false start), the engine rotation must be allowed to come to a complete stop before attempting to restart the engine. If the start is engaged while the flywheel is rotating, the starter pinion and flywheel ring gear may clash, resulting in damage to the starter.
If the starter does not turn the engine over, shut off starter immediately. Do not make further attempts to start the engine until the condition is corrected. Check the product Owners Manual to see if jump starting is suggested for this piece of equipment. If acceptable, follow Owners Manual instructions on jump starting a battery and follow all safety precautions.

3. **For a Cold Engine –** Gradually return the choke control to the **"off"** position after the engine starts and warms up.The engine/equipment may be operated during the warm-up period, but it may be necessary to leave the choke partially on until the engine warms up.
4. **For a Warm Engine –** Return choke to **"off"** position as soon as engine starts.

Engine Stopping

1. Remove the engine load by disengaging all attachments.
2a. **For engines without a shutdown solenoid:** Move the throttle to the **"slow"** or **"low"** idle position. Allow the engine to run at idle for 30-60 seconds; then stop the engine.
2b. **For engines equipped with a shutdown solenoid:** Position the throttle control somewhere between half and full throttle; then stop the engine.

Addressing Smoking Engine Concerns

Some reports have come in of engine smoking. In many cases the root causes for the smoking are not accurately determined and hence the repairs attempted do not remedy the smoking problem. When troubleshooting a smoking engine, first determine what type of smoke it is, fuel or oil. If the smoke has a blue tinge, it is caused by oil. If the smoke is black or white in color, it is caused by excess fuel. Below is a list of checks to be used as a guide to help troubleshoot an engine reported to be smoking.

Addressing Smoking Engine Concerns

Problem	Possible Fault	Solution
Fuel Related Smoking Problems	1. Is the engine able to breathe properly?	1. Check for a dirty or restricted air cleaner. If it appears dirty, replace it.
	2. Are the choke and throttle settings adjusted properly?	2. Check the choke and throttle settings in the engine manufacturers service information. If the choke is not set correctly it may not fully disengage when the lever is pulled off of choke. Also check the crankcase oil for fuel dilution. (On KOHLER engines use "Throttle and Choke Installation and Adjustment Guide" (TP-2445))
	3. Could the spark plug be fouling out?	3. Check the spark plug(s) and replace if there is any suspension of fouling.
	4. Is there too much oil in the crankcase?	4. Chech the oil level to make sure it does not exceed the full mark, also check oil for fuel dillution.
	5. Does the crankcase have proper vacuum?	5. Check the crankcase vacuum using a manometer to be sure it is within the specifications listed in the service manual.
Oil Related Smoking Problems	6. Are the drain back holes functioning properly?	6. Remove the valve cover(s) and inspect the drain back holes(s). Check to see the holes(s) are in the proper location and that there is a clear, obstruction free passage to the crankcase.
	7. Is the breather operating properly? Check crankcase vacuum. If vacuum is low, disassemble engine as necessary to reach breather(s).	7. Remove breather and check the breather passage. Make sure it is open to the crankcase with no obstructions. Inspect the breather according to the engine manufacturers service manual.*

* On a KOHLER engine inspect the reed itself for cracks or damage and replace it if necessary. Check the breather reed seating area for surface burrs or something that would prevent the reed from seating.

* On a KOHLER engine inspect the reed itself for cracks or damage and replace it if necessary. Check the breather reed seating area for surface burrs or something that would prevent the reed from seating.

If the steps above check out good but smoking continues to occur at start up, it may be necessary to install an exhaust valve guide seal. If the engine is already equipped with an exhaust valve guide seal, replace the seal with a new one.

If the engine continues to smoke, the next step is to perform a leakdown test. This test will help to determine if there may be a more extensive problem. If leakage is over 30%, proceed with the following three checks:

1. Inspect head gasket for leaks between the combustion chamber and the lifter or drainback area, and replace if necessary.
2. Inspect the cylinder bore for wear, glazing, or deep grooves.
3. Inspect the piston and rings for wear, aligned end gaps, or damaged oil ring expander, and repair or replace if necessary.

Braking Stators on KOHLER Command Single (CV15-16.5)

As of July 1, 1997, mower blades on ride-on equipment must stop within 5 seconds after the seat interlock switch is activated. At the request of some OEM customers, Kohler has developed a system which uses the charging system to make the engine stop faster, so the equipment will comply with the new regulation.

If the operator leaves the seat, an interlock circuit is activated which then short-circuits the alternator stator. The shorted stator creates maximum potential opposition to the charging magnets. Since the seat switch also cuts off ignition, and the engine is no longer producing power, the increased drag of the charging system helps oppose the flywheel momentum and stop the engine faster.

Testing this System:

The 15 amp stator has a short pigtail lead attached to each of the AC lead terminals. The seat interlock circuit completes a path between these pigtail leads, thus shorting the AC windings. Testing of this system is identical to the standard 15 amp system.

The braking stator for the 3 amp/70 watt system is entirely new. It has an additional green lead wire that connects to the seat interlock circuit. If the operator leaves the seat, the interlock circuit shorts the green lead to ground. The test procedure for the 3 amp/70 watt braking stator follows.

Troubleshooting Guide - 3 Amp/70 Watt Braking Stator

Problem	Test	Conclusion
No Charge To Battery	1. With engine running at 3400 RPM, measure voltage across battery terminals using a DC voltmeter.	1. If voltage is more than 12.6 volts, charging system is OK. If voltage is 12.5 volts or less, the stator or diode are probably faulty. Test the stator and diode (Test 2,3, and 4).
	2. Disconnect the charging lead (black) from the wiring harness.	2. If voltage is 5 volts or more, stator winding is OK.
	3. With charging lead disconnected from battery and engine stopped, measure resistance from charging lead to ground using an ohmmeter. Note reading. Reverse the leads and measure resistance again. In one direction, the resistance should be infinity ohms (open circuit). With the leads reversed, some resistance should be measured (about midscale on Rx1 range).	3. If resistance is low in both directions, the diode is shorted. Replace the diode. If resistance is high in both directions, the diode or stator winding is open. (Use Test 4).
	4. Disconnect the lighting lead (yellow) from the wiring harness. Measure the resistance from the lighting lead to ground using an ohmmeter.	4. If resistance is approximately 0.5 ohms, stator winding is OK. If resistance is 0 ohms, stator winding is shorted. Replace stator. If resistance is infinity ohms, stator winding or lead is open. Replace stator.
No Lights	1. Make sure the lights are not burned out.	1. Replace burned out lights.
	2. Disconnect the lighting lead (yellow) from the wiring harness. With engine running at 3400 RPM, measure voltage from lighting lead to ground using an AC voltmeter.	2. If voltage is 13 volts or more, stator is OK. Check for loose connections or shorts in wiring harness. If voltage is less than 13 volts, test stator using an ohmmeter (Test 3).
	3. With engine stopped, measure the resistance of stator from lighting lead to ground using an ohmmeter.	3. If resistance is approximately .15 ohms, stator is OK. If resistance is 0 ohms, stator is shorted. Replace stator. If resistance is infinity ohms, stator or lighting lead is open. Replace stator.

