HPX 4X2, HPX 4X4 Gas and Diesel

TECHNICAL MANUAL

HPX 4X2, HPX 4X4 Gas and HPX 4X4 Diesel

TM2195 15MAR21 (ENGLISH)

John Deere Horicon Works
PRINTED IN U.S.A.

Introduction

Foreword

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.

This is the safety-alert symbol. When you see this symbol on the machine or in this manual, be alert to the potential for personal injury.

Technical manuals are divided in two parts: repair and operation and tests. Repair sections tell how to repair the components. Operation and tests sections help you identify the majority of routine failures quickly.

Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job, service parts kits, specifications, wear tolerances, and torque values.

Technical Manuals are concise guides for specific machines. They are on-the-job guides containing only the vital information needed for diagnosis, analysis, testing, and repair.

Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

DX,TMIFC -19-15APR14-1/1

Contents

Original Instructions. All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

Section 10
Safety

Contents

Recognize Safety Information

This is a safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

T81389 —UN—28JUN13

OUO1082,0004291 -19-29MAY12-1/1

Understand Signal Words

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

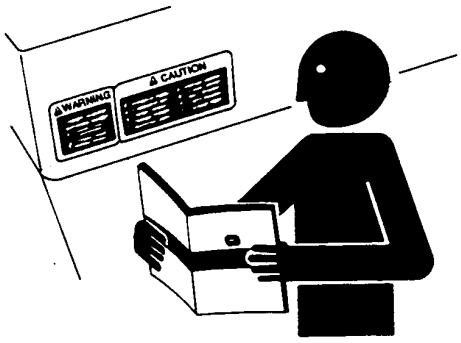
DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

TS187 —19—30SEP88

OUO1082,0004292 -19-29MAY12-1/1

Replace Safety Signs

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.



TS201 —UN—15APR13

OUO1082,0004293 -19-29MAY12-1/1

Handle Fluids Safely—Avoid Fires

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

TS227 —UN—15APR13

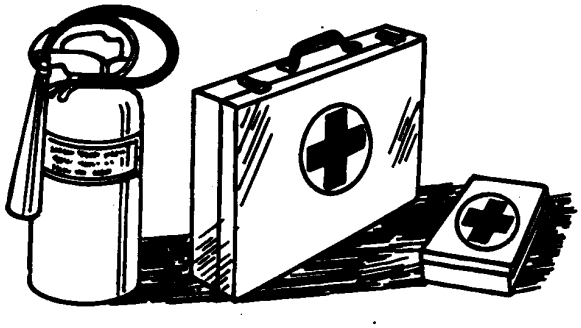
OUO1082,0004294 -19-29MAY12-1/1

Prepare for Emergencies

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 —UN—15APR13

OUO1082,0004295 -19-29MAY12-1/1

Prevent Battery Explosions

Keep sparks, lighted matches, and open flame away from the top of battery. Battery gas can explode.

Never check battery charge by placing a metal object across the posts. Use a volt-meter or hydrometer.

Do not charge a frozen battery; it may explode. Warm battery to 16°C (60°F).

TS204 —UN—15APR13

OUO1082,0004296 -19-29MAY12-1/1

Prevent Acid Burns

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:

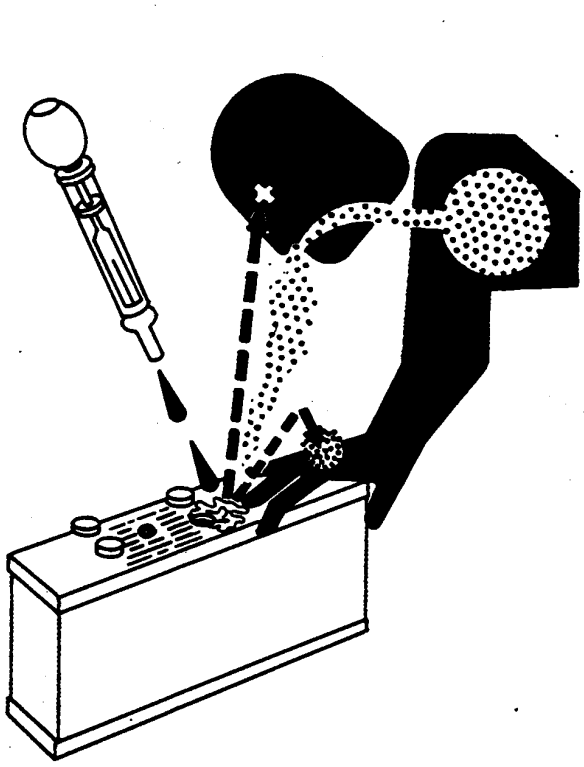
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

If you spill acid on yourself:

1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 15—30 minutes. Get medical attention immediately.

If acid is swallowed:

1. Do not induce vomiting.
2. Drink large amounts of water or milk, but do not exceed 2 L (2 quarts).
3. Get medical attention immediately.



TS203 —UN—23AUG88

OUO1082,0004297 -19-29MAY12-1/1

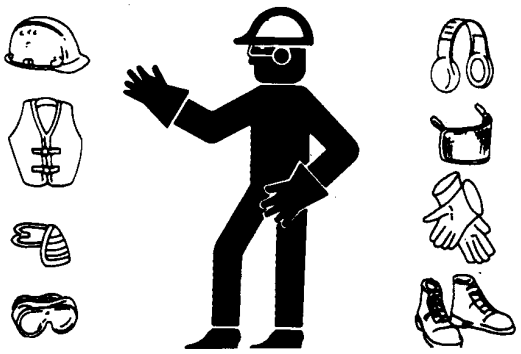
Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



TS206 —UN—15APR13

OUO1082,0004298 -19-29MAY12-1/1

Avoid High-Pressure Fluids

Inspect hydraulic hoses periodically – at least once per year – for leakage, kinking, cuts, cracks, abrasion, blisters, corrosion, exposed wire braid or any other signs of wear or damage.

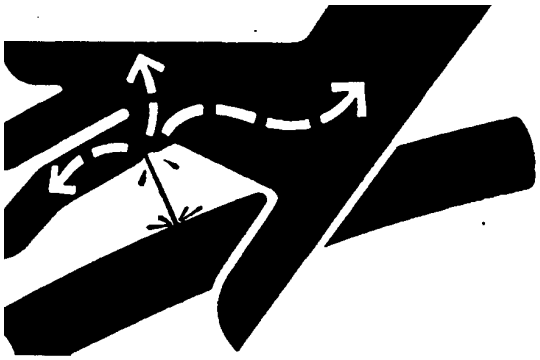
Replace worn or damaged hose assemblies immediately with John Deere approved replacement parts.

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available in English from Deere & Company Medical Department in Moline, Illinois, U.S.A., by calling 1-800-822-8262 or +1 309-748-5636.



X9811 —UN—23AUG88

OUO1082,0004299 -19-29MAY12-1/1

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can accidentally burst when heat goes beyond the immediate flame area.

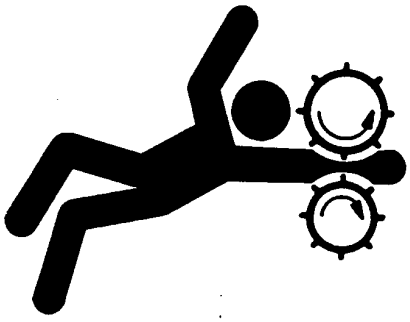
TS953 —UN—15MAY90

OUO1082,000429A -19-29MAY12-1/1

Service Machines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



TS228 —UN—23AUG88

OUO1082,000429B -19-29MAY12-1/1

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.

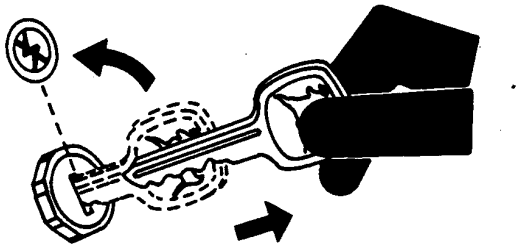
TS779 —UN—08NOV89

OUO1082,000429C -19-29MAY12-1/1

Park Machine Safely

Before working on the machine:

- Lower all equipment to the ground.
- Stop the engine and remove the key.
- Disconnect the battery ground strap.
- Hang a "DO NOT OPERATE" tag in operator station.



TS230 —UN—24MAY89

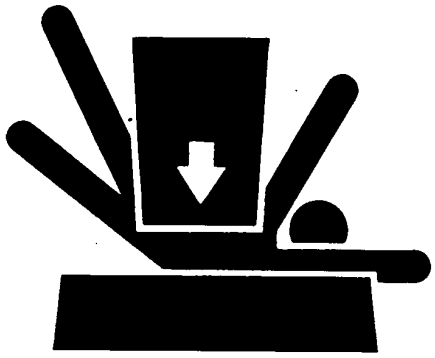
OUO1082,000429D -19-29MAY12-1/1

Support Machine Properly

Always lower the attachment or implement to the ground before you work on the machine. If the work requires that the machine or attachment be lifted, provide secure support for them. If left in a raised position, hydraulically supported devices can settle or leak down.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

When implements or attachments are used with a machine, always follow safety precautions listed in the implement or attachment operator's manual.



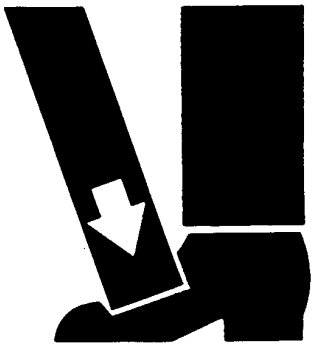
TS229 —UN—23AUG88

OUO1082,000429E -19-29MAY12-1/1

Use Proper Lifting Equipment

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



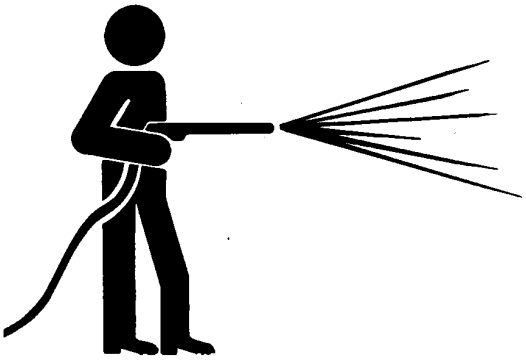
TS226 —UN—23AUG88

OUO1082,000429F -19-29MAY12-1/1

Work in Clean Area

Before starting a job:

- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



T6642EJ —UN—18OCT88

OUO1082,00042A0 -19-29MAY12-1/1

Protect Against High Pressure Spray

Spray from high pressure nozzles can penetrate the skin and cause serious injury. Keep spray from contacting hands or body.

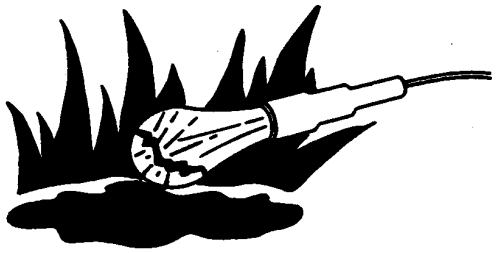
If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

TS1343 —UN—18MAR92

OUO1082,00042A1 -19-29MAY12-1/1

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



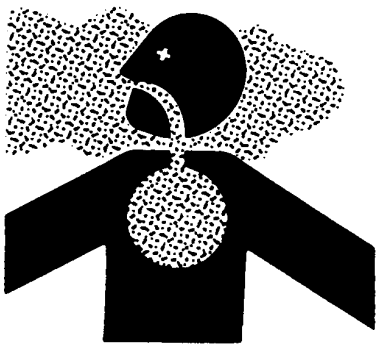
TS223 —UN—23AUG88

OUO1082,00042A2 -19-29MAY12-1/1

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.



TS220 —UN—15APR13

OUO1082,00042A3 -19-29MAY12-1/1

Remove Paint Before Welding or Heating

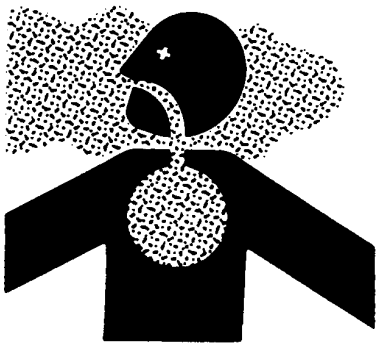
Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Remove paint before heating:

- Remove paint a minimum of 100 mm (4 in.) from area to be affected by heating. If paint cannot be removed, wear an approved respirator before heating or welding.
- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.
- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

Do not use a chlorinated solvent in areas where welding will take place.



TS220 —UN—15APR13

Do all work in an area that is well ventilated to carry toxic fumes and dust away.

Dispose of paint and solvent properly.

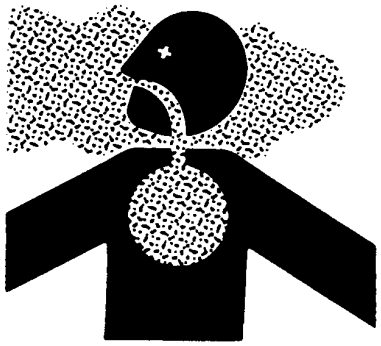
OUO1082,00042A4 -19-29MAY12-1/1

Avoid Harmful Asbestos Dust

Avoid breathing dust that may be generated when handling components containing asbestos fibers. Inhaled asbestos fibers may cause lung cancer.

Components in products that may contain asbestos fibers are brake pads, brake band and lining assemblies, clutch plates, and some gaskets. The asbestos used in these components is usually found in a resin or sealed in some way. Normal handling is not hazardous as long as airborne dust containing asbestos is not generated.

Avoid creating dust. Never use compressed air for cleaning. Avoid brushing or grinding material containing asbestos. When servicing, wear an approved respirator. A special vacuum cleaner is recommended to clean asbestos. If not available, apply a mist of oil or water on the material containing asbestos.



TS220 —UN—15APR13

Keep bystanders away from the area.

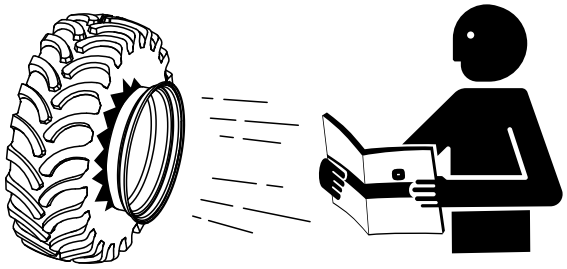
OUO1082,00042A5 -19-29MAY12-1/1

Follow Tire Recommendations

Keep your machine in proper working order.

Use only prescribed tire sizes with correct ratings and inflate to the pressure specified in this manual.

Use of other than prescribed tires may decrease stability, affect steering, result in premature tire failure, or cause other durability or safety issues.



H111235 —UN—13MAY14

DX,TIRE,INFO -19-19MAY14-1/1

Stay Clear of Rotating Drivelines

Entanglement in rotating driveline can cause serious injury or death.

Keep tractor master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

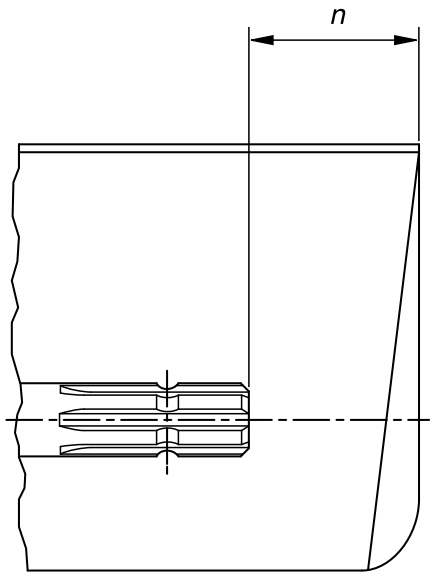
Wear close fitting clothing. Stop the engine and be sure that PTO driveline is stopped before making adjustments, connections, or cleaning out PTO driven equipment.

Do not install any adapter device between the tractor and the primary implement PTO drive shaft that will allow a 1000 rpm tractor shaft to power a 540 rpm implement at speeds higher than 540 rpm.

Do not install any adapter device that results in a portion of the rotating implement shaft, tractor shaft, or the adapter to be unguarded. The tractor master shield shall overlap the end of the splined shaft and the added adaptor device as outlined in the table.

PTO Type	Diameter	Splines	n ± 5 mm (0.20 in.)
1	35 mm (1.378 in.)	6	85 mm (3.35 in.)
2	35 mm (1.378 in.)	21	85 mm (3.35 in.)
3	45 mm (1.772 in.)	20	100 mm (4.00 in.)

TS1644 —UN—22AUG95



H96219 —UN—29APR10

OUO1082,00042A7 -19-29MAY12-1/1

Service Cooling System Safely

Explosive release of fluids from pressurized cooling system can cause serious burns.

Shut off engine. Only remove filler cap when cool enough to touch with bare hands. Slowly loosen cap to first stop to relieve pressure before removing completely.

TS281 —UN—15APR13

OUO1082,00042A8 -19-29MAY12-1/1

Dispose of Waste Properly

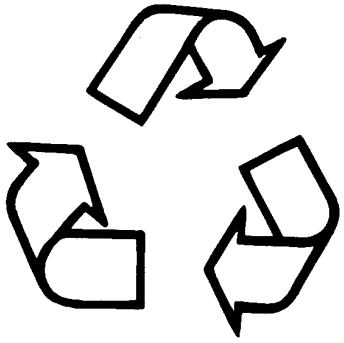
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 —UN—15APR13

OUO1082,00042A9 -19-29MAY12-1/1

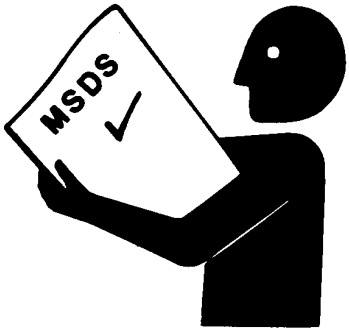
Handle Chemical Products Safely

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques.

Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

(See your John Deere dealer for MSDS's on chemical products used with John Deere equipment.)



TS1132 —UN—15APR13

OUO1082,00042AA -19-29MAY12-1/1

Live With Safety

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

TS231 —19—07OCT88

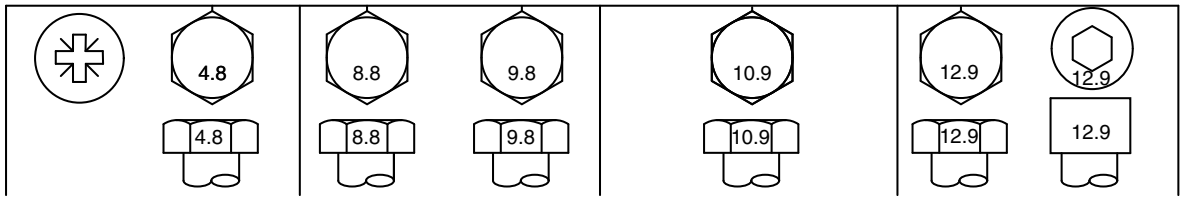
OUO1082,00042AB -19-29MAY12-1/1

Section 20
Specifications & Information

Contents

Metric Bolt and Screw Torque Values

TS1670 —UN—01MAY03



Bolt or Screw Size	Class 4.8				Class 8.8 or 9.8				Class 10.9				Class 12.9			
	Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]		Lubricated[a]		Dry[b]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
M6	4.7	42	6	53	8.9	79	11.3	100	13	115	16.5	146	15.5	137	19.5	172
									N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.
M8	11.5	102	14.5	128	22	194	27.5	243	32	23.5	40	29.5	37	27.5	47	35
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
M10	23	204	29	21	43	32	55	40	63	46	80	59	75	55	95	70
	N·m	lb.-ft.														
M12	40	29.5	50	37	75	55	95	70	110	80	140	105	130	95	165	120
M14	63	46	80	59	120	88	150	110	175	130	220	165	205	150	260	190
M16	100	74	125	92	190	140	240	175	275	200	350	255	320	235	400	300
M18	135	100	170	125	265	195	330	245	375	275	475	350	440	325	560	410
M20	190	140	245	180	375	275	475	350	530	390	675	500	625	460	790	580
M22	265	195	330	245	510	375	650	480	725	535	920	680	850	625	1080	800
M24	330	245	425	315	650	480	820	600	920	680	1150	850	1080	800	1350	1000
M27	490	360	625	460	950	700	1200	885	1350	1000	1700	1250	1580	1160	2000	1475
M30	660	490	850	625	1290	950	1630	1200	1850	1350	2300	1700	2140	1580	2700	2000
M33	900	665	1150	850	1750	1300	2200	1625	2500	1850	3150	2325	2900	2150	3700	2730
M36	1150	850	1450	1075	2250	1650	2850	2100	3200	2350	4050	3000	3750	2770	4750	3500

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For stainless steel fasteners or for nuts on U-bolts, see the tightening instructions for the specific application. Tighten plastic insert or crimped steel type lock nuts by turning the nut to the dry torque shown in the chart, unless different instructions are given for the specific application.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class. Replace fasteners with the same or higher property class. If higher property class fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*

[b] *"Dry" means plain or zinc plated without any lubrication, or M6 to M18 fasteners with JDM F13B, F13E or F13H zinc flake coating.*

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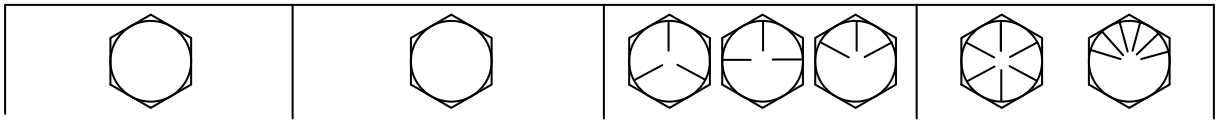
Unified Inch Bolt and Screw Torque Values

TS1671 —UN—01MAY03



Bolt or Screw Size	SAE Grade 1				SAE Grade 2[a]				SAE Grade 5, 5.1 or 5.2				SAE Grade 8 or 8.2			
	Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]		Lubricated[b]		Dry[c]	
	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.	N·m	lb.-in.
1/4	3.7	33	4.7	42	6	53	7.5	66	9.5	84	12	106	13.5	120	17	150
													N·m	lb.-ft.	N·m	lb.-ft.
5/16	7.7	68	9.8	86	12	106	15.5	137	19.5	172	25	221	28	20.5	35	26
									N·m	lb.-ft.	N·m	lb.-ft.				
3/8	13.5	120	17.5	155	22	194	27	240	35	26	44	32.5	49	36	63	46
			N·m	lb.-ft.	N·m	lb.-ft.	N·m	lb.-ft.								
7/16	22	194	28	20.5	35	26	44	32.5	56	41	70	52	80	59	100	74
	N·m	lb.-ft.														
1/2	34	25	42	31	53	39	67	49	85	63	110	80	120	88	155	115
9/16	48	35.5	60	45	76	56	95	70	125	92	155	115	175	130	220	165
5/8	67	49	85	63	105	77	135	100	170	125	215	160	240	175	305	225
3/4	120	88	150	110	190	140	240	175	300	220	380	280	425	315	540	400
7/8	190	140	240	175	190	140	240	175	490	360	615	455	690	510	870	640
1	285	210	360	265	285	210	360	265	730	540	920	680	1030	760	1300	960
1-1/8	400	300	510	375	400	300	510	375	910	670	1150	850	1450	1075	1850	1350
1-1/4	570	420	725	535	570	420	725	535	1280	945	1630	1200	2050	1500	2600	1920
1-3/8	750	550	950	700	750	550	950	700	1700	1250	2140	1580	2700	2000	3400	2500
1-1/2	990	730	1250	930	990	730	1250	930	2250	1650	2850	2100	3600	2650	4550	3350

Torque values listed are for general use only, based on the strength of the bolt or screw. DO NOT use these values if a different torque value or tightening procedure is given for a specific application. For plastic insert or crimped steel type lock nuts, for stainless steel fasteners, or for nuts on U-bolts, see the tightening instructions for the specific application. Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Replace fasteners with the same or higher grade. If higher grade fasteners are used, tighten these to the strength of the original. Make sure fastener threads are clean and that you properly start thread engagement. When possible, lubricate plain or zinc plated fasteners other than lock nuts, wheel bolts or wheel nuts, unless different instructions are given for the specific application.

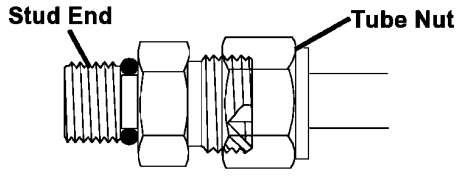
[a] Grade 2 applies for hex cap screws (not hex bolts) up to 6 in. (152 mm) long. Grade 1 applies for hex cap screws over 6 in. (152 mm) long, and for all other types of bolts and screws of any length.

[b] "Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or 7/8 in. and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.

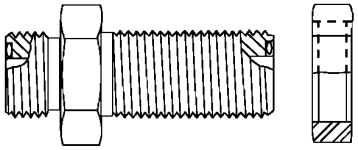
[c] "Dry" means plain or zinc plated without any lubrication, or 1/4 to 3/4 in. fasteners with JDM F13B, F13E or F13H zinc flake coating.

MX52301,0000152 -19-14APR14-1/1

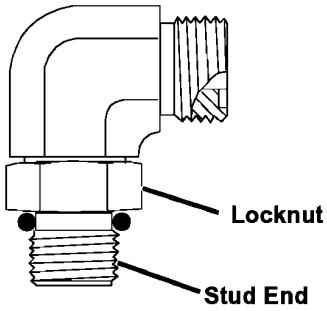
Face Seal Fittings With Inch Stud Ends Torque



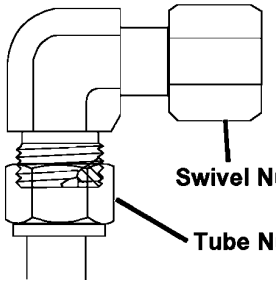
Stud Straight and Tube Nut



Bulkhead Union and Bulkhead Locknut



90 Adjustable Stud Elbow



90 Swivel Elbow and Tube Nut

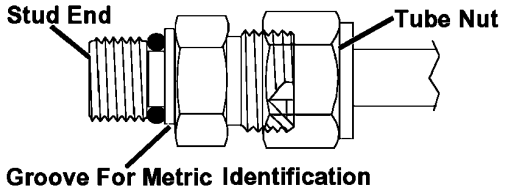
LVAL22421 —UN—01MAY12

Nominal Tube OD/Hose ID				Face Seal Tube/Hose End					O-Ring Stud Ends		
Metric Tube OD	Inch Tube OD			Thread Size	Tube Nut/Swivel Nut Torque		Bulkhead Lock Nut Torque		Thread Size	Straight Fitting or Lock Nut Torque	
mm	Dash Size	in.	mm	in.	N•m	lb-ft	N•m	lb-ft	in.	N•m	lb-ft
5	-3	0.188	4.76						3/8-24	8	6
6	-4	0.250	6.35	9/16-18	16	12	12	9	7/16-20	12	9
8	-5	0.312	7.94						1/2-20	16	12
10	-6	0.375	9.52	11/16-16	24	18	24	18	9/16-18	24	18
12	-8	0.500	12.70	13/16-16	50	37	46	34	3/4-16	46	34
16	-10	0.625	15.88	1-14	69	51	62	46	7/8-14	62	46
19	-12	0.750	19.05	1-3/16-12	102	75	102	75	1-1/16-12	102	75
22	-14	0.875	22.22	1-3/16-12	102	75	102	75	1-3/16-12	122	90
25	-16	1.000	25.40	1-7/16-12	142	105	142	105	1-5/16-12	142	105
32	-20	1.25	31.75	1-11/16-12	190	140	190	140	1-5/8-12	190	140
38	-24	1.50	38.10	2-12	217	160	217	160	1-7/8-12	217	160

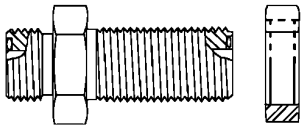
NOTE: Torque tolerance is +15%, -20%.

MX52301,0000159 -19-14APR14-1/1

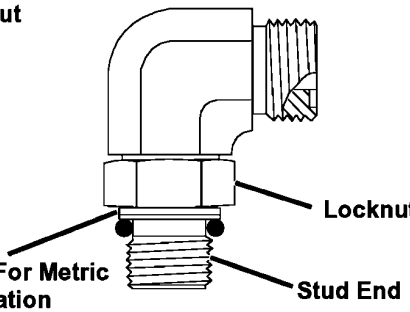
Face Seal Fittings With Metric Stud Ends Torque



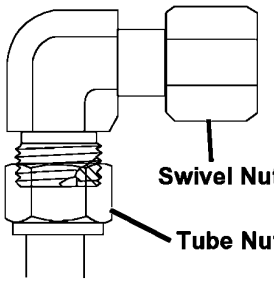
Stud Straight and Tube Nut



Bulkhead Union and Bulkhead Locknut



90 Adjustable Stud Elbow



90 Swivel Elbow and Tube Nut

LVAL22422 —UN—01MAY12

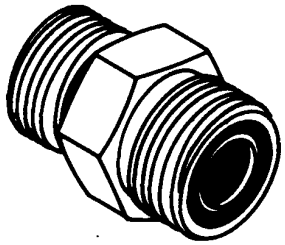
Nominal Tube OD/Hose ID				Face Seal Tube/Hose End						O-Ring Stud Ends, Straight Fitting, or Lock Nut					
Metric Tube OD	Inch Tube OD			Thread Size	Tube Nut/Swivel Nut Torque			Bulkhead Lock Nut Torque		Thread Size	Hex Size	Steel or Gray Iron Torque		Aluminum Torque	
mm	Dash Size	in.	mm	in.	mm	N•m	lb-ft	N•m	lb-ft	in.	mm	N•m	lb-ft	N•m	lb-ft
6	-4	0.250	6.35	9/16-18	17	16	12	12	9	M12X-1.5	17	21	15.5	9	6.6
8	-5	0.312	7.94												
										M14X-1.5	19	33	24	15	11
10	-6	0.375	9.52	11/16-16	22	24	18	24	18	M16X-1.5	22	41	30	18	13
12	-8	0.500	12.70	13/16-16	24	50	37	46	34	M18X-1.5	24	50	37	21	15
16	-10	0.625	15.88	1-14	30	69	51	62	46	M22X-1.5	27	69	51	28	21
	-12	0.750	19.05	1-3/16-12	36	102	75	102	75	M27 X2	32	102	75	46	34
22	-14	0.875	22.22	1-3/16-12	36	102	75	102	75	M30 X2	36				
25	-16	1.000	25.40	1-7/16-12	41	142	105	142	105	M33 X2	41	158	116	71	52
28										M38 X2	46	176	130	79	58
32	-20	1.25	31.75	1-11/16-12	50	190	140	190	140	M42x2	50	190	140	85	63
38	-24	1.5	38.10	2-12	60	217	160	217	160	M48x2	55	217	160	98	72

NOTE: Torque tolerance is +15%, -20%.

MX52301,000015A -19-14APR14-1/1

O-Ring Face Seal Fittings

1. Inspect the fitting sealing surfaces. They must be free of dirt or defects.
2. Inspect O-ring. It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.
4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.
5. Index angle fittings and tighten by hand, by pressing joint together to insure O-ring remains in place.
6. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting. Do not allow hoses to twist when tightening fittings.



T6243AD —UN—18OCT88

FLAT FACE O-RING SEAL FITTING TORQUE[a]				
Tube Size Outside Diameter	**Dash Size**	**Thread Size**	**Swivel Nut Torque**	**Bulkhead Nut Torque**
mm (in.)		**in.**	**N•m (lb-ft)**	**N•m (lb-ft)**
6.35 (1/4)	-4	9/16-18	16 (12)	5 (3.5)
9.52 (3/8)	-6	11/16-16	24 (18)	9 (6.5)
12.70 (1/2)	-8	13/16-16	50 (37)	17 (12.5)
15.88 (5/8)	-10	1-14	69 (51)	17 (12.5)
19.05 (3/4)	-12	1-3/16-12	102 (75)	17 (12.5)
22.22 (7/8)	-14	1-3/16-12	102 (75)	17 (12.5)
25.40 (1)	-16	1-7/16-12	142 (105)	17 (12.5)
31.75 (1-1/4)	-20	1-11/16-12	190 (140)	17 (12.5)
38.10 (1-1/2)	-24	2-12	217 (160)	17 (12.5)

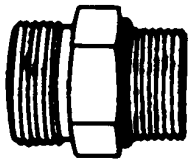
[a] *The torque values shown are based on lubricated connections as in reassembly.*

MX52301,000015B -19-14APR14-1/1

O-Ring Boss Fittings

STRAIGHT FITTING

1. Inspect O-ring boss seat for dirt or defects.
2. Lubricate O-ring with petroleum jelly. Place electrical tape over threads to protect O-ring. Slide O-ring over tape and into O-ring groove of fitting. Remove tape.
3. Tighten fitting to torque value shown on chart.



T6243AE —UN—15APR13

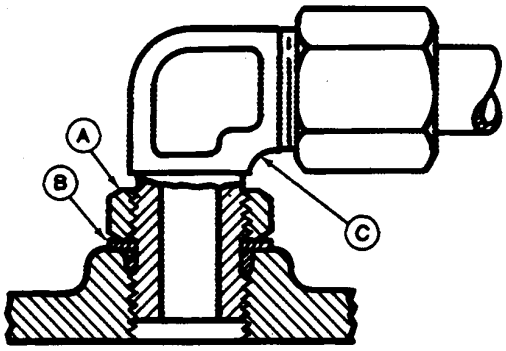
Continued on next page

MX52301,000015C -19-14APR14-1/2

ANGLE FITTING

1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.
2. Turn fitting into threaded boss until back-up washer contacts face of boss.
3. Turn fitting head-end counterclockwise to proper index (maximum of one turn).
4. Hold fitting head-end with a wrench and tighten locknut and back-up washer to proper torque value.

NOTE: Do not allow hoses to twist when tightening fittings.



T6520AB —UN—15APR13

TORQUE VALUE			
Thread Size		N·m	lb-ft
3/8-24	UNF	8	6
7/16-20	UNF	12	9
1/2-20	UNF	16	12
9/16-18	UNF	24	18
3/4-16	UNF	46	34
7/8-14	UNF	62	46
1-1/16-12	UN	102	75
1-3/16-12	UN	122	90
1-5/16-12	UN	142	105
1-5/8-12	UN	190	140
1-7/8-12	UN	217	160

NOTE: Torque tolerance is ± 10%.

MX52301,000015C -19-14APR14-2/2

Straight Fitting or Special Nut Torques

Thread Size	Torque[a]		Number of Flats[b]
	N.m	lb-ft	
3/8-24 UNF	8	6	2
7/16-20 UNF	12	9	2
1/2-20 UNF	16	12	2
9/16-18 UNF	24	18	2
3/4-16 UNF	46	34	2
7/8-14 UNF	62	46	1-1/2
1-1/16-12 UN	102	75	1
1-3/16-12 UN	122	90	1
1-5/16-12 UN	142	105	3/4
1-5/8-12 UN	190	140	3/4
1-7/8-12 UN	217	160	1/2

[a]Torque tolerance is ± 10 percent.

[b]To be used if a torque wrench cannot be used. After tightening fitting by hand, put a mark on nut or boss; then tighten special nut or straight fitting the number of flats shown.

MX52301,000015D -19-14APR14-1/1

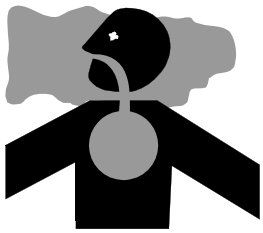
Metric Cap Screw Torque Values—Grade 7

Size	Steel or Gray Iron Torque	Aluminum
	N•m (lb-ft)	**N•m (lb-ft)**
M6	11 (8)	8 (6)
M8	24 (18)	19 (14)
M10	52 (38)	41 (30)
M12	88 (65)	70 (52)
M14	138 (102)	111 (82)
M16	224 (165)	179 (132)

MX52301,000015E -19-14APR14-1/1

Gasoline

4—Cycle Engines



MXAL32237 —UN—20JUN12

CAUTION: Avoid Injury! Gasoline is HIGHLY FLAMMABLE, handle it with care. DO NOT refuel machine while: indoors, always fill gas tank outdoors; machine is near an open flame or sparks; engine is running, STOP engine; engine is hot, allow it to cool sufficiently first; smoking. Help prevent fires: fill gas tank to bottom of filler neck only; be sure fill cap is tight after fueling; clean up any gas spills IMMEDIATELY; keep machine clean and in good repair—free of excess grease, oil, debris, and faulty or damaged parts; any storage of machines with gas left in tank should be in an area that is well ventilated to prevent possible igniting of fumes by an open flame or spark, this includes any appliance with a pilot light. To prevent fire or explosion caused by STATIC ELECTRIC DISCHARGE during fueling:•ONLY use a clean, approved POLYETHYLENE PLASTIC fuel container and funnel WITHOUT any metal screen or filter.

To avoid engine damage:

- DO NOT mix oil with gasoline;
- **ONLY use clean, fresh unleaded gasoline with an octane rating (anti-knock index) of 87 or higher.**
- Fill gas tank at the end of each day's operation to help prevent condensation from forming inside a partially filled tank.
- Keep up with specified service intervals.

Use of alternative oxygenated, gasohol blended, unleaded gasoline is acceptable as long as:

- The ethyl or grain alcohol blends DO NOT exceed 10% by volume or
- Methyl tertiary butyl ether (MTBE) blends DO NOT exceed 15% by volume.

RFG (reformulated) gasoline is acceptable for all machines designed for use of regular unleaded fuel. Older machines (that were designed for leaded fuel) may see some accelerated valve and seat wear.

IMPORTANT: Avoid Damage! California Proposition 65 Warning: Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

MX52301,000015F -19-22OCT14-1/1

Gasoline Storage

IMPORTANT: Avoid Damage! Keep all dirt, scale, water or other foreign material out of gasoline.

Keep gasoline stored in a safe, protected area. Storage of gasoline in a clean, properly marked ("UNLEADED GASOLINE") POLYETHYLENE PLASTIC container WITHOUT any metal screen or filter is recommended.

DO NOT use de-icers to attempt to remove water from gasoline or depend on fuel filters to remove water from gasoline. Use a water separator installed in the storage tank outlet. BE SURE to properly discard unstable or contaminated gasoline. When storing the machine or gasoline, it is recommended that you add **John Deere Gasoline Conditioner and Stabilizer (TY15977)** or an equivalent to the gasoline. BE SURE to follow directions on container and to properly discard empty container.

MX52301,0000160 -19-14APR14-1/1

Diesel Fuel

CAUTION: Avoid Injury! California Proposition 65 Warning: Diesel engine exhaust and some of its elements from this product are known to the State of California to cause cancer, birth defects, or other reproductive harm.

In general, diesel fuels are blended to satisfy the low air temperature requirements of the geographical area in which they are sold.

In North America, diesel fuel is usually specified to **ASTM D975** and sold as either **Grade 1** for cold air temperatures or **Grade 2** for warm air temperatures.

If diesel fuels being supplied in your area DO NOT meet any of the above specifications, use diesel fuels with the following equivalent properties:

- **Cetane Number 40 (minimum)**

A cetane number **greater than 50 is preferred**, especially for air temperatures below -20°C (-4°F) or elevations above 1500 m (5000 ft).

- Cold Filter Plugging Point (CFPP)

The air temperature at which diesel fuel **begins to cloud or jell**—at least 5°C (9°F) below the expected low air temperature range.

- **Sulfur Content of 0.05% (maximum)**

Diesel fuels for highway use in the United States now require sulfur content to be **less than 0.05%**.

If diesel fuel being used has a sulfur content **greater than 0.05%, reduce the service interval for engine oil and filter by 50%**.

Consult your local diesel fuel distributor for properties of the diesel fuel available in your area.

MX52301,0000161 -19-22OCT14-1/1

Diesel Fuel Lubricity

Diesel fuel must have adequate lubricity to ensure proper operation and durability of fuel injection system components. Fuel lubricity should pass a **minimum of 3300 gram load level** as measured by the **BOCLE** scuffing test.

MX52301,0000162 -19-14APR14-1/1

Diesel Fuel Storage

IMPORTANT: Avoid Damage! DO NOT USE GALVANIZED CONTAINERS—diesel fuel stored in galvanized containers reacts with zinc coating in the container to form zinc flakes. If fuel contains water, a zinc gel will also form. The gel and flakes will quickly plug fuel filters and damage fuel injectors and fuel pumps.

It is recommended that diesel fuel be stored **ONLY** in a clean, approved **POLYETHYLENE PLASTIC** container **WITHOUT** any metal screen or filter. This will help prevent any accidental sparks from occurring. Store fuel in an area that is well ventilated to prevent possible igniting of fumes by an open flame or spark; this includes any appliance with a pilot light.

IMPORTANT: Avoid Damage! Keep all dirt, scale, water or other foreign material out of fuel.

Keep fuel in a safe, protected area and in a clean, properly marked **("DIESEL FUEL")** container. **DO NOT** use de-icers to attempt to remove water from fuel. **DO NOT** depend on fuel filters to remove water from fuel. It is recommended that a water separator be installed in the storage tank outlet. **BE SURE** to properly discard unstable or contaminated diesel fuel and/or their containers when necessary.

MX52301,0000163 -19-22OCT14-1/1

4 - Cycle Gasoline Engine Oil

Use the appropriate oil viscosity based on the expected air temperature range during the period between recommended oil changes. Operating outside of these recommended oil air temperature ranges may cause premature engine failure.

The following John Deere oils are PREFERRED:

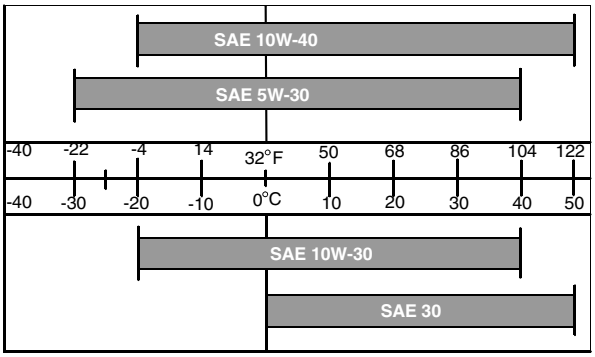
- **PLUS - 4® - SAE 10W-40;**
- **TORQ - GARD SUPREME® - SAE 5W-30.**

The following John Deere oils are also recommended, based on their specified temperature range:

- **TURF - GARD® - SAE 10W-30;**
- **PLUS - 4® - SAE 10W-30;**
- **TORQ - GARD SUPREME® - SAE 30.**

Other oils may be used if above John Deere oils are not available, provided they meet one of the following specifications:

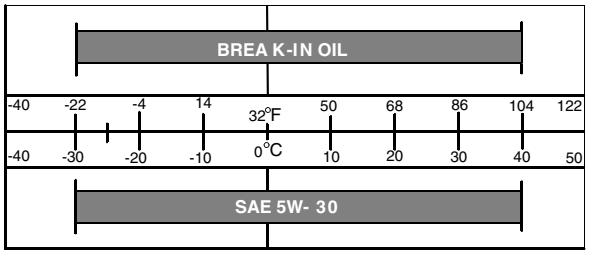
- SAE 10W-40 - API Service Classifications SG or higher
- SAE 5W-30 - API Service Classification SG or higher;
- SAE 10W-30 - API Service Classifications SG or higher;
- SAE 30 - API Service Classification SC or higher.



MXAL26708 —UN—30MAY12

MX52301,0000164 -19-14APR14-1/1

Break-In Engine Oil - 4-Cycle Gasoline



MXAL32243 —UN—20JUN12

IMPORTANT: Avoid Damage! ONLY use a quality break-in oil in rebuilt or remanufactured engines for the first 5 hours (maximum) of operation. DO NOT use oils with heavier viscosity weights than SAE 5W-30 or oils meeting specifications API SG or SH, these oils will not allow rebuilt or remanufactured engines to break-in properly.

The following John Deere oil is PREFERRED:

- **BREAK - IN ENGINE OIL.**

John Deere BREAK - IN ENGINE OIL is formulated with special additives for aluminum and cast iron type engines to allow the power cylinder components (pistons, rings, and liners as well) to “wear-in” while protecting other engine components, valve train and gears, from abnormal wear. Engine rebuild instructions should be followed closely to determine if special requirements are necessary.

John Deere BREAK - IN ENGINE OIL is also recommended for non-John Deere engines, both aluminum and cast iron types.

The following John Deere oil is **also recommended:**

- **TORQ - GARD SUPREME® - SAE 5W-30.**

If the above recommended John Deere oils are not available, use a break-in engine oil meeting the following specification during the first 5 hours (maximum) of operation:

- **SAE 5W-30 - API Service Classification SE or higher.**

IMPORTANT: Avoid Damage! After the break-in period, use the John Deere oil that is recommended for this engine.

MX52301,0000165 -19-14APR14-1/1

4 - Cycle Diesel Engine Oil

Use the appropriate oil viscosity based on the expected air temperature range during the period between recommended oil changes. Operating outside of these recommended oil air temperature ranges may cause premature engine failure.

The following John Deere oils are PREFERRED:

- **PLUS-50® - SAE 15W-40;**
- **TORQ-GARD SUPREME® - SAE 5W-30.**

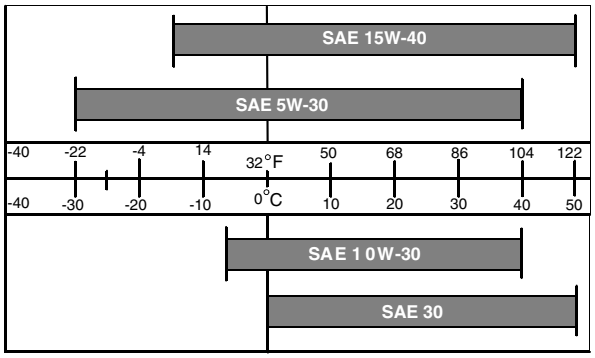
The following John Deere oils are also recommended, based on their specified temperature range:

- **TURF-GARD® - SAE 10W-30;**
- **PLUS-4® - SAE 10W-30;**
- **TORQ-GARD SUPREME® - SAE 30.**

Other oils may be used if above John Deere oils are not available, provided they meet one of the following specifications:

- SAE 15W-40 - API Service Classifications CF - 4 or higher;
- SAE 5W-30 - API Service Classification CC or higher;
- SAE 10W-30 - API Service Classification CF or higher;
- SAE 30 - API Service Classification CF or higher.

IMPORTANT: Avoid Damage! If diesel fuel with sulfur content greater than 0.5% is used, reduce the service interval for oil and filter by 50%.

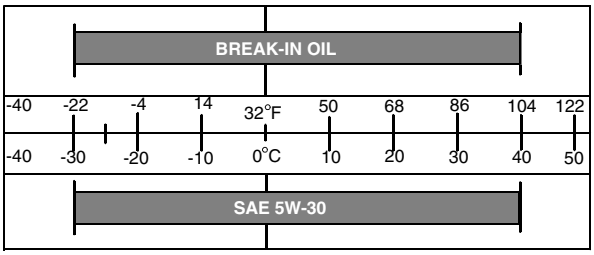


MXAL32244 —UN—20JUN12

MX52301,0000166 -19-14APR14-1/1

Break-In Engine Oil - Diesel

IMPORTANT: Avoid Damage! ONLY use this specified break-in oil in rebuilt or remanufactured engines for the first 100 hours (maximum) of operation. DO NOT use PLUS - 50®, SAE 15W40 oil or oils meeting specifications API CF - 4 or API CG - 4, these oils will not allow rebuilt or remanufactured engines to break-in properly.



MXAL32245 —UN—20JUN12

The following John Deere oil is PREFERRED:

- **BREAK - IN ENGINE OIL.**

John Deere BREAK - IN ENGINE OIL is formulated with special additives for aluminum and cast iron type engines to allow the power cylinder components (pistons, rings, and liners as well) to “wear-in” while protecting other engine components, valve train and gears, from abnormal wear. Engine rebuild instructions should be followed closely to determine if special requirements are necessary.

John Deere BREAK - IN ENGINE OIL is also recommended for non-John Deere engines, both aluminum and cast iron types.

If this preferred John Deere oil is not available, use a breakin engine oil meeting the following specification during the first 100 hours of operation:

- API Service Classification CE or higher.

IMPORTANT: Avoid Damage! After the break-in period, use the John Deere oil that is recommended for this engine.

MX52301,0000167 -19-14APR14-1/1

Transaxle and MFWD Differential Oil

Use the appropriate oil viscosity based on these air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature hydrostatic transmission or hydraulic system failures

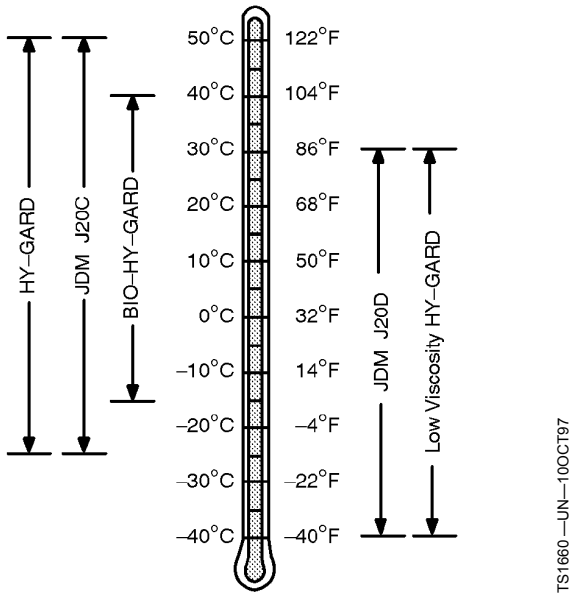
IMPORTANT: Avoid Danger! Mixing of LOW VISCOSITY Hy-Gard™ and Hy-Gard™ transmission oils is permitted. DO NOT mix any other oils in this transmission. DO NOT use engine oils or "Type F" (Red) Automatic Transmission Fluid in this transmission

John Deere J20C Hy-Gard™ transmission and hydraulic oil is recommended. John Deere J20D Low Viscosity Hy-Gard™ transmission and hydraulic oil may be used, if within the specified temperature range.

Other oils may be used if above recommended John Deere oils are not available, provided they meet one of the following specifications:

- John Deere Standard JDM J20C;
- John Deere Standard JDM J20D.

Hy-Gard is a trademark of Deere & Company



MX52301,0000312 -19-14APR14-1/1

Alternative Lubricants

Use of alternative lubricants could cause reduced life of the component.

If alternative lubricants are to be used, it is recommended that the factory fill be thoroughly removed before switching to any alternative lubricant.

MX52301,0000168 -19-14APR14-1/1

Synthetic Lubricants

Synthetic lubricants may be used in John Deere equipment if they meet the applicable performance requirements (industry classification and/or military specification) as shown in this manual.

The recommended air temperature limits and service or lubricant change intervals should be maintained as shown in the operator's manual, unless otherwise stated on lubricant label.

Avoid mixing different brands, grades, or types of oil. Oil manufacturers blend additives in their oils to meet certain specifications and performance requirements. Mixing different oils can interfere with the proper functioning of these additives and degrade lubricant performance.

MX52301,0000169 -19-14APR14-1/1

Lubricant Storage

All machines operate at top efficiency only when clean lubricants are used. Use clean storage containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination. Store drums on their sides. Make sure all containers are properly marked as to their contents. Dispose of all old, used containers and their contents properly.

MX52301,00000CF -19-14APR14-1/1

Mixing of Lubricants

In general, avoid mixing different brands or types of lubricants. Manufacturers blend additives in their lubricants to meet certain specifications and performance requirements. Mixing different lubricants can interfere with the proper functioning of these additives and lubricant properties which will downgrade their intended specified performance.

MX52301,00000D0 -19-14APR14-1/1

Oil Filters

IMPORTANT: Avoide Damage! Filtration of oils is critical to proper lubrication performance. Always change filters regularly.

The following John Deere oil filters are PREFERRED:

- AUTOMOTIVE AND LIGHT TRUCK ENGINE OIL FILTERS.

Most John Deere filters contain pressure relief and anti-drainback valves for better engine protection.

Other oil filters may be used if above recommended John Deere oil filters are not available, provided they meet the following specification:

- ASTB Tested In Accordance With SAE J806.

MX52301,00000D1 -19-11APR14-1/1

Brake Fluid

The following John Deere heavy duty brake fluid is PREFERRED for all drum and disc brakes:

- Brake Fluid — DOT 3

Other brake fluids may be used if the above John Deere brake fluid is not available and they provide the following:

- DOT3 certified.
- Conforms to Motor Vehicle Safety Standard No. 116.
- Minimum wet boiling point 140°C (284°F).
- Minimum dry boiling point 232°C (450°F) to prevent vapor lock.

MX52301,00000D2 -19-11APR14-1/1

Chassis Grease

Use the following grease based on the air temperature range. Operating outside of the recommended grease air temperature range may cause premature failures.

The following John Deere grease is PREFERRED:

- Multi-Purpose SD Polyurea Grease
- Multi-Purpose HD Lithium Complex Grease
- Moly High-Temperature EP Grease

Other greases may be used if above preferred John Deere grease is not available, provided they meet the following specification:

- Other greases may be used if above preferred John Deere grease is not available, provided they meet the following specification:

MX52301,00000D3 -19-14APR14-1/1

Recommended Engine Coolant

IMPORTANT: Avoid Damage! Using incorrect coolant mixture can cause overheating and damage to the radiator and engine:

- **Do not operate engine with plain water.**
- **Do not exceed a 50% mixture of coolant and water.**
- **Aluminum engine blocks and radiators require approved ethylene-glycol based coolant.**

The engine cooling system is filled to provide year-round protection against corrosion and cylinder liner pitting, and winter freeze protection to -37 degrees C (-34 degrees F). If protection at lower temperatures is required, consult your John Deere dealer for recommendations.

The following coolants are preferred:

- John Deere COOL-GARD II™ Premix
- John Deere COOL-GARD Premix
- John Deere COOL-GARD PG Premix

John Deere COOL-GARD II Premix and John Deere COOL-GARD Premix are available in a concentration of 50% propylene glycol.

John Deere COOL-GARD PG Premix is available in a concentration of 55% propylene glycol.

Additional recommended coolants:

- John Deere COOL-GARD II Concentrate in a 40% to 60% mixture of concentrate with water.
- John Deere COOL-GARD Concentrate in a 40% to 60% mixture of concentrate with water.

If the recommended coolants are unavailable, use an ethylene glycol or propylene glycol base coolant that meets the following specification:

- ASTM D3306 prediluted (50%) coolant.
- ASTM D3306 coolant concentrate in a 40% to 60% mixture of concentrate with water.

Check container label before using to be sure it has the appropriate specifications for your machine. Use coolant with conditioner or add conditioner to coolant before using.

Water Quality

- Water quality is important to the performance of the cooling system. Distilled, deionized, or demineralized water is recommended with ethylene glycol base engine coolant concentrate.

MX52301,000016A -19-14APR14-1/1

Product Serial Number

The 13-digit product identification number (A) is on the right-hand side frame.

MXT010281 —UN—16JUL14

MX52301,00000D6 -19-22OCT14-1/1

Gasoline Engine Serial Number Location

Engine serial number (A) is on the flywheel cover.

MXT010282 —UN—16JUL14

MX52301,00000D7 -19-22OCT14-1/1

Diesel Engine Serial Number Location

Engine serial number (A) is on valve cover. The model number designates the engine type.

MXT010283 —UN—16JUL14

MX52301,00000D8 -19-22OCT14-1/1

Section 30
Engine - Gas (Liquid Cooled)

Contents

Specifications

Item	Measurement	Specification
Engine Specifications		
Make		Kawasaki
Model		FD620D
Cylinders		2
Bore	ID	75.98—76 mm (2.991—2.992 in.)
Stroke	Length	68 mm (2.660 in.)
Cylinder	Displacement	617 cm^3
Spark Plug	Type	NGK BPR2ES (M138938)
Spark Plug	Gap	0.80 mm (0.031 in.)
Spark Plug	Torque	25 N·m (221 lb.-in.)
High Speed Idle	Speed	3675—3825 rpm
Low Speed Idle (Governed)	Speed	1050—1200 rpm
Carburetor Slow Idle Stop Screw Setting	Speed	100 rpm Less Than Governed Idle Setting
Fuel System		
Fuel Tank	Capacity	20.0 L (5.25 gal.)
Fuel Flow (in 15 seconds)	Volume (minimum)	105 mL (3.5 oz.)
Fuel System Maximum	Pressure	10 kPa (1.5 psi)
Oil System		
Engine Oil With Filter	Capacity	1.5 L (3.4 pt.)
Engine Oil Without Filter	Capacity	1.3 L (2.8 pt.)
Engine Oil	Type	John Deere Plus-4 SAE 10W-40 John Deere TURF-Guard SAE 10W-40
Oil Pressure Sensor Activates	Pressure	98 kPa (14.2 psi)
Fast Idle Oil	Pressure (minimum)	276 kPa (40 psi)
Oil Filter Bypass Valve Opening	Pressure	78.5—117.5 kPa (11.4—17.1 psi)
Oil Pump - Inner and Outer Rotor	Clearance - Service Limit	0.3 mm (0.012 in.)
Oil Pump - Outer Rotor	Diameter - Service Limit	40.47 mm (1.593 in.)

Continued on next page
MX52301,00004A3 -19-23JUL14-1/6

Item	Measurement	Specification
Oil Pump - Outer Rotor	Thickness - Service Limit	9.83 mm (0.387 in.)
Oil Pump - Pump Housing	Inside Diameter - Service Limit	40.80 mm (1.606 in.)
Oil Pump - Pump Housing	Depth - Service Limit	10.23 mm (0.403 in.)
Oil Pump Shaft Bearing	ID - Service Limit	11.07 mm (0.436 in.)
Oil Pump - Pump Shaft	Diameter - Service Limit	10.92 mm (0.430 in.)
Oil Pump - Valve Spring	Free Length - Service Limit	19.50 mm (0.77 in.)
Cooling System		
Cooling System (Including Recovery Tank)	Capacity	5.0 L (5.2 qt.)
Radiator Cap Test	Pressure (maximum)	117 kPa (17 psi)
Radiator Cap Nominal Opening	Pressure	83—96 kPa (12—14 psi)
Radiator Cap After 15 seconds	Pressure (minimum)	90 kPa (13 psi)
Radiator Cap	Pressure (minimum)	76 kPa (11 psi)
Thermostat Begin-to-Open	Temperature	Approximately 82°C (180 °F)
Thermostat Full-Open	Temperature	Approximately 96 °C (205 °F)
Lift above 96 °C (203 °F)	Lift (minimum)	7 mm (0.28 in.)
Water Pump Shaft	OD (minimum)	9.94 mm (0.391 in.)
Water Pump and Crankcase Housing Bore	ID (maximum)	10.09 mm (0.397 in.)
M6 Bolts Initial	Torque	8.5 N·m (75 lb.-in.)
M8 Bolt Initial	Torque	20 N·m (195 lb.-in.)
M6 Bolt Final	Torque	9.5 N·m (84 lb.-in.)
M8 Bolt Final	Torque	25 N·m (222 lb.-in.)
Cylinder Head		
Cylinder Head	Flatness	0.06 mm (0.002 in.)
Cylinder Head Bolt Initial	Torque	10 N·m (115 lb.-in.)

Continued on next page

MX52301,00004A3 -19-23JUL14-2/6

Item	Measurement	Specification
Cylinder Head Bolt Final	Torque	21 N·m (186 lb.-in.)
Intake Manifold Cap Screw Initial	Torque	4N·m (35 lb.-in.)
Intake Manifold Cap Screw Final	Torque	6 N·m (52 lb.-in.)
Cylinder Compression With Throttle Open	Pressure (minimum)	1171 kPa (170 psi)
Compression Variation Between Cylinders	Pressure (maximum)	138 kPa (20 psi)
Rocker Arm:		
Push Rod	Run-out (maximum)	0.80 mm (0.031 in.)
Rocker Shaft	OD (Minimum)	11.95 mm (0.470 in.)
Rocker Arm Bearing	ID (Maximum)	12.07 mm (0.475 in.)
Adjusting Nut	Torque	9 N·m (79 lb.-in.)
Valves and Springs		
Valve Guide Intake or Exhaust	ID (Maximum)	6.05 mm (0.238 in.)
Valve Stem Intake	Diameter (minimum)	5.95 mm (0.234 in.)
Valve Stem Exhaust	Diameter (minimum)	5.92 mm (0.233 in.)
Valve Stem	Runout (maximum)	0.05 mm (0.002 in.)
Valve Margin	Thickness	0.6 mm (0.024 in.)
Valve Spring	Free Length (Minimum)	29.70 mm (1.17 in.)
Intake and Exhaust Valve	Clearance (cold)	0.25 mm (0.01 in.)
Intake and Exhaust Valve Adjustment Interval	Time	300 hr.
Valve Clearance Adjusting Nut	Torque	9 N·m (79 lb.-in.)
Valve Guide	ID (maximum)	6.05 mm (0.238 in.)
Valve Seating Surface	Width	0.05—1.10 mm (0.020—0.043 in.)
Valve Seating Tolerance	Width (maximum)	2.0 mm (0.08 in.)
Valve Seat and Face	Angle	45°

Continued on next page

MX52301,00004A3 -19-23JUL14-3/6

Item	Measurement	Specification
Minimum Valve Margin	Distance	0.60 mm (0.024 in.)
Valve Narrowing	Angle	30°
Valve Cover	Torque	6 N·m (53 lb.-in.)
Crankcase		
Drain Plug	Torque	23 N·m (204 lb.-in.)
Plain Bearing Crankcase Cover	ID (maximum)	34.07 mm (1.341 in.)
Crankcase	ID (maximum)	34.11 mm (1.343 in.)
Governor Arm Nut	Torque	8 N·m (72 lb.-in.)
Crankcase Minimum	Vacuum	25 mm of H2O (1.0 in.) of H2O
Cover Bolt	Torque	25 N·m (18.5 lb.-ft.)
Reed Valve Tip	Air Gap	0.2 mm (0.008 in.)
Crankshaft		
Drive Clutch to Crankshaft Cap Screw	Torque	37 N·m (26 lb.-in.)
Crank Pin Journal	OD – Service Limit	33.93 mm (1.3358 in.)
Crank Pin	Width - Service Limit	44.5 mm (1.75 in.)
Crankshaft Total Indicated	Runout - Service Limit	0.05 mm (0.002 in.)
Crankshaft Bearing Journal	ID (Crankcase) - Service Limit	34.11 mm (1.343 in.)
Crankshaft Bearing	ID (maximum)	34.07 mm (1.341 in.)
Flywheel		
Flywheel Nut	Torque	108 N·m (80 lb.-ft.)
Sheave Half Cap Screw	Torque	15 N·m (130 lb.-in.)
Camshaft		
Cover and Crankcase Bearing	ID (maximum)	16.07 mm (0.633 in.)
Camshaft Bearing	ID - Service Limit	16.07 mm (0.633 in.)
Cam Lobe - Intake	Height	25.21 mm (0.993 in.)

Continued on next page

MX52301,00004A3 -19-23JUL14-4/6

Item	Measurement	Specification
Cam Lobe - Exhaust	Height	25.46 mm (1.002 in.)
Camshaft Journal - PTO Side	Diameter	15.91 mm (0.626 in.)
Camshaft Journal - Flywheel Side	Diameter	15.92 mm (0.627 in.)
Piston		
Ring Grove Top Ring	Clearance (maximum)	0.15 mm (0.006 in.)
Second Ring	Clearance (maximum)	0.12 mm (0.005 in.)
Oil Ring	Clearance (maximum)	Not Measured
Top, Second Piston Ring	Thickness (maximum)	1.12 mm (0.044 in.)
Top, Second Piston Ring	End Gap (maximum)	1.20 mm (0.050 in.)
Oil Ring	End Gap	1.5 mm (0.06 in.)
Pin	OD (minimum)	16.98 mm (0.668 in.)
Pin Bore	ID (maximum)	17.04 mm (0.671 in.)
Piston (Measured at 11 mm (0.433 in.) from bottom of piston skirt	OD	75.93—75.95 mm (2.989—2.990 in.)
Piston-to-Center Bore	Clearance	0.03—0.17 mm (0.001—0.007 in.)
Connecting Rod		
Piston Pin Bearing	ID (maximum)	17.05 mm (0.671 in.)
End-Cap Screw	Torque	21 N·m (186 lb.-in.)
Connecting Rod	Bend - Service Limit	0.15 mm (0.006 in.)
Connecting Rod	Twist - Service Limit	0.15 mm (0.006 in.)
Connecting Rod	Width - Service Limit	21.20 mm (0.83 in.)
Connecting Rod Big End	ID – Service Limit	34.06 mm (1.341 in.)
Cylinder Bore		
Bore	ID	75.98—76 mm (2.991—2.992 in.)
Bore	ID (maximum)	76.07 mm (2.995 in.)

Continued on next page

MX52301,00004A3 -19-23JUL14-5/6

Item	Measurement	Specification
Out of Round	Distance	0.056 mm (0.0022 in.)
Cylinder Boring Final	ID	76.46—76.48 mm (3.010—3.011 in.)
Accelerator Pedal Free	Travel	2—6 mm (0.080—0.240 in.)
Eyelet to pedal rod	Free Play	1—3 mm (0.039—0.118 in.)
Muffler Bracket Nuts	Torque	11 N·m (98 lb.- in.)
Muffler Cap Screws	Torque	27 N·m (240 lb.- in.)
Bushing Tool Dimensions:		
Bushing Tool	Diameter	40 mm (1.575 in.)
Bushing Tool	Height	26 mm (1.024 in.)
Bushing Tool	Width	33.8 mm (1.331 in.)
Starting Motor		
Starting Motor to Engine Bolt	Torque	28 N·m (20 lb.-ft.)
End Cover Bushing (Ream)	Diameter	11.02—11.04 mm (0.434—0.435 in.)
Starter Motor Commutator	Diameter (Minimum)	27 mm (1.06 in.)
Starter Motor Commutator	Runout (Maximum)	0.4 mm (0.016 in.)
Starter Motor Commutator Undercut	Gap (Nominal)	0.5—0.8 mm (0.012—0.031 in.)
Starter Motor Commutator Undercut	Gap (Minimum)	0.2 mm (0.008 in.)
Starter Motor Brush	Length (Minimum)	6.0 mm (0.24 in.)
Starter Motor Solenoid Retaining Nut	Torque	11 N·m (97 lb.-in.)
Starter Through Bolt	Torque	6 N·m (54 lb.-in.)
Starter Motor Solenoid Terminal Nut	Torque	28 N·m (20 lb.-ft.)

MX52301,00004A3 -19-23JUL14-6/6

Service Equipment and Tools

NOTE: Order tools according to information given in the ServiceGard™ Catalog. Some tools may be available from a local supplier.

ServiceGard is a trademark of Deere & Company

MX52301,00004A4 -19-13JUN14-1/9

Induction Tachometer.....JT05801	Measure engine speed

MX52301,00004A4 -19-13JUN14-2/9

Digital Tachometer.....JT05719	Measure engine speed

MX52301,00004A4 -19-13JUN14-3/9

Fuel Pump Pressure Test Kit..... JDG356	Measure fuel pump outlet pressure on Riders and Lawn and Garden tractors.

MX52301,00004A4 -19-13JUN14-4/9

Compression Gauge..... JDM59	Measure up to 300 psi. Use in 14 mm and 18 mm spark plug holes.

MX52301,00004A4 -19-13JUN14-5/9

Spark Tester D05351	Use to test the condition of the spark plug while engine is operating.

MX52301,00004A4 -19-13JUN14-6/9

Vacuum Test Kit.....JT03503	For leak testing small engines. Use in Lawn & Grounds Care products.

MX52301,00004A4 -19-13JUN14-7/9

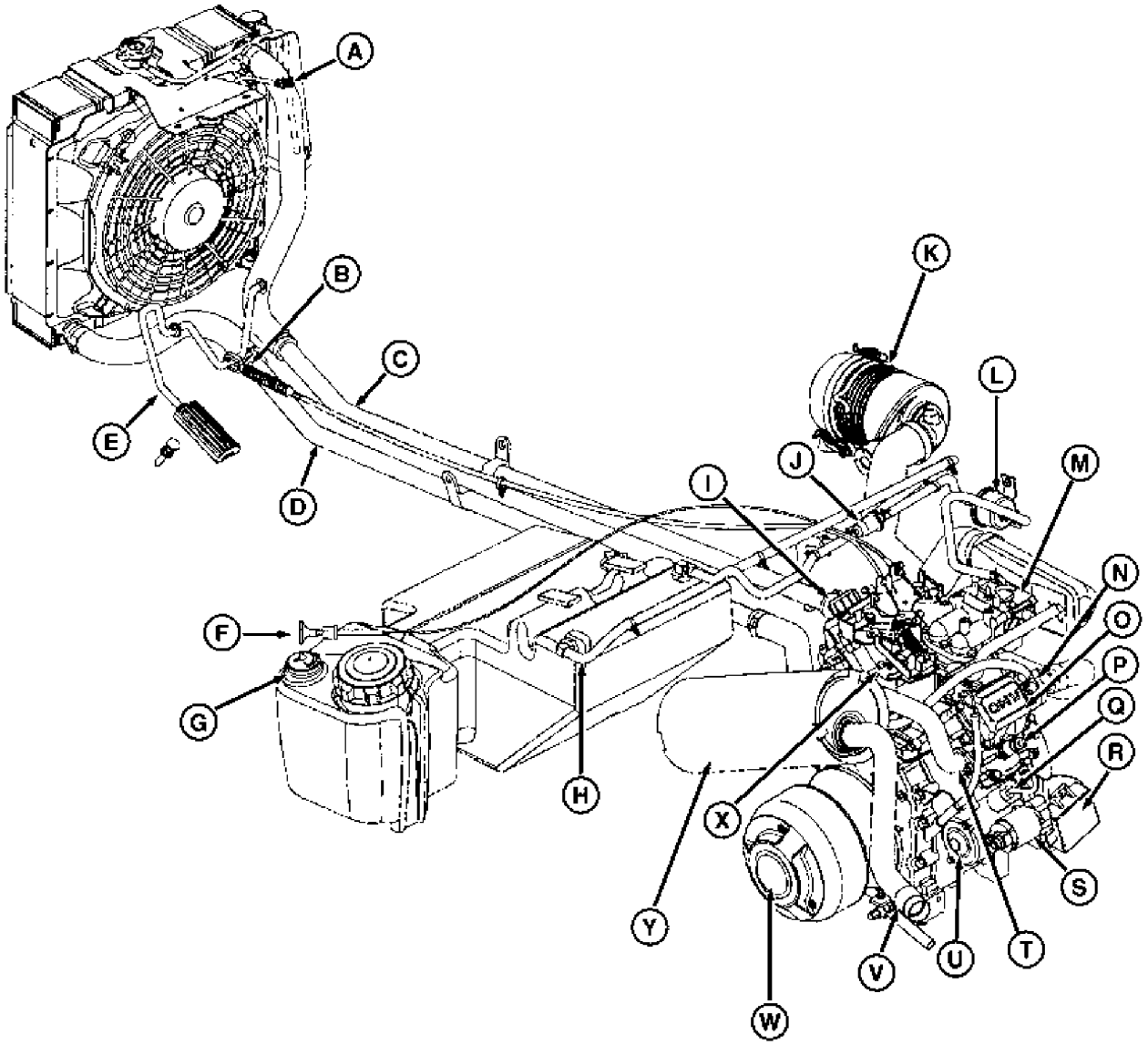
Fitting.....JT03017 Hose And Fitting Assembly hose with high-pressure quick coupler. Gauge and Quick Coupler.....JT03344	2,000 kPa (300 psi) 2-1/2" Face, 1/4" Inlet Fitting.....JT03349 1/8 BSPT x 7/16-20 UNF 38 for use with JT03017

MX52301,00004A4 -19-13JUN14-8/9

Cooling System Pressure Pump..... D05104ST Use to pressurize the engine cooling system. Adaptor..... JDG692	Use with D05104ST Radiator Pressure Test Kit to check cooling systems pressure.

MX52301,00004A4 -19-13JUN14-9/9

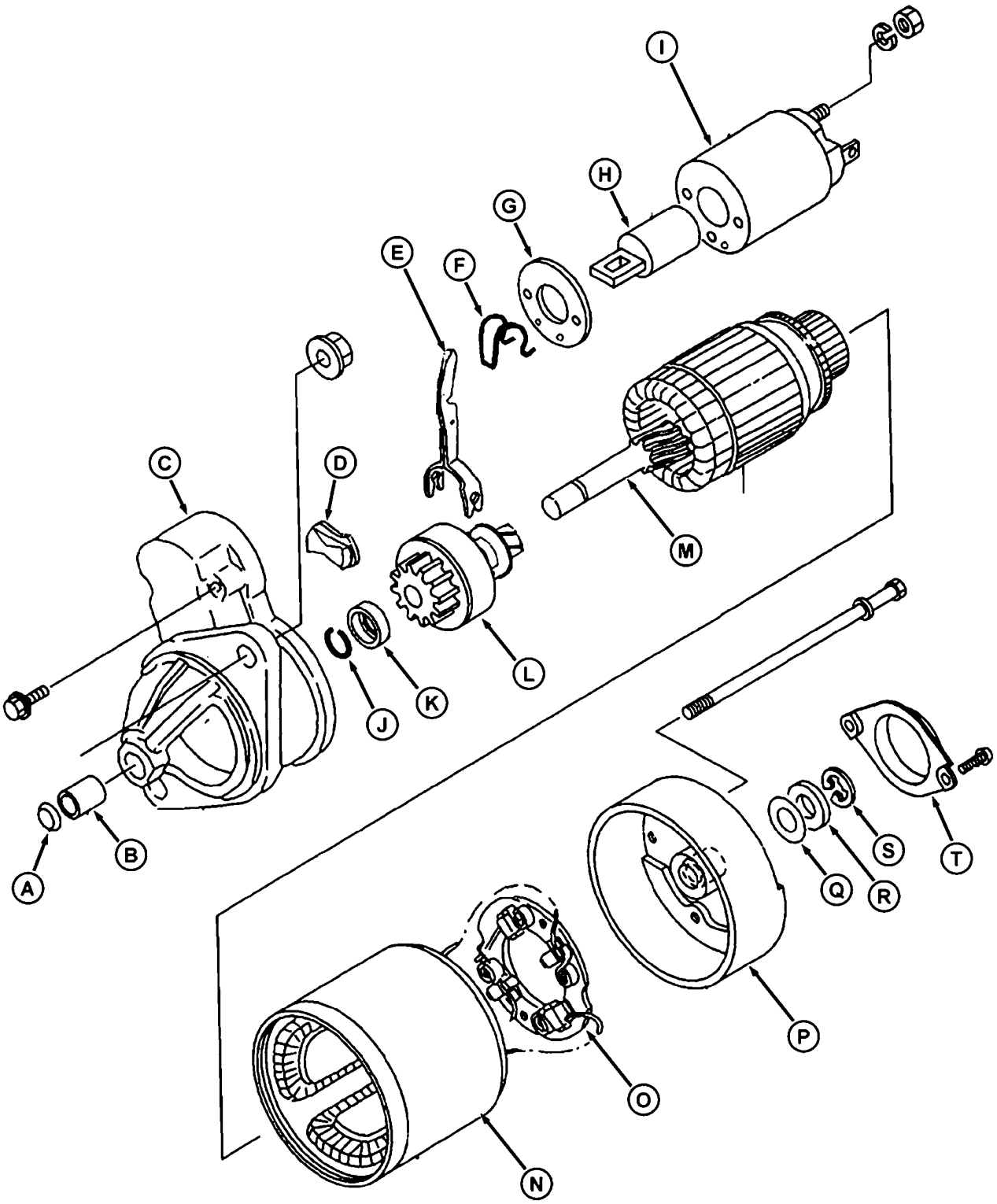
Engine Compartment Location



A—Thermostat Connector
B—Throttle Cable
C—Radiator Hose
D—Radiator Return Hose
E—Throttle Pedal
F—Choke Cable Control Knob
G—Fuel Gauge
H—Fuel Line
I— Oil Fill Cap
J—Fuel Filter
K—Air Filter Assembly
L—Fuel Pump
M—Carburetor
N—Water Pump
O—Valve Cover
P—Spark Plug
Q—Igniter
R—Vehicle Control Unit (VCU)
S—Starting Motor Solenoid
T—Exhaust Port
U—Starting Motor
V—Spark Arrester
W—Drive Clutch
X—Governor Assembly
Y—Muffler

MX52301,00000A7 -19-20OCT14-1/1

Starting Motor



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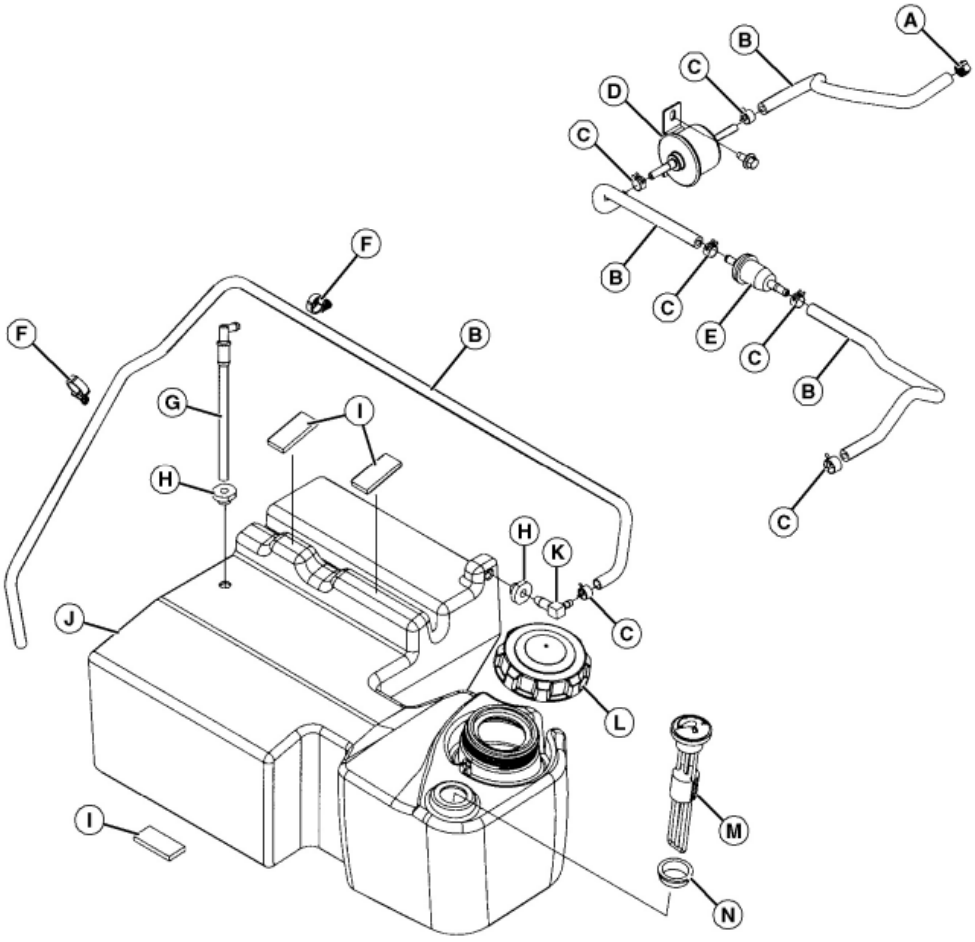
MX52301,00000A8 -19-13JUN14-1/2

A—End Cap
B—Covered Bushing
C—End Frame
D—Dust Cap
E—Shift Fork
F—Clutch Fork Pivot
G—Shim Plate
H—Plunger
I— Solenoid
J— Retaining Ring
K—Pinion Stopper
L—Clutch
M—Armature
N—Field Coil Housing
O—Filed Brush Holder
P—Rear Cover
Q—Shim
R—Shim
S—E—Clip
T—Cap

MX52301,00000A8 -19-13JUN14-2/2

Fuel System Components
(SN -130000)



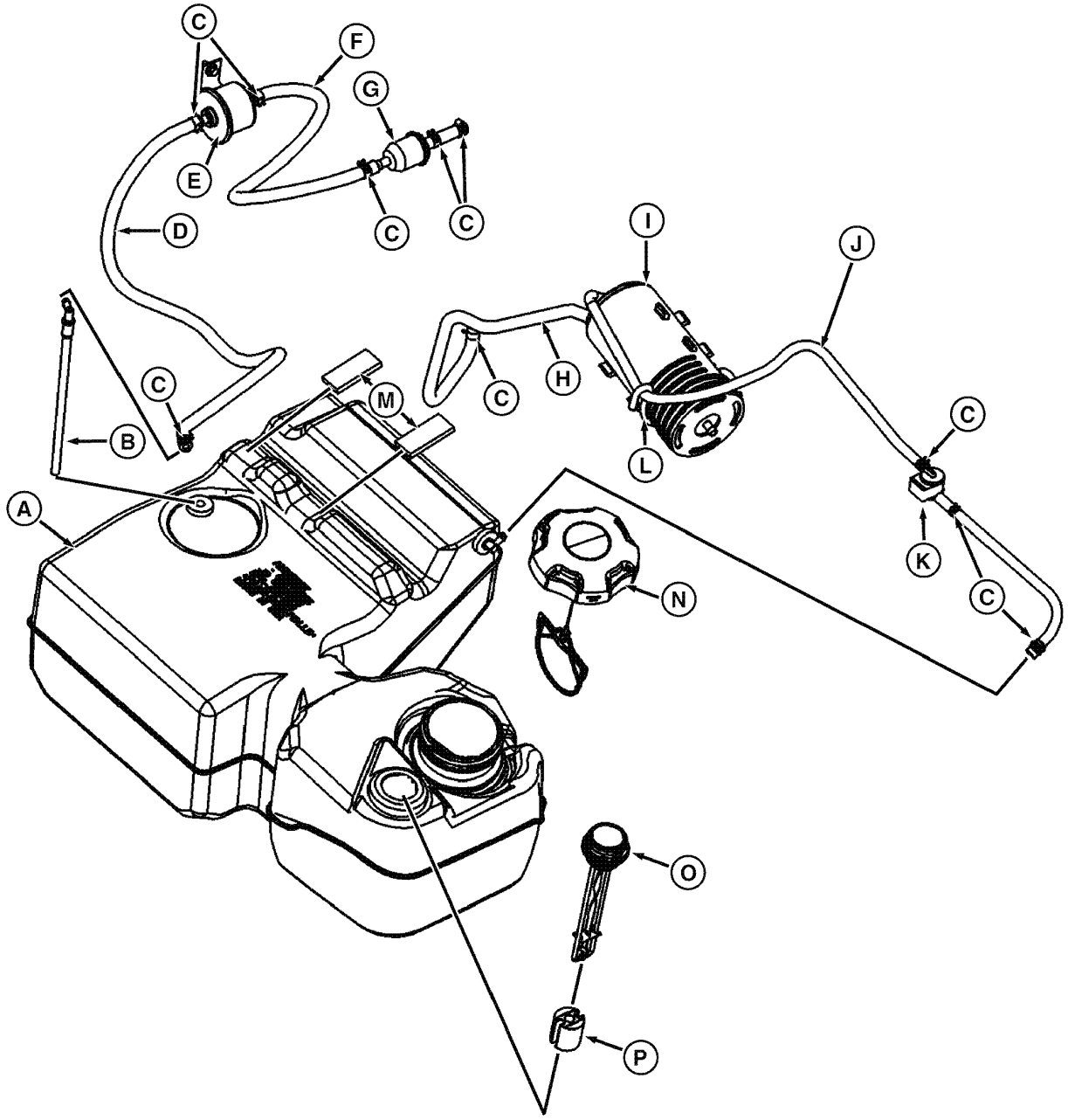
MXT010286 —UN—15MAY14

A—Clamp
B—Hose (TY22551)
C—Clip
D—Fuel Pump
E—Fuel Filter
F—Retainer
G—Pick Up Tube
H—Bushing
I— Pad
J—Fuel Tank
K—Elbow Fitting
L—Filler Cap
M—Fuel Gauge
N—Bushing

Continued on next page

MX52301,00000A9 -19-22OCT14-1/2

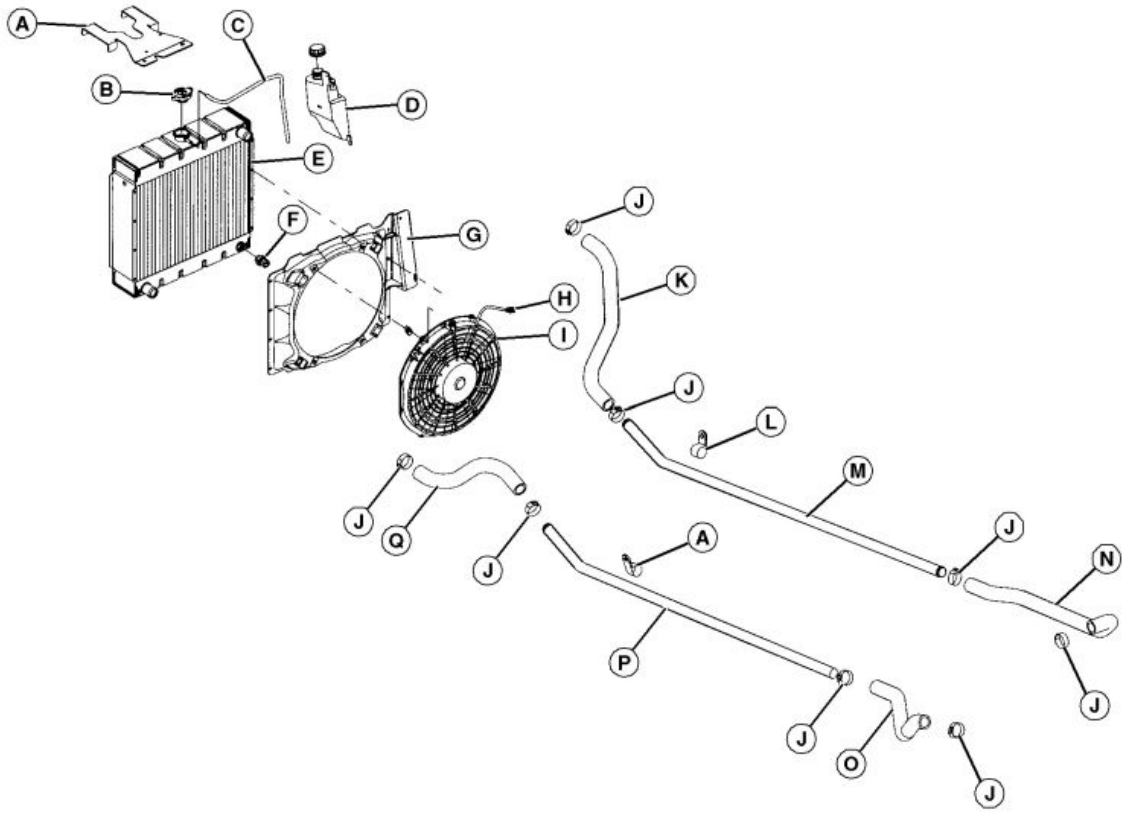
(SN 130000-)



A—Fuel Tank
B—Fuel Hose
C—Vent Hose
D—Purge Hose
E—Carbon Canister
F—Fuel Pump
G—Pump-to-Filter Hose
H—Fuel Filter
I— Bracket
J—Rollover Valve
K—Fuel Tank Cap
L—Fuel Gage

MX52301,00000A9 -19-22OCT14-2/2

Coolant System Components



MXT010287 —UN—15MAY14

A—Support Bracket
B—Radiator Cap
C—Vent Tube
D—Overflow Reservoir
E—Radiator
F—Temperature Sensor
G—Shroud
H—Cooling Fan Electrical Connector
I—Cooling Fan
J—Clamp
K—Upper Radiator Hose
L—Retainer
M—Coolant Supply Tube
N—Coolant Supply Hose
O—Coolant Return Hose
P—Coolant Return Tube
Q—Lower Radiator Hose

MX52301,00000AA -19-13JUN14-1/1

Engine Troubleshooting Guide

Engine Troubleshooting Guide

CAUTION: Avoid Injury! The engine may start to rotate at any time. Keep hands away from moving parts when testing.

NOTE: To test specific electrical components, See Electrical Section and refer to either Diagnostics or Tests & Adjustments for further guidance.

Tests and Conditions:

- Operator on Seat
- Transmission in Neutral
- Brake On

MX52301,00000AB -19-23OCT14-1/21

❶ Engine Doesn't Crank

MX52301,00000AB -19-23OCT14-2/21

Engine Electrical Connections	Are battery cables loose or dirty?	**YES:** Tighten or clean. **NO:** Go to next step.

MX52301,00000AB -19-23OCT14-3/21

Continued	Is battery fully charged? See Battery Voltage and Specific Gravity Tests	**YES:** Go to next step. **NO:** Charge battery. See Battery Charge.

MX52301,00000AB -19-23OCT14-4/21

Continued	Is key switch working correctly?	**YES:** Go to next step. **NO:** Test switch. See Cranking Circuit Operation, Gas (All), Diesel (SN -080000), or Cranking Circuit Operation, Diesel (SN 080001-) for the appropriate machine. **NO:** Replace as needed.

MX52301,00000AB -19-23OCT14-5/21

Starting Motor Solenoid	Is starting motor or solenoid defective?	**YES:** Repair or replace. See Starting Motor Solenoid Test or Starting Motor No-Load Amperage and RPM Tests . **NO:** Go to next step

MX52301,00000AB -19-23OCT14-6/21

Engine	Has engine seized?	**YES:** See engine repair section. **NO:** Go to next step.

Continued on next page

MX52301,00000AB -19-23OCT14-7/21

❷ Engine Hard To Start

⚠ CAUTION: Avoid Injury! Keep spark plug as far away from the plug hose as possible. Gasoline spray from the open cylinders may be ignited by the ignition spark and cause an explosion or fire.

MX52301,00000AB -19-23OCT14-8/21

Spark	Is there a strong blue spark?	**YES:** Go to next step **NO:** Replace spark plug. Recheck for spark and go to next step. **NO:** Check if sparks are produced between high tension lead and ignition block. Check high tension lead, ignition coil air gap, pulser coil.

MX52301,00000AB -19-23OCT14-9/21

Spark Plug Electrodes	After starting attempts, are spark plug electrodes wet?	**YES:** Check for excessive use of choke, plugged air cleaner, carburetor float level too high. **NO:** Check fuel tank and lines.

MX52301,00000AB -19-23OCT14-10/21

Compression	Check compression. See Cylinder Compression Test. Is compression sufficient?	**YES:** Make starting attempts a number of times, remove spark plug and observe electrodes. Go to next step. **NO:** Go to next step

MX52301,00000AB -19-23OCT14-11/21

Compression	Compression is low?	**YES:** Check piston rings and cylinder for wear. Inspect cylinder head. See Piston and Cylinder Removal.

MX52301,00000AB -19-23OCT14-12/21

❸ Operation Fuel System

Continued on next page

MX52301,00000AB -19-23OCT14-13/21

Engine Runs Erratically	Is fuel delivery correct? See Fuel Pump Flow Test.	**NO:** Check for plugged air/fuel passages in carburetor. See Carburetor Repair. **NO:** Check for contamination, or an air or vapor lock in the fuel tank and lines. Check fuel filter and pump.

MX52301,00000AB -19-23OCT14-14/21

❹ Operation Air Intake

MX52301,00000AB -19-23OCT14-15/21

Engine Malfunctions At Low Speed	Is unusual smoke emitted out of muffler?	**YES:** Check choke. See Choke Cable Adjustment. **NO:** Go to next step.

MX52301,00000AB -19-23OCT14-16/21

Continued	Does engine rpm drop or engine stall at a certain point when throttle is gradually opened by hand?	**YES:** Plugged passage in carburetor, clean carburetor. See Carburetor Repair. **NO:** Go to next step.

MX52301,00000AB -19-23OCT14-17/21

Continued	Is air sucked through carburetor or intake manifold flanges?	**YES:** Tighten manifold flange nuts or replace damaged gasket. **NO:** Go to next step.

MX52301,00000AB -19-23OCT14-18/21

Continued	Are valve clearances set correctly? See Valve Clearance Adjustment.	**NO:** Adjust valves.

MX52301,00000AB -19-23OCT14-19/21

❺ Engine Lubrication

Continued on next page

MX52301,00000AB -19-23OCT14-20/21

Oil Consumption Is Excessive:	Check compression. See Cylinder Compression Test. Is compression sufficient?	**NO:** Check for oil leaks, high oil level, plugged oil ring groove, oil seals, clogged breather valve, plugged drain back hole in breather, incorrect oil viscosity. **NO:** Check for worn, stuck, or broken piston rings, or worn cylinder bore.

MX52301,00000AB -19-23OCT14-21/21

Starting Motor Troubleshooting

⚠ CAUTION: Avoid Injury! The engine may start to rotate at any time. Keep hands away from moving parts when testing.

IMPORTANT: Avoid Damage! If starting motor does not turn off by turning the ignition switch to Off position, disconnect negative (-) lead from battery as soon as possible.

NOTE: To test specific electrical components, See Electrical Section and refer to either Diagnostics or Tests & Adjustments for further guidance.

MX52301,00000AC -19-23OCT14-1/8

❶ Starter

MX52301,00000AC -19-23OCT14-2/8

Battery Connection	Are battery cables loose or dirty?	**YES:** Tighten or clean. **NO:** Go to next step.

MX52301,00000AC -19-23OCT14-3/8

Battery Charge Condition	Is battery fully charged? See Battery Voltage and Specific Gravity Tests.	**YES:** Go to next step. **NO:** Charge battery. See Battery Charge.

MX52301,00000AC -19-23OCT14-4/8

Key Switch	Is key switch working correctly?	**YES:** Go to next step. **NO:** Test switch. See Cranking Circuit Operation, Gas (All), Diesel (SN -080000), or Cranking Circuit Operation, Diesel (SN 080001-). **NO:** Replace as needed.

Continued on next page

MX52301,00000AC -19-23OCT14-5/8

Defect	Is starting motor or solenoid defective?	**YES:** Test solenoid, repair, or replace. See Starting Motor Solenoid Test or Starting Motor No-Load Amperage and RPM Tests. **NO:** Go to nest step.

MX52301,00000AC -19-23OCT14-6/8

Starter Does Not Rotate	Is there a click sound from starter solenoid?	**YES:** Repair starting motor. See Starting Motor Removal and Installation. **NO:** Check that all starting conditions are met. Go to next step.

MX52301,00000AC -19-23OCT14-7/8

Engine	Has engine seized?	**YES:** See Engine Repair .

MX52301,00000AC -19-23OCT14-8/8

Summary of References

- Choke Cable Adjustment
- Crankcase Vacuum Test
- Cylinder Compression Test
- Fuel Pump Flow Test
- Fuel Pump Pressure Test
- Governor: Static Adjustment
- High Altitude Operation
- High Idle Speed Adjustment
- Oil Pressure Test
- Slow Idle Mixture and Governed Low Idle Adjustments
- Radiator Cap Pressure Test
- Thermostat Test
- Throttle Cable Adjustment
- Valve Clearance Adjustment

MX52301,0000457 -19-13JUN14-1/1

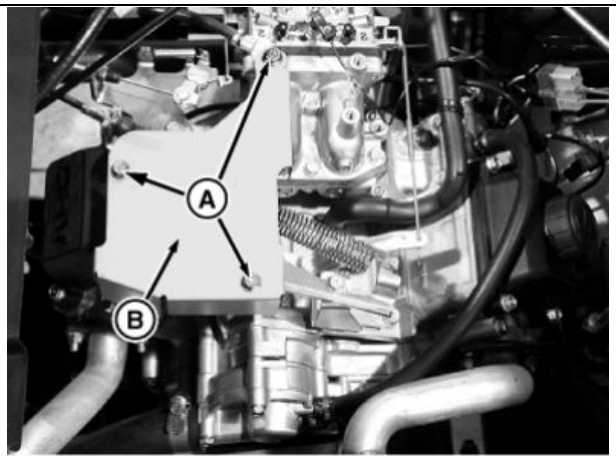
Governor: Static Adjustment

Reason: To properly position governor arm to governor shaft for proper governor operation.

Procedure:

1. Park machine safely. See the “Safety Section”. Raise cargo box.
2. Remove three cap screws (A) and throttle control arm cover (B).
3. Press pedal down and place a heavy weight on pedal.

A—Cap Screws (3) **B—Throttle Control Arm Cover**



MXT010288 —UN—10JUN14

MX52301,00000AD -19-22OCT14-1/2

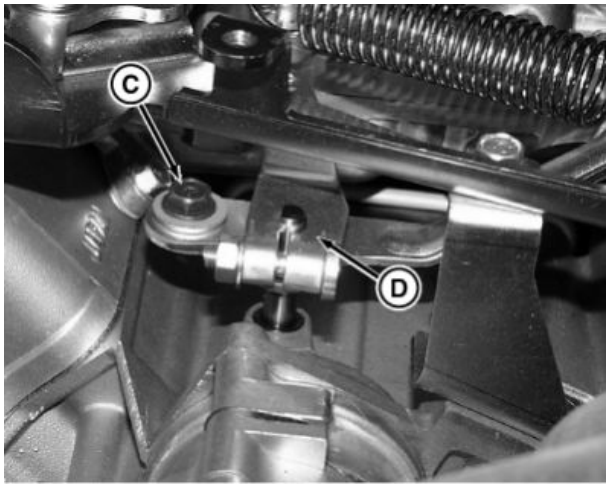
IMPORTANT: Avoid Damage! Cap screw has left-hand threads.

4. Loosen cap screw (C) on governor arm. Turn governor shaft and bracket (D) counterclockwise to remove any slack in governor linkage and arm.

IMPORTANT: Avoid Damage! DO NOT move throttle control arm by hand. This kinks the wire cable and damage it. Use pedal only.

5. Hold shaft and tighten cap screw (C).

C—Cap Screw **D—Governor Shaft and Bracket**



MXT010289 —UN—10JUN14

MX52301,00000AD -19-22OCT14-2/2

High Idle Speed Adjustment

Reason:

To ensure that engine is running at proper fast idle speed.

Equipment:

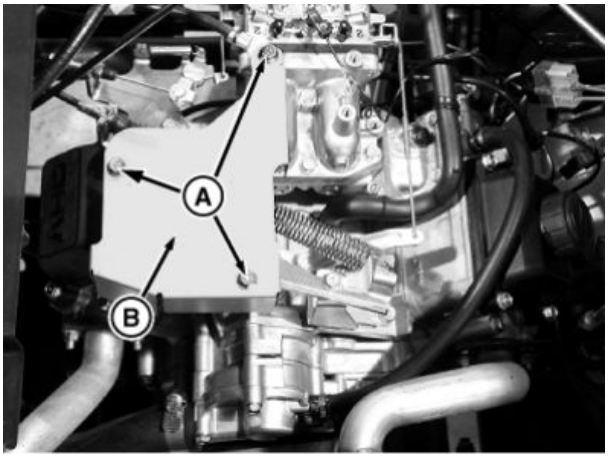
- JT05801 Induction Tachometer

— or —

- JT05719 Digital Tachometer

Procedure:

1. Park machine safely and raise cargo box. See the “Safety Section”.
2. Remove three cap screws (A) and throttle control arm cover (B).
3. Start and warm-up engine. Run engine at full throttle and check engine speed with tachometer. Record reading using tachometer.



MXT010288 —UN—10JUN14

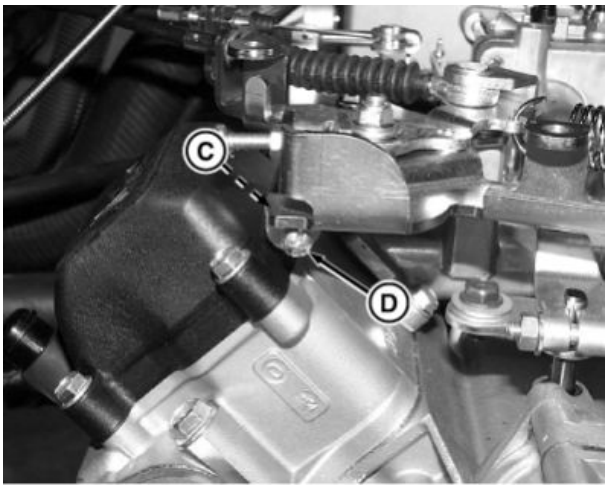
A—Cap Screws (3) **B—Throttle Control Arm Cover**

MX52301,00000AE -19-17JUL14-1/2

4. High idle speed should be 3675—3825 rpm. If engine speed is not within specification, loosen jam nut behind bracket (C) and adjust screw (D) until proper rpm is obtained and tighten jam nut.

Specification

High Idle—Speed..... 3675—3825 rpm



MXT010290 —UN—10JUN14

C—Bracket **D—Jam Nut and Adjust Screw**

MX52301,00000AE -19-17JUL14-2/2

Slow Idle Mixture and Governed Low Idle Adjustments

Reason:

To ensure correct fuel and air mixture and engine is running at proper slow idle speed.

Equipment:

- JT05801 Induction Tachometer

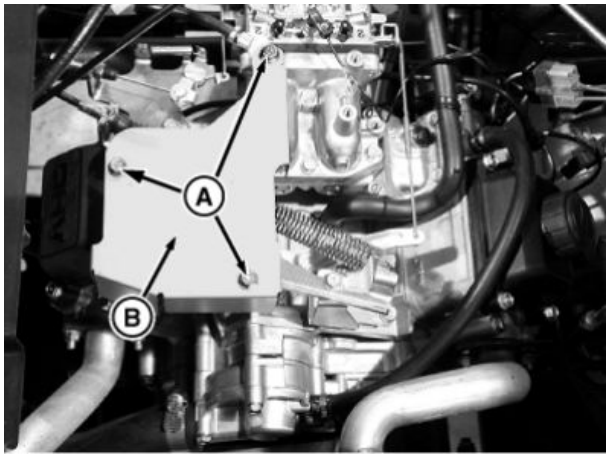
— or —

- JT05719 Digital Tachometer

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Remove three cap screws (A) and throttle control arm cover (B).

NOTE: When engine speed control pedal is released, it takes approximately 30 seconds for idle speed to stabilize.



MXT010288 —UN—10JUN14

A—Cap Screws (3) **B—Throttle Control Arm Cover**

3. Run engine at fast idle until cooling fan starts. Release pedal.

MX52301,00000AF -19-22OCT14-1/3

CAUTION: Avoid Injury! Engine components are HOT. Be extra careful not to touch the exhaust pipe or muffler while making adjustments. Wear protective eye glasses and clothing.

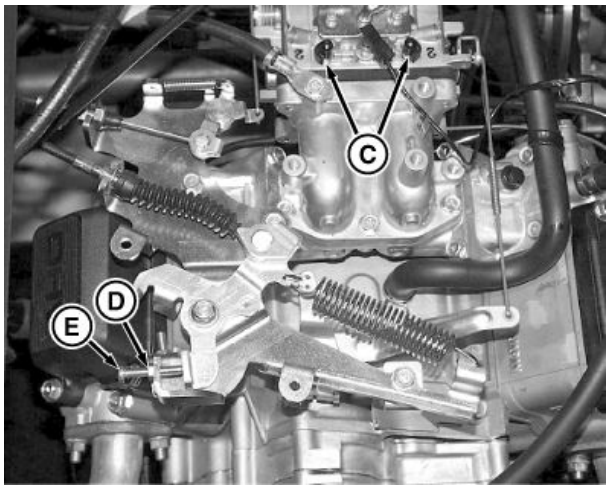
4. Check governed idle speed with tachometer. Engine idle speed should be 1050—1200 rpm. If engine speed is not within specification, loosen jam nut behind bracket (D) and adjust slow idle stop screw (E) until 1050—1200 rpm is obtained and tighten jam nut.

Specification

Slow Idle—Speed..... 1050—1200 rpm

NOTE: Do not remove mixture screw limiter caps or force beyond stops.

5. Turn slow idle mixture screws (C), until smoothest idle is obtained.
6. Repeat step 4 if necessary.



MXT010291 —UN—10JUN14

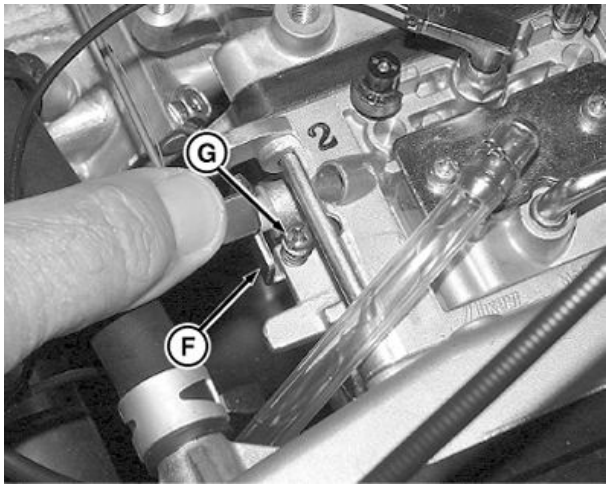
C—Slow Idle Mixture Screws (2) **E—Slow Idle Stop Screw**
D—Jam Nut

Continued on next page

MX52301,00000AF -19-22OCT14-2/3

7. Push and hold throttle so that tab (F) is against slow idle stop screw (G). While checking idle speed with tachometer, adjust screw until engine speed is 100 rpm less than governed idle speed (Step 4).

F—Throttle Tab **G—Slow Idle Stop Screw**



MXT010292 —UN—10JUN14

MX52301,00000AF -19-22OCT14-3/3

Throttle Cable Adjustment

Reason:

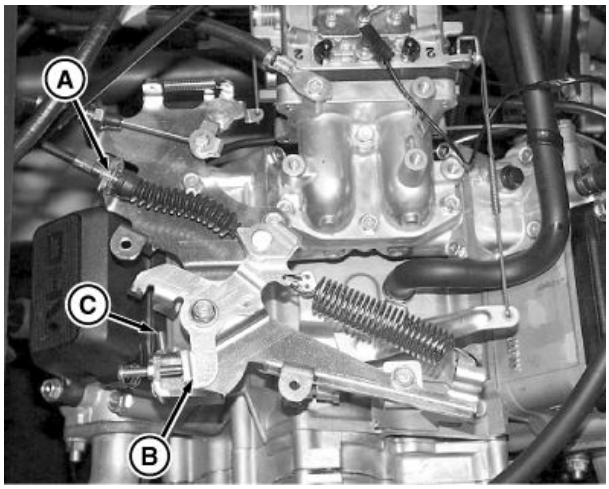
Verify that throttle cable allows throttle lever to reach full low and fast idle positions.

Procedure:

1. Park machine safely with park brake locked. See the “Safety Section”.
2. Accelerator pedal should have 2—6 mm (0.080—0.240 in.) free travel before cable moves.

Specification	
Accelerator Pedal Free Travel—Length	2—6 mm (0.080—0.240 in.)

3. Inspect cable and bracket on engine (A).
4. When engine speed control pedal is up, make sure that the tab on the throttle lever is contacting the idle stop screw (B).
5. Press engine speed control pedal all the way down to high-speed position. Check that throttle cable is pulling throttle lever all the way to the fast idle stop screw (C).



MXT010293 —UN—11JUN14

A—Cable and Bracket **C—Fast Idle Stop Screw**
B—Slow Idle Stop Screw

Continued on next page

MX52301,00000B0 -19-22OCT14-1/3

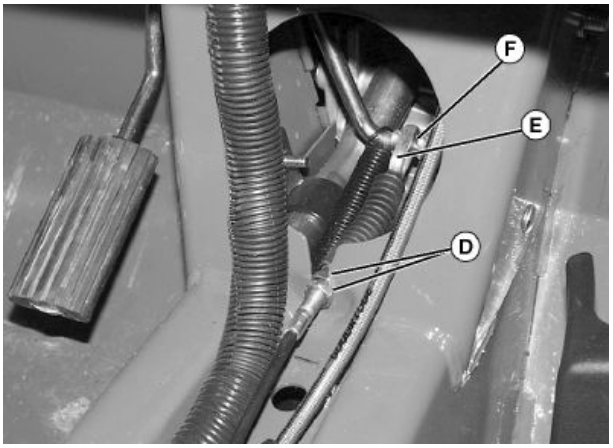
To Adjust Cable:

1. Remove tunnel cover from machine.
2. Pull cable eyelet (E) to get slack out of cable and measure free play between eyelet and pedal rod (F). Gap should be to specification.

Specification	
Eyelet to pedal rod—Free Play	1—3 mm (0.039—0.118 in.)

3. If free play is not to specification loosen nuts (D) and adjust until proper free play is obtained.
4. Install tunnel cover.

D—Nuts (2)
E—Cable Eyelet
F—Pedal Rod



MXT010294 —UN—16MAY14

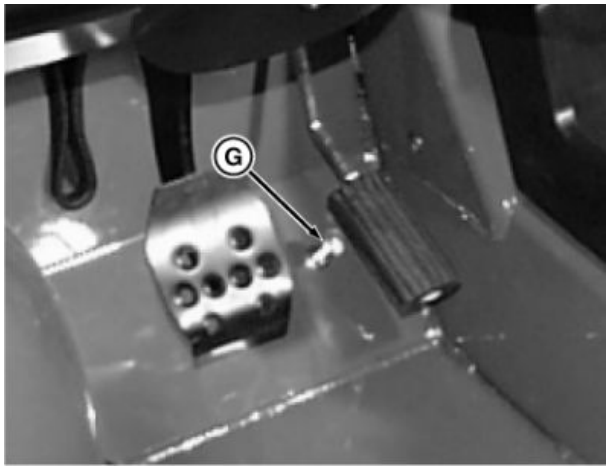
MX52301,00000B0 -19-22OCT14-2/3

5. Adjust pedal stop (G) to limit pedal travel, preventing throttle cable from being stretched.
   - Depress engine speed control pedal to full FAST idle position (throttle control arm touching fast idle stop screw (C) on

NOTE: A five pound weight on pedal aides adjustment.

- Loosen jam nuts on pedal stop (G) and turn stop bolt until just touching back of pedal.
- Turn pedal stop bolt ONE TURN until a 1—1.5 mm (0.039—0.059 in.) gap is between pedal and stop bolt.
- Tighten pedal stop jam nut. Recheck adjustment.

G—Pedal Stop



MXT010295 —UN—11JUN14

MX52301,00000B0 -19-22OCT14-3/3

Choke Cable Adjustment

Reason:

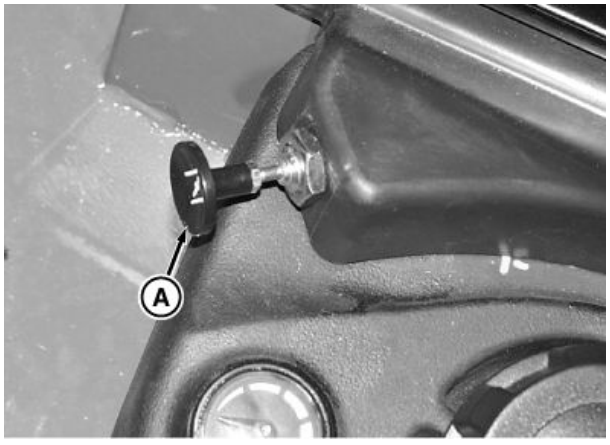
Verify full choke operation and prolong choke cable life.

NOTE: Adjust fast idle, slow idle, and mixture before adjusting choke cable.

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Be sure choke knob (A) is in open (pushed in) position.

A—Choke Knob



MXT010296 —UN—11JUN14

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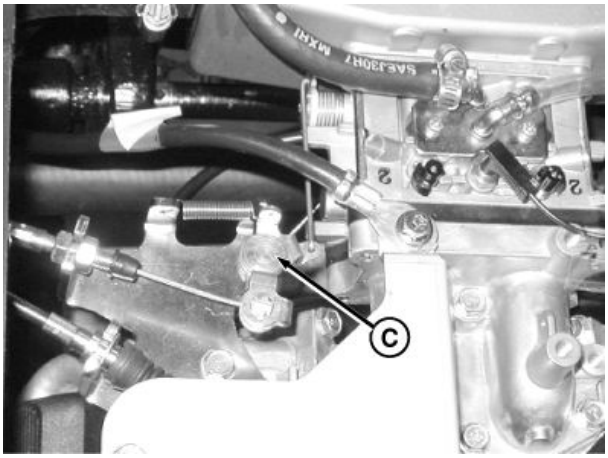
MX52301,00000B1 -19-22OCT14-1/2

3. Loosen jam nuts (B) and lift choke cable out of the bracket.
4. Make sure choke spring, arm, and linkage (C) operate freely and choke is in open (pushed in) position.
5. Hold cable and jam nuts over bracket. Position jam nuts and cable housing where there is little slack in the cable and no movement of the choke linkage. Tighten jam nuts.
6. Verify that choke opens completely when choke knob is in open (pushed in) position.

B—Jam Nuts (2)

C—Choke Spring, Arm, and Linkage



MXT010297 —UN—10JUN14

MX52301,00000B1 -19-22OCT14-2/2

Fuel Pump Pressure Test

Reason:

To determine condition of fuel pump.

Equipment:

- JDG356 Fuel Pump Pressure Test Kit

Procedure:

1. Park machine safely. See the “Safety Section”.

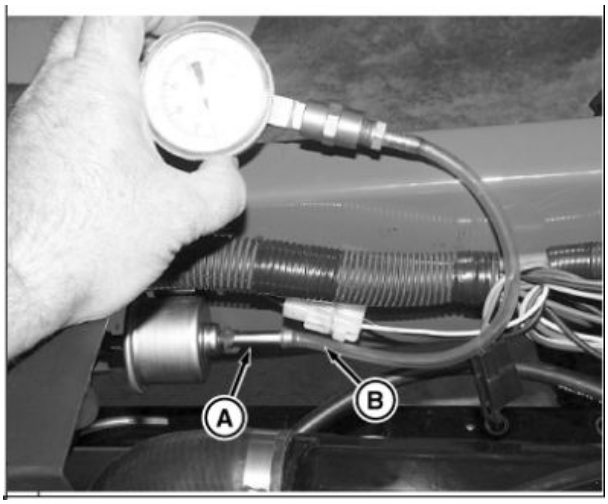
CAUTION: Avoid Injury! Gasoline vapor is explosive. Do not expose to spark or flame. Serious personal injury can result.

2. Disconnect and plug fuel hose from fuel pump outlet (A).
3. Connect hose and gauge (B) to fuel pump outlet.

NOTE: DO NOT start engine.

4. Turn key switch to ON position only.
5. Observe pressure reading, minimum pressure must be at or above specification.

Specification	
Fuel Pump	
Minimum—Pressure	10 kPa (1.5 psi)



MXT010298 —UN—11JUN14

A—Fuel Pump Outlet

B—Hose and Gage

Results:

- If fuel pressure BELOW minimum, check in-line filter and hoses for debris or restrictions. Replace filter, then retest system.
- If pressure remains BELOW minimum, replace fuel pump.

MX52301,00000B2 -19-22OCT14-1/1

Fuel Pump Flow Test

Reason:

To determine condition of fuel pump.

Equipment:

- Graduated container

Procedure:

1. Park machine safely. See the “Safety Section”.

CAUTION: Avoid Injury! Gasoline vapor is explosive. Do not expose to spark or flame. Serious personal injury can result.

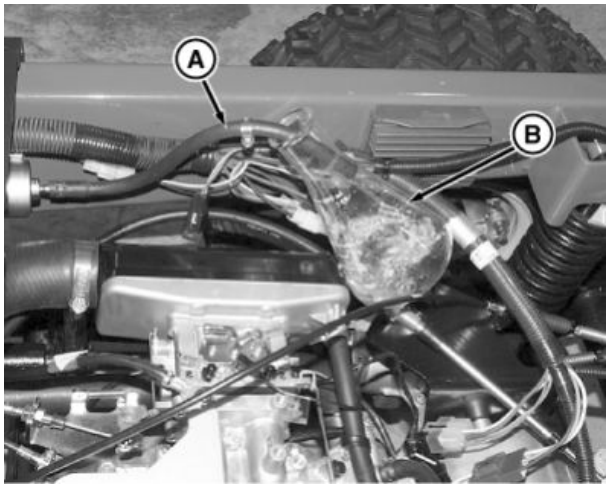
2. Disconnect fuel supply hose (A) from carburetor inlet port and put end in a graduated container (B).

NOTE: DO NOT start engine. Watch container DO NOT let it fill to overflowing. Stop test early if necessary.

3. Turn key switch to ON position for 15 seconds.
4. The graduated container should show a minimum fuel flow of **105 mL (3.5 oz) in 15 seconds**.

Results

- If fuel collected is BELOW specification, check in-line filter, hoses, and fuel shutoff valve for debris or restrictions. Replace filter, then test again.



MXT010299 —UN—11JUN14

A—Fuel Hose **B—Graduated Container**

Specification	
Fuel Collected during 15 second Flow Test—Volume	105 mL (3.5 oz.)

- If fuel collected remains BELOW minimum, replace fuel pump.

MX52301,00000B3 -19-22OCT14-1/1

High Altitude Operation

High altitude performance can be improved by installing a smaller diameter main jet in the carburetor. Change the pilot air jets from #56.3 to #60; and readjusting the idle mixture screws. Main jets available: #70 (greater than 2000 m), #72.5 (1000—2000 m) and #75 (less than 1000 m).

MX52301,00000B4 -19-13JUN14-1/1

Cylinder Compression Test

Reason:

To determine condition of pistons, rings, cylinder walls, and valves.

Equipment:

- JDM59 Compression Gauge
- D05351 Spark Tester

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Adjust valve clearance to specification with engine at top-dead center (TDC) of compression stroke. Engine must be cold.

Cylinder Compression Test Specifications—Specification

Valve with Engine at Top Dead Center (TDC)—Clearance	0.25mm (0.010 in.)
Engine Cold—Temperature	16—29 °C (60—85 °F)

3. Start and run engine until engine reaches operating temperature.

Specification

Engine Operating—Temperature	82°C (180°F)

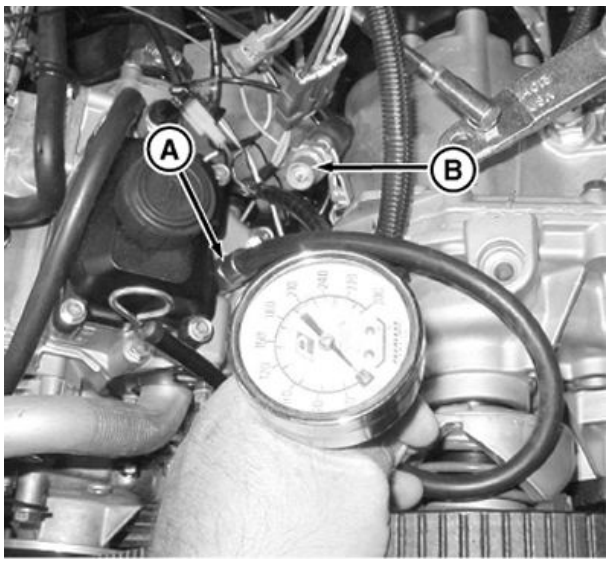
4. Remove spark plugs and install spark tester (B) on each spark plug wire. Install compression gauge (A) in one cylinder.
5. Move and hold throttle pedal in FAST idle position.
6. Be sure that choke is OFF.

IMPORTANT: Avoid Damage! DO NOT overheat starting motor during test. Starting motor Duty Cycle is five seconds ON and ten seconds OFF.

7. Crank engine for 5 to 10 compression strokes.
8. Record pressure reading for that cylinder.
   - If pressure reading is BELOW specification, squirt clean engine oil into cylinders through spark plug hole and repeat test.

Specification

Cylinder Compression—Pressure	1171 kPa (170 psi)



MXT010300 —UN—11JUN14

A—Compression Gauge (JDM59) **B—Spark Tester (D05351)**

   - If pressure INCREASES significantly, check piston, rings, and cylinder walls for wear or damage.
   - If pressure DOES NOT INCREASE significantly after retest, check for leaking valves, valve seats, or cylinder head gasket.
9. Install spark plug.
10. Repeat procedure for second cylinder.
11. Compare readings between cylinders, difference between cylinders should be below specification.

Specification

Compression Variation Between Cylinders—Pressure (maximum)	140 kPa (20 psi)

   - If the difference between the cylinders is greater than specification and the low cylinder is BELOW the minimum compression pressure specification, check for worn or stuck piston rings, worn cylinder walls, hole in top of piston, leaking valves or seats, or leaking cylinder head gaskets.

MX52301,00000B5 -19-22OCT14-1/1

Valve Clearance Adjustment

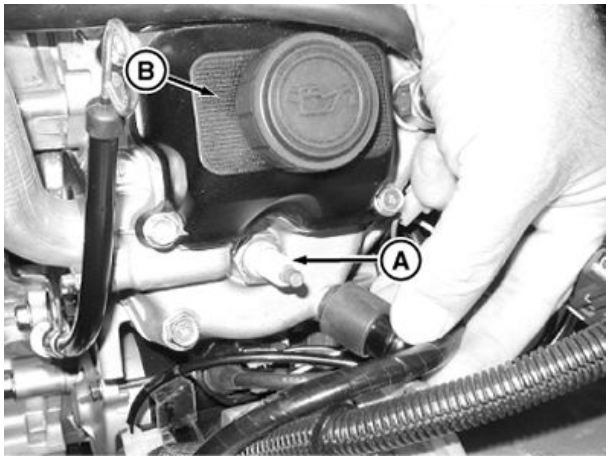
NOTE: Perform valve clearance adjustment when the engine is COLD [16—29 °C (60—85 °F)].

Reason:

To check and adjust valve clearances for proper engine operation.

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Remove spark plug (A).
3. Remove valve cover (B).



MXT010301 —UN—11JUN14

A—Spark Plug **B—Valve Cover**

MX52301,00000B6 -19-22OCT14-1/2

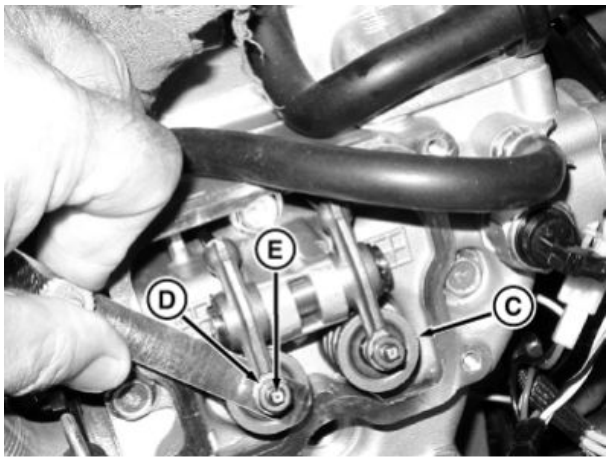
4. Find cylinder Top Dead Center (TDC) of compression:
   - Turn crankshaft counterclockwise until intake valve (C) opens.
   - Put a long, small diameter, wooden dowel into spark plug hole and rest it on top of the piston.
   - Continue to turn crankshaft counterclockwise until dowel is at highest point. The piston is at TDC of compression stroke.
   - When piston is at TDC, both intake and exhaust valve rocker arms are loose.
   - If either or both rocker arms are tight, the piston is on the exhaust stroke and the crankshaft must be turned counterclockwise another revolution (360 degrees).
5. Using a flat feeler gauge, check that valve clearance is to specification.

Specification	
Valve—Clearance	0.25 mm (0.010 in.)

6. To adjust valve clearance, loosen lock nut (D) and turn adjusting screw (F) to correct clearance.
7. Hold adjusting screw stationary while tightening lock nut to specification.

Specification	
Valve Adjusting Screw Lock Nut—Torque	9 N·m (79 lb.-in.)

8. Recheck valve clearance, readjust if necessary.
9. Repeat procedure for other valve.



MXT010302 —UN—11JUN14

C—Intake Valve **E—Adjusting Screw**
D—Lock Nut

10. Repeat procedure for other cylinder.
11. Install spark plugs and spark plug leads.
12. Install and tighten valve covers to specification.

Specification	
Valve Cover—Torque	6 N·m (53 lb.-in.)

MX52301,00000B6 -19-22OCT14-2/2

Crankcase Vacuum Test

Reason:

Verify operation of breather and condition of seals, gaskets, rings, piston, and cylinders walls.

Equipment:

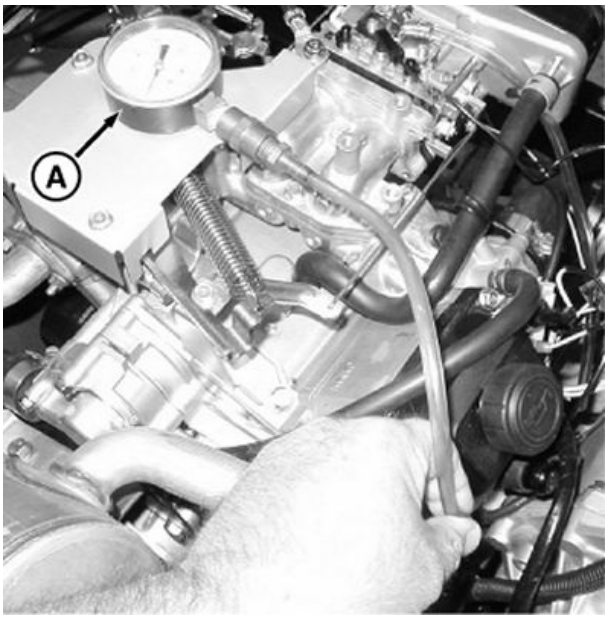
- JT03503 Vacuum Test Kit

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Remove dipstick and replace with test kit (A).
3. Start engine and run at fast idle.
4. Record crankcase vacuum reading. Gauge should read at or above specification.

Specification	
Gas Engine Crankcase—Vacuum (minimum)	25 mm of H2O (1.0 in.) of H2O

5. Turn off engine and replace test kit (A) with dipstick.



MXT010303 —UN—11JUN14

A—Vacuum Test Kit

Results:

If crankcase vacuum is LESS than specification, check the following:

- Breather reed valve clearance and condition,
- Seals and gaskets for leakage,
- Valve cover gasket for leakage,
- Rings, piston, and cylinder walls for wear or damage.
- Valve and valve seats for wear or damage.
- Head warpage.

MX52301,00000B7 -19-22OCT14-1/1

Oil Pressure Test

Reason:

To determine condition of lubrication system.

Equipment:

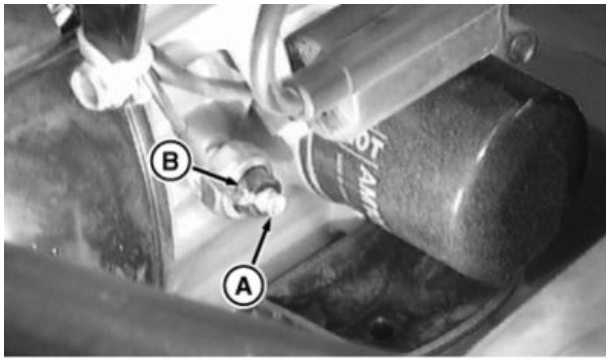
- JT03344 0—2000 kPa (300 psi) Gauge with Quick Coupler
- JT03017 Hose Assembly
- JT03349 Connector

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Check engine oil level, bring level to full mark.
3. Run engine at HIGH idle until cooling fan starts.
4. STOP engine.

IMPORTANT: Avoid Injury! Engine components are HOT. Be careful not to touch, especially the exhaust pipe or muffler, while making adjustments. Wear protective eye glasses and clothing.

5. Disconnect oil pressure switch wiring lead (A).
6. Remove oil pressure switch (B).



MXT010304 —UN—11JUN14

A—Wiring Lead **B—Oil Pressure Switch**

MX52301,00000B8 -19-22OCT14-1/2

7. Install connector (C).
8. Connect JT03017 Hose Assembly (D) and pressure gauge (E).

IMPORTANT: Avoid Damage! STOP ENGINE IMMEDIATELY and determine cause if pressure readings is below 69 kPa (10 psi).

9. Run engine at FAST idle and check oil pressure. Oil pressure must be at or above specification.

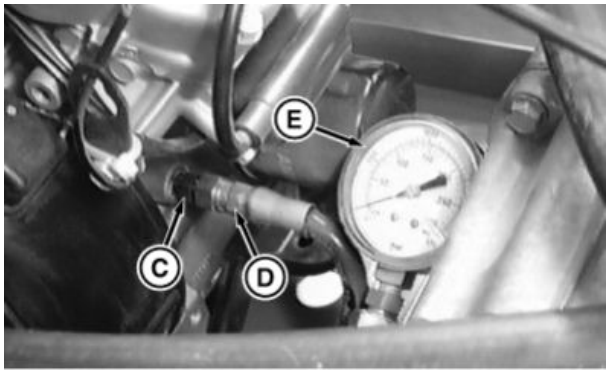
Specification	
Oil—Pressure (minimum)	276 kPa (40 psi)

10. Install oil pressure switch and switch wiring lead. Use John Deere Pipe Sealant (medium strength), or equivalent, on switch threads.

Results:

If oil pressure is BELOW specification, inspect or replace the following:

- Oil pressure relief valve,



MXT010305 —UN—11JUN14

C—Connector **E—Gauge**
D—Hose

- Oil pump,
- Oil pump suction screen or passage,
- Connecting rod and main bearings.
- Worn or damaged oil pump.
- Excessive wear of connecting rod and main bearings.

MX52301,00000B8 -19-22OCT14-2/2

Radiator Cap Pressure Test

Reason:

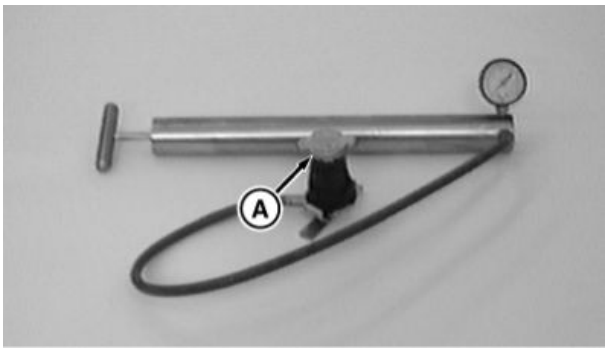
Verify that radiator cap operates at correct pressures.

Equipment:

- D05104ST Cooling System Pressure Pump
- JDG692 Adaptor

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Install radiator cap (A) on Pressure Pump.
3. Apply pressure.
4. If cap leaks, retighten and test again.



MXT010306 —UN—11JUN14

A—Radiator Cap

Results:

Replace cap if pressure not to specification:

Item	Measurement	Specification
Gas Engine Radiator Cap Pressure Specifications		
Radiator Cap	Pressure (maximum)	83—96 kPa (12—14 psi)
Radiator Cap	Pressure (minimum)	76 kPa (11 psi)

MX52301,00000B9 -19-22OCT14-1/1

Thermostat Test

Reason:

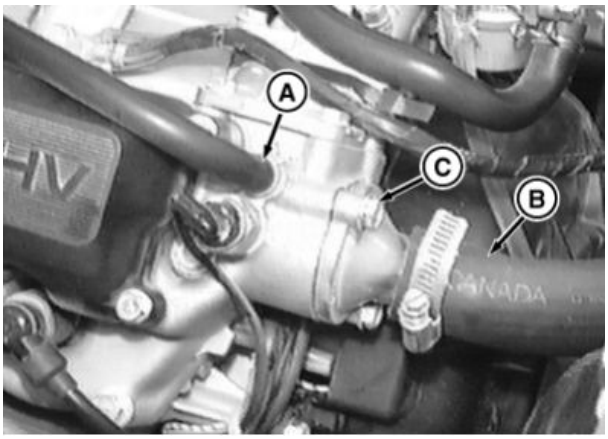
To ensure thermostat opening and closing at specified temperatures.

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.

NOTE: Be sure to wipe-up and wash-off any spilled coolant immediately.

3. Check that cooling system is cool and squeeze top radiator hose to check that system pressure has dropped.
4. Disconnect bypass hose (A) at thermostat housing, hold as-low-as possible to drain coolant into a clean container. Lower the coolant level enough to drain the thermostat housing.
5. Disconnect large hose (B), prop it up to prevent coolant leakage.



MXT010307 —UN—12JUN14

A—Bypass Hose
B—Large Hose
C—Cover

6. Remove cover (C), gasket, and thermostat.

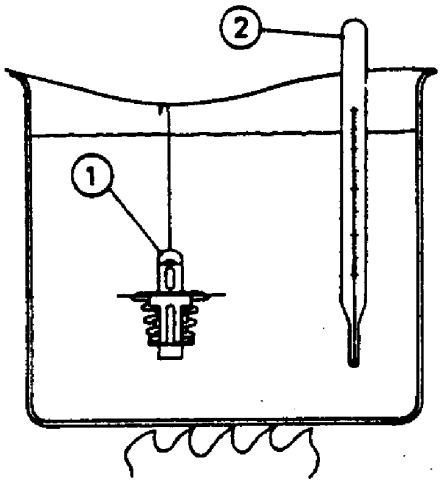
Continued on next page

MX52301,00000BA -19-22OCT14-1/2

7. Suspend thermostat and a thermometer in a container of water.
8. Heat and stir the water. Observe opening action of thermostat and compare temperatures with specifications.

Specification	
Begin Thermostat Opening—Temperature	82°C (180°F)
Thermostat Fully Open—Temperature	95°C (203°F)
Minimum lift above 96°C (203°F)—Lift	7 mm (0.28 in.)

9. Remove thermostat and observe its closing action as it cools.
   - If thermostat does not open according to specifications, replace thermostat.
   - If closing action is not smooth and slow, replace thermostat.



MXT010308 —UN—12JUN14

1— Thermostat **2— Thermometer**

MX52301,00000BA -19-22OCT14-2/2

Summary of References

- Carburetor Repair
- Camshaft Removal
- Camshaft Inspection
- Connecting Rod Assembly and Installation
- Connecting Rod Bend and Twist Inspection
- Crankcase Cover Removal and Installation
- Crankcase Breather Inspection
- Crankshaft Inspection
- Crankshaft Installation
- Cylinder Boring
- Cylinder Head Disassembly and Inspection
- Cylinder Head Removal and Installation
- Engine Removal and Installation
- Governor Removal and Inspection
- Intake Manifold Removal and Installation
- Muffler Removal and Installation
- Oil Pump Inspection
- Oil Pump Installation
- Piston and Cylinder Removal
- Piston Inspection
- Piston Ring Installation
- Starting Motor Disassembly and Inspection
- Starting Motor Removal and Installation
- Tappet and Camshaft Installation
- Water Pump Parts Inspection
- Water Pump Removal and Installation

MX52301,00004A0 -19-13JUN14-1/1

Muffler Removal and Installation

CAUTION: Caution: Avoid Injury! Muffler may be hot. Allow to cool before removing.

Removal:

1. Raise cargo box.
2. Remove four nuts (A) and engine lift bracket (B).
3. Remove muffler support cap screws (C).
4. Remove muffler.

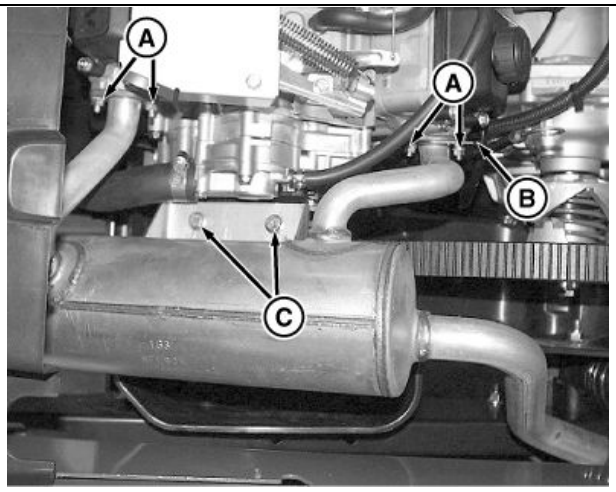
Installation

1. Clean gasket mating surfaces of old gasket material.
2. Install new gaskets and muffler. Install engine lift bracket (B). Tighten nuts (A) to specification.

Specification	
Muffler Lift Bracket Nuts—Torque	11 N·m (98 lb.-in.)

3. Tighten cap screws (C) to specification.

Specification	
Muffler Cap Screws—Torque	27 N·m (240 lb.-in.)



MXT010309 —UN—11JUN14

A—Nuts (4)
B—Engine Lift Bracket
C—Cap Screws (2)

MX52301,000031D -19-23JUL14-1/1

Engine Removal and Installation

Engine Removal:

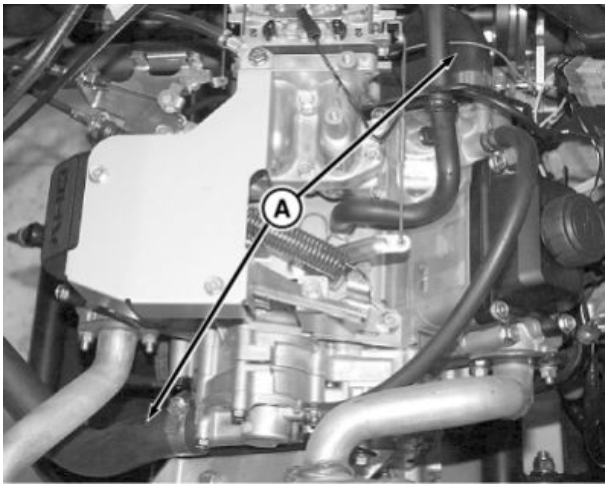
1. Park machine safely. See the “Safety Section”.

CAUTION: Avoid Injury! Touching hot surfaces can burn skin. The engine, components, and fluids are hot if the engine has been running. Keep hands and body away from hot surfaces when servicing or working near the engine and components. Allow engine to cool.

2. Remove cargo box.
3. Disconnect battery negative (-) cable.

CAUTION: Avoid Injury! Muffler may be hot. Allow muffler to cool before removing.

4. Remove muffler. See Muffler Removal and Installation.
5. Remover drive belt.
6. Catch coolant with a drain pan under engine. Loosen radiator cap. Loosen coolant hose clamps (A) and disconnect hoses from engine.



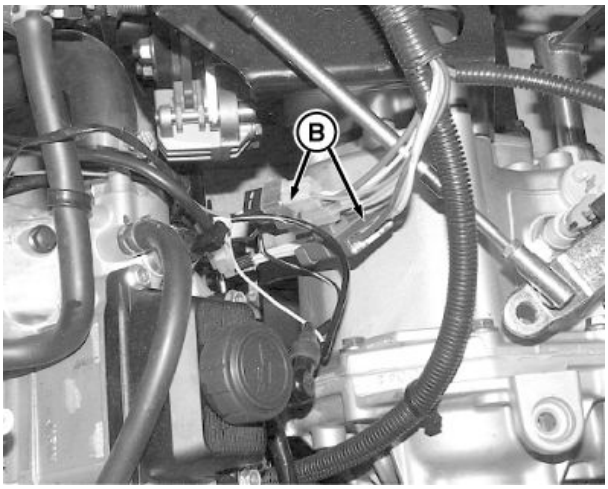
MXT010310 —UN—10JUN14

A—Coolant Hose Clamps

MX52301,000031E -19-22OCT14-1/7

7. Disconnect engine wiring harness connectors (B).

B—Engine Wring Harness Connector



MXT010311 —UN—10JUN14

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MX52301,000031E -19-22OCT14-2/7

8. Disconnect battery positive (+) cable (C) from starting motor solenoid.
9. Remove cap screw (D) from clutch guard bracket.

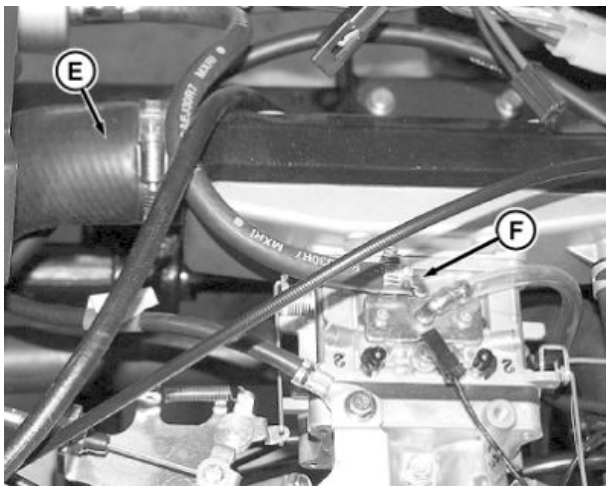
C—Positive (+) Battery Cable **D—Cap Screw**

MXT010312 —UN—10JUN14

MX52301,000031E -19-22OCT14-3/7

10. Remove air cleaner-to-engine hose (E) and fuel supply hose (F).

E—Air Cleaner Hose **F—Fuel Supply Hose**

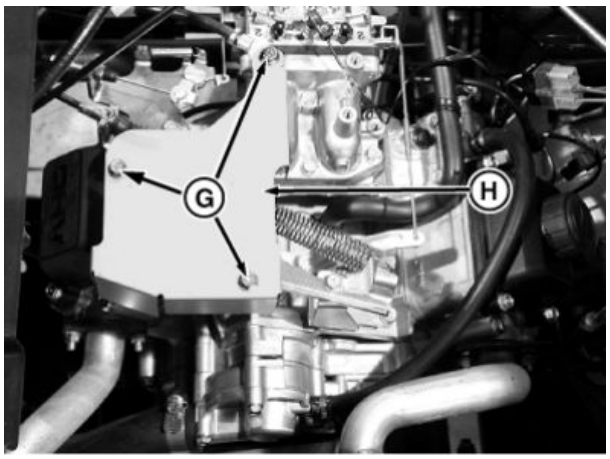


MXT010313 —UN—10JUN14

MX52301,000031E -19-22OCT14-4/7

11. Remove cap screws (G) and governor control cover (H).

G—Cap Screws (3) **H—Governor Control Lever**



MXT010314 —UN—10JUN14

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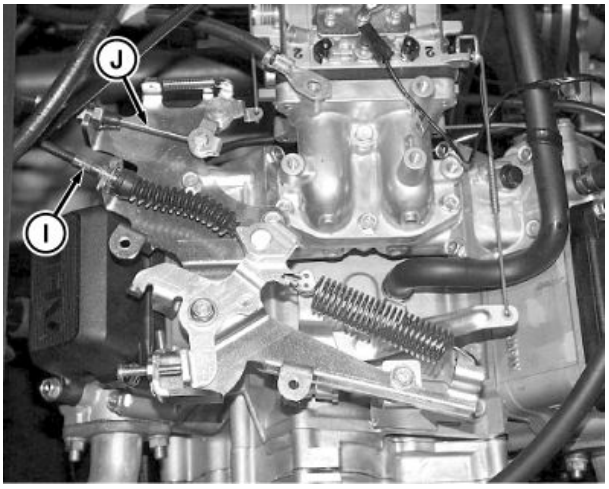
MX52301,000031E -19-22OCT14-5/7

12. Disconnect choke cable (I) and accelerator cable (J).

I— Choke Cable **J— Accelerator Cable**



MXT010315 —UN—10JUN14

MX52301,000031E -19-22OCT14-6/7

13. Remove engine mounting cap screws (K).
14. Attach lift sling to engine mounting brackets. Lift engine slightly and pull slightly to right until oil drain valve clears clutch guard. Continue lifting engine out of machine.

Installation:

Installation is done in the reverse order of removal.

1. Place engine in frame, install mounting bolts.
2. Install components and hardware removed.
   - If removed, install drive clutch and tighten cap screw to specification. Primary Drive Clutch Removal.

IMPORTANT: Avoid Damage! Proper filling of the cooling system is critical. See Radiator Drain Procedure — Gas.

3. Fill cooling system.
4. Fill engine with proper oil.

Specification	
Engine Oil With Filter—Capacity	1.5 L (3.4 pt.)
Engine Oil Without Filter—Capacity	1.3 L (2.8 pt.)

MXT010316 —UN—10JUN14

K—Engine Mounting Cap Screws (4)

5. Adjust choke cable. See Choke Cable Adjustment.

MX52301,000031E -19-22OCT14-7/7

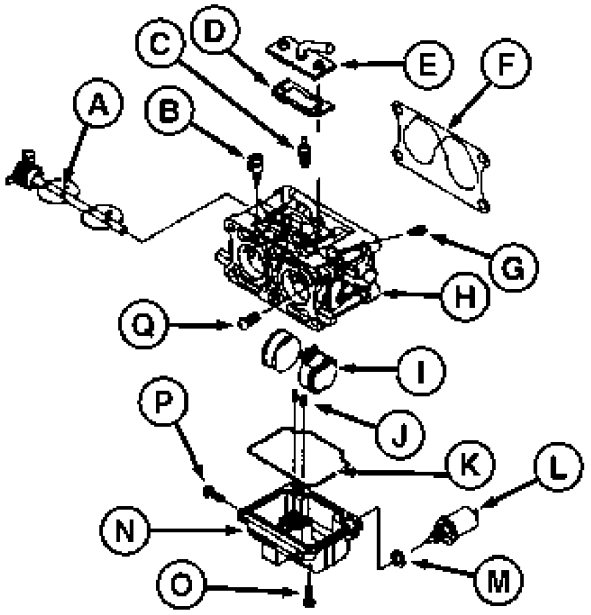
Carburetor Repair

CAUTION: Avoid Injury! Do not attempt to rebuild or adjust carburetor unless you are a factory trained technician with authorization to service California Air Resources Board / Environmental Protection Agency (CARB/EPA) Certified engines.

IMPORTANT: Avoid Damage! There are a number of plates or ball plugs on/in the carburetor that should not be removed.

NOTE: If any or all rubber or plastic parts cannot be removed for cleaning use a solvent that does **not** *damage these parts.*

A—Choke Valve Assembly
B—Idle Mixture Screws (2)
C—Heater Element
D—Gasket
E—Vent Tube
F—Gasket
G—Pilot Jet
H—Carburetor Body
I— Float
J— Main Jets (2)
K—Gasket
L—Fuel Shutoff Solenoid
M—Gasket
N—Fuel Bowl
O—Screw
P—Bowl Drain Screw
Q—Idle Speed Screw

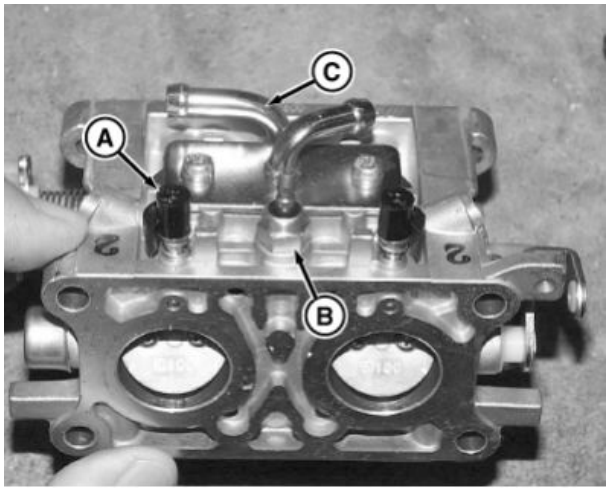


MXT010317 —UN—10JUN14

MX52301,000031F -19-13JUN14-1/7

1. Remove limiter caps (A) on slow idle mixture screws. Turn in mixture screws and **count** the number of turns required to **lightly** seat screws. Remove screws. Remove and test heater element (B). See Carburetor Heater Test (Gas Engine).
2. Remove two screws and vent elbow (C).

A—Limiter Caps
B—Test Heater
C—Vent Elbow



MXT010318 —UN—10JUN14

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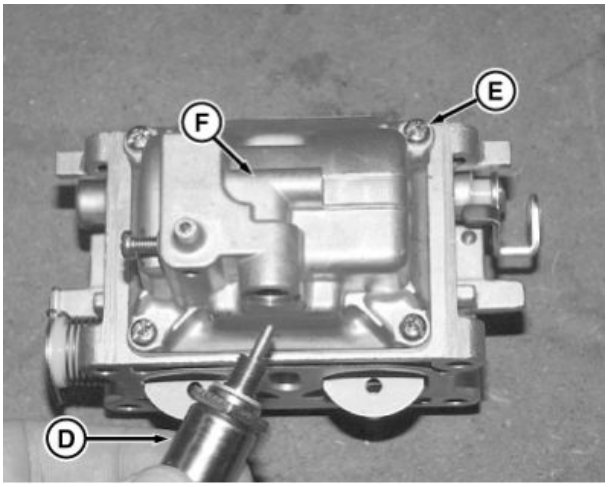
MX52301,000031F -19-13JUN14-2/7

CAUTION: Avoid Injury! Gasoline is flammable. do not smoke. Always work in a ventilated area away from open flame or spark producing equipment, including equipment that utilizes pilot lights.

3. Remove fuel shutoff solenoid (D), float bowl screws (E), and float bowl (F).

D—Fuel Shutoff Solenoid
E—Float Bowl Screws (4)
F—Float Bowl

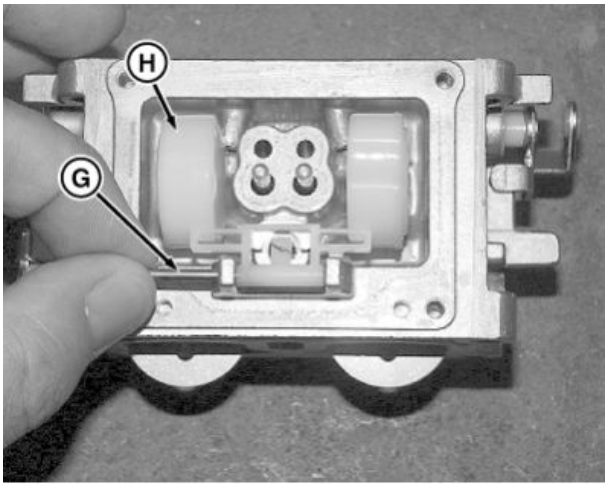


MXT010319 —UN—10JUN14

MX52301,000031F -19-13JUN14-3/7

4. Remove float hinge pin (G) and float (H).

G—Float Hinge Pin
H—Float

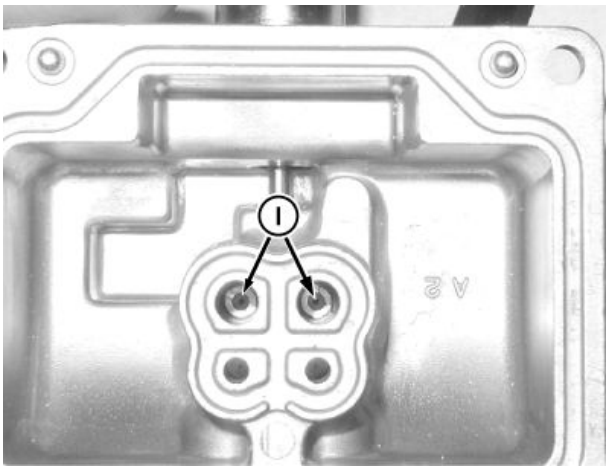


MXT010320 —UN—11JUN14

MX52301,000031F -19-13JUN14-4/7

5. Remove jets (I) from float bowl.

I— Jets



MXT011081 —UN—12JUN14

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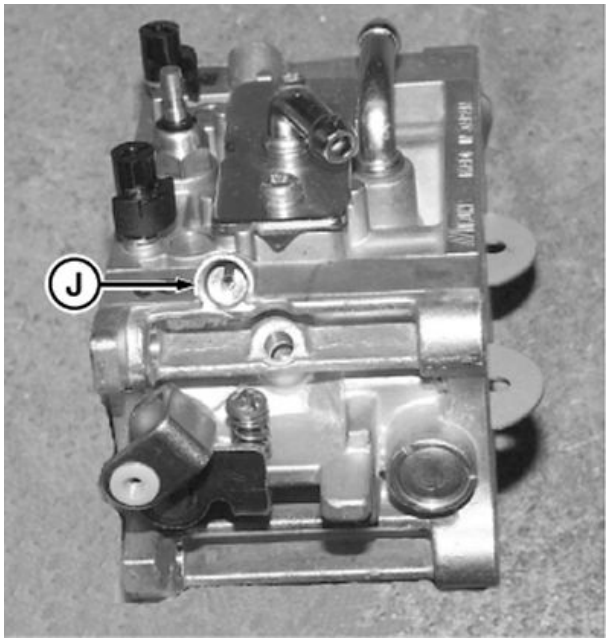
MX52301,000031F -19-13JUN14-5/7

6. Remove pilot jet (J) from each side of carburetor.
7. Spray carburetor passages with carburetor cleaner. Rinse the parts in water and dry with compressed air, do not use rags or paper to dry parts. Lint can plug the tiny passages in the carburetor
8. Inspect body for damage. Ensure that sealing surfaces and flanges are smooth, free of nicks and burrs.
9. Inspect inlet needle for wear or damage. The tip should be smooth, with no grooves or scratches. If worn or damaged, replace float assembly and carburetor body as a set.

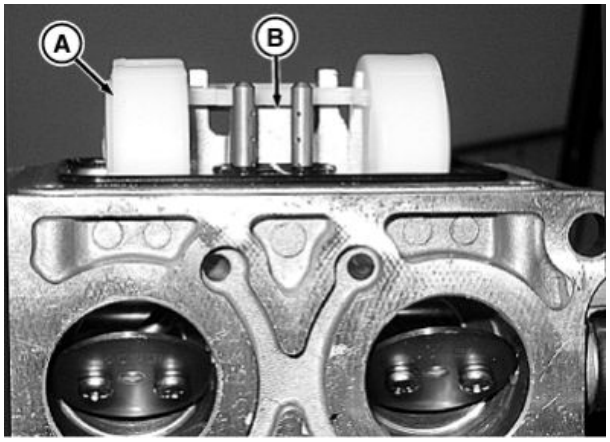
J— Pilot Jet



MXT011082 —UN—10JUN14

MX52301,000031F -19-13JUN14-6/7

10. Hold carburetor upside down at eye level with float assembly (A) installed.
11. With the float resting on the needle, there should be a slight gap (B) between the plastic connecting the floats and the carburetor body.
12. Float is plastic and not adjustable, if level is not correct, replace float and needle valve.
13. Ensure the throttle and choke valves move freely and that the shaft bosses are not elongated or worn. If shaft bosses have any of these conditions, replace the carburetor.
14. Inspect slow idle mixture screws for wear or damage, replace it if necessary.
15. Install slow idle mixture screws until lightly seated, and back out the number of turns counted at disassembly.



MXT011083 —UN—10JUN14

A—Float Assembly **B—Gap**

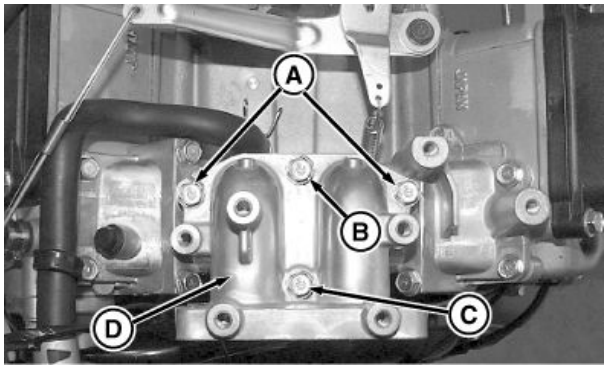
MX52301,000031F -19-13JUN14-7/7

Intake Manifold Removal and Installation

Removal:

1. Drain Coolant.
2. Remove Carburetor.
3. Remove cap screws (A, B, and C). Note the different lengths of cap screws for reassembly.
4. Remove carburetor elbow (D).

A—Cap Screw
B—Cap Screw
C—Cap Screw
D—Elbow



MXT011084 —UN—10JUN14

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MX52301,0000320 -19-17JUL14-1/2

5. To avoid warping manifold, loosen manifold bolts 1/4 turn at a time in sequence shown until all bolts are loose.
6. Remove alignment sleeves (E) and gasket (F). Visually inspect manifold passages for corrosion or deposits and clean as necessary.
7. Inspect manifold for cracks or a porous casting.

NOTE: Cracks not visible to the eye can be detected by coating suspected area with a mixture of 25% kerosene and 75% light engine oil. Wipe area dry and immediately apply a coat of zinc oxide dissolved in denatured alcohol. If cracks are present, the coating becomes discolored at crack location.

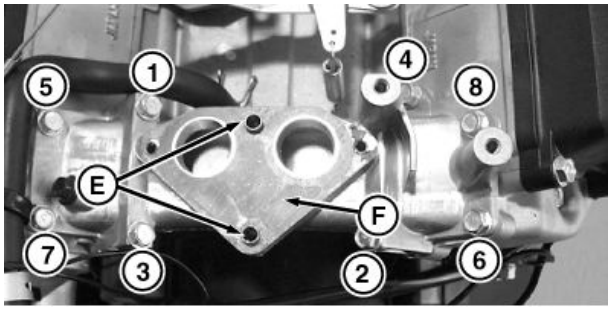
8. If cracks are present, replace manifold.

Installation:

NOTE: Before installing manifold, install cylinder heads if they were removed and tighten head bolts in sequence to **half** *the rated torque value.*

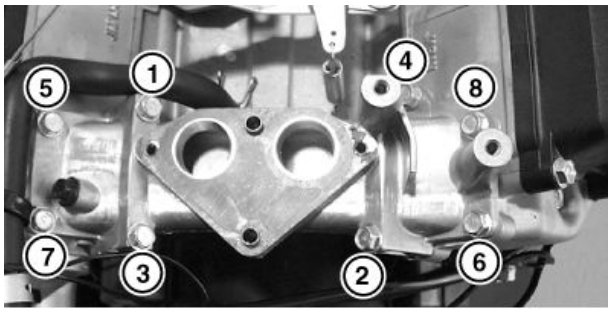
IMPORTANT: Avoid Damage! Check manifold gaskets when installing to insure correct orientation or coolant could leak into cylinders.

1. Install intake manifold and tighten bolts in sequence shown in **two** steps.
2. If cylinder heads were removed, finish tightening cylinder head bolts to 21 N·m (186 lb.-in.).



MXT011085 —UN—10JUN14

E—Alignment Sleeves (2) **F—Gasket**



MXT011086 —UN—11JUN14

Item	Measurement	Specification
First Increment Bolt Torques		
Intake Manifold	Torque	4 N·m (35 lb.-in.)
Cylinder Heads	Torque	10 N·m (89 lb.-in.)
Second Increment Bolt Torques		
Intake Manifold	Torque	6 N·m (52 lb.-in.)
Cylinder Heads	Torque	21 N·m (186 lb.-in.)

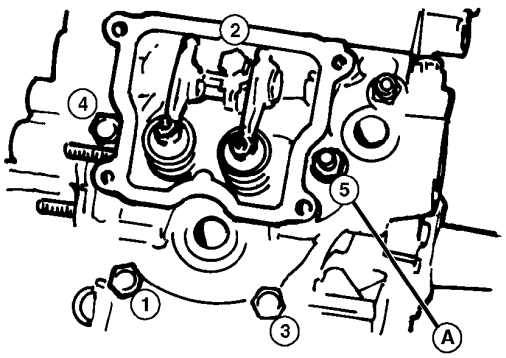
MX52301,0000320 -19-17JUL14-2/2

Cylinder Head Removal and Installation

Removal:

1. Loosen cylinder head bolts 1/4 turn at a time in the sequence shown to avoid warping the cylinder head.
2. Make note of the special bolt (A) location for reinstalling cylinder head.
3. Mark pushrods so they are reinstalled in their original positions during assembly. See Cylinder Head Disassembly and Inspection.

A—Special Bolt



LVAL21631 —UN—09APR12

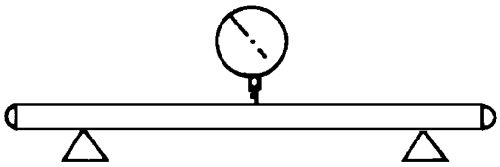
MX52301,0000321 -19-17JUL14-1/4

Push Rod Inspection:

- Place push rod on V-blocks and measure runout. If runout exceeds specification, replace push rod.

Specification	
Push Rod— Runout	0.8 mm (0.03 in.)

LVAL21632 —UN—09APR12

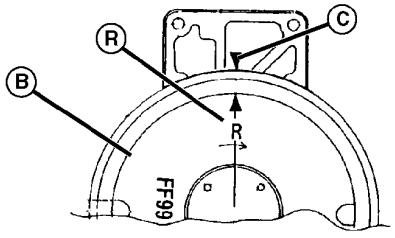


MX52301,0000321 -19-17JUL14-2/4

Installation:

⚠ CAUTION: Avoid Injury! Use a torque wrench when tightening cylinder head bolts.

1. Turn flywheel (B) clockwise to align mark (R) over triangular timing mark (C) on breather chamber.
2. Visually check to ensure that the cam lobes are at their lowest position, if not, turn flywheel 360° and align timing marks again.
3. Install the pushrods in their original positions by sliding them down the inside wall of the crankcase and positioning push rod on the tappet.



LVAL21633 —UN—09APR12

B—Flywheel **R—Mark**
C—Triangular Timing Mark

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MX52301,0000321 -19-17JUL14-3/4

IMPORTANT: Avoid Damage! Handle head gaskets carefully to avoid removing the sealing agents from the surface during handling.

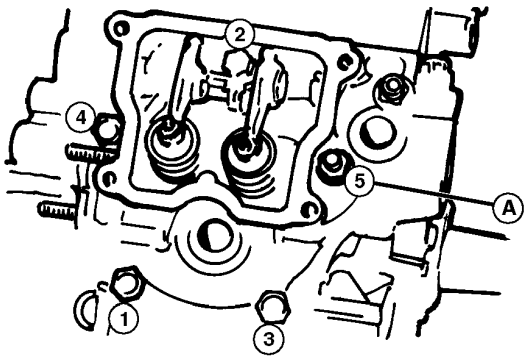
4. Install cylinder head and bolts. Ensure that special bolt is in proper location (A).

NOTE: Torque should be applied in 3 N·m (26 lb.-in.) increments.

5. Tighten head bolts in sequence shown.
   - Tighten cylinder head bolts to half the required torque. Install intake manifold before applying final torque.

Specification

Cylinder Head Bolts—Torque	21 N·m (186 lb.-in.)



LVAL21634 —UN—09APR12

A—Special Bolt

MX52301,0000321 -19-17JUL14-4/4

Cylinder Head Disassembly and Inspection

Disassembly:

NOTE: Note position of all valve train parts so they can be reinstalled in their original position.

1. Remove spark plugs. Remove circlips from rocker arm shafts and push shafts out the same side the circlip was removed from.
2. Remove spring retainers by applying pressure with your thumbs and sliding the retainer over to a side hole on the retainer.
3. Remove stem seals and bottom spring retainers.

Cleaning and Inspection:

NOTE: Use tools for cleaning that will not gouge or damage the cylinder head.

1. Scrape heads to remove carbon deposits or use a decarbonizing agent. Clean with a suitable solvent and dry with compressed air.
2. Lay a straight edge along the sealing surface of head and measure warpage with a thickness gauge at several different points. If warpage exceeds specification, repair or replace cylinder head.

Specification

Cylinder Head Warpage—Flatness (maximum) ..... 0.06 mm (0.002 in.)

3. Check cylinder head for cracks.

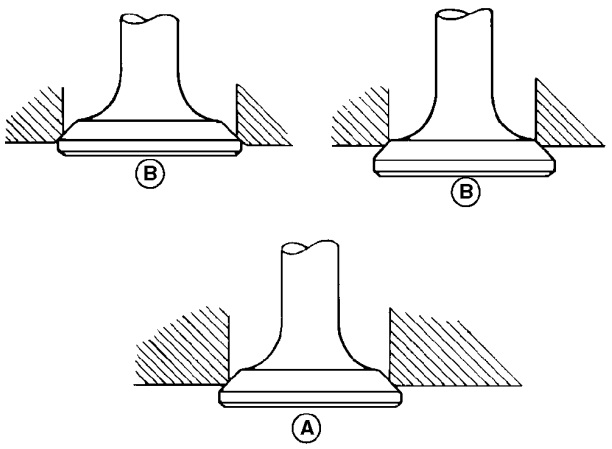
NOTE: Cracks not visible to the eye can be found by coating head with a mixture of 25% kerosene and 75% light engine oil. Wipe area dry and immediately apply a coating of zinc oxide dissolved in wood alcohol. If cracks are present, coating will become discolored at the defective area.

4. Clean and measure diameter of rocker arm shaft with a micrometer at several points. If outside diameter is less than specification, replace shaft.

Specification

Rocker Shaft—OD (minimum).....11.95 mm (0.470 in.)

5. Clean and inspect rocker arm where it contacts push rod and valve stem. If the contact points are worn or damaged, replace rocker arm.
6. Measure inside diameter of rocker arm bearing at several points using a dial bore gauge or inside micrometer. If the diameter is more than specification, replace the rocker arm.



LVAL21635 —UN—09APR12

A—Correct Valve Seat Pattern B—Incorrect Valve Seat Pattern

Specification

Rocker Arm Bearing—ID (maximum)..... 12.07 mm (0.475 in.)

NOTE: Ensure that all carbon deposits are removed from valve guide before taking any measurements.

7. Measure valve guide inside diameter in three places down the length of the guide with a small bore gauge. If the measurement on any guide is more than specification, replace cylinder head.

Specification

Valve Guide Inside Diameter: Intake or Exhaust—Diameter (maximum)..... 6.05 mm (0.238 in.)

8. Inspect valve seats for damage. If seats are warped or distorted beyond reconditioning, replace cylinder head.
9. Check valve seating pattern for correct width and evenness all the way around (A). Valve seat width should be between specification. If incorrect (B), lap valves to seats.

Specification

Valve Seat —Width.....0.5—1.1 mm (0.02—0.043 in.)

Continued on next page

10. Clean and measure valve stem at three points along length of stem. If intake valve is not within specification and exhaust valve is not within specification, replace.

Specification

Intake Valve
Stem—Diameter
(minimum)..... 5.95 mm
(0.234 in.)

Exhaust Valve
Stem—Diameter
(minimum)..... 5.92 mm
(0.233 in.)

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11. Place valve on V-blocks and measure runout, if not within specification, replace.

Specification

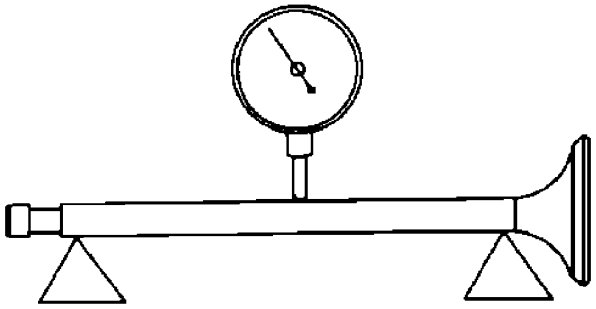
Valve Stem—Run-out
(maximum)..... 0.05 mm
(0.002 in.)

12. Measure valve head thickness (valve margin). If not within specification, replace.

Specification

Valve Margin—Thick-
ness..... 0.6 mm
(0.024 in.)

13. If grinding the valve and valve seat is necessary, follow tool instructions carefully. Lap valves after grinding with lapping compound and recheck valve seating surface for correct width and evenness of seating pattern.



LVAL21636 —UN—09APR12

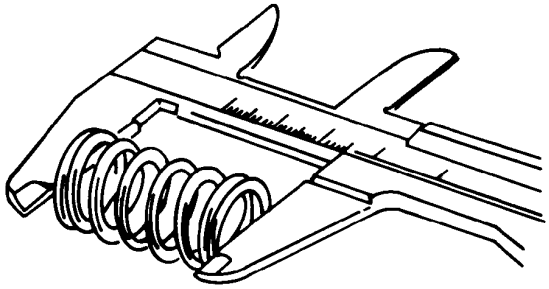
MX52301,0000322 -19-23JUL14-3/4

14. Inspect valve spring for pitting, rust, and burrs. Measure spring free length. Minimum valve spring free length should be within specification.

Specification

Valve Spring—Free
Length (minimum)..... 29.70 mm
(1.17 in.)

15. Apply clean engine oil to all contact surfaces and assemble cylinder head.



LVAL21637 —UN—09APR12

MX52301,0000322 -19-23JUL14-4/4

Crankcase Cover Removal and Installation

Removal:

Remove the Following:

- Drain engine oil
- Exhaust manifold
- Throttle control panel
- Coolant hoses and bypass tube
- Oil drip tray

IMPORTANT: Avoid Damage! Loosen or tighten crankcase cover bolts in increments in the sequence shown. Improper removal or tightening sequence may result in crankcase cover distortion.

NOTE: Two lower water pump cover bolts are not used to secure the crankcase cover. To secure the water pump to the crankcase cover leave bolts in place.

1. Unscrew mounting bolts in order shown.

NOTE: There are two knock pins on crankcase mating surface. Use a wooden or plastic mallet to tap cover loose.

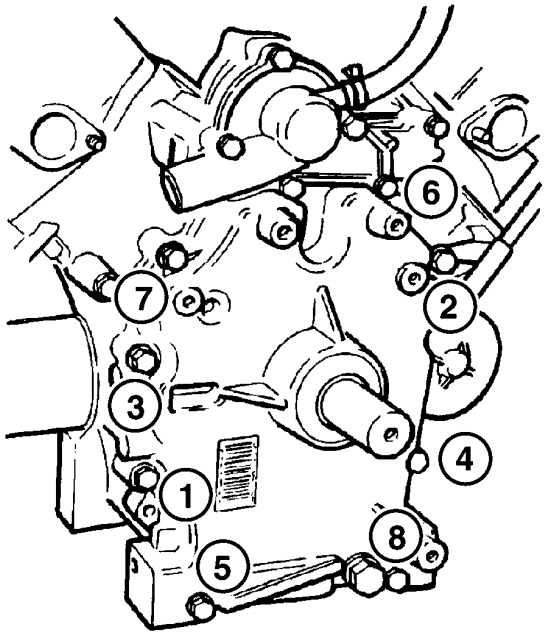
2. Remove crankcase cover from crankcase.

Inspection:

1. Clean cover with a suitable solvent and dry with compressed air.
2. Measure inside diameter of the crankshaft bearing at several points. If the measurement is not within serviceable limits, replace cover.

Specification

Crankshaft Bearing—ID -
Service Limit ..... 34.07 mm (1.341 in.)



MXT012118 —UN—12JUN14

3. Measure inside diameter of camshaft bearing on the crankcase cover at several points. Replace crankcase cover if measurement is out of serviceable limits.

Specification

Camshaft Bearing —ID -
Service Limit ..... 16.07 mm (0.633 in.)

Continued on next page

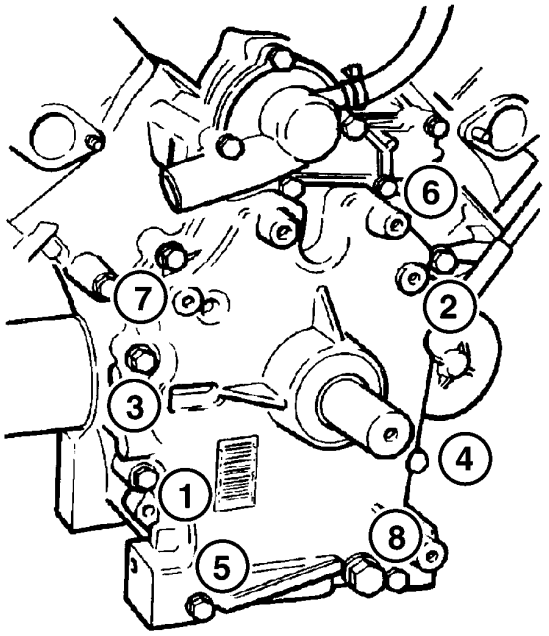
MX52301,0000323 -19-23JUL14-1/2

Installation:

IMPORTANT: Avoid Damage! Do Not force cover into position.

1. Install cover and mounting bolts.
2. Tighten bolts in sequence shown to specification.

Specification	
Crankcase Cover Bolt—Torque	25 N·m (18.5 lb.-ft.)



MXT012118 —UN—12JUN14

MX52301,0000323 -19-23JUL14-2/2

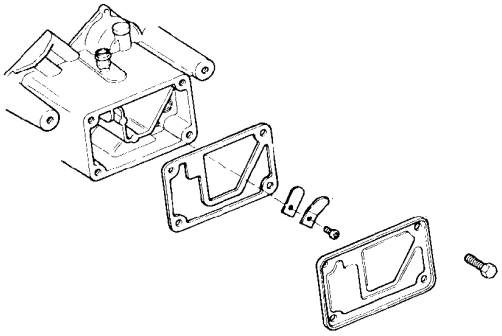
Crankcase Breather Inspection

1. Inspect reed valve (A) for breakage, hairline cracks, or distortion, replace if necessary.
2. Check breather reed valve tip air gap (B) to see if it is within specification.

Specification	
Reed Valve Tip—Air Gap	0.2 mm (0.008 in.)

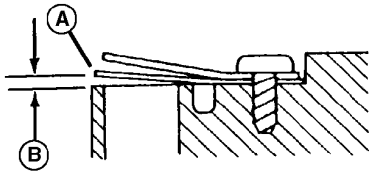
3. Inspect the back plate for damage or a rough contact surface, replace if necessary.
4. Inspect the valve seating surface for damage, repair if necessary.

A—Reed Valve **B—Air Gap**



LVAL21641 —UN—09APR12

LVAL21642 —UN—09APR12



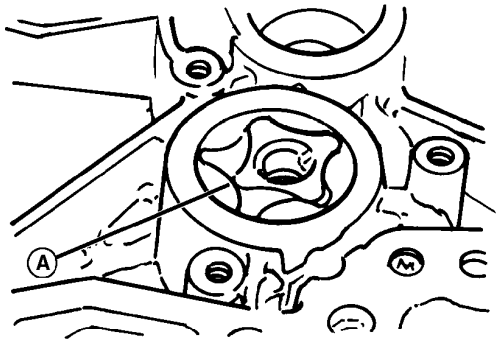
MX52301,0000324 -19-17JUL14-1/1

Oil Pump Inspection

1. Visually inspect the pump gear, inner rotor, and cover plate. If there is any sign of uneven wear or damage, replace them.
2. Check clearance between inner and outer rotor (A) with a feeler gauge. Measure clearance between high point of the inner rotor and the high point of outer rotor. If measurement exceeds specification, replace both rotors as a set.

Specification

Oil Pump - Inner and Outer Rotor—Clearance - Service Limit ..... 0.3 mm (0.012 in.)



LVAL21643 —UN—09APR12

A—Outer Rotor

MX52301,0000325 -19-17JUL14-1/4

3. Measure outside diameter of outer rotor with a micrometer at several points. If rotor diameter is less than specification, replace both rotors as a set.

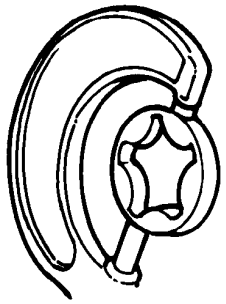
Specification

Oil Pump - Outer Rotor—Diameter - Service Limit ..... 40.47 mm (1.593 in.)

4. Measure thickness of outer rotor at several points. If measurement is less than specification, replace both rotors as a set.

Specification

Oil Pump - Outer Rotor—Thickness - Service Limit ..... 9.83 mm (0.387 in.)



LVAL21644 —UN—09APR12

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MX52301,0000325 -19-17JUL14-2/4

5. Measure inside diameter of the pump housing at several points. If inside diameter is more than specification, replace cover.

Specification

Oil Pump - Pump Housing—ID - Service Limit ..... 40.80 mm (1.606 in.)

6. Measure depth of pump housing at several points. If the measurement exceeds specification, replace cover.

Specification

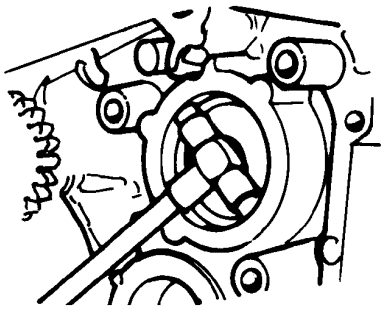
Oil Pump - Pump Housing—Depth - Service Limit ..... 10.23 mm (0.403 in.)

7. Measure inside diameter of pump shaft bearing at several points. If inside diameter is more than specification, replace cover.

Specification

Oil Pump Shaft Bearing—ID - Service Limit ..... 11.07 mm (0.436 in.)

8. Measure outside diameter of pump shaft at several points. If diameter is less than specification, replace pump shaft.



LVAL21645 —UN—09APR12

Specification

Oil Pump - Pump Shaf—Diameter - Service Limit ..... 10.92 mm (0.430 in.)

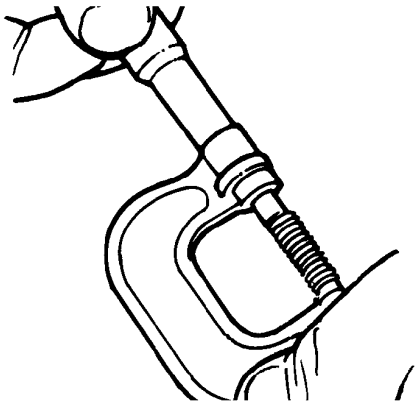
9. Visually inspect relief valve spring, steel ball, and valve seat in the cover. Remove any varnish deposits with a suitable solvent. If the ball is deformed or has any rough spots that could prevent a perfect seal, replace valve parts.

MX52301,0000325 -19-17JUL14-3/4

10. Measure valve spring free length. If free length is less than specification, replace valve spring.

Specification

Oil Pump - Valve Spring—Free Length (minimum) ..... 19.50 mm (0.77 in.)



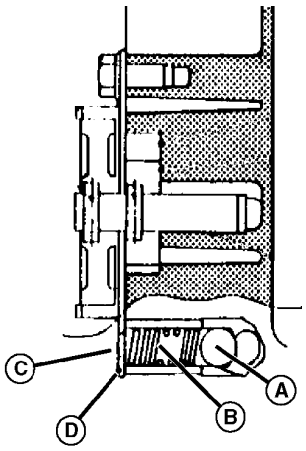
LVAL21646 —UN—09APR12

MX52301,0000325 -19-17JUL14-4/4

Oil Pump Installation

1. Fill rotor housing with engine oil for initial lubrication.
2. Install relief valve ball (A) and spring (B) and then pump assembly. Esure the 6 mm hole (C) in the cover plate (D) is aligned with center of the relief valve.

A—Relief Valve Ball
B—Spring
C—6 mm Hole
D—Cover Plate

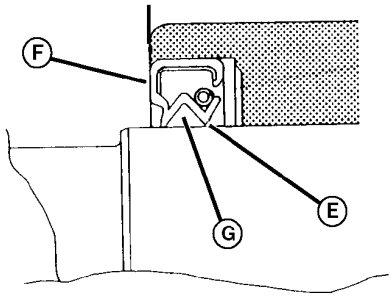


LVAL21647 —UN—09APR12

MX52301,0000326 -19-13JUN14-1/2

3. Remove crankshaft oil seal and press in a new seal with spring loaded lip (E) towards inside of the engine and outside edge of seal (F) flush with flange surface.
4. Pack space (G) between seal lip and dust lip with high temperature grease.
5. Ensure oil pump gear meshes with crankshaft gear when installing crankcase cover.

E—Spring Loaded Lip
F—Seal
G—Space



LVAL21648 —UN—09APR12

MX52301,0000326 -19-13JUN14-2/2

Camshaft Removal

NOTE: See Crankcase Cover Removal and Installation before starting this procedure.

1. Align punch mark on crankshaft gear with projection on cam gear.
2. Turn crankcase upside down to let the tappets fall away from cam lobes.
3. Pull camshaft out of crankcase.

MX52301,0000327 -19-13JUN14-1/1

Camshaft Inspection

1. Inspect camshaft gear for pitting, fatigue cracks, burrs, or evidence of improper tooth contact. Replace shaft if necessary.
2. Inspect cam lobes for wear, uneven contact, or burrs. Replace if necessary.
3. Measure height of each cam lobe. Replace if less than the service limit.

Specification	
Cam Lobe - Intake—Height	25.21 mm (0.993 in.)
Cam Lobe - Exhaust—Height	25.46 mm (1.002 in.)

4. Measure both camshaft journals at several points. is less than the service limit, replace camshaft.

Specification	
Camshaft Journal - PTO Side—Diameter	15.91 mm (0.626 in.)
Camshaft Journal - Flywheel Side—Diameter	15.92 mm (0.627 in.)

5. Measure inside diameter of camshaft bearing at several points. Replace if the diameter exceeds service limit.

Specification	
Camshaft Bearing —ID - Service Limit	16.07 mm (0.633 in.)

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Governor Removal and Inspection

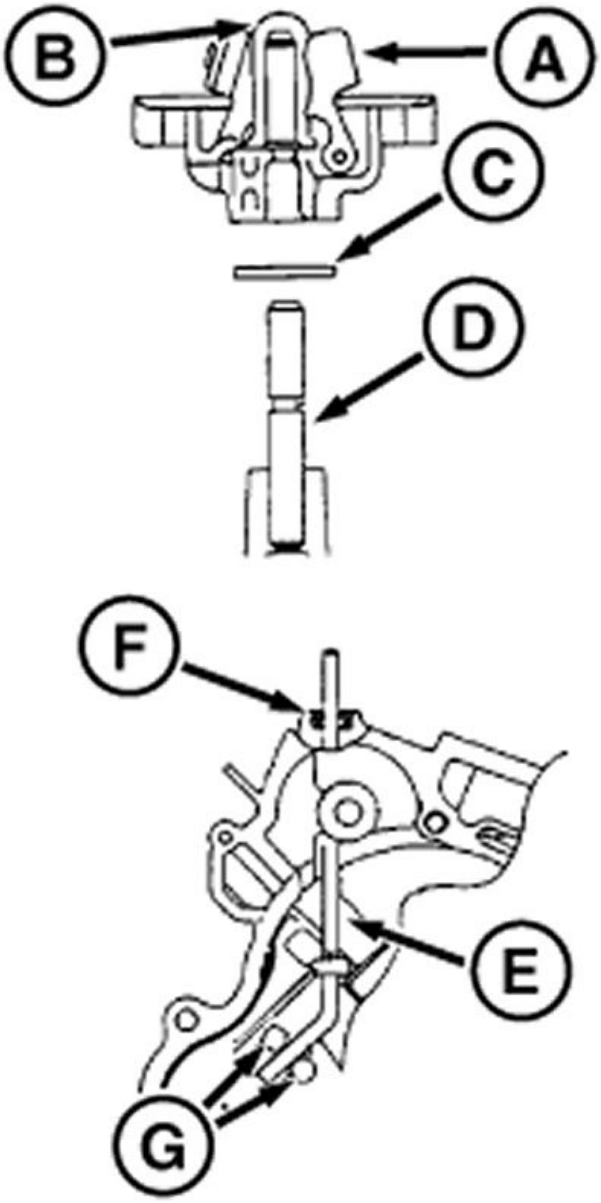
CAUTION: Avoid Injury! Do not remove governor or governor shaft unless damaged. Removal damages the assembly.

1. Remove camshaft.
2. Use two suitable screwdrivers to pry gear/flyweight assembly (A), sleeve (B), and thrust washer (C) from shaft (D). Do Not damage crankcase sealing surfaces.
3. Turn governor shaft (E) 1/4 turn clockwise to remove.
4. Replace shaft seal (F).
5. Press seal in (lip towards inside of engine) and 1.0 mm (0.04 in.) below crankcase surface.
6. Install governor shaft by properly positioning it between the two projections (G) on crankcase.

NOTE: Install thrust washer on shaft. Place sleeve into governor and install as an assembly.

7. Push assembly onto shaft until it snaps into place. Check assembly for freedom of movement.

A—Gear/Flyweight
B—Sleeve
C—Thrust Washer
D—Shaft
E—Governor Shaft
F—Shaft Seal
G—Projections



MXT011087 —UN—17JUL14

MX52301,0000329 -19-13JUN14-1/1

Piston and Cylinder Removal

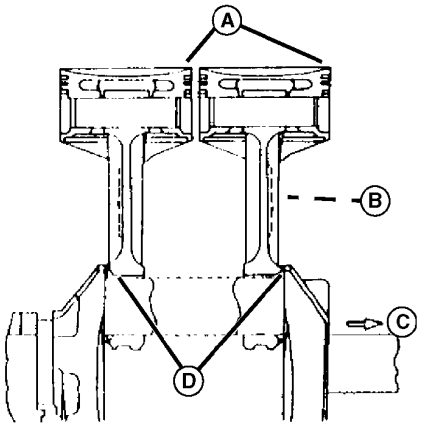
IMPORTANT: Avoid Damage! Note location of the arrow match mark (A) on the piston head in relation to "made in Japan" marking (B) on the connecting rod. Match marks are to face flywheel end of engine (C). Number 1 piston/rod orientation is opposite number 2. Large chamfers (D) in connecting rod journals face away from each other. Keep parts together as a set.

1. Turn crankshaft to expose connecting rod end caps. Mark end caps for reassembly in the same position as removed.
2. Remove carbon and/or ridge from the top of the cylinder bore with a suitable ridge remover. Remove piston and connecting rod through top of cylinder bore.

NOTE: Withdraw piston pin from the same side as the piston pin retaining ring is removed.

3. Remove piston pin retaining ring and pin.
4. Scrape carbon off piston without damaging the piston surfaces.

CAUTION: Avoid Injury! Be careful not to widen ring grooves when cleaning. Damaged grooves require piston replacement.



LVAL21649 —UN—09APR12

A—Arrow Match Mark
B—Connecting Rod Marking
C—Flywheel End of Engine
D—Chamfers

5. Clean ring grooves with a suitable ring groove cleaner.

MX52301,000032A -19-13JUN14-1/1

Piston Inspection

Analyzing Piston and Ring Wear:

Rings of the wrong size or rings having improper end gaps, or do not conform to the shape of the cylinder. This results in high oil consumption and excessive blow-by.

Ring end gaps should be staggered on the piston during installation. End gaps in alignment can cause oil consumption and blow-by.

Light scuffing or scoring of both rings and piston occurs when unusually high friction and combustion temperatures approach the melting point of the piston material.

When this condition exists, it is due to one or more of the following probable causes:

- Engine overheating
- Lack of cylinder lubrication
- Improper combustion
- Wrong bearing or piston clearance
- Too much oil in crankcase causing fluid friction.

The engine operating at abnormally high temperatures may cause varnish, lacquer, or carbon deposits to form in the piston grooves causing the rings to stick. Excessive oil consumption and blow-by occur.

Engine overheating is usually the result of one or more of these conditions:

- Overloading
- Incorrect ignition timing
- Lean fuel mixture
- Lack of coolant
- Incorrect oil
- Low oil supply
- Stale fuel.

Vertical scratches across the piston rings are due to an abrasive in the engine. Abrasives may be airborne, may have been left in the engine during overhaul, or lead and carbon deposits may have broken loose.

When this condition exists, check for one or more of the following causes:

- Damaged, collapsed or improperly installed air cleaner
- Loose connection or damaged gasket between air cleaner and carburetor
- Intake manifold leak
- Leak around carburetor throttle shaft or choke shaft
- Failure to remove abrasives from cylinder
- Air entering through breather tube.

Dirt in the oil causes scratches on the oil control ring resulting in high oil consumption.

Oil control ring inner spacer wear or distortion may result in one of these conditions:

- High oil consumption
- Increased deposits in combustion chamber
- Sticking compression rings.

Detonation, commonly called preignition, carbon knock, spark knock, pinging or timing knock, is an uneven ignition of the fuel/air mixture across the combustion chamber. Severe damage to piston valves and cylinder heads can result from detonation. The following is a list of possible causes for detonation:

- Lean fuel mixture
- Low octane fuel
- Advanced ignition timing
- Incorrect spark plug (wrong heat range)
- Broken spark plug
- Sharp edges on valves or in combustion chamber
- Overloading
- Higher than normal compression (a result of excessive deposits in the combustion chamber
- Incorrect cylinder head or milling of cylinder head (resulting in high compression).

Improper ring contact or piston contact with the cylinder wall can result from incorrect rod or piston alignment, and/or a bent connecting rod. Diagonal wear patterns and excessive wear on the ring grooves are evidence of this condition. This problem causes:

- Rapid piston wear
- Uneven piston wear
- Excessive oil consumption
- Catastrophic engine failure.

A broken piston pin retaining ring can cause severe damage in the combustion chamber. Common causes are:

- Misaligned or bent connecting rod
- Excessive crankshaft end-play
- Crankshaft journal taper
- Weak retaining rings
- Incorrectly installed retaining rings.

1. Measure the top and second ring groove clearance by inserting a new piston ring in the groove at several locations and measuring the gap between the ring and the ring land with a thickness gauge. Replace piston if the gap exceeds specification for the top groove and for the second groove.

Specification	
Piston Ring Groove Clearance - Top—Gap	0.15 mm (0.006 in.)
Piston Ring Groove Clearance - Second—Gap	0.12 mm (0.005 in.)

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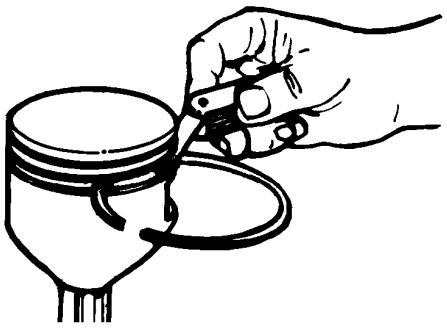


LVAL21650 —UN—09APR12

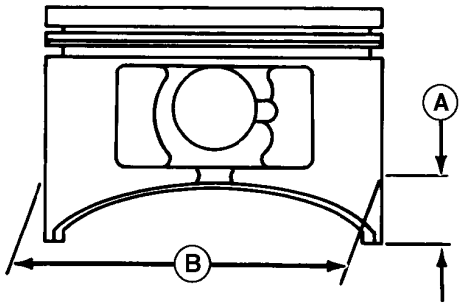
MX52301,000032B -19-17JUL14-2/5

NOTE: The oil ring is a three piece assembled ring. It is too difficult to measure the ring groove clearance, visually inspect only.

2. Measure outside diameter (B) of piston skirt at location 11 mm (0.43 in.) up from the bottom of piston at a right angle to the direction of piston pin hole (A). If less than specification, replace piston.

Specification

Piston Skirt Diameter—OD - Service Limit	75.88 mm (2.987 in.)



LVAL21651 —UN—09APR12

A—Piston Skirt 11 mm (0.043 in.) Location **B—OD**

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MX52301,000032B -19-17JUL14-3/5

3. Measure inside diameter of piston pin hole at several locations using a dial bore gauge. If not within specification, replace piston.

Specification

Piston Pin Hole—ID - Service Limit ..... 17.04 mm (0.671 in.)

4. Measure inside diameter of small end of connecting rod at several points. If more than specification, replace connecting rod.

Specification

Connecting Rod Small End—ID - Service Limit ..... 17.05 mm (0.671 in.)

5. Measure outside diameter of piston pin at several points. If less than specification, replace piston pin.

Specification

Piston Pin Outside—OD - Service Limit ..... 16.98 mm (0.668 in.)

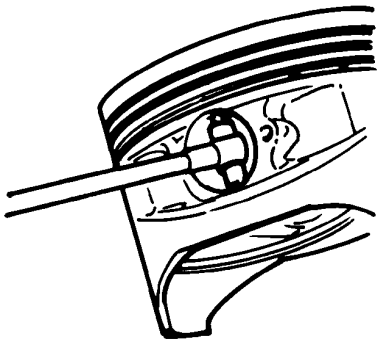
6. Measure ring thickness at several points. If less than specification for top ring and second rings, replace the entire set of rings.

Specification

Piston Ring Top and Second Rings—Thickness ..... 1.12 mm (0.044 in.)

7. Deglaze cylinder bore with rigid hone, using 250 to 300 grit stone. Finish hone using 600 to 1000 grit stone. Hone to obtain a 40°—60° crosshatch pattern.

IMPORTANT: Avoid Damage! Do Not use solvents to remove abrasives from cylinder wall.



LVAL21652 —UN—09APR12

8. Wash the cylinder with hot, soapy water and rinse with clean water. Wipe dry with a clean, lint free white cloth until the cloth shows no sign of discoloration. Apply clean engine oil to the cylinder after cleaning.

9. Position each ring (one at a time) near the bottom of the cylinder bore, use a piston to square the ring in the cylinder.

IMPORTANT: Avoid Damage! Piston ring end gap must be checked, even when using new rings.

10. Measure gap between ends of ring. If greater than specification for top and second ring gap and for the oil ring gap, replace the entire set of rings. If new, obtain the proper size rings.

Specification

Piston Ring Top, Second—End Gap ..... 1.2 mm (0.05 in.)

Piston Ring - Oil—End Gap ..... 1.5 mm (0.06 in.)

MX52301,000032B -19-17JUL14-4/5

11. Measure cylinder bore parallel with crankshaft and at right angles to crankshaft. Measure at the top, middle, and bottom of the ring travel.

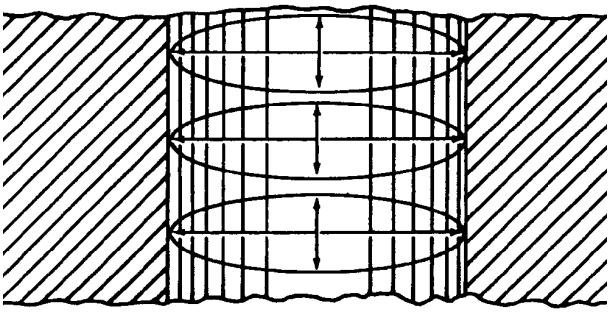
12. Replace crankcase or rebore cylinder if not within service limits.

Specification

Cylinder Bore—ID - Standard ..... 75.98—76.00 mm (2.991—2.992 in.)

Cylinder Bore—ID - Wear Limit ..... 76.07 mm (2.995 in.)

Cylinder Bore - 0.50 mm (0.0197 in.) Over Size—Diameter ..... 76.50 mm (3.012 in.)



LVAL21653 —UN—09APR12

Cylinder Bore - (Over Size) Wear Limit—Diameter ..... 76.57 mm (3.014 in.)

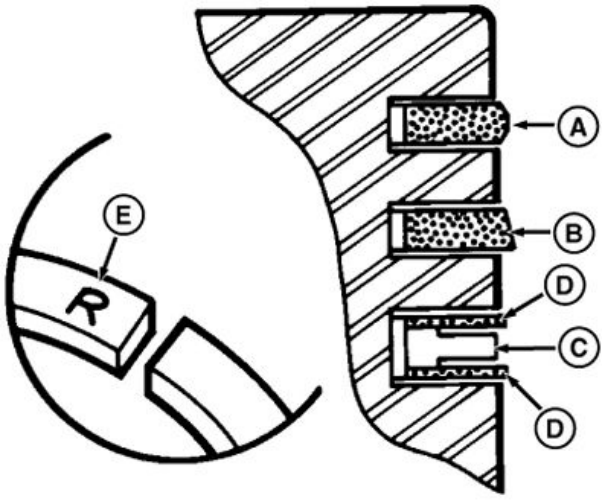
MX52301,000032B -19-17JUL14-5/5

Piston Ring Installation

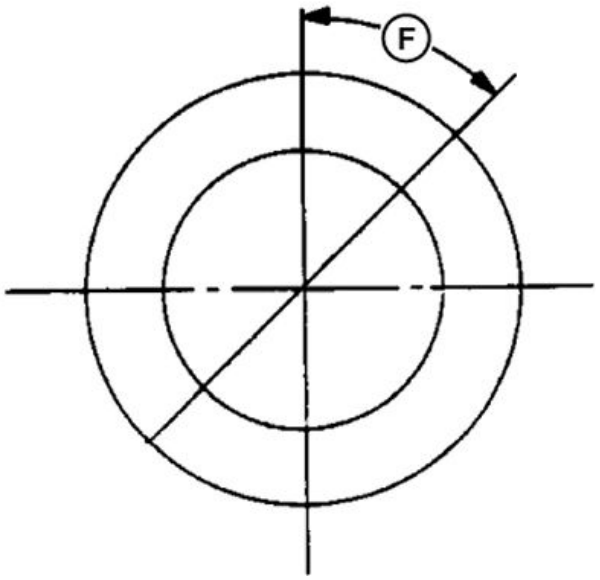
IMPORTANT: Avoid Damage! Be sure that the piston has been properly cleaned, inspected and the correct size rings and pistons are obtained before proceeding with this procedure.

1. Install spacer (C) in the oil ring groove first and ensure the spacer ends butt together.
2. Install the steel rails (D) above and below the spacer with the end gaps positioned 180° apart.
3. Install chrome-plated top ring (A) and second ring (B) with the mark (E) facing up. Align the top ring and second ring end gaps 180° apart, the steel rail end gaps 180° apart and 45° apart (F) from the top ring end gap.

A—Chrome–Plated Top Ring
B—Second Ring
C—Spacer
D—Steel Rails
E—Piston Ring Mark
F—Gap Placement



MXT011532 —UN—17JUL14



MXT011533 —UN—17JUL14

MX52301,000032C -19-17JUL14-1/1

Cylinder Boring

Tips:

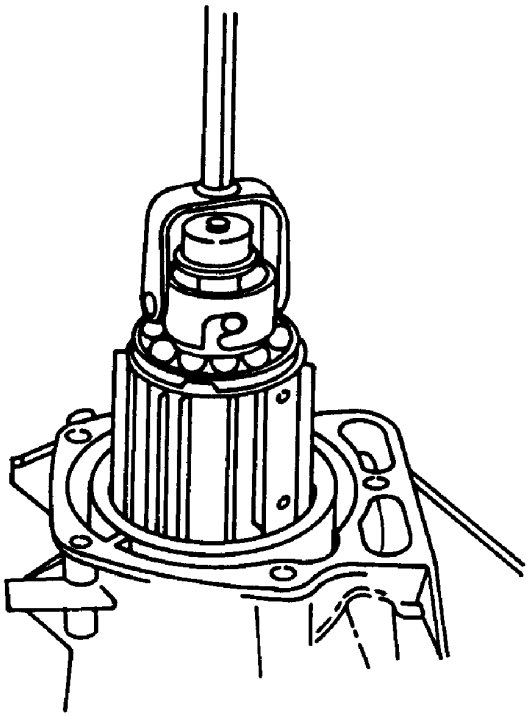
- Always resize to exactly 0.5 mm (0.02 in.) over the standard bore size. If resizing is done accurately, the stock oversize rings and pistons fit perfectly and the proper clearance is maintained.
- Resizing the cylinder bore can be done by a reliable repair shop or by using a drill press and honing tool. Machine bore the cylinder first to the initial bore diameter. Use a hone to hone out to finished dimension. Course finish using 600 then finish using 1000 grit stones.

Procedure:

1. Clean cylinder to remove burrs and any pieces of gasket that may be left after removing the head gasket.
2. Securely anchor the cylinder to the drill press table.
3. Align the center of the cylinder bore to the press center. Set press to operate at 200—250 rpm.
4. Connect the hone to the drive shaft. Set the stop on the drill press so the hone can only extend 20—25 mm (3/4—1.0 in.) above the top or below the bottom of the cylinder bore.
5. Rotate the adjusting nut (knob) on the hone until the stone just contacts the cylinder wall at the narrowest point. (If the hone cannot be turned by hand, it is too tight and must be loosened.)
6. Ensure that the hone and cylinder centers are aligned with the drill press and drive shaft centers. Pour honing oil inside the cylinder while honing. Start the drill press and move the hone up and down approximately 20 cycles per minute.
7. Check the diameter of the cylinder often during the honing process.

Bore Diameter—Specification

Cylinder Bore Initial (0.50 mm (0.02 in.) oversize)—Diameter.....76.46—76.48 mm (3.010—3.011 in.)



MXT012117 —UN—12JUN14

Cylinder Bore Final (0.50 mm (0.02 in.) oversize)—Diameter.....76.48—76.50 mm (3.011—3.012 in.)

8. Hone the cylinder until it is about 0.007—0.009 mm (0.0003—0.0004 in.) larger to allow for shrinkage when the cylinder cools.

IMPORTANT: Avoid Damage! Do Not use solvents to remove the abrasives from the cylinder wall.

9. Wash the cylinder with hot, soapy water and rinse with clean water. Wipe dry with a clean, lint free white cloth until the cloth shows no sign of discoloration. Apply clean engine oil to the cylinder after cleaning.

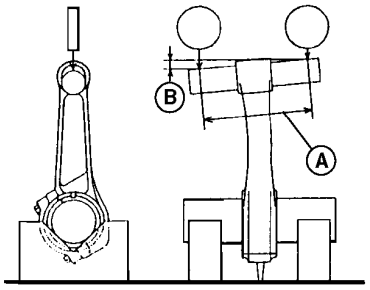
MX52301,000032D -19-13JUN14-1/1

Connecting Rod Bend and Twist Inspection

1. Select a shaft of the same diameter as the connecting rod big end, insert it and place the shaft on V-blocks that rest on a surface plate.
2. Select a shaft 100 mm (3.94 in.) long (A), the same diameter as the piston pin.
3. With the shafts installed and the connecting rod held vertically, measure the difference in height of the small end shaft above the surface plate over a 100 mm (3.94 in.) length. Determine the amount of bend (B) in the connecting rod. If the connecting rod bend exceeds the service limit, the connecting rod must be replaced.

Specification

Connecting Rod —Bend
- Service Limit ..... 0.15 mm (0.006 in.)



LVAL21657 —UN—09APR12

A—Shaft **B—Bend**

MX52301,000032E -19-17JUL14-1/2

4. With the big end still on the V-blocks, hold the connecting rod horizontally and measure the amount that the small end shaft varies from being parallel with the surface plate over a 100 mm (3.94 in.) length (C) of the shaft to determine the amount of connecting rod twist.

Specification

Connecting Rod —Twist -
Service Limit ..... 0.15 mm (0.006 in.)

5. Measure the connecting rod big end width, if less than service limits, replace connecting rod.

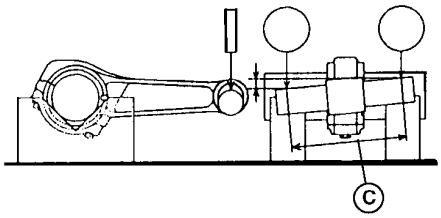
Specification

Connecting Rod —Width
- Service Limit ..... 21.20 mm (0.83 in.)

6. Assemble the connecting rod and end cap and tighten end cap screws to specification.

Specification

Connecting Rod Cap Screw—Torque ..... 21 N·m (186 lb.-in.)



LVAL21658 —UN—09APR12

C—Surface Plate

7. Measure inside diameter of the big end at several points. If larger than service limit, replace connecting rod.

Specification

Connecting Rod End—ID
- Service Limit ..... 34.06 mm (1.341 in.)

MX52301,000032E -19-17JUL14-2/2

Crankshaft Inspection

1. Measure the crankshaft pin journal (B) at several points. If less than specification, replace crankshaft.

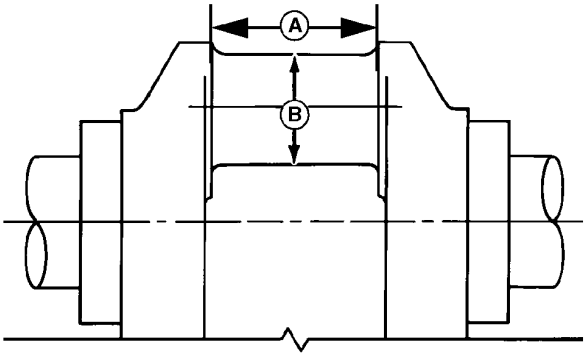
Specification

Crank Pin Journal—OD—Service Limit ..... 33.93 mm (1.3358 in.)

2. Measure the crankshaft pin width (A). If greater than specification, replace crankshaft.

Specification

Crank Pin—Width—Service Limit ..... 44.5 mm (1.75 in.)



LVAL21659 —UN—09APR12

A—Crank Pin Width **B—Crank Pin Journal OD**

MX52301,00004A1 -19-23OCT14-1/4

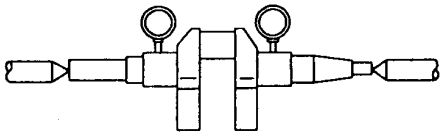
3. Set the crankshaft in alignment jig or on V-blocks. Place a dial gauge on both bearing journals.
4. Turn the crankshaft slowly and record the highest and lowest dial gauge readings. The difference between the highest and lowest readings (TIR), is the amount of runout. If the measurement exceeds specification, replace crankshaft.

Specification

Crankshaft Total Indicated—Runout—Service Limit ..... 0.05 mm (0.002 in.)

5. Measure inside diameter of the crankshaft journal bearing at several points on the crankcase. If greater than specification, replace journal bearing.

LVAL21660 —UN—09APR12



Specification

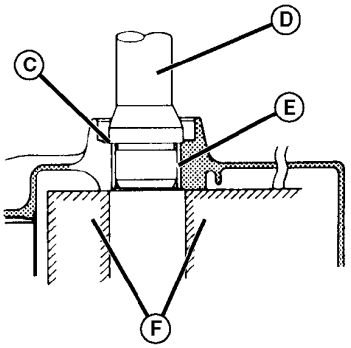
Crankshaft Bearing Journal —ID (Crankcase)—Service Limit ..... 34.11 mm (1.343 in.)

MX52301,00004A1 -19-23OCT14-2/4

Journal Bushing Replacement:

- Reinstall the service bushing using a bushing tool (D).
- Use a support block (F) under engine block.
- Coat the bushing (E) and flange surface (C) with a light film of oil, Press in the new bushing flush with the flange surface.
- No finish reaming is required.

C—Flange Surface **E—Bushing**
D—Bushing Tool **F—Support Block**



LVAL21661 —UN—09APR12

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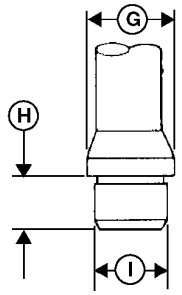
MX52301,00004A1 -19-23OCT14-3/4

To Design a Bushing Tool:



LVAL21662 —UN—09APR12

G—Bushing Tool Diameter
H—Bushing Tool Height
I— Bushing Tool Width

Item	Measurement	Specification
Bushing Tool Dimensions:		
(G) Bushing Tool	Diameter	40 mm (1.575 in.)
(H) Bushing Tool	Height	26 mm (1.024 in.)
(I) Bushing Tool	Width	33.8 mm (1.331 in.)

MX52301,00004A1 -19-23OCT14-4/4

Crankshaft Installation

IMPORTANT: Avoid Damage! Be sure that your work area is clean. Dirt in an engine shortens the life expectancy and result in expensive repairs. Use "lint free" shop rags and have plenty of clean engine oil available when assembling the engine.

1. Pack high temperature grease into the oil seal of crankcase.
2. Apply engine oil to the journal and bearing.
3. Carefully insert the crankshaft flywheel end into the main bearing and oil seal, being careful not to damage the oil seal.
4. Align crankshaft and camshaft timing marks. (See Tappet and Camshaft Installation.)
5. Install crankshaft woodruff key into the crankshaft taper.

BS62576,0000584 -19-16FEB21-1/1

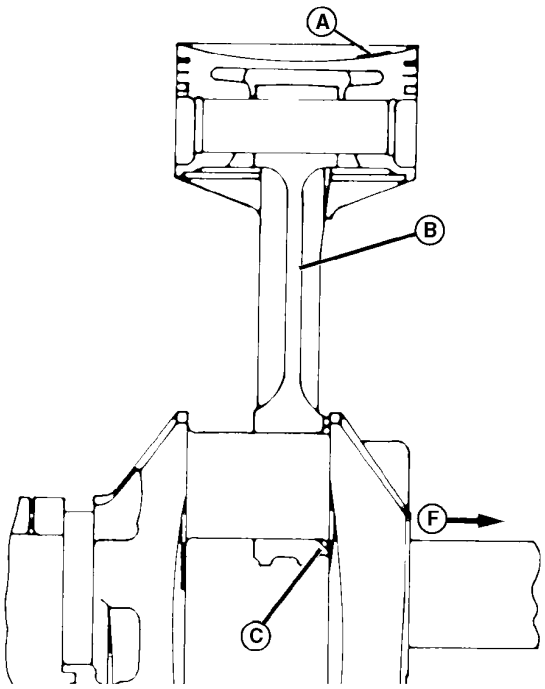
Connecting Rod Assembly and Installation

IMPORTANT: Avoid Damage! Be sure that your work area is clean. Dirt in an engine shortens the life expectancy and result in expensive repairs. Use "lint free" shop rags and have plenty of clean engine oil available when assembling the engine.

CAUTION: Avoid Injury! Never reuse piston pin snap rings. Removal weakens and deforms them.

1. Apply engine oil to piston pins and assemble pistons to connecting rods as follows.
   - Align arrow match mark (A) on No. 1 piston head with the raised letters "MADE IN JAPAN" (B) on connecting rod.
   - Align arrow match mark (A) on No. 2 piston head opposite the letters "MADE IN JAPAN" (B) on connecting rod.

A—Arrow Match Mark
B—Connecting Rod Lettering
C—Chamfer
F—Flywheel Side



LVAL21663 —UN—09APR12

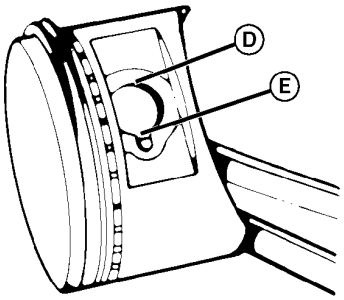
MX52301,0000330 -19-13JUN14-1/2

NOTE: Compress piston pin snap rings enough to install it and no more.

2. Install piston pin snap rings. Be sure snap ring opening (D) does not coincide with the notch (E) in the edge of the piston pin hole.
3. Apply engine oil to the piston skirt and the cylinder bore.

NOTE: Compress piston rings enough to install the pistons and no more. Lightly tap the piston with a plastic mallet.

4. Using a piston ring compressor, insert piston and connecting rod into cylinder (Arrow match mark (A) facing the flywheel (F) side).
5. Apply a light film of oil to cap bearing surface and cap screws. Install connecting rod cap with chamfer (C) facing crank web. Tighten cap screws alternately to specification.



LVAL21664 —UN—09APR12

D—Snap Ring Opening
E—Notch

Specification	
Connecting Rod Cap Screw—Torque	21 N·m (186 lb.-in.)

MX52301,0000330 -19-13JUN14-2/2

Tappet and Camshaft Installation

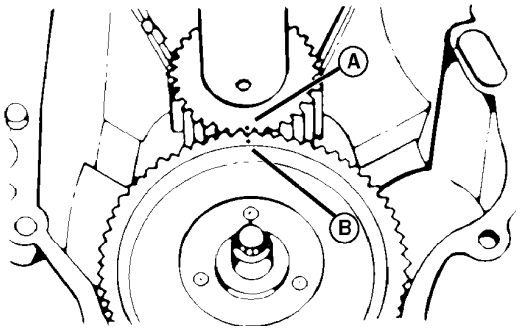
IMPORTANT: Avoid Damage! Be sure that your work area is clean. Dirt in an engine shortens the life expectancy and result in expensive repairs. Use "lint free" shop rags and have plenty of clean engine oil available when assembling the engine.

1. Lubricate and install tappets in their original positions.

   Apply Engine Oil To The Following:

   - Tappet Journal
   - Camshaft Journal
   - Cam Lobe Surface
   - Camshaft Gear.

2. Install camshaft and align the punch mark on crankshaft gear (A) with the projection on the cam gear (B).



LVAL21665 —UN—09APR12

A—Crank Gear Punch Mark **B—Cam Gear Projection**

MX52301,0000331 -19-13JUN14-1/1

Water Pump Removal and Installation

1. Park machine safely. See the "Safety Section".
2. Raise and secure cargo bed.

CAUTION: Avoid Injury! Touching hot surfaces can burn skin. The engine, components, and fluids are hot if the engine has been running. Keep hands and body away from hot surfaces when servicing or working near the engine and components. Allow engine to cool.

3. Place a suitable container below thermostat housing.

IMPORTANT: Avoid Damage! Allow engine and cooling system to cool completely.

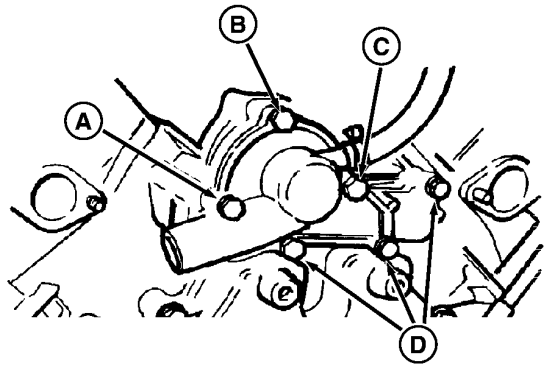
4. Loosen radiator cap to allow coolant to drain just below level of water pump assembly. See Radiator Drain Procedure — Gas.
5. Remove inlet and outlet hoses from water pump and remove cap screws and water pump assembly. Inspect parts for wear or damage and replace as necessary. See Water Pump Parts Inspection.

NOTE: Ensure water pump gear meshes with cam gear when aligning the pump for installation.

6. Replace gasket and position the pump onto the engine.
7. Install water pump bolts in positions shown and tighten to **specification in two increments**.

Initial Bolt Torques—Specification

First Increment M6
Bolts—Torque....8.5 N·m (75 lb.-in.)



MXT011088 —UN—12JUN14

A—Bolt (1) M6 X 75 mm (2.95 in.)
B—Bolt (1) M6 X 65 mm (2.56 in.)
C—Bolt (1) M8 X 70 mm (2.76 in.)
D—Bolt (3) M6 X 45 mm (1.77 in.)

First Increment M8
Bolt—Torque....20 N·m (195 lb.-in.)

Final Bolt Torques—Specification

Second Increment M6
Bolts—Torque....9.5 N·m (84 lb.-in.)