Problem	Test	Conclusion
No Lights Or Battery Charging (Braking System Test)	1. Make sure lights are not burned out.	1. Replace burned out lights.
	2. Disconnect the braking lead (green) from the wiring harness. With engine running at 3400 RPM, measure voltage from braking lead to ground using an AC voltmeter.	2. If voltage is 35 volts or more, stator is OK. Circuitry on unit that grounds braking lead is shorted. If voltage is less than 35 volts, test stator using an ohmmeter.
	3. With the engine stopped, measure the resistance from braking lead to ground using an ohmmeter.	3. If resistance is approximately 0.2-0.4 ohms, stator is OK. If resistance is 0 ohms, stator is shorted. Replace stator. If resistance is infinity ohms, stator or lighting lead is open. Replace stator.

KOHLER Smart Spark™ Ignition Systems

We thought the problems were behind us, but... At the time that last year's update book was being written we had initiated some changes that we hoped would end the component failures on Command 22 and 25 HP engines. The changes did alleviate the earlier failure modes, but a new one showed up, so we have seen some continued ignition module failures.

Feedback from the field indicates there is still a good deal of misunderstanding and confusion about the CD ignition systems, especially Smart Spark™. We hope the following review will help correct some of the misconceptions and afford a better understanding of the systems.

Operation of CD Ignition Systems

Two versions of CD ignition systems are used. The standard version with fixed timing is used on the 17-20 HP Command Twins. The 22 and 25 HP Command Twins and the new CV16 single use Smart Spark™, a modified CD system which varies the ignition timing to correspond to running speed.

A. Capacitive Discharge With Fixed Timing

This system **(Figure 1)** consists of the following components:

- A magnet assembly which is permanently affixed to the flywheel.
- Two electronic capacitive discharge ignition modules which mount to the engine crankcase (Figure 2).
- A kill switch (or key switch) which grounds the modules to stop the engine.
- Two spark plugs.

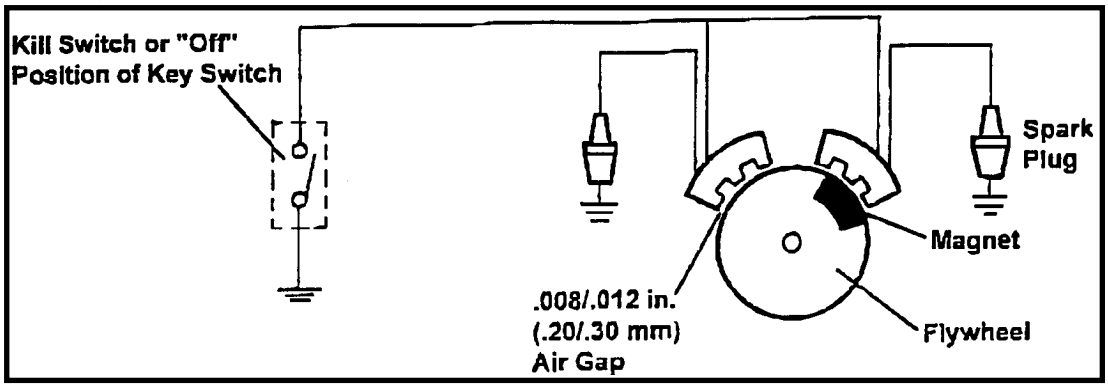


Figure 1. Capacitive Discharge Ignition System.

The timing of the spark is controlled directly by the position of the flywheel magnet group relative to engine top dead center.

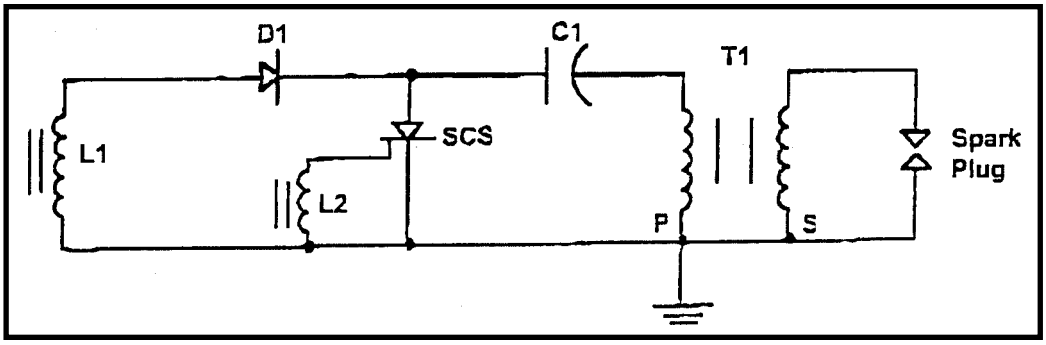


FIG. 2

Figure 2. Capacitive Discharge Ignition Module.

Operation: As the flywheel rotates, the magnet grouping passes the input coil (L1). The corresponding magnetic field induces energy into the input coil (L1). The resultant pulse is rectified by D1 and charges capacitor C1. As the magnet assembly completes its pass, it activates the triggering device (L2), which causes the semiconductor switch (SCS) to turn on. With the device switch **"on,"** the charging capacitor (C1) is directly connected across the primary (P) of the output transformer (T1). As the capacitor discharges, the current initiates a fast rising flux field in the transformer core. A high voltage pulse is generated from this action into the secondary winding of the transformer. This pulse is delivered to the spark plug gap. Ionization of the gap occurs, resulting in an arc at the plug electrodes. This spark ignites the fuel-air mixture in the combustion chamber.

The CH/CV22, 25 & CV16 engines are equipped with an electronic capacitive discharge ignition system with electronic spark advance. A typical application (Figure 3) consists of the following components:

- A magnet assembly which is permanently affixed to the flywheel.
- One (CV16) or two electronic capacitive discharge ignition modules which mount on the enginecrankcase (Figure 2).
- A spark advance module (SAM) which mounts to the engine shrouding (Figure 4).
- A 12 volt battery which supplies current to the SAM.
- A kill switch (or key switch) which grounds the SAM to stop the engine.
- One (CV16) or two spark plugs.

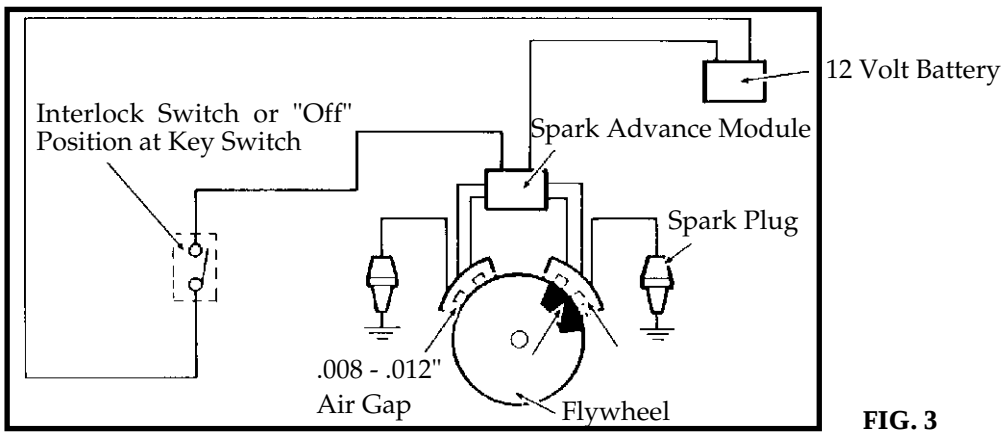


FIG. 3

Figure 3. Capacitive Discharge Ignition System with Spark Advance.