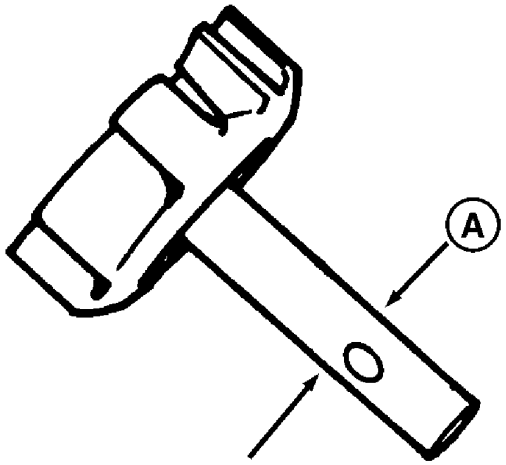
Second Increment M8
Bolt—Torque....25 N·m (222 lb.-in.)

MX52301,0000332 -19-13JUN14-1/1

Water Pump Parts Inspection

- Clean all metal parts in solvent and dry with compressed air.
- Clean all rubber and plastic parts with a mixture of detergent and water.
- Inspect the pump housing for damage. Mating surfaces should be smooth and free of burrs and nicks.
- Check the pump mechanical seal for damage. If damaged, coolant will leak from the pump body. Replace if necessary.
- Inspect the impeller for missing blades and corrosion. Measure the impeller shaft (A) at several points with a micrometer, **minimum shaft diameter is 9.94 mm (0.391 in.)**. If damage or wear is noted, replace all internal pump parts.

A—Impeller Shaft



MXT011089 —UN—12JUN14

MX52301,0000333 -19-13JUN14-1/1

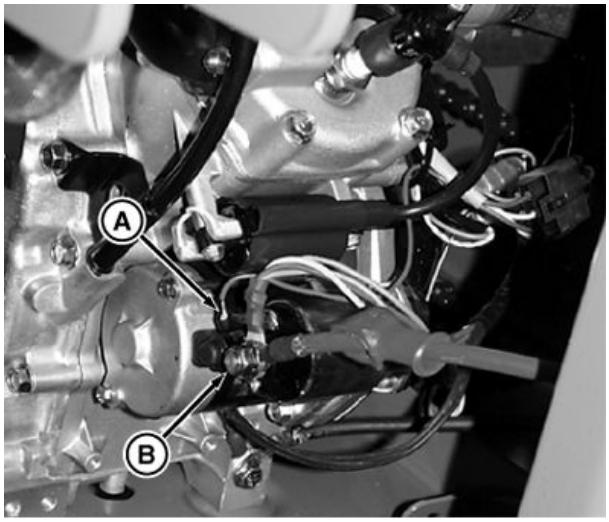
Starting Motor Removal and Installation

Removal:

1. Disconnect both the battery negative (-) and positive (+) cables from the battery.
2. Remove single (purple) wire connector (A) from starting motor solenoid.
3. Disconnect battery positive (+) cable and wire lead (B) from starting motor solenoid.

A—Purple Wire

B—Positive (+) Cable and Wire Lead



MXT011090 —UN—12JUN14

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MX52301,0000334 -19-13JUN14-1/2

4. Remove two M8x30 hex bolts (C) securing starting motor to engine block. Remove the starting motor.

Installation:

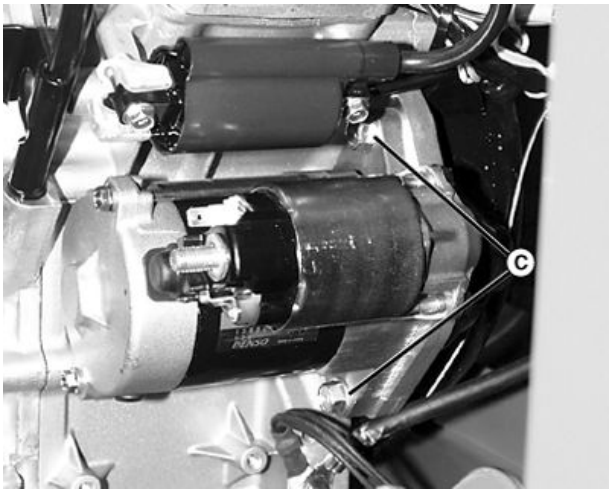
Installation is done in the reverse order of removal.

1. Place starting motor in engine frame, install mounting bolts and tighten to specification.

Specification	
Starting Motor to Engine Bolt—Torque	28 N·m (20 lb.-ft.)

2. Install wires to the proper terminals.
3. Install battery and connect positive (+) and negative (-) battery cables.

C—M8x30 Hex Bolt



LVAL21678 —UN—09APR12

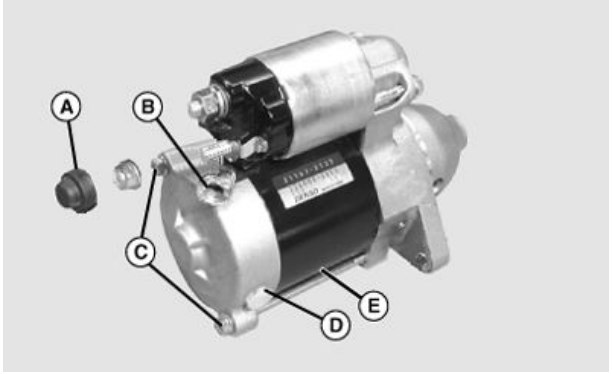
MX52301,0000334 -19-13JUN14-2/2

Starting Motor Disassembly and Inspection

Disassembly:

1. Remove cap (A) and hex nut securing field lead (B) to solenoid terminal. Remove field lead from terminal.
2. Remove two M5x100 flanged hex bolts (C).
3. Remove end cover (D) from field coil housing (E).

A—Cap
B—Field Lead
C—M5x100 Flanged Hex Bolt
D—End Cover
E—Field Coil Housing



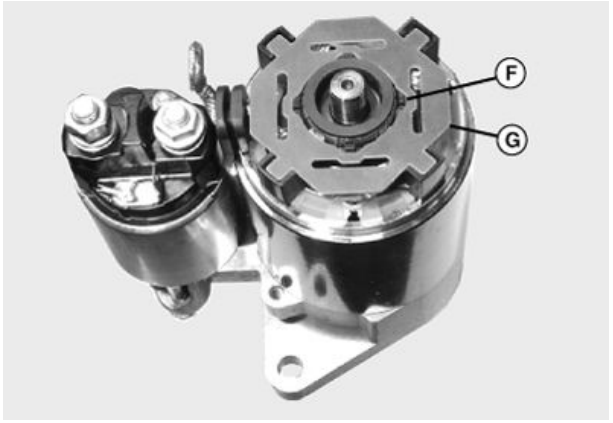
LVAL21679 —UN—09APR12

MX52301,0000335 -19-17JUL14-1/18

NOTE: Take care to retain the commutator brush springs when removing the brush insulator.

4. Press tabs (F) inward and carefully remove brush insulator (G) from field coil housing.

F—Tab
G—Brush Insulator



LVAL21680 —UN—09APR12

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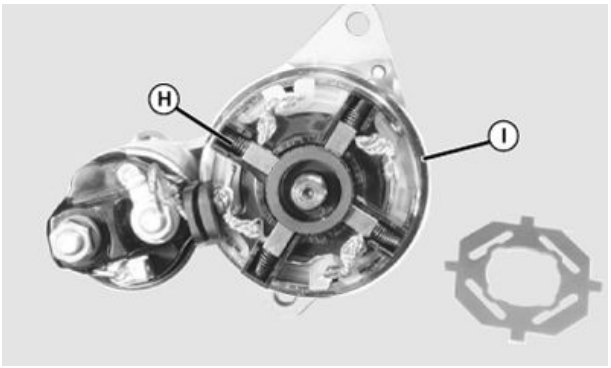
MX52301,0000335 -19-17JUL14-2/18

5. Remove and retain four brush springs (H).
6. Remove field coil housing (I) from armature and drive end housing.
7. Remove two M6 hex nuts securing starter solenoid (J) to drive end housing.
8. Withdraw solenoid assembly from housing sufficiently to clear mounting studs. Separate solenoid plunger (K) from shift fork, and remove solenoid.

NOTE: Tip the armature to ease passing the drive gear clutch through the drive end housing seal.

9. Remove armature (L) and shift fork (M) from drive end housing. Inspect shift fork for wear or damage. Replace if needed.

H—Brush Spring
I— Field Coil Housing
J— M6 Nut
K—Solenoid Plunger
L—Armature
M—Shift Fork



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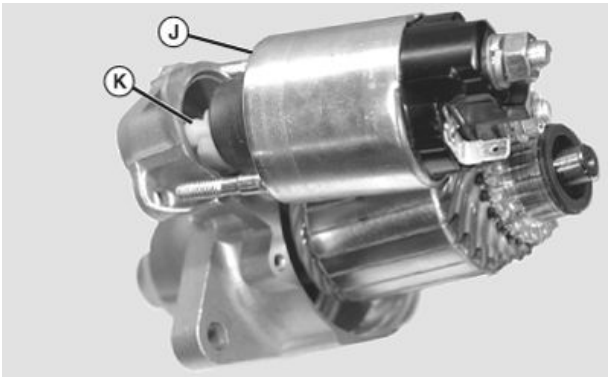

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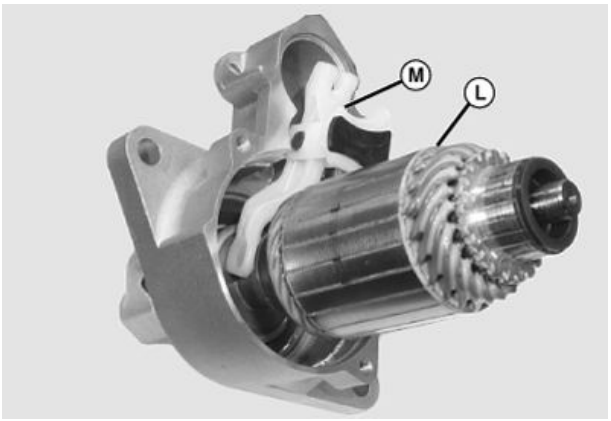

LVAL21683 —UN—09APR12

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MX52301,0000335 -19-17JUL14-3/18

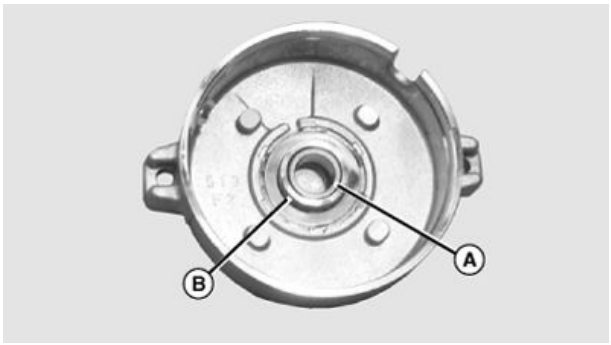
Inspection:

IMPORTANT: Avoid Damage! Do not clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a brush or an electrical contact cleaner.

With starting motor disassembled, clean and inspect components subject to wear and replace as needed.

1. Inspect end cover bushing (A). Replace if damaged or worn beyond specification.
2. Install new bushing flush with internal edge of bushing socket (B).
3. Ream new bushing to specification after installation.

Specification	
End Cover Bushing (Ream)—Diameter	11.02—11.04 mm (0.434—0.435 in.)



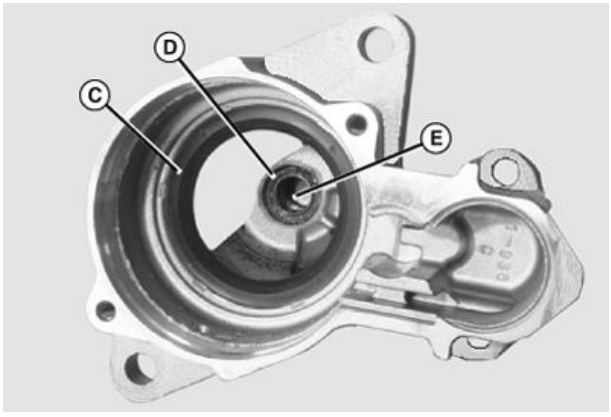
LVAL21684 —UN—09APR12

A—End Cover Bushing **B—Bushing Socket**

MX52301,0000335 -19-17JUL14-4/18

4. Inspect seal (C) for damage. Replace if needed.
5. Remove and retain thrust collar (D).
6. Inspect needle bearing (E) for damage. Replace if needed.

C—Seal
D—Thrust Collar
E—Needle Bearing

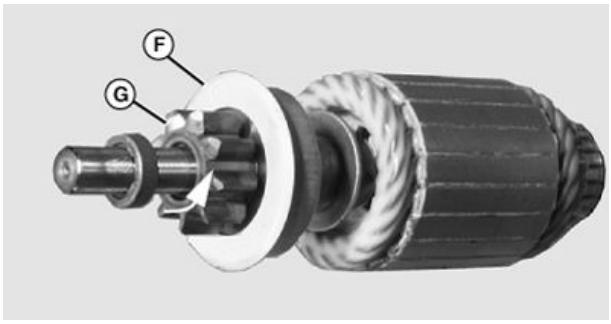


LVAL21685 —UN—09APR12

MX52301,0000335 -19-17JUL14-5/18

7. Test action of pinion gear over-running clutch (F). Pinion should turn freely in over-running direction (arrow) and must not slip in cranking direction.
8. Inspect pinion gear (G) for excessive wear or damage. Replace pinion clutch or gear as needed if damaged.

F—Pinion Gear Over–Running Clutch
G—Pinion Gear



LVAL21686 —UN—09APR12

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MX52301,0000335 -19-17JUL14-6/18

a. Press pinion stop collar (H) from retaining ring (I).

b. Pry retaining ring from pinion shaft.

c. Remove stop collar and pinion gear assembly.

d. Apply a small amount of grease to armature shaft helical gear (J).

e. Install pinion gear assembly to shaft.

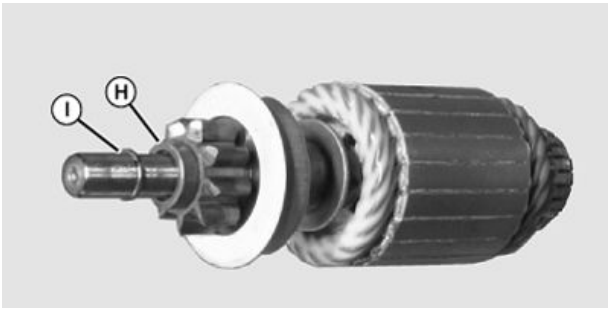
f. Install stop collar, with internal step facing away from pinion gear.

g. Install new retaining ring. Ensure that ring is seated in shaft groove (K).

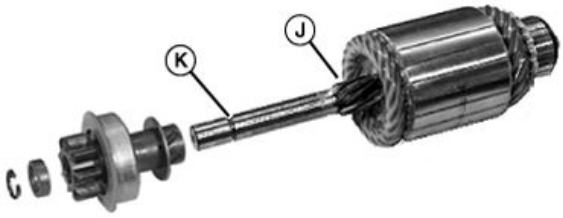
h. Press stop collar over retaining ring with pliers.

9. Clean and inspect armature. Service or replace armature as needed.

H—Pinion Stop Collar
I— Retaining Ring
J— Armature Shaft Helical Gear
K—Shaft Groove



LVAL21687 —UN—09APR12



LVAL21688 —UN—09APR12

LVAL21689 —UN—09APR12

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MX52301,0000335 -19-17JUL14-7/18

IMPORTANT: Avoid Damage! Do not clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a brush or an electrical contact cleaner.

a. Inspect armature surface (A). Look for signs of dragging against pole shoes. If contact is apparent, check armature bearing clearances.

b. Inspect commutator surface (B). Look for roughness, burned segments, or any material which might cause short circuits between segments.

IMPORTANT: Avoid Damage! Do not use emery cloth to polish the commutator surface. Metallic particles from the emery cloth may become lodged between and short out commutator segments.

c. If scored or dirty, polish commutator with fine sandpaper. Do not use emery cloth. Clean all dust from armature when finished.

d. If commutator is rough or out of round beyond specification, turn down or replace armature.

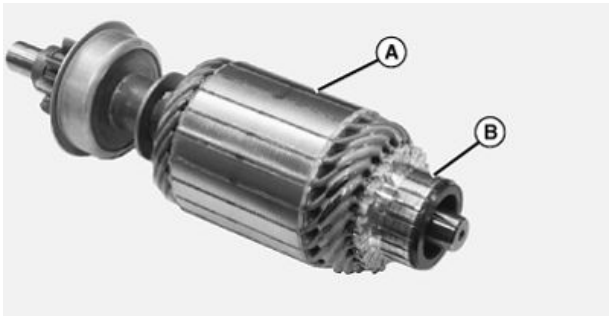
Specification

Starter Motor
Commutator—Runout
(maximum)..... 0.4 mm
(0.016 in.)

e. Ensure that commutator diameter remains within specification after being turned down.

Specification

Starter Motor
Commutator—Diameter
(minimum)..... 27 mm
(1.06 in.)



LVAL21690 —UN—09APR12

A—Armature Surface **B—Commutator Surface**

f. Ensure that undercut of insulation between segments is within specification after turning down commutator.

Specification

Starter Motor
Commutator
Undercut—Gap
(minimum)..... 0.2 mm
(0.008 in.)

Starter Motor
Commutator
Undercut—Gap
(nominal).....0.5—0.8 mm
(0.012—0.031 in.)

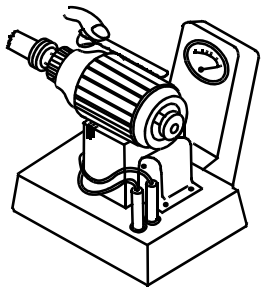
MX52301,0000335 -19-17JUL14-8/18

NOTE: Test armature windings using an ohmmeter or test light.

g. Test for short circuit in the windings using a growler. Put armature in a growler and hold a hacksaw blade above each slot while slowly rotating armature. If coil is shorted, the blade vibrates on the slot.

NOTE: A short circuit most often occurs because of copper dust or filings between two commutator segments.

h. If test indicates a short circuit in the windings, clean the commutator of dust and filings. Check the armature again. If the test still indicates a short circuit, replace the armature.



LVAL21691 —UN—09APR12

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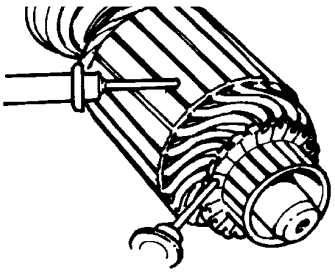
MX52301,0000335 -19-17JUL14-9/18

NOTE: Test for grounded windings using an ohmmeter or test light.

i. Armature windings are connected in parallel, so each commutator segment must be checked.

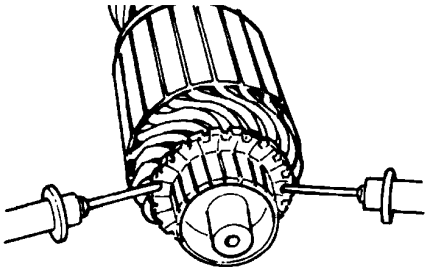
j. If the test shows continuity, a winding is grounded and the armature must be replaced.



LVAL21692 —UN—09APR12

MX52301,0000335 -19-17JUL14-10/18

k. Test for open circuits in the windings. If the test shows no continuity, the armature has an open circuit and must be replaced.



LVAL21693 —UN—09APR12

MX52301,0000335 -19-17JUL14-11/18

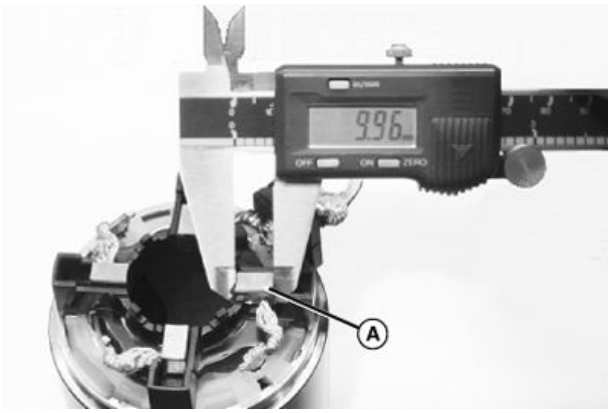
10. Inspect and test brushes, brush holder, and field coil housing.

a. Measure length of brushes (A). Replace brushes as a set if any brush is damaged or is less than minimum specified length.

Specification

Starter Motor Brush—Length (minimum)	6.0 mm (0.24 in.)

A—Brush



LVAL21694 —UN—09APR12

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MX52301,0000335 -19-17JUL14-12/18

b. There should be continuity with minimal resistance (close to 0 Ohms) between negative (-) brushes (B) and (E) and field coil housing (F).

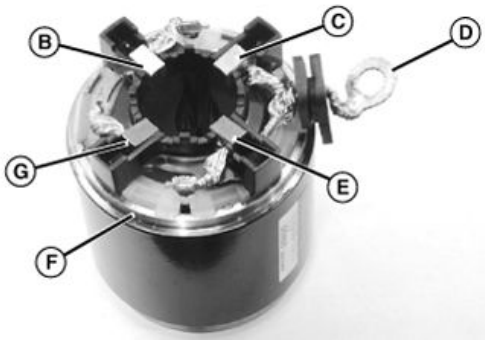
c. There should be continuity with minimal resistance between negative brushes (B) and (E).

d. There should be continuity between solenoid positive (+) connector (D) and field brushes (C) and (G).

e. There should be continuity with minimal resistance between field brushes (C) and (G).

f. There should be no continuity between positive (+) connector (D) and negative (-) brushes (B) or (E), or housing (F).

g. If any of these conditions are not met, replace the coil housing assembly.



LVAL21695 —UN—09APR12

B—Negative Brush
C—Field Brush
D—Solenoid Positive (+) Connector
E—Negative Brush
F—Field Coil Housing
G—Field Brush

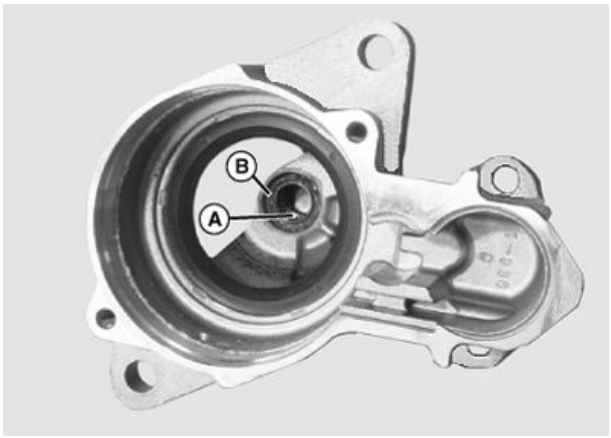
MX52301,0000335 -19-17JUL14-13/18

Assembly:

Assembly is done in the reverse order of disassembly.

1. Apply a small amount of grease to drive housing needle bearing (A).
2. Insert thrust collar (B) into housing bearing recess with stepped side of collar facing away from bearing.

A—Needle Bearing
B—Thrust Collar



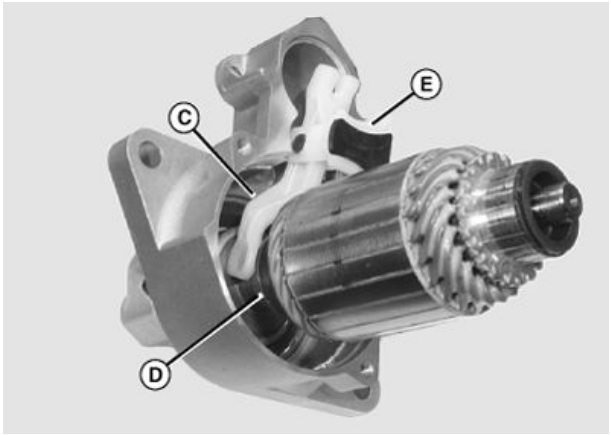
LVAL21696 —UN—09APR12

MX52301,0000335 -19-17JUL14-14/18

NOTE: Tip the armature to ease insertion of the pinion clutch through the housing seal.

3. Partially install armature to housing, passing pinion clutch through housing seal.
4. Install shift fork (C) to pinion shift collar. Ensure that shift fork is installed to clutch side of shift collar flange (D).
5. Insert armature fully into housing, fitting shift fork pivot (E) to recess in housing.

C—Shift Fork
D—Shift Collar Flange
E—Shift Fork Pivot



LVAL21697 —UN—09APR12

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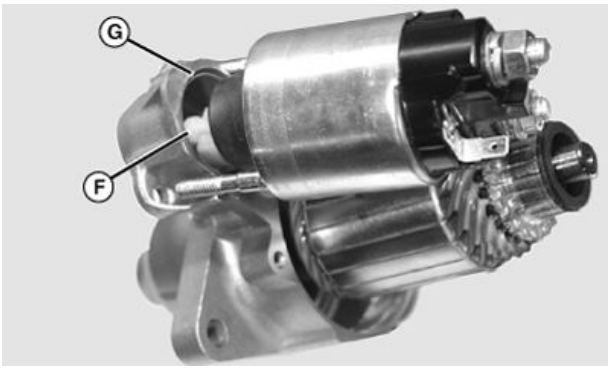
NOTE: Install the solenoid with the shorter solenoid terminal stud on the armature side.

6. Fit solenoid plunger (F) to shift fork.
7. Install solenoid to housing, ensuring that plunger boot fits into housing recess (G).
8. Secure solenoid with two M6 hex nuts and tighten to specification.

Specification

Starter Solenoid Retaining Nut—Torque ..... 11 N·m (97 lb.-in.)



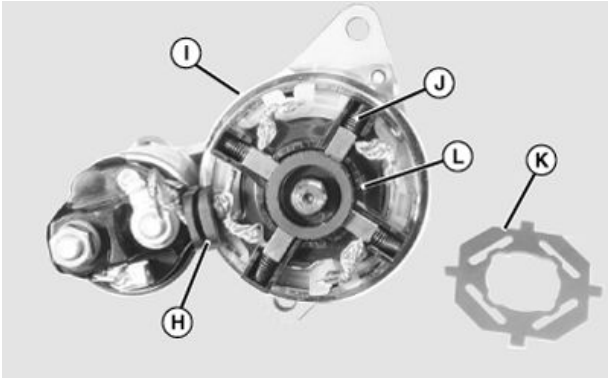
LVAL21698 —UN—09APR12

F—Solenoid Plunger **G—Housing Recess**

MX52301,0000335 -19-17JUL14-16/18

9. Ensure that coil lead insulator (H) is installed over brush housing locating tab.
10. Install coil housing (I) over armature, fitting notch at base of housing over shift fork pivot.
11. Insert four brush springs (J) behind brushes.
12. Install insulator (K) over brushes, securing insulator with locking tabs (L) on brush holder.

H—Coil Lead Insulator
I— Coil Housing
J— Brush Spring
K—Insulator
L—Locking Tab



LVAL21699 —UN—09APR12

MX52301,0000335 -19-17JUL14-17/18

13. Install end cap (M), ensuring that cap notch fits into coil lead insulator. Secure cap with two M5x100 hex bolts (N) and tighten to specification.

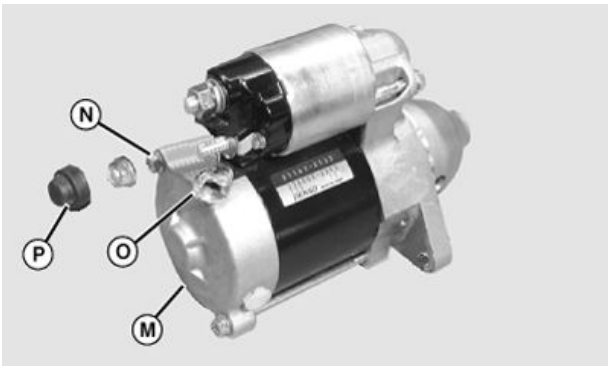
Specification

Starter Through Bolt—Torque ..... 6 N·m (54 lb.-in.)

14. Install coil winding lead (O) over solenoid terminal stud. Secure with M8 hex nut and tighten to specification. Install insulating cap (P) over nut.

Specification

Starter Motor Solenoid Terminal Nut—Torque ..... 28 N·m (20 lb.-ft.)



LVAL21700 —UN—09APR12

M—End Cap
N—M5x100 Hex Bolt
O—Coil Winding Lead
P—Insulating Cap

MX52301,0000335 -19-17JUL14-18/18

Section 40
Engine - Diesel

Contents

Continued on next page

Engine Specifications

Make ..... Yanmar
Model 3TNE68
Injection Type ..... Indirect
Type ..... 4-Cycle Diesel
Number of Cylinders 3
Firing Order ..... 1 - 3 - 2
Direction of Rotation ..... Counterclockwise (viewed from flywheel)
Compression Ratio 23:1
Oil Filter Type ..... Spin On
Cooling System ..... Liquid
Governor ..... Centrifugal

Item	Measurement	Specification
Bore	Diameter	68 mm (2.67 in.)
Stroke	Distance	72 mm (2.84 in.)
Displacement	Volume	0.784 L (47.84 cu. in.)
Oil Capacity With Filter (Approximately)	Volume	2.2 L (2.3 qt.)
Oil Capacity Without Filter (Approximately)	Volume	2.0 L (2.1 qt.)
Cooling Capacity	Volume	5 L (5.2 qt.)
Engine Speed (No-Load)	Low Idle	1025—1075 rpm
	High Idle	3625—3675 rpm

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Fuel System

System Type ..... Indirect Injection
Injection Pump ..... In-Line With Electric Shutoff Solenoid
Fuel Type ..... Diesel
Fuel Filter ..... Fuel Water Separator with Disposable Paper Element

Item	Measurement	Specification
Fuel Tank Capacity	Volume	20.0 L (5.25 gal.)

MX52301,000033A -19-18JUN14-1/1

Repair Specifications

Item	Measurement	Specification
Rocker Arm Shaft		
Standard	OD	9.97—9.99 mm (0.3925—0.3933 in.)
Wear Limit	OD	9.95 mm (0.3920 in.)
Rocker Arm and Shaft Support		
Rocker Arm and Shaft Support	Clearance	0.14 mm (0.005 in.)
Standard	ID	10.00—10.02 mm (0.3937—0.3945 in.)
Wear Limit	ID	10.09 mm (0.3972 in.)
Push Rod	Bend (maximum)	0.03 mm (0.001 in.)
Cylinder Head		
Piston-to-Cylinder Head	Clearance	0.45—0.75 mm (0.018—0.029 in.)
Head	Distortion (maximum)	0.05 mm (0.002 in.)
Intake and Exhaust Valves		
Intake Valve Seat	Width	1.15 mm (0.045 in.)
Intake Valve Seat	Width (maximum)	1.65 mm (0.065 in.)
Exhaust Valve Seat	Width	1.41 mm (0.056 in.)
Exhaust Valve Seat	Width (maximum)	1.91 mm (0.075 in.)
Valve Seat Surface Angles		
Exhaust Valve	Angle	45°
Intake Valve	Angle	30°
Lower Seat Surface	Angle	70°
Upper Seat Surface	Angle	15°
Valve Faces		
Minimum Margin	Distance	0.50 mm (0.020 in.)
Exhaust	Angle	45°
Intake	Angle	30°
Intake Valve Stem	OD	5.46—5.48 mm (0.2149—0.2157 in.)
Intake Valve Stem	OD (minimum)	5.40 mm (0.2126 in.)

Continued on next page

Item	Measurement	Specification
Exhaust Valve Stem	OD	5.44—5.46 mm (0.2142—0.2149 in.)
Exhaust Valve Stem	OD (minimum)	5.40 mm (0.2126 in.)
Valve Recession Intake	Recess	0.30—0.50 mm (0.012—0.020 in.)
Valve Recession Exhaust	Recess	0.75—0.95 mm (0.030—0.037 in.)
Valve Guides		
Standard	ID	5.50—5.52 mm (0.216—0.217 in.)
Wear Limit	ID	5.58 mm (0.220 in.)
Valve Guide	Clearance (maximum)	0.18 mm (0.007 in.)
Valve Guide	Height	7.00 mm (0.276 in.)
Valve Springs		
Valve Spring Free	Length (minimum)	28 mm (1.102 in.)
Valve Spring Inclination	Length (maximum)	0.80 mm (0.032 in.)
Connecting Rod Bearing Big End		
Connecting Rod Bearing	ID	35.970—35.980 mm (1.416—1.417 in.)
Connecting Rod Bearing	ID(minimum)	35.91 mm (1.414 in.)
Connecting Rod	Clearance (maximum)	0.16 mm (0.006 in.)
Piston Ring Grove Clearance		
First Compression Ring	Clearance	0.060—0.100 mm (0.002—0.004 in.)
Second Compression Ring	Clearance	0.090—0.125 mm (0.004—0.005 in.)
Oil Ring	Clearance	0.020—0.055 mm (0.0008—0.0022 in.)
Wear Limit All Rings	Clearance (maximum)	0.20 mm (0.0079 in.)
Piston Rings End Gap		
First Compression Ring and Oil Ring	End Gap	0.10—0.25 mm (0.004—0.010 in.)
Second Compression Ring	End Gap	0.15—0.35 mm (0.006—0.014 in.)
Wear Limit	End Gap (maximum)	1.50 mm (0.059 in.)

Continued on next page

MX52301,000033B -19-23JUL14-2/6

Item	Measurement	Specification
Piston Pin		
Standard	OD	19.991—20.00 mm (0.787—0.788 in.)
Wear Limit	OD	19.975 mm (0.786 in.)
Piston Pin to Bore	Clearance	0.045 mm (0.0018 in.)
Piston Bore	ID	20.00—20.008 mm (0.7874—0.7877 in.)
Piston Bore	ID (maximum)	20.02 mm (0.7882 in.)
Piston Pin to Bore	Clearance	0.110 mm (0.0043 in.)
Piston Pin Bushing	ID	20.025—20.038 mm (0.788—0.789 in.)
Piston Pin Bushing	ID (maximum)	20.10 mm (0.781 in.)
Piston		
Piston	OD	67.940—67.970 mm (2.675—2.676 in.)
Piston	OD (minimum)	67.90 mm (2.673 in.)
0.25 mm (0.010 in.) Oversize Piston	OD	68.19—68.22 mm (2.685—2.686 in.)
Cylinder Bore		
Cylinder Bore	ID	68.00—68.03 mm (2.677—2.678 in.)
Cylinder Bore	ID (maximum)	68.20 mm (2.685 in.)
0.25 mm (0.010 in.) Oversize Bore	ID	68.25—68.28 mm (2.687—2.688 in.)
0.25 mm (0.010 in.) Oversize Bore	ID (maximum)	68.453 mm (2.695 in.)
Deglazing	Angle	30—40° Cross-hatch Pattern
Reboring	Angle	30—40° Cross-hatch Pattern
Crankshaft and Main Bearings		
Crankshaft Maximum Bend	Distance	0.02 mm (0.001 in.)
Connecting Rod Journal	OD	35.97—35.98 mm (1.4161—1.4165 in.)
Connecting Rod Journal	OD (minimum)	35.91 mm (1.414 in.)
Main Bearing Journal	OD	39.97—39.98 mm (1.5736—1.5740 in.)

Continued on next page

MX52301,000033B -19-23JUL14-3/6

Item	Measurement	Specification
Main Bearing Journal	OD (minimum)	39.90 mm (1.5710 in.)
Main Bearing		
Main Bearing Oil	Clearance (minimum)	0.15 mm (0.0059 in.)
Main Bearing	ID	40.00—40.042 mm (1.575—1.577 in.)
Main Bearing	ID (maximum)	40.07 mm (1.578 in.)
Flywheel		
Flywheel Distortion	Flatness	0.2 mm (0.008 in.)
Camshaft		
Standard	Side Gap	0.05—0.25 mm (0.002—0.010 in.)
Camshaft	Bend (maximum)	0.02 mm (0.001 in.)
Camshaft Lobe	Height	29.97—30.03 mm (1.180—1.181 in.)
Camshaft Lobe	Height (minimum)	29.75 mm (1.171 in.)
Journal Gear Housing and Flywheel Ends	OD	35.94—35.96 mm (1.4150—1.4157 in.)
Journal Gear Housing and Flywheel Ends	OD (minimum)	35.85 mm (1.4114 in.)
Camshaft Bushing	Oil Clearance	0.18 mm (0.007 in.)
Camshaft Bushing	OD	36.00—36.065 mm (1.417—1.420 in.)
Camshaft Bushing	OD (maximum)	36.10 mm (1.421 in.)
Camshaft Oil	Clearance (maximum)	0.18 mm (0.007 in.)
Camshaft Bore	ID	36.00—36.025 mm (1.471—1.418 in.)
Camshaft Bore	ID (maximum)	36.10 mm (1.421 in.)
Intermediate Camshaft Journal	OD	35.91—35.94 mm (1.4138—1.4150 in.)
Intermediate Camshaft Journal	OD (minimum)	35.85 mm (1.4144 in.)
Cam Followers		
Standard	OD	17.950—17.968 mm (0.7067—0.7074 in.)

Continued on next page

Item	Measurement	Specification
Wear Limit	OD (minimum)	17.93 mm (0.706 in.)
Camshaft Follower to Bore	Clearance	0.032—0.068 mm (0.0013—0.0027 in.)
Camshaft Follower Bore	ID	18.000—18.018 mm (0.70887—0.7094 in.)
Camshaft Follower Bore	ID (maximum)	18.05 mm (0.711 in.)
Idler Gear		
Shaft	OD	19.959—19.980 mm (0.786—0.787 in.)
Shaft	Wear Limit	19.93 mm (0.785 in.)
Bushing	Clearance	0.15 mm (0.0059 in.)
Bushing	ID	20.00—20.021 mm (0.787—0.788 in.)
Bushing	ID (maximum)	20.08 mm (0.791 in.)
Oil Pump		
Rotor Shaft OD-to-Backing Plate ID	Clearance	0.013—0.043 mm (0.001—0.002 in.)
Rotor Shaft OD-to-Backing Plate ID	Clearance (maximum)	0.20 mm (0.0078 in.)
Rotor Wear Limit	Recess (maximum)	0.13 mm (0.005 in.)
Outer Rotor-to-Pump Body		
Outer Rotor-to-Pump Body	Clearance	0.10—0.16 mm (0.004—0.006 in.)
Outer Rotor-to-Pump Body	Clearance (maximum)	0.25 mm (0.010 in.)
Inner-to-Outer Rotor Wear Limit	Clearance	0.15 mm (0.0059 in.)
Oil Pressure Regulating Valve		
Spring Compressed	Length	14.70 mm (0.580 in.)
Compression Force	Force	12 N (2.7 lb.-force)
Spring Free	Length	21.90—24.50 mm (0.860—0.960 in.)
Fuel Injection Pump Camshaft		
Lobe	Height (minimum)	30.90 mm (1.217 in.)

Continued on next page

MX52301,000033B -19-23JUL14-5/6

Item	Measurement	Specification
Fuel Control and Governor Linkage		
Governor Shaft Bore	OD (Minimum)	7.90 mm (0.311 in.)
Governor Shaft Bore	ID (maximum)	8.15 mm (0.321 in.)
Governor Shaft Bore	Clearance	0.18 mm (0.007 in.)
Governor Shaft Bore Sleeve	ID (Maximum)	8.20 mm (0.323 in.)
Injection Pump Camshaft-to-Governor	OD (minimum)	7.90 mm (0.311 in.)
Injection Pump Camshaft-to-Governor	Clearance (maximum)	0.15 mm (0.006 in.)
Fuel Injection Nozzles		
Separator Plate Nozzle Contact Surface	Maximum Wear	0.10 mm (0.0039 in.)
Starting Motor Cover Bushing	ID	12.50—12.53 mm (0.492—0.493 in.)
Starting Motor Brush	Length (minimum)	7.70 mm (0.303 in.)

MX52301,000033B -19-23JUL14-6/6

Service Equipment and Tools

NOTE: Order tools according to information given in the ServiceGard™ Catalog. Some tools may be available from a local supplier.

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MX52301,0000338 -19-21APR14-1/24

Digital Tachometer.....JT05719	Check engine speed

MX52301,0000338 -19-21APR14-2/24

Compression Gauge Assembly.....JT01682	Used for cylinder compression check.

MX52301,0000338 -19-21APR14-3/24

Adapter..... JDG472	Used for radiator bubble test

MX52301,0000338 -19-21APR14-4/24

Belt Tension Gauge..... JDG529 or JDST28	Checks belt tension

Continued on next page

MX52301,0000338 -19-21APR14-5/24

Cooling System Pressure Pump..... D05104ST	Used for cooling system pressure test

MX52301,0000338 -19-21APR14-6/24

Radiator Pressure Test Kit (Adapters)..... JDG692	Used for cooling system pressure test

MX52301,0000338 -19-21APR14-7/24

Cooling System Pressure Pump..... D05104ST	Used for cooling system pressure tests

MX52301,0000338 -19-21APR14-8/24

Radiator Pressure Test Kit (Adapters)..... JDG692	Used for cooling system pressure tests

MX52301,0000338 -19-21APR14-9/24

Hose Assembly.....JT03017	Used for engine oil pressure test

MX52301,0000338 -19-21APR14-10/24

Connector.....JT03349	Used for engine oil pressure test

MX52301,0000338 -19-21APR14-11/24

Diesel Fuel Injection Nozzle Tester D01109AA	Used for fuel injection nozzle test

MX52301,0000338 -19-21APR14-12/24

Adapter Set.....D01110AA	Used for fuel injection nozzle test

MX52301,0000338 -19-21APR14-13/24

Straight Adapter.....23622	Used for fuel injection nozzle test

MX52301,0000338 -19-21APR14-14/24

Fuel Pump Pressure Test Kit (includes JDZ27, JTO3247 and JTO1609)..... JDG356	Used to clean fuel injection nozzle

MX52301,0000338 -19-21APR14-15/24

Pressure Gauge (0-15 psi) JDZ27	Used to clean fuel injection nozzle

MX52301,0000338 -19-21APR14-16/24

Reducer.....JTO3247	Used to clean fuel injection nozzle

MX52301,0000338 -19-21APR14-17/24

Hose Coupler.....JTO1609	Used to clean fuel injection nozzle

Continued on next page

MX52301,0000338 -19-21APR14-18/24

Clutch Center Distance Gauge..... JDG10358	Establish engine position and shims

MX52301,0000338 -19-21APR14-19/24

Valve Spring Compressor.....JDE138	Compresses valve springs

MX52301,0000338 -19-21APR14-20/24

Valve Guide Driver..... JDG504	Used to install valve guide

MX52301,0000338 -19-21APR14-21/24

Magnetic Follower Holder Kit.....D15001NU	Holds cam followers away from camshaft

MX52301,0000338 -19-21APR14-22/24

Clutch Removal Tool..... JDG1641	Used for removing clutch

MX52301,0000338 -19-21APR14-23/24

Nozzle Cleaning Kit JDF13	Used to clean fuel injection nozzle

MX52301,0000338 -19-21APR14-24/24

Torque Specifications

Item	Measurement	Specification
Rocker Arm		
Cover Bolt	Torque	11 N·m (97 lb.-in.)
Cover Special Nut	Torque	18 N·m (160 lb.-in.)
Mounting Cap Screw and Nut	Torque	26 N·m (226 lb.-in.)
Cylinder Head		
Mounting Head Cap Screw Torques		
First	Torque	13.6 N·m (120 lb.-in.)
Second	Torque	27 N·m (240 lb.-in.)
Final	Torque	41 N·m (363 lb.-in.)
Exhaust and Intake Manifolds		
Exhaust Mounting Cap Screw and Nut	Torque	11 N·m (97 lb.-in.)
Intake Mounting Cap Screw and Nut	Torque	11 N·m (97 lb.-in.)
Connecting Rod		
Cap Screw	Torque	25 N·m (220 lb.-in.)
Crankshaft Rear Oil Seal		
Seal Case-to-Block Cap Screw	Torque	11 N·m (97 lb.-in.)
Oil Pan-to-Seal Case Cap Screw	Torque	9 N·m (78 lb.-in.)
Crankshaft Main Bearings Cap Screws		
Drive Clutch to Crankshaft	Torque	37 N·m (26 lb.-ft.)
Main Bearing	Torque	54 N·m (40 lb.-ft.)
Flywheel		
Mounting Cap Screw	Torque	83 N·m (61 lb.-ft.)
Camshaft		
Thrust Plate Cap Screw	Torque	11 N·m (97 lb.-in.)
Timing Gear Cover		
Housing-to-Aluminum	Torque	9 N·m (78 lb.-in.)

Continued on next page

MX52301,000033C -19-23JUL14-1/2

Item	Measurement	Specification
Housing-to-Cast Iron	Torque	11 N·m (97 lb.-in.)
Crankshaft Pulley Cap Screw	Torque	115 N·m (85 lb.-ft.)
Oil Pan and Strainer Mounting Cap Screw		
Oil Pan-to-Block	Torque	11 N·m (97 lb.-in.)
Oil Pan-to-Seal Case	Torque	9 N·m (78 lb.-in.)
Oil Pan-to-Timing Gear	Torque	9 N·m (78 lb.-in.)
Oil Strainer-to-Block	Torque	11 N·m (97 lb.-in.)
Oil Pressure Regulating Valve		
Housing-to-Valve Body Retaining Nut	Torque	30 N·m (22 lb.-ft.)
Fuel System		
Fuel Injection Pump Mounting Nut	Torque	20 N·m (180 lb.-in.)
Fuel Injection Pump Camshaft Bearing Retaining Screw	Torque	20 N·m (180 lb.-in.)
Fuel Injectors		
Fuel Injection Pump Delivery Valve Fitting	Torque	42 N·m (31 lb.-ft.)
Mounting Nut	Torque	51 N·m (37 lb.-ft.)
Nozzle Fitting	Torque	40 N·m (30 lb.-ft.)
Nozzle	Torque	51 N·m (37 lb.-ft.)
Alternator—Nipondenso 40 Amp		
Flywheel Assembly-to-Coil Plate Assembly Nut	Torque	27 N·m (20 lb.-ft.)

MX52301,000033C -19-23JUL14-2/2

Checks Tests and Adjustment Specifications

Item	Measurement	Specification
Connecting Rod Side Play	Clearance	0.20—0.40 mm (0.0079—0.0157 in.)
Crankshaft	End Play	0.090—0.271 mm (0.004—0.011 in.)
Camshaft	End Play	0.05—0.25 mm (0.002—0.010 in.)
Coolant Temperature Switch (On Engine) Continuity	Temperature	108—110 °C (226—230 °F)
Connecting Rod Bearing	Clearance	0.033—0.059 mm (0.001—0.002 in.)
Connecting Rod Bearing	Clearance (maximum)	0.15 mm (0.0059 in.)
Crankshaft Main Bearing	Clearance	0.033—0.059 mm (0.001—0.002 in.)
Crankshaft Main Bearing	Clearance (maximum)	0.15 mm (0.0059 in.)
Valve Lift		
Intake	Lift	7.5 mm (0.300 in.)
Exhaust	Lift	7.5 mm (0.300 in.)
Valve	Clearance	0.15—0.25 mm (0.006—0.010 in.)
Timing Gear		
Crankshaft Gear	Backlash	0.04—0.12 mm (0.0016—0.0047 in.)
Camshaft Gear	Backlash	0.04—0.12 mm (0.0016—0.0047 in.)
Idler Gear	Backlash	0.04—0.12 mm (0.0016—0.0047 in.)
Fuel Injection Pump Drive Gear	Backlash	0.04—0.12 mm (0.0016—0.0047 in.)
Oil Pump Gear	Backlash	0.11—0.19 mm (0.0043—0.0075 in.)
Fuel Injection Nozzle		
Timing	Angle	15.5°—18.5°
Opening Pressure	Pressure	11242—12202 kPa (1630—1770 psi)
No Leakage for a Minimum of 10 seconds	Pressure	11 032 kPa (1600 psi)
Chatter and Spray Pattern at 11 242—12 202 kPa (1630—1770 psi) Slow Hand Lever Movement	Chatter	Fine Stream Spray Pattern

Continued on next page

MX52301,000033D -19-22OCT14-1/2

Item	Measurement	Specification
Chatter and Spray Pattern at 11 242—12 202 kPa (1630—1770 psi) Fast Hand Lever Movement	Chatter	Fine Atomized Spray Pattern
Thermostat		
Begin Opening	Temperature	71 °C (160 °F)
Fully Open	Temperature	85 °C (184 °F)
Thermostat Lift Above 85 °C (184 °F)	Lift (minimum)	8.0 mm (0.310 in.)
Starter No-Load Amp Draw/RPM		
Maximum Starter Amperage	Amperage	60 Amps at 7000 rpm
Minimum Starter rpm	Speed	7000 rpm
Water Pump and Alternator Drive Belt Applied	Force	98 N (22 lb.-force)
Water Pump and Alternator Drive Belt Deflection	Distance	10—15 mm (0.400—0.600 in.)
Operational Tests		
Radiator Bubble Test Air Pressure Into Cylinder	Pressure (maximum)	2248 kPa (355 psi)
Cooling System	Pressure (maximum)	117 kPa (15 psi)
Cooling System After 15 seconds	Pressure (minimum)	90 kPa (13 psi)
Radiator Cap Valve Opening	Pressure	83—96 kPa (12—14 psi)
Cylinder Compression	Pressure	3136—3336 kPa (454—484 psi)
Minimum Compression	Pressure	2448 kPa (355 psi)
Maximum Difference Between Cylinders	Pressure	490 kPa (71 psi)
Engine Oil Pressure at High Idle	Pressure	245—343 kPa (35—49 psi)
Fuel Pump	Flow Rate	118 cc/min. (4 oz./min.)
Minimum Fuel	Pressure	29 kPa (4.3 psi)
Accelerator Pedal Free Travel	Length	2—6 mm (0.080—0.240 in.)
Eyelet-to-Pedal Rod	Length	1—3 mm (0.039—0.118 in.)
Engine Idle Speed		
High Idle	Speed	3625—3675 rpm

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Item	Measurement	Specification
Fast Idle	Speed	1025—1075 rpm

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Other Material

Number	Name	Use
TY16021 (U.S.)/LOCTITE 17430/TY9484 (Canada) (U.S.®)	John Deere High-Flex Form-in-Place Gasket	Used to seal crankcase extension housing, rear oil seal case, and flywheel housing to engine block. Used to seal oil pan to timing gear housing and engine block. Applied to timing cover before installation.

Loctite is a trademark of Henkel Corporation

MX52301,0000339 -19-16MAY14-1/1

Specifications

Make ..... Yanmar
Model 3TNV70
Injection Type ..... Indirect
Type ..... 4-Cycle Diesel
Number of Cylinders 3
Firing Order ..... 1 - 3 - 2
Direction of Rotation ..... Counterclockwise (viewed from flywheel)
Combustion System ..... Indirect Injection Type
Compression Ratio 23.4: 1
Cooling System ..... Liquid
Governor ..... Centrifugal

General

Item	Measurement	Specification
General		
Cylinder Bore	Diameter	70 mm (2.76 in.)
Displacement	Volume	0.854 L (52.11 cu. in.)
High Idle	Speed	3625—3675 rpm
Slow Idle	Speed	1025—1075 rpm
Standard Compression (Minimum Cranking Speed 250 rpm)	Pressure	3432 kPa (498 psi)
Minimum Compression	Pressure	2746 kPa (398 psi)
Maximum Difference Between Cylinders	Pressure	245 kPa (36 psi)
Piston Stroke	Length	74 mm (2.91 in.)
Alternator Drive Belt Deflection	Length	10—15 mm (0.4—0.6 in.)
Water Pump and Alternator Drive Belt Tension	Force	98 N (22 lb.-force)
Cooling System		
Coolant Temperature Switch Closing	Temperature	110 °C (230 °F)
Cooling System	Pressure	88.2 kPa (12.8 psi)
Thermostat Fully Open	Temperature	85 °C (184 °F)
Thermostat Opening	Temperature	69.5—72.5 °C (157—163 °F)
Thermostat Minimum Lift Height above 85 °C (185 °F)	Lift	8 mm (0.315 in.)

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MX52301,000016B -19-22OCT14-1/10

Item	Measurement	Specification
Accelerator		
Accelerator Pedal Free Travel	Distance	2—6 mm (0.080—0.240 in.)
Accelerator Pedal-to-Stop Bolt	Gap	1—1-1/2 mm (0.039—0.059)
Eyelet-to-Pedal Rod	Gap	1—3 mm (0.039—0.118 in.)
Alternator		
Exposed Brush	Length (maximum)	10.5 mm (0.41 in.)
Exposed Brush	Length (minimum)	4.5 mm (0.17 in.)
Slip Ring (Minimum)	Diameter	14 mm (0.55 in.)
Gears		
All Gears	Backlash	0.06—0.12 mm (0.002—0.005 in.)
All Gears	Backlash (maximum)	0.14 mm (0.006 in.)
Idler Gear Shaft	OD	36.95—36.98 mm (1.455—1.456 in.)
Idler Gear Shaft	OD (minimum)	36.90 mm (1.452 in.)
Idler Gear Bushing	ID	37.0—37.025 mm (1.4567—1.4577 in.)
Idler Gear Bushing	Clearance	0.03—0.08 mm (0.001—0.003 in.)
Idler Gear Bushing Oil	Clearance	0.18 mm (0.007 in.)
Cam Follower	OD	20.93—20.96 mm (0.824—0.825 in.)
Cam Follower	OD (minimum)	20.90 mm (0.823 in.)
Cam Follower Bore	ID	21.00—21.02 mm (0.827—0.828 in.)
Cam Follower Bore	ID (maximum)	21.04 mm (0.828 in.)
Cam Follower-to-Bore Oil	Clearance	0.04—0.09 mm (0.002—0.004 in.)
Cam Follower-to-Bore Oil	Clearance (maximum)	0.13 mm (0.005 in.)
Oil Pump Outer Rotor and Timing Cover	Clearance	0.12—0.21 mm (0.005—0.008 in.)
Oil Pump Outer Rotor and Timing Cover	Clearance (maximum)	0.30 mm (0.012 in.)
Inner and Outer Rotors	Clearance	0.16 mm (0.006 in.)

Continued on next page

MX52301,000016B -19-22OCT14-2/10

Item	Measurement	Specification
Edge of Timing Gear Cover and Rotors	Clearance	0.02—0.07 mm (0.001—0.003 in.)
Edge of Timing Gear Cover and Rotors	Clearance (maximum)	0.12 mm (0.005 in.)
Rocker Arm and Shaft		
Rocker Arm Shaft	OD	11.97—11.98 mm (0.471—0.472 in.)
Rocker Arm Shaft	OD (minimum)	11.95 mm (0.470 in.)
Rocker Arm and Shaft Support	ID	12.00—12.02 mm (0.472—0.473 in.)
Rocker Arm and Shaft Support	ID (maximum)	12.09 mm (0.476 in.)
Rocker Arm	Oil Clearance	0.02—0.05 mm (0.001—0.002 in.)
Rocker Arm Oil	Clearance (maximum)	0.13 mm (0.005 in.)
Camshaft		
Camshaft Standard	End Play	0.05—0.15 mm (0.002—0.006 in.)
Camshaft Side	Gap	0.05—0.15 mm (0.002—0.006 in.)
Camshaft	Bend	0.00—0.02 mm (0.00—0.001 in.)
Camshaft	Bend (maximum)	0.05 mm (0.002 in.)
Camshaft Lobe	Height	34.14—34.27 mm (1.343—1.349 in.)
Camshaft Lobe	Height (minimum)	33.89 mm (1.334 in.)
Camshaft Bearing Journal Gear Side and Flywheel End	OD	39.94—35.96 mm (1.572—1.573 in.)
Camshaft Bearing Journal Gear Side and Flywheel End	OD (minimum)	39.91 mm (1.571 in.)
Intermediate Journal	OD	39.91—39.94 mm (1.571—1.572 in.)
Intermediate Journal	OD (minimum)	39.875 mm (1.570 in.)
Camshaft Bushing Standard	ID	40.0—40.08 mm (1.575—1.578 in.)
Camshaft Bushing Wear Limit	ID (maximum)	40.15 mm (1.580 in.)
Camshaft Bushing Oil	Clearance	0.04—0.14 mm (0.002—0.005 in.)
Camshaft Intermediate Bore Standard	Diameter	40.0—40.03 mm (1.575—1.576 in.)

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MX52301,000016B -19-22OCT14-3/10

Item	Measurement	Specification
Camshaft Flywheel-End Bore Standard	ID	40.0—40.03 mm (1.575—1.576 in.)
Camshaft Intermediate Bore Wear Limit	ID (maximum)	40.1 mm (1.579 in.)
Camshaft Flywheel-End Bore Wear Limit	Diameter	40.1 mm (1.579 in.)
Camshaft Intermediate Bore Oil	Clearance	0.07—0.12 mm (0.003—0.005 in.)
Camshaft Flywheel-End Bore Oil	Clearance	0.04—0.09 mm (0.002—0.003 in.)
Connecting Rod		
Connecting Rod Large End Bearing Standard	ID	41.98—42.00 mm (1.653—1.654 in.)
Connecting Rod Large End Bearing	Thickness	1.50—1.51 mm (0.0590—0.0594 in.)
Connecting Rod Large End Bearing	Clearance	0.02—0.06 mm (0.001—0.002 in.)
Connecting Rod Large End Bearing	Clearance (maximum)	0.11 mm (0.004 in.)
Connecting Rod Side Play	Clearance	0.20—0.40 mm (0.008—0.016 in.)
Crankshaft		
Crankshaft End Play	Clearance	0.11—0.25 mm (0.004—0.010 in.)
Connecting Rod Main Bearing Oil	Clearance	0.02—0.06 mm (0.001—0.002 in.)
Connecting Rod Main Bearing Oil	Clearance (maximum)	0.11 mm (0.004 in.)
Crankshaft Main Bearing	Clearance	0.02—0.05 mm (0.001—0.002 in.)
Crankshaft Main Bearing	Clearance (maximum)	0.12 mm (0.005 in.)
Crankshaft	Bend	0.02 mm (0.001 in.)
Crankshaft Connecting Rod Journal	OD	41.95—41.96 mm (1.6516—1.6519 in.)
Crankshaft Connecting Rod Journal	OD (minimum)	41.90 mm (1.647 in.)
Crankshaft Main Bearing Journal	OD	46.95—46.96 mm (1.848—1.849 in.)
Crankshaft Main Bearing Journal	OD (minimum)	46.90 mm (1.846 in.)
Main Bearing	ID	46.98—47.00 mm (1.849—1.85 in.)
Main Bearing Oil	Clearance	0.02—0.05 mm (0.001—0.002 in.)

Continued on next page

Item	Measurement	Specification
Main Bearing Oil	Clearance (maximum)	0.12 mm (0.005 in.)
Main Bearing Insert	Thickness	2.01 mm (0.079 in.)
Connecting Rods, Cylinder, and Pistons		
Cylinder Head	Distortion	0.05 mm or less (0.002 in. or less)
Cylinder Head Distortion Wear Limit	Distortion (maximum)	0.15 mm (0.006 in.)
Connecting Rod	Twist and Parallelism	0.00—0.03 mm per 100 mm (0.00—0.001 in. per 6 in.)
Connecting Rod	Twist and Parallelism (maximum)	0.08 mm per 100 mm (0.005 in. per 6 in.)
Standard-Size Piston	OD	69.96—69.99 mm (2.754—2.756 in.)
Standard-Size Piston	OD (minimum)	69.91 mm (2.752 in.)
Cylinder Bore	ID	70.01—70.02 mm (2.756—2.757 in.)
Cylinder Bore	ID (maximum)	70.20 mm (2.764 in.)
Piston-to-Cylinder	Clearance	0.03—0.05 mm (0.001—0.002 in.)
Cylinder Roundness	Out-of-Round	0.00—0.01 mm (0—0.000 in.)
Cylinder Roundness	Out-of-Round (maximum)	0.03 mm (0.001 in.)
Cylinder	Taper	0.00—0.01 mm (0.00—0.000 in.)
Cylinder	Taper (maximum)	0.03 mm (0.001 in.)
Cylinder Cross-hatch Pattern	Angle	30°—40°
Piston Pin		
Piston Pin-To-Piston	Oil Clearance	0.00—0.01 mm (0—0.0004 in.)
Piston Pin-To-Piston	Oil Clearance (maximum)	0.07 mm (0.003 in.)
Piston Pin	OD	22.00 mm (0.866 in.)
Piston Pin	OD (minimum)	21.97 mm (0.865 in.)
Piston Pin Bore	ID	22.00—22.01 mm (0.866—0.867 in.)
Piston Pin Bore	ID (maximum)	22.04 mm (0.868 in.)

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MX52301,000016B -19-22OCT14-5/10

Item	Measurement	Specification
Piston Pin Bore Oil	Clearance	0.03—0.05 mm (0.001—0.002 in.)
Piston Pin Bore Oil	Clearance (maximum)	0.11 mm (0.004 in.)
Piston Pin Connecting Rod Bushing	ID	22.03—22.04 mm (0.867—0.868 in.)
Bushing	ID (maximum)	22.07 mm (0.869 in.)
Piston Pin Connecting Rod Bushing Oil	Clearance	0.03—0.05 mm (0.001—0.002 in.)
Piston Pin Connecting Rod Bushing Oil	Clearance (maximum)	0.11 mm (0.004 in.)
Rear Journal		
Camshaft Gear and Flywheel	OD	39.94—39.96 mm (1.572—1.573 in.)
Camshaft Gear and Flywheel	OD (minimum)	39.91 mm (1.571 in.)
Camshaft Gear and Flywheel Oil	Clearance	0.04—0.09 mm (0.002—0.003 in.)
Thrust Bearing		
Insert	Thickness	1.93—1.98 mm (0.076—0.078 in.)
Top Piston Ring		
Groove	Width	1.55—1.57 mm (0.061—0.062 in.)
Ring	Width	1.47—1.49 mm (0.058—0.059 in.)
Side	Clearance	0.06—0.10 mm (0.002—0.004 in.)
Side	Clearance	0.20 mm (0.0079 in.)
Ring End	Gap	0.15—0.30 mm (0.006—0.012 in.)
Ring End	Gap (maximum)	0.39 mm (0.015 in.)
Second Piston Ring		
Groove	Width	1.54—1.56 mm (0.060—0.0614 in.)
Grove	Clearance	0.05—0.09 mm (0.002—0.0035 in.)
Ring	Thickness	1.47—1.49 mm (0.0579—0.0587 in.)
Ring End	Gap	0.18—0.33 mm (0.007—0.013 in.)
Ring End	Gap (maximum)	0.42 mm (0.017 in.)

Continued on next page

MX52301,000016B -19-22OCT14-6/10

Item	Measurement	Specification
Oil Control Ring		
Ring Groove	Width	3.01—3.03 mm (0.118—0.119 in.)
Ring	Clearance	0.02—0.06 mm (0.001—0.002 in.)
Side	Clearance (Minimum)	0.02—0.06 mm (0.001—0.002 in.)
Ring	Thickness	2.97—2.99 mm (0.117—0.118 in.)
Ring End	Gap	0.44 mm (0.017 in.)
Ring End	Wear Limit	0.15—0.35 mm (0.006—0.014 in.)
Fuel System		
Injection Timing	Angle	17°—19°
Fuel Injection Nozzle Opening	Pressure	11800—12800 kPa (1712—1856 psi)
Fuel Injection Nozzle Leakage 10 seconds at	Pressure	11 032 kPa (1650 psi)
Fuel Injection Nozzle Slow Hand Lever Movement	12 300—13 300 kPa (1784—1929 psi)	Chatter Sound with Fine Stream Spray Pattern
Fast Hand Lever Movement	Pattern	Fine Atomized Spray
Fuel Pump Flow Volume	Flow Rate	118 cc/min. (4 oz./min.)
Fuel Transfer Pump	Pressure (minimum)	29 kPa (4.3 psi)
Valve Guide		
Valve Guide	ID	6.0—6.01 mm (0.236—0.237 in.)
Valve Guide	ID (maximum)	6.08 mm (0.239 in.)
Intake Valve Guide-to-Valve Stem Oil	Clearance	0.03—0.05 mm (0.001—0.002 in.)
Exhaust Valve Guide-to-Valve Stem Oil	Clearance	0.04—0.07 mm (0.002—0.003 in.)
Valve Guide-to-Valve Stem Oil	Clearance (maximum)	0.17 mm (0.007 in.)
Valve Guide Installed	Height	9.8—10 mm (0.386—0.394 in.)
Valve Spring Free	Length	37.8 mm (1.488 in.)
Spring Inclination	Length (maximum)	1.3 mm (0.051 in.)
Valve Recession Intake and Exhaust	Recess	0.40—0.60 mm (0.016—0.024 in.)

Continued on next page

MX52301,000016B -19-22OCT14-7/10

Item	Measurement	Specification
Valve Recession Exhaust	Recess (maximum)	0.8 mm (0.031 in.)
Valve Recession Intake	Recess (minimum)	0.9 mm (0.035 in.)
Valve Stem Exhaust	OD	5.95—5.96 mm (0.234—0.235 in.)
Valve Stem Intake	OD	5.96—5.98 mm (0.234—0.235 in.)
Valve Stem Wear Limit	OD (minimum)	5.90 mm (0.232 in.)
Exhaust Valve Seat	Width	1.308—1.52 mm (0.051—0.060 in.)
Intake Valve Seat	Width	1.028—1.202 mm (0.041—0.047 in.)
Lower Seat Surface	Angle	70°
Upper Seat Surface	Angle	15°
Valve Seat	Clearance	0.15—0.25 mm (0.006—0.010 in.)
Valve	Lift	7.5 mm (0.300 in.)
Valve Face-Head Margin Exhaust	Width	1.0—1.2 mm 1.0—1.2 mm (0.039—0.047 in.)
Valve Face-Head Margin Intake	Width	0.9—1.1 mm (0.035—0.043 in.)
Valve Face-Head Margin	Width (minimum)	0.50 mm (0.02 in.)
Valve Grinding Face Angle	Angle	Intake 30° Exhaust 45°
Oil System		
Engine Oil With Filter	Capacity	2.2 L (2.3 qt.)
Engine Oil At Fast Idle	Pressure	245—343 kPa (35—49 psi)
Engine Oil At Slow Idle	Minimum	60 kPa (9 psi)
Oil Pressure Switch Open	Pressure	3—4 kPa (6—9 psi)
Torques		
Camshaft Cap Screws	Torque	11 N·m (97 lb.-in.)
Clutch Mounting Cap Screw	Torque	37 N·m (26 lb.-ft.)
Connecting Rod Cap Bolts	Torque	22.6—27.5 N·m (16.6—20.2 lb.-ft.)

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MX52301,000016B -19-22OCT14-8/10

Item	Measurement	Specification
Crankshaft Pulley Cap Screw	Torque	113—123 N·m (83—90 lb.-ft.)
Cylinder Head Bolts First (oil applied)	Torque	27 N·m (20 lb.-ft.)
Cylinder Head Bolts Final	Torque	54—58 N·m (40—43 lb.-ft.)
Engine Back Plate Mounting Cap Screw	Torque	49 N·m (36 lb.-ft.)
Exhaust Manifold to Cylinder Head Cap Screws	Torque	28 N·m (248 lb.-in.)
Fuel Injector Line Nuts	Torque	29.4—34.4 N·m (22—25 lb.-ft.)
Flywheel Mounting Cap Screws	Torque	80.4—86.4 N·m (59—63 lb.-ft.)
Fuel Injector	Torque	49—59 N·m (36—43 lb.-ft.)
Fuel Injector Nozzle Case Nut	Torque	29—49 N·m (21—36 lb.-ft.)
Fuel Return Line Nuts	Torque	24—33 N·m (18—24 lb.-ft.)
Glow Plugs	Torque	15—20 N·m (11—15 lb.-ft.)
Governor Weight Support Nut	Torque	69—74 N·m (51—55 lb.-ft.)
Injector Body	Torque	29—29 N·m (21—36 lb.-ft.)
Injector Gear Cover Cap Screws	Torque	9 N·m (80 lb.-in.)
Injector Pump Drive Gear Nut	Torque	58—68 N·m (43—50 lb.-ft.)
Injector Pump Mounting Nuts	Torque	22.5—28.4 N·m (17—21 lb.-ft.)
Main Bearing Cap Screws	Torque	75.5—81.5 N·m (55.6—60 lb.-ft.)
Main Bearing Cap Screws Minimum	Torque	54 N·m (40 lb.-ft.)
Timing Gear Housing Mounting Cap Screws	Torque	11 N·m (97 lb.-in.)
Muffler Mount Nuts	Torque	28 N·m (248 lb.-in.)
Muffler Support Bracket Cap Screws	Torque	22.5—28.4 N·m (17—21 lb.-ft.)
Oil Pan-to-Engine	Torque	25 N·m (221 lb.-in.)
Oil Pan-to-Timing Gear Housing	Torque	20 N·m (178 lb.-in.)

Continued on next page

MX52301,000016B -19-22OCT14-9/10

Item	Measurement	Specification
Oil Seal Case-to-Block Cap Screws	Torque	11 N·m (97 lb.-in.)
Oil Seal Case to Oil Pan Spacer Cap Screws	Torque	9 N·m (80 lb.-in.)
Oil Strainer Cap Screws	Torque	11 N·m (97 lb.-in.)
Oil Pump Mounting Cap Screws	Torque	25 N·m (221 lb.-in.)
Rear Oil Seal Case Cap Screws	Torque	83 N·m (61 lb.-ft.)
Rocker Arm Cover Bolt	Torque	11 N·m (97 lb.-in.)
Rocker Arm Support Bolt	Torque	26 N·m (226 lb.-in.)
Sheave Nut	Torque	69 N·m (51 lb.-ft.)
Starting Motor Mounting Bolts	Torque	28 N·m (20 lb.-ft.)
Stub Shaft-to-Flywheel Cap Screws	Torque	59 N·m (44 lb.-ft.)
Thermostat Housing Cap Screws	Torque	20 N·m (180 lb.-in.)
Timing Cover Cap Screws	Torque	9 N·m (80 lb.-in.)

MX52301,000016B -19-22OCT14-10/10

Service Equipment and Tools

NOTE: Order tools according to information given in the ServiceGard™ Catalog. Some tools may be available from a local supplier.

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MX52301,000016C -19-20JUN14-1/24

Digital Tachometer.....JT05719	Check engine speed

MX52301,000016C -19-20JUN14-2/24

Compression Gauge Assembly.....JT01682	Used for cylinder compression check.

MX52301,000016C -19-20JUN14-3/24

Adapter..... JDG472	Used for radiator bubble test

Continued on next page

MX52301,000016C -19-20JUN14-4/24

Belt Tension Gauge ..... JDG529 or JDST28	Checks belt tension

MX52301,000016C -19-20JUN14-5/24

Cooling System Pressure Pump..... D05104ST	Used for cooling system pressure test

MX52301,000016C -19-20JUN14-6/24

Radiator Pressure Test Kit (Adapters)..... JDG692	Used for cooling system pressure test

MX52301,000016C -19-20JUN14-7/24

Cooling System Pressure Pump..... D05104ST	Used for cooling system pressure tests

MX52301,000016C -19-20JUN14-8/24

Radiator Pressure Test Kit (Adapters)..... JDG692	Used for cooling system pressure tests

MX52301,000016C -19-20JUN14-9/24

Hose Assembly.....JT03017	Used for engine oil pressure test

MX52301,000016C -19-20JUN14-10/24

Connector.....JT03349	Used for engine oil pressure test

MX52301,000016C -19-20JUN14-11/24

Diesel Fuel Injection Nozzle Tester D01109AA	Used for fuel injection nozzle test

MX52301,000016C -19-20JUN14-12/24

Adapter Set.....D01110AA	Used for fuel injection nozzle test

MX52301,000016C -19-20JUN14-13/24

Straight Adapter.....23622	Used for fuel injection nozzle test

MX52301,000016C -19-20JUN14-14/24

Fuel Pump Pressure Test Kit (includes JDZ27, JTO3247 and JTO1609)..... JDG356	Used to clean fuel injection nozzle

MX52301,000016C -19-20JUN14-15/24

Pressure Gauge (0-15 psi) JDZ27	Used to clean fuel injection nozzle

MX52301,000016C -19-20JUN14-16/24

Reducer JTO3247	Used to clean fuel injection nozzle

Continued on next page

MX52301,000016C -19-20JUN14-17/24

Hose Coupler.....JTO1609	Used to clean fuel injection nozzle

MX52301,000016C -19-20JUN14-18/24

Clutch Center Distance Gauge..... JDG10358	Establish engine position and shims

MX52301,000016C -19-20JUN14-19/24

Valve Spring Compressor.....JDE138	Compresses valve springs

MX52301,000016C -19-20JUN14-20/24

Valve Guide Driver..... JDG504	Used to install valve guide

MX52301,000016C -19-20JUN14-21/24

Magnetic Follower Holder Kit.....D15001NU	Holds cam followers away from camshaft

MX52301,000016C -19-20JUN14-22/24

Clutch Removal Tool..... JDG1641	Used for removing clutch

MX52301,000016C -19-20JUN14-23/24

Nozzle Cleaning Kit JDF13	Used to clean fuel injection nozzle

MX52301,000016C -19-20JUN14-24/24

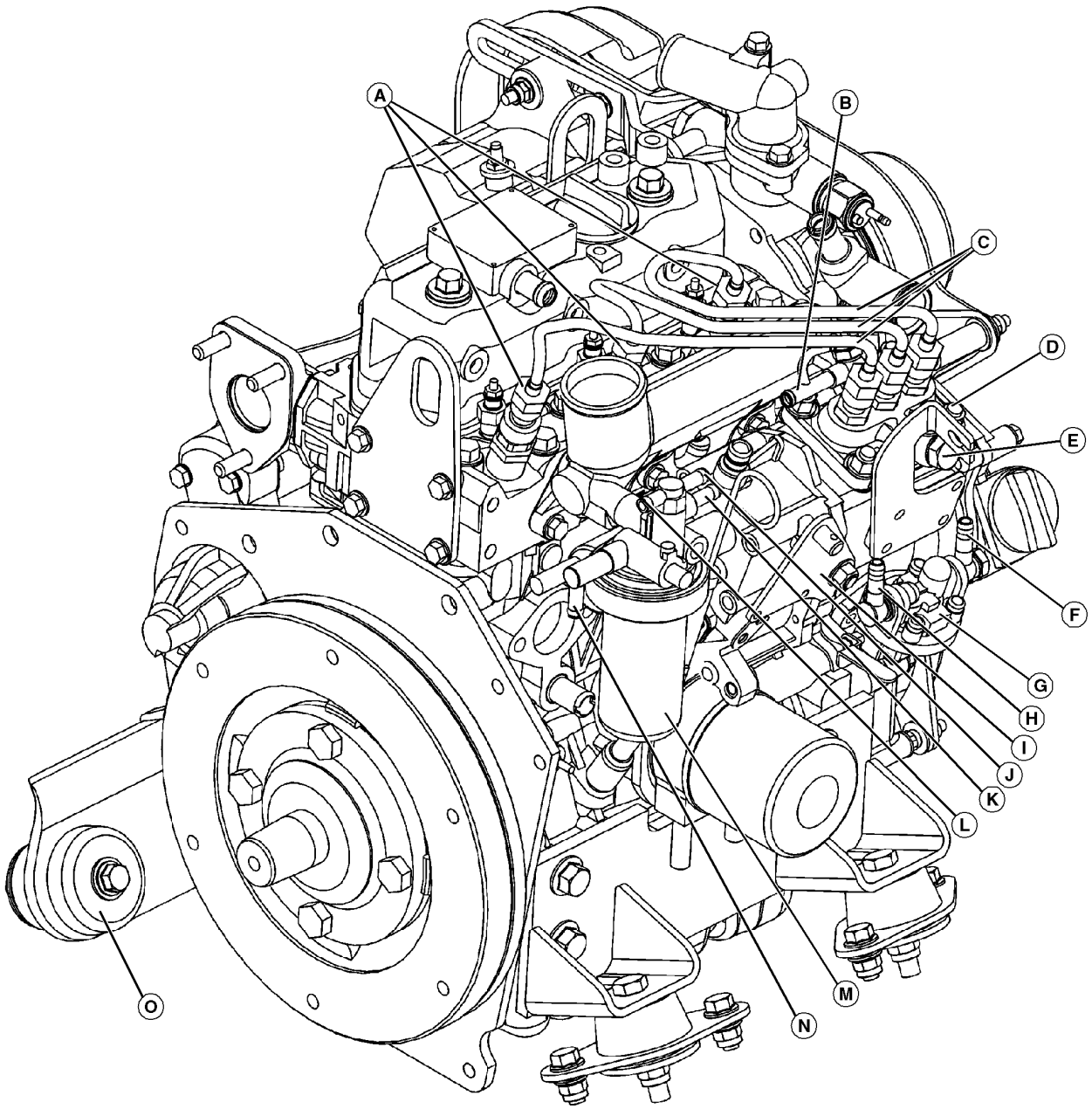
Other Material

Number	Name	Use
TY16021 (U.S.)/LOCTITE 17430/TY9484 (Canada) (U.S.®)	John Deere High-Flex Form-in-Place Gasket	Used to seal crankcase extension housing, rear oil seal case, and flywheel housing to engine block. Used to seal oil pan to timing gear housing and engine block. Applied to timing cover before installation.
LOCTITE 592 (U.S.®)	Pipe Sealant with TEFLON®	Seal pressure switch threads.
Red 0.050—0.15 mm (0.002—0.006 in.) (U.S.)	Plastigage®	Used to check connecting clearance.
		Used to check main bearing clearance.

Loctite is a trademark of Henkel Corporation
TEFLON is a trademark of DuPont Co.
Plastigage is a trademark of Perfect Circle Corporation

MX52301,000016D -19-17JUL14-1/1

Component Location



MXT010091 —UN—16JUN14

A—Fuel Injector Nozzles (3)
B—Fuel Outlet—Injection Pump to Filter (Air Bleed)
C—High-Pressure Fuel Injector Lines (3)
D—Fuel Injector Pump
E—Fuel Inlet—Filter to Injector Pump
F—Fuel Outlet—Transfer Pump to Filter
G—Fuel Transfer Pump
H—Fuel Inlet Line to Transfer Pump
I—Throttle Pivot Plate
J—Fuel Outlet—Filter to Injector Pump
K—Fuel Inlet—Injector Pump to Filter (Air Bleed)
L—Fuel Outlet—Fuel Filter to Tank
M—Fuel Filter—Water Separator
N—Fuel Inlet—Transfer Pump to Filter
O—Fifth Isolator

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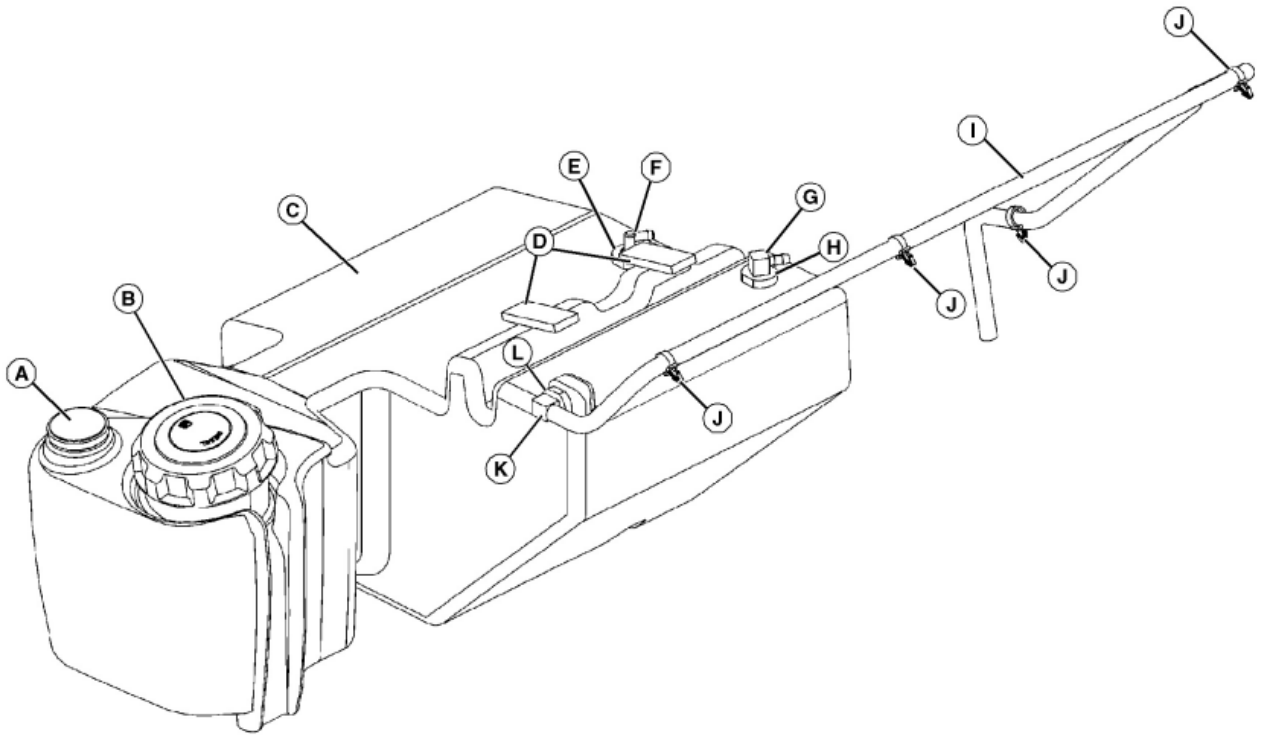
MX52301,000033F -19-22OCT14-1/4

Fuel System (SN -130000)



A—Fuel Gauge
B—Filter Cap
C—Fuel Tank
D—Pad (2)
E—Bushing
F—Pick Up Tube
G—Elbow Fitting
H—Bushing
I— Vent Hose
J—Retainer (3)
K—Elbow Fitting
L—Bushing

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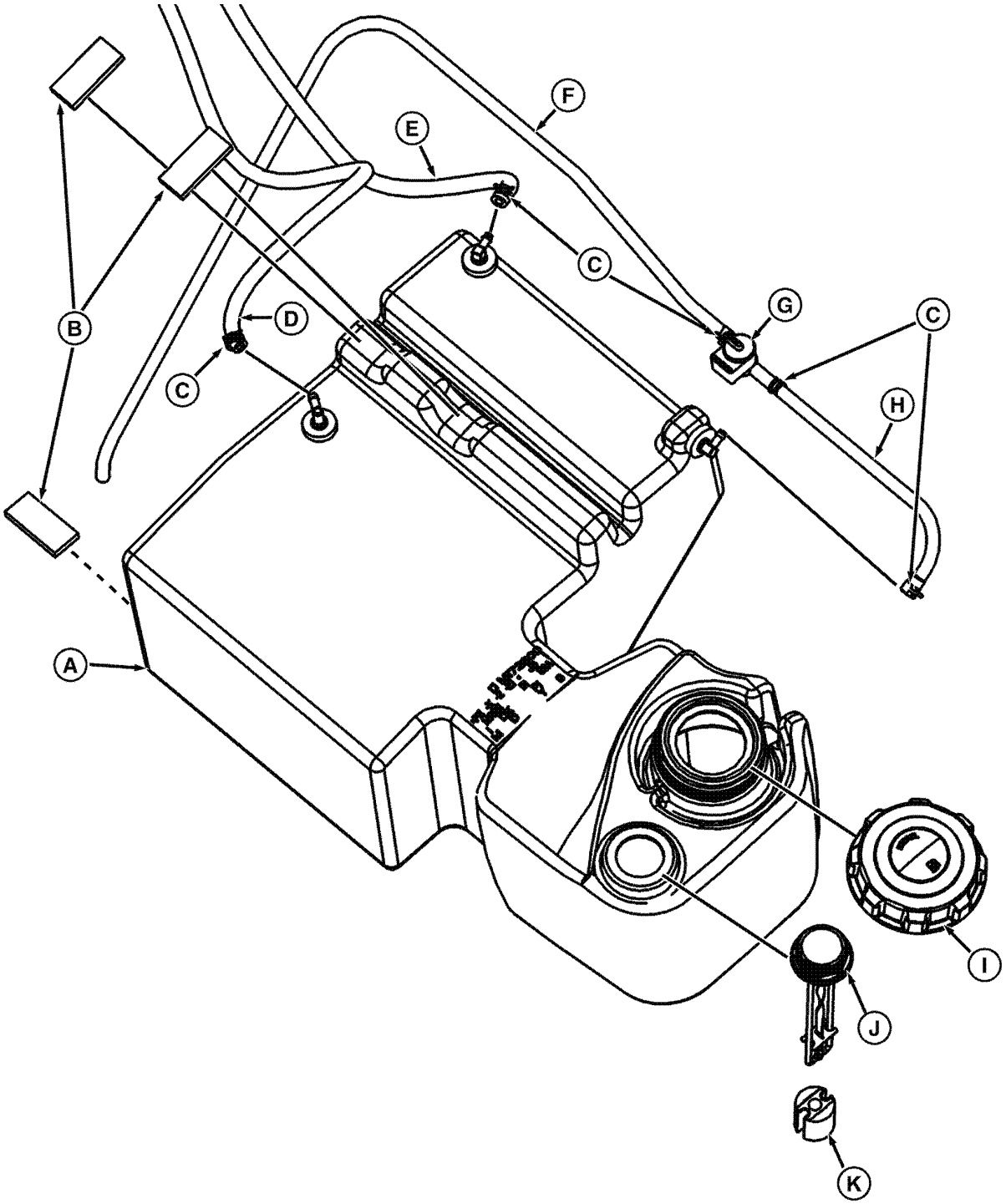
MX52301,000033F -19-22OCT14-2/4

Fuel System Components, Diesel (SN 130000-)



A—Fuel Tank
B—Pad
C—Hose Clamp
D—Fuel Intake Hose
E—Fuel Return Hose
F—Vent Tube
G—Rollover Valve
H—Rollover Valve-to-Fuel Tank Hose
I— Filler Cap
J— Fuel Gage
K—Fuel Gage Float

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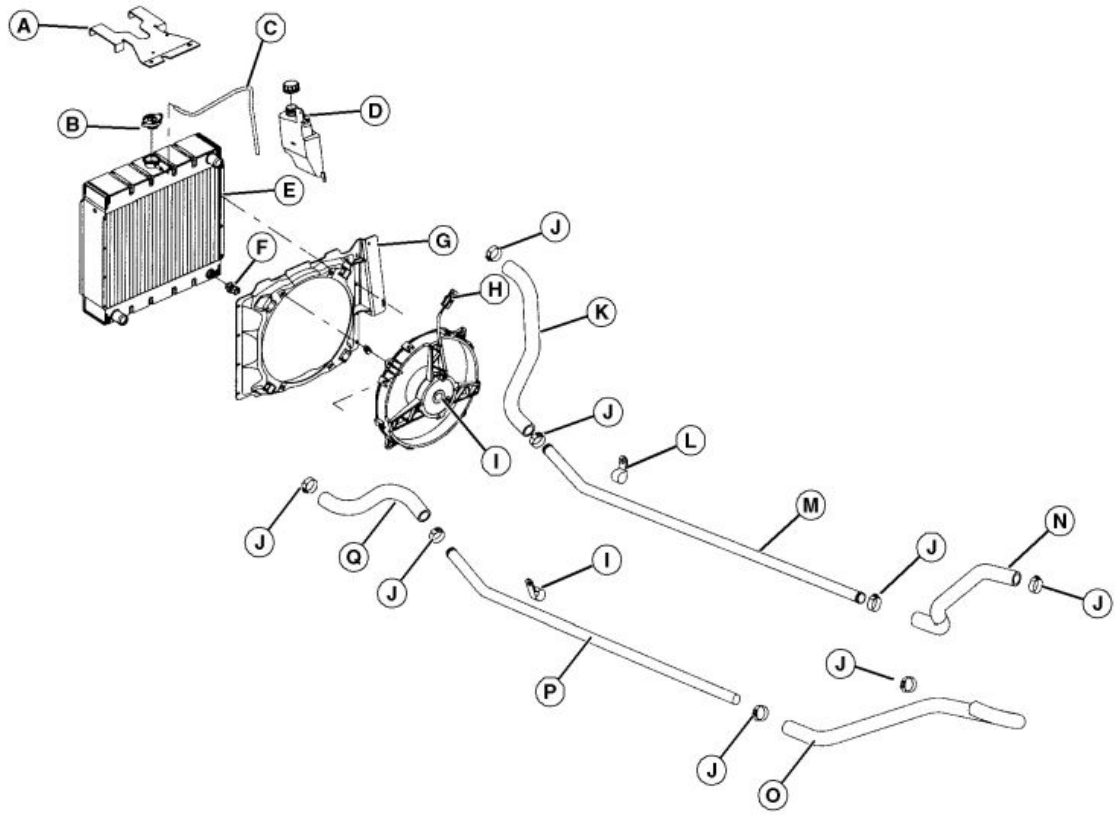
MX52301,000033F -19-22OCT14-3/4

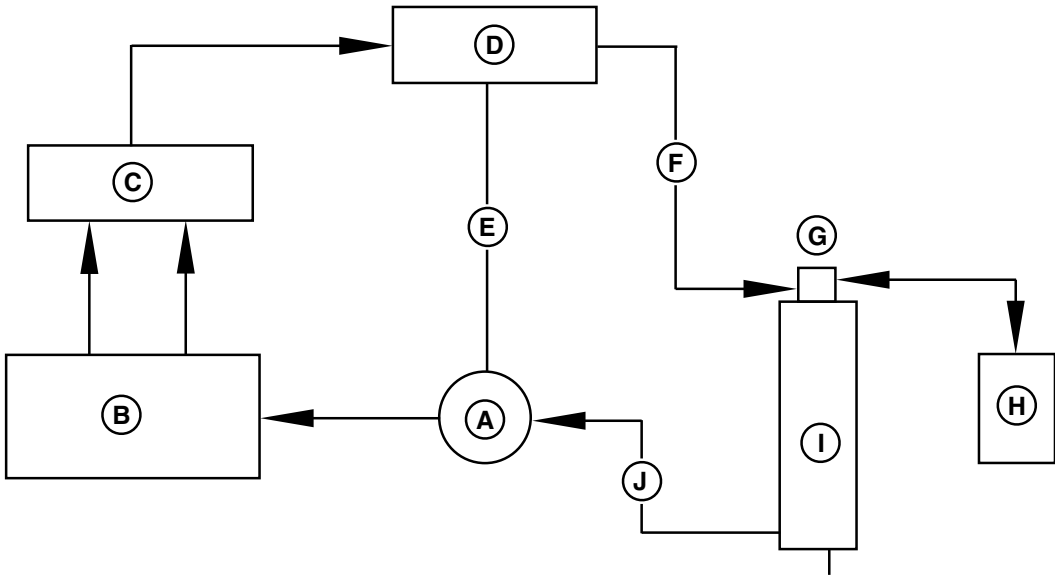


MXT011093 —UN—15MAY14

A—Support Bracket
B—Radiator Cap
C—Vent Tube
D—Overflow Reservoir
E—Radiator
F—Temperature Sensor
G—Shroud
H—Cooling Fan Electrical Connector
I— Cooling Fan
J— Clamp (6)
K—Upper Radiator Hose
L—Retainer (2)
M—Coolant Supply Tube
N—Coolant Return Hose
O—Lower Radiator Hose
P—Coolant Return Tube
Q—Lower Radiator Hose

MX52301,000033F -19-22OCT14-4/4

Cooling System Theory of Operation



LVT001020 —UN—30SEP10

A—Coolant Pump
B—Cylinder Block
C—Cylinder Head
D—Thermostat
E—Bypass Tube
F—Upper Radiator Hose
G—Pressure Cap
H—Coolant Recovery Tank
I— Radiator
J— Lower Radiator Hose

Function

The cooling system allows the engine to rise to full operating temperature when engine is started cold. It also keeps the engine from overheating once engine reaches operating temperature. The thermostat opens when operating temperature has been reached, circulating coolant from the hot engine to the radiator to prevent engine overheating. The cooling system is pressurized, which raises the boiling point of the coolant, and allows more heat to be carried away from the engine.

Theory of Operation

The cooling system includes the following components: radiator, radiator cap, upper and lower radiator hoses, coolant pump, fan, thermostat, coolant recovery tank, drain hoses, and drain valve.

When the engine is started cold, the thermostat is closed. The impeller type coolant pump pulls coolant from the cylinder head and through the bypass tube inside the water pump housing. The water pump then pushes the coolant into the cylinder block water jacket. The coolant absorbs heat from the cylinder walls, and is then pushed up into the cylinder head, and sucked back into the water pump. The circulation provides a fast warm up period, as engine heat is retained and evenly distributed throughout the engine.

As the engine reaches operating temperature, 69.5—72.5 °C (157—163 °F), the thermostat opens, and the hot coolant from the cylinder head passes through the thermostat into the top tank of the radiator. As coolant flows down through the tubes of the radiator core, heat is transferred from the coolant to the air stream being drawn through the core by the engine fan. When the coolant reaches the bottom radiator tank, it is sucked through the lower radiator hose, into the water pump, and pushed back into the cylinder block.

When coolant system pressure exceeds 88.3 ± 14.7 kPa (12.8 ± 2.2 psi), the spring in the radiator cap pushes open to allow coolant to discharge into the coolant recovery tank. As the engine cools after shutdown, a vacuum is produced in the cooling system, and coolant is drawn back out of the coolant recovery tank through a small valve in the bottom of the radiator cap.

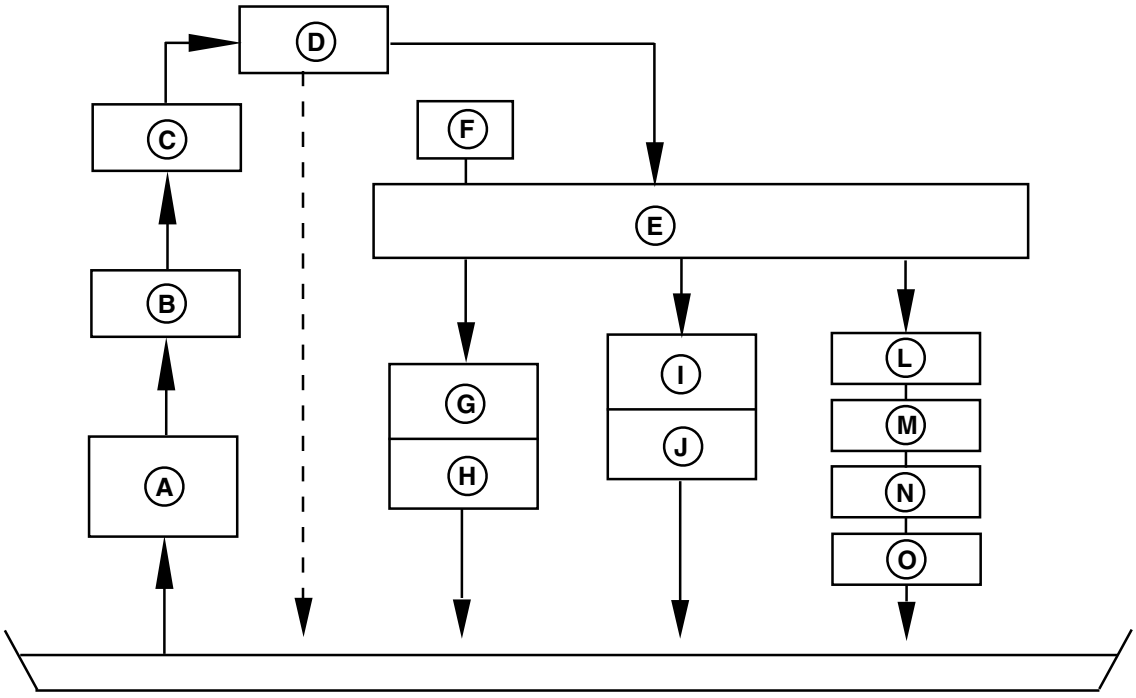
Air is pulled by the engine fan through a removable debris guard on the front of the radiator, through the radiator and fan, and back over engine block. The engine fan belt drives both the water pump and the cooling fan.

An electrical coolant temperature switch is located in the thermostat housing. When the coolant temperature reaches 107—113 °C (225—235 °F), the coolant temperature switch closes, lighting the coolant warning light on the instrument panel. The light informs the operator of the high temperature condition.

The radiator is drained with a drain valve on the lower right corner of the radiator. The engine block is drained through the drain port on the left side of the engine near the front, next to the oil pressure switch.

OUMX258,00004E6 -19-16MAY14-1/1

Lubrication System Theory of Operation



MXT011095 —UN—16MAY14

A—Oil Suction Pipe (strainer)
B—Oil Pump
C—Oil Filter with Bypass Valve
D—Regulator Valve
E—Cylinder Body Main Galley
F—Pressure Switch
G—Idler Gear Shaft
H—Fuel Injection Pump
I— Crank Journal
J— Crank Pin
K—Camshaft Bearing
L—Rocker Arm Bearings
M—Rocker Arm
N—Tappet Cam Face

Theory of Operation

The pressure lubrication system consists of an oil strainer, positive displacement oil pump, oil pressure regulating valve, full flow oil filter, and an electrical pressure warning switch.

The oil pump draws lubrication oil from the oil pan through a strainer and a suction tube. The oil is then pumped through an oil passage to the oil filter and through the engine block main oil gallery.

From the main oil gallery, oil is forwarded under pressure to the intermediate gear shaft and crankshaft main bearing journals. Drilled cross-passages in the crankshaft distribute the oil from the main bearings to connecting rod bearings.

Lube oil holes in main bearing oil grooves direct oil to the camshaft bearings.

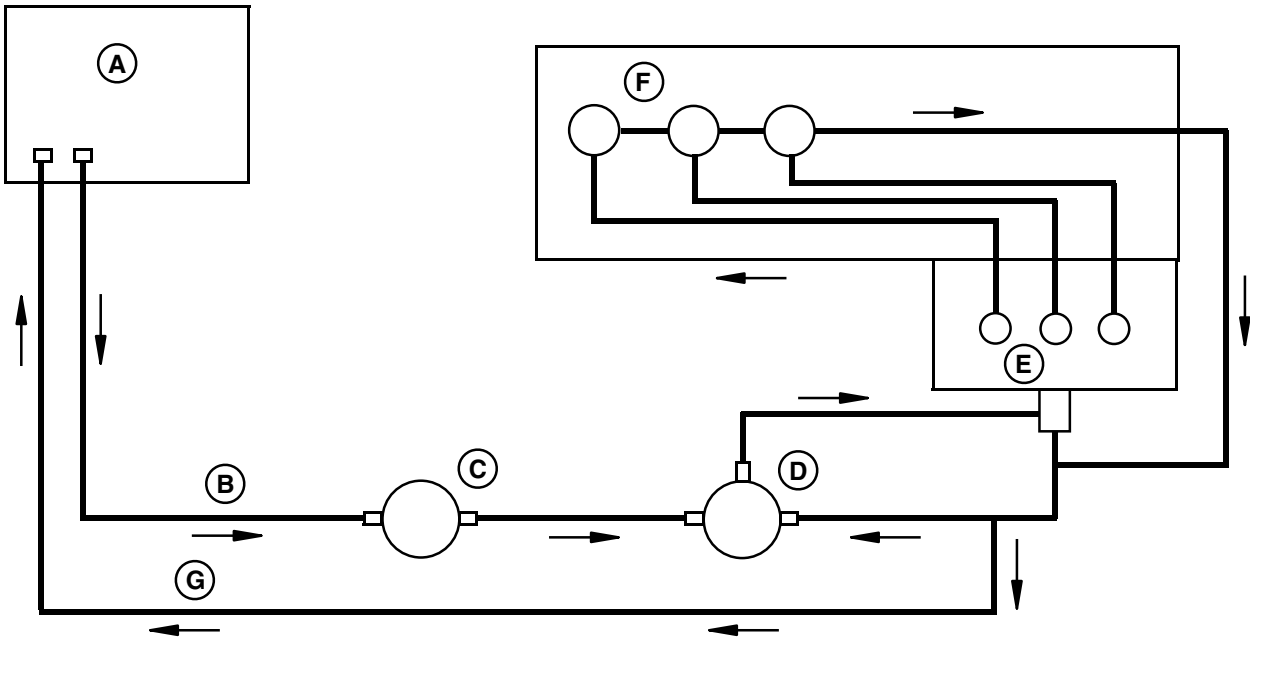
A drilled passage from the rear camshaft bearing through the cylinder block and cylinder head supplies lubricating oil to the rocker arm bearings. The hollow shaft distributes oil to the rocker arms, cam followers, and valves.

Lubrication oil is supplied to the fuel injection pump from the main oil gallery.

If oil pressure drops below specification an oil pressure switch activates an indicator light to alert the operator.

OUMX258,00004E7 -19-16MAY14-1/1

Fuel System Theory of Operation



A—Fuel Tank
B—Supply Hose
C—Inline Fuel Filter
D—Fuel Transfer Pump
E—Fuel Filter and Water Separator with Shutoff Valve
F—Fuel Injection Pump
G—Fuel Injectors
H—Fuel Return Hose

The fuel system supplies clean fuel to injection pump and nozzles, and circulates unused fuel back to the tank.

The engine driven mechanical fuel transfer pump draws fuel from the tank and pumps it to the fuel filter—water separator. If the fuel valve is on, fuel flows to the injection pump. The injection pump then directs high-pressure fuel through the injector lines to the fuel injector nozzles for combustion. Excess fuel from the injection pump is combined with leak off fuel from the injectors and is routed to the filter.

The throttle lever controls engine speed. The throttle rod is connected to the injection pump governor control lever.

The fuel shutoff solenoid controls the injection pump shutoff. When the solenoid is retracted (key in the START or ON position), the engine can run. When the key is turned off, return springs extend the solenoid to the shutoff position. The solenoid stops the flow of fuel inside the injection pump by forcing the governor rack linkage to the NO FUEL position causing the fuel injection pump to stop supplying fuel to the injectors.

The injection pump meters fuel and delivers it at high pressure to the injectors. The injection nozzle prevents flow until high pressure is reached, then opening the valve and spraying atomized fuel into the combustion chamber. Injection lines contain trapped fuel whenever injection is not taking place.

A small amount of fuel leaks past the nozzle valve to lubricate the fuel injection nozzle. This leakage combines with excess fuel from the injection pump and is returned to tank. Any air in the fuel system is bled out with return fuel to the fuel tank.

A float type fuel level sensor mounted in the tank drives an instrument panel fuel gauge.

OUMX258,00004E8 -19-17JUN14-1/1

Air System Theory of Operation

Function:

The air intake system filters air needed for combustion. The system components include: air inlet tube, air cleaner housing, unloader valve (and rubber cleanout valve), primary air filter element, secondary (or safety) air cleaner element, air filter restriction indicator, and outlet tube.

Theory of Operation:

Air enters the air cleaner inlet tube and into the air cleaner housing, and is directed into the side of a shield. The air starts a high-speed centrifugal motion which continues around the element until it reaches the far end of the air cleaner housing, to an unloader valve.

Most of the dust is separated from the air by centrifugal force that causes heavy dust particles to enter the opening at the top of the unloader valve. The air flows through the primary air filter element. The primary filter element filters the larger dirt particles before the air enters the secondary air filter element. The secondary filter removes finer dirt particles before the air enters the intake manifold cover.

The dirt that is deposited in the unloader valve is removed through the rubber diaphragm at the base of the air cleaner. When the engine is running, a pulsing action is created in the intake system by each intake stroke of the engine. This pulsing action causes the rubber diaphragm to open and close, thus emptying the unloader valve. The operator can squeeze the valve to let out the large particles.

The Air Cleaner Restriction Indicator monitors difference in pressure between the intake manifold and air cleaner. As the air filters become clogged, and intake manifold vacuum increases, the restriction indicator piston is pulled down against spring tension, and is shows when it's time to change air cleaner.

MX52301,0000170 -19-17JUN14-1/1

Engine Troubleshooting and Diagnostics

Park machine safely before performing diagnostic procedures. See the “Safety Section”.

CAUTION: The engine may start to rotate at any time. Keep hands away from all moving parts when testing.

CAUTION: Engine coolant is hot during operation.

MX52301,0000171 -19-22OCT14-1/1

Engine Oil Diagnostics

Symptom	Problem	Solution
Crankcase Contamination	Fuel in crankcase.	Broken or seized piston ring - replace rings and check cylinder.
		Seized intake or exhaust valve - replace valve and check valve guide.
		Piston ring, piston, or cylinder worn - bore or hone cylinder and replace piston.
	Water in crankcase.	Leaking cylinder head gasket - replace head gasket.
		Cracked water jacket - repair or replace water jacket.

Symptom	Problem	Solution
Low Oil Pressure	Oil level low.	Add oil.
	Oil filter clogged.	Replace Oil Filter.
	Incorrect viscosity	Check oil for too low viscosity, or coolant-or-fuel-diluted engine oil.
		Change engine oil.
	External oil leaks	Repair as necessary
	Oil pressure relief valve worn.	Clean, adjust, or replace relief valve.
	Oil pump defective.	Remove and inspect oil pump.
	Coolant in oil.	See “Coolant in Oil or Oil in Coolant”.
	Fuel in oil.	Broken or seized piston ring. Replace rings and check cylinder.
		Seized intake or exhaust valve. Check valve guides and stems.
		Piston ring, piston, or cylinder worn. Bore or hone cylinder and replace piston.
	Oil pump screen clogged or pick-up tube cracked.	Remove oil pan and clean screen. Replace pick-up tube. See Oil Pan and Strainer.

Continued on next page

MX52301,0000172 -19-17JUN14-1/2

Symptom	Problem	Solution
	Intake or Exhaust valves worn.	Check valve guides and stems.
	Crankshaft pin or bearing worn.	Regrind crankshaft and replace bearings.
	Connecting rod bolt loose.	Check for damage and retorque bolts.
	Excessive volume of fuel injected.	Check fuel injection pump and injectors.
	Broken or seized piston ring.	Replace rings and check cylinder.
	Excessive main or connecting rod bearing clearance.	Determine bearing clearance. See Connecting Rod Bearing Clearance Check.
	Piston ring, piston, or cylinder worn.	Bore or hone cylinder and replace piston.
	Piston ring end gaps not correct.	Stagger piston ring gaps.
	Piston rings installed incorrectly.	Install piston rings correctly.

Symptom	Problem	Solution
High Oil Pressure	High Oil Pressure	Improper engine oil viscosity or /type - replace engine oil and filter.
		Oil pressure relief valve failed. Inspect oil pressure relief valve. See Oil Pump Removal and Installation Diesel 3TNE68 or Oil Pump Removal and Installation Diesel 3TNV70.

MX52301,0000172 -19-17JUN14-2/2

Excessive Fuel Consumption

Symptom	Problem	Solution
Excessive Fuel Consumption	Compression leakage from valve seat.	Grind valve seat; regrind valves.
	Engine running too cool.	Check thermostat.
	Excessive volume of fuel injected.	Check fuel injection pump and injectors.
	Poor fuel injection pattern.	Clean or replace fuel injector nozzles.

MX52301,0000173 -19-17JUN14-1/1

Incorrect Manifold Pressure

Symptom	Problem	Solution
Low Manifold Pressure	Clogged air filter.	Clean or replace air filter.
	Engine at high altitude or temperature.	Use higher output engine.
	Improper intake or exhaust valve clearance.	Adjust valve clearance.
	Compression leakage from valve seat	Grind valve seat; regrind valves.
	Seized intake or exhaust valve.	Replace valve and check valve guide.

MX52301,0000174 -19-14APR14-1/1

Low Engine Compression

Symptom	Problem	Solution
Low Engine Compression	Oil filter clogged.	Replace oil filter.
	Improper engine oil viscosity or type.	Replace engine oil and filter.
	Excessive volume of fuel injected.	Check fuel injection pump and injectors.
	Compression leakage from valve seat.	Grind valve seat; regrind valves.
	Intake or Exhaust valves worn.	Check valve guides and stems.
	Seized intake or exhaust valve.	Replace valve and check valve guide.
	Piston ring, piston, or cylinder worn.	Bore or hone cylinder and replace piston.
	Broken or seized piston ring.	Replace rings and check cylinder.
	Crankshaft pin or bearing seized.	Regrind crankshaft and replace bearings.
	Piston ring end gaps not correct.	Stagger piston ring gaps.
	Piston rings installed incorrectly.	Install piston rings correctly.
	Foreign matter in combustion chamber.	Remove head and inspect for damage.

MX52301,0000175 -19-17JUN14-1/1

Engine Starting Problem

Symptom	Problem	Solution
Engine Does Not Start	Battery voltage low.	Recharge battery.
	Starting motor defective.	Replace starting motor.
	Alternator defective.	Repair or replace alternator.
	Open circuit in wiring.	Repair wiring.
	Faulty fuel shutoff solenoid circuit or fuel shutoff solenoid.	Test electrical circuit, replace fuel shutoff solenoid.
	Fuel filter clogged.	Replace fuel filter. See Fuel Filter Removal and Installation.
	Clogged or cracked fuel lines.	Clean or replace fuel lines.
	Fuel volume to injection pump low.	Check or replace fuel transfer pump.
	Water in fuel.	Check and repair.
	Improper intake or exhaust valve clearance.	Adjust valve clearance.
	Improper timing between injection pump, intake, and exhaust valves.	Adjust valve clearance. Check valve timing.
	Seized intake or exhaust valve.	Replace valve and check valve guide.
	Broken or seized piston ring.	Replace rings and check cylinder.
	Piston ring, piston, or cylinder worn.	Bore or hone cylinder and replace piston.
	Crankshaft pin or bearing seized.	Regrind crankshaft and replace bearings.
	Air entering fuel system.	Check and repair fuel supply system.

Symptom	Problem	Solution
Engine Starts But Does Not Continue Running - Exhaust Smoke Absent	Fuel filter clogged.	Replace fuel filter. See Fuel Filter Removal and Installation.
	Clogged or cracked fuel lines.	Clean or replace fuel lines.
	Water in fuel.	Check and repair.

Continued on next page

MX52301,0000176 -19-14APR14-1/2

Symptom	Problem	Solution
	Air entering fuel system.	Check and repair fuel supply system.
	Fuel volume to injection pump low.	Check or replace fuel transfer pump.
	Improper engine oil viscosity or type.	Replace engine oil and filter.
	Improper intake or exhaust valve clearance.	Adjust valve clearance.
	Crankshaft pin or bearing seized.	Regrind crankshaft and replace bearings.
	Piston ring end gaps not correct.	Stagger piston ring gaps.
	Governor not functioning properly.	Repair or replace governor.
	Improper intake or exhaust valve clearance.	Adjust valve clearance.

Symptom	Problem	Solution
Engine Starts But Does Not Continue Running - Excess Exhaust Smoke	Clogged air filter.	Clean or replace air filter.
	Seized intake or exhaust valve.	Replace valve and check valve guide.
	Broken or seized piston ring.	Replace rings and check cylinder.
	Piston ring, piston, or cylinder worn.	Bore or hone cylinder and replace piston.

MX52301,0000176 -19-14APR14-2/2

Engine Operation Poor

Symptom	Problem	Solution
Low Engine Output - Exhaust Color Normal	Fuel filter clogged.	Replace fuel filter. See Fuel Filter Removal and Installation.
	Air entering fuel system.	Check and repair fuel supply system.
	Clogged or cracked fuel lines.	Clean or replace fuel lines.
	Wrong type of fuel.	Drain and replace fuel.
	Fuel volume to injection pump low.	Check or replace fuel transfer pump.
	Improper engine oil viscosity or type.	Replace engine oil and filter.
	Improper intake or exhaust valve clearance.	Adjust valve clearance.
	Compression leakage from valve seat.	Grind valve seat; regrind valves.
	Seized intake or exhaust valve.	Replace valve and check valve guide.
	Leaking cylinder head gasket.	Replace head gasket.
	Crankshaft pin or bearing worn.	Regrind crankshaft and replace bearings.

Symptom	Problem	Solution
Low Engine Output - Exhaust Color White	Water in fuel.	Check and repair.
	Wrong type of fuel.	Drain and replace fuel.
	Poor fuel injection pattern.	Clean or replace fuel injector nozzles.
	Incorrect or retarded injection pump timing.	Check and adjust fuel injection pump timing.
	Uneven volume of fuel injected.	Check fuel injection pump and injectors.
	Broken or seized piston ring.	Replace rings and check cylinder.
	Piston ring, piston, or cylinder worn.	Bore or hone cylinder and replace piston.
	Piston ring end gaps not correct.	Stagger piston ring gaps.
	Piston rings installed incorrectly.	Install piston rings correctly.

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Symptom	Problem	Solution
	Intake or Exhaust valves worn.	Check valve guides and stems.
	Improper timing between injection pump, intake, and exhaust valves.	Adjust valve clearance. Check valve timing.

Symptom	Problem	Solution
Low Engine Output - Exhaust Color Black	Clogged air filter.	Replace air filter.
	Engine running too hot.	Check thermostat, fan belt tension.
		Check cooling system for level or leaks.
		Clean exhaust pipe.
	Water pump and /alternator belt loose.	Adjust fan belt tension.
	Wrong type of fuel.	Drain and replace fuel.
	Poor fuel injection pattern.	Clean or replace fuel injector nozzles.
	Uneven or excess volume of fuel injected.	Check fuel injection pump and injectors.
	Incorrect injection pump timing.	Check and adjust fuel injection pump timing.
	Compression leakage from valve seat.	Grind valve seat; regrind valves.
	Seized intake or exhaust valve.	Replace valve and check valve guide.
	Improper timing between injection pump, intake, and exhaust valves.	Adjust valve clearance. Check valve timing.
	Engine at high altitude or temperature.	Use higher output engine.

Symptom	Problem	Solution
Engine Runs Rough	Loud knocking noise during combustion.	Advanced fuel injection pump timing - check and adjust fuel injection pump timing.
	Uneven combustion sound.	Clogged air filter. Clean or replace air filter.
		Clogged exhaust pipe. Clean exhaust pipe.

Continued on next page

MX52301,0000177 -19-14APR14-2/5

Symptom	Problem	Solution
		Water in fuel. Check and repair.
		Wrong type of fuel. Drain and replace fuel.
		Uneven volume of fuel injected. Check fuel injection pump and injectors.
		Poor fuel injection pattern. Clean or replace fuel injector nozzles.
	Misfiring	Improper timing between injection pump, intake, and exhaust valves - adjust valve clearance. Check valve timing.
		Improper intake or exhaust valve clearance - adjust valve clearance.
		Compression leakage from valve seat. Grind valve seat; regrind valves.
		Seized intake or exhaust valve. Replace valve and check valve guide.
		Broken or seized piston ring. Replace rings and check cylinder.
		Crankshaft pin or bearing worn or seized. Regrind crankshaft and replace bearings.
		Connecting rod bolt loose. Check for damage and retorque bolts.
		Foreign matter in combustion chamber. Remove head and inspect for damage.
		Excessive timing gear backlash. Measure timing gear backlash.
	Engine surges during idle.	Water in fuel. Check and repair.
		Uneven volume of fuel injected. Check fuel injection pump and injectors.
		Poor fuel injection pattern. Clean or replace fuel injector nozzles.

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MX52301,0000177 -19-14APR14-3/5

Symptom	Problem	Solution
		Governor not functioning properly. Repair or replace governor.
		Broken or seized piston ring. Replace rings and check cylinder.
		Crankshaft pin or bearing worn or seized. Regrind crankshaft and replace bearings.
	Engine surges under load.	Water in fuel. Check and repair.
		Uneven volume of fuel injected. Check fuel injection pump and injectors.
		Poor fuel injection pattern. Clean or replace fuel injector nozzles.
		Governor not functioning properly. Repair or replace governor.
		Seized intake or exhaust valve. Replace valve and check valve guide.
		Crankshaft pin or bearing worn or seized. Regrind crankshaft and replace bearings.
	Excessive engine vibration	Uneven volume of fuel injected. Check fuel injection pump and injectors.
		Poor fuel injection pattern. Clean or replace fuel injector nozzles.
		Seized intake or exhaust valve. Replace valve and check valve guide.
		Broken or seized piston ring. Replace rings and check cylinder.
		Governor not functioning properly. Repair or replace governor.
		Crankshaft pin or bearing worn or seized. Regrind crankshaft and replace bearings.
		Connecting rod bolt loose. Check for damage and retorque bolts.

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MX52301,0000177 -19-14APR14-4/5

Symptom	Problem	Solution
		Improper injection pump timing. Check and adjust valve pump timing.
	Poor return to low speed.	Governor not functioning properly. Repair or replace governor.

MX52301,0000177 -19-14APR14-5/5

Coolant Temperature Abnormal

Symptom	Problem	Solution
Engine Coolant Temperature Above Normal	Coolant level low.	Fill cooling system to proper level.
	Radiator cores or debris screens dirty.	Clean radiators and screens.
	Radiator cap defective.	Replace radiator cap as required. See Radiator Cap Pressure Test—Diesel.
	Thermostat defective.	Test thermostat opening temperature; replace thermostat as required. See Thermostat Test—Diesel.
	Engine overloaded.	Reduce engine load.
	Crankcase oil level too low.	Fill crankcase to proper oil level.
	Alternator belt loose or defective.	Replace alternator belt, check tension.
	Premature belt wear or belt flies off pulley.	Check pulley alignment.
	Cylinder head gasket damaged.	Replace cylinder head gasket.
	Coolant pump defective.	Replace coolant pump.

Symptom	Problem	Solution
Engine Coolant Temperature Below Normal	Thermostat defective.	Test thermostat opening temperature; replace thermostat as required. See Thermostat Test—Diesel.

MX52301,0000178 -19-14APR14-1/1

Coolant in Oil or Oil in Coolant

Symptom	Problem	Solution
Coolant In Oil or Oil In Coolant	Cylinder head gasket faulty.	Look for signs of head gasket failure. Replace head gasket as necessary.
	Cylinder bores cracked.	Locate crack; repair or replace components as required.
	Cylinder head or block cracked	Locate crack; repair or replace components as required.

MX52301,0000179 -19-14APR14-1/1

Diagnostics

Test Conditions		
Machine parked on level surface. Park brake engaged. Key switch off unless indicated otherwise.		

Test or Check Point	Normal	If Not Normal
Engine dipstick and exterior engine surface - Engine Oil Check	Oil level between “L” and “H” marks. Oil not burnt, or contaminated with metal particles, fuel, or coolant. No external leakage, filter clean.	Change oil and inspect for source of contamination. Check gaskets, seals, plugs, cylinder head, block, rocker arm cover, and breather. Change oil filter.
Coolant tank and radiator - Cooling System Check	Coolant level between marks on tank when engine is warm. Coolant in expansion tank full to top.	Add proper coolant mix.
	Coolant not contaminated with oil, fuel, or discolored brown.	Drain and flush system. Check for source of contamination.
	Radiator screens free of debris.	Clean or replace.
	Hoses not cracked or leaking, clamps, and radiator cap tight.	Pressure test cooling system and cap.
	Water pump and alternator belt tight, not glazed or cracked.	Replace and adjust belt tension.
	Electric fan operates as needed. Fan blades not damaged or warped.	Repair or replace fan controls or fans.
Fuel tank, pump, lines, filter, filter shutoff valve - Fuel System Check	Fuel level correct, not contaminated, correct grade of fuel, no water, or debris in filter bowl and water separator.	Drain and clean fuel tank. Add fresh fuel. Replace filter.
	Fuel filter shutoff valve in “on” position.	Move to “on” position.
	Fuel hoses not cracked or leaking.	Replace hoses.
	Fuel hose clamps tight.	Replace or tighten clamps.
	Fuel tank does not have vacuum.	Check or replace fuel tank vent hose.
Air filter and air intake - Air Intake System Check	Air filter hose not cracked, clamps tight.	Replace and tighten clamps.
	Element not plugged. Air filter housing sealed, no dirt tracking inside filter element.	Replace element or housing.
Fuel shutoff solenoid.	Fuel shutoff solenoid must pull in when key switch is turned to “START” position, and stay in when key is in the “RUN” position. Listen for clicking as key is cycled.	If solenoid does not pull in and hold in, See Fuel Shutoff Solenoid Test (Diesel Engine).
Fuel filter and water separator.	Fuel level visible in filter bowl.	Pump lever on side of fuel transfer pump to prime pump and fuel bowl.
	Fuel bowl not full of water.	Drain water from bowl.
	Fuel present at injection pump inlet hose.	Replace fuel filter. Recheck. Test fuel pump.
Throttle pedal and cable.	Cable not binding and pedal stop adjusted correctly.	Repair, replace, or adjust throttle cable and check and adjust pedal stop.
Intake and exhaust valves	Valve clearance within specification (engine cold).	Adjust valves. Valve Clearance Adjustment—Diesel.
	Valves not sticking.	Check valve guides and stems.
Fuel is reaching injectors.	Crack fuel injection lines at injectors. Crank engine. (Be sure that fuel shutoff solenoid has pulled in.). Fuel leaks out.	No fuel present: Check fuel shutoff valve is open, fuel level, inspect filter and separator element. Test fuel pump.
Injectors are working properly	Injector spray pattern is normal and cracking pressure is within specifications.	Check spray pattern and cracking pressure. See Fuel Injection Nozzle Test—Diesel.
Engine compression tested at fuel injector ports.	Cylinder compression within specification. Pressure difference between cylinders within specification.	Perform cylinder compression test. See Cylinder Compression Test—Diesel.

Continued on next page

MX52301,000017A -19-14APR14-1/2

Test or Check Point	Normal	If Not Normal
Flywheel and starting motor	Minimum cranking rpm within specification.	See Starting Motor Loaded Amperage Draw Test.
Injection pump timing inspection (Key in run position, Engine off)	Timing should be correct. (Remove pump as the last possible solution.)	Have injection pump static timing adjustment performed by a qualified Service Repair Shop. See “Tests and Adjustments” in this section.
Injection pump slow idle speed (Engine running)	Engine runs at 1050 ± 25 rpm.	See High Idle Speed Adjustment—Diesel.
Injection pump fast idle speed (Engine running)	Engine runs at 3650 ± 25 rpm.	See High Idle Speed Adjustment—Diesel.
Governor	Engine runs smooth throughout rpm range with low smoke and good power.	Have governor torque capsule adjusted by a certified CARB/EPA service center.
Oil pressure sender port	Oil pressure in specification.	Test engine oil pressure. See Engine Oil Pressure Test—Diesel.
Thermostat	Opening temperature within specification.	Perform thermostat opening test. See Thermostat Test—Diesel.
Muffler	Not restricted.	Replace muffler.

MX52301,000017A -19-14APR14-2/2

Summary of References

MX52301,00004A9 -19-23OCT14-1/1

Air Restriction Indicator Test—Diesel

Reason:

To check operation of air filter restriction indicator and check air intake system for leaks, restrictions, or obstructions.

Procedure (Normal Operation):

1. Park machine safely. See the “Safety Section”.
2. Raise passenger seat.

NOTE: If plastic indicator housing is damaged the indicator will not function correctly.

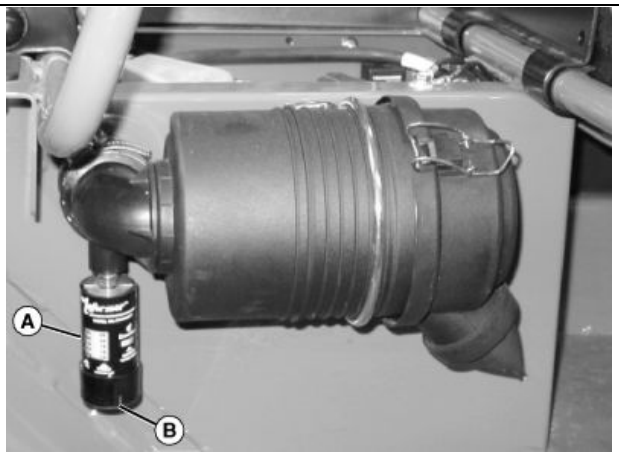
3. Locate and check air filter restriction indicator.
   a. If window (A) is clear, no air cleaner service is required.
   b. If window (A) shows fully red, air cleaner requires immediate service.

NOTE: The air filter restriction indicator operation is checked by unscrewing indicator from air filter outlet tube and sucking on vacuum port. The indicator window (A) shows easy movement of indicator moving into the red zone. Press the release button (B), on top of indicator to reset indicator.

4. Service air cleaner elements if needed.
5. Push reset button (B)on top of air filter restriction indicator.

Results:

Run engine at full load. If red indicator still comes into window after resetting button:



MXT011096 —UN—16MAY14

A—Indicator Window **B—Reset Button**

- Replace primary (large) filter element.
- Reset air filter restriction indicator button, and retest.

If red indicator is still visible after retest:

- Replace secondary (small) filter element.
- Reset air filter restriction indicator button, and retest.

If red indicator is still visible after retest:

- Check air filter housing, outlet, inlet tubes, unloader valve diaphragm.
- Run with both filter elements removed and recheck.

Continued on next page

MX52301,000017B -19-23OCT14-1/2

Procedure (Simulated Excess Restriction):

1. Make sure that park brake is ON and machine is in NEUTRAL.
2. Start engine and run at LOW idle
3. Start engine and Cover the air cleaner intake tube (A) with a piece of cardboard.
4. Watch air filter restriction indicator. The indicator should move into the red area.
5. Remove cardboard and stop engine.
6. Push indicator reset button, indicator should clear.

Results:

If restriction indicator DID NOT move, or moved little, check for:

- Loose or damaged hose clamps.
- Air leaks in air filter to engine intake hose.
- Air leaks in intake manifold.
- Air leaks at indicator mounting threads.

MXT011097 —UN—16JUN14

A—Air Cleaner Intake tube

- Cracked indicator housing or diaphragm.
- Clogged screen inside indicator mounting nipple.

MX52301,000017B -19-23OCT14-2/2

Slow Idle Speed Adjustment—Diesel

Reason:

To achieve proper slow idle rpm setting. Provides adequate rpm to keep engine running smoothly without clutch engaging.

Equipment:

- JT05719 Digital Tachometer
- (2) 10 mm Box End Wrenches

Procedure:

1. Place a small piece of reflective tape on flywheel or clutch.
2. Start engine and run for five minutes until thermostat opens.
3. Check that tab (D) on governor throttle lever is against slow idle stop screw. If not, see Throttle Cable Adjustment—Diesel.
4. Check engine speed at flywheel with JT05719 Hand Held Digital Tachometer.

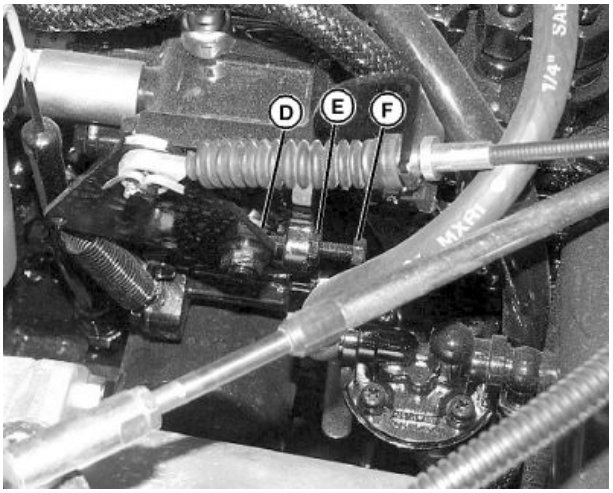
Specification

Slow Idle—Speed..... 1025—1075 rpm

Results:

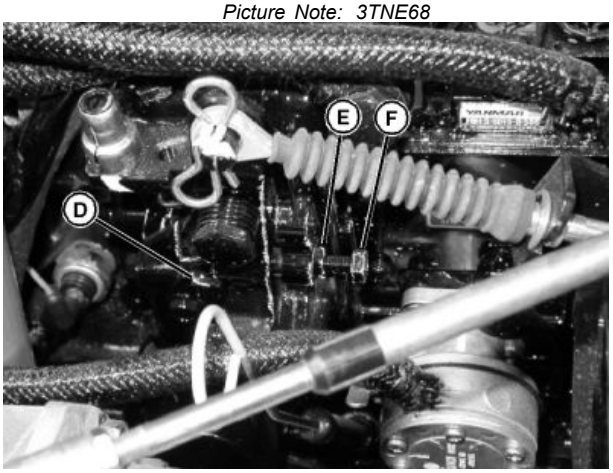
- If slow idle rpm is not according to specifications, loosen lock nut (E) and adjust slow idle stop screw (F). After adjustment, tighten lock nut, and recheck engine slow idle speed.

D—Tab
E—Lock Nut
F—Slow Idle Stop Screw



MXT011098 —UN—16MAY14

Picture Note: 3TNE68



MXT011099 —UN—16MAY14

Picture Note: 3TNV70

MX52301,000017C -19-23OCT14-1/1

High Idle Speed Adjustment—Diesel

IMPORTANT: The fast idle adjustment is preset by the engine manufacturer to comply with strict California Air Resources Board/Environmental Protection Agency (CARB/EPA) emissions requirements and is not adjustable. Tampering with the fast idle adjustment may result in severe fines or penalties.

IMPORTANT: Do not attempt to adjust the fast idle setting. It is not adjustable.

If it is determined that either the fuel injection pump or governor assembly are in need of repair, they must be replaced only as complete assemblies. Only an authorized factory trained technician is allowed to remove and install these assemblies. If replacement is necessary, remove and install the fuel injection pump and/or governor assembly as complete, individual assemblies.

Because the High idle speed is not adjustable, the throttle cable adjustment becomes critical to proper engine operation. Therefore, first make sure that the throttle cable obtains its full range of motion, stop-to-stop, before performing any diagnostic procedures.

Reason:

To verify proper fast idle speed setting. This checks that the engine is running at proper rpm's for peak performance.

Equipment:

- JT05719 Digital Tachometer

Procedure:

1. Place a small piece of reflective tape on the flywheel or clutch.

NOTE: Make sure that air cleaner is clean and not restricted. Replace air cleaner element as needed.

2. Start engine and run for 5 minutes to obtain normal operating temperature.
3. Set parking brake.
4. With transmission in neutral, press pedal down to full throttle position.
5. Check engine speed at flywheel with JT05719 Digital Tachometer.

Specification	
High Idle—Speed	3625—3675 rpm

Results:

- If engine still does not meet fast idle speed specifications, have governor inspected by an EPA authorized diesel service (ADS) center.

MX52301,000017F -19-10JUL14-1/1

Throttle Cable Adjustment—Diesel

Reason:

To ensure that throttle cable is allowing throttle lever on governor to reach full fast idle and slow idle positions.

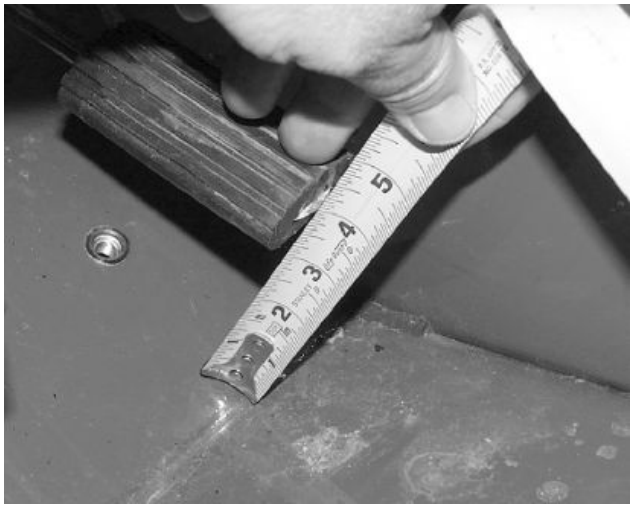
Equipment:

- 1/2 in. Wrenches

Procedure:

1. Park machine safely. See the "Safety Section".
2. Accelerator pedal should have specified amount of free travel before cable moves.

Specification	
Accelerator Pedal Free Travel—Distance	2—6 mm (0.080—0.240 in.)



MXT011100 —UN—16MAY14

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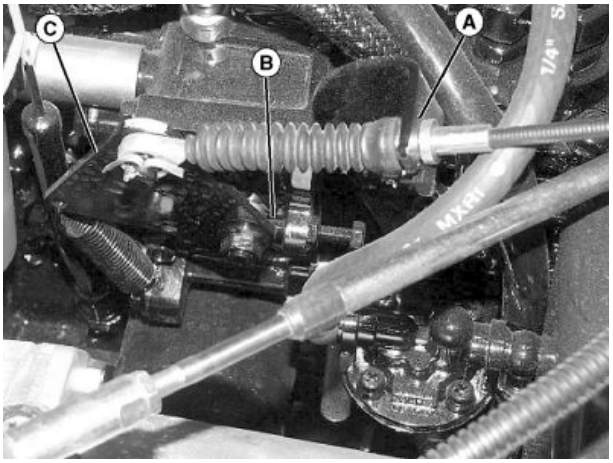
MX52301,0000180 -19-23OCT14-1/3

3. Inspect cable and bracket on engine (A).
4. When pedal is up, make sure that the tab on the throttle lever is contacting the idle stop screw (B).
5. Press pedal all the way down to high-speed position.
6. Check that throttle cable is pulling throttle lever (C) on the injection pump all the way to its travel stop inside the governor.

A—Throttle Cable and Bracket
B—Idle Stop Screw
C—Throttle Lever



MXT011101 —UN—16MAY14

MX52301,0000180 -19-23OCT14-2/3

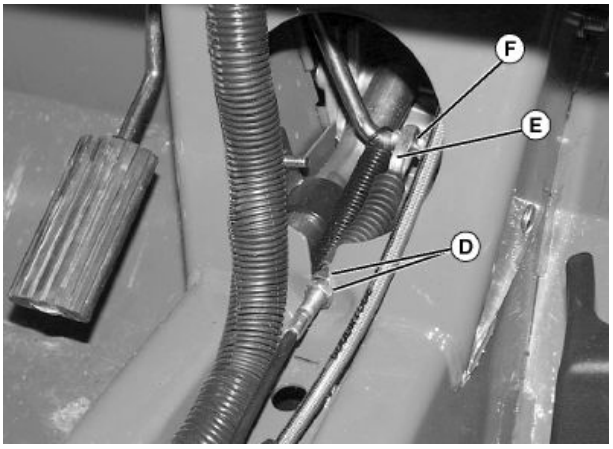
To Adjust Cable:

1. Remove tunnel cover from machine.
2. Pull cable eyelet (E) to get slack out of cable and measure free play between eyelet and pedal rod (F). Check gap to specification.

Specification	
Eyelet-to-Pedal Rod—Distance	1—3 mm (0.039—0.118 in.)

3. If free play is not to specification, loosen nuts (D) and adjust until proper free play is obtained.
4. Install tunnel cover.

D—Nuts
E—Cable Eyelet
F—Pedal Rod



MXT010294 —UN—16MAY14

MX52301,0000180 -19-23OCT14-3/3

Valve Clearance Adjustment—Diesel

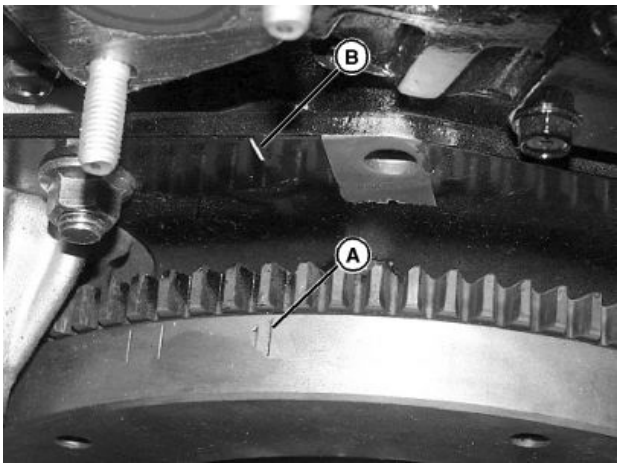
Reason:

To maintain proper clearance between valves and rocker arms for maximum compression and valve train life.

Equipment:

- Feeler Gauge
- Open-End Wrench
- Flat Blade Screwdriver

A—Flywheel
B—Backplate



MXT011203 —UN—16MAY14

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MX52301,0000181 -19-22OCT14-1/6

Procedure:

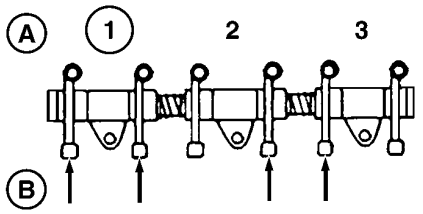
1. Park machine safely. See the “Safety Section”.
2. Engine must be cool (room temperature) before valve clearance is checked.
3. Raise and lock cargo box.
4. Be sure that key switch is off with key removed before attempting to turn engine by hand.
5. Remove air cleaner assembly, air cleaner bracket, and rocker arm cover. See Rocker Arm Cover Removal and Installation 3TNE68 or Rocker Arm Cover Removal and Installation 3TNV70.

NOTE: “Top Dead Center (TDC)” is when the piston is at its highest point of travel in the cylinder on either the compression or exhaust stroke.No. 1 cylinder is the closest to the flywheel.

6. Rotate flywheel counterclockwise until No. 1 cylinder TDC mark on flywheel (A) is aligned with mark on engine backplate (B).

NOTE: There are three marks on flywheel for each cylinder. The mark with the cylinder number stamped next to it is the TDC mark for that cylinder.

7. Try to move intake and exhaust rocker arms and push rods for No. 1 cylinder:
   a. If rocker arm and push rod are loose, the piston is at TDC on the compression stroke, proceed to step 5.
   b. If rocker arms or push rods are not loose, rotate flywheel one revolution (360°), and recheck rocker arms and push rods.
8. Measure and adjust valve clearance only on the four valves indicated with black arrows while No. 1 piston is at TDC on compression stroke.



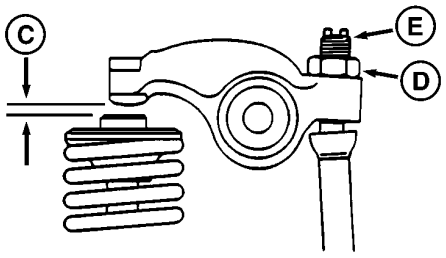
LVT001196 —UN—15OCT10

A—Cylinder Numbers **B—Flywheel End**

MX52301,0000181 -19-22OCT14-2/6

9. To adjust valves, loosen lock nut (D) and turn adjusting screw (E) until 0.20 mm (0.008 in.) feeler gauge can be inserted between rocker arm and valve cap. Hold adjusting screw while tightening lock nut to specification.

Specification	
Rocker Cover Bolt —Torque	11 N·m (97 lb.-in.)



LVT001197 —UN—15OCT10

C—Clearance Gap **E—Adjustment Screw**
D—Lock Nut

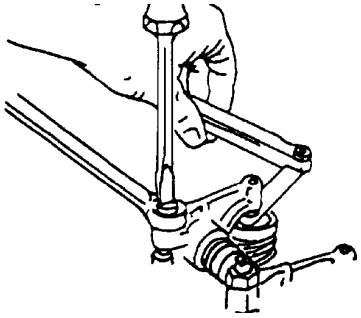
Continued on next page

MX52301,0000181 -19-22OCT14-3/6

10. Recheck valve clearance specification after tightening lock nut.

Specification

Valve —Clearance.....0.15—0.25 mm (0.006—0.010 in.)



MXAL30471 —UN—10JUL12

MX52301,0000181 -19-22OCT14-4/6

11. Check that valve cap on end-of-valve stem remained seated on valve and inside valve spring retainer.
12. Turn crankshaft pulley one revolution (360°) putting the piston in No. 1 cylinder at TDC on the exhaust stroke.

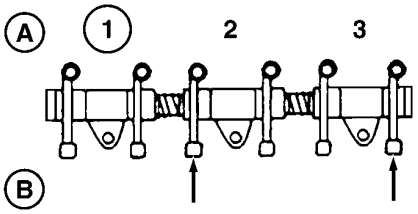
LVT001199 —UN—15OCT10

Normal Valve Cap - Not Normal Valve Cap

MX52301,0000181 -19-22OCT14-5/6

13. Measure and adjust valve clearance on the last two valves (black arrows) with No. 1 piston at TDC of exhaust stroke.

A—Cylinder Numbers **B—Flywheel End**



LVT001200 —UN—15OCT10

MX52301,0000181 -19-22OCT14-6/6

Valve Lift Check—Diesel

Reason:

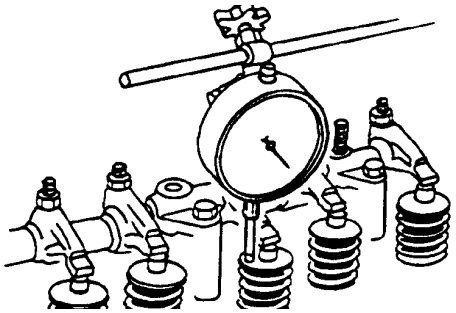
To test for excessive wear on camshaft lobes, cam followers, bent push rods, worn rocker arms, or worn valve stems.

Equipment:

- Dial Indicator

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Remove rocker arm cover.
4. Adjust valve clearance. See Valve Clearance Adjustment—Diesel.
5. Fasten dial indicator to engine and position indicator tip on valve retainer. Valve must be fully closed and rocker arm must move freely.
6. Zero the dial indicator.
7. Rotate crankshaft towards front of machine while observing dial indicator as valve is moved to the full open (down) position. Compare measurement to specification.



MXAL30474 —UN—10JUL12

Specification

Valve—Lift..... 7.5 mm (0.300 in.)

8. Repeat for each valve.

Results:

- If valve lift is less than specification, remove and inspect camshaft, camshaft followers, push rods, or rocker arms for wear or damage.

MX52301,0000182 -19-23OCT14-1/1

Cylinder Compression Test—Diesel

Reason:

To determine the condition of the pistons, rings, cylinder walls, and valves.

Equipment:

- JT01682 Compression Gauge
- JDG472 Adapter

Procedure:

1. Run engine for 5 minutes to bring to operating temperature. Shut off engine.
2. Remove injection nozzles.
3. Install heat protector from end of injector and install on JDG472 adapter (A).
4. Install JT01682 Compression Gauge Assembly (B) and JDG472 Adapter in injection port.
5. Disconnect fuel shutoff solenoid electrical connector on top of engine.

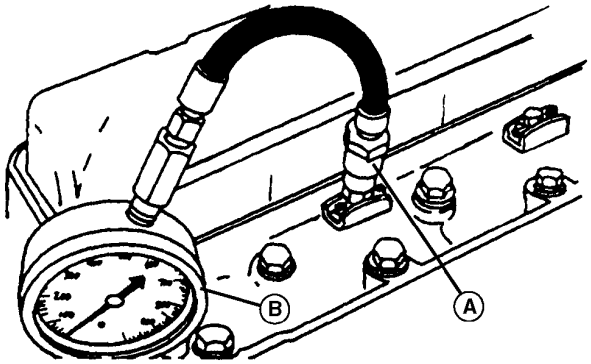
IMPORTANT: Do not overheat starting motor during test.

6. Crank engine for three seconds with starting motor.
7. Record pressure reading for each cylinder.

NOTE: Pressure listed is for 300 m (1000 ft.) above sea level. For naturally aspirated engines, reduce specification an additional 4% for each 300 m (1000 ft.) of altitude.

Results:

- If pressure reading is below specification, squirt a small amount of clean engine oil into cylinders through injector ports and repeat test.



MXAL30475 —UN—10JUL12

A—Adapter **B—Compression Gauge Assembly**

Specification	
Standard Compression Pressure (Minimum Cranking Speed 250 rpm)—Pressure	3432 kPa (498 psi)
Minimum Compression—Pressure	2746 kPa (398 psi)
Maximum Compression Pressure Difference Between Cylinders—Pressure	245 kPa (36 psi)

- If pressure increases significantly, check piston, rings, and cylinder walls for wear or damage.
- If pressure does not increase significantly after retest, check for leaking valves, valve seats, or cylinder head gasket.

MX52301,0000183 -19-10JUL14-1/1

Water Pump and Alternator Drive Belt Adjustment—Diesel

Reason:

To keep proper belt tension. To prevent shortened belt and bearing life.

Equipment:

- JDG529 or JDST28 Belt Tension Gauge
- Straight Edge

Procedure:

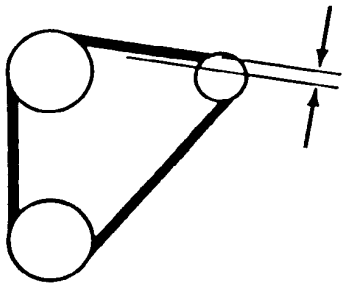
1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Remove water pump and alternator belt cover.
5. Check belt tension between water pump and alternator using Belt Tension Gauge and a straight edge.

Specification

Applied—Force.....98 N (22 lb.-force)

Results:

If deflection is not within specifications:



MXAL30476 —UN—10JUL12

Specification

Alternator Drive Belt Deflection—Distance.....10—15 mm (0.4—0.6 in.)

- Loosen top and bottom alternator mounting cap screws and nuts.
- Apply force to side of alternator housing until tension is correct.
- Tighten alternator mounting hardware.
- Install water pump and alternator belt cover.

MX52301,0000184 -19-23OCT14-1/1

Thermostat Test—Diesel

Reason:

To determine opening temperature of thermostat.

Equipment:

- Thermometer
- Glass Container
- Heating Unit

Procedure:

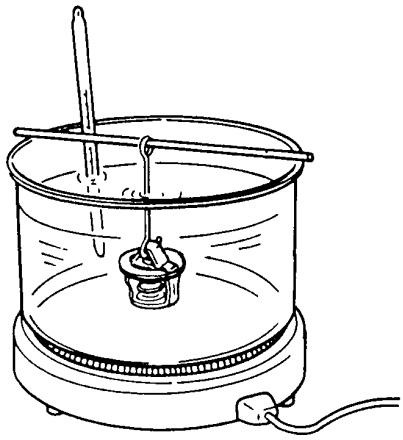
1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Remove thermostat. See Thermostat Removal and Installation.

CAUTION: Do not allow thermostat or thermometer to rest against the side or bottom of glass container when heating water. Either may rupture if overheated.

5. Suspend thermostat and a thermometer in a container of water.
6. Heat and stir the water. Observe opening action of thermometer and compare temperatures with specifications.

Specification

Begin Thermostat Opening—Temperature ..... 69.65—72.5 °C (157—163 °F)



LVT001275 —UN—25OCT10

Thermostat Fully Open—Temperature ..... 85 °C (185 °F)

Thermostat Minimum Lift—Height ..... 8 mm (0.310 in.)

7. Remove thermostat and observe its closing action as it cools.

Results:

- If thermostat does not open according to specifications, replace.
- If closing action is not smooth and slow, replace thermostat.

MX52301,0000185 -19-23OCT14-1/1

Radiator Bubble Test—Diesel

Reason:

To determine if compression pressure is leaking from combustion chamber or cylinder into cooling system.

Equipment:

- JDG472 Adapter

Procedure:

1. With coolant at proper level and radiator cap tight, run engine for 5 minutes to bring to operating temperature.
2. Remove cap from plastic coolant recovery tank.
3. Check for bubbles coming from overflow hose at bottom of tank.

   If bubbles are present, isolate source of compression leak:

   - Remove injection nozzles.
   - Install JDG472 Adapter in injection port of cylinder.
     - JDG472 Adapter
   - Move piston to bottom of stroke with intake and exhaust valves closed.
   - Connect hose from compressed air source to adapter. Do not exceed rated pressure of hoses and tools being used. Do not exceed 355 psi pressure.
   - Check for bubbles in coolant recovery tank, or air escaping from muffler, air cleaner, or oil fill opening.
   - Repeat for each cylinder.

Results:

If bubbles are present:

- Check for cracks in cylinder head and block. Check for damaged head gasket.

If air escapes from muffler:

- Check for worn exhaust valve.

If air escapes from air cleaner:

- Check for worn intake valve.

If air escapes from engine oil fill:

- Check for worn piston rings.

MX52301,0000186 -19-23OCT14-1/1

Cooling System Pressure Test—Diesel

Reason:

To inspect cooling system for leaks.

Equipment:

- D05104ST Cooling System Pressure Pump
- JDG692 Radiator Pressure Test Kit (Adapters)

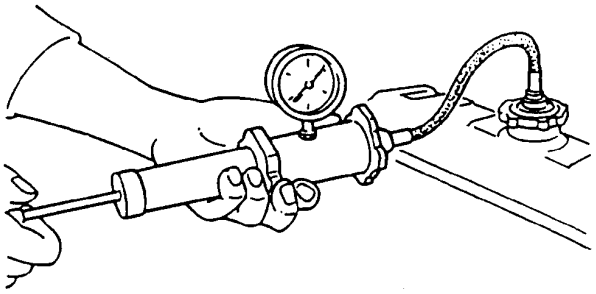
Procedure:

CAUTION: Coolant may be above boiling temperature and under pressure in cooling system. Do not remove pressure cap when system is hot. Escaping steam will burn unprotected skin. Always wear protective clothing and goggles when servicing cooling system.

1. Check cooling system is cool and check system pressure has dropped.
2. Remove radiator cap. Top off coolant if low. Attach cooling system pressure pump.
3. Pressurize system with tester to 100 kPa (15 psi).
4. Check for leaks throughout cooling system.

Results:

- Pressure holds to specifications.



M87350 —UN—15OCT10

Specification

Maximum —Pressure	117 kPa (17 psi)

Specification

Minimum Pressure after 15 seconds—Pressure	90 kPa (13 psi)

If pressure decreases, check for leaks. Repair leaks or replace parts as necessary.

- If leakage continues after all external leaks have been stopped, a defective head gasket, cracked block, or cylinder head may be the cause.

MX52301,0000187 -19-15SEP15-1/1

Radiator Cap Pressure Test—Diesel

Reason:

To test radiator cap spring and seal for correct opening pressure range.

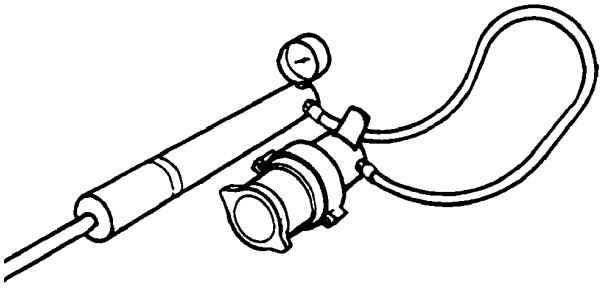
Equipment:

- D05104ST Cooling System Pressure Pump
- JDG692 Radiator Pressure Test Kit (Adapters)

Procedure:

1. Install radiator cap on appropriate adapter.
2. Attach adapter to D05104ST pressure pump.
3. Apply pressure. Pressure valve in cap should open according to specifications.

	Specification
Valve Opening—Pressure	83—96 kPa (12—14 psi)



MXAL30479 —UN—10JUL12

Results:

- If cap leaks, relieve pressure and retighten cap. Test again. Replace cap if pressure is not within specification.

MX52301,0000188 -19-23OCT14-1/1

Engine Oil Pressure Test—Diesel

Reason:

To determine if engine bearings or lubrication system components are worn.

Equipment:

- JT03017 Hose Assembly
- JT03349 Connector

Procedure:

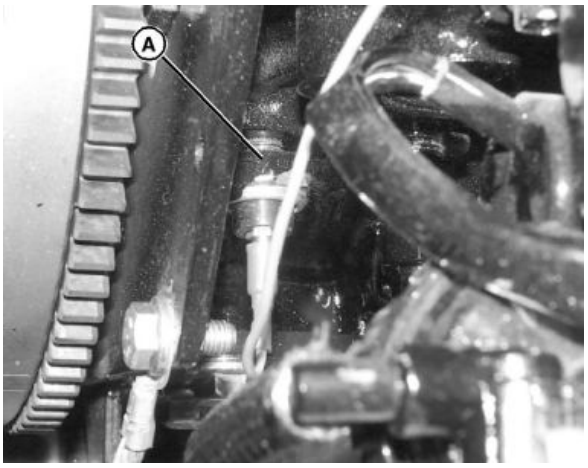
1. Park machine in safely with park brake locked. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Unplug wire to oil pressure switch.
5. Unscrew oil pressure switch (A) from block.
6. Install JT03349 Connector into block.
7. Connect Hose Assembly and Pressure Gauge.

IMPORTANT: Stop running engine if no oil pressure is present.

8. Start engine. If pressure reading is below 69 kPa (10 psi), stop engine.
9. Heat oil by running engine approximately five minutes. Check oil pressure at fast idle specification.

Specification	
Fast Idle—Speed	3625—3675 rpm

10. When test is complete:
    a. STOP engine and allow engine to cool.
    b. Remove Hose Assembly and Pressure Gauge.



MXT011193 —UN—16MAY14

A—Oil Pressure Switch

    c. Remove JT03349 Connector from block.
    d. Install oil pressure switch and switch wiring lead. Use John Deere Pipe Sealant with TEFLON (medium strength), or equivalent, on switch threads.

Results:

- If oil pressure is not within specifications, inspect oil pressure regulating valve parts for wear or damage.

Specification	
Engine Oil—Pressure	245—343 kPa (35—49 psi)

  Add or remove shims as necessary. See Lubrication System in this section.
- If oil pressure does not increase, See “Engine Has Low Oil Pressure” in Diagnosis group.

MX52301,0000189 -19-23OCT14-1/1

Injection Pump Timing—Diesel

EPA engines have an EPA compliance sticker on rocker arm cover.

CAUTION: DO NOT attempt to adjust the fuel injection pump timing. For most engine problems, the fuel injection pump timing will not have to be adjusted. If the engine performed well at one time, then performance dropped, the fuel injection timing is NOT the problem. Fuel injection timing, once set by the engine manufacturer, should NOT change during the life of the engine.

IMPORTANT: Fuel injection pump timing should NOT change during the life of the engine unless the pump has been altered illegally, or there is excessive wear to the camshaft injection pump cam lobes and lifters.

First check the fuel quality, fuel supply, fuel injectors, air intake system, and engine compression in all cylinders before considering fuel injection timing problems.

If all other possibilities have been ruled out and it is determined that the fuel injection pump and governor assembly are in need of repair, they must be replaced ONLY as complete assemblies.

Only an authorized factory trained technician is allowed to remove and install these assemblies.

Specification	
Injection Timing	
3TNE68—Angle	15.5°—18.5°

Specification	
Injection Timing	
3TNV70—Angle	17°—19°

MX52301,000018A -19-23OCT14-1/1

Fuel Injection Nozzle Test—Diesel

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical Department in Moline, Illinois, U.S.A.

Reason:

To determine opening pressure, leakage, chatter, and spray pattern of the fuel injection nozzle.

Equipment:

- D01109AA Diesel Fuel Injection Nozzle Tester
- D02220AA Adapter Set
- 23622 Straight Adapter
- Container

Connections:

1. Connect fuel injection nozzle to D01109AA Diesel Fuel Injection Nozzle Tester using parts from D01110AA Adapter Set and 23622 Straight Adapter.

IMPORTANT: To get best results use clean filtered diesel fuel to test injection nozzles.

Procedure 1:

Test fuel injection nozzle opening pressure following the Nozzle Tester manufacturer's instructions.

Results:

- If pressure reading does not meet specification, disassemble injection nozzle and inspect nozzle assembly for contamination or stuck valve. If necessary, add or remove shims to change opening pressure.

	Specification
3TNE68 — Fuel Injection Nozzle Opening—Pressure	11722—12202 kPa (1700—1770 psi)

	Specification
3TNV70 — Fuel Injection Nozzle Opening—Pressure	11800—12800 kPa (1712—1856 psi)

LVT001296 —UN—26OCT10

Procedure 2:

Test fuel injection nozzle leakage following the Nozzle Tester manufacturer's instructions.

1. Dry nozzle completely using a lint-free cloth.
2. Pressurize nozzle to 11 032 kPa (1600 psi).
3. Watch for leakage from nozzle spray orifice for a minimum of 10 seconds.

Results:

- If leakage time does not meet specification, disassemble injection nozzle and inspect nozzle assembly for contamination. Inspect valve seating surface. Replace nozzle assembly if necessary.

Procedure 3:

Test fuel injection nozzle chatter and spray pattern following the Nozzle Tester manufacturer's instructions.

1. 3TNE68 — Pressurize nozzle to 11 722—12 202 kPa (1700—1770 psi).
2. 3TNV70 — Pressurize nozzle to 11 800—12 800 kPa (1712—1856 psi).

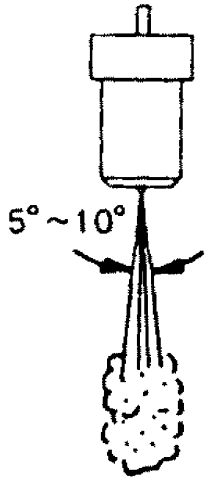
Continued on next page

MX52301,000018B -19-23OCT14-1/2

3. Listen for “chatter” sound and watch spray pattern.

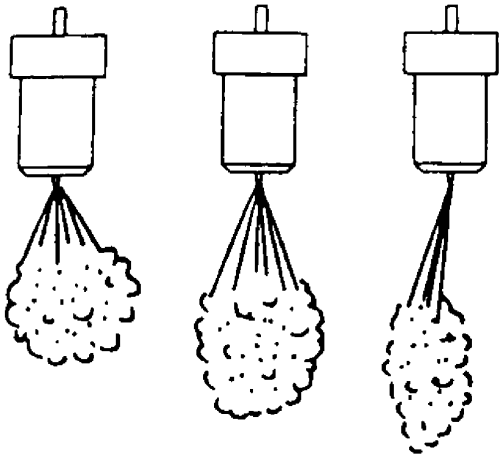
Results:

- If nozzle chatter or spray pattern does not meet specifications, disassemble injection nozzle and inspect nozzle assembly for contamination. See Fuel Injection Nozzle.
- Inspect valve seating surface. Replace nozzle assembly if necessary.
- If there is excessive difference in spray angle or injection angle, incomplete atomization or sluggish starting or stopping of injection, disassemble injection nozzle and inspect nozzle assembly for contamination. See Fuel Injection Nozzle. Replace nozzle assembly if necessary.



TCT003485 —UN—08JUN12

Correct Injection Angle



TCT003486 —UN—08JUN12

Incorrect Injection Angle

MX52301,000018B -19-23OCT14-2/2

Fuel Injection System Tests—Diesel

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting high-pressure lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical Department in Moline, Illinois, U.S.A.

Reason:

To stop fuel flow to the cylinders (one at a time), while engine is running, to determine what effect that cylinder has on overall engine performance.

Equipment:

- (2) 17 mm Open-End Wrenches

Procedure:

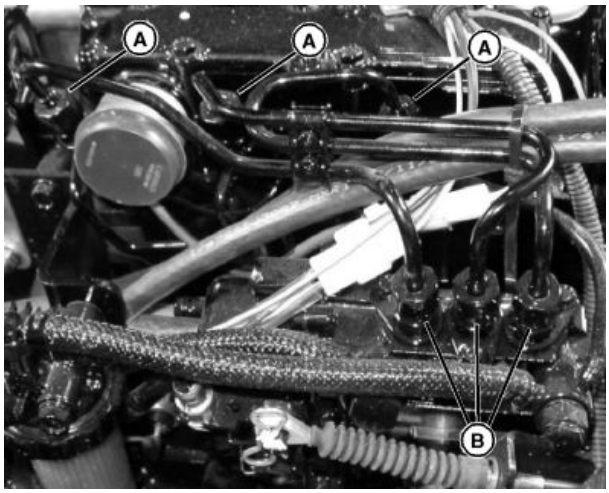
1. Park machine safely. See the “Safety Section”.
2. Raise cargo box.

CAUTION: This test causes diesel fuel to be released from fuel system. Injection pump is capable of producing extremely high pressure. Eye protection must be worn. Do not open fuel injector connectors more than 1/8 of a turn. Do not place hands near injectors during test. Do not allow any debris to enter air intake during test. Do not smoke.

3. Start engine and run at slow idle.

IMPORTANT: Air intake hose removed for photo. Do not operate engine without proper air filtration in place.

4. Use two 17 mm open-end wrenches. Loosen nut on one high-pressure fuel injector line, either at the injector nozzle (A), or at injection pump (B), while holding lower nut stationary with second wrench. Only loosen nut 1/8 of a turn (45°).
5. Listen for engine speed drop and exhaust noise change.
6. Tighten nut and allow engine to return to original speed before loosening next cylinder fuel line nut.



MXT012108 —UN—16JUN14

A—Injector Nozzle **B—Injection Pump**

7. Compare sound and speed of each cylinder as it is disabled.
8. Tighten fuel line nuts and stop engine

Results:

- When fuel flow is stopped to a cylinder, engine rpm should drop, engine should begin to vibrate and run rough, and exhaust noise will be uneven until fuel flow is restored.

If test produces the results described, but engine performance remains poor, test the following:

- Clogged air cleaner elements, leaking air filter outlet hoses or clamps.
- Restriction in exhaust system.
- Presence of coolant or diesel in crankcase oil.

If defeating a single cylinder has no effect on overall engine performance, test the following:

- Fuel injector nozzle opening pressure, spray pattern, and leakage and for that cylinder. SeeFuel Injection Nozzle Test—Diesel.
- Cylinder compression or cylinder leakage test.
- Fuel supply pump pressure.
- Fuel shutoff solenoid is opening fully.
- Fuel control and governor linkage flyweights allowing full fuel flow to injection pump.
- Injection pump timing correct.

If the test results are within specifications, remove injection pump and have tested at an Authorized Diesel Service (ADS) Center.

MX52301,000018C -19-23OCT14-1/1

Injection Pump Static Timing Check—Diesel

Reason:

To make sure that the injection pump timing is set to manufacturers specification.

Equipment:

- Timing Tool (Made from high-pressure pipe, nut, and a clear plastic straw**)** straw from WD40, carburetor cleaner, or brake parts cleaner.
- External fuel supply

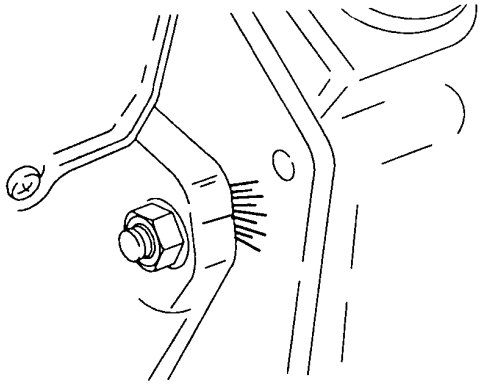
Procedure:

IMPORTANT: The injection pump timing should be correct. The timing is set at the factory, and will not normally change during the life of the engine. Check and adjust the timing only as the last option, or if there is reason to believe that the timing has been altered. Check the fuel, fuel supply system, injectors, air intake system, and cylinder compression before continuing.

1. Park machine safely with park brake on. See the “Safety Section”.
2. Remove hood.
3. Remove air cleaner assembly.

NOTE: Normal rotation of engine, as viewed from the flywheel end, is counterclockwise. The number one fuel injection line is closest to flywheel.

4. If injection pump was removed, align the arrow or line on the injection pump flange on the mark noted during pump removal.
5. Clean areas around injectors and top of injection pump and remove the fuel injector lines.



MXT011103 —UN—16MAY14

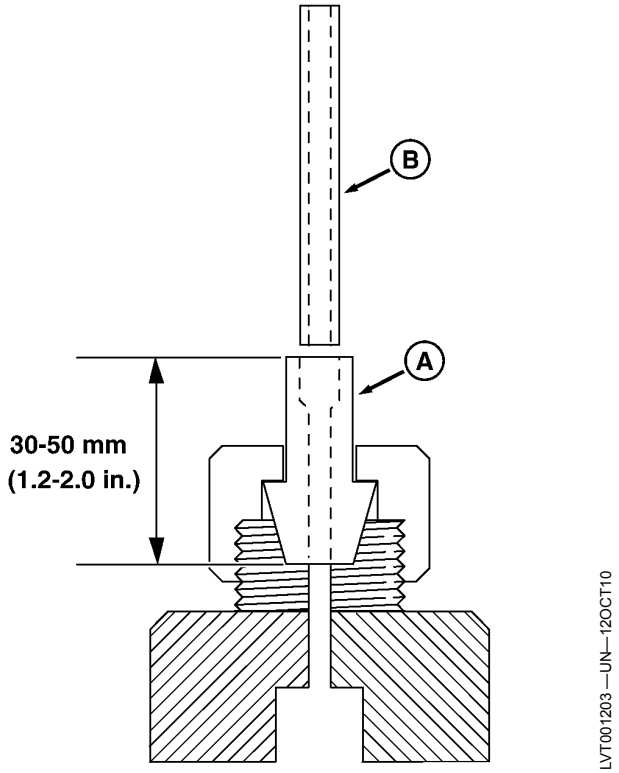
6. To keep dirt from entering system cover openings on injectors and the number 2 and 3 delivery valves on injection pump.

Continued on next page

MX52301,000018D -19-23OCT14-1/4

7. Install the timing tool (A) and clear straw (B) on the number one delivery valve of injection pump.
8. Pump primer lever on the fuel transfer pump to make sure that injection pump is full of fuel.

A—Timing Tool **B—Clear Straw**



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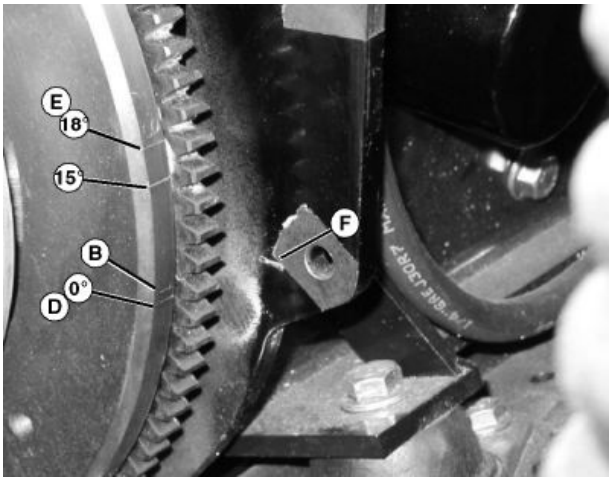
MX52301,000018D -19-23OCT14-2/4

9. Identify which set of timing marks are for number one cylinder (B) and mark flywheel. See Valve Lift Check—Diesel.

NOTE: Fuel shutoff solenoid must be energized to allow for fuel flow procedure. Make sure that battery has enough charge to pull in and hold in fuel shutoff solenoid. If engine is out of vehicle, remove fuel shutoff solenoid.

10. Momentarily turn ignition switch to START position and listen for fuel shutoff solenoid to click. release to ON position to pull in fuel shutoff solenoid. (Fuel shutoff solenoid must be activated during test)
11. Turn the flywheel counterclockwise (as viewed from the flywheel end) until the timing tool straw shows fuel movement.
12. Turn the crankshaft pulley clockwise (back) until the No. 1 cylinder top dead center (TDC) mark (D) and pump timing marks (E) have gone past the mark on the engine backplate F) by at least 50 mm (2 in.).
13. Snap the straw with your finger until the level of the fuel, or a bubble, is set part way up the straw. This level is the point to watch for fuel movement.
14. Slowly turn the flywheel counterclockwise (as viewed from the flywheel end) until the fuel in the straw just starts to move. Stop rotating the flywheel the instant the fuel begins to move.



MXT011102 —UN—16MAY14

Timing MARKS and Positions: 3TNE68, 3TNV70 similar.

B—Cylinder Number (#1 Pictured)
D—0° Position of Cylinder #1
E—Pump Timing Mark
F—Flywheel Guard Mark

MX52301,000018D -19-23OCT14-3/4

NOTE: If there is no fuel movement, engine may be on exhaust stroke. Rotate flywheel 360° and repeat test.

15. Check the injection pump timing marks on the flywheel. The 17° (3TNE68) or 18° (3TNV70) mark on the flywheel must line up with the timing mark (F) on flywheel plate.

Results:

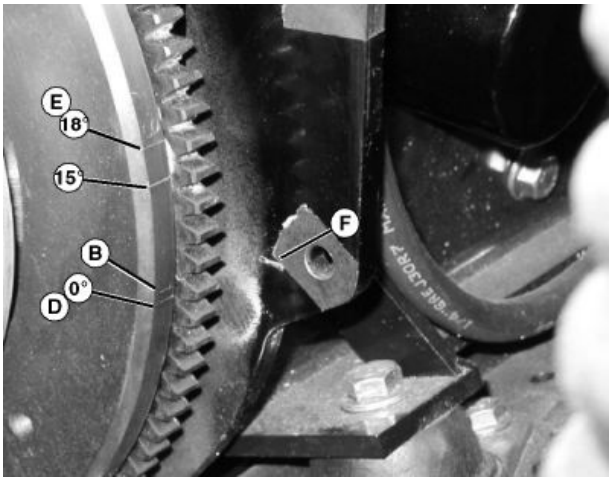
- If the timing is not within specifications, loosen the three injection pump mounting nuts. Turn the top of the pump toward the engine block to retard the timing or away from the block to advance the timing.

Engine Injection Timing—Specification

3TNE68—Angle	15.5°—18.5°
3TNV70—Angle	17°—19°

Recheck the timing. If the timing did not change, remove pump and have it tested by an authorized diesel injection service shop.

- If the timing is correct, remove timing tool, install injector lines, install air cleaner assembly.



MXT011102 —UN—16MAY14

Timing MARKS and Positions: 3TNE68, 3TNV70 similar.

B—Cylinder Number (#1 Pictured)
D—0° Position of Cylinder #1
E—Pump Timing Mark
F—Flywheel Guard Mark

MX52301,000018D -19-23OCT14-4/4

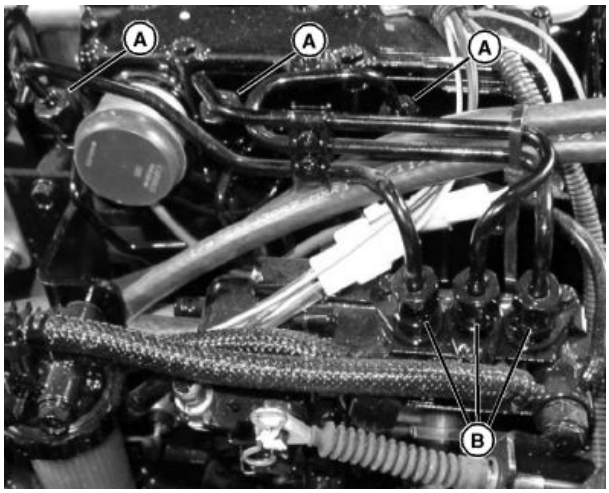
Fuel System Air Bleeding—Diesel

Reason:

The machine incorporates a self bleeding fuel system which forces air out of the fuel filter, injection pump, and injection nozzles, and vents it back to the fuel tank. Fuel system bleeding is usually not necessary after a repair. If the system is drained and does not self-prime without overheating the starter, proceed as follows:

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Raise Hood
3. Be sure that fuel tank is not empty, and fuel valve on fuel filter is in OPEN (“O”) position.
4. Remove air intake hose from the intake manifold and plug intake port to prevent debris from entering manifold.
5. Using a 17 mm open-end wrench, loosen high-pressure line nuts (A) on top of fuel injector nozzles 1/4 turn.
6. Crank engine until fuel is seen seeping from all three injector fittings.



MXT012108 —UN—16JUN14

A—Injector Nozzle **B—Injection Pump**

7. Tighten line nuts and install air intake hose.

MX52301,000018F -19-23OCT14-1/1

Fuel Transfer Pump Flow Test—Diesel

Reason:

To determine fuel transfer pump output volume.

Equipment:

- Graduated container

Procedure:

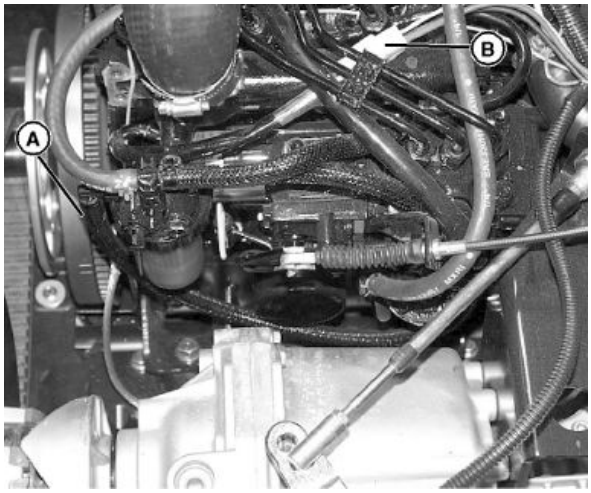
1. Park machine safely with park brake locked. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Disconnect fuel supply hose (A) from fuel filter.

CAUTION: Keep away from flywheel and clutch parts while cranking engine!

5. Disconnect fuel shutoff solenoid connector (B).

NOTE: Be sure that fuel tank is not empty, fuel lines are not pinched or kinked, and battery is fully charged. Do not crank starter for long periods of time to prevent overheating of starter windings.

6. Place end-of-fuel hose into a graduated container and crank engine for 15 seconds.
7. Measure volume of fuel and multiply by four for a per minute value.



MXT011194 —UN—16MAY14

A—Hose **B—Solenoid Connector**

Specification	
Fuel Pump—Flow Rate	118 cc/min (4 oz/min)

Results:

- If fuel volume is below specification, check that fuel lines are not pinched, kinked, or obstructed.
- If fuel lines are OK, replace fuel transfer pump.

MX52301,0000190 -19-23OCT14-1/1

Fuel Transfer Pump Pressure Test—Diesel

Reason:

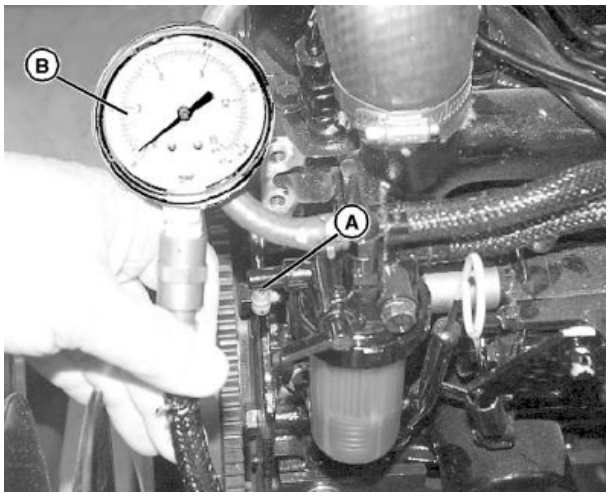
To determine transfer pump operating pressure.

Equipment:

- JDG356 Fuel Pump Pressure Test Kit (includes JDZ27, JTO3247, and JTO1609)
- JDZ27 Pressure Gauge (0—15 psi)
- JTO3247 Reducer
- JTO1609 Hose Coupler

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Disconnect transfer pump outlet hose from inlet of fuel filter (A).
5. Install gauge (B) to transfer pump hose.



MXT011104 —UN—16JUN14

A—Fuel Filter **B—Gauge**

Continued on next page

MX52301,000018E -19-23OCT14-1/2

6. Use manual pump lever (C) on fuel transfer pump to pressurize test gauge and note reading on gauge.
7. Disconnect electrical connector from fuel shutoff solenoid to prevent engine from starting
8. Crank engine with starter for 5—10 seconds watching test gauge. Do not overheat starter

Results:

- If pressure is below specification, replace fuel transfer pump.

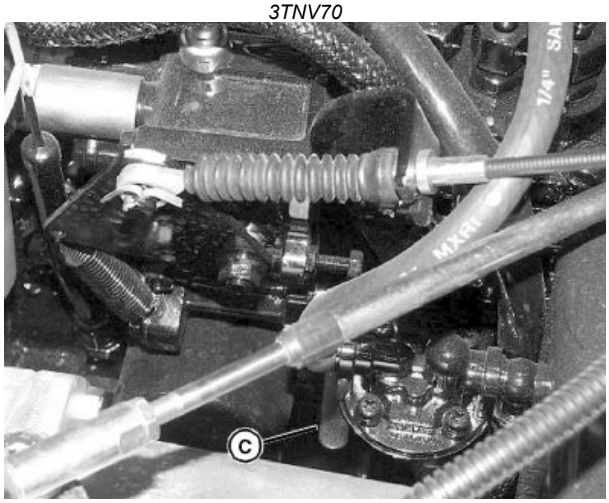
Specification

Minimum
Fuel—Pressure..... 29 kPa (4.3 psi)

C—Manual Pump Lever

MXAL30492 —UN—10JUL12

3TNV70



MXT011105 —UN—16JUN14

Picture Note:3TNE68

MX52301,000018E -19-23OCT14-2/2

Summary of References

- Engine Removal and Installation Diesel
- Muffler Removal and Installation Diesel
- Rocker Arm Cover Removal and Installation 3TNE68
- Rocker Arm Cover Removal and Installation 3TNV70
- Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods
- Cylinder Head Removal and Installation Diesel 3TNE68
- Cylinder Head Removal and Installation Diesel 3TNV70
- Intake Manifold Removal and Installation Diesel 3TNE68
- Exhaust Manifold Removal and Installation Diesel
- Cylinder Head Recondition
- Crankshaft Rear Oil Seal
- Crankshaft Front Oil Seal
- Timing Gear Cover Diesel 3TNE68
- Timing Gear Cover Diesel 3TNV70
- Camshaft End Play Check
- Timing Gear Backlash Check
- Idler Gear 3TNE68
- Idler Gear 3TNV70
- Cam Followers
- Camshaft 3TNE68
- Camshaft 3TNV70
- Oil Pan and Strainer
- Connecting Rod Side Play Check
- Crankshaft End Play Check Diesel
- Connecting Rod Bearing Clearance Check
- Crankshaft Main Bearing Clearance Check
- Piston to Cylinder Head Clearance
- Connecting Rod Repair
- Pistons
- Cylinder Bore
- Crankshaft and Main Bearings
- Flywheel Removal and Installation
- Flywheel Plate
- Timing Gear Housing
- Oil Pump Removal and Installation Diesel 3TNE68
- Oil Pump Removal and Installation Diesel 3TNV70
- Oil Pressure Regulating Valve 3TNE68
- Coolant Temperature Switch
- Thermostat Removal and Installation
- Water Pump Removal and Installation—Diesel
- Fuel Filter Removal and Installation
- Fuel Filter Assembly Removal and Installation
- Fuel Transfer Pump Diesel 3TNE68
- Fuel Transfer Pump Diesel 3TNV70
- Fuel Injection Nozzle
- Fuel Injector Pump Diesel 3TNE68
- Fuel Injection Pump Diesel 3TNV70
- Fuel Injection Pump Camshaft 3TNE68
- Governor 3TNE68
- Fuel Control and Governor Linkage
- Fuel Shutoff Solenoid Removal and Installation
- Starting Motor Removal and Installation Diesel
- 20 Amp Alternator
- 40 Amp Alternator

BS62576,0000298 -19-01NOV20-1/1

Engine Removal and Installation Diesel

MX52301,0000347 -19-22OCT14-1/15

Center Distance Gauge JDG1749	Setting Center Distance Between Engine and Transaxle.

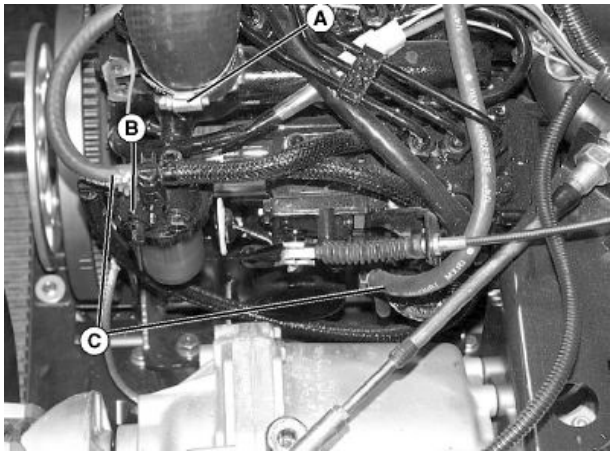
Continued on next page

MX52301,0000347 -19-22OCT14-2/15

Removal:

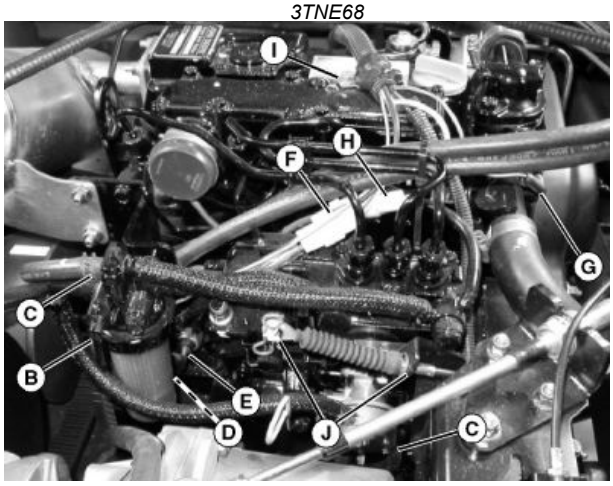
1. Park machine safely. See the “Safety Section”.
2. Disconnect battery negative (-) cable.
3. Remove cargo box. See Cargo Box Removal and installation.
4. Allow muffler to cool, or wear protective gloves before working on muffler. Remove muffler. See Muffler Removal and Installation Diesel .
5. Remove drive belt.
6. Loosen clamp on air intake hose (A) and disconnect hose. Cover opening.
7. Shut off valve on fuel filter(B). Mark fuel hoses (C) for proper reinstallation. Disconnect and plug ends of fuel hoses.

A—Air Intake Hose
B—Fuel Filter Valve
C—Fuel Hoses



MXT011106 —UN—16MAY14

3TNE68



MXT011107 —UN—16MAY14

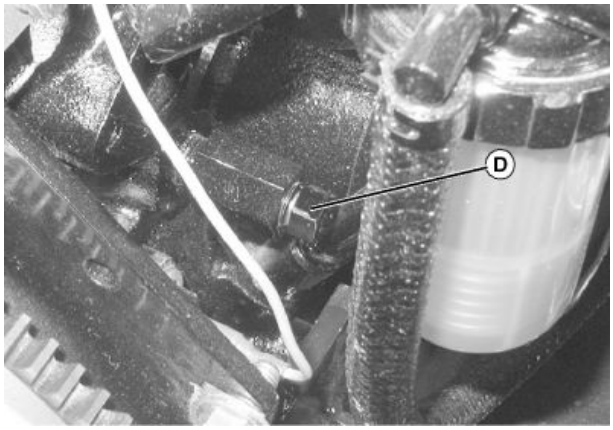
3TNV70

MX52301,0000347 -19-22OCT14-3/15

CAUTION: Coolant may be above boiling temperature and under pressure in cooling system. Do not remove pressure cap when system is hot. Escaping steam burns unprotected skin. Always wear protective clothing and goggles when servicing cooling system.

8. Loosen radiator cap. Place container under engine block drain valve (D). Open drain valve and drain coolant from engine.

D—Engine Block Drain Valve



MXT011108 —UN—16MAY14

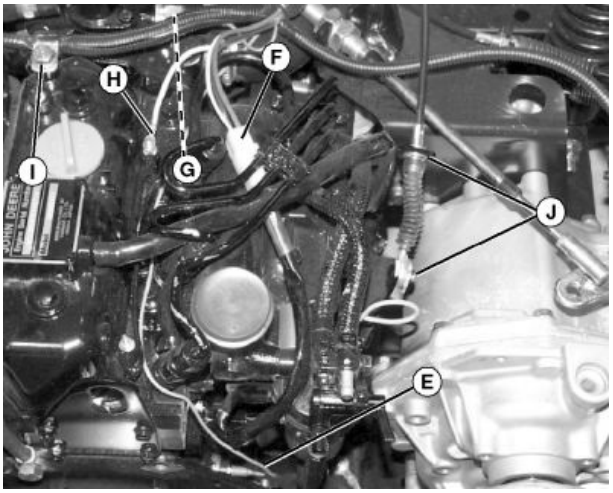
3TNE68 shown, 3TNV70 similar.

Continued on next page

MX52301,0000347 -19-22OCT14-4/15

9. Disconnect oil switch wire (E), fuel shutoff solenoid connector (F), coolant temperature switch (G), glow plug wire (H), and remove bolt from wire harness clamp (I).
10. Disconnect throttle cable (J).

E—Oil Switch Wire
F—Fuel Shutoff Solenoid Connector
G—Coolant Temperature Switch
H—Glow Plug Wire
I— Wire Harness Clamp
J—Throttle Cable

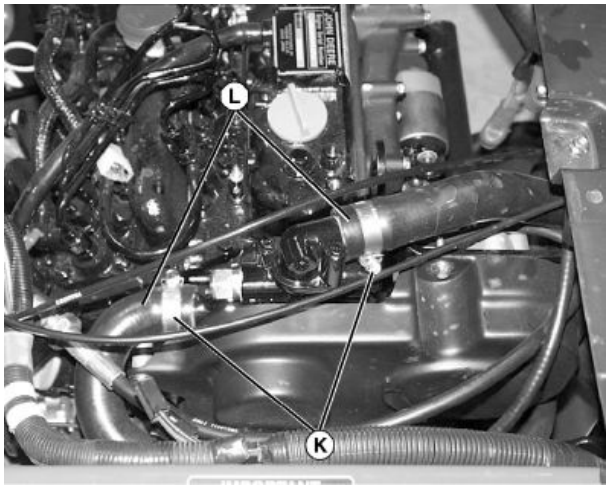


MXT011109 —UN—16MAY14

MX52301,0000347 -19-22OCT14-5/15

11. Loosen Coolant Hose Clamps (K) and disconnect radiator hoses (L).

K—Hose Clamps (2)
L—Radiator Hoses (2)



MXT011110 —UN—16JUN14

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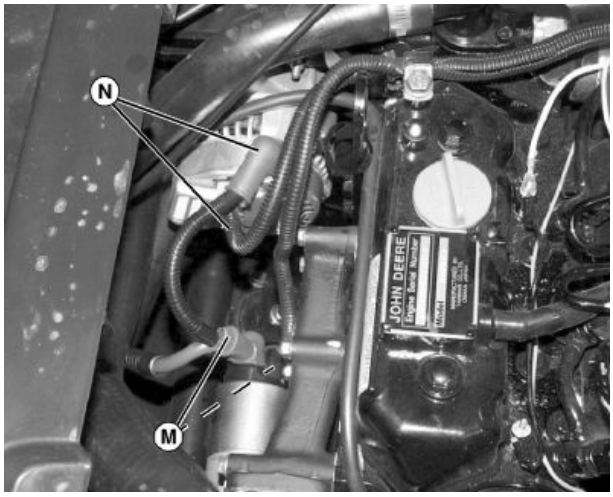
MX52301,0000347 -19-22OCT14-6/15

12. Disconnect wiring from starting motor (M) and alternator (N).

M—Starting Motor **N—Alternator**



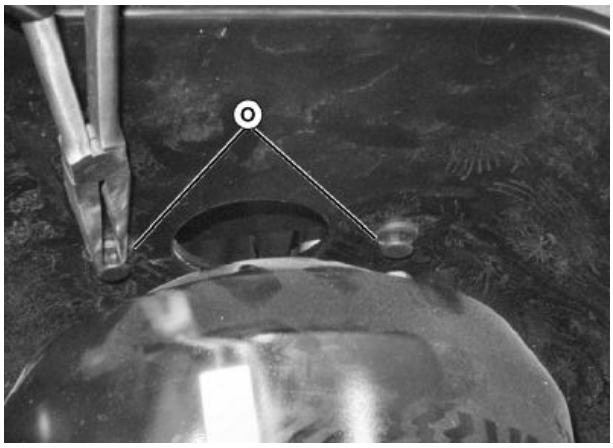
MXT011111 —UN—16MAY14

3TNE68 shown, 3TMV70 similar.

MX52301,0000347 -19-22OCT14-7/15

13. Remove two plastic rivets (O) next to clutch access hole from left side of belt guard.

O—Plastic Rivets

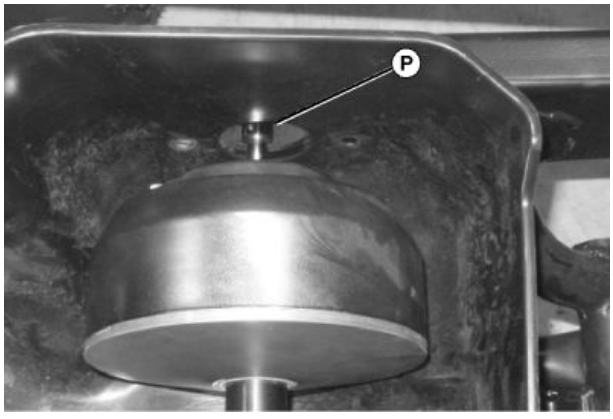


MXT011112 —UN—16MAY14

MX52301,0000347 -19-22OCT14-8/15

14. Remove plastic plug from clutch cover. Remove clutch retaining bolt. Install JDG 1641 clutch removal tool (P) and remove clutch.

P—Clutch Removal Tool



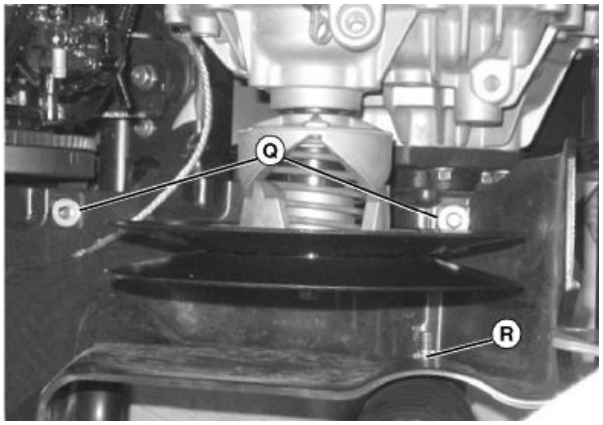
MXT011113 —UN—16MAY14

Continued on next page

MX52301,0000347 -19-22OCT14-9/15

15. Remove two bolts (Q) securing bottom of belt guard. Remove nut from left lower shock bolt (R) and pull bolt out enough to clear guard. Pull up front of guard or remove guard completely to access engine mounts.

Q—Bolts **R—Shock Bolt**



MXT011114 —UN—16MAY14

MX52301,0000347 -19-22OCT14-10/15

16. Remove cap screws from four engine isolators (S), and fifth engine isolator (T).
17. Attach safe lifting device to lift brackets on top of engine. Remove engine from machine.

Installation:

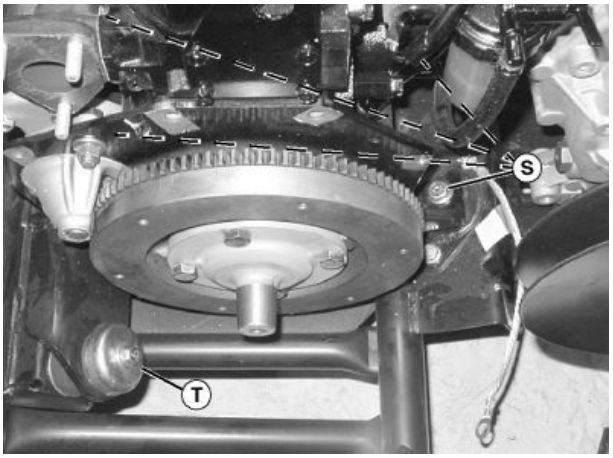
Installation is done in reverse order of removal.

1. Place engine in frame, loosely install four main mounting cap screws through main isolators and engine mounting brackets.
2. Lift engine 5—10 mm (0.2—0.4 in.) to release strain on isolators.
3. Lower engine fully onto isolators. Tighten four main mounting cap screws to specification.

Specification

Four Main Mounting Cap Screw—Torque.....50 N·m (37 lb.-ft.)

4. Install belt guard without fasteners.
5. Install clutch and tighten cap screws to specification



MXT011115 —UN—16MAY14

S—Engine Isolators (4) **T—Fifth Engine Isolator**

Specification

Clutch Cap Screw —Torque.....37 N·m (26 lb.-ft.)

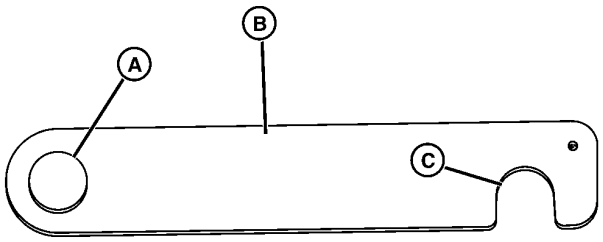
Continued on next page

MX52301,0000347 -19-22OCT14-11/15

6. Place the closed end (A) of clutch center distance gauge (B) (JDG10358) over the end of the secondary clutch. Position the open end (C) over the center shaft of the engine drive clutch.

NOTE: The engine can be pushed toward the driven clutch to allow the gauge to drop onto the clutch shaft.

7. Make sure closed end (A) is seated completely over bushing end at transmission driven clutch.



MXT011116 —UN—22MAY14

A—Closed-End
B—Center Distance Gauge (JDG1749)
C—Open End

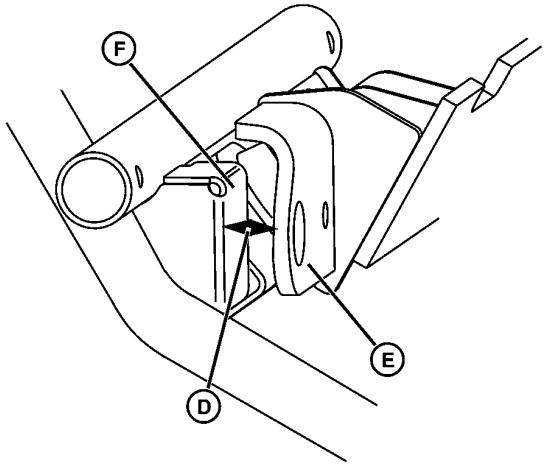
MX52301,0000347 -19-22OCT14-12/15

NOTE: The gap is defined as the distance between the frame and engine snubber brackets when the center distance tool is in place and properly positioning the engine relative to the driven clutch. Isolator parts are not installed during this measurement.

8. Measure the distance (D) between the engine isolator bracket (E) and the frame bracket (F).
9. Compare the measurement with the GAP column of the Diesel Engine Isolator Shim Washer Chart. Determines the approximate number of 1.5 mm shim washers installed with the isolator mounting hardware.

Diesel Engine Isolator Shim Washers	
Gap (mm)	**Number of Shims**
21.10—22.75 mm	0
22.75—24.40 mm	1
24.40—26.05 mm	2
26.05—27.70 mm	3
27.70—29.35 mm	4

10. Remove center distance gauge.



MXT011117 —UN—22MAY14

D—Distance
E—Isolator Bracket
F—Frame Bracket

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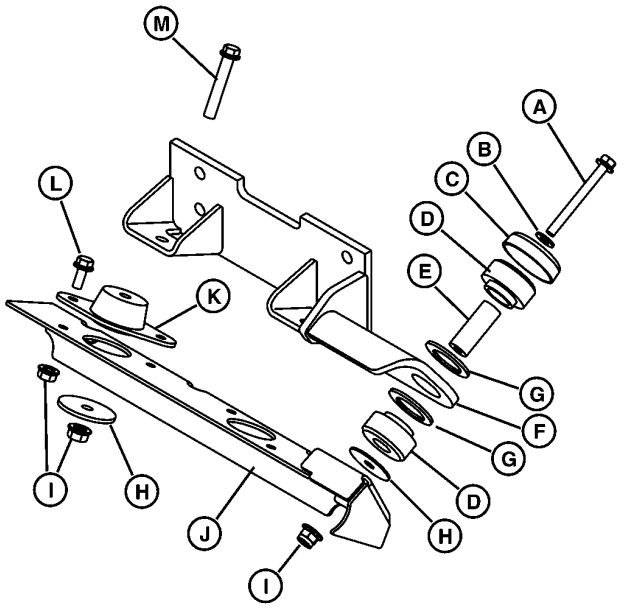
MX52301,0000347 -19-22OCT14-13/15

11. Install fifth isolator parts in order shown.
12. Install correct number shim washers (G) as determined.
13. The washer (H), one rubber mounting (D), and shim washers (G), and are installed between the frame mounting bracket (J) and engine mounting bracket (F).

A—Capscrew
B—Washer
C—Metal Cup
D—Rubber Mount
E—Bushing
F—Engine Mount
G—Washer
H—24H1313 Shim Washer (as required)
I— Flange Nut
J— Frame Mount
K—Isolator (4 used)
L—Cap Screw
M—Cap Screw



MXT011118 —UN—22MAY14

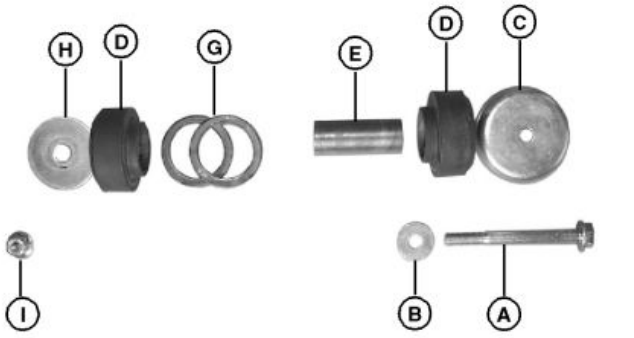
MX52301,0000347 -19-22OCT14-14/15

14. Assemble bushing (E), rubber mount, (D), metal cup (C), washer (B), and cap screw (A) onto engine mount (F).
15. Install second rubber mount (D), metal cup (H), washer (B), and fifth isolation mounting cap screw (A). Install nut (I).
16. Tighten fifth isolation mounting cap screw (A) and nut (I) to specification.

Specification

Fifth Isolator Mounting Cap Screw and Nut—Torque ..... 30—44 N·m (22—32 lb.-ft.)

17. Verify center distance again by placing the center distance gauge on the primary clutch first. Verify that the closed end of the gauge easily slips onto the secondary clutch bearing. Remove or add shims as necessary.
18. Install cap screws and plastic rivets in belt guard.
19. Connect all electrical wires.
20. Connect fuel lines and throttle cable.
21. Connect air cleaner and connect hose to intake manifold.
22. Install drive belt.
23. Fill cooling system with approved coolant. See Radiator Fill and Bleed Procedure — Diesel .



MXT011119 —UN—16MAY14

A—Cap Screw
B—Washer
C—Metal Cup
D—Rubber Mount
E—Bushing
F—Engine Mount
G—24H1313 Shim Washers (as required
H—Metal Cup
I— Nut

24. If drained, fill engine with proper oil. Refer to Specifications section.

Specification

Engine Oil With Filter—Capacity ..... 2.2 L (2.3 qt.)

25. Connect battery negative (-) cable.

MX52301,0000347 -19-22OCT14-15/15

Muffler Removal and Installation Diesel

Removal:

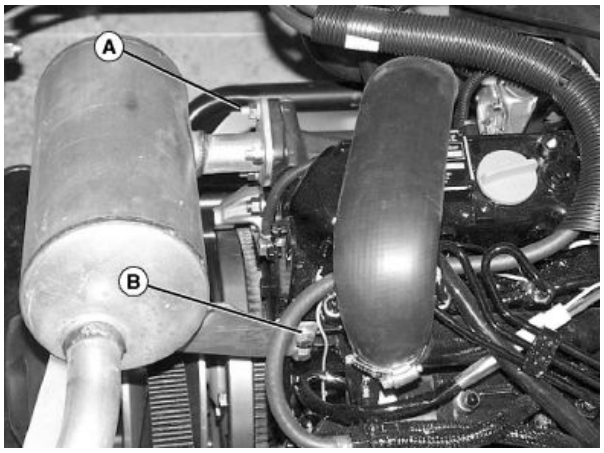
CAUTION: Muffler may be hot. Allow muffler to cool before removing.

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Allow muffler to cool, or wear protective gloves before working on muffler.
4. Remove three nuts (A) holding muffler flange to exhaust manifold. Remove two cap screws (B) from muffler bracket to cylinder head. Remove muffler.
5. Inspect studs on exhaust manifold. Replace if worn.

Installation:

Installation is done in the reverse order of removal.

- Clean sealing surfaces of muffler flange and exhaust manifold and replace gasket before installation.
- Install muffler on exhaust manifold studs and tighten mounting nuts (A) to specification.



MXT011120 —UN—16MAY14

A—Nuts (3 used) **B—Cap Screws (2 used)**

Specification	
Muffler Mount Nuts—Torque	28 N·m (248 lb.-in.)

- Install and tighten muffler bracket cap screws (B).

MX52301,0000348 -19-22OCT14-1/1

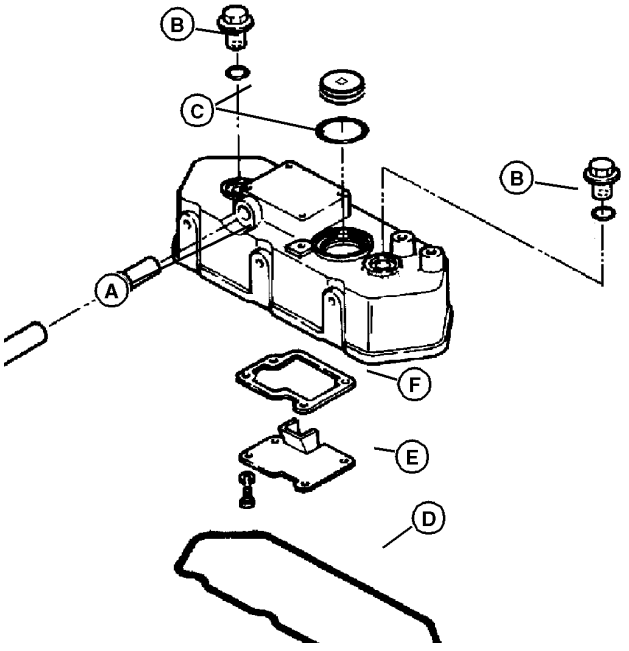
Rocker Arm Cover Removal and Installation 3TNE68

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Disconnect intake air hose from intake manifold.
4. Remove crankcase breather tube from breather fitting (A) on rocker cover.
5. Remove two special nuts (B) securing cover to cylinder head.
6. Remove rocker cover.
7. Inspect O-ring seals (C) for wear or damage. Replace if necessary. Inspect O-ring type rocker cover seal (D) for damage, replace if necessary.
8. Disassemble breather baffle (E) and clean all parts thoroughly, replace gasket (F).

Installation:

Installation is done in reverse order of removal. Tighten cover bolts to specification

Specification:—Specification	
Rocker Arm Cover Bolt—Torque	18 N·m (159 lb.-in.)



MXT011121 —UN—16MAY14

A—Fitting
B—Nuts (2 used)
C—O-ring Seals (2)
D—Rocker Cover Seal
E—Breather Baffle
F—Gasket

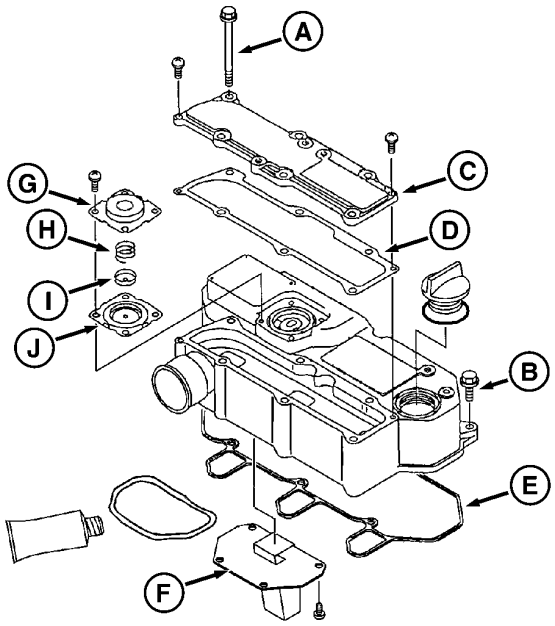
MX52301,0000372 -19-22OCT14-1/1

Rocker Arm Cover Removal and Installation 3TNV70

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Remove Muffler. See Muffler Removal and Installation Diesel .
4. Loosen hose clamp from air cleaner hose and remove air cleaner.
5. Remove six long (A) and three short bolts (B) securing valve cover to cylinder head.
6. Remove valve cover.
7. Remove intake cover (C) and clean off mating surfaces and replace gasket (D).
8. Remove and disassemble breather baffle (F) and clean or replace mesh media.
9. Remove diaphragm cover (G), spring (H), center plate (I), and diaphragm (J).
10. Inspect diaphragm (J), spring (H), and center plate (I) for wear or damage. Diaphragm must not have any cracks or tears and must not leak. Replace parts showing any wear.
    - Clean all parts.
    - Install valve arm cover using a new gasket.
    - Use John Deere Form in Place Gasket between breather baffle and valve cover.
    - Tighten rocker cover bolts to specification during installation.

Specification

Rocker Arm Cover Bolt—Torque	11 N·m (97 lb.-in.)

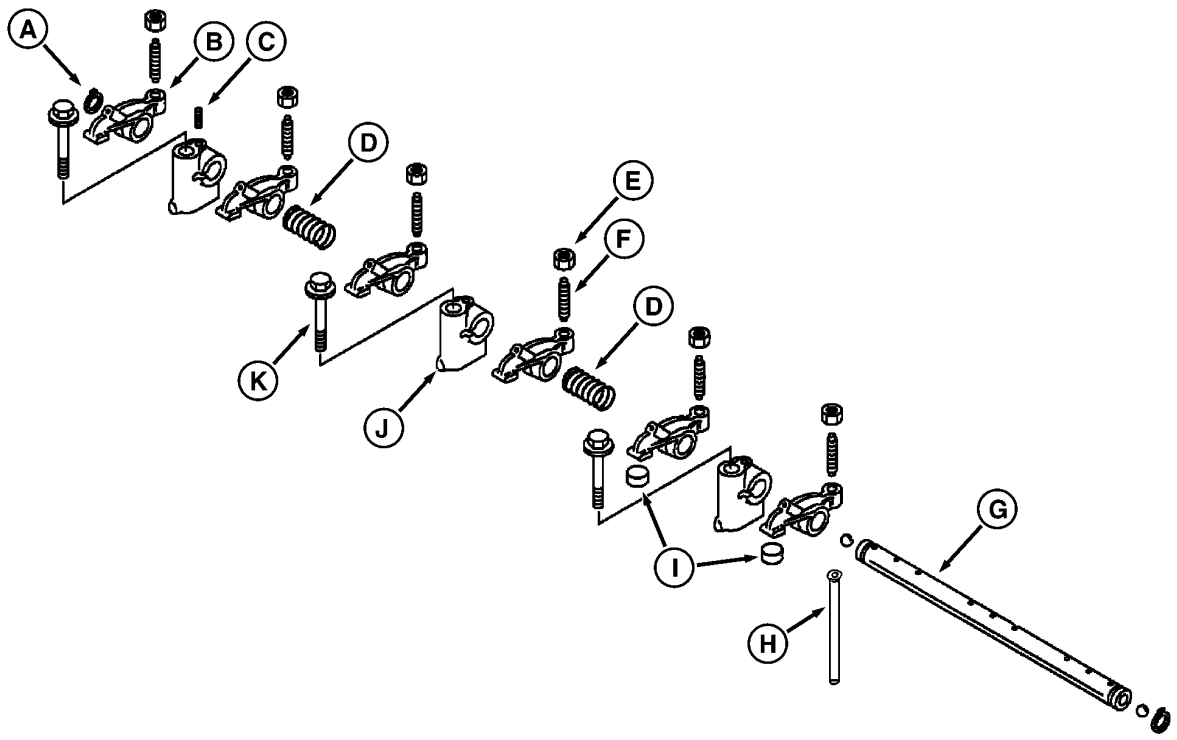


LVT001256 —UN—22OCT10

A—Long Bolts (6 used)
B—Short Bolts (3 used)
C—Intake Cover
D—Top Gasket
E—Bottom Gasket
F—Breather Baffle
G—Diaphram Cover
H—Spring
I— Center Plate
J— Diaphram

MX52301,000034A -19-22OCT14-1/1

Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods



LVT001257 —UN—22OCT10

A—Retaining Ring (2 used)
B—Rocker Arm (3 intake and 3 exhaust)
C—Set Screw
D—Rocker Arm Shaft Spring (2 used)
E—Nut (6 used)
F—Adjusting Screw (6 used)
G—Rocker Arm Shaft
H—Push Rod
I— Valve Caps (6 used)
J— Rocker Arm Support (3 used)
K—Mounting Cap Screw (3 used)

1. Before disassembly, mark all parts for location to aid reassembly.
2. Remove end retaining rings (A) and slide components off rocker arm shaft (B).
3. Remove set screw (C) from center support. Remove rocker arm shaft from center support.
4. Clean all parts of varnish and oil.

OUMX258,00004E9 -19-24JUL14-1/5

5. Measure outer diameter of rocker arm shaft.

Rocker Arm Shaft, 3TNE68—Specification

Standard—OD.....9.97—9.98 mm (0.392—0.393 in.)
Wear Limit—OD (minimum)..... 9.95 mm (0.392 in.)

Rocker Arm Shaft, 3TNV70—Specification

Standard—OD..... 11.97—11.98 mm (0.471—0.472 in.)
Wear Limit—OD (minimum).....11.95 mm (0.470 in.)

M35262 —UN—29AUG88

Replace rocker arm shaft if less than wear limit.

Continued on next page

OUMX258,00004E9 -19-24JUL14-2/5

6. Measure inside diameter of rocker arms and rocker shaft supports.

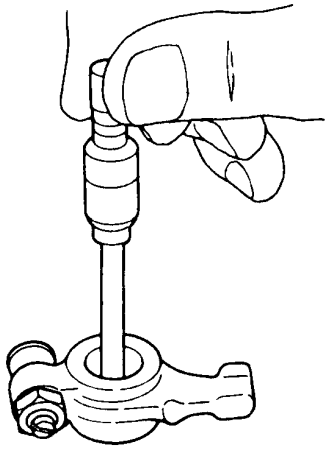
Rocker Arm and Shaft Support, 3TE68—Specification

Standard Rocker Arm and Shaft Support—ID	10.00—10.02 mm (0.394—0.395 in.)
Wear Limit—ID (maximum)	10.09 mm (0.397 in.)
Rocker Arm and Shaft Support—Clearance	0.14 mm (0.005 in.)

Rocker Arm and Shaft Support, 3TNV70—Specification

Standard—ID	12.00—12.02 mm (0.472—0.473 in.)
Wear Limit—ID (maximum)	12.09 mm (0.476 in.)
Rocker Arm and Shaft Support—Clearance	0.14 mm (0.005 in.)

Replace rocker arms or supports if ID is more than wear limit.



MXAL30519 —UN—16MAY14

7. If shaft, support, and arm clearance (support or arm ID minus shaft OD) exceed wear limit, replace all parts.

OUMX258,00004E9 -19-24JUL14-3/5

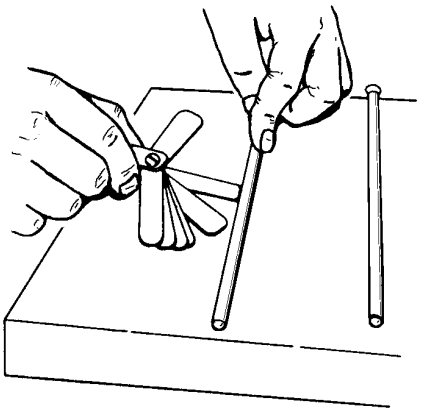
8. Lay push rod on flat surface and roll while checking for a gap under center of rod. Check dimension using a feeler gauge.

Specification

Push Rod—Gap	0—0.03 mm (0.0—0.001 in.)

Replace push rod if not within specifications.

9. Check the surface of the adjusting screw that contacts the push rod for wear. Replace push rod or adjusting screw if worn.
10. Check the rocker arm-to-valve stem cap contact surface for wear. Replace rocker arm if worn.
11. Assemble rocker arm assembly.



LVT001032 —UN—15JUL10

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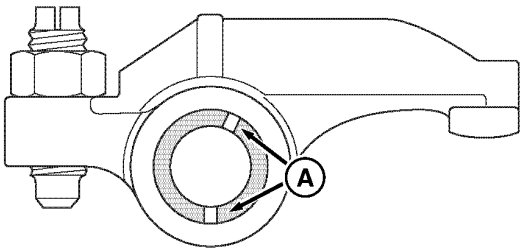
OUMX258,00004E9 -19-24JUL14-4/5

a. Make sure oil holes (A) are oriented as shown when assembling rocker arm shaft components. Assemble rocker shaft (G) aligning set screw hole in shaft with set screw (C) in number one cylinder shaft support (flywheel end).

b. Be sure that rocker arms are installed in same order as removed.

12. Install rocker arm assembly. See Rocker Arm Cover Removal and Installation 3TNE68 or Rocker Arm Cover Removal and Installation 3TNV70.



LVT001258 —UN—22OCT10

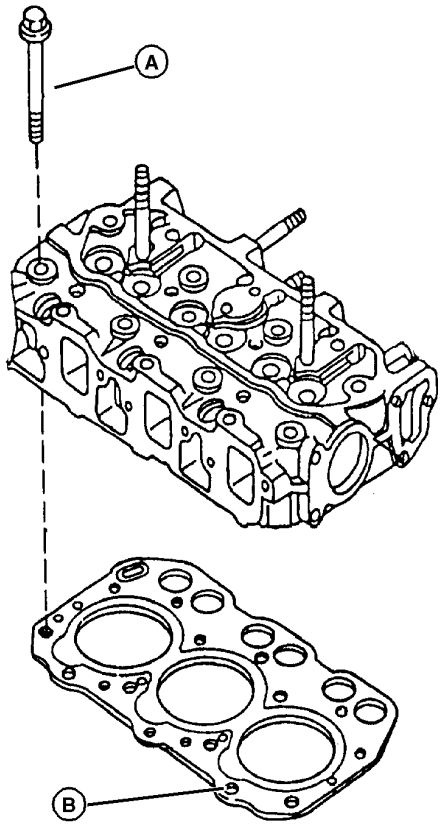
A—Oil Holes

OUMX258,00004E9 -19-24JUL14-5/5

Cylinder Head Removal and Installation Diesel 3TNE68

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Disconnect negative battery cable from battery.
4. Shut off fuel valve on fuel filter.
5. Remove air cleaner hose from intake manifold and plug opening.
6. Allow engine to cool, and cooling system pressure to return to zero. Drain coolant from engine block drain valve.
7. Remove muffler. See Muffler Removal and Installation Diesel.
8. Remove water pump. See Water Pump Removal and Installation—Diesel.
9. Remove high-pressure fuel lines and fuel injector nozzles.
10. Disconnect glow plug wire.
11. Remove coolant temperature sensor wire from sensor.
12. Loosen then remove cylinder head bolts (A).
13. Using lift bracket and hoist, pull head straight up from block.
14. Remove exhaust and intake manifolds. See Intake Manifold Removal and Installation Diesel 3TNE68 and Exhaust Manifold Removal and Installation Diesel.
15. Remove rocker arm cover. See Rocker Arm Cover Removal and Installation 3TNE68.
16. Remove rocker arm assembly, push rods, and valve caps from cylinder head. See Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods.



MXT011125 —UN—16MAY14

A—Cylinder Head Bolts (14) **B—Oil Passage**

17. Disassemble and inspect cylinder head and valves. See Cylinder Head Recondition.

Continued on next page

MX52301,0000375 -19-23OCT14-1/3

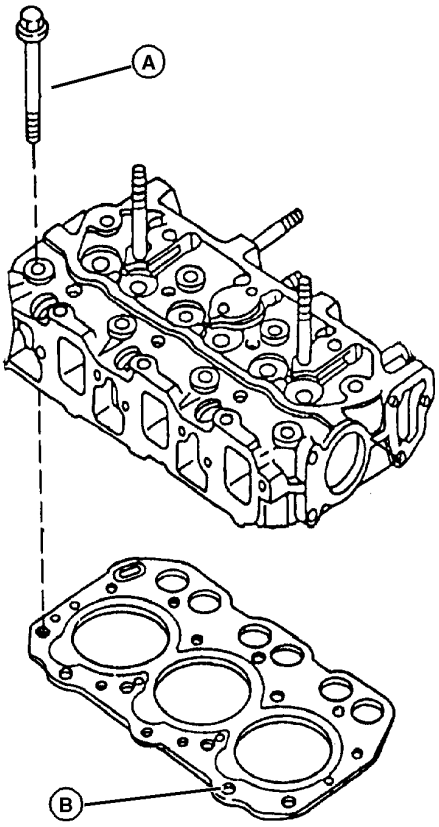
Installation:

1. Clean all threads in top of cylinder block with a flat bottom tap, and blow debris from hole.
2. Clean top of cylinder block and check for flatness.
3. Place a new cylinder head gasket on cylinder block with oil passage (B) lined up with oil port in block.
4. Position cylinder head on gasket.

IMPORTANT: Oil passage (B) in gasket must be located over oil passage in cylinder block.

5. Clean threads of cylinder head bolts (A) and dip in clean oil before installing. Install all bolts finger tight before tightening with wrench.

A—Cylinder Head Bolts (14) **B—Oil Passage**



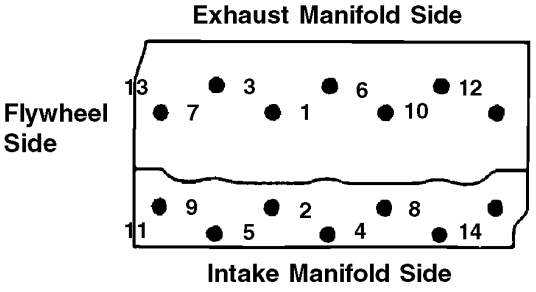
MXT011125 —UN—16MAY14

MX52301,0000375 -19-23OCT14-2/3

IMPORTANT: Cylinder head mounting cap screws must be checked for proper torque after 50 hours of engine operation.

6. Tighten cylinder head bolts in sequence shown in two steps from specifications.

Specification	
Cylinder Head Bolts (oil applied) First —Torque	13.6 N·m (120 lb.-in.)
Cylinder Head Bolts Second—Torque	27 N·m (240 lb.-in.)
Cylinder Head Bolts Final—Torque	41 N·m (360 lb.-in.)



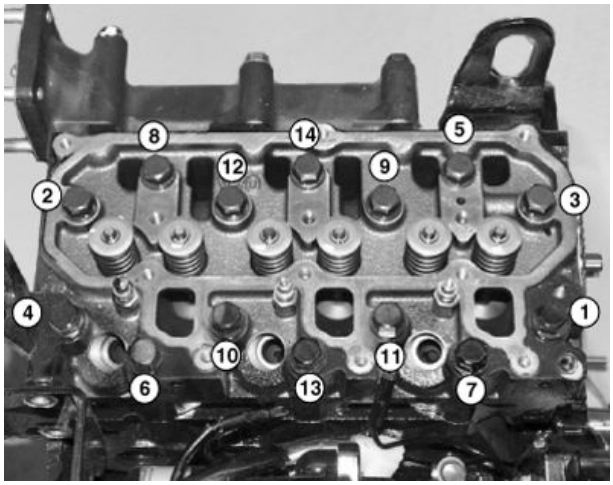
MXT011126 —UN—16MAY14

MX52301,0000375 -19-23OCT14-3/3

Cylinder Head Removal and Installation Diesel 3TNV70

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Disconnect negative battery cable from battery.
4. Shut off fuel valve on fuel filter.
5. Remove air cleaner hose from valve cover.
6. Allow engine to cool, and cooling system pressure to return to zero. Drain coolant from engine block drain valve under right side of machine.
7. Remove muffler and tailpipe from exhaust manifold. See Muffler Removal and Installation Diesel .
8. Remove coolant recovery tank and mounting bracket from cylinder head.
9. Remove coolant hoses from thermostat housing and water pump.
10. Remove coolant temperature sensor wire from sensor.
11. Remove upper alternator bracket and fan belt from water pump.
12. Remove water pump. See Water Pump Removal and Installation—Diesel.
13. Remove high-pressure fuel lines and fuel leak-off line running from fuel injection pump to nozzles.
14. Disconnect glow plug wiring harness from engine harness.
15. Remove valve cover. See Rocker Arm Cover Removal and Installation 3TNV70.
16. Remove rocker arm assembly, push rods, and valve caps from cylinder head. See Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods.
17. Remove the cylinder head bolts in the sequence shown.
18. Using lift brackets and hoist, pull head straight up from block.
19. Remove exhaust manifold.
20. Disassemble and inspect cylinder head and valves. See Cylinder Head Recondition.



Removal Sequence

MXAL30525 —UN—10JUL12

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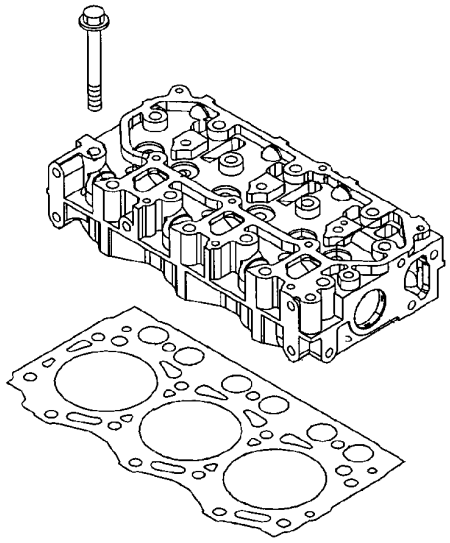
MX52301,000034C -19-23OCT14-1/3

Installation:

1. Clean all threads in top of cylinder block with a flat bottom tap, and blow debris from hole.
2. Clean top of cylinder block and check for flatness.

IMPORTANT: Oil passage in gasket must be located over oil passage in cylinder block.

3. Place a new cylinder head gasket on cylinder block with locating pins on front and rear of block inside holes in gasket. Lineup oil port on left rear of block with oil hole in gasket.
4. Clean threads of cylinder head bolts and dip in clean oil before installing. Install all bolts finger tight before tightening with wrench.



LVT001276 —UN—25OCT10

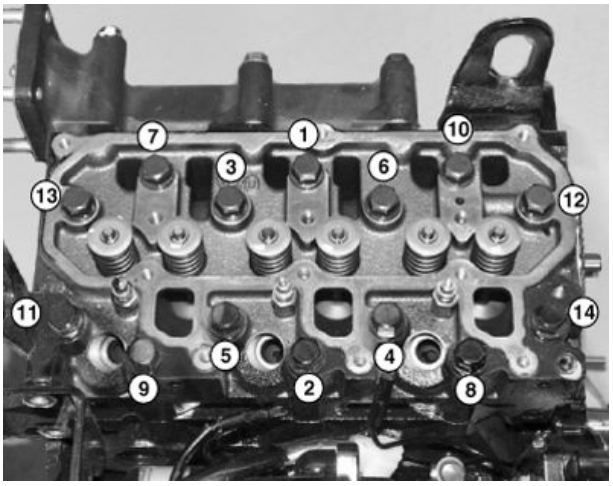
MX52301,000034C -19-23OCT14-2/3

IMPORTANT: Cylinder head mounting cap screws must be checked for proper torque after 50 hours of engine operation.

5. Tighten cylinder head bolts in three steps to specification in sequence shown.

Cylinder Head Bolts—Specification

Initial Tightening (oil applied)—Torque	27 N·m (20 lb.-ft.)
Second—Torque	41 N·m (30 lb.-ft.)
Final—Torque	53.9—57.9 N·m (39.7—42.7 lb.-ft.)



MXAL30526 —UN—10JUL12

Installation Sequence

MX52301,000034C -19-23OCT14-3/3

Intake Manifold Removal and Installation Diesel 3TNE68

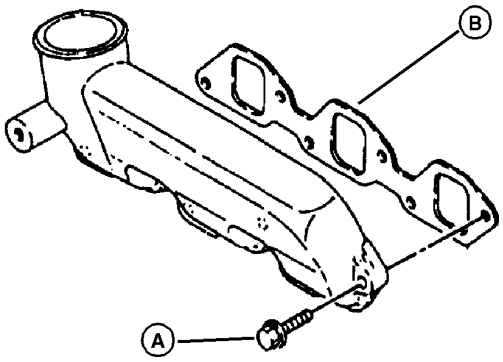
Removal:

1. Remove cylinder head. See Cylinder Head Removal and Installation Diesel 3TNE68.
2. Remove four M6x20 intake manifold mounting cap screws (A)
3. Remove gasket (B) and clean mating surfaces. Check flange for flatness with straight edge.

Installation

1. Install new gasket (B)
2. Tighten mounting cap screws to specification.

Specification	
Intake Manifold Cap Screw—Torque	11 N·m (97 lb.-in.)



MXT011127 —UN—16MAY14

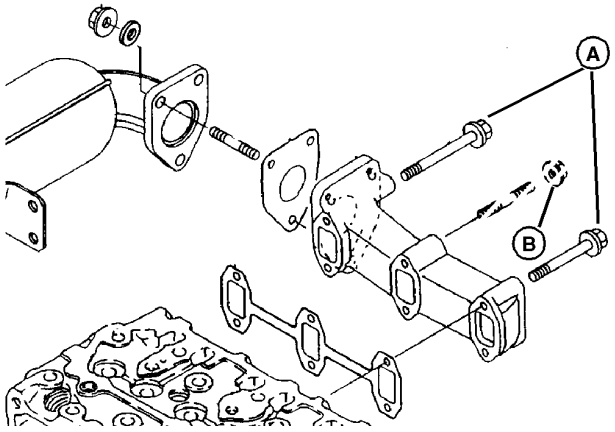
A—Intake Manifold Mounting Cap Screws (4) **B—Gasket**

MX52301,0000376 -19-17JUL14-1/1

Exhaust Manifold Removal and Installation Diesel

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Allow muffler to cool, or wear protective gloves before working on exhaust.
4. Remove muffler and gasket. See Muffler Removal and Installation Diesel .



MXT011128 —UN—16MAY14

Picture Note: 3TNE68

A—Cap Screws **B—Flange Nuts**

5. 3TNE68: Remove four cap screws (A) and two flange nuts (B) holding manifold to cylinder head.

   3TNV70: Remove six cap screws (A) holding exhaust manifold to cylinder head.

Installation:

- Clean mating surfaces and install new gaskets.
- Tighten manifold to cylinder head cap screws to specification.

Specification

Cylinder Head Cap Screws—Torque ..... 11 N·m (97 lb.-in.)

- Tighten muffler-to-manifold nuts first.

Specification

Muffler Mount Nuts—Torque ..... 28 N·m (248 lb.-in.)

- Tighten muffler support bracket bolts.

Specification

Muffler Support Bracket Cap Screws—Torque ..... 22.5–28.4 N·m (17–21 lb.-ft.)

MX52301,000034D -19-22OCT14-1/1

Cylinder Head Recondition

NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

Disassembly:

1. Compress valve springs (A) using JDE138 valve spring compressor.

NOTE: If necessary, tap on valve spring retainer (B) while initially operating compressor to break retainer free from collets.

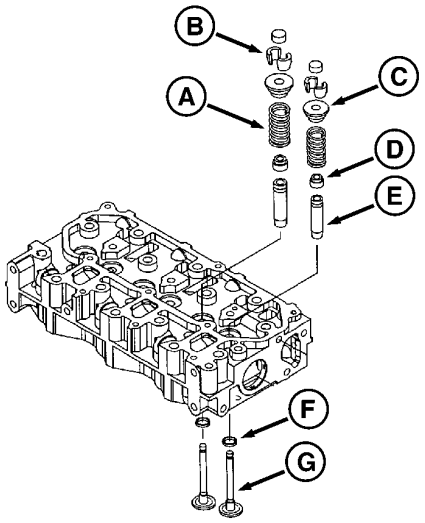
2. Remove collet halves (B) from retainer (C).
3. Slowly release compressor and valve spring.
4. Remove valve spring (C), stem seal (D), and valve (G) from head.
5. Intake and exhaust valve guides (E) and seats (F) are press fit. Remove guides only if replacement is necessary. See “Valve Guides” later in this procedure.
6. Inspect all parts for wear or damage. Clean all carbon deposits and measure all parts for proper clearances.

Assembly:

IMPORTANT: Do not reuse valve stem seals. Used seals will leak.

1. Apply clean engine oil on intake and exhaust valve stems during assembly.
2. Install springs with smaller pitch end or paint mark toward cylinder head.

NOTE: If new valves are installed, measure valve recession. See “Valve Recession Measurement”.



LVT001309 —UN—26OCT10

A—Valve Spring
B—Collet Halves
C—Retainer
D—Stem Seal
E—Valve Guide
F—Seat
G—Valve

3. Compress spring and retainer using valve spring compressor, and install collets as removed.
4. After each valve has been assembled, tap on top of valve stem with a plastic hammer to seat retainer.

Inspection:

Before inspection, thoroughly clean all components of carbon or dirt.

MX52301,000034E -19-24JUL14-1/13

Cylinder Head:

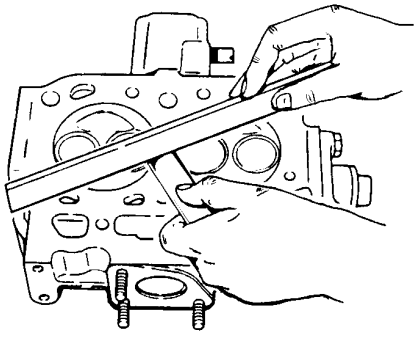
- Measure cylinder head flatness. Place a straightedge along each of the four sides and each diagonal. Measure clearance between straight edge and combustion surface with a feeler gauge.

If distortion exceeds the wear limit, replace the cylinder head.

Cylinder Head Distortion—Specification

Standard—Flatness	0—0.05 mm (0—0.002 in.)
Wear Limit—Flatness (maximum)	0.15 mm (0.006 in.)

- Measure valve recession. See procedure in this group.



LVT001310 —UN—26OCT10

- Measure piston-to-cylinder head clearance. See Piston to Cylinder Head Clearance.

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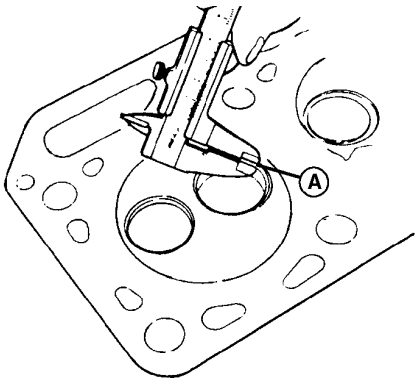
MX52301,000034E -19-24JUL14-2/13

- Measure valve seat width (A).

If necessary, grind valve seats to meet specifications. See “Valve Seat Grinding” in this section.

Specification	
Intake Valve Seat	
3TNE68—Width	1.15 mm (0.045 in.)
Intake Valve Seat	
3TNV70—Width	1.028—1.202 mm (0.041—0.047 in.)

Specification	
Exhaust Valve Seat	
3TNE68—Width	1.41 mm (0.056 in.)
Exhaust Valve Seat	
3TNV70—Width	1.308—1.52 mm (0.051—0.060 in.)



MXAL30530 —UN—10JUL12

A—Valve Seat Width

MX52301,000034E -19-24JUL14-3/13

Intake and Exhaust Valves:

1. Check valve for out-of-round, bent or warped condition using a valve inspection center. Replace valve if necessary.
   - If valve faces are worn, burned or pitted, grind valves to proper face angle. If valve face margin (B) is less than 0.50 mm (0.02 in.) specification after grinding, replace valve.

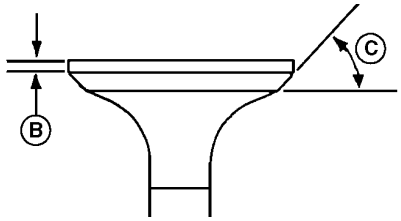
Specification	
Valve Face Head	
Margin—Width	Intake 0.9—1.1 mm (0.035—0.043 in.)
	Exhaust 1.0—1.2 mm (0.039—0.047 in.)
Valve Margin (Intake or Exhaust)—Width (minimum)	0.50 mm (0.02 in.)

   - Valve face angle (C) specification.

Specification	
Valve Grinding	
Face—Angle	Intake 30°
	Exhaust 45°

MXAL30531 —UN—10JUL12

MXAL30532 —UN—10JUL12



B—Valve Face Margin **C—Valve Face Angle**

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MX52301,000034E -19-24JUL14-4/13

2. Measure valve stem diameter at two locations shown. Replace valve if measurement is less than wear limit specification.

Valve Stem Diameter 3TNE68—Specification

Intake Valve Stem —OD.....5.460—5.475 mm (0.215—0.216 in.)

Exhaust Valve Stem—OD.....5.445—5.460 mm (0.214—0.215 in.)

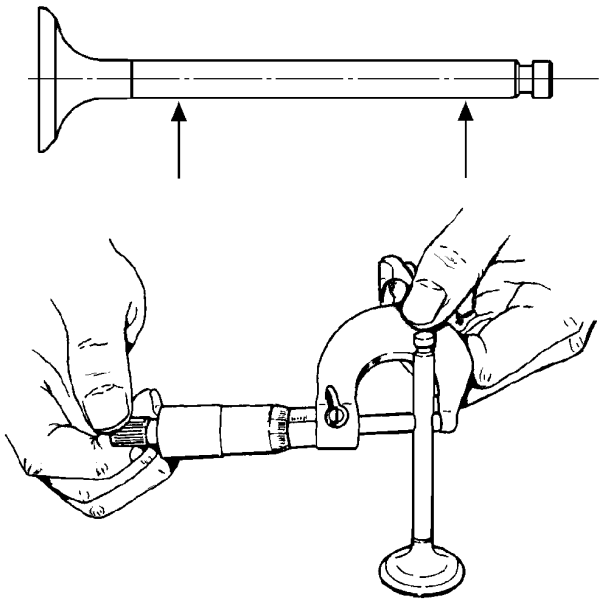
Wear Limit (Both Intake and Exhaust)—OD (minimum).....5.4. mm (0.213 in.)

Valve Stem Diameter 3TNV70—Specification

Intake Valve Stem—OD.....5.96—5.98 mm (0.234—0.235 in.)

Exhaust Valve Stem—OD.....5.95—5.96 mm (0.234—0.235 in.)

Wear Limit (Both Intake and Exhaust)—OD (minimum)..... 5.90 mm (0.232 in.)



LVT001311 —UN—26OCT10

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MX52301,000034E -19-24JUL14-5/13

3. Measure valve recession (C) using a depth gauge. Replace valve or cylinder head if measurement exceeds specifications.

Specification

Valve Recession Intake
3TNE68—Recess.....0.3—0.5 mm (0.012—0.019 in.)

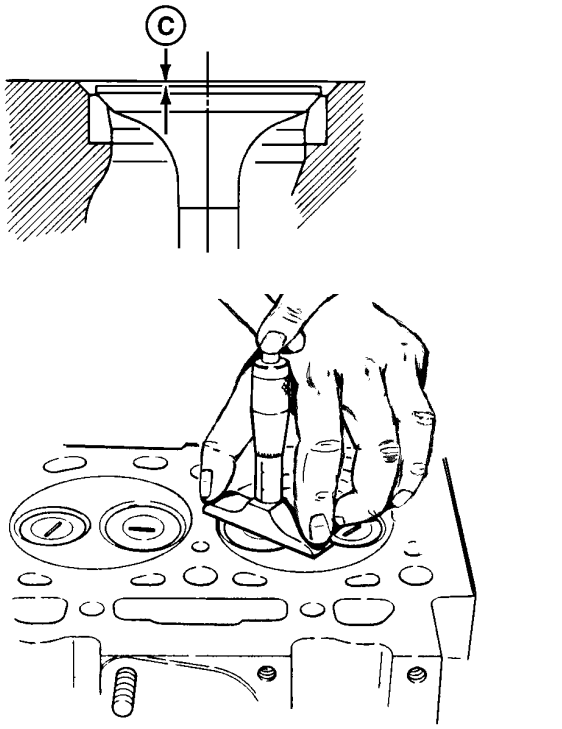
Valve Recession Exhaust
3TNE68—Recess.....0.7—0.95 mm (0.027—0.37 in.)

Valve Wear Limit
Intake and Exhaust
3TNE68—Recess
(maximum)..... 1.0 mm (0.39 in.)

Valve Recession
Intake and Exhaust
3TNV70—Recess.....0.40—0.60 mm (0.016—0.024 in.)

Wear Limit Intake
3TNV70—Recess
(maximum)..... 0.9 mm (0.035 in.)

Wear Limit Exhaust
3TNV70—Recess
(maximum)..... 0.8 mm (0.031 in.)



LVT001312 —UN—26OCT10

C—Valve Recession

Valve Guides:

1. Clean valve guides using a valve guide brush.
2. Measure valve guide inside diameter using a ball or telescoping snap gauge and compare to specifications.

Specification

Valve Guide 3TNE68
Standard—ID.....5.500—5.515 mm (0.216—0.217 in.)

Wear Limit 3TNE68—ID
(maximum)..... 5.58 mm (0.220 in.)

Valve Guide 3TNV70
Standard—ID.....6.0—6.01 mm (0.236—0.237 in.)

Wear Limit 3TNV70—ID
(maximum)..... 6.08 mm (0.239 in.)

   a. If diameter exceeds wear limit, knurl, or replace guide.
   b. If diameter is less than wear limit, determine guide-to-stem clearance (guide diameter minus stem diameter).
   c. If clearance exceeds 0.15 mm (0.006 in.) but is less than 0.17 mm (0.007 in.), knurl valve guides using a 6 mm Valve Guide Knurler.
   d. If clearance exceeds 0.17 mm (0.007 in.), replace valve guide.

Valve Guide-to-Valve Stem Oil Clearance and Wear Limit 3TNE68 and 3TNV70—Specification

Valve Guide-to-Valve
Stem Oil—Intake
Clearance.....0.03—0.05 mm (0.001—0.002 in.)

Valve Guide-to-Valve
Stem Oil—Exhaust
Clearance.....0.04—0.07 mm (0.002—0.003 in.)

Wear Limit
(Both Intake and
Exhaust)—Clearance
(maximum)..... 0.17 mm (0.007 in.)

Valve Guide Replacement:

NOTE: Valve guides are a tight press fit. Place valve guides in a freezer for at least 20 minutes before installing to ease installation.

- Use JDE504 Valve Guide Driver.

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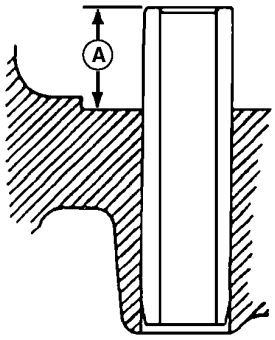
MX52301,000034E -19-24JUL14-6/13

1. Install valve guides with tapered ends down. Push valve guides down until top of valve guides are set to distance (A) specification from top of cylinder head.

Specification	
Valve Guide Installed 3TE68—Height	7 mm (0.276 in.)
Valve Guide Installed 3TNV70—Height	9.8—10 mm (0.386—0.394 in.)

2. Ream inside diameter of valve guides using 5.50 mm Valve Guide Reamer.

A—Valve Guide Height



MXAL30535 —UN—10JUL12

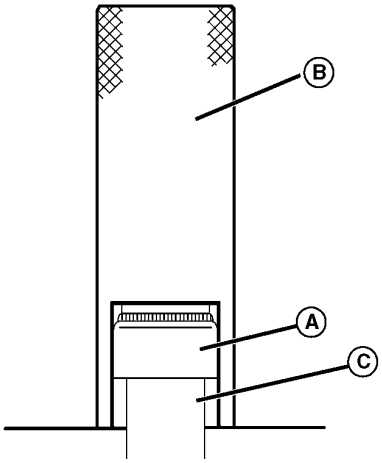
MX52301,000034E -19-24JUL14-7/13

Valve Stem Seal Installation:

NOTE: Always install new valve stem seals. Intake and exhaust stem seals are not the same. Intake valve stem seals have a white spring around the seal, exhaust stem seals have a black spring. Make sure seals are installed correctly.

1. Lubricate valve stem seals (A) and install on valve guide (C) with stem seal installer (B).

A—Valve Stem Seals
B—Stem Seal Installer
C—Valve Guide

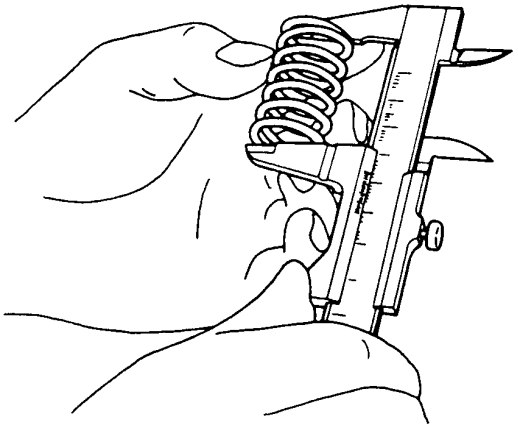


MXAL30536 —UN—10JUL12

MX52301,000034E -19-24JUL14-8/13

Valve Springs:

1. Measure spring free length. Replace spring if measurement exceeds specification.



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MX52301,000034E -19-24JUL14-9/13

2. Measure spring inclination (B). Replace spring if measurement exceeds specification.

Valve Spring Specifications 3TNE68—Specification

Valve Spring Free
(C)—Length (maximum)..... 28 mm
(1.12 in.)
Spring (B)—Length
(maximum)..... 0.80 mm
(0.031 in.)

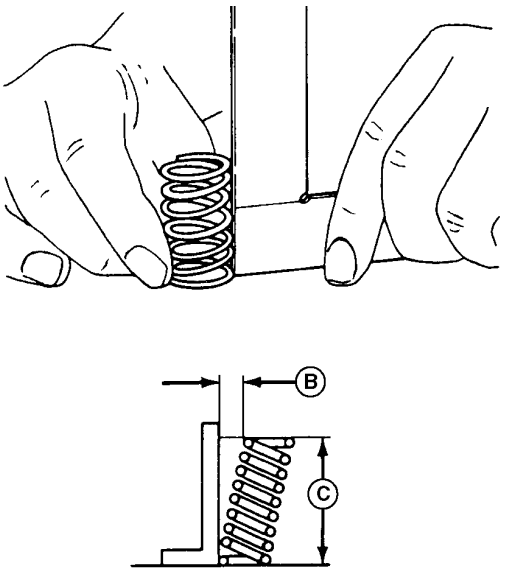
Valve Spring Specifications 3TNV70—Specification

Valve Spring Free
(C)—Length (maximum)..... 37.8 mm
(1.488 in.)
Maximum Spring
(B)—Length (maximum)..... 1.3 mm
(0.051 in.)

Valve Seat Grinding:

IMPORTANT: Never cut valve seats. Cutting a valve seat can damage its sealing surface, which results in leaks or valve seat failure. Grind and lap valve seats.

NOTE: LIGHTLY grind valve seats only for a few seconds to avoid excessive valve seat width. If valve guide is replaced, always replace guide before grinding valve seat, as guide centers seat grinder pilot.



MXAL30538 —UN—10JUL12

B—Spring Inclination **C—Valve Spring Free Length**

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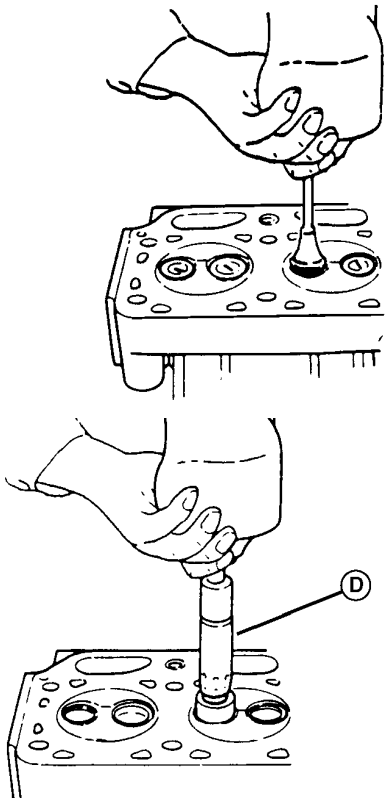
MX52301,000034E -19-24JUL14-10/13

1. Grind intake valve seat using a 30° seat grinder, and exhaust valve seat using a 45° seat grinder. Follow tool manufacturers instructions.



LVT001315 —UN—26OCT10

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MX52301,000034E -19-24JUL14-11/13

2. Measure valve seat width (E) after grinding.
3. If seat is too wide after grinding, grind lower seat surface (F) using a 70° seat grinder until seat width is close to specifications.

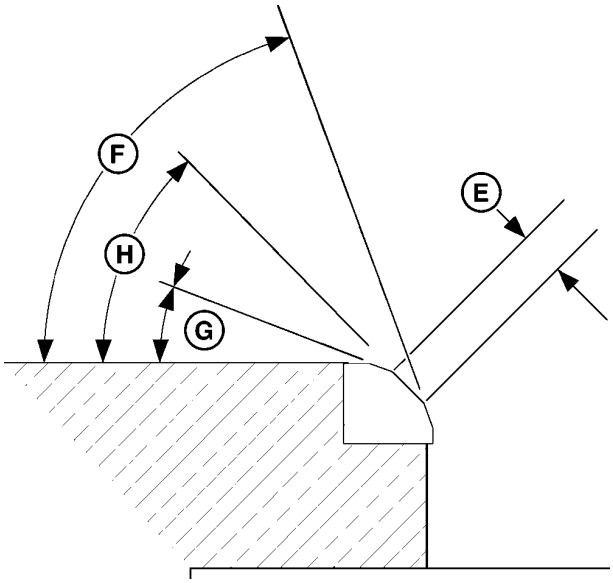
Valve Seat Angle—Specification

Lower Seat Surface—Angle	70°
Upper Seat Surface—Angle	15°

4. Grind upper seat surface (G) using a 15° seat grinder until seat width is narrowed to specifications.
5. If valve seats (H) are ground, measure valve recession and check contact pattern between the seat and valve with bluing dye.

NOTE: If valve recession exceeds maximum specifications or seats cannot be reconditioned, replace valves or cylinder head.

6. Lap valves.



LVT001316 —UN—26OCT10

E—Valve Seat Width
F—Lower Seat Surface
G—Upper Seat Surface
H—Valve Seats

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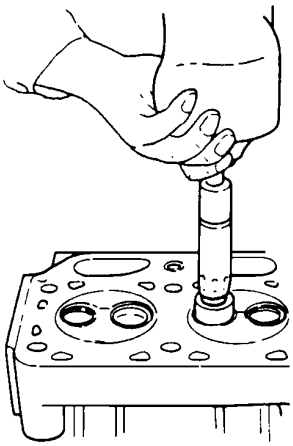
Valve Lapping:

NOTE: Use a rubber type lapping tool for valves without a lapping tool groove slit.

If seat does not make proper contact, lap the valve into the seat.

1. Apply small amount of fine lapping compound to face of valve.
2. Turn valve to lap valve to seat.
3. Lift valve from seat every 8 to 10 strokes. Lap until a uniform ring appears around the surface of the valve face.
4. To remove lapping compound wash all parts in solvent. Dry parts.
5. Check position of lap mark on valve face. Lap mark must be on or near center of valve face.

l— Valve Face



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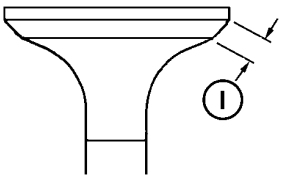

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MX52301,000034E -19-24JUL14-13/13

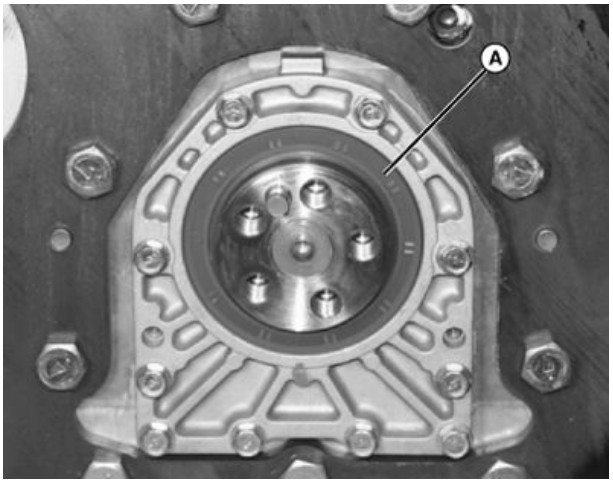
Crankshaft Rear Oil Seal

1. Remove flywheel.
2. Carefully pry oil seal (A) from oil seal case.

NOTE: If oil seal has worn a groove in crankshaft at oil seal contact point, install seal up to 3 mm (0.120 in.) farther into oil seal case.

3. Replace oil seal using a driver set. Install seal with lip toward cylinder block. Install seal flush with surface of oil seal case.

A—Oil Seal



MXAL30543 —UN—10JUL12

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MX52301,000034F -19-17JUL14-1/2

Rear Oil Seal Case:

NOTE: It is not necessary to remove oil seal case to remove oil seal, nor is it necessary to remove oil seal to remove oil seal case.

1. Remove six oil seal case-to-cylinder block cap screws (B) and two oil pan-to-seal case cap screws (C).
2. Remove ten oil seal case-to-cylinder block cap screws (A).
3. Pry oil seal case from block. Note positions of two alignment pins (B).
4. Remove old oil seal and clean all old gasket material from seal case.

NOTE: The four cap screws along the bottom of the seal case thread into the aluminum oil pan spacer. They have a different torque specification than the cap screws that thread into the engine block.

5. Install seal case with form-in-place gasket sealer on mating surfaces. Tighten cap screws to specification.

Crankshaft Rear Oil Seal Case Cap Screws—Specification

Seal Case-to-Block Cap Screws—Torque	11 N·m (97 lb.-in.)
Seal Case to Oil Pan Spacer Cap Screws—Torque	9 N·m (80 lb.-in.)

6. Install new oil seal (E) after oil seal case is installed.
7. Install flywheel and tighten cap screws to specification.

Specification

Flywheel Bolts—Torque	83 N·m (61 lb.-ft.)

8. Install clutch stub shaft and tighten to specification.

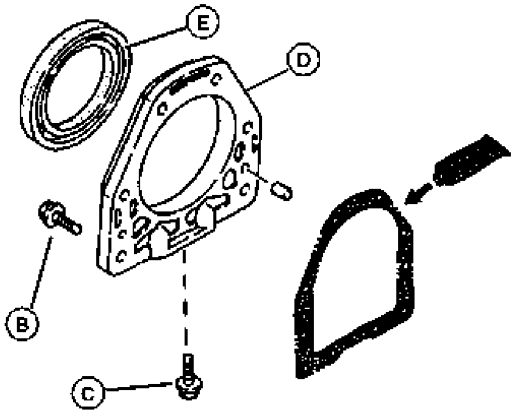
Specification

Stub Shaft-to-Flywheel Cap Screws—Torque	59 N·m (44 lb.-ft.)

9. Install clutch and tighten to specification.

Specification

Clutch Mounting Cap Screw—Torque	37 N·m (26 lb.-ft.)



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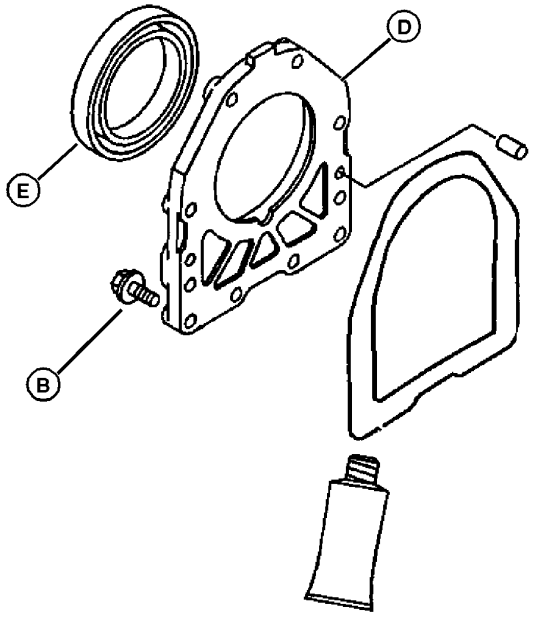
3TNE68



MXT011129 —UN—16JUN14

3TNV70

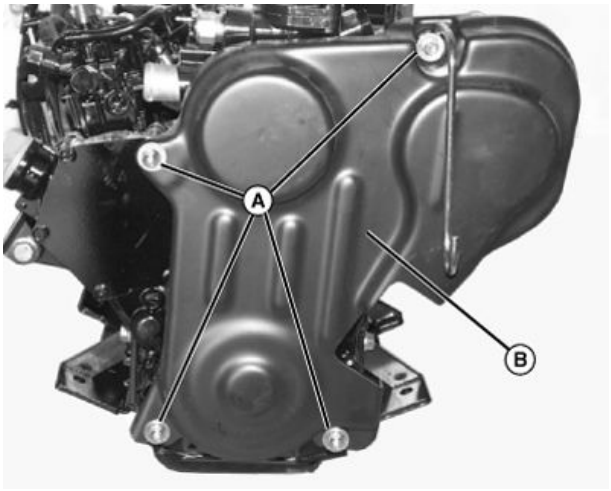
B—Cap Screws
C—Oil Pan-to-Seal Case Cap Screws
D—Oil Seal Case
E—Oil Seal

MX52301,000034F -19-17JUL14-2/2

Crankshaft Front Oil Seal

1. Remove engine from machine See Engine Removal and Installation Diesel.
2. Remove fasteners (A) and alternator belt cover (B).
3. Loosen alternator mounts and remove belt.
4. Remove crankshaft pulley mounting bolt and washer.

A—Fasteners **B—Belt Cover**

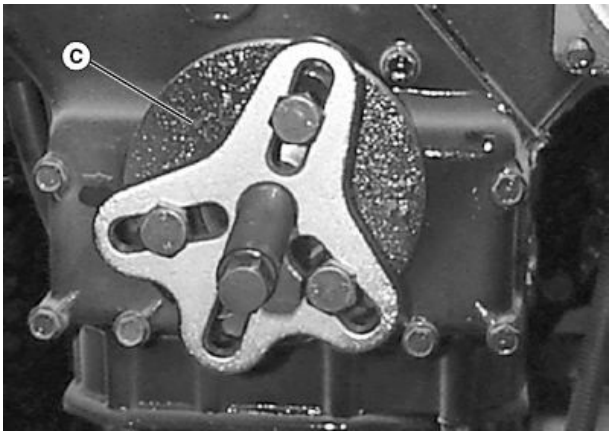


MXAL30545 —UN—10JUL12

MX52301,0000350 -19-18JUN14-1/3

5. Install puller to crankshaft sheave and remove sheave (C).

C—Sheave



MXT011131 —UN—16MAY14

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MX52301,0000350 -19-18JUN14-2/3

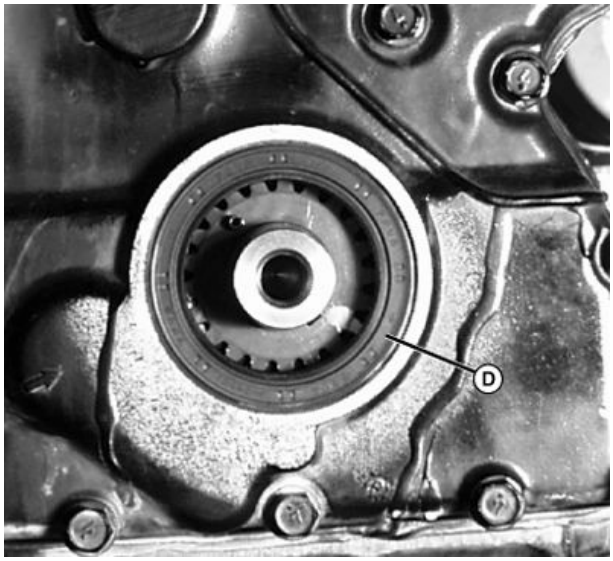
6. Carefully pry oil seal (D) from timing cover.
7. Install new oil seal using a driver set. Install seal with lip toward engine. Install seal flush with surface of cover.
8. Coat lip of seal with clean engine oil.
9. Install crankshaft sheave on crankshaft, lining up pin on crankshaft timing gear with hole in crankshaft sheave. Tighten cap screw to specification.

Specification

Crankshaft Pulley Cap Screw—Torque ..... 113—123 N·m (83—90 lb.-ft.)

10. Install alternator and water pump belt and adjust belt tension.
11. Install belt cover.

D—Oil Seal



MXAL30547 —UN—10JUL12

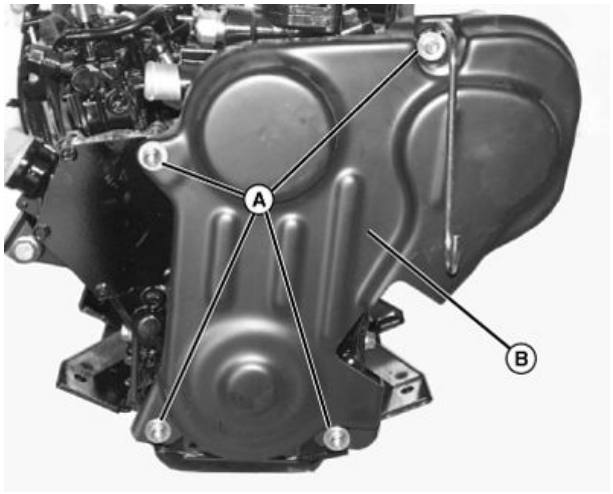
MX52301,0000350 -19-18JUN14-3/3

Timing Gear Cover Diesel 3TNE68

Removal and Installation:

1. Remove engine from machine. See Engine Removal and Installation Diesel.
2. Remove fasteners (A) and alternator belt cover (B). Note position of spacer and washers on engine studs inside cover.

A—Fasteners **B—Belt Cover**



MXAL30548 —UN—10JUL12

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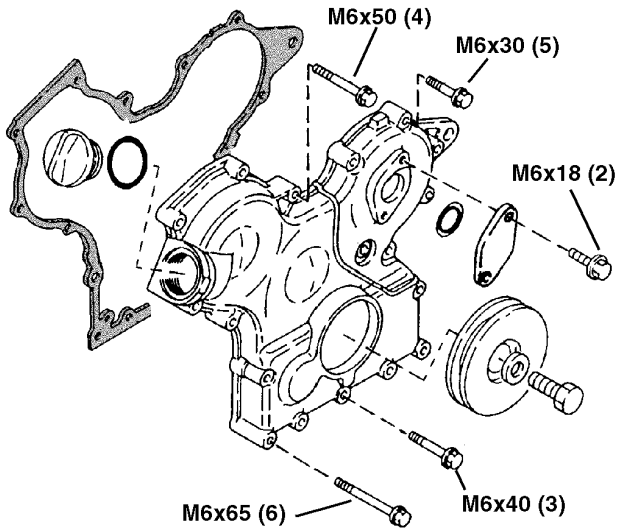
MX52301,0000378 -19-18JUN14-1/2



MXT011132 —UN—16MAY14

3. Remove crankshaft pulley mounting bolt and washer.
4. Install puller to remove crankshaft pulley from crankshaft.

NOTE: It is not necessary to remove end cover or end cover O-ring to remove timing gear.

5. Remove mounting cap screws and timing gear cover.
6. Clean all old gasket material from timing gear cover, and timing gear housing on block.
7. Apply a thin bead of John Deere Form-In-Place Gasket Sealer to timing gear cover before installation
8. Tighten all timing gear cover mounting cap screws to specification.

Specification	
Timing Cover Cap Screws—Torque	9 N·m (78 lb.-in.)

9. Install crankshaft pulley, carefully lining up flats on pulley with flats on oil pump rotor and key on crankshaft. Install flat washer with new O-ring. Tighten to specification.

Specification	
Crankshaft Pulley Cap Screw—Torque	88 N·m (65 lb.-ft.)

10. Install alternator and drive belt. Adjust belt tension.
11. Install alternator belt cover.

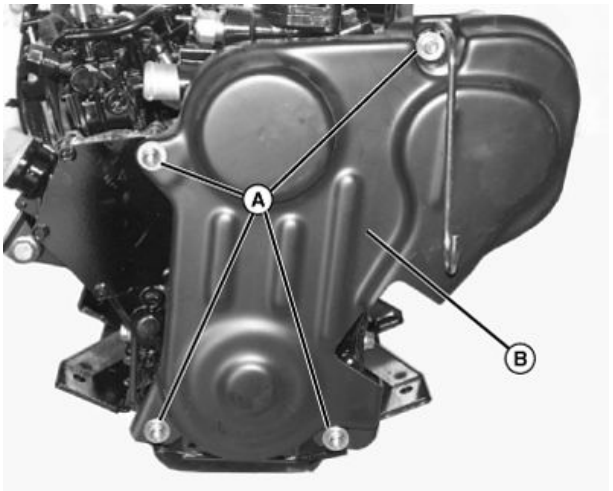
MX52301,0000378 -19-18JUN14-2/2

Timing Gear Cover Diesel 3TNV70

Removal and Installation:

1. Remove engine from machine. See Engine Removal and Installation Diesel.
2. Remove fan, spacer, and sheave from water pump
3. Remove fasteners (A) and alternator belt cover (B). Note position of spacer and washers on engine studs inside cover.
4. Remove crankshaft pulley mounting bolt and washer.

A—Fasteners **B—Belt Cover**



MXAL30548 —UN—10JUL12

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MX52301,0000351 -19-18JUN14-1/3

5. Install puller to crankshaft sheave and remove sheave (C).

C—Sheave

MXAL30549 —UN—10JUL12

MX52301,0000351 -19-18JUN14-2/3

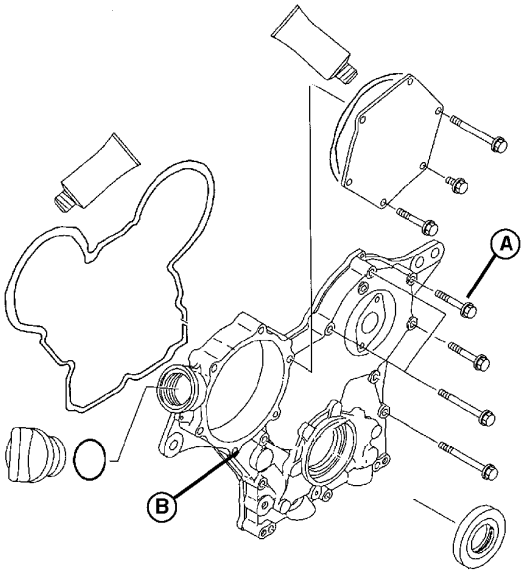
6. Remove timing cover mounting cap screws (A).
7. Remove timing gear cover (B) from timing gear housing.
8. Clean all old gasket material from timing gear cover, and timing gear housing on block.
9. Replace O-rings in timing gear housing.
10. Apply a thin bead of John Deere Form-In-Place Gasket Sealer to timing gear cover before installation
11. Tighten all timing gear cover mounting cap screws to specification.

Specification	
Timing Cover Cap Screws—Torque	9 N·m (80 lb.-in.)

12. Install crankshaft pulley, carefully lining up flats on pulley with flats on oil pump rotor and key on crankshaft. Install flat washer with new O-ring. Tighten to specification.

Specification	
Crankshaft Pulley Cap Screw—Torque	113—123 N·m (83—90 lb.-ft.)

13. Install water pump sheave and fan.



MXAL30550 —UN—10JUL12

A—Cap Screws **B—Timing Gear Cover**

14. Install alternator and drive belt. Adjust belt tension.
15. Install alternator belt cover.

MX52301,0000351 -19-18JUN14-3/3

Camshaft End Play Check

Reason:

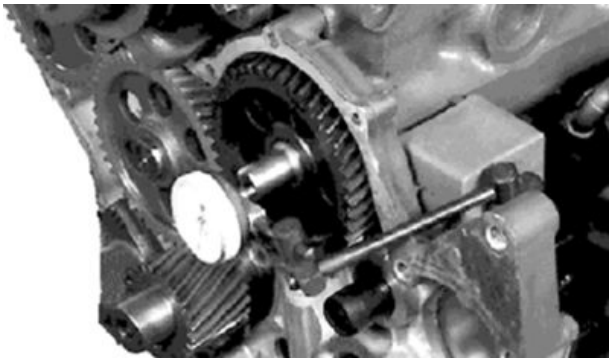
To determine proper side clearance between camshaft gear and camshaft thrust plate, to prevent excessive camshaft-to-camshaft follower wear.

Procedure:

1. Remove timing gear cover. See Timing Gear Cover Diesel 3TNE68 or Timing Gear Cover Diesel 3TNV70.
2. Fasten dial indicator to engine and position indicator tip on end of camshaft.
3. Push camshaft toward the rear as far as possible.
4. Zero the dial indicator.
5. Pull camshaft forward as far as possible.

Results:

- If end play exceeds specification, remove camshaft and replace thrust plate.



MXAL30551 —UN—10JUL12

Specification

Camshaft 3TNE68—End Play	0.05—0.25 mm (0.002—0.010 in.)
Camshaft 3TNV70—End Play	0.05—0.15 mm (0.002—0.006 in.)

MX52301,0000352 -19-17JUL14-1/1

Timing Gear Backlash Check

Reason:

To check for wear between meshing gears, resulting in excessive noise and poor engine performance.

Require Tools:

- Dial Indicator

Procedure:

1. Remove timing gear cover See Timing Gear Cover Diesel 3TNE68 or Timing Gear Cover Diesel 3TNV70.
2. Place dial indicator magnetic base on cylinder block with tip of indicator on tooth of gear being measured.
3. Holding opposite gear stationary, move measured gear back and forth while measuring backlash between meshing gears.

Results:

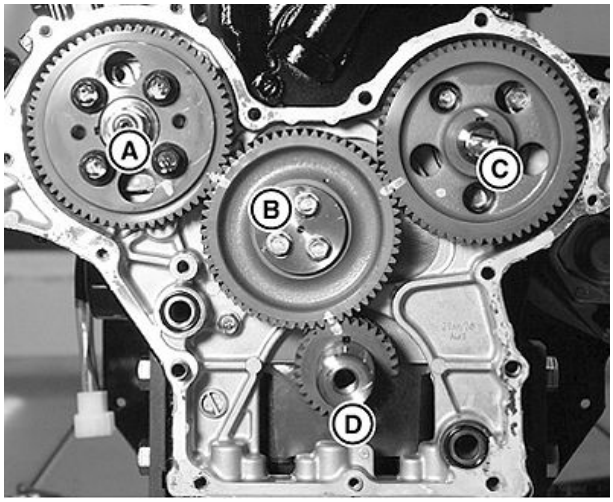
- If backlash exceeds specifications, replace meshing gears as a set: Idler Gear, Camshaft Gear, Crankshaft Gear, Oil Pump Gear or Idler Gear, and Fuel Injection Pump Gear.

Backlash 3TNE68—Specification

All Gears But Oil Pump—Backlash.....0.04—0.12 mm (0.002—0.005 in.)

Wear Limit—Backlash (maximum)..... 0.14 mm (0.006 in.)

Oil Pump Gear—Backlash.....0.11—0.19 mm (0.004—0.007 in.)



LVT001698 —UN—06DEC10

A—Fuel Injection Pump Drive Gear
B—Idler Gear
C—Camshaft Gear
D—Crankshaft Gear

Wear Limit—Backlash (maximum)..... 0.20 mm (0.008 in.)

Backlash All Gears 3TNV70—Specification

Standard —Backlash (maximum).....0.06—0.12 mm (0.002—0.005 in.)

Wear Limit—Backlash (maximum)..... 0.14 mm (0.006 in.)

MX52301,0000353 -19-24JUL14-1/1

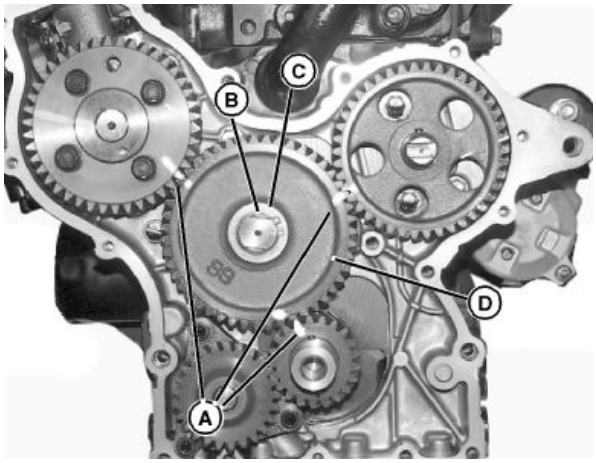
Idler Gear 3TNE68

Removal and Installation:

1. Remove timing gear cover. See Timing Gear Cover Diesel 3TNE68.
2. Check backlash of timing gears. See Timing Gear Backlash Check.

NOTE: Due to the odd number of teeth on the idler gear, timing marks only align periodically. When all timing marks on gears align, the piston closest to the water pump (No. 3) is at TDC on compression stroke. (No. 1 cylinder is closest to the flywheel.)

3. Rotate crankshaft and align timing marks (A).
4. Remove snap ring (B), washer (C), and idler gear (D).
5. Inspect all parts for wear or damage. See "Inspection/Replacement" procedures.



MXT011133 —UN—16MAY14

3TNE68 Gear Position

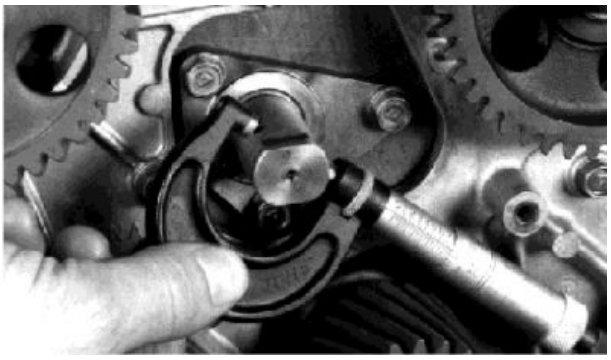
A—Timing Marks
B—Snap Ring
C—Washer
D—Idler Gear

MX52301,0000379 -19-24JUL14-1/3

Inspection:

- Inspect gear for chipped or broken teeth. Replace if necessary.
- Measure idler gear shaft diameter.
- If shaft diameter is damaged or less than wear limit specification, replace idler gear shaft.

Specification	
Idler Gear Shaft—OD	19.96—19.98 mm (0.786—0.787 in.)
Wear Limit—OD (maximum)	19.93 mm (0.785 in.)



MXT011134 —UN—16MAY14

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MX52301,0000379 -19-24JUL14-2/3

- Measure idler gear bushing (B) diameter.
- If bushing diameter exceeds wear limit, replace bushing.

Specification

Idler Gear Bushing—ID.....20.00—20.021 mm (0.787—0.788 in.)

To replace bushing:

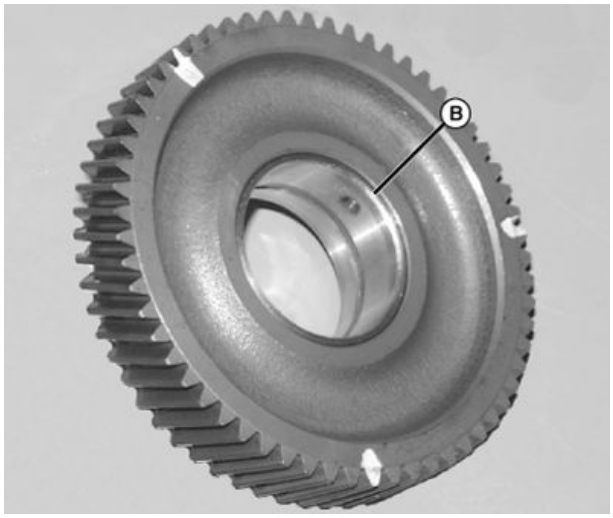
- Replace bushing using a driver set. Align oil holes in bushing and idler gear. Install bushing flush with surface of idler gear.
- Align oil holes in bushing and idler gear. bushing flush with surface of idler gear.
- If bushing oil clearance (bushing ID minus shaft OD) exceeds specification, replace bushing, shaft or both.

Specification

Bushing —Oil Clearance.....0.020—0.062 mm (0.001—0.002 in.)

Wear Limit—Oil Clearance (maximum).....0.15 mm (0.006 in.)

Installation:



MXAL30555 —UN—10JUL12

B—Idler Gear Bushing

Installation in reverse order of removal.

MX52301,0000379 -19-24JUL14-3/3

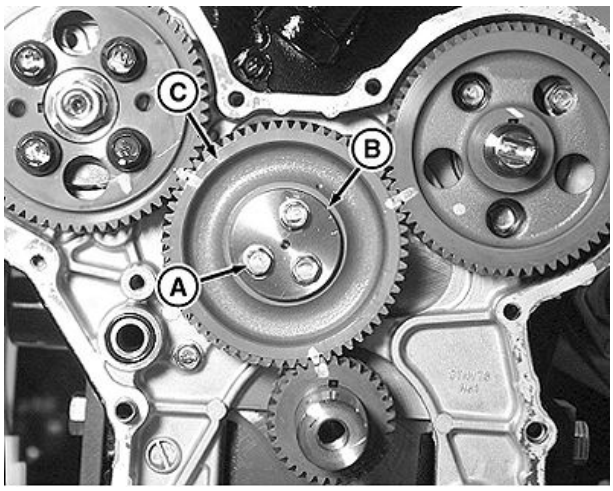
Idler Gear 3TNV70

Removal and Installation:

1. Remove timing gear cover. See Timing Gear Cover Diesel 3TNV70.
2. Check backlash of timing gears. See Timing Gear Backlash Check.

NOTE: Due to the odd number of teeth on the idler gear, timing marks only align periodically. When all timing marks on gears align, the piston closest to the water pump (No. 3) is at TDC on compression stroke. (No. 1 cylinder is closest to the flywheel.)

3. Rotate crankshaft and align timing marks.
4. Remove three bolts (A), shaft, (B) and idler gear (C).
5. Inspect all parts for wear or damage. See “Inspection/Replacement” procedures.
6. Installation is done in the reverse order of removal.



LVT001700 —UN—06DEC10

A—Bolts (3 used)
B—Shaft
C—Idler Gear

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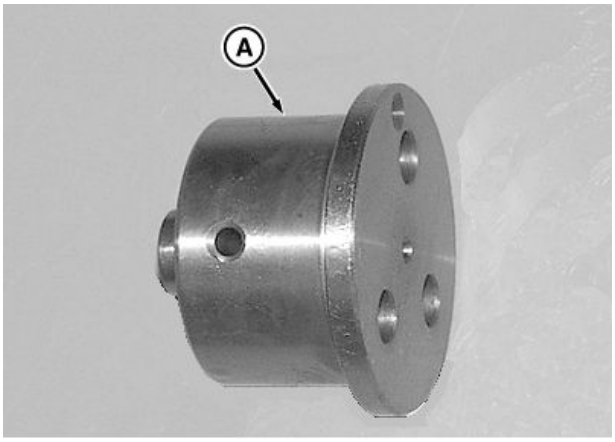
MX52301,0000354 -19-23JUL14-1/3

Inspection:

- Inspect gear for chipped or broken teeth. Replace if necessary.
- Measure idler gear shaft (A) diameter.

If shaft diameter is damaged or less than wear limit specification, replace idler gear shaft.

Specification	
Idler Gear Shaft—OD	36.95–36.98 mm (1.455–1.456 in.)
Wear Limit—OD (minimum)	36.90 mm (1.452 in.)



LVT001029 —UN—14JUL10

A—Shaft

MX52301,0000354 -19-23JUL14-2/3

- Measure idler gear bushing (B) diameter.
- If bushing diameter exceeds wear limit, replace bushing.

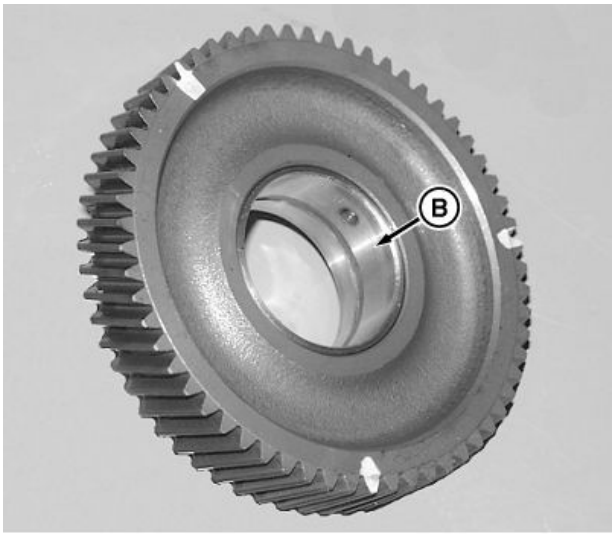
Specification	
Idler Gear Bushing—ID	37.0—37.025 mm (1.4567—1.4577 in.)
Wear Limit—ID (maximum)	37.075 mm (1.4596 in.)

To replace bushing:

- Replace bushing using a driver set. Align oil holes in bushing and idler gear. Install bushing flush with surface of idler gear.

If bushing oil clearance (bushing ID minus shaft OD) exceeds specification, replace bushing, shaft or both.

Specification	
Bushing—Oil Clearance	0.03—0.08 mm (0.001—0.003 in.)



LVT001030 —UN—14JUL10

B—Idler Gear Bushing

MX52301,0000354 -19-23JUL14-3/3

Cam Followers

Removal:

1. Remove cylinder head. See Cylinder Head Removal and Installation Diesel 3TNE68.

IMPORTANT: Cam followers must be installed in the same bores from which they were removed.

2. Put a mark on each cam follower and cylinder block bore to aid in installation.
3. Remove cam followers from cylinder block with magnetic pick-up tool.
4. Inspect all parts for wear or damage. See “Inspection” procedures.

Installation:

Installation is done in the reverse order of removal.

1. Apply clean engine oil on all parts during installation.
2. Install cam followers after camshaft is installed.

Inspection:

1. Inspect cam follower contact surface for abnormal wear. Normal wear (B) has circles around the lifter base and base has flat surface. Abnormal wear (A) occurs when cam follower does not spin in the bore and the cam starts wearing away the follower. Replace if necessary.

M82293A —UN—12JUN00

A—Abnormal Wear **B—Normal Wear**

Continued on next page

MX52301,0000355 -19-24JUL14-1/2

NOTE: Replace camshaft and lifters as a set.

2. Measure cam follower diameter.

   - If stem diameter is less than wear limit, replace cam follower.

Cam Follower 3TNE68—Specification

Standard—OD	17.95—17.97 (0.707—0.708 in.)
Wear Limit—OD (minimum)	17.93 mm (0.706 in.)

Cam Follower 3TNV70—Specification

Standard—OD	20.93—20.96 mm (0.824—0.825 in.)
Wear Limit—OD (minimum)	20.90 mm (0.823 in.)

IMPORTANT: Always replace all camshaft followers when installing a new camshaft. Always replace camshaft when installing new followers.

3. Measure cam follower bore diameter in cylinder block.

Specification

Cam Follower Bore 3TNE68—ID	18.00—18.018 mm (0.7087—0.7094 in.)
Cam Follower Bore 3TNV70—ID	21.00—21.02 mm (0.827—0.828 in.)

   - If cam follower bore diameter exceeds wear limit, replace cylinder block.

Specification

Wear Limit 3TNE68—ID (maximum)	18.05 mm (0.711 in.)

MXAL30557 —UN—10JUL12

Wear Limit 3TNV70—ID (maximum)	21.04 mm (0.828 in.)

   - If bore clearance (bore ID minus follower stem OD) exceeds specification, replace cam follower, cylinder block or both.

Specification

Follower-to-Bore 3TNE68—Oil Clearance	0.032—0.068 mm (0.0013—0.0027 in.)
Follower-to-Bore 3TNV70—Oil Clearance	0.04—0.09 mm (0.002—0.004 in.)
Wear Limit—Oil Clearance (maximum)	0.13 mm (0.005 in.)

MX52301,0000355 -19-24JUL14-2/2

Camshaft 3TNE68

IMPORTANT: Always replace all camshaft followers when installing a new camshaft. The components wear as a set and replacing only one of the components accelerate wear on the other.

Camshaft Removal:

1. Remove rocker arm assembly and push rods. See Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods.
2. Remove timing gear cover. See Timing Gear Cover Diesel 3TNE68.
3. Check camshaft end play. See Camshaft End Play Check.
4. Check backlash of timing gears. See Timing Gear Backlash Check.

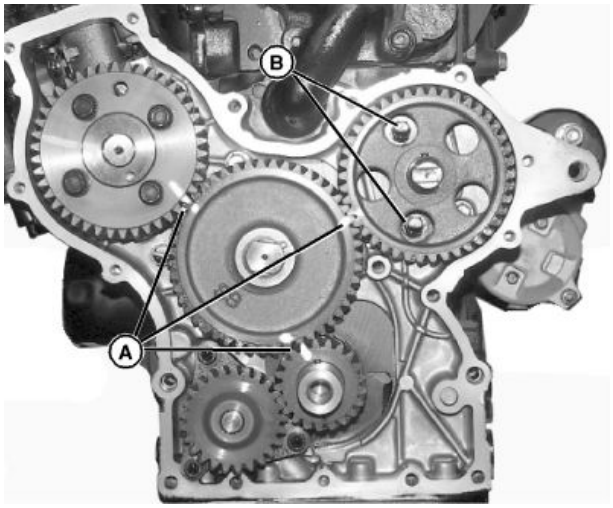
NOTE: If camshaft is being removed with cylinder head installed, use a magnetic follower holder tool, or turn engine until oil pan is upward, to hold cam followers away from camshaft.

5. Hold cam followers away from camshaft using a magnetic follower holder kit such as D15001NU.

NOTE: Due to the odd number of teeth on the idler gear, timing marks only align periodically.

6. Rotate crankshaft and align timing marks (A).

IMPORTANT: DO NOT allow camshaft lobes to hit bearing surfaces while removing camshaft. Machined surfaces can be damaged.



MXT011136 —UN—16MAY14

A—Timing Marks
B—Cap Screws (2)
C—Camshaft

7. Remove two cap screws (B) holding camshaft mounting flange to block (through holes in camshaft gear).
8. Inspect all parts for wear or damage. See “Inspection/Replacement” procedures.

Continued on next page

MX52301,000037A -19-24JUL14-1/9

Camshaft Installation:

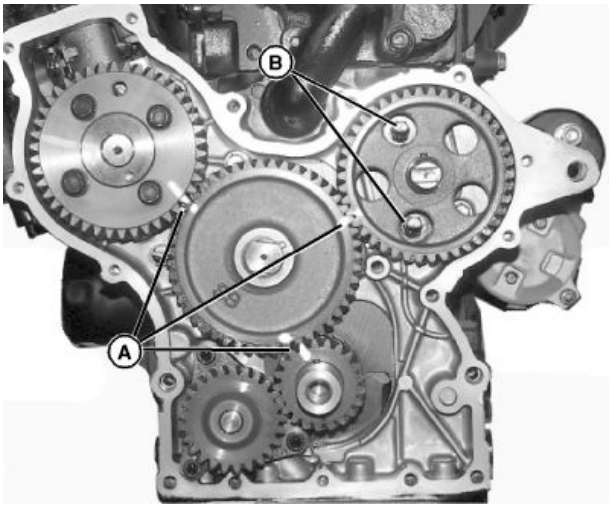
- Apply clean engine oil on all parts during installation.

IMPORTANT: DO NOT allow camshaft lobes to hit bearing surfaces while installing camshaft. Machined surfaces can be damaged.

1. Rotate crankshaft to align timing marks (A).
2. Install camshaft (C) into cylinder block, being careful not to allow camshaft lobes to scratch camshaft bushings. Align camshaft gear timing marks with timing marks on idler gear.
3. Install two camshaft thrust plate cap screws (B) through holes in cam gear. Tighten to specification.

Specification	
Camshaft Cap Screws (3TNE68)—Torque	11 N·m (97 lb.-in.)

4. Install timing gear cover. See Timing Gear Cover Diesel 3TNE68.
5. If cam followers were removed, replace into same holes as removed.



MXT011136 —UN—16MAY14

A—Timing MARKS
B—Cap Screws
C—Camshaft

6. Install push rods and rocker arm assembly See Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods.

MX52301,000037A -19-24JUL14-2/9

Camshaft Side Gap Measurement:

1. Check camshaft end play while camshaft is installed in cylinder block using a dial indicator, as described in Camshaft End Play Check.
2. Check camshaft side gap while camshaft is removed from cylinder block using a feeler gauge between camshaft thrust plate (D) and front side of first camshaft bearing journal (E), as shown.
   - If side gap is excessive per specification, remove gear and replace thrust plate.

Specification	
Camshaft Side (3TNE68)—Gap	0.05—0.25 mm (0.002—0.010 in.)

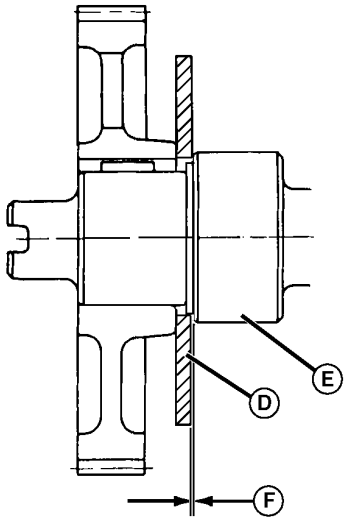
Camshaft Gear Removal:

1. Inspect gear for chipped or broken teeth. Replace if necessary.
2. Remove gear from camshaft using a knife-edge puller and an arbor press. Place flat side of puller against camshaft gear.

Camshaft Gear Installation:

CAUTION: DO NOT heat oil over 182 °C (360 °F). Oil fumes or oil can ignite above 193 °C (380 °F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

1. Heat gear to approximately **150 °C (300 °F)**.



MXAL30559 —UN—10JUL12

D—Camshaft Thrust Plate
E—Camshaft Bearing Journal
F—Camshaft Side Gap

Continued on next page

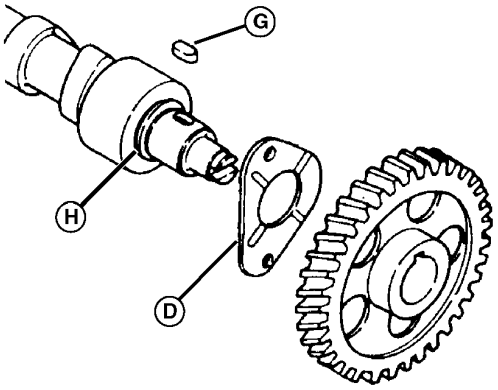
MX52301,000037A -19-24JUL14-3/9

IMPORTANT: Be sure that thrust plate is not trapped between camshaft gear and stepped shoulder while gear is being pressed.

2. Install key (G) into slot of camshaft.
3. Install thrust plate (D) (if removed) onto camshaft, centering onto stepped shoulder (H). (Thrust plate has no “front” or “rear” side.)

IMPORTANT: Be sure that thrust plate is not trapped between camshaft gear and stepped shoulder while gear is being pressed.

4. Install heated camshaft gear with longer hub of camshaft gear facing camshaft . Align slot in gear with key in shaft. Press camshaft into gear until hub of gear is tight against camshaft shoulder. Thrust plate must spin freely on camshaft.



MXAL30560 —UN—10JUL12

D—Thrust Plate
G—Key
H—Stepped Shoulder

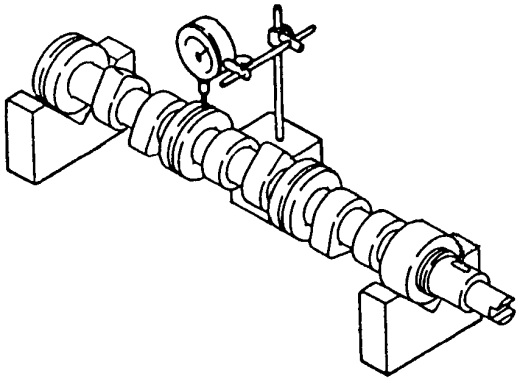
MX52301,000037A -19-24JUL14-4/9

Camshaft Inspection:

1. Inspect camshaft for bend by using a pair of V-blocks and an indicator. Turn camshaft slowly and read variation on indicator. The runout measured on the indicator is twice the variation. If variation is greater than wear limit, replace camshaft.

Specification

Camshaft
(3TNE68)—Runout.....0.00—0.02 mm
(0.00—0.001 in.)
Wear Limit
(3TNE68)—Runout
(maximum)..... 0.05 mm
(0.002 in.)



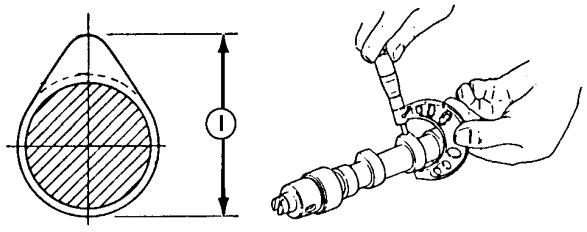
MXAL30561 —UN—10JUL12

MX52301,000037A -19-24JUL14-5/9

2. Measure camshaft lobe height (I) using a micrometer. If lobe height is less than wear limit, or if there are chips in or scratches on lobes or bearing journals, replace camshaft.

Specification

Camshaft Lobe
(3TNE68)—Height.....29.97—30.03 mm
(1.180—1.182 in.)
Wear Limit—Height
(minimum)..... 29.75 mm
(1.171 in.)



MXAL30562 —UN—10JUL12

I— Camshaft Lobe Height

Continued on next page

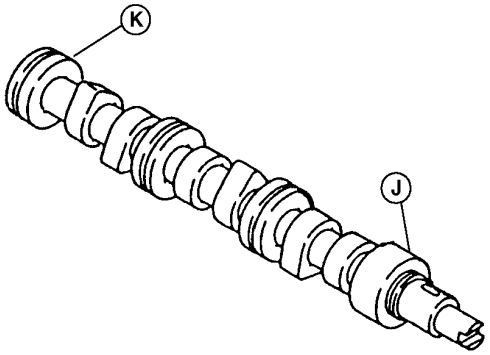
MX52301,000037A -19-24JUL14-6/9

3. Measure camshaft end journals and intermediate journal outside diameters.

   If journal diameters are less than wear limit, replace camshaft.

Specification

Camshaft Bearing Journal Gear Side (J) and Flywheel (K) End (3TNE68)—OD	35.94—35.96 mm (1.415—1.416 in.)
Wear Limit (3TNE68)—OD (minimum)	35.85 mm (1.411 in.)
Intermediate Journal (3TNE68)—OD	35.91—35.935 mm (1.414—1.415 in.)
Wear Limit—OD (minimum)	35.85 mm (1.411 in.)



MXAL30563 —UN—10JUL12

J—Gear Side **K—Flywheel End**

MX52301,000037A -19-24JUL14-7/9

4. Measure camshaft bushing (L) diameter at gear housing end.

Specification

Camshaft Bushing (3TNE68)—ID	36.00—36.065 mm (1.417—1.420 in.)

- If bushing diameter exceeds wear limit, replace bushing.

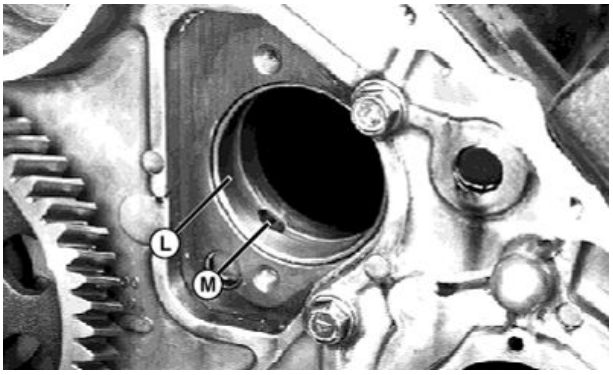
Specification

Camshaft Bushing (3TNE68)—ID (maximum)	36.10 mm (1.421 in.)

- If bushing oil clearance (bushing ID minus camshaft journal OD) exceeds specification, replace bushing, camshaft or both.

Specification

Camshaft Bushing Oil (3TNE68)—Clearance	0.18 mm (0.007 in.)



MXAL30564 —UN—10JUL12

L—Camshaft Bushing **M—Oil Hole**

- To replace bushing:
- Remove and replace bushing using a bushing driver. Be careful not to push bushing inside of engine. Align oil holes (M) in new bushing and cylinder block.

Continued on next page

MX52301,000037A -19-24JUL14-8/9

NOTE: Engine back plate must be removed to measure camshaft intermediate and flywheel end bearing diameters.

5. Measure intermediate and flywheel end camshaft bore diameters using the following procedures:
   - Remove engine back plate.
   - Remove plug (N) using a long wooden dowel. Insert wooden dowel through gear housing side.
   - Measure intermediate (O) and flywheel end camshaft bore (P) diameters.

Specification

Camshaft Bore(3TNE68)—ID.....36.00—36.065 mm (1.417—1.420 in.)

If bore diameter exceeds wear limit, replace cylinder block.

Specification

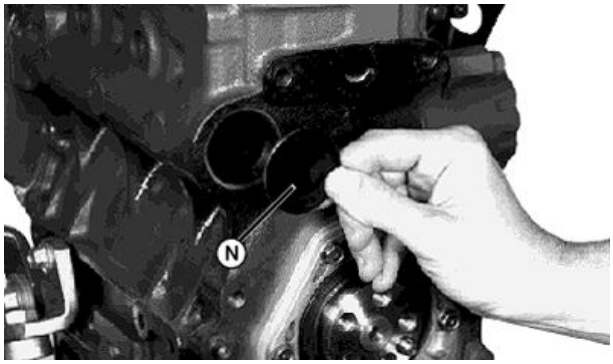
Wear Limit (3TNE68)—ID (maximum)..... 36.10 mm (1.421 in.)

If bore clearance (bore ID minus camshaft journal OD) exceeds specification, replace camshaft, cylinder block or both.

Specification

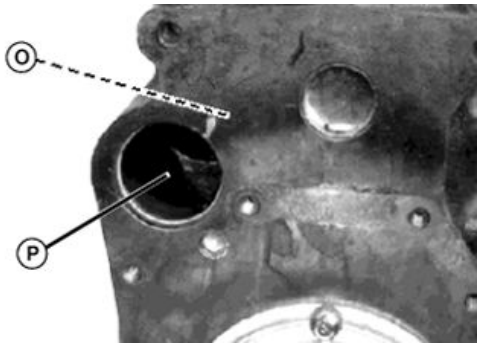
Oil Clearance (3TNE68)—ID (maximum)..... 0.18 mm (0.007 in.)

- Apply John Deere Form-In Place Gasket, or an equivalent, on outer edge of plug. Install a new plug until it bottoms in bore.



MXAL30565 —UN—10JUL12

N—Plug



MXAL30566 —UN—10JUL12

O—Intermediate diameter

P—Flywheel End Camshaft Bore

- Install engine back plate.

MX52301,000037A -19-24JUL14-9/9

Camshaft 3TNV70

IMPORTANT: Always replace all camshaft followers when installing a new camshaft. The components wear as a set and replacing only one of the components accelerate wear on the other.

Camshaft Removal:

1. Remove rocker arm assembly and push rods. See Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods.
2. Remove timing gear cover. See Timing Gear Cover Diesel 3TNV70.
3. Check camshaft end play. See Camshaft End Play Check.
4. Check backlash of timing gears. See Timing Gear Backlash Check.

NOTE: If camshaft is being removed with cylinder head installed, use a magnetic follower holder tool, or turn engine until oil pan is upward, to hold cam followers away from camshaft.

5. Hold cam followers away from camshaft using a magnetic follower holder kit such as D15001NU.

NOTE: Due to the odd number of teeth on the idler gear, timing marks only align periodically.

6. Rotate crankshaft and align timing marks.

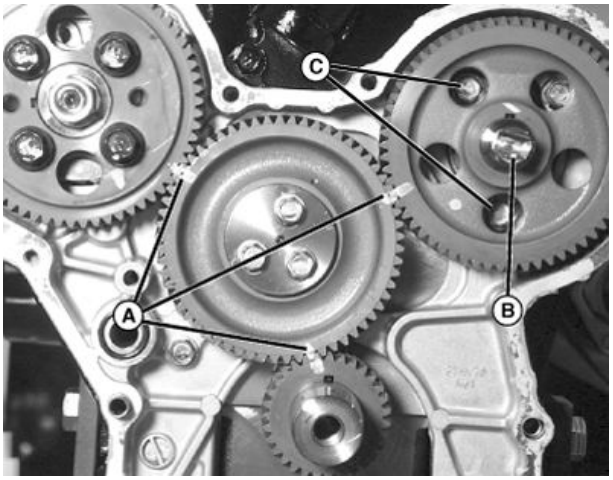
IMPORTANT: DO NOT allow camshaft lobes to hit bearing surfaces while removing camshaft. Machined surfaces can be damaged.

7. Remove two cap screws (C) holding camshaft mounting flange to block (through holes in camshaft gear).
8. Inspect all parts for wear or damage. See “Camshaft Inspection.”

Camshaft Installation:

- Apply clean engine oil on all parts during installation.

IMPORTANT: DO NOT allow camshaft lobes to hit bearing surfaces while installing camshaft. Machined surfaces can be damaged.



MXAL30558 —UN—10JUL12

A—Timing MARKS
B—Camshaft
C—Thrust Plate Cap Screws

1. Rotate crankshaft to align timing marks (A).
2. Install camshaft (B) into cylinder block, being careful not to allow camshaft lobes to scratch camshaft bushings. Align camshaft gear timing marks with timing marks on idler gear.
3. Install two camshaft thrust plate cap screws (C) through holes in cam gear. Tighten to specification.

Specification

Camshaft Cap Screws (3TNV70)—Torque ..... 11 N·m (97 lb.-in.)

4. Install timing gear cover. See Timing Gear Cover Diesel 3TNV70.
5. If cam followers were removed, replace into same holes as removed.
6. Install push rods and rocker arm assembly. See Disassemble, Inspect, and Assemble Rocker Arm Assembly and Push Rods.

Continued on next page

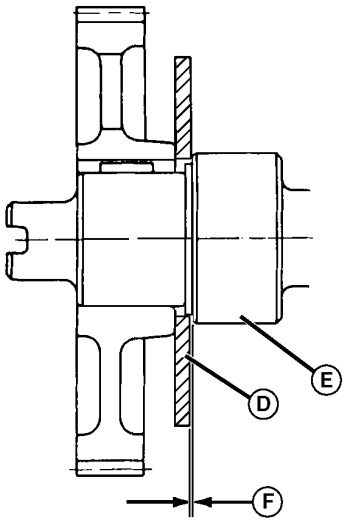
MX52301,0000356 -19-23JUL14-1/8

Camshaft Side Gap Measurement:

1. Check camshaft end play while camshaft is installed in cylinder block using a dial indicator, as described in See Camshaft End Play Check.
2. Check camshaft side gap while camshaft is removed from cylinder block using a feeler gauge between camshaft thrust plate (D) and frontside of first camshaft bearing journal (E), as shown below.
   - If side gap is excessive per specification, remove gear and replace thrust plate.

Specification

Camshaft Side (3TNV70)
—Gap.....0.05—0.15 mm (0.002—0.006 in.)



MXAL30559 —UN—10JUL12

D—Camshaft Thrust Plate **F—Camshaft Side Gap**
E—Camshaft Bearing Journal

Camshaft Gear Removal:

1. Inspect gear for chipped or broken teeth. Replace if necessary.
2. Remove gear from camshaft using a knife-edge puller and an arbor press. Place flat side of puller against camshaft gear.

Camshaft Gear Installation:

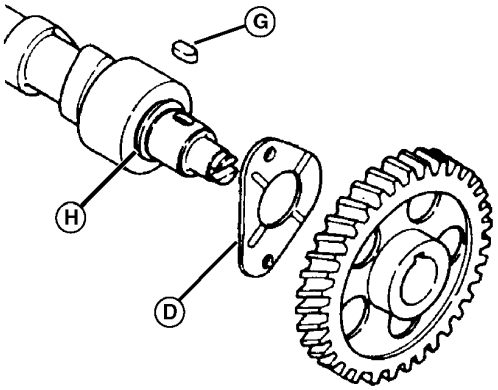
CAUTION: DO NOT heat oil over 182 °C (360 °F). Oil fumes or oil can ignite above 193 °C (380 °F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

1. Heat gear to approximately **150 °C (300 °F)**.

MX52301,0000356 -19-23JUL14-2/8

IMPORTANT: Be sure that thrust plate is not trapped between camshaft gear and stepped shoulder while gear is being pressed.

2. Install key (G) into slot of camshaft.
3. Install thrust plate (D) onto camshaft, centering onto stepped shoulder (H). (Thrust plate has no “front” or “rear” side.)
4. Install heated camshaft gear with longer hub of camshaft gear facing camshaft. Align slot in gear with key in shaft. Press camshaft into gear until hub of gear is tight against camshaft shoulder. See “Important” above. Thrust plate must spin freely on camshaft.



MXAL30560 —UN—10JUL12

D—Thrust Plate **H—Stepped Shoulder**
G—Key

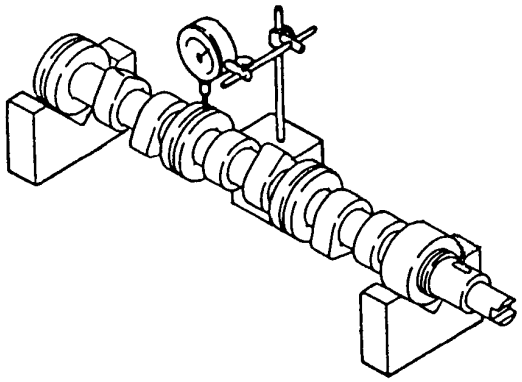
Continued on next page

MX52301,0000356 -19-23JUL14-3/8

Camshaft Inspection:

1. Inspect camshaft for bend by using a pair of V-blocks and a dial indicator. Turn camshaft slowly and read variation on indicator. If variation is greater than wear limit, replace camshaft.

Specification	
Camshaft (3TNV70)—Bend	0.00—0.02 mm (0.00—0.001 in.)
Wear Limit (3TNV70)—Bend (maximum)	0.05 mm (0.002 in.)

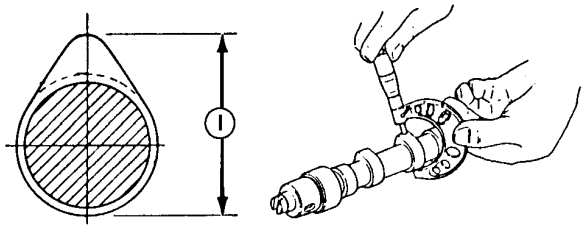


MXAL30561 —UN—10JUL12

MX52301,0000356 -19-23JUL14-4/8

2. Measure camshaft lobe height (I) using a micrometer. If lobe height is less than wear limit, or if there are chips in or scratches on lobes or bearing journals, replace camshaft.

Specification	
Camshaft Lobe (3TNV70)—Height	34.14—34.27 mm (1.343—1.349 in.)
Wear Limit (3TNV70)—Height (minimum)	33.89 mm (1.334 in.)



MXAL30562 —UN—10JUL12

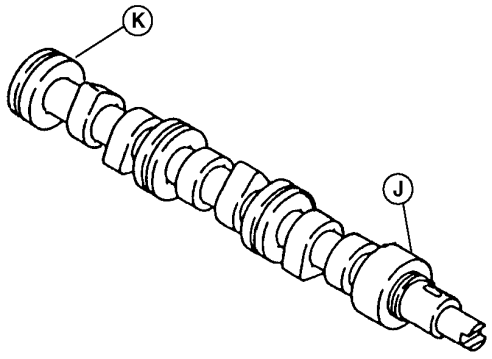
I— Camshaft Lobe Height

MX52301,0000356 -19-23JUL14-5/8

3. Measure camshaft end journals and intermediate journal outside diameters.

   If journal diameters are less than wear limit, replace camshaft.

Specification	
Camshaft Bearing Journal Gear Side (J) and Flywheel (K) End Standard (3TNV70)—OD	39.94—39.96 mm (1.572—1.573 in.)
Wear Limit (3TNV70)—OD (minimum)	39.91 mm (1.571 in.)
Intermediate Journal (3TNV70)—OD	39.91—39.94 mm (1.571—1.572 in.)
Wear Limit (3TNV70)—OD (minimum)	39.875 mm (1.569 in.)



MXAL30563 —UN—10JUL12

J— Gear Side **K—Flywheel End**

Continued on next page

MX52301,0000356 -19-23JUL14-6/8

4. Measure camshaft bushing (L) diameter at gear housing end.

Specification

Camshaft Bushing
(3TNV70)—ID.....40.0—40.08 mm
(1.575—1.578 in.)

- If bushing diameter exceeds wear limit, replace bushing.

Specification

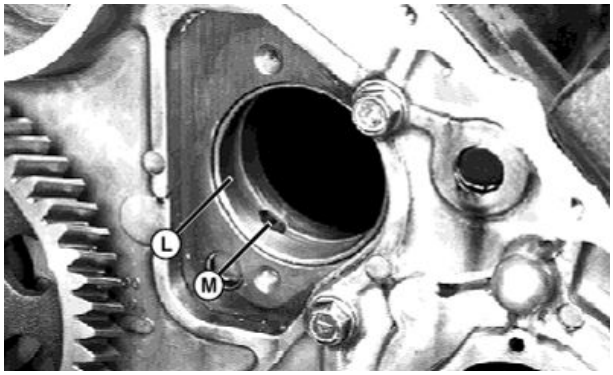
Wear Limit (3TNV70)—ID
(maximum)..... 40.15 mm
(1.580 in.)

- If bushing oil clearance (bushing ID minus camshaft journal OD) exceeds specification, replace bushing, camshaft or both.

Specification

Oil Clearance
(3TNV70)—Clearance.....0.04—0.14 mm
(0.002—0.005 in.)

- To replace bushing:



MXAL30564 —UN—10JUL12

L—Camshaft Bushing **M—Oil Hole**

To Replace Bushing:

1. Remove and replace bushing using a bushing driver. Be careful not to push bushing inside of engine. Align oil holes (M) in new bushing and cylinder block.

Continued on next page

MX52301,0000356 -19-23JUL14-7/8

NOTE: Engine back plate must be removed to measure camshaft intermediate and flywheel end bearing diameters.

2. Measure intermediate and flywheel end camshaft bore diameters using the following procedures:
   - Remove engine back plate.
   - Remove plug (N) using a long wooden dowel. Insert wooden dowel through gear housing side.
   - Measure intermediate (O) and flywheel end camshaft bore (P) diameters.

Specification

Camshaft Intermediate Bore (3TNV70)—ID.....40.0—40.03 mm (1.575—1.576 in.)

Camshaft Flywheel-End Bore (3TNV70)—ID.....40.0—40.03 mm (1.575—1.576 in.)

   - If bore diameter exceeds wear limit, replace cylinder block.

Specification

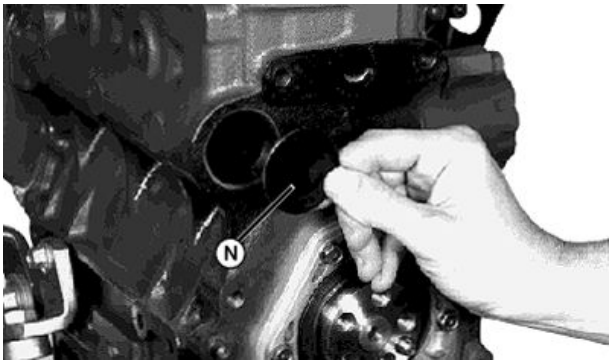
Camshaft Intermediate Bore Wear Limit (3TNV70)—ID (maximum).....40.1 mm (1.579 in.)

Camshaft Flywheel-End Bore Wear Limit (3TNV70)—ID (maximum).....40.1 mm (1.579 in.)

   - If bore clearance (bore ID minus camshaft journal OD) exceeds specification, replace camshaft, cylinder block or both.

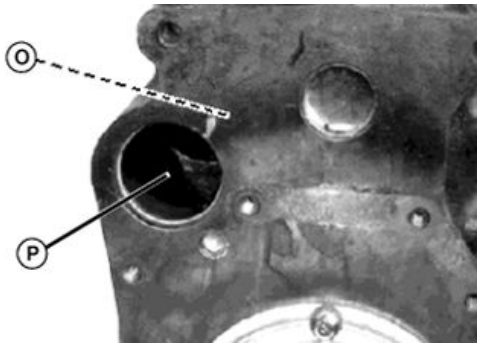
Specification

Camshaft Intermediate Bore Oil Clearance (3TNV70)—Clearance.....0.07—0.12 mm (0.003—0.005 in.)



MXAL30565 —UN—10JUL12

N—Plug



MXAL30566 —UN—10JUL12

O—Intermediate diameter

P—Flywheel End Camshaft Bore

Camshaft Flywheel-End Bore Oil Clearance (3TNV70)—Clearance.....0.04—0.09 mm (0.002—0.003 in.)

   - Apply John Deere Form-In Place Gasket, or an equivalent, on outer edge of plug. Install a new plug until it bottoms in bore.
   - Install engine back plate.

MX52301,0000356 -19-23JUL14-8/8

Oil Pan and Strainer

Removal:

1. Drain engine oil.
2. Remove cap screws securing oil pan. Remove oil pan and remove old gasket material.
3. Remove cap screws securing oil strainer. Remove oil strainer.

Installation:

1. Clean gasket mating surfaces and apply thin bead of John Deere Form-In Place Gasket on both sides of oil pan spacer.
2. Install oil strainer with new O-ring and tighten cap screws to specification.

Specification	
Oil Strainer Cap Screws—Torque	9 N·m (78 lb.-in.)

3. Install oil pan and tighten cap screws to specification.

Specification	
Oil Pan-to-Engine Cap Screws—Torque	11 N·m (97 lb.-in.)
Oil Pan-to-Timing Gear Housing Cap Screws—Torque	9 N·m (78 lb.-in.)

4. Install drain plug with new washer.
5. Fill crankcase to proper lever with correct engine oil See “Specifications - 3TNE68.”

MX52301,0000357 -19-03JUL14-1/1

Connecting Rod Side Play Check

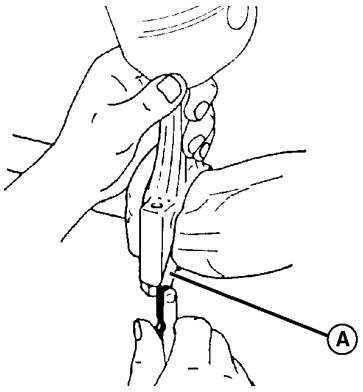
Reason:

To determine proper side clearance between crankshaft and connecting rod.

Procedure:

1. Measure between connecting rod cap and crankshaft with a feeler gauge (A). Compare measurement with specification.

Specification	
Connecting Rod Side Play Standard —Clearance	0.20—0.40 mm (0.008—0.016 in.)



MXAL30567 —UN—10JUL12

A—Feeler Gauge

Results:

- If side play exceeds specification, replace connecting rod and connecting rod cap.

MX52301,0000358 -19-17JUN14-1/1

Crankshaft End Play Check Diesel

Reason:

To determine condition of thrust bearings for proper side clearance between crankshaft and engine block.

Required Tools:

- Dial Indicator

Procedure:

NOTE: Crankshaft end play is measured at front end or rear end of crankshaft.

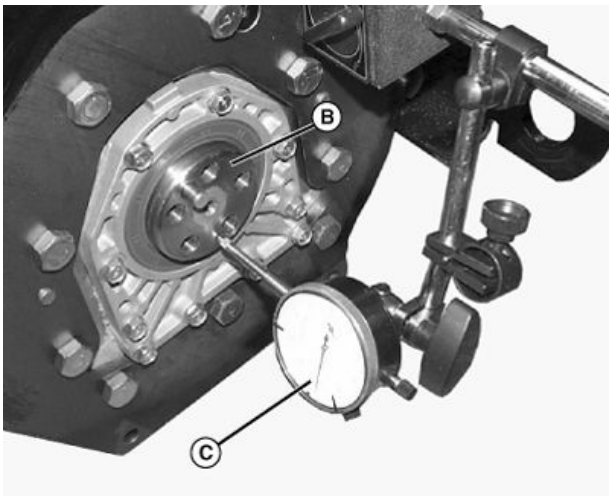
1. Fasten dial indicator to engine and position indicator tip on end of crankshaft.

IMPORTANT: Do not use excessive force when moving crankshaft to avoid damaging bearings.

2. Push crankshaft (B) toward rear as far as possible.
3. Zero the dial indicator (C).
4. Using a bar, gently pry the crankshaft as far forward as possible.

Results:

If end play exceeds wear limit, replace thrust bearings.



MXAL30568 —UN—10JUL12

B—Crankshaft **C—Dial Indicator**

Crankshaft End-Play Specifications—Specification

Crankshaft (3TNE68)—End Play	0.090—0.271 mm (0.004—0.011 in.)
Crankshaft (3TNV70)—End Play	0.11—0.25 mm (0.004—0.010 in.)

MX52301,0000359 -19-07JUL14-1/1

Connecting Rod Bearing Clearance Check

Reason:

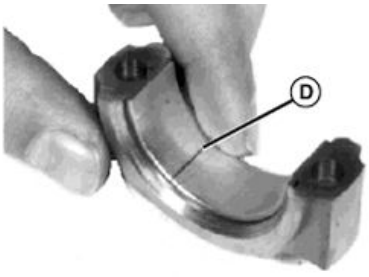
To measure oil clearance between connecting rod bearing and crankshaft journal.

Procedure:

IMPORTANT: Connecting rod caps must be installed on the same connecting rod and in the same direction to prevent crankshaft and connecting rod damage.

1. Remove connecting rod cap.
2. Wipe oil from bearing insert and crankshaft journal.
3. Put a piece of Plastigage® , (D) or an equivalent, along the full length of the bearing insert approximately 6 mm (0.25 in.) off center.
4. Turn crankshaft approximately 30° from bottom dead center.
5. Install connecting rod end cap and original cap screws. Tighten cap screws to specification.

Plastigage is a trademark of Perfect Circle Corporation



MXAL30569 —UN—10JUL12

D—PLASTIGAGE®

Specification

Connecting Rod Cap Bolts—Torque	22.6—27.5 N·m (16.6—20.2 lb.-ft.)

6. Remove cap screws and connecting rod cap.

Continued on next page

MX52301,000035A -19-23JUL14-1/2

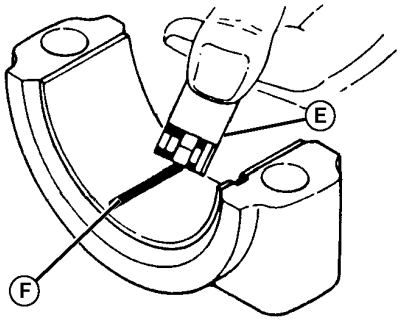
NOTE: The flattened PLASTIGAGE® is found on either the bearing insert or crankshaft journal.

7. Use the graduation marks on the envelope (E) to compare the width of the flattened PLASTIGAGE® (F) at its widest point.
8. Determine bearing clearance. The number within the graduation marks indicates the bearing clearance in inches or millimeters depending on which side of the envelope is used.
9. Remove PLASTIGAGE®.

Results:

- If clearance exceeds specification, replace bearing inserts.

Specification	
Connecting Rod Bearing Standard—Clearance	0.02—0.06 mm (0.001—0.002 in.)
Wear Limit—Clearance (maximum)	0.11 mm (0.004 in.)



MXAL30570 —UN—10JUL12

E—Envelope **F—PLASTIGAGE®**

MX52301,000035A -19-23JUL14-2/2

Crankshaft Main Bearing Clearance Check

Reason:

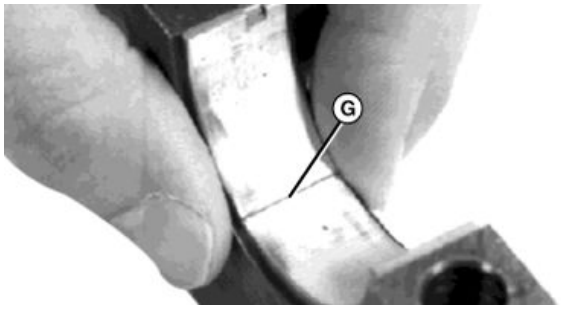
To measure oil clearance between main bearing and crankshaft journal.

Procedure:

IMPORTANT: Main bearing caps must be installed on the same main bearing and in the same direction to prevent crankshaft and main bearing damage.

NOTE: The engine must be removed from the machine to perform this test.

1. Remove main bearing cap.
2. Wipe oil from bearing insert and crankshaft journal.
3. Place a piece of PLASTIGAGE®, (G) or an equivalent, along the full length of the bearing insert approximately 6 mm (0.250 in.) off center.
4. Install main bearing cap and cap screws. Tighten cap screws to specification.



MXAL30571 —UN—10JUL12

G—PLASTIGAGE®

Specification	
Main Bearing Cap Screws—Torque	75.5—81.5 N·m (56—60 lb.-ft.)

5. Remove cap screws and main bearing cap.

Continued on next page

MX52301,000035B -19-23JUL14-1/2

NOTE: The flattened PLASTIGAGE® is found on either the bearing insert or crankshaft journal.

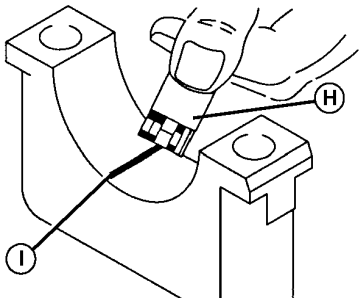
6. Use the graduated marks on the envelope (H) to compare the width of the flattened PLASTIGAGE® (I) at its widest point.
7. Determine main bearing clearance. The number within the graduation marks indicates the bearing clearance in inches or millimeters depending on which side of the envelope is used.

Specification	
Crankshaft Main Bearing—Clearance	0.02—0.05 mm (0.001—0.002 in.)

8. Remove PLASTIGAGE®.

Results:

- If clearance exceeds specification, replace bearing inserts.



MXAL30572 —UN—10JUL12

H—Envelope **I— Flattened PLASTIGAGE®**

Specification	
Wear Limit—Clearance (maximum)	0.12 mm (0.005 in.)

MX52301,000035B -19-23JUL14-2/2

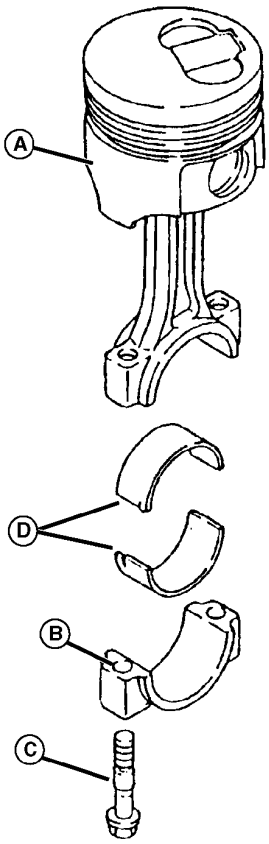
Piston to Cylinder Head Clearance

1. Place small pieces of solder or clay in three positions on the flat part of the piston head.
2. Install cylinder head and old gasket. Install cylinder head cap screws and tighten in proper sequence to specified torque. See Cylinder Head Removal and Installation Diesel 3TNE68 or See Cylinder Head Removal and Installation Diesel 3TNV70.
3. Slowly turn crankshaft one complete revolution.
4. Remove cylinder head and gasket.
5. Measure thickness of flattened pieces of solder. Calculate average thickness of solder pieces to obtain piston-to-cylinder head clearance specification.

Specification	
Piston-to-Cylinder Head (3TNE68)—Clearance	0.59—0.74 mm (0.023—0.029 in.)
Piston-to-Cylinder Head (3TNV70)—Clearance	0.75—0.89 mm (0.029—0.035 in.)

Results:

- If clearance is less than specifications, replace cylinder head.



MXAL30573 —UN—10JUL12

A—Connecting Rod and Piston **C—Cap Screws (2 used)**
B—Connecting Rod Cap **D—Bearing Inserts**

MX52301,00004AB -19-24JUL14-1/1

Connecting Rod Repair

Removal:

1. Remove oil pan and strainer tube. See Oil Pan and Strainer.
2. Remove cylinder head. See Cylinder Head Removal and Installation Diesel 3TNE68 or Cylinder Head Removal and Installation Diesel 3TNV70.
3. Check cylinder bore for ridges. These ridges cause damage to piston if ridge is not removed.
4. If necessary, remove ridge from top of cylinder bore using a ridge reamer.
5. Measure connecting rod side play. See Connecting Rod Side Play Check.
6. Measure connecting rod bearing clearance. See Connecting Rod Bearing Clearance Check.

IMPORTANT: Pistons and cylinders are matched. Pistons must be installed in the cylinders from which they are removed.

7. Remove two cap screws (C) and connecting rod cap (B).

IMPORTANT: Keep connecting rods and caps together. Rods and caps are a matched set. Note alignment marks on each part.

8. Note connecting rod alignment mark in relation to the cylinders. Starting at flywheel end with cylinder number one, then two, then three.
9. Push piston and connecting rod (A) out of cylinder bore using a wooden dowel.
10. Remove bearing inserts (D).
11. Disassemble and inspect all parts for wear or damage. See “Disassembly, Inspection, and Replacement” procedures.

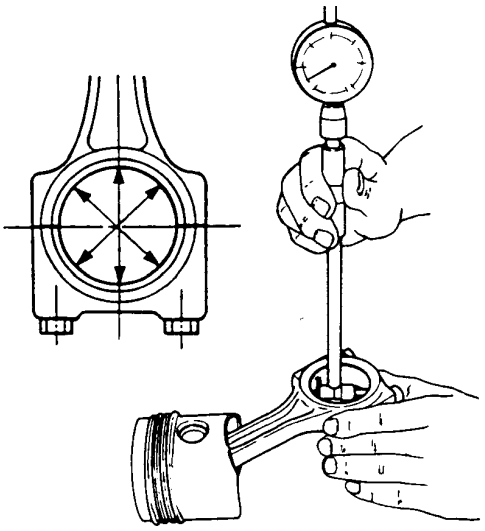
Inspection Replacement:

1. Inspect all parts for wear or damage. Replace as necessary.
2. Measure crankshaft connecting rod journal diameter. See “Crankshaft, Main Bearings, and Flywheel” in this section.
3. Install connecting rod cap and bearing inserts on connecting rod. Install old connecting rod cap screws and tighten to specification.

Specification

Connecting Rod Cap Screw—Torque	22.6—27.5 N·m (16.6—20.2 lb.-ft.)

4. Measure connecting rod bearing diameter.



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Connecting Rod Bearing—3TNE68—Specification

Connecting Rod Large End Bearing Standard—OD	35.970—35.980 mm (1.417—1.419 in.)
Wear Limit—OD (minimum)	35.91 mm (1.414 in.)
Clearance—Clearance (maximum)	0.16 mm (0.006 in.)

Connecting Rod Bearing—3TNV70—Specification

Connecting Rod Large End Bearing —OD	41.98—42.00 mm (1.653—1.654 in.)
Connecting Rod Large End—Bearing Thickness	1.50—1.51 mm (0.059 in.)

- If bearing diameter exceeds wear limit, replace bearing inserts.

Continued on next page

- If bearing clearance (bearing ID minus crankshaft journal OD) exceeds specification, grind crankshaft connecting rod journals. Install undersized bearing inserts, or replace bearing inserts and crankshaft.

Connecting Rod Large End Bearing ID Clearance—Specification

Connecting Rod Large End Bearing (3TNE68)—Clearance	0.16 mm (0.006 in.)
Connecting Rod Large End Bearing (3TNV70)—Clearance	0.02—0.06 mm (0.001—0.002 in.)

Connecting Rod Large End Wear Limit—Specification

Connecting Rod Large End Wear Limit (3TNE68)—Clearance (maximum)	35.91 mm (1.414 in.)
Connecting Rod Large End Wear Limit (3TNV70)—Clearance (maximum)	0.11 mm (0.004 in.)

5. With rings installed on piston, measure piston ring groove clearance. Measure several places around each piston.

Installation:

Installation is done in reverse order of removal.

- Apply clean engine oil on all parts during installation.
- Never reuse connecting rod cap screws, replace with new cap screws.

IMPORTANT: Pistons must be installed in cylinders from which they were removed and in the same direction. Be careful not to damage crankshaft rod journal while installing piston

1. If new piston rings are being installed, deglaze cylinder bore. See “Deglazing” in Cylinder Bore.

Continued on next page

IMPORTANT: Do not touch bearing insert surfaces. Oil and acid from your finger corrodes the bearing surface.

2. Install bearing inserts on connecting rod and rod cap, aligning tangs (G) with grooves.
3. Install piston and connecting rod into the cylinder from which it was removed, with alignment marks (H) on connecting rod and with piston size mark (F) on top of piston toward fuel injection pump.

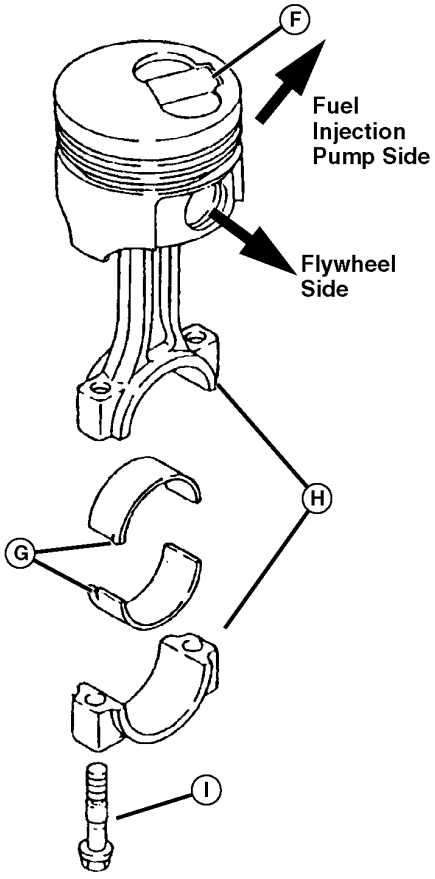
IMPORTANT: Connecting rod caps must be installed on the same connecting rods they were removed from.

4. Match the connecting rods to caps using alignment marks (H) on connecting rod and with piston size mark (F) on top of piston toward fuel injection pump. Install caps.
5. Dip entire connecting rod cap screw (I) in clean engine oil. Install new cap screws and tighten to specifications.

Specification	
Connecting Rod Cap Screw—Torque	22.6—27.5 N·m (16.6—20.2 lb.-ft.)

- If a new piston and connecting rod were installed, stamp a number corresponding to the cylinder number on the connecting rod cap and connecting rod.

6. Install cylinder head. See Cylinder Head Removal and Installation Diesel 3TNE68 or Cylinder Head Removal and Installation Diesel 3TNV70.
7. If a new piston and connecting rod were installed, stamp a number corresponding to the cylinder number on the connecting rod cap and connecting rod.
8. Install oil pan and strainer tube.



MXAL30575 —UN—10JUL12

F—Piston Size Mark
G—Aligning Tangs
H—Alignment MARKS
I— Cap Screw

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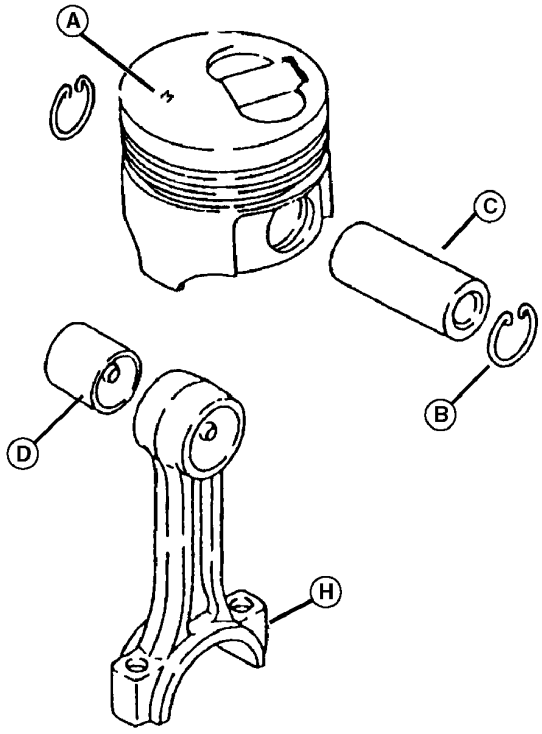
Pistons

Disassembly:

IMPORTANT: Pistons must be installed on the same connecting rod they were removed from.

- Note assembly mark on each piston (A) and connecting rod (H) to aid in assembly.
- Remove piston pin retainer (B) and piston pin (C).
- Piston pin bushing (D) is press fit in connecting rod. Remove bushing only if replacement is necessary. See “Inspection/Replacement” procedures.
- Inspect all parts for wear or damage. Replace as necessary.

A—Assembly Mark
B—Piston Pin Retainer
C—Piston Pin
D—Piston Pin Bushing
H—Connecting Rod



MXAL30576 —UN—10JUL12

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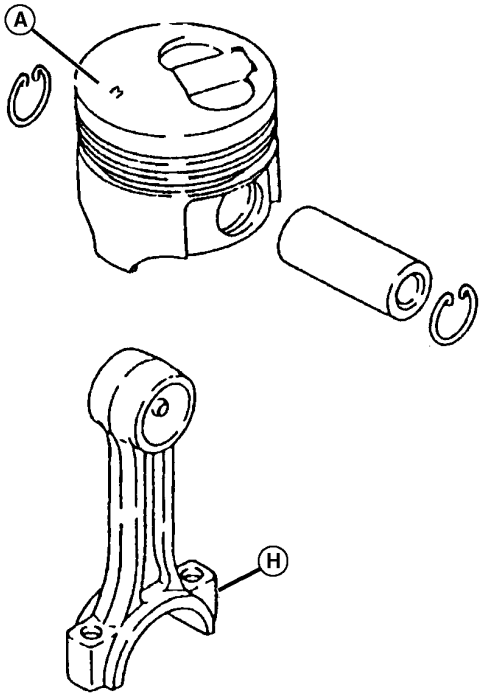
Assembly:

1. Apply clean engine oil to all parts during assembly.
2. Assemble piston to connecting rod with piston size mark (A) opposite of connecting rod “punched” alignment mark (H). If a new connecting rod is used, assemble piston to connecting rod with piston size mark on same side as connecting rod bearing insert groove.

IMPORTANT: Pistons must be installed on the same connecting rod they were removed from.

3. Lubricate piston pin with new engine oil and install pin and retaining rings.

A—Piston Size Mark
H—Alignment Mark



MXAL30577 —UN—10JUL12

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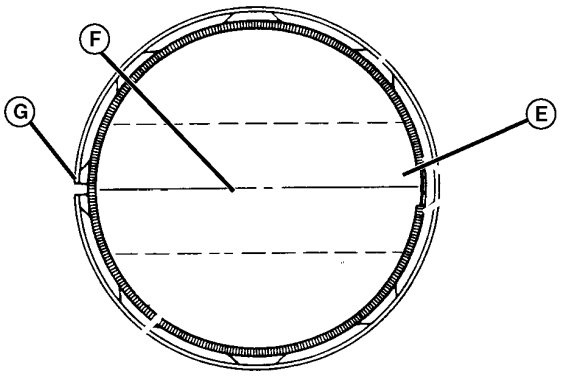
MX52301,000035D -19-24JUL14-2/12

4. Install oil ring expander (E) in bottom ring groove of piston with ends aligned with center of piston pin (F).
5. Install oil ring over expander with ring gap (G) (180°) opposite of expander ends.

E—Oil Ring Expander **G—Ring Gap**
F—Piston Pin



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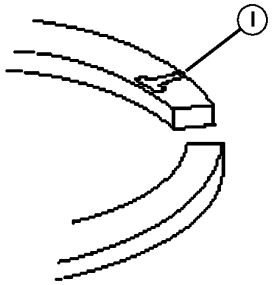
MX52301,000035D -19-24JUL14-3/12

6. First and second compression rings have a letter or mark (I) near the end gap. This mark indicates the top of the ring. Install the ring with this mark toward the top of the piston.

I— Mark



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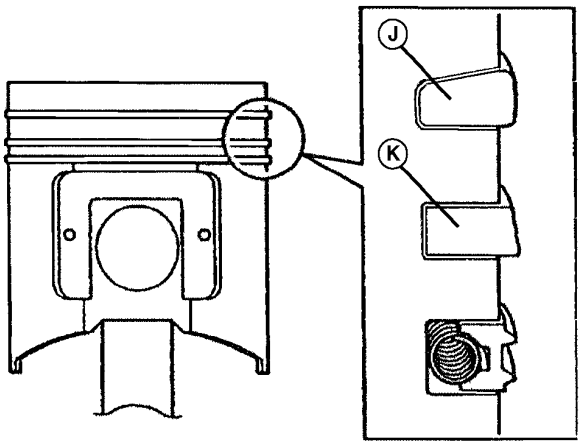
7. Install second compression ring (K), identified by its dark color and tapered face, in middle groove with manufacturer's mark toward top of piston. Turn ring until gap is 120° away from oil ring gap.

J— First Compression Ring **K—Second Compression Ring**



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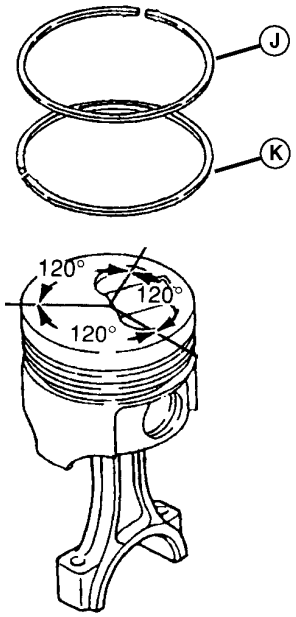
8. Install first compression ring (J) (chrome plated), with manufacturer's mark toward top of piston, in top groove. Turn ring until gap is 120° away from second ring gap.

J— First Compression Ring **K—Second Compression Ring**



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9. Measure piston ring groove clearance with a feeler gauge and compare with specifications.

Specification	
Piston Ring Groove Top Ring—Clearance	0.06—0.10 mm (0.002—0.004 in.)
Piston Ring Groove Top Ring—Clearance (maximum)	0.21 mm (0.0083 in.)

Specification	
Piston Ring Groove Second Ring (3TNE68)—Clearance	0.09—0.125 mm (0.003—0.005 in.)
Piston Ring Groove Second Ring (3TNV70)—Clearance	0.05—0.09 mm (0.002—0.0035 in.)
Piston Ring Groove Second Ring—Clearance (maximum)	0.21 mm (0.0083 in.)

Specification	
Piston Ring Groove Oil Ring Standard—Clearance	0.02—0.06 mm (0.001—0.002 in.)

MXAL30582 —UN—10JUL12

Piston Ring Groove Oil Ring—Clearance (maximum)	0.18 mm (0.0071 in.)

- If clearance exceeds maximum limit, replace rings or piston.

Continued on next page

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10. To measure piston ring end gap (J), use a piston to push ring into cylinder bore until ring is approximately 30 mm (1.18 in.) from bottom of cylinder bore.
11. Measure end gap with a feeler gauge.
    - If end gap exceeds wear limit, replace rings.

Compression Ring End Gap Wear Limits 3TNE68—Specification

First, Second, Oil Ring—Gap (maximum)..... 1.50 mm (0.059 in.)

Compression Ring End Gap Wear Limits 3TNV70—Specification

First Ring—Gap (maximum)..... 0.39 mm (0.015 in.)

Second Ring—Gap (maximum)..... 0.42 mm (0.017 in.)

Oil Ring—Gap (maximum)..... 0.44 mm (0.017 in.)

- If end gap is less than minimum, file end of ring until it meets specification.

Standard Piston Ring End Gaps 3TNE68—Specification

First Compression Ring—End Gap.....0.1—0.25 mm (0.004—0.01 in.)

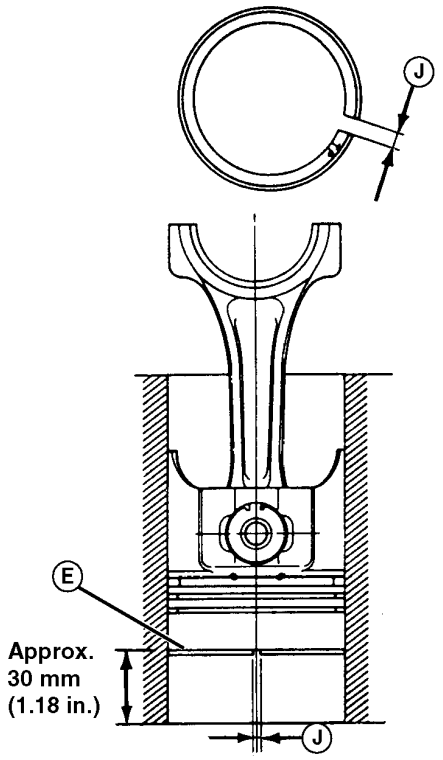
Second Compression Ring—End Gap.....0.15—0.35 mm (0.006—0.014 in.)

Oil Ring—End Gap.....0.15—0.35 mm (0.006—0.014 in.)

Standard Piston Ring End Gaps 3TNV70—Specification

First Compression Ring—End Gap.....0.15—0.30 mm (0.006—0.012 in.)

Second Compression Ring—End Gap.....0.18—0.33 mm (0.007—0.013 in.)



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J— Piston Ring End Gap

Oil Ring—End Gap.....0.15—0.35 mm (0.006—0.014 in.)

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12. Measure piston pin diameter. Measure diameter at six places.

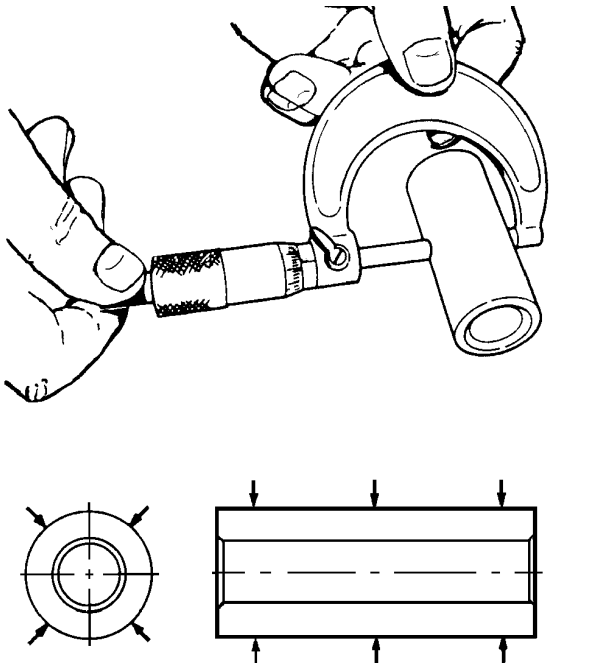
    - If pin diameter is less than wear limit, replace pin.

Piston Pin OD Standard—Specification

Piston Pin Standard
(3TNE68)—OD.....19.991—20.000 mm
(0.7870—0.7874 in.)
Piston Pin Standard
(3TNV70)—OD.....21.995—22.009 mm
(0.8659—0.8665 in.)

Piston Pin OD Wear Limit—Specification

Piston Pin
(3TNE68)—OD
(minimum)..... 19.90 mm
(0.7835 in.)
Piston Pin 3TNV70)—OD
(minimum)..... 21.965 mm
(0.8648 in.)



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13. Measure piston pin bore diameter in piston.

Piston Pin Bore ID Standard—Specification

Piston Pin Bore Standard
(3TNE68)—ID.....20.00—20.008 mm
(0.7874—0.7877 in.)
Piston Pin Bore Standard
(3TNV70)—ID.....22.000—22.009 mm
(0.8661—0.8665 in.)

- If piston pin bore exceeds wear limit, replace piston.

Piston Pin Bore ID Wear Limit—Specification

Piston Pin Bore Wear
Limit (3TNE68)—ID
(maximum)..... 20.02 mm
(0.788 in.)
Piston Pin Bore Wear
Limit (3TNV70)—ID
(maximum)..... 22.04 mm
(0.868 in.)

Piston Pin Bore ID Oil Clearance Wear Limit—Specification

Piston Pin Bore
(3TNE68)—Clearance
(maximum)..... 0.12 mm
(0.0047 in.)
Piston Pin Bore
(3TNV70)—Clearance
(maximum)..... 0.074 mm
(0.003 in.)

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- If bore clearance (bore ID minus pin OD) exceeds specification, replace piston, piston pin or both.

Piston Pin Bore ID Oil—Specification

Piston Pin Bore
(3TNE68)—Clearance.....0.000—0.017 mm
(0.0000—0.0007 in.)
Piston Pin Bore
(3TNV70)—Clearance.....0.000—0.014 mm
(0.0000—0.0006 in.)

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MX52301,000035D -19-24JUL14-10/12

14. Measure piston pin bushing diameter in connecting rod.

Piston Pin Connecting Rod Bushing Specifications—Specification

Piston Pin Connecting Rod Bushing ID (3TNE68)—ID ..... 20.025—20.038 mm (0.788—0.789 in.)

Piston Pin Connecting Rod Bushing ID (3TNV70)—ID ..... 22.025—22.038 mm (0.867—0.868 in.)

- If bushing diameter exceeds wear limit, replace bushing.

Piston Pin Bushing Wear Specifications—Specification

(3TNE68)—ID (minimum) ..... 20.10 mm (0.791 in.)

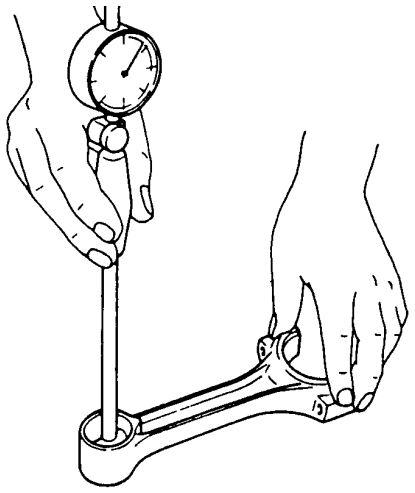
Piston Pin Bushing (3TNV70)—ID (minimum) ..... 22.07 mm (0.869 in.)

NOTE: Piston pin bushing is press fit. Replace bushing using a driver set. When installing bushing, make sure to align oil hole in bushing with hole in connecting rod.

- If bushing clearance (bushing ID minus pin OD) exceeds specification, replace bushing, piston pin or both.

Oil Clearance—Specification

(3TNE68)—Clearance ..... 0.025—0.047 mm (0.0009—0.0018 in.)



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(3TNV70)—Clearance ..... 0.025—0.047 mm (0.0009—0.0018 in.)

Wear Limit—Specification

(3TNE68)—Clearance (maximum) ..... 0.2 mm (0.0078 in.)

(3TNV70)—Clearance (maximum) ..... 0.105 mm (0.0041 in.)

Continued on next page

15. Measure piston diameter perpendicular to piston pin bore at distance A.

Specification

Piston Measurement Location—Distance	22—25 mm (0.866—0.984 in.)

NOTE: If engine has had a previous major overhaul, oversize pistons and rings may be installed. Pistons and rings are available in 0.25 mm (0.010 in.) oversize.

- If piston diameter is less than wear limit, install a new piston.

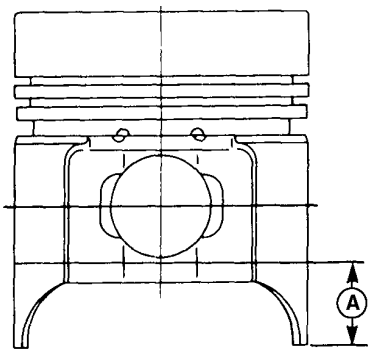
Standard-Size Piston OD—Specification

(3TNE68)—OD	67.94—67.97 mm (2.675—2.676 in.)
(3TNV70)—OD	69.96—69.99 mm (2.754—2.756 in.)

Standard-Size Piston Wear Limit—Specification

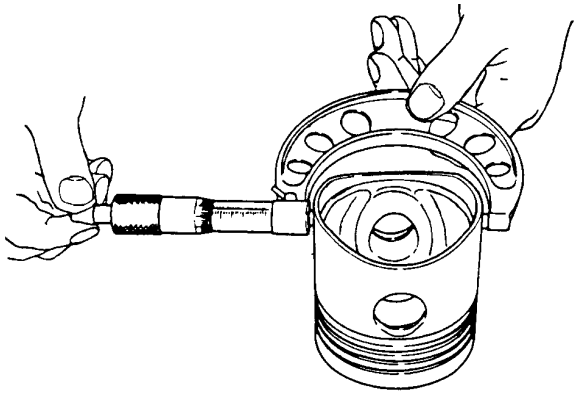
(3TNE68)—OD (minimum)	67.90 mm (2.673 in.)
(3TNV70)—OD (minimum)	69.91 mm (2.674 in.)

16. Measure cylinder bore diameter. See procedure in this group.



MXAL30587 —UN—10JUL12

A—Measurement



MXAL30588 —UN—10JUL12

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Cylinder Bore

Inspection:

NOTE: If engine has had a previous major overhaul, oversize pistons and rings may be installed.

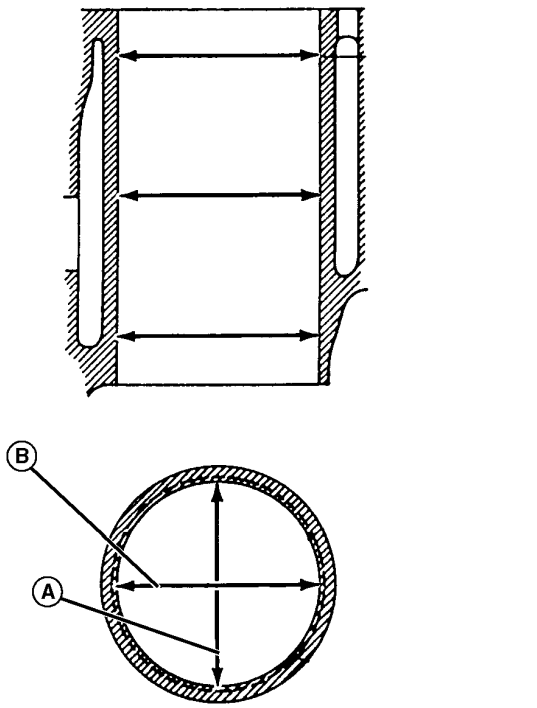
1. Measure cylinder bore diameter at three positions; top, middle, and bottom. At these three positions, measure in both directions; along crankshaft center line (A) and direction of crankshaft rotation (B).

3TNE68—Specification

Cylinder Bore—ID.....68.00—68.03 mm (2.677—2.678 in.)
Cylinder Bore Wear Limit—ID (maximum)..... 68.20 mm (2.685 in.)
Piston to Cylinder Clearance—Clearance..... 0.25 mm (0.010 in.)
Cylinder Roundness —ID..... 0.01 mm (0.0003 in.)
Cylinder Round-ness—Run-out (maxi-mum)..... 0.03 mm (0.001 in.)
Oversize Bore—ID.....68.25—68.28 mm (2.687—2.688 in.)
Oversize Bore Wear Limit—ID (maximum)..... 68.45 mm (2.695 in.)

Specifications 3TNV70—Specification

Cylinder Bore —ID.....70.01—70.02 mm (2.756—2.757 in.)
Cylinder Bore ID Wear Limit—ID (maximum)..... 70.20 mm (2.764 in.)
Piston-to-Cylinder —Clearance.....0.03—0.05 mm (0.001—0.002 in.)
Cylinder Round-ness—ID.....0.00—0.01 mm (0—0.0004 in.)
Cylinder Roundness—Di-ameter (wear limit)..... 0.03 mm (0.001 in.)



MXAL30589 —UN—10JUL12

A—Crankshaft Center Line **B—Crankshaft Rotation**

Cylinder Taper—Length.....0.00—0.01 mm (0—0.0004 in.)
Wear Limit—Length (maximum)..... 0.03 mm (0.001 in.)

Results:

- If cylinder bore exceeds wear limit, replace cylinder block or have cylinder rebored. See “Reboring” within this Group.
- If cylinder is rebored, oversize pistons and rings must be installed. Pistons and rings are available in 0.25 mm (0.010 in.) oversize.
- If clearance (cylinder bore ID minus piston OD) exceeds specification, replace cylinder block, piston or both; or rebore cylinder and install oversize piston and rings.

Continued on next page

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Deglazing:

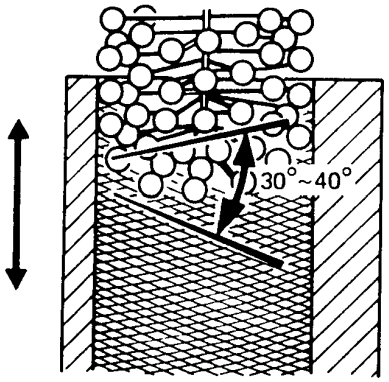
IMPORTANT: If cylinder bores deglazed with crankshaft installed in engine, put clean shop towels over crankshaft to protect journal and bearing surfaces from abrasives.

1. Deglaze cylinder bores using a flex-hone with 180 grit stones.
2. Use flex-hone to obtain specified pattern.

Specification	
Cross-hatch Pattern—Angle	30°—40°

IMPORTANT: Do not use gasoline, kerosene, or commercial solvents to clean cylinder bores. Solvents do remove all abrasives from cylinder walls.

3. Remove excess abrasive residue from cylinder walls using a clean dry rag. Clean cylinder walls using clean white rags and warm soapy water. Continue to clean cylinder until white rags show no discoloration.



MXAL30590 —UN—10JUL12

MX52301,000035E -19-23JUL14-2/3

Reboring:

NOTE: The cylinder block can be rebored to use oversize pistons and rings. Pistons and rings are available in 0.25 mm (0.010 in.) oversize. See this group for cylinder bore ID specifications.

1. Align center of bore to drill press center.

IMPORTANT: Check stone for wear or damage. Use a rigid hone with 300 grit stones.

2. Adjust hone so lower end is even with lower end-of-cylinder bore.
3. Adjust rigid hone stones until they contact narrowest point of cylinder.
4. Coat cylinder with honing oil. Hone should turn by hand. Adjust if too tight.
5. Run drill press at about 250 rpm Move hone up and down in order to obtain specified pattern.

Specification	
Cross-hatch Pattern—Angle	30°—40°

NOTE: Measure bore when cylinder is cool.

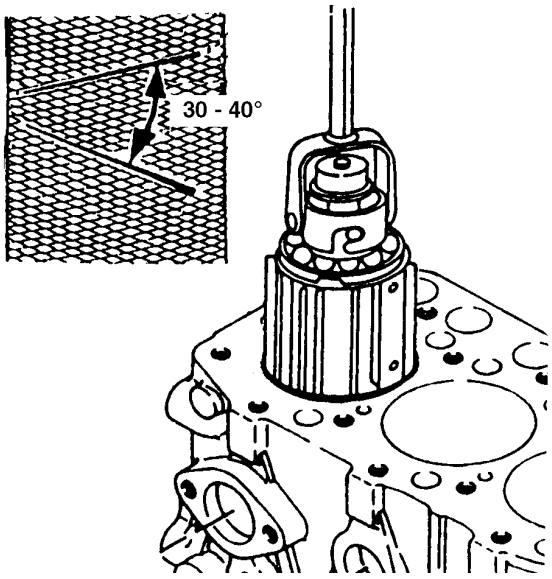
6. Stop press and check cylinder diameter.

NOTE: Finish should not be smooth. It should have a 30—40° crosshatch pattern.

7. Remove rigid hone when cylinder is within 0.03 mm (0.001 in.) of desired size.
8. Use a flex hone with 180 grit stones for honing to final size.
9. Check bore for size, taper, and out-of-round. See Inspection procedures.

IMPORTANT: Do not use solvents to clean cylinder bore. Solvents do not remove all metal particles and abrasives produced during honing.

10. Clean cylinder thoroughly using warm soapy water until clean white rags show no discoloration.
11. Dry cylinder and apply engine oil.



MXAL30591 —UN—10JUL12

MX52301,000035E -19-23JUL14-3/3

Crankshaft and Main Bearings

Removal:

1. Check crankshaft end play. See Crankshaft End Play Check Diesel.
2. Remove flywheel. See Flywheel Removal and Installation.
3. Remove rear oil seal case. See Crankshaft Rear Oil Seal.
4. Remove timing gear cover, timing gears, timing gear housing, and flywheel of engine.
5. Check crankshaft bearing clearance. See Crankshaft Main Bearing Clearance Check.

IMPORTANT: Connecting rod end caps must be installed on the same connecting rods from which they were removed. Note alignment marks on caps and rods.

6. Remove connecting rod cap screws and end caps.
7. Push pistons and connecting rods away from crankshaft.

IMPORTANT: Main bearing caps must be installed on the same main bearings from which they were removed.

8. Remove main bearing cap screws, caps, and cap thrust bearings.
9. Remove crankshaft.
10. Remove block thrust bearings and main bearing inserts.
11. Inspect all parts for wear or damage. See "Inspection/Replacement" procedure.

Installation:

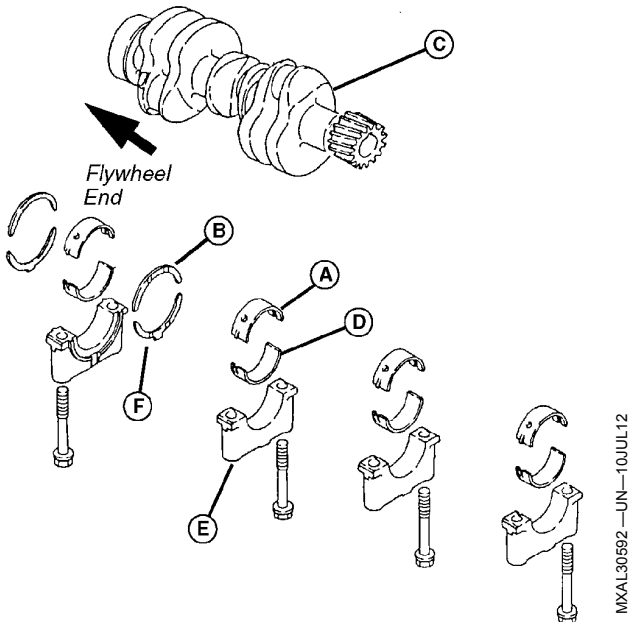
1. Apply clean engine oil on all parts during installation.

IMPORTANT: Do not touch bearing insert surfaces. Oil and acid from your finger corrodes the bearing surface.

2. Install bearing inserts drilled with oil passage (A) in cylinder block bearing bores, aligning tangs with slots in bores.
3. Install block thrust bearings (B) with oil grooves facing away from engine block.

NOTE: Main bearing caps (E) have "raised arrows" marked "FW" and are stamped with numbers. Both correspond to their location on the engine block. The number "1" main bearing bore is at flywheel end. Install bearing caps beginning with number 1, then 2, etc. with the arrow pointing toward the flywheel.

4. Install crankshaft (C).



MXAL30592 —UN—10JUL12

A—Oil Passage
B—Thrust Bearings
C—Crankshaft
D—Bearing Inserts
E—Main Bearing Caps
F—Cap Thrust Bearings

5. Install smooth bearing inserts (D) in main bearing caps (E), aligning tangs with slots in caps.
6. Install cap thrust bearings (F), with oil grooves facing away from cap, in the number "1" main bearing cap.
7. Install main bearing caps in their original locations with arrows pointing toward flywheel side of engine.

IMPORTANT: Do not use high-speed power tools or air wrenches to tighten main bearing cap screws.

8. Dip entire main bearing cap screw in clean engine oil. Install cap screws and tighten. Do **not** tighten to specifications.
9. Using a soft-faced hammer, tap the front end of the crankshaft then the rear end of the crankshaft to align the thrust bearings.
10. Tighten main bearing cap screws to specifications. When tightening, start at center main bearing cap and work out, alternating to the ends. Turn crankshaft by hand. If it does not turn easily, disassemble the parts and find the cause.

(3TNE68)—Specification

Main Bearing Cap Screws
(3TNE68)—Torque.....54 N·m (40 lb.-ft.)

(3TNV70)—Specification

Main Bearing Cap Screws
(3TNV70)—Torque.....75.5—81.5 N·m (55.6—60 lb.-ft.)

Continued on next page

MX52301,000035F -19-17JUL14-1/6

MX52301,000035F -19-17JUL14-2/6

Inspection:

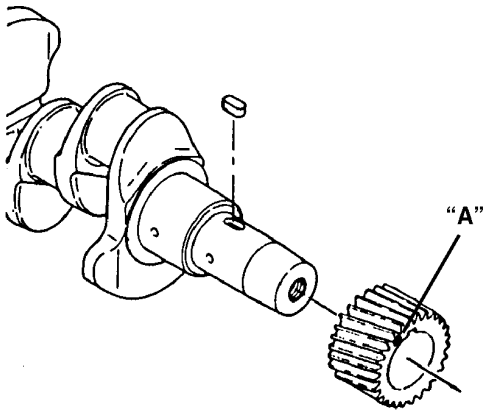
1. Inspect crankshaft gear for chipped or broken teeth. Replace if necessary.

   To replace gear:

   - Remove gear from crankshaft using a knife-edge puller and a press.

CAUTION: Do not heat oil over 182 °C (360 °F). Oil fumes or oil can ignite above 193 °C (380 °F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

   - Heat gear to approximately 150 °C (300 °F). Install gear with timing mark “A” toward press table. Align slot in gear with key in shaft. Press crankshaft into gear until gear is tight against crankshaft shoulder.



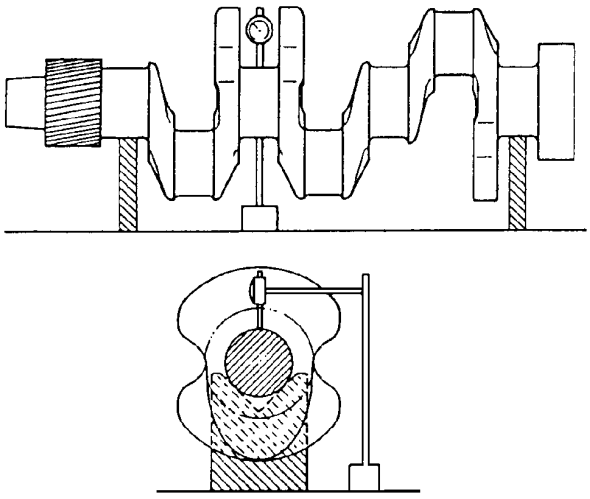
MXAL30593 —UN—10JUL12

MX52301,000035F -19-17JUL14-3/6

2. Inspect crankshaft for bend using v-blocks and a dial indicator. Turn crankshaft slowly and read variation on indicator. If variation is greater than specification , replace crankshaft.

Specification

Crankshaft—Bend (maximum)	0.02 mm (0.001 in.)



MXAL30594 —UN—10JUL12

Continued on next page

MX52301,000035F -19-17JUL14-4/6

NOTE: If engine has had a previous major overhaul, journals may be ground and undersized bearing inserts installed.

3. Measure crankshaft connecting rod journal and main bearing journal diameters. Measure several places around each journal.

3TNE68—Specification

Crankshaft Connecting Rod Journal —OD.....35.97—35.98 mm (1.4161—1.4165 in.)

Crankshaft Connecting Rod Journal Wear Limit—OD (minimum).....35.91 mm (1.414 in.)

3TNV70—Specification

Crankshaft Connecting Rod Journal —OD.....41.952—41.962 mm (1.6517—1.6520 in.)

Crankshaft Connecting Rod Journal Wear Limit—OD (maximum).....42.90 mm (1.6497 in.)

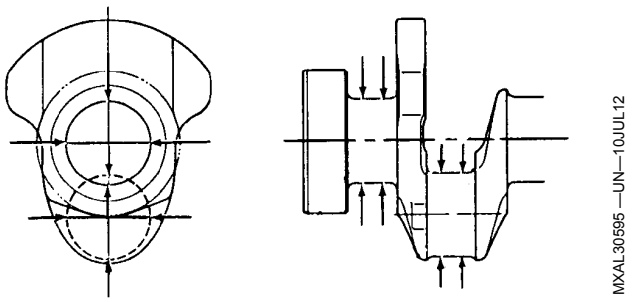
3TNE68—Specification

Crankshaft Main Bearing Journal—OD.....39.97—39.98 mm (1.5736—1.5740 in.)

Crankshaft Main Bearing Journal Wear Limit—OD (minimum).....39.90 mm (1.571 in.)

3TNV70—Specification

Crankshaft Main Bearing Journal —OD.....46.952—46.962 mm (1.8485—1.8489 in.)



MXAL30595 —UN—10JUL12

Crankshaft Main Bearing Journal Wear Limit—OD (minimum).....46.902 mm (1.8465 in.)

- If journal diameter is less than wear limit, replace crankshaft or have journals ground under size by a qualified machine shop.
- If journals are ground, undersize bearing inserts must be installed. Bearing inserts are available in 0.25 mm (0.010 in.) undersize.

4. Install bearing inserts and main bearing cap on main bearing. Tighten main bearing cap screws to a minimum specification to compress main bearing for measurement.

Specification

Main Bearing Cap Screws—Torque (Minimum).....54 N·m (40 lb.-ft.)

Continued on next page

5. Measure main bearing diameter.

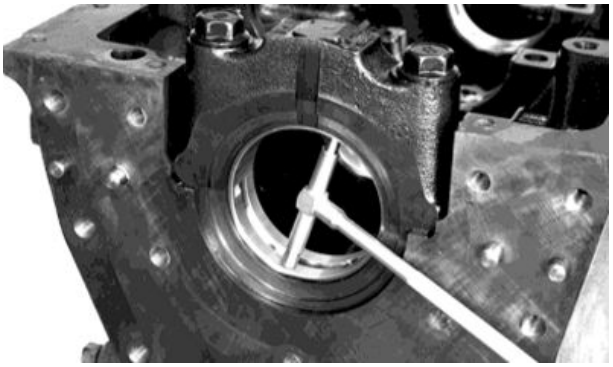
Main Bearing Specifications 3TNE68—Specification

Main Bearing—ID	40.000—40.042 mm (1.5748—1.5765 in.)
Main Bearing Oil —Clearance	0.15 mm (0.0059 in.)
Main Bearing—ID (maximum)	40.07 mm (1.5776 in.)

Main Bearing Specifications 3TNV70—Specification

Main Bearing—Clearance	46.98—47.00 mm (1.849—1.850 in.)
Main Bearing Oil —Clearance	0.02—0.05 mm (0.001—0.002 in.)
Main Bearing Oil Clearance Wear Limit—Clearance (maximum)	0.11 mm (0.0043 in.)
Main Bearing Insert —Thickness	2.01 mm (0.079 in.)

- If bearing diameter exceeds wear limit, replace bearing inserts



MXAL30596 —UN—10JUL12

- If bearing clearance (bearing ID minus crankshaft main bearing journal OD) exceeds specification, replace bearing inserts and crankshaft. If necessary, have crankshaft journals ground under size by a qualified machine shop and install undersized bearing inserts.
- Bearing inserts are available in 0.25 mm (0.010 in.) undersize.

6. Clean and inspect oil passages in main bearing journals, connecting rod journals, and main bearing bores in cylinder block.
7. Inspect crankshaft for cracks or damage. Replace if necessary.

MX52301,000035F -19-17JUL14-6/6

Flywheel Removal and Installation

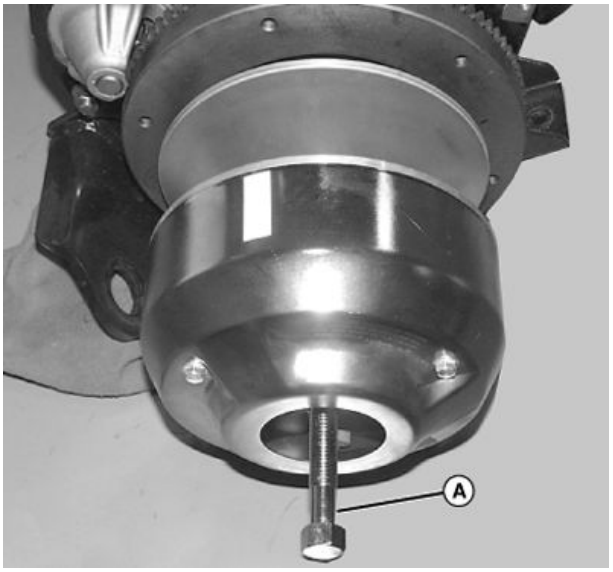
Essential or Required Tools:

- JDG1641 Clutch Removal Tool

Removal:

1. Remove clutch using JDG1641 clutch removal tool (A).

A—Clutch Removal Tool



MXAL30597 —UN—10JUL12

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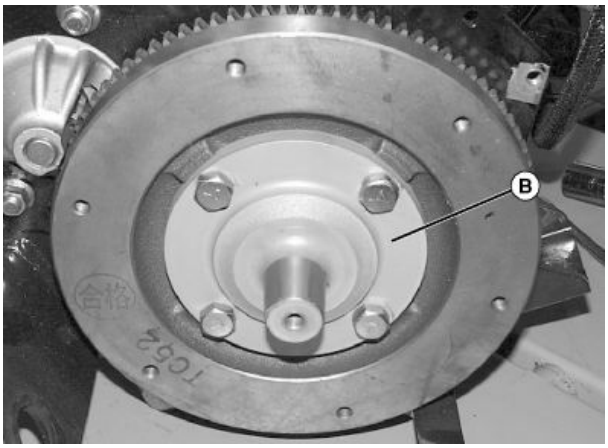
MX52301,0000360 -19-17JUN14-1/3

2. Remove the four bolts and clutch stub shaft (B).

B—Stub Shaft



MXT010918 —UN—16JUN14

MX52301,0000360 -19-17JUN14-2/3

3. Remove five flywheel mounting cap screws (C) from flywheel to crankshaft.
4. Pull flywheel from crankshaft alignment pin.

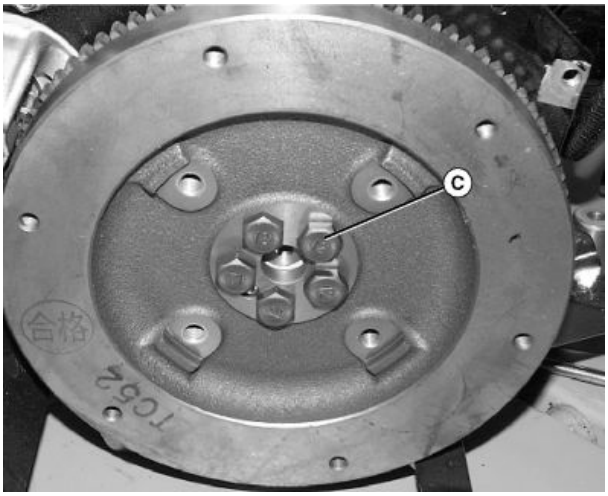
IMPORTANT: Never reuse flywheel mounting cap screws. Always install new.

5. Inspect flywheel ring gear teeth for wear or chips. Replace worn parts.

Installation:

1. Align flywheel on dowel pin and install five new flywheel mounting cap screws. Tighten cap screws to specification.

	Specification
Flywheel Mounting Cap Screws—Torque	80.4—86.4 N·m (59—63 lb.-ft.)



MXT010919 —UN—16JUN14

C—Cap Screws

MX52301,0000360 -19-17JUN14-3/3

Flywheel Plate

Removal:

1. Remove flywheel.
2. If desired, remove starting motor (A).
3. Remove mounting cap screws (B) and flywheel plate (C).

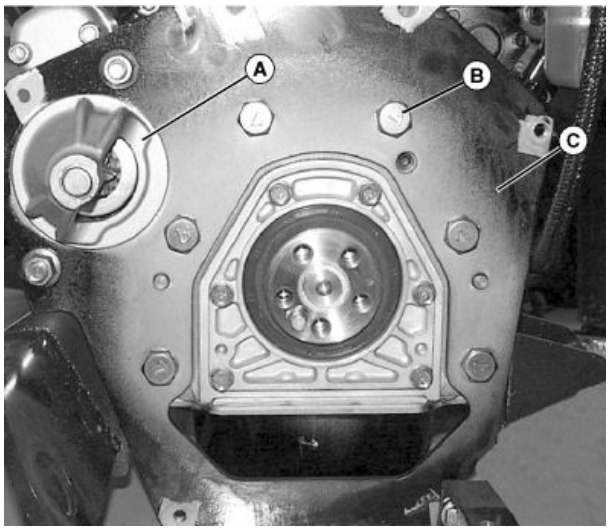
Installation:

Installation is done in reverse order of removal.

- Tighten mounting cap screws to specifications.

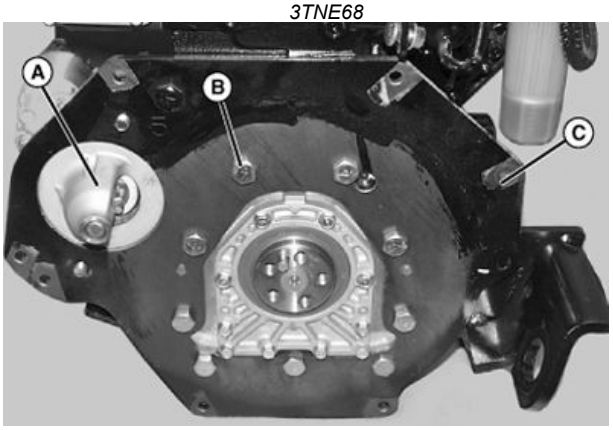
Specification	
Flywheel Plate Mounting Cap Screws —Torque	59—64 N·m (80.4—86.4 lb.-ft.)

A—Starting Motor
B—Cap Screws
C—Flywheel Plate



MXT011137 —UN—16JUN14

3TNE68



MXAL30600 —UN—10JUL12

3TNV70

MX52301,0000361 -19-07JUL14-1/1

Timing Gear Housing

Removal:

1. Remove engine. See Engine Removal and Installation Diesel.
2. Remove timing gear cover. See Timing Gear Cover Diesel 3TNE68 or Timing Gear Cover Diesel 3TNV70.
3. Remove fuel injector lines from engine. See Fuel Injection Nozzle.
4. Remove engine camshaft. See Timing Gear Cover Diesel 3TNE68 or Timing Gear Cover Diesel 3TNV70.
5. Remove idler gear. See Idler Gear 3TNE68 or Idler Gear 3TNV70.
6. Remove water pump. See Water Pump Removal and Installation—Diesel.
7. Remove oil dipstick tube.
8. Remove oil pan. See Oil Pan and Strainer.
9. Remove timing gear housing mounting cap screws and remove housing from cylinder block.
10. Remove fuel injection pump if replacing timing housing.

MXAL30500 —UN—10JUL12

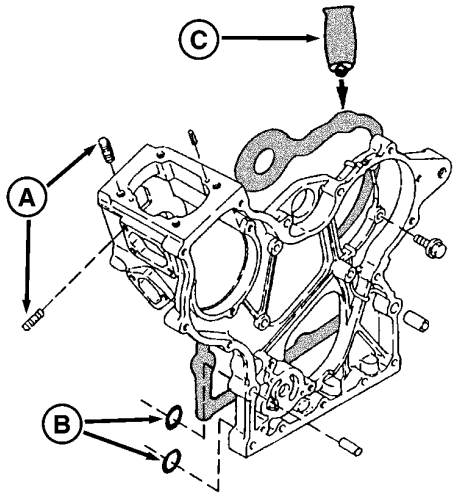
MX52301,0000362 -19-23OCT14-1/3

Installation3TNE68:

Installation is done in the reverse order of removal.

1. Clean all parts of old gasket sealer, gasket material, oil, and dirt before attempting installation.
2. Apply low strength thread lock to studs (B) before installing into timing gear housing
3. Replace O-rings (C).
4. Apply form-in-place gasket (D) on cover
5. Tighten mounting cap screws to specification.

Specification	
Mounting Cap Screws (3TNE68)—Torque	11 N·m (97 lb.-in.)



MXT011152 —UN—16JUN14

A—Studs
B—O-rings
C—Form in Place Gasket

Continued on next page

MX52301,0000362 -19-23OCT14-2/3

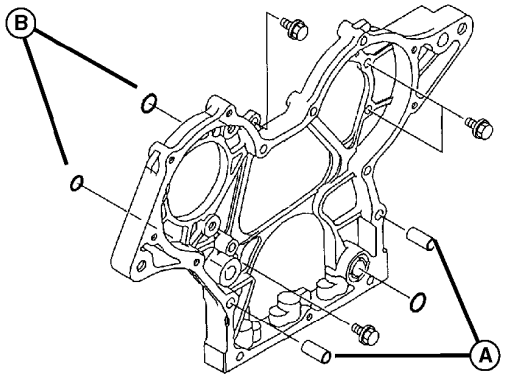
Installation —3TNV70:

Installation is done in the reverse order of removal.

1. Clean all parts of old gasket sealer, gasket material, oil, and dirt before attempting installation.
2. Install alignment dowels (A) in timing housing.
3. Replace O-rings (B).
4. Apply form-in-place gasket to timing housing when installing to cylinder block.
5. Tighten mounting cap screws to specification.

Specification	
Mounting Cap Screws (3TNV70)—Torque	11 N·m (97 lb.-in.)

6. Apply thread lock (low strength) to injection pump studs and install (if removed).



MXAL30601 —UN—10JUL12

A—Alignment Dowels **B—O-rings**

MX52301,0000362 -19-23OCT14-3/3

Oil Pump Removal and Installation Diesel 3TNE68

Removal and Installation:

1. Remove timing gear cover See Timing Gear Cover Diesel 3TNE68.
2. Check oil pump gear for backlash. Replace entire oil pump assembly if backlash is more tan 0.25 mm (0.010 in.)
3. Remove three mounting cap screws (A), oil pump (B), and gasket (C).
4. Inspect all parts for wear or damage. See “Disassembly/Assembly.”

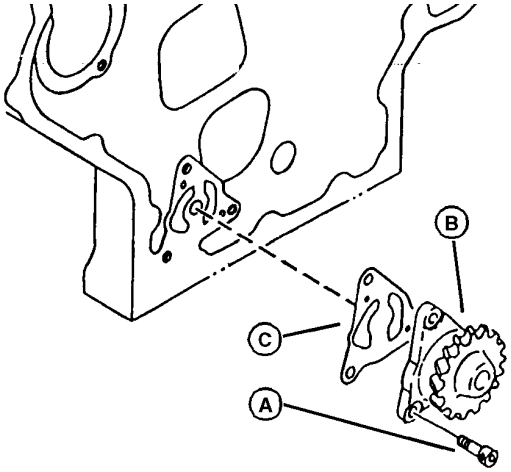
Installation:

Tighten mounting cap screws to specification

Specification	
Oil Pump Mounting Cap Screws (3TNE68)—Torque	25 N·m (220 lb.-in.)

Disassembly and Assembly:

1. Remove gear using a knife edge puller and a press. Gear is press fit on rotor shaft
2. Inspect parts for wear or damage. See “Inspection” procedures.



MXT011154 —UN—16JUN14

A—Screws (3 used) **C—Gasket**
B—Oil Pump

3. Coat all parts with clean engine oil.
4. Install outer rotor with identification mark facing toward the rotor shaft assembly.

Continued on next page

MX52301,000037B -19-23OCT14-1/4

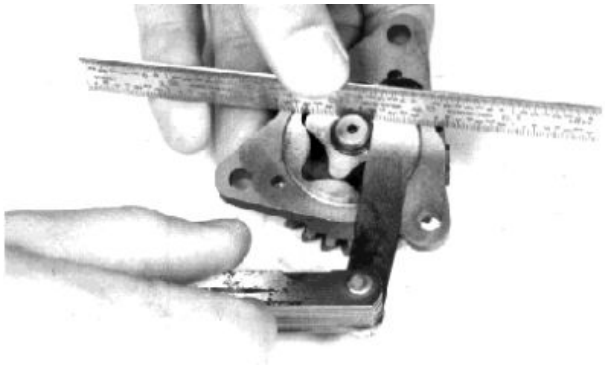
Inspection:

1. Check rotor shaft OD and the shaft hole ID in backing plate. If clearance is more than wear limit, replace entire assembly.

Rotor Shaft and Plate Clearance 3TNE68—Specification

Standard—Clearance	0.013—0.043 mm (0.001—0.002 in.)
Wear Limit—Clearance (maximum)	0.20 mm (0.008 in.)

2. Check rotor recess. If rotors are below face of pump housing more than 0.13 mm (0.005 in.), replace rotor assembly.



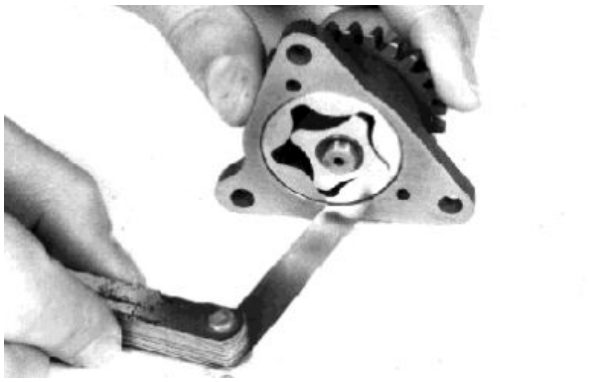
MXT011155 —UN—16JUN14

MX52301,000037B -19-23OCT14-2/4

3. Check outer rotor-to-pump body clearance. If clearance is more than wear limit, replace entire assembly.

Outer Rotor-to-Pump Body Clearance 3TNE68—Specification

Standard—Clearance	0.10—0.16 mm (0.004—0.006 in.)
Wear Limit—Clearance (maximum)	0.25 mm (0.010 in.)



MXT011156 —UN—16JUN14

MX52301,000037B -19-23OCT14-3/4

4. Check inner-to-outer rotor clearance. If clearance is more than 0.15 mm (0.0059 in.), replace rotor assembly.

MXT011157 —UN—16JUN14

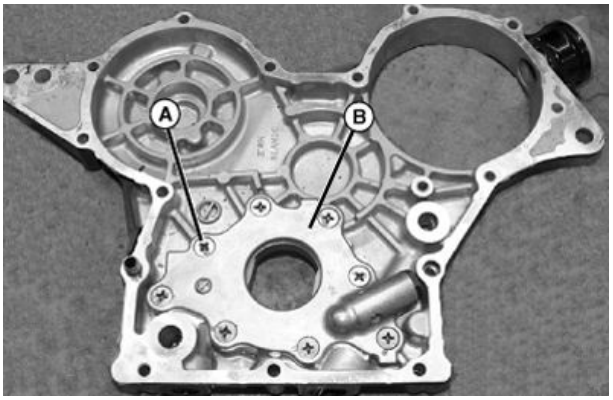
MX52301,000037B -19-23OCT14-4/4

Oil Pump Removal and Installation Diesel 3TNV70

Removal and Installation

1. Remove timing gear cover.
2. Remove the eight screws (A) from oil pump cover (B) and remove cover.

A—Screws (8 used) **B—Oil Pump Cover**

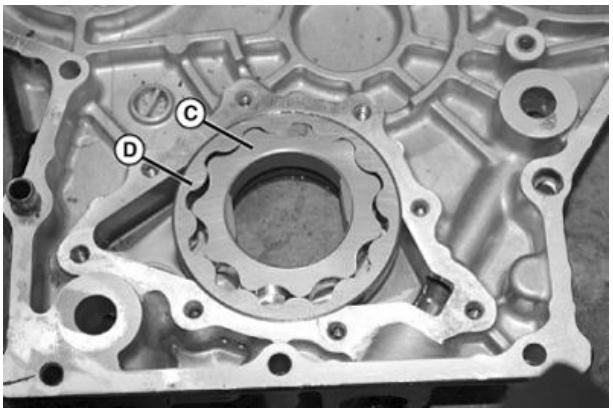


MXAL30602 —UN—10JUL12

MX52301,0000363 -19-17JUL14-1/7

3. Remove inner rotor (C) and outer rotor (D) and check for wear or damage. Check inside of cover for wear or deep scratches. Replace any worn or damaged parts.

C—Inner Rotor **D—Outer Rotor**



MXAL30603 —UN—10JUL12

MX52301,0000363 -19-17JUL14-2/7

4. Inspect inside of oil pump cover for grooves or deep scratches. Replace cover if worn or damaged.

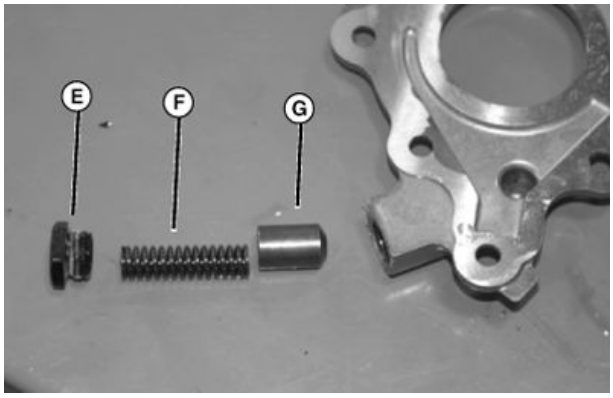
MXAL30604 —UN—10JUL12

Continued on next page

MX52301,0000363 -19-17JUL14-3/7

5. Remove relief valve cap (E), spring (F), and valve (G). Inspect all parts for wear or damage. If any parts are worn or damaged, entire cover and relief valve are replaced as an assembly.

E—Relief Valve Cap
F—Spring
G—Valve



MXAL30605 —UN—10JUL12

MX52301,0000363 -19-17JUL14-4/7

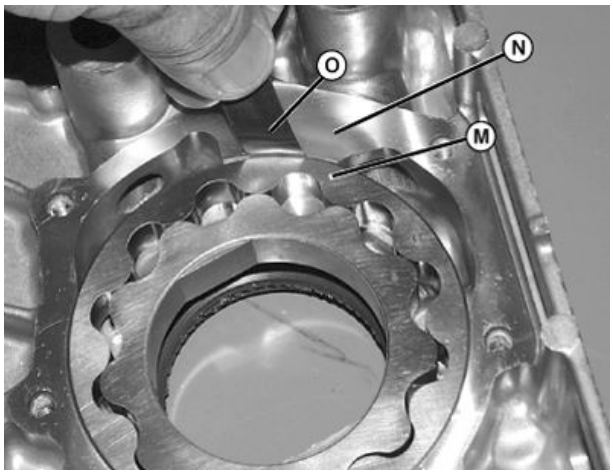
6. Measure clearance between outer rotor (M) and timing cover (N) with a feeler gauge (O).

3TNV70—Specification

Outer Rotor and Timing Cover—Clearance	0.12—0.21 mm (0.005—0.008 in.)
Outer Rotor and Timing Cover—Clearance (maximum)	0.30 mm (0.012 in.)

If clearance exceeds wear limit, replace timing cover and both rotors.

M—Outer Rotor
N—Timing Cover
O—Feeler Gauge



MXAL30606 —UN—10JUL12

MX52301,0000363 -19-17JUL14-5/7

7. Measure between high spots of inner and outer rotors with a feeler gage. If clearance exceeds specification replace rotors.

Specification

Inner and Outer Rotors (3TNV70) —Clearance	0.16 mm (0.006 in.)

MXAL30607 —UN—10JUL12

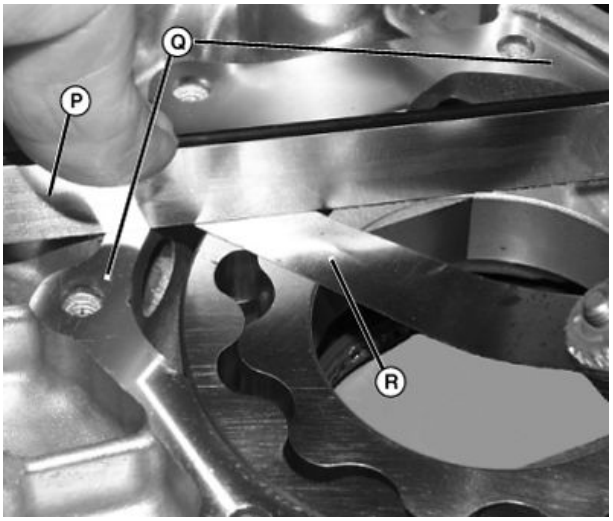
Continued on next page

MX52301,0000363 -19-17JUL14-6/7

8. Place a straight edge (P) across timing gear cover bosses (Q). Measure gap between edge of timing gear cover and the rotors with a feeler gauge (R). If clearance exceeds wear limit replace timing gear cover and rotors.

Specification	
Edge of Timing Gear Cover and Rotors (3TNV70)—Clearance	0.02—0.07 mm (0.001—0.003 in.)
Edge of Timing Gear Cover and Rotors Wear limit (3TNV70)—Clearance (maximum)	0.12 mm (0.005 in.)

9. Assemble in the reverse order of disassembly.
10. Apply medium strength thread locking compound to oil pump cover screws and relief valve cap when installing.



MXAL30608 —UN—10JUL12

P—Straight Edge
Q—Timing Gear Cover Bosses
R—Feeler Gauge

MX52301,0000363 -19-17JUL14-7/7

Oil Pressure Regulating Valve 3TNE68

Removal:

1. Remove oil filter (A)
2. Remove retaining nut (B) and valve assembly (C).

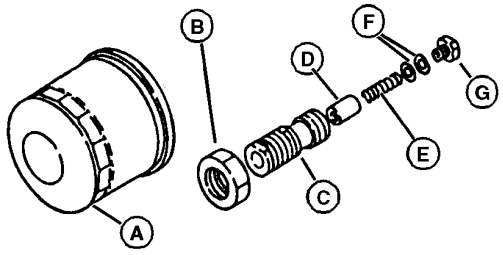
NOTE: Valve components are not serviced individually. Replace complete regulating valve if any components are defective.

Inspection:

1. Remove cap (G), shims (F), spring (E), and plunger (D). Inspect parts for wear or damage. Replace complete valve if any wear or damage is found.
2. Check spring free and compressed length.

Oil Regulating Valve Spring—Specification	
Released—Length	21.90—24.50 mm (0.860—0.960 in.)
Compressed Spring—Length	14.70 mm (0.580 in.)
Compressed Length Tension—Force	12 N (2.7 lb.-force)

3. If valve is reassembled for use, after tightening cap, stake it in place with a center punch.



MXT011143 —UN—16JUN14

A—Oil Filter
B—Retaining Nut
C—Valve Assembly
D—Plunger
E—Spring
F—Shims
G—Cap

Installation:

Installation is done in reverse order of removal

- Tighten retaining nut to specification:

Specification	
Oil Pressure Regulating Valve Retaining Nut—Torque	30 N·m (22 lb.-ft.)

BS62576,0000299 -19-01NOV20-1/1

Coolant Temperature Switch

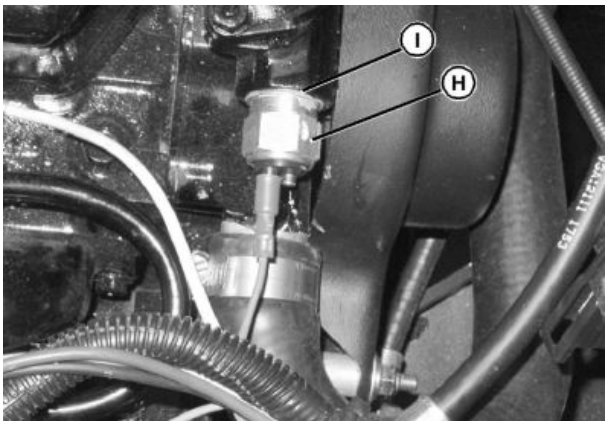
Removal:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Open engine drain valve to drain coolant level to below coolant sensor level.
5. Disconnect wiring lead.
6. Remove sensor (H) and washer (I).
7. Test sensor. See Engine Coolant Temperature Switch Test.

Installation:

Installation is done in reverse order of removal.

- Replace copper washer.



MXT011144 —UN—16JUN14

H—Sensor **I— Washer**

MX52301,0000364 -19-22OCT14-1/1

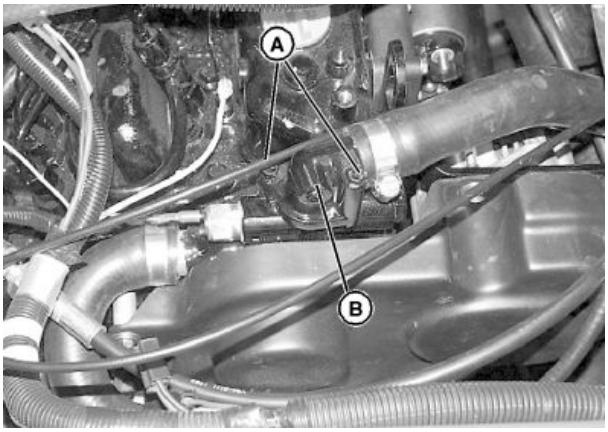
Thermostat Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool before servicing cooling system.
3. Raise and lock cargo box.
4. Squeeze top radiator hose to verify that the system pressure has dropped before opening radiator cap.
5. Place container under engine block drain and open valve. Open radiator cap to speed up draining. Drain only enough coolant to lower coolant level below thermostat housing.

NOTE: It may be necessary to tap the housing with a soft-faced hammer.

6. Remove two cap screws (A) and remove thermostat housing (B).



MXT011145 —UN—16JUN14

A—Cap Screws (2 used) **B—Thermostat Housing**

Continued on next page

MX52301,0000365 -19-22OCT14-1/2

7. Remove thermostat (C) from water pump. See Thermostat Removal and Installation.
8. Test thermostat. See Thermostat Test—Diesel.

Installation:

- Clean mating surfaces of water pump and thermostat housing. Install new O-ring (D) when installing thermostat
- Tighten cap screws to specification.

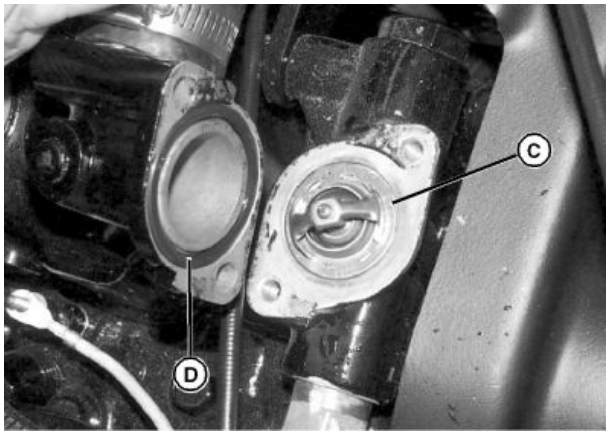
Thermostat Housing Cap Screws—Specification

3TNE68—Torque.....9 N·m (80 lb.-in.)

Specification

3TNV70—Torque.....20 N·m (180 lb.-in.)

- Fill cooling system with approved coolant.



MXT011146 —UN—16JUN14

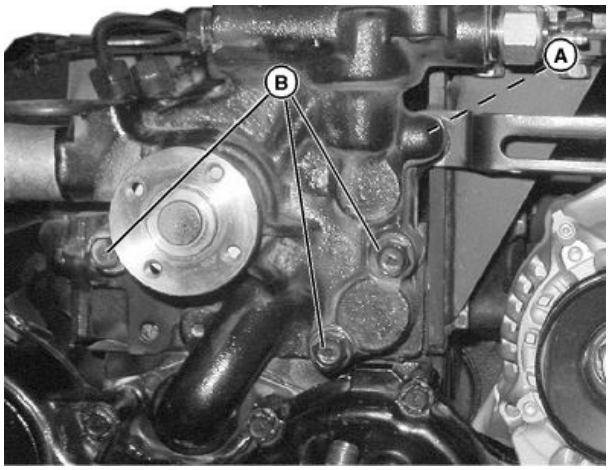
C—Thermostat **D—O-ring**

MX52301,0000365 -19-22OCT14-2/2

Water Pump Removal and Installation—Diesel

Removal:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool and pressure in cooling system to drop before working on water pump.
3. Raise and lock cargo box.
4. Open engine drain valve to drain coolant from cylinder block.
5. Disconnect coolant temperature switch lead.
6. Disconnect upper and lower radiator hoses and remove radiator See Engine Removal and Installation Diesel.
7. Disconnect coolant hoses from water pump.
8. Remove water pump and alternator drive belt
9. Remove four cap screws retaining water pump pulley.
10. Remove cap screw (A) from alternator bracket.
11. Remove three water pump mounting cap screws (B), and remove water pump.
12. Inspect all parts for wear or damage.
13. Clean cylinder block mating surfaces of all old gasket material.



MXT011158 —UN—16JUN14

A—Cap Screw **B—Water Pump Mounting Cap Screws (3 used)**

Installation:

Installation is done in the reverse order of removal.

1. Clean cylinder block mating surfaces of all old gasket material.

Continued on next page

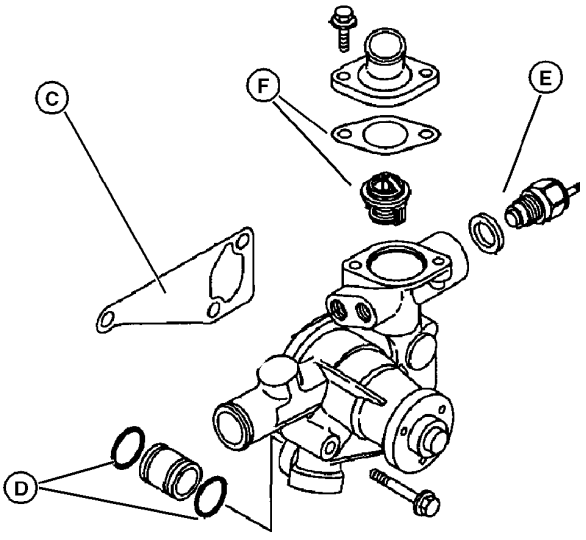
MX52301,0000366 -19-23OCT14-1/2

2. Install new gasket (C) and O-ring (D).
3. Tighten mounting cap screws to specification.

Specification	
Pump Mounting Cap Screws—Torque	25 N·m (221 lb.-in.)

4. Install coolant temperature switch and sealing washer (E).
5. Install thermostat and gasket (F).
6. Install water pump pulley and spacer.
7. Install coolant hoses, fill with coolant.
8. Adjust water pump and alternator drive belt tension.

C—Gasket
D—O-rings (2 used)
E—Sealing Washer
F—Thermostat and Gasket



MXT011147 —UN—16JUN14

MX52301,0000366 -19-23OCT14-2/2

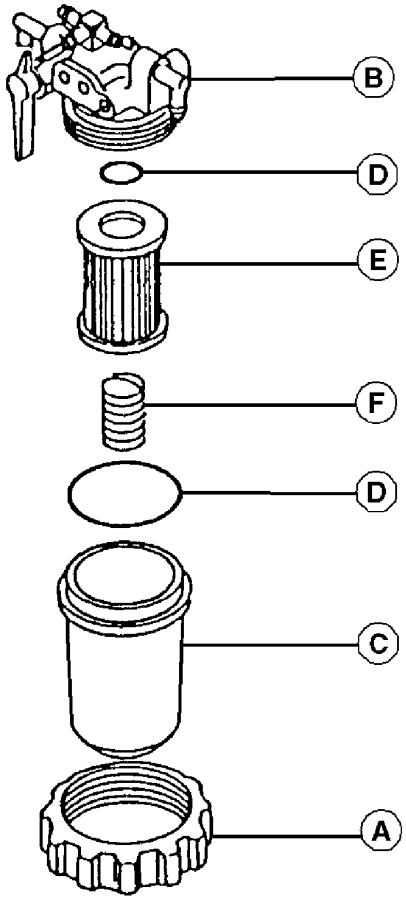
Fuel Filter Removal and Installation

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Remove the retaining ring (A) from the mounting base (B) while holding on to the filter cover (C).
4. Remove the filter cover (C) from the mounting base
5. Remove and replace the O-ring (D) and filter element (E).
6. Be sure the spring (F) is in the filter cover (C) and place the filter element (E) in the filter cover.
7. Before installing the filter cover and element in the mounting base, verify the O-ring (D) is in the groove inside the mounting base (B).
8. Install the filter cover (C) and the element (E) in the mounting base (B).

IMPORTANT: Tighten only enough to keep the filter assembly from leaking. Overtightening the retaining nut may damage the filter cover or retaining ring.

9. Place the retaining ring (A) over filter cover and screw on the mounting base to retain filter cover to mounting base.

A—Retaining Ring
B—Mounting Base
C—Filter Cover
D—O-ring
E—Filter Element
F—Spring



MXT011159 —UN—16JUN14

MX52301,0000367 -19-22OCT14-1/1

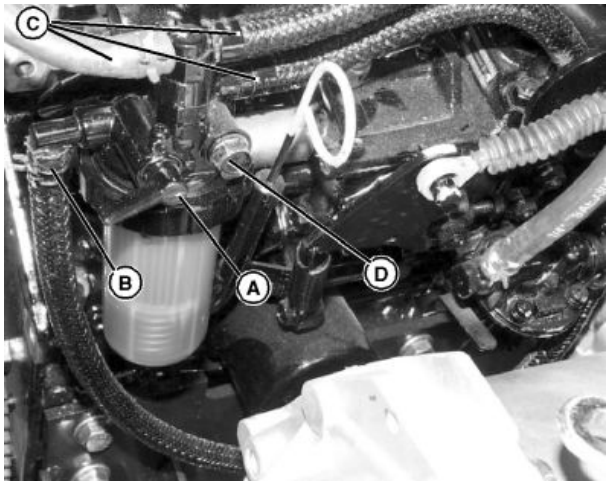
Fuel Filter Assembly Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Close fuel shut off valve (A).

NOTE: When disconnecting fuel supply hose (B) from fuel filter assembly be sure to cap hose to prevent spills and hose contamination.

5. Mark, remove, and plug fuel lines (B and C) from fuel filter assembly.
6. Remove cap screw (D) securing filter assembly to mounting bracket.
7. Remove fuel filter assembly.



MXT011160 —UN—16JUN14

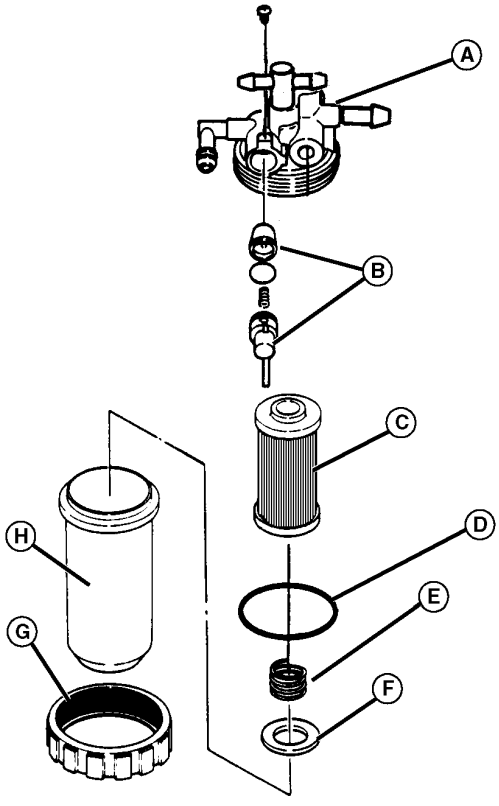
A—Fuel Shut Off Valve
B—Fuel Line, Supply
C—Fuel Lines
D—Cap Screw

MX52301,0000368 -19-22OCT14-1/2

Installation:

- Installation is done in the reverse order of removal.
- Replace filter
- Open fuel shutoff valve.

A—Filter Housing
B—Shut Off Assembly
C—Filter Element
D—O-ring
E—Spring
F—Water Indicator Ring
G—Bowl Nut
H—Bowl



MXAL30616 —UN—10JUL12

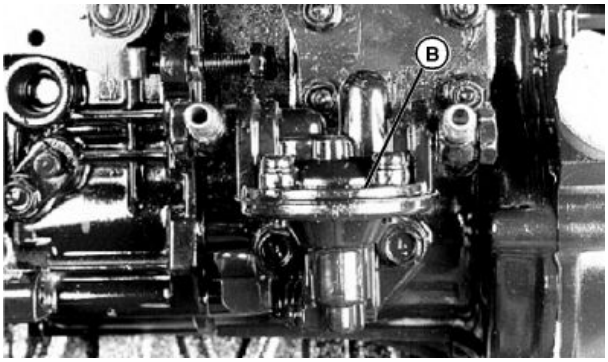
MX52301,0000368 -19-22OCT14-2/2

Fuel Transfer Pump Diesel 3TNE68

Removal:

CAUTION: Diesel fuel is flammable! Never work on fuel system near open flames or sparks. Close fuel filter and water separator shutoff valve before disconnecting any fuel lines from pumps.

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Close fuel shutoff valve at fuel filter and water separator.
5. Remove inlet and outlet hose clamps at fuel transfer pump (B) and disconnect hoses.
6. Remove two cap screws securing fuel pump assembly to frame.
7. Remove all old gasket material from mating surfaces before installation.



MXT011161 —UN—16JUN14

B—Fuel Transfer Pump

Installation:

Installation is done in the reverse order of removal.

- Install new gasket.

MX52301,000037C -19-22OCT14-1/1

Fuel Transfer Pump Diesel 3TNV70

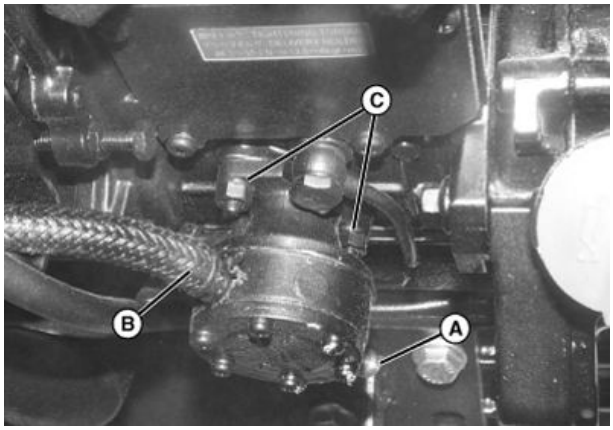
Removal:

CAUTION: Diesel fuel is flammable! Never work on fuel system near open flames or sparks. Close fuel filter and water separator shutoff valve before disconnecting any fuel lines from pumps.

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Close fuel shutoff valve at fuel filter and water separator.
5. Disconnect fuel hoses from inlet (A) and outlet (B) from fuel transfer pump and disconnect hoses.
6. Remove two fuel pump mounting cap screws (C).
7. Remove all old gasket material from mating surfaces before installation.

Installation:

Installation is done in the reverse order of removal.



MXAL30617 —UN—10JUL12

A—Inlet
B—Outlet
C—Cap Screws

- Install new gasket.

MX52301,000036A -19-22OCT14-1/1

Fuel Injection Nozzle

Removal:

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source.

Such information is available from the Deere & Company Medical Department in Moline, Illinois, U.S.A.

IMPORTANT: Never steam clean or pour cold water on injection pump while the pump is running, or engine is warm. Doing so can damage the pump.

When removing injection lines, DO NOT turn pump delivery valve fittings. Turning fittings may damage pump internally. Always use a backup wrench when removing lines.

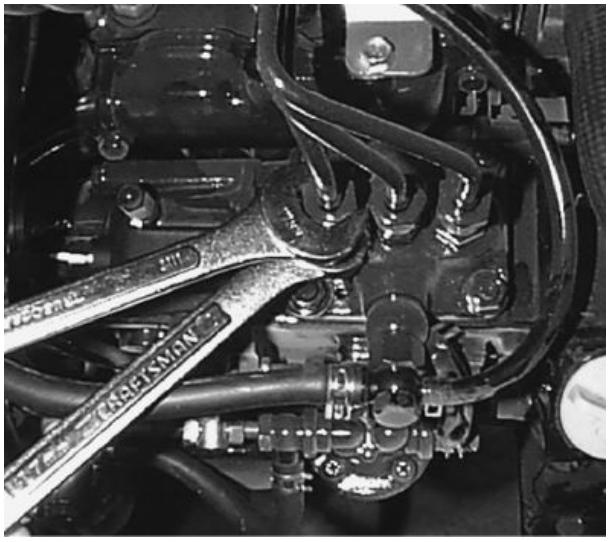
1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.

IMPORTANT: When removing injection lines, Do not turn pump delivery valve fittings. Turning fittings may damage pump internally. Always use a backup wrench when removing lines.

4. Clean the injection pump lines and area around the pump using a parts cleaning solvent or steam cleaner.

NOTE: Nozzles are matched to the cylinders. If removing more than one nozzle, tag nozzles, according to the cylinder from which it was removed.

5. Loosen fuel line connectors at injection pump to release pressure in the fuel system. When loosening connectors, use a backup wrench to prevent delivery valves from turning.
6. Loosen fuel line clamp, and remove fuel lines



MXT011148 —UN—16JUN14

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MX52301,000036B -19-22OCT14-1/5

7. Remove nuts (A) and leak-off hose assembly.
8. Remove bronze washer (C) and O-ring (D).
9. Remove injection nozzle (E), washers (F), and heat protector (G).
10. Test injection nozzles. See Fuel Injection Nozzle Test—Diesel.

Installation:

Installation is done in reverse order of removal.

- Replace bronze washer (C).
- Replace heat protectors
- Tighten leak-off hose nuts to specification

Specification	
Leak-off Hose Nut—Torque	40 N·m (30 lb.-ft.)

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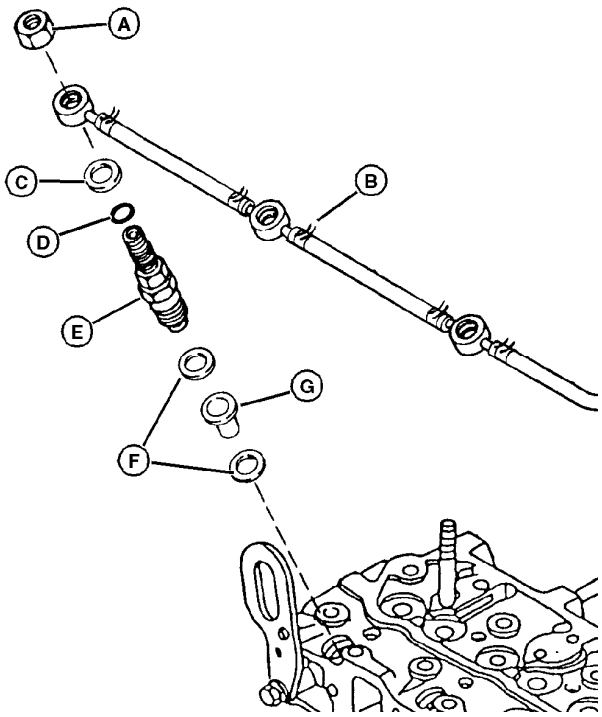
- Tighten injection nozzle to specification

Specification	
Fuel Injector—Torque	50 N·m (37 lb.-ft.)



MXT011149 —UN—16JUN14

A—Nut
B—Hose Assembly
C—Bronze Washer
D—O-ring
E—Injection nozzle
F—Washers (2 used)
G—Heat Protector

Continued on next page

MX52301,000036B -19-22OCT14-2/5

Repair:

NOTE: If servicing more than one nozzle, keep parts for each nozzle separate from one another.

IMPORTANT: If injection nozzles are disassembled to be cleaned, the same number and thickness of shims must be installed.

- Clean and inspect nozzle assembly. See “Cleaning and Inspection.”.
- After assembly is complete, test injection nozzle. See Fuel Injection Nozzle Test—Diesel.

Cleaning and Inspection:

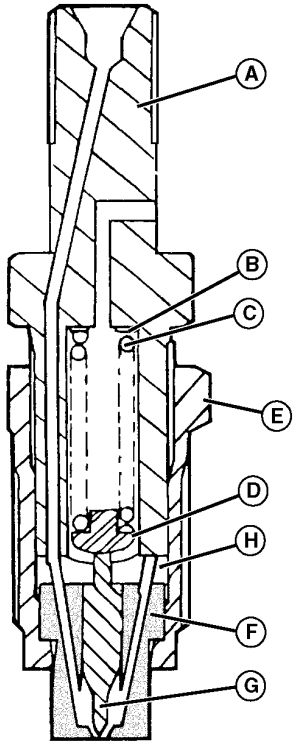
NOTE: To clean nozzles properly, JDF13 Nozzle Cleaning Kit is recommended. The Cleaning Kit is available through the John Deere ServiceGard™ Catalog.

1. Remove anticorrosive grease from new or reconditioned nozzles by washing them thoroughly in diesel fuel.

IMPORTANT: Never use a steel brush to clean nozzles. The steel brush distorts the spray hole.

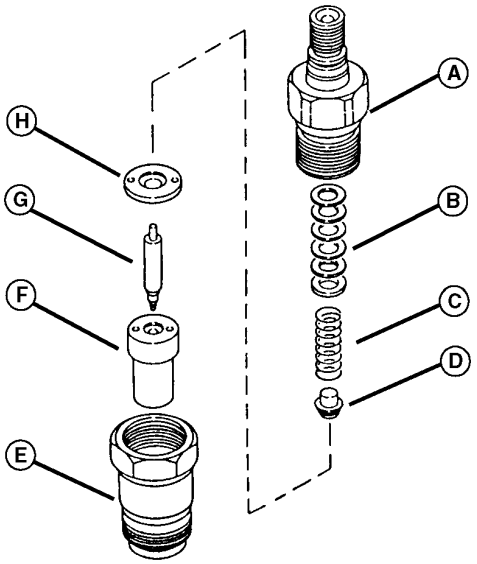
2. Remove carbon from used nozzles, and clean by washing in diesel fuel. If parts are coated with hardened carbon or lacquer, it may be necessary to use a brass wire brush (supplied in Nozzle Cleaning Kit).
3. After removing carbon or lacquer from the exterior of nozzle, inspect sealing surfaces between separator plate and nozzle body for nicks or scratches.

A—Injector Body
B—Pressure Adjusting Shims
C—Nozzle Spring
D—Nozzle Spring Seat
E—Nozzle Housing
F—Nozzle Body
G—Nozzle Valve
H—Valve Stop Spacer



MXAL30623 —UN—10JUL12

Injection Nozzle Cross Section



MXAL30624 —UN—10JUL12

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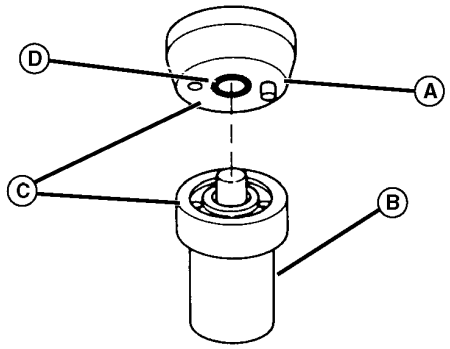
MX52301,000036B -19-22OCT14-3/5

4. Inspect condition of separator plate (A) and nozzle body (B). Contact area of separator plate (both parts) must not be scored or pitted. Use an inspection magnifier (No. 16487 or equivalent) to aid in making the inspection.
5. Check nozzle contact surface on separator plate (D) for wear. If contact surface is more than 0.10 mm (0.0039 in.), replace nozzle assembly.
6. Inspect the piston (large) part of nozzle valve to see that it is not scratched or scored and that lower (tip) end of valve is not broken. If any of these conditions are present, replace the nozzle assembly (C).
7. Further inspect the nozzle assembly by performing a slide test. Use the following procedure:
   a. Dip the nozzle valve in clean diesel fuel. Insert valve in nozzle body.
   b. Hold nozzle vertical, and pull valve out about 1/3 of its engaged length.

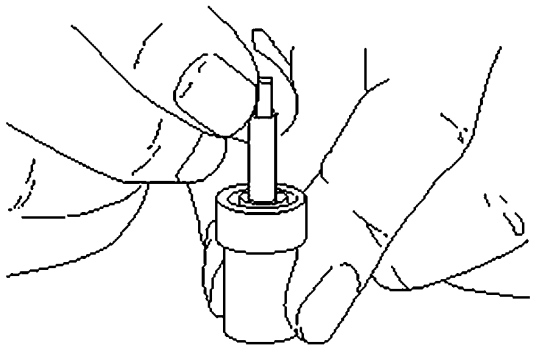


MXAL30625 —UN—10JUL12

A—Separator Plate
B—Nozzle Body
C—Nozzle Assembly
D—Separator Plate

MX52301,000036B -19-22OCT14-4/5

   c. Release valve. Valve should slide down to its seat by its own weight.
   d. Replace nozzle assembly if the valve does not slide freely to its seat.



MXAL30626 —UN—10JUL12

MX52301,000036B -19-22OCT14-5/5

Fuel Injector Pump Diesel 3TNE68

Removal:

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from the Deere & Company Medical Department in Moline, Illinois, U.S.A. In the United States and Canada only, this information may be obtained by calling 1-800-822-8262.

CAUTION: DO NOT attempt to remove the CARB/EPA Certified Emissions fuel injection pump unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions engines.

IMPORTANT: Never steam clean or pour cold water on injection pump while the pump is running, or engine is warm. Doing so can damage the pump.

When removing injection lines, DO NOT turn pump delivery valve fittings. Turning fittings may damage pump internally. Always use a backup wrench when removing lines.

MXT011162 —UN—16JUN14

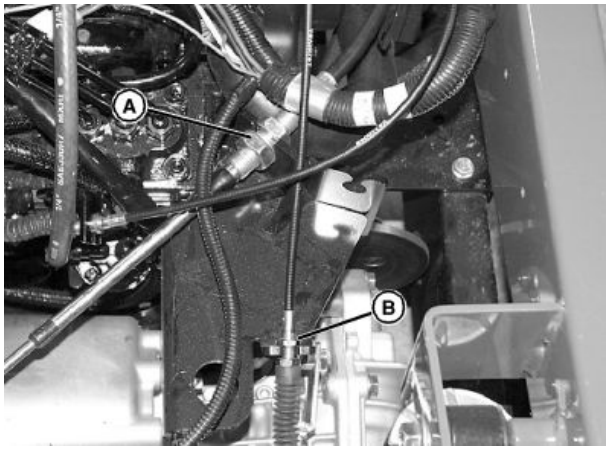
Picture Note: Engine emission compliance sticker located on rocker arm cover.

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock cargo box.
4. Turn the fuel shutoff valve on the fuel filter and water separator to the CLOSED (“C”) position.
5. Clean the injection pump lines and area around the pump using a parts cleaning solvent or steam cleaner.
6. Remove the air cleaner assembly.

MX52301,000037D -19-22OCT14-1/9

7. Loosen jam nuts on shift cable (A) and differential lock cable (B) and slide cables out of bracket.

A—Shift Cable **B—Differential Lock Cable**



MXT011163 —UN—16JUN14

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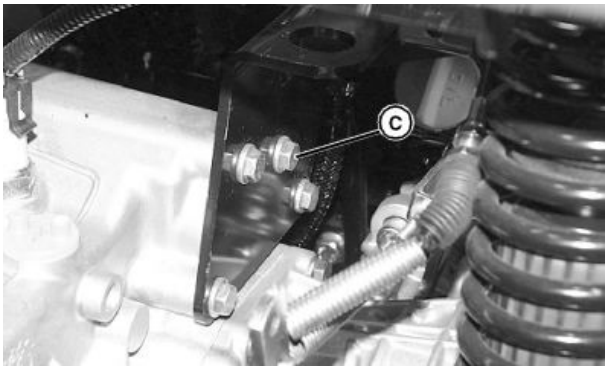
MX52301,000037D -19-22OCT14-2/9

8. Remove four cap screws (C) from the cable bracket and remove bracket
9. Disconnect hose from air cleaner to intake manifold and cover opening in intake manifold.

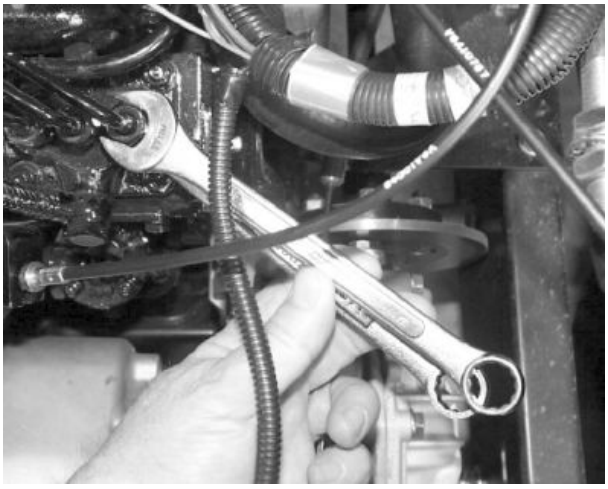
C—Cap Screws (4 used)



MXT011164 —UN—16JUN14

MX52301,000037D -19-22OCT14-3/9

10. Remove fuel injector lines from injection pump and injector nozzles. Use a backup wrench to keep delivery valves from loosening.

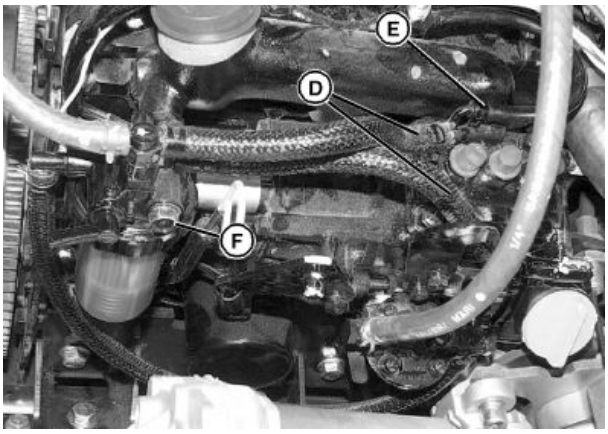


MXT011165 —UN—16JUN14

MX52301,000037D -19-22OCT14-4/9

11. Mark and disconnect fuel lines (D) and (E). Remove cap screw (F) from fuel filter and move filter assembly aside.
12. Disconnect hoses from fuel injection pump.

D—Fuel Lines
E—Fuel Line
F—Cap Screw



MXT011166 —UN—16JUN14

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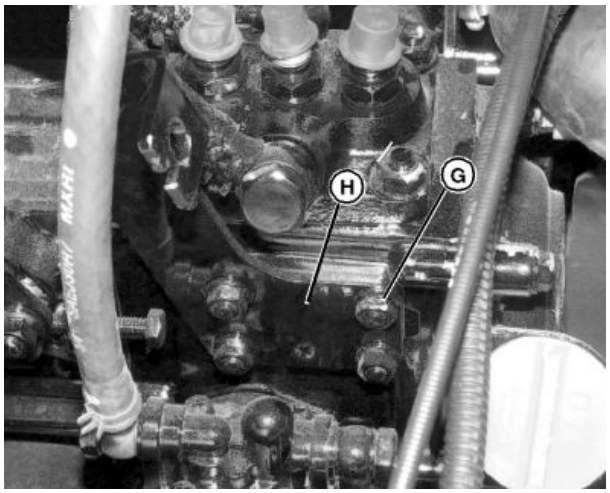
MX52301,000037D -19-22OCT14-5/9

13. Remove four nuts (G) and cover (H).

G—Nuts (4 used) **H—Cover**



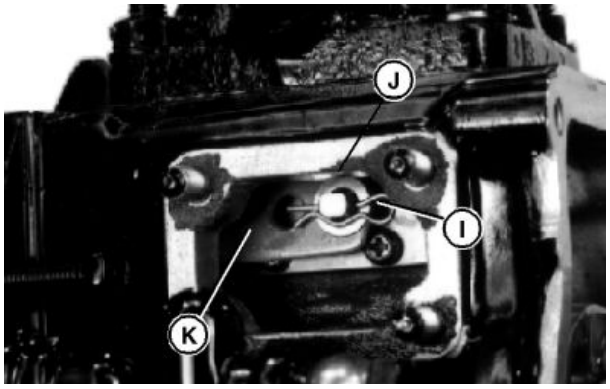
MXT011167 —UN—16JUN14

MX52301,000037D -19-22OCT14-6/9

NOTE: Washer may be fixed to linkage. Do not drop pin during removal.

14. Remove pin (I) and washer (J) if not fixed to arm (K). Disconnect governor linkage (K).

I— Pin **K—Governor Linkage**
J— Washer



MXT011168 —UN—16JUN14

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MX52301,000037D -19-22OCT14-7/9

IMPORTANT: If injection pump is being removed to be serviced or replaced, a new 0.8 mm (0.031 in.) shim must be installed between injection pump and housing.

15. Remove four nuts (L) to remove fuel injection pump (M) and shim (N).

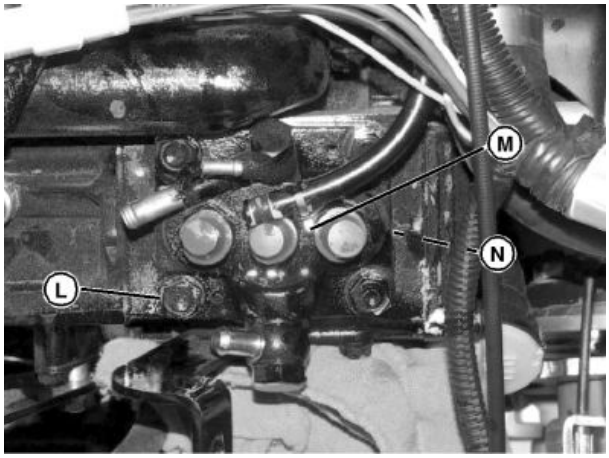
Installation:

Installation is done in the reverse order of removal.

IMPORTANT: If injection pump is being removed to be serviced or replaced, a new 0.8 mm (0.031 in.) shim must be installed between injection pump and housing.

NOTE: Governor linkage has two holes. Connect governor linkage to injection pump rack using hole closes to injection pump gear.

NOTE: Do not drop pin or washer during installation



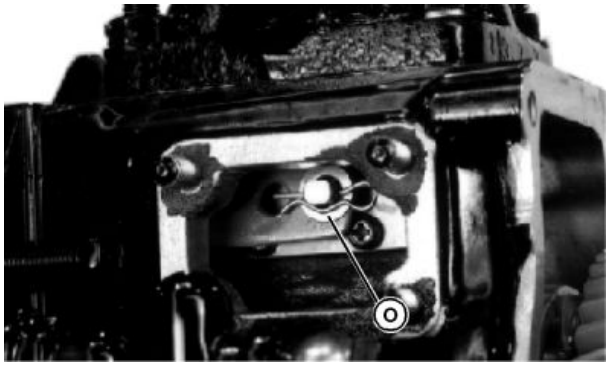
MXT011169 —UN—16JUN14

L—Nuts (4 used)
M—Fuel Injection Pump
N—Shim

MX52301,000037D -19-22OCT14-8/9

1. When connecting governor linkage to injection pump rack (O), attach link to rack at hole closest to injection pump gear.
2. Bleed fuel system
3. Tighten injection body nuts, injection nozzle, and leak-off hose nuts to specification.

Specification	
Fuel Injection Body Nuts—Torque	20 N·m (180 lb.-in.)
Fuel Injection Nozzle—Torque	50 N·m (37 lb.-ft.)
Fuel Leak-off Hose Nuts—Torque	40 N·m (30 lb.-ft.)



MXT011170 —UN—16JUN14

O—Injection Pump Rack

MX52301,000037D -19-22OCT14-9/9

Fuel Injection Pump Diesel 3TNV70

Removal:

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids.

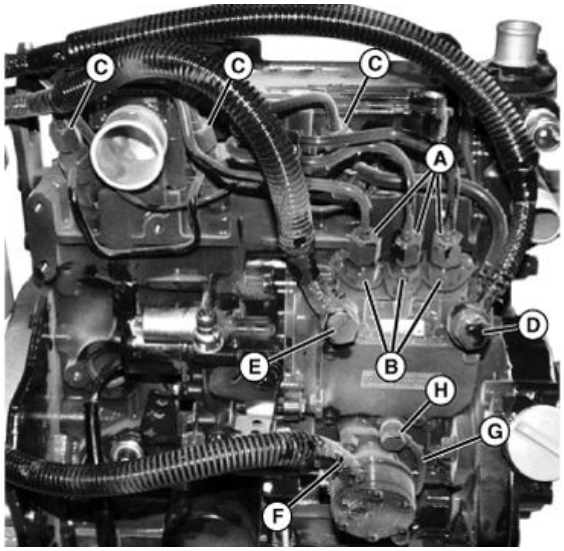
If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from the Deere & Company Medical Department in Moline, Illinois, U.S.A. In the United States and Canada only, this information may be obtained by calling 1-800-822-8262.

CAUTION: DO NOT attempt to remove the CARB/EPA Certified Emissions fuel injection pump unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions engines.

IMPORTANT: Never steam clean or pour cold water on injection pump while the pump is running, or engine is warm. Doing so can damage the pump.

When removing injection lines, DO NOT turn pump delivery valve fittings. Turning fittings may damage pump internally. Always use a backup wrench when removing lines.

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Remove hood.
4. Turn the fuel shutoff valve on the fuel filter and water separator to the CLOSED (“C”) position.
5. Clean the injection pump lines and area around the pump using a parts cleaning solvent or steam cleaner.
6. Remove the intake hose from the intake manifold.
7. Remove the engine. See Engine Removal and Installation Diesel.
8. Slowly loosen fuel line connectors (A) at injection pump to release pressure in the fuel system. When loosening connectors, use a backup wrench to prevent delivery valves (B) from turning.
9. Loosen fuel line nuts (C) at fuel injector nozzle
10. Remove fuel line connector nuts at the injection pump and the injector nozzles and remove fuel lines.
11. Cover ends of injectors, delivery valves, and fuel lines with plastic caps to prevent dirt from entering system.
12. Disconnect the fuel leak-off hose (D).
13. Disconnect the fuel input hose (E).
14. Remove outlet hose clamps at fuel transfer pump and disconnect hose (F).
15. Remove the injector lubrication line (G) by removing the upper (H) and lower banjo bolts.
16. Remove injection pump gear cover on front of timing gear cover



MXAL30627 —UN—10JUL12

A—Fuel Line Connectors
B—Delivery Valves
C—Fuel Line Nuts
D—Fuel Return Hose
E—Fuel Inlet Hose
F—Hose
G—Injector Lubrication Line
H—Upper Banjo Bolts

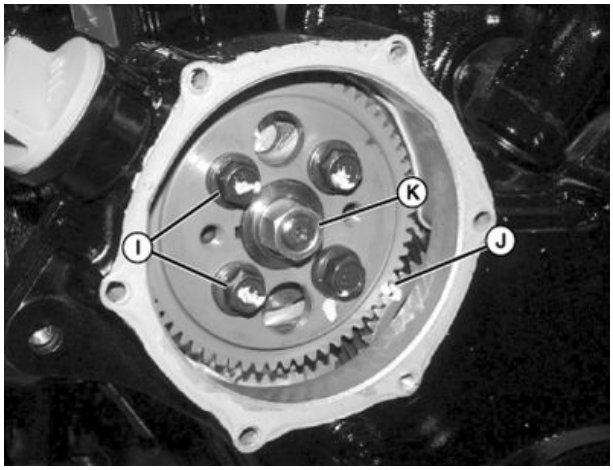
Continued on next page

MX52301,000036C -19-22OCT14-1/3

IMPORTANT: DO NOT loosen four cap screws (I) attaching gear to hub! This gear and hub assembly times the injection pump camshaft in relation the crankshaft for precise timing of EPA engines. This procedure is done at the pump manufacturing plant and cannot be duplicated in the field!

NOTE: Due to the odd number of teeth on the idler gear, timing marks only align periodically. When all timing marks on gears align, the piston closest to the water pump (No. 3) is at TDC on compression stroke. (No. 1 cylinder is closest to the flywheel.)

17. Rotate crankshaft and align timing marks (J).
18. Remove the lock nut (K) and using a puller, remove the injection pump gear.



MXAL30628 —UN—10JUL12

I— Cap Screws
J— Timing MARKS
K—Lock Nut

Continued on next page

MX52301,000036C -19-22OCT14-2/3

19. Note the location of the injection pump timing mark (L) as related to the timing gear housing timing marks (M). The replacement pump needs to be installed in the exact same location.
20. Remove the three mounting nuts (N) securing the injection pump to the crankcase and remove the injection pump.

Installation:

Installation is done in the reverse order of removal.

CAUTION: DO NOT attempt to adjust the ARB/EPA Certified Emissions fuel injection pump unless you are a factory trained technician with authorization to service CARB/EPA Certified Emissions engines.

- Install and tighten injection pump to specification, aligning the timing mark to the same mark on the timing gear housing as noted during removal.

Specification

Injector Pump Mounting Nuts (3TNV70)—Torque ..... 22.5—28.4 N·m (17—21 lb.-ft.)

- Install and tighten the three cap screws to specification.
- Align the timing gear marks and install injection pump gear and lock nut and tighten to specification.