The timing of the spark is controlled by the position of the flywheel magnet group relative to the engine top dead center and the delay created by the spark advance module. **Do not** attempt to convert engines from Smart Spark™ to fixed timing by changing the ignition modules.

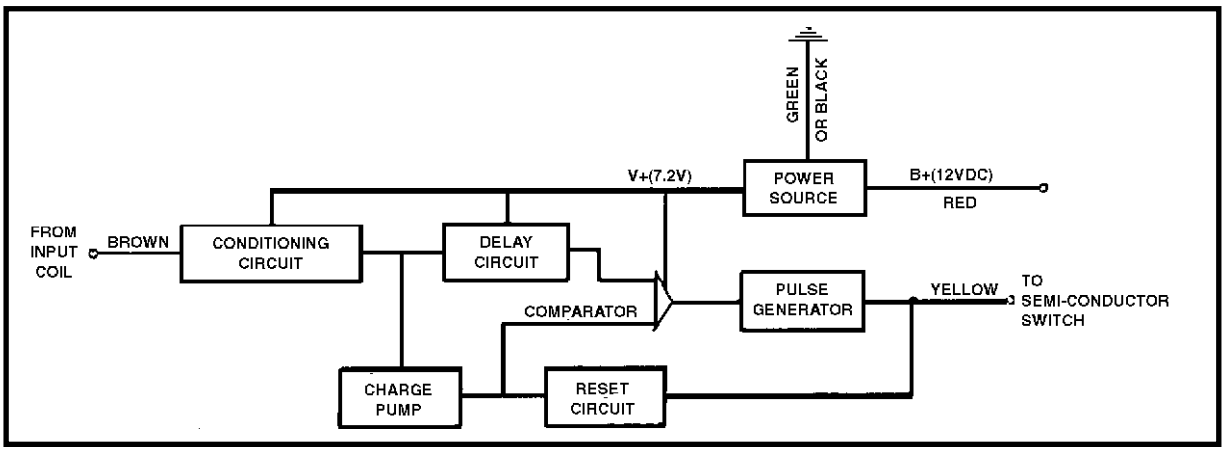


Figure 4. Block Diagram - Spark Advance Module.

Operation: The ignition module for this system operates in the same fashion as the fixed timing module, except the trigger circuit for the semiconductor (L2, Figure 2) is replaced by the spark advance module (Figure 4).

In addition to charging the capacitor (C1, Figure 2) in the ignition module, a pulse from the input coil of the ignition module (L1, Figure 2) is fed to the input of the conditioning circuit. The conditioning circuit shapes this pulse, putting it in a usable form for the additional circuits. This pulse starts the charge pump, which charges a capacitor in a linear fashion that can be directly related to the engine speed. At the same time the pulse resets the delay circuit for length of the pulse width. The comparator is off during this period and no output is generated. As soon as the original pulse drops back to zero, the capacitor in the delay circuit begins to charge.

When the charge on the delay capacitor exceeds the charge on the charge pump capacitor the comparator changes state, activating the pulse generator. This pulse turns ''ON'' the CD ignition module semiconductor. Energy is then transferred to the secondary of the output transformer (T1, Figure 2). The high voltage pulse generated here is delivered to the spark plug, causing arcing of the spark gap and igniting the fuel-air mixture in the combustion chamber. As the trigger pulse is generated, all associated circuits are reset, their capacitors discharged. The longer it takes the delay circuit to surpass the charge pump capacitor voltage, the later the trigger pulse will occur, retarding the timing accordingly.

In summary, the SAM receives the pulse from the ignition module via the brown lead. It determines how much spark retard is required for the operating speed and then sends a signal pulse back to the SCS in the ignition module via the yellow lead. From that point on, the firing sequence is the same as the fixed timing system.

Troubleshooting CD Ignition Systems

The CD ignition systems are intended to be trouble free for the life of the engine. Other than periodically checking/replacing the spark plugs, no maintenance or timing adjustments are necessary or possible. Mechanical systems do occasionally fail or break down, however, so the following troubleshooting information is provided to help you get to the root of the reported problem.

CAUTION: High Energy Electric Spark!

The CD ignition systems produce a high energy electric spark, but the spark must be discharged, or damage to the system can result. *Do NOT crank or run an engine with a spark plug lead disconnected.* **Always provide a path for the spark to discharge to ground**.

Reported ignition problems are most often due to poor connections. Before beginning the test procedure, check all wiring. Be certain all ignition-related wires are connected, including the spark plug leads. Be certain all terminal connections fit snugly. Make sure the ignition switch is in the run position.

NOTE: The CD ignition systems are sensitive to excessive load on the kill lead. If a customer complains of hard starting, low power, or misfire under load, it may be due to excessive draw on the kill circuit. Disconnect any auxiliary kill wires or interlock switches connected to the kill circuit and operate the engine to determine if the reported problem is gone.

NOTE: The spark advance module (SAM), used with Smart Spark™, requires an external power source of at least 7 volts DC. If you are installing a replacement battery on a unit that has an engine with Smart Spark™, be certain the battery is fully charged before attempting to start the engine.

Testing Of CD Ignition Systems

The following procedures are provided for troubleshooting CD ignition problems on Command engines. They will allow you to isolate and pinpoint the failed component(s). For engines with the standard, fixed-timing CD system (C17-20), disregard procedure 3 and use only steps 1-4 in procedure 1. For CV16 engines, disregard all references to opposite/second spark plug or cylinder.

Three types of ignition problems have been identified:

1. No fire
2. Intermittent fire
3. Incorrect timing or advance

Separate troubleshooting procedures are provided for each type of problem. **Perform the preliminary test first, then follow the procedure that matches the symptoms.**

Special Hand Tools Required:

- Hand Tachometer
- Tester 24 455 02*
- Automotive timing light
- Multi-meter (digital)

Specifications Required:

- Spark plug gap .030”
- Ignition module air gap .008-.012” (.010 nominal)

* NOTE: Ignition tester 24 455 02 must be used to test CD ignition systems. Use of any other tester can result in inaccurate findings. Battery on unit must be fully charged and properly connected before making any of these tests (a battery that is hooked up or charged backward will crank the engine, but it won't have spark). Be sure drive is in neutral and all external loads are disconnected.

Preliminary Test
To be certain the reported problem is in the engine ignition system, it should be isolated from the unit.