Specification

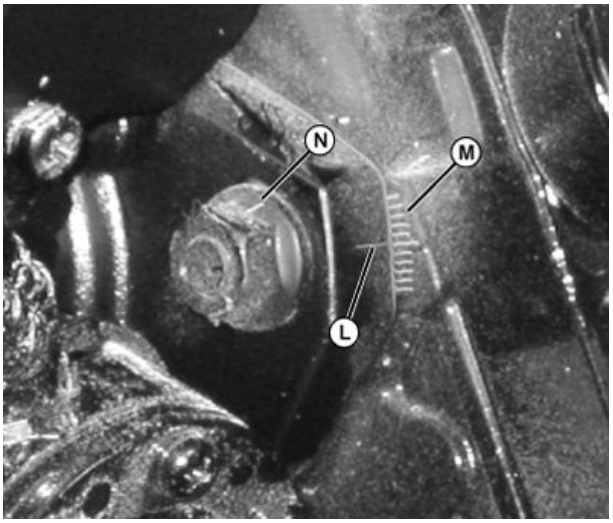
Injector Pump Drive Gear Nut (3TNV70)—Torque ..... 58—68 N·m (43—50 lb.-ft.)

- Install injection pump gear cover and tighten cap screws to specification.

Specification

Injector Gear Cover Cap Screws (3TNV70)—Torque ..... 11 N·m (97 lb.-in.)

- Install the outlet hoses to the fuel transfer pump.
- Install the injection pump lubrication line and secure with banjo bolts.



MXAL30629 —UN—10JUL12

L—Injector Timing MARK
M—Housing Timing MARKS
N—Mounting Nuts (3 used)

- Install the fuel input hose and injector nozzle leakoff hose to the injection pump.
- Install fuel lines at the injection pump and the injector nozzles and tighten the connector nuts to specification. When tightening connectors, use a backup wrench to prevent delivery valves from turning.

Specification

Injector Line Nuts (3TNV70)—Torque ..... 29.4—34.4 N·m (22—25 lb.-ft.)

- Install and connect the fuel shutoff solenoid.
- Install the engine. See Engine Removal and Installation Diesel.
- Install the air intake hose to the intake manifold.
- Turn the fuel shutoff valve on the fuel filter and water separator to the OPEN (“O”) position.
- Bleed the fuel system.

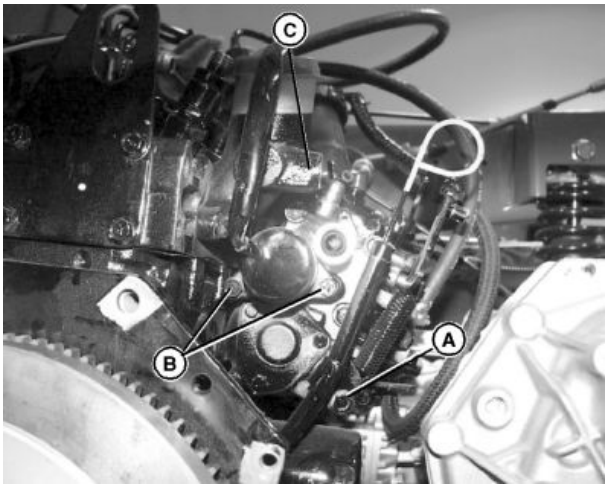
MX52301,000036C -19-22OCT14-3/3

Fuel Injection Pump Camshaft 3TNE68

IMPORTANT: Do not loose four bolts on injection pump camshaft gear!

Removal:

1. Remove timing gear cover. See Timing Gear Cover Diesel 3TNE68.
2. Remove fuel injection pump. See Fuel Injector Pump Diesel 3TNE68.
3. Remove fuel transfer pump. See Fuel Transfer Pump Diesel 3TNE68.
4. Remove cap screw (A) and dipstick tube
5. Remove two cap screws (B). Disconnect and remove fuel shutoff solenoid.



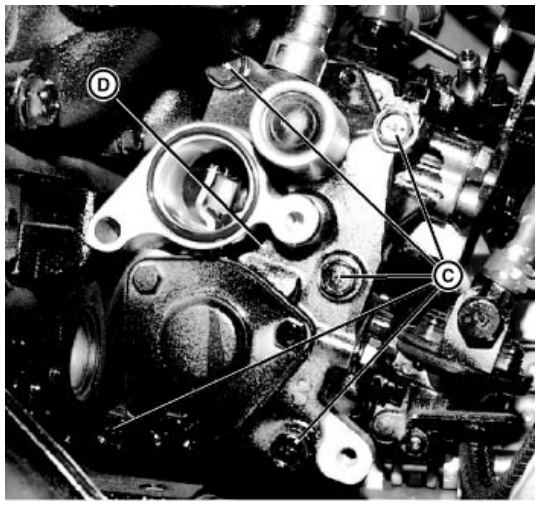
MXT011171 —UN—16JUN14

A—Cap Screw
B—Cap Screws (2 used)
C—Cap Screws (6 used)

MX52301,000037E -19-07JUL14-1/8

6. Remove five remaining cap screws (C) attaching governor assembly (D) to timing gear housing.
7. Remove governor assembly (D).

C—Cap Screws (6 used) **D—Governor Assembly**



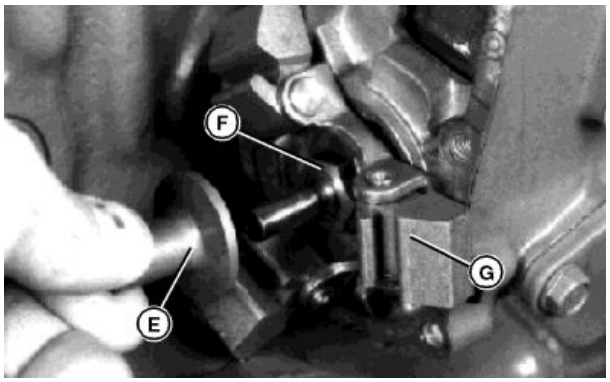
MXT011172 —UN—16JUN14

Continued on next page

MX52301,000037E -19-07JUL14-2/8

8. Remove sleeve (E), nut (F), and governor weights (G) from end-of-injection pump camshaft.

E—Sleeve
F—Nut
G—Governor Weights



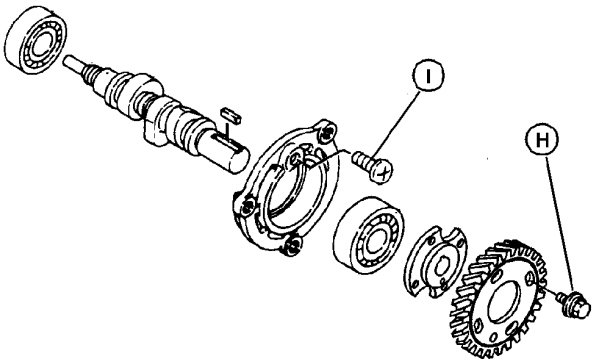
MXT011173 —UN—16JUN14

MX52301,000037E -19-07JUL14-3/8

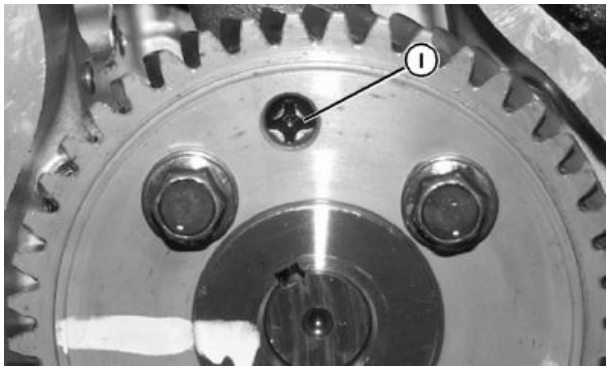
IMPORTANT: The injection pump camshaft has a gear with for slots bolted to a hub on the camshaft. Do not loosen the bolts (H) securing the gear or camshaft timing will be altered!

9. Remove bearing retaining Screw (I).

I— Bearing Retaining Screw



MXT011174 —UN—16JUN14



MXT011175 —UN—16JUN14

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MX52301,000037E -19-07JUL14-4/8

IMPORTANT: Do not allow fuel injection pump camshaft lobes to hit bearing surfaces while removing camshaft. Machined surfaces may be damaged.

10. Carefully tap the rear of camshaft (J) with plastic hammer to remove from housing.
11. Disassemble and inspect all parts for wear or damage. See “Fuel Injection Pump Camshaft Inspection.”

Installation:

Installation is done in reverse order of removal.

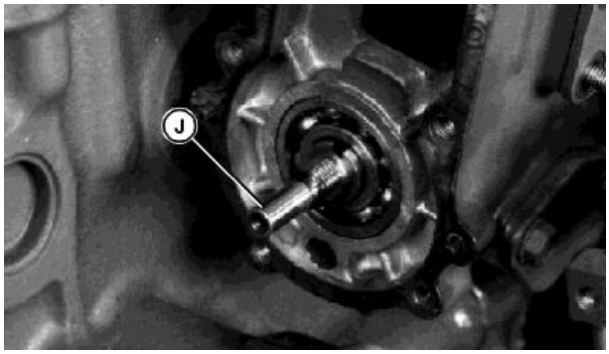
- After installing camshaft assembly into housing, tap on end-of-camshaft gear with a plastic hammer to seat bearings in bores.
- Tighten bearing retainer screw (I) to specification.

Specification	
Bearing Retainer Screw (3TNE68)—Torque	20 N·m (180 lb.-in.)

- Align timing marks (K) on all timing gears and idler gear when installing camshaft.

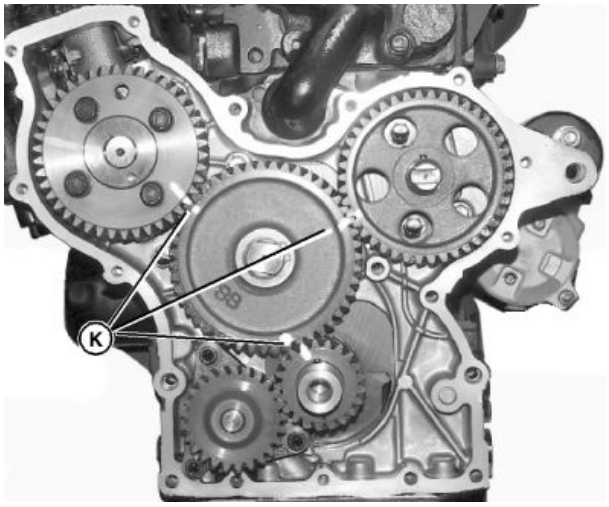
Disassembly:

NOTE: Gear and bearings are press fit on shaft.



MXT011176 —UN—16JUN14

J— Camshaft



MXT011177 —UN—16JUN14

MX52301,000037E -19-07JUL14-5/8

IMPORTANT: Hold camshaft while removing gear and bearings. Shaft can be damaged if dropped.

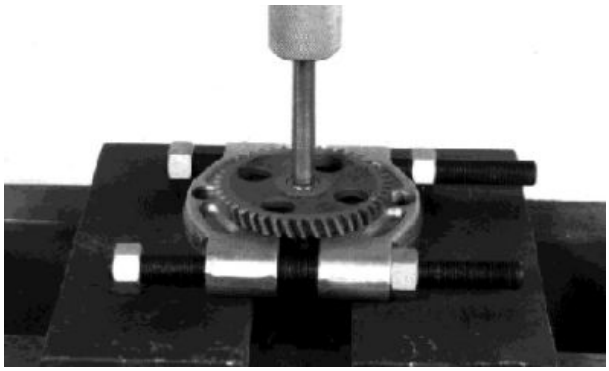
1. Remove gear using knife edge puller and a press.
2. Remove key
3. Remove bearings using a knife edge puller and a press.
4. Inspect all parts for wear or damage. See “Fuel Injection Pump Camshaft Inspection.”

Assembly

NOTE: Install large bearing on gear end.

IMPORTANT: When pressing bearings apply pressure on the inner bearing race only.

1. Install bearings on ends of camshaft using a 3/4 inch deep well socket and a press. Press until bearing races bottom on camshaft shoulders.



MXT011178 —UN—16JUN14

2. Install key.
3. Put camshaft gear on a flat surface and press camshaft assembly into gear. Press until gear shoulder butts up against inner bearing race.

Inspection:

Continued on next page

MX52301,000037E -19-07JUL14-6/8

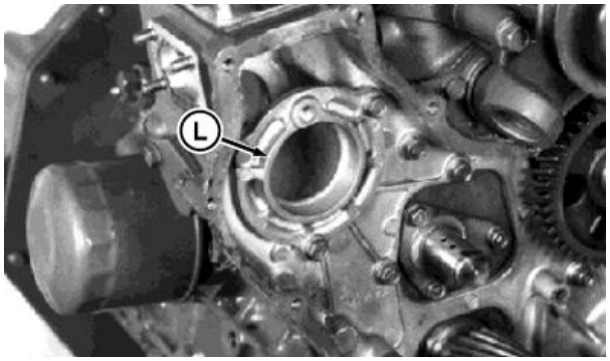
1. Measure height of each camshaft lobe. Replace camshaft if lobe height is less than 30.90 mm (1.217 in.)

MXT011179 —UN—16JUN14

MX52301,000037E -19-07JUL14-7/8

2. Inspect camshaft bearing supports in timing gear housing. Check for cracks, damage, or indications that bearings have spun in support.
   - If rear bearing bore is damaged, replace timing gear housing.
   - If front bearing bore (L) is damaged, remove three cap screws and replace support.
3. Inspect all parts for wear or damage. Replace as necessary.

L—Front Bearing Bore



MXT011180 —UN—16JUN14

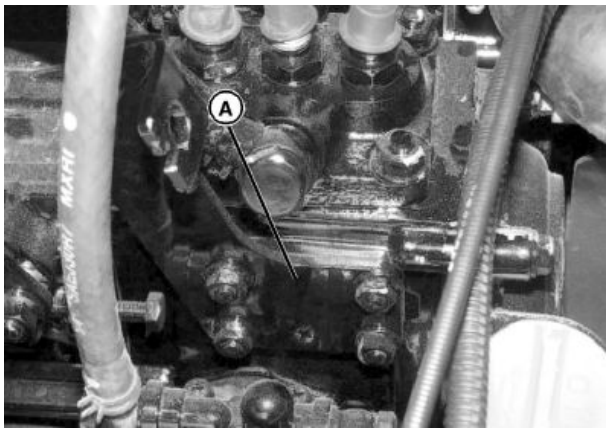
MX52301,000037E -19-07JUL14-8/8

Governor 3TNE68

Removal:

1. Remove rocker arm cover breather hose.
2. Remove throttle cable and governor linkage (A).

A—Governor Linkage Cover



MXT011151 —UN—16JUN14

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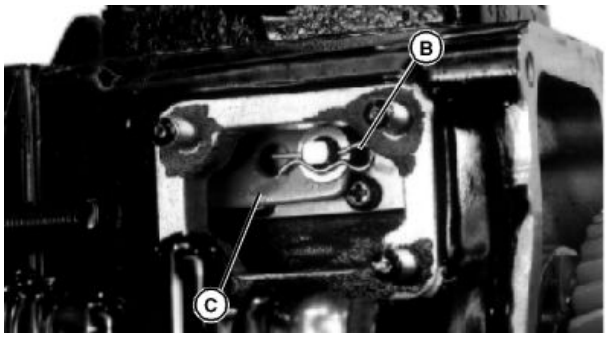
MX52301,000037F -19-17JUN14-1/4

3. **Picture Note: Washer may be fixed to linkage. Do not drop pin during removal**

   Remove pin (B) and washer to disconnect governor linkage (C).

B—Pin **C—Governor Linkage**

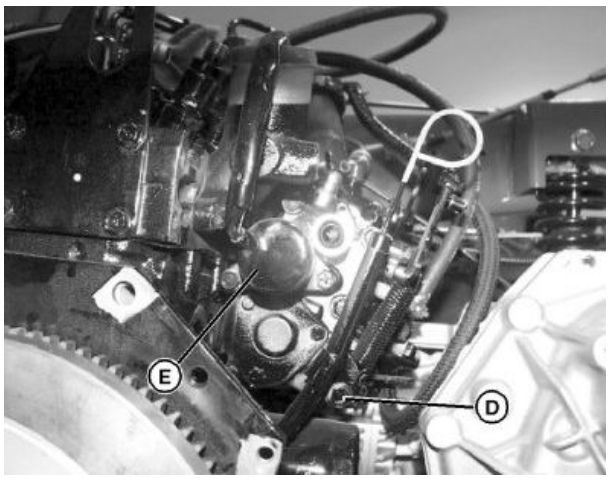


MXT011153 —UN—16JUN14

MX52301,000037F -19-17JUN14-2/4

4. Remove cap screw (D) and dipstick tube.
5. Remove two cap screws and fuel shutoff solenoid (E).
6. Remove remaining cap screws, and governor housing.

D—Cap Screw **E—Fuel Shutoff Solenoid**



MXT011138 —UN—16JUN14

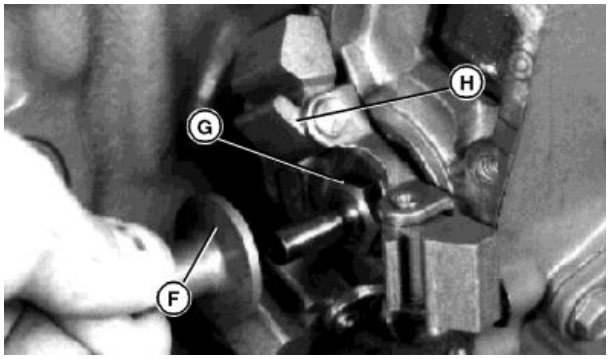
MX52301,000037F -19-17JUN14-3/4

7. Remove sleeve (F).
8. Remove nut (G) and governor weight assembly (H).
9. Disassemble and inspect all parts for wear or damage.

Installation

Installation is done in the reverse order of removal.

- Clean all gasket material from mating surfaces and install new gasket.
- Governor linkage has two holes. Connect governor linkage to injection pump rack using hole at end of linkage.
- Check and adjust slow idle settings. See Slow Idle Speed Adjustment—Diesel.



MXT011139 —UN—16JUN14

F— Sleeve
G—Nut
H—Governor Weight Assembly

MX52301,000037F -19-17JUN14-4/4

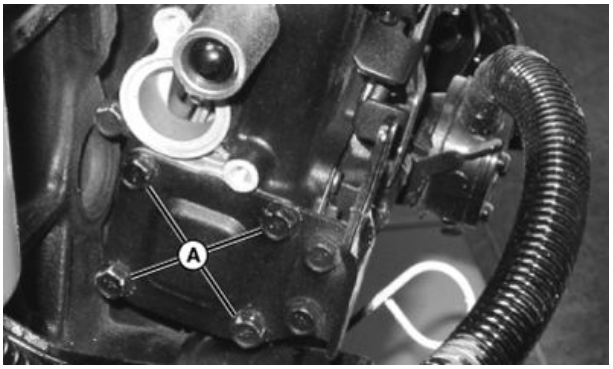
Fuel Control and Governor Linkage

Removal:

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Remove cargo box. See Cargo Box Removal and installation.
4. Remove air cleaner assembly
5. Loosen the throttle cable retaining clamp and disconnect throttle cable.
6. Disconnect and remove fuel shutoff solenoid.

NOTE: Pooled oil drains out when the governor cover is removed. Catch oil with a suitable container.

7. Remove the four cap screws (A) and governor cover.



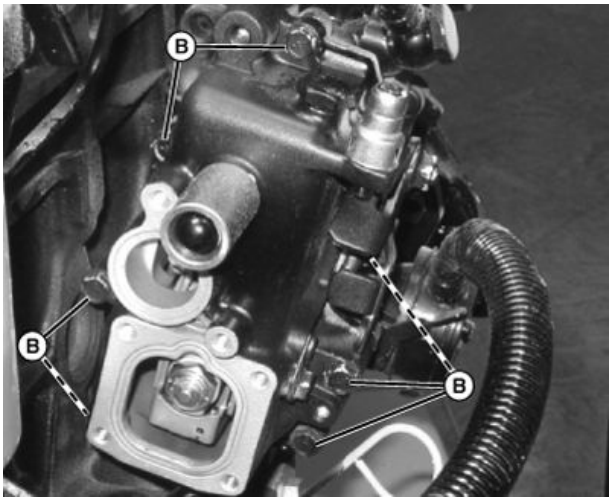
MXAL30630 —UN—10JUL12

A—Cap Screws (4 used)

MX52301,000036D -19-22OCT14-1/5

8. Remove seven cap screws (B) attaching governor housing to injection pump body.

B—Cap Screws (7 used)



MXAL30631 —UN—10JUL12

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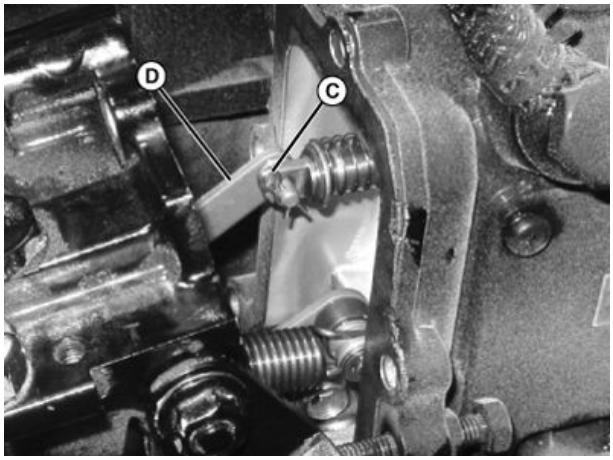
MX52301,000036D -19-22OCT14-2/5

9. Pull governor housing and gasket away from the injection pump enough to access the governor linkage.
10. Remove pin (C) and disconnect governor linkage (D).

C—Pin **D—Governor Linkage**

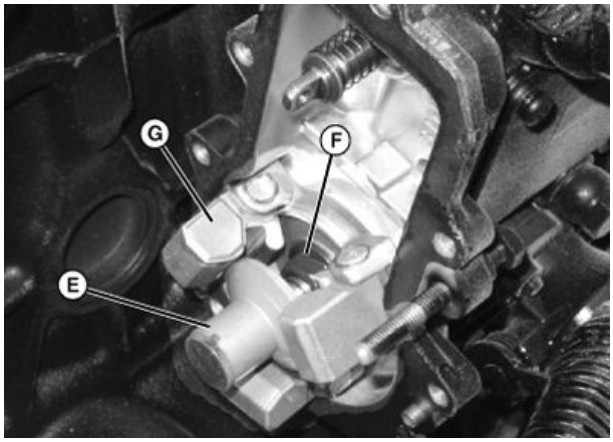


MXAL30632 —UN—10JUL12

MX52301,000036D -19-22OCT14-3/5

11. Remove sleeve (E).
12. Remove nut (F) and governor weights (G).

E—Sleeve **G—Governor Weights**
F—Nut



MXAL30633 —UN—10JUL12

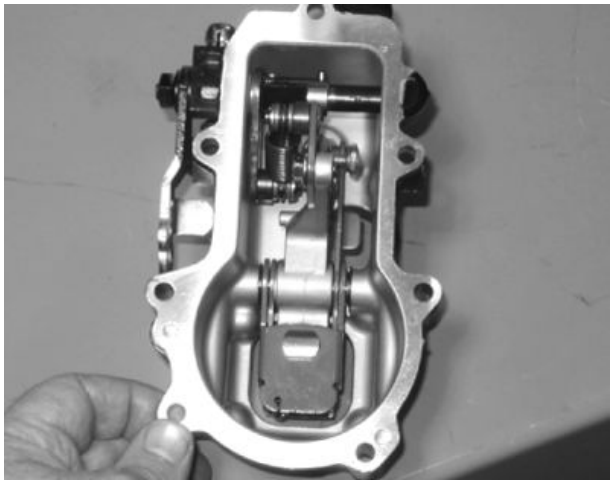
MX52301,000036D -19-22OCT14-4/5

13. Inspect all parts for wear or damage.

Installation:

Installation is done in the reverse order of removal.

- Check and adjust slow idle settings. See Slow Idle Speed Adjustment—Diesel.

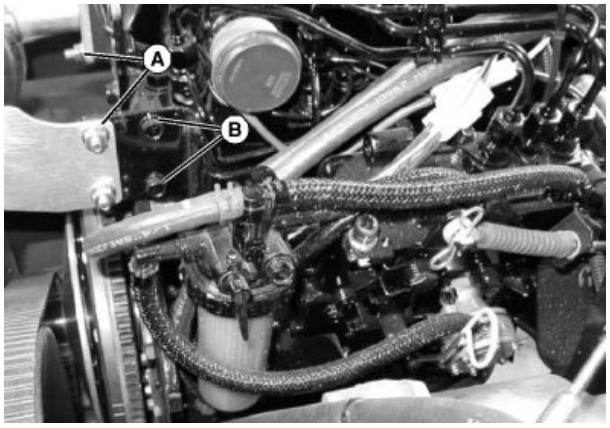


MXAL30634 —UN—10JUL12

MX52301,000036D -19-22OCT14-5/5

Fuel Shutoff Solenoid Removal and Installation

1. Park machine safely. See the “Safety Section”.
2. Allow engine to cool.
3. Raise and lock the cargo box.
4. Turn the fuel shutoff valve on the fuel filter and water separator to the CLOSED (“C”) position.
5. Remove the air intake hose from the intake manifold cover.
6. Clean around the fuel shutoff solenoid using a parts cleaning solvent or steam cleaner.
7. Remove all nuts (A) securing the muffler and remove muffler.
8. Remove Cap screw (B) and bracket.



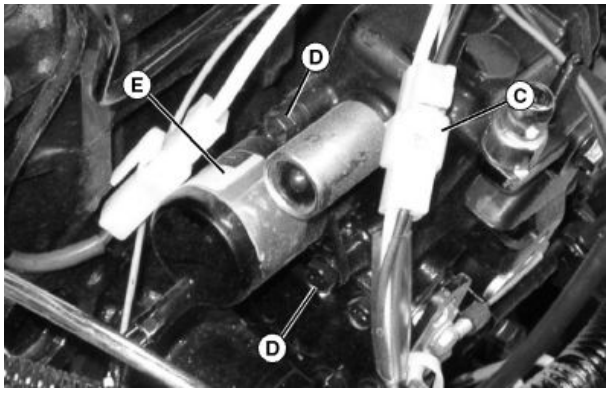
MXT011399 —UN—16JUN14

A—Nuts **B—Cap Screws**

MX52301,000036E -19-22OCT14-1/2

9. Disconnect the electrical connector (C) to the fuel shutoff solenoid.
10. Remove the two solenoid mounting cap screws (D) and remove solenoid (E) from governor housing.
11. Test fuel solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine).
12. Installation is in reverse of removal. Check condition of O-ring on solenoid before installing.

C—Electrical Connector **E—Solenoid**
D—Cap Screws (2 used)



MXT011140 —UN—16JUN14

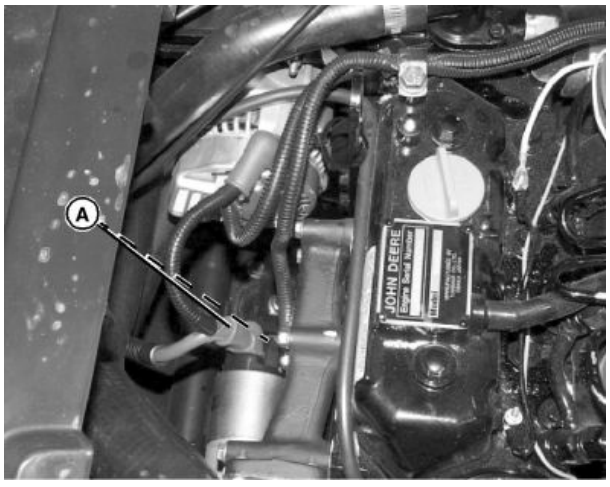
MX52301,000036E -19-22OCT14-2/2

Starting Motor Removal and Installation Diesel

Removal:

1. Park machine in safely with park brake locked. See the “Safety Section”.
2. Disconnect negative battery cable.
3. Remove battery cable and solenoid wire (A) from starting motor.

A—Solenoid Wire



MXT011141 —UN—16JUN14

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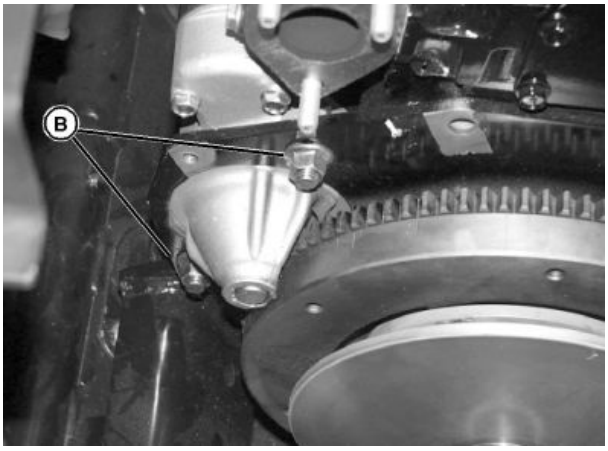
MX52301,000036F -19-23OCT14-1/3

4. 3TNE68 - Remove two nuts (B) from starting motor studs and remove starting motor.

B—Nuts (2 used)



MXT011142 —UN—16JUN14

Picture Note: 3TNE68

MX52301,000036F -19-23OCT14-2/3

5. 3TNV70 - Remove two cap screws (C) securing starting motor to flywheel plate, and remove starting motor.

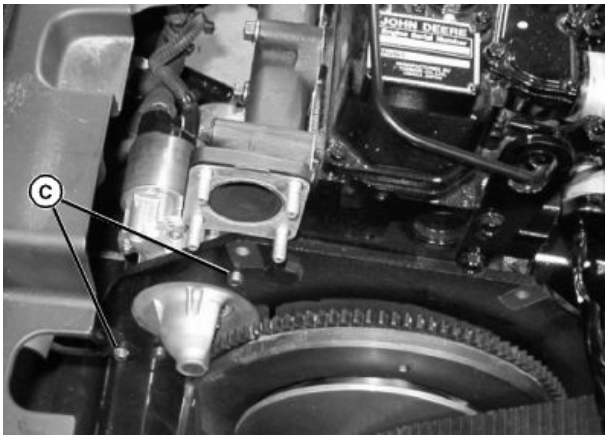
Installation:

1. Install starting motor to engine backplate as removed and tighten cap screws to specification.

Specification	
Starting Motor Cap Screws—Torque	28 N·m (21 lb.-ft.)

2. Install battery cable and solenoid wire.
3. Reconnect negative battery lead to battery.

C—Cap Screws (2 used)



MXT011202 —UN—16JUN14

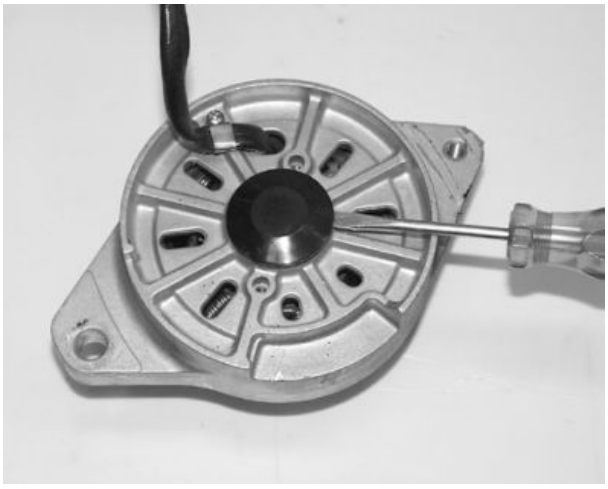
Picture Note: 3TNV70

MX52301,000036F -19-23OCT14-3/3

20 Amp Alternator

Disassembly:

1. Pry plastic cover from back of alternator.



MXT011185 —UN—16JUN14

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MX52301,0000380 -19-20JUN14-1/8

2. Remove nut (A), lockwasher, and flat washer.

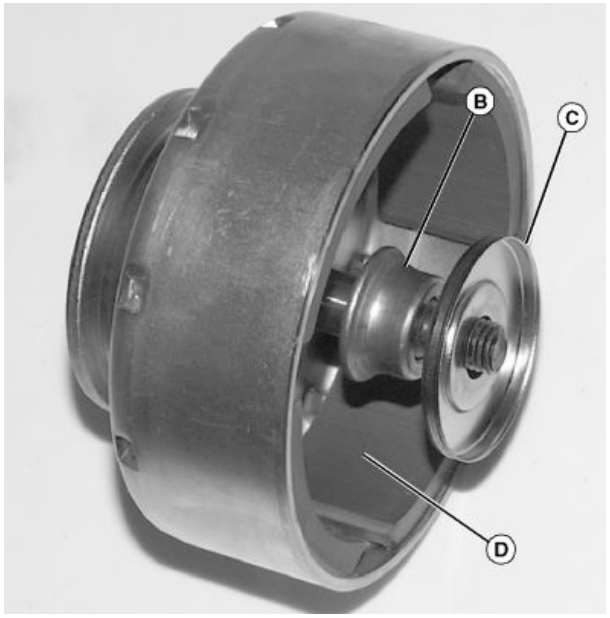
A—Nut

MXT011186 —UN—16JUN14

MX52301,0000380 -19-20JUN14-2/8

3. Remove the rotor assembly. Note orientation of spacer (B) and dust cover (C). Check magnets (D) for cracks and good magnetism.

B—Spacer
C—Dust Cover
D—Magnets



MXT011187 —UN—16JUN14

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MX52301,0000380 -19-20JUN14-3/8

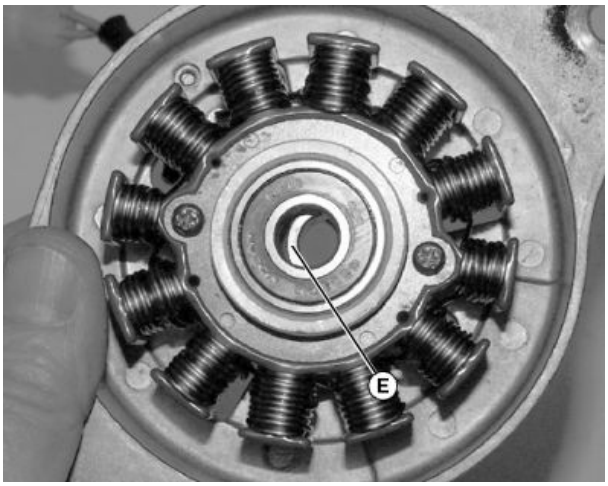
4. Remove outer sheave and shaft (bolt). Inspect parts for wear or damage.

MXT011188 —UN—16JUN14

MX52301,0000380 -19-20JUN14-4/8

5. To replace bearings, slide the spacer between the bearings over to the side (E) and press or drive out the first bearing with the spacer.

E—Side



MXT011189 —UN—16JUN14

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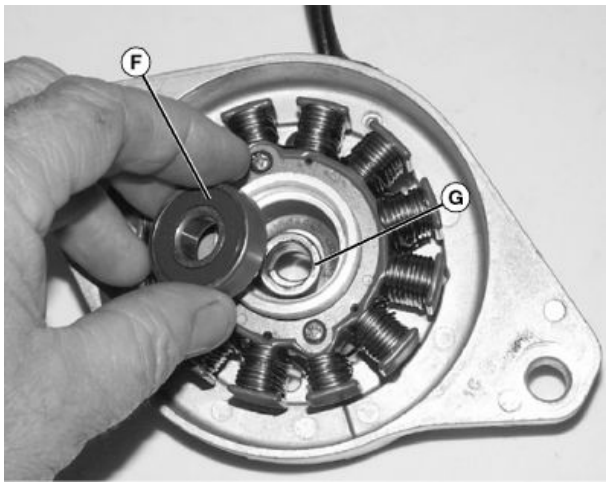
MX52301,0000380 -19-20JUN14-5/8

6. Remove bearing and spacer, then drive out the other bearing.

F—Bearing **G—Spacer**

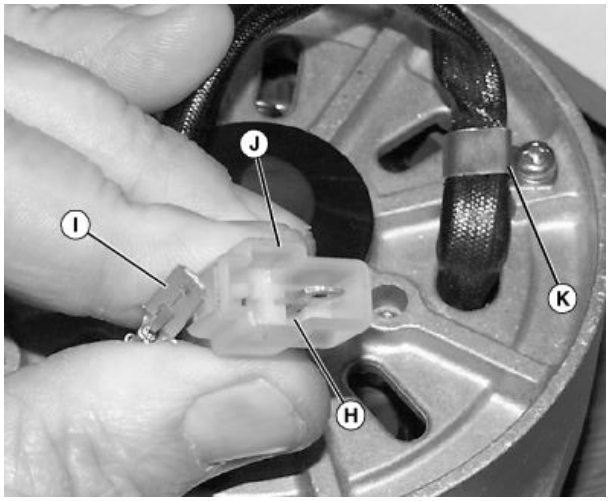


MXT011190 —UN—16JUN14

MX52301,0000380 -19-20JUN14-6/8

7. If replacing stator, use a small screwdriver to bend tangs (H) in to release wire terminals (I) from connector plug (J). Remove wire clamp (K).

H—Tangs **J—Connector Plug**
I—Terminals **K—Wire Clamp**



MXT011191 —UN—16JUN14

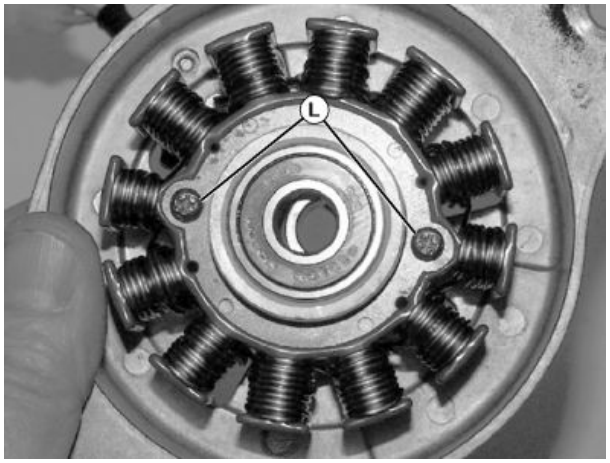
MX52301,0000380 -19-20JUN14-7/8

8. Remove screws (L) and remove stator.
9. Inspect all parts and replace any worn or damaged parts.

Assembly:

Assembly is done in reverse order of disassembly

L—Screws (2 used)



MXT011192 —UN—16JUN14

MX52301,0000380 -19-20JUN14-8/8

40 Amp Alternator

Required Tools:

- Bearing Puller Set

Disassembly:

1. Clamp sheave in a soft jaw vise and remove sheave nut (A).
2. Use puller to remove sheave (B).

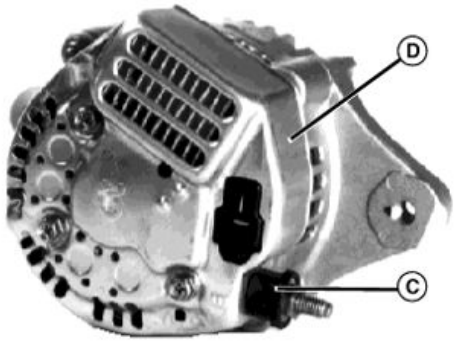
A—Sheave Nut **B—Sheave**

MXAL30637 —UN—10JUL12

MX52301,0000370 -19-17JUL14-1/16

3. Remove insulator (C).
4. Remove cover (D).

C—Insulator **D—Cover**

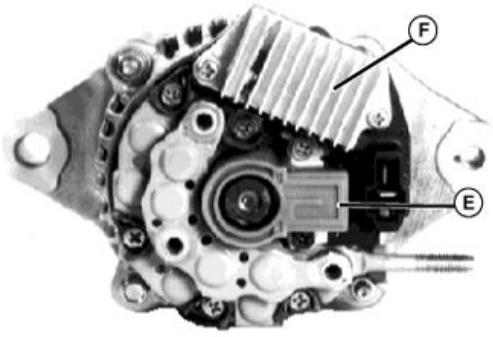


MXAL30638 —UN—10JUL12

MX52301,0000370 -19-17JUL14-2/16

5. Remove brush holder and cover (E).
6. Remove regulator (F).

E—Brush Holder and Cover **F—Regulator**



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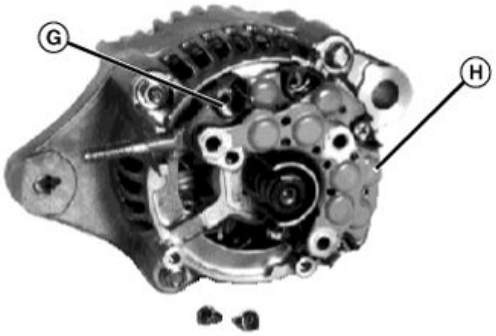
NOTE: Remember location of short screw on regulator tab.

7. Remove screw and straighten wire leads (G).
8. Remove rectifier (H).

G—Wire Leads **H—Rectifier**



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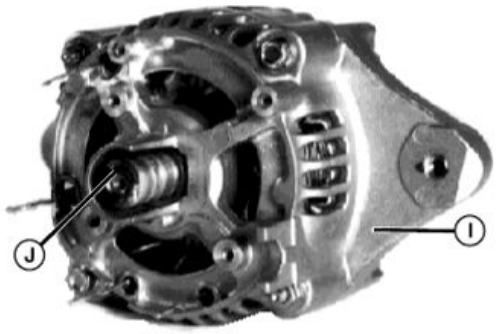
MX52301,0000370 -19-17JUL14-4/16

9. Remove rear case assembly (I).
10. Press rotor shaft (J) from rear case.

I— Rear Case Assembly **J— Rotor Shaft**

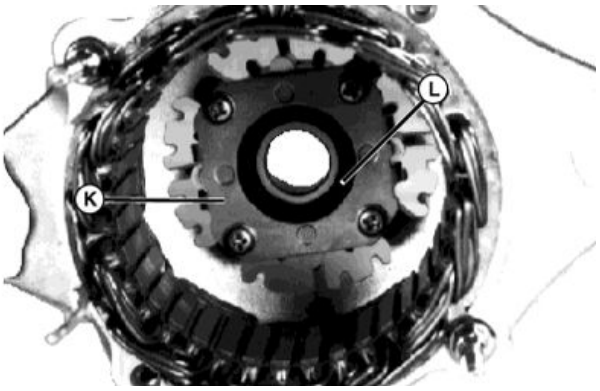


MXAL30641 —UN—10JUL12

MX52301,0000370 -19-17JUL14-5/16

11. Remove retainer plate (K).
12. Press bearing (L) from case with bearing puller set.

K—Retainer Plate **L—Bearing**



MXAL30642 —UN—10JUL12

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MX52301,0000370 -19-17JUL14-6/16

Inspection:

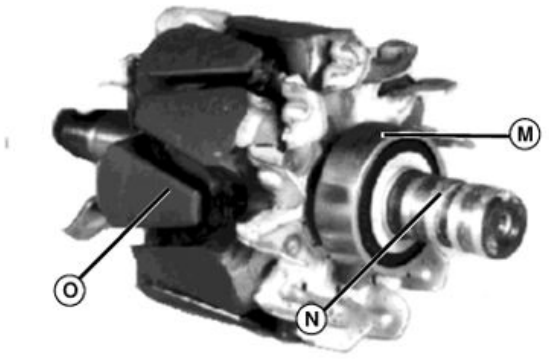
1. Inspect bearing (M) for smooth rotation. Replace if necessary.
2. Inspect slip rings (N) for dirt or rough spots. If necessary, use No. 00 sandpaper or 400-grit silicon carbide paper to polish rings.
3. Measure outer diameter of slip rings (N). Replace rotor if less than specification.

Specification	
Slip Ring—OD (minimum)	14 mm (0.55 in.)

4. Check continuity between slip rings (N) using volt-ohm-amp meter or multimeter. Replace rotor assembly if there is no continuity.
5. Check continuity between slip rings and rotor core (O). Replace rotor assembly if there is continuity.

NOTE: Use an ohmmeter that is sensitive to 0—1 ohm.

6. Inspect stator for defective insulation, discoloration, or burned odor.



MXAL30643 —UN—10JUL12

M—Bearing
N—Slip Rings
O—Rotor Core

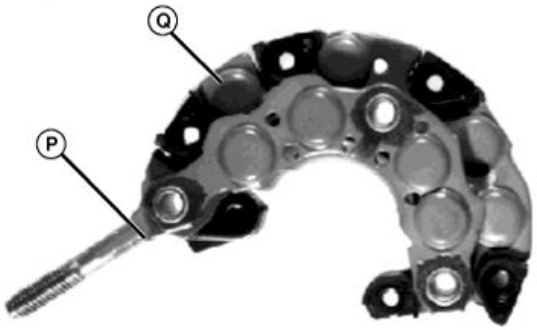
7. Check for continuity between each stator lead and body. Replace stator if there is continuity.

MX52301,0000370 -19-17JUL14-7/16

NOTE: Set ohmmeter to the K Ohm range.

8. Check continuity between lead (P) and each diode lead (Q). Reverse ohmmeter leads and recheck. There should be continuity in one direction, but not the other. Replace diodes or rectifier plate if bad.

P—Lead
Q—Diode Lead



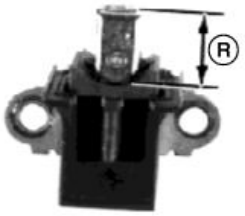
MXAL30644 —UN—10JUL12

MX52301,0000370 -19-17JUL14-8/16

9. Measure length of brush protruding from holder. Dimension (R) must be within specification.

Specification	
Exposed Brush—Length	4.5 mm (0.17 in.)
Exposed Brush—Length (maximum)	10.5 mm (0.41 in.)

R—Dimension



MXAL30645 —UN—10JUL12

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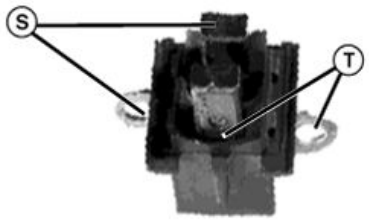
MX52301,0000370 -19-17JUL14-9/16

10. Check continuity between brush and terminal (S). Check continuity between brush and terminal (T). There must be continuity only at these points.

S—Terminal **T—Terminal**



MXAL30646 —UN—10JUL12

MX52301,0000370 -19-17JUL14-10/16

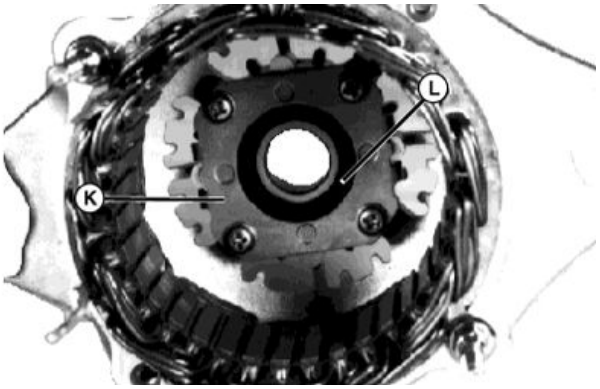
Assembly:

1. Press new bearing (L) into case.
2. Install retainer plate (K).

NOTE: Check that rotor fan does not contact case and that rotor assembly turns smoothly in bearing.

3. Press rotor shaft (J) into rear case.

K—Retainer Plate **L—Bearing**

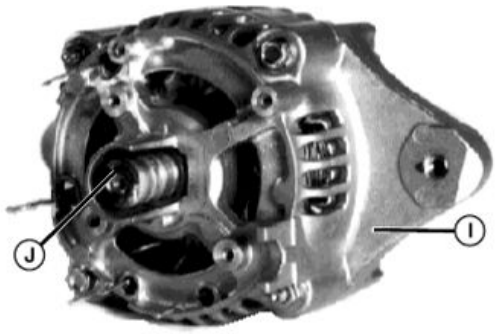


MXAL30642 —UN—10JUL12

MX52301,0000370 -19-17JUL14-11/16

4. Install rear case assembly (I).

I— Rear Case Assembly **J— Rotor Shaft**



MXAL30641 —UN—10JUL12

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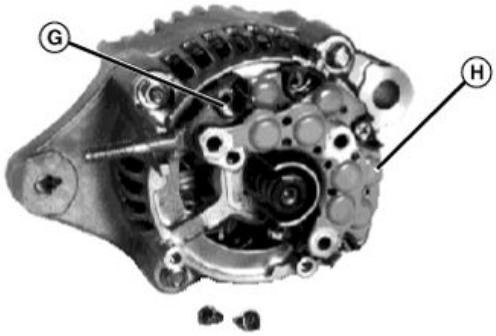
MX52301,0000370 -19-17JUL14-12/16

5. Install rectifier (H).
6. Install screws through loop formed in wire leads (G).

G—Wire Leads **H—Rectifier**



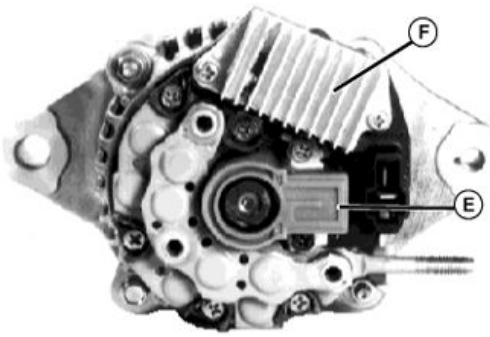
MXAL30640 —UN—10JUL12

MX52301,0000370 -19-17JUL14-13/16

IMPORTANT: Check that short screw is installed in regulator tab. Longer screw will contact frame and cause damage to the charging system.

7. Install regulator (F).
8. Install brush holder (E).

E—Brush Holder and Cover **F—Regulator**

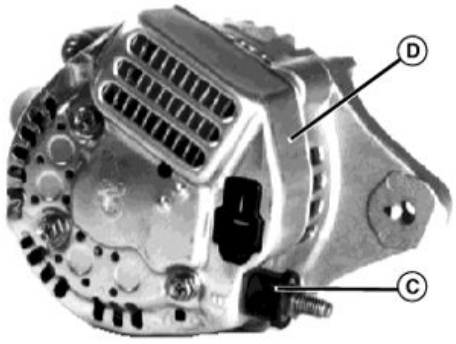


MXAL30639 —UN—10JUL12

MX52301,0000370 -19-17JUL14-14/16

9. Install regulator cover (D).
10. Install insulator (C) and nut.

C—Insulator **D—Cover**



MXAL30638 —UN—10JUL12

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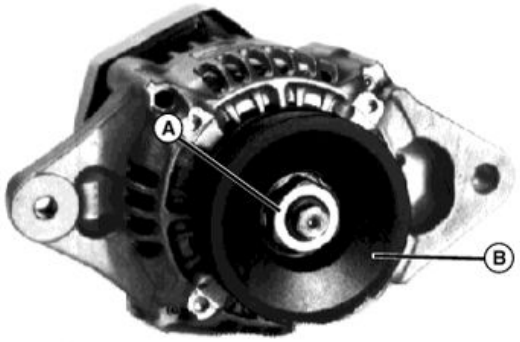
11. Install sheave (B).
12. Clamp sheave in soft jaw vise. Install sheave nut (A) and tighten to specification.

Specification	
Alternator Sheave Nut —Torque	69 N·m (51 lb.-ft.)

A—Sheave Nut **B—Sheave**



MXAL30637 —UN—10JUL12

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Section 50
Electrical

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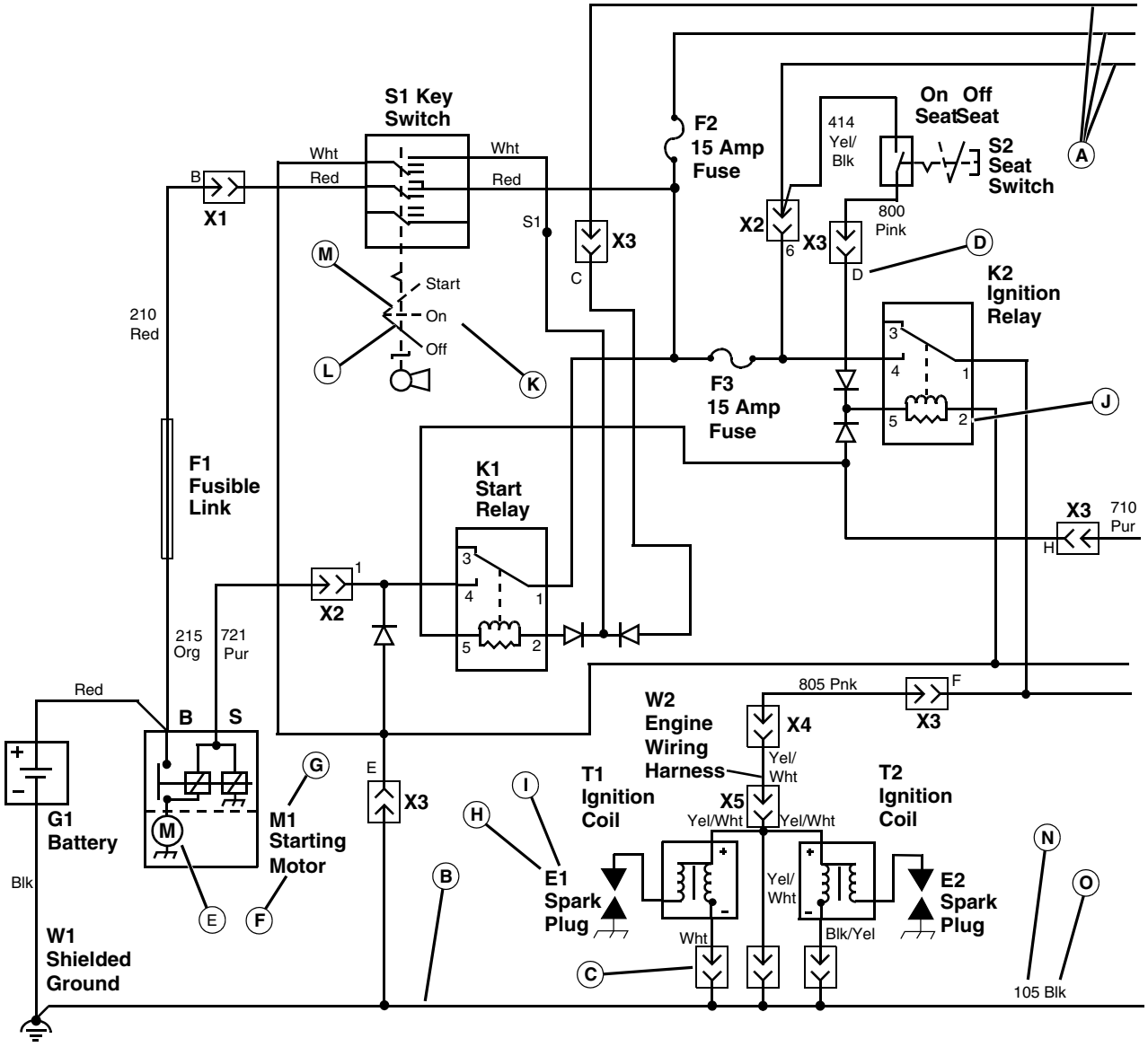
Reading Electrical Schematics



The schematic is made up of individual circuits laid out in a sequence of related functions. It is formatted with all power wires (A) across the top and all ground wires (B) across the bottom. Current flow is generally from top to bottom through each circuit and component. All components are shown in the off position. The diagram does not list connector (C) information unless needed to avoid confusion. If the connector is shown, the number next to it is the terminal pin location (D) in the connector.

Each component is shown by a symbol (E), its name (F), and an identification code (G). The identification code contains a device identifying letter (H) and number (I).

The identifying letter is always the same for a specific component, but the identifying numbers are numbered consecutively from upper left to lower right. The terminal designation (J) is placed directly inside or outside the symbol next to the connecting wire path. Switch positions (K) are also placed directly inside or outside the symbol. The solid line (L) shows the position the switch is currently in and dash lines (M) represent other switch positions.

The circuit number (N) and wire color (O) of the wires are shown directly next to the wire path.

The same component name and identification code are used consistently on all diagrams in this section. Components can be easily cross-referenced.

KN52281,10037A8 -19-31JUL12-1/1

Theory Of Operation Information

The theory of operation stories divide the electrical system into individual circuits by function. Each circuit is isolated from the main wiring schematic and only shows the components that are used in it. The story contains information on function, operating conditions, and theory of operation. The circuit schematics are drawn with the components in the operating position, with the power, or battery positive, into them across the top and the ground, or battery negative, across the bottom.

KN52281,10037A9 -19-31JUL12-1/1

Diagnostic Information

The diagnostic procedures is used to test the complete circuit regardless of the problem or complaint. Select a symptom or system from the quick check or troubleshooting chart and follow the test procedures under that heading.

The diagnostic procedure lists:

- Test conditions
- Test sequence
- Test location
- Normal reading
- Check or test to perform if reading is not normal

When performing the test or check, be sure to set your machine up to the test conditions listed and follow the sequence carefully. The diagram that accompanies each test procedure is drawn to resemble machine components. The key letter on the art matches the letter in the procedure and the leader line points to the exact point the test is to be made.

KN52281,10037AA -19-31JUL12-1/1

Wire Color Abbreviation Chart

Item	Measurement	Specification
Wire Color Abbreviation Chart		
Blk		Black
Blu		Blue
Brn		Brown
Grn		Green
Gry		Gray
Org		Orange
Pnk		Pink
Pur		Purple
Red		Red
Tan		Tan
Wht		White
Yel		Yellow
Blk/Wht		Black/White
Blu/Wht		Blue/White
Brn/Wht		Brown/White
Brn/Yel		Brown/Yellow
Dk Blu		Dark Blue
Dk Brn/Lt Grn		Dark Brown/Light Green
Dk Brn/Red		Dark Brown/Red
Dk Brn/Yel		Dark Brown/Yellow
Dk Grn		Dark Green
Lt Blue		Light Blue
Lt Grn		Light Green
Org/Wht		Orange/White
Pnk/Blk		Pink/Black
Pur/Wht		Purple/White
Red/Blk		Red/Black
Red/Wht		Red/White
Wht/Blk		White/Black
Wht/Red		White/Red
Yel/Blk		Yellow/Black
Yel/Red		Yellow/Red
Yel/Wht		Yellow/White

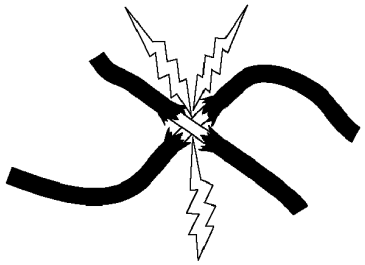
KN52281,10037AB -19-31JUL12-1/1

Common Circuit Tests

Shorted Circuit:

A shorted circuit may result in the wrong component operating (i.e. improper wire-to-wire contact). To test for a shorted or improperly wired circuit:

1. Turn component switch ON.
2. Start at the controlling switch of the component that should not be operating.
3. Follow the circuit and disconnect wires at connectors until component stops operating.



MXAL35072 —UN—27JUL12

4. Shorted or improper connections will be the last two wires disconnected.

KN52281,10037AC -19-31JUL12-1/3

High Resistance or Open Circuit:

High resistance or open circuits usually result in slow, dim or no component operation (i.e. poor, corroded, or disconnected connections). Voltage at the component will be low when the component is in operation. To test for high resistance and open circuits:

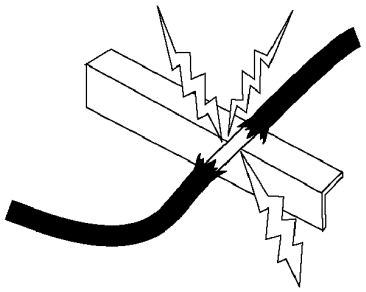
1. Check all terminals and grounds of the circuit for corrosion.
2. If terminals are not corroded or loose, the problem is in the component or wiring.

MXAL35073 —UN—27JUL12

KN52281,10037AC -19-31JUL12-2/3

Grounded Circuit:

Grounded circuits usually result in no component operation or a blown fuse.



MXAL35074 —UN—27JUL12

KN52281,10037AC -19-31JUL12-3/3

Conductors For 12 Volt Circuits

STRANDED CONDUCTORS FOR 12 VOLT CIRCUITS						
SAE Wire Size (Gauge)	20	18	16	14	12	10
Metric Wire Size (MM)	0.5	0.8	1.0	2.0	3.0	5.0
Typical Stranding	7 X 28	16 X 30	19 X 29	19 X 27	19 X 25	19 X 23
Minimum Conductor Area In Circular Mils	1072	1537	2336	3702	5833	9343

KN52281,10037AD -19-12AUG19-1/1

Gasoline Engine Machines

Item	Measurement	Specification
Electrical System		
Type	Voltage	12 V
Battery Size	Amperage	340 Cold Cranking Amps @ -18 °C (0°F)
Alternator	Amperage	12 Amps @1100 rpm, 21 Amps @ 3200 rpm
Spark Plug Gap		0.80 mm (0.031 in.)
Spark Plug Torque		25 N·m (18 lb.-ft.)
Instrument Panel Bulb	Type	AR62407
Headlight Bulb	Wattage	37.5 W
Radiator Fan Temperature Switch Closing Temperature		90—96 °C (194—204 °F)
Radiator Fan Temperature Switch Torque		21—27 N·m (185—239 lb.-in.)
Engine Coolant Temperature Switch Closing Temperature		108—114 °C (227—237 °F)
Pulser Coil Resistance		183—193 Ohm

MX52301,00000E0 -19-27OCT14-1/1

Diesel Engine Machines

Item	Measurement	Specification
Electrical System		
Type	Voltage	12 V
Battery Size	Amperage	480 Cold Cranking Amps @ -18 °C (0°F)
Alternator	Amperage	40 Amp Regulated
Regulator	Type	Solid State

MX52301,00000E1 -19-27OCT14-1/1

Fuses

Gasoline Engine Machines

Fuse	Circuit	Fuse Size
F1	Starting Motor Solenoid Circuit	30 A
F2	Radiator Fan Motor Circuit	15 A
F3	Charging Circuit	25 A
F4	Rear Attachments Circuit	40 A
F5	Accessory Power Port	10 A
F6	Ignition Switch and Acc. ON Circuit	15 A
F7	Front Attachments Circuit	40 A
F8	Not Used	Open

SN -110000

Fuse	Circuit	Fuse Size
F1	Starting Motor Solenoid Circuit	30 A
F2	Radiator Fan Motor Circuit	15 A
F3	Charging Circuit	25 A
F4	Lights Circuit	10 A
F5	Accessory Power Port	10 A
F6	Ignition Switch and Acc. ON Circuit	15 A
F7	Front Attachments Circuit	40 A
F8	Rear Attachments Circuit	40 A
F9	Center Accessory Power Port In-line Fuse	10 A

SN 110001-

Diesel Engine Machines

Fuse	Circuit	Fuse Size
F1	Starting Motor Solenoid Circuit	30 A
F2	Radiator Fan Motor Circuit	25 A
F3	Glow Plug Circuit	30 A
F4	Rear Attachments Circuit	40 A
F5	Accessory Power Port	10 A
F6	Ignition Switch and Acc. ON Circuit	15 A
F7	Front Attachments Circuit	40 A
F8	Not Used	Open

SN -080000

Fuse	Circuit	Fuse Size
F1	Front Power Port	10 A
F2	Not Used	Open
F3	Front Attachments Circuit	40 A
F4	Rear Attachments Circuit	40 A
F5	Radiator Fan Motor Circuit	30 A
F6	Glow Plug Circuit	30 A
F7	Starting Motor Solenoid Circuit	30 A
F8	Ignition Switch and Acc. ON Circuit	15 A
F9	Center Accessory Power Port In-line Fuse	10 A

SN 080001-110000

Fuse	Circuit	Fuse Size
F1	Lights Circuit	10 A
F2	Front Power Port	10 A
F3	Front Attachments Circuit	40 A
F4	Rear Attachments Circuit	40 A
F5	Radiator Fan Motor Circuit	30 A
F6	Glow Plug Circuit	30 A
F7	Starting Motor Solenoid Circuit	30 A
F8	Ignition Switch and Acc. ON Circuit	15 A
F9	Center Accessory Power Port In-line Fuse	10 A

SN 110001-

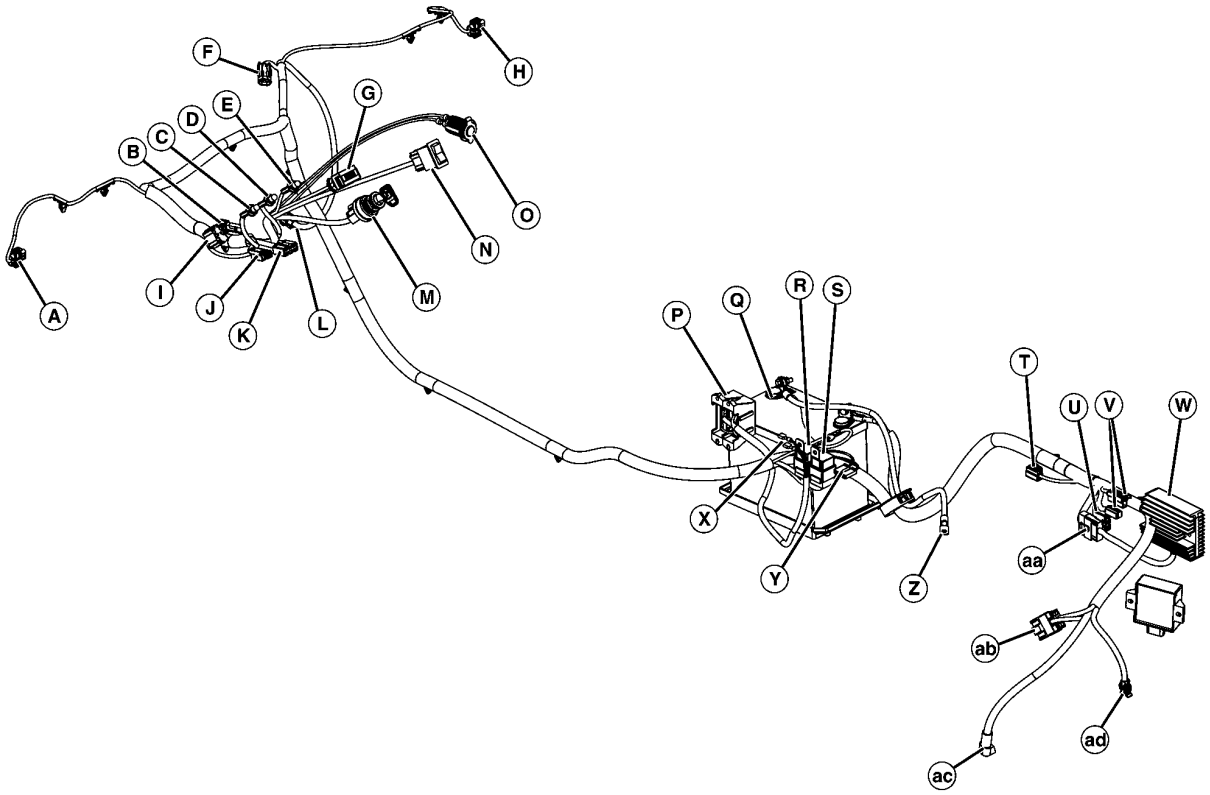
MX52301,00000E2 -19-22OCT14-1/1

Summary of References

- Electrical Components—Gas Engines (SN -040000)
- Electrical Components—Diesel Engines (SN -040000)
- Electrical Schematic and Wiring harness Legend (Gas and Diesel Engines SN -040000)

MX52301,0000443 -19-23OCT14-1/1

Electrical Components—Gas Engines (SN -040000)



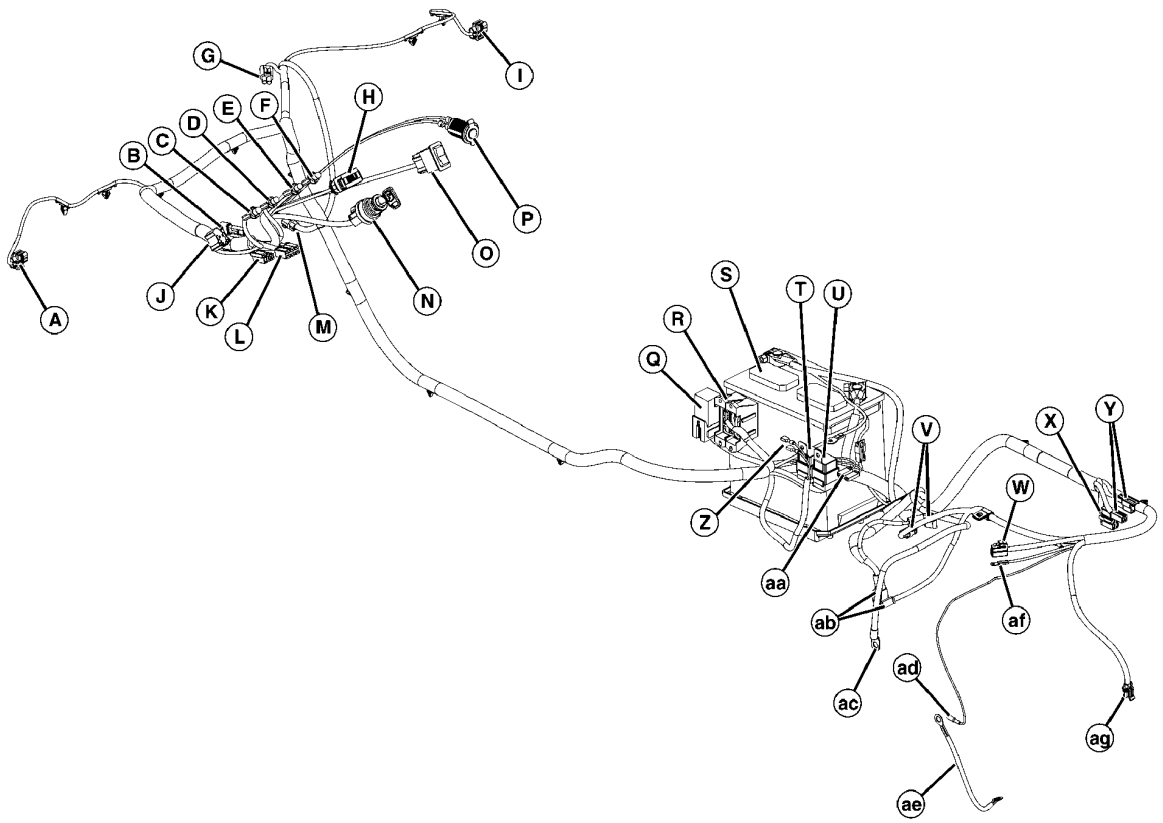
MXT011836 —UN—20JUN14

Picture Note: Shown from left rear

A—E3 Left Headlight
B—V1 Diode
C—H3 Oil Pressure Light
D—H2 Engine Temperature Light
E—H1 Park Brake Light
F—X5 Radiator Fan Connector
G—P1 Hourmeter
H—E4 Right Headlight
I— X9 Lift Switch Connector (Option)
J— X14 Front Power Connector
K—X15 Front Light Harness Connector
L—B1 Radiator Temperature Switch
M—S1 Key Switch
N—S4 Light Switch
O—X13 12 VDC Power Port
P—Fuse Blocks
Q—G1 Battery
R—K1 Start Relay
S—K2 Radiator Fan Relay
T—X2 Fuel Pump Connector
U—X16 Rear Lights Harness Connector
V—X17 Rear Power Connector
W—N1 Voltage Regulator/Rectifier
X—S3 Park Brake Switch Connectors
Y—X8 Accessory Connectors
Z—Engine Ground
AA—X3 Voltage Regulator/Rectifier Connector
AB—X1 and X4 Engine Wiring Harness Connectors
AC—M1 Starting Motor
AD—S2 Neutral Start Switch

MX52301,00000E3 -19-24OCT14-1/1

Electrical Components—Diesel Engines (SN -040000)



MXT011837 —UN—20JUN14

Picture Note: Shown from left rear

A—E3 Left Headlight
B—V1 Diode
C—H3 Engine Oil Pressure Light
D—H2 Engine Temperature Light
E—H1 Park Brake Light
F—H4 Discharge Light
G—X5 Radiator Fan Connector
H—P1 Hourmeter
I— E4 Right Headlight
J—X9 Lift Switch Connector (Option)
K—X14 Front Power Connector
L—X15 Front Light Harness Connector
M—B1 Radiator Temperature Sensor
N—S1 Key Switch
O—S4 Light Switch
P—X13 12 VDC Power Port
Q—A1 Glow Plug Module
R—Fuse Blocks
S—G1 Battery
T—K1 Start Relay
U—K2 Radiator Fan Relay
V—G2 Alternator Connectors
W—X2 Fuel Solenoid Connector
X—X16 Rear Lights Harness Connector
Y—X17 Rear Power Connector
Z—S3 Park Brake Switch Connectors
AA—X8 Accessory Connectors
AB—M1 Starting Motor Connectors
AC—Engine Ground
AD—B4 Engine Oil Pressure Switch Connector
AE—Engine to Frame Ground Cable
AF—Glow Plugs Connector
AG—S2 Neutral Start Switch

MX52301,00000E5 -19-24OCT14-1/1

Electrical Schematic and Wiring harness Legend (Gas and Diesel Engines SN -040000)

A1 — Igniter Module (Gas Engines)
A1 — Glow Plug Module (Diesel Engines)
B1 — Radiator Temperature Sensor
B2 — Pulser Coil (Gas Engines)
B3 — Engine Coolant Temperature Switch
B4 — Engine Oil Pressure Switch
E1 — Spark Plug (Gas Engines)
E2 — Spark Plug (Gas Engines)
E3 — Left Headlight
E4 — Right Headlight
F1 — Start Relay and Motor Fuse (30A)
F2 — Radiator Fan Fuse (15A) (Gas Engines)
F2 — Radiator Fan Fuse (25A) (Diesel Engines)
F3 — Voltage Regulator Fuse (25A) (Gas Engines)
F3 — Glow Plugs Fuse (30A) (Diesel Engines)
F4 — Rear Unswitched Options Fuse (40A)
F5 — Accessory Power Port Fuse (10A)
F6 — Switched Power Fuse (15A)
F7 — Front Unswitched Options Fuse (40A)
F8 — Not Used
G1 — Battery
G2 — Stator (Gas Engines)
G2 — Alternator (Diesel Engines) (Option for Gas Engines)
H1 — Park Brake Light
H2 — Engine Coolant Temperature Light
H3 — Engine Oil Pressure Light
H4 — Discharge Light (Diesel Engines)
K1 — Start Relay
K2 — Fan Relay
M1 — Starting Motor
M2 — Radiator Fan Motor
N1 — Voltage Regulator/Rectifier (Gas Engines)
P1 — Hourmeter
R1 — Carburetor Heater (Gas Engines)
R1 — Glow Plug (Diesel Engines)
R2 — Glow Plug (Diesel Engines)
R3 — Glow Plug (Diesel Engines)
S1 — Key Switch
S2 — Neutral Start Switch
S3 — Park Brake Switch
S4 — Light Switch
S5 — Cargo Box Control Switch (Option)
T1 — Ignition Coil (Gas Engines
T2 — Ignition Coil (Gas Engines)
V1 — Diode
W1 — Shielded Ground
Y1 — Starting Motor Solenoid
Y2 — Fuel Pump (Gas Engines)
Y3 — Fuel Shutoff Solenoid
X1 — Main Wiring Harness to W2 Engine Wiring Harness Connector (Gas Engines)
X2 — Main Wiring Harness to Y2 Fuel Pump (Gas Engines)
X3 — Main Wiring Harness to N1 Voltage Regulator/Rectifier (Gas Engines)
X3 — Main Wiring Harness to Y3 Fuel Shutoff Solenoid (Diesel Engines)
X4 — N1 Voltage Regulator/Rectifier to G2 Alternator (Gas Engines)
X4 — Main Wiring Harness to G2 Alternator
X5 — Main Wiring Harness to M2 Radiator Fan Motor
X6 — W2 to W3 Engine Wiring Harnesses
X6a — Engine Wiring Harness to B2 Pulser Coil (Gas Engines)
X7 — Main Wiring Harness Optional Attachments Connector (Front) Switched Power
X8 — Main Wiring Harness Optional Attachments Connector (Mid) Switched Power
X9 — Main Wiring Harness to Cargo Box Control Switch (Option)
X10 — Main Wiring Harness to Cargo Box Raise/Lower Motor (Option)
X11 — Main Wiring Harness to Left Headlight
X12 — Main Wiring Harness to Right Headlight
X13 — Main Wiring Harness to Accessory Power Port
X14 — Main Wiring Harness Optional Attachments Connector (Front) Unswitched Power
X15 — Main Wiring Harness to Front Lights Harness (Option)
X16 — Main Wiring Harness to Rear Lights Harness
X17 — Main Wiring Harness Optional Attachments Connector (Rear) Unswitched Power

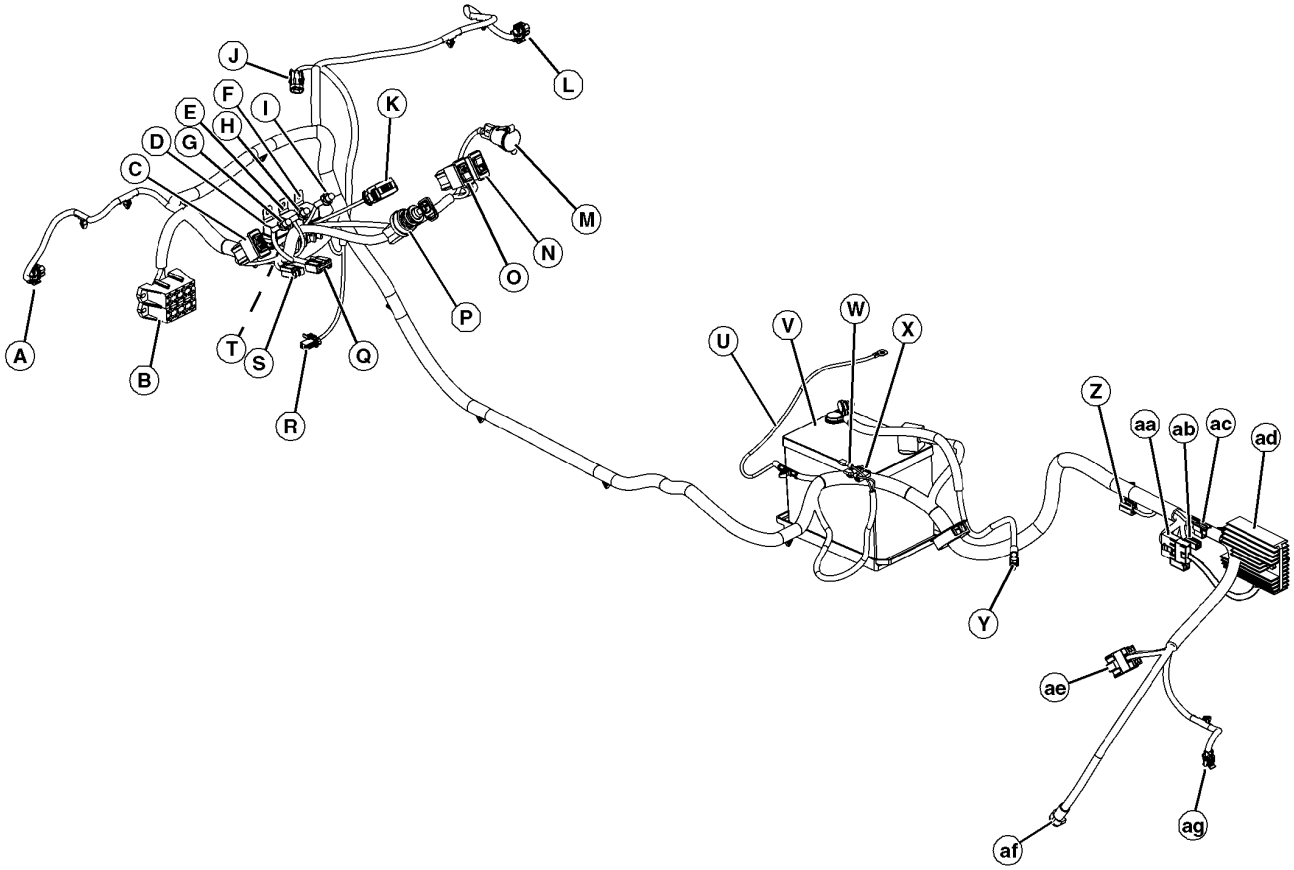
MX52301,00000E6 -19-24OCT14-1/1

Summary of References

- Electrical Components—Gas Engines (SN 040001-080000)
- Electrical Components—Gas Engines (SN 080001-)
- Electrical Components—Diesel Engines (SN 040001-080000)
- Electrical Components—Diesel Engines (SN 080001-110000)
- Electrical Components—Diesel Engines (SN 110001-)
- Electrical Schematic and Wiring Harness Legend (SN 040001-080000)
- Electrical Schematic and Wiring Harness Legend (Gas Engines SN 080001-)
- Electrical Schematic and Wiring harness Legend (Diesel Engines SN 080001-110000)
- Electrical Schematic and Wiring harness Legend (Diesel Engines SN 110001-)

MX52301,0000763 -19-24OCT14-1/1

Electrical Components—Gas Engines (SN 040001-080000)



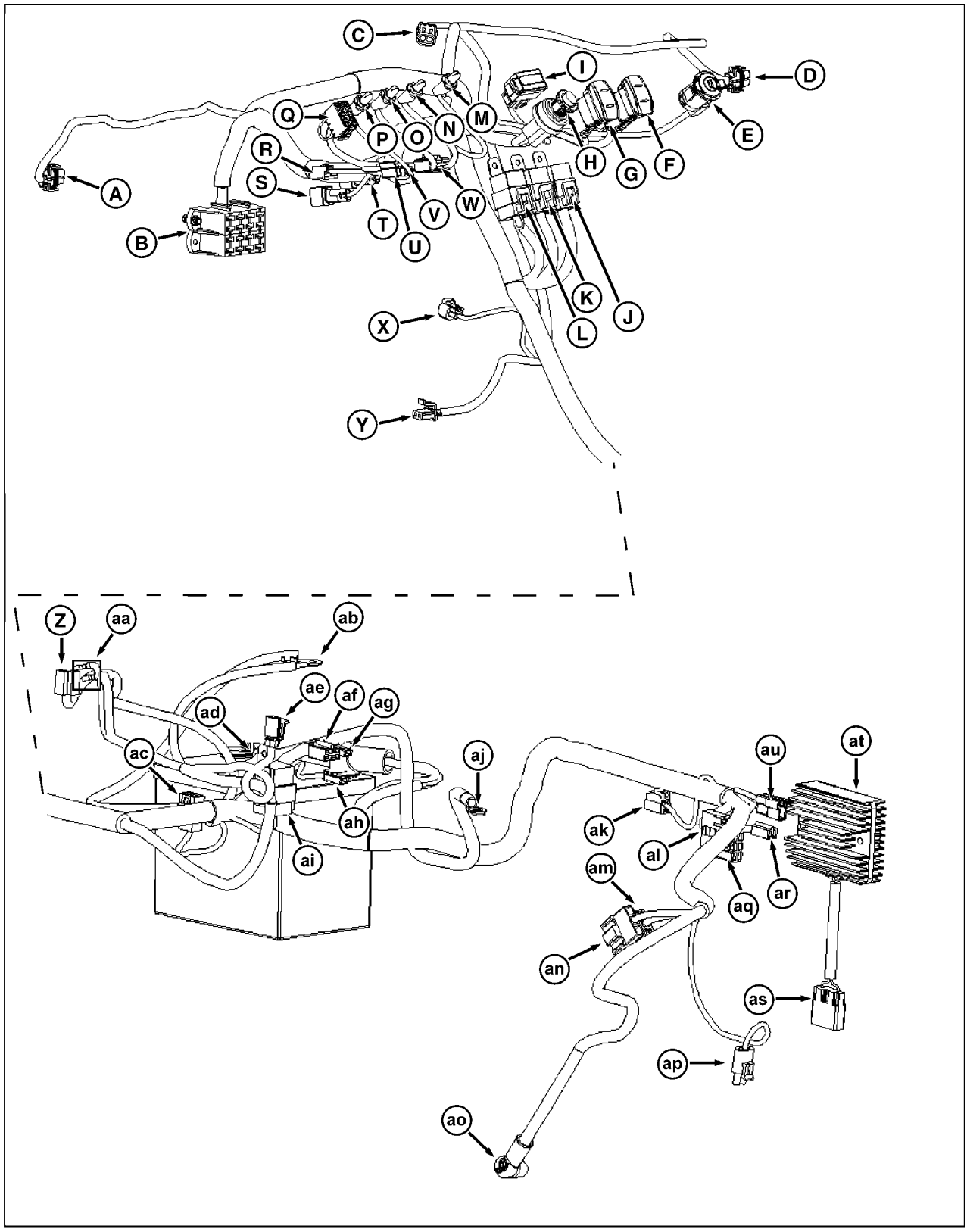
MXT011838 —UN—19JUN14

Picture Note: Shown from left rear

A—E3 Left Headlight
B—Fuse Blocks
C—S5 Cargo Box Lift Switch (Option)
D—K1 Start Relay
E—K2 Radiator Fan Relay
F—K3 4WD Interlock Relay
G—H3 Oil Pressure Light
H—H2 Engine Temperature Light
I— H1 Park Brake Light
J— X5 Radiator Fan Connector
K—P1 Hourmeter
L— E4 Right Headlight
M—X13 12VDC Power Port
N—S4 Light Switch
O—S5 4WD Switch
P—S1 Key Switch
Q—X15 Front Light Harness Connector
R—X18 4WD Clutch
S—X14 Front Power Connector
T— V1 Diode
U—Frame Ground Wire
V—G1 Battery
W—S3 Park Brake Switch Connectors
X—X8 Accessory Connectors
Y—Engine Ground
Z— X2 Fuel Pump Connector
AA—X3 Voltage Regulator/Rectifier Connector
AB—X17 Rear Power Connector
AC—X16 Rear Lights Harness Connector
AD—N1 Voltage Regulator/Rectifier
AE—X1 and X4 Engine Wiring Harness Connectors
AF—M1 Starting Motor
AG—S2 Neutral Start Switch

KK36721,0000120 -19-22OCT14-1/1

Electrical Components—Gas Engines (SN 080001-)



MXT012714 —UN—24OCT14

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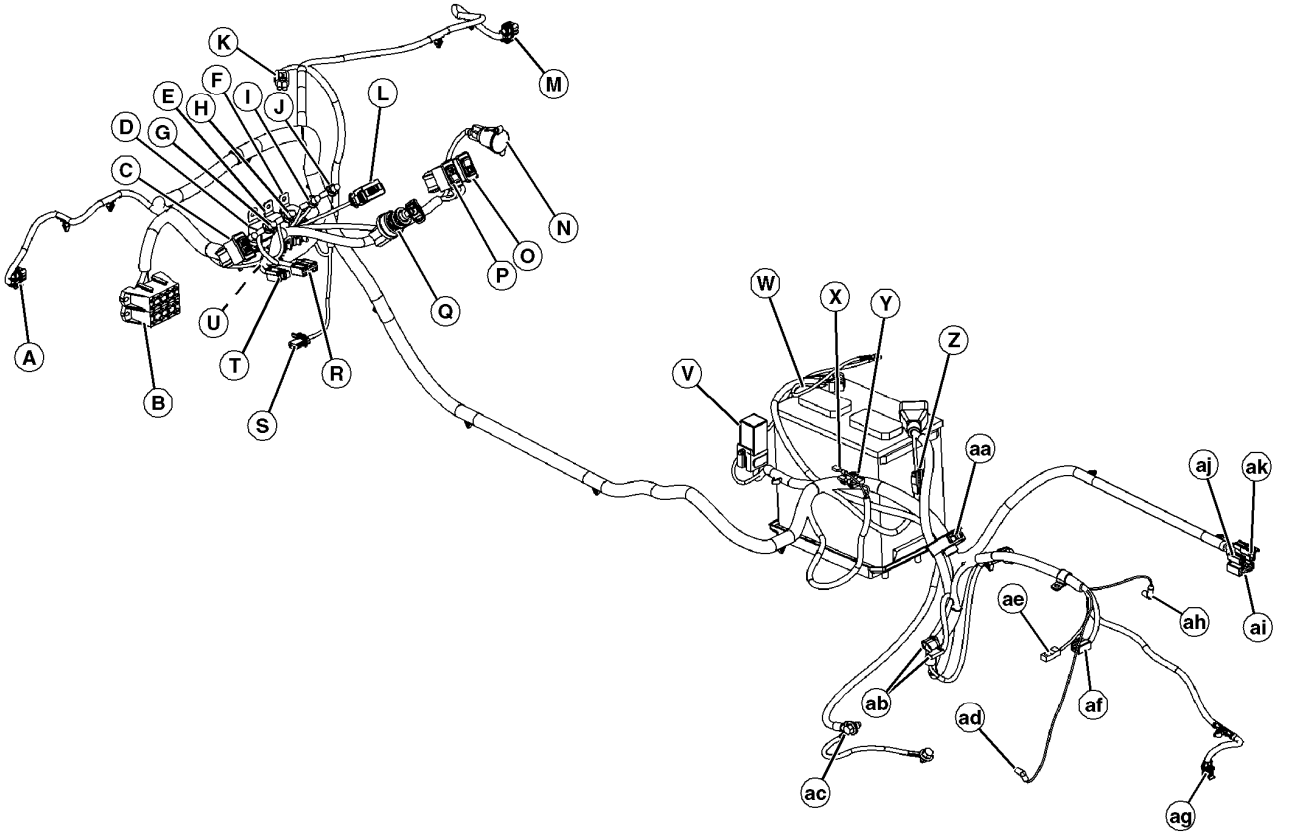
MX52301,0000764 -19-27OCT14-1/2

A—Left Headlight C15
B—Fuse Block C13, C24
C—Radiator Fan Connector C22
D—Right Headlight C17
E—Accessory Power Port C38
F—Light Switch C7
G—4WD Switch C34
H—Key Switch C3
I— Hour Meter C8
J—4WD Interlock Relay C33
K—Radiator Fan Relay C26
L—Start Relay C25
M—Park Brake Light C1
N—Engine Coolant Temperature Light C16
O—Oil Pressure LIght C18
P—Seat Belt Light C32
Q—Cargo Box Lift Switch (Option) C2
R—Optional Lights Connector C96
S—Diode C21
T—Diode C97
U—Front Power Connector (Switched) C5
V—Front Power Connector (Unswitched) C6
W—Front Lights Connector C11
X—Radiator Temperature Switch C23
Y—4WD Clutch C35
Z—Accessory Power Port C38
AA—Park Brake Switch T9, T10
AB—Frame Ground T7
AC—Fuse Holder C89
AD—Battery
AE—Seat Belt Switch C30
AF—Mid Options Power C100
AG—Cab Power C28
AH—Cab Ground C27
AI— Seat Belt Light Relay C31
AJ—Engine Ground
AK—Fuel Pump C29
AL—N1 Voltage Regulator/Rectifier Connector
AM—Engine Connector
AN—Alternator C4
AO—Starting Motor CT-6
AP—Neutral Start Switch C12
AQ—Rear Lights C19
AR—Rear Power (Unswitched) C10
AS—N1 Voltage Regulator/Rectifier to Harness Connector
AT—N1 Voltage Regulator/Rectifier
AU—Cargo Box Lift C9

MX52301,0000764 -19-27OCT14-2/2

Electrical Components—Diesel Engines (SN 040001-080000)

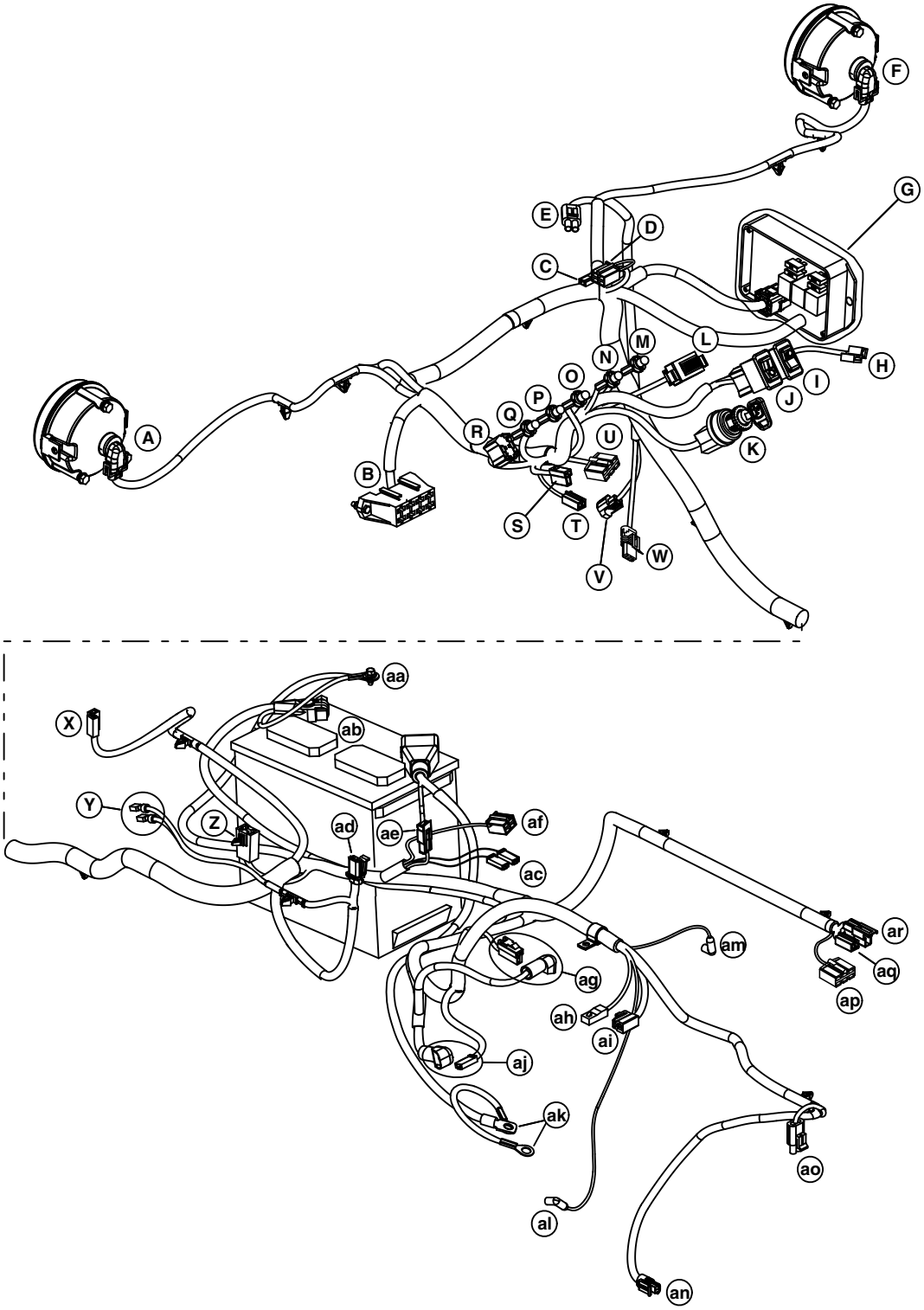


MXT011839 —UN—19JUN14

A—E3 Left Headlight
B—Fuse Blocks
C—S5 Cargo Box Lift Switch (Option)
D—K1 Start Relay
E—K2 Radiator Fan Relay
F—K3 4WD Interlock Relay
G—H3 Engine Oil Pressure Light
H—H2 Engine Temperature Light
I— H1 Park Brake Light
J—H4 Discharge Light
K—X5 Radiator Fan Connector
L—P1 Hourmeter
M—E4 Right Headlight
N—X13 12VDC Power Port
O—S4 Light Switch
P—S5 4WD Switch
Q—S1 Key Switch
R—X15 Front Light Harness Connector
S—X18 4WD Clutch
T—X14 Front Power Connector
U—V1 Diode
V—A1 Glow Plug Module
W—G1 Battery
X—S3 Park Brake Switch Connectors
Y—X8 Accessory Connectors
Z—X1 Fusible Link Connector
AA—G2 Alternator Connector
AB—M1 Starting Motor Connectors
AC—Engine Ground
AD—B4 Engine Oil Pressure Switch Connector
AE—Glow Plugs Connector
AF—X2 Fuel Solenoid Connector
AG—S2 Neutral Start Switch
AH—B3 Coolant Temperature Switch Connector
AI— X17 Rear Power Connector
AJ—X10 Cargo Box Lift Connector (Option)
AK—X16 Rear Lights Harness Connector

KK36721,0000121 -19-24OCT14-1/1

Electrical Components—Diesel Engines (SN 080001-110000)



MXT011840 —UN—20MAY14

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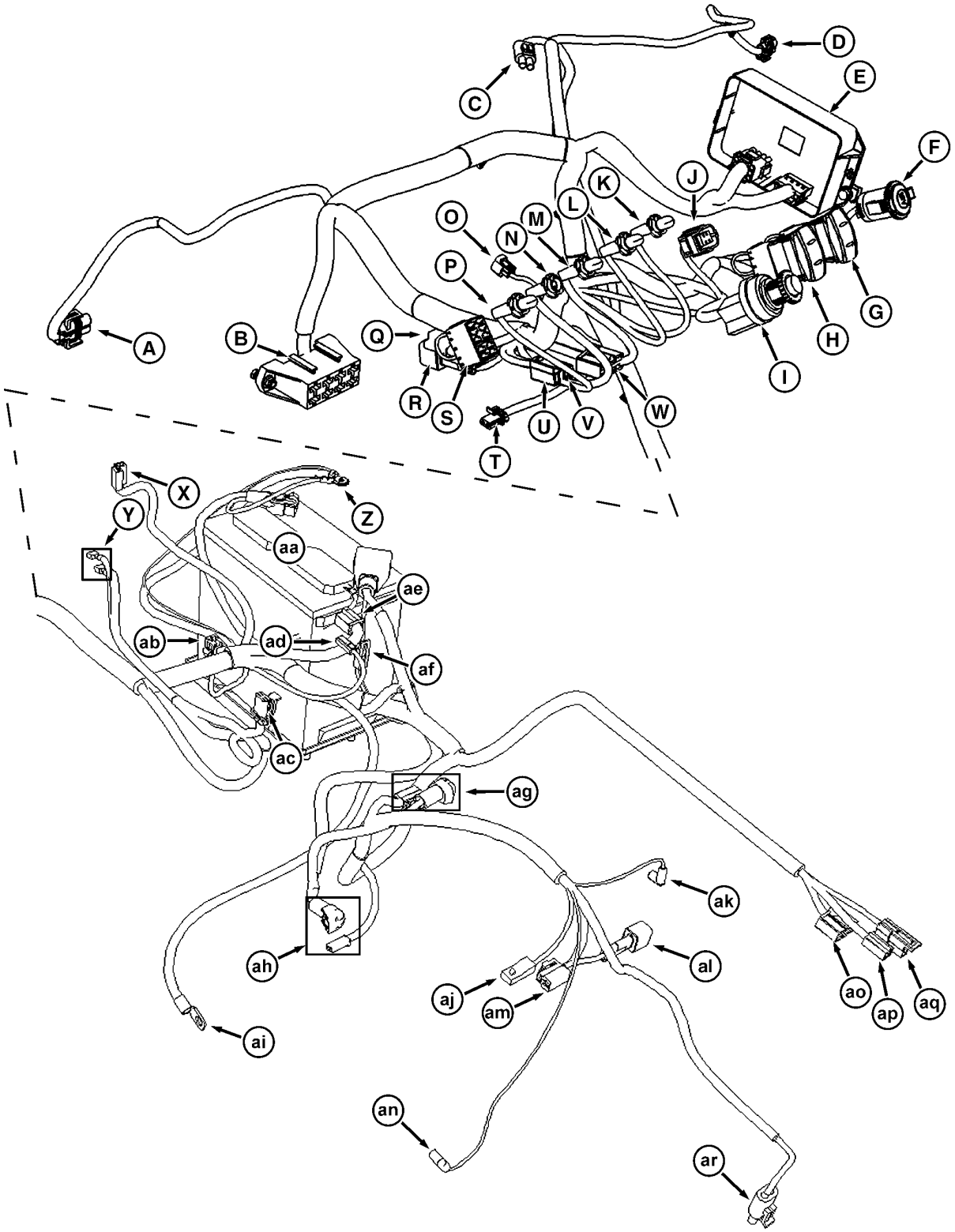
KK36721,0000122 -19-24OCT14-1/2

A—Left Headlight E3
B—Fuse Block C13
C—to EPAS LED C99
D—to EPAS Unit C98
E—to Radiator Fan Motor C22
F—Right Headlight E4
G—VCU/Connectors C49, C50
H—Front Power Port C38
I— Light Switch S4
J— 4WD Switch S6
K—Key Switch S1
L—Hour Meter P1
M—Discharge Light H4
N—Park Brake Light H1
O—Temperature/Glow Plug Light H2
P—Oil Pressure Light H3
Q—Seat Belt Light H5
R—Cargo Box Lift Switch S5 (option)
S—to Front Attachments C5
T—Front Power Connector C6
U—to Front Lights C14
V—Radiator Temperature Switch B1
W—4WD Clutch Y4
X—Center Power Port C90
Y—to Park Brake Switch S3
Z—Center Power Port Fuse (F9) C89
AA—Chassis/Harness Ground
AB—Battery G1
AC—Power Connectors C27, C28
AD—to Seat Belt Switch S7
AE—to Fuse Link C51
AF—Cab Power Connector C100
AG—Alternator (G2) Connectors C4
AH—to Glow Plugs C19
AI— to Fuel Solenoid Y3
AJ—Starting Motor (Y1) Connectors C52
AK—Engine Grounds
AL—Oil Pressure Switch B4
AM—Coolant Temperature Switch B3
AN—Neutral Switch S2
AO—Neutral Switch S2
AP—to Rear Lights C20
AQ—Rear Power Connector C10
AR—to Cargo Box Lift C9 (option)

KK36721,0000122 -19-24OCT14-2/2

Electrical Components—Diesel Engines (SN 110001-)



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MX52301,0000761 -19-27OCT14-1/2

A—Left Headlight C15
B—Fuse Block C13
C—To Radiator Fan Motor C22
D—Right Headlight C17
E—VCU/Connectors C49, C50
F—Accessory Power Port C38
G—Light Switch C7
H—4WD Switch C34
I— Key Switch C3
J— Hour Meter C8
K—Discharge Light C31
L—Park Brake Light C1
M—Temperature/Glow Plug Light C16
N—Oil Pressure Light C18
O—Radiator Temperature Switch B1
P—Seat Belt Light C42
Q—Lights Option C96
R—Diode C97
S—Cargo Box Lift Switch C2(option)
T—4WD Clutch C35
U—Front Attachments C5(switched)
V—Front Power Connector C6
W—To Front Lights C14
X—Center Power Port C90
Y—To Park Brake Switch S3
Z—Chassis/Harness Ground
AA—Battery G1
AB—Center Power Port Fuse (F9) C89
AC—To Seat Belt Switch C11
AD—Power Connectors C27, C28
AE—Optional Attachments Connector C100
AF—To Fuse Link C51
AG—Alternator (G2) Connectors C4
AH—Starting Motor (Y1) Connectors C52
AI— Engine Ground
AJ—To Glow Plugs C19
AK—Coolant Temperature Switch T12
AL—Diode DC22 (SN 120001-)
AM—To Fuel Solenoid C29
AN—Oil Pressure Switch B4
AO—To Rear Lights C20
AP—Rear Power Connector C10
AQ—To Cargo Box Lift C9 (option)
AR—Neutral Switch S2

MX52301,0000761 -19-27OCT14-2/2

Electrical Schematic and Wiring Harness Legend (SN 040001-080000)

Electrical Components:

A1 — Igniter Module (Gas Engines)
A1 — Glow Plug Module (Diesel Engines)
B1 — Radiator Temperature Sensor
B2 — Pulser Coil (Gas Engines)
B3 — Engine Coolant Temperature Switch
B4 — Engine Oil Pressure Switch
E1 — Spark Plug (Gas Engines)
E2 — Spark Plug (Gas Engines)
E3 — Left Headlight
E4 — Right Headlight
F1 — Start Relay and Motor Fuse (30A)
F2 — Radiator Fan Fuse (15A) (Gas Engines)
F2 — Radiator Fan Fuse (25A) (Diesel Engines)
F3 — Voltage Regulator Fuse (25A) (Gas Engines)
F3 — Glow Plugs Fuse (30A) (Diesel Engines)
F4 — Rear Unswitched Options Fuse (40A)
F5 — Accessory Power Port Fuse (10A)
F6 — Switched Power Fuse (15A)
F7 — Front Unswitched Options Fuse (40A)
F8 — Not Used
G1 — Battery
G2 — Stator (Gas Engines)
G2 — Alternator (Diesel Engines) (Option for Gas Engines)
H1 — Park Brake Light
H2 — Engine Coolant Temperature Light
H3 — Engine Oil Pressure Light
H4 — Discharge Light (Diesel Engines)
K1 — Start Relay
K2 — Fan Relay
K3 — 4WD Interlock Relay
M1 — Starting Motor
M2 — Radiator Fan Motor
N1 — Voltage Regulator/Rectifier (Gas Engines)
P1 — Hourmeter
R1 — Carburetor Heater (Gas Engines)
R1 — Glow Plug (Diesel Engines)
R2 — Glow Plug (Diesel Engines)
R3 — Glow Plug (Diesel Engines)
S1 — Key Switch
S2 — Neutral Start Switch
S3 — Park Brake Switch
S4 — Light Switch
S5 — Cargo Box Control Switch (Option)
S6 — 4WD Switch
T1 — Ignition Coil (Gas Engines)
T2 — Ignition Coil (Gas Engines)
V1 — Diode
W1 — Shielded Ground
Y1 — Starting Motor Solenoid
Y2 — Fuel Pump (Gas Engines)
Y3 — Fuel Shutoff Solenoid
Y4 — 4WD Clutch

Connectors:

X1 — Main Wiring Harness to W2 Engine Wiring Harness Connector (Gas Engines)
X2 — Main Wiring Harness to Y2 Fuel Pump (Gas Engines)
X3 — Main Wiring Harness to N1 Voltage Regulator/Rectifier (Gas Engines)
X3 — Main Wiring Harness to Y3 Fuel Shutoff Solenoid (Diesel Engines)
X4 — N1 Voltage Regulator/Rectifier to G2 Alternator (Gas Engines)
X4 — Main Wiring Harness to G2 Alternator
X5 — Main Wiring Harness to M2 Radiator Fan Motor
X6 — W2 to W3 Engine Wiring Harnesses
X6a — Engine Wiring Harness to B2 Pulser Coil (Gas Engines)
X7 — Main Wiring Harness Optional Attachments Connector (Front) Switched Power
X8 — Main Wiring Harness Optional Attachments Connector (Mid) Switched Power
X9 — Main Wiring Harness to Cargo Box Control Switch (Option)
X10 — Main Wiring Harness to Cargo Box Raise/Lower Motor (Option)
X11 — Main Wiring Harness to Left Headlight
X12 — Main Wiring Harness to Right Headlight
X13 — Main Wiring Harness to Accessory Power Port
X14 — Main Wiring Harness Optional Attachments Connector (Front) Unswitched Power
X15 — Main Wiring Harness to Front Lights Harness (Option)
X16 — Main Wiring Harness to Rear Lights Harness (Option)
X17 — Main Wiring Harness Optional Attachments Connector (Rear) Unswitched Power
X18 — Main Wiring Harness to 4WD Clutch

KK36721,0000123 -19-24OCT14-1/1

Electrical Schematic and Wiring Harness Legend (Gas Engines SN 080001-)

B1 — Radiator Temperature Switch
B3 — Engine Coolant Temperature Switch
B4 — Engine Oil Pressure Switch
C1 — Park Brake Light Connector
C2 — Cargo Box Lift Switch Connector
C3 — Key Switch Connector
C4 — Alternator Connector
C5 — Front Options Connector (Switched)
C6 — Front Options Connector (Unswitched)
C7 — Light Switch Connector
C8 — Hour Meter Connector
C9 — Cargo Box Lift Power Connector
C10 — Rear Options Power Connector (Unswitched)
C11 — Front Lights Connector Connector
C12 — Neutral Start Switch Connector
C13 — Fuse Block Connector
C14 — Engine Connector
C15 — Left Headlight Connector
C17 — Right Headlight Connector
C16 — Engine Coolant Temperature Light Connector
C18 — Engine Oil Pressure Light Connector
C19 — Rear Lights Connector
C20 — N1 Voltage Retulator/Rectifier Connector
C21 — Diode Connector
C22 — Radiator Fan Motor Connector
C23 — Radiator Temperature Switch Connector
C24 — Fuse Block Connector
C25 — Start Relay Connector
C26 — Fan Relay Connector
C28 — Cab Solenoid Connector (Power)
C27 — Cab Solenoid (Ground) Connector
C29 — Fuel Pump Connector
C30 — Seat Belt Switch Connector
C31 — Seat Belt Light Relay Connector
C32 — Seat Belt Light Connector
C33 — 4WD Interlock Relay Connector
C34 — 4WD Switch Connector
C35 — 4WD Clutch Connector
C38 — Accessory Power Port Connector
C89 — Fuse Holder Connector
C90 — Power Port Connector
C96 — Lights Option Connector
C97 — Diode Connector
C100 — Mid Options Power Connector
CT-6 — Starting Motor Connector
E3 — Left Headlight
E4 — Right Headlight
F1 — Fuse, Start Motor Solenoid (30A)
F2 — Fuse, Radiator Fan (15A)
F3 — Fuse, Voltage Regulator/Rectifier (25A)
F4 — Fuse (SN 080001-110000), Rear Optional Attachments (40A)
F4 — Fuse (SN 110001-), Lights (10A)
F5 — Fuse, Accessory Power Port (10A)
F6 — Fuse, Key Switch (15A)
F7 — Fuse, Front Optional Attachments (40A)
F8 — (SN 080001-110000), Not Used
F8 — Fuse (SN 110001-), Rear Optional Attachments (40A)
F9 — Fuse, Center Power Port (10A)
G2 — Stator
H1 — Park Brake Light
H2 — Engine Coolant temperature Light
H3 — Engien Oil Pressure Light
H31 — Seat Belt Light
K1 — Start Relay
K2 — Fan Relay
K3 — 4WD Interlock Relay
K31 — Seat Belt Light relay
M1 — Starting Motor
M2 — Radiator Fan Motor
N1 — Voltage Regulator/Rectifier
P1 — Hour Meter
S1 — Key Switch
S2 — Neutral Start Switch
S3 — Park Brake Switch
S4 — Light Switch
S5 — Cargo Box Lift Switch (Option)
S6 — 4WD Switch
S32 — Seat Belt Switch
T7 — Frame Ground
T8 — Fuse Links
T9 — Park Brake Switch (Power)
T10 — Park Brake Switch
T11 — Battery Power
V2 — Diode
V1 — Diode
Y1 — Starting Motor Solenoid
Y2 — Fuel Pump
Y4 — 4WD Clutch

MX52301,0000765 -19-27OCT14-1/1

Electrical Schematic and Wiring Harness Legend (Diesel Engines SN 080001-110000)

Electrical Components and Connectors:

A2 — Vehicle Control Unit (VCU)
B1 — Radiator Temperature Switch
B3 — Coolant Temperature Switch
B4 — Engine Oil Pressure Switch
B5 — Speed Sensor
C2 — Cargo Box Lift Switch Connector
C3 — Key Switch Connector
C4 — G2 Alternator Connector
C5 — Front Attachments Connector
C6 — Front Power Connector
C7 — Light Switch Connector
C8 — Hour Meter Connector
C9 — Cargo Box Lift Connector
C10 — Rear Power Connector
C11 — Seat Switch Connector
C12 — Neutral Switch Connector
C13 — Fuse Block
C14 — Front Lights Connector
C15 — Left Headlight Connector
C17 — Right Headlight Connector
C19 — Glow Plug Power Connector
C20 — Rear Lights Connector
C22 — Radiator Fan Connector
C23 — Radiator Temperature Switch Connector
C26 — Speed Sensor Connector
C27 — Ground Connector
C28 — Power Connector
C29 — Fuel Shutoff Solenoid Connector
C34 — Fuel Shutoff Solenoid Connector
C35 — 4WD Clutch Connector
C38 — Front Power Port Connector
C49 — VCU Connector (J2)
C50 — VCU Connector (J2)
C51 — 218 Fuse Link Connector
C52 — Y1 Start Motor Solenoid Connector
C89 — F9 Fuse Holder
C90 — Center Power Port
C98 — EPAS Unit Connector
C99 — EPAS LED Connector
C100 — Cab Power Connector
ECM — Electronic Control Module
EPAS — Electric Power Assist Steering (some models)
E3 — Left Headlight
E4 — Right Headlight
F1 — Fuse, Front Power Port (10A)
F2 — not used
F3 — Fuse, Front Power Connector (40A)
F4 — Fuse, Rear Power Connector (40A)
F5 — Fuse, Radiator Fan (30A)
F6 — Fuse, Glow Plugs (30A)
F7 — Fuse, Start Motor Solenoid (30A)
F8 — Fuse, Accessory Power (15A)
F9 — Fuse, Center Power Port (10A)
G1 — Battery
G2 — Alternator
H1 — Park Brake Light
H2 — Temperature and Glow Plug Light
H3 — Oil Pressure Light
H4 — Discharge Light
H5 — Seat Belt Light
M1 — Starting Motor
M2 — Radiator Fan Motor
P1 — Hour Meter
R1-2-3 — Glow Plugs
S-(X) — Splice
S1 — Key Switch
S2 — Neutral Switch
S3 — Park Brake Switch
S4 — Light Switch
S5 — Cargo Box Lift Switch (option)
S6 — 4WD Switch
S7 — Seat Belt Switch
W2 — Battery Wiring Harness
Y1 — Starting Motor Solenoid
Y3 — Fuel Shutoff Solenoid
Y4 — 4WD Clutch

KK36721,0000124 -19-27OCT14-1/1

Electrical Schematic and Wiring harness Legend (Diesel Engines SN 110001-)

Electrical Components and Connectors:

A2 — Vehicle Control Unit (VCU)
B1 — Radiator Temperature Switch
B3 — Coolant Temperature Switch
B4 — Engine Oil Pressure Switch
B5 — Speed Sensor
C1 — Park Brake Light Connector
C2 — Cargo Box Lift Switch Connector
C3 — Key Switch Connector
C4 — G2 Alternator Connector
C5 — Front Attachments Connector
C6 — Front Power Connector
C7 — Light Switch Connector
C8 — Hour Meter Connector
C9 — Cargo Box Lift Connector
C10 — Optional Rear Power Connector (Unswitched)
C11 — Seat Belt Switch Connector
C12 — Neutral Switch Connector
C13 — Fuse Block
C14 — Front Lights Connector
C15 — Left Headlight Connector
C17 — Right Headlight Connector
C18 — Engine Oil Pressure Light
C19 — Glow Plug Power Connector
C20 — Rear Lights Connector
C22 — Radiator Fan Connector
C23 — Radiator Temperature Switch Connector
C27 — Ground Connector
C28 — Power Connector
C29 — Fuel Shutoff Solenoid Connector
C31 — Discharge Light Connector
C34 — Fuel Shutoff Solenoid Connector
C35 — 4WD Clutch Connector
C38 — Front Power Port Connector
C42 — Seat Belt Light
C49 — VCU Connector (J2)
C50 — VCU Connector (J1)
C51 — 218 Fuse Link Connector
C52 — Y1 Start Motor Solenoid Connector
C89 — F9 Fuse Holder
C90 — Center Power Port
C96 — Optional Lights Connector
C97 — Diode
C100 — Mid Optional Attachments Connector
E3 — Left Headlight
E4 — Right Headlight
F1 — Fuse, Rear Power Connector (40A)
F2 — Fuse, Front Power Connector (40A)
F3 — Fuse, Front Power Port (10A)
F4 — Fuse, Lights (10A)
F5 — Fuse, Radiator Fan (30A)
F6 — Fuse, Glow Plugs (30A)
F7 — Fuse, Start Motor Solenoid (30A)
F8 — Fuse, Accessory Power (15A)
F9 — Fuse, Center Power Port (10A)
G1 — Battery
G2 — Alternator
H1 — Park Brake Light
H2 — Temperature and Glow Plug Light
H3 — Oil Pressure Light
H4 — Discharge Light
H5 — Seat Belt Light
M1 — Starting Motor
M2 — Radiator Fan Motor
P1 — Hour Meter
R1-2-3 — Glow Plugs
S-(X) — Splice
S1 — Key Switch
S2 — Neutral Switch
S3 — Park Brake Switch
S4 — Light Switch
S5 — Cargo Box Lift Switch (option)
S6 — 4WD Switch
S7 — Seat Belt Switch
T4 — Oil Pressure Switch Connector
T7 — Ground
T9 — Park Brake Switch Connector (Power)
T10 — Park Brake Switch Connector
T13 — Ground Connector
W2 — Battery Wiring Harness
Y1 — Starting Motor Solenoid
Y3 — Fuel Shutoff Solenoid
Y4 — 4WD Clutch

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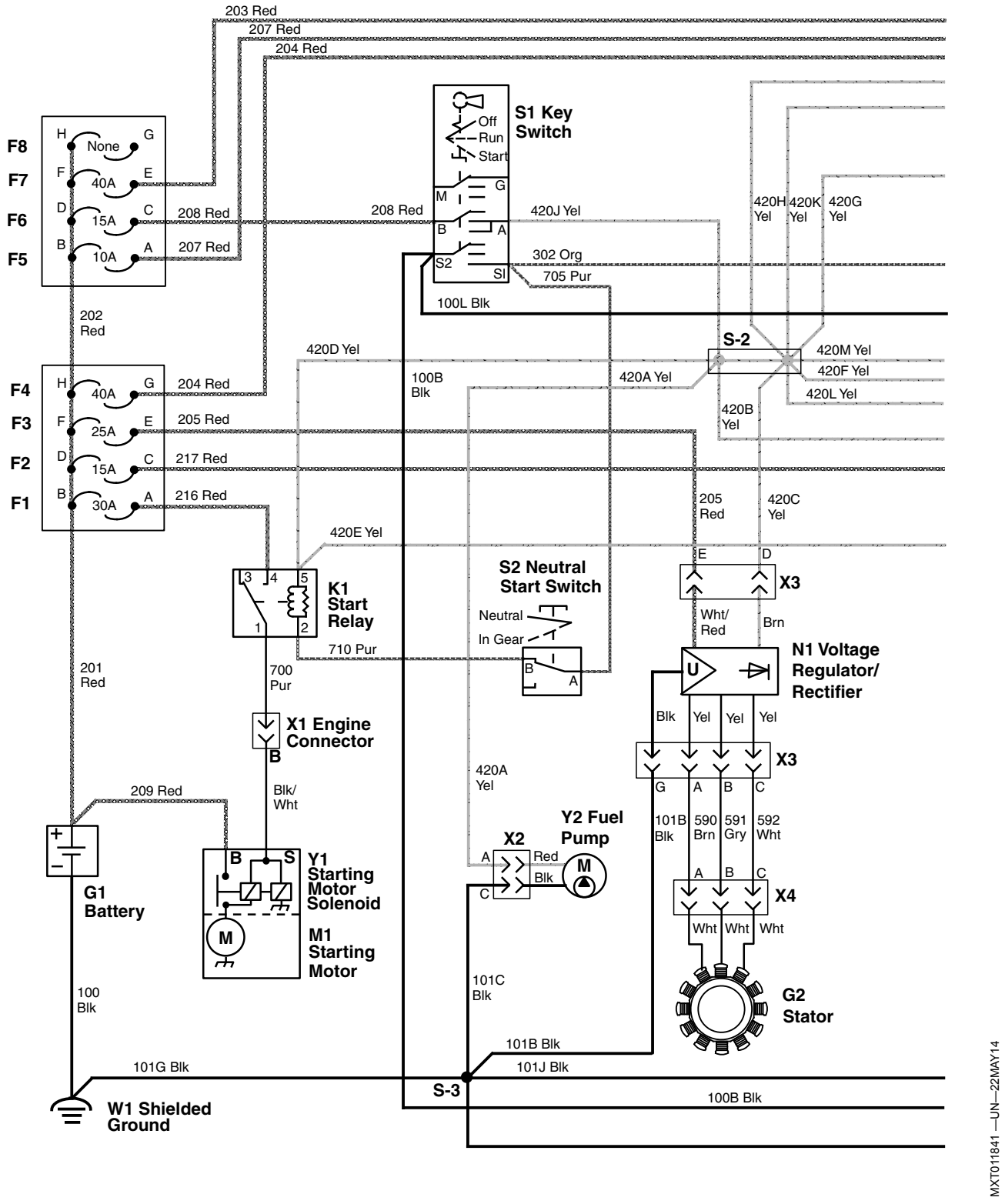
Group 40
Schematics and Harnesses (SN -040000)

Summary of References

- Main Schematic (Gas Engines SN -040000)
- Main Wiring Harness (Gas Engines SN -040000)
- Main Harness Wire Codes (Gas Engines SN -040000)
- W2 Engine Wiring Harnesses (Gas Engines SN -040000)
- Main Schematic (Diesel Engines SN -040000)
- Main Wiring Harness (Diesel Engines SN -040000)
- Main Harness Wire Color Codes (Diesel Engines SN -040000)

MX52301,0000444 -19-22OCT14-1/1

Main Schematic (Gas Engines SN -040000)



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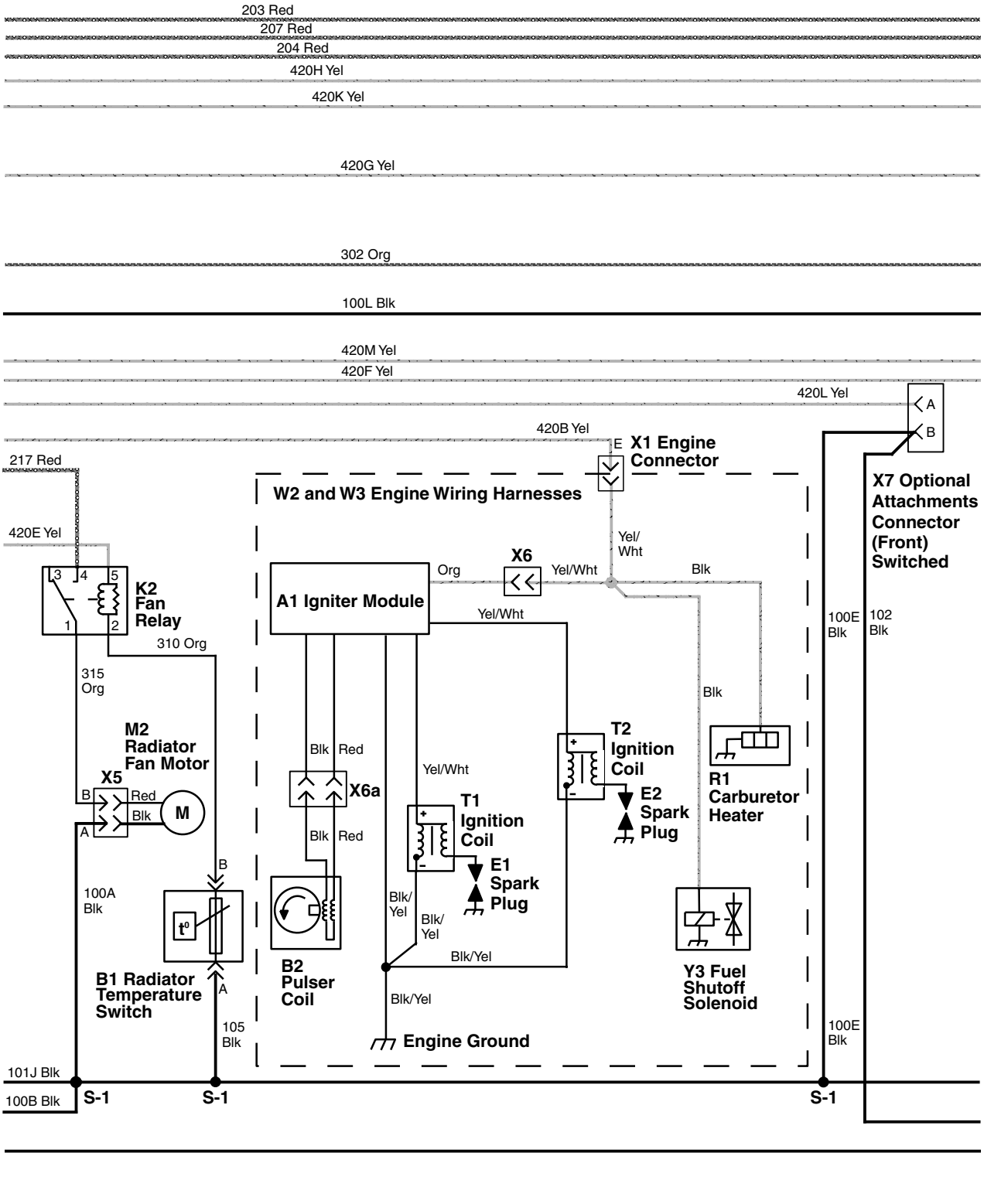
MX52301,00000F1 -19-24OCT14-1/4

Main Schematic (Gas Engines SN -040000) 2 of 4



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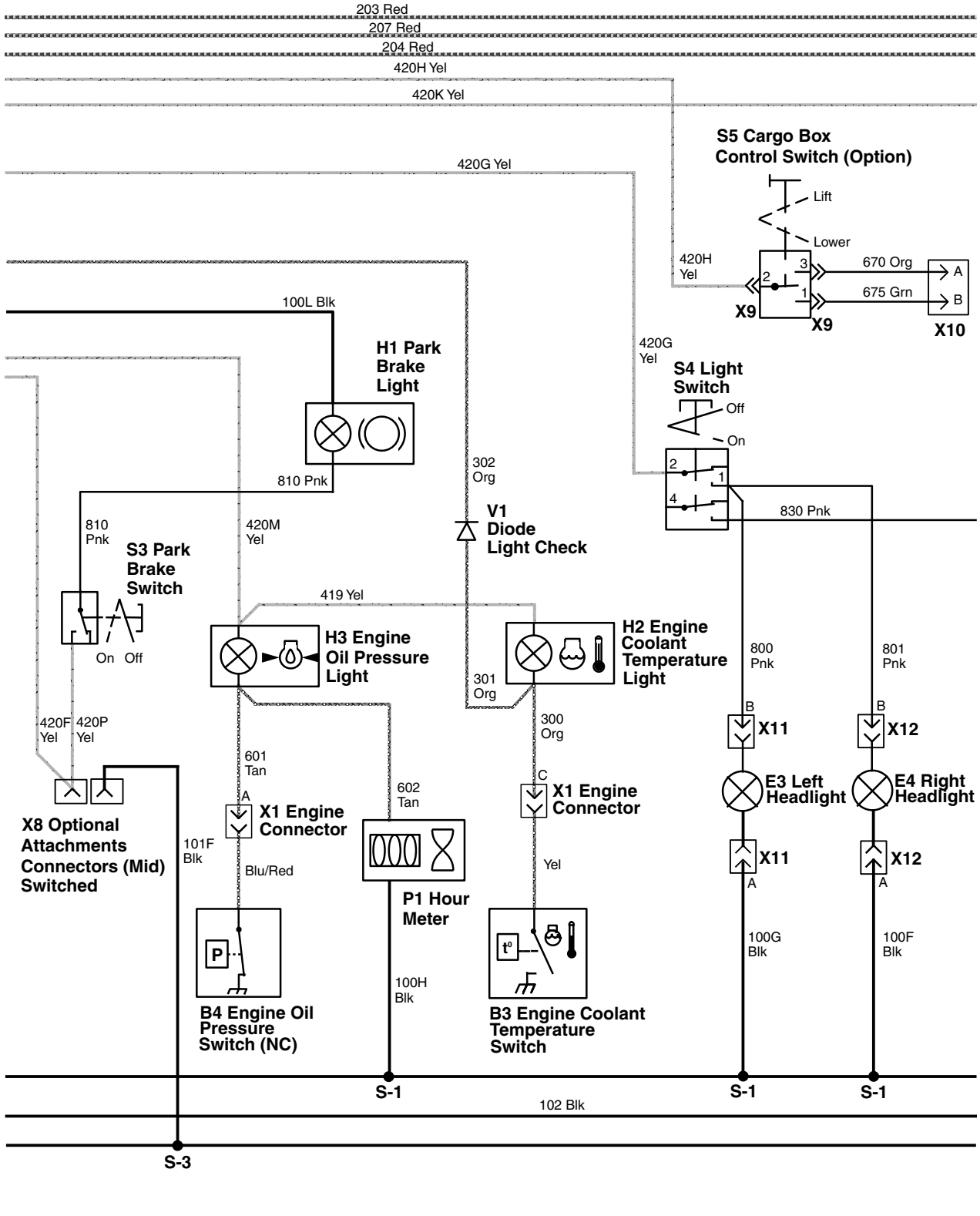
MX52301,00000F1 -19-24OCT14-2/4

Main Schematic (Gas Engines SN -040000) 3 of 4



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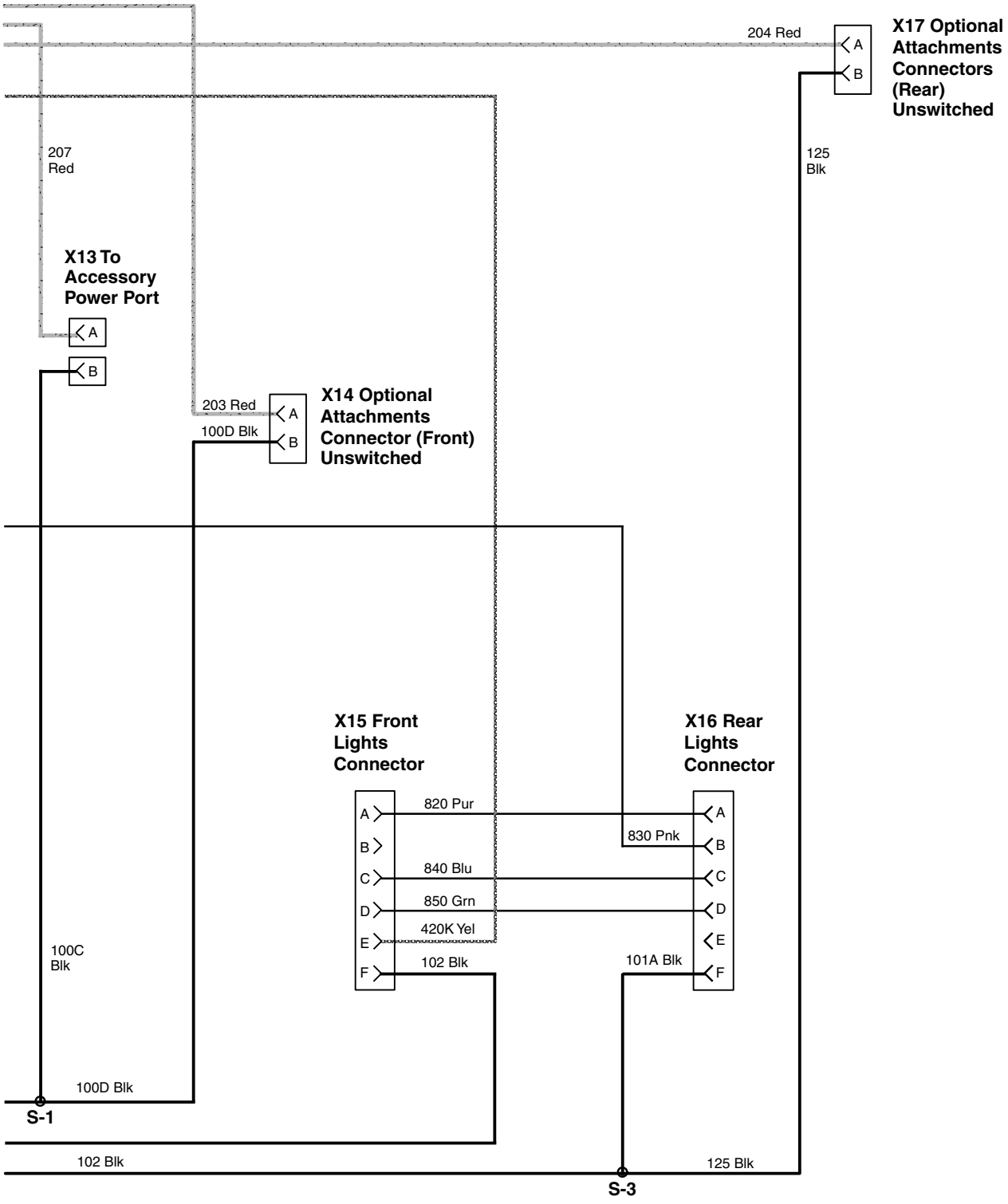
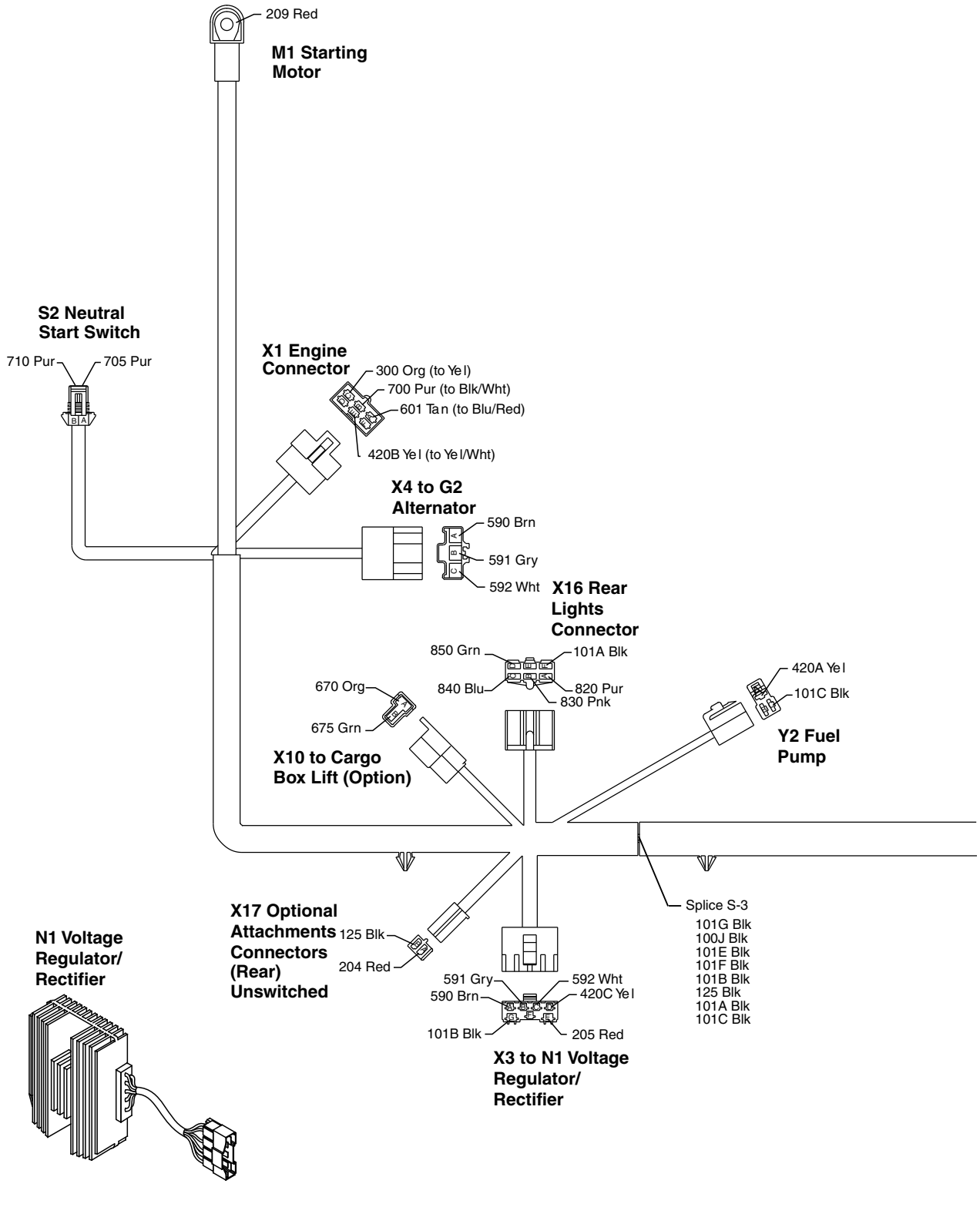
MX52301,00000F1 -19-24OCT14-3/4

Main Schematic (Gas Engines SN -040000) 4 of 4



MX52301,00000F1 -19-24OCT14-4/4

Main Wiring Harness (Gas Engines SN -040000)



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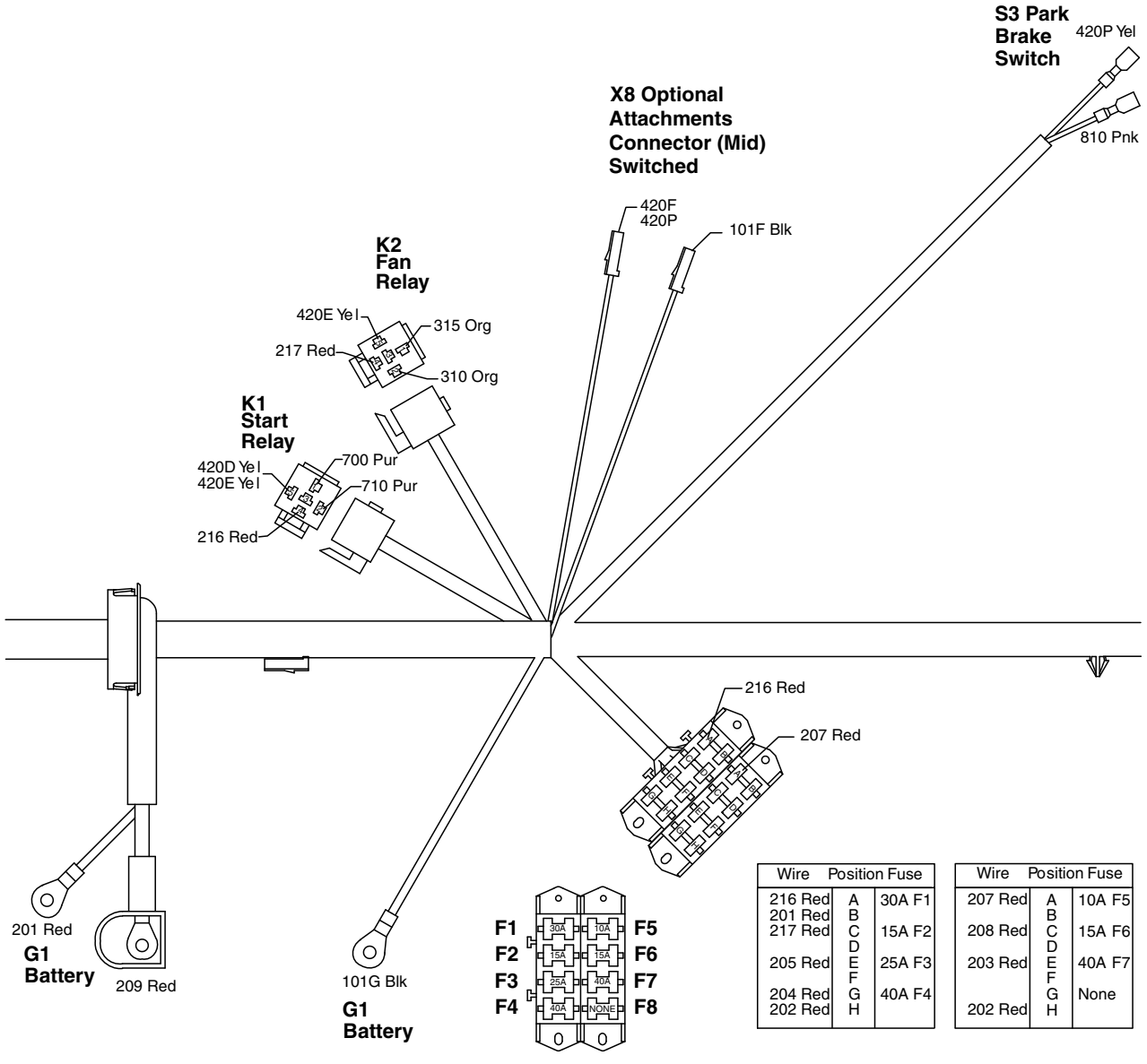
MX52301,00000F2 -19-24OCT14-1/4

Main Wiring Harness (Gas Engines SN -040000) 2 of 4



Wire	Position	Fuse
216 Red	A	30A F1
201 Red	B	
217 Red	C	15A F2
	D	
205 Red	E	25A F3
	F	
204 Red	G	40A F4
202 Red	H	

Wire	Position	Fuse
207 Red	A	10A F5
	B	
208 Red	C	15A F6
	D	
203 Red	E	40A F7
	F	
	G	None
202 Red	H	

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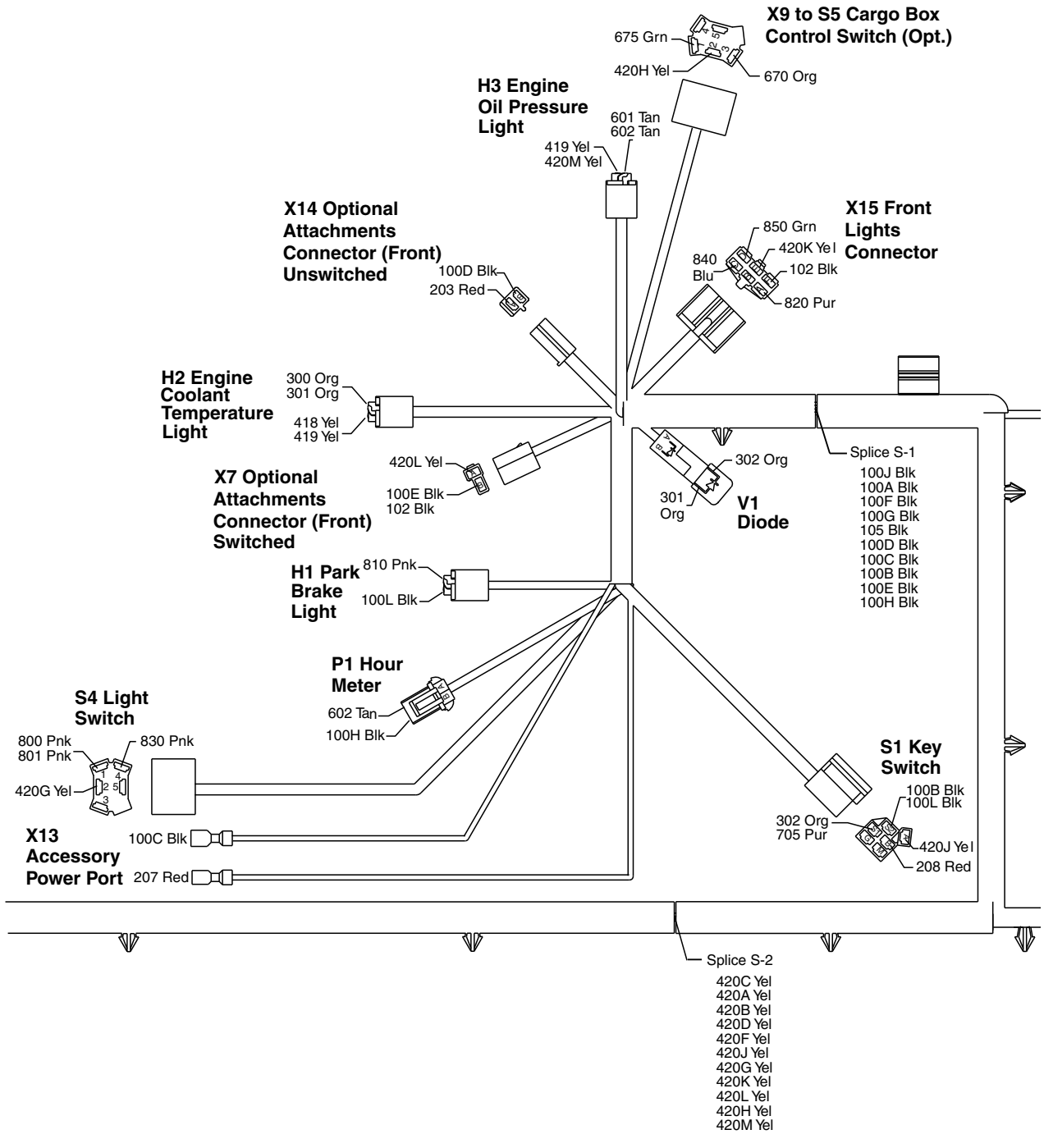
MX52301,00000F2 -19-24OCT14-2/4

Main Wiring Harness (Gas Engines SN -040000) 3 of 4



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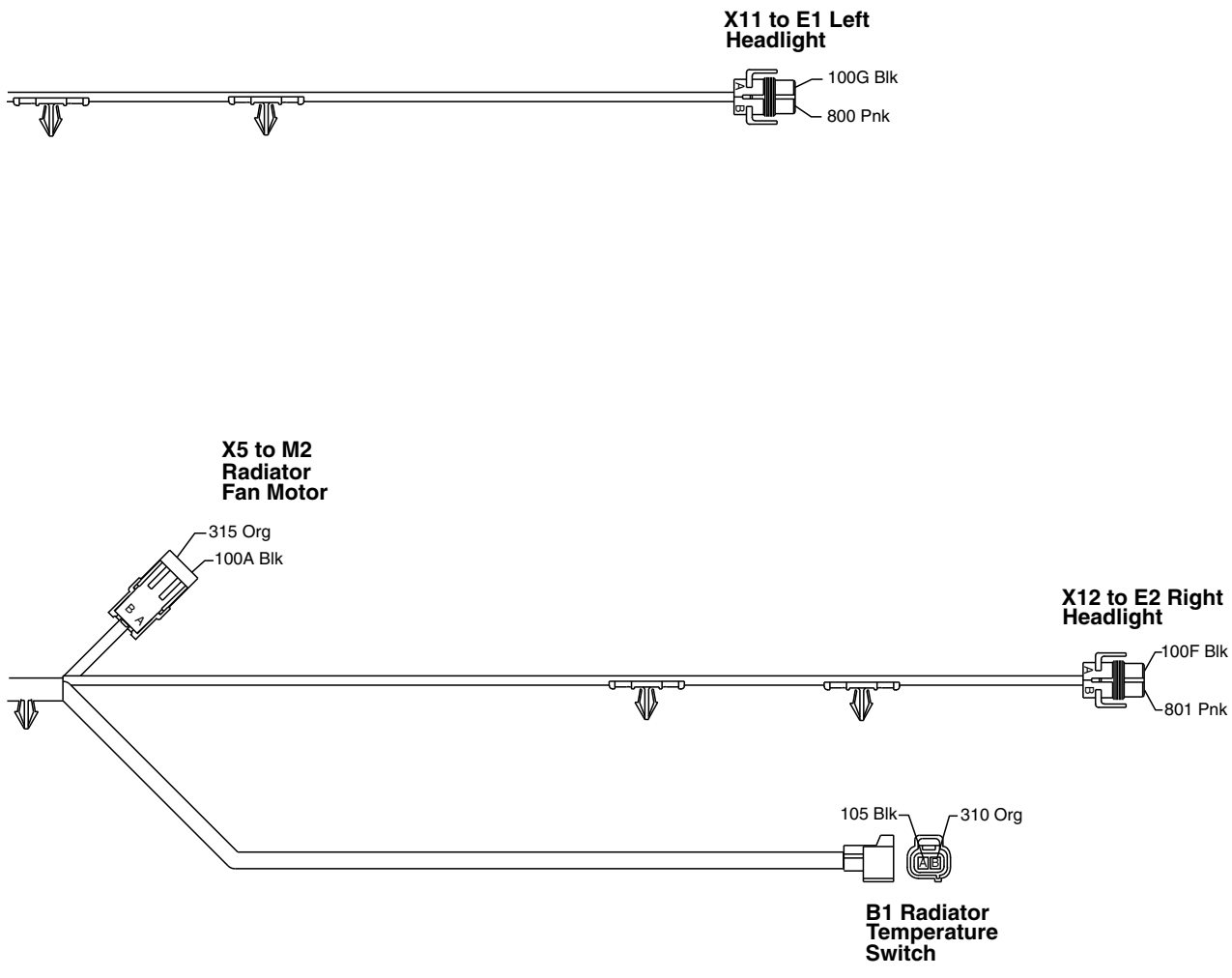
MX52301,00000F2 -19-24OCT14-3/4

Main Wiring Harness (Gas Engines SN -040000) 4 of 4



MX52301,00000F2 -19-24OCT14-4/4

Main Harness Wire Codes (Gas Engines SN -040000)

Size/No./Color	Wire Connection Points
2.0 100A Blk	S-1, X5 [A] (M2)
1.0 100B Blk	S1 [S2], S-1
2.0 100C Blk	X13, S-1
3.0 100D Blk	S-1, X14 [B]
1.0 100E Blk	S-1, X7 [B]
0.8 100F Blk	S-1, X12 [A]
0.8 100G Blk	S-1, X11 [A]
0.8 100H Blk	P1 [B], S-1
3.0 100J Blk	S-1, S-3
3.0 100L Blk	H1, S1 [S2]
1.0 101A Blk	S-3, X16 [F]
3.0 101B Blk	S-3, X3 [G] (N1)
0.8 101C Blk	S-3, X2 [C] (Y2)
0.8 101F Blk	X8, S-3
5.0 101G Blk	W1, S-3
1.0 102 Blk	X7 [B], X15 [F]
0.8 105 Blk	S-1, B1 [A]
3.0 125 Blk	S-3, X17 [B]
5.0 201 Red	G1, Fuse Block
2.0 202 Red	Jumper
3.0 203 Red	F7, X14 [A]
3.0 204 Red	F4, X17 [A]
3.0 205 Red	F3, X3 [E] (N1)
2.0 207 Red	F5, X13 (Power Port)
2.0 208 Red	F6, S1 [B]
6.0 209 Red	G1, M1
3.0 216 Red	F1, K1 [4]
2.0 217 Red	F2, K2 [4]
0.8 300 Org	X1 [C], H2
0.8 301 Org	H2, V1 [B]
0.8 302 Org	V1 [A], S1 [S1]
0.8 310 Org	K2 [2], B1 [B]
2.0 315 Org	K2 [1], X5 [B] (Me)
0.8 419 Yel	H3, H2
0.8 420A Yel	S-2, X2 [A] (Y2)
0.8 420B Yel	S-2, X1 [E]
1.0 420C Yel	S-2, X3 [D] (N1)
0.8 420D Yel	S-2, K1 [5]
0.8 420E Yel	K1 [5], K2 [5]
0.8 420F Yel	S-2, X8
1.0 420G Yel	S-2, S4 [2]
0.8 420H Yel	S-2, X9 [2] (S5)
2.0 420J Yel	S1 [A], S-2
1.0 420K Yel	S-2, X15 [E]
1.0 420L Yel	S-2, X7 [A]
0.8 420M Yel	S-2, H3
0.8 420P Yel	X8, S3
2.0 590 Brn	X4 [A] (G2), X3 [A] (N1)
2.0 591 Gry	X4 [B] (G2), X3 [B] (N1)
2.0 592 Wht	X4 [C] (G2), X3 [C] (N1)
0.8 601 Tan	H3, X1 [A] (B4)
0.8 602 Tan	H3, P1 [A]
1.0 670 Org	X9 [3] (S5), X10 [A]
1.0 675 Grn	X9 [1] (S5), X10 [B]
3.0 700 Pur	K1 [1], X1 [B] (Y1)
0.8 705 Pur	S2 [A], S1 [S1]
0.8 710 Pur	K1 [2], S2 [B]
0.8 800 Pnk	S4 [1], X11 [B] (E3)
0.8 801 Pnk	S4 [1], X12 [B] (E4)
0.8 810 Pnk	S3, H1
1.0 820 Pur	X15 [A], X16 [A]
1.0 830 Pnk	S4 [4], X16 [B]
1.0 840 Blu	X15 [C], X16 [C]
1.0 850 Grn	X15 [D], X16 [D]

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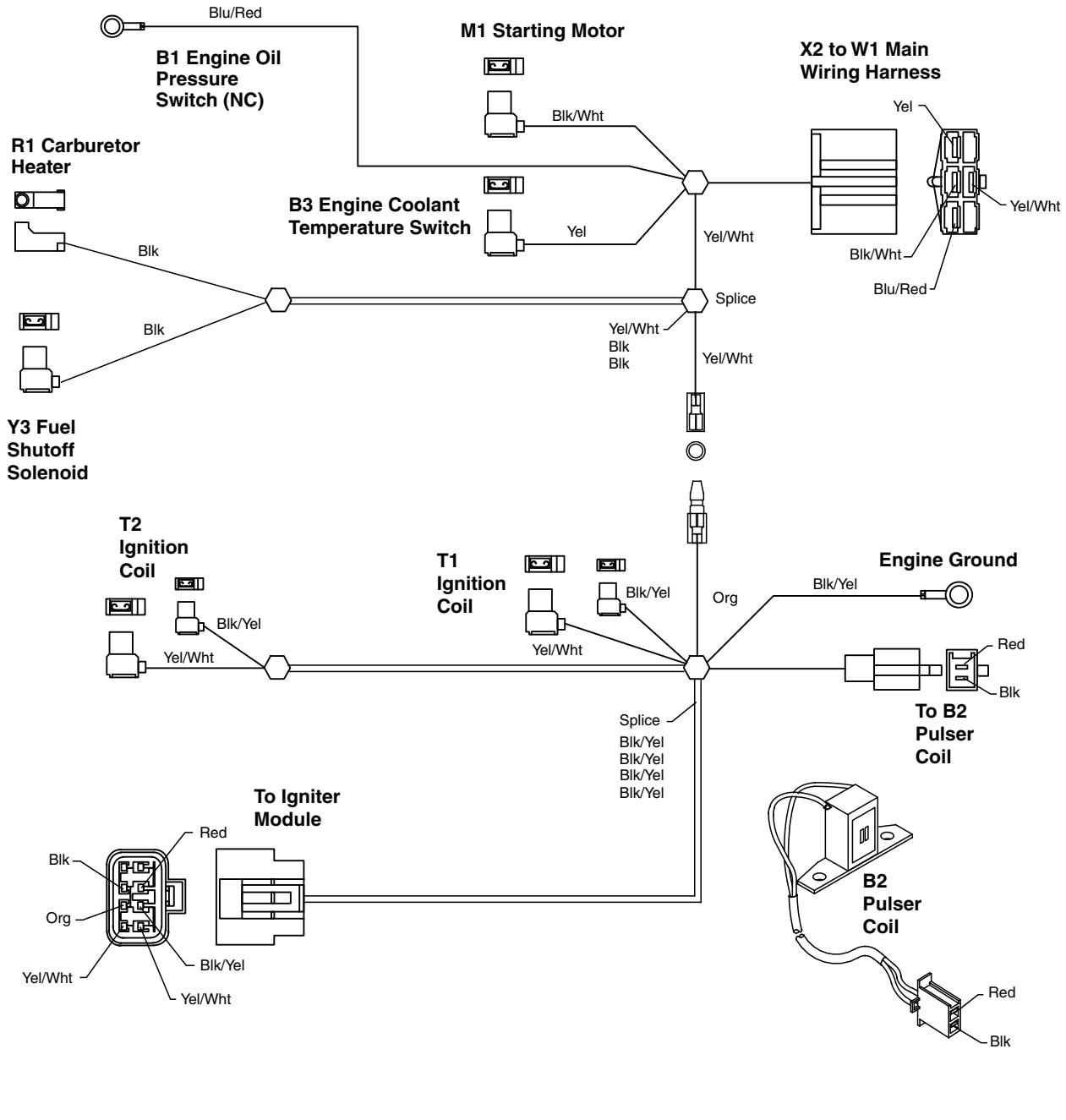
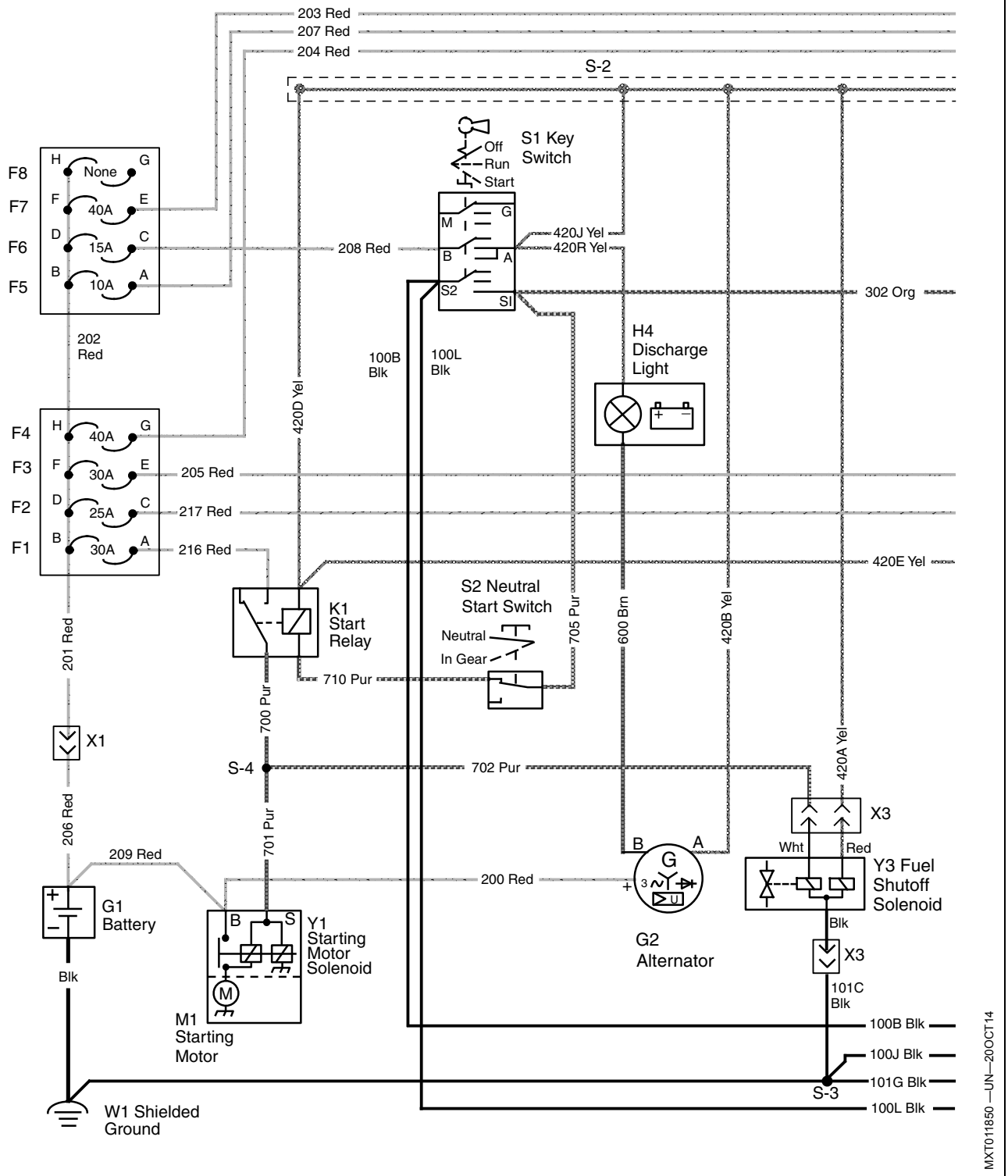
W2 Engine Wiring Harnesses (Gas Engines SN -040000)

W2 Engine Wiring Harnesses (Gas Engine)



MX52301,00000F4 -19-24OCT14-1/1

Main Schematic (Diesel Engines SN -040000)



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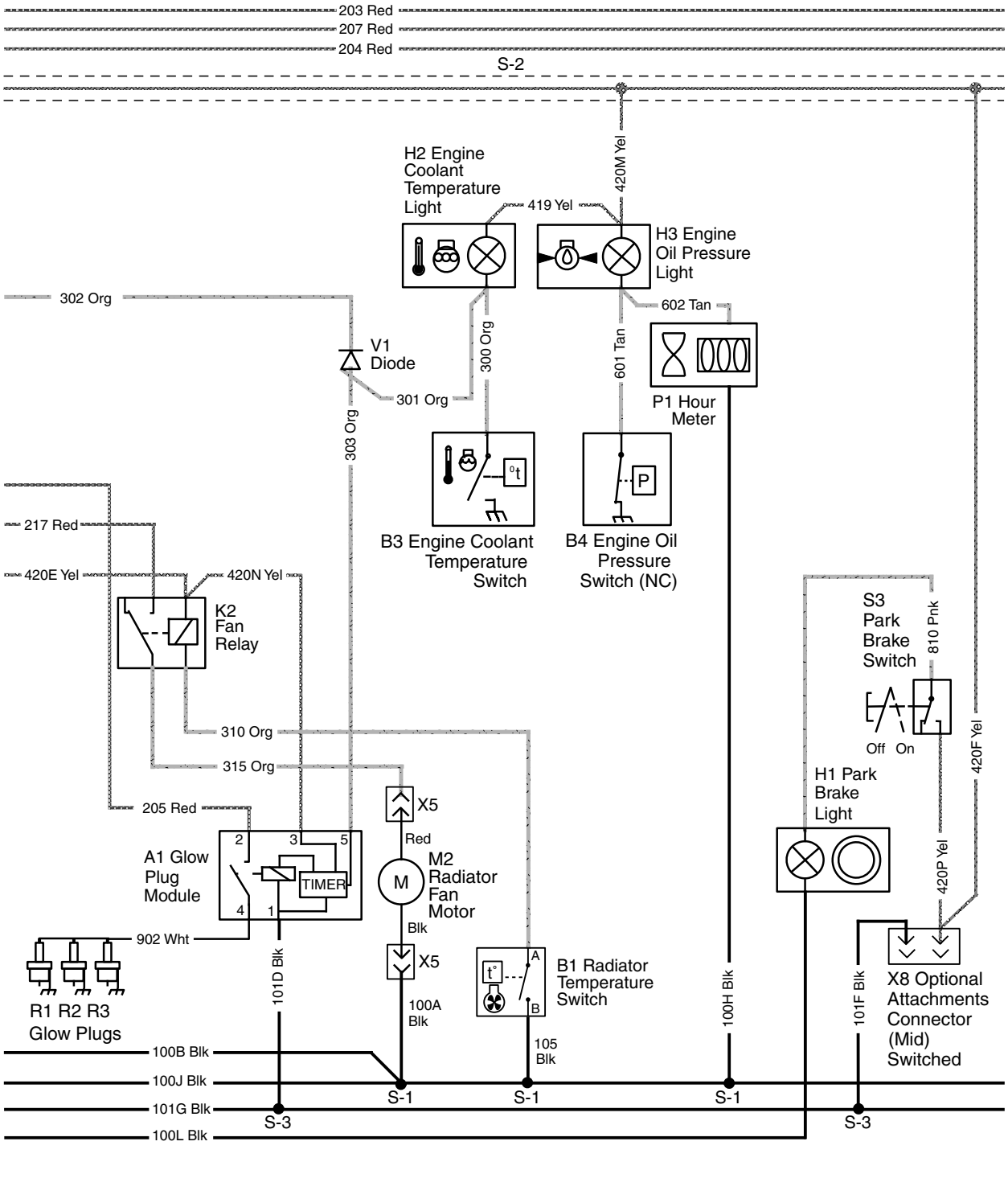
Main Schematic (Diesel Engines SN -040000) 2 of 3



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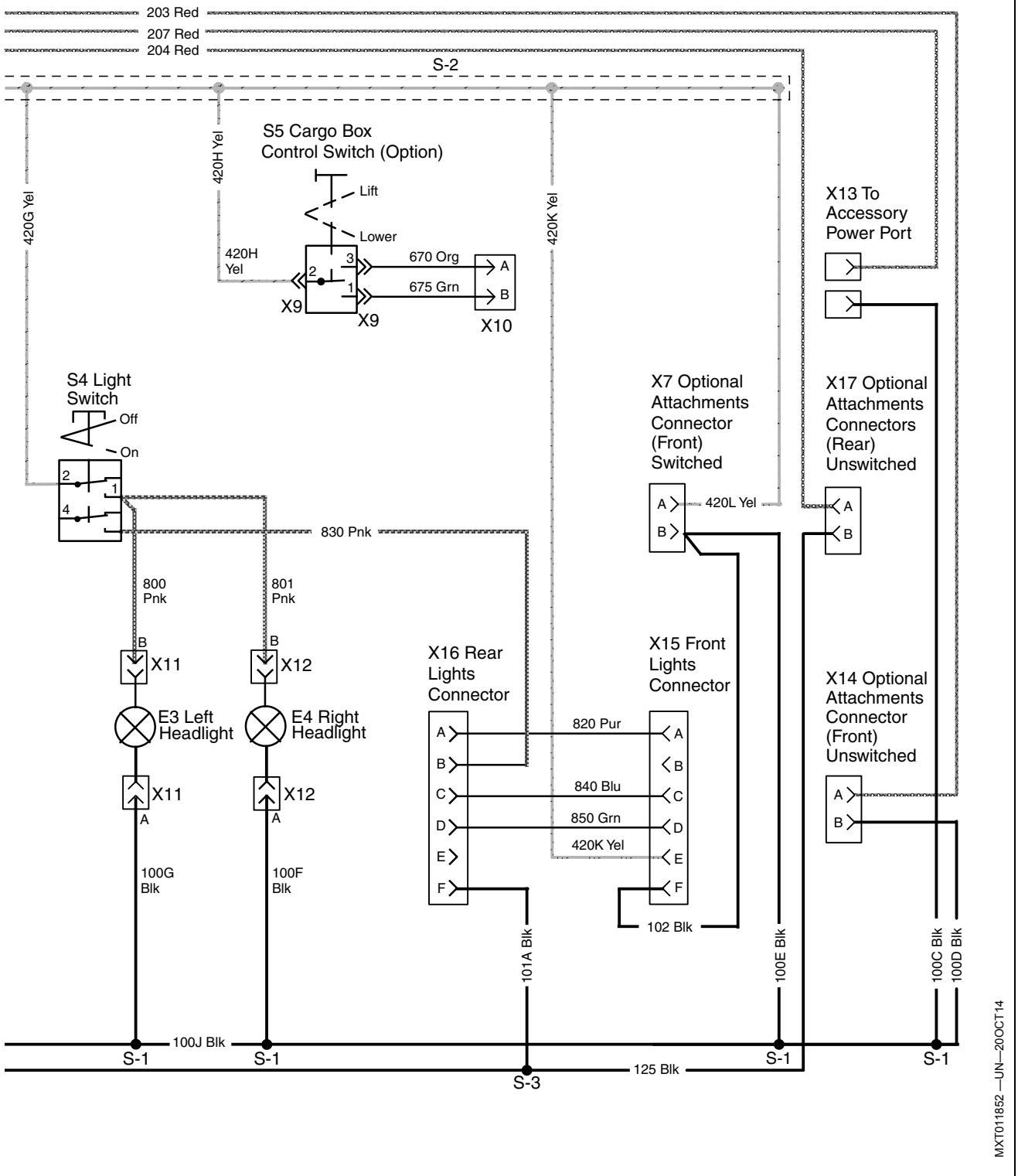
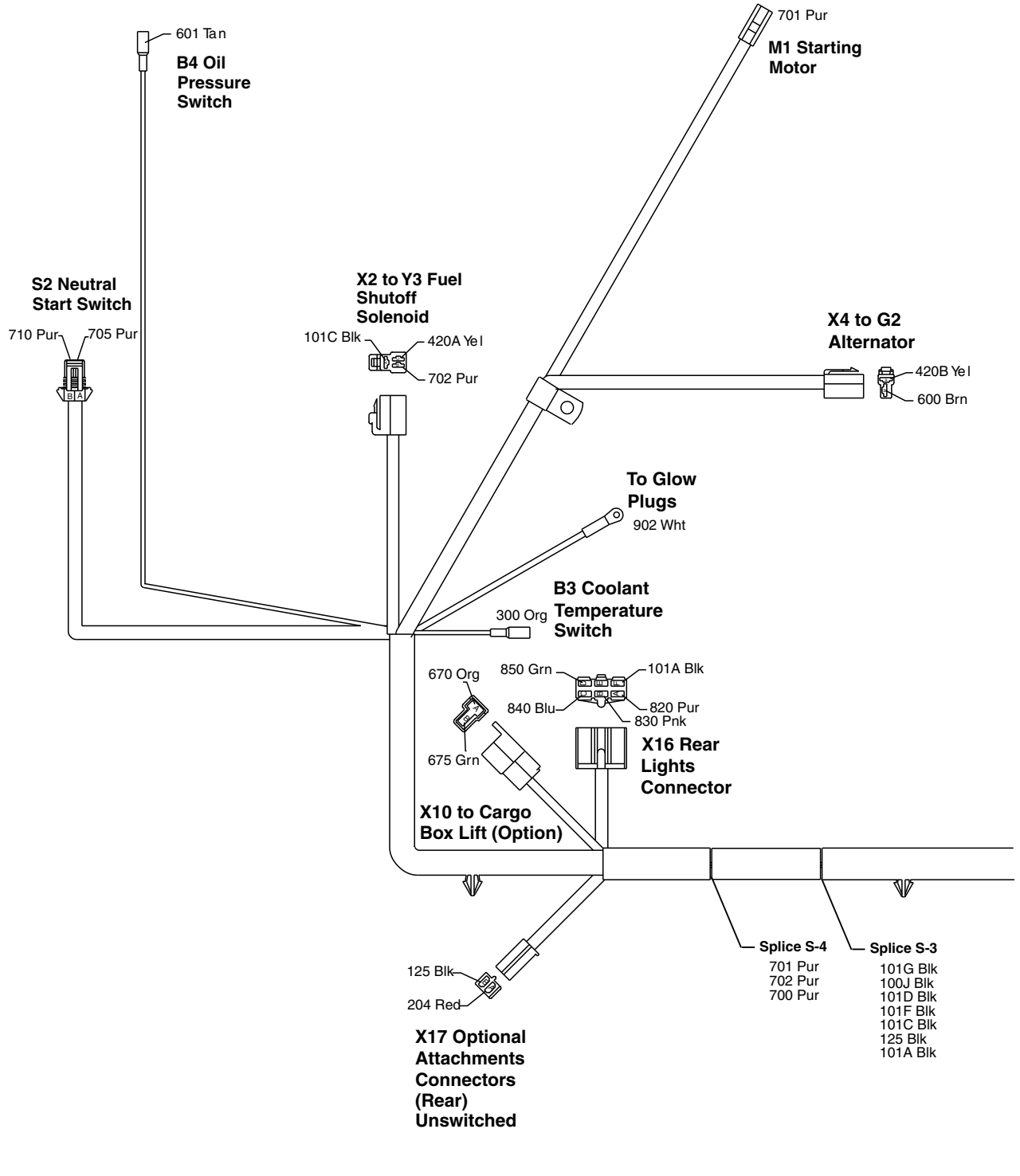
MX52301,00000F5 -19-24OCT14-2/3

Main Schematic (Diesel Engines SN -040000) 3 of 3



MX52301,00000F5 -19-24OCT14-3/3

Main Wiring Harness (Diesel Engines SN -040000)



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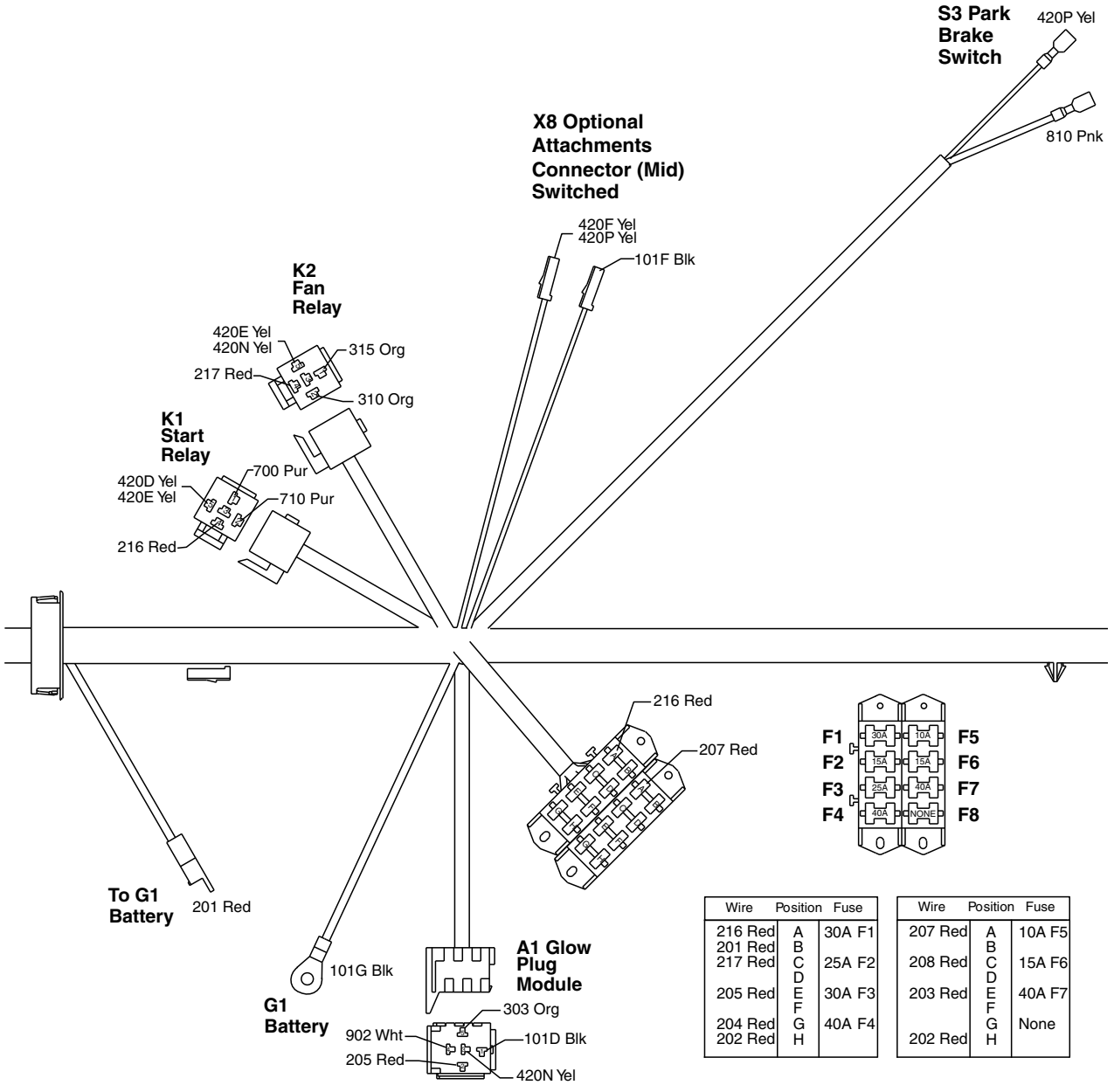
Main Wiring Harness (Diesel Engines SN -040000) 2 of 4



Wire	Position	Fuse
216 Red	A	30A F1
201 Red	B	
217 Red	C	25A F2
205 Red	D	30A F3
	E	
204 Red	F	40A F4
202 Red	G	
	H	

Wire	Position	Fuse
207 Red	A	10A F5
	B	
208 Red	C	15A F6
203 Red	D	40A F7
	E	
	F	None
202 Red	G	
	H	

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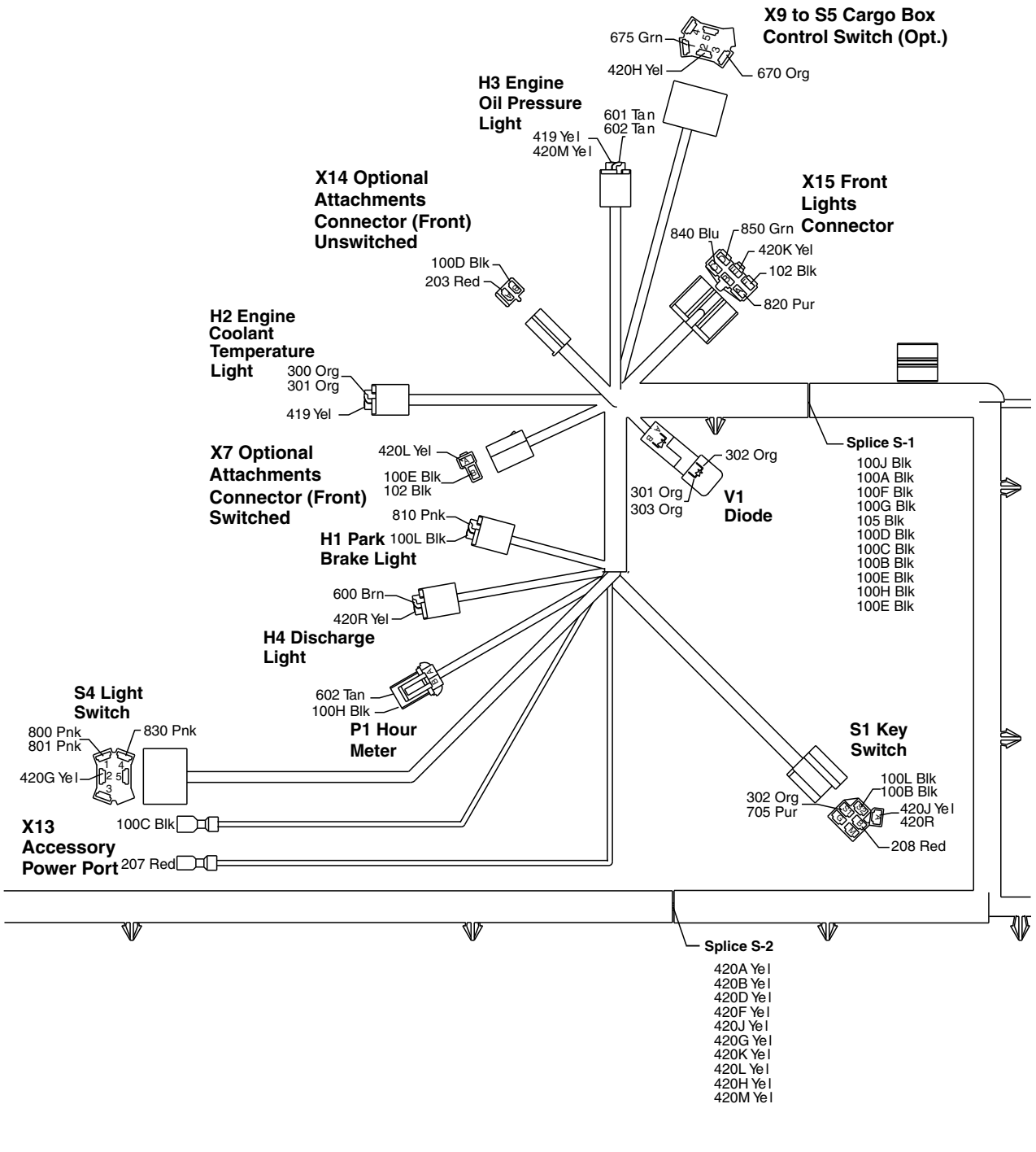
MX52301,00000F6 -19-24OCT14-2/4

Main Wiring Harness (Diesel Engines SN -040000) 3 of 4



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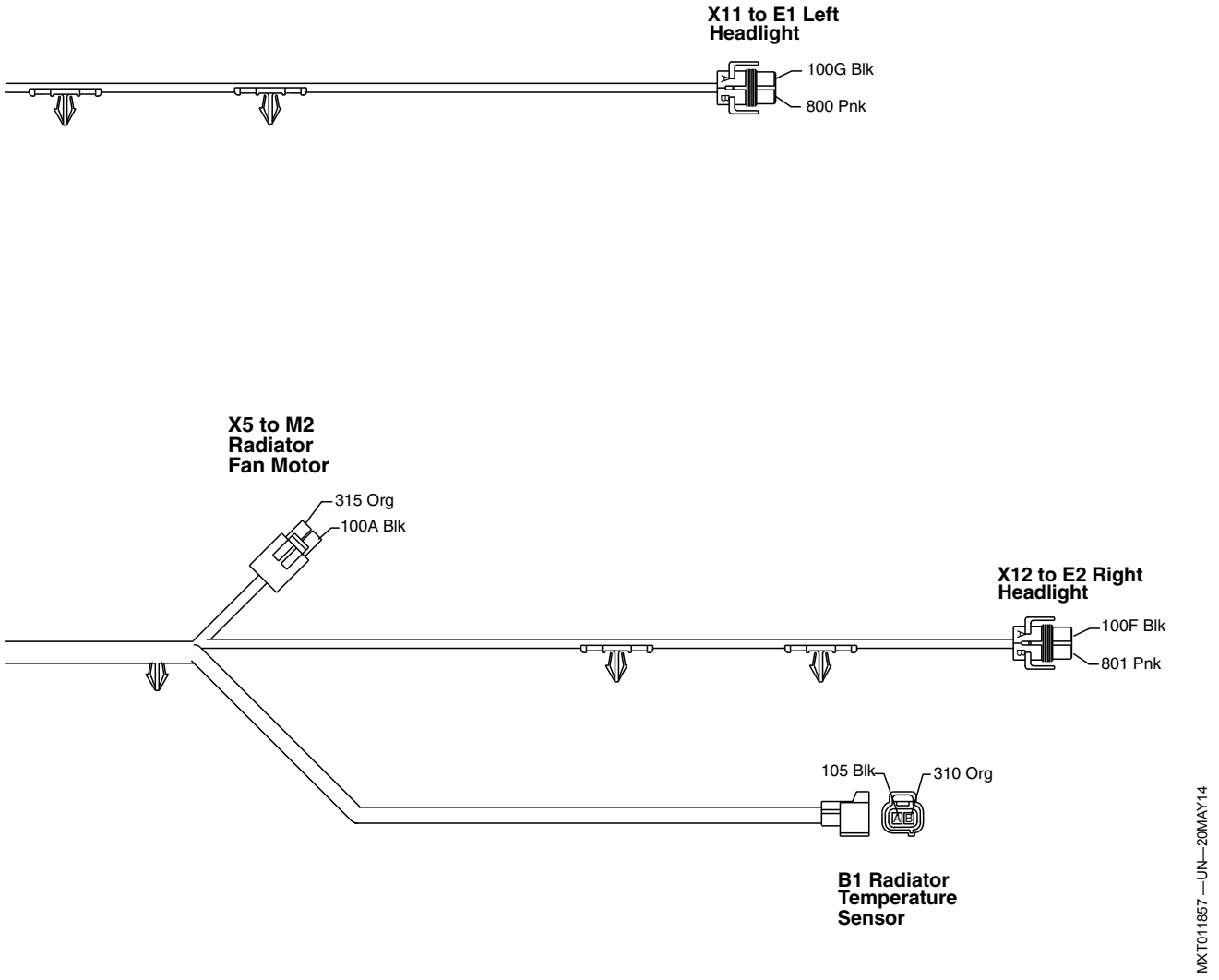
MX52301,00000F6 -19-24OCT14-3/4

Main Wiring Harness (Diesel Engines SN -040000) 4 of 4



MX52301,00000F6 -19-24OCT14-4/4

Main Harness Wire Color Codes (Diesel Engines SN -040000)

Size/No./Color	Wire Connection Points
2.0 100A Blk	Splice 1, X5[A] (M2)
1.0 100B Blk	S1[S2], Splice 1
2.0 100C Blk	X13 (Power Port), Splice 1
3.0 100D Blk	Splice 1, X14[B]
1.0 100E Blk	Splice 1, X7[B]
0.8 100F Blk	Splice 1, X12[A] (E4)
0.8 100G Blk	Splice 1, X11[A] (E3)
0.8 100H Blk	P1[B], Splice 1
3.0 100J Blk	Splice 1, Splice 3
0.8 100L Blk	S1, H1
1.0 101A Blk	Splice 3, X16[F]
0.8 101C Blk	Splice 3, X2[A] (Y2)
0.8 101D Blk	Splice 3, A1[1]
0.8 101F Blk	X8, Splice 3
5.0 101G Blk	W1, Splice 3
1.0 102 Blk	X7[B], X15[F]
0.8 105 Blk	Splice 1, B1[A]
3.0 125 Blk	Splice 3, X17[B]
5.0 201 Red	X1, Fuse Block
2.0 202 Red	Fuse Block Jumper
3.0 203 Red	F7, X14[A]
3.0 204 Red	F4, X17[A]L
3.0 205 Red	F3, A1[2]
2.0 206 Red	G1, X1
2.0 207 Red	F5, X13 (Power Port)
2.0 208 Red	F6, S1[B]
3.0 209 Red	G1, M1
3.0 216 Red	F1, K1[4]
2.0 217 Red	F2, K2[4]
0.8 300 Org	H2, B3
0.8 301 Org	V1[B], H2
0.8 302 Org	V1[A], S1[S1]
0.8 303 Org	V1[B], A1[5]
0.8 310 Org	K2[2], B1[B]
2.0 315 Org	K2[1], X5[B] (M2)
0.8 419 Yel	H3, H2
0.8 420A Yel	Splice 2, X2[B] (Y2)
0.8 420B Yel	Splice 2, G2[A]
0.8 420D Yel	Splice 2, K1[5]
0.8 420E Yel	K1[5], K2[5]
0.8 420F Yel	Splice 2, X8
1.0 420G Yel	Splice 2, S4[2]
0.8 420H Yel	Splice 2, X9[2] (S5)
2.0 420J Yel	S1[A], Splice 2
1.0 420K Yel	Splice 2, X15[E]
1.0 420L Yel	Splice 2, X7[A]
0.8 420M Yel	Splice 2, H3
0.8 420N Yel	K2[5], A1[3]
0.8 420P Yel	S3, X8
0.8 420R Yel	S1, H1
0.8 600 Brn	H4, G2[B]
0.8 601 Tan	H3, B4
0.8 602 Tan	H3, P1[A]
1.0 670 Org	X9[3] (S5), X10[A]
1.0 675 Grn	X9[1] (S5), X10[B]
3.0 700 Pur	Splice 4, K1[1]
3.0 701 Pur	Splice 4, Y1
3.0 702 Pur	Splice 4, X2[C] (Y2)
0.8 705 Pur	S2[A], S1[S1]
0.8 710 Pur	K1[2], S2[B]
0.8 800 Pnk	S4[1], X11[B] (E3)
0.8 801 Pnk	S4[1], X12[B] (E4)
0.8 810 Pnk	S3, H1
1.0 820 Pur	X15[A], X16[A]
1.0 830 Pnk	S4[4], X16[B]
1.0 840 Blu	X15[C], X16[C]
1.0 850 Grn	X15[D], X16[D]
3.0 902 Wht	A1[4], R1-R2-R3

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Group 41
Schematics and Harnesses (SN 040001-110000)

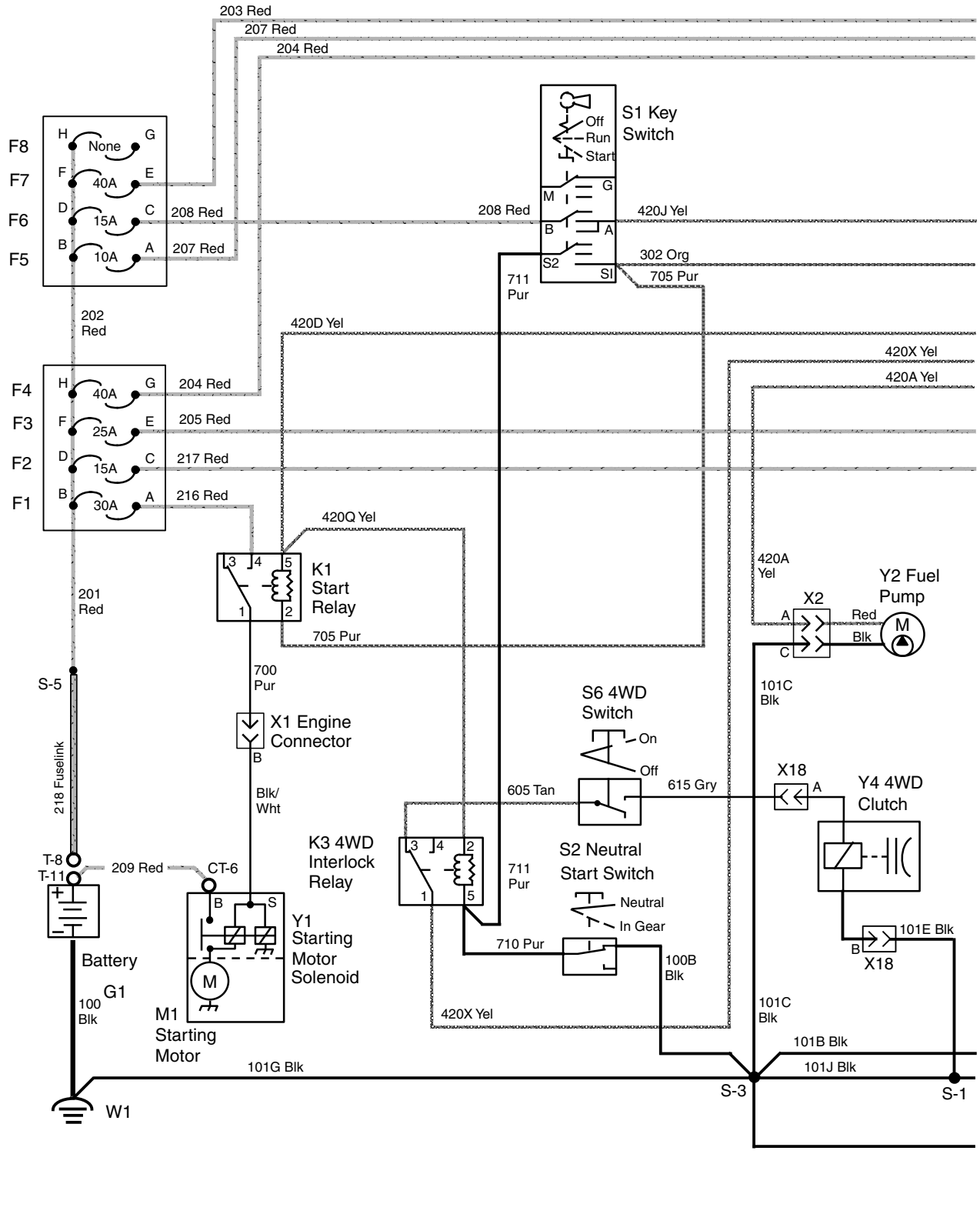
Summary of References

- Main Wiring Schematic (Gas Engines SN 040001-080000)
- Main Wiring Harness (Gas Engines SN 040001-080000)
- Main Harness Wire Color Codes (Gas Engine SN 040001-080000)
- Main Wiring Schematic (Gas Engines SN 080001-110000)
- Main Wiring Harness (Gas Engines SN 080001-110000)
- Main Harness Wire Color Codes (Gas Engine SN 080001-110000)
- W2 Engine Wiring Harnesses (Gas Engine SN 040001-)
- Main Schematic (Diesel Engines SN 040001-080000)
- Main Wiring Harness (Diesel Engines SN 040001-080000)
- Main Harness Wire Color Codes (Diesel Engines SN 040001-080000)
- Main Schematic (Diesel Engines SN 080001-110000)
- Main Wiring Harness (Diesel Engines SN 080001-110000)
- Main Harness Wire Color Codes (Diesel Engines SN 080001-110000)
- Battery Wiring Harness—Diesel (SN 040001-)

MX52301,0000445 -19-23OCT14-1/1

Main Wiring Schematic (Gas Engines SN 040001-080000)

1 of 4



Schematic 1 of 4

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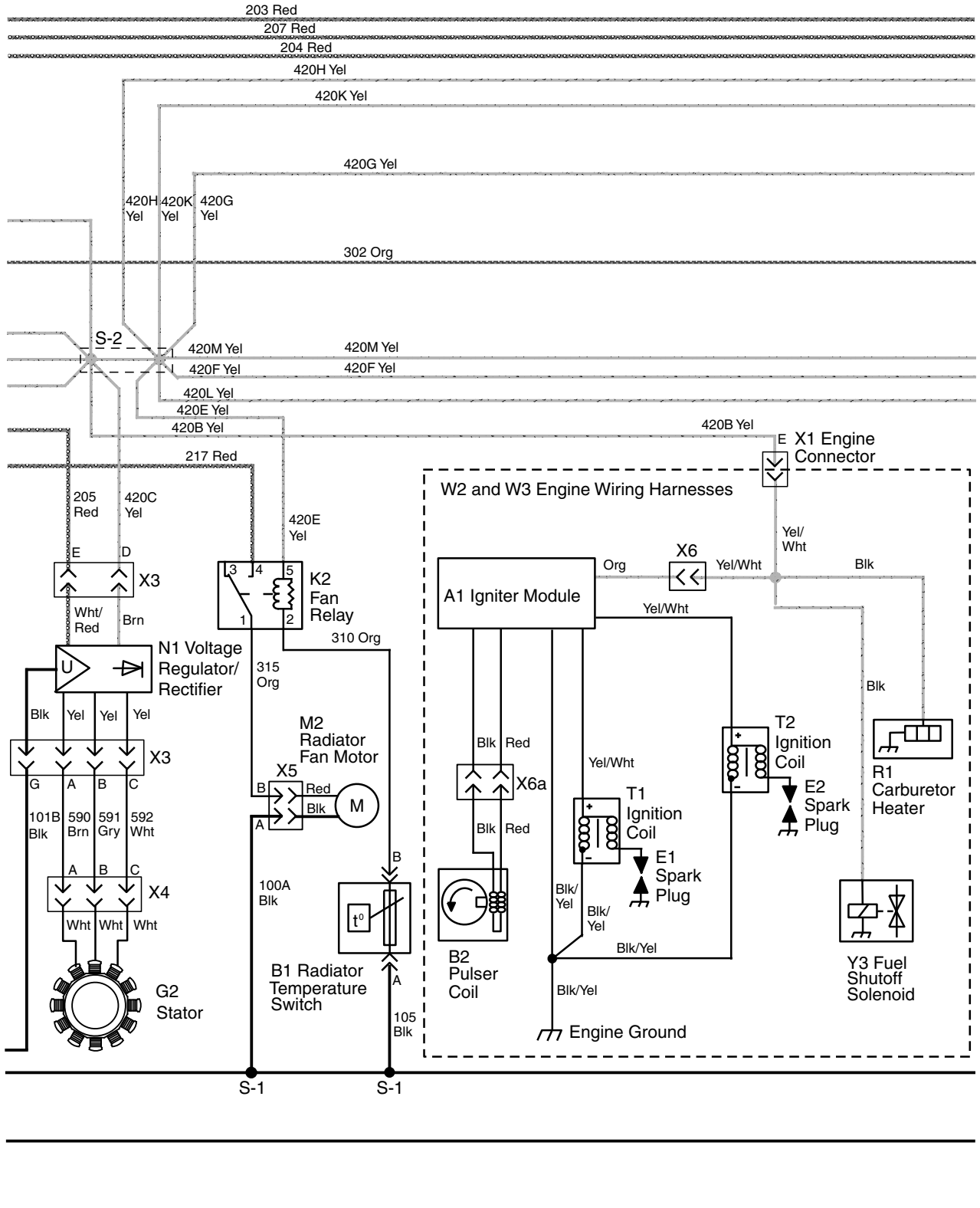
MX52301,00000F9 -19-24OCT14-1/4

Main Wiring Schematic (Gas Engines SN 040001-080000) 2 of 4



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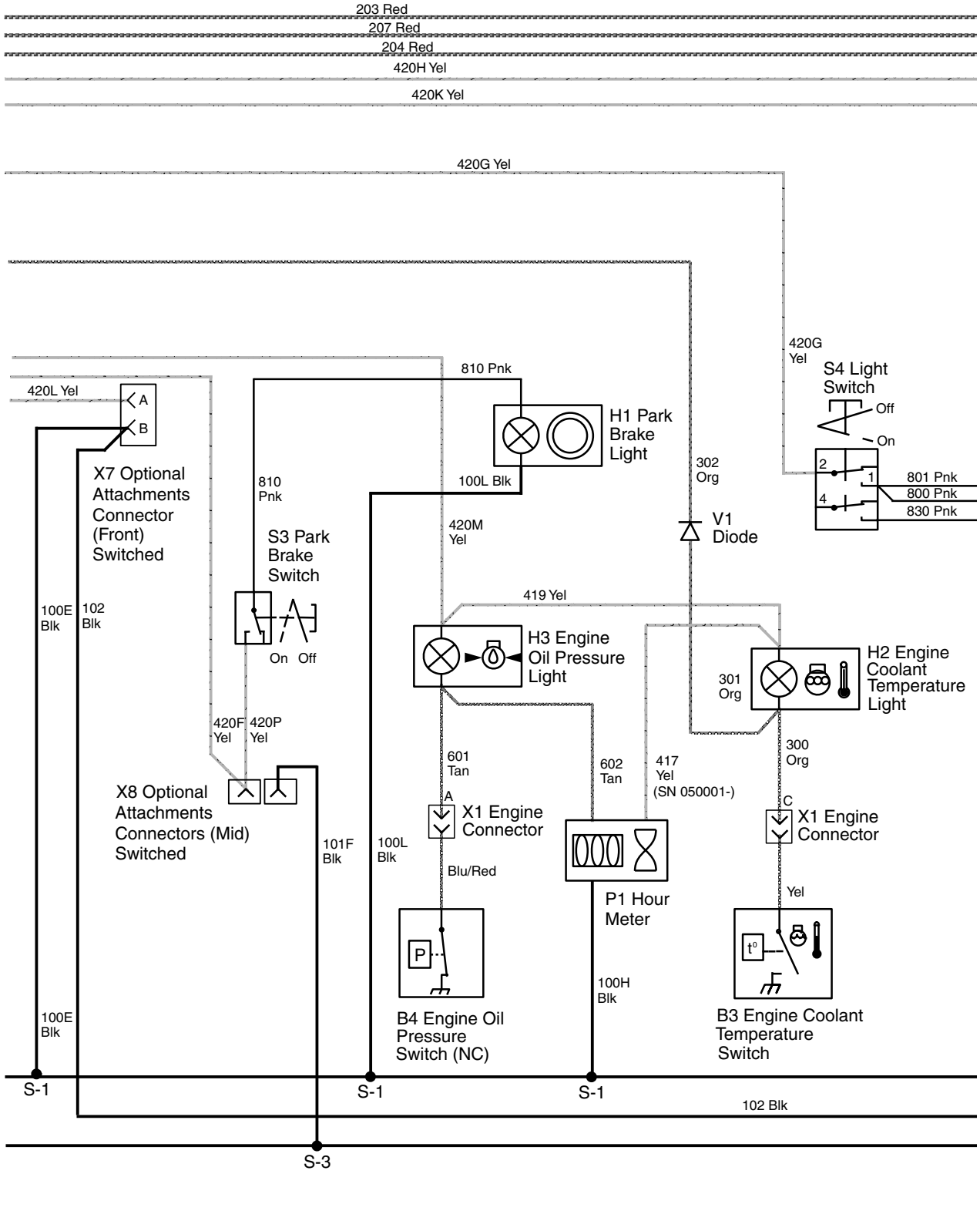
MX52301,00000F9 -19-24OCT14-2/4

Main Wiring Schematic (Gas Engines SN 040001-080000) 3 of 4



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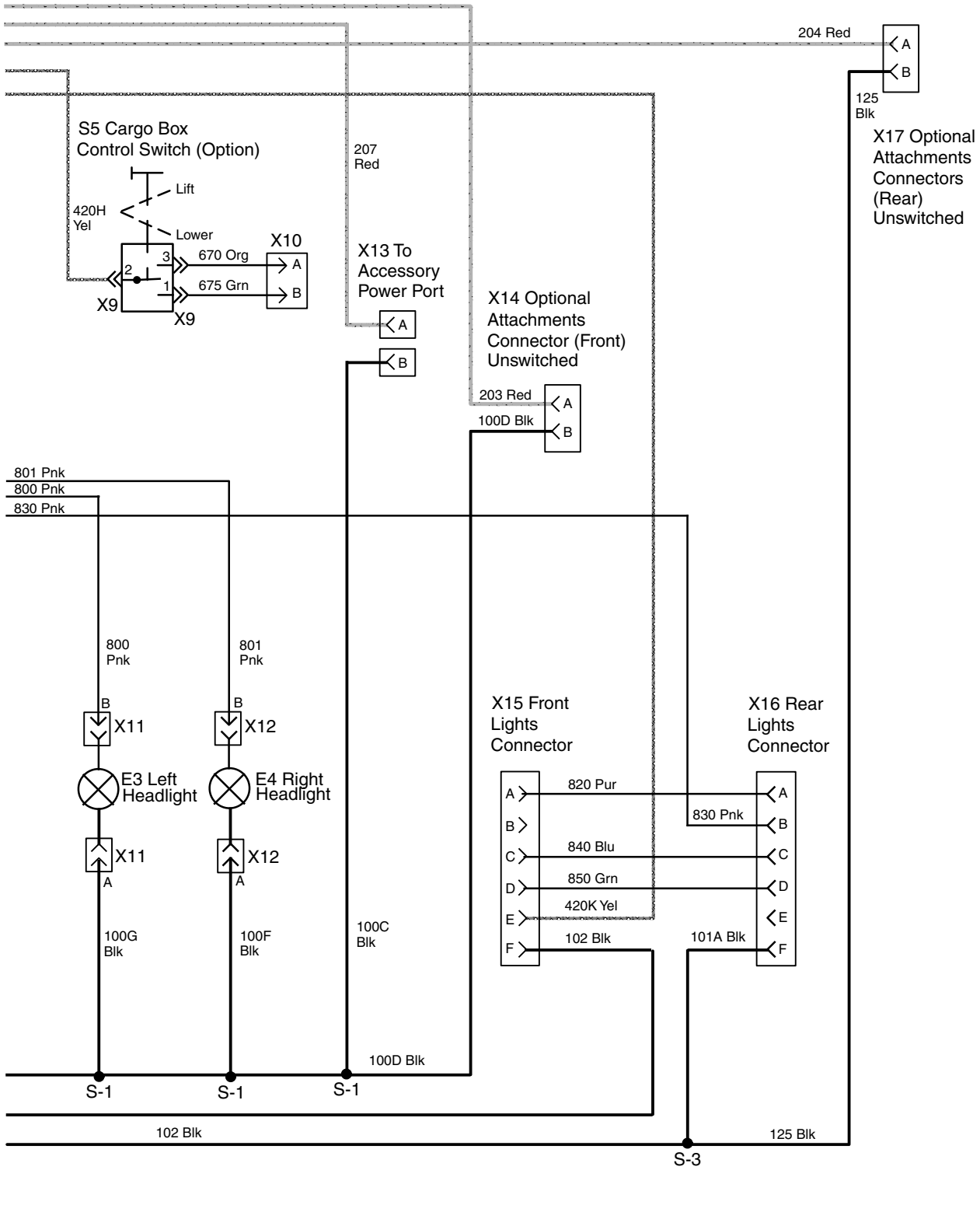
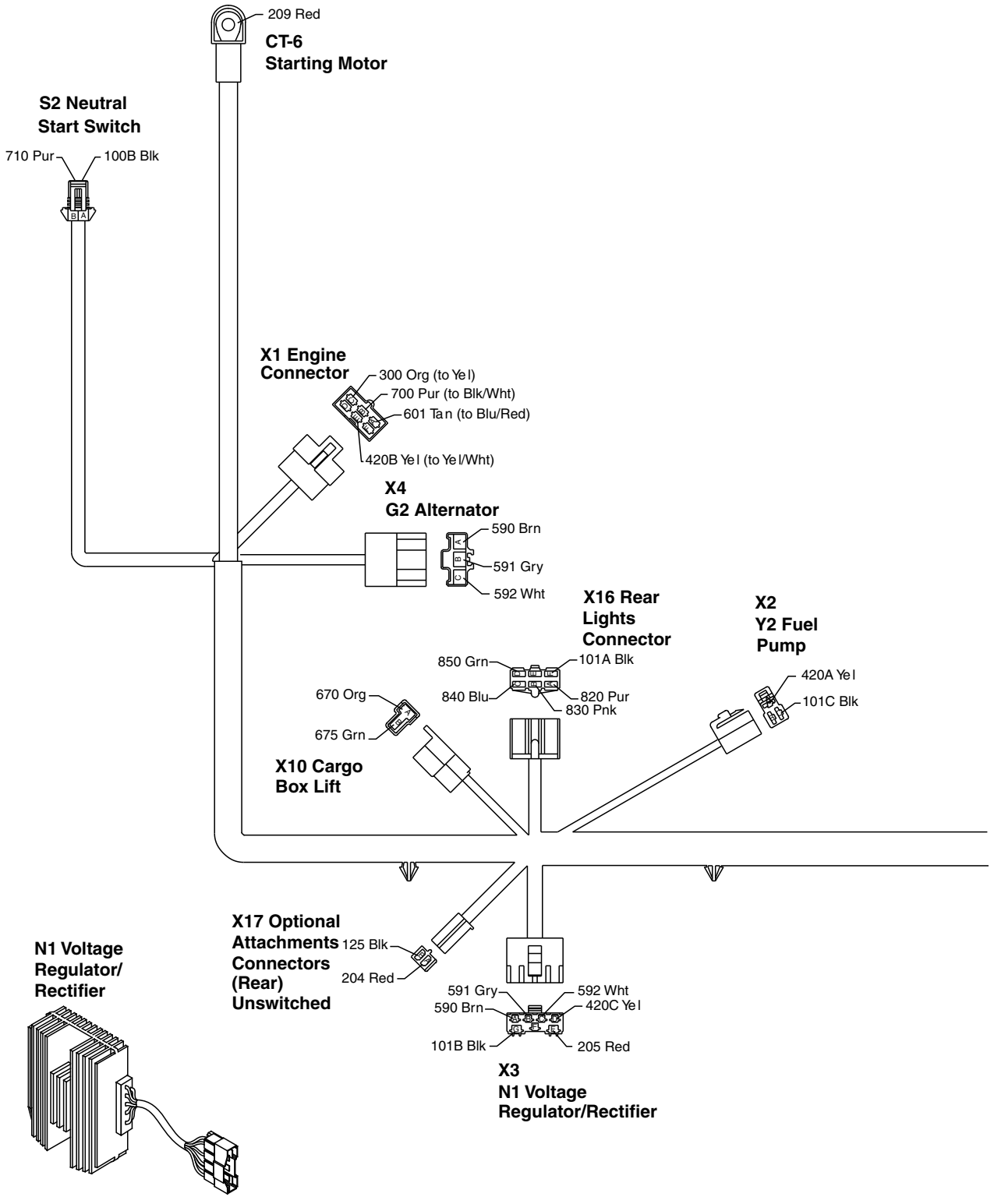
MX52301,00000F9 -19-24OCT14-3/4

Main Wiring Schematic (Gas Engines SN 040001-080000) 4 of 4



MX52301,00000F9 -19-24OCT14-4/4

Main Wiring Harness (Gas Engines SN 040001-080000)



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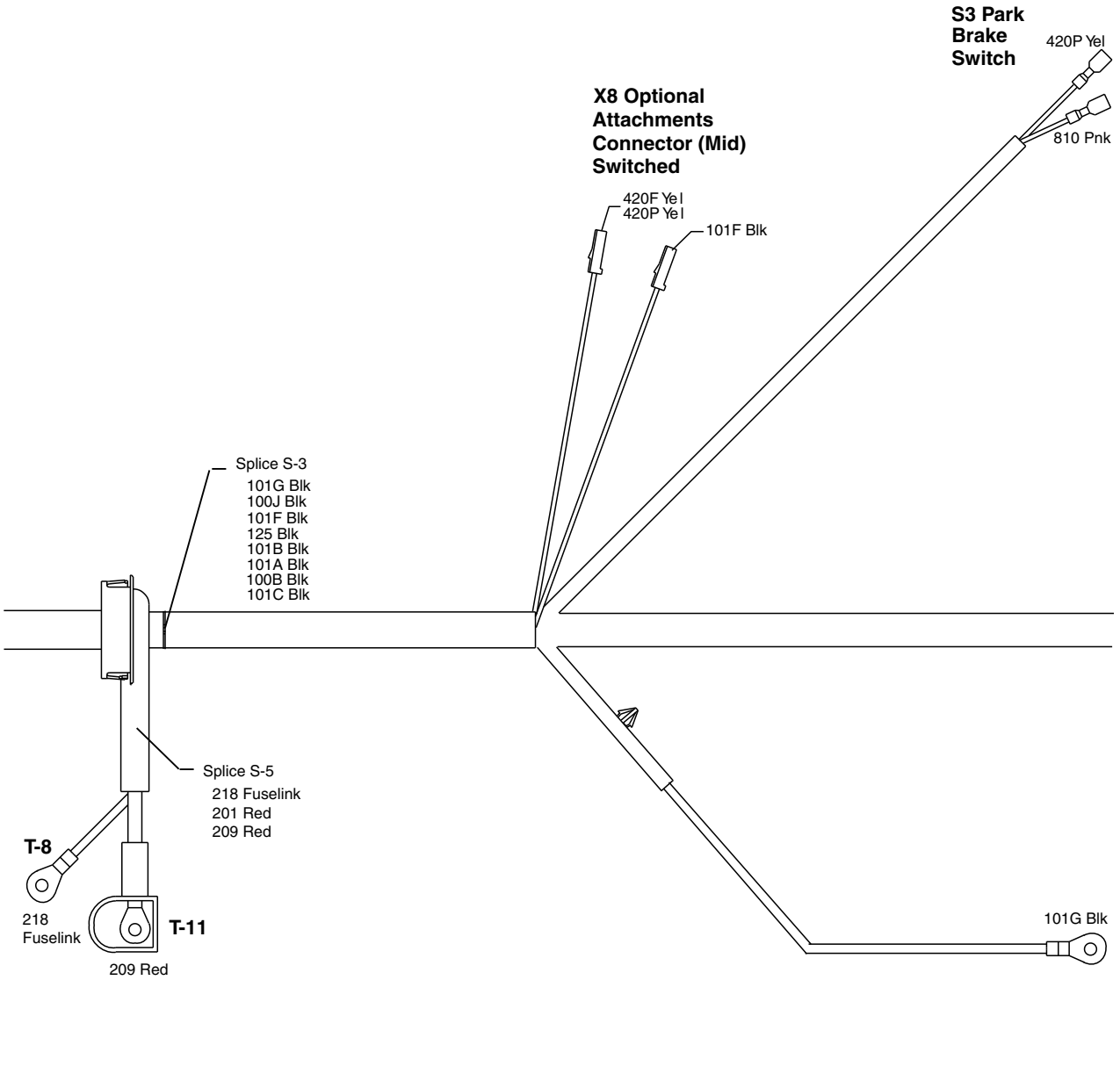
Main Wiring Harness (Gas Engines SN 040001-080000) 2 of 4



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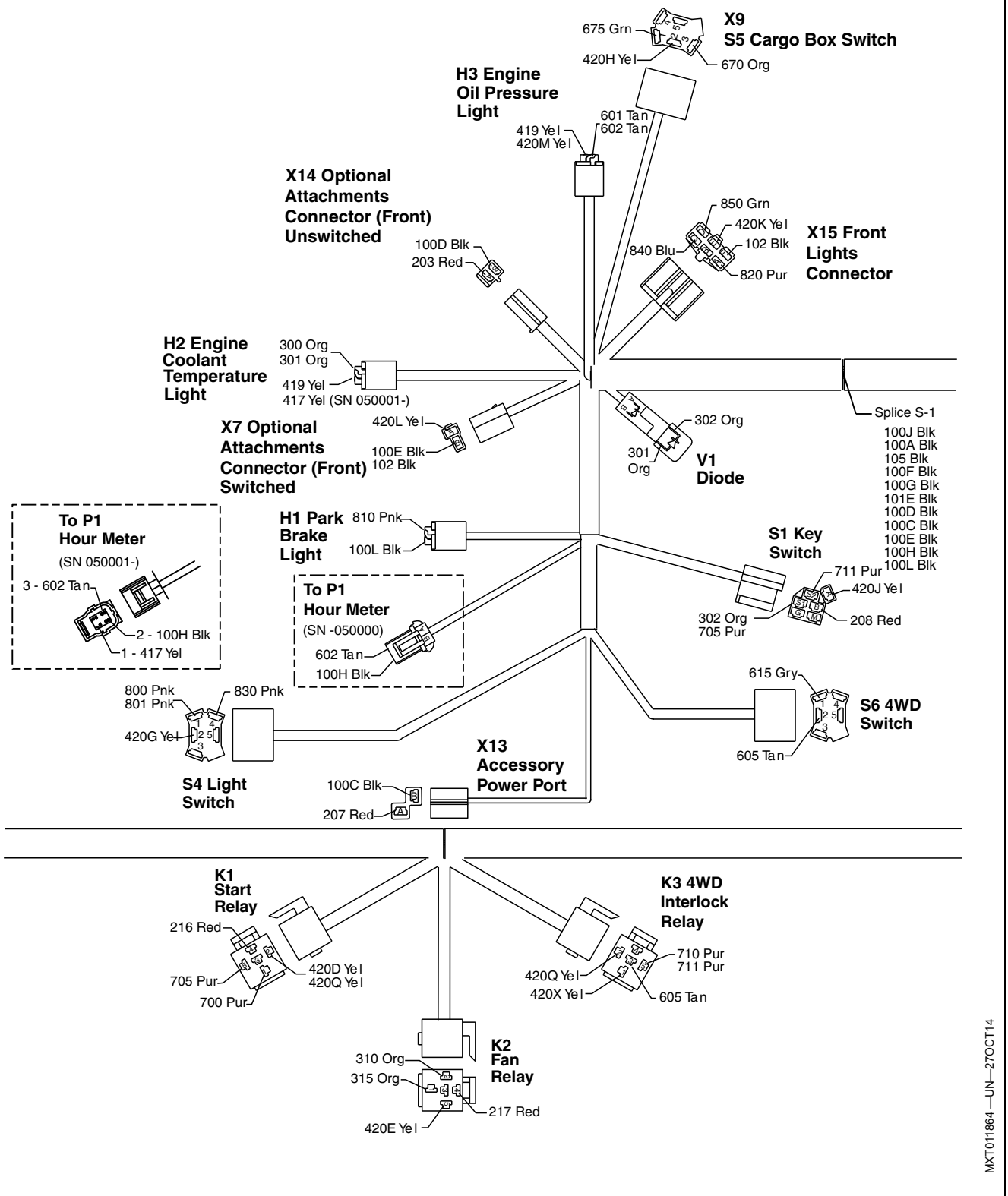
Main Wiring Harness (Gas Engines SN 040001-080000) 3 of 4