1. Locate the plug connectors where the wiring harnesses from the engine and unit are joined. Separate the connectors and remove the white ''kill'' lead from the engine connector. Rejoin the connectors and position or insulate the kill lead terminal so it cannot touch ground. Try to start** the engine to verify whether the reported problem is still present.

   a. If the problem is gone, the electrical system on the unit is suspect. Check the key switch, wires, connections, operator presence interlocks, etc.

   b. If the problem persists, follow the procedure that corresponds to the observed condi tion. Leave the kill lead isolated until all testing is completed.

Procedure #1 – No Fire
If the engine turns over but will not fire, follow this procedure.

1. Disconnect one spark plug lead, attach it to spark tester 24 455 02, and attach tester clip to a good ground **DO NOT** attach clip to spark plug.
2. Crank the engine over and observe tester for spark.
3. Repeat steps 1 and 2 on opposite cylinder.
4. If spark is observed on only one cylinder replace the ignition module that did not have spark.
5. If there is no spark on either cylinder, one module may be failed and pulling down the entire system. The SAM (spark advance module) may not be getting voltage, or the SAM may be faulty. Remove the blower housing and proceed as follows.

   a. Disconnect the yellow and brown leads from one ignition module and test for spark on the other module. Reattach yellow and brown leads. Repeat the test for the opposite ignition module. If either module has spark, **that module and the SAM are working**. Replace the module that has no spark.™ A faulty module can be confirmed by doing a resistance test. Disconnect the yellow and brown leads and test resistance from the narrow terminal to the laminations with a good digital ohmmeter. Resistance should be 900-1000 ohms. If resistance is below 300 ohms, module is faulty and must be replaced. If neither module has spark, test resistance on both. If resistance is good on both, proceed to step b.™

   b. Trace the red lead from the SAM to its power source connection. Test for battery voltage at connection with key switch in ''start'' and ''run'' positions. At least 7 volts must be present. If voltage is low, trace the green ground lead from the SAM and check for a good connection to ground. If available voltage is good, and resistance of modules was good (step a), replace the SAM and retest modules for spark.

Procedure #2 – Intermittent Spark

If a misfire or intermittent misfire is noticed, follow this procedure.

1. Start engine and warm up for 10 minutes. Stop engine.**
2. Disconnect one spark plug lead and attach it to spark tester 92/15024 455 02. Attach a tester clip to a good ground, where it will not vibrate loose during test running. **DO NOT** attach clip to spark plug.
3. Be sure drive is in neutral and disengage any external loads.
4. Start engine and run on one cylinder.
5. With engine running at 1200-1800 RPM, observe tester for consistent firing for 10-15 seconds.
6. Accelerate engine to 2800-3000 RPM and observe tester for consistent firing for 10-15 seconds.
7. Stop engine** and repeat procedure for opposite cylinder.
8. If intermittent spark was observed at any time, replace the inconsistent module(s).

Intermittent Spark Complaints on KOHLER 22HP & 25 HP with Smart Spark™ Ignition

We have received isolated reports of intermittent or lost spark on Command engines with the Smart Spark™ ignition system. Our investigation has determined that the dielectric compound used to waterproof the terminal connections on the ignition modules may be a possible cause. We have learned that the original dielectric material we were using can dry out and skin over from time and heat. It then forms a dark varnish-like coating on the terminals which can disrupt current flow across the connection. In some cases, excess compound got inside the shield of the female terminal, further contributing to a potential problem.

If a situation is encountered involving inconsistent or disrupted spark, proceed as follows:

1. Remove the blower housing to access the ignition modules.
2. Disconnect the brown and yellow leads from the modules and carefully inspect all of the terminals, both the male spade and female shielded portions.
3. If a dark coating is observed, clean each of the terminal connections thoroughly with cleaning solvent specified for electrical contacts. A small wire brush can be used with the solvent to remove any remaining residue from the contact surfaces. When clean, blow the terminals dry with compressed air.
4. Reinstall the wires back onto their respective terminals.
5. Use either Fel-Pro Lubri-Sel or GE/Novaguard G661 (Kohler Part 71/501 25 357 11) silicon dielectric compound, and carefully apply a bead around the base of each terminal connection. The beads should overlap between the two connections to forma a solid bridge of compound and prevent any possibility of arcing between them. **Do not** put any compound inside the connectors.
6. Check for spark on both cylinders with ignition tester 92/150 24 455 02. If spark is good, reinstall the blower housing.
7. Test run the unit and check if any misfire is still present.

8

Ignition Failures on KOHLER 22HP and 25 HP Command Engines

There have been reports that engine ignition has no spark while cranking, but when the key is released, one spark is noticed. The tendency has been to replace the SAM first, and if that does not correct the problem, the SAM and both ignition modules are changed.

Most of these reports can be traced to one faulty ignition module and many parts are being changed unnecessarily. Depending on the failure mode, a faulty ignition module can pull down the entire system and prevent both sides from firing.

If you encounter the above symptoms, test the system as follows:

Test	Conclusion
1. Remove the blower housing and disconnect the yellow and brown leads from one ignition module. Test for spark on the other module with tester 24 455 02. Reverse the test procedure.	1. If either module had spark, that module and the SAM are working. Perform step 2 on any ignition module that did not have spark.
2. Disconnect the yellow lead and test resistance from the narrow terminal to the laminations with a good digital ohmmeter.	2. Resistance should be 900-1000 ohms. If resistance is below 300 ohms, module is definitely faulty and must be replaced.* If neither module had spark, but the resistance on both is good, refer to previous section on Intermittent Spark.

* Remove graphite insulator washers described in the next section.

Remove Ignition Module Insulator Washer 24 468 12

A graphite insulator washer, part number 24 468 12, was being used between the ignition modules and the mounting bosses on Command 22 and 25 HP engines. Following further testing and evaluation the washer has been discontinued, effective at serial number 2629700007.

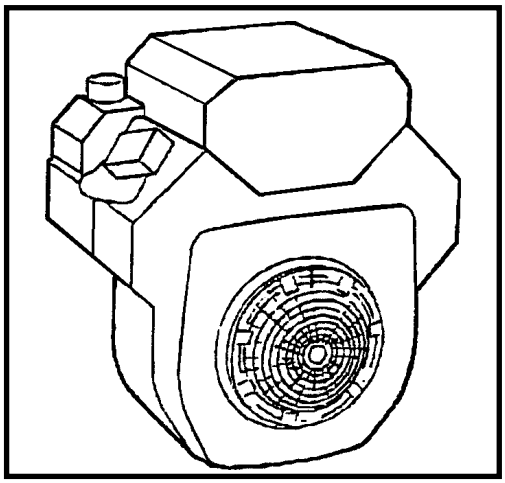
Ignition module kit 24 757 23 was implemented for servicing engines with the insulator washers. Due to the preseason order program, there is a substantial quantity of the kits in the field. When using one of these kits, use only the ignition module. Discard the screws and washers and disregard steps 9 and 20 of the instruction sheet TT436-A. Remove and discard all old graphite washers from the engine before mounting the new module, including those behind the other ignition module that hasn't failed.

Upon depletion of stock, the kit will supercede back to bare ignition module 24 584 03.*

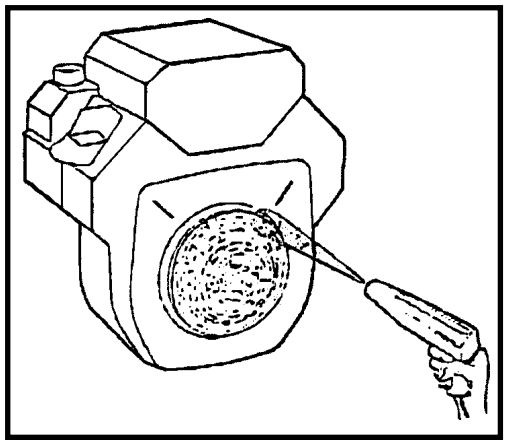
Procedure #3 – Incorrect Timing or Advance

If incorrect timing or advance is suspected, a timing light test will help identify the problem.

1. Use a marking pen or a piece of narrow tape (1-line correction tape works very well) to make a line near the edge of the flywheel screen.



2. Connect an automotive timing light to monitor spark on the #1 cylinder.
3. Run the engine at idle and use the timing light beam to locate the line you put on the screen. Draw a line on the blower housing adjacent to the one on the screen. Accelerate to full throttle and watch the movement of the line on the screen relative to the line on the blower housing. Stop the engine**, move the timing light to the #2 side and repeat the procedure. Stop the engine** when finished.



4. The marks you made on the blower housing, corresponding to the firing points of the cylinders, should be 90° apart. As you accelerated, the timing should have advanced 5 to 15, and the line on the screen should have moved 1/2″ to 3/4″ (13-16 mm) counter clockwise from the mark on the blower housing.

a. If the marks on the housing are not 90° apart or the timing did not advance, remove the blower housing and follow step 5b from Procedure 1 to test voltage to the SAM. If voltage checks good, replace the SAM.

b. If the marks on the housing are at the same position, one of the ignition modules is firing out of time, usually indicating a wiring problem between the SAM and one of the modules. Remove the lower housing and check the wires and connections between the SAM and modules. If the wiring and connections are good, replace the SAM.

5. If the modules are firing and advancing properly but the engine still acts like it's out of time, make the following checks on the flywheel.

a. Check the two magnets on the outside of the flywheel for equal charge by comparing magnetic pull with a steel rule or small screwdriver. If a significant difference is noted, replace the flywheel.
b. Remove the flywheel and check for a sheared key.

**NOTE: If the engine starts or runs during any of the testing, you may need to ground the kill lead to shut it down. Because you have interrupted the kill circuit, it may not stop with the switch.

Reinstall the kill lead into the connector when the ignition problem has been diagnosed and corrected. If your testing has not revealed a problem with the ignition system, refer to Section 3 in the appropriate KOLHER service manual and troubleshoot other possibilities.

TILLER TROUBLESHOOTING

Symptom: **Engine runs but tiller won't move / Tiller transmission hard to shift or won't go into gear / Tiller moves but tine won't turn**

What should you do before you replace a transmission on a (CRT) Counter Rotating Tiller.

- Verify the shift indicator roll pin is installed connecting the shift lever to the shift arm on the transmission. The transmission won't shift gear if this roll pin is missing.
- Verify that the drive engagement control is adjusted and working properly.
- Verify that the drive belt is installed and adjusted .
- Check to see that the rivet are installed through the wheel rim and the ground drive shaft.
- Replace broken shear pin in the tine shaft.

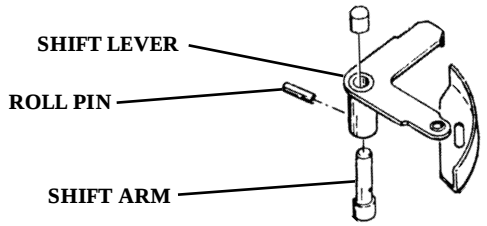
TO REPLACE GROUND DRIVE BELT

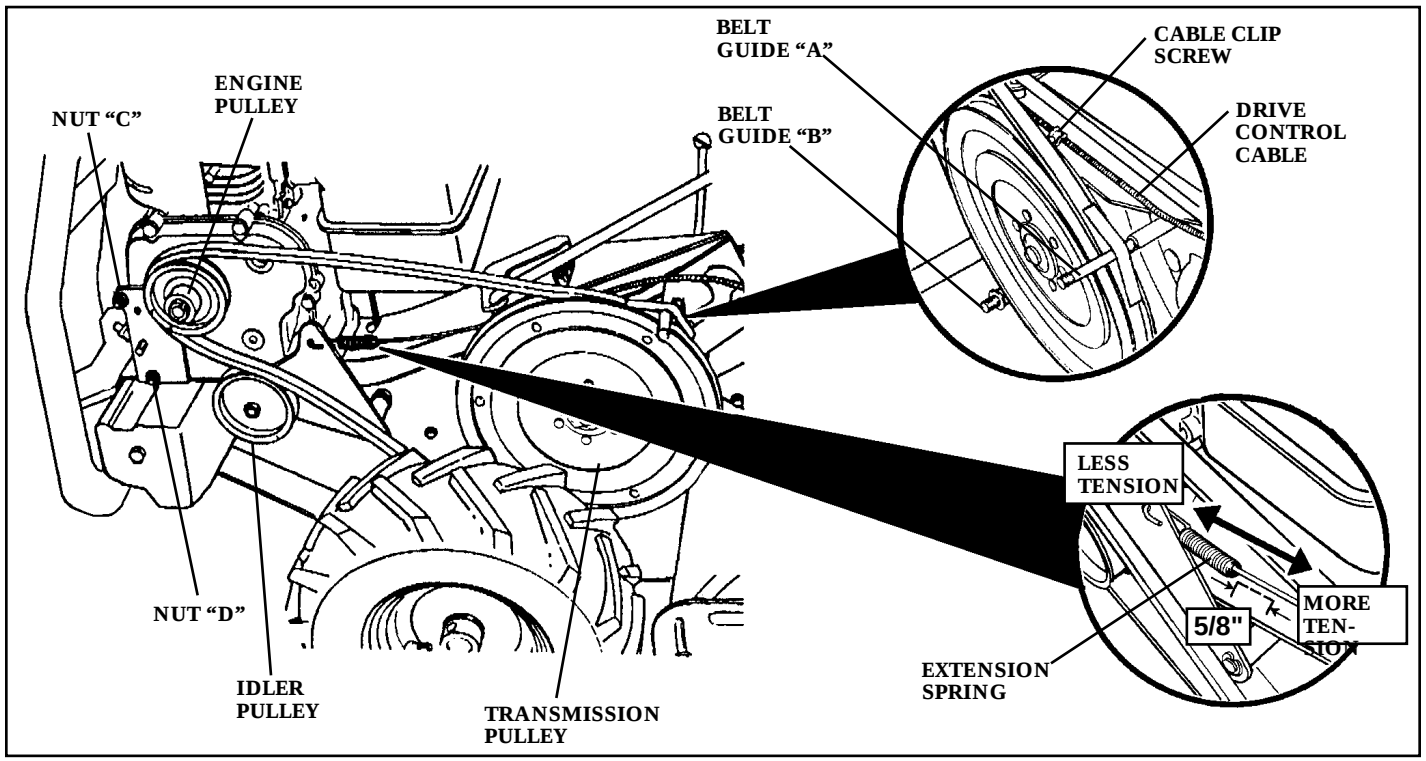
- Remove belt guard.
- Loosen belt guides "A" and "B" and also nuts "C" and "D".
- Remove old belt by slipping from engine pulley first.
- Place new belt in groove of transmission pulley and into engine pulley. BELT MUST BE IN GROOVE ON TOP OF IDLER PULLEY. NOTE POSITION OF BELT TO GUIDES.
- Tighten belt guides "A" and "B" and nuts "C" and "D".
- Check belt adjustment as described below.
- Replace belt guard.
- Reposition wheel and replace clevis pin and hairpin clip.
- Replace inner and outer side shields.