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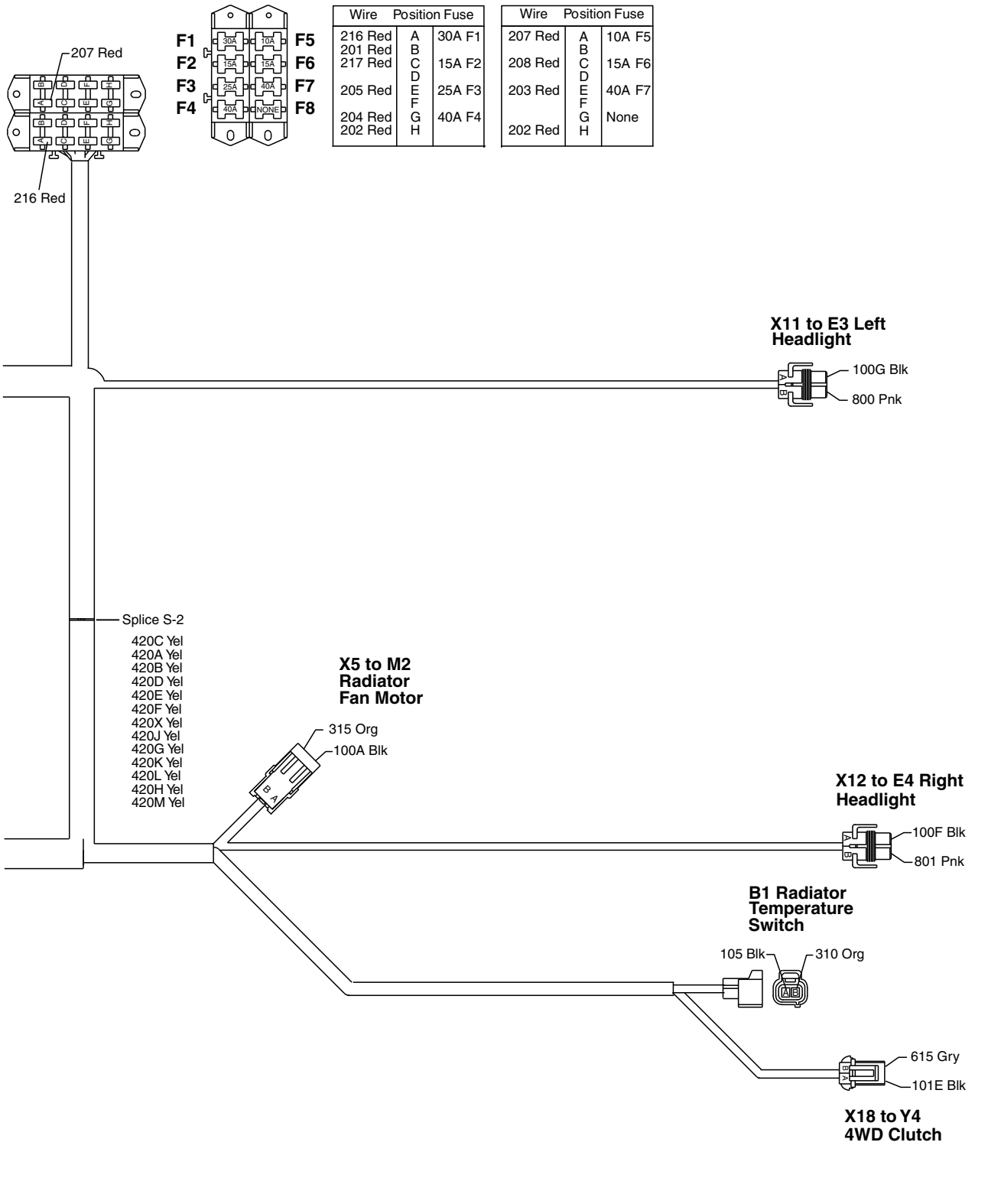
MX52301,00000FA -19-24OCT14-3/4

Main Wiring Harness (Gas Engines SN 040001-080000) 4 of 4



Wire	Position	Fuse
216 Red	A	30A F1
201 Red	B	
217 Red	C	15A F2
	D	
205 Red	E	25A F3
	F	
204 Red	G	40A F4
202 Red	H	

Wire	Position	Fuse
207 Red	A	10A F5
	B	
208 Red	C	15A F6
	D	
203 Red	E	40A F7
	F	
	G	None
202 Red	H	

MX52301,00000FA -19-24OCT14-4/4

Main Harness Wire Color Codes (Gas Engine SN 040001-080000)

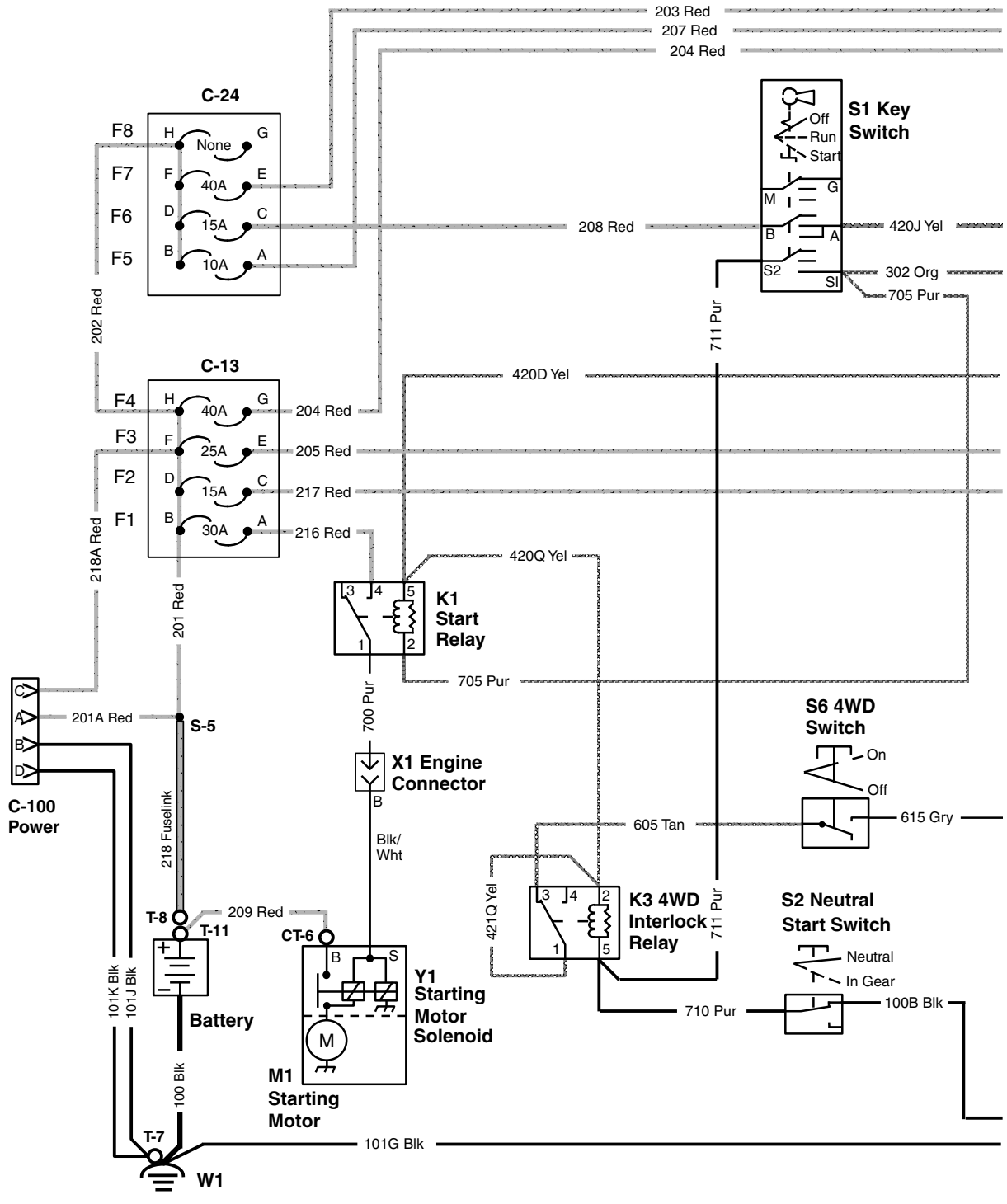
Size/No./Color	Wire Connection Points
2.0 100A Blk	S-1, X5 [A]
1.0 100B Blk	S2 [A], S-3
2.0 100C Blk	S-1, X13 [B]
3.0 100D Blk	S-1, X14 [B]
1.0 100E Blk	S-1, X7 [B]
0.8 100F Blk	S-1, X12 [A]
0.8 100G Blk	S-1, X11 [A]
0.8 100H Blk (SN -050000)	P1 [B], S-1
0.8 100H Blk (SN 050001-)	P1 [2], S-1
3.0 100J Blk	S-1, S-3
3.0 100L Blk	H1 [B], S-1
1.0 101A Blk	S-3, X16 [F]
3.0 101B Blk	S-3, X3 [G]
0.8 101C Blk	S-3, X2 [C]
0.8 101E Blk	S-1, X18 [B]
0.8 101F Blk	X8, S-3
5.0 101G Blk	W1, S-3
1.0 102 Blk	X7 [B], X15 [F]
0.8 105 Blk	S-1, B1 [A]
3.0 125 Blk	S-3, X17 [B]
5.0 201 Red	S-5, F1 [B]
2.0 202 Red	Jumper
3.0 203 Red	F7 [E], X14 [A]
3.0 204 Red	F4 [G], X17 [A]
3.0 205 Red	F3 [E], X3 [E] (N1)
2.0 207 Red	F5 [A], X13 [A]
2.0 208 Red	F6 [C], S1 [B]
6.0 209 Red	CT-6, T-11
3.0 216 Red	F1 [A], K1 [4]
2.0 217 Red	F2 [C], K2 [4]
2.0 218 Fuselink	T-8, S-5
0.8 300 Org	X1 [C], H2 [A]
0.8 301 Org	H2 [A], V1 [B]
0.8 302 Org	V1 [A], S1 [S1]
0.8 310 Org	K2 [2], B1 [B]
2.0 315 Org	K2 [1], X5 [B]

Size/No./Color	Wire Connection Points
0.8 417 Yel (SN 050001-)	P1 [1], H2 [B]
0.8 419 Yel	H3 [B], H2 [B]
0.8 420A Yel	S-2, X2 [A]
0.8 420B Yel	S-2, X1 [E]
1.0 420C Yel	S-2, X3 [D]
0.8 420D Yel	-2, K1 [2]
0.8 420E Yel	S-2, K2 [5]
0.8 420F Yel	-2, X8
1.0 420G Yel	S-2, S4 [2]
0.8 420H Yel	S-2, X9 [2]
2.0 420J Yel	S1 [A], S-2
1.0 420K Yel	S-2, X15 [E]
1.0 420L Yel	S-2, X7 [A]
0.8 420M Yel	S-2, H3 [B]
0.8 420P Yel	X8, S3
0.8 420Q Yel	K1 [2], K3 [2]
0.8 420X Yel	S-2, K3 [1]
2.0 590 Brn	X4 [A], X3 [A]
2.0 591 Gry	X4 [B], X3 [B]
2.0 592 Wht	X4 [C], X3 [C]
0.8 601 Tan	H3 [A], X1 [A]
0.8 602 Tan (SN -050000)	H3 [A], P1 [A]
0.8 602 Tan (SN 050001-)	H3 [A], P1 [3]
0.8 605 Tan	S6 [2], K3 [3]
0.8 615 Gry	S6 [1], X18 [B]
1.0 670 Org	X9 [3], X10 [A]
1.0 675 Grn	X9 [1], X10 [B]
3.0 700 Pur	K1 [1], X1 [B]
0.8 705 Pur	S1 [S1], K1 [5]
0.8 710 Pur	K3 [5], S2 [B]
0.8 711 Pur	K3 [5], S1 [S2]
0.8 800 Pnk	S4 [1], X11 [B]
0.8 801 Pnk	S4 [1], X12 [B]
0.8 810 Pnk	S3, H1 [A]
1.0 820 Pur	X15 [A], X16 [A]
1.0 830 Pnk	S4 [4], X16 [B]
1.0 840 Blu	X15 [C], X16 [C]
1.0 850 Grn	X15 [D], X16 [D]

MX52301,00000FB -19-24OCT14-1/1

Main Wiring Schematic (Gas Engines SN 080001-110000)

1 of 5

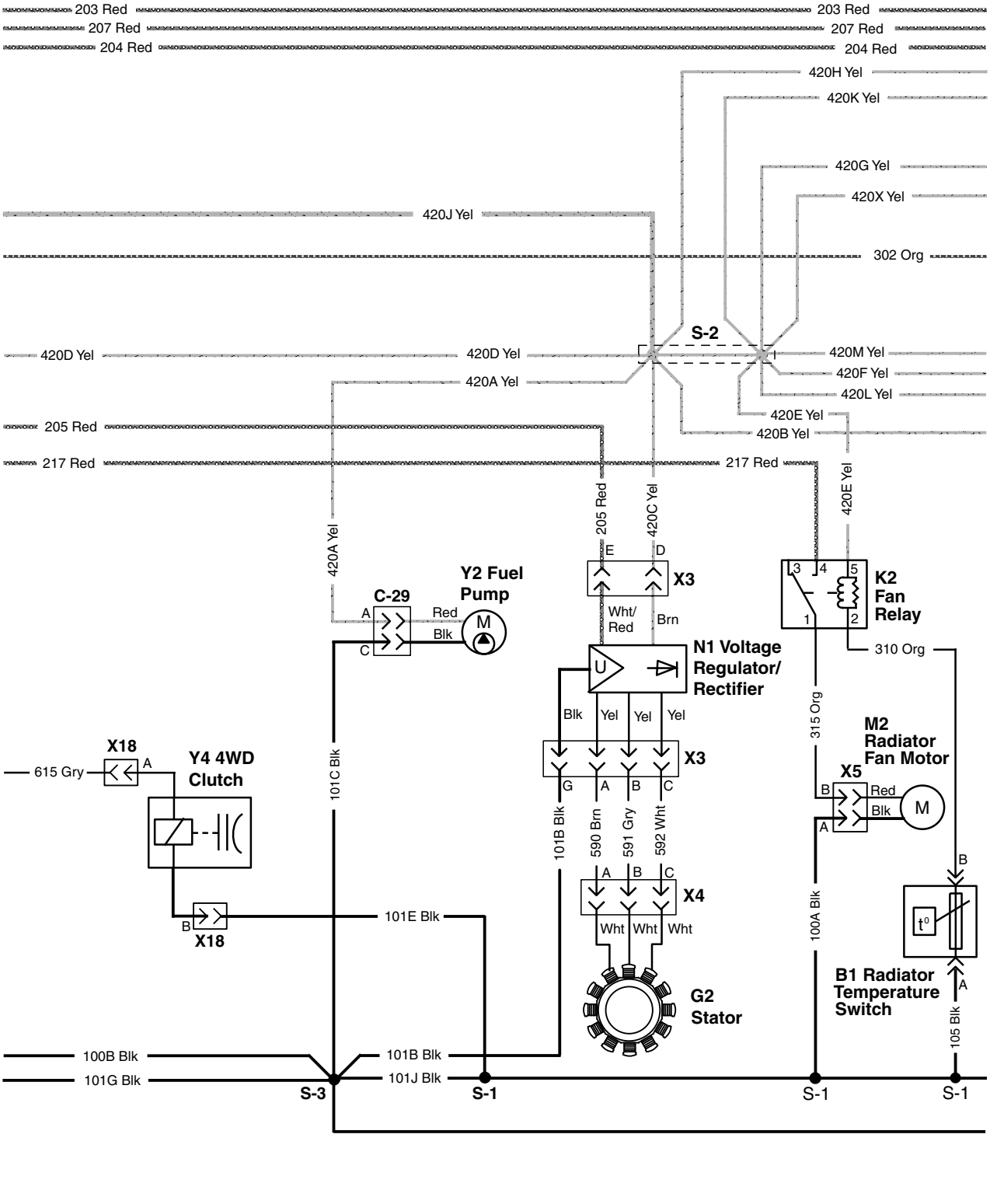


Schematic 1 of 5

Continued on next page

OUMX258,00005E8 -19-24OCT14-1/5

Main Wiring Schematic (Gas Engines SN 080001-110000) 2 of 5



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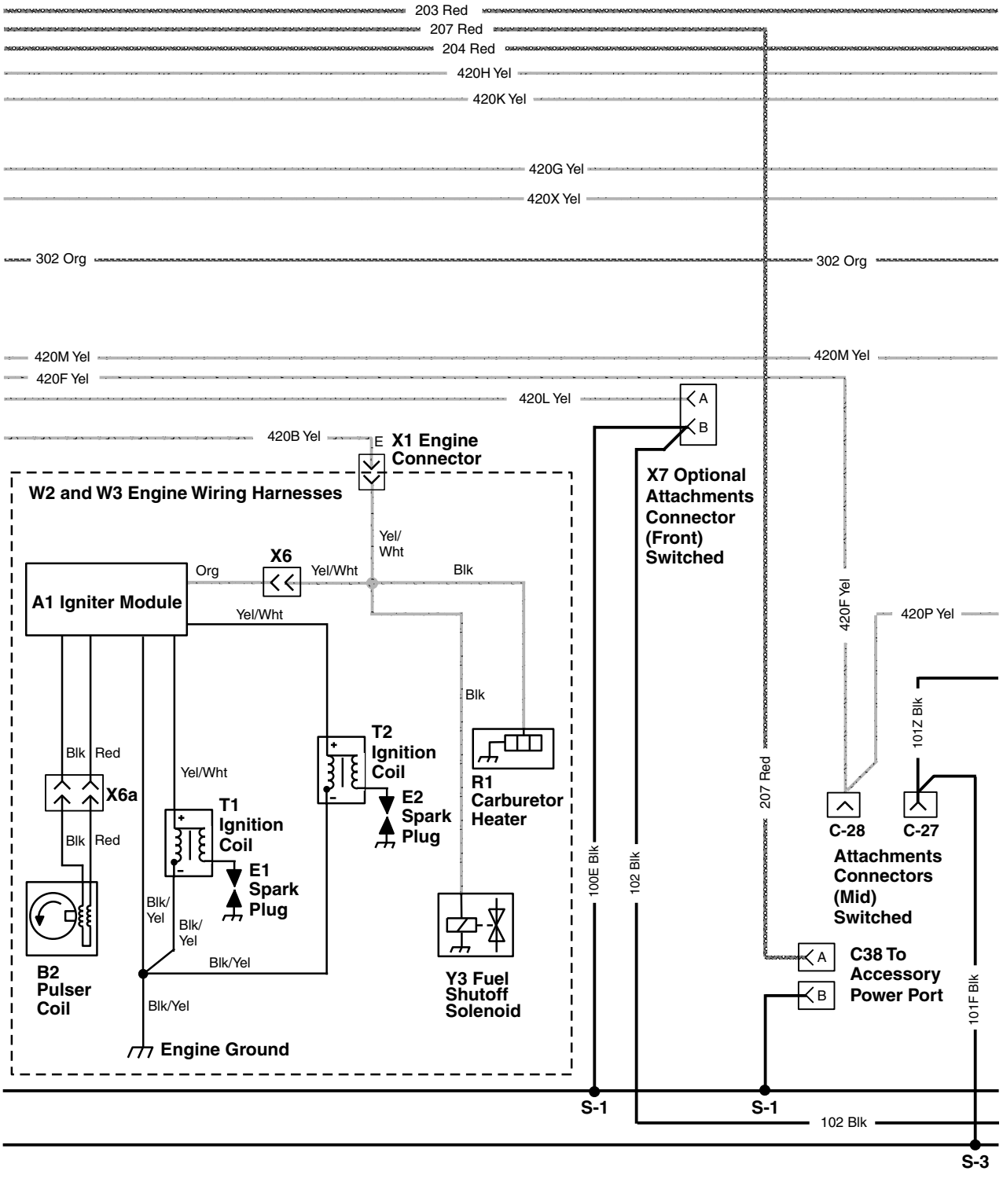
OUMX258,00005E8 -19-24OCT14-2/5

Main Wiring Schematic (Gas Engines SN 080001-110000) 3 of 5



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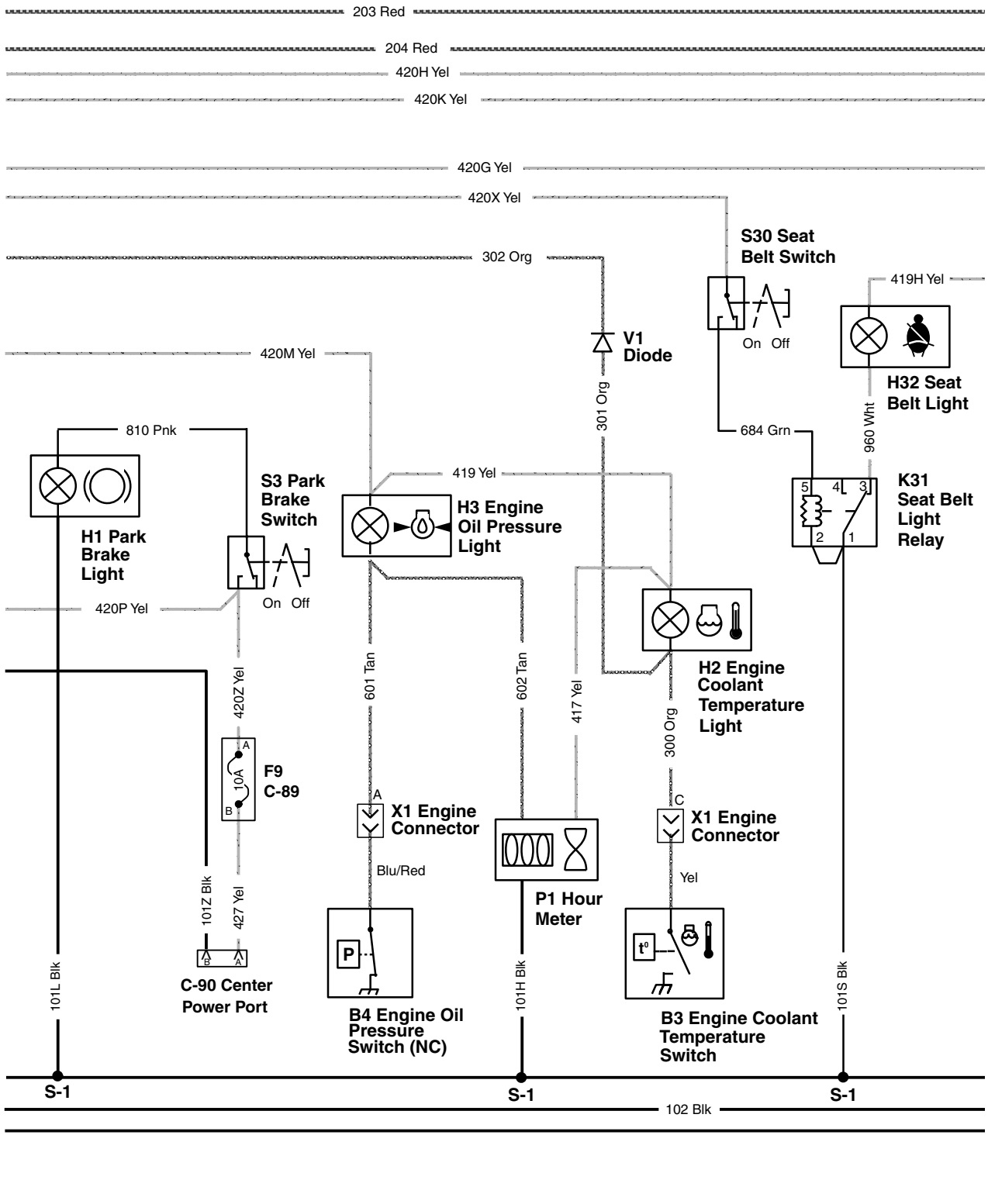
OUMX258,00005E8 -19-24OCT14-3/5

Main Wiring Schematic (Gas Engines SN 080001-110000) 4 of 5



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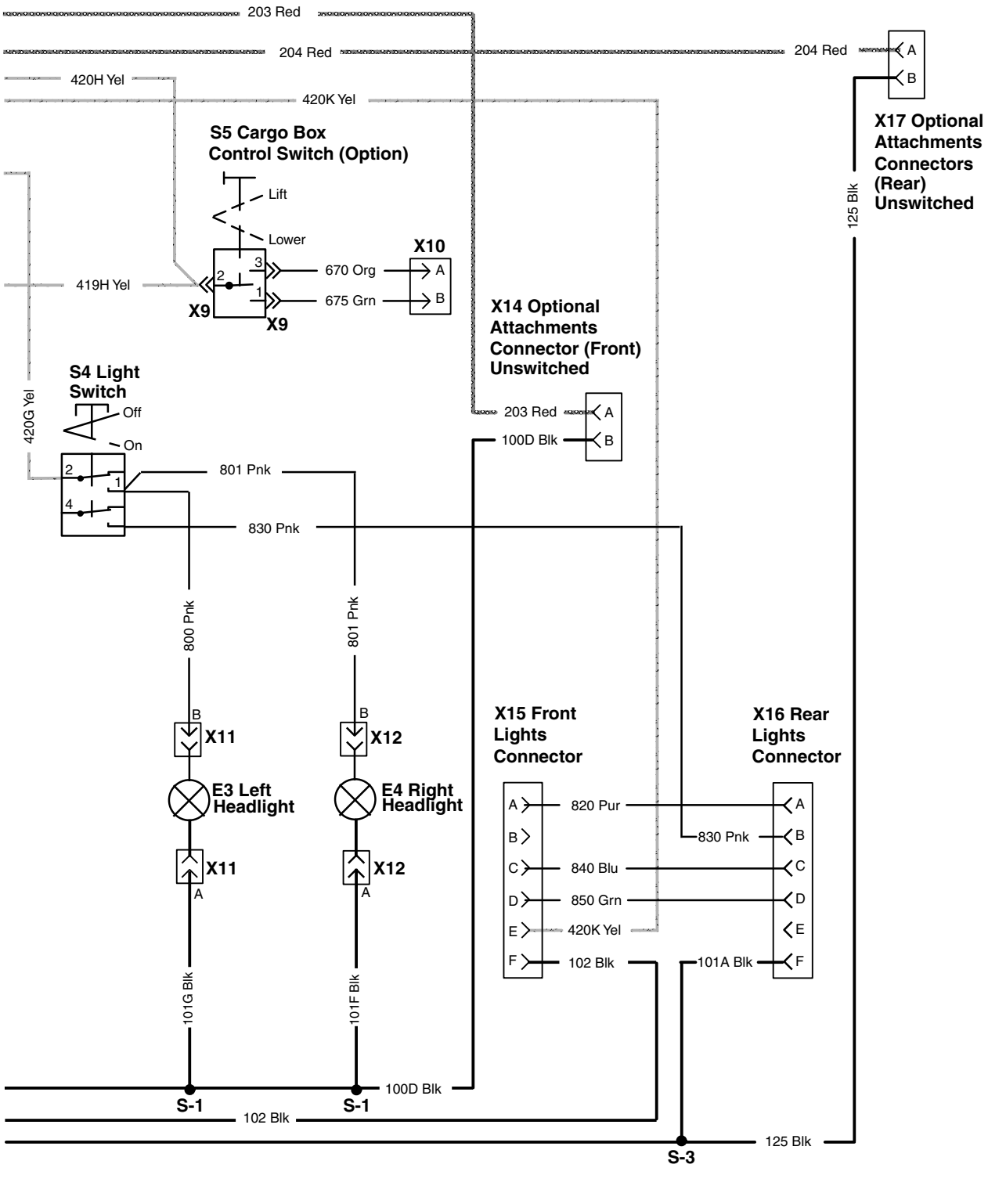
OUMX258,00005E8 -19-24OCT14-4/5

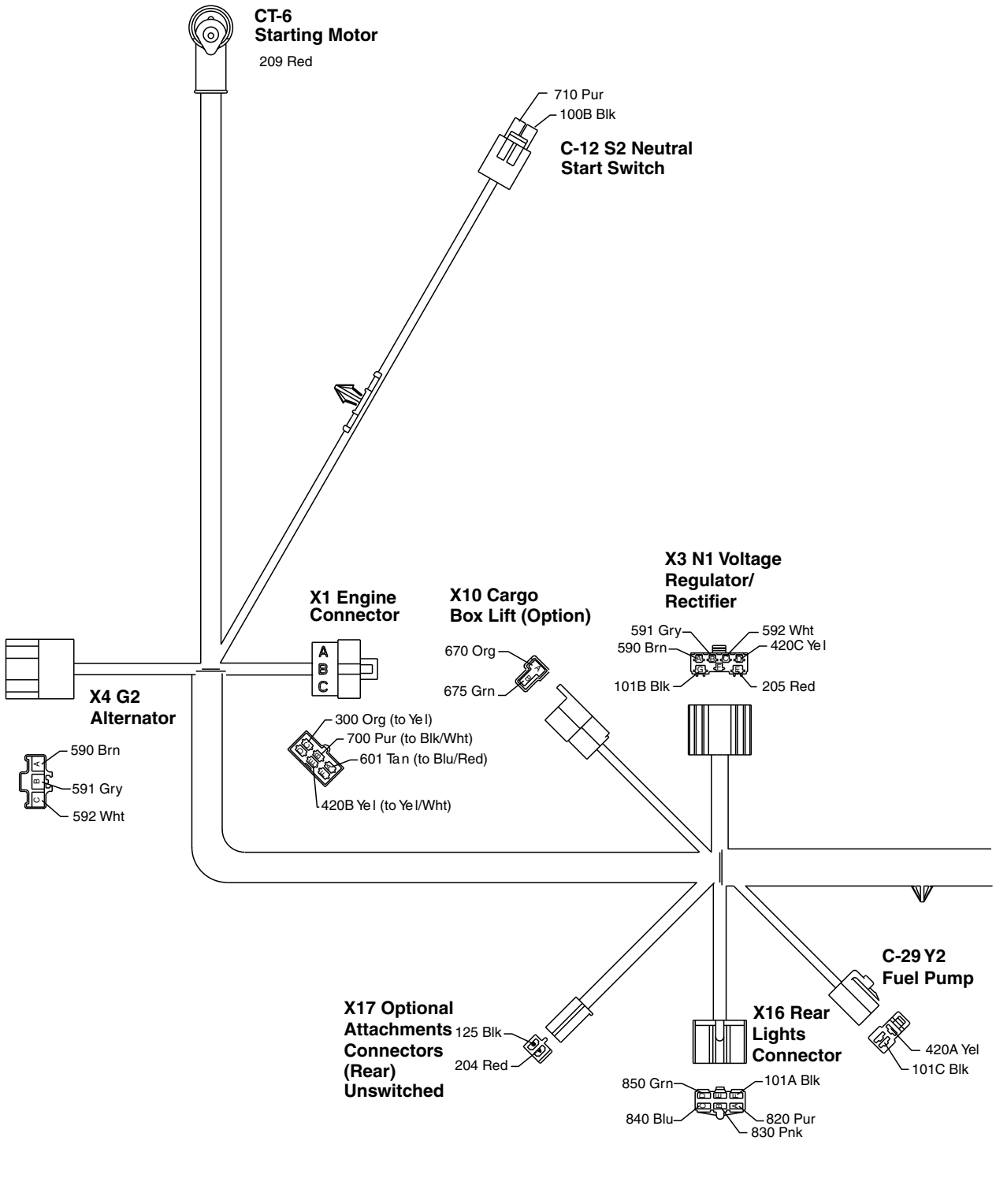
Main Wiring Schematic (Gas Engines SN 080001-110000) 5 of 5



OUMX258,00005E8 -19-24OCT14-5/5

Main Wiring Harness (Gas Engines SN 080001-110000)

1 of 5



Main Harness 1 of 5

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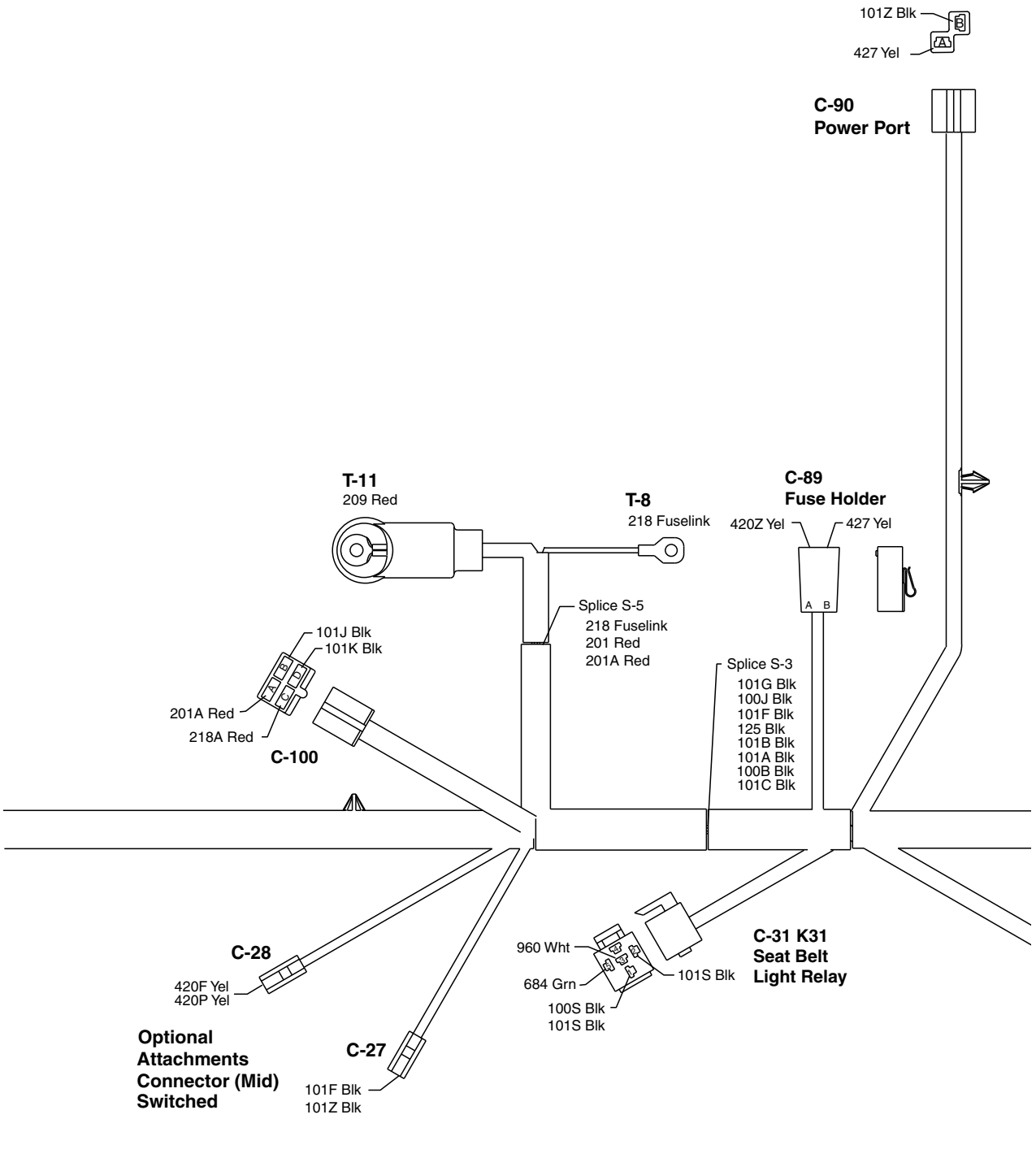
OUMX258,00005E9 -19-24OCT14-1/5

Main Wiring Harness (Gas Engines SN 080001-110000) 2 of 5



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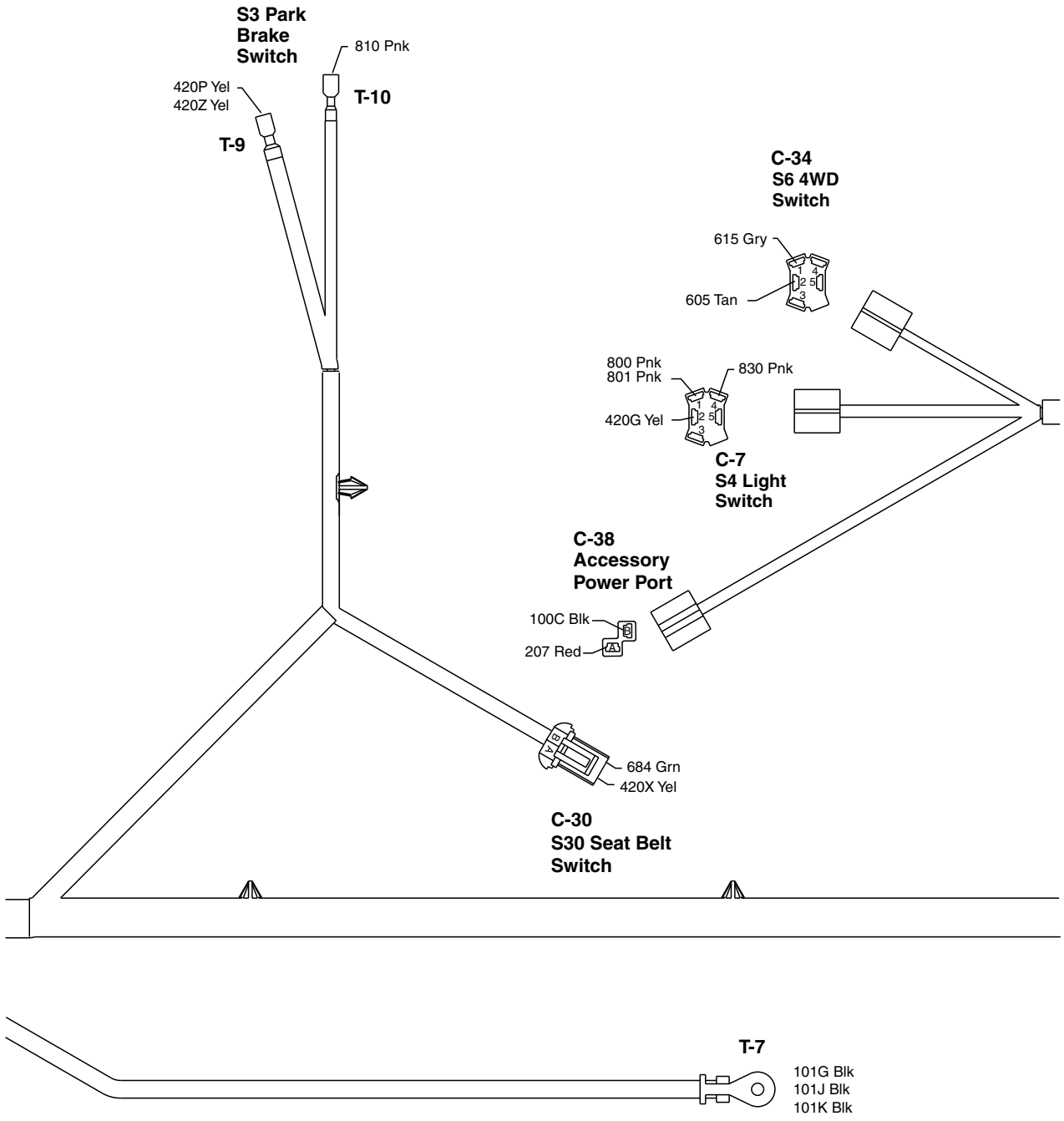
OUMX258,00005E9 -19-24OCT14-2/5

Main Wiring Harness (Gas Engines SN 080001-110000) 3 of 5



MXT012201 —UN—06AUG14

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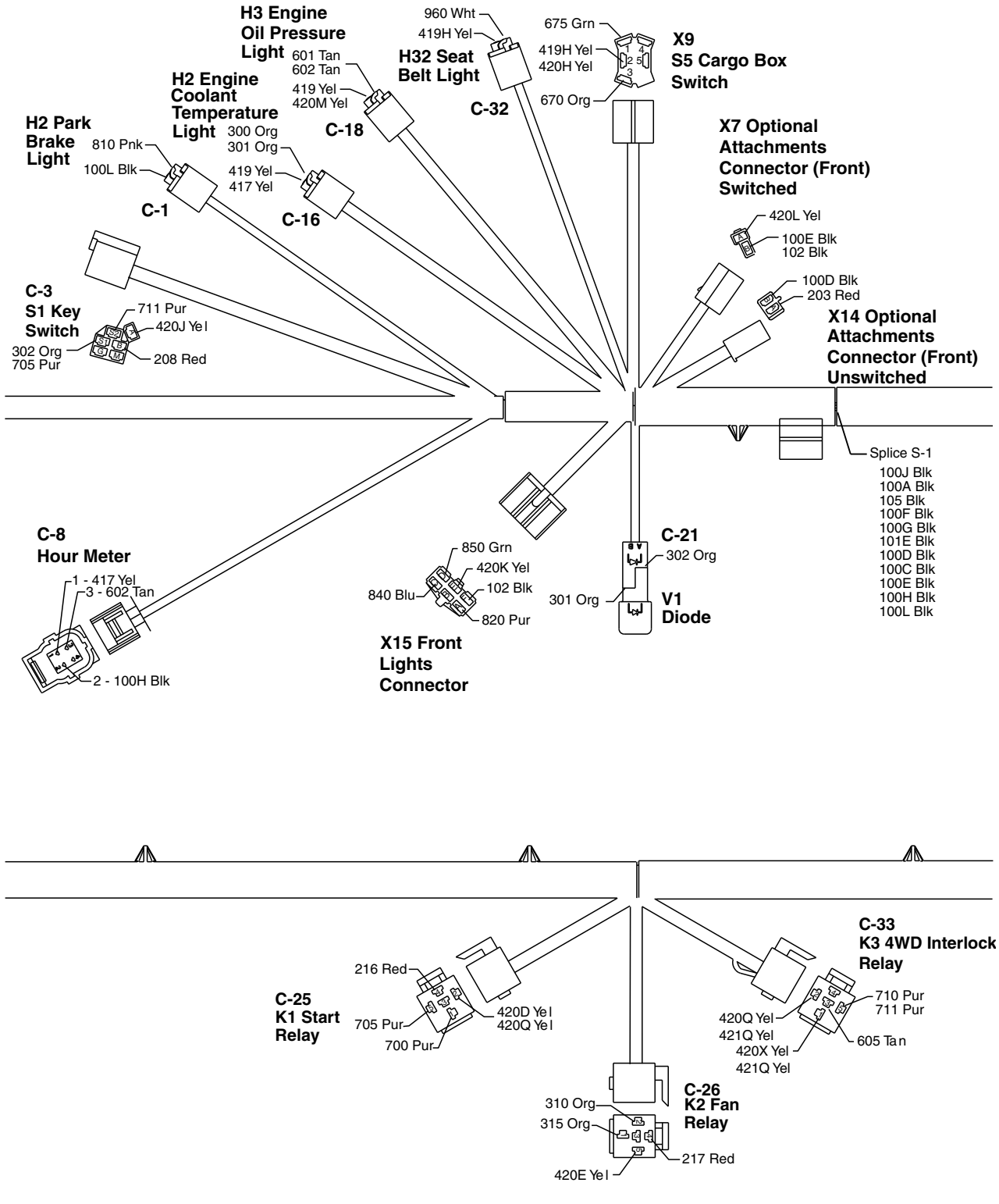
OUMX258,00005E9 -19-24OCT14-3/5

Main Wiring Harness (Gas Engines SN 080001-110000) 4 of 4



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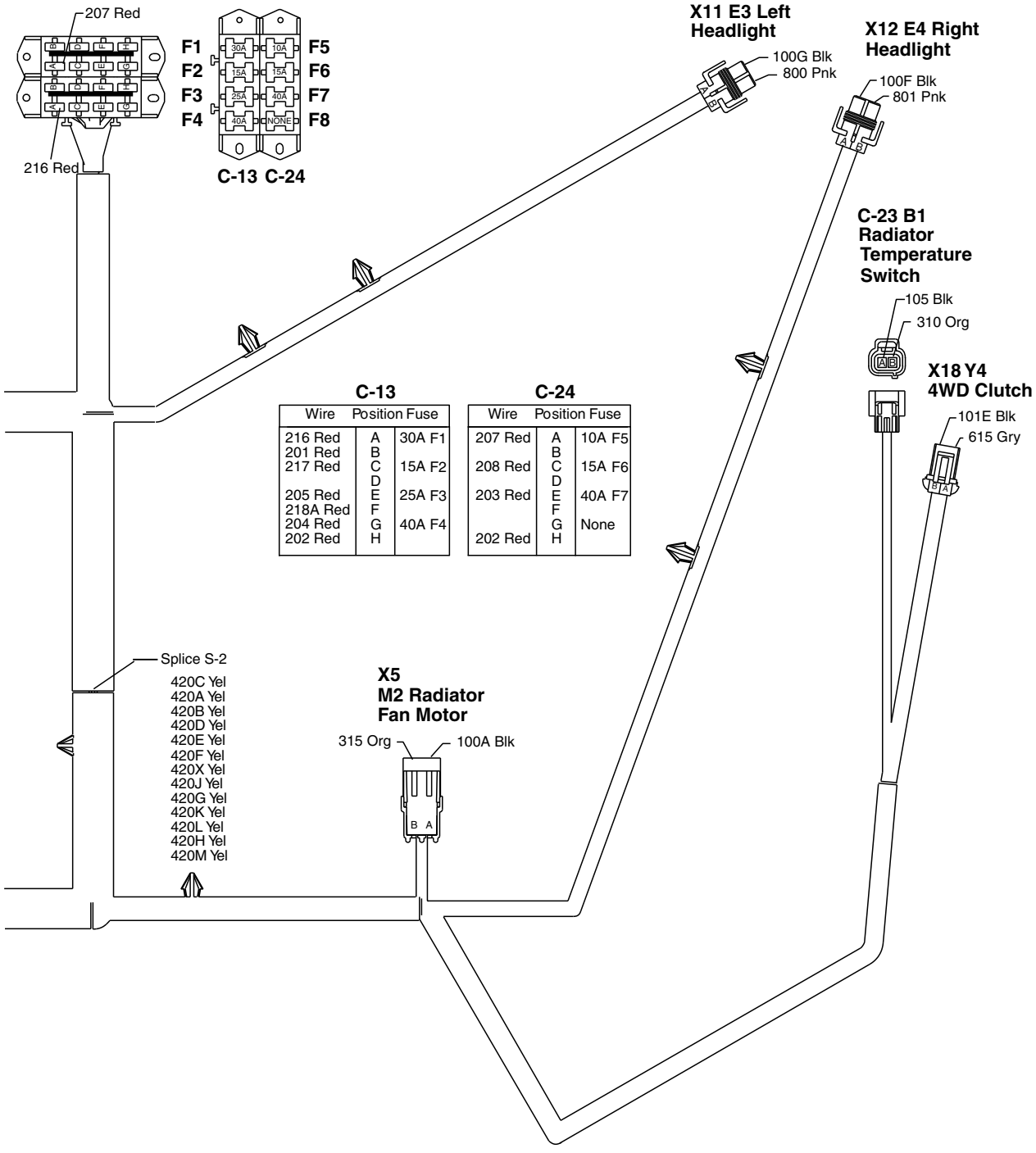
OUMX258,00005E9 -19-24OCT14-4/5

Main Wiring Harness (Gas Engines SN 080001-110000) 5 of 5



C-13

Wire	Position	Fuse
216 Red	A	30A F1
201 Red	B	
217 Red	C	15A F2
	D	
205 Red	E	25A F3
218A Red	F	
204 Red	G	40A F4
202 Red	H	

C-24

Wire	Position	Fuse
207 Red	A	10A F5
	B	
208 Red	C	15A F6
	D	
203 Red	E	40A F7
	F	
	G	None
202 Red	H	

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OUMX258,00005E9 -19-24OCT14-5/5

Main Harness Wire Color Codes (Gas Engine SN 080001-110000)

Size/No./Color	Wire Connection Points
2.0 100A Blk	S-1, X5 [A]
1.0 100B Blk	C-12 [A], S-3
2.0 100C Blk	S-1, C-38 [B]
3.0 100D Blk	S-1, X14 [B]
1.0 100E Blk	S-1, X7 [B]
0.8 100F Blk	S-1, X12 [A]
0.8 100G Blk	S-1, X11 [A]
0.8 100H Blk	C-8 [2], S-1
3.0 100J Blk	S-1, S-3
0.8 100L Blk	C-1 [B], S-1
0.8 100S Blk	C-31 [1], S-3
1.0 101A Blk	S-3, X16 [F]
3.0 101B Blk	S-3, X3 [G]
0.8 101C Blk	S-3, C-29 [C]
0.8 101E Blk	S-1, X18 [B]
0.8 101F Blk	C-27, S-3
5.0 101G Blk	T-7, S-3
5.0 101J Blk	C-100 [B], T-7
5.0 101K Blk	C-100 [D], T-7
0.8 101S Blk	C-31 [1], C-31 [2]
1.0 101Z Blk	C-90 [B], C-27
1.0 102 Blk	X7 [B], X15 [F]
0.8 105 Blk	S-1, C-23 [A]
3.0 125 Blk	S-3, X17 [B]
5.0 201 Red	S-5, C-13 [B]
5.0 201A Red	S-5, C100 [A]
3.0 202 Red	C-13 [H], C-24 [H]
3.0 203 Red	C-13 [E], X14 [A]
3.0 204 Red	C-13 [G], X17 [A]
3.0 205 Red	C-13 [E], X3 [E]
2.0 207 Red	C-24 [A], C-38 [A]
2.0 208 Red	C-24 [C], C-3 [B]
14.0 209 Red	CT-6, T-11
3.0 216 Red	C-13 [A], C-25 [4]
2.0 217 Red	C-13 [C], C-26 [4]
218 Fuselink	T-8, S-5
5.0 218A Red	C-13 [F], C-100 [C]
0.8 300 Org	X1 [C], C-16 [A]
0.8 301 Org	C-16 [A], C-21 [B]
0.8 302 Org	C-21 [A], C-3 [S1]
0.8 310 Org	C-26 [2], C-23 [B]
2.0 315 Org	C-26 [1], X5 [B]
0.8 417 Yel	C-8 [1], C-16 [B]
0.8 419 Yel	C-18 [B], C-16 [B]
0.8 419H Yel	X9 [2], C-32 [A]
0.8 420A Yel	S-2, C-29 [A]
0.8 420B Yel	S-2, X1 [E]
1.0 420C Yel	S-2, X3 [D]
0.8 420D Yel	S-2, C-25 [2]
0.8 420E Yel	S-2, C-26 [5]
0.8 420F Yel	S-2, C-28
1.0 420G Yel	S-2, C-7 [2]
0.8 420H Yel	S-2, X9 [2]
2.0 420J Yel	C-3 [A], S-2
1.0 420K Yel	S-2, X15 [E]
1.0 420L Yel	S-2, X7 [A]
0.8 420M Yel	S-2, C-18 [B]
0.8 420P Yel	T-9, C-28
0.8 420Q Yel	C-25 [2], C-33 [2]
0.8 420X Yel	S-2, C-30 [A]
1.0 420Z Yel	T-9, C-89 [A]
0.8 421Q Yel	C-33 [1], C-33 [C]
1.0 427 Yel	C-89 [B], C-90 [A]
2.0 590 Brn	X4 [A], X3 [A]
2.0 591 Gry	X4 [B], X3 [B]
2.0 592 Wht	X4 [C], X3 [C]
0.8 601 Tan	C-18 [A], X1 [A]
0.8 602 Tan	C-18 [A], C-8 [3]
0.8 605 Tan	C-34 [2], C-33 [3]
0.8 615 Gry	C-34 [1], X18 [B]
0.8 670 Org	X9 [3], X10 [A]
0.8 675 Grn	X9 [1], X10 [B]
0.8 684 Grn	C-31 [5], C-30 [B]
3.0 700 Pur	C-25 [1], X1 [B]
0.8 705 Pur	C-3 [S1], C-25 [5]
0.8 710 Pur	C-33 [5], C-12 [B]
0.8 711 Pur	C-33 [5], C-3 [S2]
0.8 800 Pnk	C-7 [1], X11 [B]
0.8 801 Pnk	C-7 [1], X12 [B]
0.8 810 Pnk	T-10, C-1 [A]
0.8 820 Pur	X15 [A], X16 [A]
0.8 830 Pnk	C-7 [4], X16 [B]
0.8 840 Blu	X15 [C], X16 [C]
0.8 850 Grn	X15 [D], X16 [D]
0.8 960 Wht	C-31 [3], C-32 [B]

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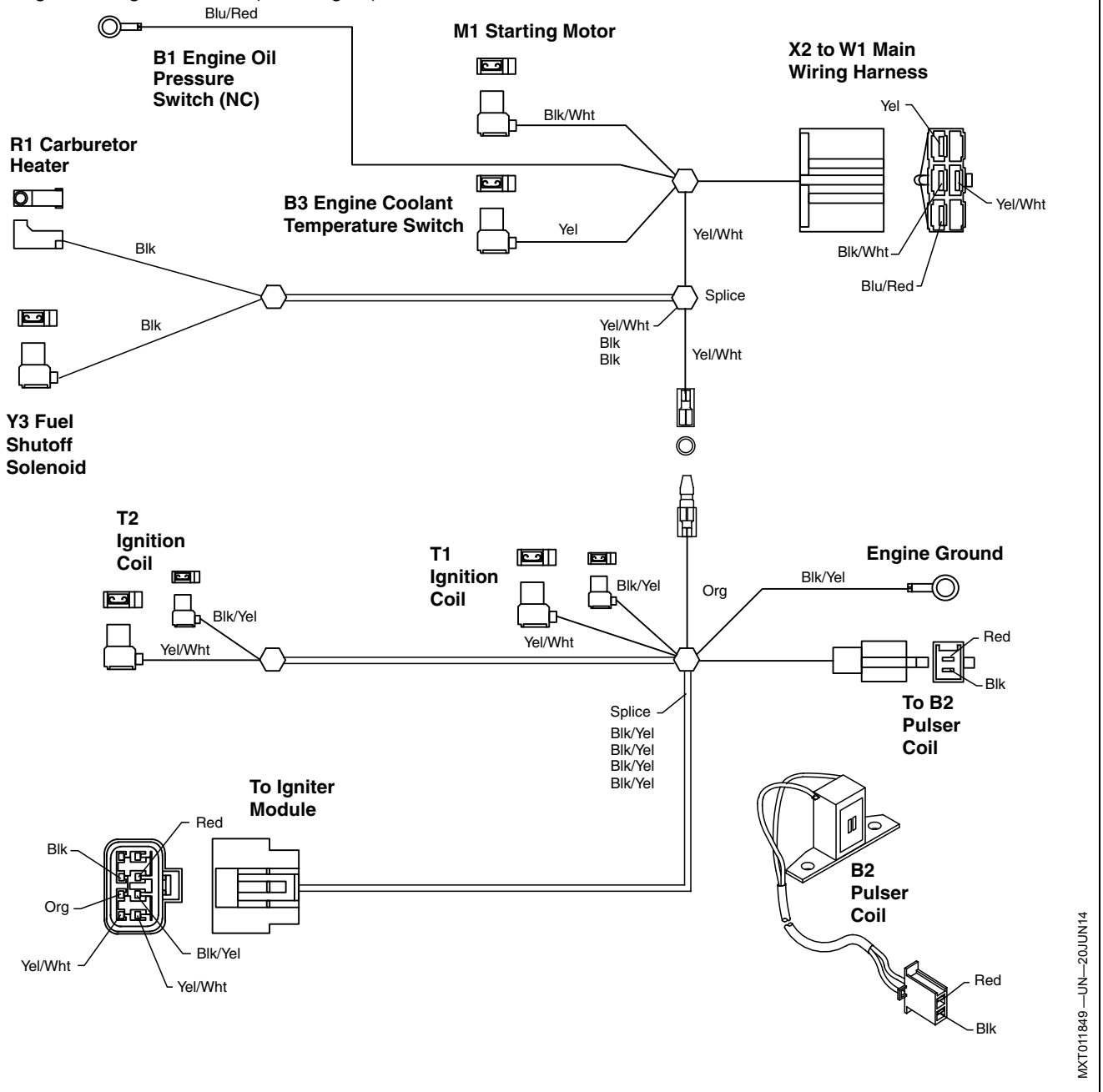
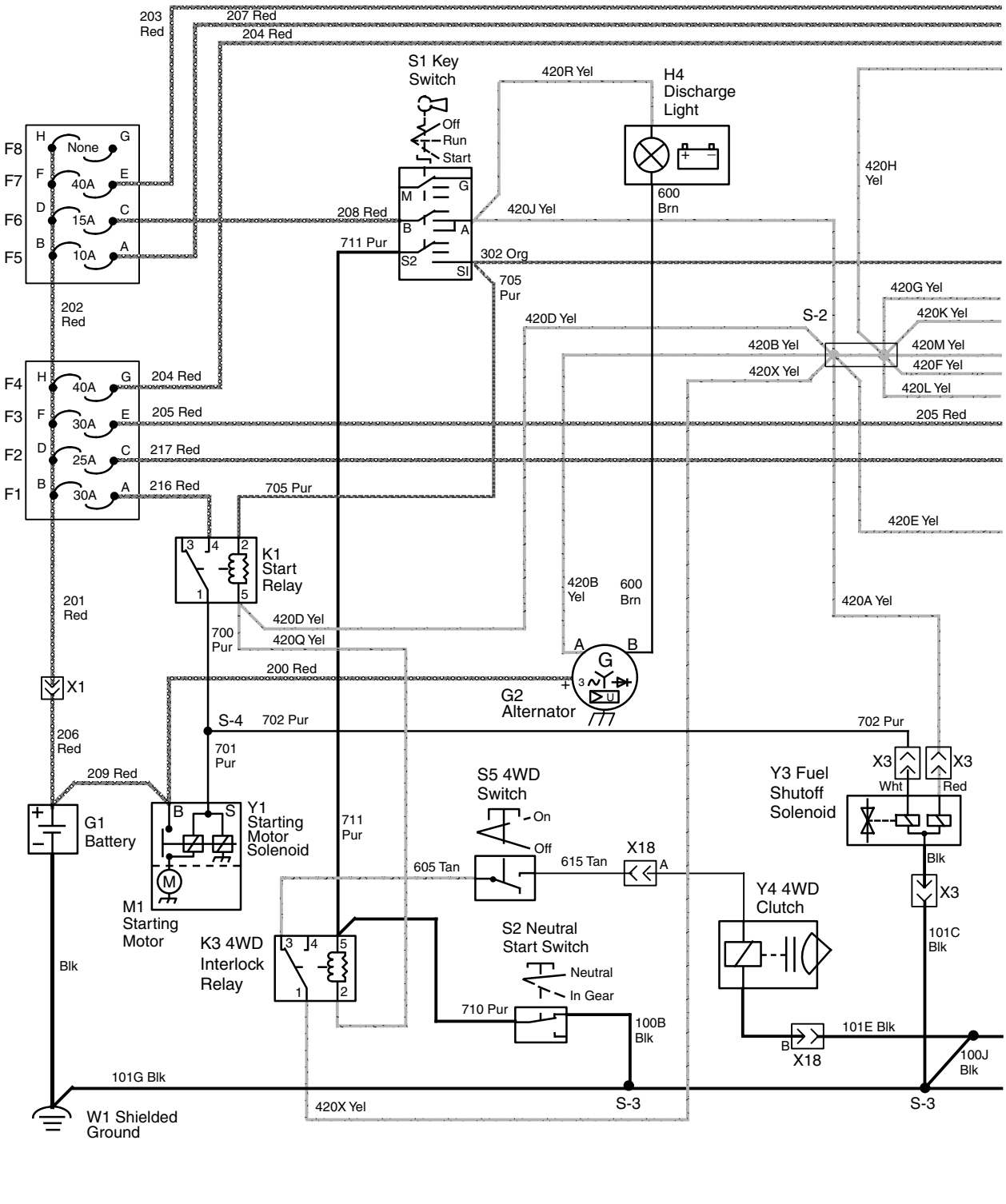
W2 Engine Wiring Harnesses (Gas Engine SN 040001-)

W2 Engine Wiring Harnesses (Gas Engine)



MX52301,000043E -19-24OCT14-1/1

Main Schematic (Diesel Engines SN 040001-080000)
1 of 3



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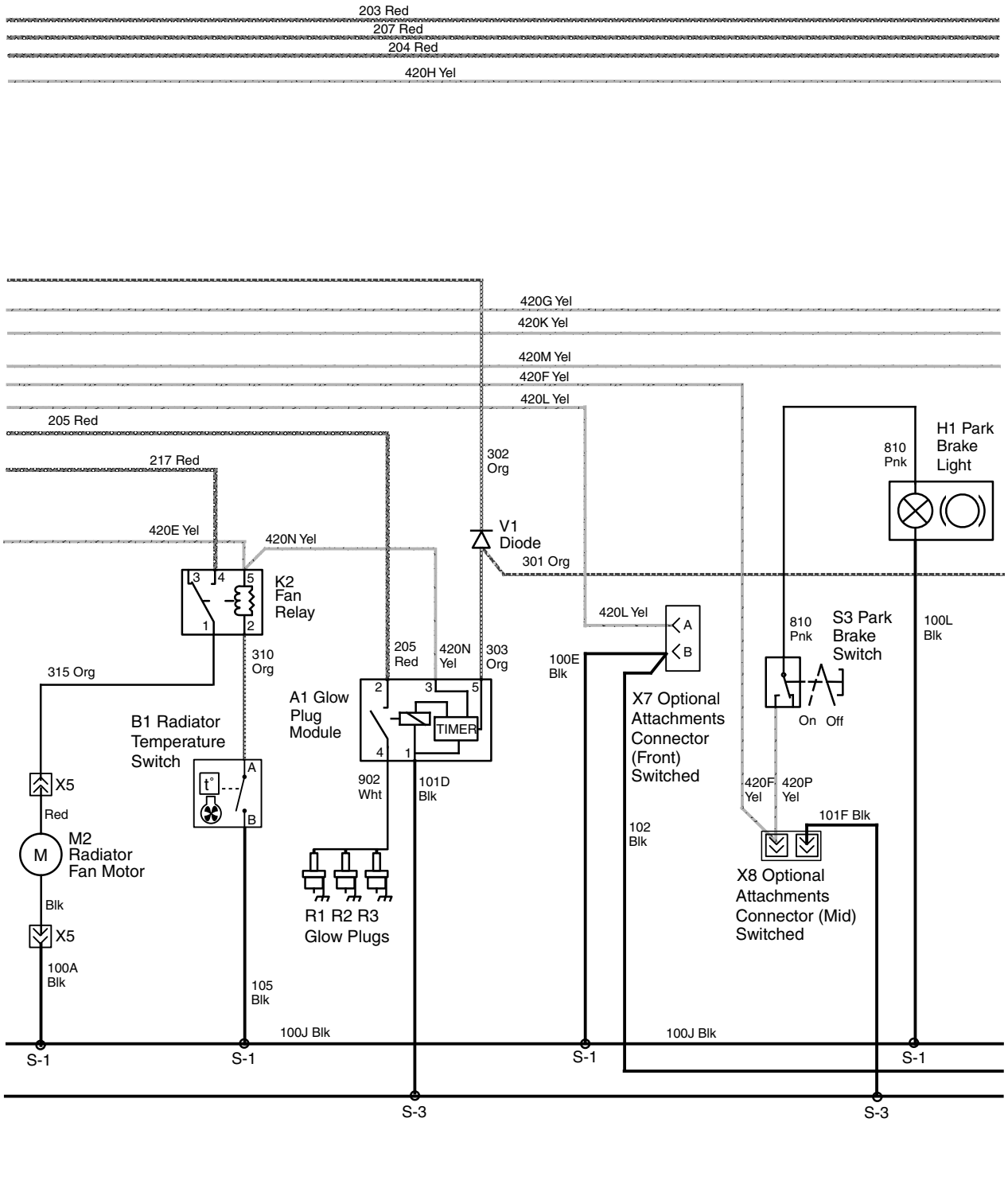
MX52301,00000FC -19-24OCT14-1/3

Main Schematic (Diesel Engines SN 040001-080000) 2 of 3



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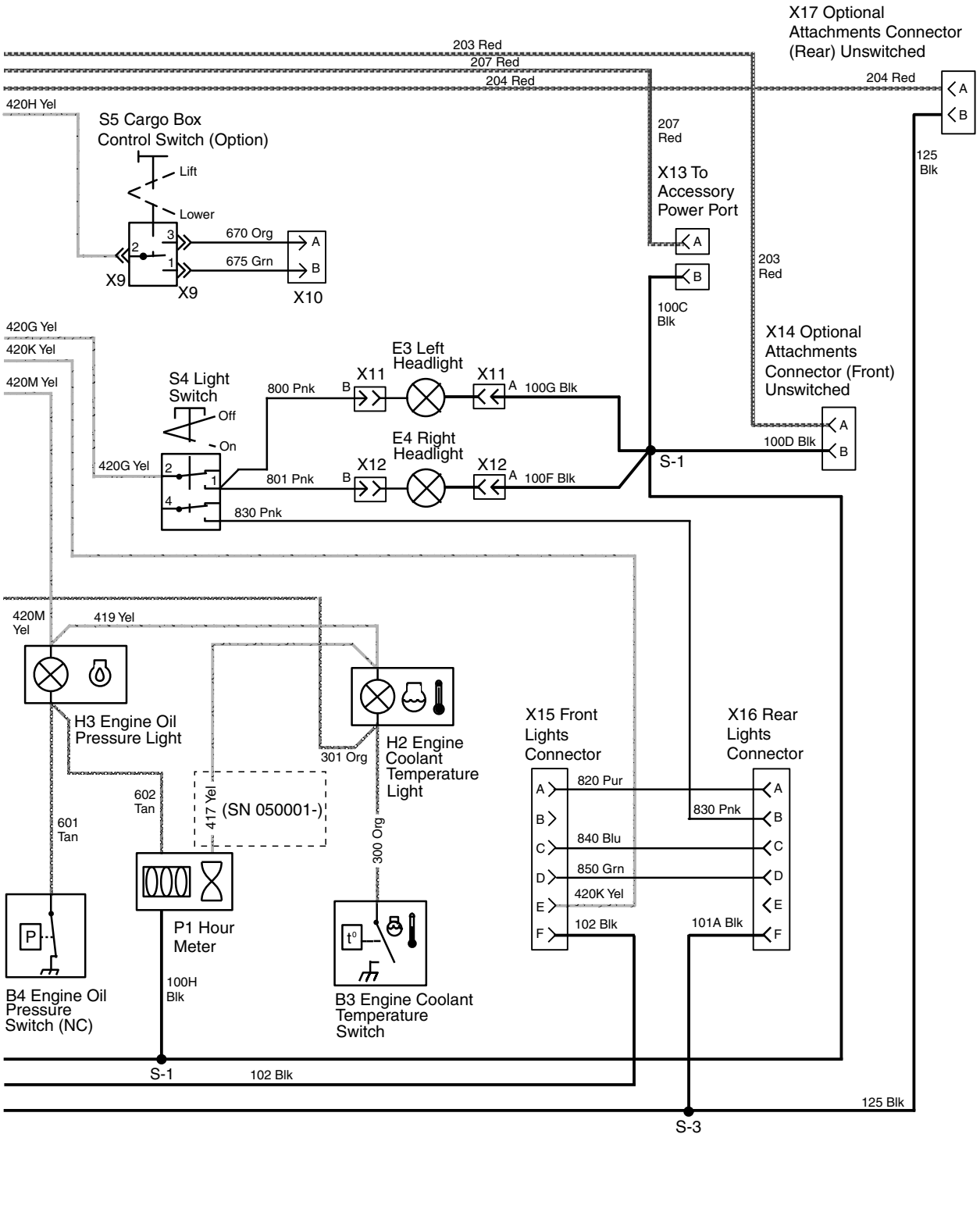
MX52301,00000FC -19-24OCT14-2/3

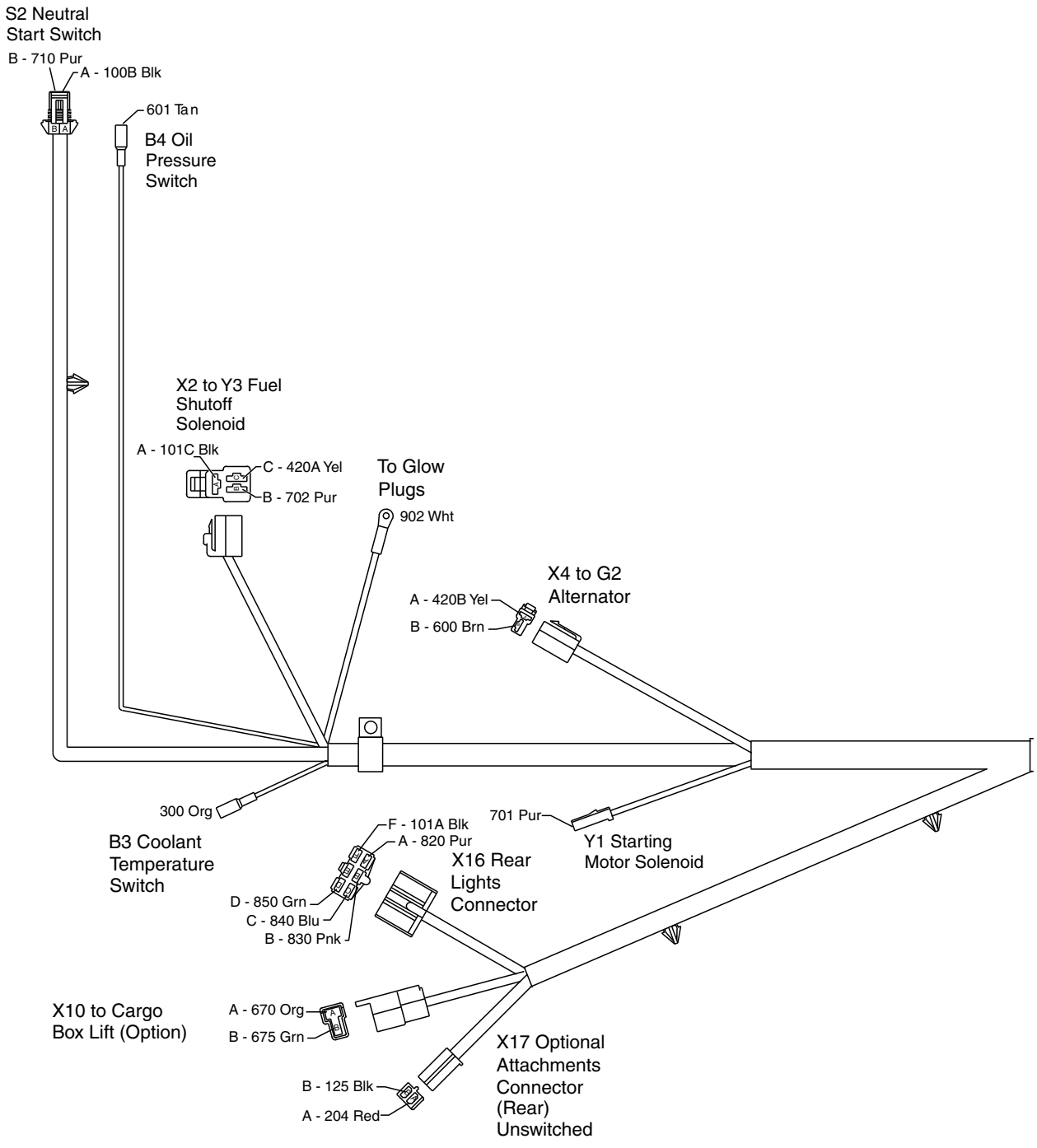
Main Schematic (Diesel Engines SN 040001-080000) 3 of 3



MX52301,00000FC -19-24OCT14-3/3

Main Wiring Harness (Diesel Engines SN 040001-080000)

1 of 4



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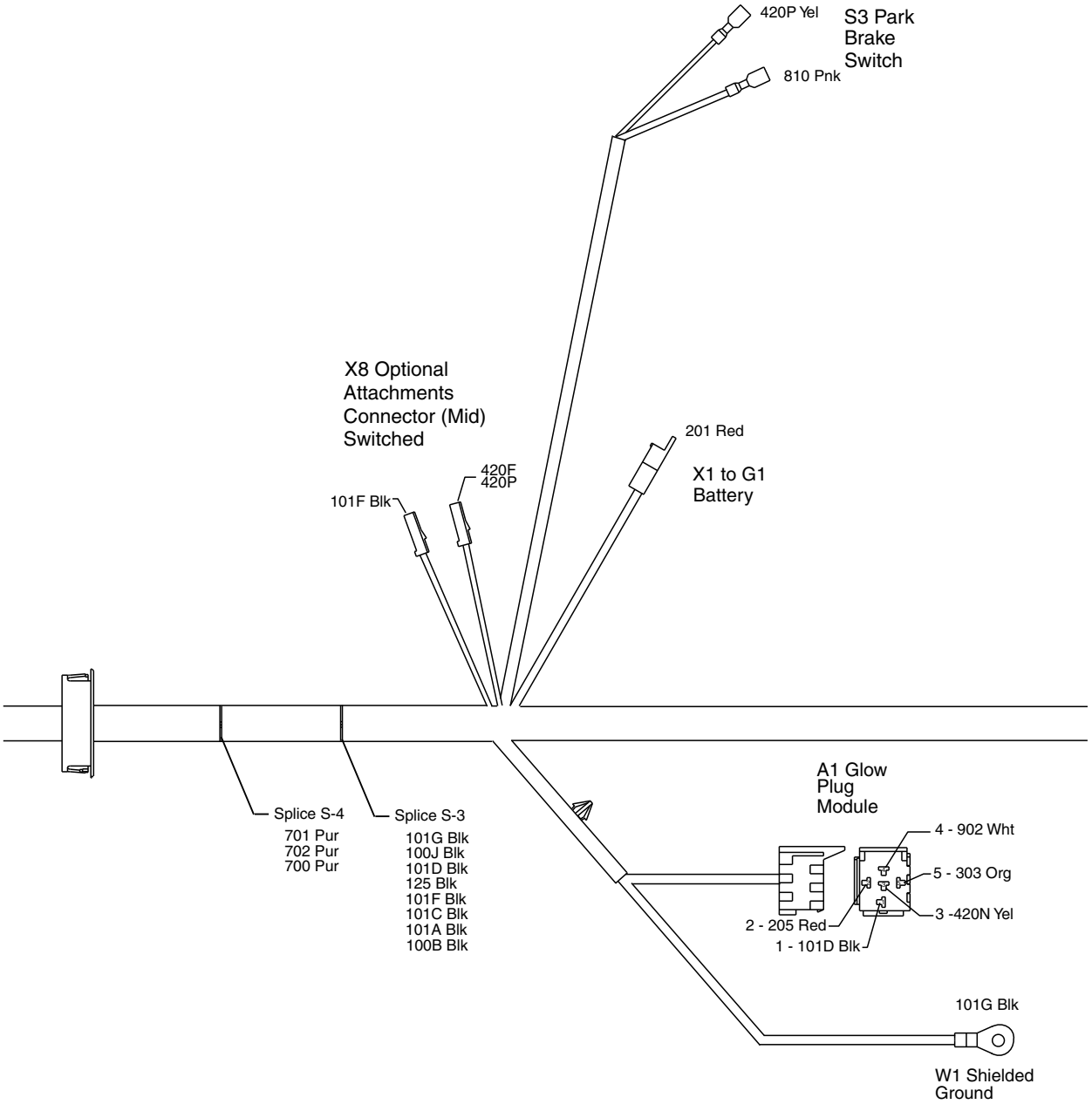
MX52301,00000FD -19-24OCT14-1/4

Main Wiring Harness (Diesel Engines SN 040001-080000) 2 of 4



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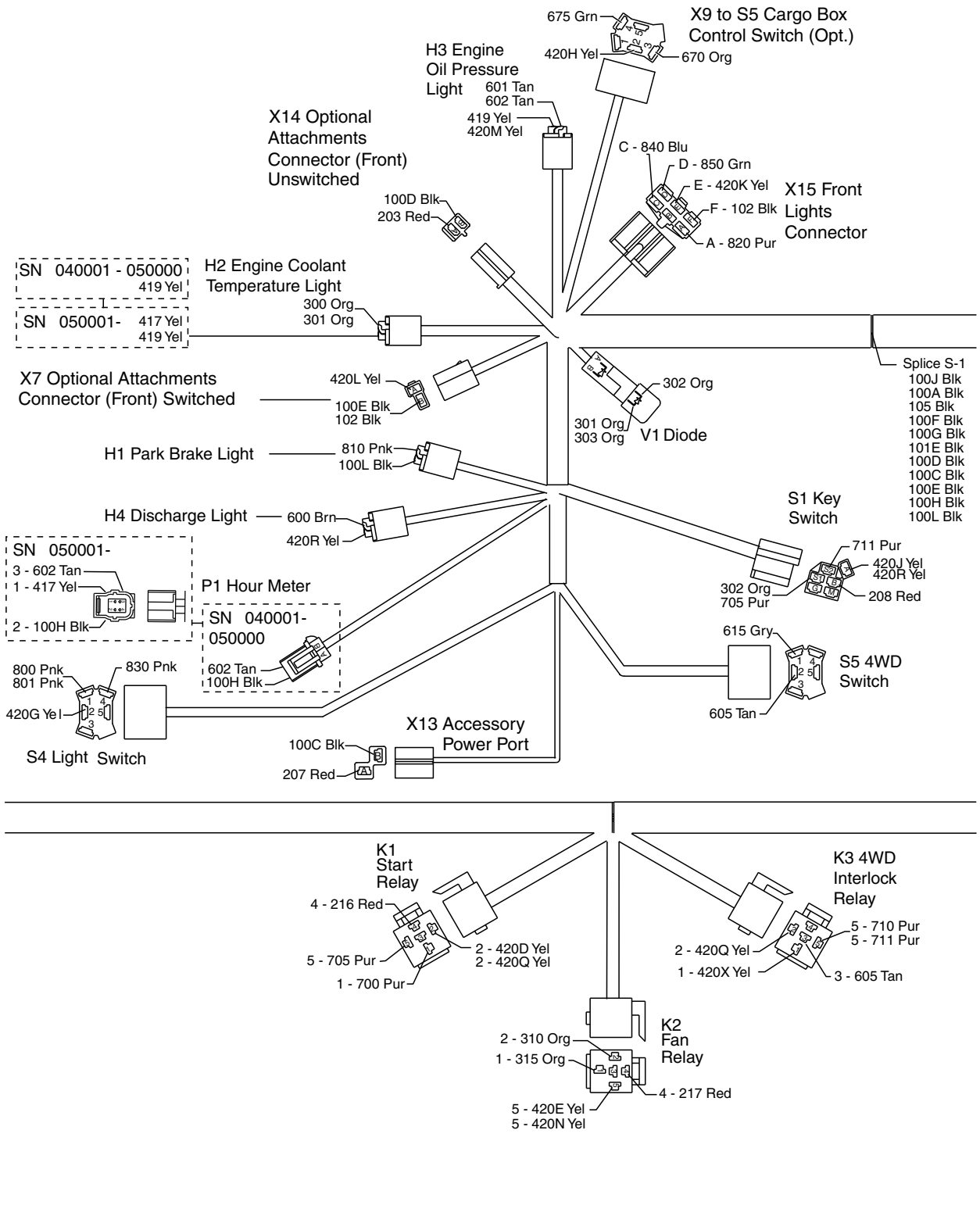
MX52301,00000FD -19-24OCT14-2/4

Main Wiring Harness (Diesel Engines SN 040001-080000) 3 of 4



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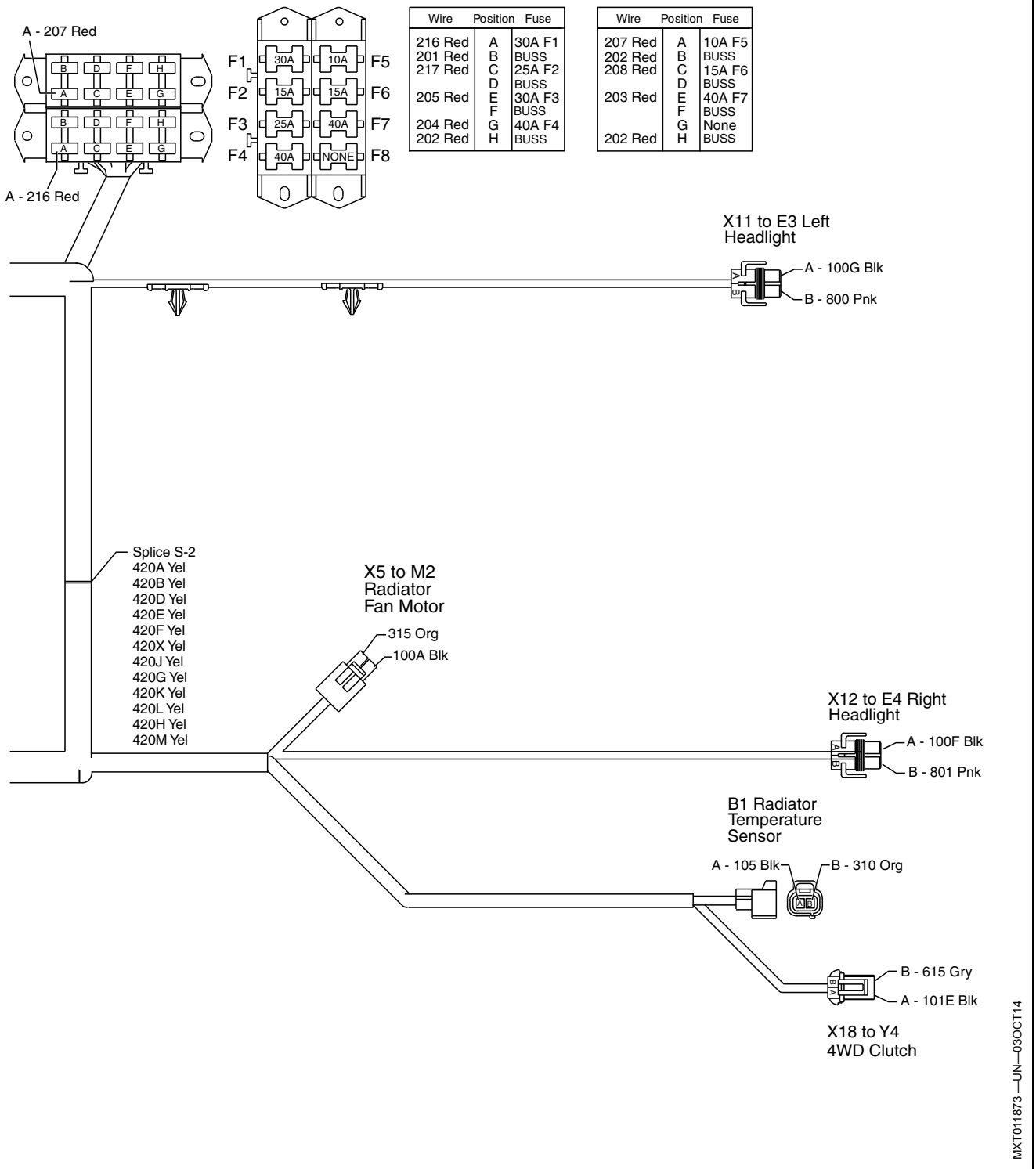
Main Wiring Harness (Diesel Engines SN 040001-080000) 4 of 4



Wire	Position	Fuse
216 Red	A	30A F1
201 Red	B	BUSS
217 Red	C	25A F2
	D	BUSS
205 Red	E	30A F3
	F	BUSS
204 Red	G	40A F4
202 Red	H	BUSS

Wire	Position	Fuse
207 Red	A	10A F5
202 Red	B	BUSS
208 Red	C	15A F6
	D	BUSS
203 Red	E	40A F7
	F	BUSS
	G	None
202 Red	H	BUSS

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Main Harness Wire Color Codes (Diesel Engines SN 040001-080000)

Size/No./Color	Wire Connection Points
2.0 100A Blk	Splice 1, X5[A] (M2)
1.0 100B Blk	Splice 3, S2
2.0 100C Blk	Splice 1, X13[B] (Power Port)
3.0 100D Blk	Splice 1, X14[B]
1.0 100E Blk	Splice 1, X7[B]
0.8 100F Blk	Splice 1, X12[A] (E4)
0.8 100G Blk	Splice 1, X11[A] (E3)
0.8 100H Blk	Splice 1, P1[B] (P1[2] for SN 050000-)
3.0 100J Blk	Splice 1, Splice 3
0.8 100L Blk	Splice 1, H1[B]
1.0 101A Blk	Splice 3, X16[F]
0.8 101C Blk	Splice 3, X2[A] (Y2)
0.8 101D Blk	Splice 3, A1[1]
0.8 101E Blk	Splice 1, X18[A] (Y4)
0.8 101F Blk	Splice 3, X8
5.0 101G Blk	W1, Splice 3
1.0 102 Blk	X7[B], X15[F]
0.8 105 Blk	Splice 1, B1[A]
3.0 125 Blk	Splice 3, X17[B]
5.0 201 Red	X1, Fuse Block
2.0 202 Red	Fuse Block Jumper
3.0 203 Red	F7[E], X14[A]
3.0 204 Red	F4[G], X17[A]
3.0 205 Red	F3[E], A1[2]
2.0 206 Red	G1, X1
2.0 207 Red	F5[A], X13[A] (Power Port)
2.0 208 Red	F6[C], S1[B]
3.0 209 Red	G1, Y1[B]
3.0 216 Red	F1[A], K1[4]
2.0 217 Red	F2[C], K2[4]
0.8 300 Org	H2[A], B3
0.8 301 Org	V1[B], H2[A]
0.8 302 Org	V1[A], S1[S1]
0.8 303 Org	V1[B], A1[5]
0.8 310 Org	K2[2], B1[B]
2.0 315 Org	K2[1], X5[B] (M2)
0.8 417 Yel (SN 050000-)	H2[B], P1[1]
0.8 419 Yel	H3[B], H2[B]
0.8 420A Yel	Splice 2, X2[B] (Y3)
0.8 420B Yel	Splice 2, X4[A] (G2)
0.8 420D Yel	Splice 2, K1[2]
0.8 420E Yel	Splice 2, K2[5]
0.8 420F Yel	Splice 2, X8
1.0 420G Yel	Splice 2, S4[2]
0.8 420H Yel	Splice 2, X9[2] (S5)
2.0 420J Yel	S1[A], Splice 2
1.0 420K Yel	Splice 2, X15[E]
1.0 420L Yel	Splice 2, X7[A]
0.8 420M Yel	Splice 2, H3[B]
0.8 420N Yel	K2[5], A1[3]
0.8 420P Yel	S3, X8
0.8 420R Yel	S1[A], H4[B]
0.8 420Q Yel	K1[2], K3[2]
0.8 420X Yel	Splice 2, K3[1]
0.8 600 Brn	H4[A], X4[B] (G2)
0.8 601 Tan	H3[A], B4
0.8 602 Tan	H3[A], P1[A] (P1[3] for SN050000-)
0.8 605 Tan	S5[2], K3[3]
0.8 615 Gry	S5[1], X18[B] (Y4)
1.0 670 Org	X9[3] (S5), X10[A]
1.0 675 Grn	X9[1] (S5), X10[B]
3.0 700 Pur	Splice 4, K1[1]
3.0 701 Pur	Splice 4, Y1[B]
3.0 702 Pur	Splice 4, X2[C] (Y3)
0.8 705 Pur	K1[5], S1[S1]
0.8 710 Pur	K3[5], S2[A]
0.8 711 Pur	K3[5], S1[S2]
0.8 800 Pnk	S4[1], X11[B] (E3)
0.8 801 Pnk	S4[1], X12[B] (E4)
0.8 810 Pnk	S3, H1[A]
1.0 820 Pur	X15[A], X16[A]
1.0 830 Pnk	S4[4], X16[B]
1.0 840 Blu	X15[C], X16[C]
1.0 850 Grn	X15[D], X16[D]
3.0 902 Wht	A1[4], R1-R2-R3

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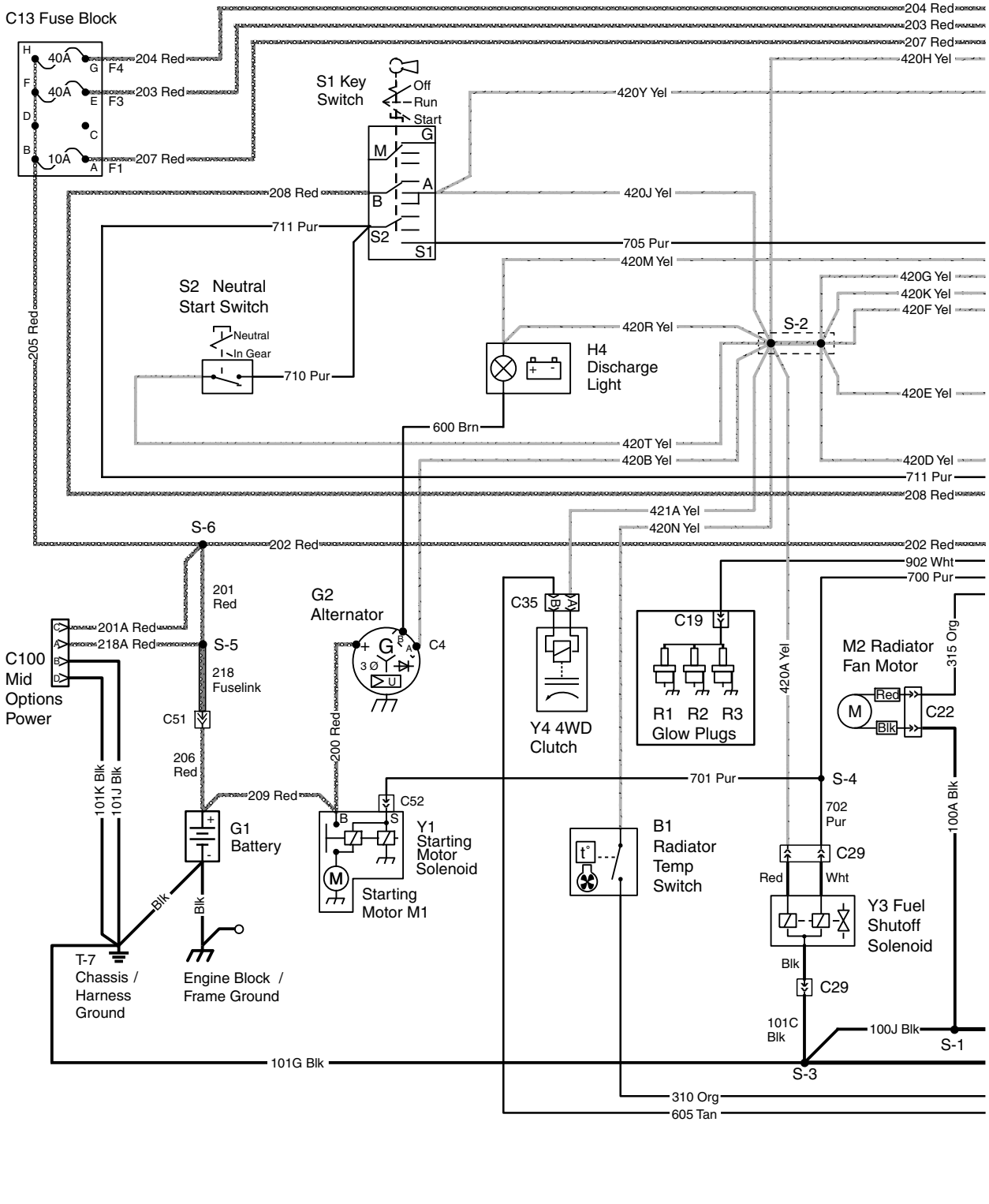
Main Schematic (Diesel Engines SN 080001-110000)

1 of 3



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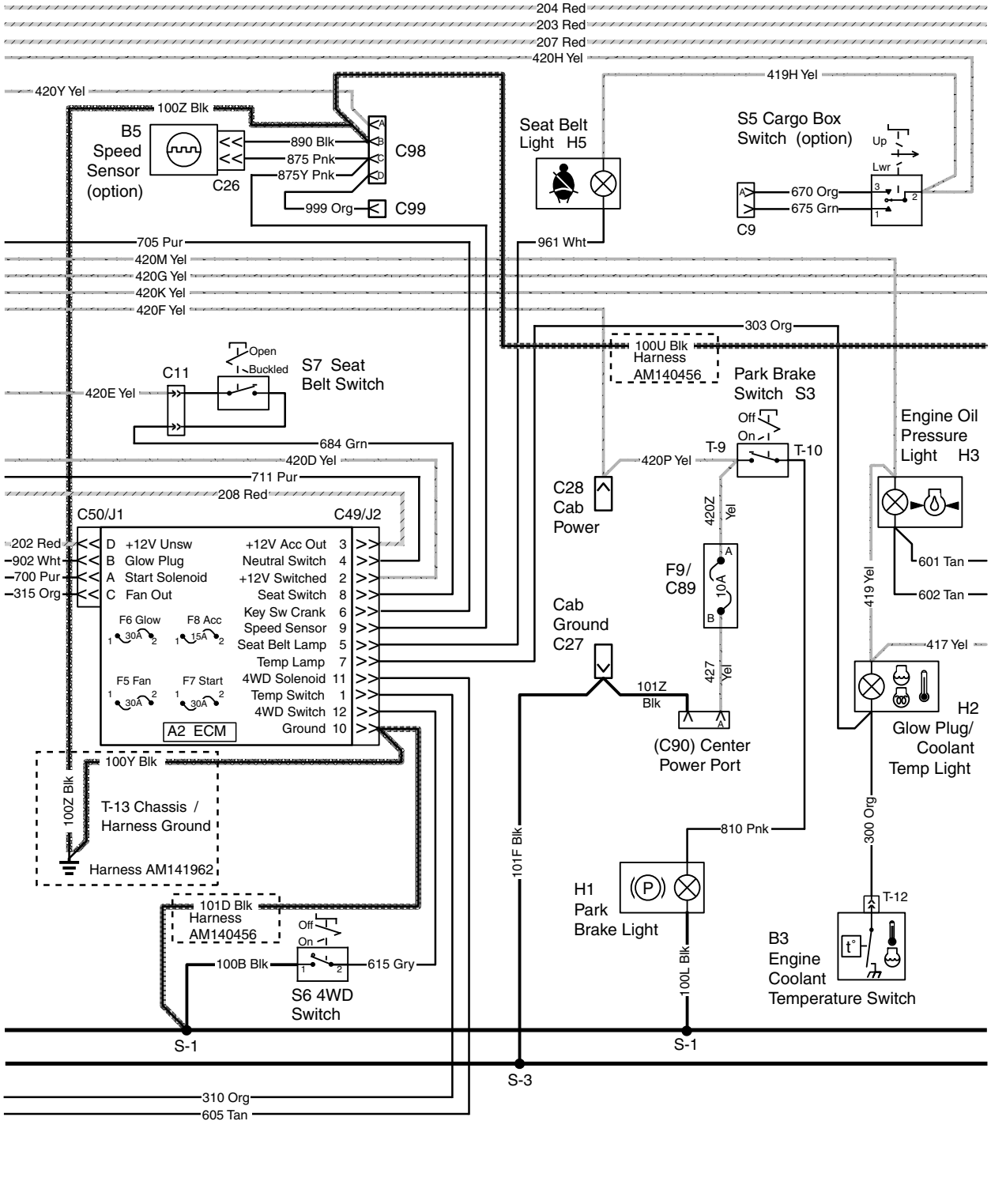
Main Schematic (Diesel Engines SN 080001-110000) 2 of 3



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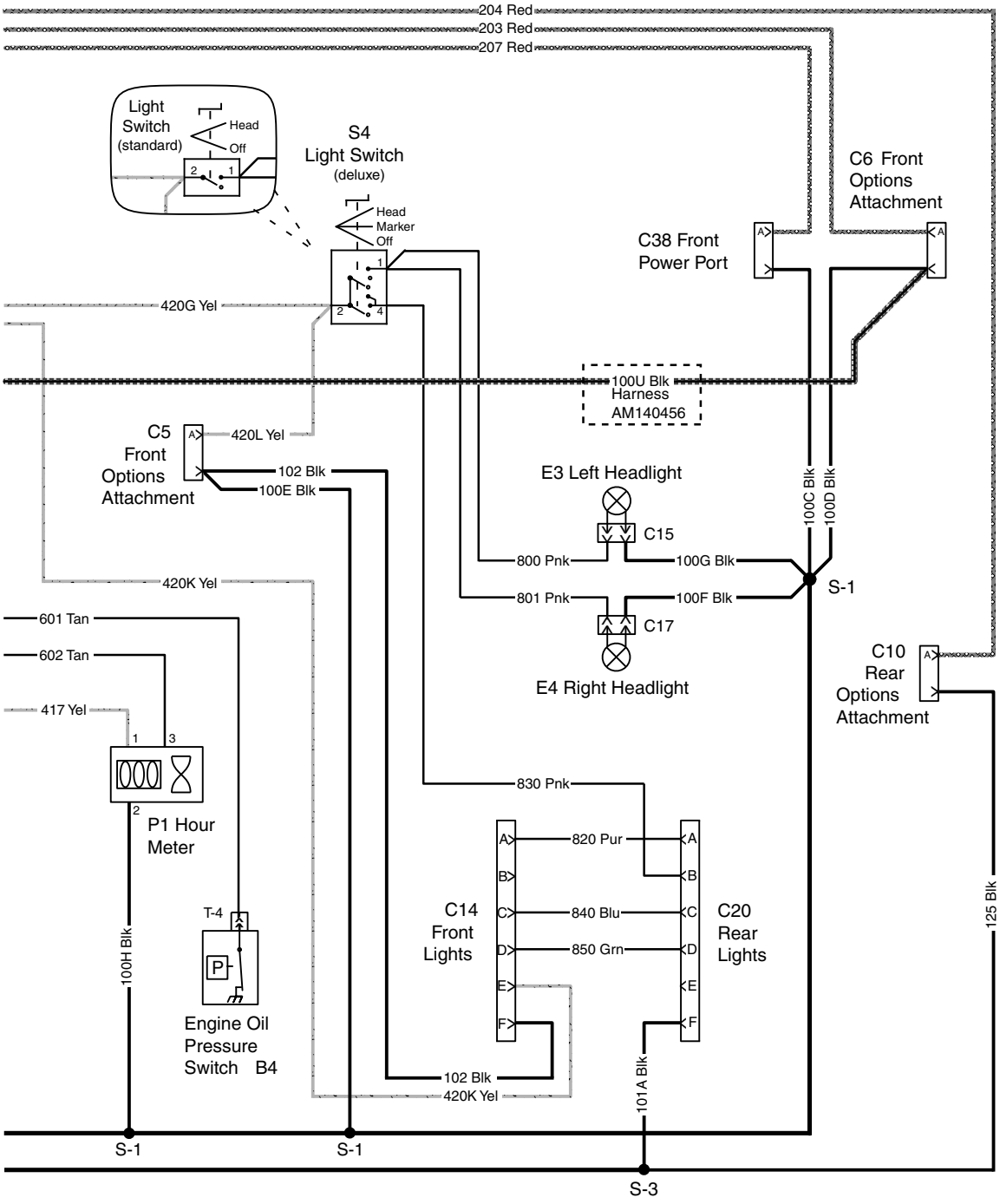
MX52301,00000FF -19-24OCT14-2/3

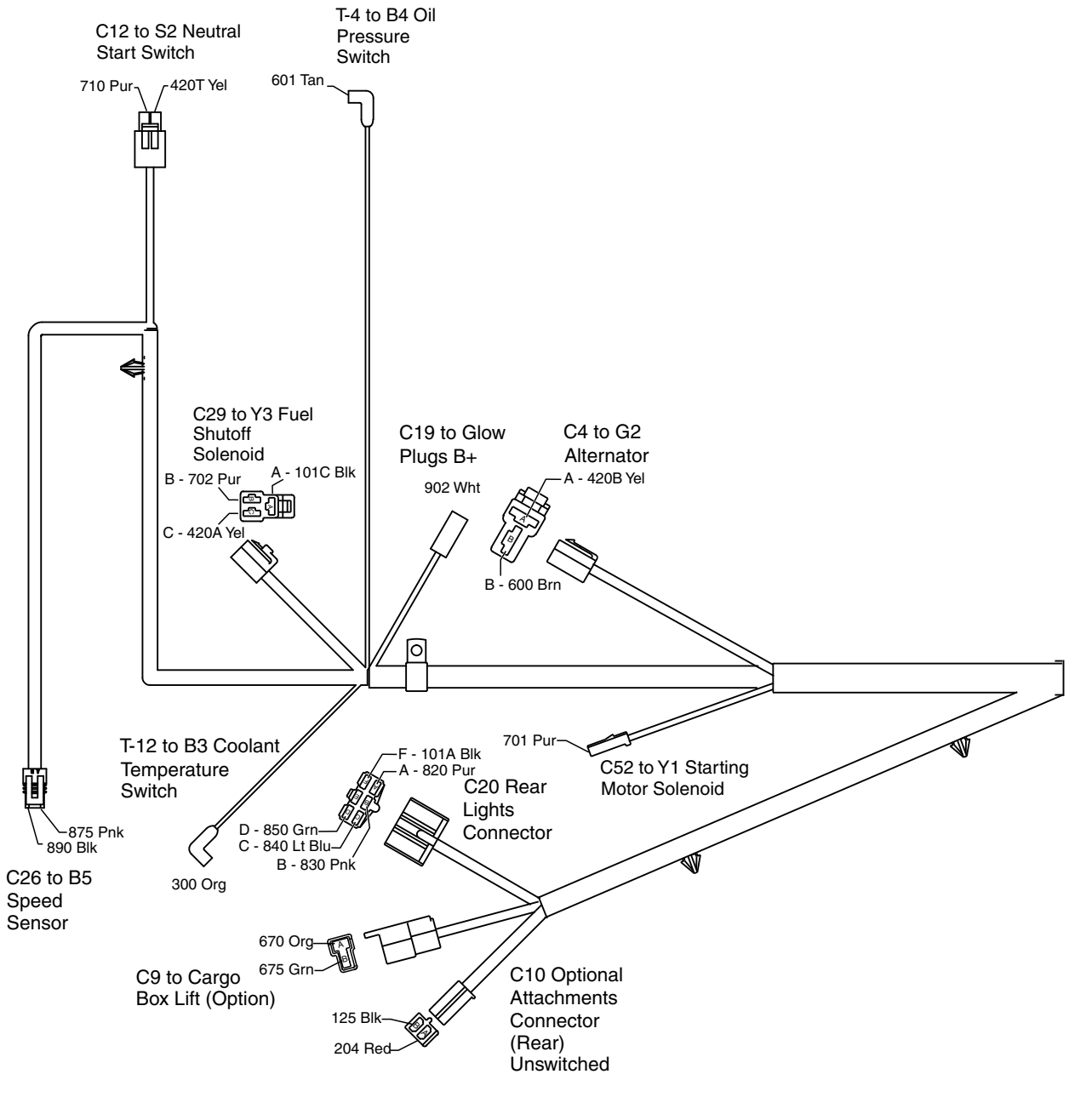
Main Schematic (Diesel Engines SN 080001-110000) 3 of 3



MX52301,00000FF -19-24OCT14-3/3

Main Wiring Harness (Diesel Engines SN 080001-110000)

1 of 4



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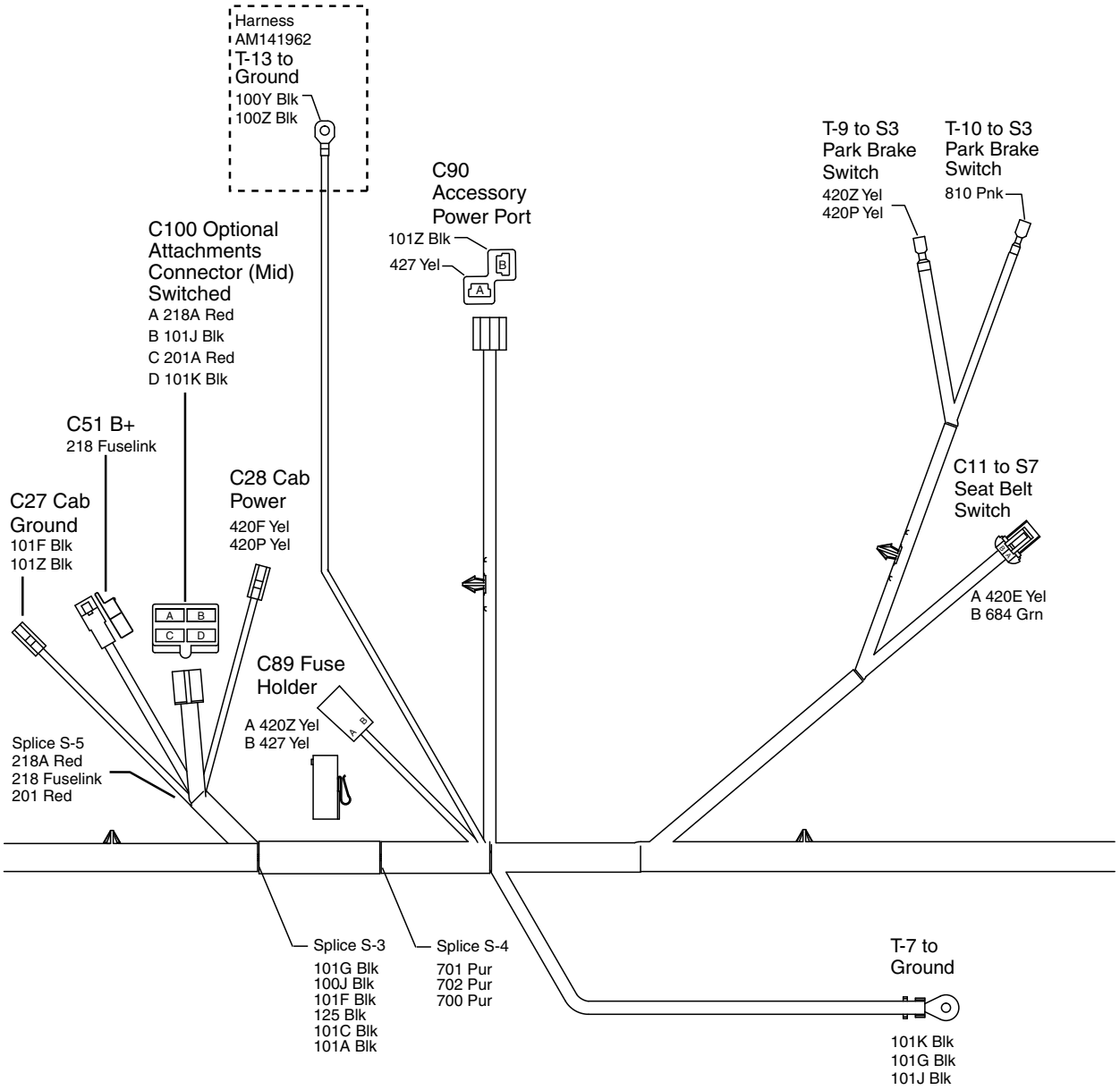
MX52301,0000100 -19-24OCT14-1/4

Main Wiring Harness (Diesel Engines SN 080001-110000) 2 of 4



MXT011878 —UN—27OCT14

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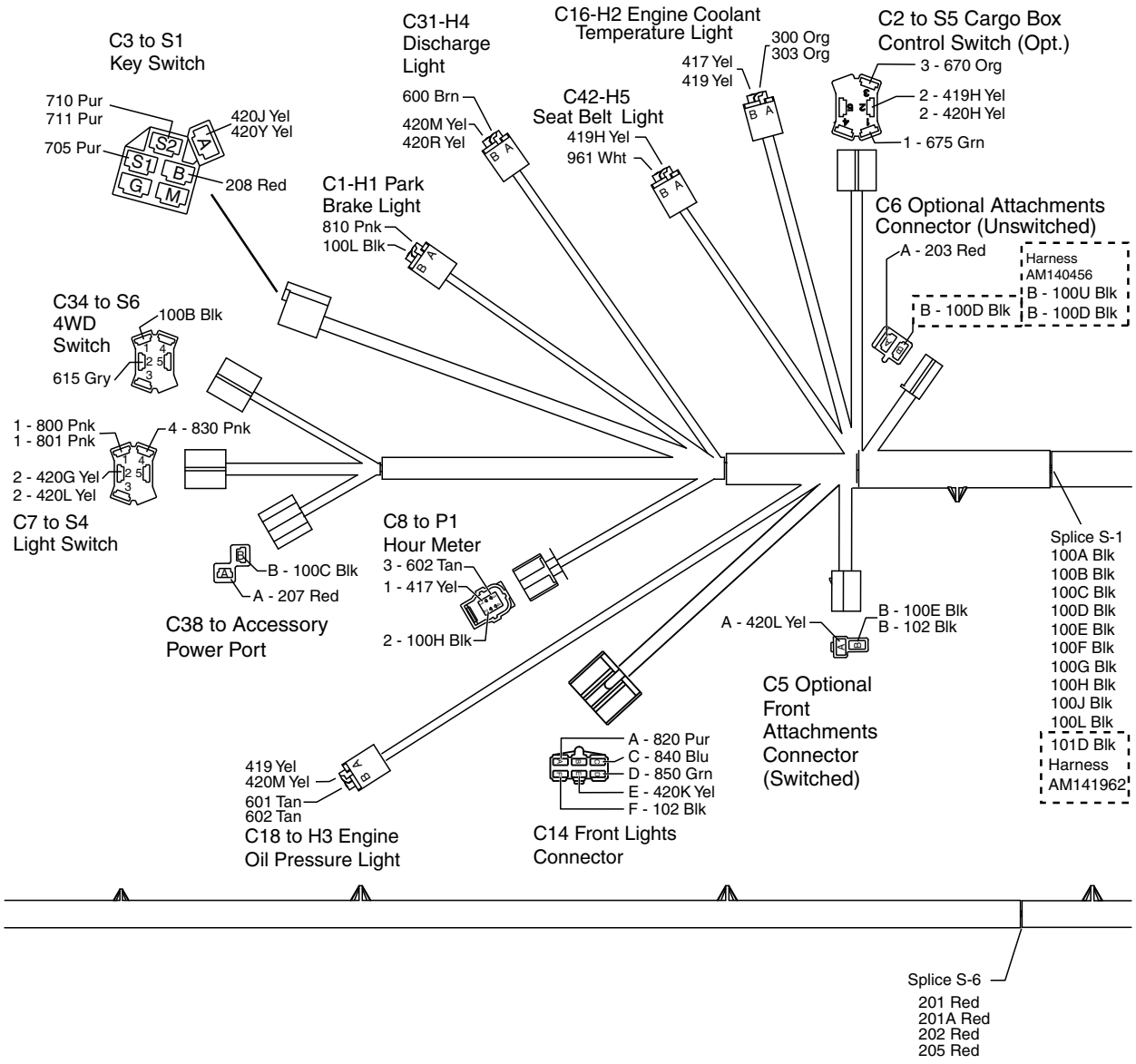
MX52301,0000100 -19-24OCT14-2/4

Main Wiring Harness (Diesel Engines SN 080001-110000) 3 of 4



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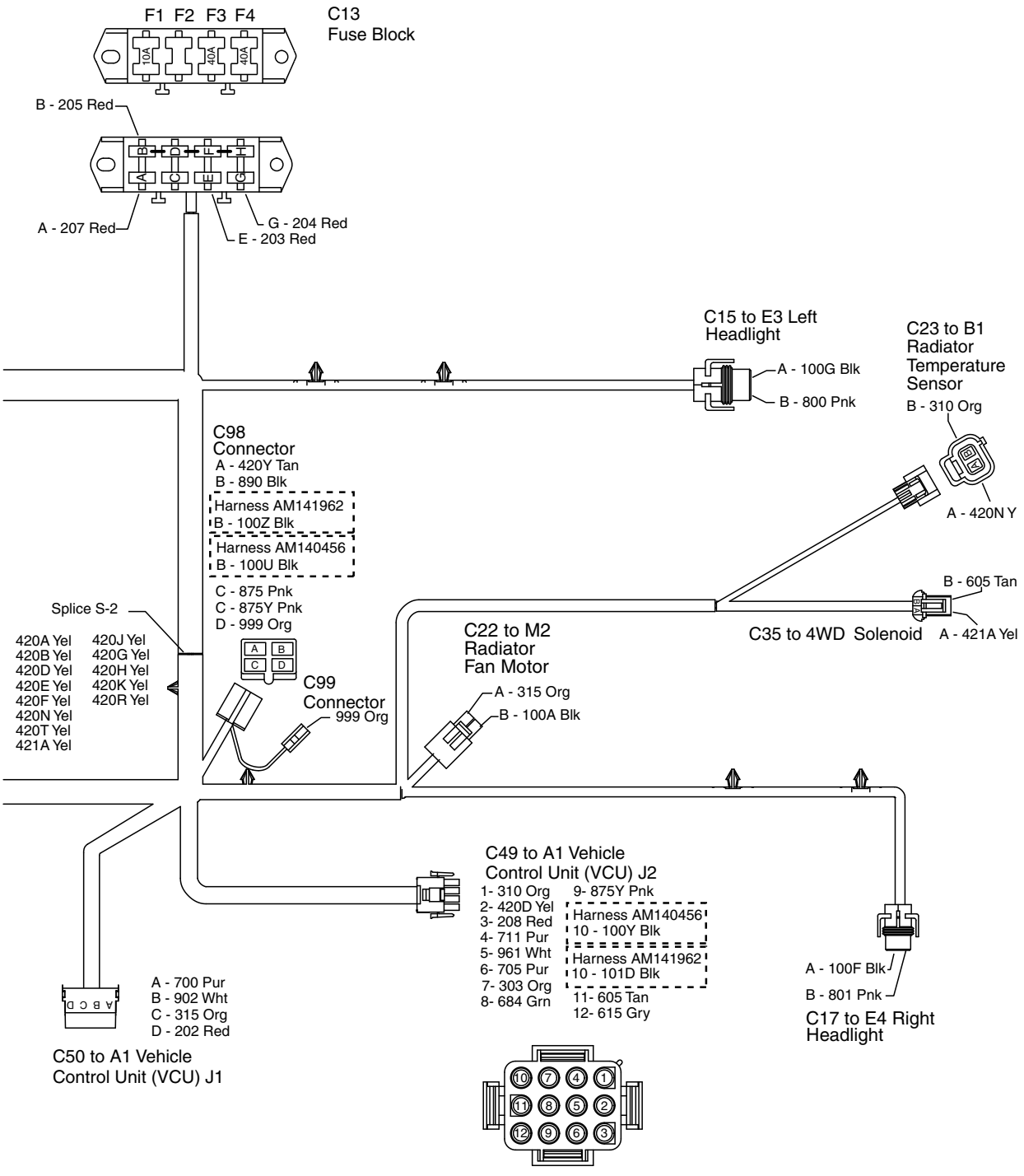
MX52301,0000100 -19-24OCT14-3/4

Main Wiring Harness (Diesel Engines SN 080001-110000) 4 of 4



MX52301,0000100 -19-24OCT14-4/4

Main Harness Wire Color Codes (Diesel Engines SN 080001-110000)

3.0 100A Blk	Splice S-1, C22 (M2)
0.8 100B Blk	Splice S-1, C34 (S6)
2.0 100C Blk	Splice S-1, C29 (Y3)
3.0 100D Blk	Splice S-1, C6
0.8 100E Blk	Splice S-1, C5
0.8 100F Blk	Splice S-1, C17 (E4)
0.8 100G Blk	Splice S-1, C15 (E3)
0.8 100H Blk	Splice S-1, C8 (P1)
3.0 100J Blk	Splice S-1, Splice S-3
0.8 100L Blk	Splice S-1, C1 (H1)
0.8 100U Blk (Harness AM141962)	C6 (B), C98 (B)
0.8 100Y Blk (Harness AM141962)	C49 (A1 VCU J2-10), T-13
0.8 100Z Blk (Harness AM141962)	C98, T-13
0.8 101A Blk	Splice S-3, C20
3.0 101C Blk	Splice S-3, C29 (Y3)
0.8 101D Blk (Harness AM141962)	Splice S-1, C49 (A1 VCU J2-10)
0.8 101F Blk	Splice S-3, C27
5.0 101G Blk	T-7, Splice S-3
5.0 101J Blk	C100, T-7
5.0 101K Blk	C100, T-7
1.0 101Z Blk	C90, C27
0.8 102 Blk	C14, C5
3.0 125 Blk	Splice S-3, C10
5.0 201 Red	Splice S-5, Splice S-6
5.0 201A Red	Splice S-6, C100
5.0 202 Red	Splice S-6, C50 (A1 VCU J1-D)
3.0 203 Red	C13-E (F3), C6
3.0 204 Red	C13-G (F4), C10
3.0 205 Red	Splice S-6, C13-B (F1)
1.0 207 Red	C13-A (F1), C38
2.0 208 Red	C49 (A1 VCU J2-3), C3 (S1)
2.0 218 Fuse Link	G1 Battery, Splice S-5
5.0 218A Red	Splice S-5, C100
0.8 300 Org	T-12, C16 (H2)
0.8 303 Org	C49 (A1 VCU J2-7), C16 (H2)
0.8 310 Or	C49 (A1 VCU J2-1), C23 (B1)
2.0 315 Org	C50 (A1 VCU J1-C), C22 (M2)
0.8 417 Yel	C8 (P1), C16 (H2)
0.8 419 Yel	C16 (H2), C18 (H3)
0.8 419H Yel	C2 (S5), C42 (H5)
0.8 420A Yel	Splice S-2, C29 (Y3)
0.8 420B Yel	Splice S-2, C4 (G2)

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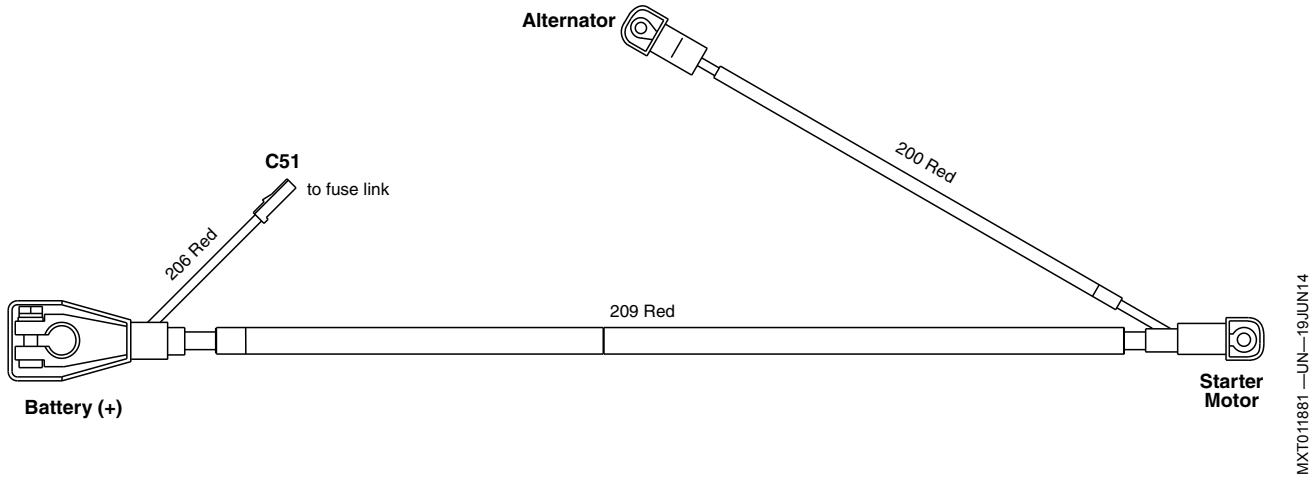
MX52301,0000101 -19-27OCT14-1/2

0.8 420D Yel	C49 (A1 VCU J2-2), Splice S-2
0.8 420E Yel	C11 (S7), Splice S-2
0.8 420F Yel	Splice S-2, C28
0.8 420G Yel	C7 (S4), Splice S-2
0.8 420H Yel	C98, Splice S-2
2.0 420J Yel	C3 (S1), Splice S-2
0.8 420K Yel	C14, Splice S-2
0.8 420L Yel	C7 (S4), C5
0.8 420M Yel	C31 (H4), C18 (H3)
0.8 420N Yel	Splice S-2, C23 (B1)
0.8 420P Yel	C28, T-9 (S3)
0.8 420R Yel	Splice S-2, C31 (H4)
0.8 420T Yel	Splice S-2, C12 (S2)
0.8 420Y Tan	C3 (S1), C98
1.0 420Z Yel	T-9 (S3), C89 (F9)
0.8 421A Yel	Splice S-2, C35 (Y4)
1.0 427 Yel	C89 (F9), C90
0.8 600 Brn	C31 (H4), C4 (G2)
0.8 601 Tan	C18 (H3), T-4 (B4)
0.8 602 Tan	C18 (H3), C8 (P1)
0.8 605 Tan	C35 (Y4), C49 (A1 VCU J2-11)
0.8 615 Gry	C34 (S6), C49 (A1 VCU J2-12)
0.8 670 Org	C2 (S5), C9
0.8 675 Grn	C2 (S5), C9
0.8 684 Grn	C11 (S7), C49 (A1 VCU J2-8)
3.0 700 Pur	C50 (A1 VCU J1-A), Splice S-4
3.0 701 Pur	C52 (Y1), Splice S-4
3.0 702 Pur	Splice S-4, C29 (Y3)
0.8 705 Pur	C49 (A1 VCU J2-6), C3 (S1)
0.8 710 Pur	C3 (S1), C12 (S2)
0.8 711 Pur	C3 (S1), C49 (A1 VCU J2-4)
0.8 800 Pnk	C7 (S4), C15 (E3)
0.8 801 Pnk	C7 (S4), C17 (E4)
0.8 810 Pnk	T-10 (S3), C1 (H1)
0.8 820 Pur	C14, C20
0.8 830 Pnk	C7 (S4), C20
0.8 840 Lt Blu	C14, C20
0.8 850 Grn	C14, C20
0.8 875 Pnk	C98, C26
0.8 875Y Pnk	C98, C49 (A1 VCU J2-9)
0.8 890 Blk	C98, C26
3.0 902 Wht	C50 (A1 VCU J1-B), C19
0.8 961 Wht	C42 (H5), C49 (A1 VCU J2-5)
0.8 999 Org	C98, C99

MX52301,0000101 -19-27OCT14-2/2

Battery Wiring Harness—Diesel (SN 040001-)



Size/No./Color	Wire Connection Points
8.0 200 Red	G2, Y1
5.0 206 Red	G1, C51
19.0 209 Red	G1, Y1

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Group 42
Schematics and Harnesses (SN 110000-)

Summary of References

- Main Wiring Schematic (Gas Engines SN 110001-120000)
- Main Wiring Harness (Gas Engines SN 110001-120000)
- Main Harness Wire Color Codes (Gas Engine SN 110001-120000)
- Main Wiring Schematic (Gas Engines SN 120001-)
- Main Wiring Harness (Gas Engines SN 120001-)
- Main Harness Wire Color Codes (Gas Engine SN 120001-)
- Main Wiring Schematic (Diesel Engines SN 110001-120000)
- Main Wiring Harness (Diesel Engines SN 110001-120000)
- Main Harness Wire Color Codes (Diesel Engines SN 110001-120000)
- Main Wiring Schematic (Diesel Engines SN 120001-)
- Main Wiring Harness (Diesel Engines SN 120001-)
- Main Harness Wire Color Codes (Diesel Engines SN 120001-)

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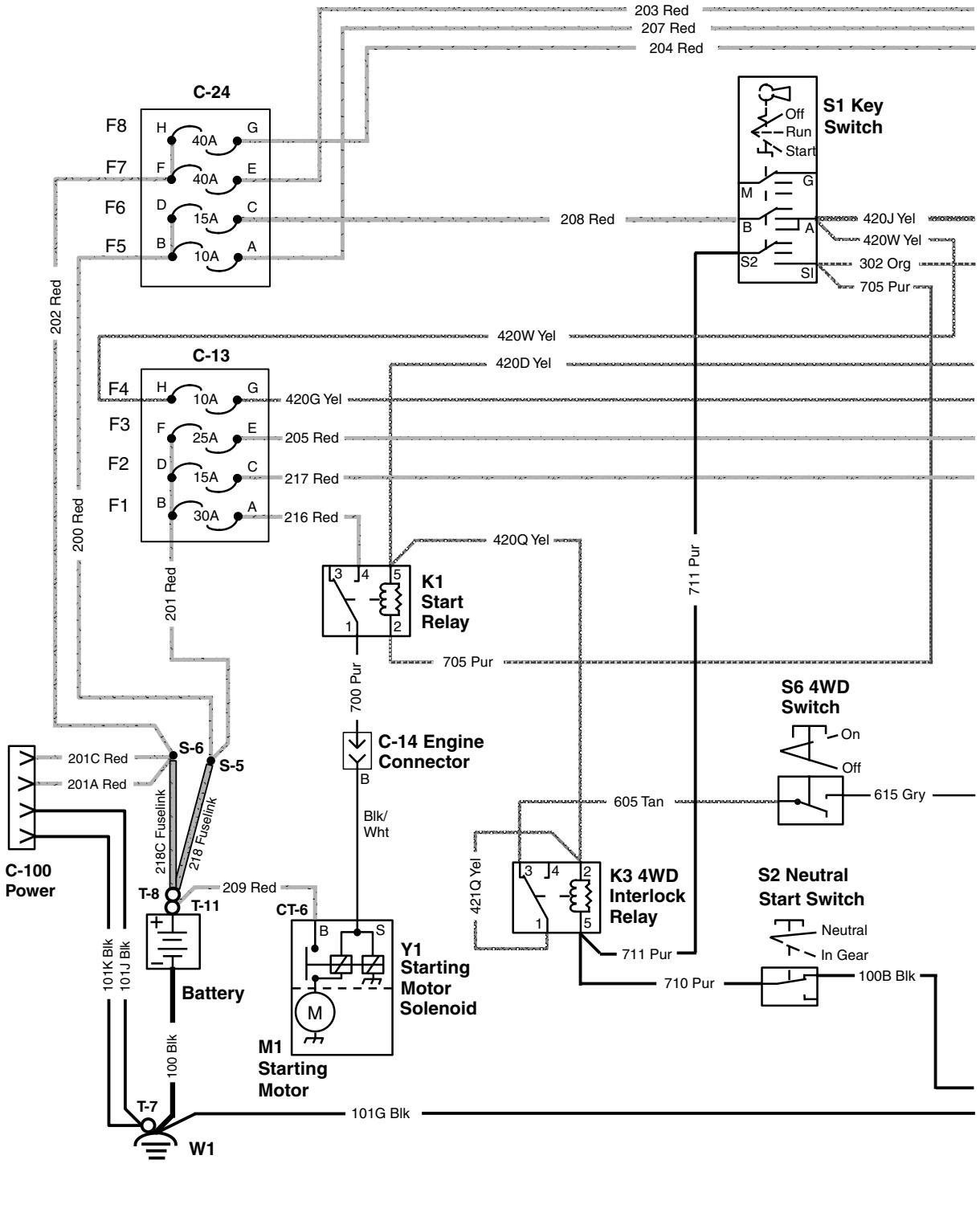
Main Wiring Schematic (Gas Engines SN 110001-120000)

1 of 5



Schematic 1 of 5

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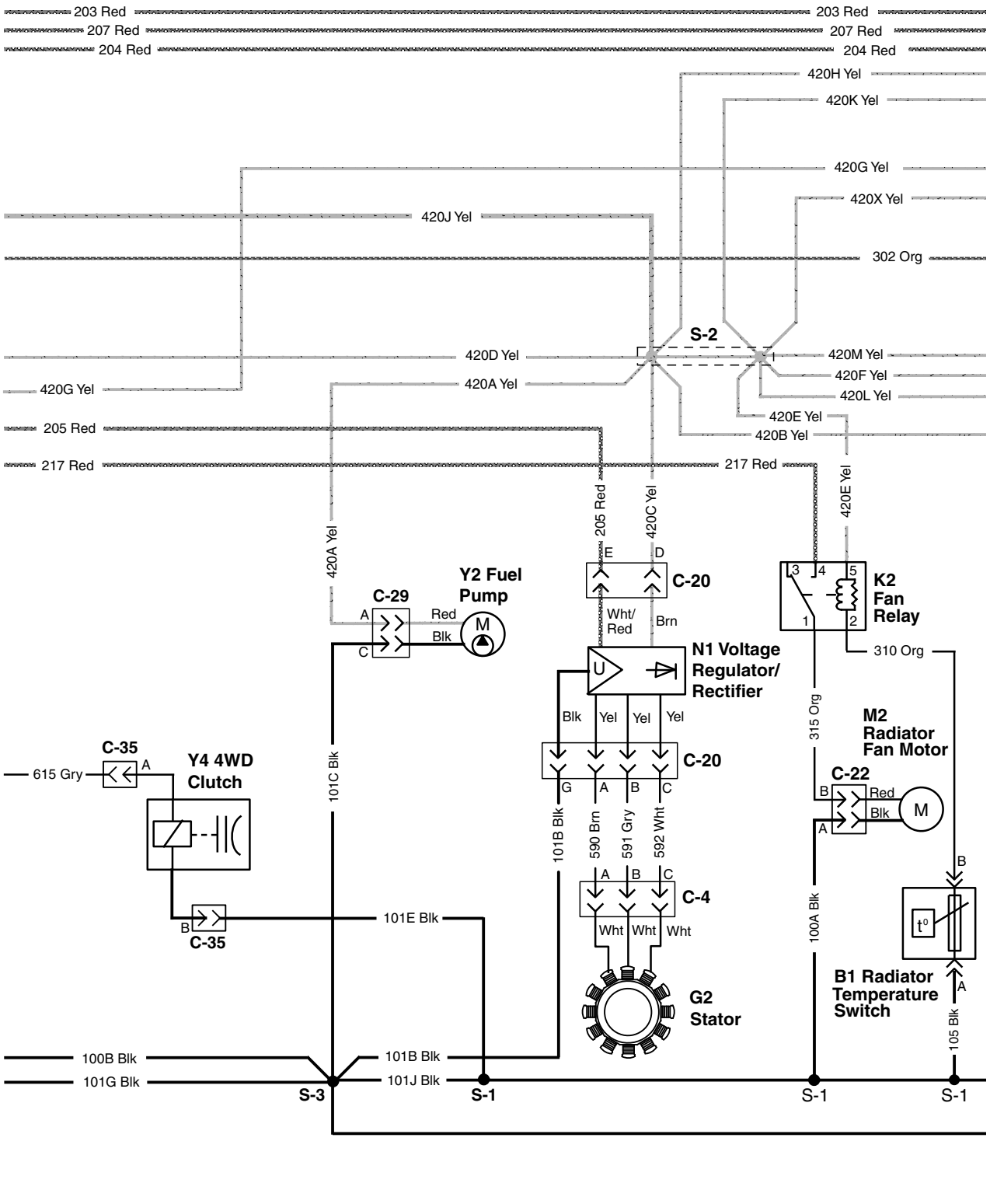
OUMX258,00005EB -19-24OCT14-1/5

Main Wiring Schematic (Gas Engines SN 110001-120000) 2 of 5



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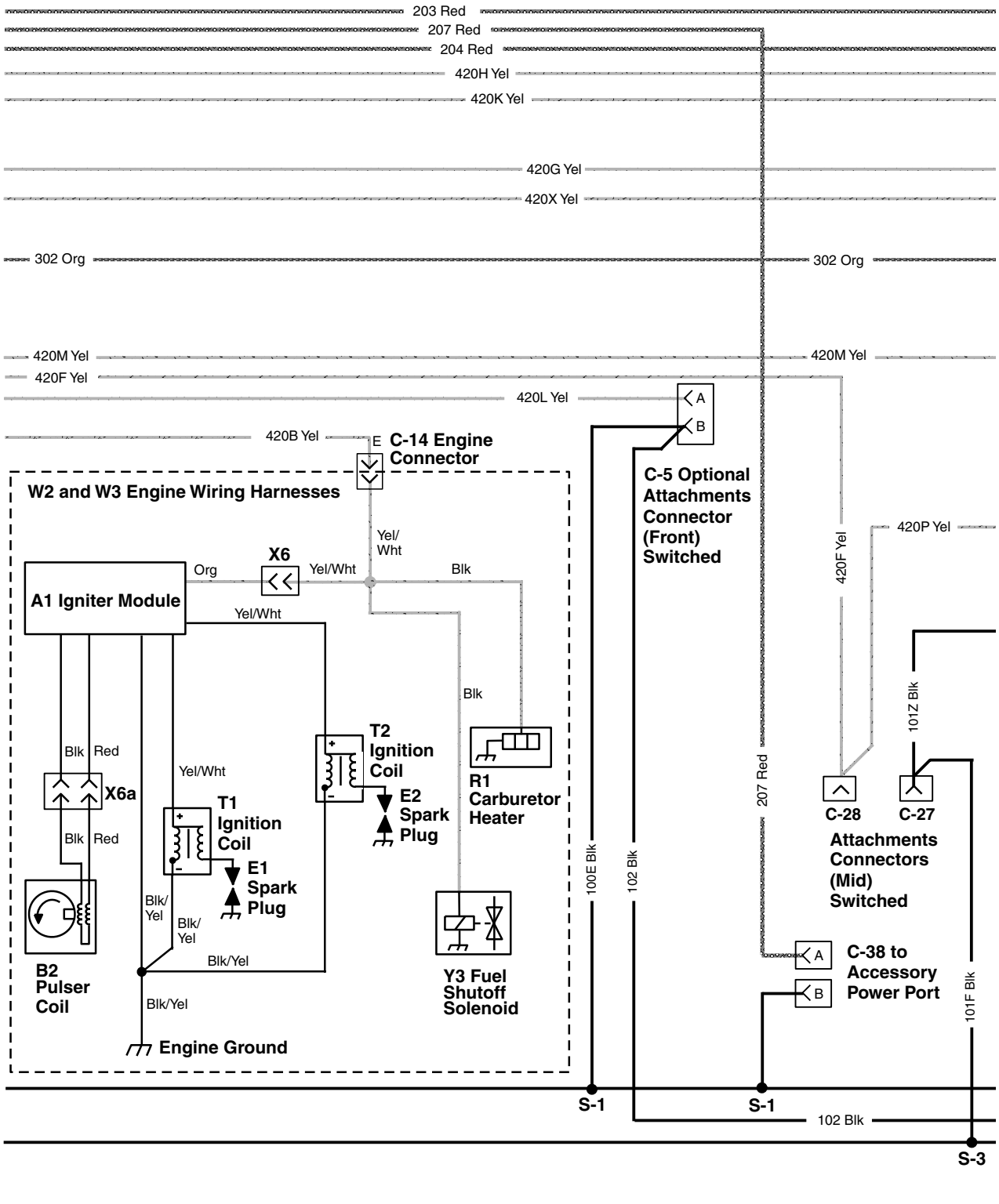
OUMX258,00005EB -19-24OCT14-2/5

Main Wiring Schematic (Gas Engines SN 110001-120000) 3 of 5



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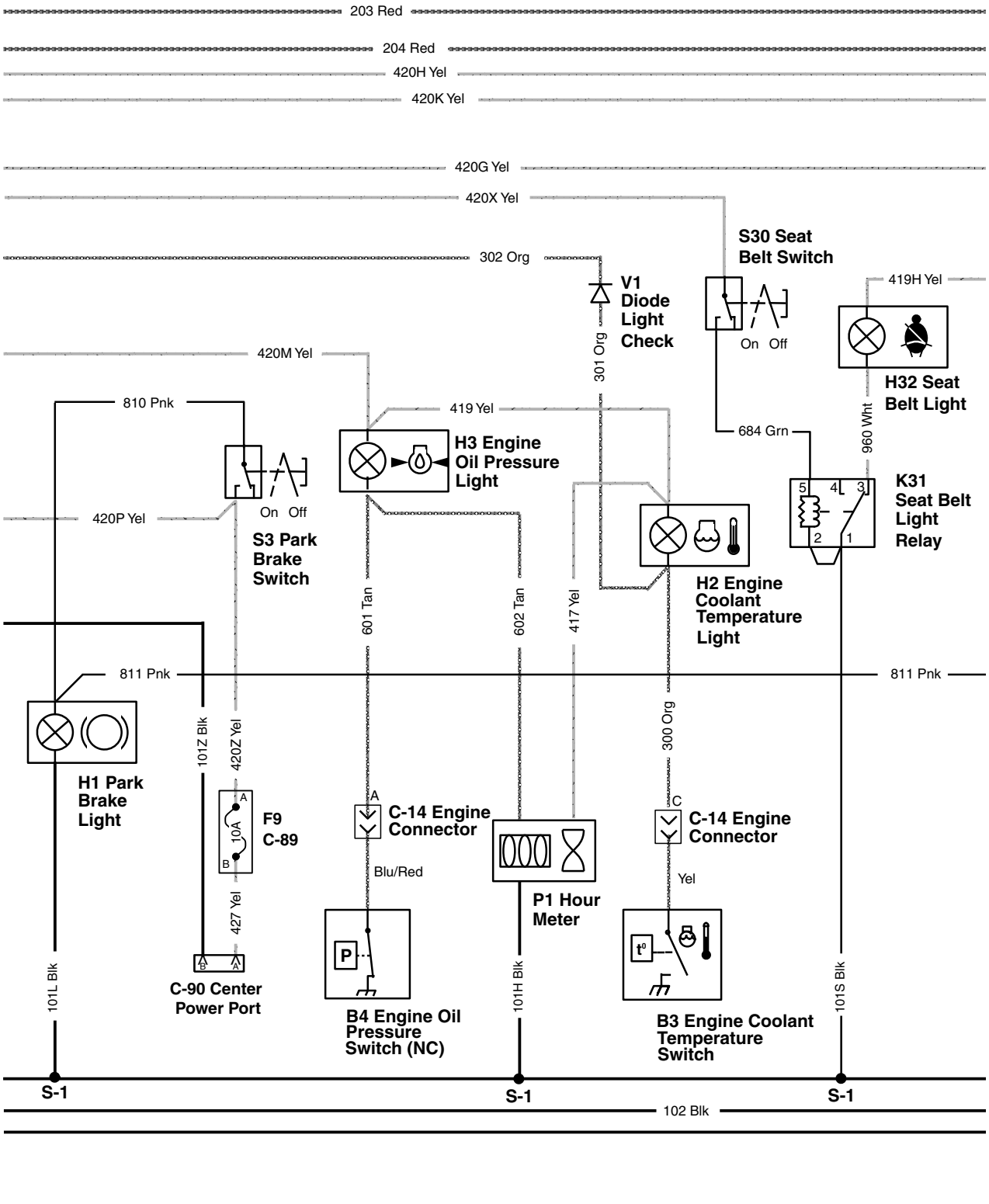
OUMX258,00005EB -19-24OCT14-3/5

Main Wiring Schematic (Gas Engines SN 110001-120000) 4 of 5



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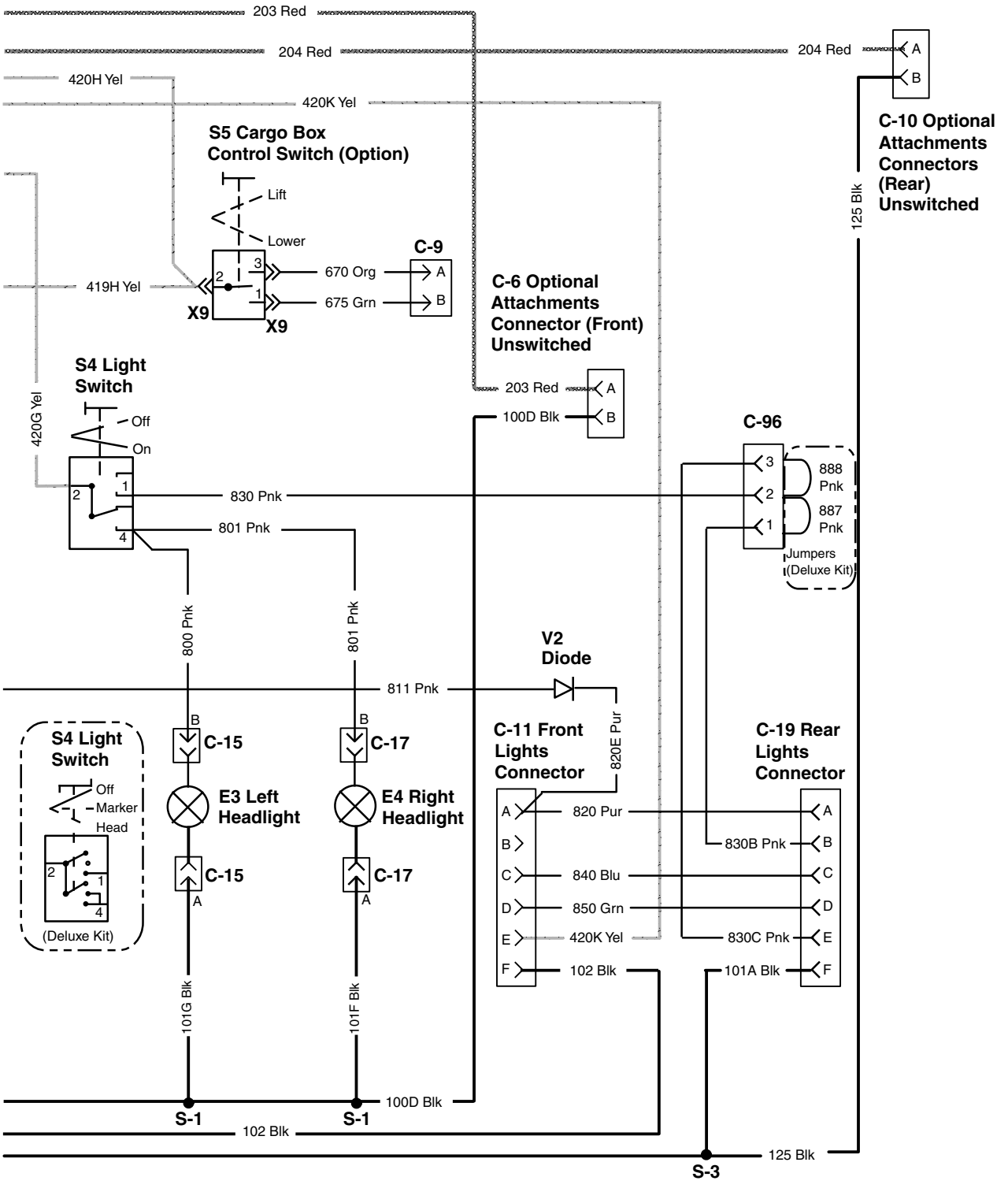
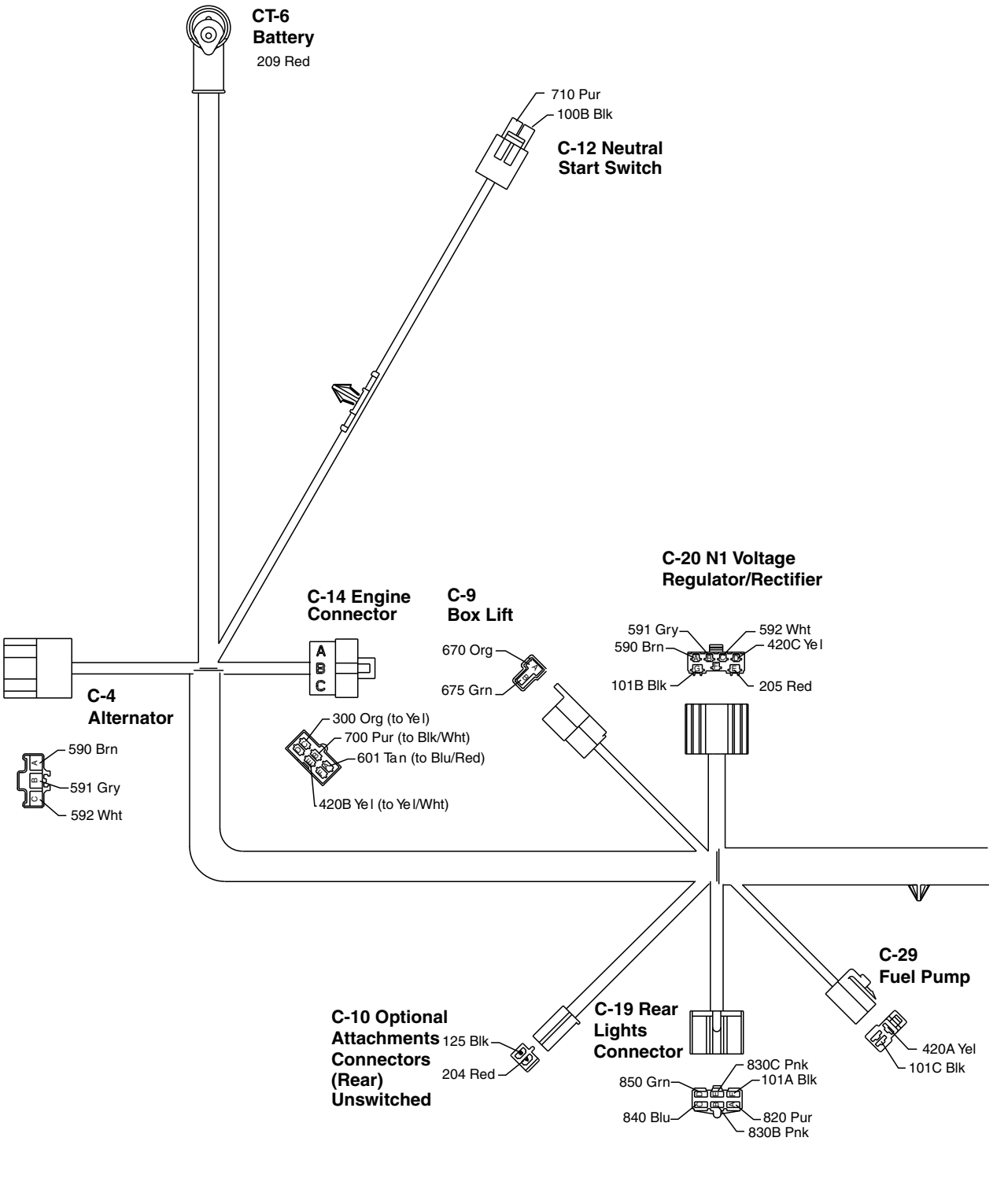
Main Wiring Schematic (Gas Engines SN 110001-120000) 5 of 5



OUMX258,00005EB -19-24OCT14-5/5

Main Wiring Harness (Gas Engines SN 110001-120000)



Main Harness 1 of 5

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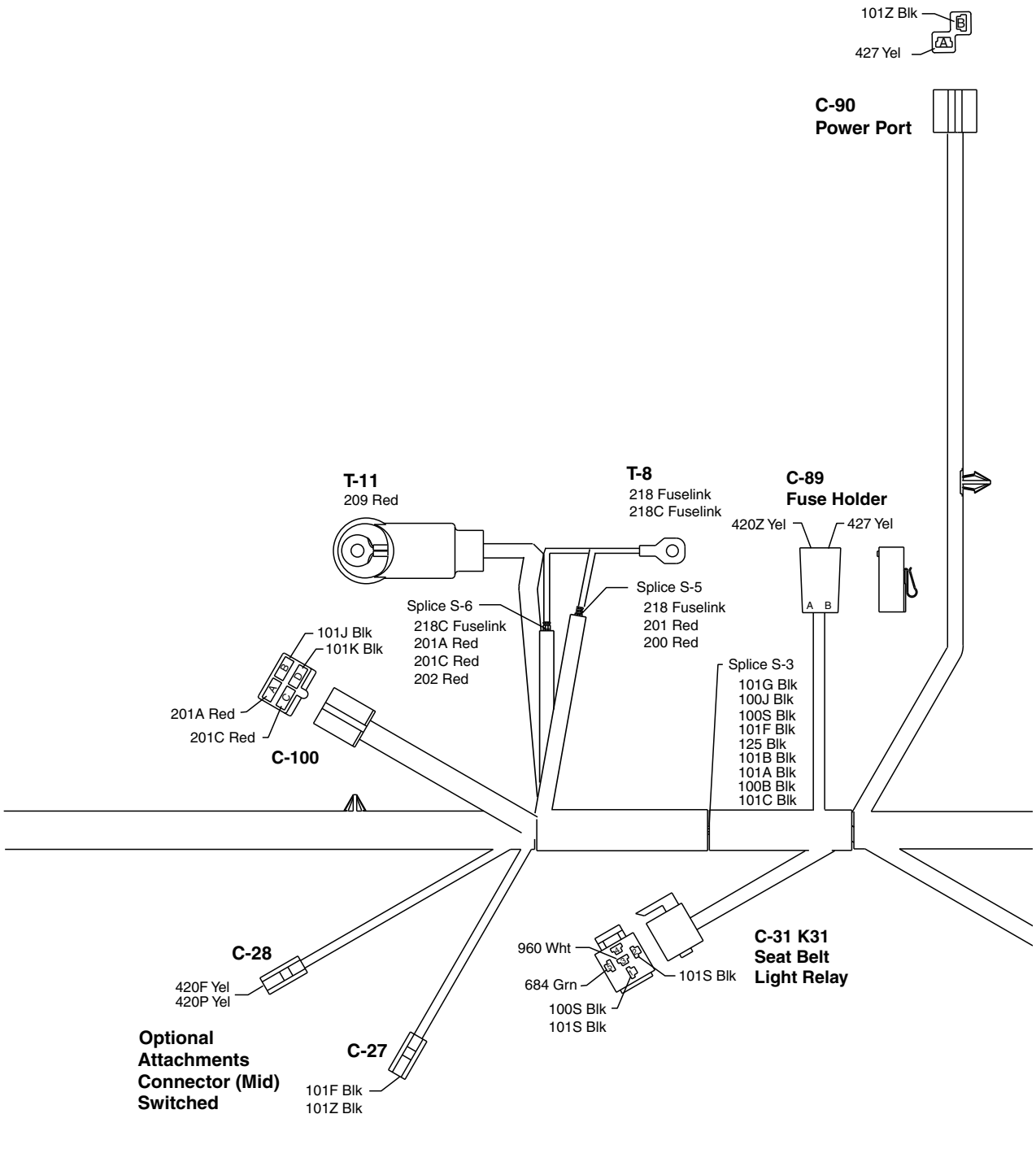
OUMX258,00005EC -19-27OCT14-1/5

Main Wiring Harness (Gas Engines SN 110001-120000) 2 of 5



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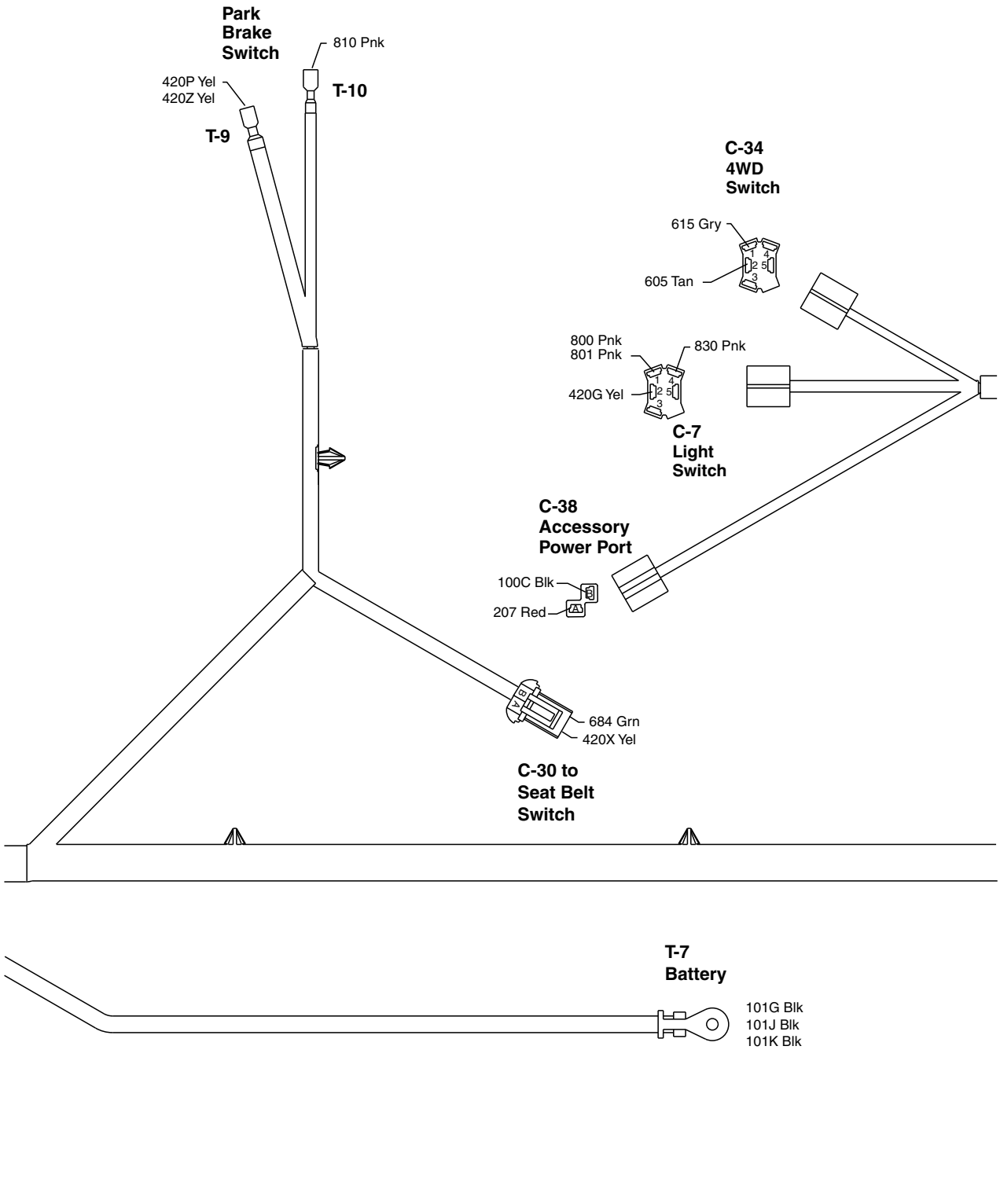
OUMX258,00005EC -19-27OCT14-2/5

Main Wiring Harness (Gas Engines SN 110001-120000) 3 of 5



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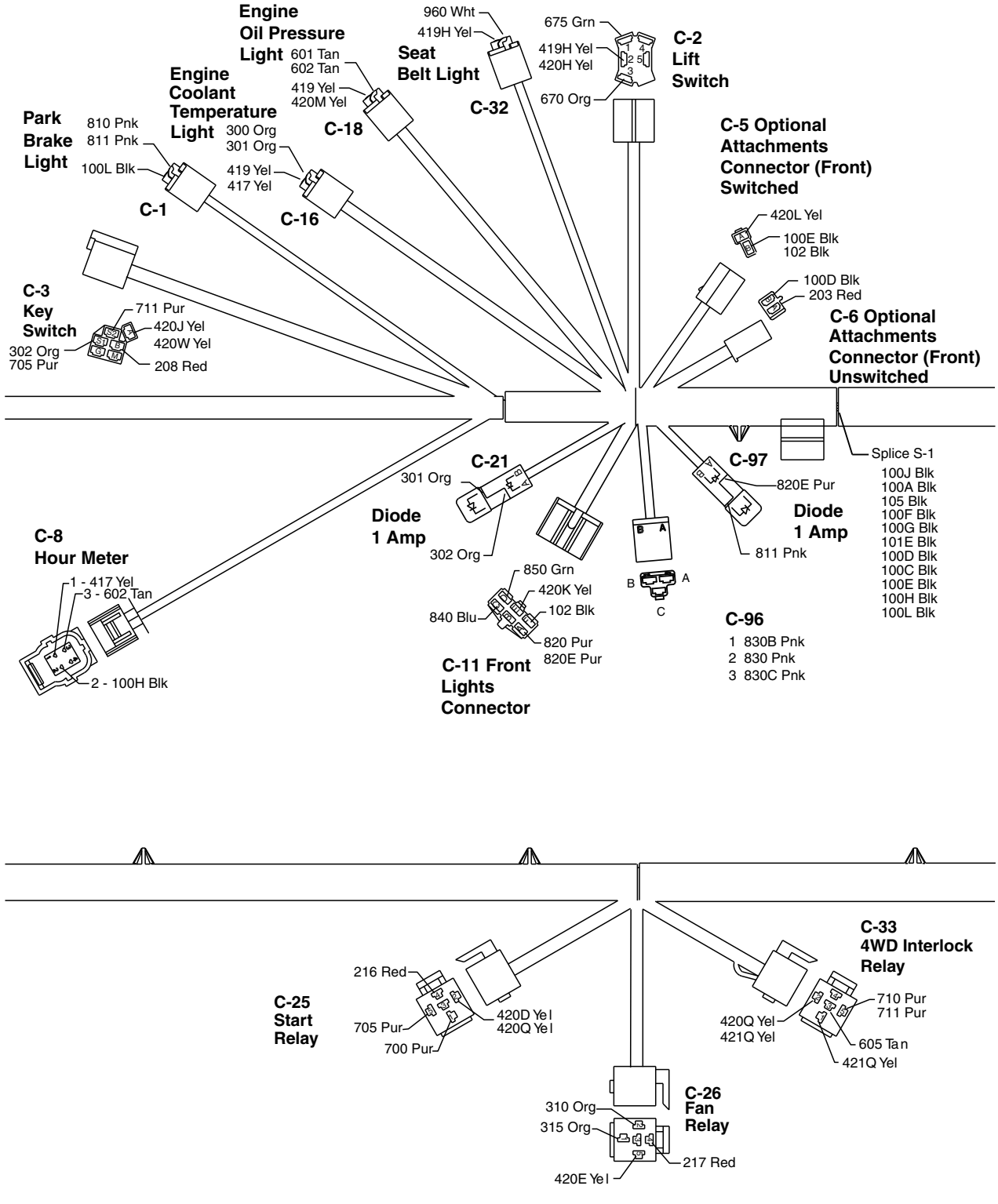
OUMX258,00005EC -19-27OCT14-3/5

Main Wiring Harness (Gas Engines SN 110001-120000) 4 of 5



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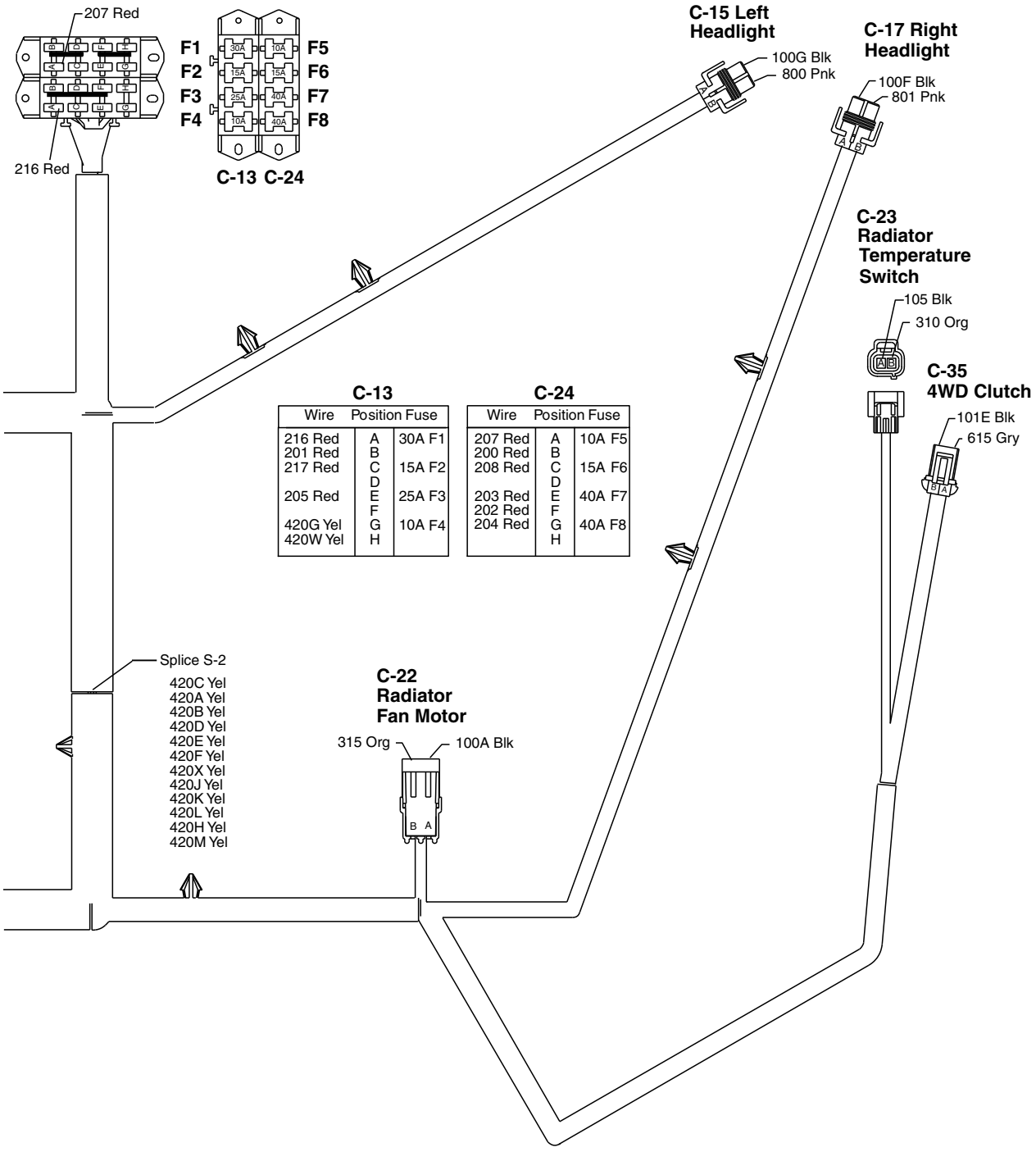
OUMX258,00005EC -19-27OCT14-4/5

Main Wiring Harness (Gas Engines SN 110001-120000) 5 of 5



OUMX258,00005EC -19-27OCT14-5/5

Main Harness Wire Color Codes (Gas Engine SN 110001-120000)

Size No. Color	Wire Connection Points
2.0 100A Blk	S-1, C-22 [A]
1.0 100B Blk	C-12 [A], S-3
2.0 100C Blk	S-1, C-38 [B]
3.0 100D Blk	S-1, X14 [B]
1.0 100E Blk	S-1, C-17 [B]
0.8 100F Blk	S-1, C-17 [A]
0.8 100G Blk	S-1, C-15 [A]
0.8 100H Blk	C-8 [2], S-1
3.0 100J Blk	S-1, S-3
0.8 100L Blk	C-1 [B], S-1
0.8 100S Blk	C-31 [1], S-3
1.0 101A Blk	S-3, C-19 [F]
3.0 101B Blk	S-3, C-20 [G]
0.8 101C Blk	S-3, C-29 [C]
0.8 101E Blk	S-1, C-35 [B]
0.8 101F Blk	C-27, S-3
5.0 101G Blk	T-7, S-3
5.0 101J Blk	C-100 [B], T-7
5.0 101K Blk	C-100 [D], T-7
0.8 101S Blk	C-31 [1], C-31 [2]
1.0 101Z Blk	C-90 [B], C-27
1.0 102 Blk	X7 [B], C-11 [F]
0.8 105 Blk	S-1, C-23 [A]
3.0 125 Blk	S-3, C-10 [B]
3.0 200 Red	C-24 [B], S-5
5.0 201 Red	S-5, C-13 [B]
5.0 201A Red	S-6, C-100 [A]
5.0 201C Red	S-6, C-100 [C]
3.0 202 Red	S-6, C-24 [F]
3.0 203 Red	C-13 [E], C-6 [A]
3.0 204 Red	C-10 [A], C-24 [G]
3.0 205 Red	C-13 [E], C-20 [E]
2.0 207 Red	C-24 [A], C-38 [A]
2.0 208 Red	C-24 [C], C-3 [B]
14.0 209 Red	CT-6, T-11
3.0 216 Red	C-13 [A], C-25 [4]
2.0 217 Red	C-13 [C], C-26 [4]
218 Fuselink	T-8, S-5
218C Fuselink	T-8, S-6
5.0 218A Red	C-13 [F], C-100 [C]
0.8 300 Org	C-14 [C], C-16 [A]
0.8 301 Org — 1 A Diode	C-16 [A], C-21 [B]
0.8 302 Org — 1 A Diode	C-21 [A], C-3 [S1]
0.8 310 Org	C-26 [2], C-23 [B]
2.0 315 Org	C-26 [1], C-22 [B]

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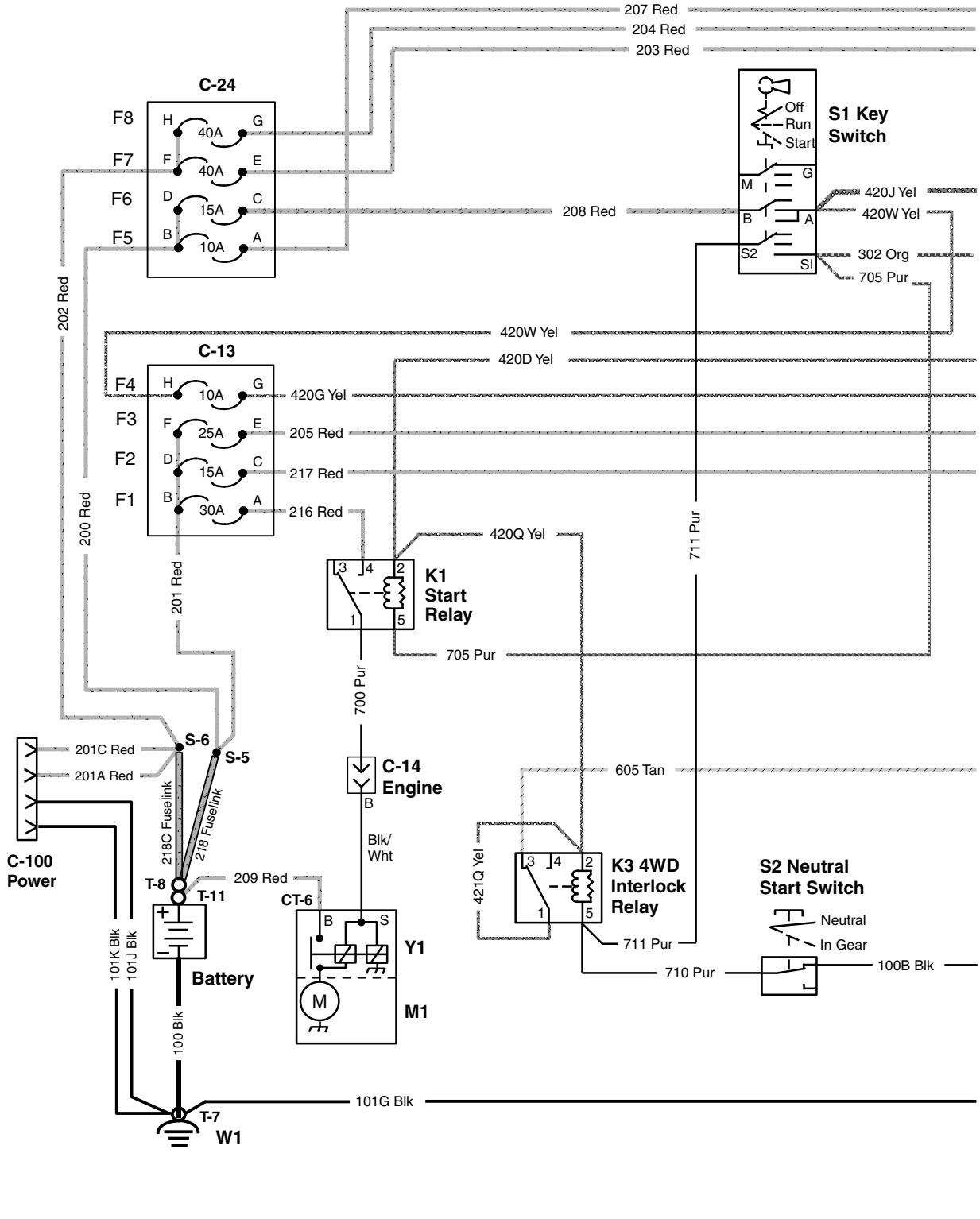
Size No. Color	Wire Connection Points
0.8 417 Yel	C-8 [1], C-16 [B]
0.8 419 Yel	C-18 [B], C-16 [B]
0.8 419H Yel	C-2 [2], C-32 [A]
0.8 420A Yel	S-2, C-29 [A]
0.8 420B Yel	S-2, X1 [E]
1.0 420C Yel	S-2, C-20 [D]
0.8 420D Yel	S-2, C-25 [2]
0.8 420E Yel	S-2, C-26 [5]
0.8 420F Yel	S-2, C-28
1.0 420G Yel	C-13 [G], C-7 [2]
0.8 420H Yel	S-2, C-2 [2]
2.0 420J Yel	C-3 [A], S-2
1.0 420K Yel	S-2, C-11 [E]
1.0 420L Yel	S-2, C-5 [A]
0.8 420M Yel	S-2, C-18 [B]
0.8 420P Yel	T-9, C-28
0.8 420Q Yel	C-25 [2], C-33 [2]
1.0 420W Yel	C-3 [A], C-13 [H]
0.8 420X Yel	S-2, C-30 [A]
1.0 420Z Yel	T-9, C-89 [A]
0.8 421Q Yel	C-33 [1], C-33 [C]
1.0 427 Yel	C-89 [B], C-90 [A]
2.0 590 Brn	C-4 [A], C-20 [A]
2.0 591 Gry	C-4 [B], C-20 [B]
2.0 592 Wht	C-4 [C], C-20 [C]
0.8 601 Tan	C-18 [A], C-14 [A]
0.8 602 Tan	C-18 [A], C-8 [3]
0.8 605 Tan	C-34 [2], C-33 [3]
0.8 615 Gry	C-34 [1], C-35 [B]
0.8 670 Org	C-2 [3], C-9 [A]
0.8 675 Grn	C-2 [1], C-9 [B]
0.8 684 Grn	C-31 [5], C-30 [B]
3.0 700 Pur	C-25 [1], C-14 [B]
0.8 705 Pur	C-3 [S1], C-25 [5]
0.8 710 Pur	C-33 [5], C-12 [B]
0.8 711 Pur	C-33 [5], C-3 [S2]
0.8 800 Pnk	C-7 [1], C-15 [B]
0.8 801 Pnk	C-7 [1], C-17 [B]
0.8 810 Pnk	T-10, C-1 [A]
0.8 811 Pnk — 1 A Diode	C-1 [A], C-97 [B]
0.8 820 Pur	C-11 [A], C-19 [A]
0.8 820E Pur — 1 A Diode	C-11 [A], C-97 [A]
0.8 830 Pnk	C-7 [4], C-19 [B]
0.8 830B Pnk	C-19 [B], C-96 [1]
0.8 830C Pnk	C-19 [E], C-96 [3]
0.8 840 Blu	X15 [C], C-19 [C]
0.8 850 Grn	X15 [D], C-19 [D]
0.8 960 Wht	C-31 [3], C-32 [B]

Main Wiring Schematic (Gas Engines SN 120001-)

1 of 6



Schematic 1 of 6

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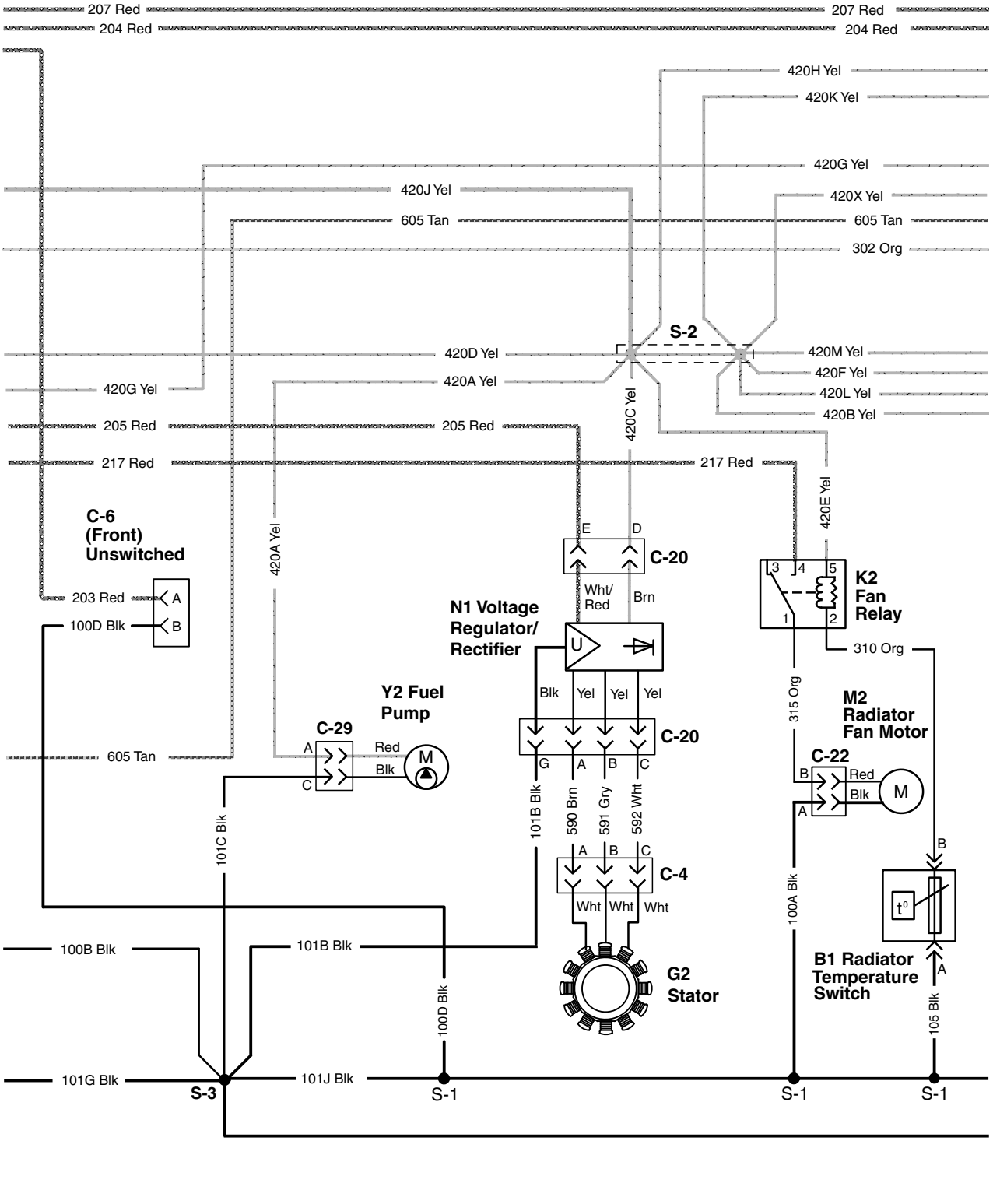
OUMX258,00005EF -19-13MAY15-1/6

Main Wiring Schematic (Gas Engines SN 120001-) 2 of 6



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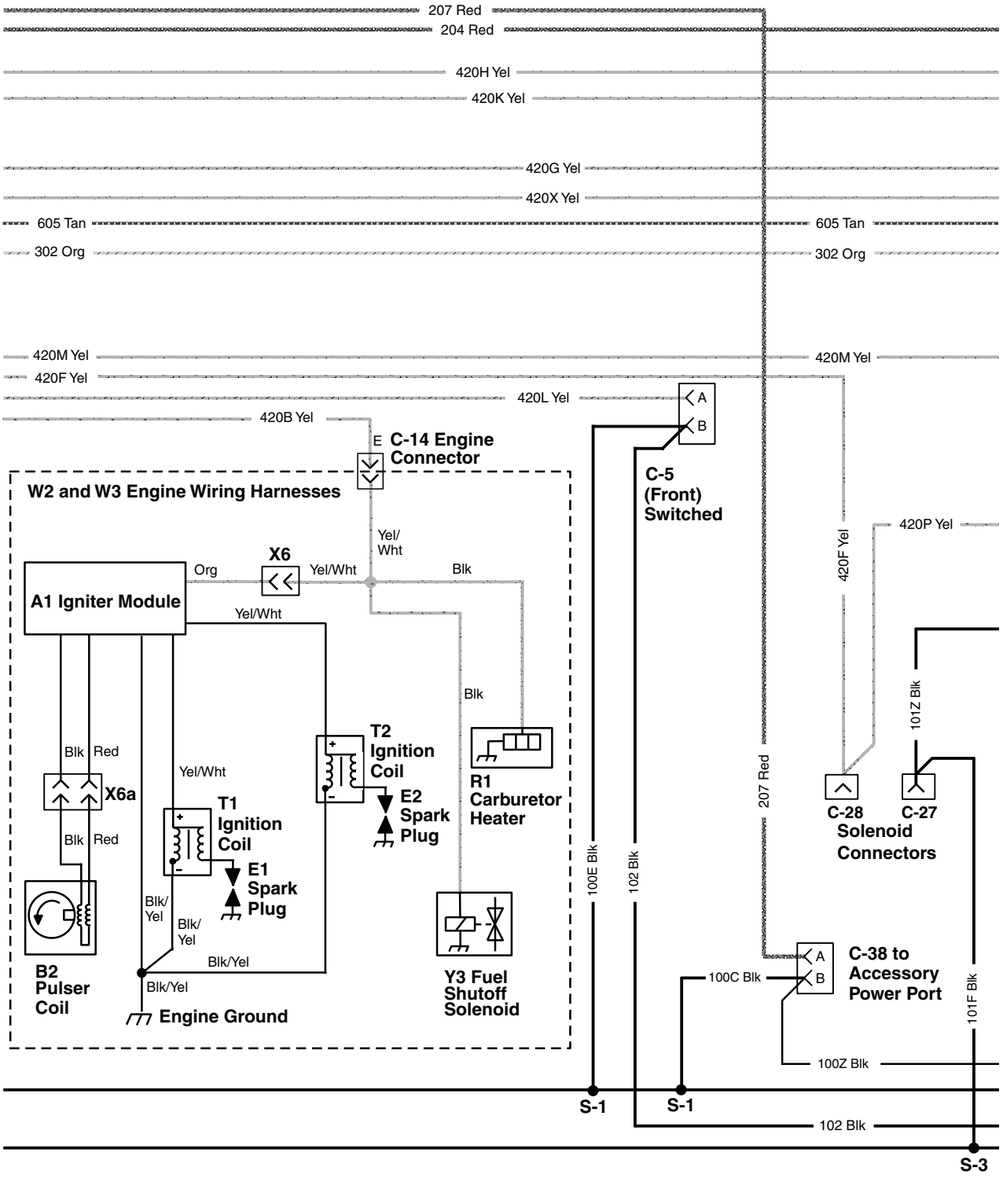
OUMX258,00005EF -19-13MAY15-2/6

Main Wiring Schematic (Gas Engines SN 120001-) 3 of 6



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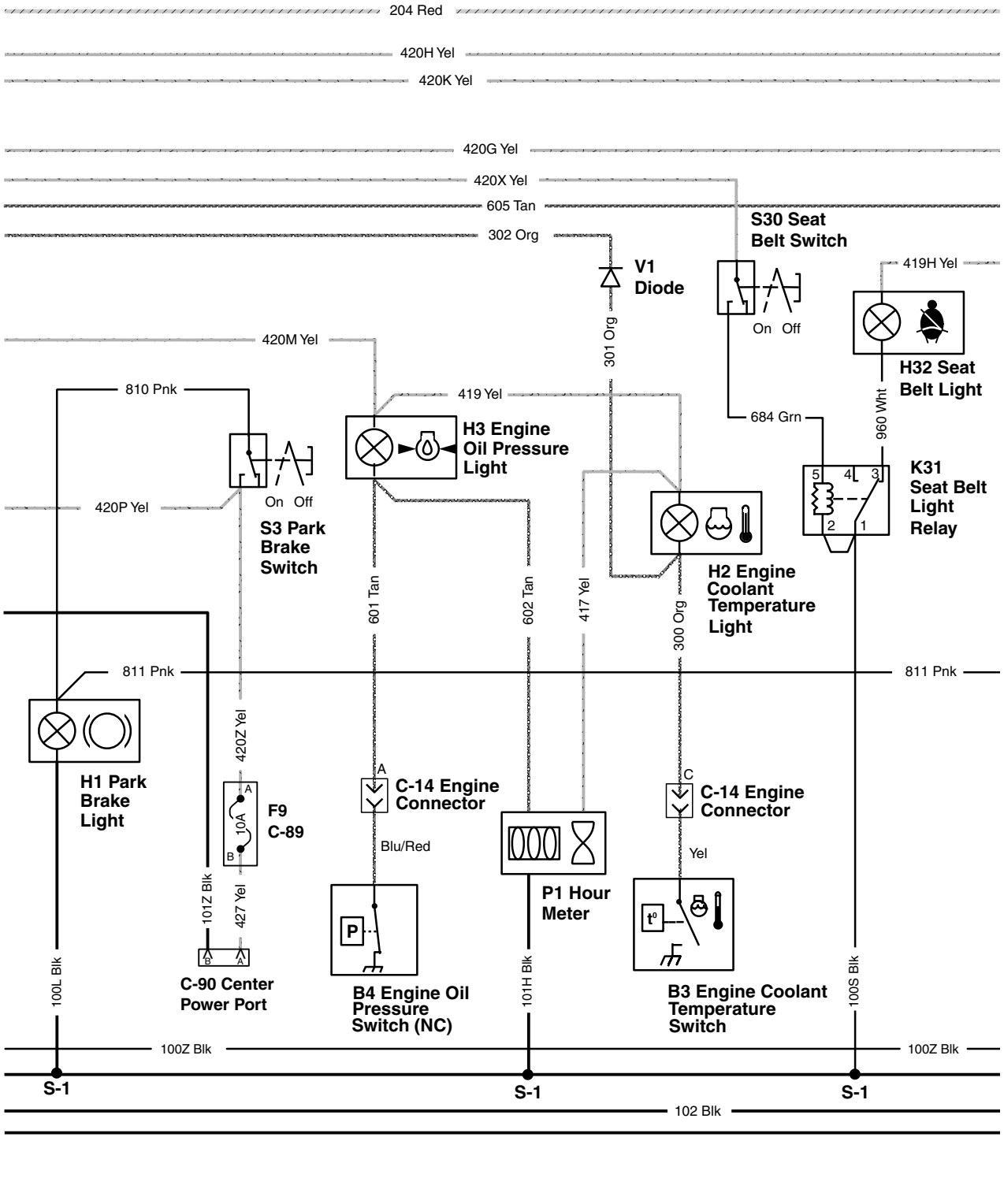
OUMX258,00005EF -19-13MAY15-3/6

Main Wiring Schematic (Gas Engines SN 120001-) 4 of 6



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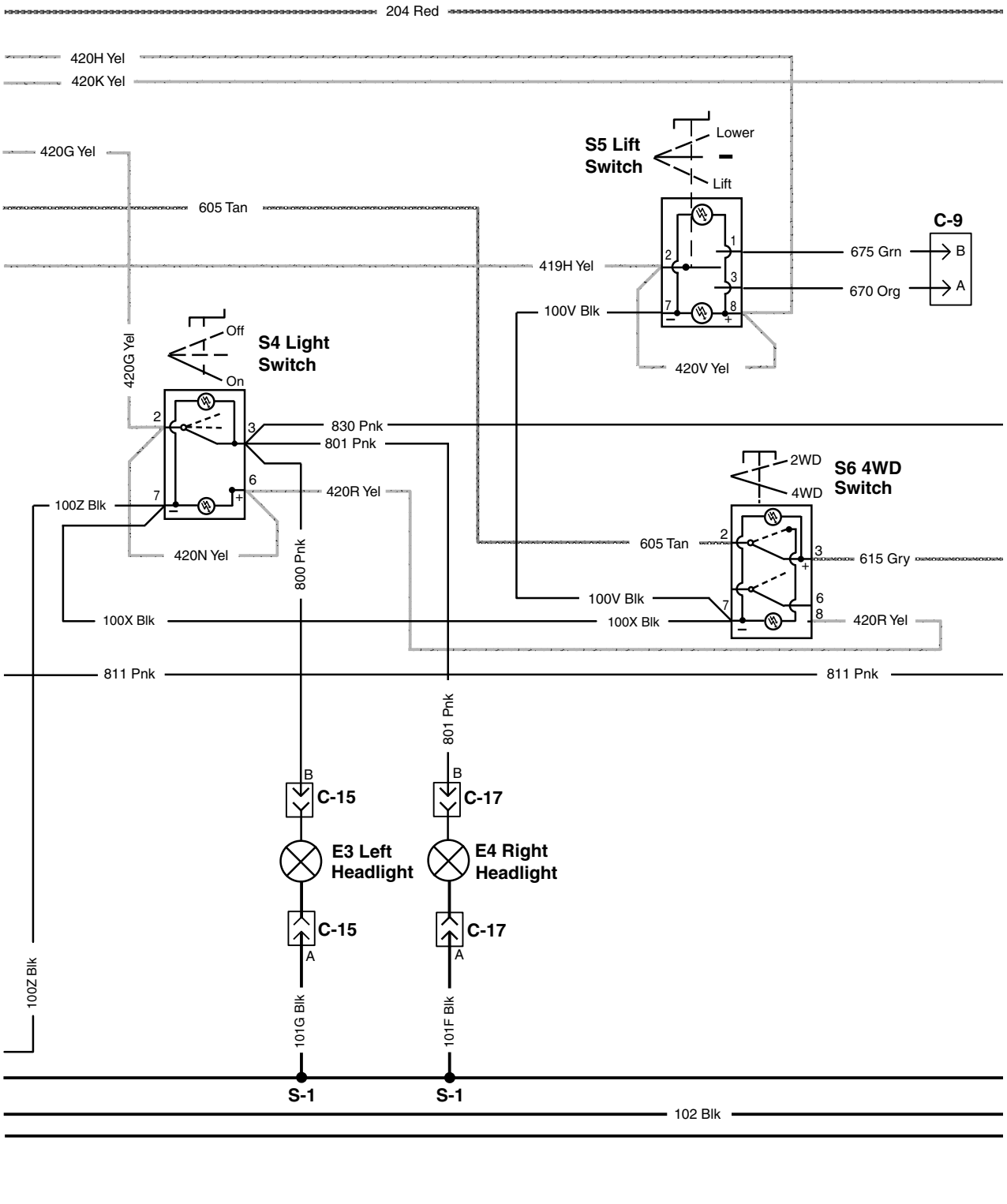
OUMX258,00005EF -19-13MAY15-4/6

Main Wiring Schematic (Gas Engines SN 120001-) 5 of 6



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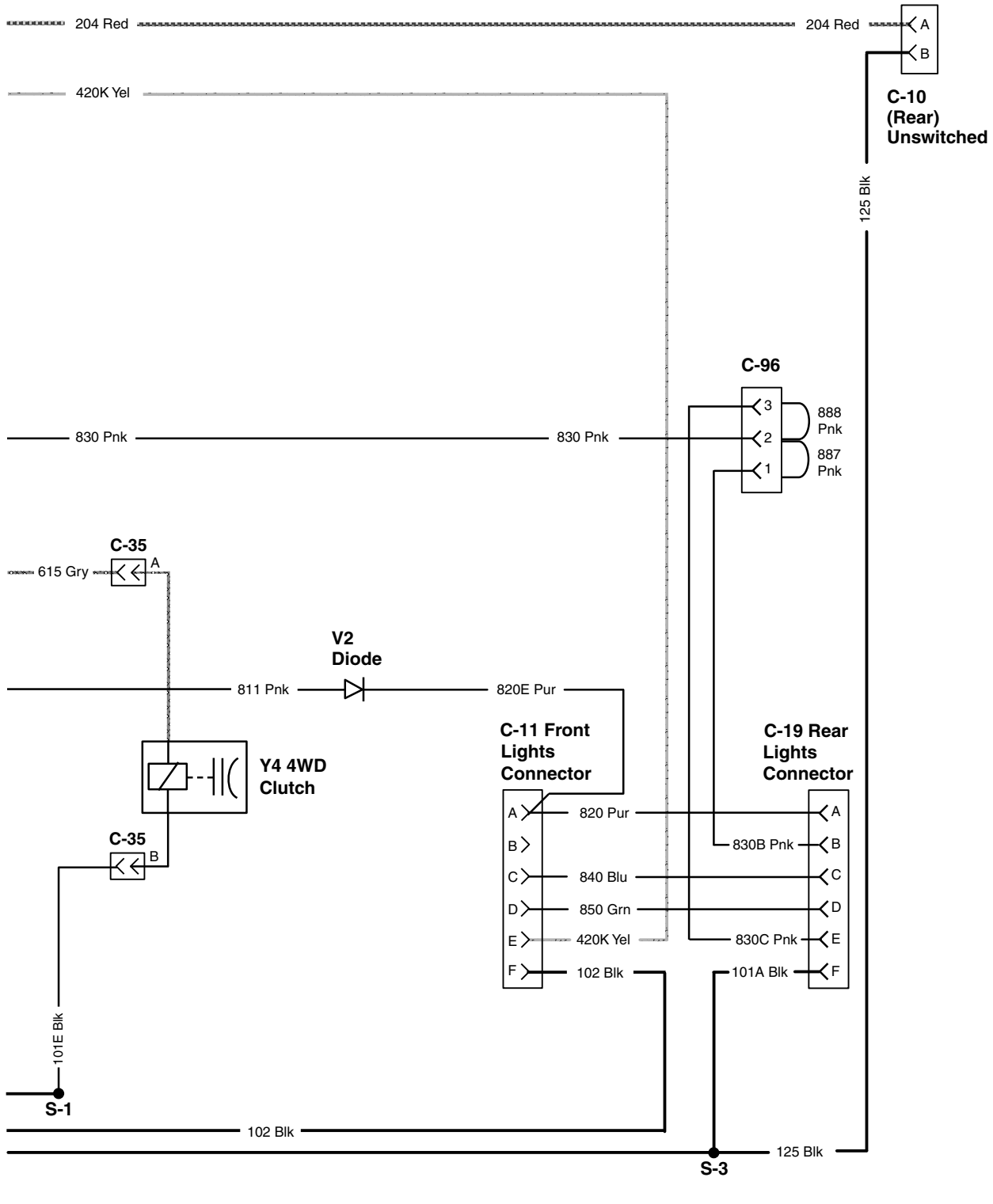
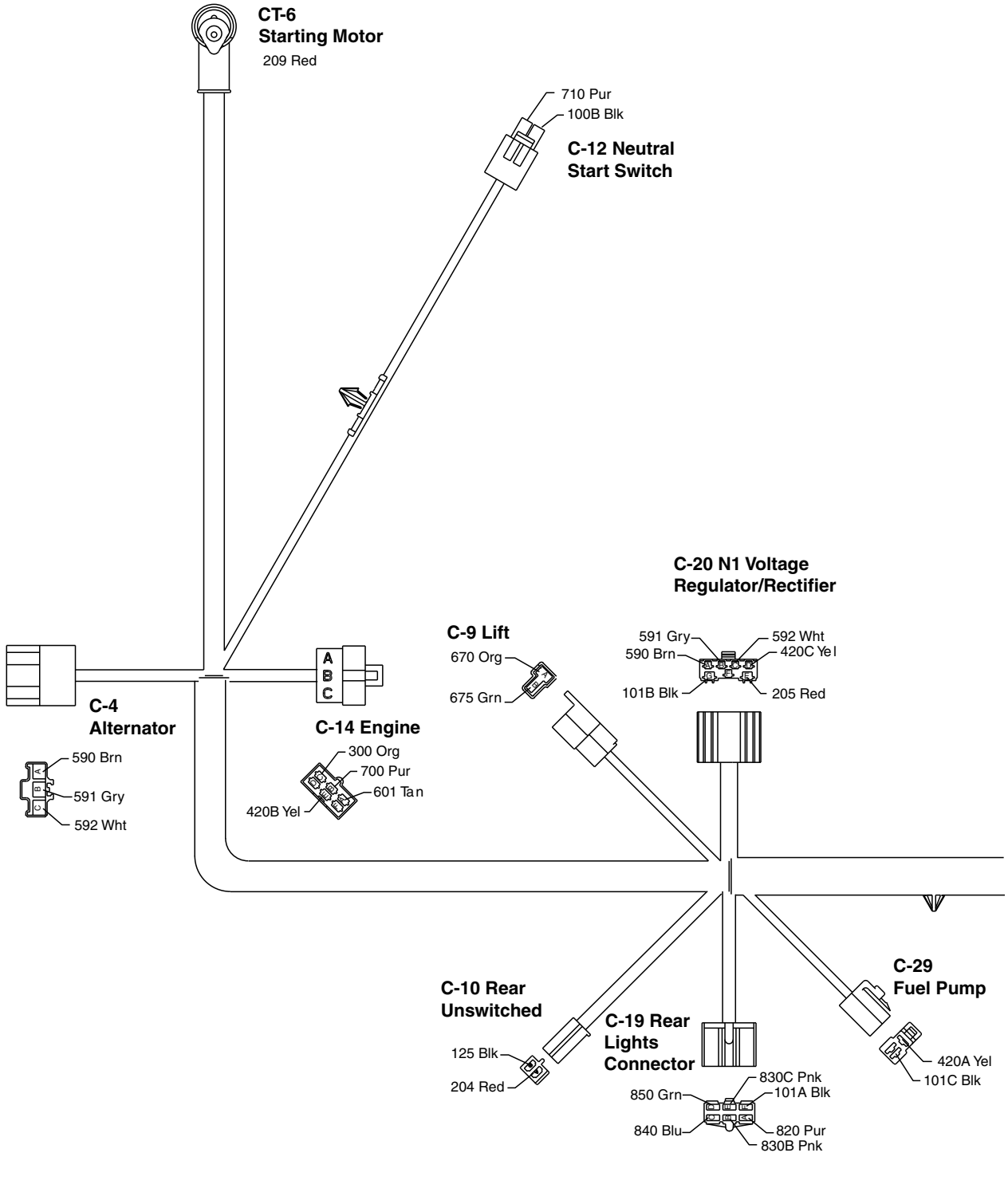
OUMX258,00005EF -19-13MAY15-5/6

Main Wiring Schematic (Gas Engines SN 120001-) 6 of 6



OUMX258,00005EF -19-13MAY15-6/6

Main Wiring Harness (Gas Engines SN 120001-)



Main Harness 1 of 5

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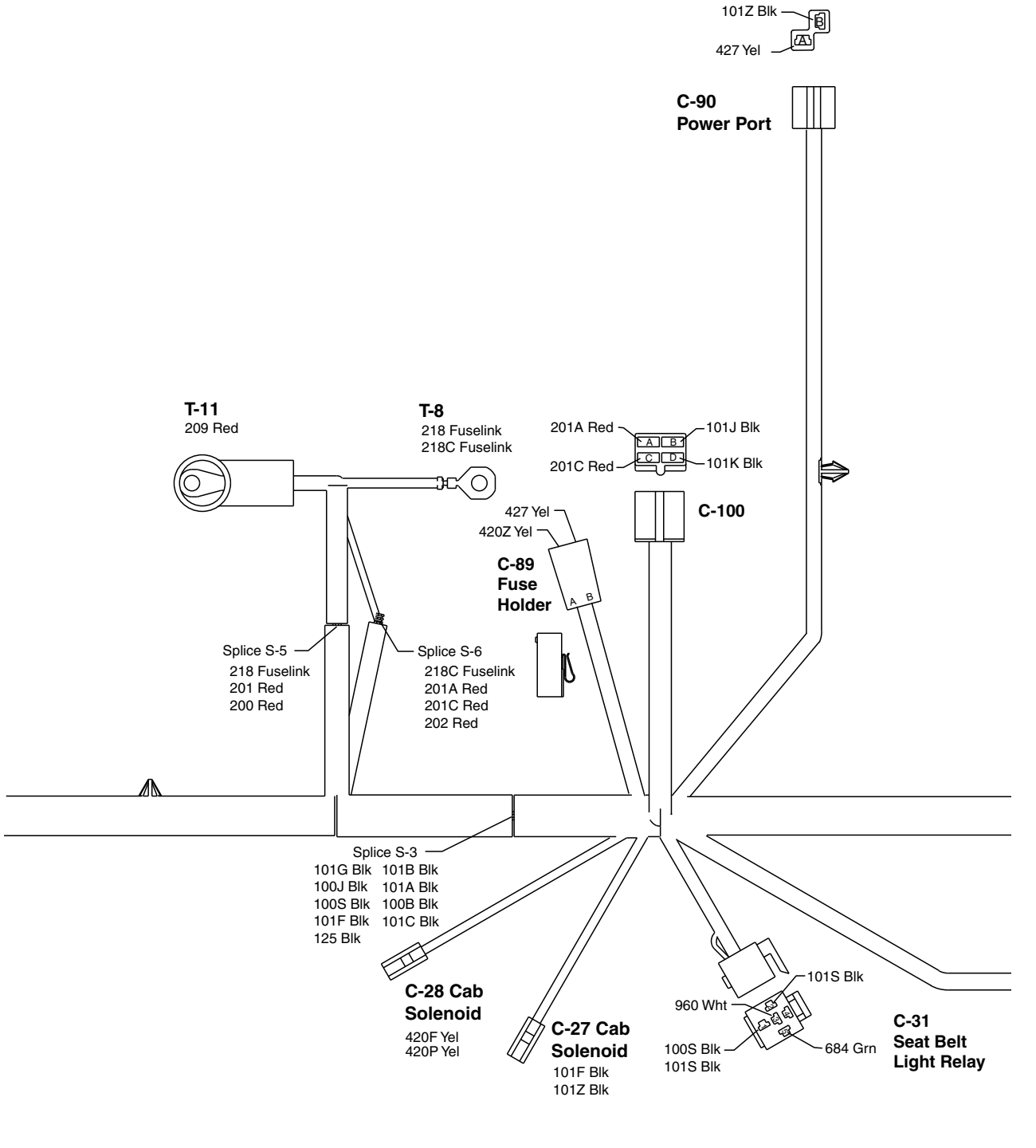
OUMX258,00005F0 -19-27OCT14-1/5

Main Wiring Harness (Gas Engines SN 120001-) 2 of 5



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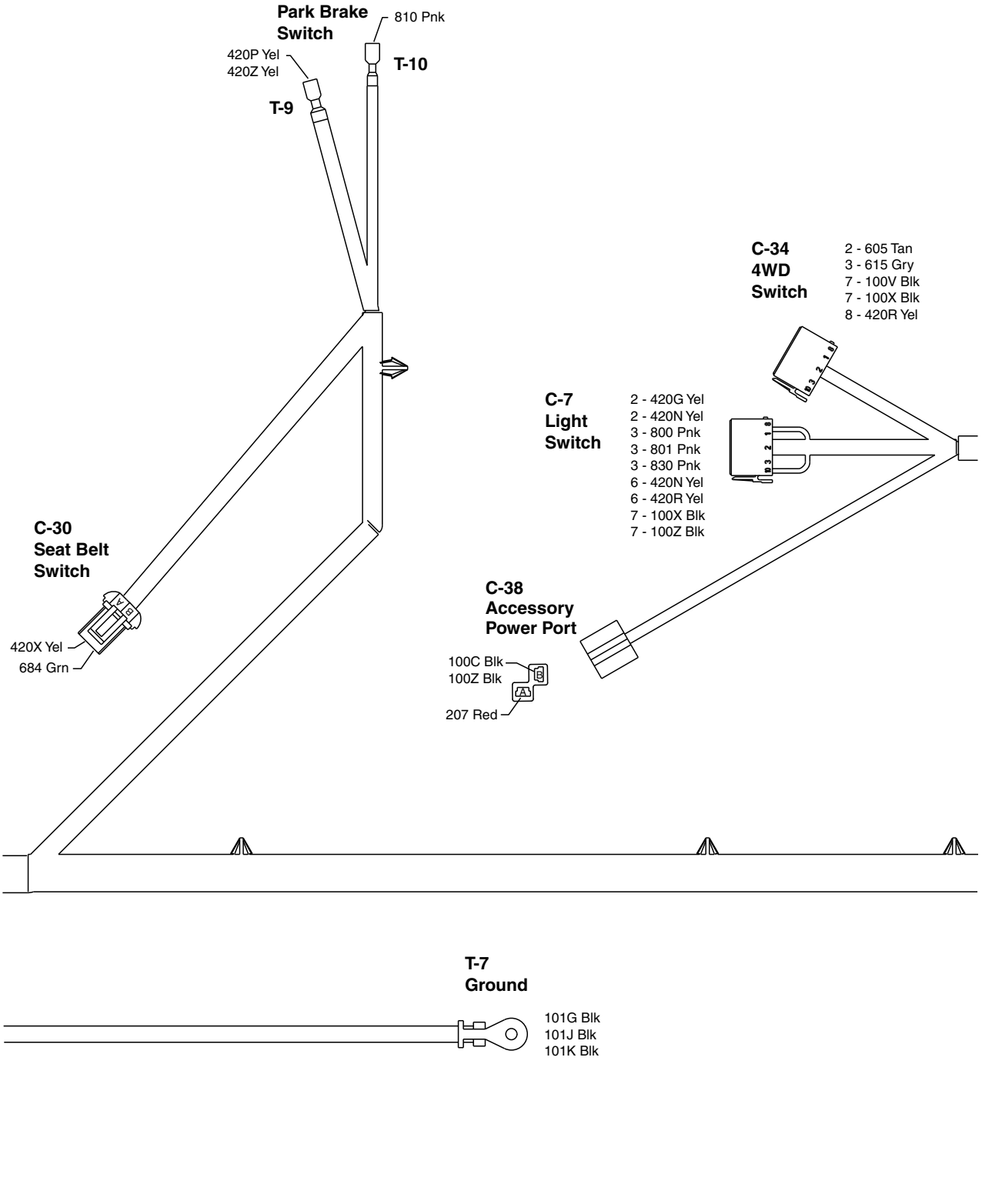
OUMX258,00005F0 -19-27OCT14-2/5

Main Wiring Harness (Gas Engines SN 120001-) 3 of 5



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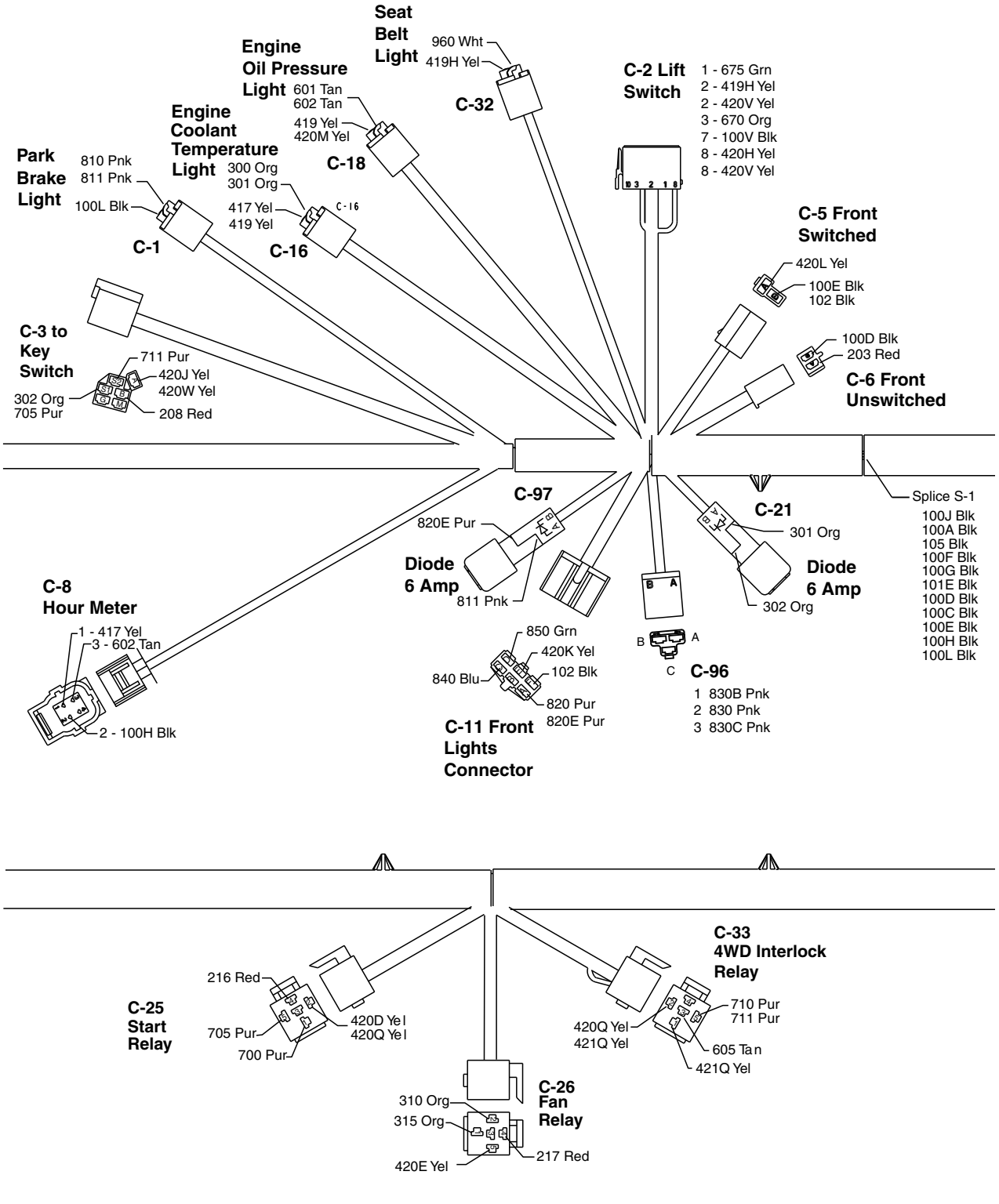
OUMX258,00005F0 -19-27OCT14-3/5

Main Harness 4 of 5



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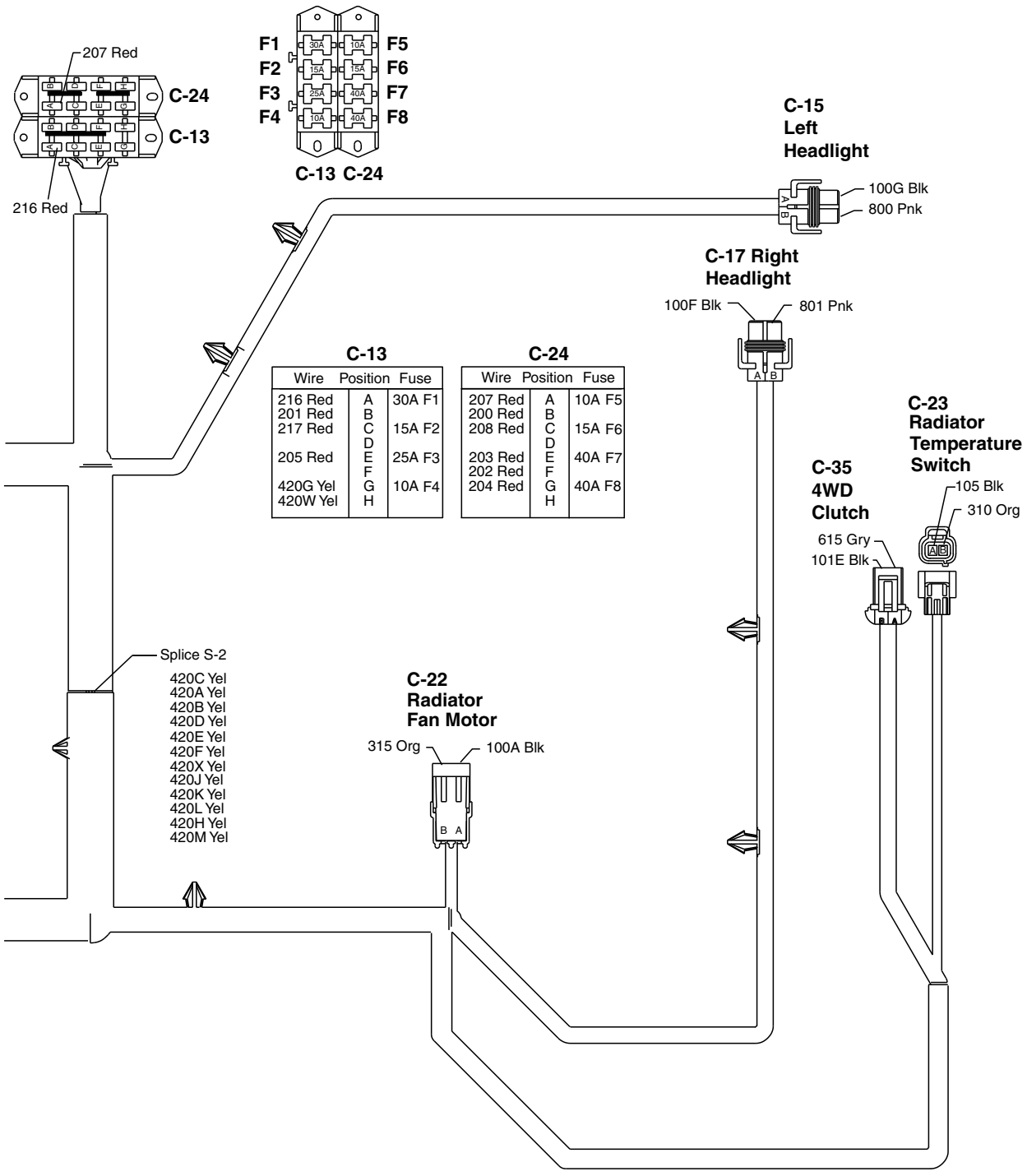
OUMX258,00005F0 -19-27OCT14-4/5

Main Harness 5 of 5



C-13

Wire	Position	Fuse
216 Red	A	30A F1
201 Red	B	
217 Red	C	15A F2
	D	
205 Red	E	25A F3
	F	
420G Yel	G	10A F4
420W Yel	H	

C-24

Wire	Position	Fuse
207 Red	A	10A F5
200 Red	B	
208 Red	C	15A F6
	D	
203 Red	E	40A F7
202 Red	F	
204 Red	G	40A F8
	H	

MXT012223 —UN—07AUG14

OUMX258,00005F0 -19-27OCT14-5/5

Main Harness Wire Color Codes (Gas Engine SN 120001-)