GROUND DRIVE BELT ADJUSTMENT

For proper belt tension, the extension spring should have about 5/8 inch stretch when drive control bar is in "ENGAGED" position. This tension can be attained as follows:

- Loosen cable clip screw securing the drive control cable.
- Slide cable forward for less tension and rearward for more tension until about 5/8 inch stretch is obtained while the drive control bar is engaged.
- Tighten cable clip screw securely.





9

Rear Tine Tiller Transmission Replacement

Teardown CRT Tiller:

1. **Remove both front Counter Weights.**
2. **Remove right side Outer Shield and Side Shield.**
3. **Remove the right Tine Assembly.**
4. **Remove right Wheel Assembly.**
5. **Remove all bolts that hold right side of Tine Shield to the transmission.**
6. **Remove right side engine Bolts, remove engine Reinforcement Bracket, and disconnect Throttle Cable from engine.**
7. **Remove the Nut and Lock Washer that holds Idler Arm Shaft on the transmission .**
8. **Remove control cable Clamp from the transmission and transfer to the new transmission.**
9. **Change to the left side of the tiller. Remove the Outer Shield and Side Shield.**
10. **Remove the left the Tine Assembly.**
11. **Remove left Wheel Assembly.**
12. **Remove one Bolt that holds the Latch Bracket Assembly to the transmission.**
13. **Remove the Bolt at the top of Depth Stake and remove the Depth Stake.**
14. **Remove all bolts holding Tine Shield on left side of the transmission.**
15. **Remove the Belt Guard.**
16. **Disconnect the Control Cable from the idler bracket. Remove the Idler Arm Bracket with Pulley and Idler Arm Shaft as a complete Assembly.**
17. **Remove the Pulley from transmission.**
18. **Remove left side engine Bolts, remove Engine and Engine Reinforcement Bracket from the transmission.**
19. **Remove Shift Indicator, Shift Rod and remove Handle Assembly from transmission.**
20. **Remove the long Bolt that holds the top rear of belt guard to the transmission and install on new transmission.**

Instructions are from Standing at the operating position of the tiller .
On DRT models, remove both depth stakes at the same time.

Rear Tine Tiller Transmission Replacement

Assemble Tiller

1. **Install Engine and engine Reinforcement Brackets on transmission and tighten all bolts.**

2. **Install Counter Weight onto transmission and tighten bolts.**

3. **Install Idler Bracket Assembly to the transmission and tighten.**

4. **Install Transmission Pulley and route V-Belt around transmission pulley and engine pulley.**

5. **Install Handle Assembly, hook up Control Cable to idler bracket , install Shift Indicator and Shift Rod to shift lever and hook up Throttle Control. Adjust Control Cable Spring for 5/8" stretch.**

6. **Add top rear belt guard Bolt and Spacers, put long Spacer on first, then add Pinch Guard, then the Short Spacer and Washer. Place the spacer and washer onto the rear lower belt guard bolt.**

7. **Install Belt Guard add Flat Washer and Cap Nut to front and top back studs, at bottom of belt guard use flat washer and regular nut.**

8. **Install Tine Shield and front Tines Shield Brackets as an assembly. Place all bolts and nuts before tightening.**

9. **Install right and left Tine Assembles. Use recommended Shear Pins.**

10. **Install right and left inner Side Shields and tighten nuts.**

11. **Install right and left outer Side Shields.**

12. **Install both Wheel Assembles.**

13. **Lift up and slide Depth Stake into slot in transmission. Secure Depth Stake with Bolt, Nut, and Rubber Tip. Adjust to lowest position.**

On DRT models, install both depth stakes at the same time.

9

RELOCATE THE CLUTCH CONTROL CABLE ON THE TOP OF THE TILLER TRANSMISSION, (SEE FIG. I), AND MOVE THE CONTROL CABLE SPRING ON THE IDLER BRACKET FROM NUMBER ONE LOCATION TO NUMBER TWO LOCATION, (SEE FIG. 2). CHECK SPRING EXTENSION FOR PROPER BELT TENSION. SEE OWNERS MANUAL FOR DETAILS.