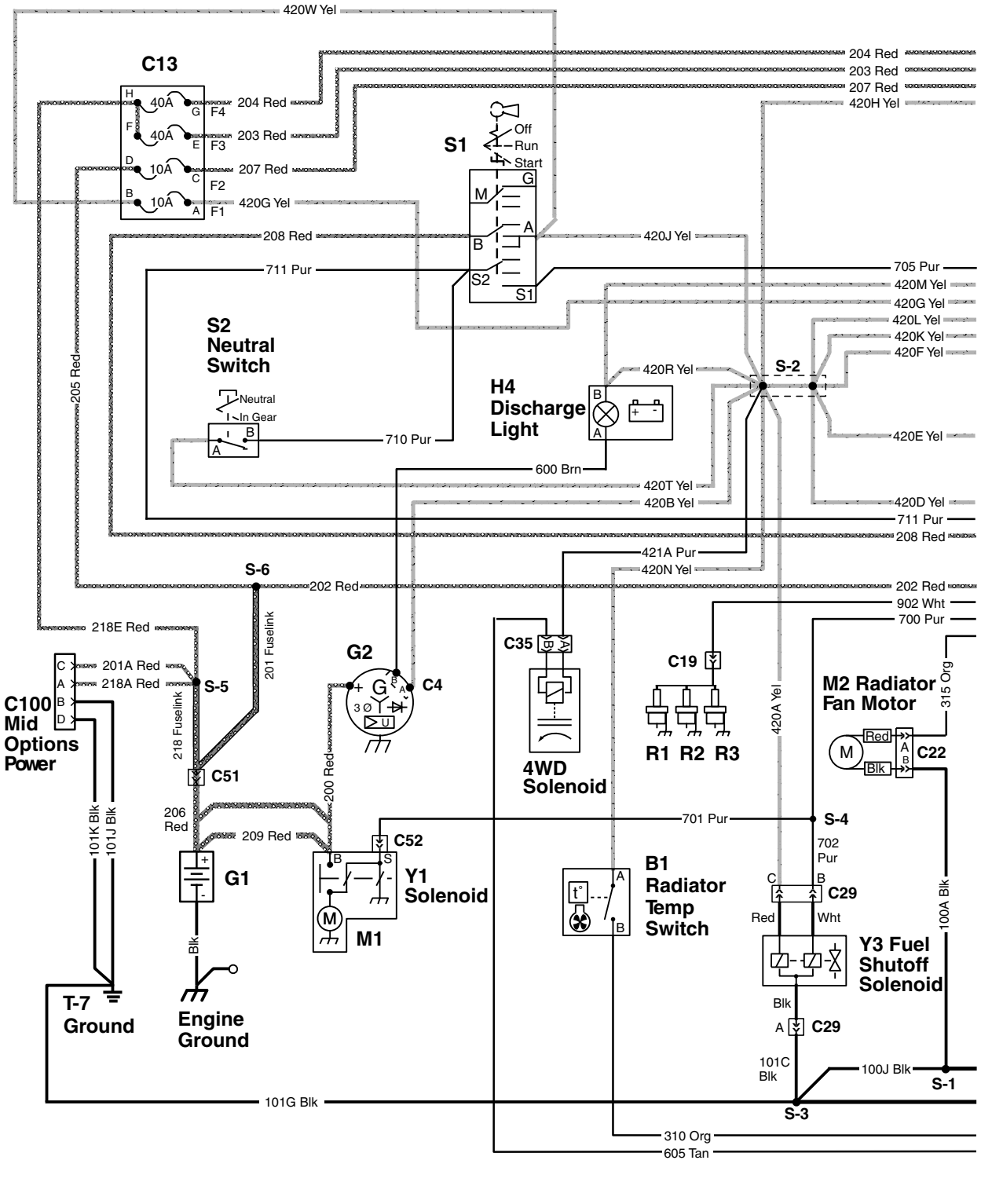
Size/No./Color	Wire Connection Points
2.0 100A Blk	S-1, C-22 [A]
1.0 100B Blk	C-12 [A], S-3
2.0 100C Blk	S-1, C-38 [B]
3.0 100D Blk	S-1, C-6 [B]
1.0 100E Blk	S-1, C-5 [B]
0.8 100F Blk	S-1, C-17 [A]
0.8 100G Blk	S-1, C-15 [A]
0.8 100H Blk	C-8 [2], S-1
3.0 100J Blk	S-1, S-3
0.8 100L Blk	C-1 [B], S-1
0.8 100S Blk	C-31 [1], S-3
0.8 100V Blk	C-34 [7], C-2 [7]
0.8 100X Blk	C-7 [7], C-34 [7]
0.8 100Z Blk	C-7 [7], C-38 [B]
1.0 101A Blk	S-3, C-19 [F]
3.0 101B Blk	S-3, C-20 [G]
0.8 101C Blk	S-3, C-29 [C]
0.8 101E Blk	S-1, C-35 [B]
0.8 101F Blk	C-27, S-3
5.0 101G Blk	T-7, S-3
5.0 101J Blk	C-100 [B], T-7
5.0 101K Blk	C-100 [D], T-7
0.8 101S Blk	C-31 [1], C-31 [2]
1.0 101Z Blk	C-90 [B], C-27
1.0 102 Blk	C-5 [B], C-11 [F]
0.8 105 Blk	S-1, C-23 [A]
3.0 125 Blk	S-3, C-10 [B]
3.0 200 Red	C-24 [B], S-5
5.0 201 Red	S-5, C-13 [B]
5.0 201A Red	S-6, C-100 [A]
5.0 201C Red	S-6, C-100 [C]
3.0 202 Red	S-6, C-24 [F]
3.0 203 Red	C-13 [E], C-6 [A]
3.0 204 Red	C-10 [A], C-24 [G]
3.0 205 Red	C-13 [E], C-20 [E]
2.0 207 Red	C-24 [A], C-38 [A]
2.0 208 Red	C-24 [C], C-3 [B]
14.0 209 Red	CT-6, T-11
3.0 216 Red	C-13 [A], C-25 [4]
2.0 217 Red	C-13 [C], C-26 [4]
218 Fuselink	T-8, S-5
218C Fuselink	T-8, S-6
0.8 300 Org	C-14 [C], C-16 [A]
0.8 301 Org — 6 A Diode	C-16 [A], C-21 [A]
0.8 302 Org — 6 A Diode	C-21 [B], C-3 [S1]
0.8 310 Org	C-26 [2], C-23 [B]
2.0 315 Org	C-26 [1], C-22 [B]
0.8 417 Yel	C-8 [1], C-16 [B]

Continued on next page

Size/No./Color	Wire Connection Points
0.8 419 Yel	C-18 [B], C-16 [B]
1.0 427 Yel	C-90 [A], C-89 [B]
0.8 419H Yel	C-2 [2], C-32 [A]
0.8 420A Yel	S-2, C-29 [A]
0.8 420B Yel	S-2, C-14 [E]
1.0 420C Yel	S-2, C-20 [D]
0.8 420D Yel	S-2, C-25 [2]
0.8 420E Yel	S-2, C-26 [5]
0.8 420F Yel	S-2, C-28
1.0 420G Yel	C-13 [G], C-7 [2]
0.8 420H Yel	S-2, C-2 [8]
2.0 420J Yel	C-3 [A], S-2
1.0 420K Yel	S-2, C-11 [E]
1.0 420L Yel	S-2, C-5 [A]
0.8 420M Yel	S-2, C-18 [B]
0.8 420N Yel	C-7 [2], C-7 [6]
0.8 420P Yel	T-9, C-28
0.8 420Q Yel	C-25 [2], C-33 [2]
0.8 420R Yel	C-34 [8], C-7 [6]
0.8 420V Yel	C-2 [2], C-2 [8]
1.0 420W Yel	C-3 [A], C-13 [H]
0.8 420X Yel	S-2, C-30 [A]
1.0 420Z Yel	T-9, C-89 [A]
0.8 421Q Yel	C-33 [1], C-33 [2]
1.0 427 Yel	C-89 [B], C-90 [A]
2.0 590 Brn	C-4 [A], C-20 [A]
2.0 591 Gry	C-4 [B], C-20 [B]
2.0 592 Wht	C-4 [C], C-20 [C]
0.8 601 Tan	C-18 [A], C-14 [A]
0.8 602 Tan	C-18 [A], C-8 [3]
0.8 605 Tan	C-34 [2], C-33 [3]
0.8 615 Gry	C-34 [3], C-35 [A]
0.8 670 Org	C-2 [3], C-9 [A]
0.8 675 Grn	C-2 [1], C-9 [B]
0.8 684 Grn	C-31 [5], C-30 [B]
3.0 700 Pur	C-25 [1], C-14 [B]
0.8 705 Pur	C-3 [S1], C-25 [5]
0.8 710 Pur	C-33 [5], C-12 [B]
0.8 711 Pur	C-33 [5], C-3 [S2]
0.8 800 Pnk	C-7 [3], C-15 [B]
0.8 801 Pnk	C-7 [3], C-17 [B]
0.8 810 Pnk	T-10, C-1 [A]
0.8 811 Pnk — 6 A Diode	C-1 [A], C-97 [A]
0.8 820 Pur	C-11 [A], C-19 [A]
0.8 820E Pur — 6 A Diode	C-11 [A], C-97 [B]
0.8 830 Pnk	C-7 [3], C-96 [2
0.8 830B Pnk	C-19 [B], C-96 [1]
0.8 830C Pnk	C-19 [E], C-96 [3]
0.8 840 Blu	C-11 [C], C-19 [C]
0.8 850 Grn	C-11 [D], C-19 [D]

Main Wiring Schematic (Diesel Engines SN 110001-120000)

1 of 3



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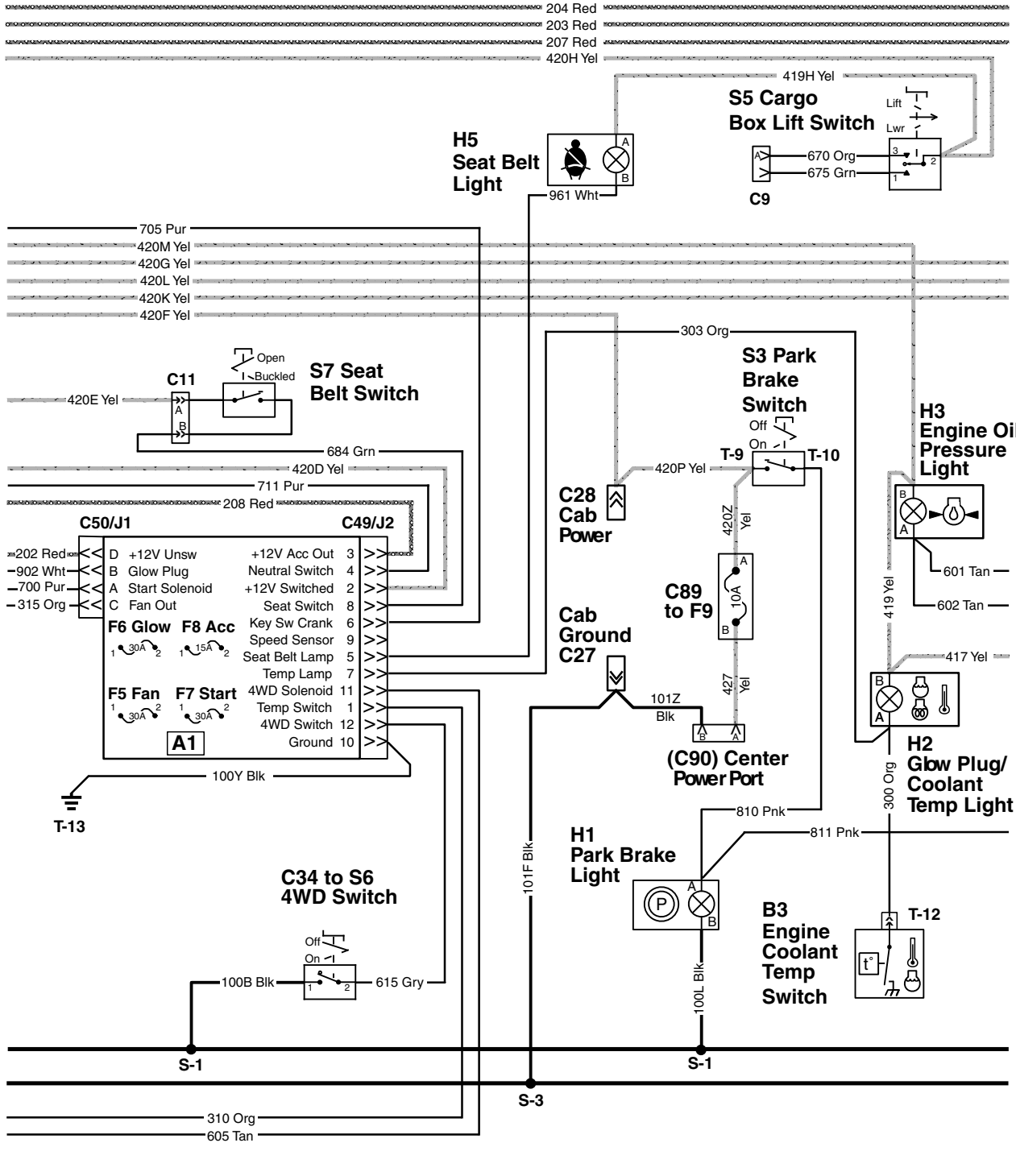
KK36721,0000118 -19-13MAY15-1/3

Main Wiring Schematic (Diesel Engines SN 110001-120000) 2 of 3



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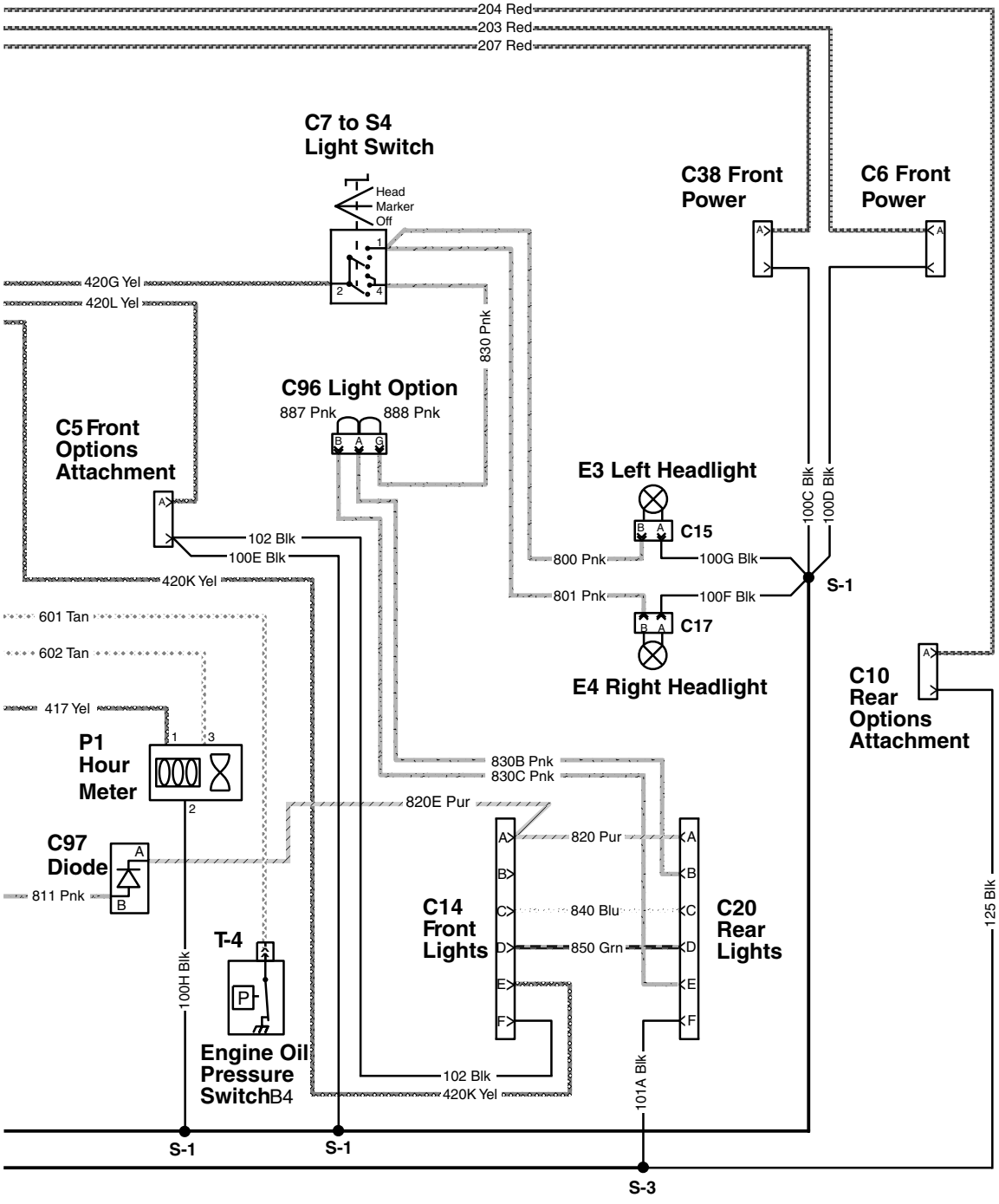
KK36721,0000118 -19-13MAY15-2/3

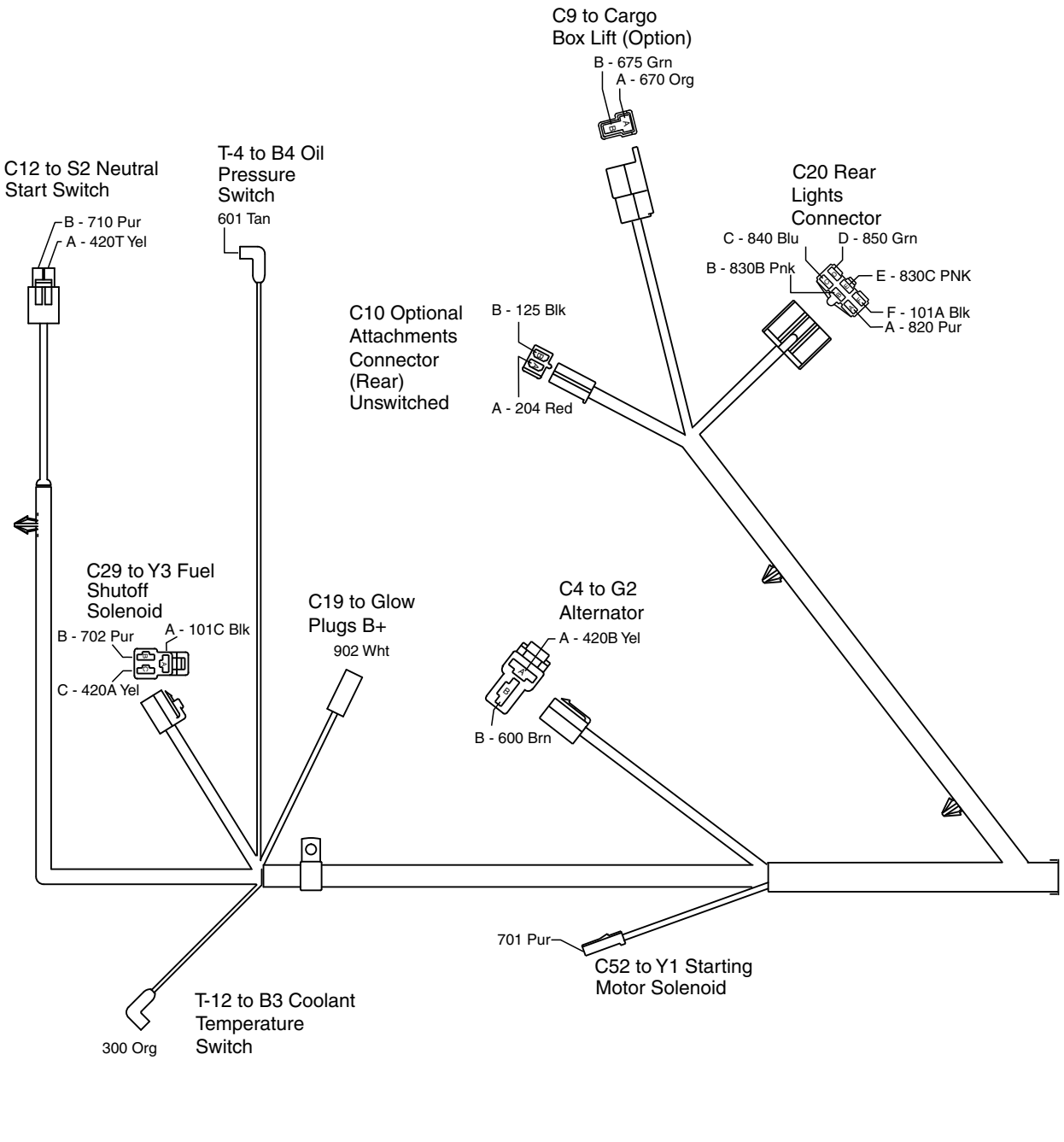
Main Wiring Schematic (Diesel Engines SN 110001-120000) 3 of 3



KK36721,0000118 -19-13MAY15-3/3

Main Wiring Harness (Diesel Engines SN 110001-120000)

1 of 4



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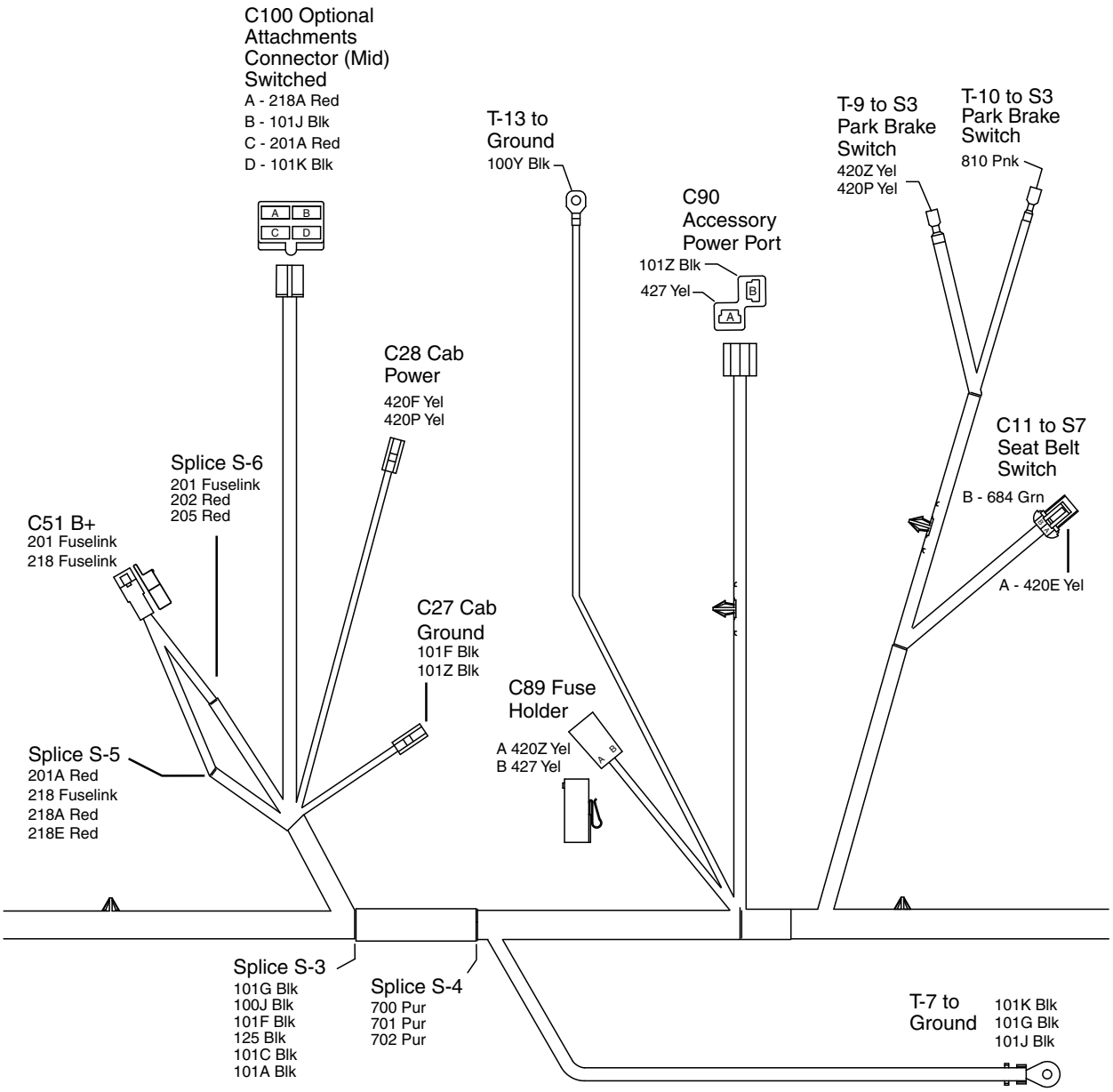
KK36721,0000119 -19-24OCT14-1/4

Main Wiring Harness (Diesel Engines SN 110001-120000) 2 of 4



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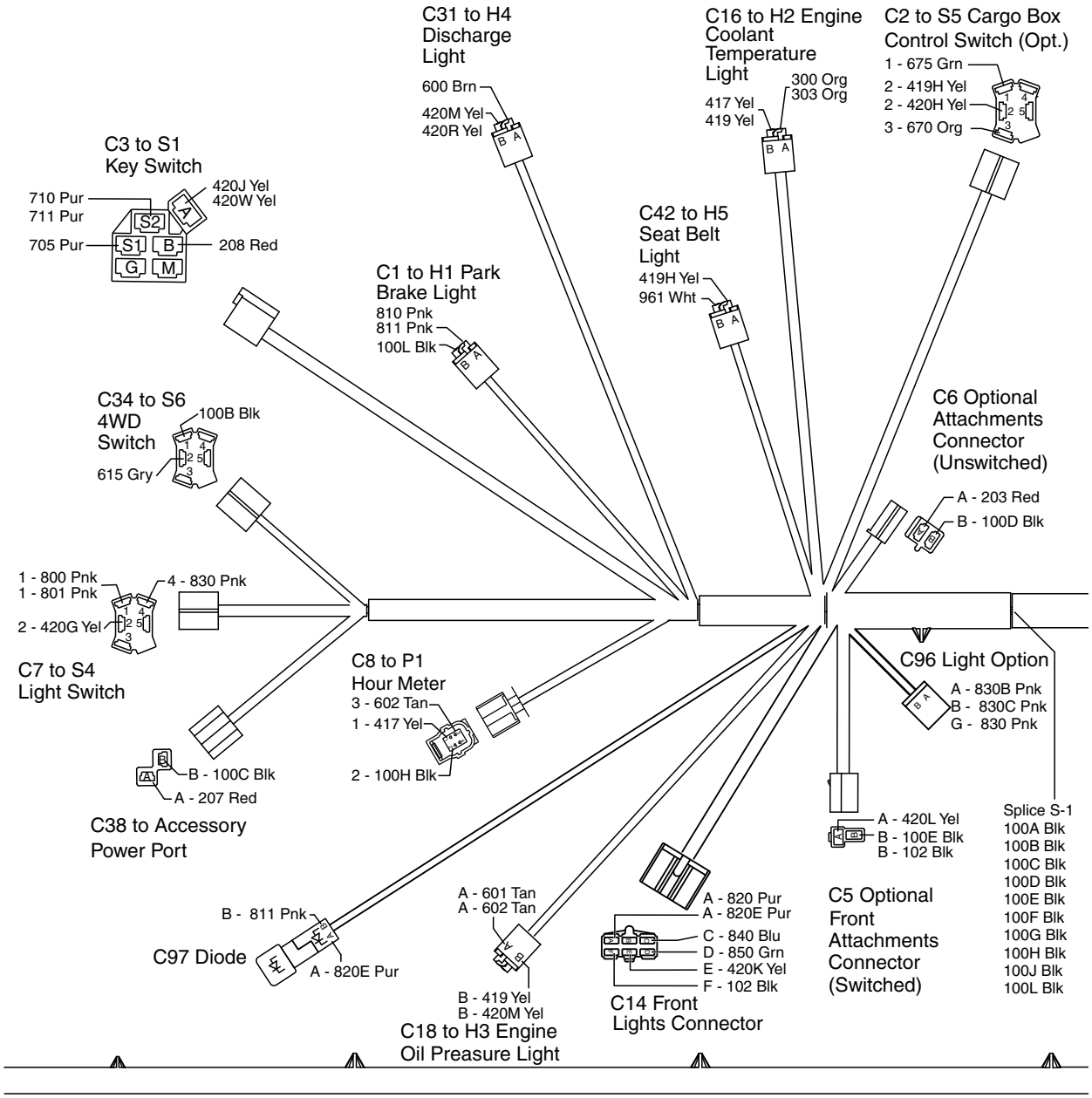
KK36721,0000119 -19-24OCT14-2/4

Main Wiring Harness (Diesel Engines SN 110001-120000) 3 of 4



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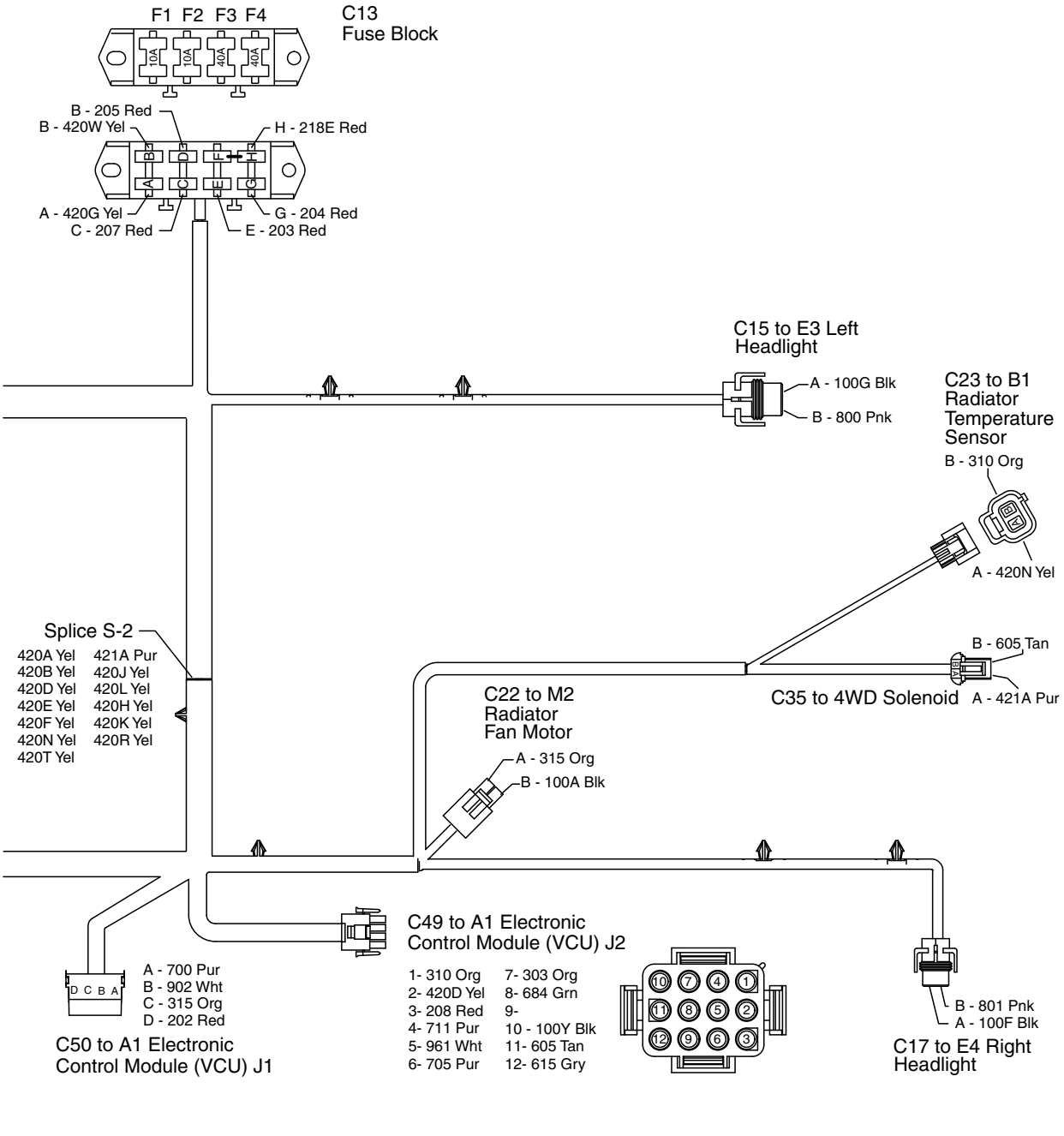
KK36721,0000119 -19-24OCT14-3/4

Main Wiring Harness (Diesel Engines SN 110001-120000) 4 of 4



KK36721,0000119 -19-24OCT14-4/4

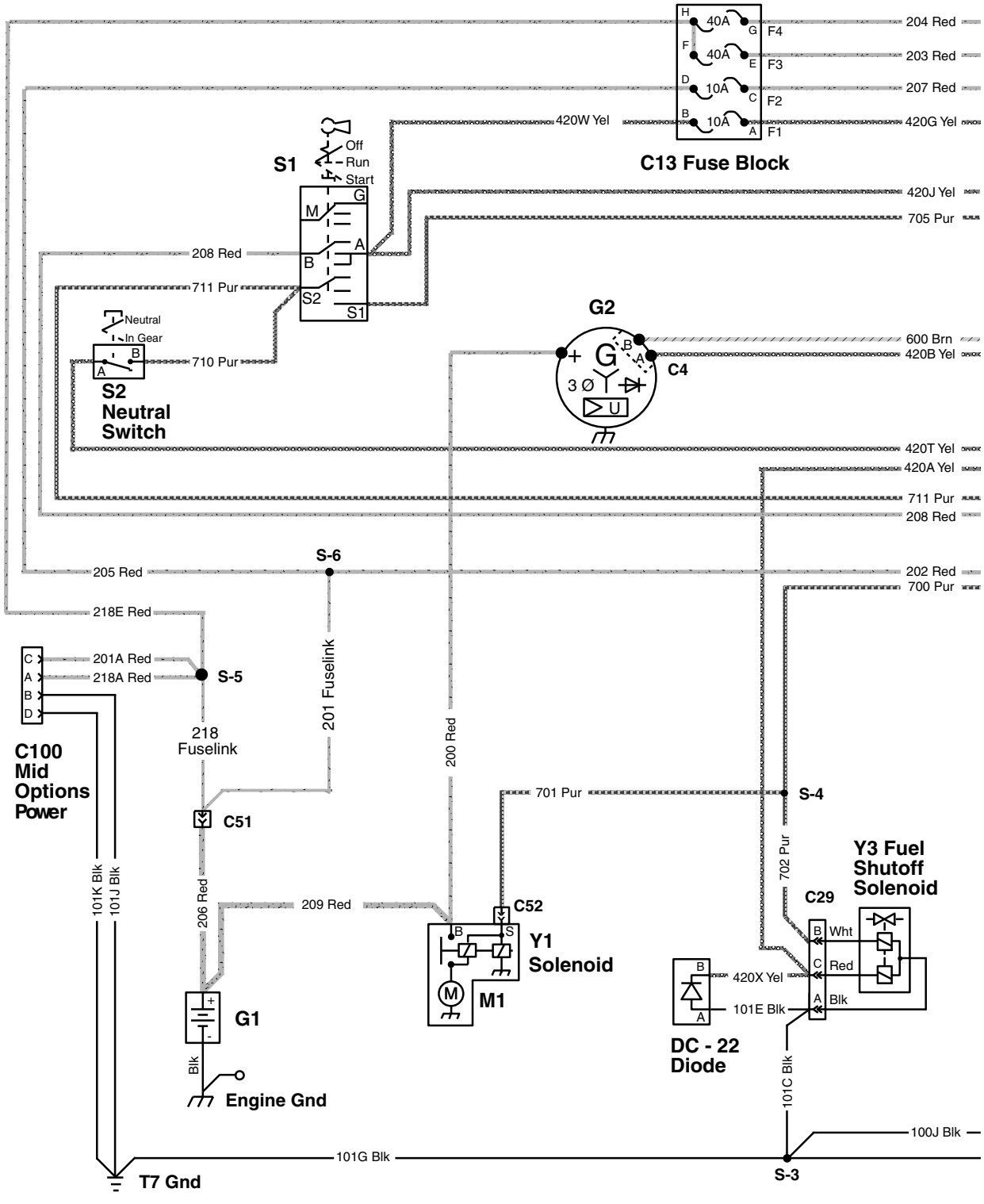
Main Harness Wire Color Codes (Diesel Engines SN 110001-120000)

Size No. Color	Wire Connection Points
3.0 100A Blk	Splice S-1, C22.B (M2)
0.8 100B Blk	Splice S-1, C34.1 (S6)
2.0 100C Blk	Splice S-1, C38.B
3.0 100D Blk	Splice S-1, C6.B
0.8 100E Blk	Splice S-1, C5.B
0.8 100F Blk	Splice S-1, C17.A (E4)
0.8 100G Blk	Splice S-1, C15.A (E3)
0.8 100H Blk	Splice S-1, C8.2 (P1)
3.0 100J Blk	Splice S-1, Splice S-3
0.8 100L Blk	Splice S-1, C1.B (H1)
0.8 100Y Blk	C49 (A1 VCU J2-10), T-13
0.8 101A Blk	Splice S-3, C20.F
3.0 101C Blk	Splice S-3, C29 (Y3)
0.8 101F Blk	Splice S-3, C27
5.0 101G Blk	T-7, Splice S-3
5.0 101J Blk	C100, T-7
5.0 101K Blk	C100, T-7
1.0 101Z Blk	C90, C27
0.8 102 Blk	C14.F, C5.B
3.0 125 Blk	Splice S-3, C10.B
5.0 201 Fuse Link	C51, Splice S-6
5.0 201A Red	Splice S-5, C100.C
5.0 202 Red	Splice S-6, C50 (A1 VCU J1-D)
3.0 203 Red	C13.E (F3), C6.A
3.0 204 Red	C13.G (F4), C10.A
3.0 205 Red	Splice S-6, C13.D (F1)
1.0 207 Red	C13.C (F1), C38.A
2.0 208 Red	C49 (A1 VCU J2-3), C3.B (S1)
2.0 218 Fuse Link	C51, Splice S-5
5.0 218A Red	Splice S-5, C100.A
5.0 218E Red	Splice S-5, C13.H
0.8 300 Org	T-12, C16.A (H2)
0.8 303 Org	C49 (A1 VCU J2-7), C16.A (H2)
0.8 310 Or	C49 (A1 VCU J2-1), C23.B (B1)
2.0 315 Org	C50 (A1 VCU J1-C), C22.A (M2)
0.8 417 Yel	C8.1 (P1), C16.B (H2)
0.8 419 Yel	C16.B (H2), C18.B (H3)
0.8 419H Yel	C2.2 (S5), C42.A (H5)
0.8 420A Yel	Splice S-2, C29.C (Y3)
0.8 420B Yel	Splice S-2, C4.A (G2)
0.8 420D Yel	C49 (A1 VCU J2-2), Splice S-2
0.8 420E Yel	C11.A (S7), Splice S-2
0.8 420F Yel	Splice S-2, C28
0.8 420G Yel	C7.2 (S4), C13.A
0.8 420H Yel	C2.2, Splice S-2
2.0 420J Yel	C3.A (S1), Splice S-2
0.8 420K Yel	C14.E, Splice S-2
0.8 420L Yel	Splice S-2, C5.A
0.8 420M Yel	C31.B (H4), C18.B (H3)
0.8 420N Yel	Splice S-2, C23.A (B1)
0.8 420P Yel	C28, T-9 (S3)
0.8 420R Yel	Splice S-2, C31.B (H4)
0.8 420T Yel	Splice S-2, C12.A (S2)
0.8 420W Yel	C3.A (S4), C13.B
1.0 420Z Yel	T-9 (S3), C89.A (F9)
0.8 421A Pur	Splice S-2, C35.A (Y4)
1.0 427 Yel	C89.B (F9), C90.A
0.8 600 Brn	C31.A (H4), C4.B (G2)
0.8 601 Tan	C18.A (H3), T-4 (B4)
0.8 602 Tan	C18.A (H3), C8.3 (P1)
0.8 605 Tan	C35.B (Y4), C49 (A1 VCU J2-11)
0.8 615 Gry	C34.2 (S6), C49.12 (A1 VCU J2-12)
0.8 670 Org	C2.3 (S5), C9.A
0.8 675 Grn	C2.1 (S5), C9.B
0.8 684 Grn	C11.B (S7), C49 (A1 VCU J2-8)
3.0 700 Pur	C50 (A1 VCU J1-A), Splice S-4
3.0 701 Pur	C52 (Y1), Splice S-4
3.0 702 Pur	Splice S-4, C29.B (Y3)
0.8 705 Pur	C49 (A1 VCU J2-6), C3.S1 (S1)
0.8 710 Pur	C3.S2 (S1), C12.B (S2)
0.8 711 Pur	C3.S2 (S1), C49 (A1 VCU J2-4)
0.8 800 Pnk	C7.1 (S4), C15.B (E3)
0.8 801 Pnk	C7.1 (S4), C17.B (E4)
0.8 810 Pnk	T-10 (S3), C1.A (H1)
0.8 811 Pnk	C97.B (Diode), C1.A (H1)
0.8 820 Pur	C14.A, C20.A
0.8 820E Pur	C97.A (Diode), C14.A
0.8 830 Pnk	C7.4 (S4), C96.G
0.8 830B Pnk	C20.B, C96.A
0.8 830C Pnk	C20.E, C96.B
0.8 840 Lt Blu	C14.C, C20.C
0.8 850 Grn	C14.D, C20.D
3.0 902 Wht	C50 (A1 VCU J1-B), C19
0.8 961 Wht	C42.B (H5), C49 (A1 VCU J2-5)

KK36721,000011A -19-24OCT14-1/1

Main Wiring Schematic (Diesel Engines SN 120001-)

1 of 4



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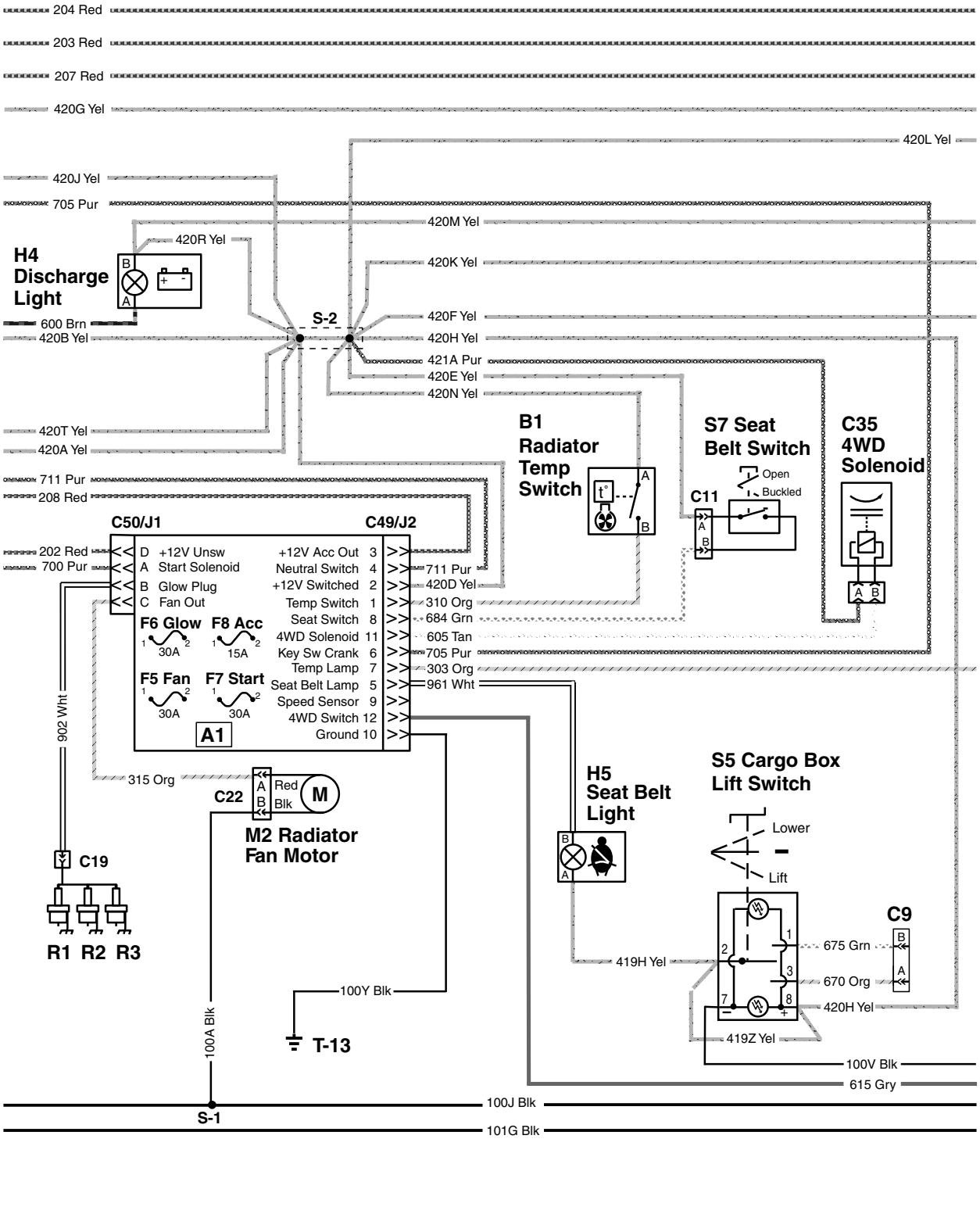
KK36721,000011B -19-13MAY15-1/4

Main Wiring Schematic (Diesel Engines SN 120001-) 2 of 4



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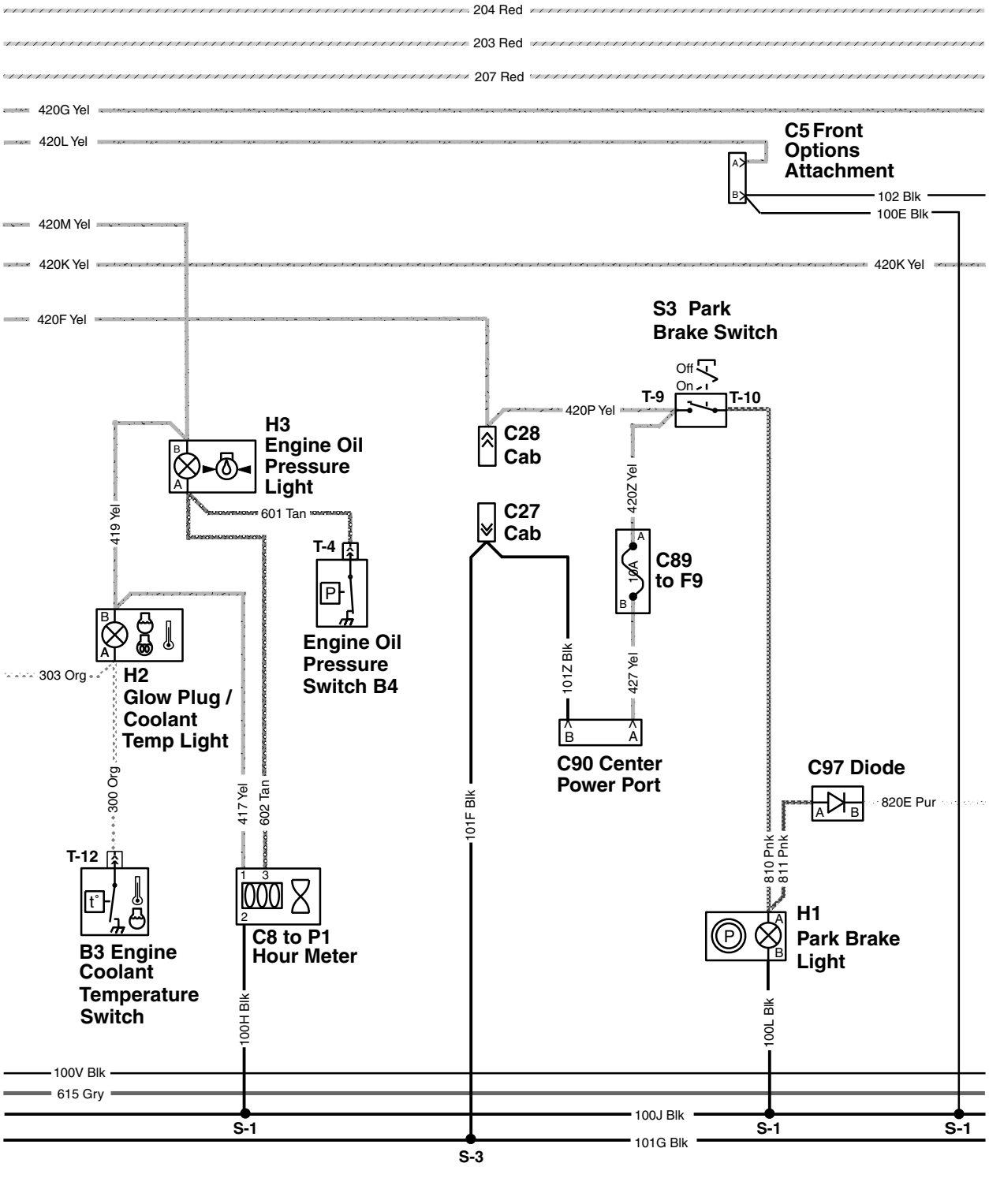
KK36721,000011B -19-13MAY15-2/4

Main Wiring Schematic (Diesel Engines SN 120001-) 3 of 4



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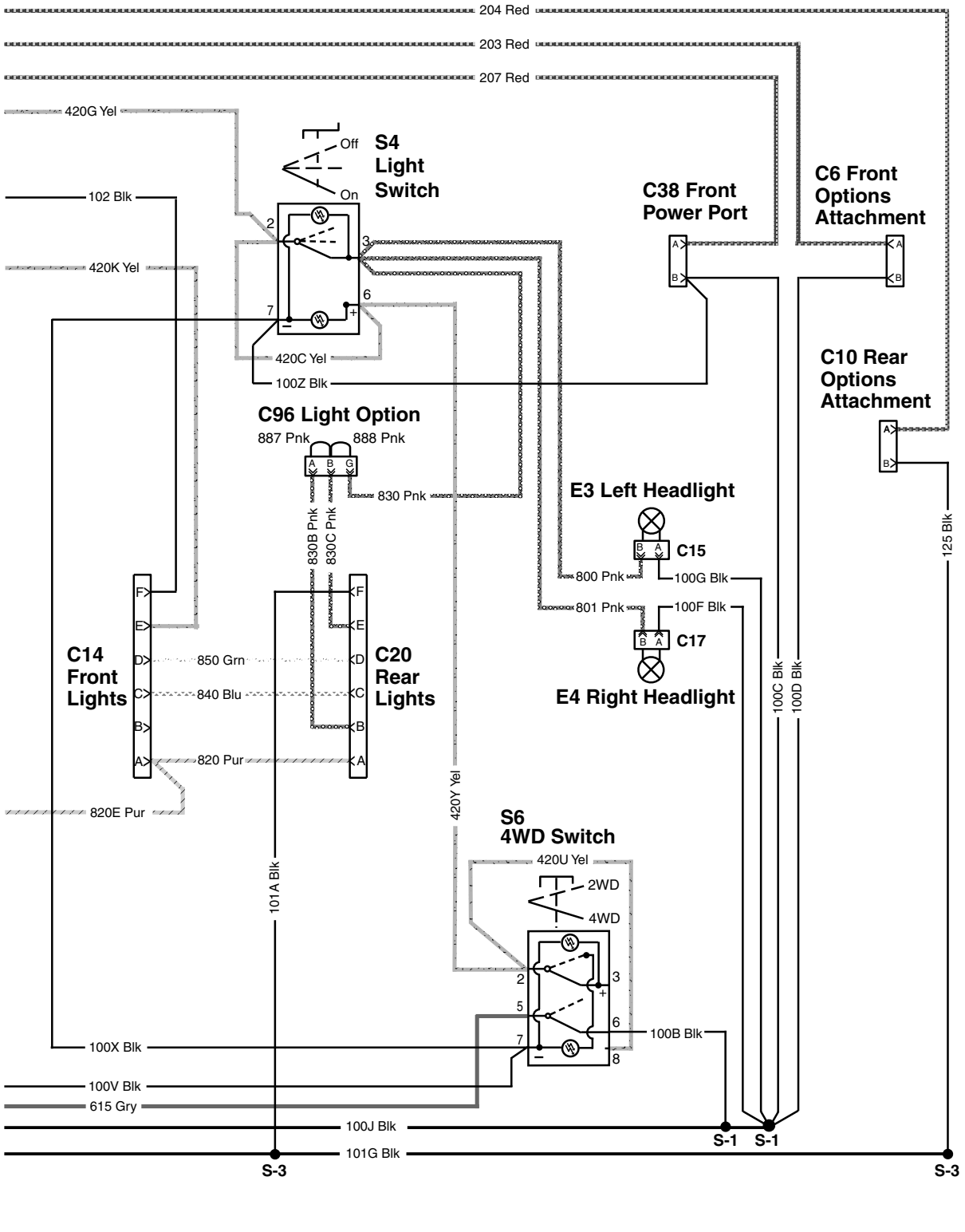
KK36721,000011B -19-13MAY15-3/4

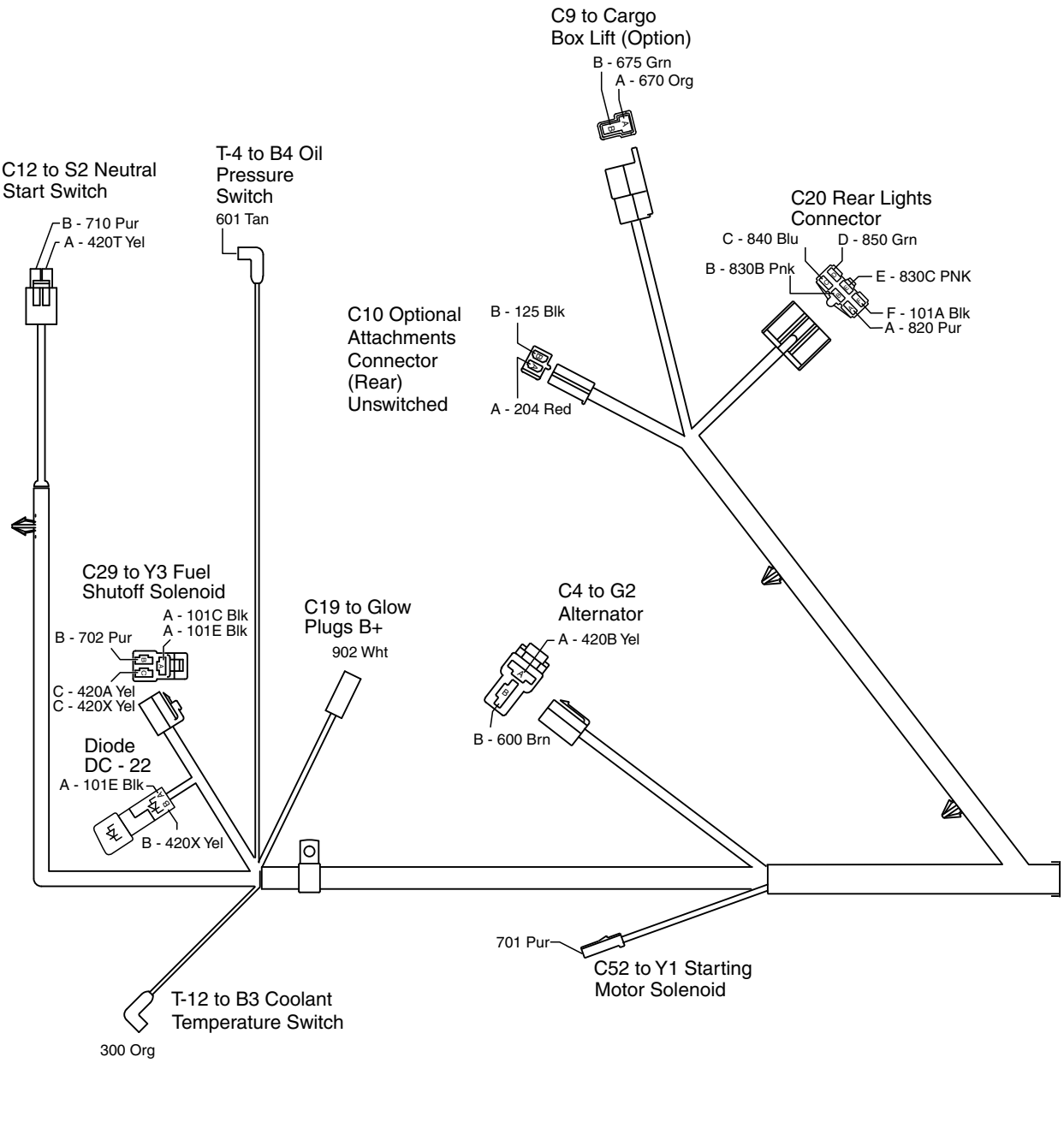
Main Wiring Schematic (Diesel Engines SN 120001-) 4 of 4



KK36721,000011B -19-13MAY15-4/4

Main Wiring Harness (Diesel Engines SN 120001-)

1 of 4



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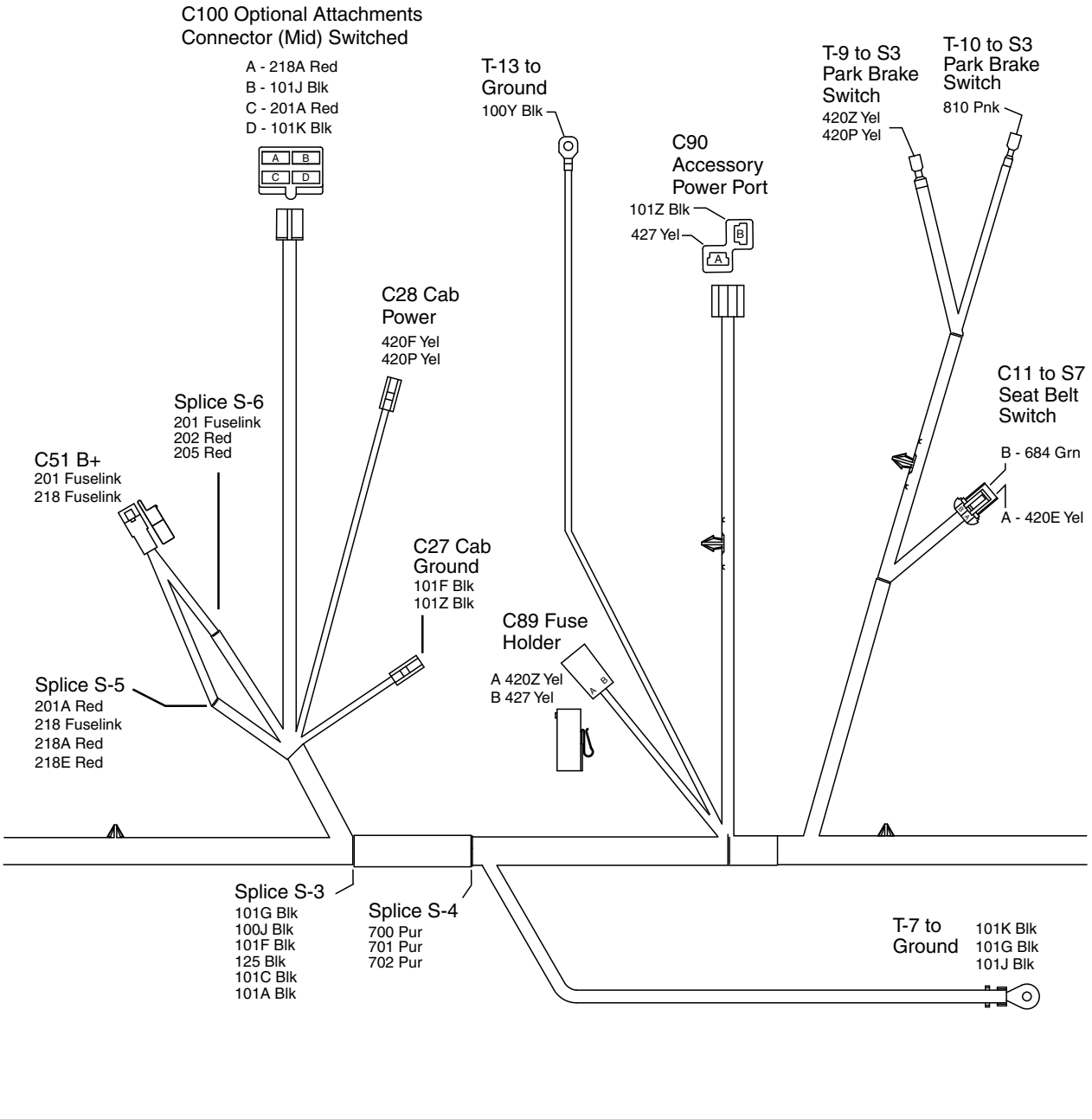
Main Wiring Harness (Diesel Engines SN 120001-) 2 of 4



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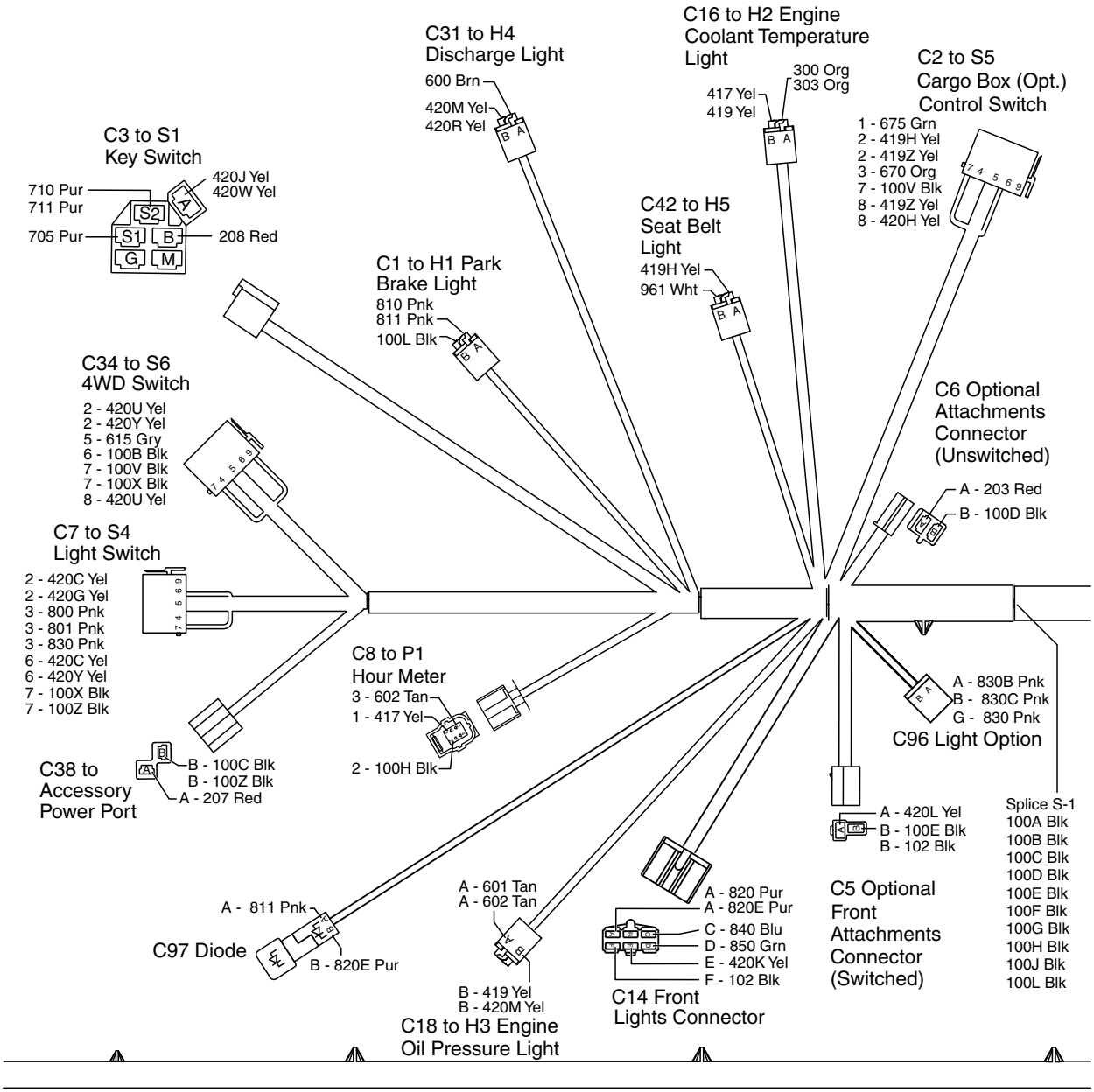
KK36721,000011C -19-24OCT14-2/4

Main Wiring Harness (Diesel Engines SN 120001-) 3 of 4



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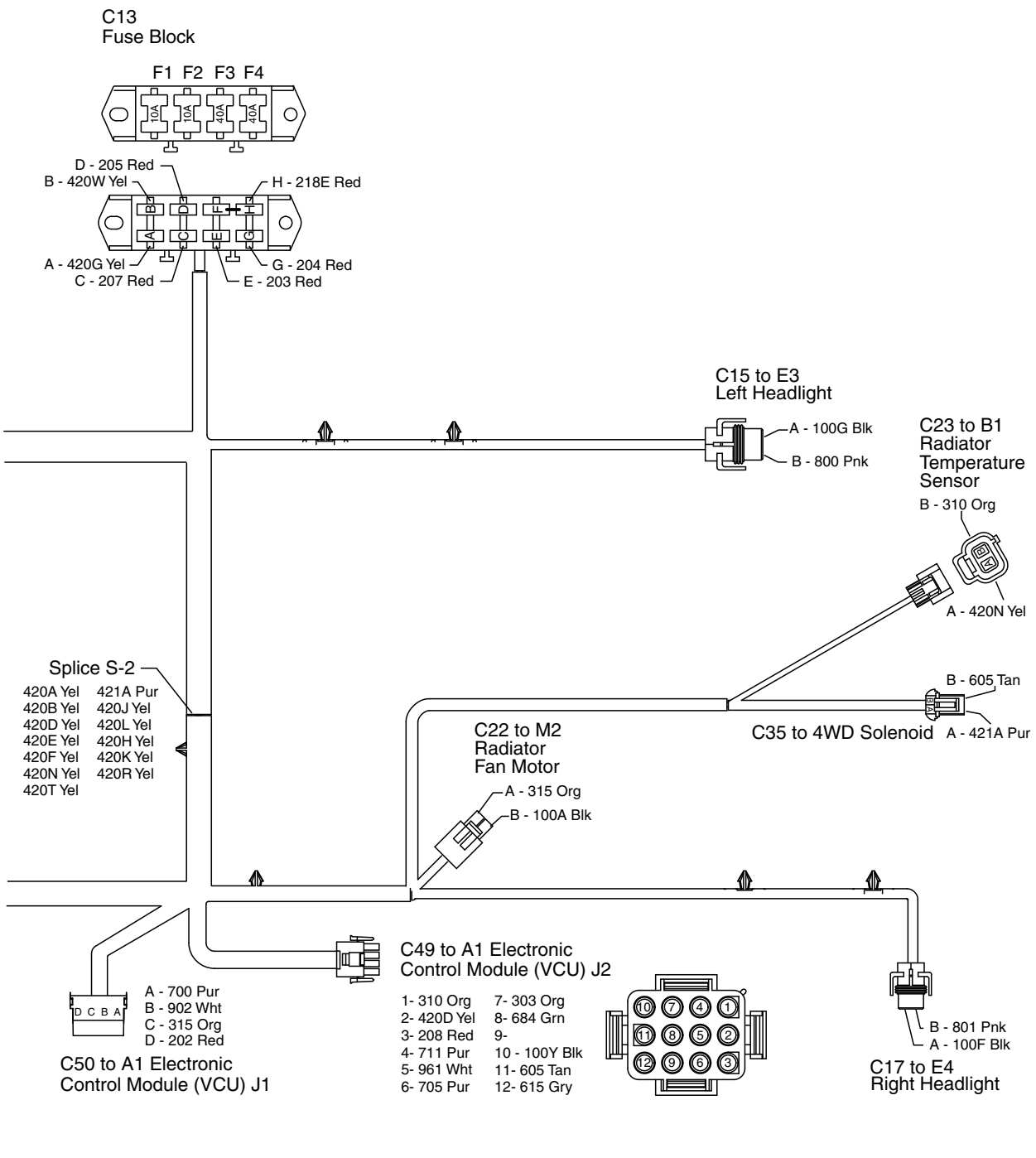
Main Wiring Harness (Diesel Engines SN 120001-) 4 of 4



KK36721,000011C -19-24OCT14-4/4

Main Harness Wire Color Codes (Diesel Engines SN 120001-)

Size No. Color	Wire Connection Points
3.0 100A Blk	Splice S-1, C22.B (M2)
0.8 100B Blk	Splice S-1, C34.6 (S6)
2.0 100C Blk	Splice S-1, C38.B
3.0 100D Blk	Splice S-1, C6.B
0.8 100E Blk	Splice S-1, C5.B
0.8 100F Blk	Splice S-1, C17.A (E4)
0.8 100G Blk	Splice S-1, C15.A (E3)
0.8 100H Blk	Splice S-1, C8.2 (P1)
3.0 100J Blk	Splice S-1, Splice S-3
0.8 100L Blk	Splice S-1, C1.B (H1)
0.8 100V Blk	C34.7, C2.7
0.8 100X Blk	C7.7, C34.7
0.8 100Y Blk	C49 (A1 VCU J2-10), T-13
0.8 100Z Blk	C7.7, C38.B
0.8 101A Blk	Splice S-3, C20.F
3.0 101C Blk	Splice S-3, C29.A (Y3)
0.8 101E Blk	C29.A, DC22.A (Diode)
0.8 101F Blk	Splice S-3, C27
5.0 101G Blk	T-7, Splice S-3
5.0 101J Blk	C100.B, T-7
5.0 101K Blk	C100.D, T-7
1.0 101Z Blk	C90.B, C27
0.8 102 Blk	C14.F, C5.B
3.0 125 Blk	Splice S-3, C10.B
5.0 201 Fuse Link	C51, Splice S-6
5.0 201A Red	Splice S-5, C100.C
5.0 202 Red	Splice S-6, C50 (A1 VCU J1-D)
3.0 203 Red	C13.E (F3), C6.A
3.0 204 Red	C13.G (F4), C10.A
3.0 205 Red	Splice S-6, C13.D (F1)
1.0 207 Red	C13.C (F1), C38.A
2.0 208 Red	C49 (A1 VCU J2-3), C3.B (S1)
2.0 218 Fuse Link	C51, Splice S-5
5.0 218A Red	Splice S-5, C100.A
5.0 218E Red	Splice S-5, C13.H
0.8 300 Org	T-12, C16.A (H2)
0.8 303 Org	C49 (A1 VCU J2-7), C16.A (H2)
0.8 310 Or	C49 (A1 VCU J2-1), C23.B (B1)
2.0 315 Org	C50 (A1 VCU J1-C), C22.A (M2)
0.8 417 Yel	C8.1 (P1), C16.B (H2)
0.8 419 Yel	C16.B (H2), C18.B (H3)
0.8 419H Yel	C2.2 (S5), C42.A (H5)
0.8 419Z Yel	C2.2, C2.8
0.8 420A Yel	Splice S-2, C29.C (Y3)
0.8 420B Yel	Splice S-2, C4.A (G2)
0.8 420C Yel	C7.2, C7.6

Continued on next page

Size No. Color	Wire Connection Points
0.8 420D Yel	C49 (A1 VCU J2-2), Splice S-2
0.8 420E Yel	C11.A (S7), Splice S-2
0.8 420F Yel	Splice S-2, C28
0.8 420G Yel	C7.2 (S4), C13.A
0.8 420H Yel	C2.8, Splice S-2
2.0 420J Yel	C3.A (S1), Splice S-2
0.8 420K Yel	C14.E, Splice S-2
0.8 420L Yel	Splice S-2, C5.A
0.8 420M Yel	C31.B (H4), C18.B (H3)
0.8 420N Yel	Splice S-2, C23.A (B1)
0.8 420P Yel	C28, T-9 (S3)
0.8 420R Yel	Splice S-2, C31.B (H4)
0.8 420T Yel	Splice S-2, C12.A (S2)
0.8 420U Yel	C34.2, C34.8
0.8 420W Yel	C3.A (S4), C13.B
0.8 420X Yel	C29.C, DC22.B (Diode)
0.8 420Y Yel	C7.6, C34.2
1.0 420Z Yel	T-9 (S3), C89.A (F9)
0.8 421A Pur	Splice S-2, C35.A (Y4)
1.0 427 Yel	C89.B (F9), C90.A
0.8 600 Brn	C31.A (H4), C4.B (G2)
0.8 601 Tan	C18.A (H3), T-4 (B4)
0.8 602 Tan	C18.A (H3), C8.3 (P1)
0.8 605 Tan	C35.B (Y4), C49 (A1 VCU J2-11)
0.8 615 Gry	C34.5 (S6), C49 (A1 VCU J2-12)
0.8 670 Org	C2.3 (S5), C9.A
0.8 675 Grn	C2.1 (S5), C9.B
0.8 684 Grn	C11.B (S7), C49 (A1 VCU J2-8)
3.0 700 Pur	C50 (A1 VCU J1-A), Splice S-4
3.0 701 Pur	C52 (Y1), Splice S-4
3.0 702 Pur	Splice S-4, C29.B (Y3)
0.8 705 Pur	C49 (A1 VCU J2-6), C3.S1 (S1)
0.8 710 Pur	C3.S2 (S1), C12.B (S2)
0.8 711 Pur	C3.S2 (S1), C49 (A1 VCU J2-4)
0.8 800 Pnk	C7.3 (S4), C15.B (E3)
0.8 801 Pnk	C7.3 (S4), C17.B (E4)
0.8 810 Pnk	T-10 (S3), C1.A (H1)
0.8 811 Pnk	C97.A (Diode), C1.A (H1)
0.8 820 Pur	C14.A, C20.A
0.8 820E Pur	C97.B (Diode), C14.A
0.8 830 Pnk	C7.3 (S4), C96.G
0.8 830B Pnk	C20.B, C96.A
0.8 830C Pnk	C20.E, C96.B
0.8 840 Lt Blu	C14.C, C20.C
0.8 850 Grn	C14.D, C20.D
3.0 902 Wht	C50 (A1 VCU J1-B), C19
0.8 961 Wht	C42.B (H5), C49 (A1 VCU J2-5)

Summary of References

- Power Circuit Operation, Gas (SN -040000)l
- Power Circuit Schematic, Gas (SN -040000)
- Power Circuit Operation, Gas (SN 040001-)
- Power Circuit Schematic, Gas (SN 040001-)
- Power Circuit Operation, Diesel (SN -080000)
- Power Circuit Schematic, Diesel (SN -040000)
- Power Circuit Schematic, Diesel (SN 040001-080000)
- Power Circuit Operation, Diesel (SN 080001-)
- Power Circuit Schematic, Diesel (SN 080001-110000)
- Power Circuit Schematic, Diesel (SN 110001-)
- Cranking Circuit Schematic, Gas and Diesel (SN -040000)
- Cranking Circuit Operation, Gas (All), Diesel (SN -080000)
- Cranking Circuit Operation, Diesel (SN 080001-)
- Seat Belt Circuit Operation, Diesel (SN 080001-)
- Cranking and Seat Belt Circuit Schematic, Diesel (SN 080001-)
- Ignition Circuit Operation, Gas (All)
- Ignition Circuit Schematic, Gas (All)
- Charging Circuit Operation, Gas (All)
- Charging Circuit Schematic, Gas (All)
- Charging Circuit Operation, Diesel (All)
- Charging Circuit Schematic, Diesel (SN -080000)
- Charging Circuit Schematic, Diesel (SN 080001-)
- Fuel Pump Circuit Operation, Gas (All)
- Fuel Pump Circuit Schematic, Gas (All)
- Fuel Shutoff Solenoid Circuit Operation, Gas (All)
- Fuel Shutoff Solenoid Circuit Schematic, Gas (All)
- Fuel Shutoff Circuit Operation, Diesel (All)
- Fuel Shutoff Circuit Schematic, Diesel (SN -040000)
- Fuel Shutoff Circuit Schematic, Diesel (SN 040001-080000)
- Fuel Shutoff Circuit Schematic, Diesel (SN 080001-)
- Carburetor Heater Circuit Operation, Gas (All)
- Carburetor Heater Circuit Schematic Gas, (All)
- Glow Plug Circuit Operation, Diesel (All)
- Glow Plug Circuit Schematic, Diesel (SN -040000)
- Glow Plug Circuit Schematic, Diesel (SN 040001-080000)
- Glow Plug Circuit Schematic, Diesel (SN 080001-)
- 4WD Clutch Circuit Operation, (All)
- 4WD Clutch Circuit Schematic, Gas (SN 040001-), Diesel (SN 040001-080000)
- 4WD Circuit Schematic, Diesel (SN 080001-)
- Engine Oil Pressure Light Circuit Operation, Gas (All), Diesel (SN -080000)
- Hour Meter Circuit Operation, Gas (All), Diesel (SN -080000)
- Engine Oil Pressure Light/Hour Meter Circuit Schematic, Gas (All), Diesel (SN -080000)
- Engine Oil Pressure Light Circuit Operation, Diesel (SN 080001-)
- Hour Meter Circuit Operation, Diesel (SN 080001-)
- Engine Oil Pressure Light /Hour Meter Circuit Schematic, Diesel (SN 080001-)
- Cooling Fan and Temperature Light Circuit Operation, Gas (All), Diesel (SN -080000)
- Cooling Fan and Temperature Light Circuit Schematic, Gas (All), Diesel (SN -080000)
- Cooling Fan and Temperature Light Circuit, Diesel (SN 080001-)
- Cooling Fan and Temperature Light Circuit Schematic, Diesel (SN 080001-)
- Headlight Circuit Operation Gas, (All), Diesel (SN -080000)
- Headlight Circuit Schematic, Gas (All) Diesel (SN -080000)
- Headlight Circuit Operation, Diesel (SN 080001-)
- Headlight Circuit Schematic, Diesel (SN 080001-)
- Park Brake Circuit Operation, Gas (All), Diesel (SN -080000)
- Park Brake Circuit Schematic, Gas (All), Diesel (SN -080000)
- Park Brake Circuit Operation, Diesel (SN 080001-)
- Park Brake Circuit Schematic, Diesel (SN 080001-)
- Accessory Power Port Circuit Operation, Gas (All), Diesel (SN -080000)
- Accessory Power Port Circuit Schematic, Gas (All), Diesel (SN -080000)
- Accessory Power Port Circuit Operation, Diesel (SN 080001-)
- Accessory Power Port Circuit Schematic, Diesel (SN 080001-)

MX52301,0000446 -19-23OCT14-1/1

Power Circuit Operation, Gas (SN -040000)

Function:

Provides unswitched and switched power to the primary components whenever the battery is connected and the key switch is in the run position.

Operating Conditions Unswitched Circuits:

- Battery fully charged and properly connected to the wiring harness.
- Ground circuit properly connected to the wiring harness.

Battery voltage must be present at the following components with the key switch “OFF”:

- Battery Positive Terminal
- Y1 Starting Motor Solenoid “B” Terminal 209 Red wire
- K1 Start Relay 216 Red wire
- K2 Fan Relay 217 Red wire
- N1 Voltage Regulator, Rectifier “E” terminal 205 Red
- X17 Rear Optional Attachments Connector “A” terminal 204 Red wire
- X13 Accessory Power Port Connector “A” terminal 207 Red wire
- S1 Key Switch “B” terminal 208 Red wire
- X14 Front Optional Attachments Connector “A” terminal 203 Red wire

Unswitched Circuit Operation:

The positive battery cable connects the battery to the Y1 starting motor solenoid. Power is also directly run from the battery positive terminal to two fuse blocks. These fuse blocks distribute power to all unswitched circuits, except for the Y1 starting motor solenoid. The individual fuses in the blocks protect the components and wiring from damage by preventing a high current circuit overload.

The battery cable and fuse block connections must be in good condition for proper electrical system operation.

The ground cable and connections are equally important. Proper operation depends on these cables and connections to carry the power necessary for operation.

Operating Conditions Switched Circuits:

- Unswitched circuits functioning properly.
- Key switch in the RUN position.

Battery voltage must be present at the following locations:

- Y2 Fuel Pump 420A Yel wire
- N1 Voltage Regulator 420C Yel wire
- K1 Start Relay 420D Yel wire
- K2 Fan Relay 420E Yel wire
- X15 Front Lights Connector “E” terminal 420K Yel wire
- S3 Park Brake Switch 420P Yel wire
- S4 Light Switch 420G Yel wire
- S5 Cargo Box Control Switch (option) 420H Yel wire
- X7 Front Optional Attachments Connector “A” terminal 420L Yel wire
- X8 Mid-Optional Attachments Connector 420F Yel wire
- H2 Engine Coolant Temperature Light 419 Yel wire
- H3 Engine Oil Pressure Light 420M Yel wire
- X1 Engine Connector “E” terminal 420B Yel wire:
  - R1 Carburetor Heater
  - Y3 Fuel Shutoff Solenoid
  - X6 Connector of A1 Ignitor Module

Switched Circuit Operation:

Power supplied by the battery, through a fuse block is supplied to the S1 key switch. When the key switch is in the ON position, power is routed to a central splice. This splice distributes power to the switched components through individual circuits and grounds.

Static Switched Circuits:

- Switched circuits functioning properly.

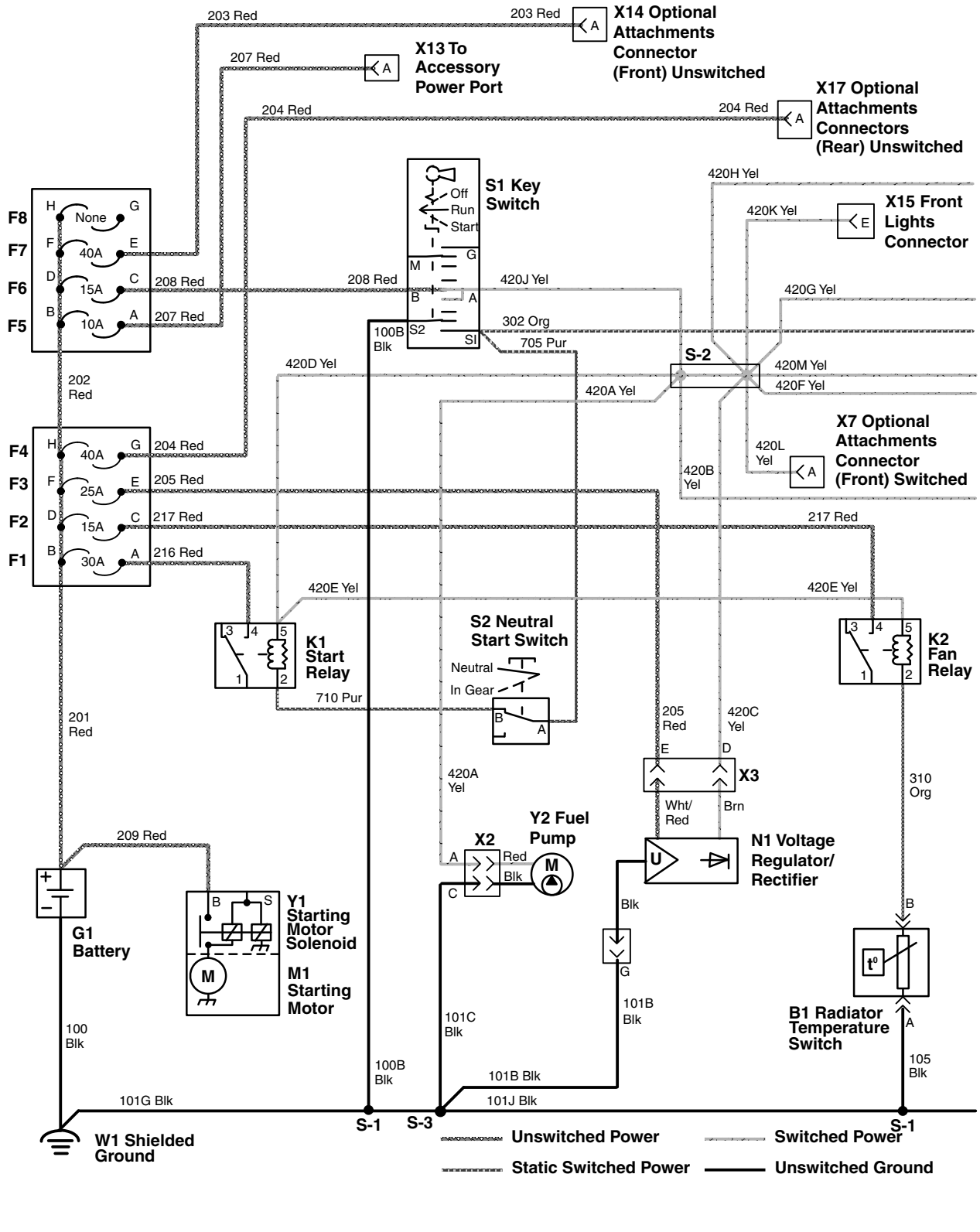
When the key switch is in the run position, battery voltage is sent to several components. These components are switched on the ground side to activate

Battery voltage must be present at the following locations:

- B1 Radiator Temperature Switch 310 Org wire
- B3 Engine Coolant Temperature Switch 300 Org wire
- V1 Light Check Diode 301 and 302 Org wires
- S1 Key Switch “S1” terminal 302 Org and 705 Pur wires
- B4 Engine Oil Pressure Switch 601 Tan wire when engine oil pressure is within operating range.
- S2 Neutral Start Switch 705 and 710 Pur wires
- P1 Hour Meter 602 Tan wire

MX52301,0000103 -19-24OCT14-1/1

Power Circuit Schematic, Gas (SN -040000)



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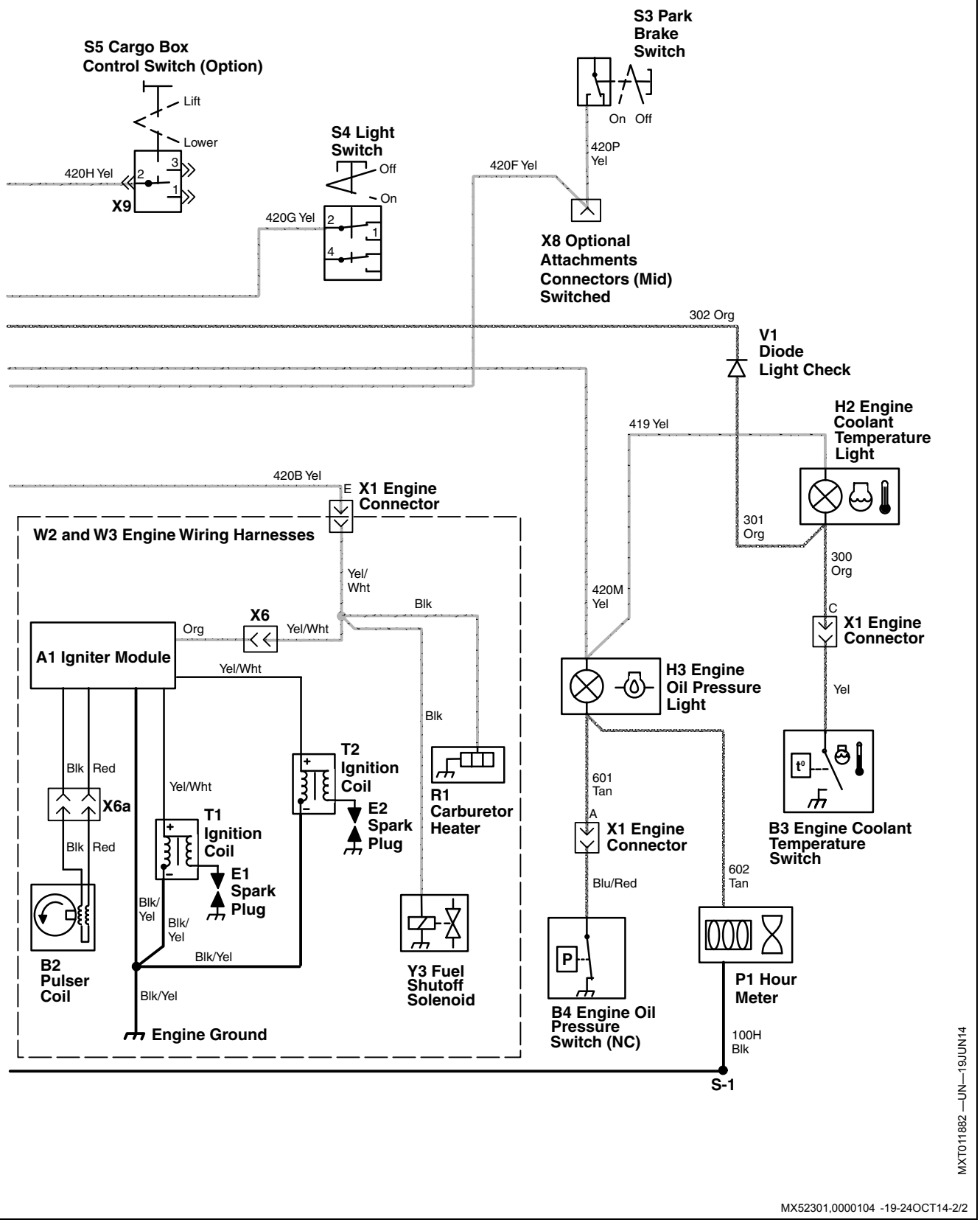
MX52301,0000104 -19-24OCT14-1/2

Power Circuit Schematic 2 of 2



MX52301,0000104 -19-24OCT14-2/2

Power Circuit Diagnosis, Gas (SN -040000)

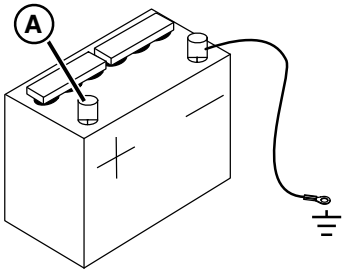
Power Circuit Diagnosis (Gas Engines SN -40000)

MX52301,0000105 -19-24OCT14-1/34

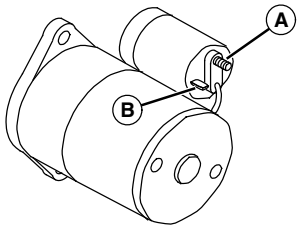
❶ Battery Circuit

Test Procedure A

MX52301,0000105 -19-24OCT14-2/34

Battery	Test Conditions: • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is 12.4 V or above present at the positive battery terminal **(A)**?  MXT011883 —UN—04JUN14	**YES:** Go to next step. **NO:** Test battery. See Battery Load Test.

MX52301,0000105 -19-24OCT14-3/34

Starter Motor Solenoid	Is battery voltage present at the battery terminal of the starter solenoid **(A)**?  MXT011957 —UN—03JUL14	**YES:** Go to next step. **NO:** Check 209 Red cable and connections.

Continued on next page

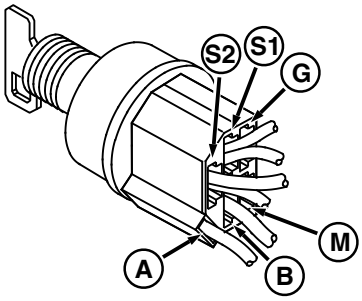
MX52301,0000105 -19-24OCT14-4/34

❷ Unswitched Circuit Wiring:

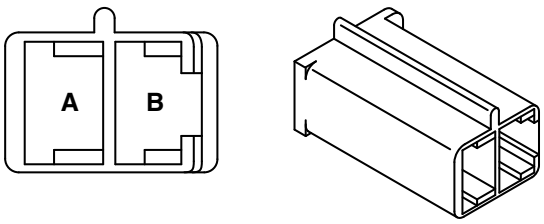
MX52301,0000105 -19-24OCT14-5/34

Circuit Wiring	Is battery voltage present at both sides of all fuses **(F1—F7)**?	**YES:** Yes: Go to next step. **NO:** Check 201 Red wire, 202 Red wire (behind fuse blocks), and all fuses.

MX52301,0000105 -19-24OCT14-6/34

Switch Connector	Is battery voltage present at the 208 Red wire **(B)** of switch connector?  MXT004463 —UN—31MAY12	**YES:** Connect switch. Go to next step. **NO:** Test F6 fuse. Test battery and positive (+) battery cable. Check 201 and 202 Red wires and connections. Check 208 Red wire and connections.

MX52301,0000105 -19-24OCT14-7/34

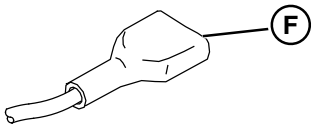
Optional Attachment Connector	Is battery voltage present at X14 front optional attachments connector, 203 Red wire **(B)**?  RXA0062502 —UN—05NOV02	**YES:** Go to next step **NO:** Check 203 Red wire.

Continued on next page

MX52301,0000105 -19-24OCT14-8/34

Accessory Power Port

Is battery voltage present at X13 accessory outlet, 207 Red wire **(F)**?



MXT011888 —UN—28MAY14
F—207 Red Wire

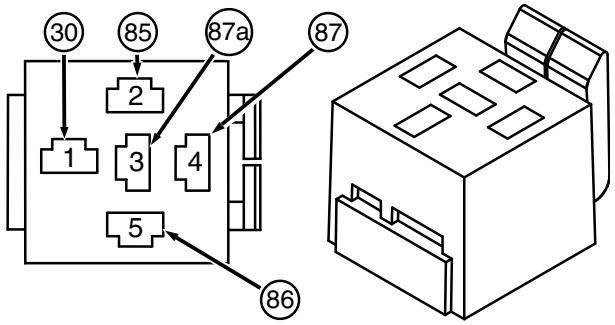
YES: Go to next step.

NO: Check 207 Red wire.

MX52301,0000105 -19-24OCT14-9/34

Start Relay Connector

Remove K1 start relay. Is battery voltage present at terminal **[4 (87)]** of relay connector, 216 Red wire?



MXT011889 —UN—09JUL14

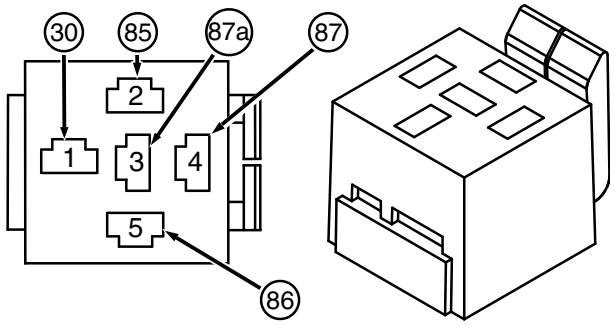
YES: Install relay. Go to next step.

NO: Check 216 Red wire.

MX52301,0000105 -19-24OCT14-10/34

Fan Relay Connector

Remove K2 fan relay. Is battery voltage present at terminal **[4 (87)]** of relay connector, 217 Red wire?



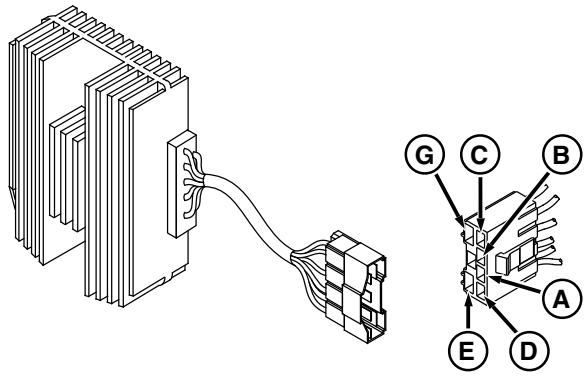
MXT011889 —UN—09JUL14

YES: Install relay. Go to next step.

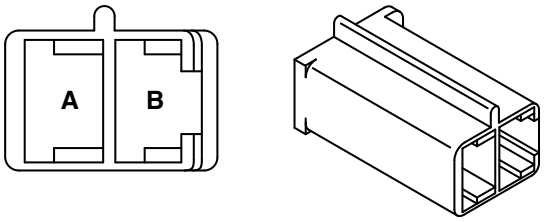
NO: Check 217 Red wire.

Continued on next page

MX52301,0000105 -19-24OCT14-11/34

Regulator, Rectifier	Disconnect N1 voltage regulator, rectifier. Is battery voltage present at X3 connector, 205 Red wire **(E)**?  MXT011891 —UN—04JUN14 **E—205 Red Wire**	**YES:** Connect regulator, rectifier. Go to next step. **NO:** Check 205 Red wire.

MX52301,0000105 -19-24OCT14-12/34

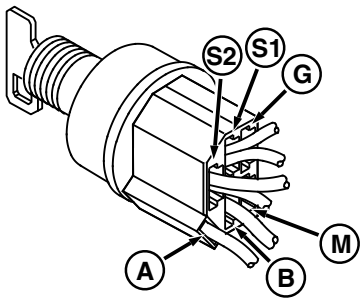
Rear Optional Attachments Connector	Is battery voltage present at X17 rear optional attachments connector, 204 Red wire **(B)**?  RXA0062502 —UN—05NOV02	**YES:** Test complete; or go to switched power circuit tests. **NO:** Check 204 Red wire.

MX52301,0000105 -19-24OCT14-13/34

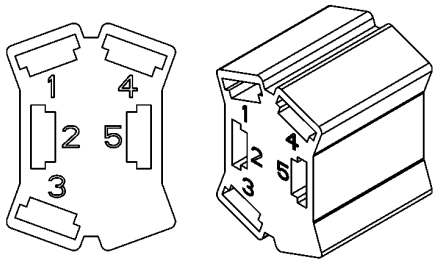
❶ Switched Circuit Wiring:

Continued on next page

MX52301,0000105 -19-24OCT14-14/34

Key Switch	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is battery voltage present at the switch connector, 420J Yel wire **(A)**?  MXT004463 —UN—31MAY12	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test.

MX52301,0000105 -19-24OCT14-15/34

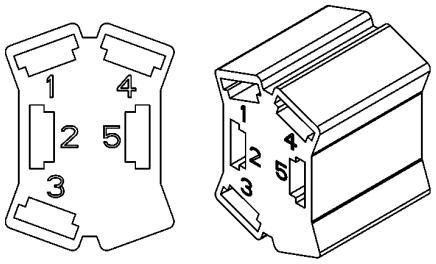
Light Switch	Disconnect S4 light switch. Is battery voltage present at the switch connector, 420G Yel wire **(2)**?  MXT001666 —UN—10OCT11	**YES:** Connect switch. Go to next step. **NO:** Check 420J and 420G Yel wires, and connections.

Continued on next page

MX52301,0000105 -19-24OCT14-16/34

Cargo Box Lift Switch

Disconnect S5 cargo box lift switch. Is battery voltage present at the switch connector, 420H Yel wire **(2)**?



MXT001666 —UN—10OCT11

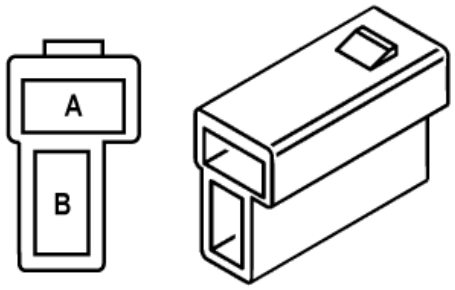
YES: Connect switch. Go to next step.

NO: Check 420J and 420H Yel wires, and connections

MX52301,0000105 -19-24OCT14-17/34

Front Optional Attachments Connector

Is battery voltage present at X7 front optional attachments connector, 420L Yel wire **(A)**?



MXT001682 —UN—12MAY17

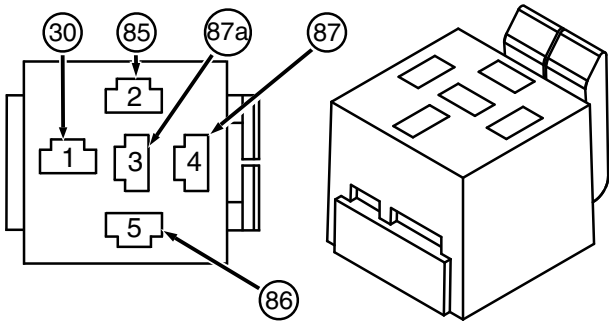
YES: Go to next step.

NO: Check 420J and 420L Yel wires, and connections.

MX52301,0000105 -19-24OCT14-18/34

Start Relay Connector

Remove relay. Is battery voltage present at terminal **[5 (86)]** of K1 start relay connector, 420D Yel wire?



MXT011889 —UN—09JUL14

YES: Install relay. Go to next step.

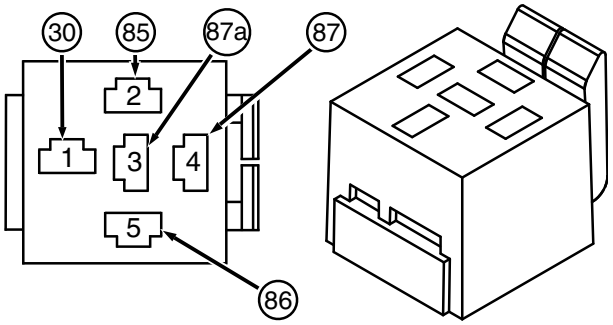
NO: Check 420D Yel wire.

Continued on next page

MX52301,0000105 -19-24OCT14-19/34

Fan Relay Connector

Remove relay. Is battery voltage present at terminal **[5 (86)]** of K2 fan relay connector, 420E Yel wire?



MXT011889 —UN—09JUL14

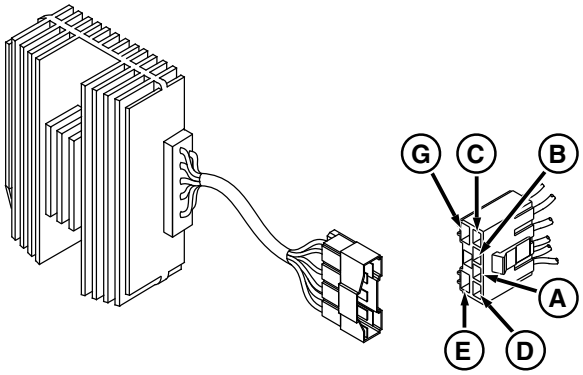
YES: Install relay. Go to next step.

NO: Check 420E Yel wire.

MX52301,0000105 -19-24OCT14-20/34

Regulator, Rectifier

Disconnect N1 voltage regulator, rectifier. Is battery voltage present at the X3 connector, 420C Yel wire **(D)**?



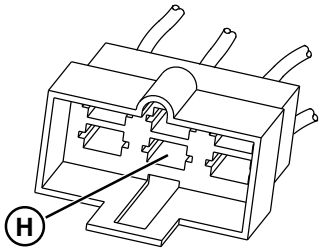
MXT011891 —UN—04JUN14
D—420C Yellow Wire

YES: Connect regulator, rectifier. Go to next step.

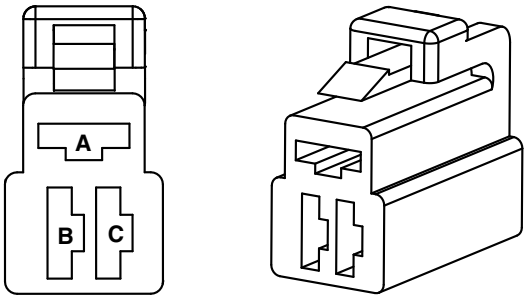
NO: Check 420C Yel wire.

Continued on next page

MX52301,0000105 -19-24OCT14-21/34

Engine Connector	Disconnect engine connector. Is battery voltage present at the X1 engine connector, 420B Yel wire **(H)**?  MXT011900 —UN—28MAY14 **H—420B Yellow Wire**	**YES:** Connect engine wiring harness. Go to next step. **NO:** Check 420B Yel wire

MX52301,0000105 -19-24OCT14-22/34

Fuel Pump Connector	Disconnect fuel pump connector. Is battery voltage present at the Y2 fuel pump connector, 420A Yel wire **(C)**?  MXT010230 —UN—20OCT14	**YES:** Connect fuel pump. Go to next step. **NO:** Check 420A Yel wire.

MX52301,0000105 -19-24OCT14-23/34

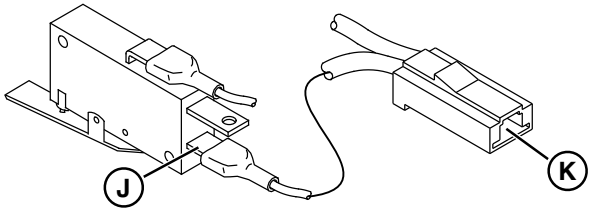
Park Brake Light	Is park brake light illuminated?	**YES:** Skip next step and continue tests. **NO:** Go to next step.

Continued on next page

MX52301,0000105 -19-24OCT14-24/34

Park Brake Switch

Is battery voltage present at S3 park brake switch, 420P Yel wire **(J)**?



MXT011902 —UN—28MAY14
J—420P Yellow Wire
K—420P Yellow Wire

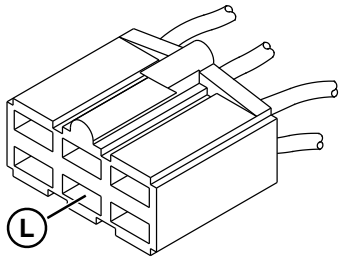
YES: Go to next step. Test park brake switch.

NO: Check 420P and 420F Yel **(K)** wires.

MX52301,0000105 -19-24OCT14-25/34

Front Lights Connector

Is battery voltage present at the X15 front lights connector, 420K Yel wire **(L)**?



MXT011903 —UN—28MAY14
L—420K Yellow Wire

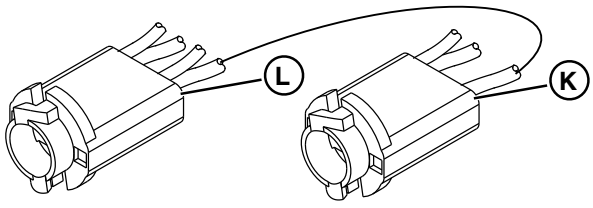
YES: Go to next step.

NO: Check 420K Yel wire.

MX52301,0000105 -19-24OCT14-26/34

Engine Coolant Temperature Light

Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire **(L)**? Is H3 engine oil pressure light illuminated?



MXT011904 —UN—02JUN14
L—419 Yellow Wire
K—419 Yellow Wire

YES: Go to next step

NO: Check 419 **(K)**and 420M **(L)** Yel wires.

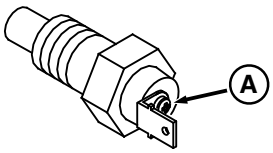
NO: Check 419 **(K)** and 420M **(L)** Yel wires. Test H3 engine oil pressure bulb

Continued on next page

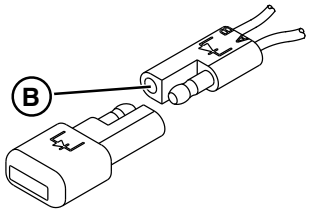
MX52301,0000105 -19-24OCT14-27/34

❶ Static Switched Circuit Wiring:

MX52301,0000105 -19-24OCT14-28/34

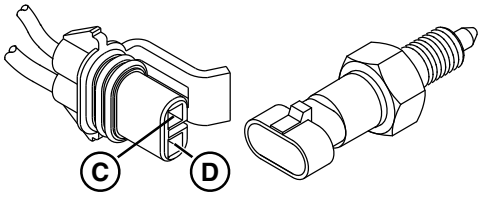
Engine Coolant Temperature Switch	**Test Procedure C** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is battery voltage present at B3 engine coolant temperature switch, Yel wire **(A)**?  MXT011905 —UN—16OCT17	**YES:** Go to next step. **NO:** Test H2 engine coolant temperature bulb. Check 300 Org wire and Yel engine wire and connections.

MX52301,0000105 -19-24OCT14-29/34

V1 Diode	Disconnect V1 diode. Is battery voltage present at V1 diode 301 Org wire **(B)**?  MXT011906 —UN—29MAY14 **B—301 Orange Wire**	**YES:** Install diode. Go to next step. **NO:** Test H2 engine coolant temperature bulb. Check 301 Org wire and connections.

Continued on next page

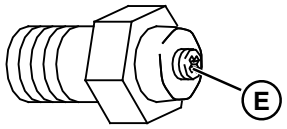
MX52301,0000105 -19-24OCT14-30/34

Neutral Start Switch Connector	Disconnect S2 neutral start switch connector. Is battery voltage present at the S2 neutral start switch, 705 Pur wire **(C)**?  MXT011907 —UN—04JUN14 **C—705 Purple Wire** **D—710 Purple Wire**	**YES:** Go to next step. **NO:** Test V1 diode. Check 302 Org and 705 Pur wires and connections.

MX52301,0000105 -19-24OCT14-31/34

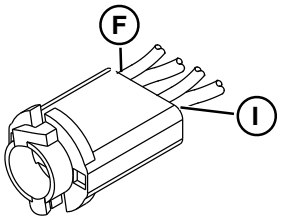
Neutral Start Switch Connector	Disconnect S2 neutral start switch connector. Is battery voltage present at the S2 neutral start switch, 710 Pur wire **(D)**?	**YES:** Connect switch. Go to next step. **NO:** Test K1 start relay. Check 710 Pur wire and connections.

MX52301,0000105 -19-24OCT14-32/34

Engine Oil Pressure Switch	Is continuity to ground present at B4 engine oil pressure switch, Blu/Red wire **(E)**?  MXT011909 —UN—28MAY14 **E—Blue/Red Wire**	**YES:** Go to next step. **NO:** Test B4 engine oil pressure switch. Check engine ground wire and connections.

Continued on next page

MX52301,0000105 -19-24OCT14-33/34

Engine Oil Pressure Light	Is continuity to ground present at B3 engine oil pressure light, 601 Tan wire **(F)**?  MXT011910—UN—10JUN14 **F—601 Tan Wire**	**YES:** Test complete. **NO:** Check 601 Tan and engine Blu/Red wires and connections. Test complete.

MX52301,0000105 -19-24OCT14-34/34

Power Circuit Operation, Gas (SN 040001-)

Function:

Provides unswitched and switched power to the primary components whenever the battery is connected and the key switch is in the run position.

Operating Conditions Unswitched Circuits:

- Battery fully charged and properly connected to the wiring harness.
- Ground circuit properly connected to the wiring harness.

Battery voltage must be present at the following components with the key switch “OFF”:

- Battery Positive Terminal
- Y1 Starting Motor Solenoid “B” Terminal 209 Red wire
- K1 Start Relay 216 Red wire
- K2 Fan Relay 217 Red wire
- N1 Voltage Regulator, Rectifier “E” terminal 205 Red
- X17 (SN -110000), C-10 (SN 110001-) Rear Optional Attachments Connector “A” terminal 204 Red wire
- X13 (SN -080000), C-13 (SN 080001-) Accessory Power Port Connector “A” terminal 207 Red wire
- S1 Key Switch “B” terminal 208 Red wire
- X14 (SN -110000), C-6 (SN 110001-) Front Optional Attachments Connector “A” terminal 203 Red wire
- C100-A 201A Red wire (SN 080001-)
- C100-C 218A Red wire (SN 080001-110000), 201C (SN 110001-)

Unswitched Circuit Operation:

The positive battery cable connects the battery to the Y1 starting motor solenoid. Power is also directly run from the battery positive terminal to two fuse blocks. These fuse blocks distribute power to all unswitched circuits, except for the Y1 starting motor solenoid. The individual fuses in the blocks protect the components and wiring from damage by preventing a high current circuit overload.

The battery cable and fuse block connections must be in good condition for proper electrical system operation.

The ground cable and connections are equally important. Proper operation depends on these cables and connections to carry the power necessary for operation.

Operating Conditions Switched Circuits:

- Unswitched circuits functioning properly.
- Key switch in the RUN position.

Battery voltage must be present at the following locations:

- Y2 Fuel Pump 420A Yel wire
- N1 Voltage Regulator 420C Yel wire
- K1 Start Relay 420D Yel wire
- K2 Fan Relay 420E Yel wire
- X15 (SN -110000), C-11 (SN 110001-)Front Lights Connector “E” terminal 420K Yel wire
- S3 Park Brake Switch 420P Yel wire
- S4 Light Switch 420G Yel wire
- S5 Cargo Box Control Switch (option) 420H Yel wire
- X7 (SN -110000), C-5 (SN 110001-) Front Optional Attachments Connector “A” terminal 420L Yel wire
- X8 (SN -080000), C-28 (SN 080001-) Mid-Optional Attachments Connector 420F Yel wire
- H2 Engine Coolant Temperature Light 419 Yel wire
- H3 Engine Oil Pressure Light 420M Yel wire
- X1 (SN -110000), C-14 (SN 110001-) Engine Connector “E” terminal 420B Yel wire:
  - R1 Carburetor Heater
  - Y3 Fuel Shutoff Solenoid
  - X6 Connector of A1 Ignitor Module
- K3 4WD Interlock Relay 420Q Yel wire
- K3 4WD Interlock Relay 420X (SN -080000) 421Q (SN 080001-) Yel wire
- C90 Power Port
- S30 Seat Belt Switch (SN 080001-) 420X Yel wire
- S6 4WD Switch (SN 120001-)

Switched Circuit Operation:

Power supplied by the battery, through a fuse block is supplied to the S1 key switch. When the key switch is in the ON position, power is routed to a central splice. This splice distributes power to the switched components through individual circuits and grounds.

Static Switched Circuits:

- Switched circuits functioning properly.

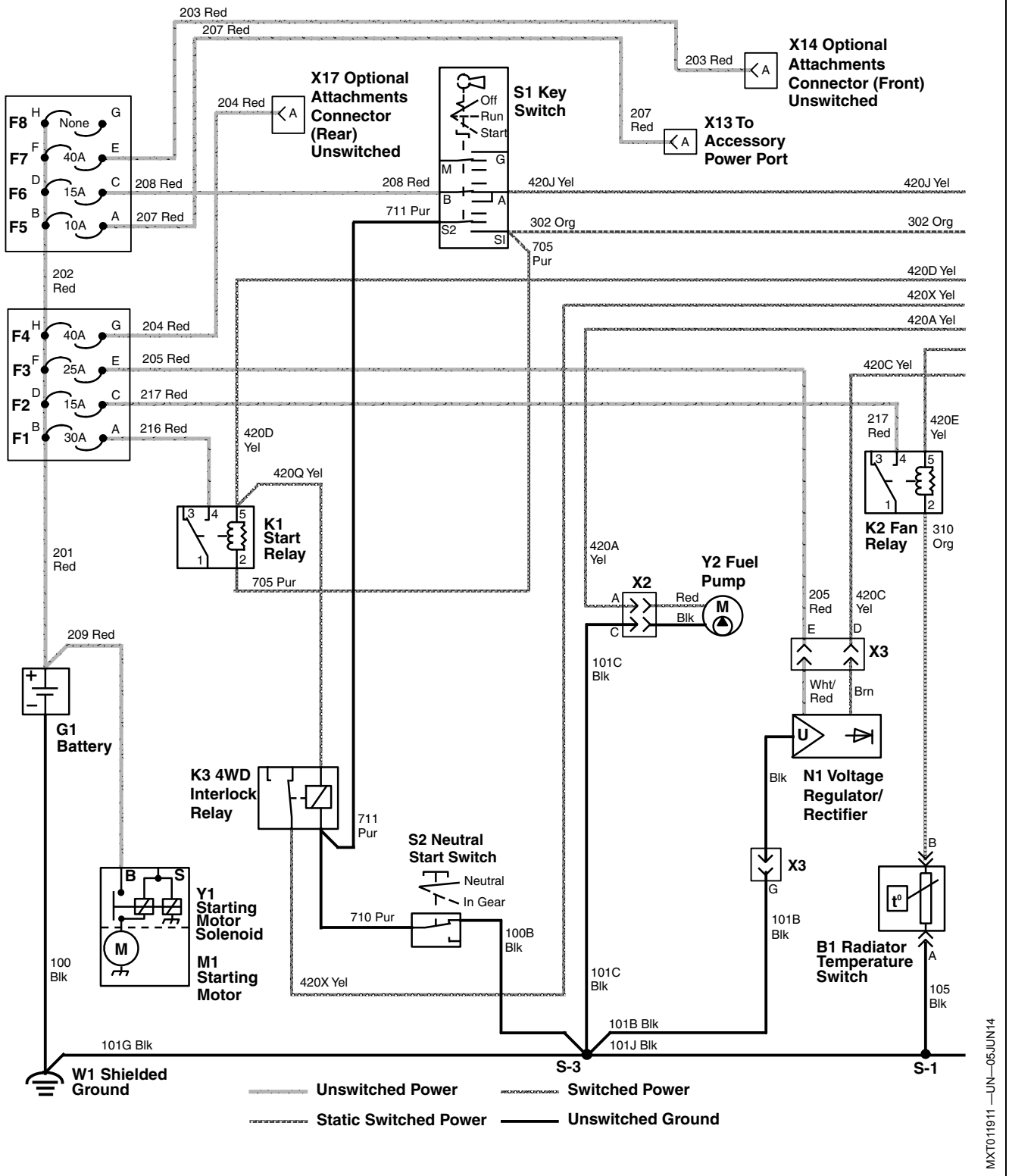
When the key switch is in the run position, battery voltage is sent to several components. These components are switched on the ground side to activate

Battery voltage must be present at the following locations:

- B1 Radiator Temperature Switch 310 Org wire
- B3 Engine Coolant Temperature Switch 300 Org wire
- V1 Light Check Diode 301 and 302 Org wires
- S1 Key Switch “S1” terminal 302 Org and 705 Pur wires
- B4 Engine Oil Pressure Switch 601 Tan wire when engine oil pressure is within operating range.
- K1 Start Relay 705 Pur wire
- P1 Hour Meter 602 Tan wire when engine oil pressure is within operating range.
- K31 Seat Belt Relay (SN 080001-) 960 Wht wire
- H32 Seat Belt Light (SN 080001-) 419H Yel Wire

MX52301,00003AC -19-24OCT14-1/1

Power Circuit Schematic, Gas (SN 040001-)



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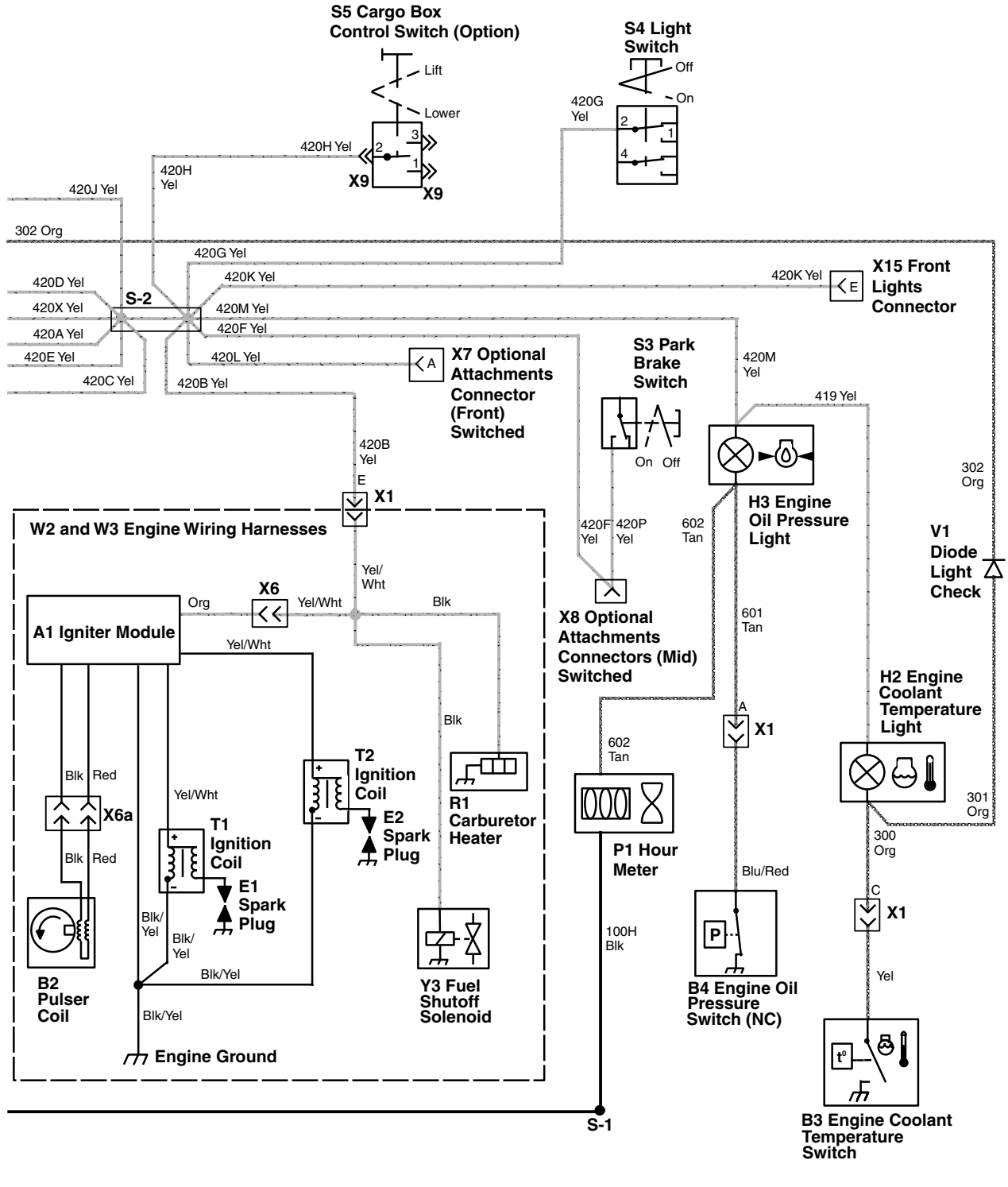
MX52301,0000108 -19-24OCT14-1/11

Power Circuit Schematic (Gas Engines) (SN 040001-080000) 2 of 2



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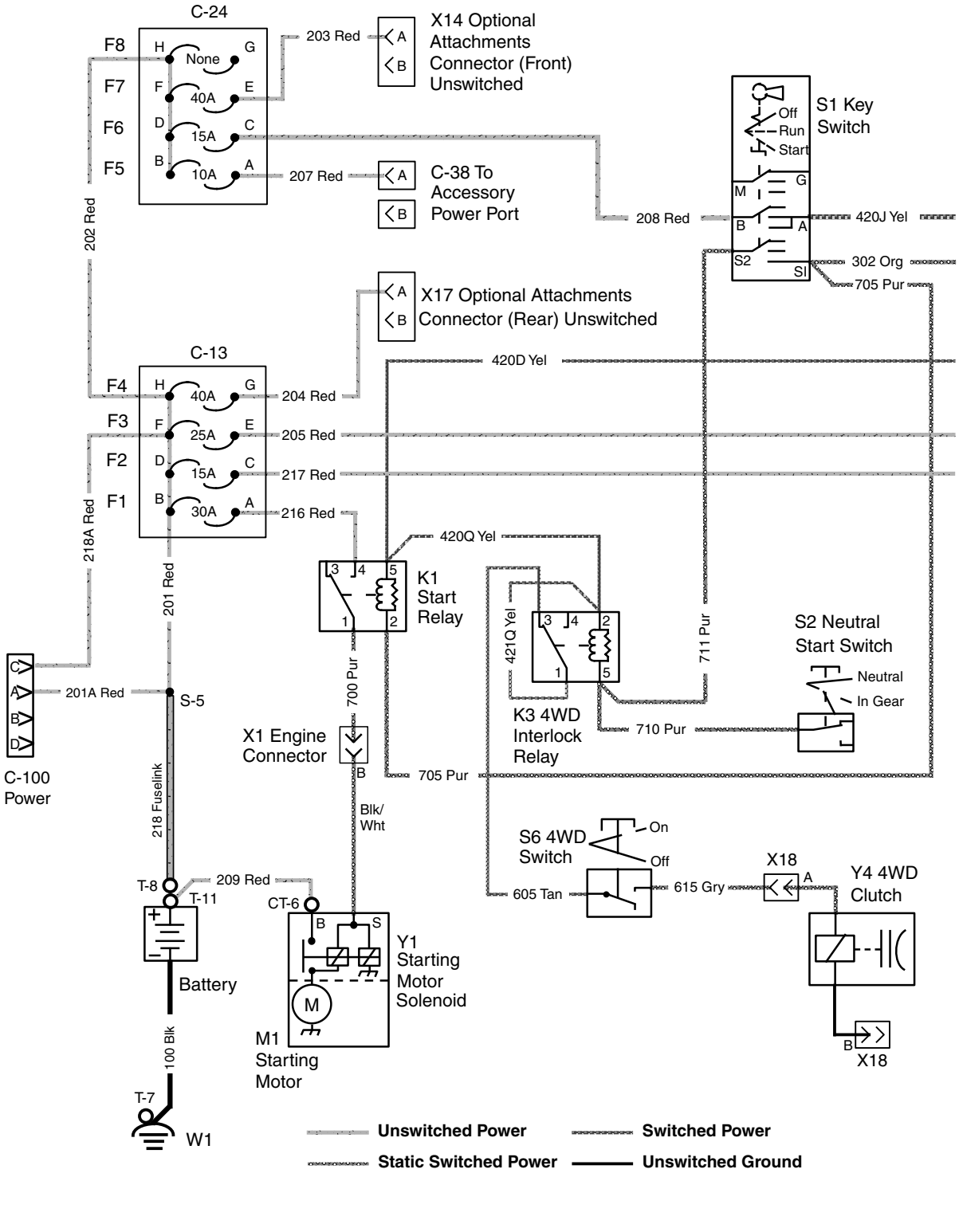
MX52301,0000108 -19-24OCT14-2/11

Power Circuit Schematic (Gas Engines) (SN 080001-110000) 1 of 3



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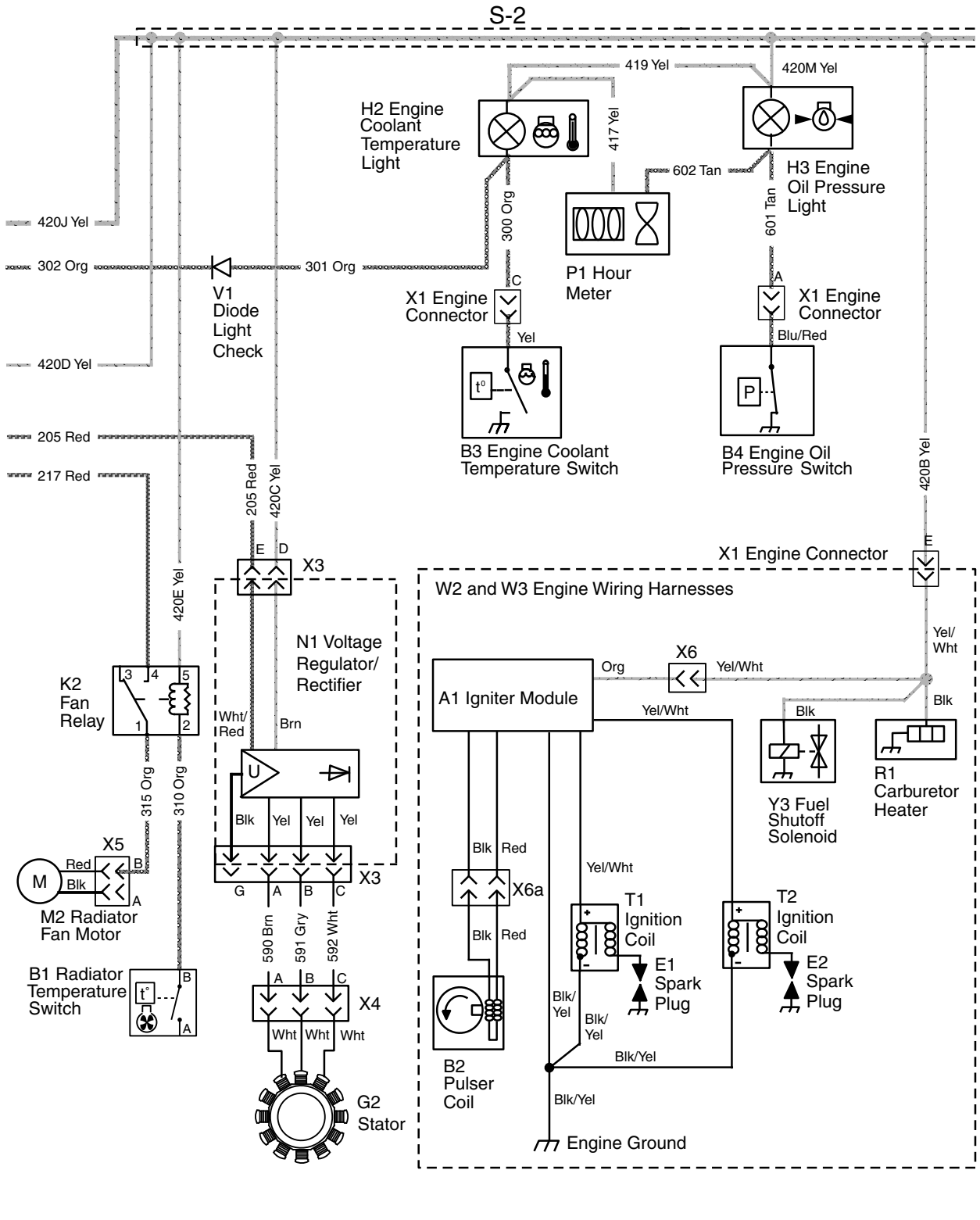
MX52301,0000108 -19-24OCT14-3/11

Power Circuit Schematic (Gas Engines) (SN 080001-110000) 2 of 3



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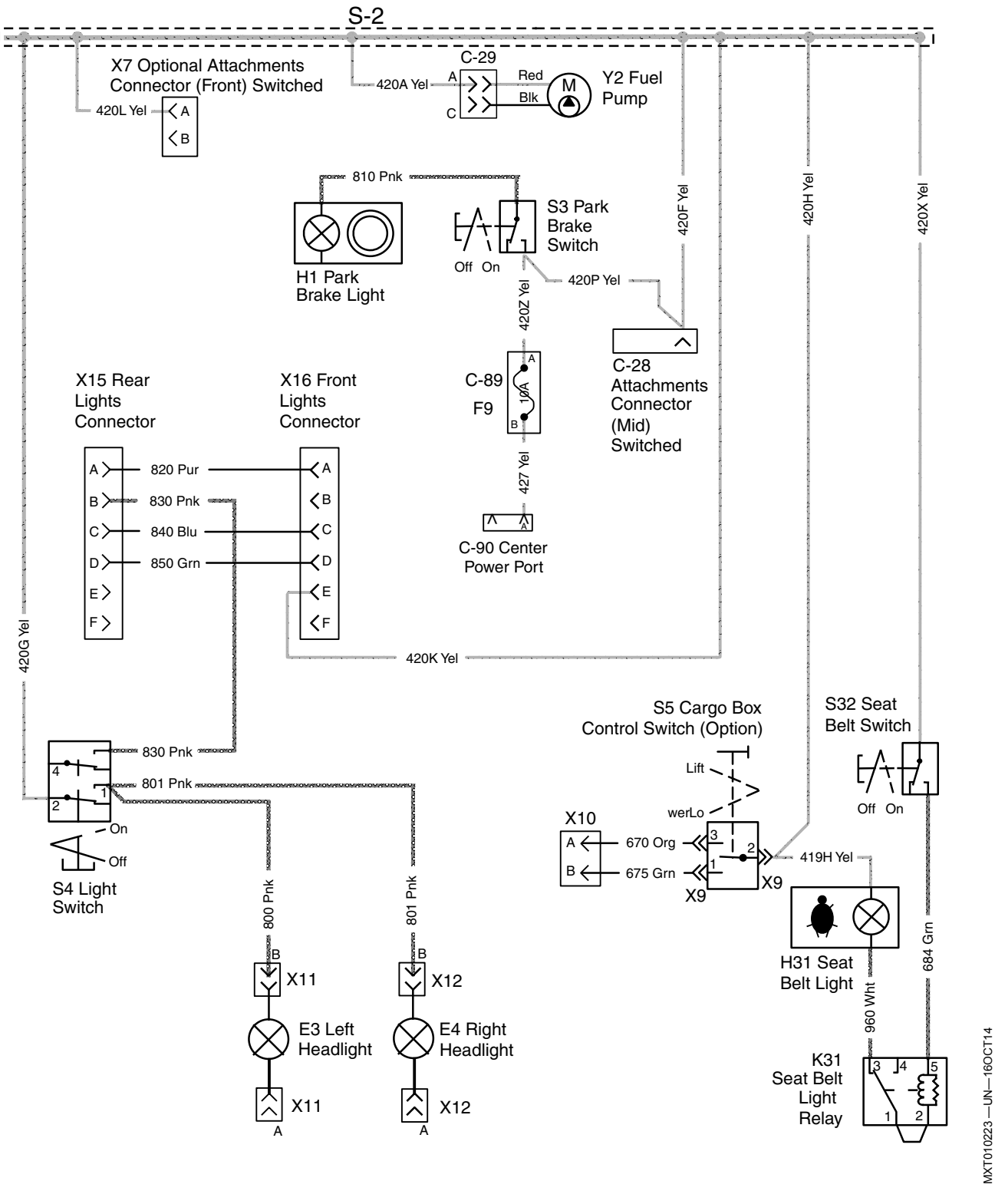
MX52301,0000108 -19-24OCT14-4/11

Power Circuit Schematic (Gas Engines) (SN 080001-110000) 3 of 3



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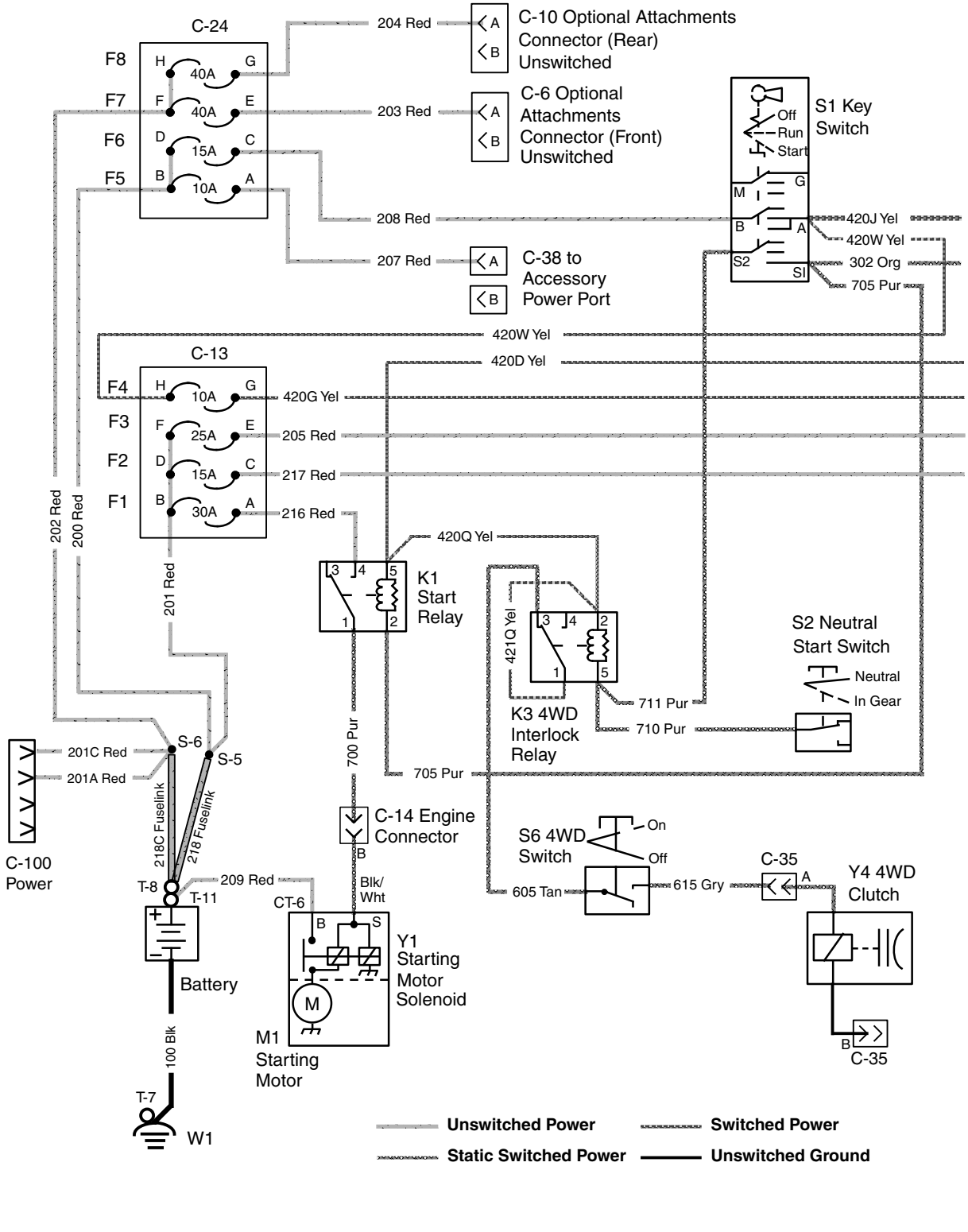
MX52301,0000108 -19-24OCT14-5/11

Power Circuit Schematic (Gas Engines) (SN 110001-120000) 1 of 3



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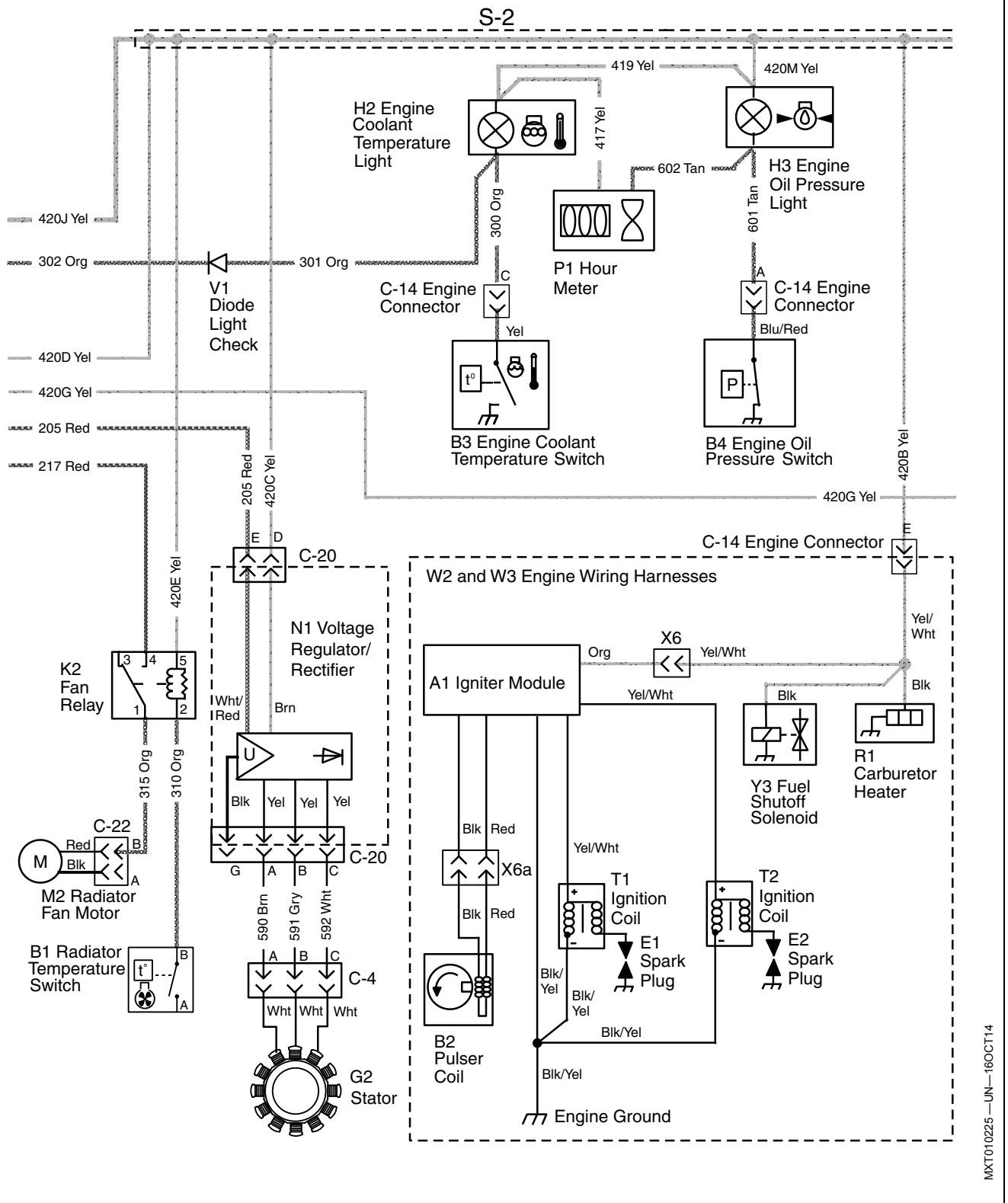
MX52301,0000108 -19-24OCT14-6/11

Power Circuit Schematic (Gas Engines) (SN 110001-120000) 2 of 3



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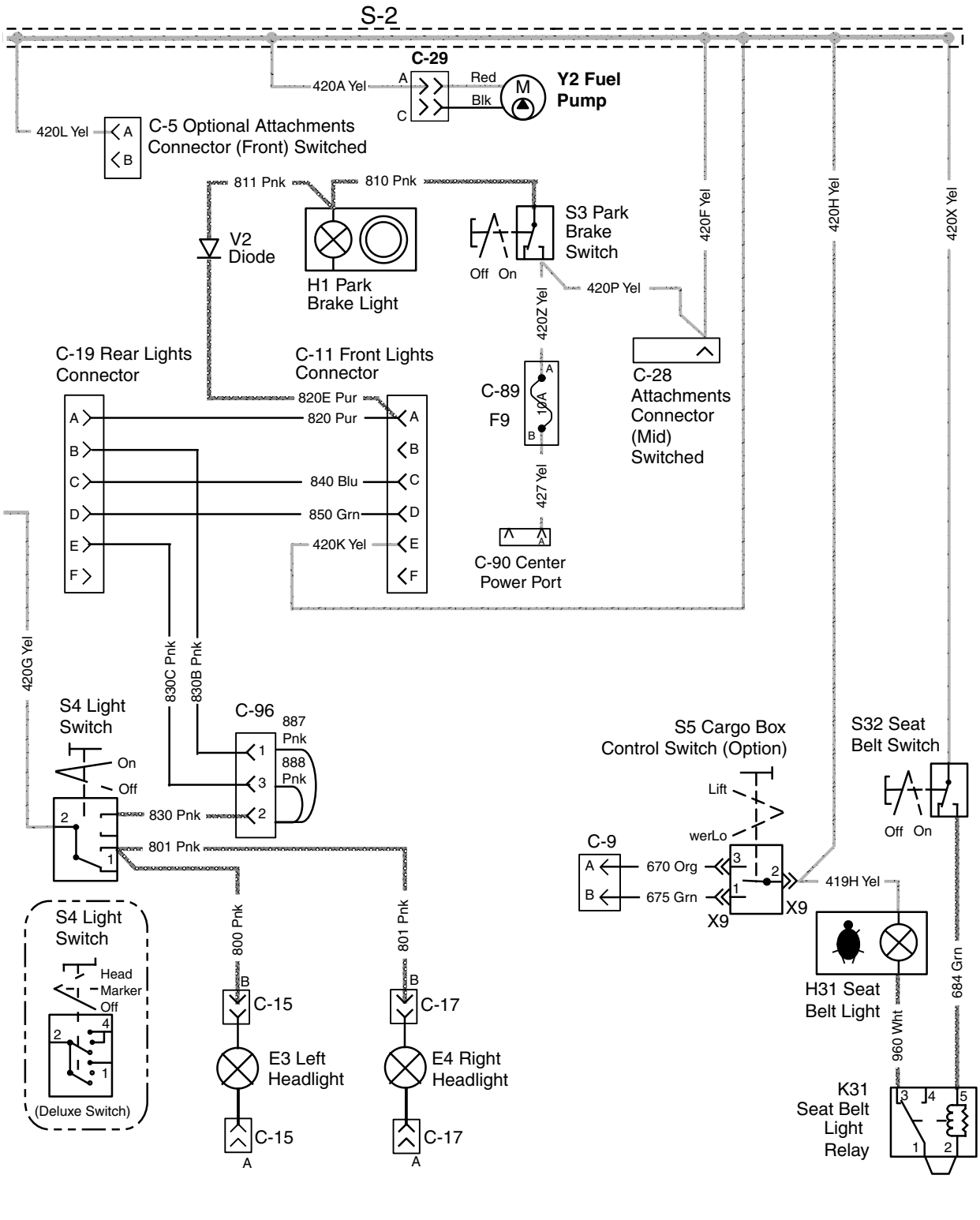
MX52301,0000108 -19-24OCT14-7/11

Power Circuit Schematic (Gas Engines) (SN 110001-120000) 3 of 3



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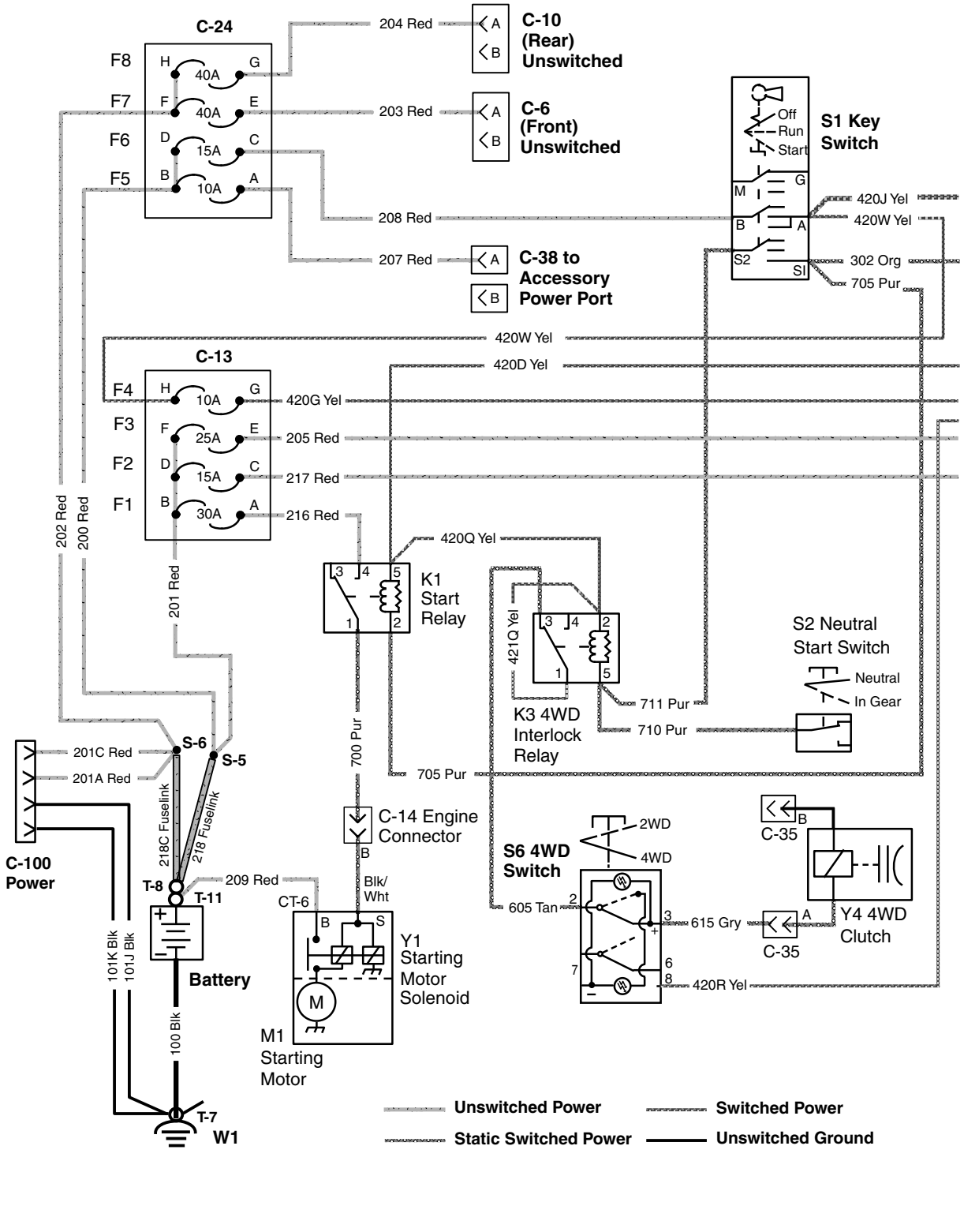
MX52301,0000108 -19-24OCT14-8/11

Power Circuit Schematic (Gas Engines) (SN 120001-) 1 of 3



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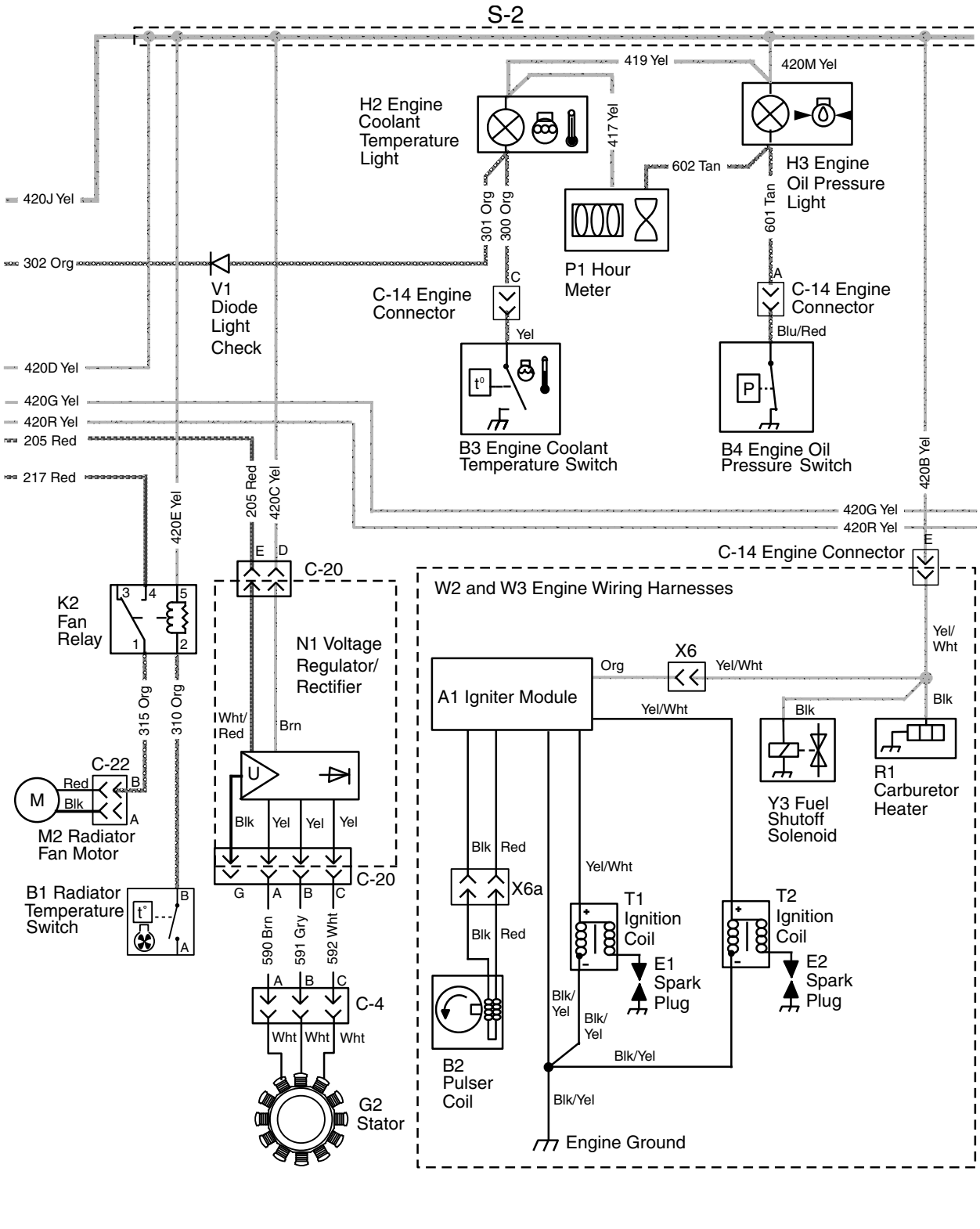
MX52301,0000108 -19-24OCT14-9/11

Power Circuit Schematic (Gas Engines) (SN 120001-) 2 of 3



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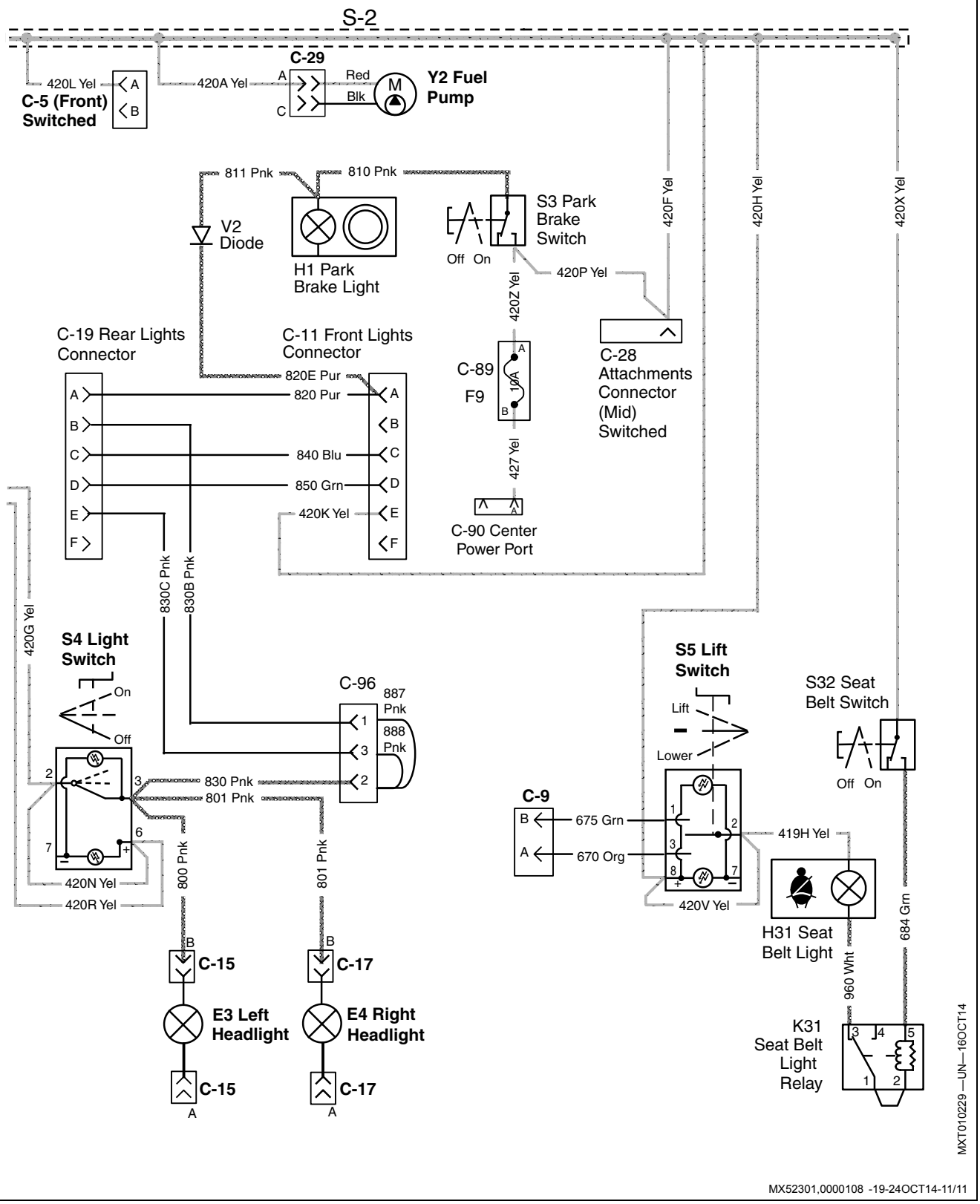
MX52301,0000108 -19-24OCT14-10/11

Power Circuit Schematic (Gas Engines) (SN 120001-) 3 of 3



MX52301,0000108 -19-24OCT14-11/11

Power Circuit Diagnosis, Gas (SN 040001-)

Power Circuit Diagnosis (Gas Engines SN 40001-)

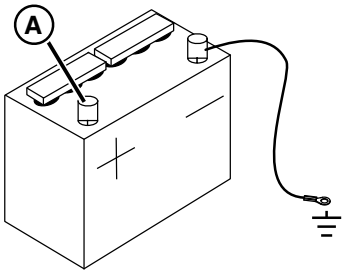
MX52301,0000109 -19-24OCT14-1/45

❶ Battery Circuit

Test Procedure A

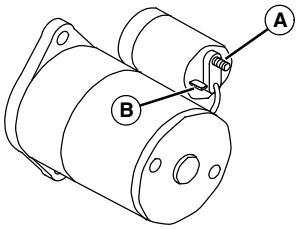
NOTE: Some switches and relays are tested more than once (Unswitched, Switched, and Static modes; Procedures A, B, and C).

MX52301,0000109 -19-24OCT14-2/45

Battery	Test Conditions: • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is 12.4 V or above present at the positive battery terminal **(A)**?  MXT011883 —UN—04JUN14	**YES:** Go to next step. **NO:** Test battery. See Battery Load Test.

Continued on next page

MX52301,0000109 -19-24OCT14-3/45

Starter Motor Solenoid	Is battery voltage present at the battery terminal of the starter solenoid **(A)**?  MXT011957 —UN—03JUL14	**YES:** Go to next step. **NO:** Check 209 Red cable and connections.

MX52301,0000109 -19-24OCT14-4/45

C100 (SN 080001-110000)	Is battery voltage present at wires 218A red, and 201A Red?	**YES:** Go to next step. **NO:** Check Fuselink 218. Check wire connections and continuity.

MX52301,0000109 -19-24OCT14-5/45

C100 (SN 110001-)	Is battery voltage present at wires 201A Red, and 201C Red?	**YES:** Go to next step. **NO:** Check Fuselink 218 and Fuselink 218C. Check wire connections and continuity.

MX52301,0000109 -19-24OCT14-6/45

❷ Unswitched Circuit Wiring:

MX52301,0000109 -19-24OCT14-7/45

Circuit Wiring (SN040001-110000)	Is battery voltage present at both sides of all fuses **(F1—F7)**?	**YES:** Yes: Go to next step. **NO:** Check 201 Red wire, 202 Red wire (behind fuse blocks). Check all fuses and Fuselinks.

MX52301,0000109 -19-24OCT14-8/45

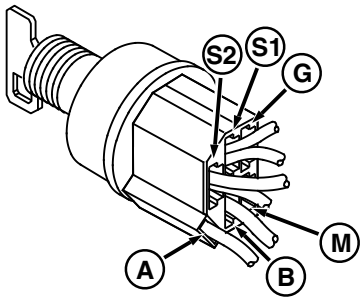
Circuit Wiring (SN110001-)	Is battery voltage present at both sides of all fuses **(F1—F3, F5—F8)**?	**YES:** Yes: Go to next step. **NO:** Check 200 Red, 201 Red wire, and 202 Red wires (behind fuse blocks). Check all fuses and Fuselinks.

Continued on next page

MX52301,0000109 -19-24OCT14-9/45

Key Switch Connector

Is battery voltage present at the 208 Red wire **(B)** of switch connector?



MXT004463 —UN—31MAY12

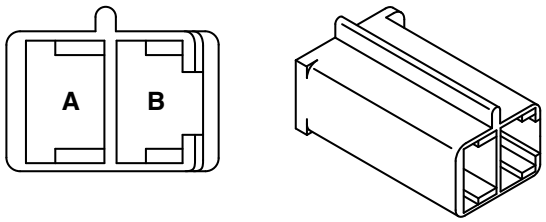
YES: Connect switch. Go to next step.

NO: Test F6 fuse. Test battery and positive (+) battery cable. Check wires and connections on 208 Red, 201 Red, 202 Red, and (SN 110001-) 200 Red.

MX52301,0000109 -19-24OCT14-10/45

Optional Attachment Connector Front (X14 (SN040001-110000), C-6 (SN110001-))

Is battery voltage present at front optional attachments connector, 203 Red wire **(B)**?



RXA0062502 —UN—05NOV02

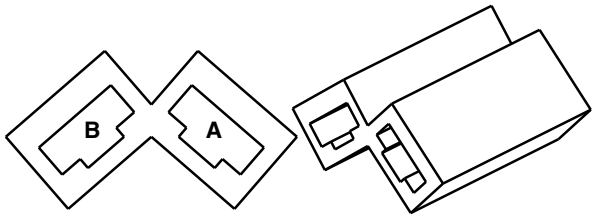
YES: Go to next step

NO: Check 203 Red wire.

MX52301,0000109 -19-24OCT14-11/45

Accessory Power Port (Connector X13 (SN040001-110000), C-38 (SN110001-))

Is battery voltage present at accessory outlet, 207 Red wire **(A)**?



MXT011853 —UN—20OCT14

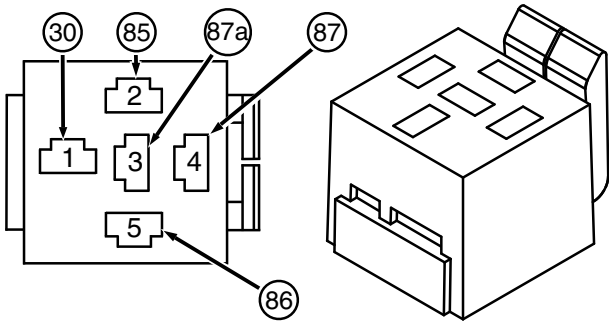
A—207 Red Wire
B—100C Blk Wire

YES: Go to next step.

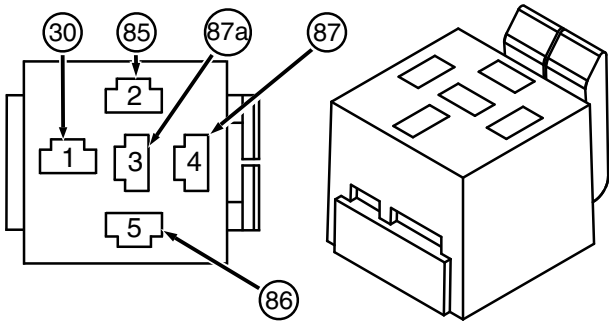
NO: Check 207 Red wire.

Continued on next page

MX52301,0000109 -19-24OCT14-12/45

Start Relay Connector	Remove K1 start relay. Is battery voltage present at terminal **[4 (87)]** of relay connector, 216 Red wire?  MXT011889 —UN—09JUL14	**YES:** Install relay Go to next step. **NO:** Check 216 Red wire.

MX52301,0000109 -19-24OCT14-13/45

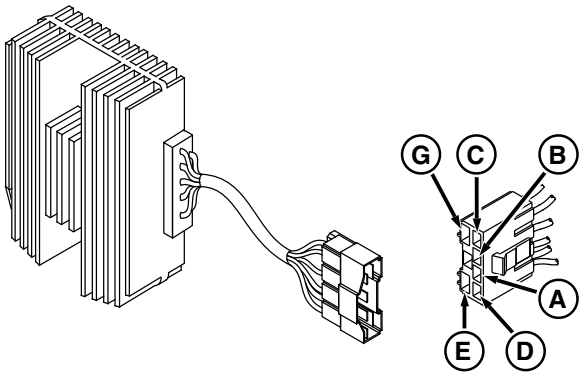
Fan Relay Connector	Remove K2 fan relay. Is battery voltage present at terminal **[4 (87)]** of relay connector, 217 Red wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Go to next step. **NO:** Check 217 Red wire.

Continued on next page

MX52301,0000109 -19-24OCT14-14/45

Regulator, Rectifier (Connector X3 (SN040001-110000), C-20 (SN110001-))

Disconnect N1 voltage regulator, rectifier. Is battery voltage present at connector, 205 Red wire **(E)**?



MXT011891 —UN—04JUN14

A—590 Brn wire
B—591 Gry Wire
C—592 Wht Wire
D—420C Yel Wire
E—205 Red Wire
F—Not Used
G—101B Blk Wire

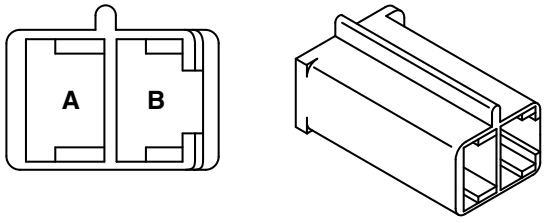
YES: Connect regulator, rectifier. Go to next step.

NO: Check 205 Red wire.

MX52301,0000109 -19-24OCT14-15/45

Optional Attachments Connector Rear (X17 (SN040001-110000), C-10 (SN110001-))

Is battery voltage present at X17 rear optional attachments connector, 204 Red wire **(B)**?



RXA0062502 —UN—05NOV02

YES: Tests complete or go to switched power circuit tests.

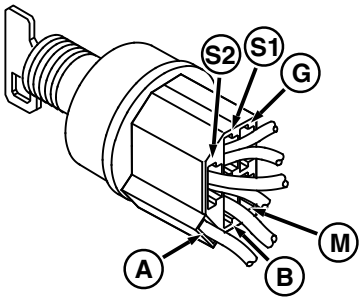
NO: Check 204 Red wire.

MX52301,0000109 -19-24OCT14-16/45

❶ Switched Circuit Wiring

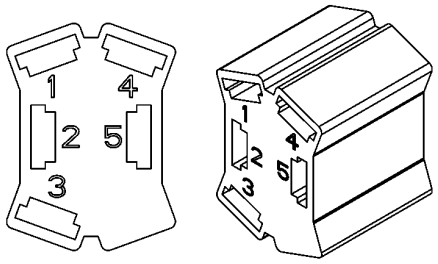
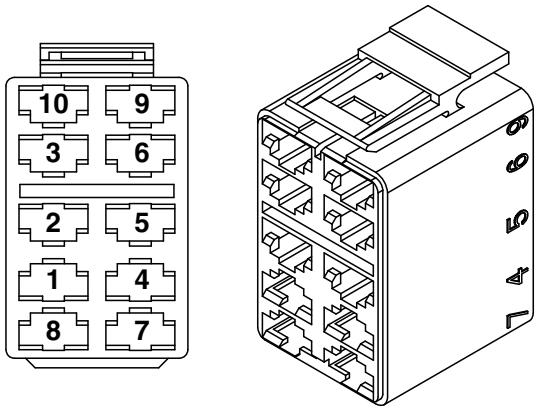
Continued on next page

MX52301,0000109 -19-24OCT14-17/45

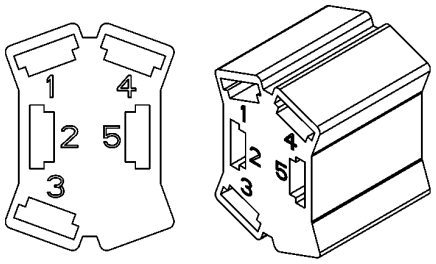
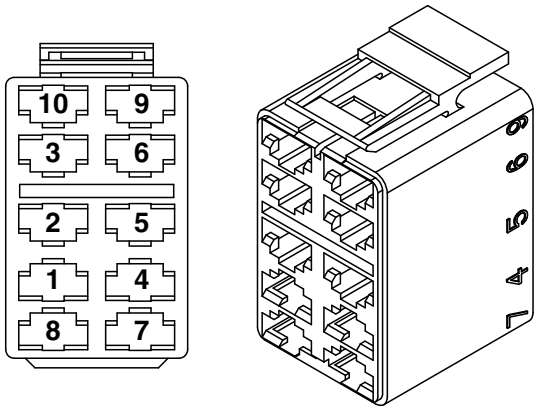
Key Switch	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the run position, engine not running. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is battery voltage present at the 420J Yel wire **(A)** of switch connector?  MXT004463 —UN—31MAY12	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test.

Continued on next page

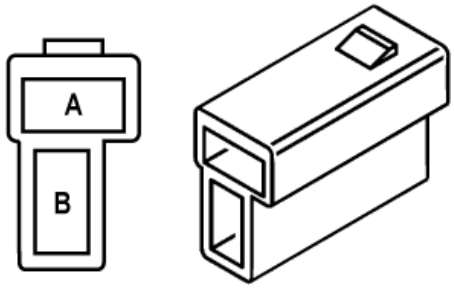
MX52301,0000109 -19-24OCT14-18/45

Light Switch	Disconnect S4 light switch. Is battery voltage present at the switch connector, 420G Yel wire **(2)**?  MXT001666 —UN—10OCT11 *Connector (SN -120000)*  TCT007682 —UN—19JUL13 *Connector (SN 120001-)*	**YES:** Connect switch. Go to next step. **NO:** Check 420G Yel wire and connections. (SN 120001-) Also Check Fuse F4 and 420W Yel wire.

Continued on next page

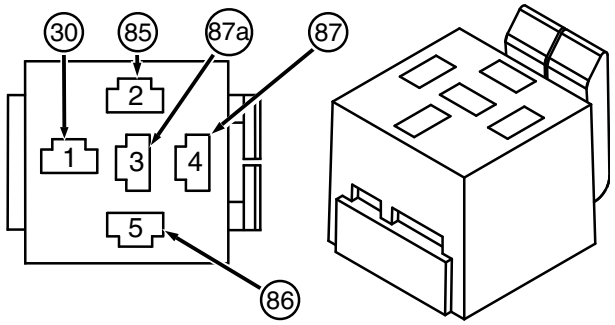
Cargo Box Lift Switch	Disconnect S5 cargo box lift switch. Is battery voltage present at the switch connector, 420H Yel wire **(2) (SN -120000), (8) (SN 120001-)**?  MXT001666 —UN—10OCT11 *Connector (SN -120000)*  TCT007682 —UN—19JUL13 *Connector (SN 120001-)*	**YES:** Connect switch. Go to next step. **NO:** Check 420H Yel wire, and connections

MX52301,0000109 -19-24OCT14-20/45

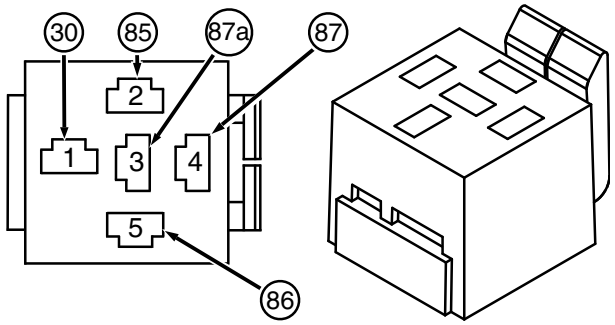
Switched Optional Attachment Connector Front (X7 (SN040001-110000), C-5 (SN110001-))	Is battery voltage present at front optional attachments connector, 420L Yel wire **(A)**?  MXT001682 —UN—12MAY17	**YES:** Go to next step. **NO:** Check 420L Yel wire, and connections.

Continued on next page

MX52301,0000109 -19-24OCT14-21/45

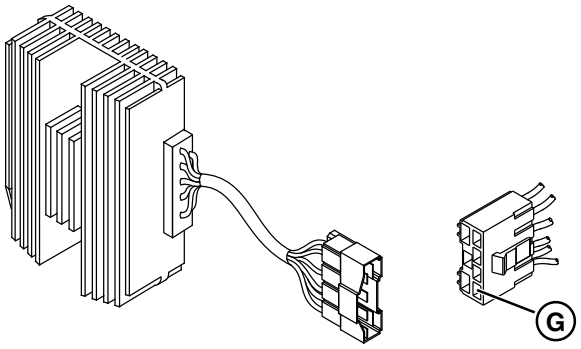
Start Relay Connector	Remove relay. Is battery voltage present at terminal **[5 (86)]** of K1 start relay connector, 420D Yel wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Go to next step. **NO:** Check 420D Yel wire.

MX52301,0000109 -19-24OCT14-22/45

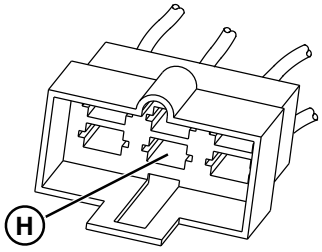
Fan Relay Connector	Remove relay. Is battery voltage present at terminal **[5 (86)]** of K2 fan relay connector, 420E Yel wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Go to next step. **NO:** Check 420E Yel wire.

Continued on next page

MX52301,0000109 -19-24OCT14-23/45

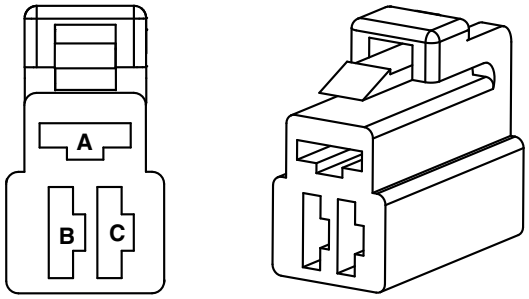
Regulator, Rectifier (Connector X3 (SN040001-110000), C-20 (SN110001-))	Disconnect N1 voltage regulator, rectifier. Is battery voltage present at the connector, 420C Yel wire **(G)**?  MXT011899 —UN—28MAY14 **G—420C Yellow Wire**	**YES:** Connect regulator, rectifier. Go to next step. **NO:** Check 420C Yel wire.

MX52301,0000109 -19-24OCT14-24/45

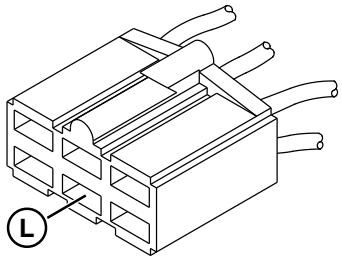
Engine Connector (X1 (SN040001-110000), C-14 (SN110001-))	Disconnect engine connector. Is battery voltage present at the engine connector, 420B Yel wire **(H)**?  MXT011900 —UN—28MAY14 **H—420B Yellow Wire**	**YES:** Connect engine wiring harness. Go to next step. **NO:** Check 420B Yel wire

Continued on next page

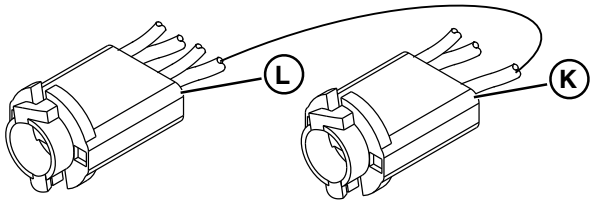
MX52301,0000109 -19-24OCT14-25/45

Fuel Pump Connector (X2 (SN040001-080000), C-29 (SN080001-))	Disconnect fuel pump connector. Is battery voltage present at the Y2 fuel pump connector, 420A Yel wire **(C)**?  MXT010230 —UN—20OCT14 **A—420A Yel Wire** **B—Not Used** **C—101C Blk Wire**	**YES:** Connect fuel pump. Go to next step. **NO:** Check 420A Yel wire.

MX52301,0000109 -19-24OCT14-26/45

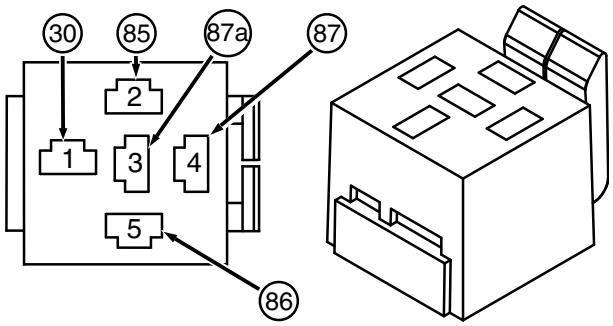
Front Lights Connector (X15 (SN080001-110000), C-11 (SN110001-))	Is battery voltage present at the front lights connector, 420K Yel wire **(L)**?  MXT011903 —UN—28MAY14 **L—420K Yellow Wire**	**YES:** Go to next step. **NO:** Check 420K Yel wire.

MX52301,0000109 -19-24OCT14-27/45

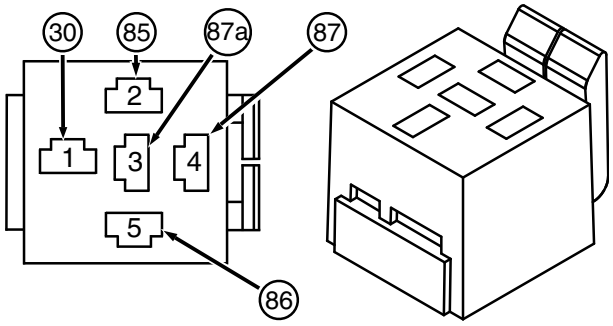
Engine Coolant Temperature Light	Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire **(L)**? Is H3 engine oil pressure light illuminated?  MXT011904 —UN—02JUN14 **L—419 Yellow Wire** **K—419 Yellow Wire**	**YES:** Go to next step **NO:** Check 419 **(K)** and 420M **(L)** Yel wires. Test H3 engine oil pressure bulb

Continued on next page

MX52301,0000109 -19-24OCT14-28/45

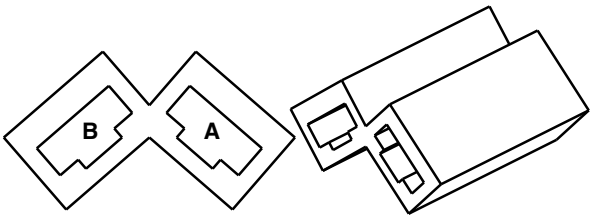
4WD interlock Relay Connector	Remove relay. Is battery voltage present at terminal **[2 (85)]** of K3 4WD interlock relay connector, 420Q Yel wire?  MXT011889 —UN—09JUL14	**YES:** Go to next step. **NO:** Check 420Q and 420D Yel wires.

MX52301,0000109 -19-24OCT14-29/45

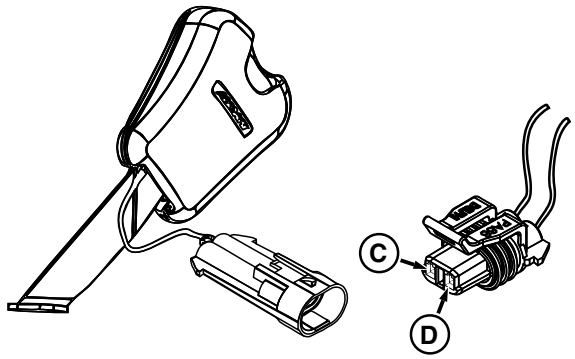
4WD Interlock Relay Connector	Is battery voltage present at terminal **[1 (30)]** of K3 4WD interlock relay connector, 420X (SN -080000), 421Q (SN 080001-) Yel wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Test complete. **NO:** Check 420X (SN -080000), 421Q (SN 080001-) Yel wire.

Continued on next page

MX52301,0000109 -19-24OCT14-30/45

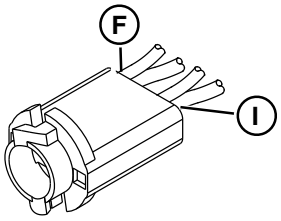
Center Power Port (SN 080001–)	Is battery voltage present at C90 center accessory outlet, 427Z Yel wire **(A)**?  MXT011853 —UN—20OCT14 **A—427 Yel Wire** **B—101Z Blk Wire**	**YES:** Go to next step. **NO:** Check F9 fuse, 427, 420Z, 420P, and 420F Yel wires and connections.

MX52301,0000109 -19-24OCT14-31/45

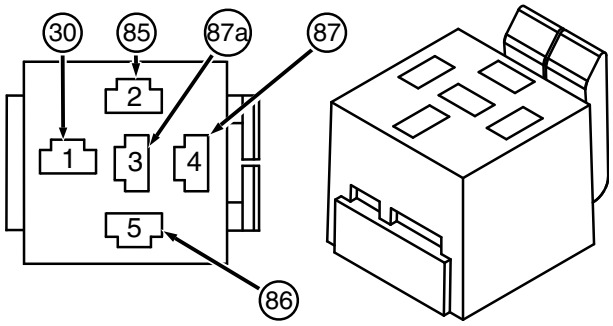
Seat Belt Switch (SN 080001-)	Disconnect C-30 connector to seat belt light switch. Is battery voltage present at 420X  MXT010231 —UN—22OCT14 **C—420X Yel** **D—684 Grn**	**YES:** Go to next step. **NO:** Check 420X wire and connections.

Continued on next page

MX52301,0000109 -19-24OCT14-32/45

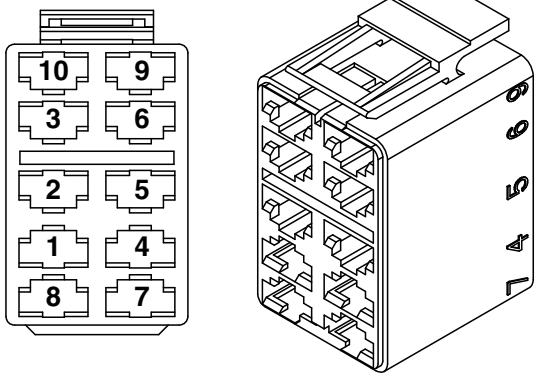
Seat Belt Light (SN 080001-)	Disconnect C-32 connector to the seat belt light. Is battery voltage present at 419H Yel wire **(A)** of main wire harness?  MXT011910 —UN—10JUN14 **F—419H Yel wire**	**YES:** Go to next step. **NO:** Check 419H Yel, 420H Yel, and (SN 120001-) 420V Yel wires and connections.

MX52301,0000109 -19-24OCT14-33/45

Seat Belt Light Relay (SN 080001-)	Remove relay. Is battery voltage present at terminal **[3 (87a)]** of K31 seat belt relay connector, 960 Wht wire?  MXT011889 —UN—09JUL14	**YES:** Go to next step. **NO:** Check 960 Wht wire and connections. **NO:** Check seat belt light bulb. See Bulb Test. **NO:** Test relay. See Relay Test.

Continued on next page

MX52301,0000109 -19-24OCT14-34/45

4WD Switch (SN 120001-)	Disconnect S6 4WD switch connector. Is battery voltage present at terminal 8 of S6 4WD switch connector, 420R Yel wire?  TCT007682 —UN—19JUL13 **1, 4—7, 9, 10—Not Used** **2— 605 tan Wire** **3— 615 Gry Wire** **8— 420R Yel Wire**	**YES:** Go to next step. **NO:** Check 420R wire and connections **NO:** Check wires 420G and 420N at S4 light switch terminals 2 and 6. Check fuse F4.

MX52301,0000109 -19-24OCT14-35/45

❶ Static Switched Circuit Wiring

Continued on next page

MX52301,0000109 -19-24OCT14-36/45

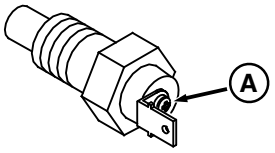
Engine Coolant Temperature Switch

Test Procedure C

Test Conditions:

- Park Brake Engaged
- Machine parked safely. See the “Safety Section”.
- Key switch in the run position.
- Cargo box raised and locked.
- Battery fully charged.
- Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground.
- Voltmeter positive (Red) placed on designated test point.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wires and connections for looseness and corrosion.

Is battery voltage present at B3 engine coolant temperature switch, engine harness Yel wire **(A)**?



MXT011905 —UN—16OCT17
A—Yellow Wire

YES: Go to next step.

NO: Test H2 engine coolant temperature bulb. Check 300 Org wire and Yel engine wire and connections.

MX52301,0000109 -19-24OCT14-37/45

Park Brake Light

Is Park Brake Light on?

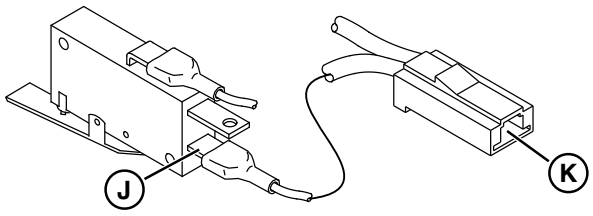
YES: Go to V2 Diode Connector (SN 110001-) OR Start Relay Connector (SN -110001) test.

NO: Check park break light bulb. See Bulb Test.

MX52301,0000109 -19-24OCT14-38/45

Park Brake Switch

Is battery voltage present at S3 park brake switch, 420P Yel wire **(J and K)**?



MXT011902 —UN—28MAY14
J—420P Yel Wire
K—420P and 420F Yel Wires

YES: Check park break switch. See Park Brake Switch Test.

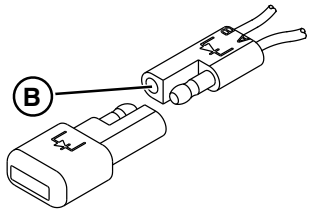
NO: Check wires 420P **(J)**and 420F Yel **(K)**.

Continued on next page

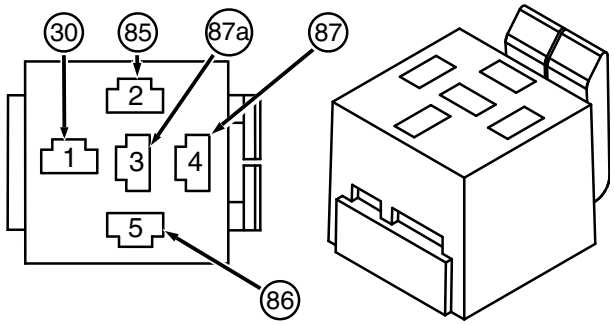
MX52301,0000109 -19-24OCT14-39/45

V2 Diode Connector (SN 110001-)	Is voltage present at C-11 front lights connector wire 820E Pur?	**YES:** Go to Start Relay Connector **NO:** Check 820E Pur wire and connections. Go to next step

MX52301,0000109 -19-24OCT14-40/45

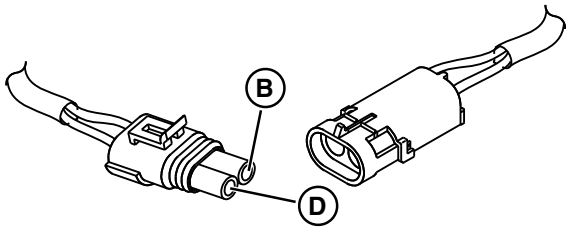
V2 Diode (SN 110001-)	Disconnect V2 diode. Is battery voltage present at V2 diode 811 Pnk wire **(B)**?  MXT011906 —UN—29MAY14 **B—811 Pnk Wire**	**YES:** Test Diode. See Diode Test. Install diode. Go to next step. **NO:** Check 811 Pnk wire and connections. Install diode. Go to next step.

MX52301,0000109 -19-24OCT14-41/45

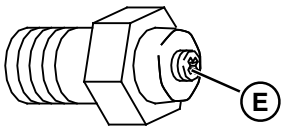
Start Relay Connector	Remove relay. Is battery voltage present at terminal **[5 (86)]** of K1 start relay connector, 705 Pur wire?  MXT011889 —UN—09JUL14	**YES:** Go to next step. **NO:** Test V1 diode. See Diode Test. Check 301 Org, 302 Org, and 705 Pur wires and connections.

Continued on next page

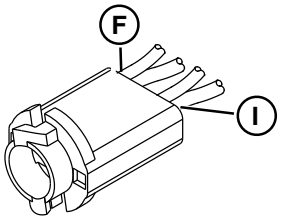
MX52301,0000109 -19-24OCT14-42/45

Radiator Temperature Switch Connector	Disconnect B1 radiator temperature switch connector. Is battery voltage present at the main wire harness, 310 Org wire **(D)**?  MXT011916 —UN—17JUN14 **D—310 Orange Wire**	**YES:** Connect switch. Go to next step. **NO:** Test K2 fan relay. Check 310 Orange wire and connections.

MX52301,0000109 -19-24OCT14-43/45

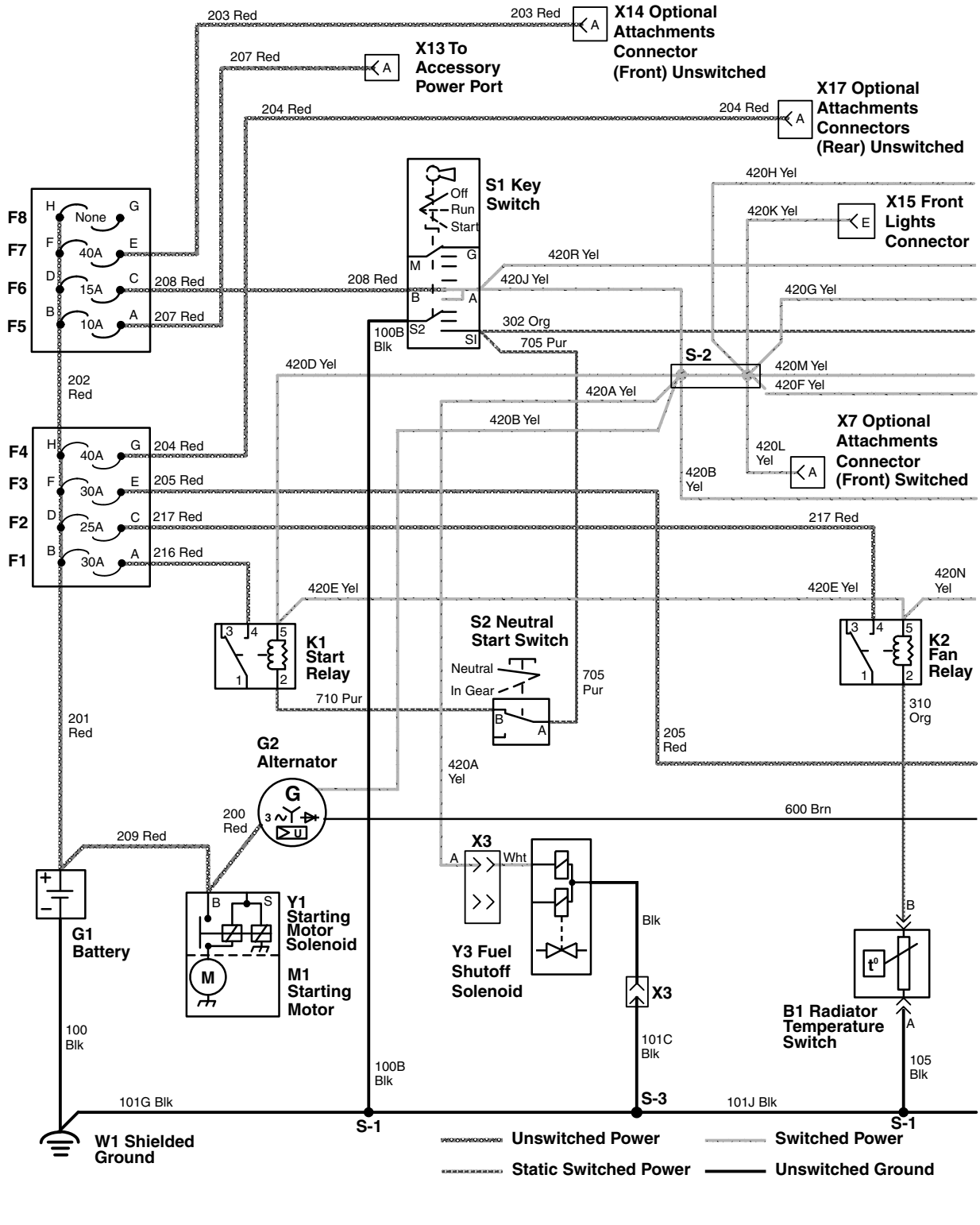
Engine Oil Pressure Switch	Is continuity to ground present at B4 engine oil pressure switch, Blu/Red wire **(E)**?  MXT011909 —UN—28MAY14 **E—Blue/Red Wire**	**YES:** Go to next step. **NO:** Test B4 engine oil pressure switch. Check engine ground wire and connections.

MX52301,0000109 -19-24OCT14-44/45

Engine Oil Pressure Light	Is continuity to ground present at H3 engine oil pressure light, 601 Tan wire **(F)**?  MXT011910 —UN—10JUN14 **F—601 Tan Wire**	**YES:** Test complete **NO:** Check 601 Tan and engine Blu/Red wires and connections. Test complete.

MX52301,0000109 -19-24OCT14-45/45

Power Circuit Schematic, Diesel (SN -040000)



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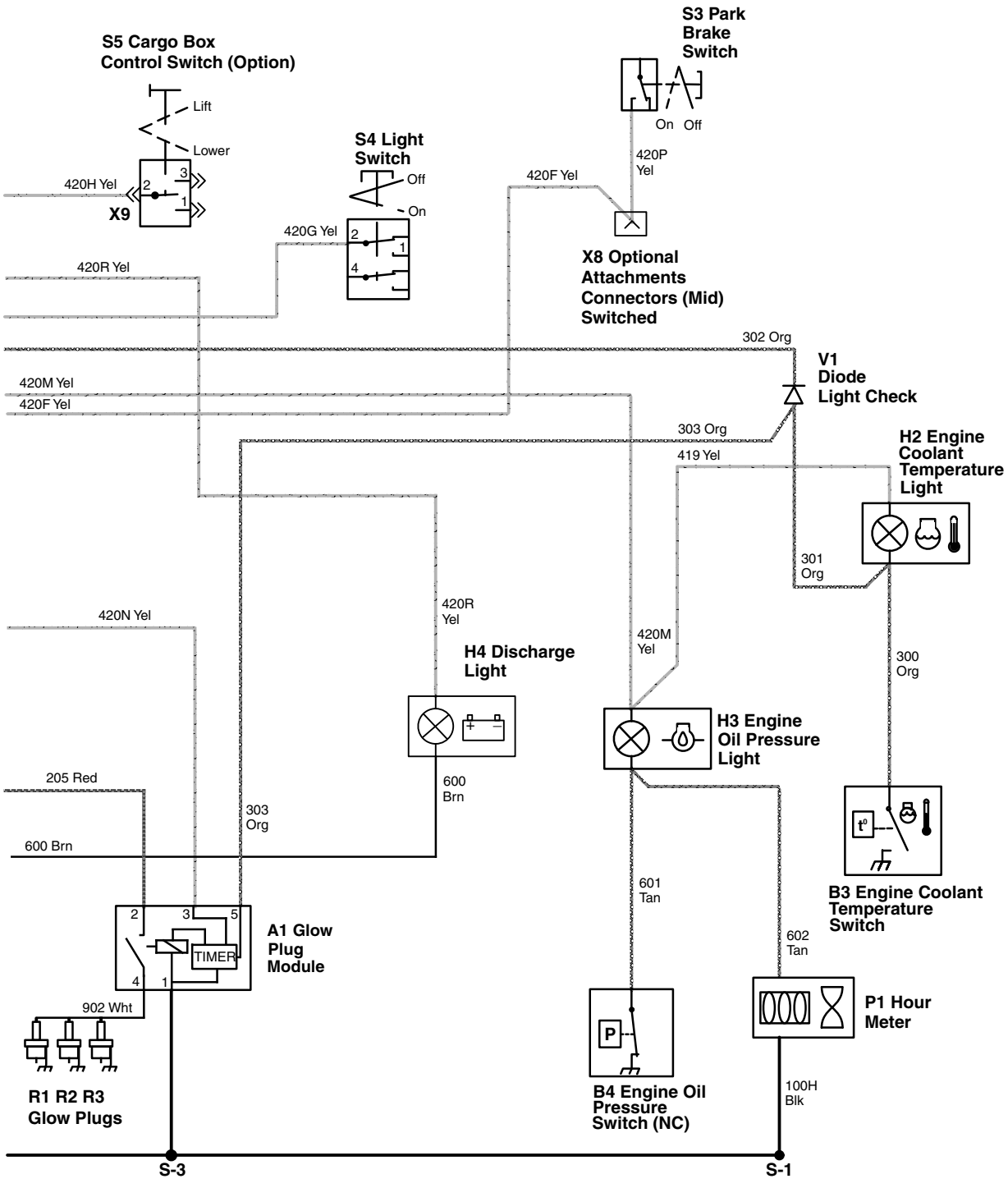
MX52301,000010B -19-24OCT14-1/2

**Power Circuit Schematic (Diesel Engine)
(SN -40000) 2 of 2**



MX52301,000010B -19-24OCT14-2/2

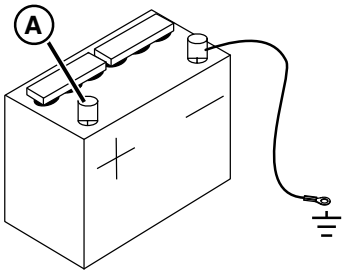
Power Circuit Diagnosis, Diesel (SN -040000)

Power Circuit Diagnosis (Diesel Engines SN -40000)

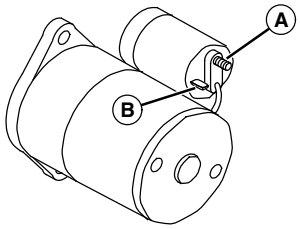
MX52301,000010C -19-24OCT14-1/35

❶ Battery Circuit

MX52301,000010C -19-24OCT14-2/35

Battery	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is 12.4 V or above present at battery positive terminal (A)?  MXT011883 —UN—04JUN14	**YES:** Go to next step. **NO:** Test battery. See Battery Load Test.

MX52301,000010C -19-24OCT14-3/35

Starter Motor Solenoid	Is battery voltage present at battery terminal of starter solenoid (A)?  MXT011957 —UN—03JUL14	**YES:** Go to next step. **NO:** Check 209 Red cable and connections.

Continued on next page

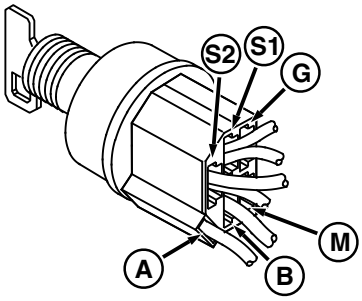
MX52301,000010C -19-24OCT14-4/35

❷ Unswitched Circuit Wiring:

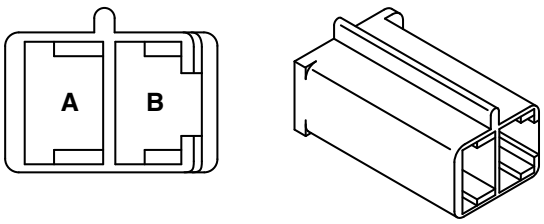
MX52301,000010C -19-24OCT14-5/35

Circuit Wiring	Is battery voltage present at both sides of all fuses (F1—F7)?	**YES:** Yes: Go to next step. **NO:** Check 201 Red wire, 202 Red wire (behind fuse blocks), and all fuses.

MX52301,000010C -19-24OCT14-6/35

Switch Connector	Is battery voltage present at the switch connector, 208 Red wire (B)?  MXT004463 —UN—31MAY12	**YES:** Connect switch. Go to next step. **NO:** Test F6 fuse. Test battery and positive (+) battery cable. Check 201 and 202 Red wires and connections. Check 208 Red wire and connections.

MX52301,000010C -19-24OCT14-7/35

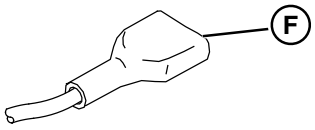
Optional Attachment Connector	Is battery voltage present at X14 front optional attachments connector, 203 Red wire (B)?  RXA0062502 —UN—05NOV02	**YES:** Go to next step **NO:** Check 203 Red wire.

Continued on next page

MX52301,000010C -19-24OCT14-8/35

Accessory Power Port

Is battery voltage present at X13 accessory outlet, 207 Red wire (F)?



MXT011888 —UN—28MAY14
F—207 Red Wire

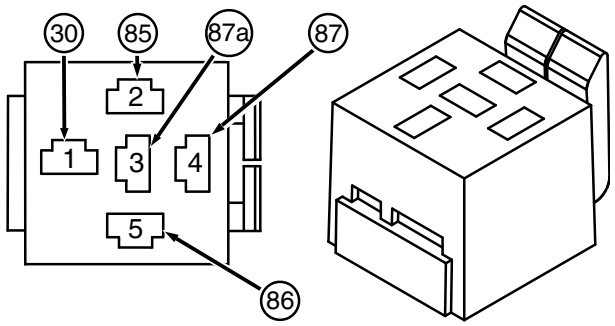
YES: Go to next step.

NO: Check 207 Red wire.

MX52301,000010C -19-24OCT14-9/35

Start Relay Connector

Remove K1 start relay. Is battery voltage present at terminal 4 (87) of relay connector, 216 Red wire?



MXT011889 —UN—09JUL14

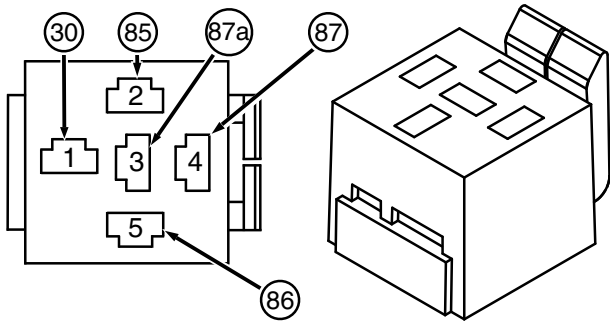
YES: Install relay Go to next step.

NO: Check 216 Red wire.

MX52301,000010C -19-24OCT14-10/35

Fan Relay Connector

Remove K2 fan relay. Is battery voltage present at terminal 4 (87) of relay connector, 217 Red wire?



MXT011889 —UN—09JUL14

YES: Install relay. Go to next step.

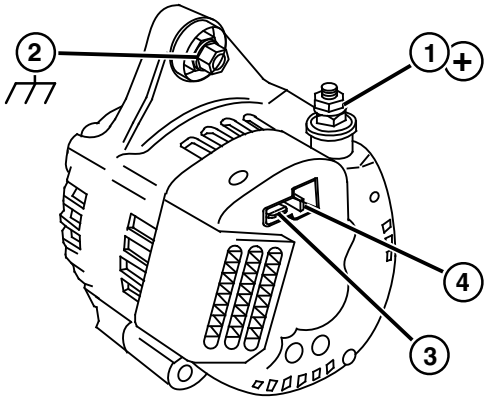
NO: Check 217 Red wire.

Continued on next page

MX52301,000010C -19-24OCT14-11/35

Alternator

Is battery voltage present at battery terminal of alternator, 200 Red wire (1)?



MXT011919 —UN—04JUN14

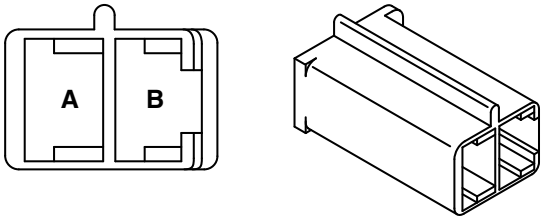
YES: Go to next step.

NO: Check 200 Red wire.

MX52301,000010C -19-24OCT14-12/35

Rear Optional Attachments Connector

Is battery voltage present at X17 rear optional attachments connector, 204 Red wire (B)?



RXA0062502 —UN—05NOV02

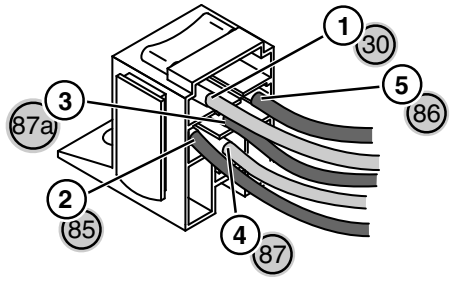
YES: Go to next step.

NO: Check 204 Red wire.

MX52301,000010C -19-24OCT14-13/35

Glow Plug Module

Is battery voltage present at 205 Red wire (2) of A1 glow plug module?



MXT011570 —UN—09JUL14

YES: Tests complete or go to switched power circuit tests.

NO: Check 205 Red wire and connections

Continued on next page

MX52301,000010C -19-24OCT14-14/35

❶ Switched Circuit

MX52301,000010C -19-24OCT14-15/35

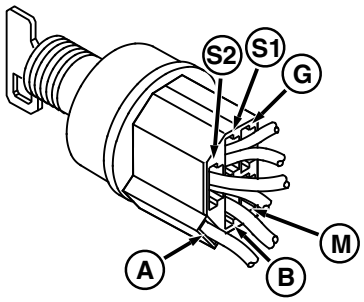
Key Switch

Test Procedure B

Test Conditions:

- Unswitched power circuits OK.
- Machine parked safely. See the “Safety Section”.
- Park brake locked
- Key switch in the run position with engine not running.
- Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground.
- Voltmeter positive (Red) placed on designated test point.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wires and connections for looseness and corrosion.

Is battery voltage present at the S1 key switch, 420J Yel wire (A)?



MXT004463 —UN—31MAY12

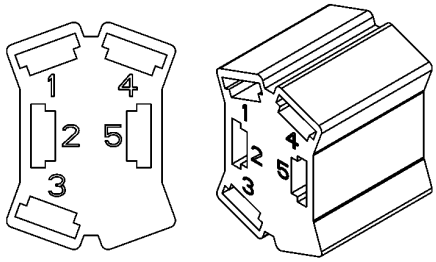
YES: Go to next step.

NO: Test key switch. See Key Switch Test.

MX52301,000010C -19-24OCT14-16/35

Light Switch

Disconnect S4 light switch. Is battery voltage present at switch connector, 420G Yel wire (2)?



MXT001666 —UN—10OCT11

YES: Connect switch. Go to next step.

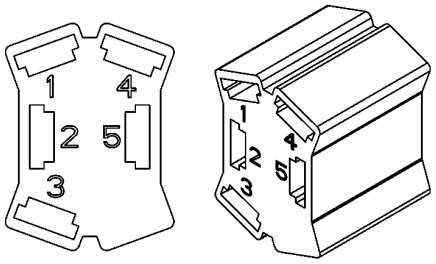
NO: Check 420J and 420G Yel wires, and connections.

Continued on next page

MX52301,000010C -19-24OCT14-17/35

Cargo Box Lift Switch

Disconnect S5 cargo box lift switch. Is battery voltage present at pin 2 of switch connector, 420H Yel wire (2)?



MXT001666 —UN—10OCT11

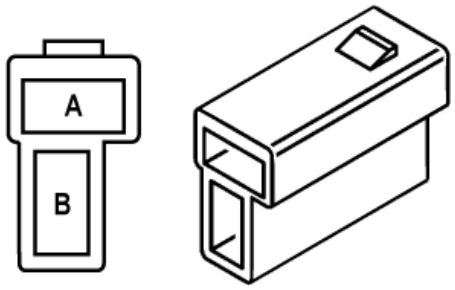
YES: Connect switch. Go to next step.

NO: Check 420J and 420H Yel wires, and connections

MX52301,000010C -19-24OCT14-18/35

Front Optional Attachments Connector

Is battery voltage present at X7 front optional attachments connector, 420L Yel wire (A)?



MXT001682 —UN—12MAY17

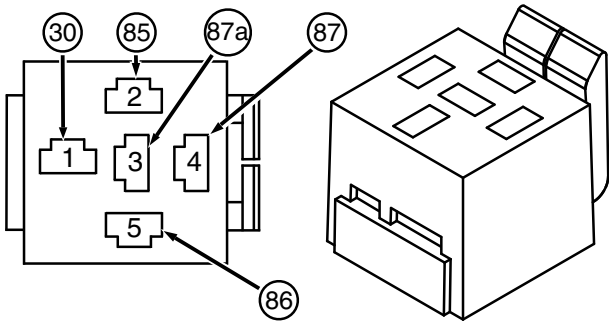
YES: Go to next step.

NO: Check 420J and 420L Yel wires, and connections.

MX52301,000010C -19-24OCT14-19/35

Start Relay Connector

Remove relay. Is battery voltage present at terminal 5 (86) of K1 start relay connector, 420D Yel wire?



MXT011889 —UN—09JUL14

YES: Install relay. Go to next step.

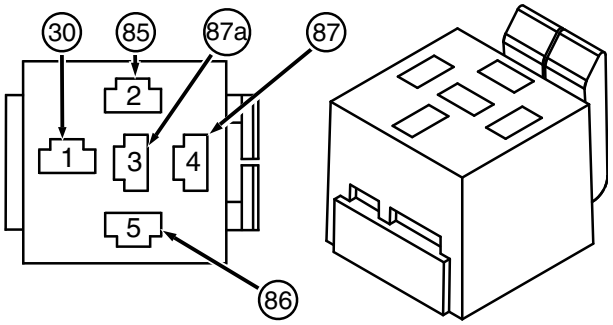
NO: Check 420D Yel wire.

Continued on next page

MX52301,000010C -19-24OCT14-20/35

Fan Relay Connector

Remove relay. Is battery voltage present at terminal 5 (86) of K2 fan relay connector, 420E Yel wire?



MXT011889 —UN—09JUL14

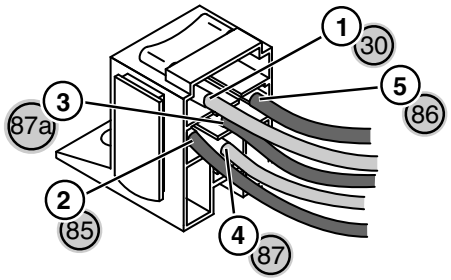
YES: Install relay. Go to next step.

NO: Check 420E Yel wire.

MX52301,000010C -19-24OCT14-21/35

Glow Plug Module

Is battery voltage present at 420N Yel wire (3) of A1 glow plug module?



MXT011570 —UN—09JUL14

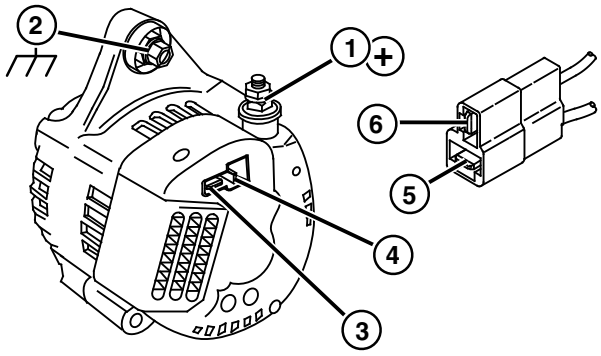
YES: Go to next procedure.

NO: Check 420N Yel wire and connections.

MX52301,000010C -19-24OCT14-22/35

Alternator Connector

Disconnect alternator connector. Is battery voltage present at 420B Yel wire (5)?



MXT011922 —UN—04JUN14
5— 420 Yellow Wire

YES: Connect alternator connector. Go to next step.

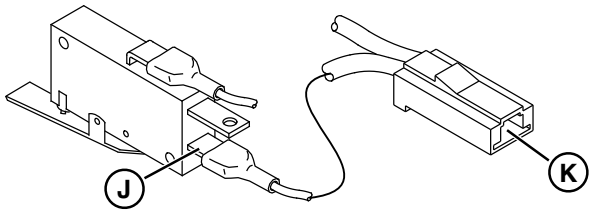
NO: Check 420B Yel wire.

Continued on next page

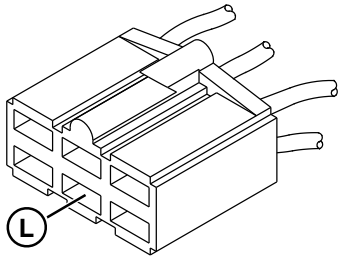
MX52301,000010C -19-24OCT14-23/35

Park Brake Light	Is park brake light illuminated?	**YES:** See Park Brake Circuit Diagnosis, Gas (All), Diesel (SN -080000). **NO:** Go to next step.

MX52301,000010C -19-24OCT14-24/35

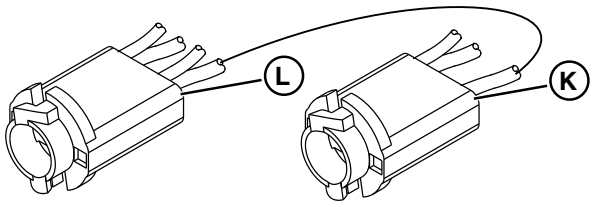
Park Brake Switch	Is battery voltage present at S3 park brake switch, 420P Yel wire (J)?  MXT011902 —UN—28MAY14 **J—420P Yellow Wire** **K—420P Yellow Wire**	**YES:** Go to next step. Test park brake switch. **NO:** Check 420P and 420F Yel (K) wires.

MX52301,000010C -19-24OCT14-25/35

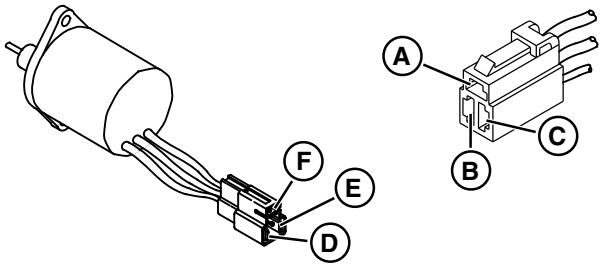
Front Lights Connector	Is battery voltage present at the X15 front lights connector, 420K Yel wire (L)?  MXT011903 —UN—28MAY14 **L—420K Yellow Wire**	**YES:** Go to next step. **NO:** Check 420K Yel wire.

Continued on next page

MX52301,000010C -19-24OCT14-26/35

Engine Coolant Temperature Light	Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire (L)? Is H3 engine oil pressure light illuminated?  MXT011904 —UN—02JUN14 **L—419 Yellow Wire** **K—419 Yellow Wire**	**YES:** Go to next step **NO:** Check 419 (K)and 420M (L) Yel wires. **NO:** Check 419 (K) and 420M (L) Yel wires. Test H3 engine oil pressure bulb

MX52301,000010C -19-24OCT14-27/35

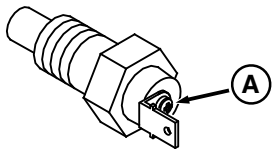
Fuel Shutoff Solenoid	Is battery voltage present at X3 connector, 420A Yel wire (D) of Y3 fuel shutoff solenoid?  MXT011926 —UN—21OCT14 **D—420A Yellow Wire**	**YES:** Tests complete or go to static switched power tests. **NO:** Check 420A Yel wire and connections.

MX52301,000010C -19-24OCT14-28/35

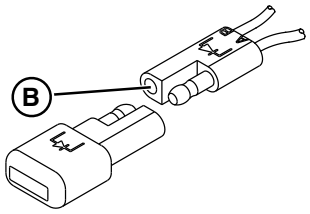
❶ Static Switched Circuit Wiring

Continued on next page

MX52301,000010C -19-24OCT14-29/35

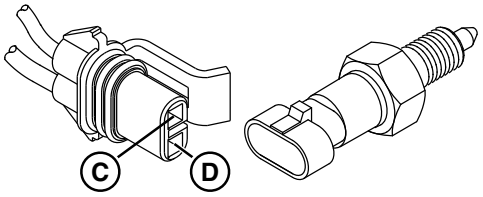
Engine Coolant Temperature Switch	**Test Procedure C** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is battery voltage present at B3 engine coolant temperature switch, Yel wire (A)?  MXT011905 —UN—16OCT17 **A—Yellow Wire**	**YES:** Go to next step. **NO:** Test H2 engine coolant temperature bulb. Check 300 Org wire and Yel engine wire and connections.

MX52301,000010C -19-24OCT14-30/35

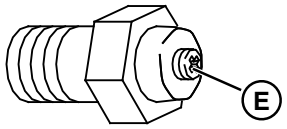
V1 Diode	Disconnect V1 diode. Is battery voltage present at V1 diode 301 Org wire (B)?  MXT011906 —UN—29MAY14 **B—301 Orange Wire**	**YES:** Install diode. Go to next step. **NO:** Test H2 engine coolant temperature bulb. Check 301 Org wire and connections.

Continued on next page

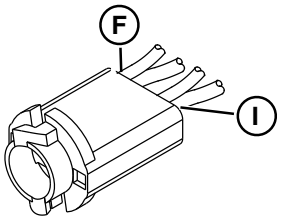
MX52301,000010C -19-24OCT14-31/35

Neutral Start Switch Connector	Disconnect S2 neutral start switch connector. Is battery voltage present at S2 neutral start switch, 705 Pur wire (C)?  MXT011907 —UN—04JUN14 **C—705 Purple Wire** **D—710 Purple Wire**	**YES:** Go to next step. **NO:** Test V1 diode. Check 302 Org and 705 Pur wires and connections. MX52301,000010C -19-24OCT14-32/35

Neutral Start Switch Connector	Disconnect S2 neutral start switch connector. Is battery voltage present at pin B of S2 neutral start switch, 710 Pur wire (D)?	**YES:** Connect switch. Go to next step. **NO:** Test K1 start relay. Check 710 Pur wire and connections. MX52301,000010C -19-24OCT14-33/35

Engine Oil Pressure Switch	Is continuity to ground present at B4 engine oil pressure switch, Blu/Red wire (E)?  MXT011909 —UN—28MAY14 **E—Blue/Red Wire**	**YES:** Go to next step. **NO:** Test B4 engine oil pressure switch. Check engine ground wire and connections. MX52301,000010C -19-24OCT14-34/35

Continued on next page

Engine Oil Pressure Light	Is continuity to ground present at B3 engine oil pressure light, 601 Tan wire (F)?  MXT011910—UN—10JUN14 **F—601 Tan Wire**	**YES:** Test complete. **NO:** Check 601 Tan and engine Blu/Red wires and connections. Test complete.

MX52301,000010C -19-24OCT14-35/35

Power Circuit Operation, Diesel (SN -080000)

NOTE: The battery cable and fuse block connections must be in good condition for proper electrical system operation. The ground cable and connections are equally important. Proper operation depends on these cables and connections to carry the power necessary for operation.

Function:

Provide unswitched battery power to the primary electrical circuits. Provide [key switch-controlled] battery power to the secondary electrical circuits.

Operating Conditions Unswitched Circuits:

- Battery fully charged and properly connected to the wiring harness.
- Ground circuit properly connected to the wiring harness.

Battery voltage must be present at the following components with the key switch “OFF”:

- Battery Positive Terminal
- Y1 Starting Motor Solenoid “B” Terminal 209 Red wire
- G2 Alternator positive 200 Red wire
- S1 Key Switch “B” terminal 208 Red wire
- K1 Start Relay 216 Red wire
- K2 Fan Relay 217 Red wire
- X17 Rear Optional Attachments Connector “A” terminal 204 Red wire
- X13 Accessory Power Port Connector “A” terminal 207 Red wire
- X14 Front Optional Attachments Connector “A” terminal 203 Red wire
- G2 Alternator positive 200 Red wire
- A1 Glow Plug Module 205 Red wire
- Fuses F1—F7

Unswitched Circuit Operation:

Both the battery and the alternator output are connected to the “B” terminal of starting motor solenoid Y1. From the battery positive terminal, power passes through the 218 fuse link and is distributed to various system components and fuses. The fuses and fuse link protect the components and wiring from high overload currents or short circuits.

Operating Conditions Switched Circuits:

- Unswitched circuits functioning properly.
- Key switch in the RUN position.

Battery voltage must be present at the following locations:

- S4 Light Switch 420G Yel wire
- S5 Cargo Box Control Switch (option) 420H Yel wire
- S3 Park Brake Switch 420P Yel wire
- Y3 Fuel Shutoff Solenoid 420A Yel wire
- G2 Alternator 420B Yel wire
- K1 Start Relay 420D Yel wire
- K2 Fan Relay 420E Yel wire
- X15 Front Lights Connector “E” terminal 420K Yel wire
- H3 Engine Oil Pressure Light 420M Yel wire
- H2 Engine Coolant Temperature Light 419 Yel wire
- X8 Mid-Optional Attachments Connector 420F Yel wire
- X7 Front Optional Attachments Connector “A” terminal 420L Yel wire
- A1 Glow Plug Module 420N Yel wire
- (SN040001-080000) K3 4WD Interlock Relay 420Q Yel wire
- (SN040001-080000) K3 4WD Interlock Relay 420X Yel wire
- (SN040001-080000) H4 Discharge Light 420R Yel wire

Switched Circuit Operation:

The key switch receives fused, unswitched battery power from the Fuse Block. Moving the key switch to the RUN or START position provides power to a central splice. The splice supplies all switched circuits

Static Switched Circuits:

- Switched circuits functioning properly.

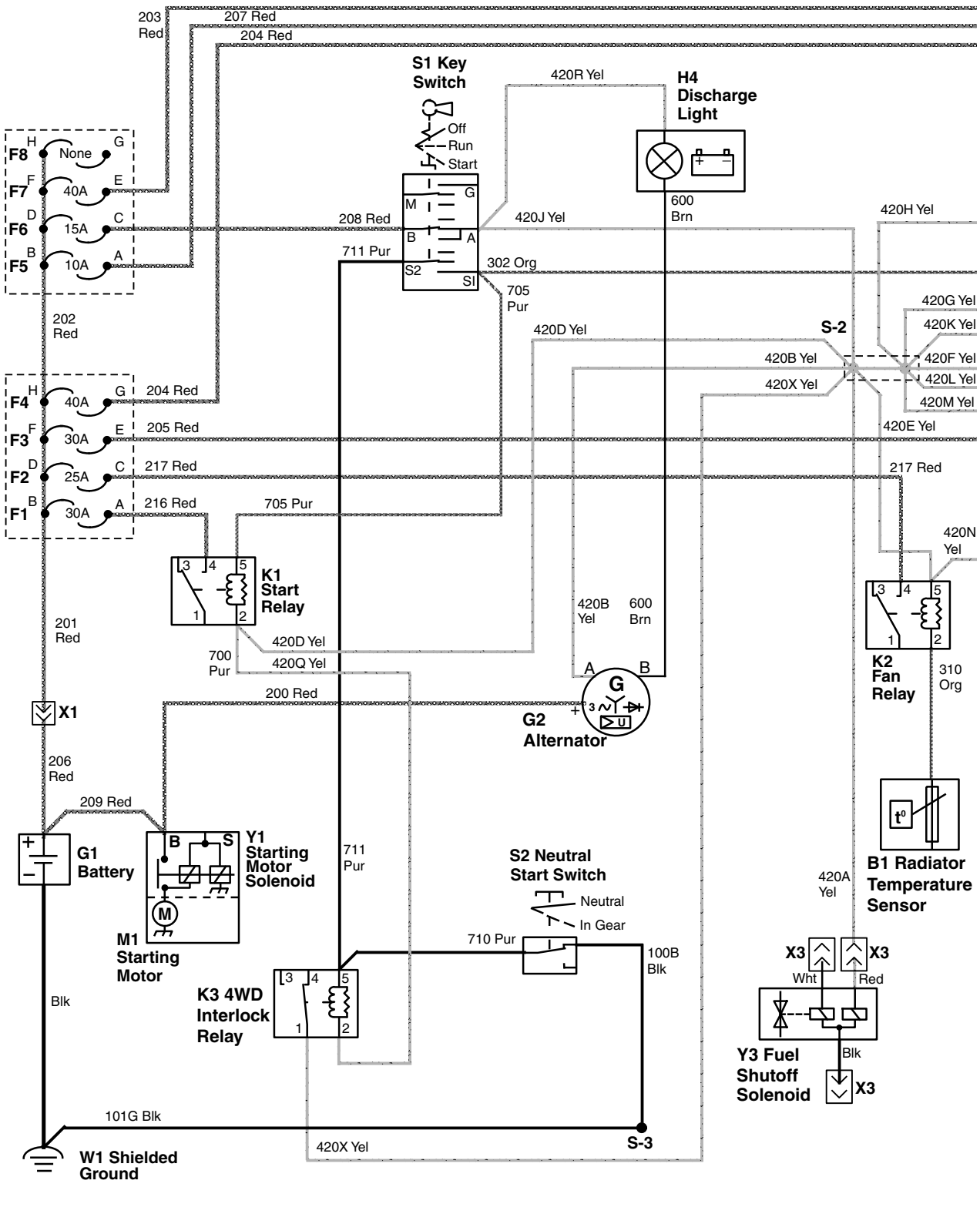
When the key switch is in the run position, battery voltage is sent to several components. These components are switched on the ground side to activate.

Battery voltage must be present at the following locations:

- B1 Radiator Temperature Switch 310 Org wire
- B3 Engine Coolant Temperature Switch 300 Org wire
- V1 Light Check Diode 301 and 302 Org wires
- S1 Key Switch “S1” terminal 302 Org and 705 Pur wires
- B4 Engine Oil Pressure Switch 601 Tan wire when engine oil pressure is within operating range.
- P1 Hour Meter 602 Tan wire when engine oil pressure is within operating range.
- A1 Glow Plug Module 303 Org wire
- A1 Glow Plug Module 303 Org wire
- (SN -040000) S2 Neutral Start Switch 705 and 710 Pur wires
- (SN040001-080000) K1 Start Relay 705 Pur wire

MX52301,000010D -19-24OCT14-1/1

Power Circuit Schematic, Diesel (SN 040001-080000)



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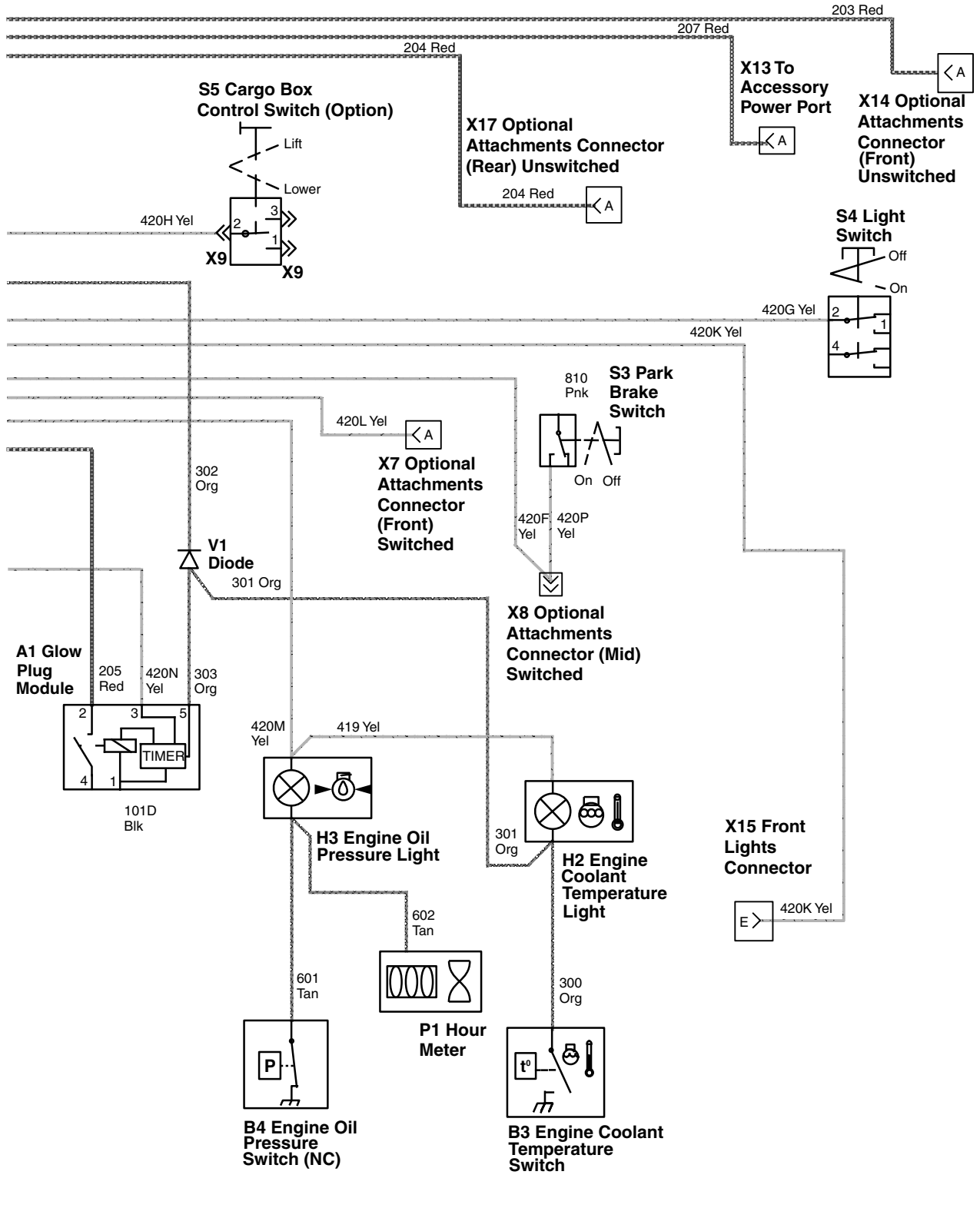
MX52301,000010E -19-24OCT14-1/2

Power Circuit Schematic (Diesel Engine) (SN 040001-080000) 2 of 2



MX52301,000010E -19-24OCT14-2/2

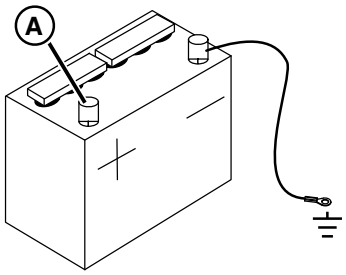
Power Circuit Diagnosis, Diesel (SN 040001-080000)

Power Circuit Diagnosis (Diesel Engines SN 040001-080000)

MX52301,000010F -19-24OCT14-1/36

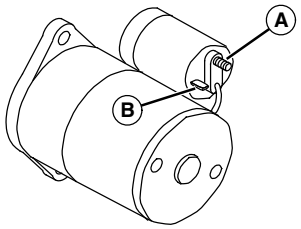
❶ Battery Circuit

MX52301,000010F -19-24OCT14-2/36

Battery	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is 12.4 V or above present at battery positive terminal (A)?  MXT011883 —UN—04JUN14 **A—Positive Battery Terminal**	**YES:** Go to next step. **NO:** Test battery. See Battery Load Test.

Continued on next page

MX52301,000010F -19-24OCT14-3/36

Starter Motor Solenoid	Is battery voltage present at battery terminal of starter solenoid (A)?  MXT011957 —UN—03JUL14 **A—Starter Motor Solenoid Battery Terminal**	**YES:** Go to next step. **NO:** Check 209 Red cable and connections.

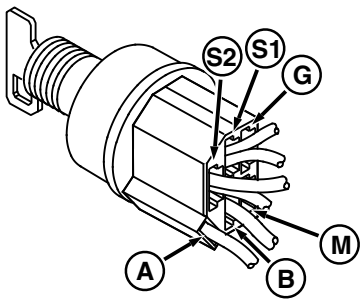
MX52301,000010F -19-24OCT14-4/36

❷ Unswitched Circuit Wiring:

MX52301,000010F -19-24OCT14-5/36

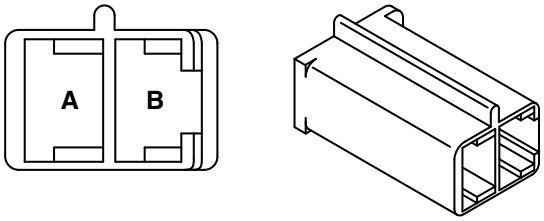
Circuit Wiring	Is battery voltage present at both sides of all fuses (F1—F7) ?	**YES:** Yes: Go to next step. **NO:** Check 201 Red wire, 202 Red wire (behind fuse blocks), and all fuses.

MX52301,000010F -19-24OCT14-6/36

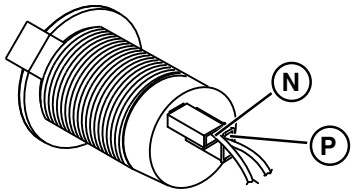
Switch Connector	Is battery voltage present at the switch connector, 208 Red wire (B)?  MXT004463 —UN—31MAY12	**YES:** Connect switch. Go to next step. **NO:** Test F6 fuse. Test battery and positive (+) battery cable. Check 201 and 202 Red wires and connections. Check 208 Red wire and connections.

Continued on next page

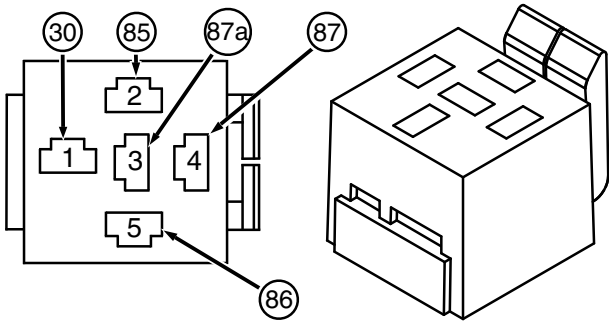
MX52301,000010F -19-24OCT14-7/36

Front Optional Attachment Connector	Is battery voltage present at X14 front optional attachments connector, 203 Red wire (B)?  RXA0062502 —UN—05NOV02	**YES:** Go to next step **NO:** Check 203 Red wire.

MX52301,000010F -19-24OCT14-8/36

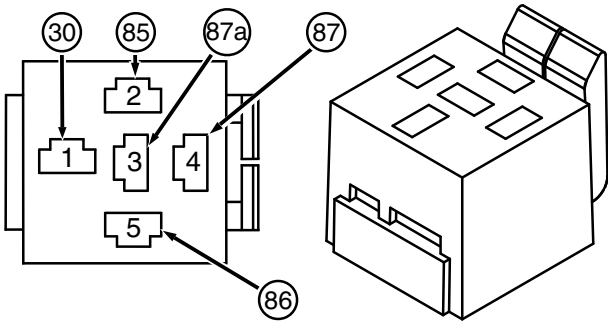
Accessory Power Port	Is battery voltage present at X13 accessory outlet, 207 Red wire (N)?  MXT011913 —UN—10JUN14	**YES:** Go to next step. **NO:** Check 207 Red wire.

MX52301,000010F -19-24OCT14-9/36

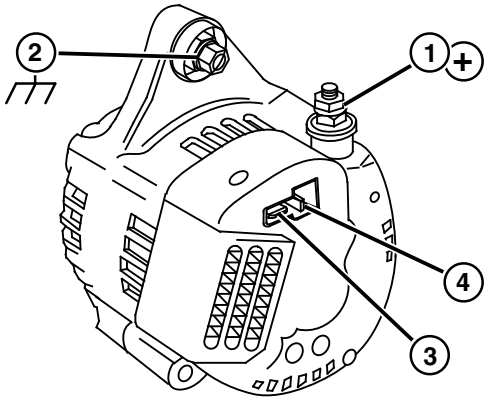
Start Relay Connector	Remove K1 start relay. Is battery voltage present at terminal 4 (87) of relay connector, 216 Red wire?  MXT011889 —UN—09JUL14	**YES:** Install relay Go to next step. **NO:** Check 216 Red wire.

Continued on next page

MX52301,000010F -19-24OCT14-10/36

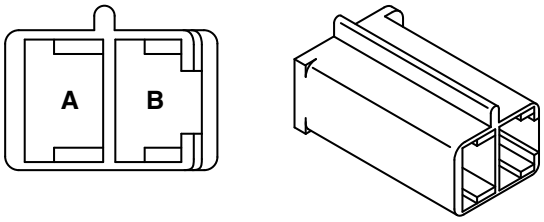
Fan Relay Connector	Remove K2 fan relay. Is battery voltage present at terminal 4 (87) of relay connector, 217 Red wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Go to next step. **NO:** Check 217 Red wire.

MX52301,000010F -19-24OCT14-11/36

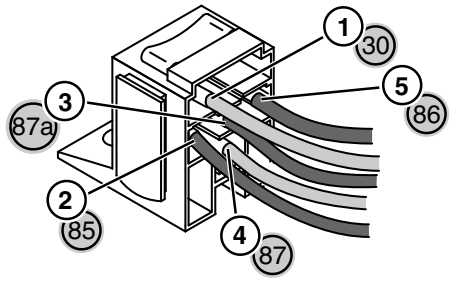
Alternator	Is battery voltage present at battery terminal of alternator, 200 Red wire (1)?  MXT011919 —UN—04JUN14 **1— Alternator Terminal.**	**YES:** Go to next step. **NO:** Check 200 Red wire.

Continued on next page

MX52301,000010F -19-24OCT14-12/36

Rear Optional Attachments Connector	Is battery voltage present at X17 rear optional attachments connector, 204 Red wire (B)?  RXA0062502 —UN—05NOV02	**YES:** Go to next step. **NO:** Check 204 Red wire.

MX52301,000010F -19-24OCT14-13/36

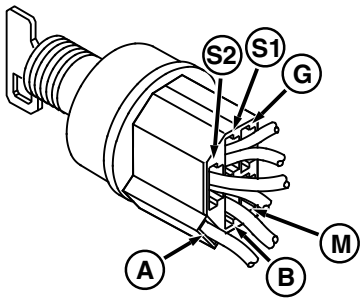
Glow Plug Module	Is battery voltage present at 205 Red wire (2) of A1 glow plug module?  MXT011570 —UN—09JUL14	**YES:** Tests complete or go to switched power circuit tests. **NO:** Check 205 Red wire and connections

MX52301,000010F -19-24OCT14-14/36

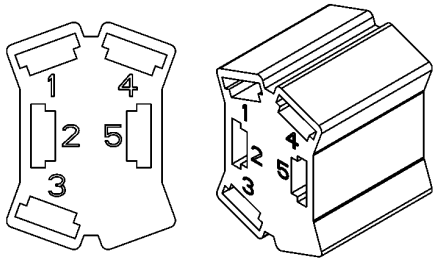
❶ **Switched Circuit**

Continued on next page

MX52301,000010F -19-24OCT14-15/36

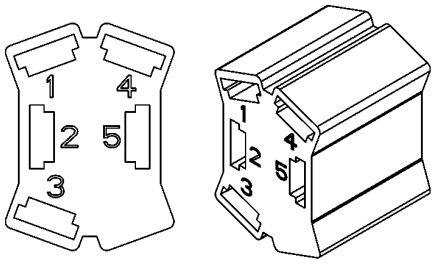
Key Switch	**Test Procedure B** **Test Conditions:** • Unswitched power circuits OK. • Machine parked safely. See the “Safety Section”. • Park brake locked • Key switch in the run position with engine not running. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is battery voltage present at the S1 key switch, 420J Yel wire (A)?  MXT004463 —UN—31MAY12	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test.

MX52301,000010F -19-24OCT14-16/36

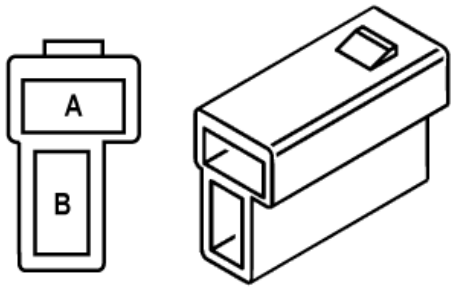
Light Switch	Disconnect S4 light switch. Is battery voltage present at switch connector, 420G Yel wire (2)?  MXT001666 —UN—10OCT11	**YES:** Connect switch. Go to next step. **NO:** Check 420J and 420G Yel wires, and connections.

Continued on next page

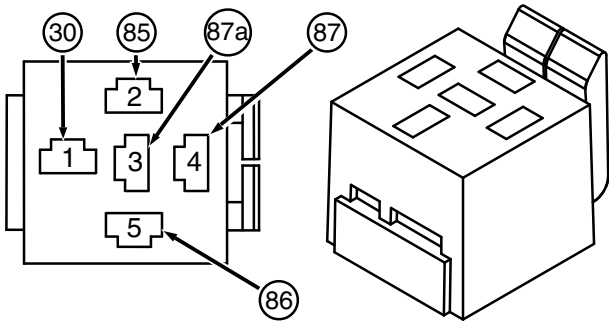
MX52301,000010F -19-24OCT14-17/36

Cargo Box Lift Switch	Disconnect S5 cargo box lift switch. Is battery voltage present at pin 2 of switch connector, 420H Yel wire (2)?  MXT001666 —UN—10OCT11	**YES:** Connect switch. Go to next step. **NO:** Check 420J and 420H Yel wires, and connections

MX52301,000010F -19-24OCT14-18/36

Front Optional Attachments Connector	Is battery voltage present at X7 front optional attachments connector, 420L Yel wire (A)?  MXT001682 —UN—12MAY17	**YES:** Go to next step. **NO:** Check 420J and 420L Yel wires, and connections.

MX52301,000010F -19-24OCT14-19/36

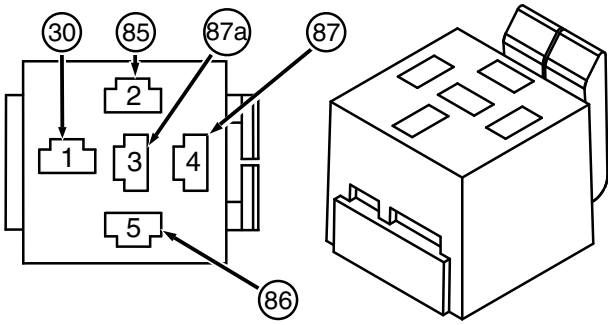
Start Relay Connector	Remove relay. Is battery voltage present at terminal 5 (86) of K1 start relay connector, 420D Yel wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Go to next step. **NO:** Check 420D Yel wire.

Continued on next page

MX52301,000010F -19-24OCT14-20/36

Fan Relay Connector

Remove relay. Is battery voltage present at terminal 5 (86) of K2 fan relay connector, 420E Yel wire?



MXT011889 —UN—09JUL14

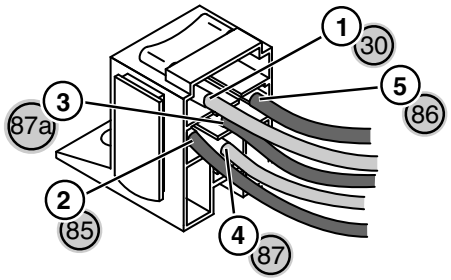
YES: Install relay. Go to next step.

NO: Check 420E Yel wire.

MX52301,000010F -19-24OCT14-21/36

Glow Plug Module

Is battery voltage present at 420N Yel wire (3) of A1 glow plug module?



MXT011570 —UN—09JUL14

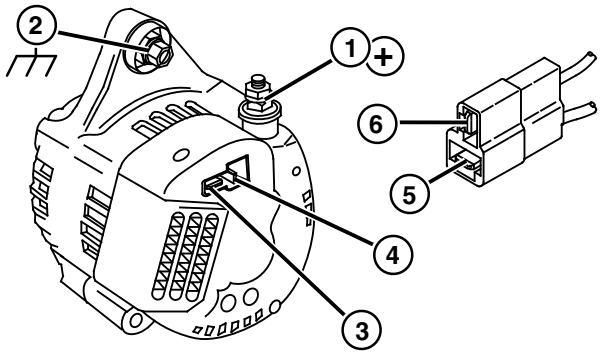
YES: Go to next procedure.

NO: Check 420N Yel wire and connections.

MX52301,000010F -19-24OCT14-22/36

Alternator Connector

Disconnect alternator connector. Is battery voltage present at 420B Yel wire (5)?



MXT011922 —UN—04JUN14
5— 420 Yellow Wire

YES: Connect alternator connector. Go to next step.

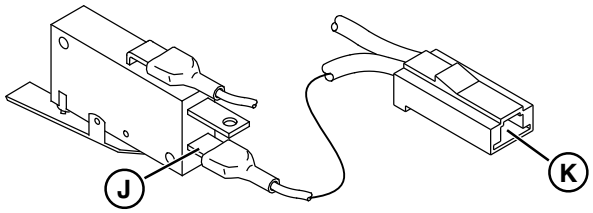
NO: Check 420B Yel wire.

Continued on next page

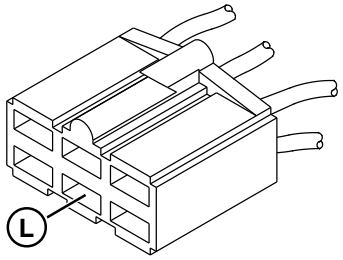
MX52301,000010F -19-24OCT14-23/36

Park Brake Light	Is park brake light illuminated?	**YES:** See Park Brake Circuit Diagnosis, Gas (All), Diesel (SN -080000). **NO:** Go to next step.

MX52301,000010F -19-24OCT14-24/36

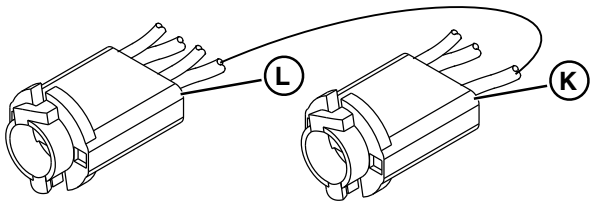
Park Brake Switch	Is battery voltage present at S3 park brake switch, 420P Yel wire (J)?  MXT011902 —UN—28MAY14 **J—420P Yellow Wire** **K—420P Yellow Wire**	**YES:** Go to next step. Test park brake switch. **NO:** Check 420P and 420F Yel (K) wires.

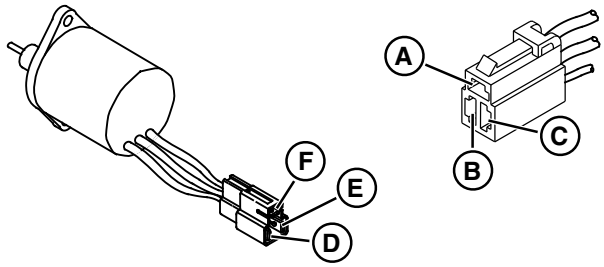
MX52301,000010F -19-24OCT14-25/36

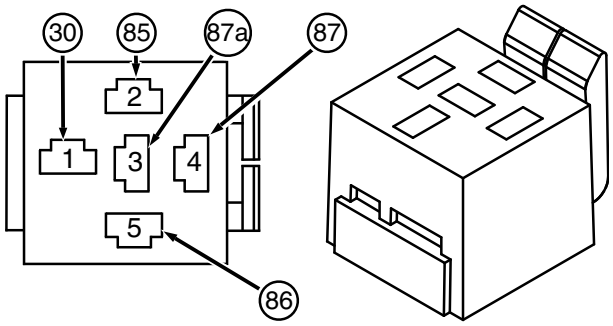
Front Lights Connector	Is battery voltage present at the X15 front lights connector, 420K Yel wire (L)?  MXT011903 —UN—28MAY14 **L—420K Yellow Wire**	**YES:** Go to next step. **NO:** Check 420K Yel wire.

Continued on next page

MX52301,000010F -19-24OCT14-26/36

Engine Coolant Temperature Light	Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire (L)? Is H3 engine oil pressure light illuminated?  MXT011904 —UN—02JUN14 **L—419 Yellow Wire** **K—419 Yellow Wire**	**YES:** Go to next step **NO:** Check 419 (K)and 420M (L) Yel wires. **NO:** Check 419 (K) and 420M (L) Yel wires. Test H3 engine oil pressure bulb
		MX52301,000010F -19-24OCT14-27/36

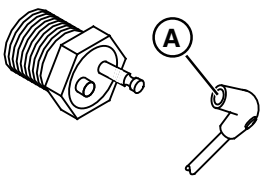
Fuel Shutoff Solenoid	Is battery voltage present at X3 connector, 420A Yel wire (D) of Y3 fuel shutoff solenoid?  MXT011926 —UN—21OCT14 **D—420A Yellow Wire**	**YES:** Tests complete or go to static switched power tests. **NO:** Check 420A Yel wire and connections.
	Continued on next page	MX52301,000010F -19-24OCT14-28/36

4WD Interlock Relay Connector	Remove relay. Is battery voltage present at terminal 2 (85) of K3 4WD interlock relay connector, 420Q Yel wire?  MXT011889 —UN—09JUL14	**YES:** Install relay. Tests complete or go to static switched power tests. **YES:** Go to next step. **NO:** Check 420X Yel wire. **NO:** Check 420Q and 420D Yel wires.
	Is battery voltage present at terminal 1 (30) of K3 4WD interlock relay connector, 420X Yel wire?	

MX52301,000010F -19-24OCT14-29/36

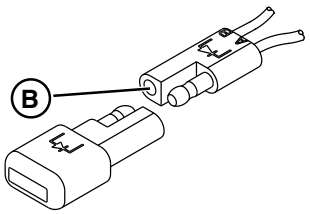
❶ Static Switched Circuit Wiring

MX52301,000010F -19-24OCT14-30/36

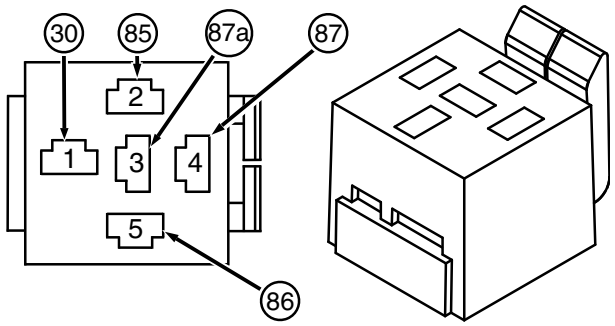
Engine Coolant Temperature Switch	**Test Procedure C** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Key switch in the off position. • Cargo box raised and locked. • Battery fully charged. • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Voltmeter positive (Red) placed on designated test point. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wires and connections for looseness and corrosion. Is battery voltage present at B3 engine coolant temperature switch, Yel wire (A)?  MXT012710 —UN—21OCT14 **A—Yellow Wire**	**YES:** Go to next step. **NO:** Test H2 engine coolant temperature bulb. Check 300 Org wire and Yel engine wire and connections.

Continued on next page

MX52301,000010F -19-24OCT14-31/36

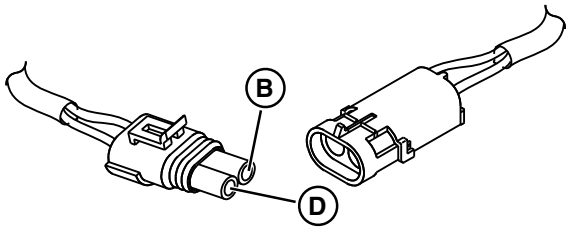
V1 Diode	Disconnect V1 diode. Is battery voltage present at V1 diode 301 Org wire (B)?  MXT011906 —UN—29MAY14 **B—301 Orange Wire**	**YES:** Install diode. Go to next step. **NO:** Test H2 engine coolant temperature bulb. Check 301 Org wire and connections.

MX52301,000010F -19-24OCT14-32/36

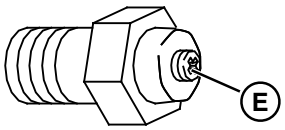
Neutral Start Switch Connector	Remove relay. Is battery voltage present at terminal 5 (86) of K1 start relay connector, 705 Pur wire?  MXT011889 —UN—09JUL14	**YES:** Go to next step. **NO:** Test V1 diode. Check 302 Org and 705 Pur wires and connections.

Continued on next page

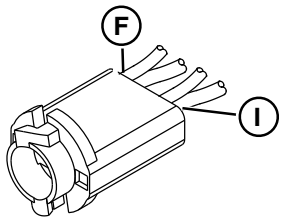
MX52301,000010F -19-24OCT14-33/36

Radiator temperature switch connector	Disconnect B1 radiator temperature switch connector. Is battery voltage present at pin B of main wire harness, 310 Org wire (D)?  MXT011916 —UN—17JUN14 **D—310 Orange Wire**	**YES:** Connect switch. Go to next step. **NO:** Test K2 fan relay. Check 310 Org wire and connections.

MX52301,000010F -19-24OCT14-34/36

Engine Oil Pressure Switch	Is continuity to ground present at B4 engine oil pressure switch, Blu/Red wire (E)?  MXT011909 —UN—28MAY14 **E—Blue/Red Wire**	**YES:** Go to next step. **NO:** Test B4 engine oil pressure switch. Check engine ground wire and connections.

MX52301,000010F -19-24OCT14-35/36

Engine Oil Pressure Light	Is continuity to ground present at B3 engine oil pressure light, 601 Tan wire (F)?  MXT011910 —UN—10JUN14 **F—601 Tan Wire**	**YES:** Test complete **NO:** Check 601 Tan and engine Blu/Red wires and connections. Test complete.

MX52301,000010F -19-24OCT14-36/36

Power Circuit Operation, Diesel (SN 080001-)

NOTE: The battery cable and fuse block connections must be in good condition for proper electrical system operation. The ground cable and connections are equally important. Proper operation depends on these cables and connections to carry the power necessary for operation.

Function:

Provide unswitched battery power to the primary electrical circuits. Provide [key switch-controlled] battery power to the secondary electrical circuits.

Operating Conditions Unswitched Circuits:

- Battery fully charged and properly connected to the wiring harness.
- Ground circuit properly connected to the wiring harness.

Battery voltage must be present at the following components with the key switch “OFF”:

- Battery Positive Terminal
- Y1 Starting Motor Solenoid “B” Terminal 209 Red wire
- C3 to S1 Key Switch “B” terminal 208 Red wire
- C10 Rear Power Connector 204 Red wire
- C38 Front Power Port Connector 207 Red wire
- C6 Front Power Connector 203 Red wire
- G2 Alternator positive 200 Red wire
- C49 Electronic Control Module 208 Red wire
- C50 Electronic Control Module 202 Red wire
- C100 Cab Power connector 201A, 218A Red wires
- (SN080001-110000) Fuses F1, F3, F4
- (SN110001-) Fuses F1—F4

Unswitched Circuit Operation:

Both the battery and the alternator output are connected to the “B” terminal of starting motor solenoid Y1. From the battery positive terminal, power passes through the 218 fuse link and is distributed to various system components and fuses. The fuses and fuse link protect the components and wiring from high overload currents or short circuits.

Operating Conditions Switched Circuits:

- Unswitched circuits functioning properly.
- Key switch in the RUN position.

Battery voltage must be present at the following locations:

- C7 to S4 Light Switch 420G Yel wire
- C2 to S5 Cargo Box Control Switch (option) 420H Yel wire and (SN110001-) 419Z Yel Jumper wire
- T9 to S3 Park Brake Switch 420P Yel wire
- C29 to Y3 Fuel Shutoff Solenoid 420A Yel wire
- C4 to G2 Alternator Connector 420B Yel wire
- C49 VCU Connector 420D Yel wire
- C14 Lights Connector 420K Yel wire
- C18 to H3 Engine Oil Pressure Light 420M Yel wire
- C16 to H2 Coolant and Glow Plug Temperature Light 419 Yel wire
- C28 Power Connector 420F Yel wire
- C5 Front Attachments Connector 420L Yel wire
- C31 to H4 Discharge Light 420R Yel wire
- C23 to B1 Radiator Temperature Switch 420N Yel wire
- C42 to H5 Seat Belt Light 419H Yel wire
- C8 to P1 Hour Meter 417 Yel wire
- C3 to S1 Key Switch 420J Yel wire
- C11 to S7 Seat Belt Switch 420E Yel wire
- C12 to S2 Neutral Switch 420T Yel wire
- C89 to F9 Fuse Holder 420Z Yel wire
- C90 Center Power Port Connector 427 Yel wire
- (SN080001-110000) C98 Connector 420Y Yel wire
- C35 to Y4 4WD Solenoid 421A Yel wire (421A Pur wire (SN 110001-)).

Switched Circuit Operation:

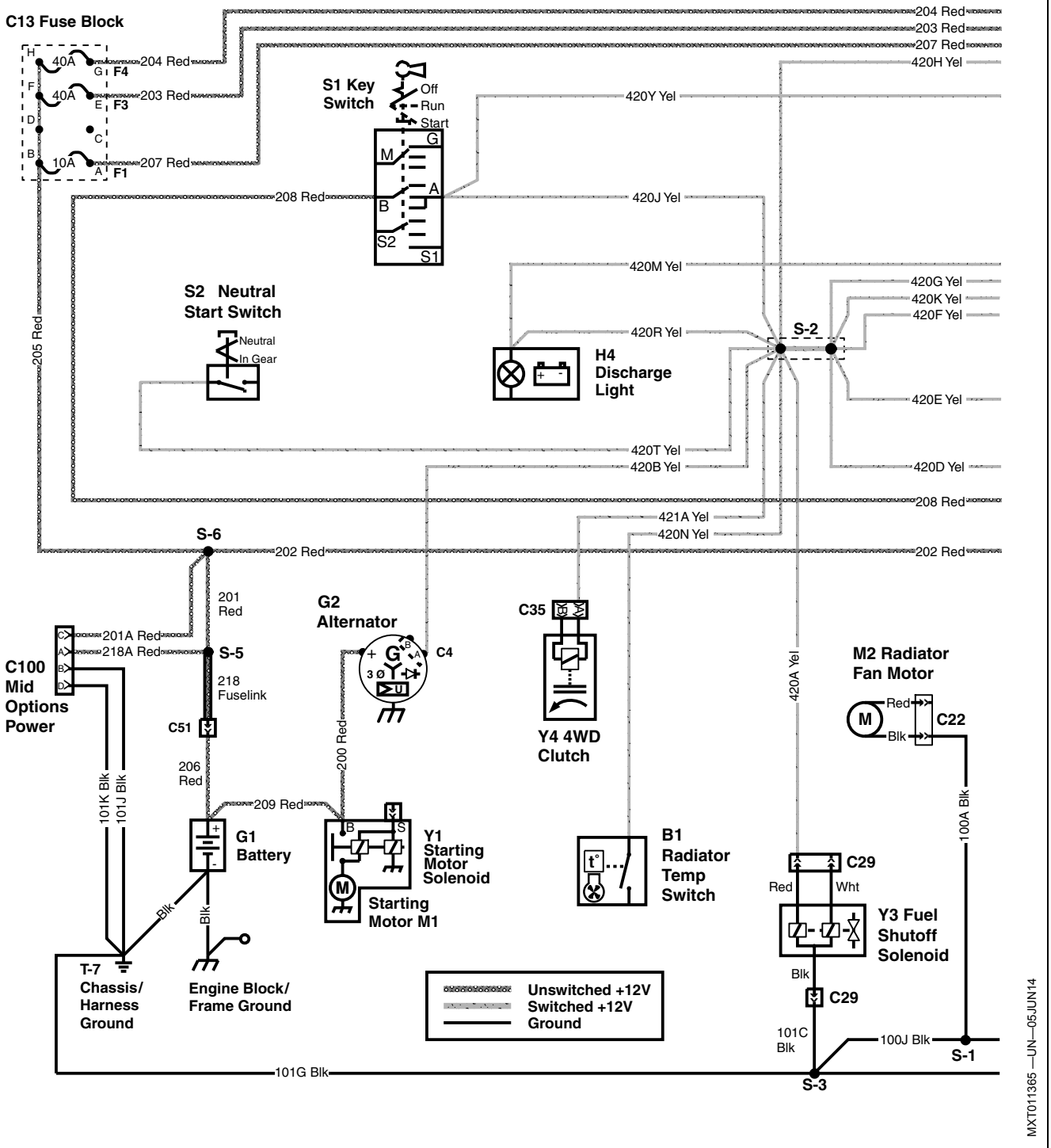
The key switch receives fused, unswitched battery power from the VCU. Moving the key switch to the RUN or START position provides power to a central splice. The splice supplies all switched circuits (except for C98, which is wired directly to the key switch (SN080001-110000)).

Ground Circuits:

The negative battery cable wire is made up of two conductors. A large-gauge wire connects the battery to the engine block. A smaller wire from the battery attaches to the chassis which creates the ground tie point for the harness. The floating frame of vehicle is electrically joined to the engine block through a flexible bonding jumper. Most harness component ground wires lead to one of two splices (S-1 and S-3). Splice S-1 is wired to S-3, while S-3 is wired to the chassis ground tie point on the machine. Cab Power connector C100 carries high current and uses two separate wires to chassis ground. The control module and speed sensor also utilize separate ground wires to minimize electrical noise in the control system. The oil pressure switch, coolant temperature switch, glow plugs, alternator, and starting motor are all grounded via the engine block.

MX52301,0000110 -19-24OCT14-1/1

Power Circuit Schematic, Diesel (SN 080001-110000)
1 of 3



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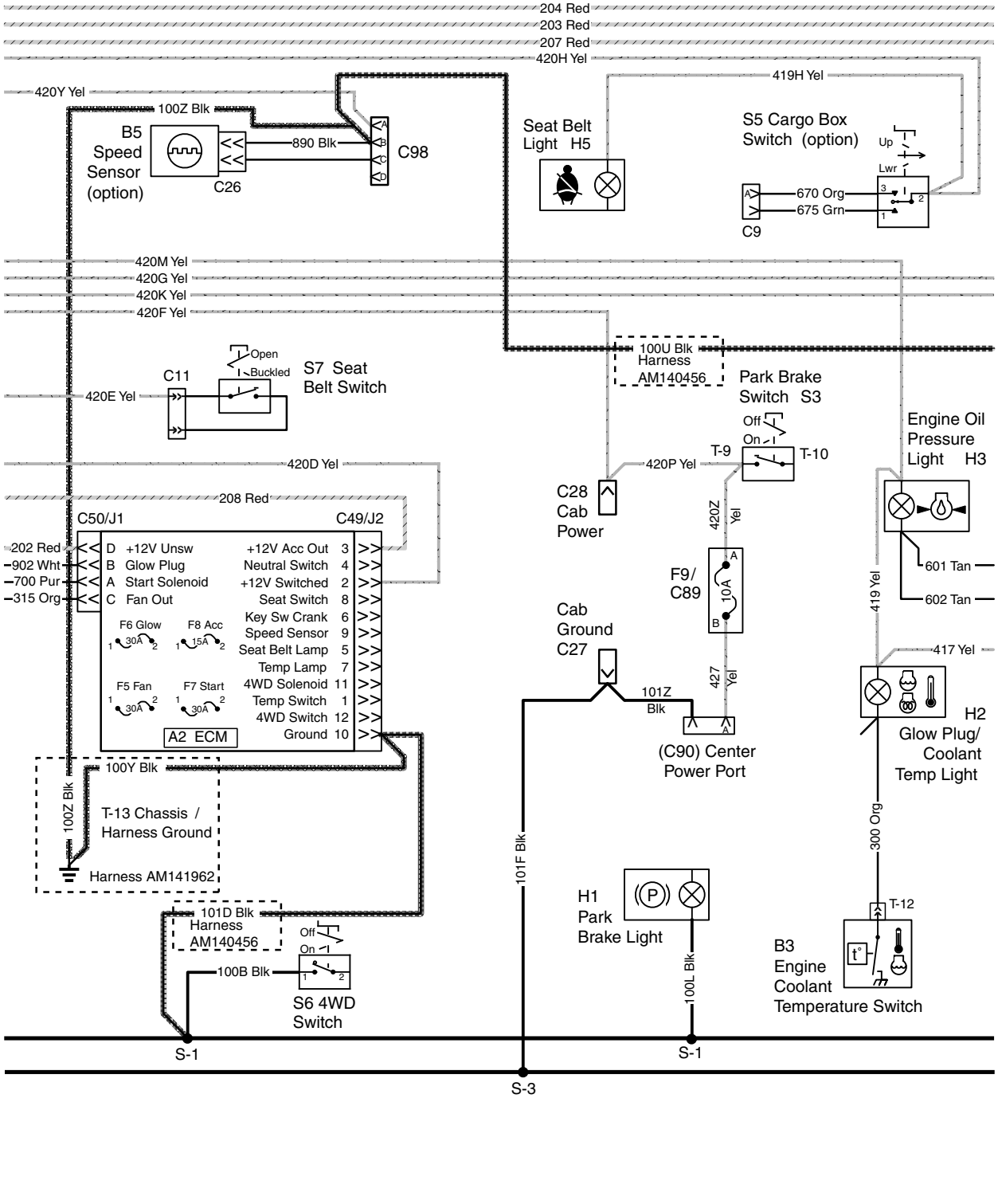
MX52301,0000111 -19-24OCT14-1/3

Power Circuit Schematic (Diesel Engine) (SN 080001-110000) 2 of 3



MXT011929 —UN—27OCT14

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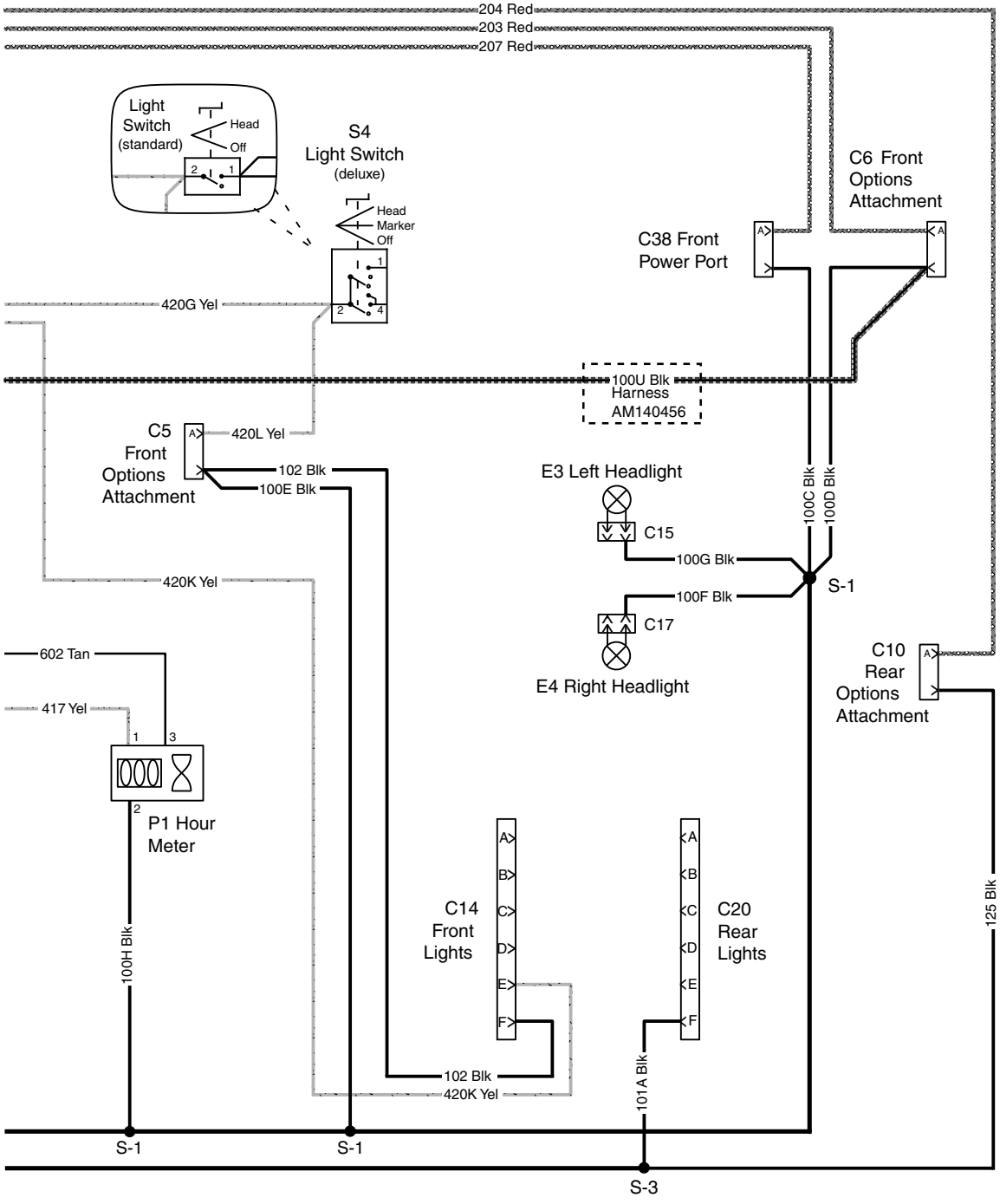
MX52301,0000111 -19-24OCT14-2/3

Power Circuit Schematic (Diesel Engine) (SN 080001-110000) 3 of 3



MX52301,0000111 -19-24OCT14-3/3

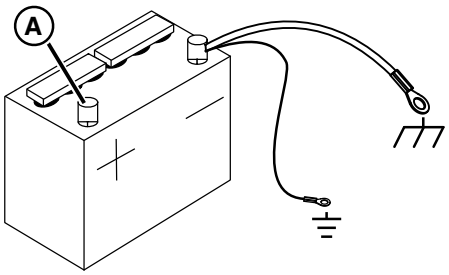
Power Circuit Diagnosis, Diesel (SN 080001-110000)

Power Circuit Diagnosis (Diesel Engines SN 080001-110000)

MX52301,0000112 -19-24OCT14-1/45

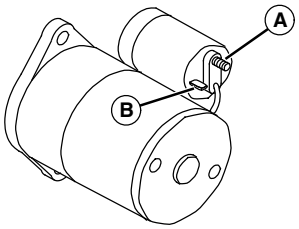
❶ Battery Circuit

MX52301,0000112 -19-24OCT14-2/45

Battery	**Test Procedure A:** **Test Conditions** • Machine parked safely. See the “Safety Section”. • Unswitched power circuits OK. • Open hood and remove storage tray. • Key switch in RUN position with engine not running • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity • Check wires and connections for looseness and corrosion. Is 12.4 V or above present at battery positive terminal (A)?  MXT011931 —UN—04JUN14 **A—Battery Positive Terminal**	**YES:** Go to next step **NO:** Test battery. See Battery Load Test.

Continued on next page

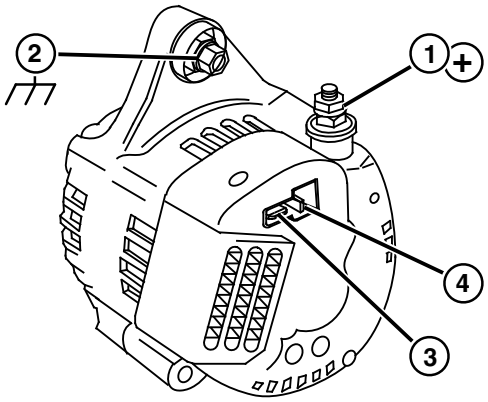
MX52301,0000112 -19-24OCT14-3/45

Starter Motor Solenoid	Is battery voltage present at battery terminal of starter solenoid (A)?  MXT011957 —UN—03JUL14 **A—Starter Motor Solenoid Battery Terminal**	**YES:** Go to next step **NO:** Check 209 Red battery cable and connections.

MX52301,0000112 -19-24OCT14-4/45

❷ Unswitched Power

MX52301,0000112 -19-24OCT14-5/45

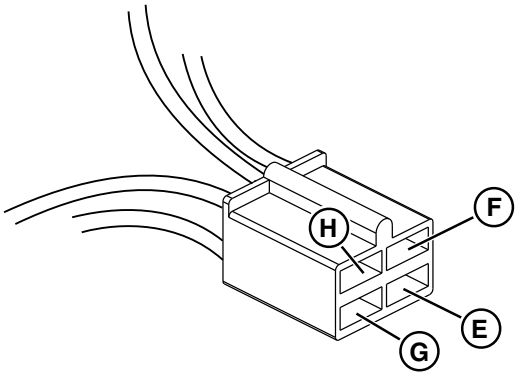
Alternator	Is battery voltage present at the alternator battery terminal (1)?  MXT011919 —UN—04JUN14 **1—Alternator Terminal.**	**YES:** Go to next step. **NO:** Check 200 Red cable and connections

MX52301,0000112 -19-24OCT14-6/45

Fuses	Is battery voltage present at both sides of fuses F1, F3 and F4?	**YES:** Go to next step **NO:** Test fuse. **NO:** Test 218 fuse link. Check connector C51, Red wires 201, 205 and 206.

Continued on next page

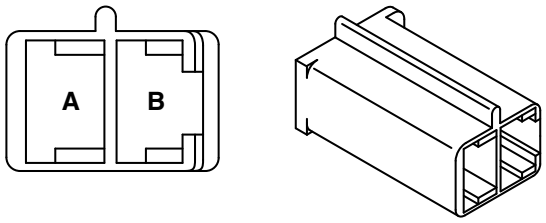
MX52301,0000112 -19-24OCT14-7/45

Cab Power Connector Wires	Is battery voltage present at the C100 Cab Power Connector Red wires 218A (E) and 201A (F)?  MXT011934 —UN—10JUN14 **E—218A Red** **F—201A Red** **G—101J Black** **H—101K Black**	**YES:** Go to next step. **NO:** Confirm that voltages in previous step are OK. Check 218A and 201A Red wires and connections.

MX52301,0000112 -19-24OCT14-8/45

Cab Power Connector	Is there continuity between ground and Blk wires 101J (G) and 101K (H)?	**YES:** Go to next step. **NO:** Check 101J and 101K Blk wires and connections.

MX52301,0000112 -19-24OCT14-9/45

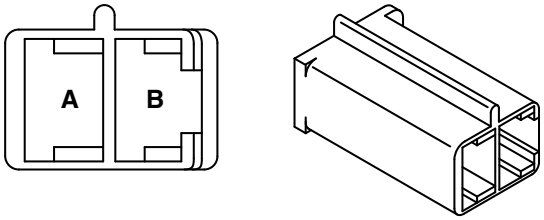
Front Power Connector	Is battery voltage present at Front Power connector C6, 203 Red wire (B)?  RXA0062502 —UN—05NOV02 **A—100D Black Wire** **B—203 Red Wire**	**YES:** Go to next step. **NO:** Check 203 Red wire, fuse F3.

Continued on next page

MX52301,0000112 -19-24OCT14-10/45

Front Power Connector	Is there continuity between 100D Blk wire (A) and ground	**YES:** Go to next step. **NO:** Check 100D, 100J and 101G Blk wires and connections.

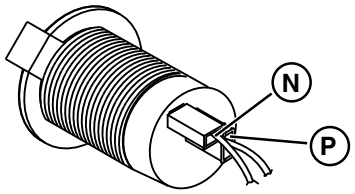
MX52301,0000112 -19-24OCT14-11/45

Rear Power Connector	Is battery voltage present at Rear Power connector C10, 204 Red wire (B)?  RXA0062502 —UN—05NOV02 **A—125 Black Wire** **B—204 Red Wire**	**YES:** Go to next step **NO:** Check 204 Red wire, fuse F4.

MX52301,0000112 -19-24OCT14-12/45

Rear Power Connector	Is there continuity between 125 Blk wire (A) and ground?	**YES:** Go to next step. **NO:** Check 125 and 101G Blk wires and connections.

MX52301,0000112 -19-24OCT14-13/45

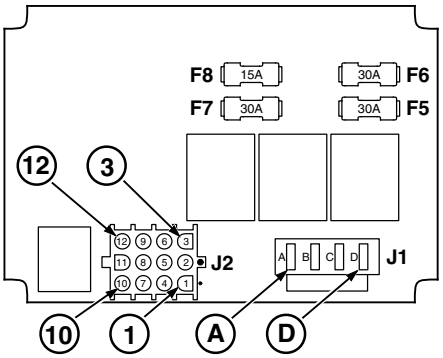
Front Power Port	Is battery voltage present at Front Power port C38, 207 Red wire (N)?  MXT011913 —UN—10JUN14 **N—207 Red Wire** **P—100C Black Wire**	**YES:** Go to next step. **NO:** Check 207 Red wire, fuse F1.

Continued on next page

MX52301,0000112 -19-24OCT14-14/45

Front Power Port	Is there continuity between 100C Blk wire (P) and ground?	**YES:** Replace accessory outlet if defective. Go to next step. **NO:** Check 100C, 100J and 101G Blk wires and connections.

MX52301,0000112 -19-24OCT14-15/45

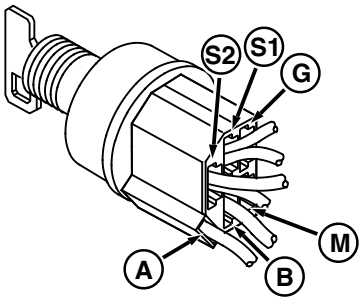
VCU Connectors	Is battery voltage present at VCU connectors **J1-D** and **J2-3**?  MXT011938—UN—04JUN14 **J1-D— 202 Red Wire** **J2-3— F8 Fuse** **J2-10— 100Y Black Wire**	**YES:** Go to next step. **NO:** J1-D, Check 202 Red wire and connections **NO:** J2-3, Test F8 fuse.

MX52301,0000112 -19-24OCT14-16/45

VCU Connector	Is there continuity between **J2-10**100Y Blk wire, and ground?	**YES:** Go to next step. **NO:** Check 100Y Blk wire and connections

Continued on next page

MX52301,0000112 -19-24OCT14-17/45

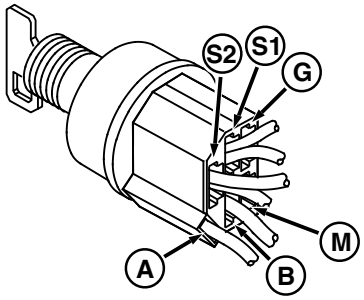
Key Switch Connector	Is battery voltage present at the B terminal of key switch connector, 208 Red wire (B)?  MXT004463 —UN—31MAY12 **B—208 Red Wire**	**YES:** Go to next step. **NO:** Test F8 fuse. **NO:** Check 208 Red wire and connections

MX52301,0000112 -19-24OCT14-18/45

❶ Switched Power

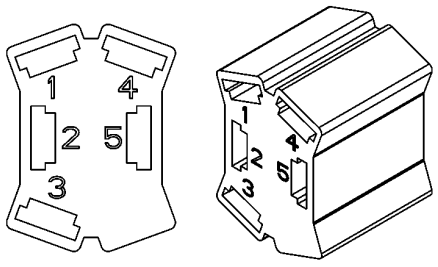
Continued on next page

MX52301,0000112 -19-24OCT14-19/45

Key Switch Connector	**Test Procedure B** **Test Conditions** • Machine parked safely. See the “Safety Section”. • Unswitched power circuits OK. • Open hood and remove storage tray. • Key switch in RUN position with engine not running • Negative (Blk) lead of voltmeter placed on battery negative (-) terminal or suitable frame ground. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity • Check wires and connections for looseness and corrosion. Is battery voltage present at terminal A of key switch connector, 420J and 420Y Yel wires (A)?  MXT004463 —UN—31MAY12 **A—420J and 420Y Yellow Wires**	**YES:** Go to next step.[1] **NO:** Test key switch. See Key Switch Test.

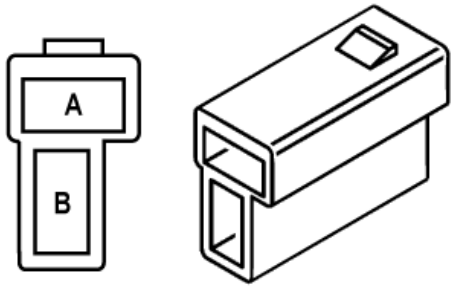
[1]Check for a defective 420J Yel wire if voltage is present only at (A) and not found elsewhere in the switched power circuit.

MX52301,0000112 -19-24OCT14-20/45

Light Switch	Unplug S4 light switch. Is battery voltage present at pin 2 of switch connector, 420G and 420L Yel wires (2)?  MXT001666 —UN—10OCT11 **2— 420G and 420L Yel Wires**	**YES:** Reconnect switch. Go to next step. **NO:** Check 420G and 420J Yel wires and connections.

Continued on next page

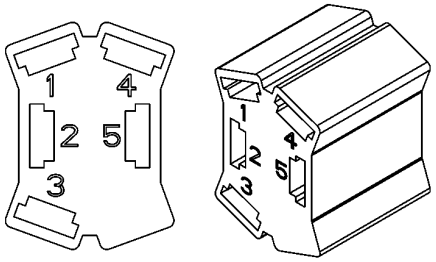
MX52301,0000112 -19-24OCT14-21/45

Front Attachments Connector	Is battery voltage present at Front Attachments connector C5, 420L Yel wire (A)?  MXT001682 —UN—12MAY17 **A—420L Yellow Wire** **B—100E Black Wire**	**YES:** Go to next step. **NO:** Check 420L and 420J Yel wires and connections.

MX52301,0000112 -19-24OCT14-22/45

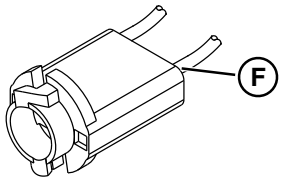
Front Attachments Connector	Is there continuity from 100E Blk wire (B) to ground?	**YES:** Go to next step. **NO:** Check 100E, 100J and 101G Blk wires and connections.

MX52301,0000112 -19-24OCT14-23/45

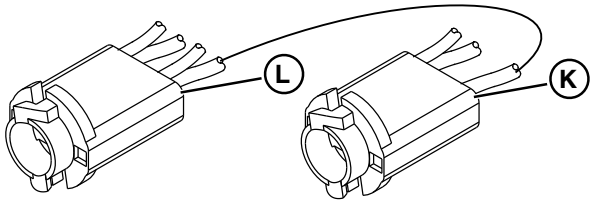
Cargo Box Lift Switch	Unplug S5 cargo box lift switch (if present). Is battery voltage present at pin 2 of switch connector, 420H and 419H Yel wires (2)?  MXT001666 —UN—10OCT11 **2—419H Yellow Wires**	**YES:** Reconnect switch. Go to next step. **NO:** Check 420H and 420J Yel wires and connections.

Continued on next page

MX52301,0000112 -19-24OCT14-24/45

Seat Belt Light Socket	Is battery voltage present at H5 seat belt light socket, 419H Yel wire (F)?  MXT011942 —UN—10JUN14 **F—419H Yellow Wires**	**YES:** Go to next step. **NO:** Check 419H Yel wire and connections.

MX52301,0000112 -19-24OCT14-25/45

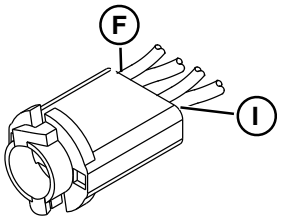
Light Socket	Is battery voltage present at H4 discharge light socket, 420R Yel wire (L)?  MXT011904 —UN—02JUN14 **L—420R Yellow Wire** **K—420M Yellow Wire**	**YES:** Go to next step. **NO:** Check 420R and 420J Yel wires and connections

MX52301,0000112 -19-24OCT14-26/45

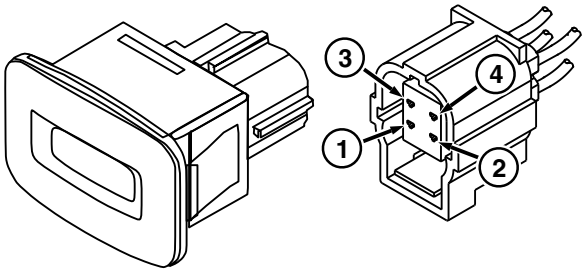
Oil Pressure Light Socket	Is battery voltage present at H3 oil pressure light socket, 420M Yel wire (K)?	**YES:** Go to next step. **NO:** Check 420M and 420J Yel wire and connections

Continued on next page

MX52301,0000112 -19-24OCT14-27/45

Coolant Temperature Light Socket	Is battery voltage present at H2 coolant temperature light socket, 419 Yel wire (I)?  MXT011910 —UN—10JUN14 **I— 419 Yellow Wire**	**YES:** Go to next step. **NO:** Check 419 Yel wire and connections.

MX52301,0000112 -19-24OCT14-28/45

Hour Meter	Unplug P1 hour meter. Is battery voltage present at pin 1 of the connector, 417 Yel wire (1)?  MXT004456 —UN—30MAY12 **1—417 Yellow Wire** **2—100H Black Wire**	**YES:** Go to next step. **NO:** Check 417 Yel wire and connections.

MX52301,0000112 -19-24OCT14-29/45

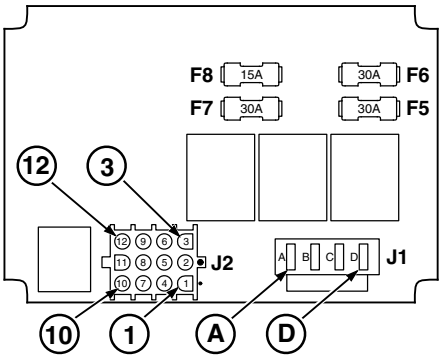
Hour Meter	Is there continuity from pin 2, 100H Blk wire (2) to ground?	**YES:** Attach hour meter. Go to next step. **NO:** Check 100H, 100J and 101G Blk wires and connections.

Continued on next page

MX52301,0000112 -19-24OCT14-30/45

VCU Connector

Is battery voltage present at VCU connector **J2-2** 420D Yel wire?



MXT011938 —UN—04JUN14
J2-2— 420D Yellow Wire

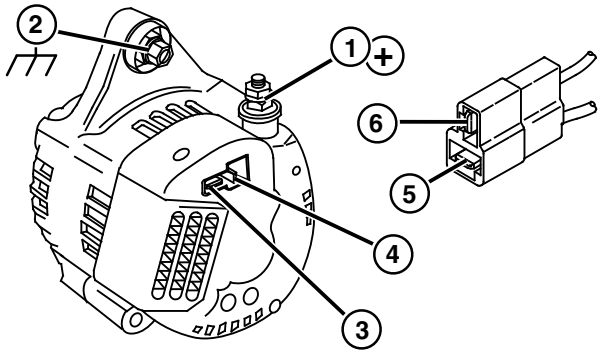
YES: Go to next step.

NO: Check 420D and 420J Yel wires and connections.

MX52301,0000112 -19-24OCT14-31/45

Alternator

Unplug alternator connector C4. Is battery voltage present at the 420B Yel wire (5)?



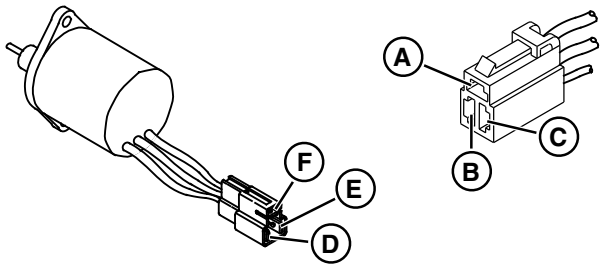
MXT011922 —UN—04JUN14
5— 420B Yellow Wire

YES: Reattach connector. Go to next step.

NO: Check 420B and 420J Yel wires and connections

Continued on next page

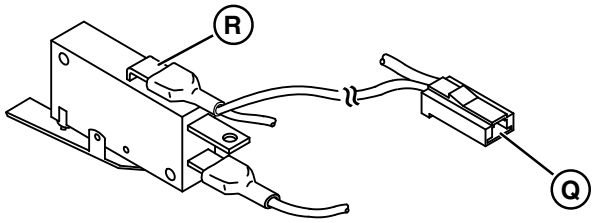
MX52301,0000112 -19-24OCT14-32/45

Fuel Shutoff Solenoid	Unplug fuel shutoff solenoid. Is battery voltage present at the harness connector 420A Yel wire (A)?  MXT011926 —UN—21OCT14 **A—420A Yellow Wire** **C—101C Black Wire**	**YES:** Go to next step. **NO:** Check 420A and 420J Yel wires and connections.

MX52301,0000112 -19-24OCT14-33/45

Fuel Shutoff Solenoid	Is there continuity to ground at 101C Blk wire (C)?	**YES:** Reattach connector. Go to next step. **NO:** Check 101C and 101G Blk wires and connections.

MX52301,0000112 -19-24OCT14-34/45

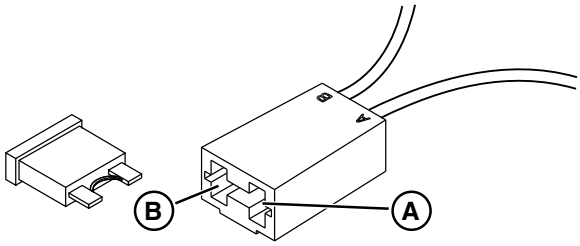
Cab Power Connector	Is battery voltage present at C28 Cab Power connector, 420F Yel wire (Q)?  MXT011949 —UN—10JUN14 **Q—420F Yellow Wire** **R—420P Yellow Wire**	**YES:** Go to next step **NO:** Check 420F and 420J Yel wires.

MX52301,0000112 -19-24OCT14-35/45

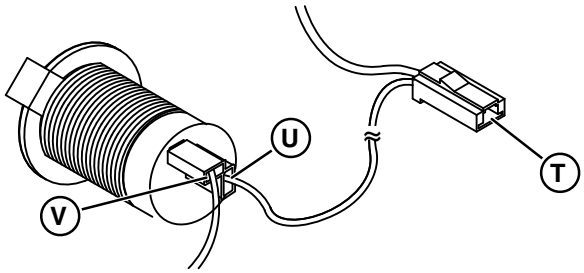
Park Brake Switch	Is battery voltage present at S3 park brake switch, 420P Yel wire (R)?	**YES:** Go to next step. **NO:** Check 420P Yel wire.

Continued on next page

MX52301,0000112 -19-24OCT14-36/45

Fuse Holder	Remove fuse F9 from C89 fuse holder. Is battery voltage present at holder 420Z Yel wire (A)?  MXT011950 —UN—10JUN14 **A—420Z Yellow Wire**	**YES:** Reinsert fuse. Go to next step. **NO:** Check 420Z Yel wire.

MX52301,0000112 -19-24OCT14-37/45

Cab Ground Connector	Is there continuity from C27 Cab Ground connector, 101F Blk wire (T) to ground?  MXT011951 —UN—10JUN14 **T—101F Black Wire** **U—101Z Black Wire** **V—427 Yellow Wire**	**YES:** Go to next step. **NO:** Check 101F and 101G Blk wires.

MX52301,0000112 -19-24OCT14-38/45

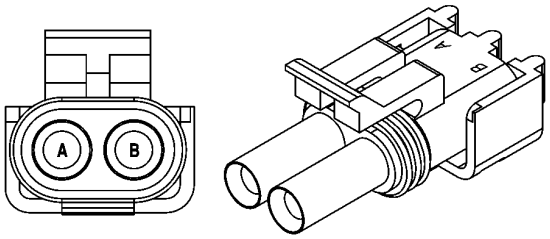
Center Power Port	Is there continuity from Center Power port connector C90, 101Z Blk wire (U) to ground?	**YES:** Go to next step. **NO:** Check 101Z Blk wire.

MX52301,0000112 -19-24OCT14-39/45

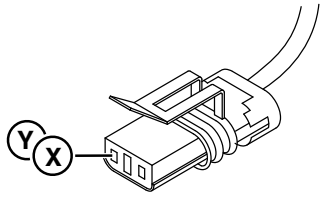
Center Power Port	Is battery voltage present at 427 Yel wire (V)?	**YES:** Replace accessory outlet if defective. Go to next step. **NO:** Test fuse F9. Check 427 Yel wire.

Continued on next page

MX52301,0000112 -19-24OCT14-40/45

Neutral Switch	Unplug connector from the S2 neutral switch. Is battery voltage present at 420T Yel wire (A)?  MXT001674 —UN—11OCT11 **A—420T Yellow Wire**	**YES:** Reattach connector. Go to next step. **NO:** Check 420T and 420J Yel wires.

MX52301,0000112 -19-24OCT14-41/45

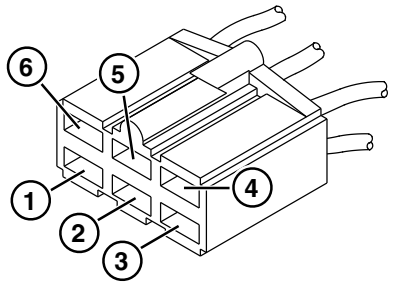
4WD Clutch	Unplug connector from the Y4 4WD clutch. Is battery voltage present at pin A, 421A Yel wire (X)?  MXT011953 —UN—10JUN14 **X—421A Yellow Wire** **Y—420E Yellow Wire**	**YES:** Reattach connector. Go to next step **NO:** Check 421A and 420J Yel wires.

MX52301,0000112 -19-24OCT14-42/45

Seat Belt Switch	Disconnect seat belt switch from wiring harness. Is battery voltage present at pin A, 420E Yel wire (Y)?	**YES:** Reconnect switch to harness. Go to next step. **NO:** Check 420E and 420J Yel wires and connections.

Continued on next page

MX52301,0000112 -19-24OCT14-43/45

Front Light Connector	Is battery voltage present at C14 Front Light connector, 420K Yel wire (2)?  MXT011954 —UN—21OCT14 **1— 101A Black Wire & 102 Black Wire** **2— 420K Yellow Wire**	**YES:** Go to next step. **NO:** Check 420K and 420J Yel wires and connections

MX52301,0000112 -19-24OCT14-44/45

Rear Light Connector	Is continuity to ground present at C14 Front Light connector, 102 Blk wire (1), and C20 Rear Light connector, 101A Blk wire (1)?	**YES:** Tests complete. **NO:** (C14)—Check 102, 100E and100J Blk wires. **NO:** (C20)—Check 101A Blk wire.

MX52301,0000112 -19-24OCT14-45/45

Power Circuit Operation, Diesel (SN 110001-)

NOTE: The battery cable and fuse block connections must be in good condition for proper electrical system operation. The ground cable and connections are equally important. Proper operation depends on these cables and connections to carry the power necessary for operation.

Function:

Provide unswitched battery power to the primary electrical circuits. Provide [key switch-controlled] battery power to the secondary electrical circuits.

Operating Conditions Unswitched Circuits:

- Battery fully charged and properly connected to the wiring harness.
- Ground circuit properly connected to the wiring harness.

Battery voltage must be present at the following components with the key switch “OFF”:

- Battery Positive Terminal
- Y1 Starting Motor Solenoid “B” Terminal 209 Red wire
- C3 to S1 Key Switch “B” terminal 208 Red wire
- C10 Rear Power Connector 204 Red wire
- C38 Front Power Port Connector 207 Red wire
- C6 Front Power Connector 203 Red wire
- G2 Alternator positive 200 Red wire
- C49 Electronic Control Module 208 Red wire
- C50 Electronic Control Module 202 Red wire
- C100 Cab Power connector 201A, 218A Red wires
- Fuses F2—F4

Unswitched Circuit Operation:

Both the battery and the alternator output are connected to the “B” terminal of starting motor solenoid Y1. From the battery positive terminal, power passes through the 201 fuse link and is distributed to various system components and fuses. The fuses and fuse link protect the components and wiring from high overload currents or short circuits.

Operating Conditions Switched Circuits:

- Unswitched circuits functioning properly.
- Key switch in the RUN position.

Battery voltage must be present at the following locations:

- C7 to S4 Light Switch 420G Yel wire
- C2 to S5 Cargo Box Control Switch (option) 420H Yel wire and 419Z Yel jumper wire
- T9 to S3 Park Brake Switch 420P Yel wire and DC-22 diode 420X Yel wire
- C29 to Y3 Fuel Shutoff Solenoid 420A Yel wire
- C4 to G2 Alternator Connector 420B Yel wire
- C49 VCU Connector 420D Yel wire
- C14 Lights Connector 420K Yel wire
- C18 to H3 Engine Oil Pressure Light 420M Yel wire
- C16 to H2 Coolant and Glow Plug Temperature Light 419 Yel wire
- C28 Cab Power Connector 420F Yel wire
- C5 Front Attachments Connector 420L Yel wire
- C31 to H4 Discharge Light 420R Yel wire
- C23 to B1 Radiator Temperature Switch 420N Yel wire
- C42 to H5 Seat Belt Light 419H Yel wire
- C8 to P1 Hour Meter 417 Yel wire
- C3 to S1 Key Switch 420J Yel wire
- C11 to S7 Seat Belt Switch 420E Yel wire
- C12 to S2 Neutral Switch 420T Yel wire
- C89 to F9 Fuse Holder 420Z Yel wire
- C90 Center Power Port Connector 427 Yel wire
- C35 to Y4 4WD Solenoid 421A Pur wire
- C34 to S6 4WD Switch 420Y and 420 Yel wires

Switched Circuit Operation:

The key switch receives fused, unswitched battery power from the ECM. Moving the key switch to the RUN or START position provides power to a central splice. The splice supplies all switched circuits.

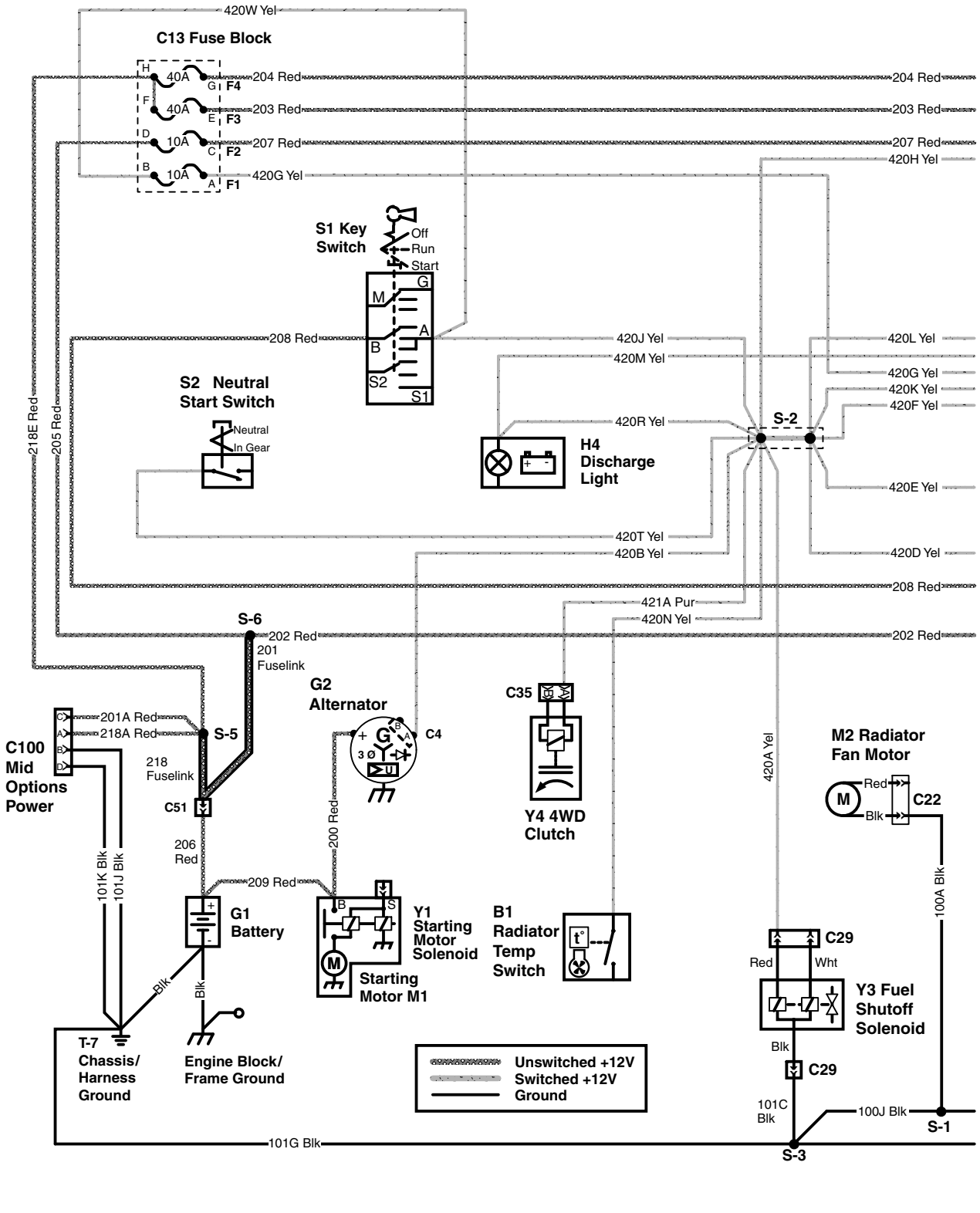
Ground Circuits:

The negative battery cable wire is made up of two conductors. A large-gauge wire connects the battery to the engine block. A smaller wire from the battery attaches to the chassis which creates the ground tie point for the harness. The floating frame of vehicle is electrically joined to the engine block through a flexible bonding jumper. Most harness component ground wires lead to one of two splices (S-1 and S-3). Splice S-1 is wired to S-3, while S-3 is wired to the chassis ground tie point on the machine. Cab Power connector C100 carries high current and uses two separate wires to chassis ground. The oil pressure switch, coolant temperature switch, glow plugs, alternator, and starting motor are all grounded via the engine block.

MX52301,00006C5 -19-24OCT14-1/1

Power Circuit Schematic, Diesel (SN 110001-)

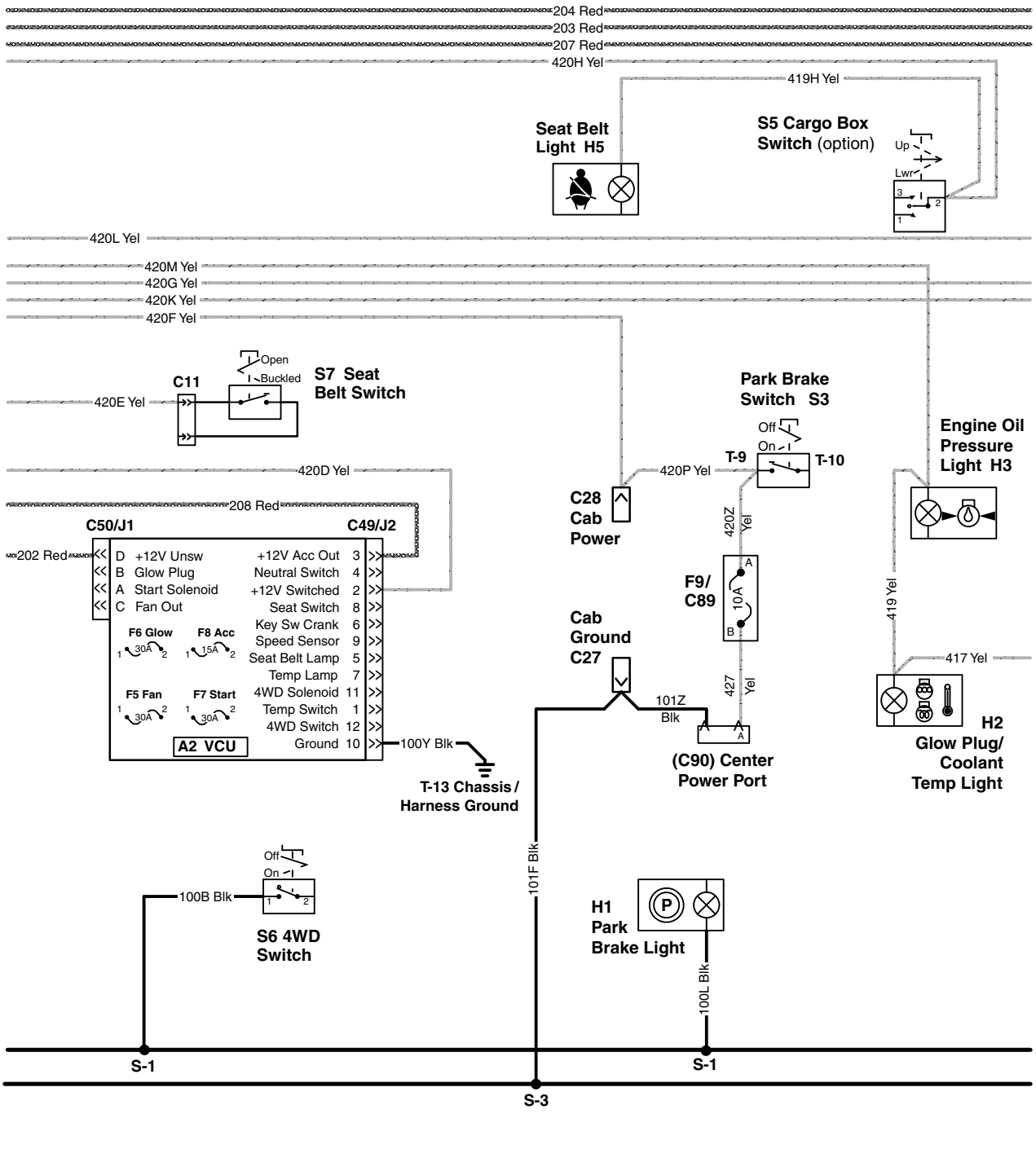
(SN 110001-120000) 1 of 3



Continued on next page

MX52301,00006C6 -19-24OCT14-1/6

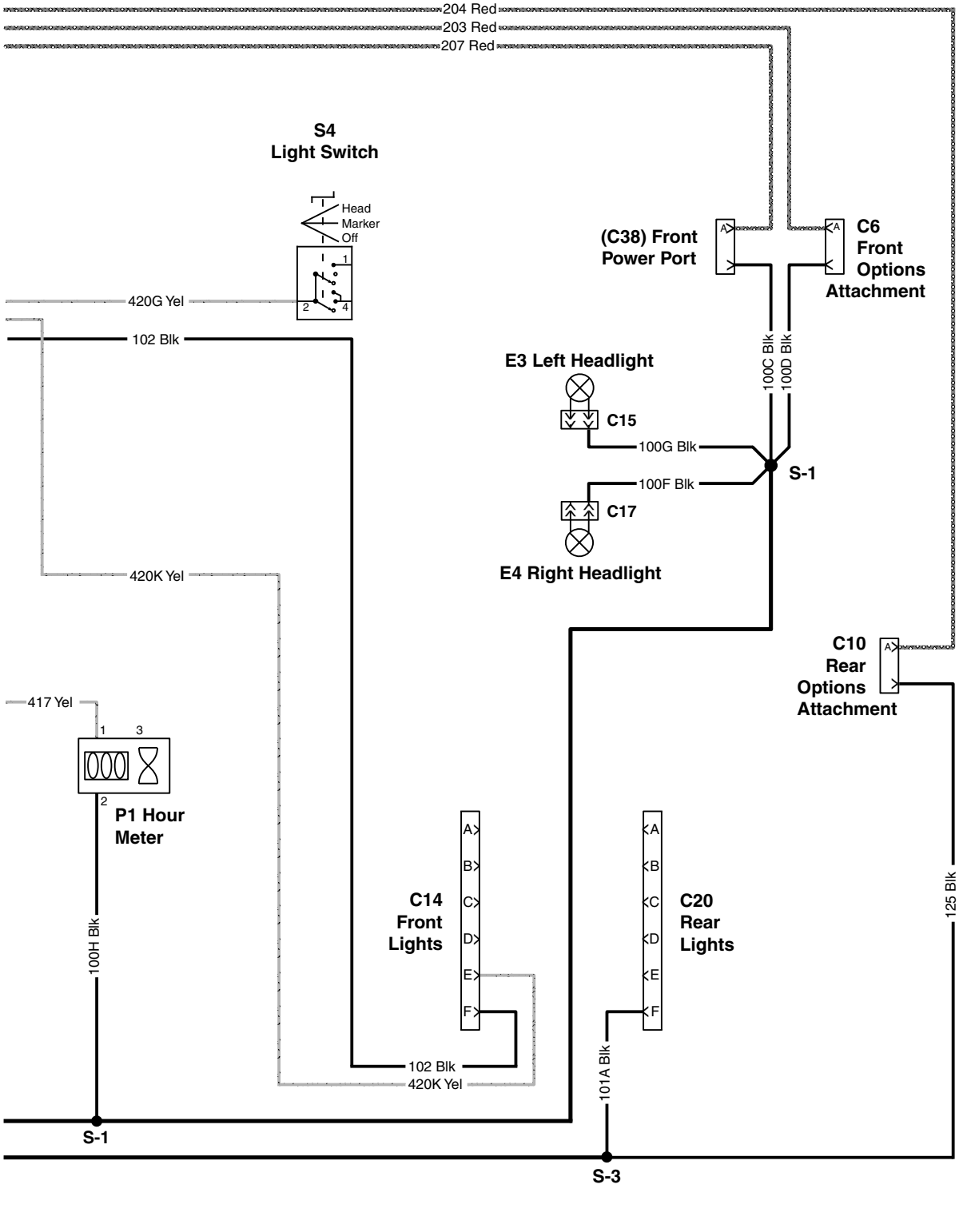
Power Circuit Schematic, Diesel (SN 110001-120000) 2 of 3



Continued on next page

MX52301,00006C6 -19-24OCT14-2/6

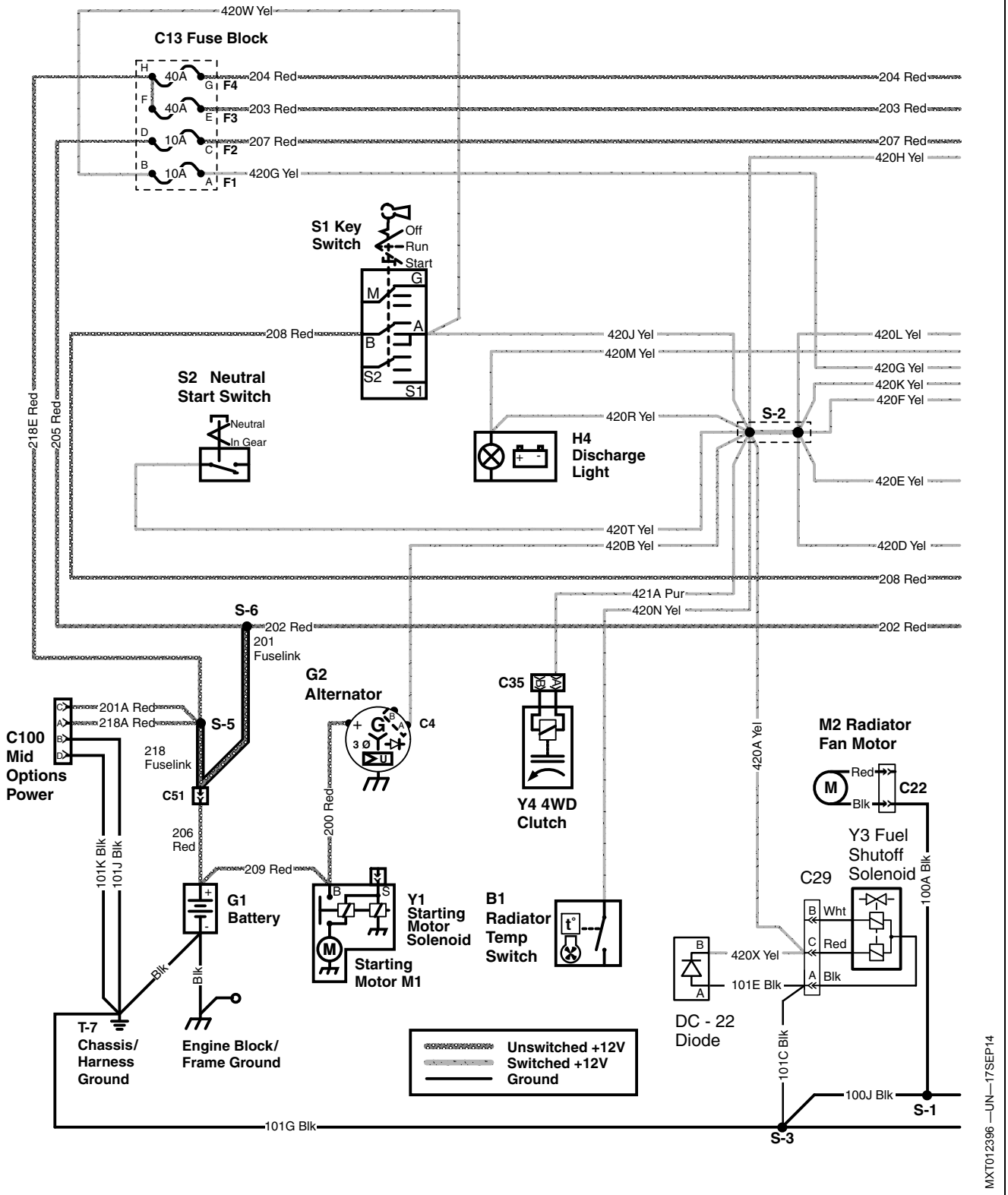
Power Circuit Schematic, Diesel (SN 110001-120000) 3 of 3



Continued on next page

MX52301,00006C6 -19-24OCT14-3/6

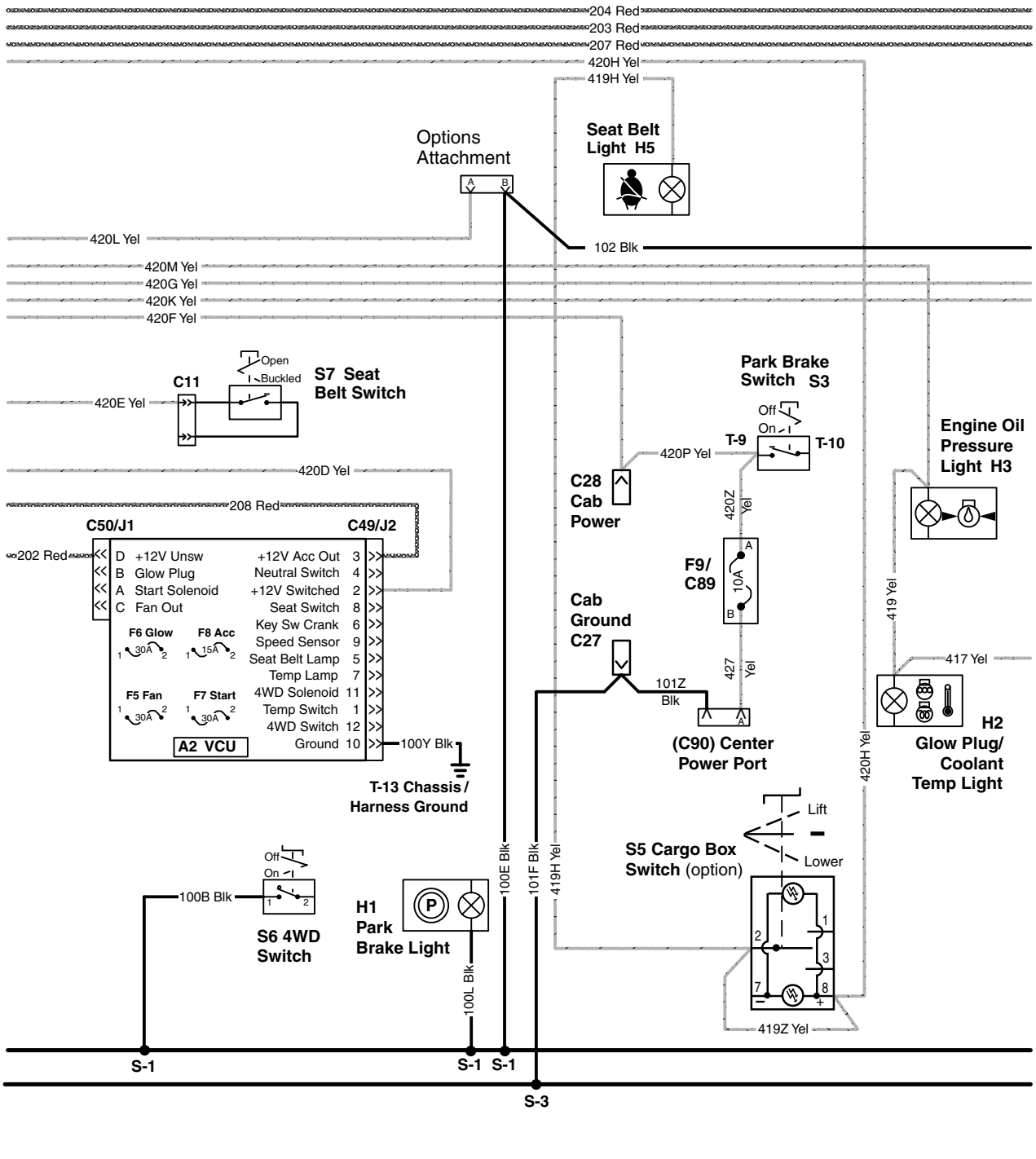
Power Circuit Schematic, Diesel (SN 120001-) 1 of 3



Continued on next page

MX52301,00006C6 -19-24OCT14-4/6

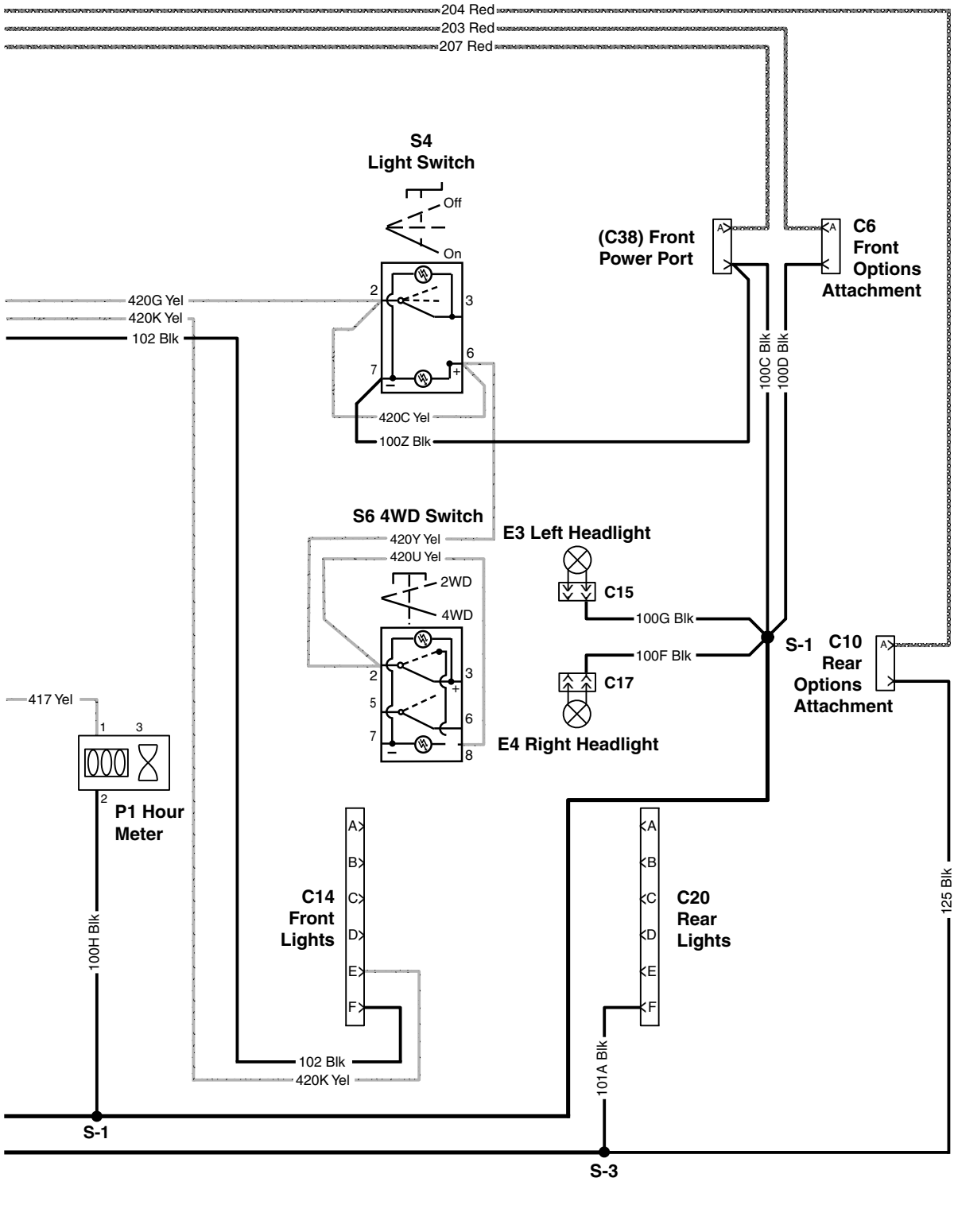
Power Circuit Schematic, Diesel (SN 120001-) 2 of 3



Continued on next page

MX52301,00006C6 -19-24OCT14-5/6

Power Circuit Schematic, Diesel (SN 120001-) 3 of 3



MX52301,00006C6 -19-24OCT14-6/6

Power Circuit Diagnosis, Diesel (SN 110001-)

MX52301,00006C7 -19-24OCT14-1/1

Cranking Circuit Operation, Gas (All), Diesel (SN -080000)

Function:

To engage the starter motor by energizing the starter motor solenoid.

In addition:

The circuit tests the engine coolant temperature bulb, and, on diesel engines, supplies current to the fuel shutoff solenoid pull-in coil.

Operating Conditions:

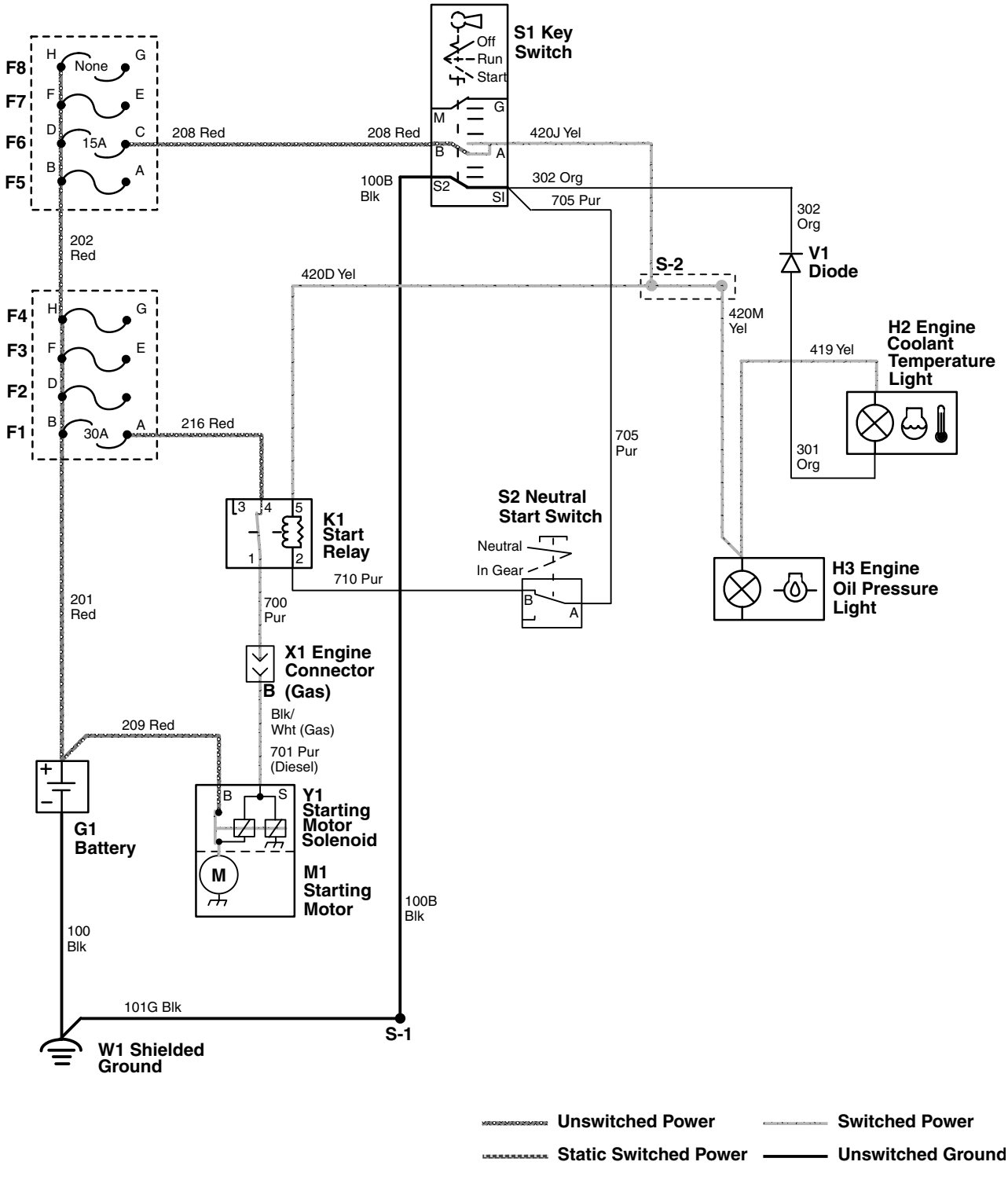
- Transmission must be in NEUTRAL.
- Key switch must be in the START position.

Theory of Operation:

The starter solenoid is used to switch the high starter motor current. The start relay is used to switch the starter solenoid. The start relay is energized when the neutral switch is closed (transmission in neutral) and the key switch is turned to start.

KK36721,0000125 -19-24OCT14-1/1

Cranking Circuit Schematic, Gas and Diesel (SN -040000)



MXT011956 —UN—05JUN14

MX52301,0000114 -19-24OCT14-1/1

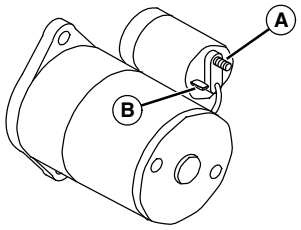
Cranking Circuit Diagnosis, Gas, and Diesel (SN -040000)

Cranking Circuit Diagnosis (Gas and Diesel Engines SN -040000)

MX52301,0000115 -19-24OCT14-1/12

❶ Cranking Circuit

MX52301,0000115 -19-24OCT14-2/12

Starting Motor Solenoid	**Test Procedure A:** **Test Conditions:** • Park brake locked. • Cargo Box raised and locked • Hood open and storage tray removed. • Transmission in neutral. • Battery fully charged. • Spark plug wires disconnected and grounded to frame. (Gas engines) • Disconnect fuel solenoid. (Diesel engines) • Key switch in the start position during each test step. Is battery voltage present at B terminal of Y1 starting motor solenoid (A)?  MXT011957 —UN—03JUL14 **A—B Terminal of Y1 Starting Motor Solenoid** **B—S Terminal of Starting Motor Solenoid**	**YES:** Go to next step. **NO:** Check battery cables and connections. Test battery. See Battery Load Test.

MX52301,0000115 -19-24OCT14-3/12

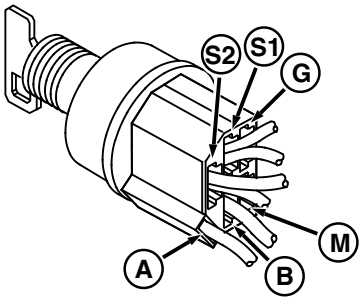
Starting Motor Solenoid	Is battery voltage present at S terminal of starting motor solenoid (B)?	**YES:** Cranking circuit is operating properly. Go to next step **NO:** Skip next step and continue tests.

Continued on next page

MX52301,0000115 -19-24OCT14-4/12

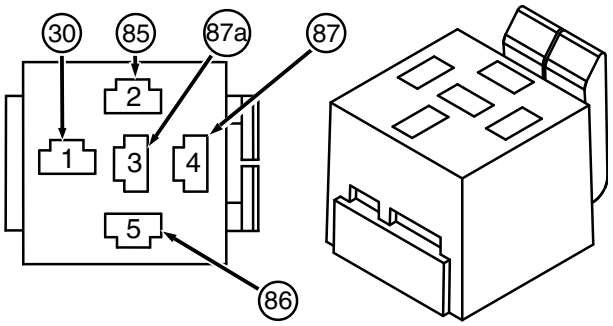
Starting Motor	Is starting motor cranking engine?	**YES:** Starting motor solenoid and motor are operating properly. To test H2 engine coolant light circuit, go to step 1 of engine coolant light circuit test, if OK, cranking circuit test complete. **NO:** Test starting motor solenoid. See Starting Motor Solenoid Test.

MX52301,0000115 -19-24OCT14-5/12

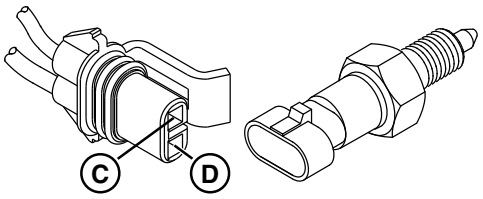
Key Switch	Is battery voltage present at B terminal of S1 key switch, 208 Red wire (B)?  MXT004463 —UN—31MAY12 **B—208 Red Wire**	**YES:** Go to next step. **NO:** See Power Circuit Diagnosis, Gas (SN -040001) Section 50 Group 55 or Power Circuit Diagnosis, Diesel (SN -040000) Section 50 Group 55.

Continued on next page

MX52301,0000115 -19-24OCT14-6/12

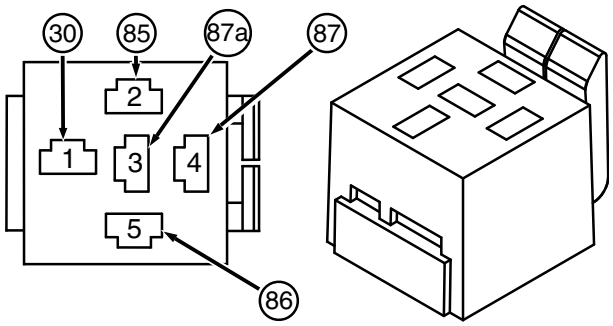
Start Relay Connector	Remove K1 start relay. With key switch in start position, is battery voltage present at terminal 5 (86) of K1 start relay connector, 420D Yel wire?  MXT011889 —UN—09JUL14 **5 (86)—420D Yellow Wire**	**YES:** Install relay. Go to next step. **NO:** Test key switch. See Key Switch Test.

MX52301,0000115 -19-24OCT14-7/12

Neutral Start Switch	Disconnect S2 neutral start switch. With key switch in start position, is continuity to ground present at A terminal S2 neutral start switch connector, 705 Pr wire (C)?  MXT011907 —UN—04JUN14 **C—705 Purple Wire**	**YES:** Connect neutral start switch. Go to next step. **NO:** Test key switch. See Key Switch Test.

Continued on next page

MX52301,0000115 -19-24OCT14-8/12

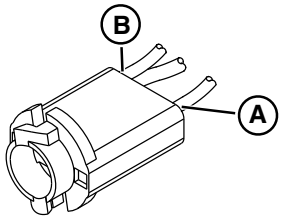
Start Relay	Remove K1 start relay. With key switch in start position, is continuity to ground present at terminal 2 (85) of K1 start relay, 710 Pur wire?  MXT011889 —UN—09JUL14 **2 (85)—710 Purple Wire**	**YES:** Install relay. Test neutral start switch. See Neutral Start Switch Test. If neutral start switch is OK, test start relay. See Relay Test. **NO:** Cranking circuit test complete. To test H2 engine coolant light circuit, go to step 1 of engine coolant light circuit test, if OK, cranking circuit test complete.

MX52301,0000115 -19-24OCT14-9/12

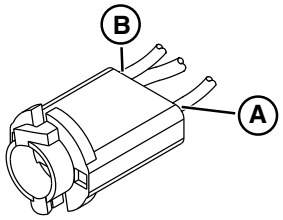
❶ Engine Coolant Circuit Check

Continued on next page

MX52301,0000115 -19-24OCT14-10/12

Engine Temperature Light Socket	**Test Procedure B:** **Test Conditions:** • Park brake locked. • Hood open and storage tray removed. • Transmission in neutral. • Battery fully charged. • X1 engine connector disconnected. • Key switch in the start position during each test step. Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire (A)? Is H2 engine coolant temperature light illuminated?  MXT011522 —UN—11JUN14 **A—419 Yellow Wire**	**YES:** Both conditions are yes. Circuit is operating properly. Test complete. **NO:** No voltage. Test key switch. See Key Switch Test. Check 420J, 420M, and 419 Yel wires and connections. Repair as needed and retest. **NO:** Light not illuminated. Test H2 engine coolant temperature bulb. See Bulb Test. If bulb is OK, go to next step.

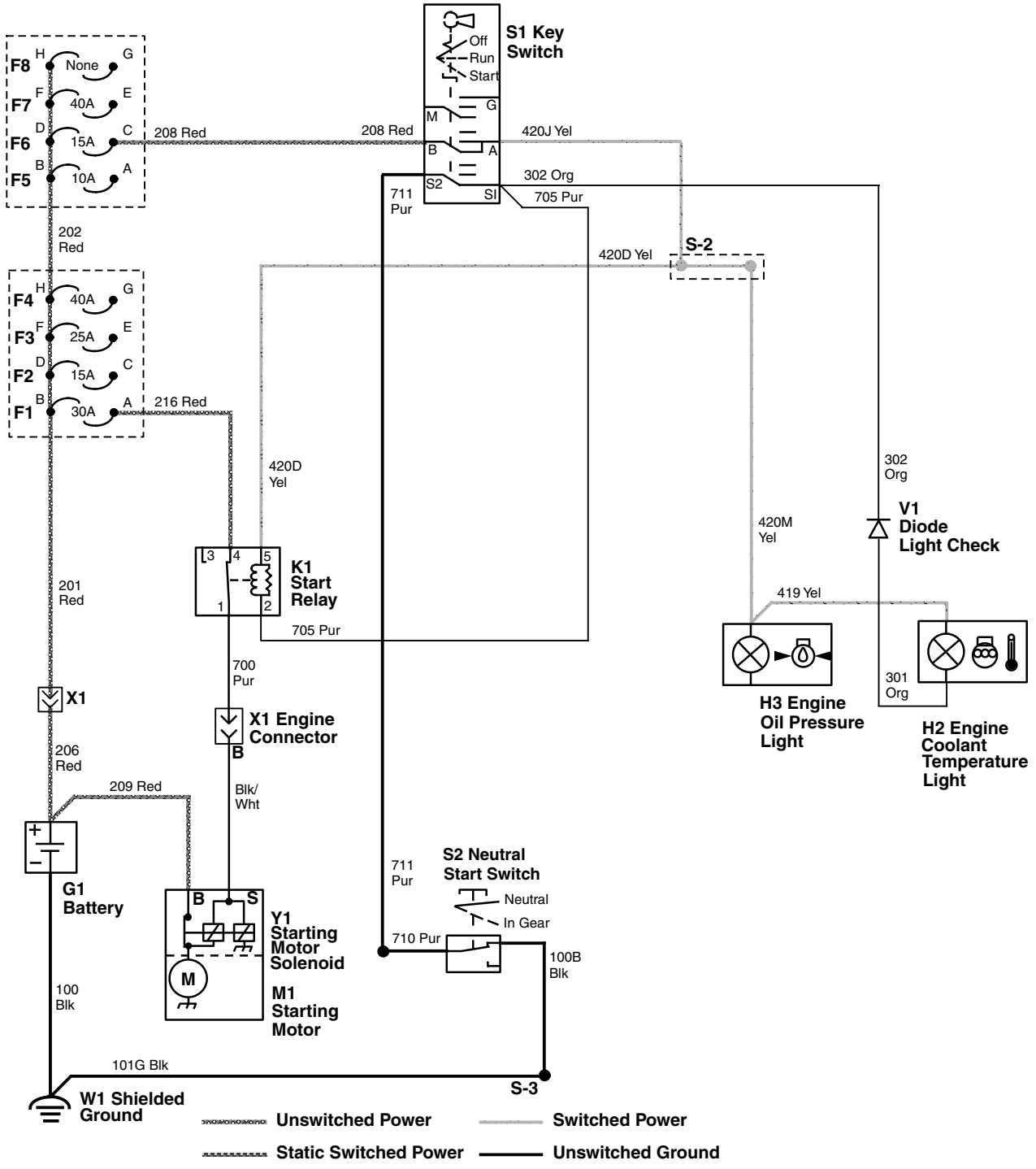
MX52301,0000115 -19-24OCT14-11/12

Engine Coolant Temperature Light Socket	Is continuity to ground present at H2 engine coolant temperature light socket, 301 Org wire (B)?  MXT011522 —UN—11JUN14 **B—301 Orange Wire**	**YES:** Test complete. **NO:** Test V1 diode. See Diode Test. Test key switch. See Key Switch Test. Check 302 Org, 100B and 101G Blk wires and connections.

MX52301,0000115 -19-24OCT14-12/12

Cranking Circuit Schematic, Gas (SN 040001-), Diesel (SN 040001-080000)

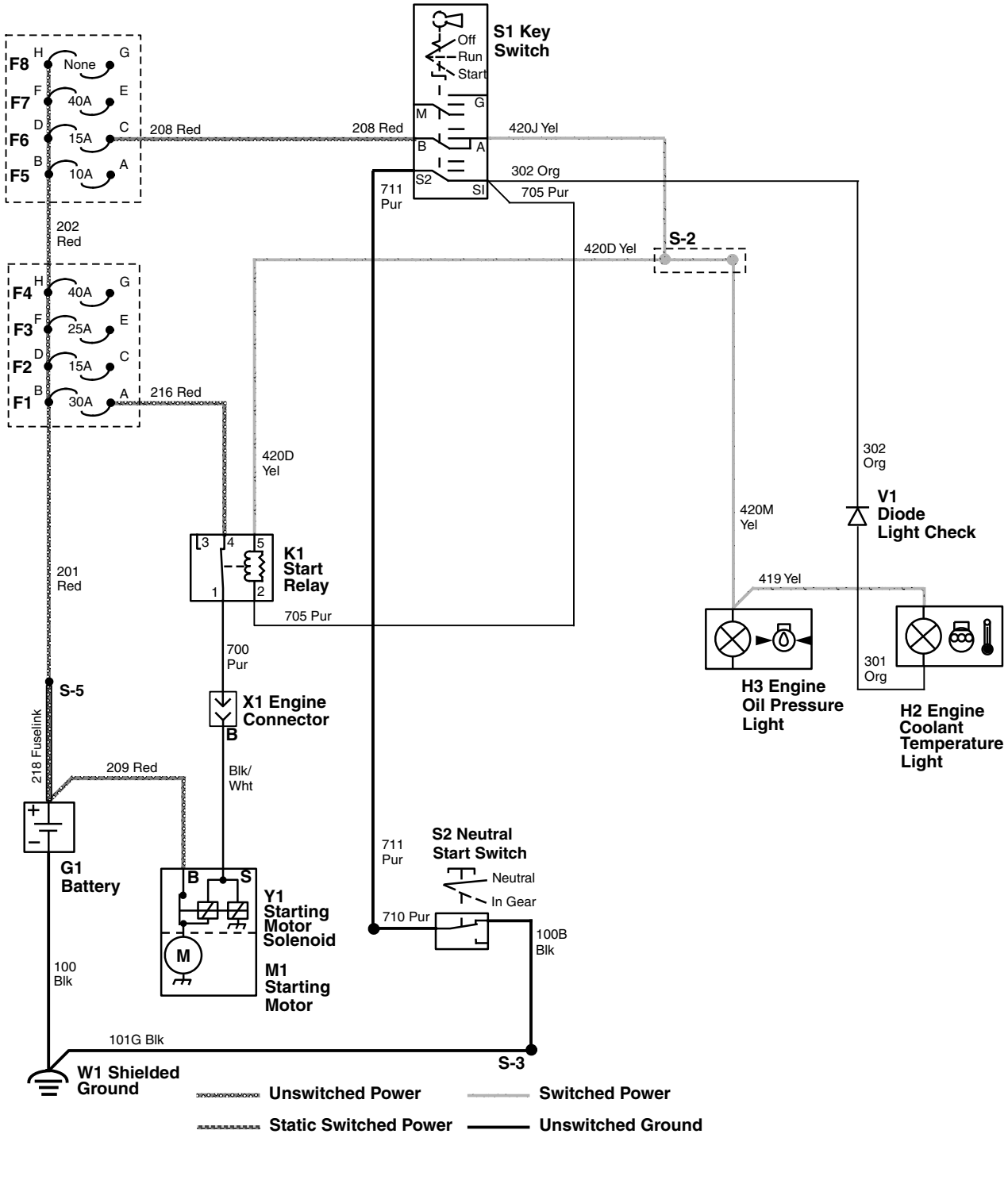
Cranking Circuit Schematic Diesel (SN 040001-080000)



Continued on next page

MX52301,0000116 -19-24OCT14-1/3

Cranking Circuit Schematic Gas (SN 040001-110000)

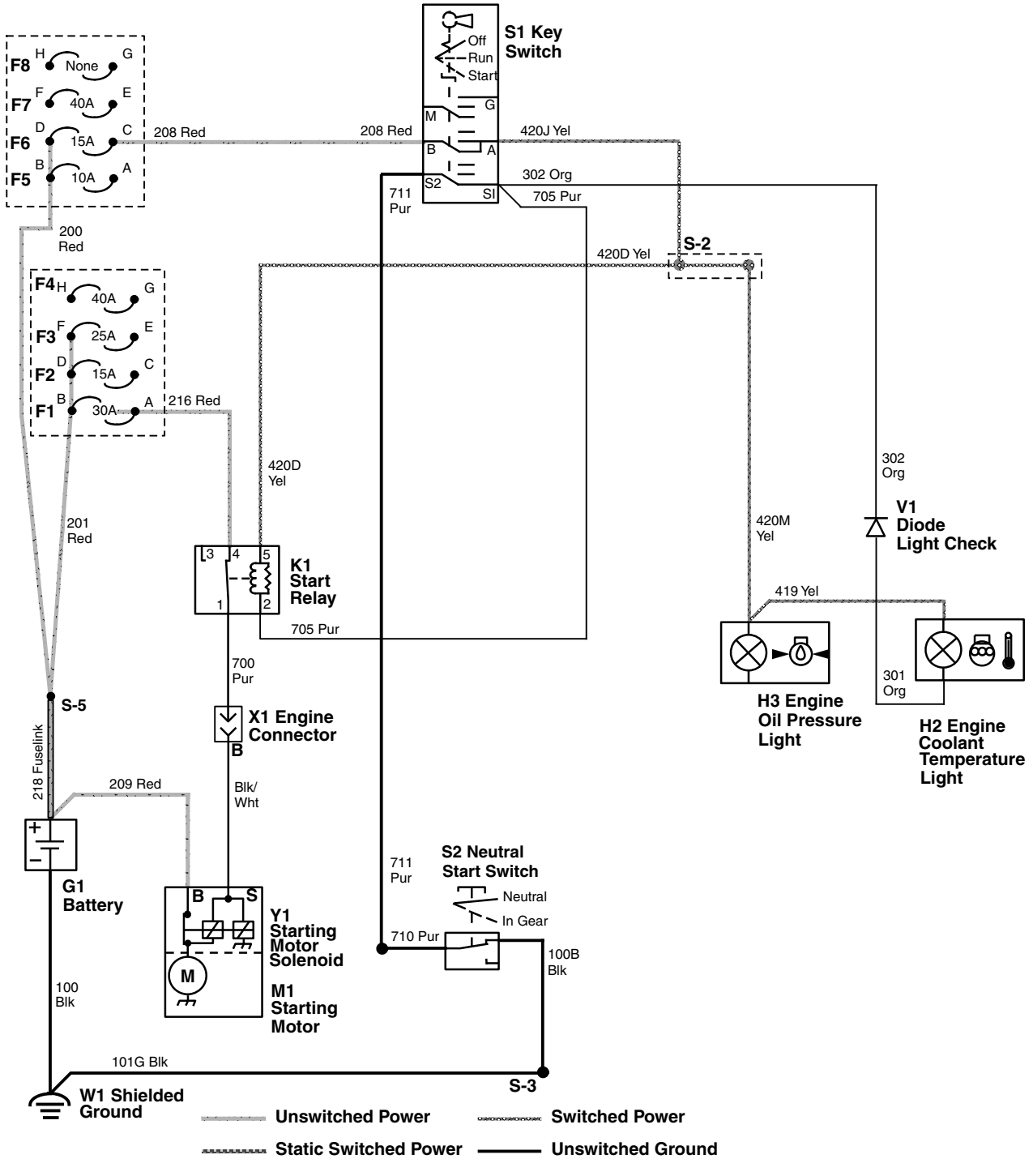


MXT012318 —UN—16SEP14

Continued on next page

MX52301,0000116 -19-24OCT14-2/3

Cranking Circuit Schematic Gas (SN 110001-)



MX52301,0000116 -19-24OCT14-3/3

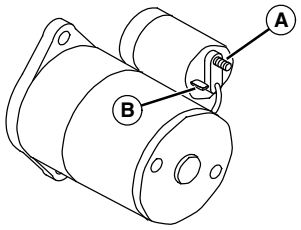
Cranking Circuit Diagnosis, Gas (SN 040001-), Diesel (SN 040001-080000)

Cranking Circuit Diagnosis (Gas Engines SN 040001-) (Diesel Engines 040001-080000)

MX52301,0000117 -19-24OCT14-1/13

❶ Cranking Circuit

MX52301,0000117 -19-24OCT14-2/13

Starting Motor Solenoid	**Test Procedure A:** **Test Conditions:** • Park brake locked. • Cargo Box raised and locked • Hood open and storage tray removed. • Transmission in neutral. • Battery fully charged. • Spark plug wires disconnected and grounded to frame. (Gas engines) • Disconnect fuel solenoid. (Diesel engines) • Key switch in the start position during each test step. Is battery voltage present at starting motor solenoid terminal (A)?  MXT011957 —UN—03JUL14 **A—Battery Terminal of Y1 Starting Motor Solenoid** **B—S Terminal of Starting Motor Solenoid**	**YES:** Go to next step. **NO:** Check battery cables and connections. Test battery. See Battery Load Test.

MX52301,0000117 -19-24OCT14-3/13

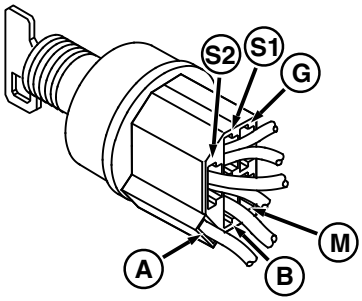
Starting Motor Solenoid	Is battery voltage present at starting motor solenoid terminal (B)?	**YES:** Cranking circuit is operating properly. Go to next step **NO:** Skip next step and continue tests.

Continued on next page

MX52301,0000117 -19-24OCT14-4/13

Starting Motor	Is starting motor cranking engine?	**YES:** Starting motor solenoid and motor are operating properly. To test H2 engine coolant light circuit, go to step 1 of engine coolant light circuit test, if OK, cranking circuit test complete. **NO:** Test starting motor solenoid. See Starting Motor Solenoid Test.

MX52301,0000117 -19-24OCT14-5/13

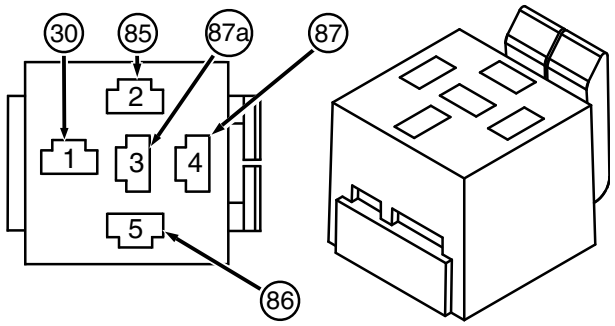
Key Switch	Is battery voltage present at B terminal of S1 key switch, 208 Red wire (B)?  MXT004463 —UN—31MAY12 **B—208 Red Wire**	**YES:** Go to next step. **NO:** See Power Circuit Operation, Gas (SN 040001-) or See Power Circuit Operation, Diesel (SN -080000).

Continued on next page

MX52301,0000117 -19-24OCT14-6/13

Start Relay Connector

Remove K1 start relay. With key switch in start position, is battery voltage present at terminal 5 (86) of K1 start relay connector, 420D Yel wire?



MXT011889 —UN—09JUL14
5 (86)—420D Yellow Wire
2 (85)—705 Purple Wire

YES: Go to next step.

NO: Test key switch. See Key Switch Test. Check 420J and 420D Yel wires.

MX52301,0000117 -19-24OCT14-7/13

Start Relay

With key switch in start position and transmission in neutral, is continuity to ground present at terminal 2 (85) of K1 start relay, 705 Pur wire?

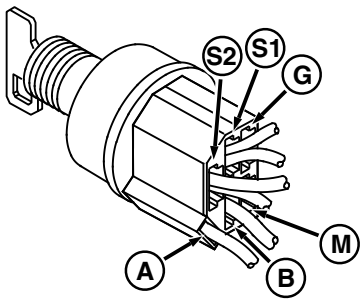
YES: Install relay. Test neutral start switch. See Neutral Start Switch Test. If neutral start switch is OK, test start relay. See Relay Test.

NO: Go to next step.

MX52301,0000117 -19-24OCT14-8/13

Key Switch

With transmission in neutral, is continuity to ground present at terminal **(S2)** of S1 key switch, 711 Pur wire?



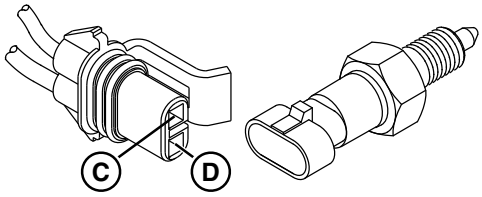
MXT004463 —UN—31MAY12
S2—711 Key Switch

YES: Test key switch. See Key Switch Test.

NO: Go to next step.

Continued on next page

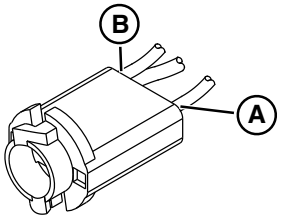
MX52301,0000117 -19-24OCT14-9/13

Neutral Start Switch	Disconnect S2 neutral start switch. is continuity to ground present at A terminal S2 neutral start switch connector, 705 Pur wire (C)?	**YES:** Test neutral start switch. See Neutral Start Switch Test. Cranking circuit test complete. To test H2 engine coolant light circuit, go to step 1 of engine coolant light circuit test, if OK, cranking circuit test complete.
	 MXT011907—UN—04JUN14 **C—705 Purple Wire**	**NO:** Check 100B and 101G wires and connections.

MX52301,0000117 -19-24OCT14-10/13

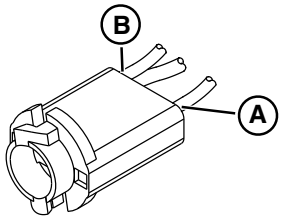
❶ Engine Coolant Circuit Check

MX52301,0000117 -19-24OCT14-11/13

Engine Temperature Light Socket	**Test Procedure B:** **Test Conditions:** • Park brake locked. • Hood open and storage tray removed. • Transmission in neutral. • Battery fully charged. • X1 engine connector disconnected.	**YES:** Both conditions are yes. Circuit is operating properly. Test complete.
	• Key switch in the start position during each test step.	**NO:** No voltage. Test key switch. See Key Switch Test. Check 420J, 420M, and 419 Yel wires and connections. Repair as needed and retest.
	Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire (A)? Is H2 engine coolant temperature light illuminated?  MXT011522—UN—11JUN14 **A—419 Yellow Wire**	**NO:** Light not illuminated. Test H2 engine coolant temperature bulb. See Bulb Test. If bulb is OK, go to next step.

Continued on next page

MX52301,0000117 -19-24OCT14-12/13

Engine Coolant Temperature Light Socket	With key switch in start position and transmission in neutral, Is continuity to ground present at H2 engine coolant temperature light socket, 301 Org wire (B)?  MXT011522 —UN—11JUN14 **B—301 Orange Wire**	**YES:** Ground circuit is functional. Check the bulb and bulb socket. **NO:** Test V1 diode. See Diode Test. Test key switch. SEE. Check 302 Org, 100B and 101G Blk wires and connections.

MX52301,0000117 -19-24OCT14-13/13

Cranking Circuit Operation, Diesel (SN 080001-)

Function:

To engage the starter motor by energizing the starter motor solenoid.

The circuit also tests the seat belt light.

Operating Conditions:

- Transmission must be in neutral.
- Key switch turned to the START position.

Theory of Operation:

The starter solenoid is used to switch the high starter motor current. The VCU is used to switch the starter solenoid.

Before the start solenoid is energized, the VCU must first receive the correct signals from these inputs:

- Key “ON” power (key switch in RUN or START).
- Neutral switch closed (transmission in neutral).
- Key switch cranking (key switch in START).

With all conditions met, the VCU activates an onboard start relay. This relay connects unswitched power from fuse F7 to the starting motor solenoid.

MX52301,0000118 -19-24OCT14-1/1

Seat Belt Circuit Operation, Diesel (SN 080001-)

Function:

To indicate that the seat belt is properly fastened.

Operating Conditions:

- Key switch in RUN position

Theory of Operation

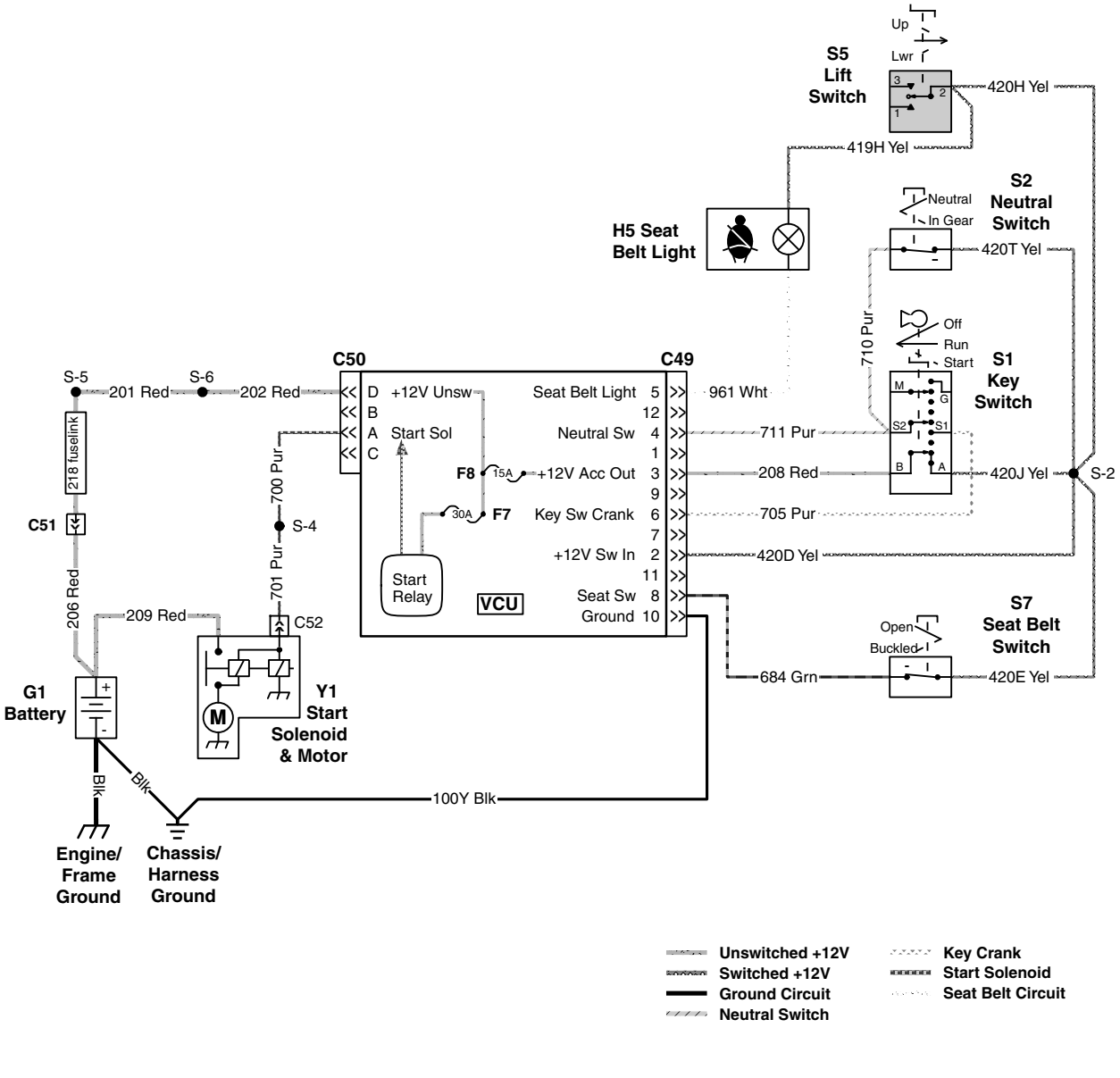
The VCU monitors the state of the seat belt switch. If the seat belt is sensed to be unbuckled (switch open), the VCU responds by activating the seat belt light.

The VCU provides a visual check of the seat belt when the key switch is in the START position.

MX52301,0000119 -19-24OCT14-1/1

Cranking and Seat Belt Circuit Schematic, Diesel (SN 080001-)

Cranking and Seat Belt Circuit Schematic (Diesel Engines 080001-120000)



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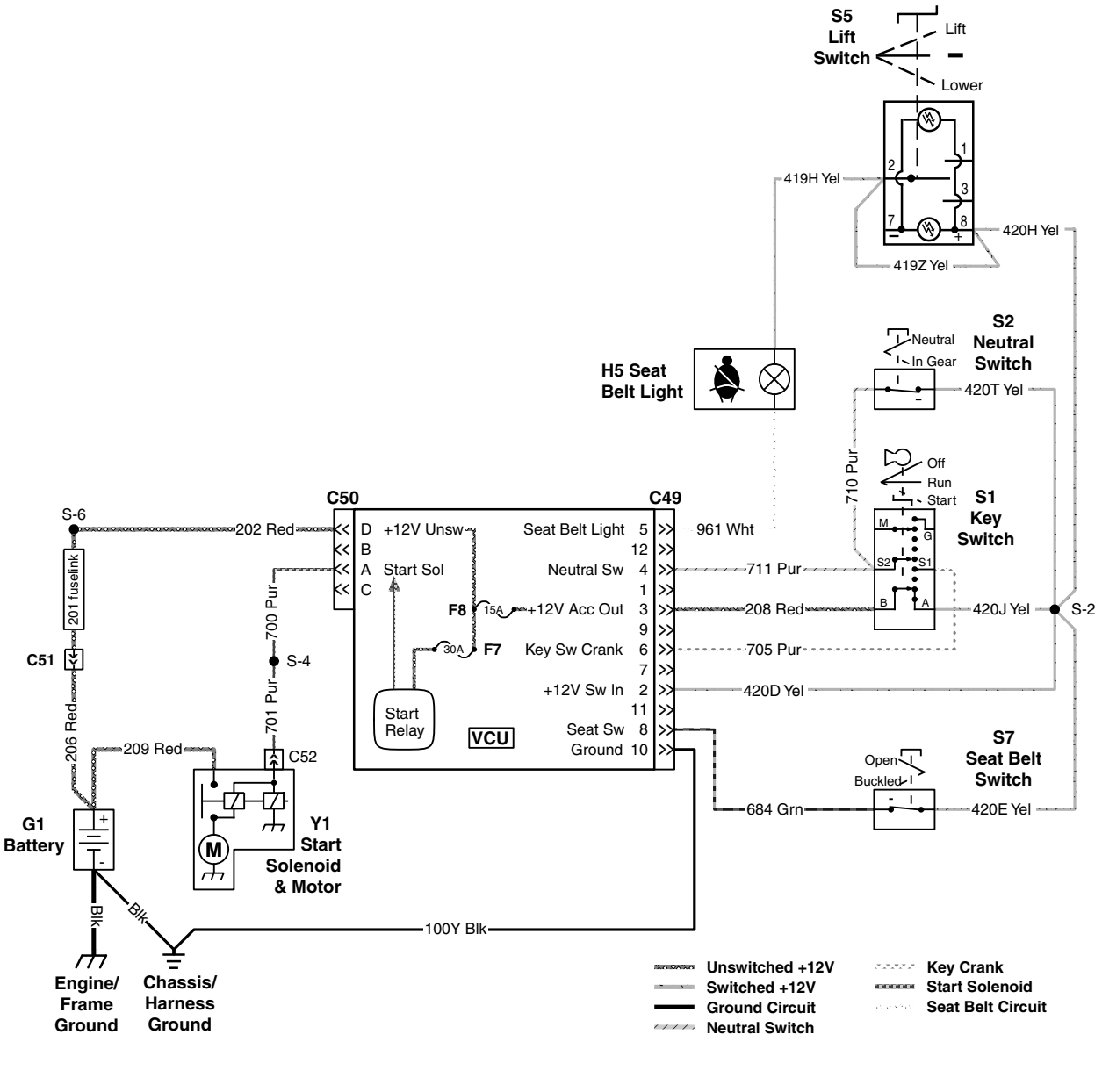
MX52301,000011A -19-24OCT14-1/2

Cranking and Seat Belt Circuit Schematic, Diesel (SN 120001-)



MX52301,000011A -19-24OCT14-2/2

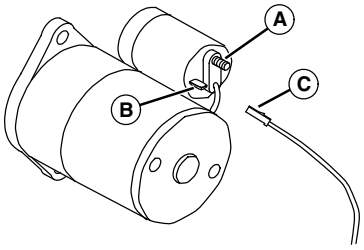
Cranking Circuit Diagnosis, Diesel (SN 080001-)

Cranking Circuit Diagnosis (Diesel Engines 080001-)

MX52301,000011B -19-24OCT14-1/15

❶ Cranking Circuit

MX52301,000011B -19-24OCT14-2/15

Starting Motor Solenoid Battery Terminal	**Test Procedure A:** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Cargo Box raised and locked • Battery fully charged. • Unplug fuel solenoid connector. • Open hood and remove storage tray. • Key switch position as directed. Key switch OFF. Is battery voltage present at the starting motor solenoid battery terminal (A)?  MXT011529 —UN—06JUN14 **A—Terminal** **B—Starter Motor Solenoid** **C—701 Purple Wire**	**YES:** Go to next step. **NO:** Check battery cables and connections. Test battery. See Battery Load Test.

MX52301,000011B -19-24OCT14-3/15

Starter Motor Solenoid	Unplug connector C52, 701 Pur wire (C) from starter solenoid (B). Key switch to START. Is battery voltage present at (C)?	**YES:** Cranking circuit is operational. Go to next step. **NO:** Circuit malfunction. Skip to Test Procedure B.

MX52301,000011B -19-24OCT14-4/15

Starting Motor	Reattach connector (C) to starter solenoid (B). Key switch to START. Is starting motor cranking engine?	**YES:** Starting solenoid and motor are operating properly. Go to next step. **NO:** Test starting motor solenoid. See Starting Motor Solenoid Test.

Continued on next page

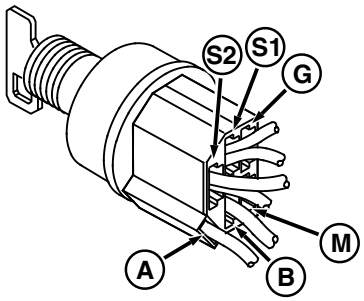
MX52301,000011B -19-24OCT14-5/15

Seat Belt	Key switch to START. Does seat belt light come on?	**YES:** Cranking test complete. Reconnect fuel solenoid. **NO:** See Seat Belt Circuit Diagnosis, Diesel (SN 080001-) Group 50 Section 55.

MX52301,000011B -19-24OCT14-6/15

❶ Cranking Circuit

MX52301,000011B -19-24OCT14-7/15

Key Switch Connector	**Test Procedure B:** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Cargo Box raised and locked • Battery fully charged. • Unplug fuel solenoid connector. • Open hood and remove storage tray. • Key switch position as directed. Is battery voltage present at key switch connector 208 Red wire (B)?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire** **B—208 Red Wire** **S1—705 Purple wire** **S2—710 and 711 Purple Wire**	**YES:** Go to next step. **NO:** Check F8 fuse, Red wires 201, 202, 206, 208 and fuse link 218. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.

MX52301,000011B -19-24OCT14-8/15

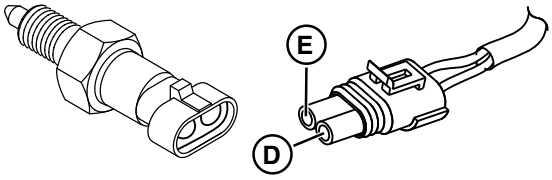
Key Switch	Key switch to RUN. Is battery voltage present at 420J Yel wires (A)?	**YES:** Go to next step. **NO:** See Key Switch Test.

Continued on next page

MX52301,000011B -19-24OCT14-9/15

Key Switch

With transmission in neutral, is battery voltage present at 710 and 711 Pur wires (S2)?



MXT011531 —UN—11JUN14
D—710 Purple wire Neutral Switch Connector
E—420T Yellow Wire Neutral Switch Connector

YES: Go to next step.

NO: See Neutral Start Switch Test.

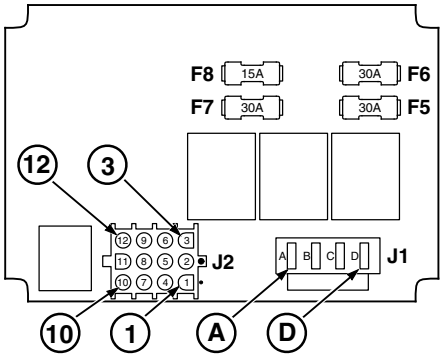
NO: Check 710 Pur wire continuity from (S2) to the neutral switch connector (D).

NO: Check for voltage at the neutral switch connector 420T Yel wire (E). Check 420T and 420J Yel wires from (E) to (A).

MX52301,000011B -19-24OCT14-10/15

VCU Connector

Key switch to RUN. Is battery voltage present at VCU connector **(J2-2)** 420D Yel wire and **(J2-4)** 711 Pur wire?



MXT011938 —UN—04JUN14
J1-A— 700 Purple Wire
J2-2— 420D Yellow Wire
J2-4— 711 Purple Wire
J2-6— 705 Purple Wire
J2-10— 100Y Black Wire

YES: Go to next step.

NO: Check 420D and 420J Yel wires from VCU **(J2-2)** to key switch **(A)**.

NO: Check 711 Pur wire continuity from VCU **(J2-4)** to key switch **(S2)**.

Continued on next page

MX52301,000011B -19-24OCT14-11/15

VCU Connector	Key switch to OFF. Is there continuity between **(J2-10)**100Y Blk wire and **ground**?	**YES:** Go to next step. **NO:** Check 100Y Blk wire and connections.

MX52301,000011B -19-24OCT14-12/15

VCU Connector	Key switch to START. Is battery voltage present at **key switch** connector 705 Pur wire **(S1)**?	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test.

MX52301,000011B -19-24OCT14-13/15

VCU Connector	Key switch to START. Is battery voltage present at VCU connector **(J2-6)**, 705 Pur wire?	**YES:** Go to next step. **NO:** Check 705 Pur wire continuity from VCU **(J2-6)** to key switch **(S1)**.

MX52301,000011B -19-24OCT14-14/15

VCU Connector	Key switch to START. Is battery voltage present at **(J1-A)**?	**YES:** Check 700 and 701 Pur wires from VCU **(J1-A)**to starter solenoid connector **(C)**. **NO:** Check F7 fuse. If OK, and all power, ground, and input connections and readings are correct, replace VCU.

MX52301,000011B -19-24OCT14-15/15

Seat Belt Circuit Diagnosis, Diesel (SN 080001-)

Seat Belt Circuit Diagnosis (Diesel Engines 080001-)

MX52301,000011C -19-02SEP15-1/5

❶ Seat Belt Circuit:

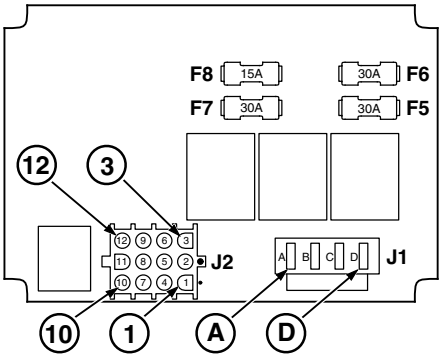
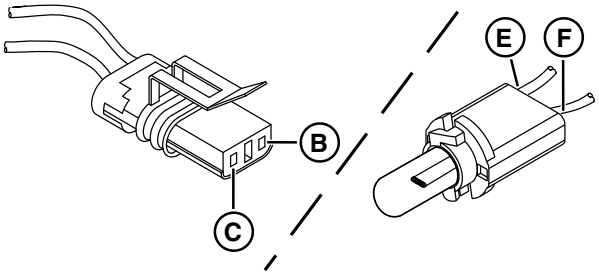
Continued on next page

MX52301,000011C -19-02SEP15-2/5

ECM Connector	**Test Procedure:** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Battery fully charged. • Open hood and remove storage tray.	**YES:** Go to next step.
	• Seat belt buckled and unbuckled as directed.	**YES:** Go to next step. **NO:** (Seat belt light OFF) Check H5 seat belt light. See Bulb Test. **NO:** Confirm that belt buckle is properly seated in belt latch. Test seat belt switch. See Seat Belt Switch Test.
	• Key switch position as directed.	**NO:** (Seat belt light OFF) Check continuity of 961 Wht wire from **(J2-5)** to H5 seat belt light socket **(E)**. **NO:** Check 684 Grn wire continuity from **(J2-8)** to seat belt switch harness connector **(B)**.

Continued on next page

MX52301,000011C -19-02SEP15-3/5

	Key switch to RUN; seat belt BUCKLED. Is battery voltage present at ECM connector **(J2-8)**, 684 Grn wire?  MXT011938 —UN—04JUN14  MXT011534 —UN—18JUN14 **B—Seat Belt Switch Harness Connector** **C—420E Yellow Wire** **E—Seat Belt Light Socket** **F—419H Yellow Wire** **J2-5— 961 White Wire** **J2-8— 684 Green Wire**	**NO:** (Seat belt light OFF) Check H5 419H Yel wire **(F)** for power. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55. **NO:** Check for voltage at the seat belt switch harness connector 420E Yel wire **(C)**. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.
	Is battery voltage present at ECM connector **(J2-5)** 961 Wht wire?	**NO:** (Seat belt light ON) Check 961 Wht wire for shorts.

MX52301,000011C -19-02SEP15-4/5

Seat Belt Light	Key switch to RUN. Unbuckle seat belt. Does seat belt light come on?	**YES:** Recheck all power, ground, and input connections and readings at ECM. If OK, replace module. **YES:** Test complete **NO:** Unplug seat belt switch. If light goes out, replace seat belt latch assembly. **NO:** Go to next step.
	Does voltage at **(J2-8)** measure zero (no voltage)?	**NO:** Check 684 Grn wire for shorts.

MX52301,000011C -19-02SEP15-5/5

Ignition Circuit Operation, Gas (All)

Function:

- To create a spark at the correct time that ignites the fuel/air mixture in the cylinder, keeping the engine running.
- To ground the ignition system in order to shut off the engine.

Operating Conditions:

- Key switch must be in the RUN or START position.
- Flywheel on engine must be rotating the reference point past the pulser coil.
- Pulser coil must be the proper distance from the reference point as it rotates past.

Theory of Operation:

The ignition system is a digitally controlled capacitive discharge design. The A1 ignitor module controls Ignition timing and is not adjustable. The engine is shut off by grounding both sides of the ignition coils through the A1 ignitor module.

When the key switch is in the START or RUN position, power is supplied from the G1 battery through 218 Fuselink (SN 040001-), 200 (SN110001-), 201 and 202 (SN -110000) Red wires, F6 fuse, S1 key switch, 420J Yel wire S-2 power splice, 420B Yel wire to the X1 engine connector and on to the A1 ignitor module.

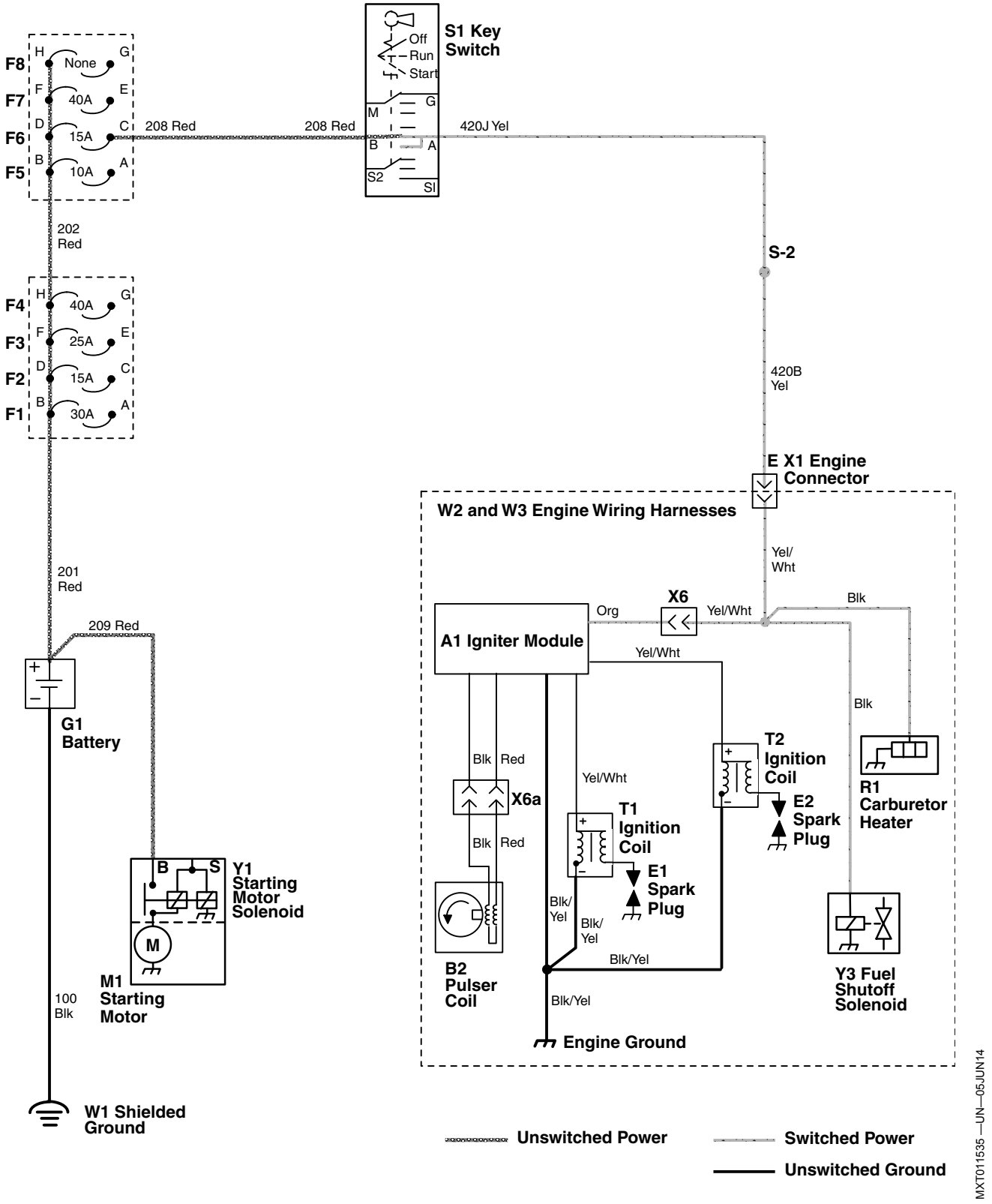
The A1 ignitor module controls spark timing by detecting raised reference points on the flywheel with a single pulser coil. Each cylinder is fired independently by the A1 ignitor module.

The engine is shut off by turning the key switch to the OFF position which, in turn, shuts off power to the A1 ignitor module. This grounds both sides of the T1 and T2 ignition coils and spark is no longer produced.

MX52301,000011D -19-22OCT14-1/1

Ignition Circuit Schematic, Gas (All)

Ignition Circuit Schematic (Gas Engine -040000)



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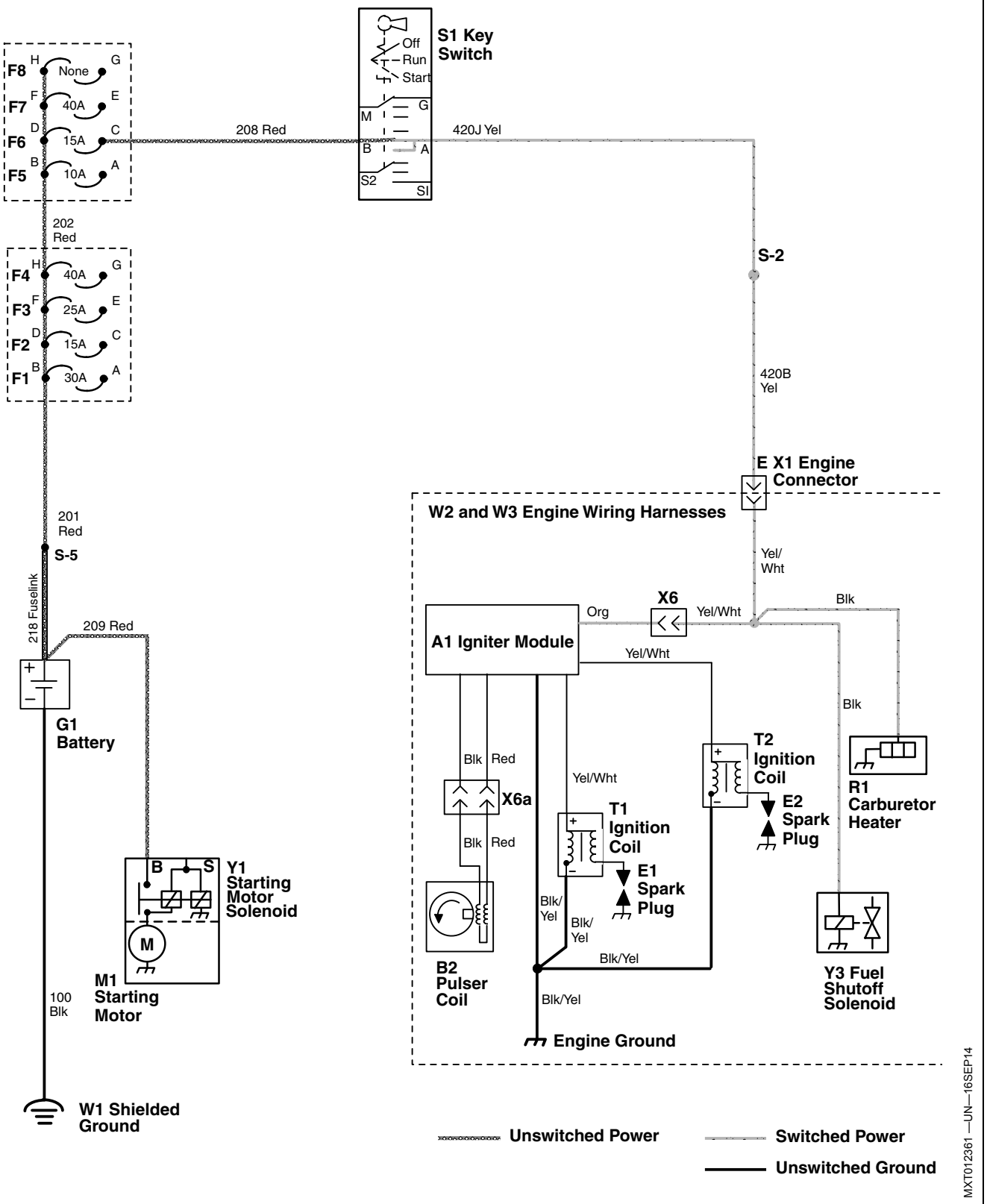
MG39705,00002D8 -19-02JAN20-1/3

Ignition Circuit Schematic (Gas Engine 040001-110000)



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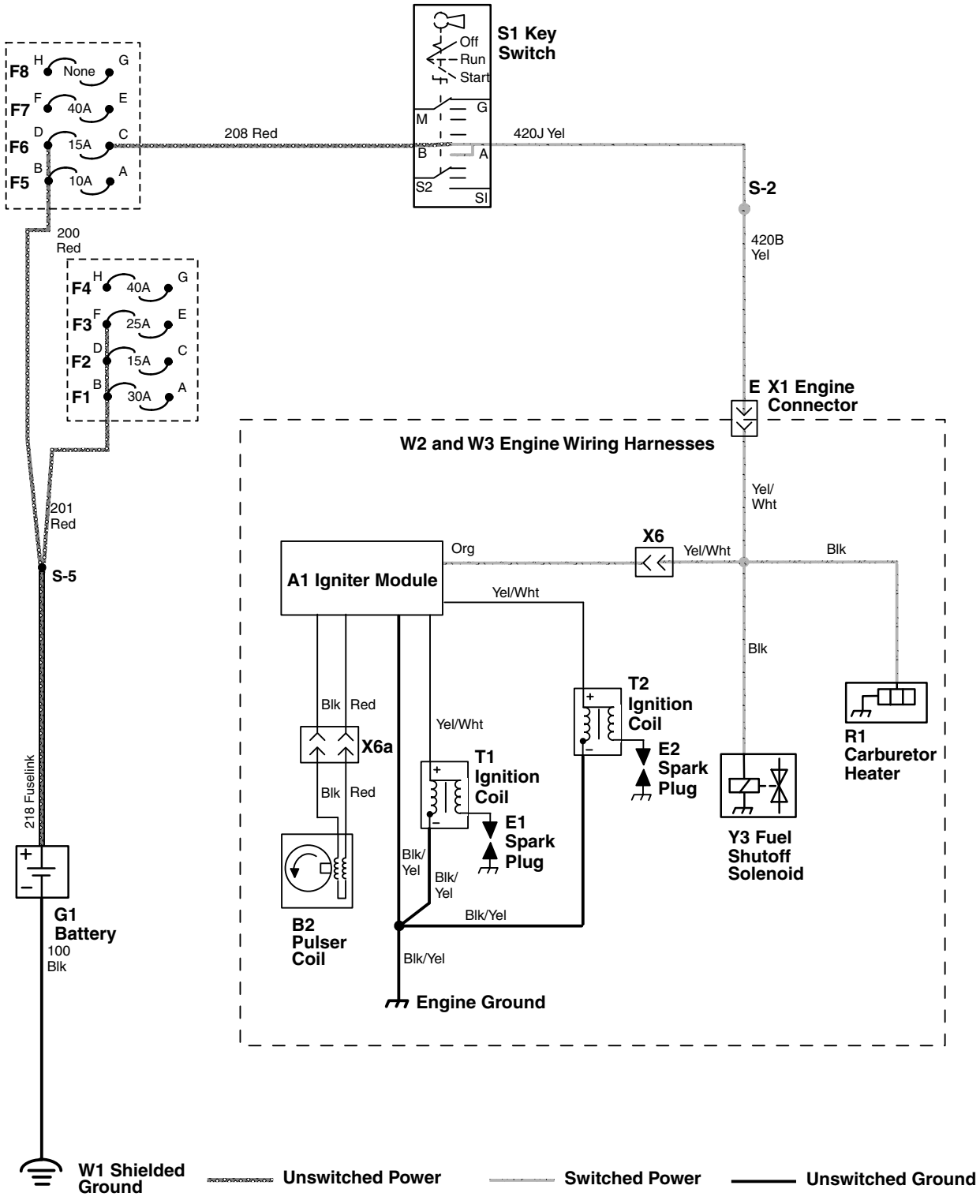
MG39705,00002D8 -19-02JAN20-2/3

Ignition Circuit Schematic (Gas Engine 110001-)



MG39705,00002D8 -19-02JAN20-3/3

Ignition Circuit Diagnosis, Gas (All)

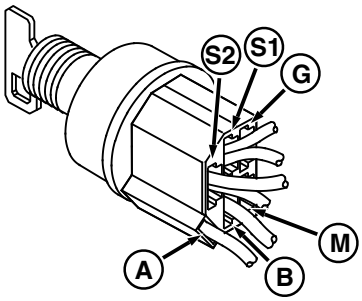
Ignition Circuit Diagnosis (Gas Engines — All)

MX52301,0000120 -19-03MAY17-1/11

❶ Ignition Circuit—Off

MX52301,0000120 -19-03MAY17-2/11

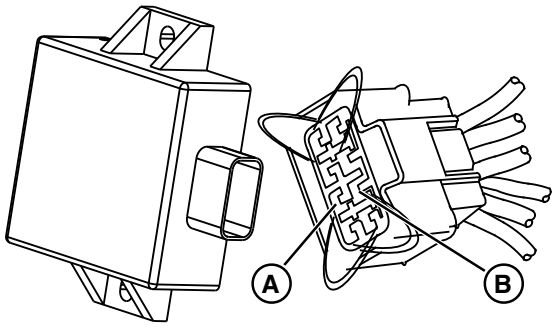
Key Switch	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Key switch in the off position, engine not running. • Check wires and connections for looseness and corrosion. Is battery voltage present at the B terminal of the S1 key switch, 208 Red wire (B)?	**YES:** Go to next step. **NO:** Test the unswitched power circuit. See Power Circuit Operation, Gas (SN -040000), Power Circuit Operation, Gas (SN 040001-).



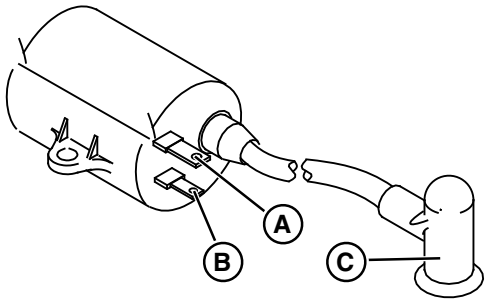
MXT004463 —UN—31MAY12
B—208 Red Wire

Continued on next page

MX52301,0000120 -19-03MAY17-3/11

Ignitor Module	A1 Ignitor module disconnected. Is continuity to ground present at the X6 ignitor connector, Blk/Yel wire (B)?  MXT011537 —UN—18JUN14 **B—Black/Yellow Wire**	**YES:** Connect ignitor module connector. Go to next step. **NO:** Check engine ground and Blk/Yel wire and connections.

MX52301,0000120 -19-03MAY17-4/11

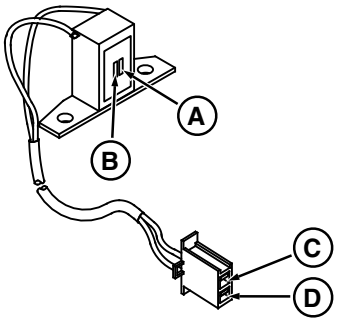
T1 Ignition Coil	Is continuity to ground present at the T1 ignition coil, Yel/Wht wire (A)?  MXT011994 —UN—12JUN14 **A—Yellow/White Wire**	**YES:** Go to next step. **NO:** Check Yel/Wht wire and connections. If OK, replace A1 ignitor module.

MX52301,0000120 -19-03MAY17-5/11

T2 Ignition Coil	Is continuity to ground present at the T2 ignition coil, Yel/Wht wire (A)?	**YES:** Go to next step. **NO:** Check Yel/Wht wire and connections. If OK, replace A1 ignitor module.

Continued on next page

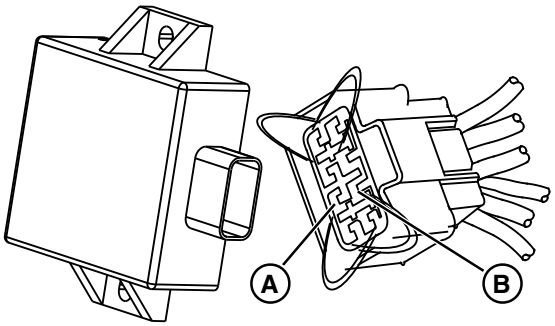
MX52301,0000120 -19-03MAY17-6/11

Pulser Coil	Measure resistance across pulser coil (C & D). Is resistance 188 Ohms ± 5 Ohms?  MXT011992 —UN—12JUN14 **C & D—Pulser Coil**	**YES:** Ignition coils are OK. Go to next step. **YES:** Pulser coil is OK. Go to next step. **NO:** Replace components that fail spark test. **NO:** Replace pulser coil.
	Perform spark test on each ignition coil. See Spark Test. Is a strong blue spark present on each ignition coil?	

MX52301,0000120 -19-03MAY17-7/11

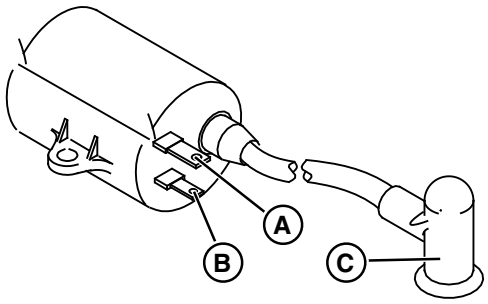
❶ Ignition Circuit—On

MX52301,0000120 -19-03MAY17-8/11

Ignition Connector	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Key switch in the run position, engine not running. • Check wires and connections for looseness and corrosion. A1 Ignitor module disconnected. Is battery voltage present at the X6 ignitor connector, Org wire (A)?  MXT011537 —UN—18JUN14	**YES:** Go to next step. **NO:** Test the key switch. See Key Switch Test. Check 420B and 420J Yel wires and connections.

Continued on next page

MX52301,0000120 -19-03MAY17-9/11

T1 Ignition Coil	Is battery voltage present at the T1 ignition coil, Yel/ Wht wire (A)?  MXT011994 —UN—12JUN14 **A—Yellow/White Wire**	**YES:** Go to next step **NO:** Check Yel/Wht wire and connections. If OK, replace A1 ignitor module.

MX52301,0000120 -19-03MAY17-10/11

T2 Ignition Coil	Is battery voltage present at the T2 ignition coil, Yel/ Wht wire (A)?	**YES:** Test complete. **NO:** Check Yel/Wht wire and connections. If OK, replace A1 ignitor module. Test complete.

MX52301,0000120 -19-03MAY17-11/11

Charging Circuit Operation, Gas (All)

Function:

To maintain battery voltage between 12.4 and 13.2 V.

Operating Conditions:

- Key switch must be in the RUN position.
- Engine must be RUNNING for the charging system to operate.

Theory of Operation:

The charging system is a permanent magnet and stator design. The N1 voltage regulator/rectifier controls the charging output.

With the S1 key switch in the run position, battery sensing circuit current flows from battery positive terminal through 218 Fuselink (SN 040001-), 200 (SN 110001-), 201 and 202 (SN -110000) Red wires, F6 fuse, 208 Red wire, S1 key switch, 420J Yel wire, S-2 power splice, 420C Yel wire, and Brn wire to the N1 voltage regulator/rectifier.

The battery sensing circuit allows the voltage regulator/ rectifier to monitor battery voltage.

As the flywheel turns, permanent magnets located in the flywheel induce AC current in the stator. The AC current flows to the voltage N1 regulator/rectifier. The voltage regulator/rectifier converts AC current to DC current to charge the battery.

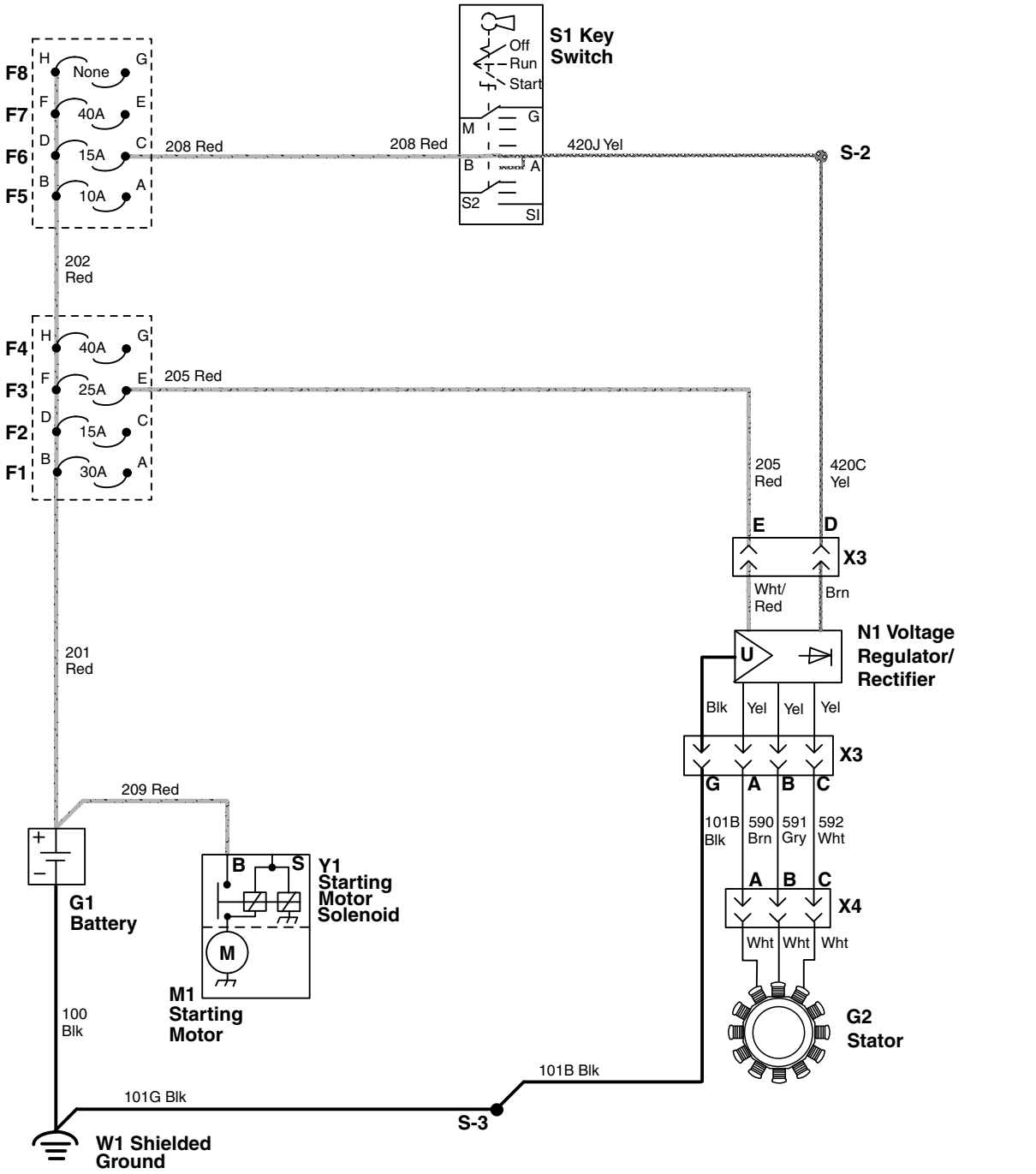
If G1 battery voltage is low, the voltage regulator/rectifier allows DC current to flow to the battery, through the Wht/ Red wire, 205 Red wire, F3 fuse, 218 Fuselink (SN 040001-), and 201 Red wire. When the battery is fully charged, the regulator stops current flow to the battery.

The ground circuit provides a path to ground for the voltage regulator/rectifier through the Blk, 101B Blk, and 101G Blk wires.

MX52301,0000121 -19-22OCT14-1/1

Charging Circuit Schematic, Gas (All)

Charging Circuit Schematic (Gas Engine -040000)



MXT011543 —UN—05JUN14

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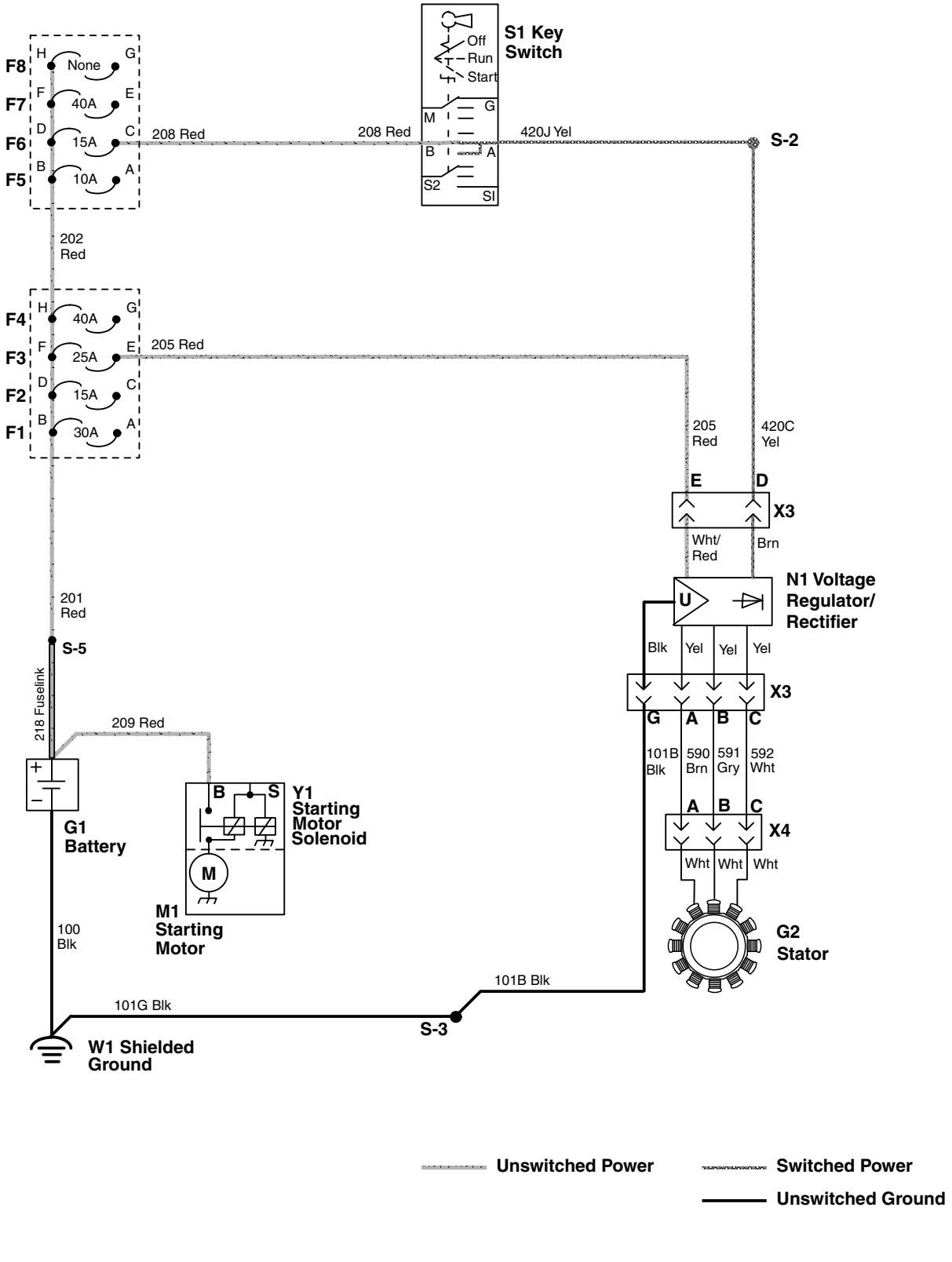
MX52301,0000122 -19-16SEP14-1/3

Charging Circuit Schematic (Gas Engine 040001-110000)



MXT012363 —UN—16SEP14

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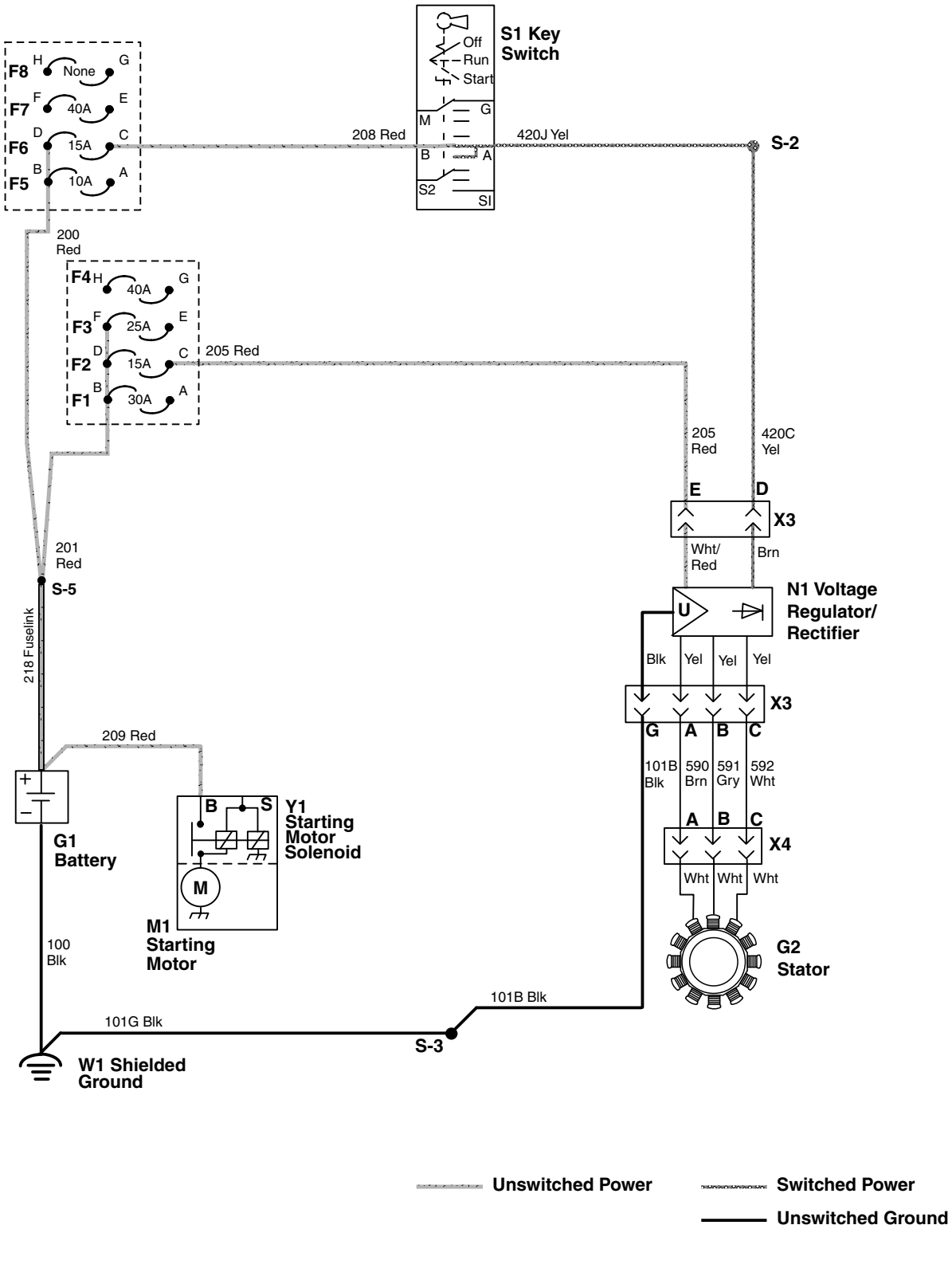
MX52301,0000122 -19-16SEP14-2/3

Charging Circuit Schematic (Gas Engine 110001-)



MX52301,0000122 -19-16SEP14-3/3

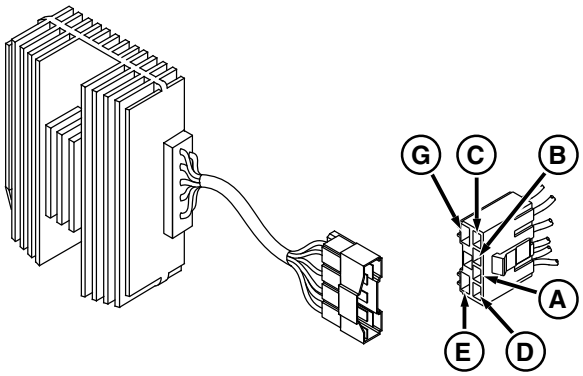
Charging Circuit Diagnosis, Gas (All)

Charging Circuit Diagnosis (Gas Engines — All)

MX52301,0000123 -19-22OCT14-1/7

❶ Charging Circuit

MX52301,0000123 -19-22OCT14-2/7

Ground Presence	**Test Procedure A** **Test Conditions** • Machine parked safely. See the “Safety Section”. • Cargo box raised and locked • Key switch in the run position, engine not running. • Check wires and connections for looseness and corrosion. Disconnect N1 voltage regulator, rectifier. Is continuity to ground present at pin **(G)** of X3 connector, 101B Blk wire?  MXT011891 —UN—04JUN14 **C—420C Yellow Wire** **E—205 Red Yellow Wire** **G—101B Black Wire**	**YES:** Go to next step. **NO:** Check 101B Blk and 101G Blk wires and connections.

MX52301,0000123 -19-22OCT14-3/7

Voltage Presence	Disconnect N1 voltage regulator, rectifier. Is battery voltage present at pin **(E)** of X3 connector, 205 Red Yel wire?	**YES:** Go to next step. **NO:** Test the unswitched power circuit. See Power Circuit Operation, Gas (SN -040000) , Power Circuit Operation, Gas (SN 040001-).

Continued on next page

MX52301,0000123 -19-22OCT14-4/7

Voltage Presence	Disconnect N1 voltage regulator, rectifier. Is battery voltage present at pin **(D)** of X3 connector, 420C Yel wire?	**YES:** Go to next step. **NO:** Test the switched power circuit. See Power Circuit Operation, Gas (SN -040000), Power Circuit Operation, Gas (SN 040001-)

MX52301,0000123 -19-22OCT14-5/7

❶ Charging Circuit

MX52301,0000123 -19-22OCT14-6/7

Voltage Output	**Test Procedure B** **Test Conditions** • Park brake locked. • Transmission in Neutral • Cargo box raised and locked • Key switch in the run position, engine running at slow idle. • Engine speed increased from slow idle to fast idle during test. Start measuring voltage at battery terminals with engine running at slow idle. Record voltage as engine speed is increased to fast idle. Does voltage increase from approximately 12.0 V to approximately 15.0 V?	**YES:** Test complete. **NO:** Test voltage rectifier, regulator. See Unregulated Voltage Test (Gas Engine). Test stator. See Stator Resistance Test (Gas Engine).

MX52301,0000123 -19-22OCT14-7/7

Charging Circuit Operation, Diesel (All)

Function:

To maintain proper battery voltage and supply power to electrical systems.

Operating Conditions:

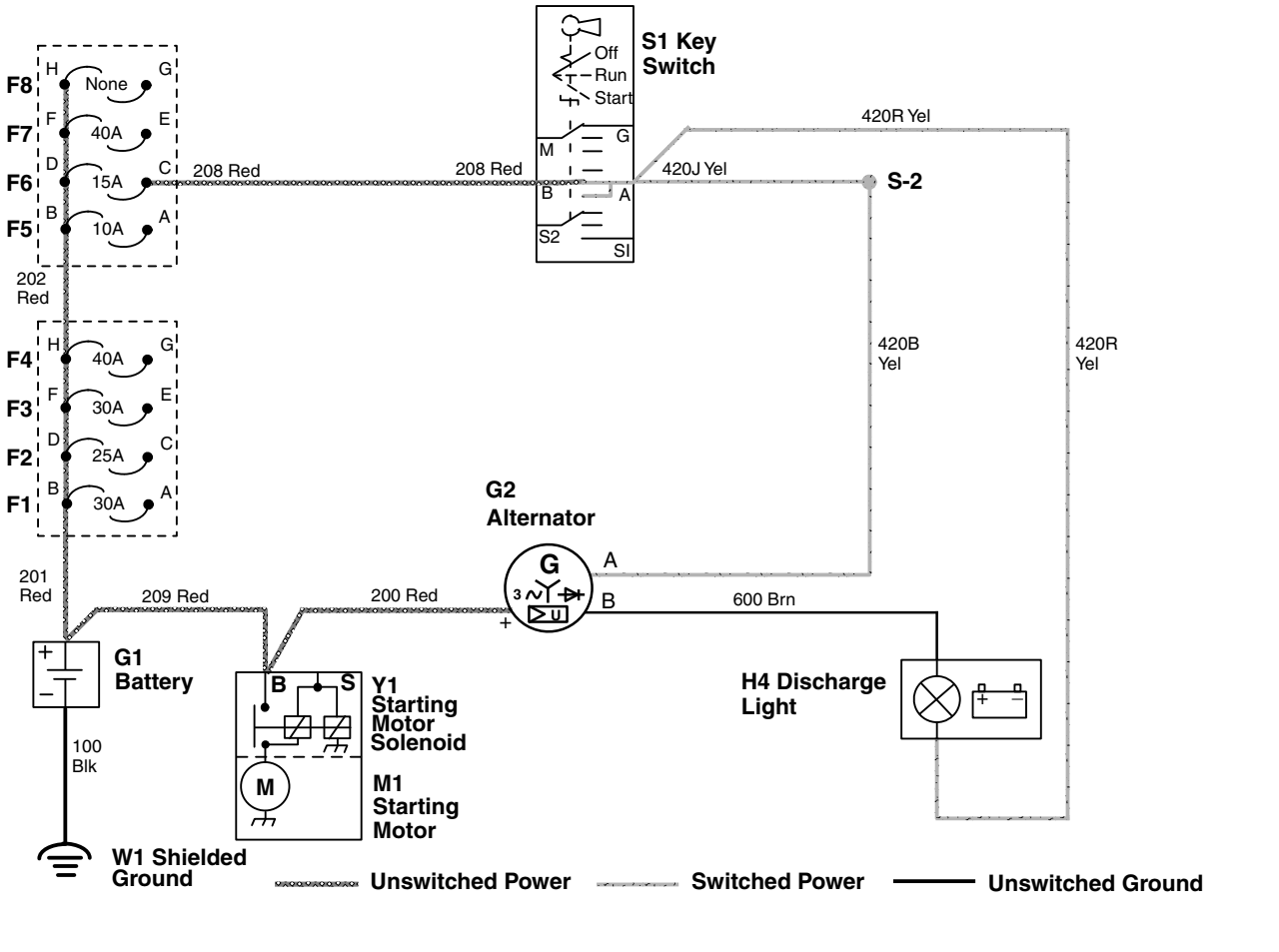
- Key switch must be in the RUN position.
- Engine must be RUNNING for the charging system to operate.

Theory of Operation:

The charging system consists of an alternator with an internal voltage regulator/rectifier. The internal voltage regulator/rectifier controls charging output. The alternator is grounded through the engine ground. A discharge indicator light is mounted on the dash to alert the operator of charging system problems.

KK36721,0000105 -19-16SEP14-1/1

Charging Circuit Schematic, Diesel (SN -080000)



MX52301,000061A -19-24OCT14-1/1

Charging Circuit Diagnosis, Diesel (SN -080000)

Test Procedure A

Test Conditions:

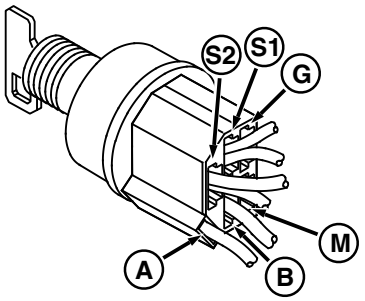
- Machine parked safely. See the “Safety Section”.
- Test output of alternator. See Alternator Unregulated Amperage Test and See Alternator Regulated Output Test.
- Cargo box raised and locked.
- Open hood and remove storage tray.
- Key switch in run position, engine not running.
- Disconnect any other attachment option from the main wiring harness.
- Battery fully charged.

Alternator Circuit

1. Is battery voltage present at the **(B)** terminal of the S1 key switch?

   Yes: Go to next step.

   No: Check F6 fuse, 206, 201, 202, and 208 Red wires, and connections.



MXT004463 —UN—31MAY12

2. Is battery voltage present at the **(A)** terminal of the S1 key switch?

   Yes: Go to next step.

   No: Test key switch. See Key Switch Test.

KK36721,0000108 -19-24OCT14-1/2

3. Is battery voltage present at the alternator, 420B Yel wire **(3)**?

   Yes: Go to next step.

   No: Check 420J and 420B Yel wires, S-2 splice, and connections.

4. Is continuity to ground present at adjustment bolt **(2)** of alternator?

   Yes: Go to next step.

   No: Check engine ground and connections.

5. Is battery voltage present at alternator 200 Red wire **(1)**?

   Yes: Go to next step.

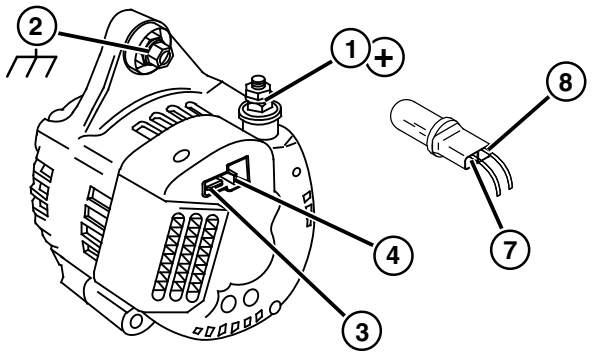
   No: Check 209 and 200 Red wires and connections.

6. Is battery voltage present at 420R Yel wire **(8)** of discharge light?

   Yes: Go to next step.

   No: Check 420R Yel wire and connections. Test key switch. See Key Switch Test.

7. Is continuity present between discharge light 600 Brn wire termination **(7)** and alternator 600 Brn wire termination **(4)**?



MXT011550 —UN—04JUN14

   Yes: Test discharge light bulb. If OK, go to next step.

   No: Check 600 Brn wire and connections.

8. Is continuity between 600 Brn wire at alternator and ground?

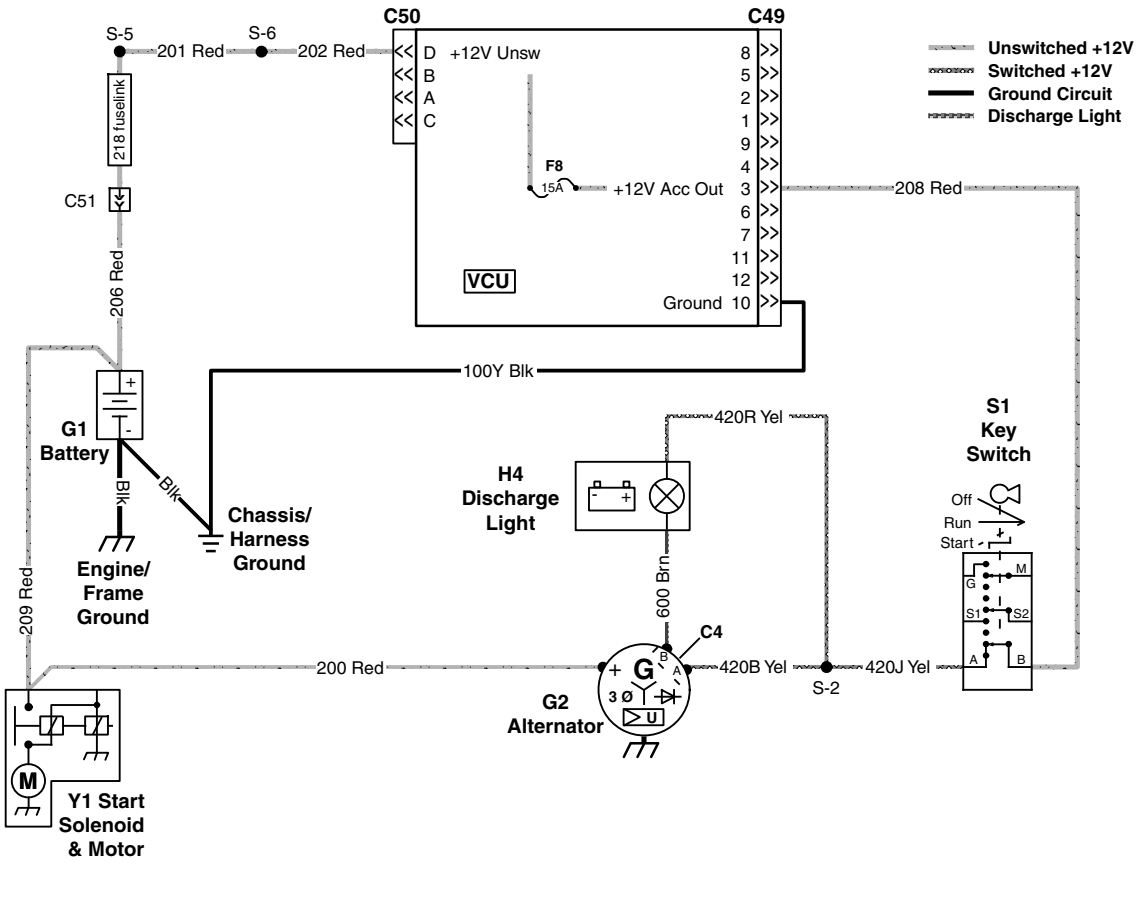
   Yes: End of test.

   No: Check engine ground. If OK, disassemble and check alternator internal components. See High Capacity Alternator Removal and Installation. If OK, replace voltage regulator.

KK36721,0000108 -19-24OCT14-2/2

Charging Circuit Schematic, Diesel (SN 080001-)

Charging Circuit Schematic (Diesel Engines SN 080001-110000)



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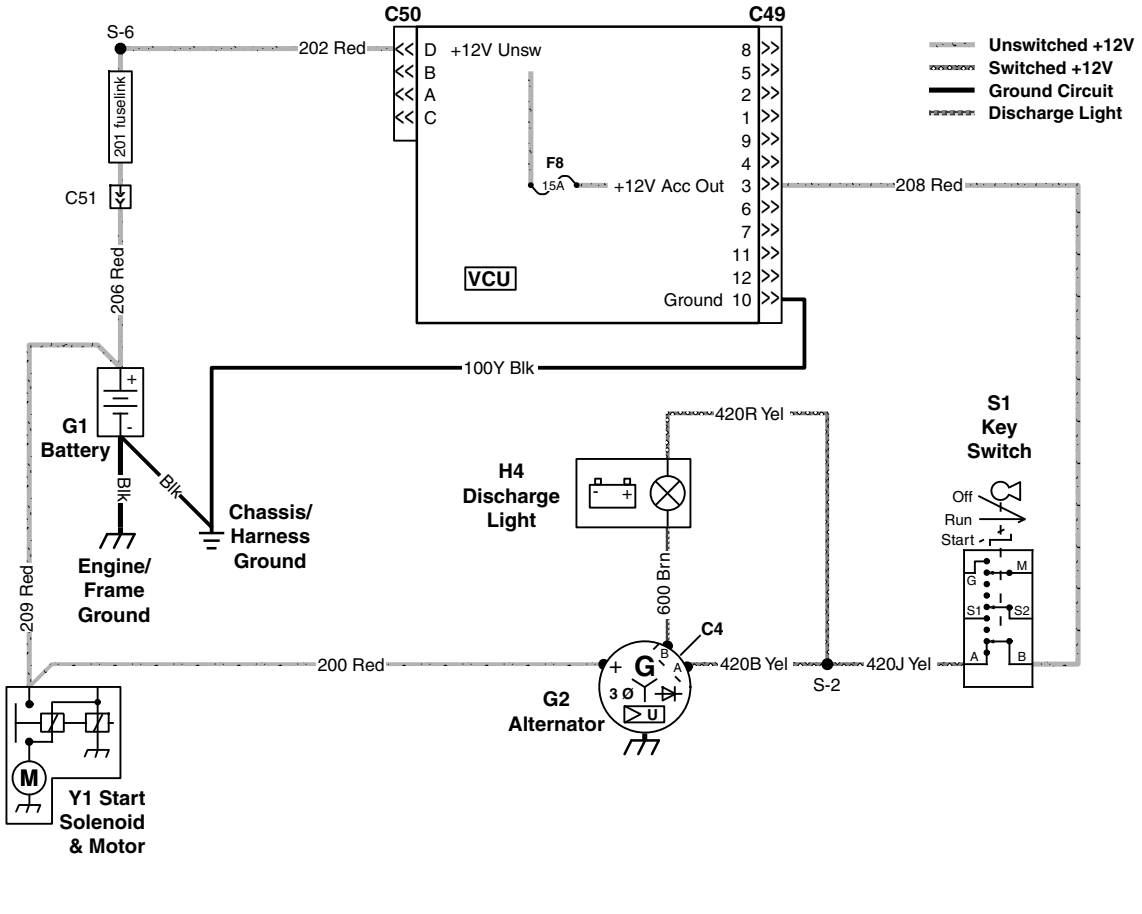
MX52301,00003AD -19-24OCT14-1/2

Charging Circuit Schematic (Diesel Engines SN 110001-)



MX52301,00003AD -19-24OCT14-2/2

Charging Circuit Diagnosis, Diesel (SN 080001-)

Charging Circuit Diagnosis (Diesel Engines SN 080001-)

MX52301,00003AE -19-24OCT14-1/9

❶ Alternator Circuit

Continued on next page

MX52301,00003AE -19-24OCT14-2/9

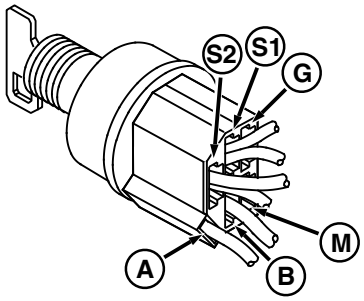
Key Switch Connector

Test Procedure:

Test Conditions

- Machine parked safely. See the “Safety Section”.
- Cargo box raised and locked.
- Battery fully charged
- Open hood and remove storage tray.
- Disconnect any other attachment option from the main wiring harness.
- Key switch in RUN position, engine not running.

Is battery voltage present at key switch connector 208 Red wire **(B)**?



MXT004463 —UN—31MAY12
A—420Y and 420J Yellow Wires
B—208 Red Wire

YES: Go to next step.

NO: Check F8 fuse, 206, 201, 202 and 208 Red wires, 218 fuse link and connections.

MX52301,00003AE -19-24OCT14-3/9

Key Switch Connector

Is battery voltage present at key switch connector 420Y and 420J Yel wires **(A)**?

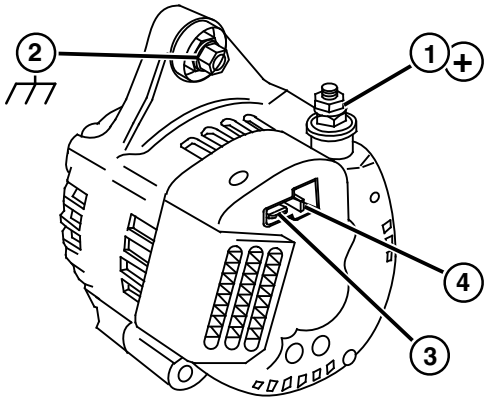
YES: Go to next step.

NO: Test key switch. See Key Switch Test.

MX52301,00003AE -19-24OCT14-4/9

Alternator Battery Terminal

Is battery voltage present at the alternator battery terminal, 200 Red wire **(1)**?



MXT011919 —UN—04JUN14
1— Terminal
2— Frame Mount

YES: Go to next step.

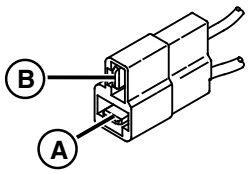
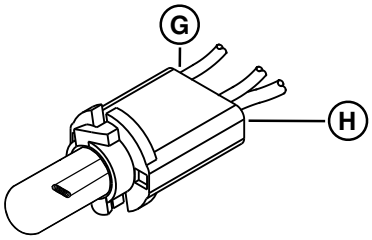
NO: Check 209 and 200 Red wires and connections.

Continued on next page

MX52301,00003AE -19-24OCT14-5/9

Voltage Presence	Measure voltage between alternator frame **(2)** and negative (-) battery post. Is reading less than 0.1 V?	**YES:** Go to next step. **NO:** Check engine and battery grounds and connections.

MX52301,00003AE -19-24OCT14-6/9

Connector	Unplug connector C4 from alternator. Is battery voltage present at the 420B Yel wire **(A)**?  MXT011553 —UN—12JUN14 **A—420B Yellow Wire** **B—600 Brown Wire**  MXT011559 —UN—08JUL14 **G—600 Brown Wire** **H—420R and 420M Yellow Wires**	**YES:** Go to next step. **NO:** Check 420B and 420J Yel wires and connections.

MX52301,00003AE -19-24OCT14-7/9

Voltage Presence	Is voltage present at the 600 Brn wire **(B)**?	**YES:** Go to next step. **NO:** Test H4 discharge light bulb. **NO:** Check 600 Brn wire from **(B)** to discharge light **(G)**. **NO:** Check for battery voltage at discharge light 420R and 420M Yel wires **(H)**.

Continued on next page

MX52301,00003AE -19-24OCT14-8/9

Discharge Light	Reattach connector C4 to alternator. Is discharge light now glowing?	**YES:** Check belt tension at alternator pulley. If OK, disassemble and check alternator internal components. See High Capacity Alternator Removal and Installation. If OK, replace voltage regulator.[1] **NO:** Replace voltage regulator.[1]

[1]Unregulated output test not recommended for VCU-equipped vehicles.

MX52301,00003AE -19-24OCT14-9/9

Fuel Pump Circuit Operation, Gas (All)

Function:

To provide a constant flow of fuel to the engine.

Operating Conditions:

- Key switch in the START or RUN position.

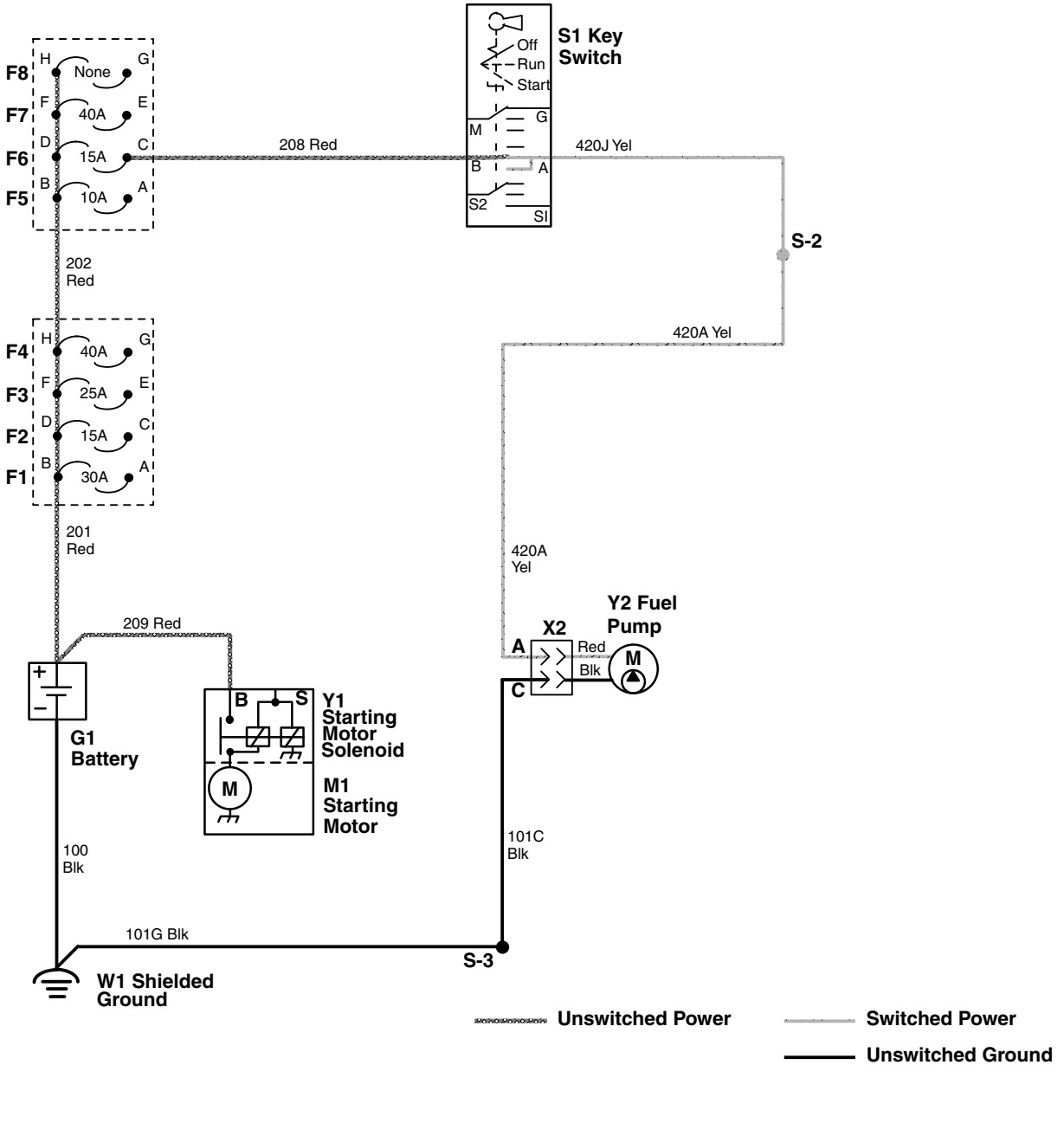
Theory of Operation:

The G1 battery supplies current through the F6 fuse and S1 key switch to the S-2 power splice. Voltage then flows, over the 420A Yel wire to the Y2 fuel pump. The fuel pump is a constant flow 10.8 kPa (1.6 psi) DC sealed unit. The 101C Blk, S3 splice, and 101G Blk wire completes the circuit to ground.