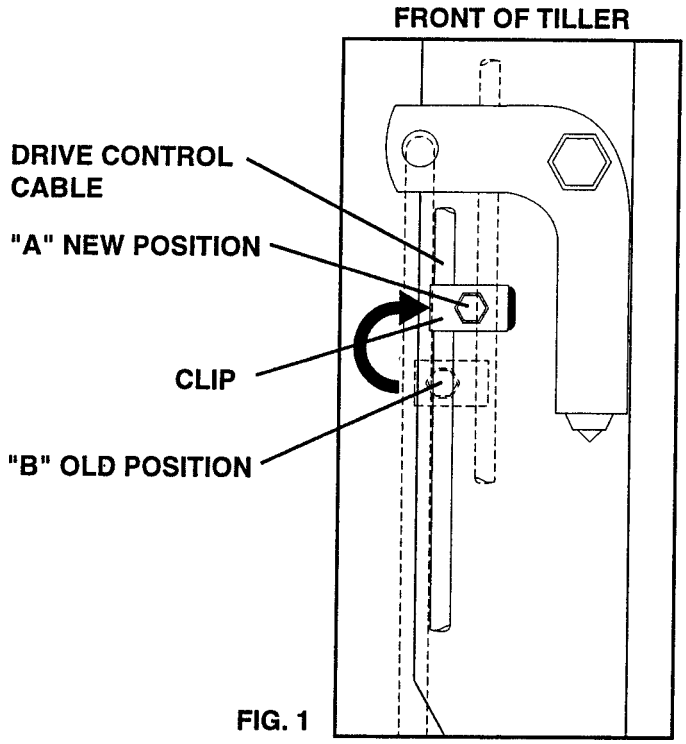


FIG. 1

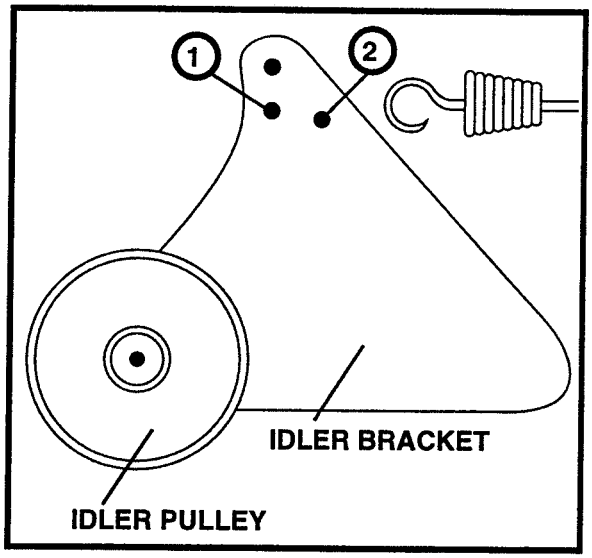
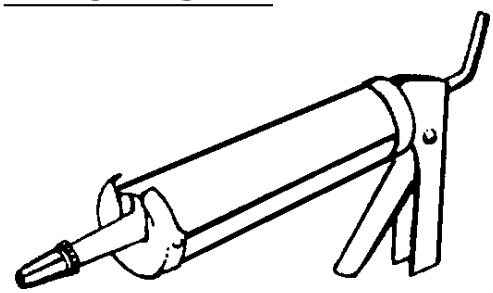


FIG. 2

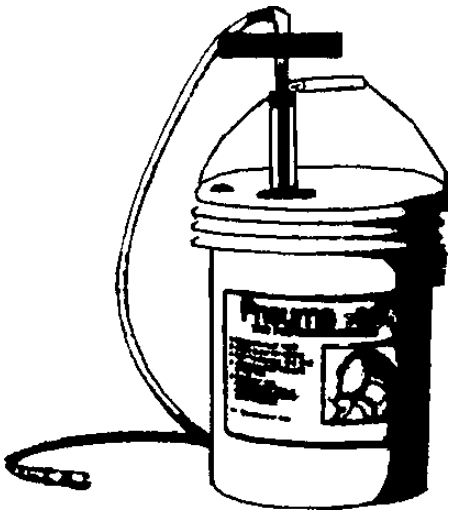
PNEUMASEAL



10 OZ. CAULKING TUBE

92/192 P/N 144334

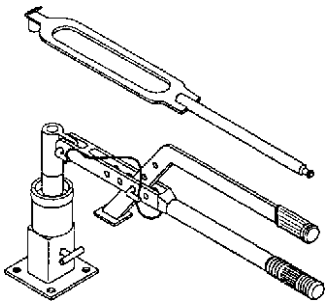
Designed to install quickly and easily in to all tires.



PUMP FOR PAIL
92/192 P/N 100035

5 GALLON PAIL 92/192 P/N 144335

Recommended for D/71 road technicians. Using pail and pump, it is possible to install sealant without fully deflating tires. The pump is purchased seperately and is required to install pneumaseal from the 5 gallon pail.



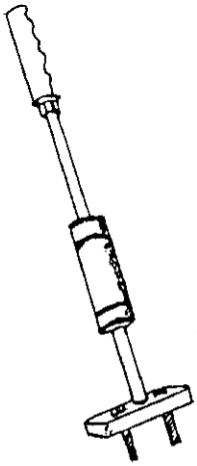
TIRE CHANGER

Changes tires in minutes

Lawn or Garden tires on 4" to 12" rims

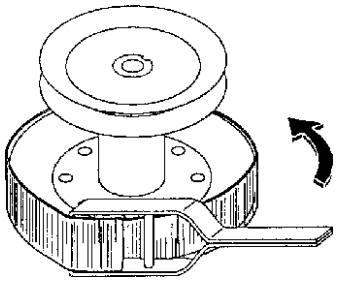
Includes Carry Bag

Order Information:
D92/150 Part #QE-10



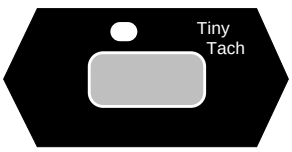
PULLER FOR REAR WHEELS AND ENGINE STACK PULLEY

Order Information:
See Tips bulletin board
D92/150 Part #QE-3



STRAP WRENCH FOR ENGINE STACK PULLEY

Order Information:
See Tips bulletin board
D92/150 Part #QE-6



TINY TACH

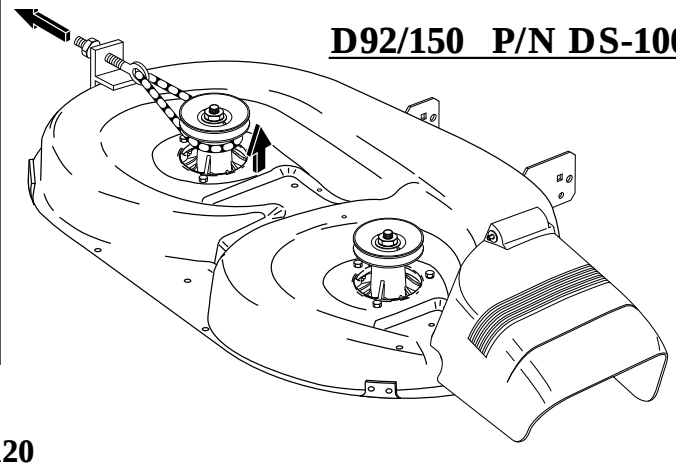
Required for proper factory carb adjustment.

Maintains safe RPM for PRO CPSC compliance.

Required for 1995 C.A.R.B. standard tune-up.

D92/150 Part #2CRWC

D92/150 P/N DS-100



Hand Tools

Div.	Src.	Part No.	Description
92	309	9-800130	Tool Set, Small Engine (see note *)
92	309	9-44664	Adjustable Wrench Set, 3 piece
92	309	9-46802	Allen Wrench Set, 11piece, Standard
92	309	9-46803	Allen Wrench Set, 11piece, Metric
92	9	9-AL56161	T Handle Hex Keys, 8 pieces
92	309	9-38464	Ball Pein Hammer, 12 oz.
92	309	9-38126	Claw Hammer, Fiberglass
92	309	9-38112	Dead Blow Hammer, 3 lb.
92	309	9-45076	Diagonal Cutting Pliers, 7"
92	309	9-11189	Drill, 9.6Volt Reversible
92	309	9-18503	Ear Protection or use ear plugs
92	309	9-44565	Flair Nut Tubing Wrench Set
92	309	9-44202	Flex Handle, 1/2" Dr. (breakerbar)
92	309	9-LB11 220	Flex Spout Oiler, 16 oz.
92	309	9-42024	Gasket Scraper (putty knife 1 1/4"wide)
92	309	9-47725	GasketScraper, general purpose, w/3 blades
92	309	9-18579	Goggles
92	309	9-LB11145	Grease Gun
92	309	9-3559	Hack Saw, 12"
92	309	BH10633	Hex Driver Set, 8 piece
92	309	9-WR415	Impact Socket Set, 6pt, 13pc, 7/16" to 1 1/4"
92	309	9-45964	Locking Pliers, 7" curved (vice grip)
92	309	9-NF04927	Metal File, Half Round
92	309	9-82558	Needle Nose Pliers
92	309	9-4196	Nut Drive Set, 7piece, (3/16" to 1/2")
92	309	9-KD3082	Oil Filter Wrench
92	309	9-30842	Pipe Wrench, 14"
92	309	9-4301	Punch Chisel Set, 5 piece
92	309	9-42892	Rolling Wedge Bar, 16"
92	309	9-41144	Screwdriver Power Set, 5 phillips, 5 STD
92	309	9-34790	Socket Wrench Set 1/2" Drive
92	309	9-34789	Socket Wrench Set, Metric, 1/4" & 3/8" Dr.
92	309	9-34788	Socket Wrench Set, SAE, 1/4" & 3/8" Dr.
92	309	9-6513	Tool Box, flat top
92	309	9-34323	Torx Bit Set, 7 pieces
92	309	9-3669	Wire Brush, 1 1/16" x 10"
92	309	9-49661	Wrench Set, Box and Open End
92	309	9-49671	Wrench Set, Metric, Box/Open End, 11 pcs

Division 71 Supplies Continued

Div.	Src.	Part No.	Description
92	192	144334	Tire Sealant, Pneumaseal, 10 oz. caulking tube
71	500	100032	Tire Sealant, Pneumaseal, 16 oz. bottle
71	500	100033	Tire Sealant, Pneumaseal, 32 oz. bottle
92	192	144335	Tire Sealant, Pneumaseal, 5 gallon pail
92	192	100035	Tire Sealant Pump for 5 gallon pail

*** Many listed tools will not be needed if this is ordered. See Industrial Tool Catalog.**

Specialty Tools and Test Equipment

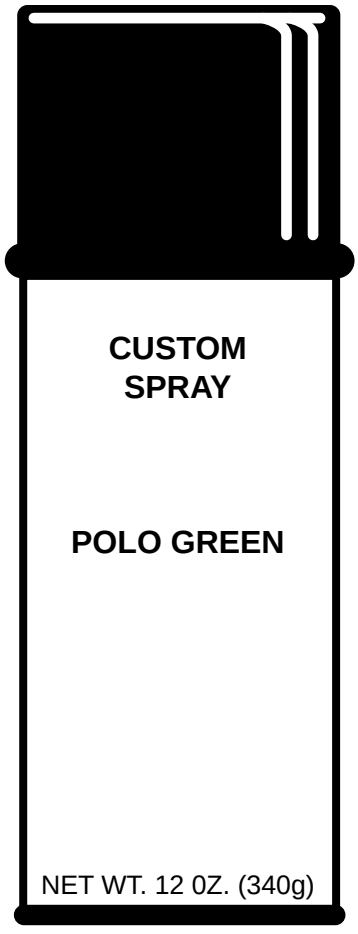
Div.	Src.	Part No.	Description
92	150	670297	Air Gap Gauge, Tecumseh
92	309	9-16237	Air Hose Blow Gun Kit
92	309	9-18874	Air Impact Wrench, 1/2" Drive
92	150	BT1260	Battery Load Tester(Milton)
92	309	9-51865	Bench Vice (opens to 5")
92	150	19359	DC Shunt (only works with Fluke 73)
92	150	19413	Engine Leakdown Tester
92	309	KD2424	Feeler Gauge set
92	150	670314	Flywheel Knock
92	150	670103	Flywheel Knock, Tecumseh
92	150	670169	Flywheel Knock, Tecumseh
92	309	9-BL612	Grinder
92	150	19368	Ignition Tester
92	150	24-455-02	Ignition Tester for Kohler 22-25 HP
92	192	150834	Jumper Wire Test Kit
92	150	25-761-02	Manometer for crankcase pressure
92	309	9-38662	Micrometer, 0-1.0"
92	150	DS-100	Mower Deck Straightener
92	150	BK390	Multimeter
92	150	19390	Multimeter, Fluke73
92	309	9-KD2286	Puller, Harmonic Balancer
92	150	QE-3	Puller, rear wheels and engine stack pulley
92	150	19340	Ring Expander
92	309	9-KD3245	Seal Puller
92	150	19435	Starter Drive Install Tool, Briggs & Stratton
92	150	19436	Starter Drive Removal Tool, Briggs
92	150	25-761-18	Starter Drive Tool Kit, Kohler
92	150	QE-6	Strap Wrench for Engine Stack Pulley
92	150	19352	Tang Bender
92	309	9-52382	Tap and Die set, 39 piece
92	150	19404	Telescoping Gauge
92	309	9-2134	Timing Light
92	150	2CRWC	Tiny Tachometer and hourmeter
92	150	QE-10	Tire Changer
92	150	19393	Torque Wrench, Spring 0-600 inch lb. 3/8" Dr.
92	309	9-44544	Torque Wrench, "Digitorkt" 25-250 ft.lb.
92	150	19353	Universal Socket, B&S Vanguard Starter
92	150	19063	Valve Spring Compressor

Division 71 Supplies

Div.	Src.	Part No.	Description
92	192	45404	Adhesive, gel instant, 3gr. tube
92	192	76765	Anti-seize, 1 lb brush topcan
92	192	80369	Battery Cleaner, 6OZ. aerosol
92	192	80370	Battery protector and sealer, 6OZ. aerosol
92	192	87010C	Carb & Choke Cleaner, 15OZ. aerosol, CarbForce
92	192	51831	Gasket Eliminator, Flange Seal, 50ml bottle
92	192	85010C	Lubricant, White Lithium multi-purpose, 14 oz.
92	192	84010C	Penetrant, Lubricant, Corrosion Prevenative 15OZ.
92	192	56531	PST Pipe Sealant, 50ml. bottle
92	192	66010	Quick metal press fit repair 6 ml tube
92	192	58730	RTV Silicone Ultra Blue, 3Oz.tube
92	192	82010C	Cleaner/Degreaser 32 oz. bottle/case
92	192	148691	Terminal/Connector Kit
92	192	26221	Threadlocker 10ml locktite, permanent
92	192	24221	Threadlocker242 10ml locktite, removable

Touch - Up Paints for Lawn & Garden

PART NUMBER	DESCRIPTION	PAINT CODE
71 / 917 / 150020	POLO GREEN Spray Paint	558
71 / 917 / 150131	SATIN BLACK Spray Paint	
71 / 917 / 130937	DOVER GRAY Spray Paint	459, 478
71 / 917 / 126967X	NEW SEARS SILVER Spray Paint	417
71 / 917 / 136247	RED Spray Paint	505, 506, 394, 423
71 / 917 / 126965X	ORANGE Spray Paint	412, 422
71 / 917 / 126966X	GRAY Spray Paint	410, 418
71 / 917 / 144401	GREEN Spray Paint	550
71 / 917 / 126963X	GREEN (New RALLY) Spray Paint	419
71 / 917 / 130939	GREEN (POULAN) Spray Paint	419
71 / 917 / 126964X	YELLOW (POULAN PRO) Spray Paint	416, 421
71 / 917 / 130941	YELLOW Spray Paint	472, 473
71 / 917 / 136246	BLUE (Dark) Spray Paint	510, 511
71 / 917 / 108521X	BRONZE (Old Roper) Spray Paint	388
71 / 917 / 126687X	BRONZE (New Roper) Spray Paint	425



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