MX52301,00003AF -19-19JUN14-1/1

Fuel Pump Circuit Schematic, Gas (All)

Fuel Pump Circuit Schematic (Gas Engine -040000)



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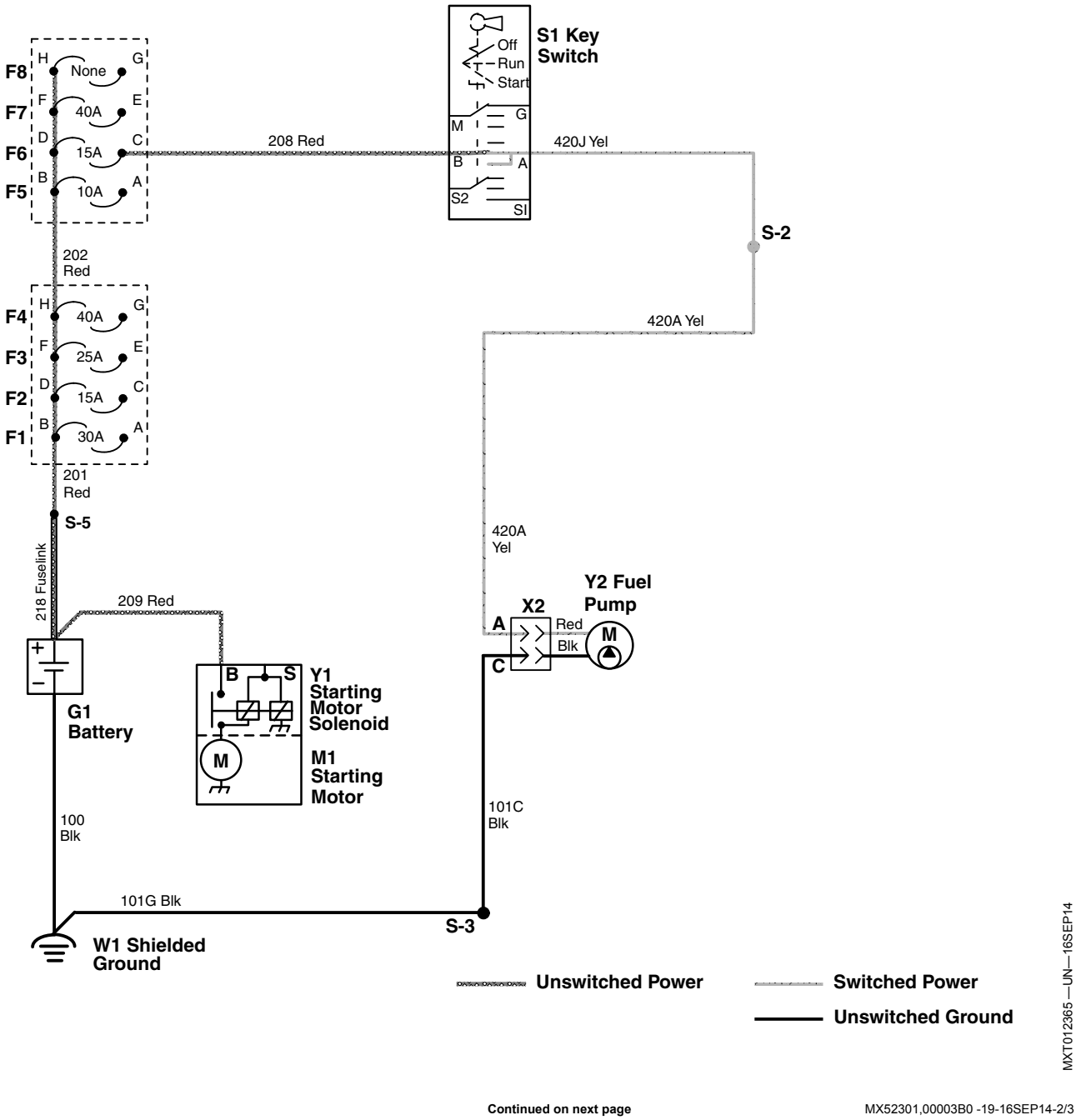
MX52301,00003B0 -19-16SEP14-1/3

Fuel Pump Circuit Schematic (Gas Engine 040001-110000)



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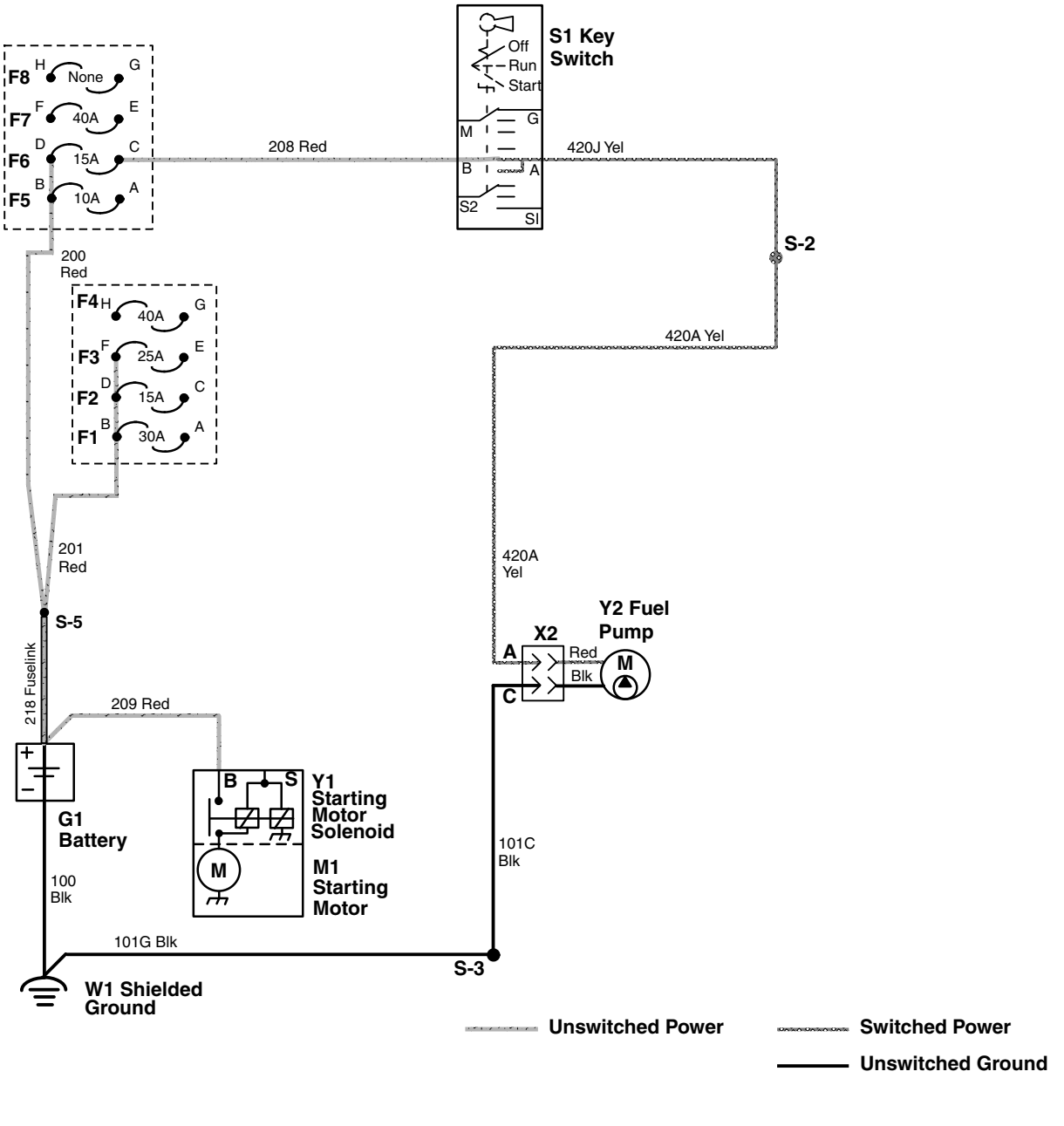
MX52301,00003B0 -19-16SEP14-2/3

Fuel Pump Circuit Schematic (Gas Engine 110001-)



MX52301,00003B0 -19-16SEP14-3/3

Fuel Pump Circuit Diagnosis, Gas (All)

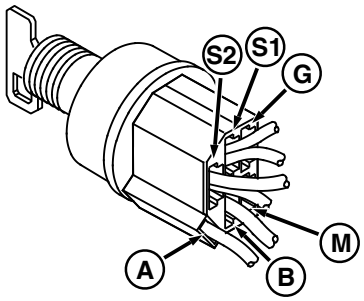
Fuel Pump Circuit Diagnosis (Gas Engine—All)

MX52301,00003B1 -19-24OCT14-1/5

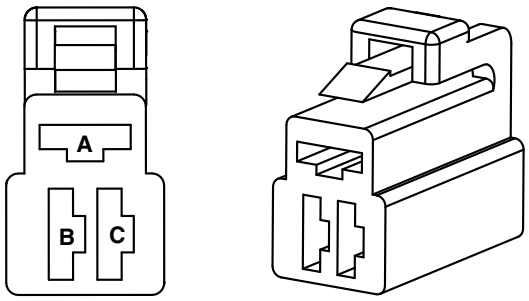
❶ Fuel Pump Circuit

Continued on next page

MX52301,00003B1 -19-24OCT14-2/5

Key Switch	**Test Procedure:** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Cargo box raised and locked. • Battery fully charged • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is battery voltage present at key switch (A)?  MXT004463 —UN—31MAY12 **A—Pin A**	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test. See Power Circuit Diagnosis, Gas (SN -040001) or (SN 040001-) Section 50 Group 55.

MX52301,00003B1 -19-24OCT14-3/5

Fuel Pump Connector	Disconnect Y2 fuel pump from harness. Is battery voltage present at fuel pump connector 420A Yel wire **(C)**?  MXT010230 —UN—20OCT14 **A — 101C Black Wire** **C — 4210A Yellow Wire**	**YES:** Go to next step. **NO:** Check 420J and 420A Yel wires and connections

MX52301,00003B1 -19-24OCT14-4/5

Fuel Pump Connector	Is continuity to ground present at fuel pump connector, 101C Blk wire **(A)**?	**YES:** Test fuel pump. See Fuel Pump Flow Test. **NO:** Check 101C and 101G Blk wires and connections.

MX52301,00003B1 -19-24OCT14-5/5

Fuel Shutoff Solenoid Circuit Operation, Gas (All)

Function:

To shut off the supply of fuel to the carburetor with the key switch in the OFF position.

Operating Conditions:

- Key switch in the ON position to allow fuel to the carburetor.

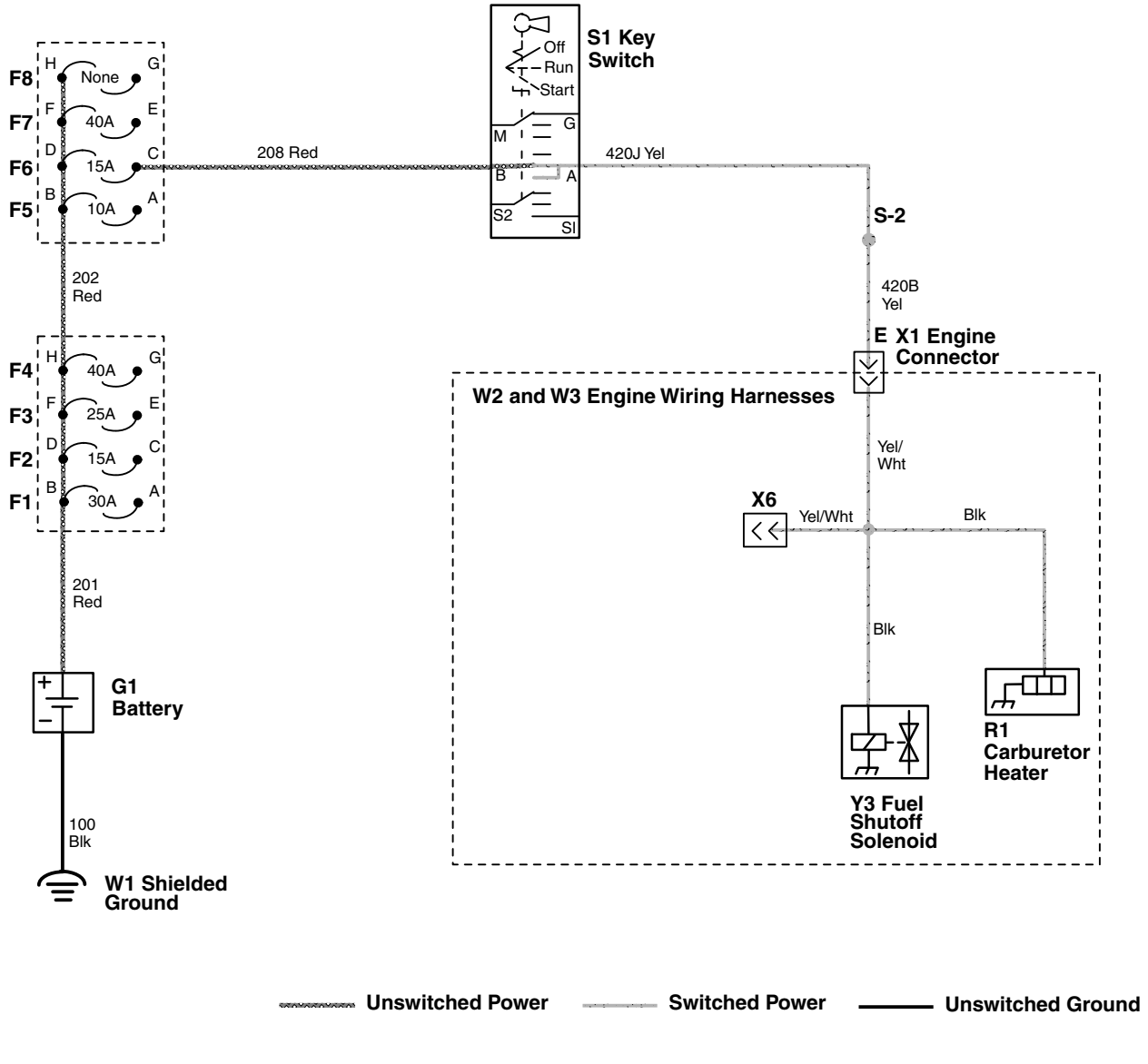
Theory of Operation:

The G1 battery supplies current through the F6 fuse and S1 key switch over the 420J Yel wire to the S2 splice. Battery voltage then flows over the 420B Yel wire to the X1 engine connector. A Yel/Wht wire, splice, and a Blk wire carry power to the Y3 fuel shutoff solenoid. The path to ground is completed the body of the solenoid to the engine. The solenoid to energized and allows fuel to the carburetor.

MX52301,00003B2 -19-19JUN14-1/1

Fuel Shutoff Solenoid Circuit Schematic, Gas (All)

Fuel Shutoff Circuit Schematic (Gas Engine -040000)



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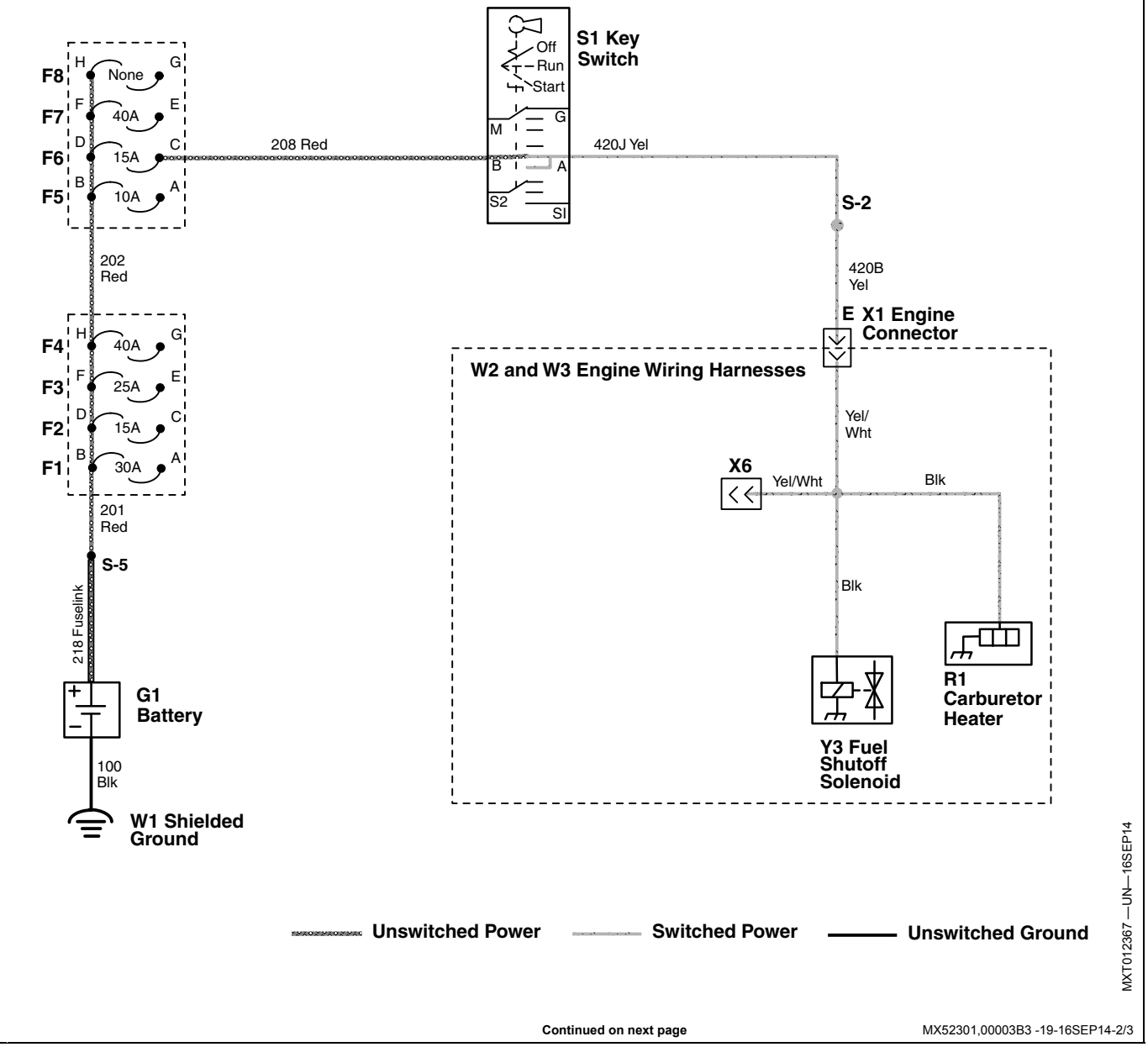
MX52301,00003B3 -19-16SEP14-1/3

Fuel Shutoff Circuit Schematic (Gas Engine 040001-110000)



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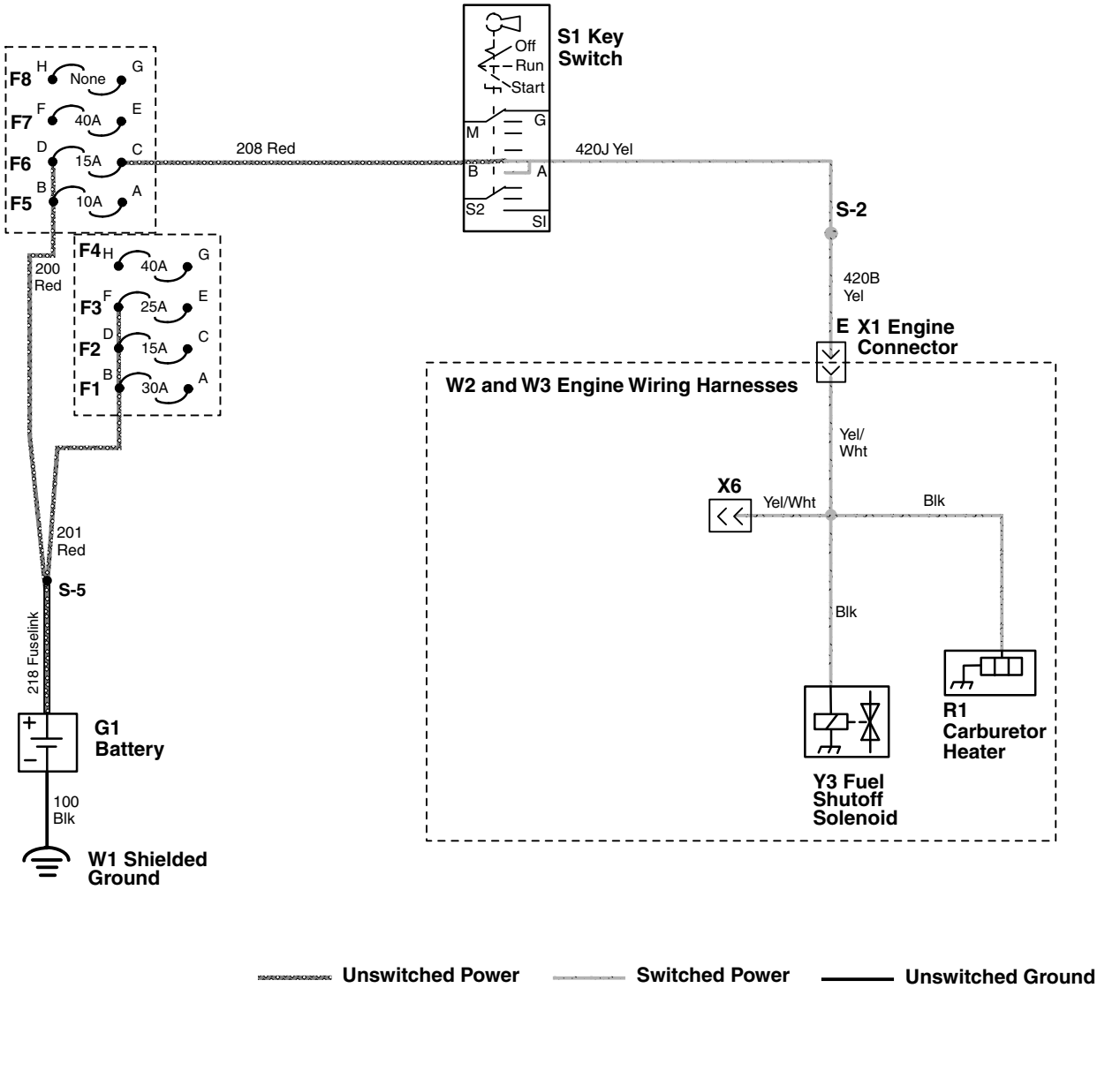
MX52301,00003B3 -19-16SEP14-2/3

Fuel Shutoff Circuit Schematic (Gas Engine 1100001-)



MX52301,00003B3 -19-16SEP14-3/3

Fuel Shutoff Solenoid Circuit Diagnosis, Gas (All)

Fuel Shutoff Circuit Diagnosis (Gas Engine—All)

MX52301,00003B4 -19-22OCT14-1/5

❶ Fuel Shutoff Circuit

MX52301,00003B4 -19-22OCT14-2/5

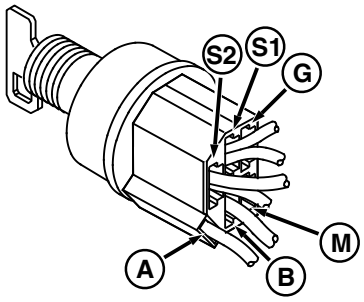
Key Switch

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at key switch (A)?



MXT004463 —UN—31MAY12

A—Pin A

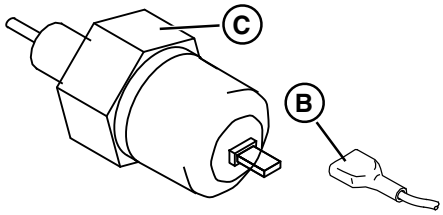
YES: Go to next step.

NO: Test key switch. See Key Switch Test. See Power Circuit Diagnosis, Gas (SN -040001) or (SN 040001-) Section 50 Group 55..

MX52301,00003B4 -19-22OCT14-3/5

Fuel Shutoff Solenoid

Disconnect Y3 fuel shutoff solenoid from harness. Is battery voltage present at Y3 fuel shutoff solenoid, Blk wire (B)?



MXT011557 —UN—12JUN14

B—Black Wire

C—Y3 Fuel Shutoff Solenoid

YES: Go to next step.

NO: Check Blk, Yel/Wht, 420B, and 420J Yel wires and connections.

Continued on next page

MX52301,00003B4 -19-22OCT14-4/5

Continuity of Ground	Is continuity to ground present at body of Y3 fuel shutoff solenoid (C)?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Gas Engine). **NO:** Check engine ground to frame and battery.

MX52301,00003B4 -19-22OCT14-5/5

Fuel Shutoff Circuit Operation, Diesel (All)

Function:

To shut off the supply of fuel to the engine with the key switch in the OFF position.

Operating Conditions:

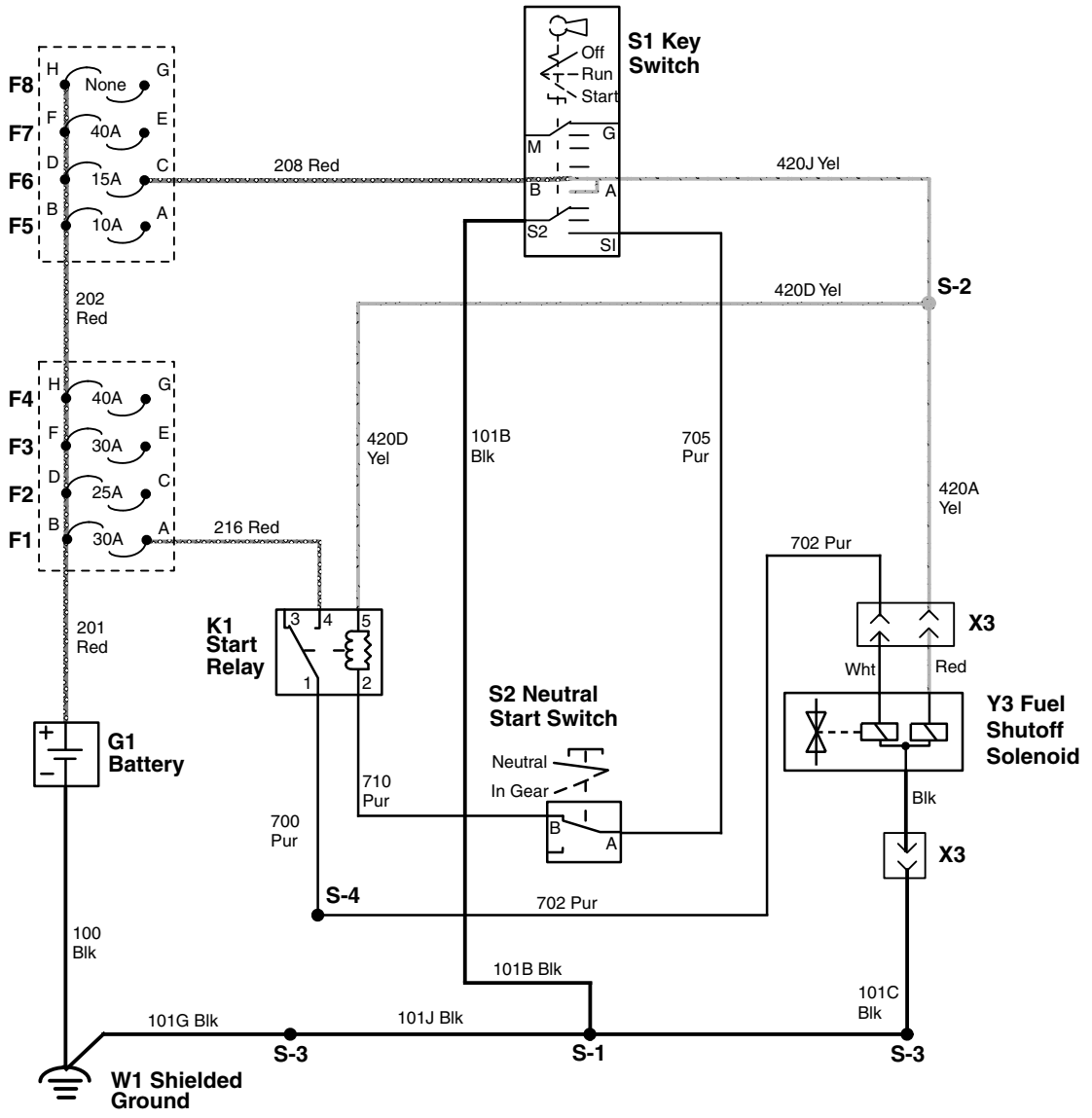
- To allow fuel to the engine, turn key switch to START position and then return key to ON position.

Theory of Operation:

The fuel solenoid has two coils: the pull-in and the hold-in. The pull-in coil receives power from the same source as the starter solenoid. It retracts the solenoid plunger when the key is turned to the start position and opens the fuel valve. The hold-in coil is active with the key in the run and start position. It keeps the valve open after the pull-in coil is deactivated. When the key is turned off the hold-in coil is released and the fuel valve is closed.

MX52301,00003EE -19-17SEP14-1/1

Fuel Shutoff Circuit Schematic, Diesel (SN -040000)



MX52301,00003EF -19-24OCT14-1/1

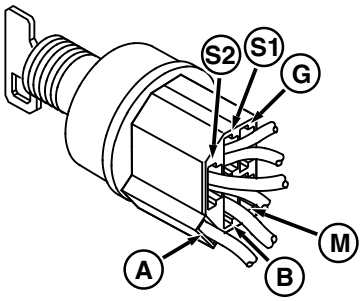
Fuel Shutoff Circuit Diagnosis, Diesel (SN -040000)

Fuel Shutoff Circuit Solenoid Diagnosis (Diesel Engine SN -040000)

MX52301,00003F0 -19-24OCT14-1/14

❶ Fuel Shutoff Solenoid Pull-in Circuit

MX52301,00003F0 -19-24OCT14-2/14

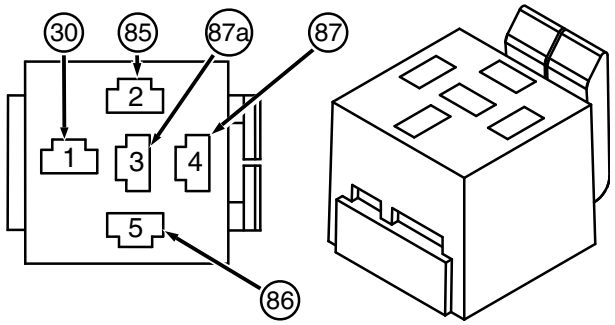
Ground Continuity	**Test Procedure A** **Test Conditions** • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Starter solenoid Pur wire disconnected to prevent accidental starting. • Key switch in start position. • Check wire connections for looseness and corrosion. Is continuity to ground present at 705 Pur wire **(S1)** of key switch?  MXT004463 —UN—31MAY12 **S1—705 Purple Wire** **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Test S1 key switch. See Key Switch Test. **NO:** Check 101B, 101J, and 101G Blk wires to ground.

MX52301,00003F0 -19-24OCT14-3/14

Key Switch	Is battery voltage present at 420J Yel wire **(A)** of key switch?	**YES:** Go to next step. **NO:** Test power circuit to key switch. See Power Circuit Diagnosis, Diesel (SN -040000) Section 50 Group 55. **NO:** Test key switch. See Key Switch Test.

Continued on next page

MX52301,00003F0 -19-24OCT14-4/14

Start Relay	Is battery voltage present at 420D Yel wire **(5)** of K1 start relay connector?  MXT011889—UN—09JUL14 **1—700 Purple Wire** **2—710 Purple Wire** **4—216 Red Wire** **5—420D Yellow Wire**	**YES:** Go to next step. **NO:** Check 420J and 420D Yel wires and connections.

MX52301,00003F0 -19-24OCT14-5/14

Start Relay	Is battery voltage present at 216 Red wire **(4)** of K1 start relay?	**YES:** Go to next step. **NO:** Check 201 Red wire, F1 fuse, and 216 Red wire and connections.

MX52301,00003F0 -19-24OCT14-6/14

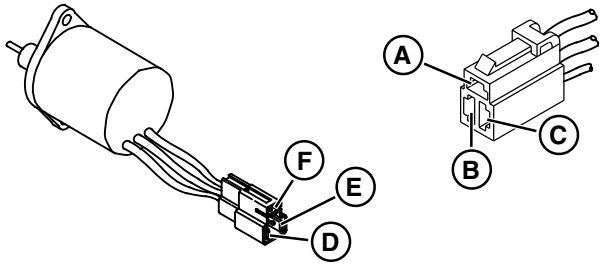
Start Relay and Ground	Is continuity to ground present at 710 Pur wire **(2)** of K1 start relay?	**YES:** Test K1 start relay. See Relay Test. Go to next step **NO:** Test S2 neutral start switch. See Neutral Start Switch Test. If OK, check 710 and 705 Pur wires and connections.

MX52301,00003F0 -19-24OCT14-7/14

Start Relay	Is battery voltage present at 700 Pur wire **(1)** of K1 start relay?	**YES:** Go to next step. **NO:** Test K1 start relay. See Relay Test.

Continued on next page

MX52301,00003F0 -19-24OCT14-8/14

Fuel Shutoff Solenoid	Is battery voltage present at X3 connector, 702 Pur wire **(E)** of fuel shutoff solenoid?  MXT011926—UN—21OCT14 **E—702 Purple Wire** **F—101C Black Wire**	**YES:** Go to next step. **NO:** Check 700 and 702 Pur wires and connections.

MX52301,00003F0 -19-24OCT14-9/14

Fuel Shutoff Solenoid and Ground	Is there continuity between X3 connector, 101C Blk wire **(F)** at fuel shutoff solenoid and **ground**?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine). **NO:** Check 101C, 100J, and 100G Blk wires, connections, and splices.

MX52301,00003F0 -19-24OCT14-10/14

❶ Fuel Shutoff Solenoid Hold-in Circuit

Continued on next page

MX52301,00003F0 -19-24OCT14-11/14

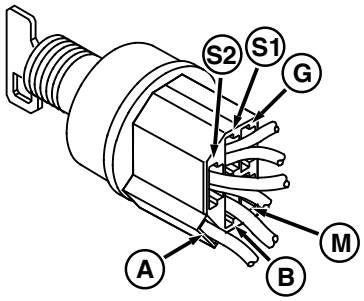
Key Switch

Test Procedure B

Test Conditions

- park safely See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Battery fully charged.
- Key switch in start position.
- Check wire connections for looseness and corrosion.

Is battery voltage present at 420J Yel wire **(A)** of key switch?



MXT004463 —UN—31MAY12
A—420J Yellow Wire

YES: Go to next step

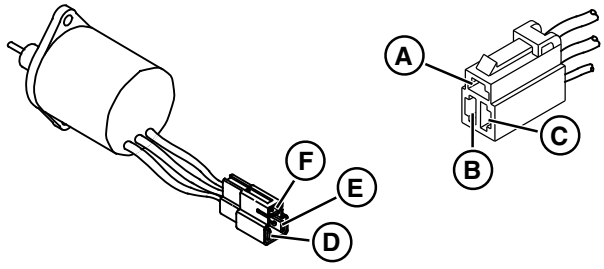
NO: Test power circuit to key switch. See Power Circuit Diagnosis, Diesel (SN -040000) Section 50 Group 55.

NO: Test power circuit to key switch. See Key Switch Test.

MX52301,00003F0 -19-24OCT14-12/14

Fuel Shutoff Solenoid

Is battery voltage present at X3 connector, 420A Yel wire **(D)** of fuel shutoff solenoid?



MXT011926 —UN—21OCT14
D—420A Yellow Wire
F—101C Black Wire

YES: Go to next step.

NO: Check 420J and 420A Yel wires, splice, and connections.

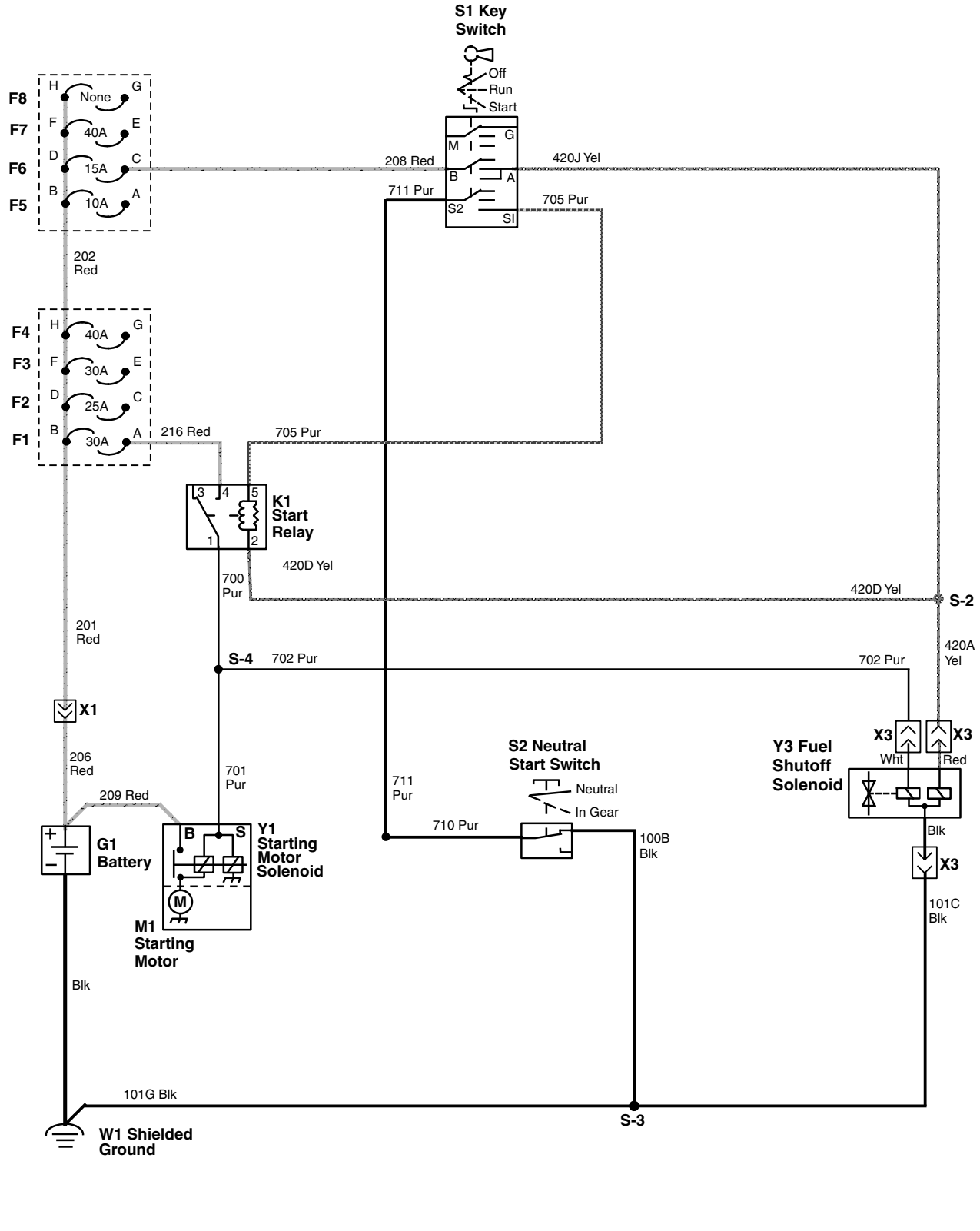
Continued on next page

MX52301,00003F0 -19-24OCT14-13/14

Fuel Shutoff Solenoid and Ground	Is there continuity between X3 connector, 101C Blk wire **(F)** at fuel shutoff solenoid and ground?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine). **NO:** Check 101C, 100J, and 100G Blk wires, connections, and splices.

MX52301,00003F0 -19-24OCT14-14/14

Fuel Shutoff Circuit Schematic, Diesel (SN 040001-080000)



MX52301,00003B6 -19-24OCT14-1/1

Fuel Shutoff Circuit Diagnosis, Diesel (SN 040001-080000)

Fuel Shutoff Circuit Diagnosis (Diesel Engine SN 040001-080000)

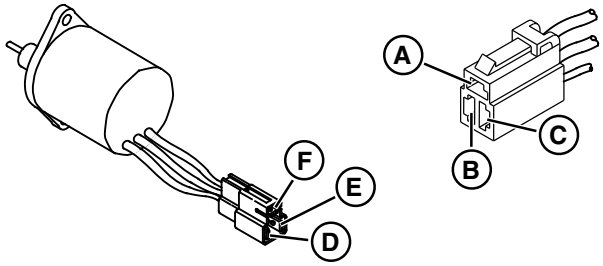
MX52301,00003B7 -19-24OCT14-1/8

❶ Fuel Shutoff Solenoid Pull-In Circuit

MX52301,00003B7 -19-24OCT14-2/8

Engine Crank	**Test Procedure A** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Cargo box raised and locked. • Battery fully charged. • Pur wire at starter solenoid disconnected to prevent accidental starting. • Key switch in start position. • Check wire connections for looseness and corrosion. When test conditions are set, does the engine start?	**YES:** Go to next step. **NO:** See Cranking Circuit Operation, Gas (All), Diesel (SN -080000). When complete, go to next step.

MX52301,00003B7 -19-24OCT14-3/8

Fuel Shutoff Solenoid	Is battery voltage present at X3 connector, 702 Pur wire **(E)** of fuel shutoff solenoid?  MXT011926 —UN—21OCT14 **E—702 Purple Wire** **F—101C Black Wire**	**YES:** Go to next step. **NO:** Check 700 and 702 Pur wires and connections

MX52301,00003B7 -19-24OCT14-4/8

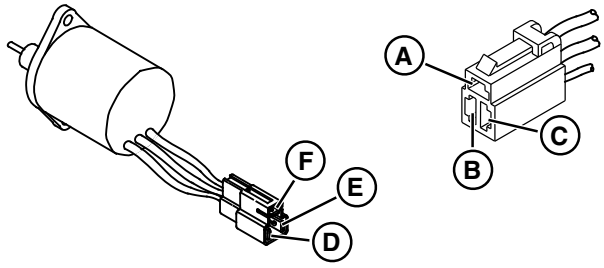
Fuel Shutoff Solenoid and Ground	Is there continuity between X3 connector, 101C Blk wire **(F)** at fuel shutoff solenoid and ground?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine). **NO:** Check 101C and 100G Blk wires, connections, and splices.

Continued on next page

MX52301,00003B7 -19-24OCT14-5/8

❶ Fuel Shutoff Solenoid Hold-In Circuit

MX52301,00003B7 -19-24OCT14-6/8

Fuel Shutoff Solenoid	**Test Procedure B** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Cargo box raised and locked. • Battery fully charged. • Key switch in start position. • Check wire connections for looseness and corrosion. Is battery voltage present at X3 connector, 420A Yel wire **(D)** of fuel shutoff solenoid?  MXT011926 —UN—21OCT14 **D—420A Yellow Wire** **F—101C Black Wire**	**YES:** Go to next step. **NO:** Check 420J and 420A Yel wires, splice, and connections. Test key switch. See Key Switch Test. **NO:** Test power circuit. See Power Circuit Operation, Diesel (SN -080000).

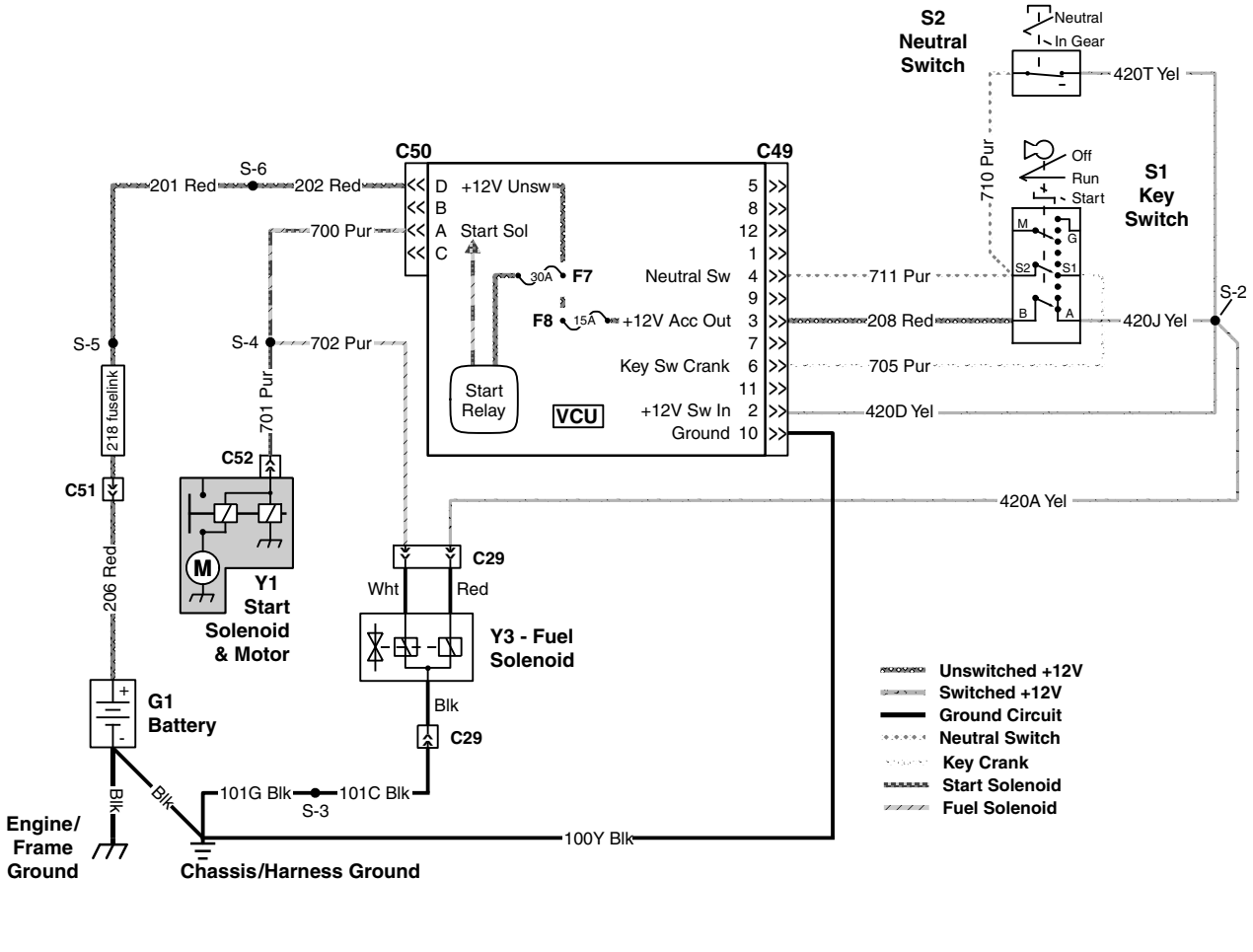
MX52301,00003B7 -19-24OCT14-7/8

Fuel Shutoff Solenoid and Ground	Is there continuity between X3 connector, 101C Blk wire **(F)** at fuel shutoff solenoid and **ground**?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine). **NO:** Check 101C and 100G Blk wires, connections, and splices.

MX52301,00003B7 -19-24OCT14-8/8

Fuel Shutoff Circuit Schematic, Diesel (SN 080001-)

Fuel Shutoff Circuit Schematic (Diesel Engine SN 080001-110000)



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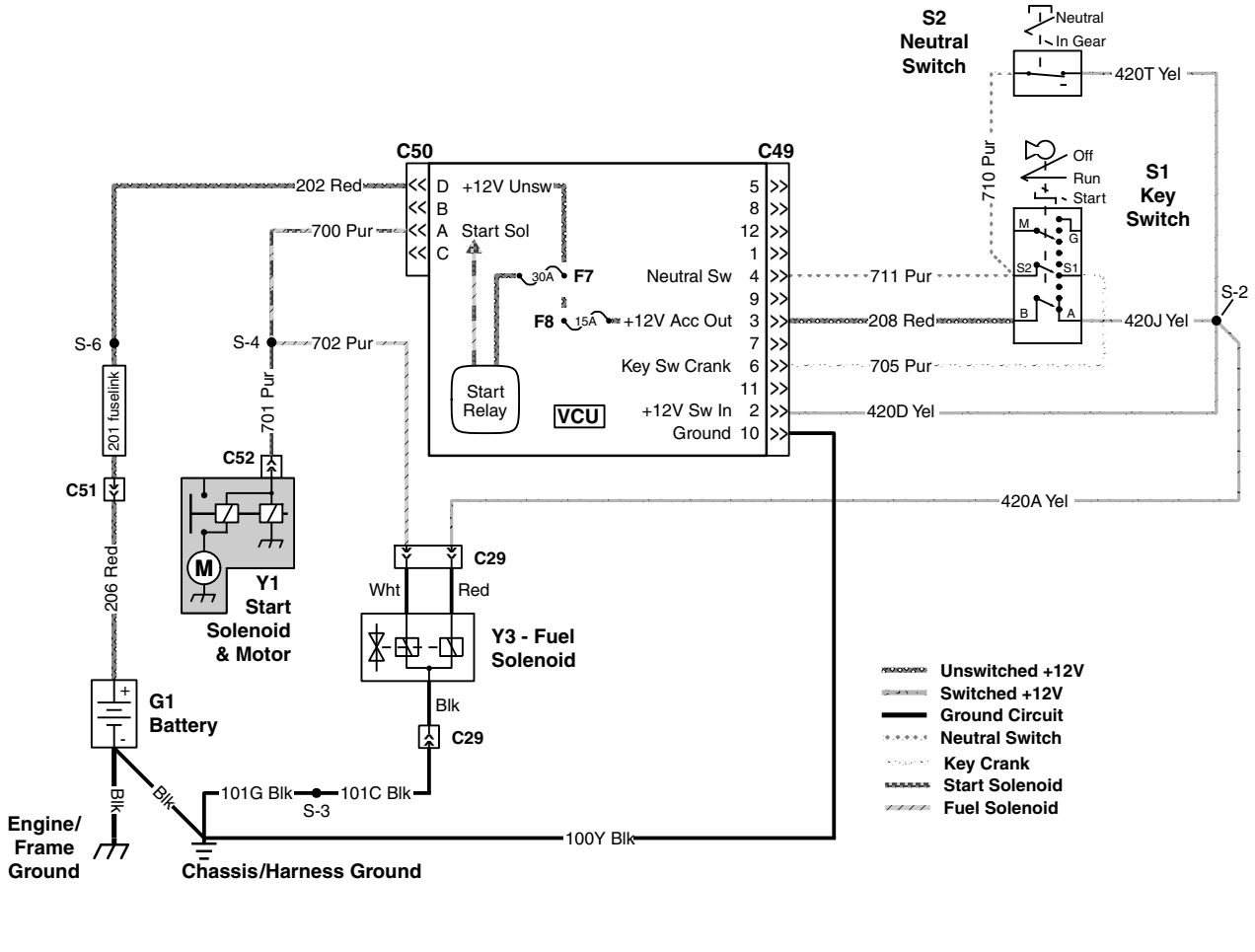
MX52301,00003B9 -19-24OCT14-1/2

Fuel Shutoff Circuit Schematic (Diesel Engine SN 110001-)



MX52301,00003B9 -19-24OCT14-2/2

Fuel Shutoff Circuit Diagnosis, Diesel (SN 080001-)

Fuel Shutoff Circuit Diagnosis (Diesel Engine SN 080001-)

MX52301,00003BA -19-24OCT14-1/8

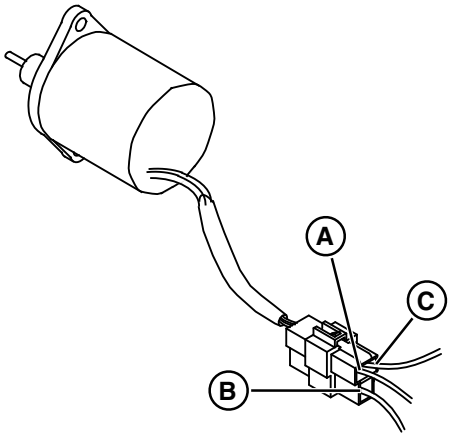
❶ Fuel Shutoff Solenoid Pull-In Circuit

Continued on next page

MX52301,00003BA -19-24OCT14-2/8

Engine Crank	**Test Procedure A:** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Cargo box raised and locked. • Battery fully charged. • Pur wire disconnected from starter solenoid to prevent accidental starting. • Key switch in START position. • Check wire connections for looseness and corrosion. When test conditions are met, does the engine start?	**YES:** Go to next step. **NO:** See Cranking Circuit Diagnosis, Diesel (SN 080001-) in this section, and make repairs as needed. When complete, go to next step.

MX52301,00003BA -19-24OCT14-3/8

Fuel Shutoff Solenoid	While cranking, is battery voltage present at the fuel shutoff solenoid connector C29, 702 Pur wire (A)?  MXT011566 —UN—13JUN14 **A—702 Purple Wire** **B—101C Black Wire** **C—420A Yellow Wire**	**YES:** Go to next step. **NO:** Check 702 Pur wire and connections.

MX52301,00003BA -19-24OCT14-4/8

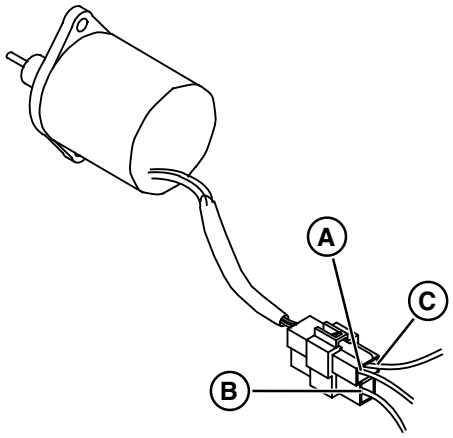
Fuel Shutoff Solenoid and Ground	Is there continuity between 101C Blk wire (B) and ground?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine). **NO:** Check 101C and 101G Blk wires and connections.

Continued on next page

MX52301,00003BA -19-24OCT14-5/8

❶ Fuel Shutoff Solenoid Hold-In Circuit

MX52301,00003BA -19-24OCT14-6/8

Fuel Shutoff Solenoid	**Test Procedure B:** **Test Conditions:** • Park brake locked. • Transmission in neutral. • Cargo box raised and locked. • Battery fully charged. • Key switch in START position. • Check wire connections for looseness and corrosion. Is battery voltage present at the fuel shutoff solenoid connector C29, 420A Yel wire (C)?  MXT011566 —UN—13JUN14 **A—702 Purple Wire** **B—101C Black Wire** **C—420A Yellow Wire**	**YES:** Go to next step. **NO:** Check 420A Yel wire and connections. **NO:** See Power Circuit Diagnosis, Diesel (SN 080001-) in this section.

MX52301,00003BA -19-24OCT14-7/8

Fuel Shutoff Solenoid and Ground	Is there continuity between 101C Blk wire (B) and ground?	**YES:** Test fuel shutoff solenoid. See Fuel Shutoff Solenoid Test (Diesel Engine). **NO:** Check 101C and 101G Blk wires and connections.

MX52301,00003BA -19-24OCT14-8/8

Carburetor Heater Circuit Operation, Gas (All)

Function:

To preheat the air/fuel mixture entering the engine in order to prevent spark plug fouling and poor engine performance.

Operating Conditions:

- Key switch in RUN or START position.

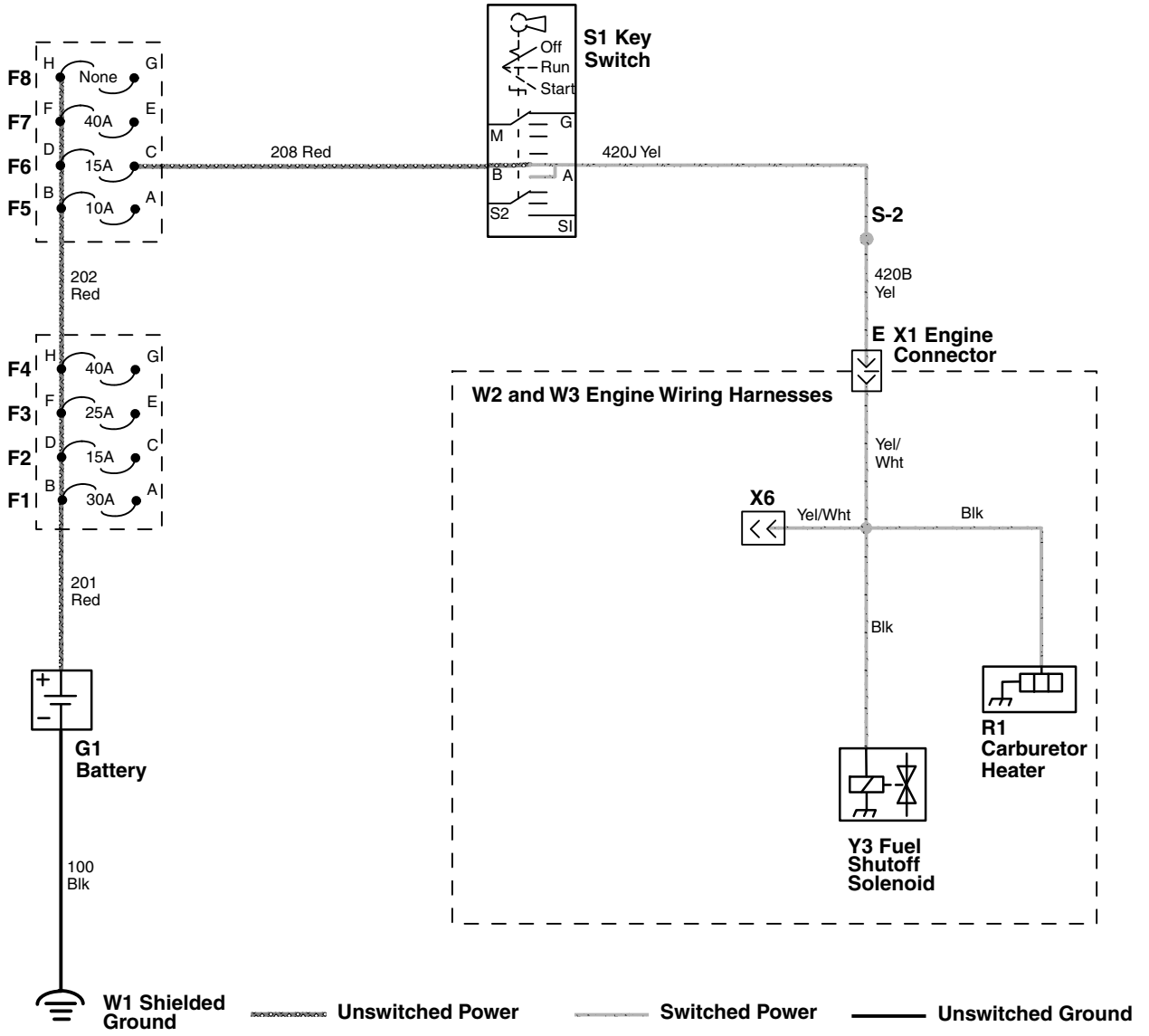
Theory of Operation:

The G1 battery supplies current through the F6 fuse and S1 key switch to the S2 splice. Battery voltage then flows over the 420B Yel wire to the X1 engine connector. A Yel/Wht wire, splice, and a Blk wire carrie power to the R1 carburetor heater. The heater is grounded to the engine through an internal resistance of approximately 8.0 Ohms (cold) controlling current.

MX52301,00003BB -19-22OCT14-1/1

Carburetor Heater Circuit Schematic Gas, (All)

Carburetor Heater Circuit Schematic (SN -040000)



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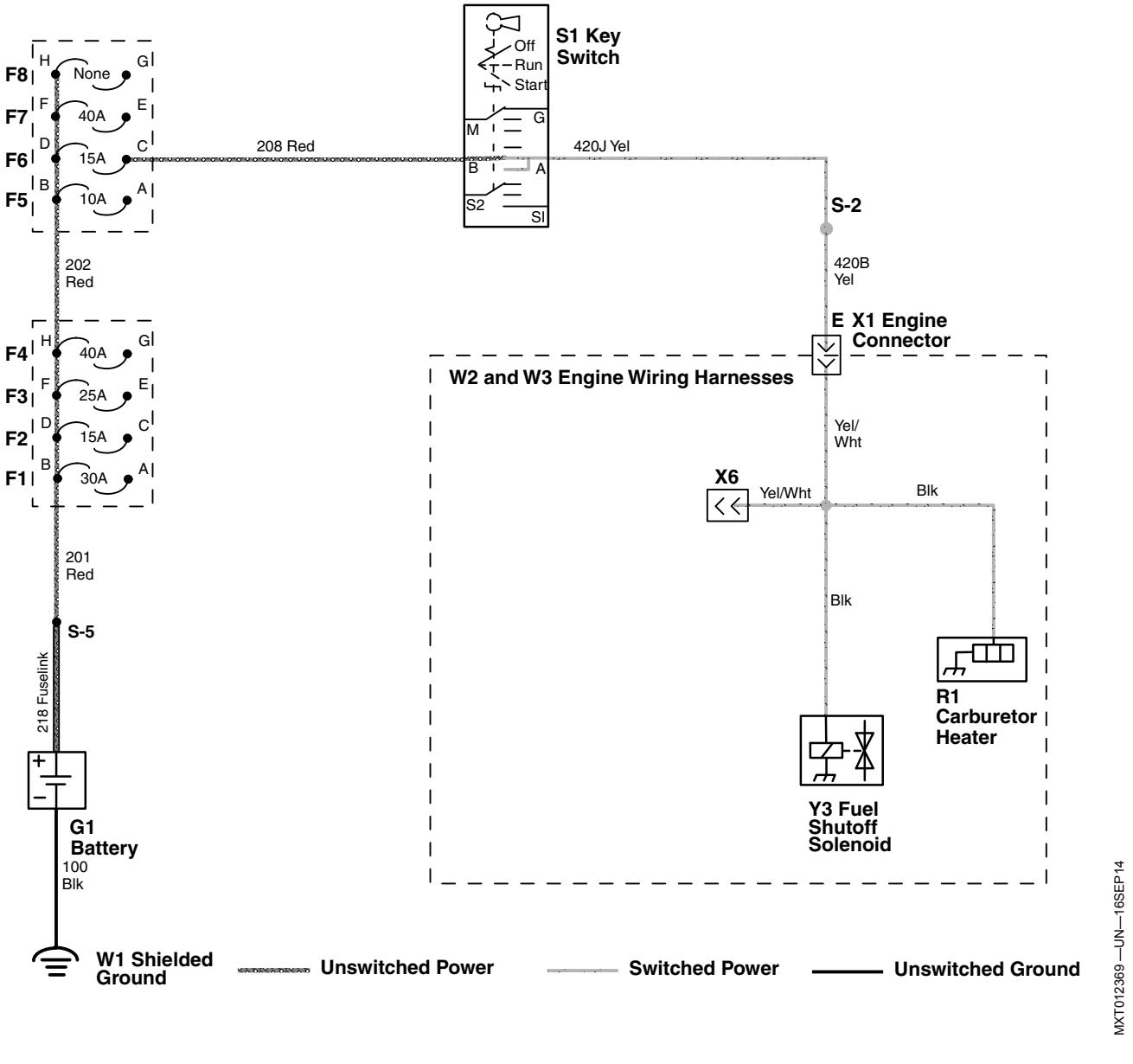
MX52301,00003BC -19-22OCT14-1/3

Carburetor Heater Circuit Schematic (SN 040001-110000)



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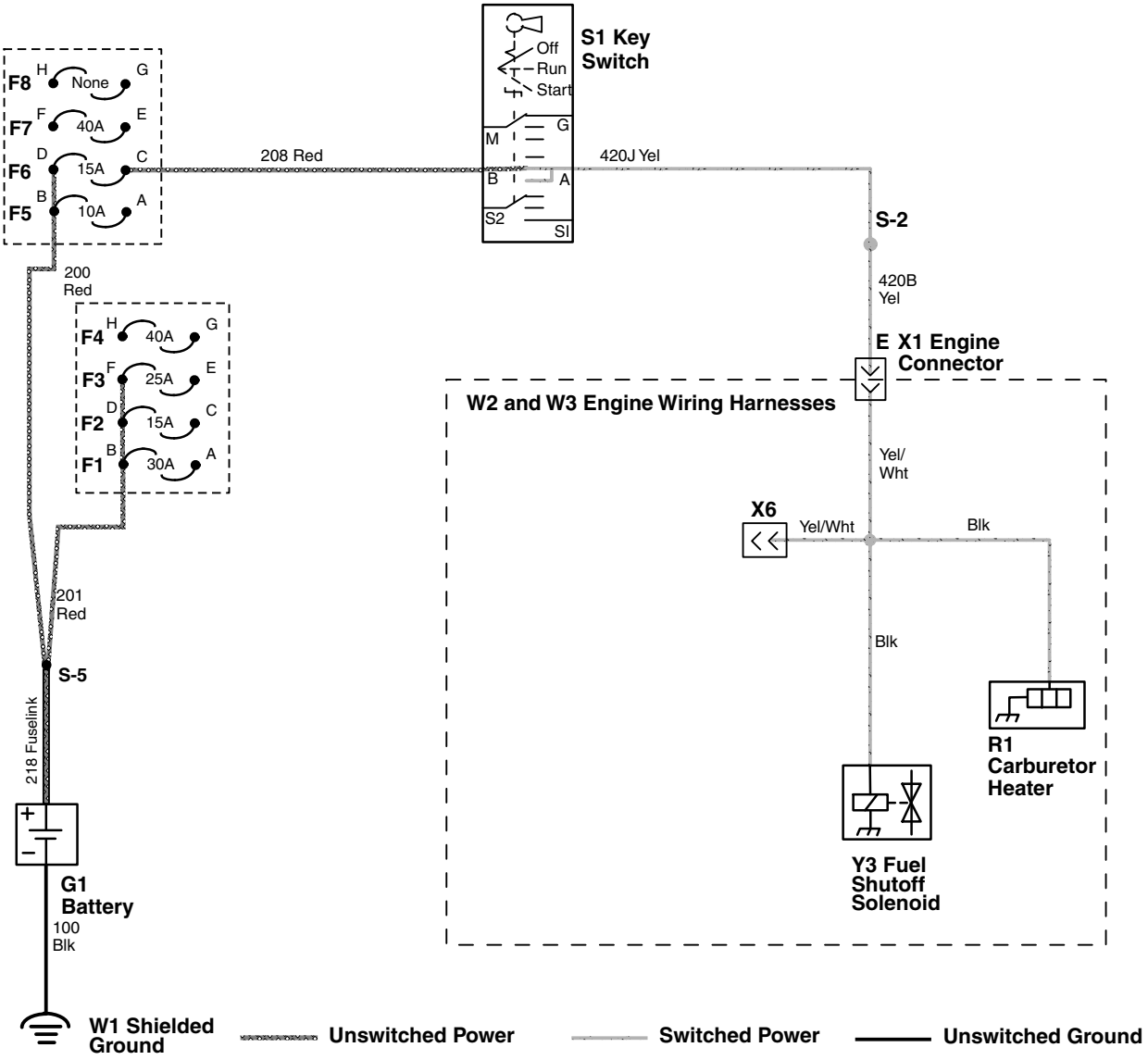
MX52301,00003BC -19-22OCT14-2/3

Carburetor Heater Circuit Schematic (SN 110001-)



MX52301,00003BC -19-22OCT14-3/3

Carburetor Heater Circuit Diagnosis, Gas (All)

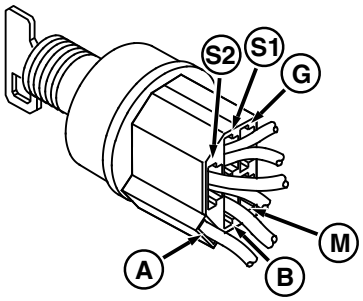
Carburetor Heater Circuit Diagnosis (Gas Engine All)

MX52301,00003BD -19-22OCT14-1/5

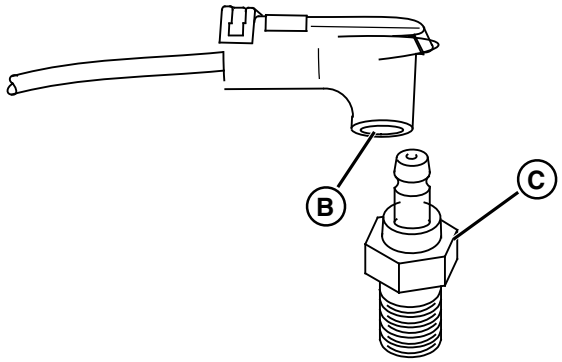
❶ **Carburetor Heater Circuit**

Continued on next page

MX52301,00003BD -19-22OCT14-2/5

Key Switch	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is battery voltage present at 420J Yel wire **(A)** of key switch?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test. See Power Circuit Diagnosis, Gas (SN -040001) Section 50 Group 55 or See Power Circuit Operation, Gas (SN 040001-)

MX52301,00003BD -19-22OCT14-3/5

Carburetor Heater	Disconnect R1 carburetor heater from harness. Is battery voltage present at R1 carburetor heater, Blk wire **(B)**?  MXT011568 —UN—13JUN14 **B—Black Wire** **C—Carburetor Heater Body**	**YES:** Go to next step. **NO:** Check Blk, Yel/Wht, 420B, and 420J Yel wires and connections.

MX52301,00003BD -19-22OCT14-4/5

Carburetor Heater Body	Is continuity to ground present at body of R1 carburetor heater **(C)**?	**YES:** Test carburetor heater. **NO:** Check engine ground to frame and battery.

MX52301,00003BD -19-22OCT14-5/5

Glow Plug Circuit Operation, Diesel (All)

Function:

To provide an added source of heat for combustion during cold starts, especially below 5°C (40°F).

Operating Conditions:

- Key switch must be in the start or run position.

Theory of Operation:

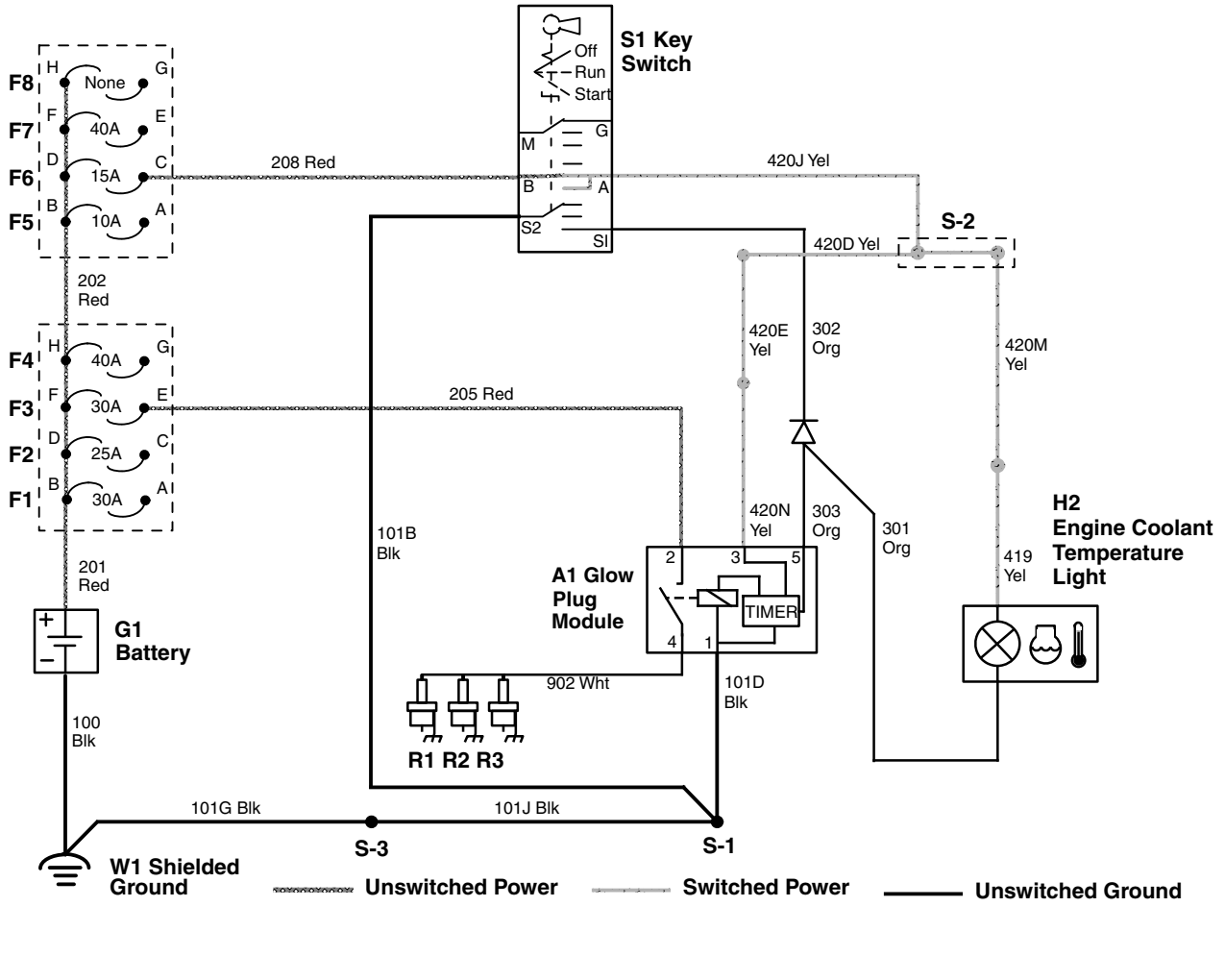
The ignition system is designed to inject diesel fuel into the precombustion chamber and piston cylinder. Heat from compression ignites the fuel and air mixture. Glow plugs in each precombustion chamber provide extra heat when needed. When the key is turned to the run position the glow plug cycle (0—30 seconds) starts. A timer determines the length of the preheat cycle based upon the initial ambient temperature. The coolant temperature light turns on during preheat and goes out when the glow plug control times out.

NOTE: Although the light will go out, the glow plugs will remain on for the duration shown in the timing chart.

Deg C	Deg F	Lamp	Relay on Time
-20	-4	9s	30s
0	32	7s	24s
20	68	4s	15s
40	104	1s	8s
60	140	0s	4s
75	167	0s	1s

KK36721,0000126 -19-15OCT14-1/1

Glow Plug Circuit Schematic, Diesel (SN -040000)



MX52301,00003BF -19-24OCT14-1/1

Glow Plug Circuit Diagnosis, Diesel (SN -040000)

Glow Plug Circuit Diagnosis (SN -040000)

MX52301,00003C0 -19-24OCT14-1/8

❶ Glow Plug Circuit

MX52301,00003C0 -19-24OCT14-2/8

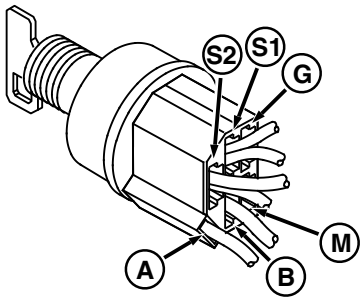
Key Switch

Test Procedure A

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at 420J Yel wire **(A)** of key switch?



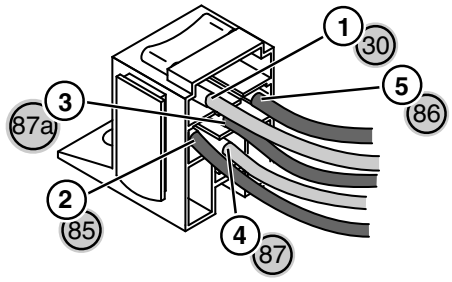
MXT004463 —UN—31MAY12
A—420J Yellow Wire

YES: Go to next step.

NO: Check power circuit to key switch. See Power Circuit Diagnosis, Diesel (SN -040000) Section 50 Group 55. If OK, test key switch. See Key Switch Test.

Continued on next page

MX52301,00003C0 -19-24OCT14-3/8

Glow Plug Module	Is battery voltage present at 420N Yl wire **(3)** of A1 glow plug module?  MXT011570 —UN—09JUL14 **1— 101D Black Wire** **2— 205 Red Wire** **3— 420N Yellow Wire**	**YES:** Go to next step. **NO:** Check 420J, 420E and 420N Yel wires, splices and connections.

MX52301,00003C0 -19-24OCT14-4/8

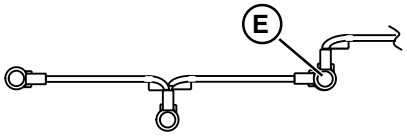
Glow Plug Module and Ground	Is there continuity between 101D Blk wire **(1)** of A1 glow plug module and **ground**?	**YES:** Go to next step. **NO:** Check 101D, 101J, and 101G Blk wires, splices, and connections.

MX52301,00003C0 -19-24OCT14-5/8

Voltage Presence in Glow Plug Module	Is battery voltage present at 205 Red wire **(2)** of A1 glow plug module?	**YES:** Go to next procedure. **NO:** Check 206 and 201 Red wires, F3 fuse, and 205 Red wire and connections.

Continued on next page

MX52301,00003C0 -19-24OCT14-6/8

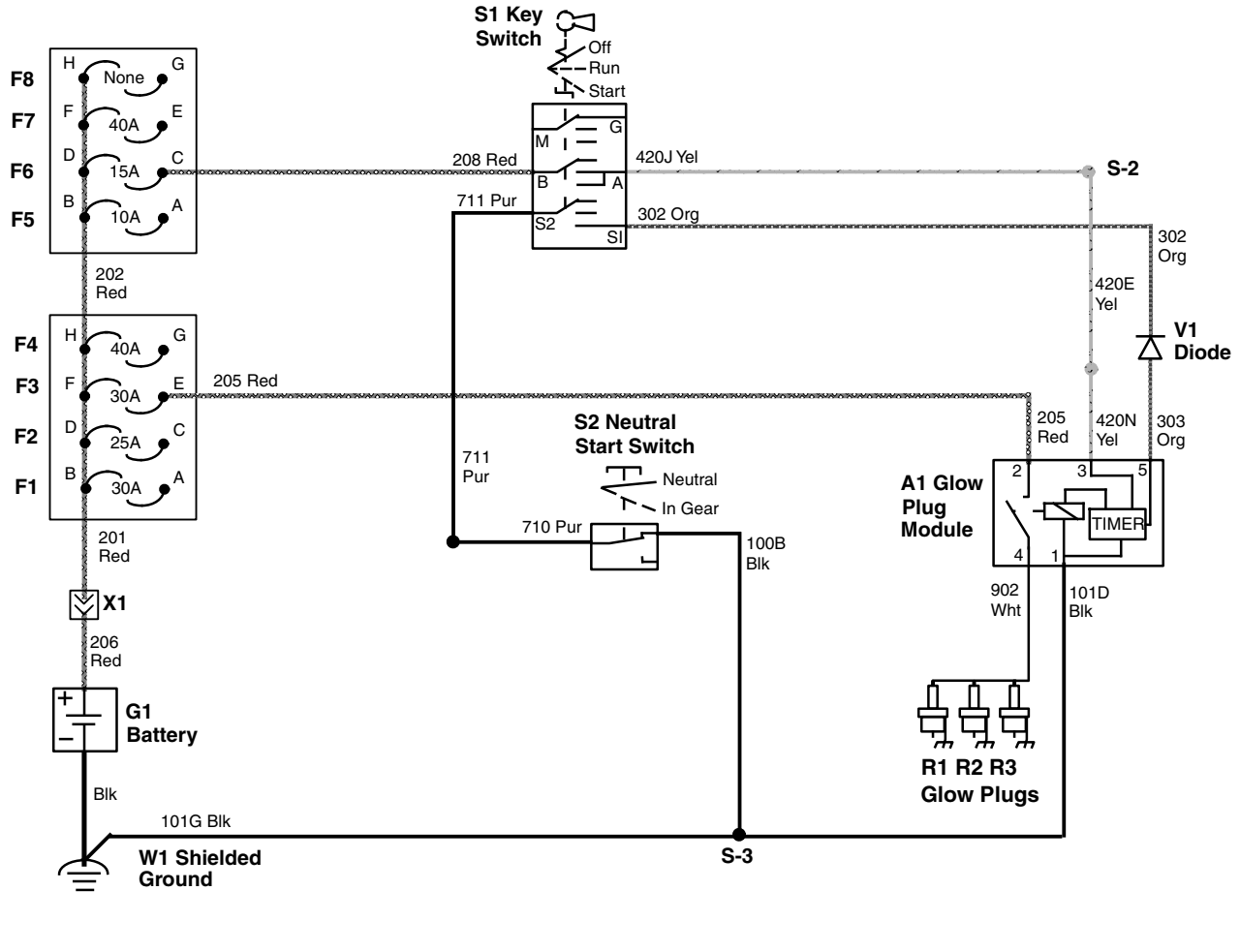
Glow Plug Module	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. *NOTE: There is approximately a 30 second window during key switch OFF-ON cycles in which the tests are valid (power to the glow plugs).* Is battery voltage present at 902 Wht glow plug wire (E)?  MXT011571 —UN—13JUN14 **E—902 White Glow Plug Wire**	**YES:** Go to next step. **NO:** Replace A1 glow plug module.

MX52301,00003C0 -19-24OCT14-7/8

Voltage Presence after 30 seconds	After approximately 30 seconds, does battery voltage turn off at 902 Wht glow plug wire?	**YES:** Test glow plugs and connections. See Glow Plug Test (Diesel Engine). **NO:** Replace A1 glow plug module.

MX52301,00003C0 -19-24OCT14-8/8

Glow Plug Circuit Schematic, Diesel (SN 040001-080000)



MX52301,00003C2 -19-24OCT14-1/1

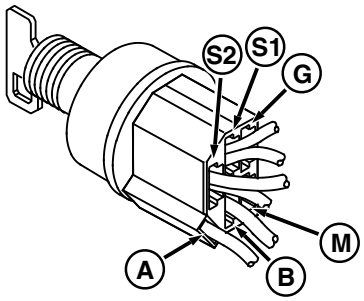
Glow Plug Circuit Diagnosis, Diesel (SN 040001-080000)

Glow Plug Circuit Diagnosis (SN 040001-080000)

MX52301,00003C3 -19-24OCT14-1/8

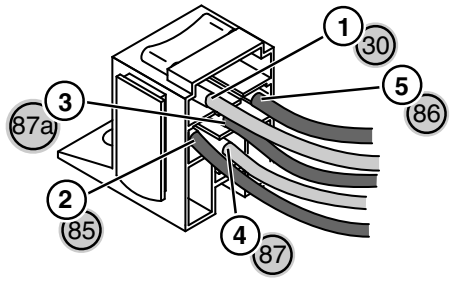
❶ Glow Plug Circuit

MX52301,00003C3 -19-24OCT14-2/8

Key Switch	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is battery voltage present at 420J Yel wire **(A)** of key switch?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Check power circuit to key switch. See Power Circuit Operation, Diesel (SN -080000). If OK, test key switch. See Key Switch Test.

Continued on next page

MX52301,00003C3 -19-24OCT14-3/8

Glow Plug Module	Is battery voltage present at 420N Yl wire **(3)** of A1 glow plug module?  MXT011570 —UN—09JUL14 **1— 101D Black Wire** **2— 205 Red Wire** **3— 420N Yellow Wire**	**YES:** Go to next step. **NO:** Check 420J, 420E and 420N Yel wires, splices and connections.

MX52301,00003C3 -19-24OCT14-4/8

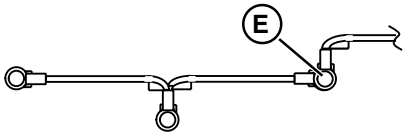
Glow Plug Module and Ground	Is there continuity between 101D Blk wire **(1)** of A1 glow plug module and **ground**?	**YES:** Go to next step. **NO:** Check 101D, 101J, and 101G Blk wires, splices, and connections.

MX52301,00003C3 -19-24OCT14-5/8

Voltage Presence in Glow Plug Module	Is battery voltage present at 205 Red wire **(2)** of A1 glow plug module?	**YES:** Go to next procedure. **NO:** Check 206 and 201 Red wires, F3 fuse, and 205 Red wire and connections.

Continued on next page

MX52301,00003C3 -19-24OCT14-6/8

Glow Plug Module	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. *NOTE: There is approximately a 30 second window during key switch OFF-ON cycles in which the tests are valid (power to the glow plugs).* Is battery voltage present at 902 Wht glow plug wire **(E)**?  MXT011571 —UN—13JUN14 **E—902 White Glow Plug Wire**	**YES:** Go to next step. **NO:** Replace A1 glow plug module.

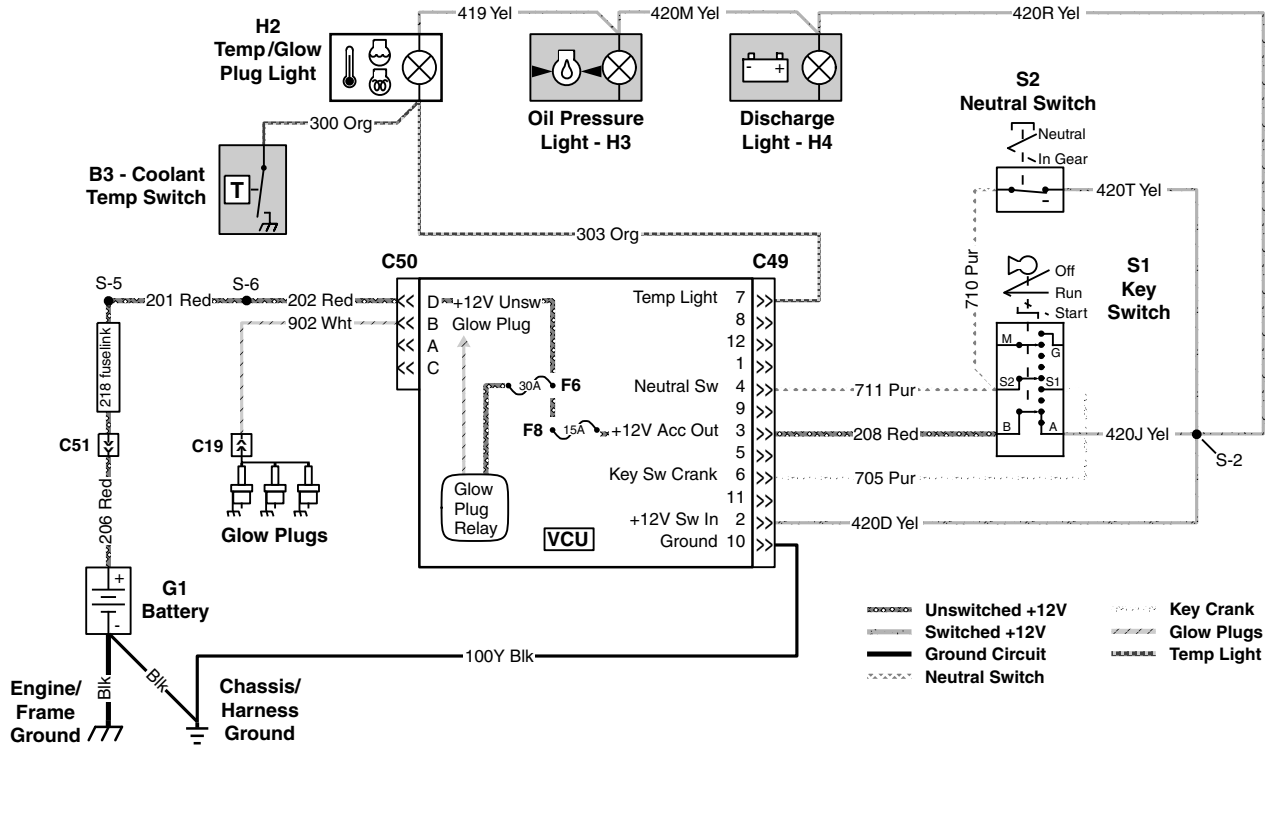
MX52301,00003C3 -19-24OCT14-7/8

Voltage Presence after 30 seconds	After approximately 30 seconds, does battery voltage turn off at 902 Wht glow plug wire?	**YES:** Test glow plugs and connections. See Glow Plug Test (Diesel Engine). **NO:** Replace A1 glow plug module.

MX52301,00003C3 -19-24OCT14-8/8

Glow Plug Circuit Schematic, Diesel (SN 080001-)

Glow Plug Circuit Schematic (SN 080001-110000)



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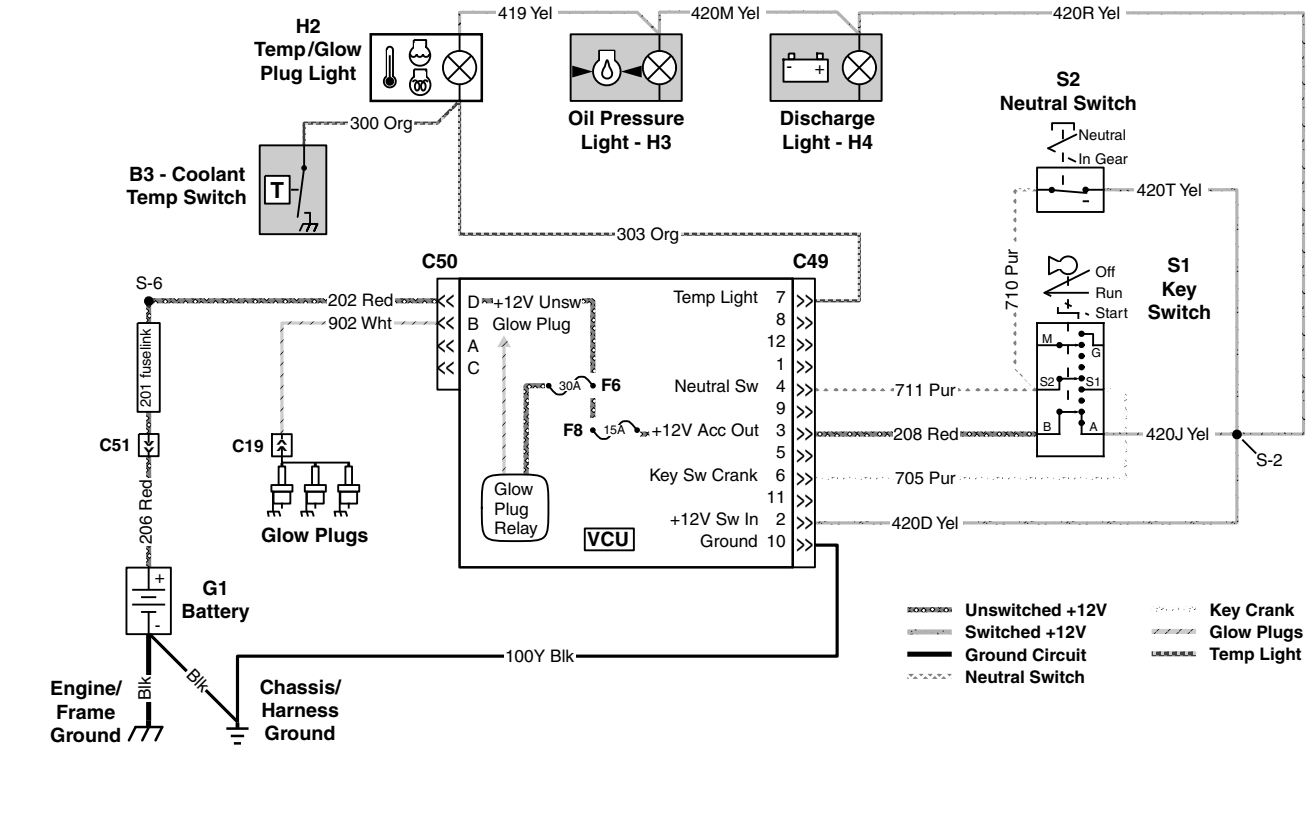
MX52301,00003C5 -19-24OCT14-1/2

Glow Plug Circuit Schematic (SN 110001-)



MX52301,00003C5 -19-24OCT14-2/2

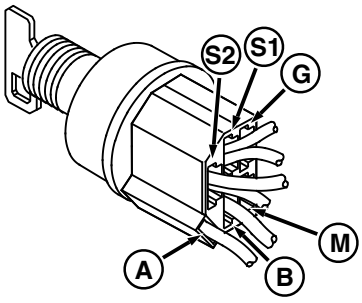
Glow Plug Circuit Diagnosis, Diesel (SN 080001-)

Glow Plug Circuit Diagnosis (SN 080001-)

MX52301,00003C6 -19-24OCT14-1/10

❶ Glow Plug Circuit—Chassis

MX52301,00003C6 -19-24OCT14-2/10

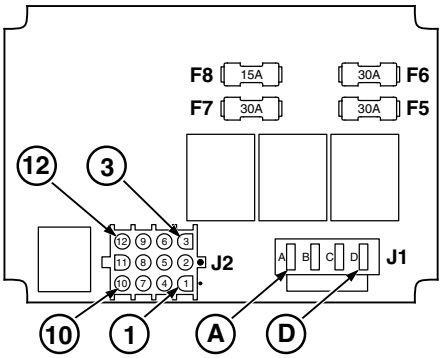
Key Switch	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is battery voltage present at key switch connector 208 Red wire **(B)**?  MXT004463 —UN—31MAY12 **A—420Y and 420J Yellow Wires** **B—208 Red Wire**	**YES:** Go to next step. **NO:** Check F8 fuse, Red wires 201, 202, 206, 208 and 218 fuse link. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.

MX52301,00003C6 -19-24OCT14-3/10

Key Switch	Key switch to RUN. Is battery voltage present at 420Y and 420J Yel wires **(A)**?	**YES:** Go to next step. **NO:** See Key Switch Test.

Continued on next page

MX52301,00003C6 -19-24OCT14-4/10

VCU Connector Voltage	Is battery voltage present at VCU connector **(J2-2)**, 420D Yel wire?  MXT011938 —UN—04JUN14 **(J1-B)—Pin B** **(J2-2)—420D Yellow Wire** **(J2-7)—303 Orange Wire** **(J2-10)—100Y Black Wire**	**YES:** Go to next step. **NO:** Check 420D and 420J Yel wires from VCU **(J2-2)** to key switch **(A)**.
		MX52301,00003C6 -19-24OCT14-5/10

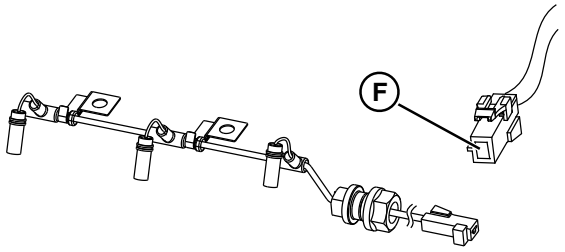
Voltage Presence	Is voltage present at **(J2-7)**, 303 Org wire?	**YES:** Go to next step. **NO:** Test H2 Temp bulb. See Bulb Test. **NO:** Check continuity of 303 Org wire from **(J2-7)** to H2 light socket.
		MX52301,00003C6 -19-24OCT14-6/10

Continuity	Key switch to OFF. Is there continuity between **(J2-10)**, 100Y Blk wire and **ground**?	**YES:** Go to next step. **NO:** Check 100Y Blk wire and connections.
		MX52301,00003C6 -19-24OCT14-7/10

❶ Glow Plug Circuit—Engine

Continued on next page

MX52301,00003C6 -19-24OCT14-8/10

Power in Glow Plug Wire	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. • Glow plug connector C19 (902 Wht wire) disconnected. *NOTE: There is window of approximately 1~30 seconds during key switch OFF-ON cycles in which the tests are valid (power to the glow plugs).* Key switch from OFF to RUN. Is power present at 902 Wht glow plug wire **(F)**?  MXT011575 —UN—13JUN14 **F—902 White Glow Plug Wire**	**YES:** Go to next step. **NO:** Check F6 fuse. Check 902 Wht wire continuity from **(F)** to VCU connector **(J1-B)** If OK, and all power, ground, and input connections and readings are correct, replace VCU.

MX52301,00003C6 -19-24OCT14-9/10

Power Disconnect	Does power at **(F)** turn off within 30 seconds?	**YES:** Glow plug circuit functioning. Test glow plugs and connections. See Glow Plug Test (Diesel Engine). **NO:** Replace VCU.

MX52301,00003C6 -19-24OCT14-10/10

4WD Clutch Circuit Operation, (All)

Function:

To provide power to energize the 4WD clutch.

Operating Conditions:

- Key switch must be in the run position.
- Transmission must be in gear (neutral switch open).
- 4WD switch must be on (contacts closed).

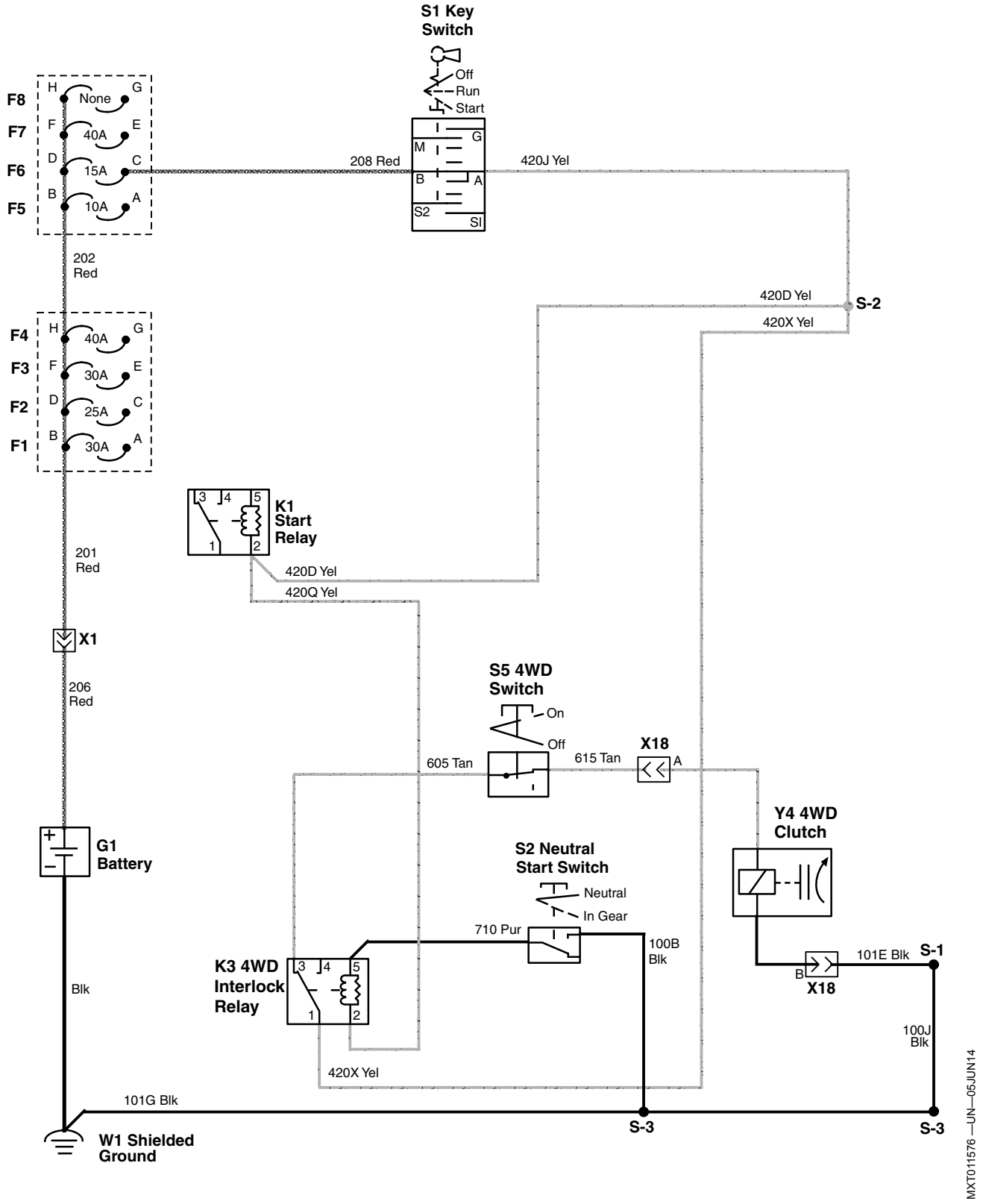
Theory of Operation:

The 4WD circuit allows the operator to engage the 4WD system. When activated, the front differential transfers power train power to the front wheels. A solenoid-operated clutch in the front axle housing couples a drive shaft from the transmission to the front differential. With operating conditions met, a relay completes the circuit for the front axle clutch and 4WD is engaged.

MX52301,00003C7 -19-19SEP14-1/1

4WD Clutch Circuit Schematic, Gas (SN 040001-), Diesel (SN 040001-080000)

4WD Clutch Circuit Schematic (Diesel SN 040001—080000)



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MX52301,00003C8 -19-24OCT14-1/5

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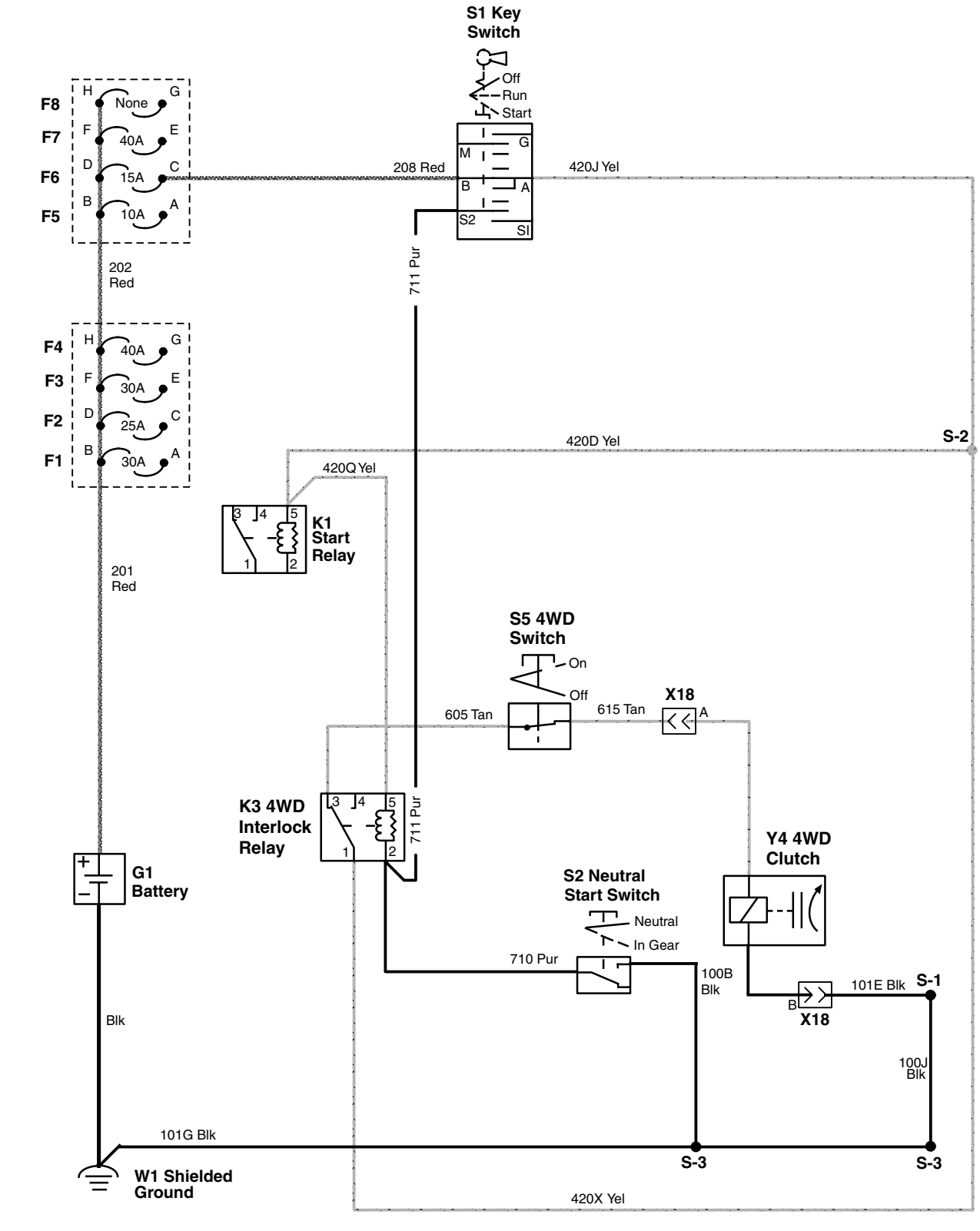
4WD Clutch Circuit Schematic (Gas SN 040001—080000)



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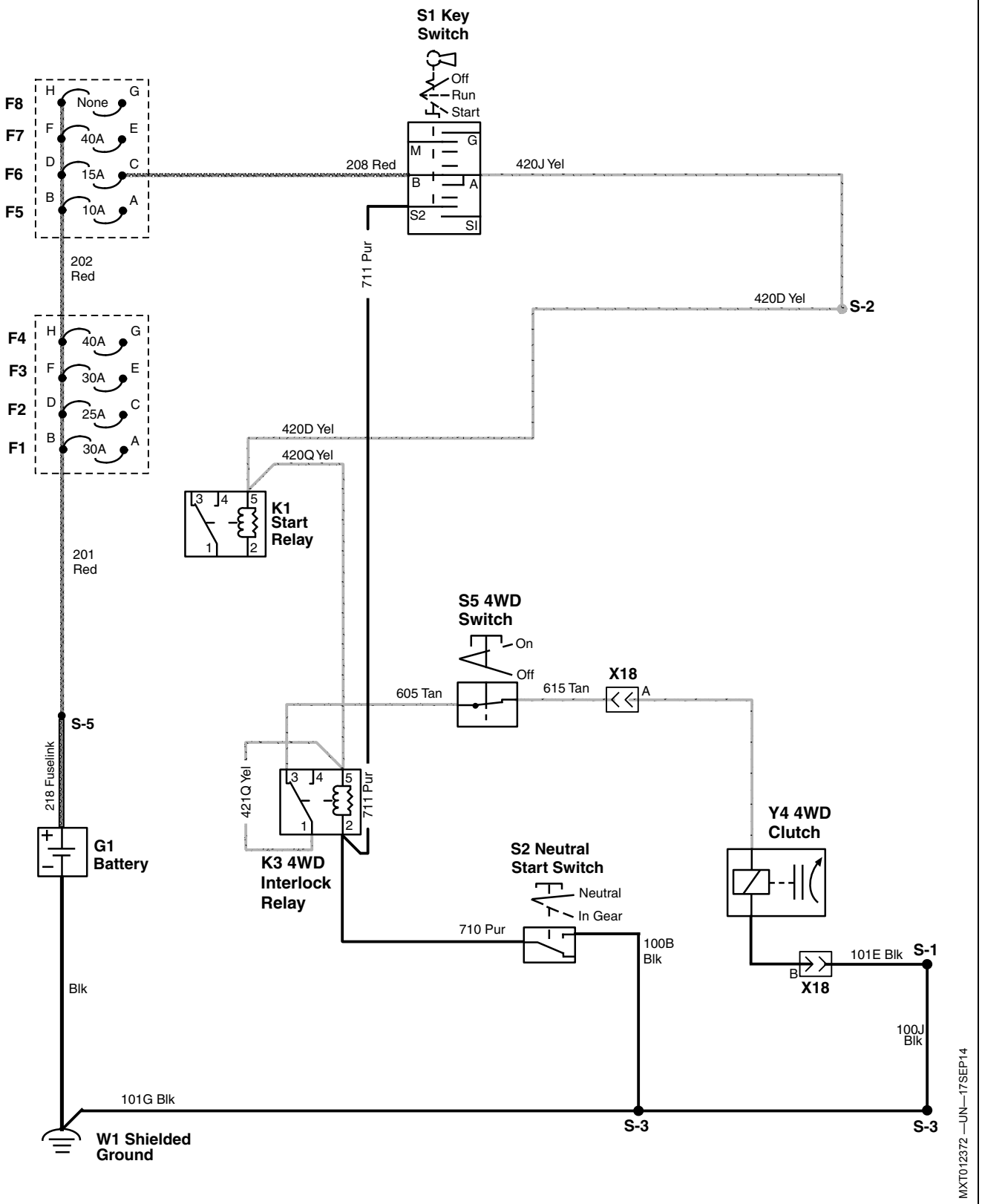
MX52301,00003C8 -19-24OCT14-3/5

4WD Clutch Circuit Schematic (Gas SN 080001—110001)



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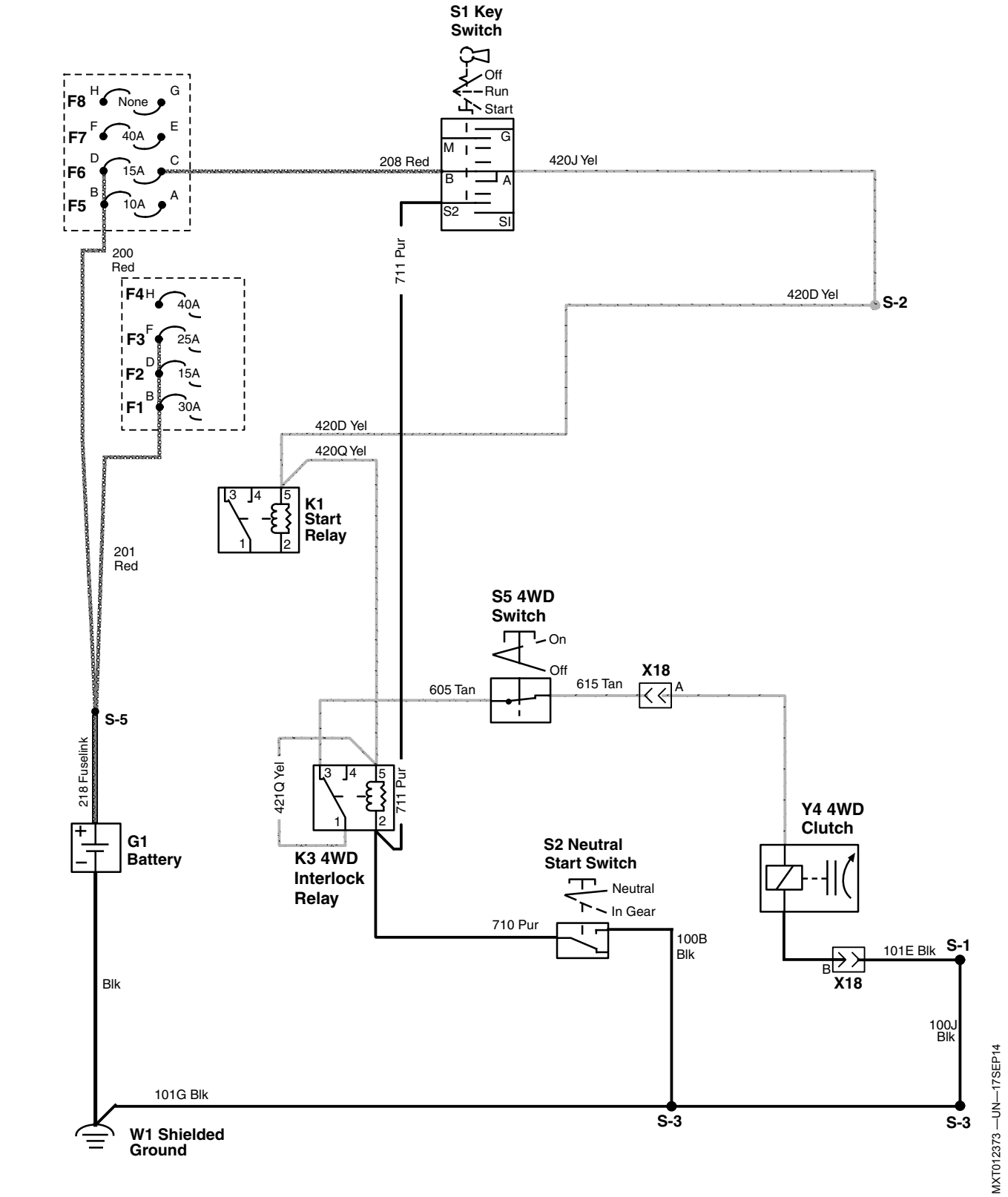
MX52301,00003C8 -19-24OCT14-4/5

4WD Clutch Circuit Schematic (Gas SN 110001-)



MX52301,00003C8 -19-24OCT14-5/5

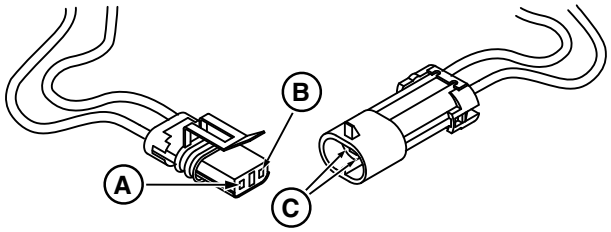
4WD Clutch Circuit Diagnosis, Gas (SN 040001-), Diesel (SN 040001-080000)

4WD Clutch Circuit

MX52301,00003C9 -19-24OCT14-1/8

❶ 4WD Clutch Circuit

MX52301,00003C9 -19-24OCT14-2/8

Main Wire Harness	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Transmission in gear. • Key switch in run position, engine off. • 4WD switch on. • Check wire connections for looseness and corrosion. Disconnect the X18 connector to the 4WD clutch. Is battery voltage present at 615 Tan wire **(A)** of main wire harness?  MXT011577—UN—16JUN14 **A—615 Tan Wire** **B—101E Black Wire** **C—Clutch Connector Terminals**	**YES:** Go to next step. **NO:** Skip next two steps and continue tests.

MX52301,00003C9 -19-24OCT14-3/8

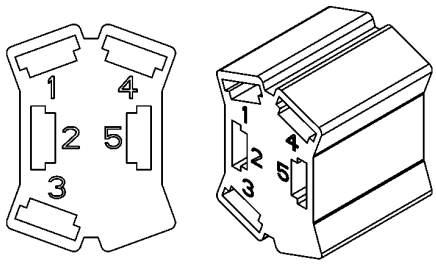
Ground Presence	Is continuity to ground present at the 101E Blk wire **(B)** of X18 connector?	**YES:** Go to next step. **NO:** Check 101E and 101G Blk wires, splices, and connections.

Continued on next page

MX52301,00003C9 -19-24OCT14-4/8

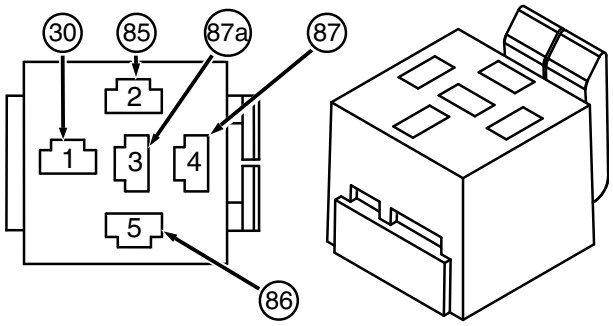
Clutch Connector	Measure the resistance across the terminals of the clutch connector **(C)**. Is the resistance reading 22—28 Ohms?	**YES:** Clutch electrical circuit is functional. Go to Power Train Section and check mechanical functions. See Front Differential Removal and Installation (SN 040001-). **NO:** Replace the 4WD clutch. See Front Differential Removal and Installation (SN 040001-) and See Front Differential Disassembly (SN 040001-).

MX52301,00003C9 -19-24OCT14-5/8

4WD Switch	Is battery voltage present at terminal **(2)** of S5 4WD switch, 605 Tan wire?  MXT001666 —UN—10OCT11 **2—605 Tan Wire**	**YES:** Check 615 Tan wire and connections. If OK, replace 4WD switch. **NO:** Go to next step.

Continued on next page

MX52301,00003C9 -19-24OCT14-6/8

Terminal	Remove relay. Is battery voltage present at terminal **2 (85)** of K3 4WD interlock relay connector, 420Q Yel wire?  MXT011889 —UN—09JUL14 **2 (85)—420Q Yellow Wire** **1 (30)—420X (SN 040001-080000), 421Q (SN 080001-) Yellow Wire**	**YES:** Test relay. See Relay Test. **NO:** Check 420Q, 420D Yel wires, and switched power circuit. See Power Circuit Operation, Gas (SN 040001-) or See Power Circuit Operation, Diesel (SN -080000).

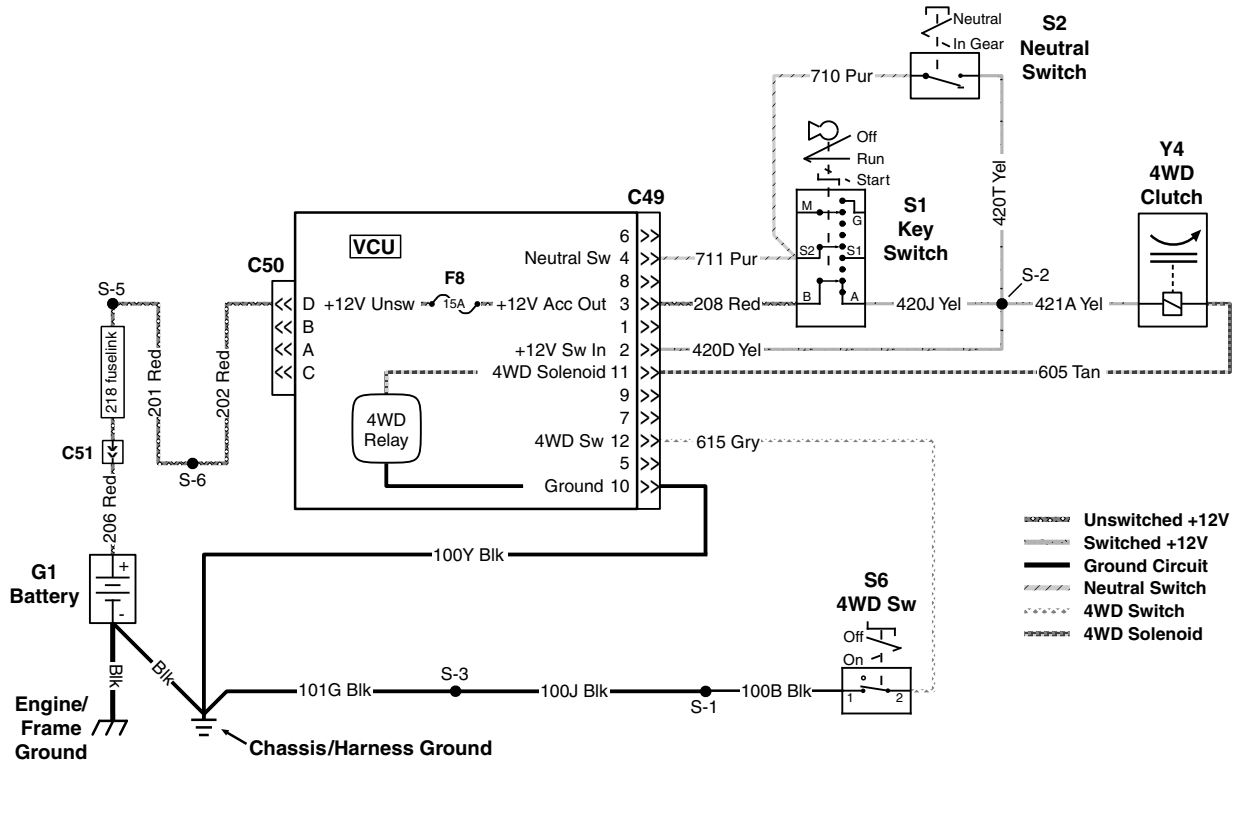
MX52301,00003C9 -19-24OCT14-7/8

4WD Interlock Relay Terminal	Is battery voltage present at terminal **1 (30)** of K3 4WD interlock relay connector, 420X Yel wire?	**YES:** Check 605 Tan wire and connections. If OK, replace 4WD interlock relay. Test complete. **NO:** Install relay. Check 420X (SN 040001-080000), 421Q (SN 080001-) Yel wire, and switched power circuit. See Power Circuit Operation, Gas (SN 040001-) or See Power Circuit Operation, Diesel (SN -080000).

MX52301,00003C9 -19-24OCT14-8/8

4WD Circuit Schematic, Diesel (SN 080001-)

4WD Circuit Schematic (Diesel SN 080001-110000)



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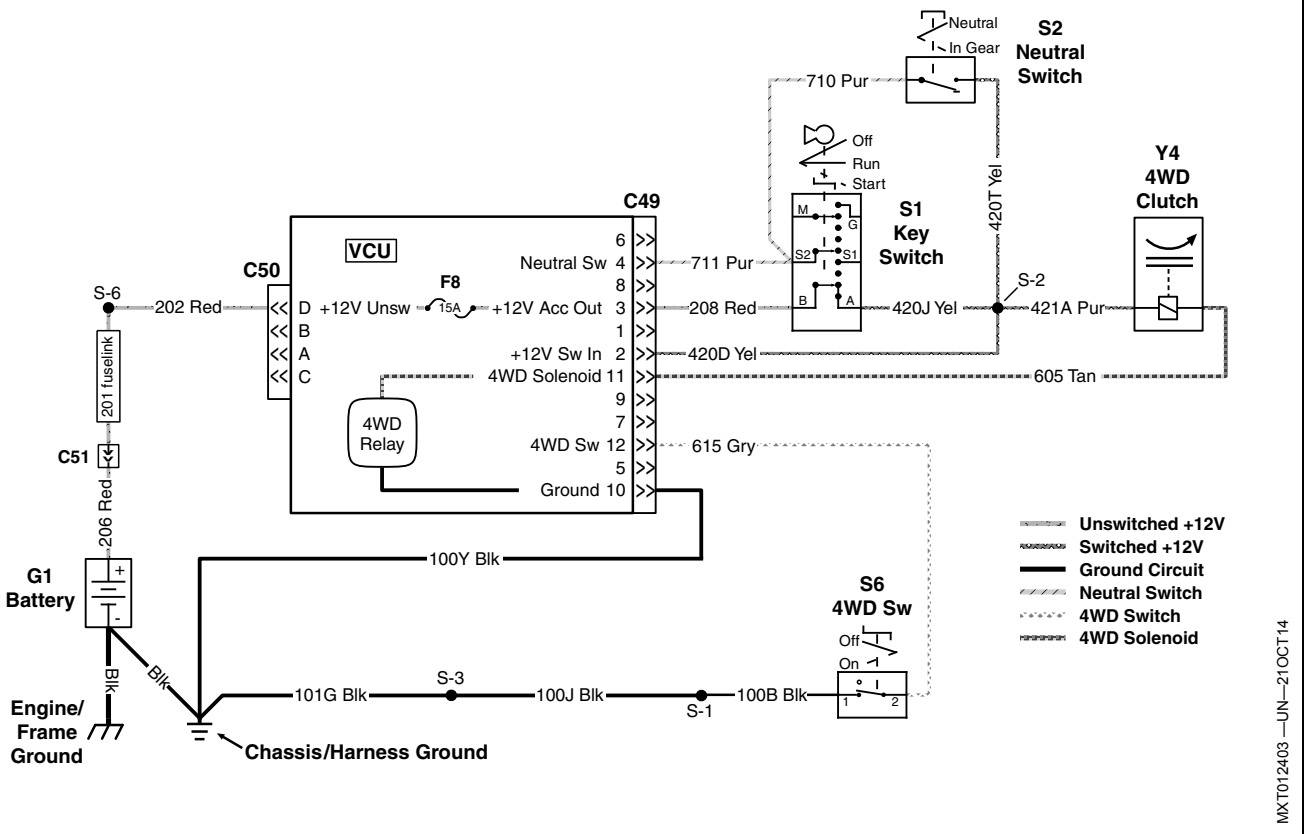
MX52301,00003CB -19-24OCT14-1/3

4WD Circuit Schematic (Diesel SN 110001-120000)



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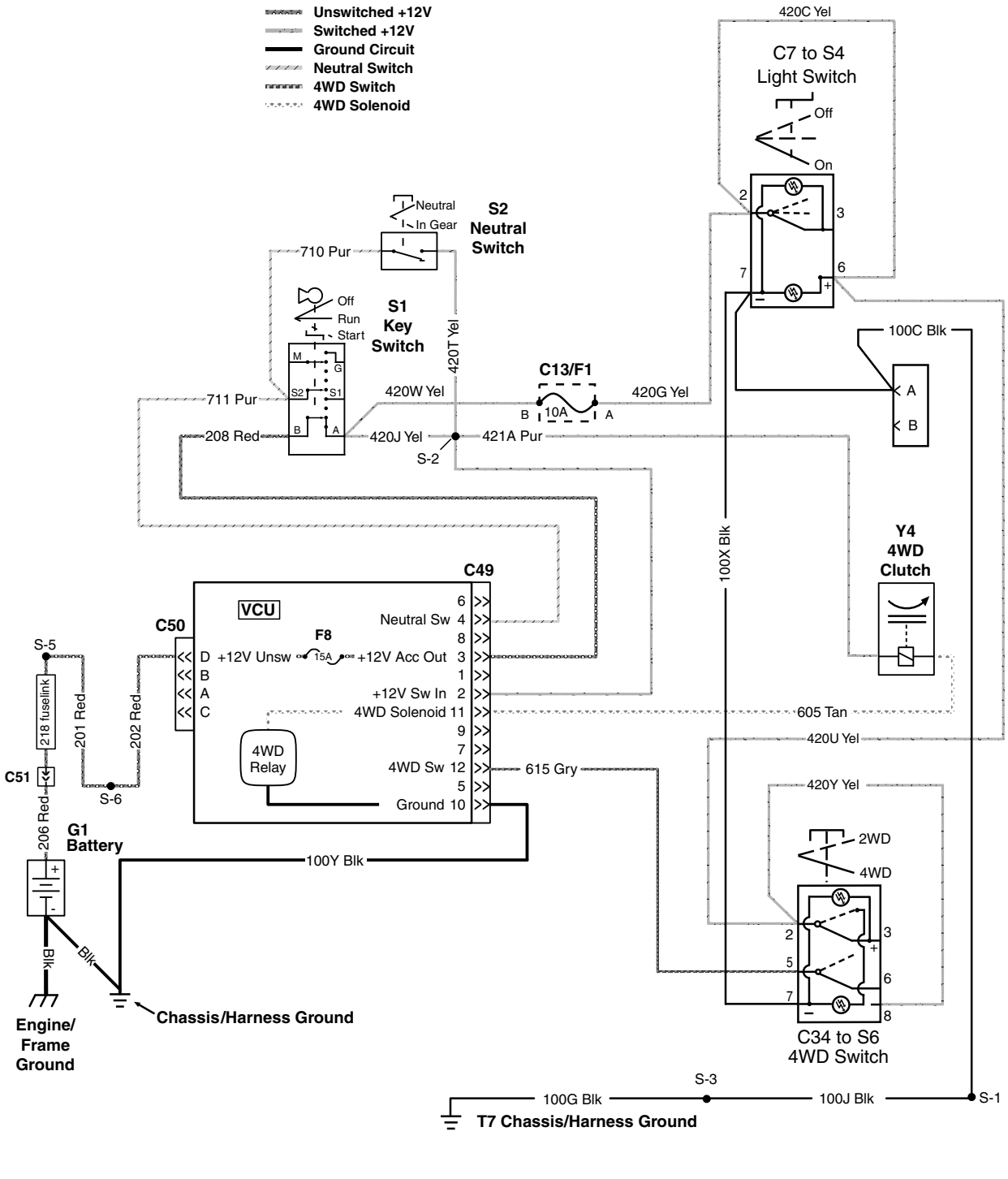
MX52301,00003CB -19-24OCT14-2/3

4WD Circuit Schematic (Diesel SN 120001-)



MX52301,00003CB -19-24OCT14-3/3

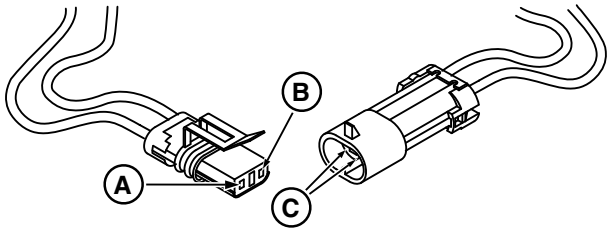
4WD Circuit Diagnosis, Diesel (SN 080001-)

4WD Circuit Diagnosis (Diesel SN 080001-)

MX52301,00003CC -19-24OCT14-1/9

❶ 4WD Circuit

MX52301,00003CC -19-24OCT14-2/9

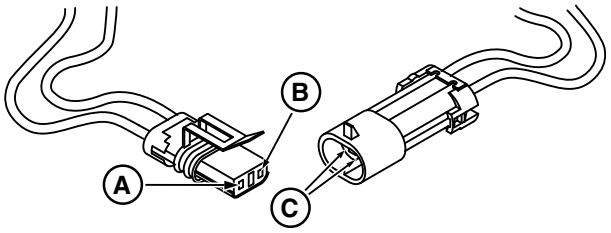
Connector	Test Procedure	
	Test Conditions: • Machine parked safely. See the “Safety Section”. • Park brake locked. • Transmission in gear. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • 4WD switch position as directed. • Check wire connections for looseness and corrosion. *NOTE: Confirm that the engine starts and runs normally before testing.* 4WD switch OFF. Transmission in gear. Key switch to RUN. Unplug harness connector from the 4WD clutch. Is battery voltage present at 421A wire **(A)**?  MXT011577 —UN—16JUN14 **A—421A Wire** **C—Clutch Connector Terminals** **B—Main Harness Clutch Connector**	**YES:** Go to next step. **NO:** Check 421A wire and connections.

Continued on next page

MX52301,00003CC -19-24OCT14-3/9

Clutch Connector Terminals

Measure the resistance across clutch connector terminals **(C)**. Is the reading 22—28 ohms?



MXT011577 —UN—16JUN14

A—421A Wire
C—Clutch Connector Terminals
B—Main Harness Clutch Connector

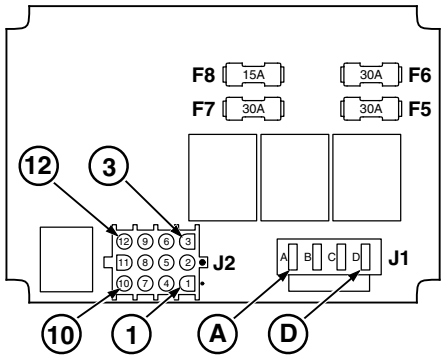
YES: Go to next step.

NO: Replace the 4WD clutch. See Front Differential Removal and Installation (SN 040001-) and See Front Differential Disassembly (SN 040001-).

MX52301,00003CC -19-24OCT14-4/9

VCU Connector

Reattach harness connector to the 4WD clutch. Is battery voltage present at VCU connector **(J2-11)**, 605 Tan wire?



MXT011938 —UN—04JUN14

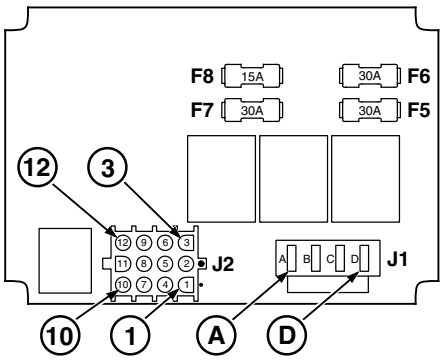
J2-4— 711 Purple Wire
J2-11— 605 Tan Wire
J2-12— 615 Gray Wire

YES: Go to next step

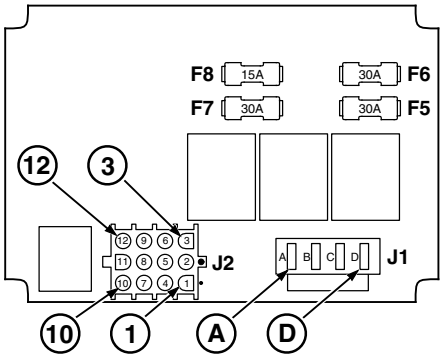
NO: Check 605 Tan wire continuity between **(J2-11)** and main harness clutch connector **(B)**.

Continued on next page

MX52301,00003CC -19-24OCT14-5/9

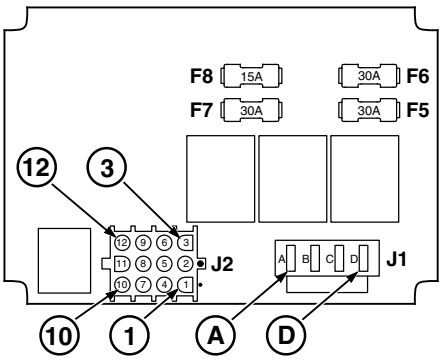
VCU Connector	Transmission in gear. Does VCU connector at **(J2-4)**, 711 Pur wire read zero (0) volts?  MXT011938 —UN—04JUN14 **J2-4— 711 Purple Wire** **J2-11— 605 Tan Wire** **J2-12— 615 Gray Wire**	**YES:** Go to next step. **NO:** Test neutral switch. See Neutral Start Switch Test.

MX52301,00003CC -19-24OCT14-6/9

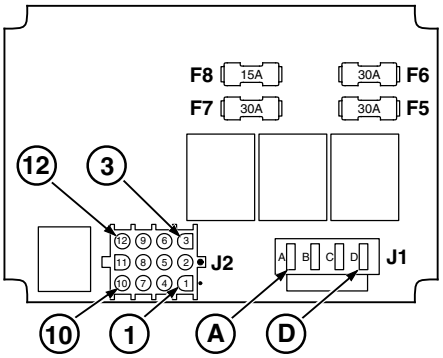
VCU Connector	4WD switch OFF. Is battery voltage present at VCU connector **(J2-12)** 615 Gry wire?  MXT011938 —UN—04JUN14 **J2-4— 711 Purple Wire** **J2-11— 605 Tan Wire** **J2-12— 615 Gray Wire**	**YES:** Go to next step. **NO:** Check 4WD switch. See 4WD Switch Test. **NO:** Check 615 Gry wire for short to ground.

Continued on next page

MX52301,00003CC -19-24OCT14-7/9

VCU Connector	4WD switch ON. Does **(J2-12)**read zero (0) volts?  MXT011938 —UN—04JUN14 **J2-4— 711 Purple Wire** **J2-11— 605 Tan Wire** **J2-12— 615 Gray Wire**	**YES:** Go to next step **NO:** Check 4WD switch. See 4WD Switch Test. **NO:** Check 615 Gry wire continuity between **(J2-12)** and 4WD switch connector **(2)**. **NO:** Check continuity of 100B Blk wire. Measure from switch connector **(1)** to **ground** splice S—1.

MX52301,00003CC -19-24OCT14-8/9

VCU Connector	4WD switch ON. Transmission in gear. Does (J2-11), 605 Tan wire now read zero (0) volts?  MXT011938 —UN—04JUN14 **J2-4— 711 Purple Wire** **J2-11— 605 Tan Wire** **J2-12— 615 Gray Wire**	**YES:** 4WD solenoid circuit OK. Refer to Power Train section of book for mechanical repairs. **NO:** Recheck all power, ground, and signal connections and voltages. If OK, replace VCU.

MX52301,00003CC -19-24OCT14-9/9

Engine Oil Pressure Light Circuit Operation, Gas (All), Diesel (SN -080000)

Function:

To provide a visual warning if the engine oil pressure drops below a preset level.

Operating Conditions:

- Key switch in the ON position with engine running.

Theory of Operation:

With the engine OFF and key switch in the RUN position, oil pressure is below 28 kPa (4 psi). The oil pressure switch is closed, completing the circuit path to ground and illuminating the light. This informs the operator that the light is functioning.

When the engine is started and running, the light goes out when the oil pressure is adequate to open the pressure switch, turning out the light.

The G1 battery supplies power through the 201 Red wire to the F6 fuse and then to the S1 key switch. With the key switch in the ON position, power is supplied to the 420J Yel wire, S-2 power splice, and 420M Yel wire to the H3 engine oil pressure light. The 601 Tan and Blu/Red (Gas Engine) wires complete the circuit to the B4 engine oil pressure switch. When the B4 engine oil pressure switch is closed, oil pressure is below 28 kPa (4 psi), the ground path is completed thought the engine ground.

MX52301,00003CD -19-24OCT14-1/1

Hour Meter Circuit Operation, Gas (All), Diesel (SN -080000)

Function:

To record the number of hours the key switch is in the RUN position with the engine running.

Operating Conditions:

- Key switch in the RUN position.
- Engine running

Theory of Operation (SN -050000)

Power flows from the G1 battery through the F6 fuse and the S1 key switch to the S2 splice. The 420M Yel wire carries the current to the H3 engine oil pressure light. The engine (normally closed) oil pressure switch provides a ground when the engine off or oil pressure is low. With engine oil pressure switch closed, a ground is at both sides of the hour meter and the meter does not run.

When the engine oil pressure switch opens, the current passes through the oil pressure light and the 602 Tan wire continues the circuit to the P1 hour meter.

The H3 engine oil pressure light does not illuminate because the P1 hour meter provides a sufficient voltage drop of 1.6M ohms in the series circuit.

The 100H Blk wire, splice 1, 100J Blk wire, splice 3 and 100G Blk wire completes the path to ground.

Theory of Operation (Diesel SN 050001-080000) (Gas SN 050001-)

Power flows from the G1 battery through the F6 fuse and the S1 key switch to the S2 splice. The 420M Yel wire carries the current to the H3 engine oil pressure light. The engine (normally closed) oil pressure switch provides a ground when the engine off or oil pressure is low. With engine oil pressure switch closed, a ground is at both sides of the hour meter and the meter does not run.

Power flows from 420M Yel wire at the H3 Oil Pressure light to the H2 Engine Coolant Temperature Light through the 419 Yel wire. From the H2 Engine Coolant Temperature light, power flows to the P1 Hour meter through the 417 Yel wire.

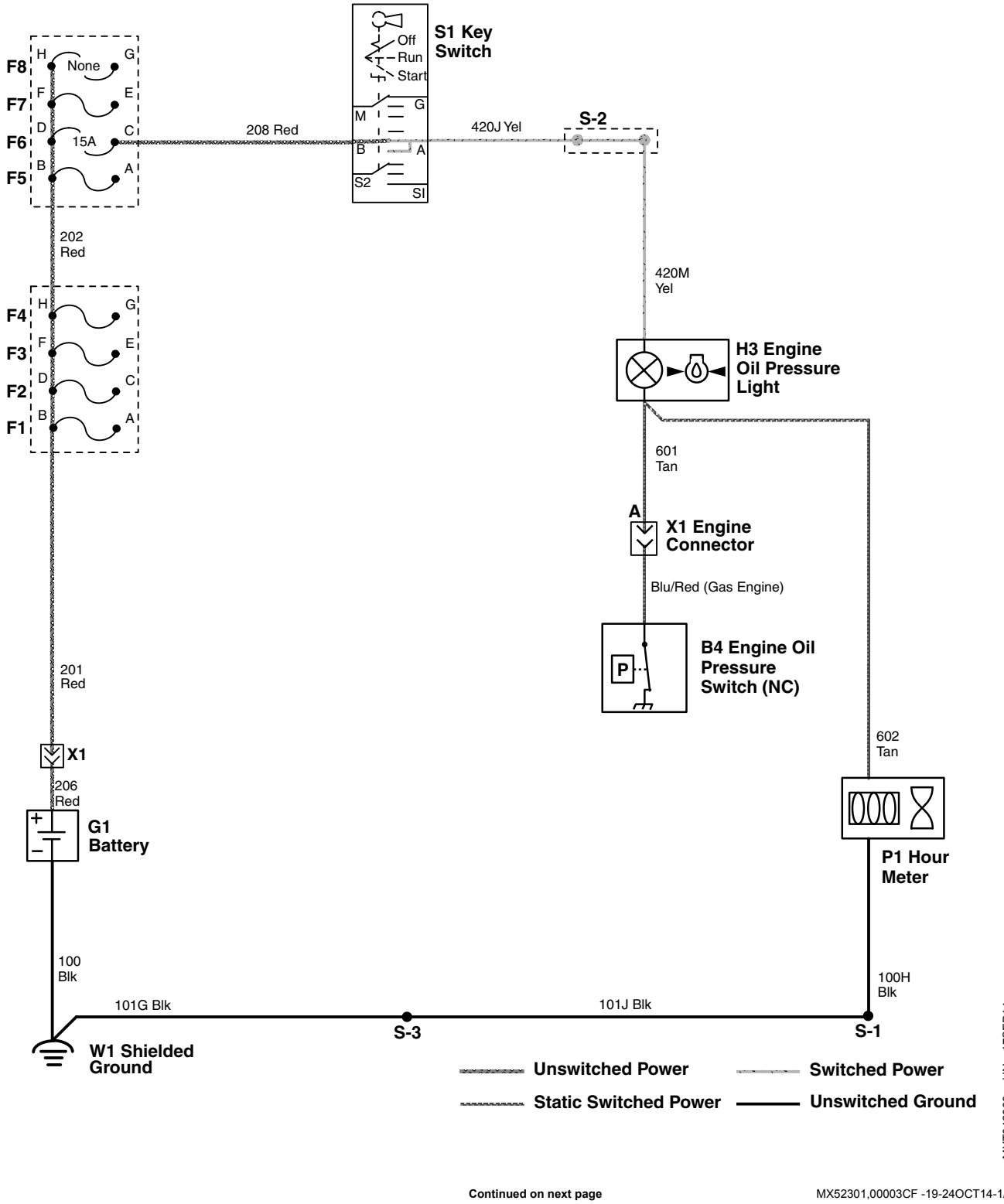
When the engine oil pressure switch opens, the current passes through the oil pressure light and the 602 Tan wire continues the circuit to the P1 hour meter which activates the hour meter.

The 100H Blk wire, splice 1, 100J Blk wire, splice 3 and 100G Blk wire completes the path to ground.

MX52301,00003CE -19-24OCT14-1/1

Engine Oil Pressure Light/Hour Meter Circuit Schematic, Gas (All), Diesel (SN -080000)

Engine Oil Pressure Light/Hour Meter Circuit Schematic (Diesel SN -080000)



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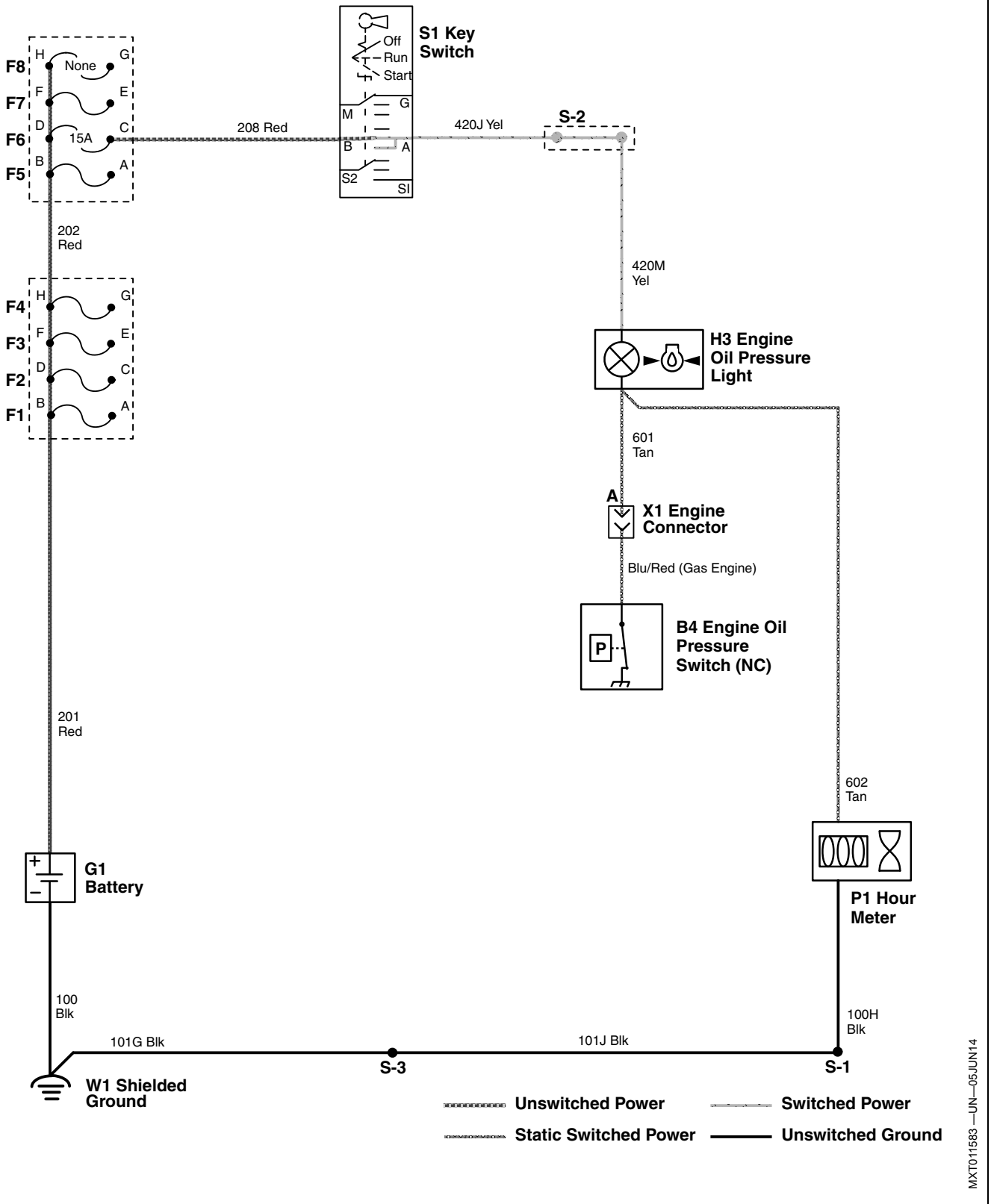
MX52301,00003CF -19-24OCT14-1/4

Engine Oil Pressure Light/Hour Meter Circuit Schematic (Gas -040000)



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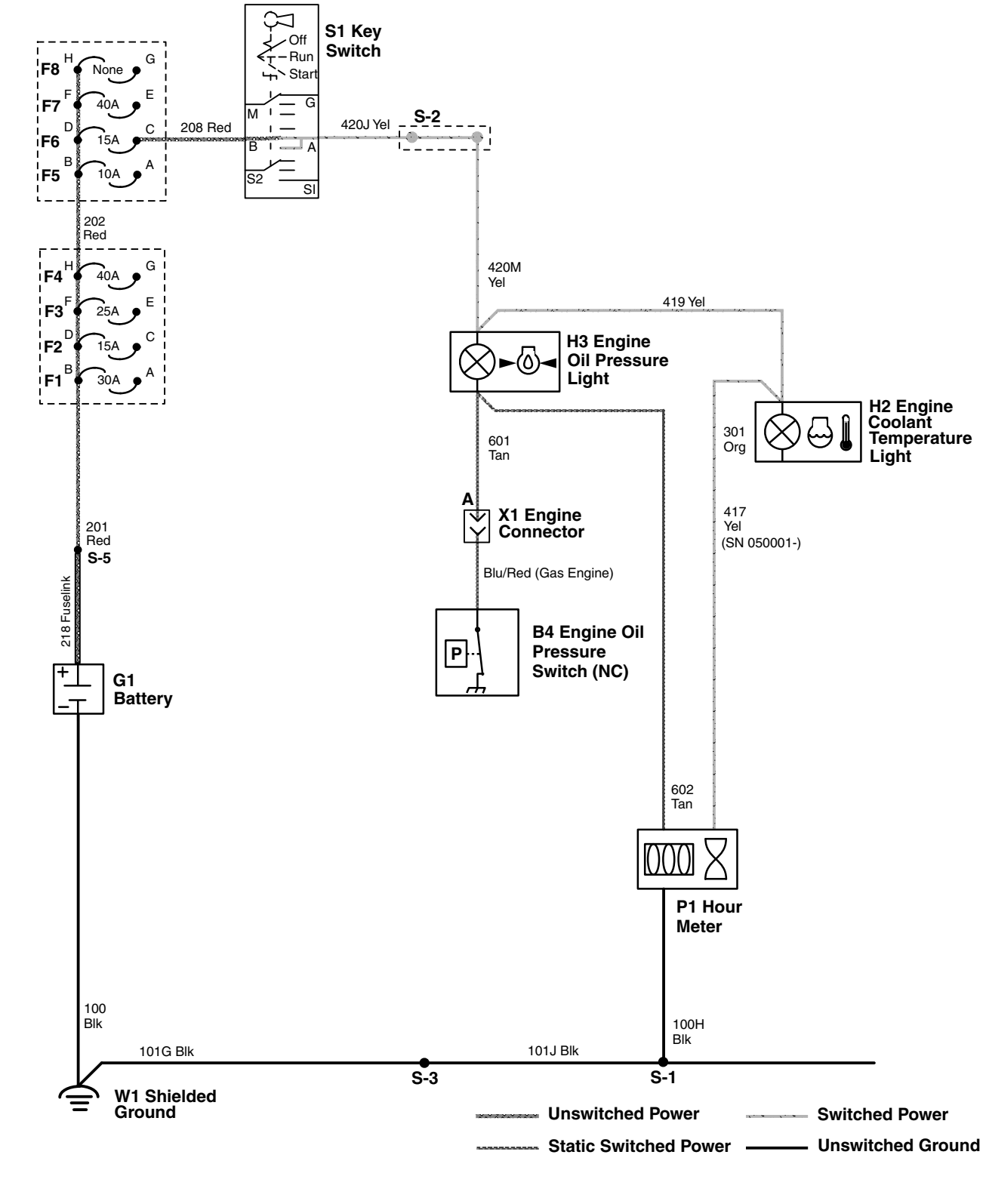
MX52301,00003CF -19-24OCT14-2/4

Engine Oil Pressure Light/Hour Meter Circuit Schematic (Gas 040001-110000)



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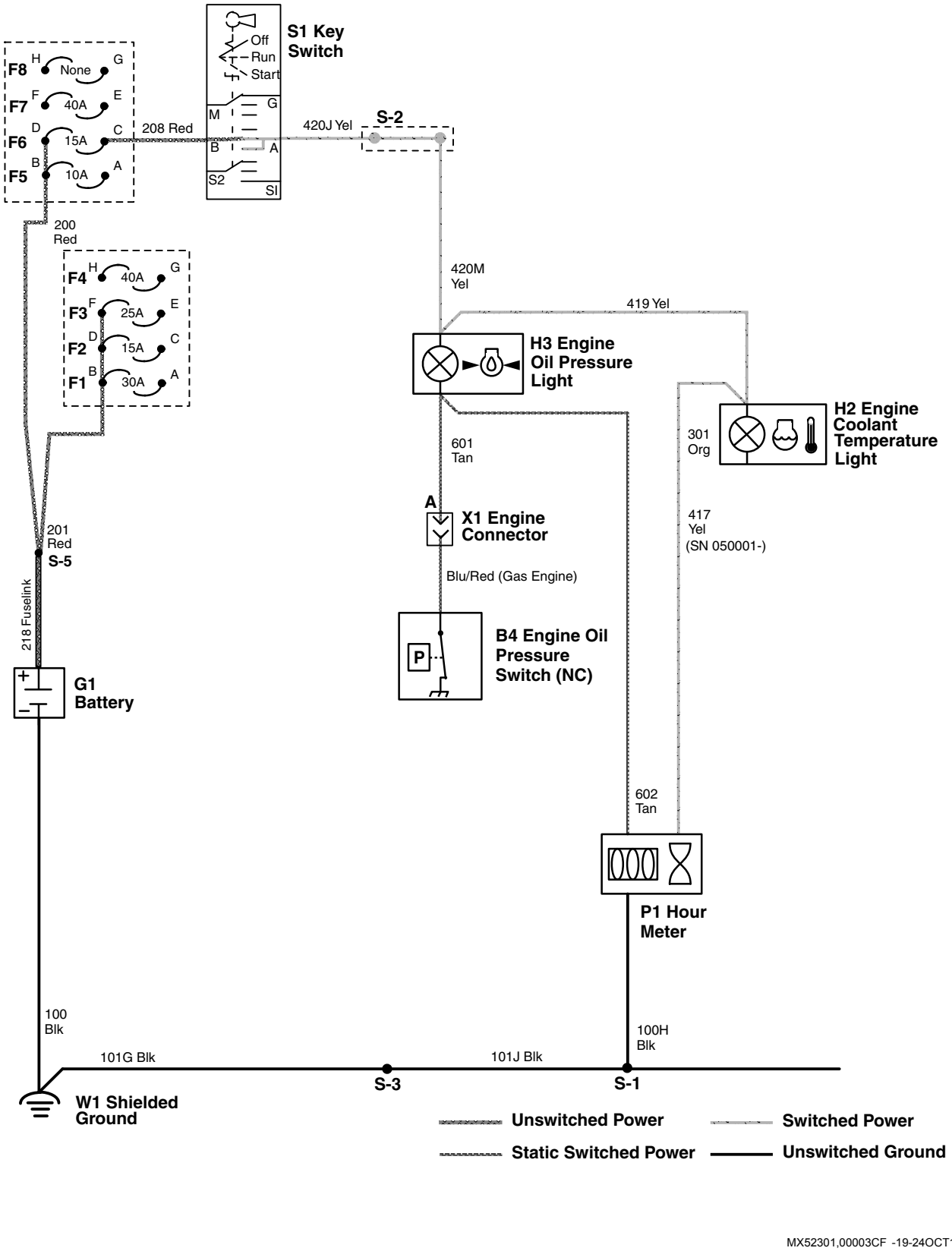
MX52301,00003CF -19-24OCT14-3/4

Engine Oil Pressure Light/Hour Meter Circuit Schematic (Gas 110001-)



MX52301,00003CF -19-24OCT14-4/4

Engine Oil Pressure Light Diagnosis, Gas (All), Diesel (SN -080000)

Engine Oil Pressure Light Diagnosis (Gas—All) (Diesel SN -080000)

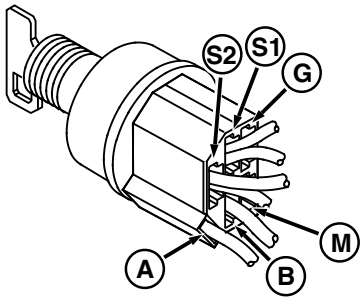
MX52301,00003D0 -19-24OCT14-1/7

❶ Engine Oil Pressure Circuit

MX52301,00003D0 -19-24OCT14-2/7

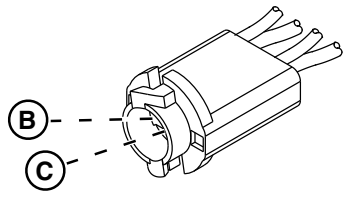
Engine Oil Pressure Light	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion.	**YES:** Circuit is operational. Test oil pressure switch. See Engine Oil Pressure Switch Test.
	Is H3 engine oil pressure light illuminated?	**NO:** Test bulb. Replace as needed. If OK, go to next step.

MX52301,00003D0 -19-24OCT14-3/7

Key Switch	Is battery voltage present at 420J Yel wire **(A)** of S1 key switch?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Check power circuit to key switch. See Key Switch Test. See Power Circuit Diagnosis, Gas (SN -040001) or (SN 040001-) Section 50 Group 55. ,See Power Circuit Operation, Diesel (SN -080000).

Continued on next page

MX52301,00003D0 -19-24OCT14-4/7

Engine Oil Pressure Light Socket	Remove H3 engine oil pressure light socket from instrument panel. Remove bulb. Is battery voltage present at H3 engine oil pressure light socket, 420M Yel wire **(B)**?  MXT011584 —UN—16JUN14 **B—420M Yellow Wire** **C—601 Tan Wire**	**YES:** Go to next step. **NO:** Check 420J and 420M Yel wires and connections.

MX52301,00003D0 -19-24OCT14-5/7

Ground Continuity	Is continuity to ground present at H3 engine oil pressure light socket, 601 Tan wire **(C)**?	**YES:** Test complete. **NO:** Disconnect hour meter and go to next step.

MX52301,00003D0 -19-24OCT14-6/7

Ground Continuity	Is continuity to ground present at H3 engine oil pressure light socket, 601 Tan wire **(C)**?	**YES:** Test hour meter. Engine oil pressure circuit is operational. **NO:** Test engine oil pressure switch. See Engine Oil Pressure Switch Test.

MX52301,00003D0 -19-24OCT14-7/7

Hour Meter Circuit Diagnosis, Gas (All), Diesel (SN -080000)

Hour Meter Circuit Diagnosis (Gas—All) (Diesel SN -080000)

MX52301,00003D1 -19-24OCT14-1/6

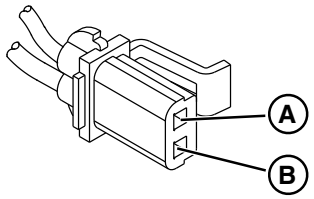
❶ Hour Meter Circuit Diagnosis (Gas—All) (Diesel SN -080000)

Continued on next page

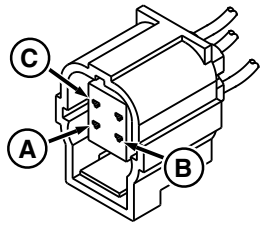
MX52301,00003D1 -19-24OCT14-2/6

Hour Meter Circuit	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Engine oil pressure circuit operating properly. • Cargo box raised and locked. • Open hood and remove storage tray. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is H3 engine oil pressure light illuminated?	**YES:** Go to next step. **NO:** See Engine Oil Pressure Light Diagnosis, Gas (All), Diesel (SN -080000).

MX52301,00003D1 -19-24OCT14-3/6

Hour Meter Connector (SN -050000)	Disconnect X1 engine connector. Disconnect P1 hour meter from harness. Is battery voltage present at terminal of the P1 hour meter connector, 602 Tan wire (A)?  MXT011585 —UN—16JUN14 **A—602 Tan Wire** **B—100H Black Wire**	**YES:** Go to next step. **NO:** Check 602 Tan wire and connections.

MX52301,00003D1 -19-24OCT14-4/6

Hour Meter Connector (SN 050001-)	Disconnect X1 engine connector. Disconnect P1 hour meter from harness. Is battery voltage present at terminal of the P1 hour meter connector, 417 Yel wire (A)?  MXT012378 —UN—16SEP14 **A—417 Yel wire** **B—100H Blk wire** **C—605 Tan wire**	**YES:** Go to next step. **NO:** Check 417 Yel wire and connections.

Continued on next page

MX52301,00003D1 -19-24OCT14-5/6

Ground Continuity	Is continuity to ground present at terminal of the P1 hour meter connector, 100H Blk wire (B)?	**YES:** Replace hour meter. **NO:** Check 100H, 101J, and 101G Blk wires and connections.

MX52301,00003D1 -19-24OCT14-6/6

Engine Oil Pressure Light Circuit Operation, Diesel (SN 080001-)

Function:

To provide a visual warning if the engine oil pressure drops below a preset level.

Operating Conditions:

- Key switch in the RUN position with engine running.

Theory of Operation:

The oil pressure switch closes whenever engine oil pressure is below 28 kPa (4 psi). The switch completes a circuit path (601 Tan wire) to ground and illuminates the oil pressure light. With proper function of the circuit, the light will come on at start-up.

After the engine starts, the light goes out as oil pressure builds and opens the pressure switch. If the oil pressure light comes on while the machine is running, the operator must immediately stop the engine and correct the situation before proceeding.

Power for the oil pressure light is supplied by the 420-series Yel wires. The oil pressure switch and engine block provide a ground path.

MX52301,00003D2 -19-24OCT14-1/1

Hour Meter Circuit Operation, Diesel (SN 080001-)

Function:

To record the hours of engine operation.

Operating Conditions:

- Key switch in the RUN position with engine running.

Theory of Operation:

The hour meter starts counting when a positive (battery) voltage is applied to the enable input (602 Tan wire). Counting stops when the input is brought to ground potential. This signal is found at the oil pressure light/ pressure switch connection.

When the oil pressure switch is open, the oil pressure light is off. With no voltage drop across the light, the enable input now sees system voltage by way of the light filament.

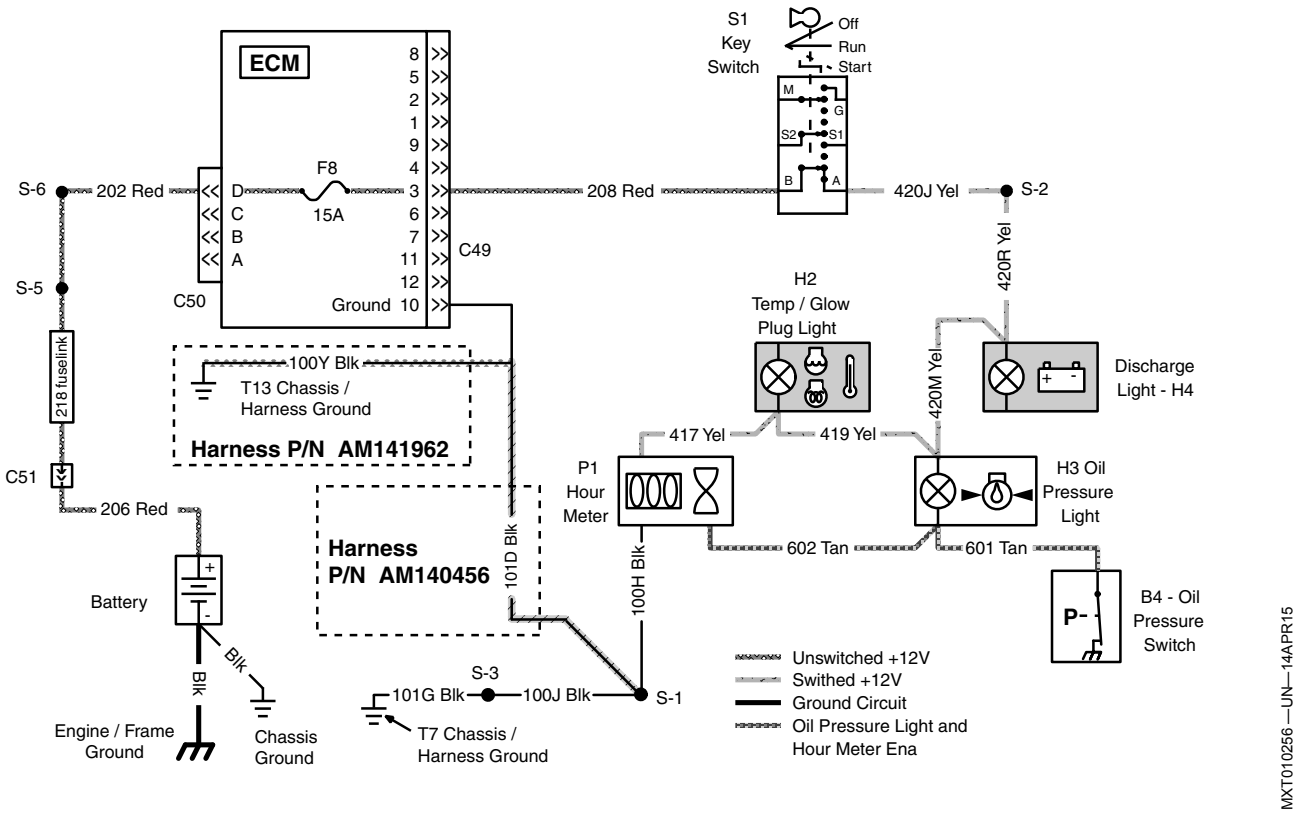
When closed, the oil pressure switch connects both the oil pressure light and enable input to ground. This simultaneously turns on the light and stops the meter.

Power for the hour meter is supplied by the key switch via the 417, 419 and 420-series Yel wires. The ground path consists of Blk wires 101G, 100J and 100H.

MX52301,00003D3 -19-24OCT14-1/1

Engine Oil Pressure Light /Hour Meter Circuit Schematic, Diesel (SN 080001-)

Engine Oil Pressure Light /Hour Meter Circuit Schematic (Diesel SN 080001-110000)



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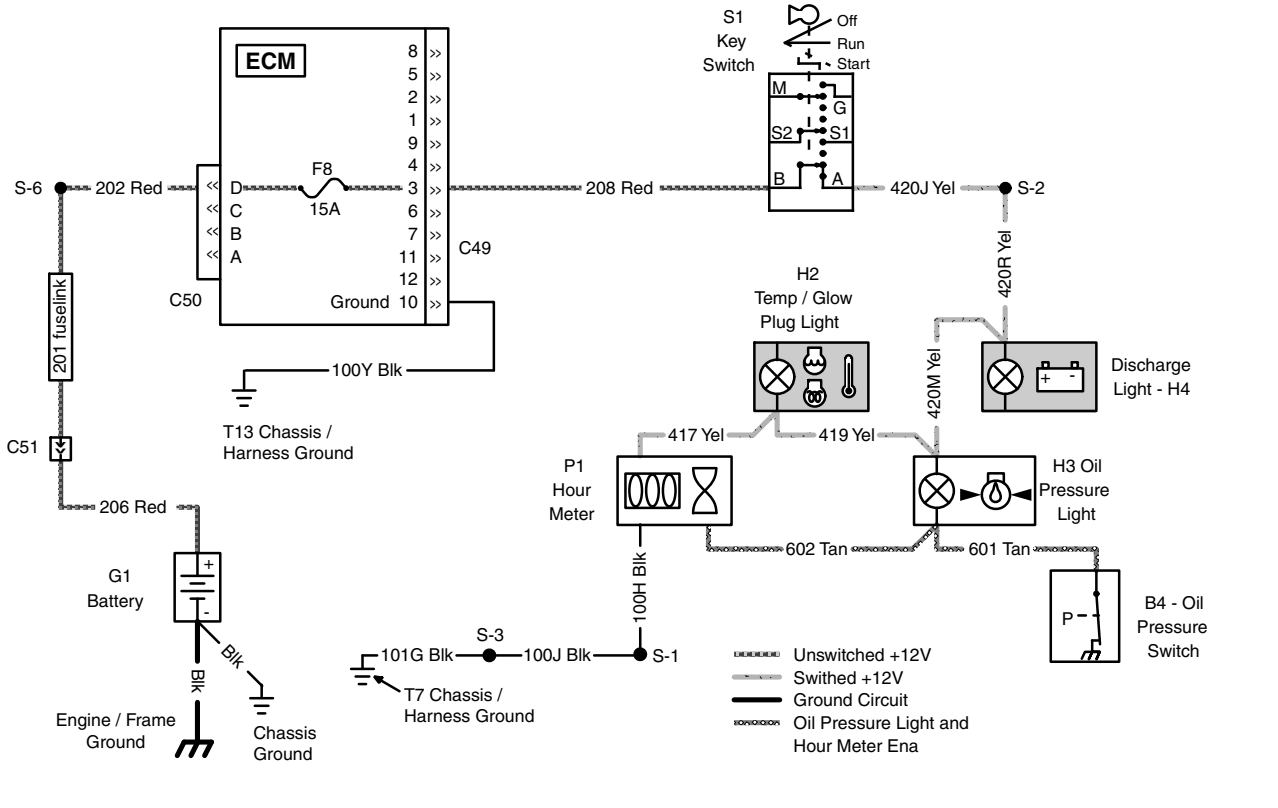
MX52301,00003D4 -19-16APR15-1/2

Engine Oil Pressure Light /Hour Meter Circuit Schematic (Diesel SN 110001-)



MX52301,00003D4 -19-16APR15-2/2

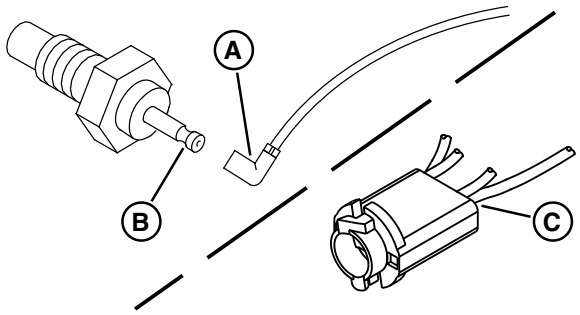
Engine Oil Pressure Light Diagnosis, Diesel (SN 080001-)

MX52301,00003D5 -19-24OCT14-1/5

❶ Engine Oil Pressure Light Circuit

Continued on next page

MX52301,00003D5 -19-24OCT14-2/5

Oil Pressure Switch	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Open hood and remove storage tray. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion.	**YES:** Test oil pressure switch. See Engine Oil Pressure Switch Test.
	Unplug the 601 Tan wire (A) from the B4 oil pressure switch (B). Is battery voltage present at **(A)**?  MXT011587—UN—16JUN14 **A—601 Tan Wire** **B—Oil Pressure Switch** **C—420M Yellow Wire**	**NO:** Go to next step.

MX52301,00003D5 -19-24OCT14-3/5

Oil Pressure Light	Is the oil pressure light still illuminated while **(A)** is unplugged from **(B)**?	**YES:** Disconnect hour meter. If light goes out, replace hour meter. **YES:** Check Tan wires 601 and 602 for shorts to ground. **NO:** Go to next step.

Continued on next page

MX52301,00003D5 -19-24OCT14-4/5

Oil Pressure Light Socket	Is battery voltage present at the H3 engine oil pressure light socket, 420M Yel wire **(C)**?	**YES:** Test H3 light bulb. See Bulb Test. **YES:** Check 601 Tan wire for open. **NO:** Check 420M Yel wire and connections. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55, or Power Circuit Operation, Diesel (SN 110001-).

MX52301,00003D5 -19-24OCT14-5/5

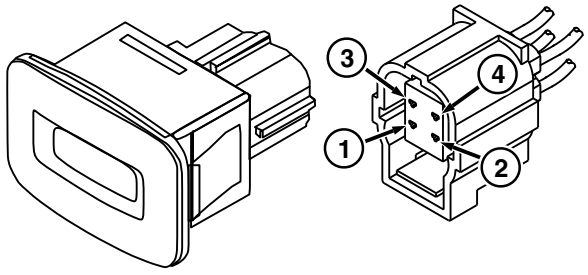
Hour Meter Circuit Diagnosis, Diesel (SN 080001-)

Hour Meter Circuit Diagnosis (Diesel SN 080001-)

MX52301,00003D6 -19-24OCT14-1/6

❶ Hour Meter Circuit

MX52301,00003D6 -19-24OCT14-2/6

Connector	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Engine Oil Pressure Circuit tested and operating properly. • Cargo box raised and locked. • Open hood and remove storage tray. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Unplug P1 hour meter. Is battery voltage present at **(pin 1)** of the connector, 417 Yel wire?  MXT004456 —UN—30MAY12 **1— 417 Yellow Wire** **2— 100H Black Wire** **3— 602 Tan Wire**	**YES:** Go to next step. **NO:** Check 417 Yel wire and connections. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55, or Power Circuit Operation, Diesel (SN 110001-).

Continued on next page

MX52301,00003D6 -19-24OCT14-3/6

Continuity	Is there continuity from **(pin 2)**, 100H Blk wire to **ground**?	**YES:** Go to next step. **NO:** Check 100H, 100J and 101G Blk wires.

MX52301,00003D6 -19-24OCT14-4/6

Hour Meter Connector Pin	At the oil pressure switch, unplug the 601 Tan wire. Is battery voltage present at hour meter connector **(pin 3)**, 602 Tan wire?	**YES:** If **(1), (2)** and **(3)** are OK, replace hour meter. End test. **NO:** Go to next step.

MX52301,00003D6 -19-24OCT14-5/6

Oil Pressure Light	Is the oil pressure light still illuminated?	**YES:** Check Tan wires 601 and 602 for shorts to ground. **NO:** Check 602 Tan wire for open.

MX52301,00003D6 -19-24OCT14-6/6

Cooling Fan and Temperature Light Circuit Operation, Gas (All), Diesel (SN -080000)

Function:

To provide engine cooling when coolant reaches a predetermined temperature. Also provides an indicator light when the coolant temperature exceeds a predetermined level.

Operating Conditions:

- Key switch in the RUN position.
- Engine at operating temperature.

Theory of Operation—Cooling Fan:

The G1 battery supplies unswitched power through the F2 fuse (15 A—gasoline engines; 25 A—diesel engines) to the K2 fan relay. The relay is activated as follows:

The G1 battery supplies power through the F6 fuse and S1 key switch to the S2 splice. The 420D Yel wire carries this power to the K1 start relay where it splices to the 420E Yel wire which leads to the K2 fan relay. Current exits the relay over the 310 Org wire to the B1 radiator temperature switch. If the coolant temperature is 83—89°C (182—192°F), the switch closes the circuit to ground through the 105 Blk wire, S1 splice, 100J Blk wire, S3 splice, and 101G Blk wire to ground. This causes the K2 fan relay to energize.

With the relay energized, it allows power to flow from the F2 fuse, 217 Red wire across the K2 fan relay, 315 Org wire to the M2 radiator fan motor. The 100A Blk wire, S1 splice, 101J Blk wire, S3 splice, and 101G Blk wire complete the circuit to ground.

As the temperature drops below the preset level, the B1 radiator temperature switch opens and the K2 fan relay unlatches, causing the cooling fan to shut off.

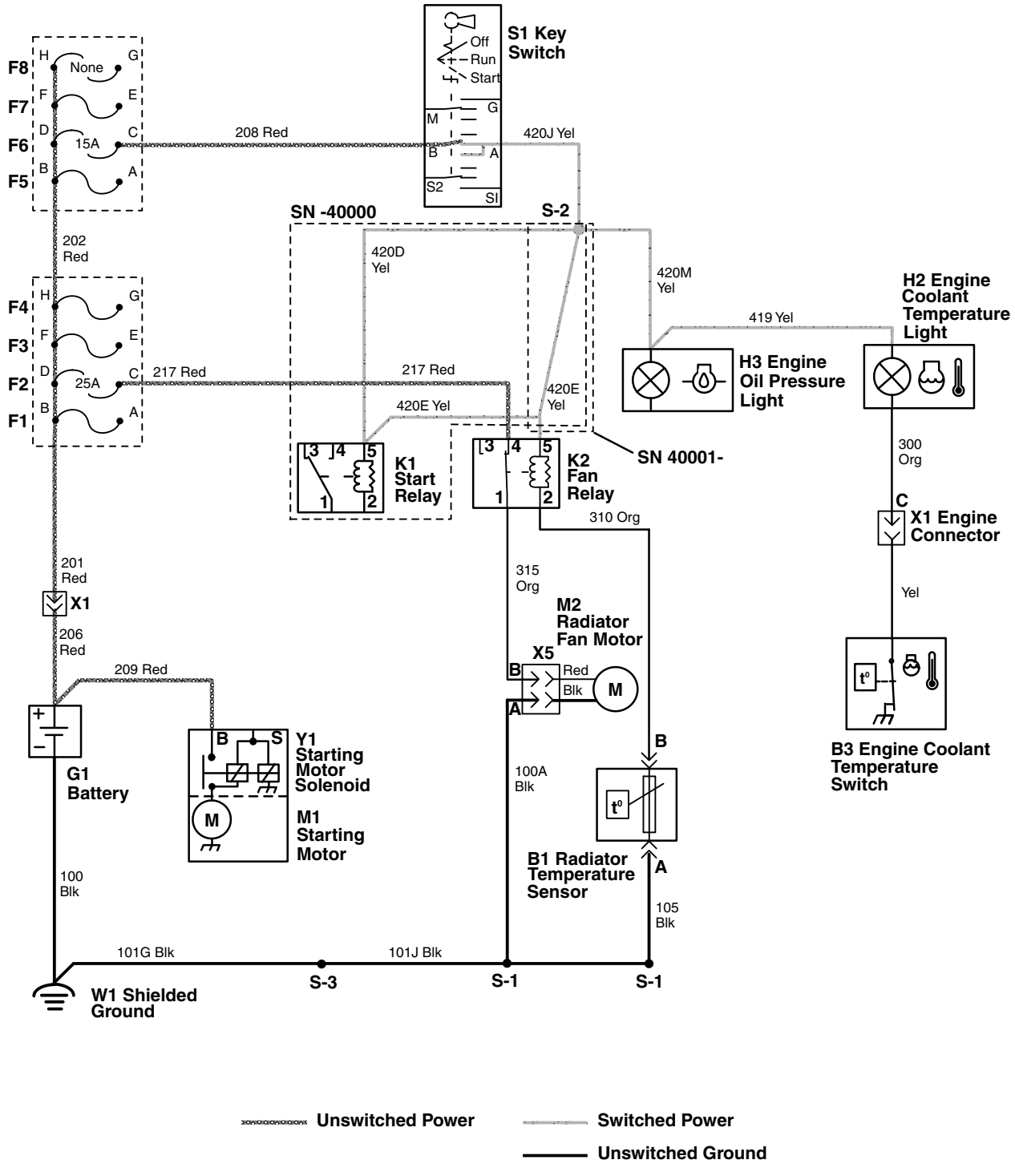
Theory of Operation—Engine Temperature Light:

The G1 battery supplies switched power through the F6 fuse and S1 key switch to the S2 splice. Current then flows through the 420M Yel wire to the H3 engine oil pressure light, where a splice to the 419 Yel wire carries power to the H2 engine coolant temperature light. The B3 engine coolant temperature switch which closes the circuit and completes a path to ground at 107—113°C (225—235°F).

MX52301,00003D7 -19-25OCT19-1/1

Cooling Fan and Temperature Light Circuit Schematic, Gas (All), Diesel (SN -080000)

Cooling Fan and Temperature Light Circuit Schematic (Diesel -080000)



MXT012390 —UN—21OCT14

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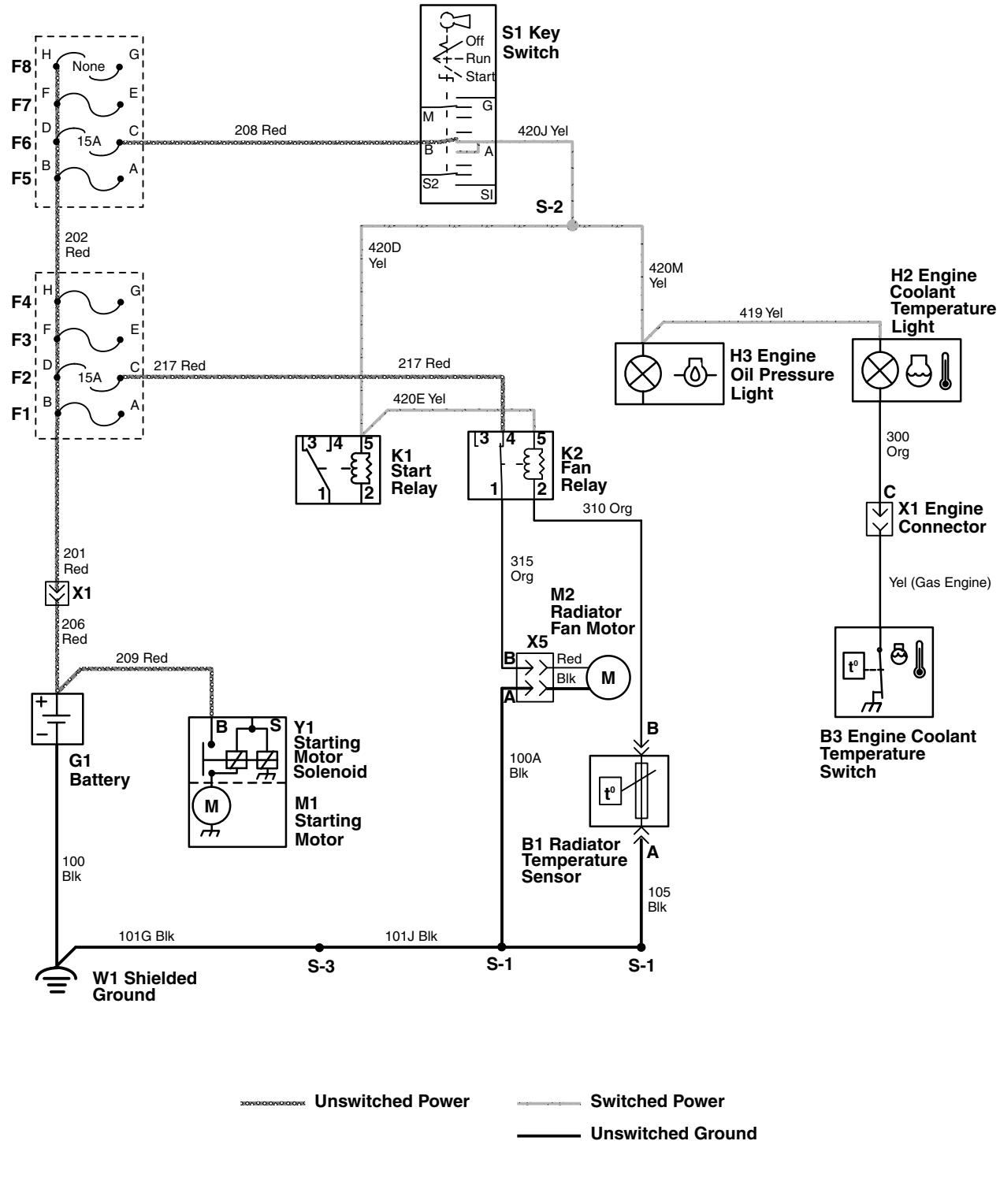
MX52301,00003D8 -19-24OCT14-1/4

Cooling Fan and Temperature Light Circuit Schematic (Gas -040000)



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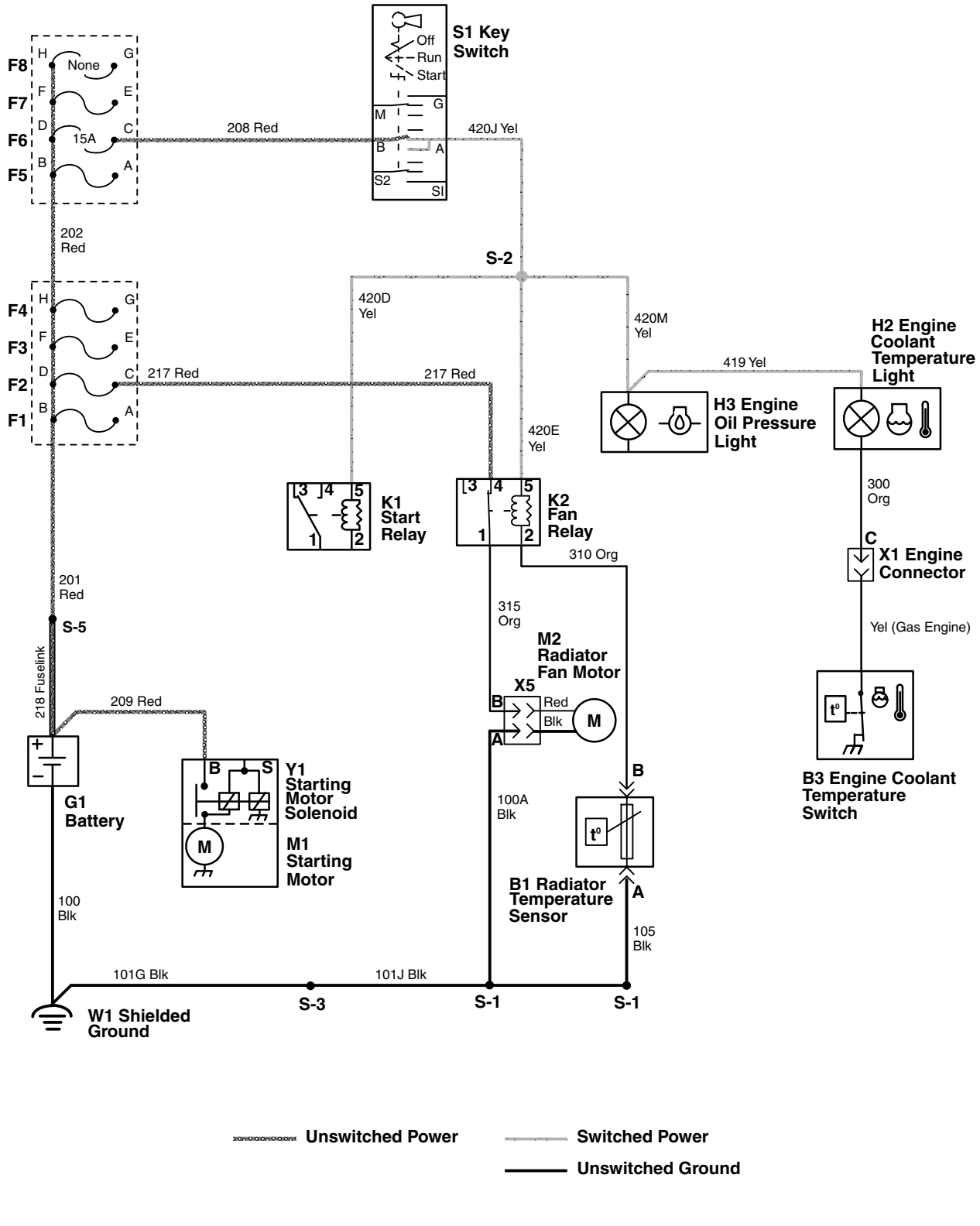
MX52301,00003D8 -19-24OCT14-2/4

Cooling Fan and Temperature Light Circuit Schematic (Gas 040001-110000)



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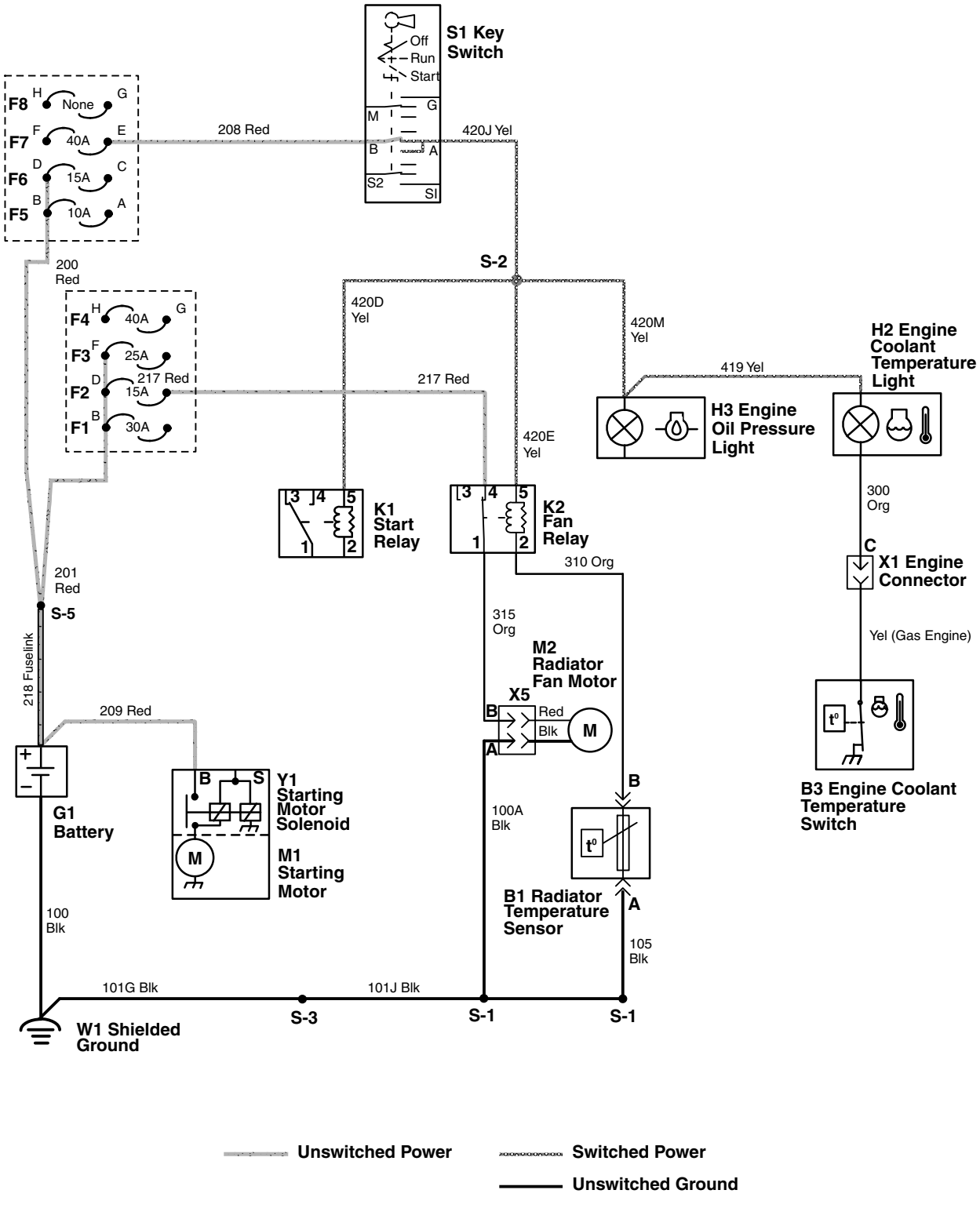
MX52301,00003D8 -19-24OCT14-3/4

Cooling Fan and Temperature Light Circuit Schematic (Gas 110000-)



MXT0112377 —UN—16SEP14

MX52301,00003D8 -19-24OCT14-4/4

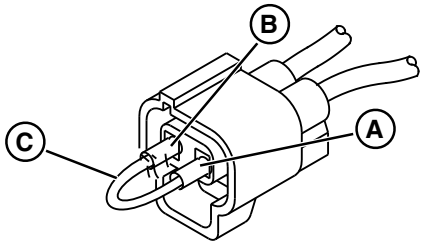
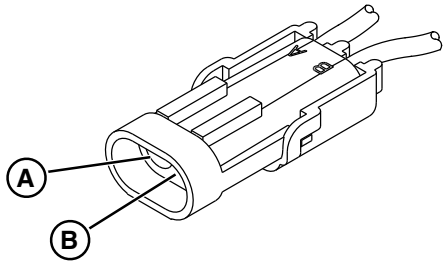
Cooling Fan and Temperature Light Circuit Diagnosis, Gas (All), and Diesel (SN -080000)

Cooling Fan and Temperature Light Circuit Diagnosis, Diesel (SN -080000), and Gas (All)

MX52301,00003D9 -19-24OCT14-1/14

❶ Cooling Fan Circuit

MX52301,00003D9 -19-24OCT14-2/14

Connector Terminal		
	Test Procedure A **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Install jumper wire **(C)** across B1 radiator temperature sensor connector terminals A and B.	
	 MXT011590 —UN—17JUN14 **A—Terminal 105 Blk wire** **B—Terminal 310 Org wire** **C—Jumper Wire**	
	• Disconnect X5 connector to M2 radiator fan motor. • Key switch in run position, engine not running. Is battery voltage present at **(B)** terminal of X5 radiator fan motor connector, 315 Org wire?	**YES:** Go to next step. **NO:** Test fan relay. See Relay Test.
	 MXT011591 —UN—17JUN14 **A—100A Black Wire** **B—315 Orange Wire**	

Continued on next page

MX52301,00003D9 -19-24OCT14-3/14

Ground Continuity	Is continuity to ground present at **(A)** terminal of X5 radiator fan motor connector, 100A Blk wire?	**YES:** Go to next step. **NO:** Check 100A, 101J, and 101G Blk wires and connections.

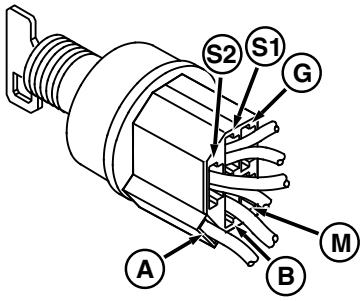
MX52301,00003D9 -19-24OCT14-4/14

Fan Motor Connector	Connect X5 fan motor connector to fan. Does fan run?	**YES:** Remove jumper and go to next procedure. **NO:** Replace M2 radiator fan.

MX52301,00003D9 -19-24OCT14-5/14

❶ Cooling Fan Circuit

MX52301,00003D9 -19-24OCT14-6/14

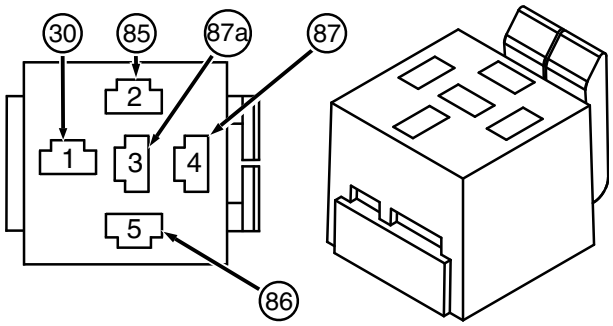
Key Switch	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Jumper removed from B1 radiator temperature sensor connector (installed in previous procedure). • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is battery voltage present at **(A)** terminal, 420J Yel wire of S1 key switch?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Test key switch. See Key Switch Test.

Continued on next page

MX52301,00003D9 -19-24OCT14-7/14

Fan Relay

Remove K2 fan relay. Is battery voltage present at terminal **4 (87)** 217 Red wire and terminal **5 (86)** 420E Yel wire of K2 fan relay connector?



MXT011889—UN—09JUL14
4 (87)—217 Red Wire
5 (86)—420E Yellow Wire

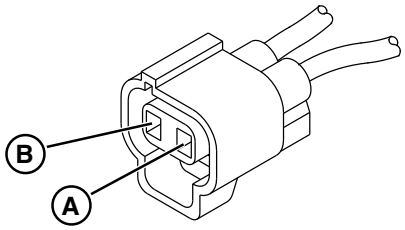
YES: Install relay. Go to next step.

NO: See Power Circuit Diagnosis, Gas (SN -040001) or (SN 040001-) Section 50 Group 55. See Power Circuit Operation, Diesel (SN -080000).

MX52301,00003D9 -19-24OCT14-8/14

Radiator Temperature Sensor Connector

Disconnect B1 radiator temperature sensor connector. Is battery voltage present at 310 Org wire of B1 radiator temperature sensor connector **(B)**?



MXT011593—UN—17JUN14
B—310 Orange Wire
A—105 Black Wire

YES: Go to next step.

NO: Test fan relay. See Relay Test.

MX52301,00003D9 -19-24OCT14-9/14

Ground Presence

Is continuity to ground present at 105 Blk wire of B1 radiator temperature sensor connector **(A)**?

YES: Test radiator temperature sensor. See Radiator Coolant Temperature Switch Test. Connect B1 radiator temperature switch connector. Go to next step.

NO: Check 105, 101J, and 101G Blk wires and connections.

Continued on next page

MX52301,00003D9 -19-24OCT14-10/14

❶ Temperature Light Circuit

MX52301,00003D9 -19-24OCT14-11/14

Key Switch

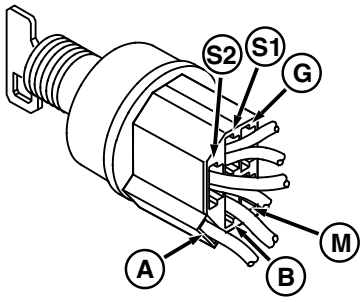
CAUTION: Avoid Injury. Prevent accidental start of radiator cooling fan: Before turning key switch to run position, disconnect X5 connector to M2 radiator fan motor.

Test Procedure C

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at **(A)** terminal, 420J Yel wire of S1 key switch?



MXT004463 —UN—31MAY12
A—420J Yellow Wire

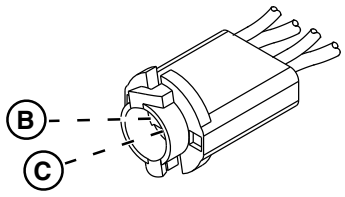
YES: Go to next step.

NO: Test key switch. See Key Switch Test.

MX52301,00003D9 -19-24OCT14-12/14

Coolant Temperature Light Socket

Remove H2 engine coolant temperature light socket from instrument panel. Remove bulb. Is battery voltage present at H2 engine coolant temperature light socket, 419 Yel wire **(B)**?



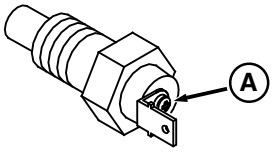
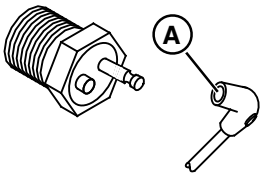
MXT011584 —UN—16JUN14
B—419 Yellow Wire

YES: Test bulb. See Bulb Test. Install bulb. Install H2 engine coolant temperature light socket into instrument panel. Go to next step.

NO: Check 420J, 420M, and 419 Yel wires.

Continued on next page

MX52301,00003D9 -19-24OCT14-13/14

Engine Coolant Temperature Switch	Is battery voltage present at B3 engine coolant temperature switch wire **(A)**?  MXT011905 —UN—16OCT17  MXT012710 —UN—21OCT14 **A (Diesel Engine)—300 Orange Wire**	**YES:** Test B3 engine coolant temperature switch. See Engine Coolant Temperature Switch Test. **NO:** Check Yel (Gas Engine) wire of engine harness and 300 Org wire and connections.

MX52301,00003D9 -19-24OCT14-14/14

Cooling Fan and Temperature Light Circuit, Diesel (SN 080001-)

Function:

To energize the radiator fan when coolant temperature reaches a preset level, and activate an indicator light if the engine temperature exceeds safe operating limits.

Operating Conditions:

- Key switch in the RUN position.
- Engine at operating temperature.

Theory of Operation—Cooling Fan:

As the engine coolant heats up, the contacts of a radiator-mounted thermal switch closes at 83—86°C (182—192°F). The switch signals the ECM to activate the onboard fan relay. The fan motor is powered up, pulling cool air through the radiator.

Whenever the glow plugs are powered, the ECM suspends operation of the radiator fan motor by turning off the fan relay. This limits the current that passes through the ECM and electrical system while starting the engine.

Fuse F5 supplies power to the fan motor via the ECM fan relay. Both the temperature light and radiator temperature switch connect to the switched power circuit. Splice S-1 is the connection point for the fan motor ground wire.

Theory of Operation—Engine Temperature Light:

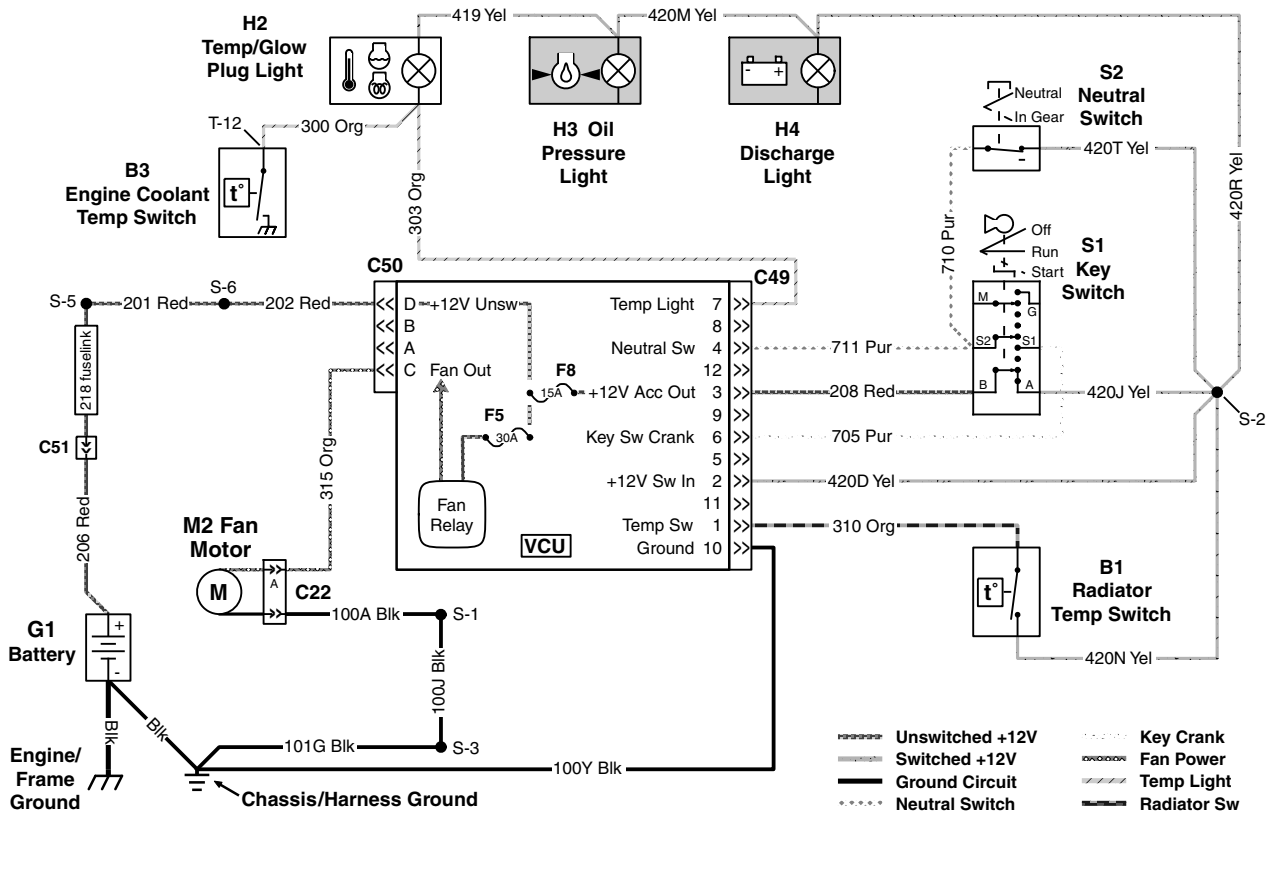
When the coolant temperature exceeds 107—113°C (225—235°F), the engine coolant temperature switch completes a path to ground. This activates the dash-mounted temperature light, alerting the operator of the overheating problem.

The temperature light is also used by the ECM as the glow plug heating indicator. The ECM provides a visual light check when the key switch is turned to the START position.

MX52301,00003DA -19-25OCT19-1/1

Cooling Fan and Temperature Light Circuit Schematic, Diesel (SN 080001-)

Cooling Fan and Temperature Light Circuit Schematic (Diesel SN 080001-110000)



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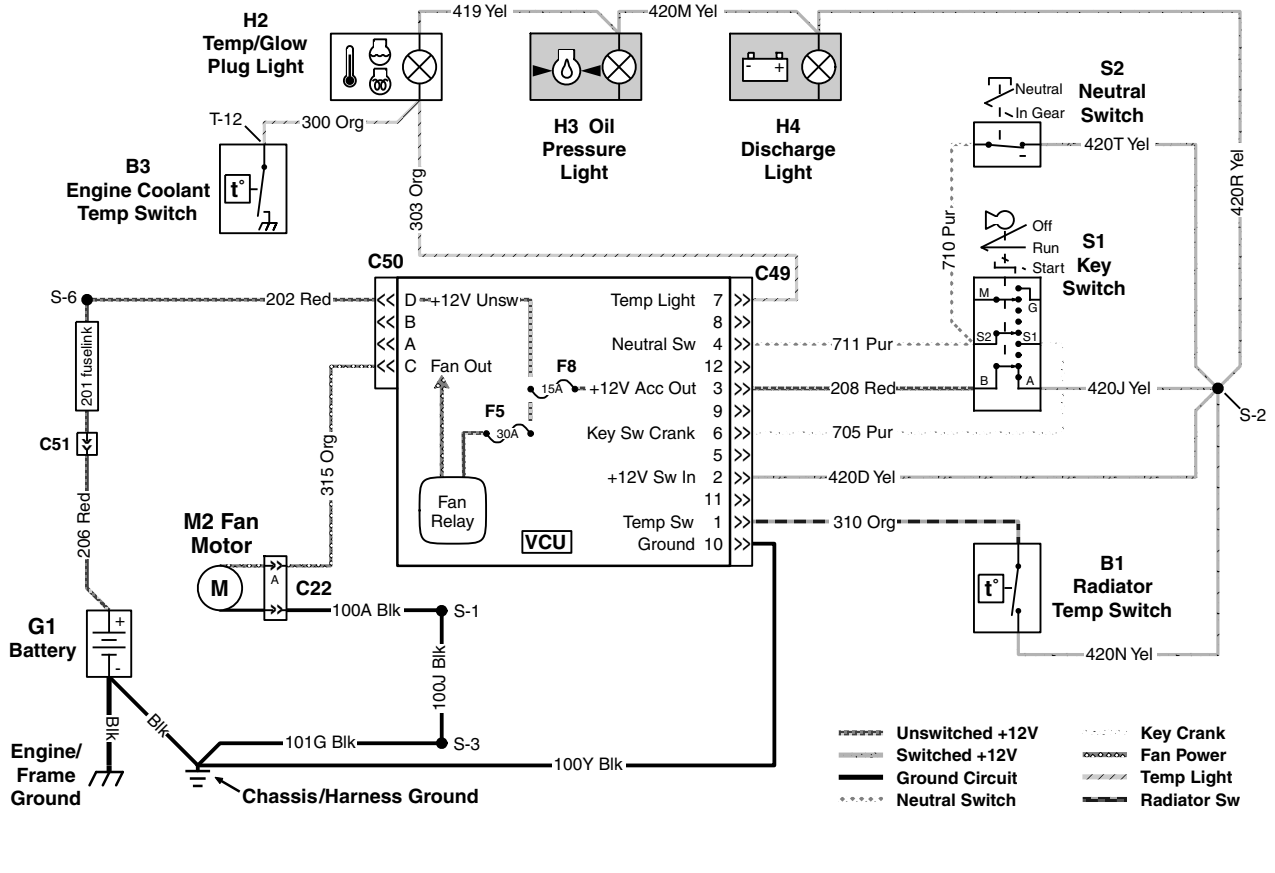
MX52301,00003DB -19-24OCT14-1/2

Cooling Fan and Temperature Light Circuit Schematic (Diesel SN 110001-)



MX52301,00003DB -19-24OCT14-2/2

Cooling Fan and Temperature Light Circuit Diagnosis, Diesel (SN 080001-)

Cooling Fan and Temperature Light Circuit Diagnosis (Diesel SN 080001-)

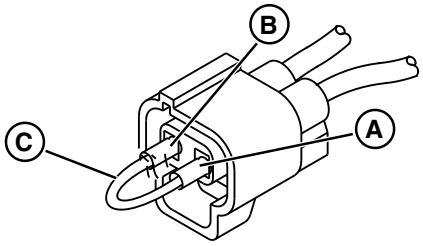
MX52301,00003F7 -19-24OCT14-1/12

❶ Cooling Fan Circuit

Continued on next page

MX52301,00003F7 -19-24OCT14-2/12

Fan Motor Connector	Test Procedure A Test Conditions: • Machine parked safely. See the “Safety Section”. • Engine starts and runs normally • Park brake locked. • Open hood and remove storage tray. • Power circuits checked and OK. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.	

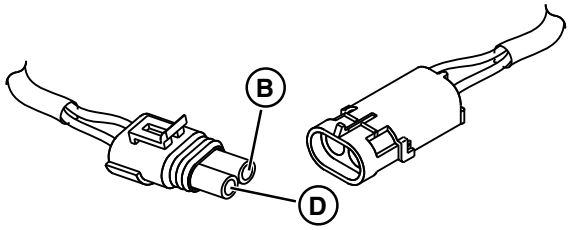


MXT011590 —UN—17JUN14
C—Jumper Wire

• Unplug connector from the B1 radiator temp switch.	
• Install jumper wire **(C)** across the connector terminals.	**YES:** Test radiator temperature switch. See Radiator Coolant Temperature Switch Test.
• Key switch in RUN position, engine not running.	**NO:** Test fuse F5 (on VCU).
With jumper wire **(C)** installed, is fan motor spinning?	**NO:** Leave jumper **(C)** in place and go to next step.

MX52301,00003F7 -19-24OCT14-3/12

Connector	Unplug connector C22 from fan motor. Is there continuity between ground and the 100A Blk wire **(B)**?	**YES:** Go to next step.



MXT011916 —UN—17JUN14
B—100A Black Wire
D—315 Orange Wire

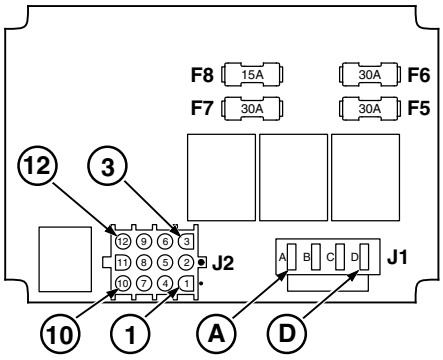
NO: Check 100A Blk wire from **(B)** to splice S-1.

MX52301,00003F7 -19-24OCT14-4/12

Voltage Presence	Is battery voltage present at the 315 Org wire **(D)**?	**YES:** Replace fan motor. **NO:** Go to next step.

Continued on next page

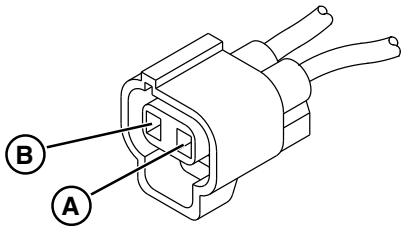
MX52301,00003F7 -19-24OCT14-5/12

VCU Connector	Is battery voltage present at VCU connector **(J1-C)**, 315 Org wire?  MXT011938 —UN—04JUN14 **J1-C— 315 Orange Wire** **J2-1— 310 Orange Wire**	**YES:** Check 315 Org wire continuity from VCU **(J1-C)** to fan motor connector **(D)**. **NO:** Go to next step.

MX52301,00003F7 -19-24OCT14-6/12

VCU Connector	Is battery voltage present at connector **(J2-1)**, 310 Org wire?	**YES:** Recheck wires, connectors, and fuses. If OK, and there is no power to the fan motor, replace VCU. **NO:** Go to next step.

MX52301,00003F7 -19-24OCT14-7/12

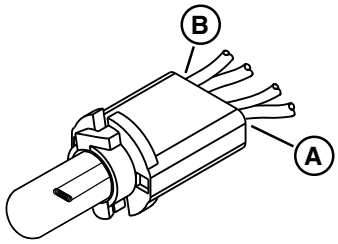
Radiator Temperature Switch	Remove jumper from the radiator temp switch connector. Is there battery power at 420N Yel wire **(A)**?  MXT011593 —UN—17JUN14 **AF—420N Yellow Wire** **BG—310 Orange Wire**	**YES:** Check 310 Org wire continuity from Radiator Temperature Switch **(B)** to VCU **(J2-1)**. **NO:** Check the 420N Yel wire from Radiator Temperature Switch **(A)** to splice S-2.

MX52301,00003F7 -19-24OCT14-8/12

❶ Temperature Light Circuit

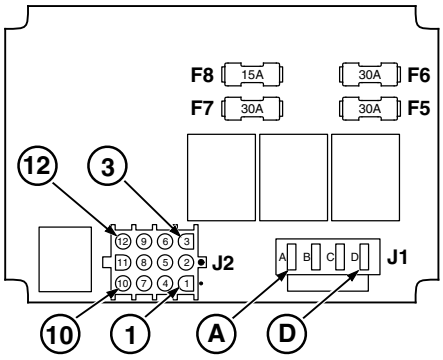
Continued on next page

MX52301,00003F7 -19-24OCT14-9/12

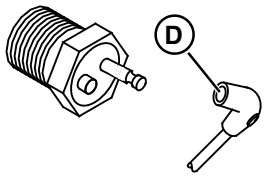
Engine Temperature Light	Test Procedure B Test Conditions: • Machine parked safely. See the “Safety Section”. • Park brake locked. • Open hood and remove storage tray. • Power circuits checked and OK. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55. • Key switch in RUN position, engine not running. • Check wire connections for looseness and corrosion. Is battery voltage present at the H2 engine coolant temperature light 419 and 417 Yel wires **(A)** and 300 and 303 Org wires **(B)**?  MXT011600 —UN—17JUN14 **A—419 and 417 Yellow Wires** **B—300 and 303 Orange Wires**	**YES:** Go to next step. **NO:** (A) Check 419 Yel wire. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55, or Power Circuit Operation, Diesel (SN 110001-). **NO:** (B) Test H2 Temp bulb. See Bulb Test. **NO:** (B)-Bulb lit. Check 300 and 303 Org wires for short.

Continued on next page

MX52301,00003F7 -19-24OCT14-10/12

VCU Connector	Is battery voltage present at VCU connector **(J2-7)**, 303 Org wire?  MXT011938 —UN—04JUN14 **J2-7— 303 Orange Wire**	**YES:** Go to next step. **NO:** Check 303 Org wire continuity from **(J2-7)** to coolant temperature light **(B)**.

MX52301,00003F7 -19-24OCT14-11/12

Engine Coolant Temperature Switch	Disconnect 300 Org wire from B3 engine coolant temperature switch. Is battery voltage present at **(D)**?  MXT011962 —UN—17JUN14 **D—300 Orange Wire**	**YES:** Test engine temperature switch. See Engine Coolant Temperature Switch Test. **NO:** Check 300 Org wire continuity from **(D)** to coolant temperature light **(B)**.

MX52301,00003F7 -19-24OCT14-12/12

Headlight Circuit Operation Gas, (All), Diesel (SN -080000)

Function:

Provides power to the headlights.

Operating Conditions:

- Key switch in the RUN position.
- Headlight switch in the ON position.

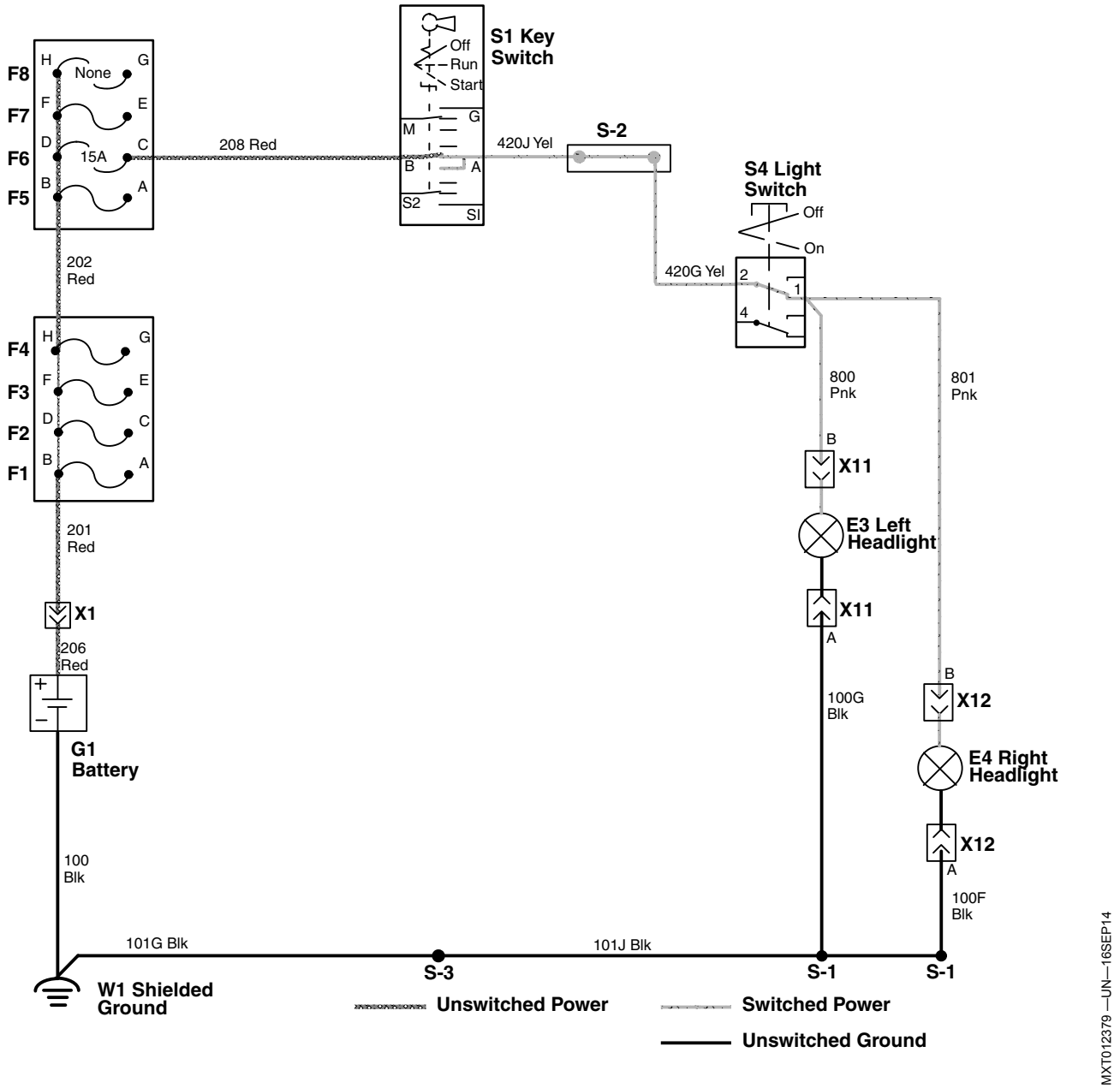
Theory of Operation:

Power flows from the G1 battery through the F6 fuse, S1 key switch, and on to the S-2 power splice. The 420G Yel wire carries power to the S4 light switch. With the switch in the ON position, current then continues to the E3 Left headlight and the E4 Right headlight. The 100G (Left) and 100F (Right) Blk wires provide ground through the S1 and S3 splices.

MX52301,00003DC -19-24OCT14-1/1

Headlight Circuit Schematic, Gas (All) Diesel (SN -080000)

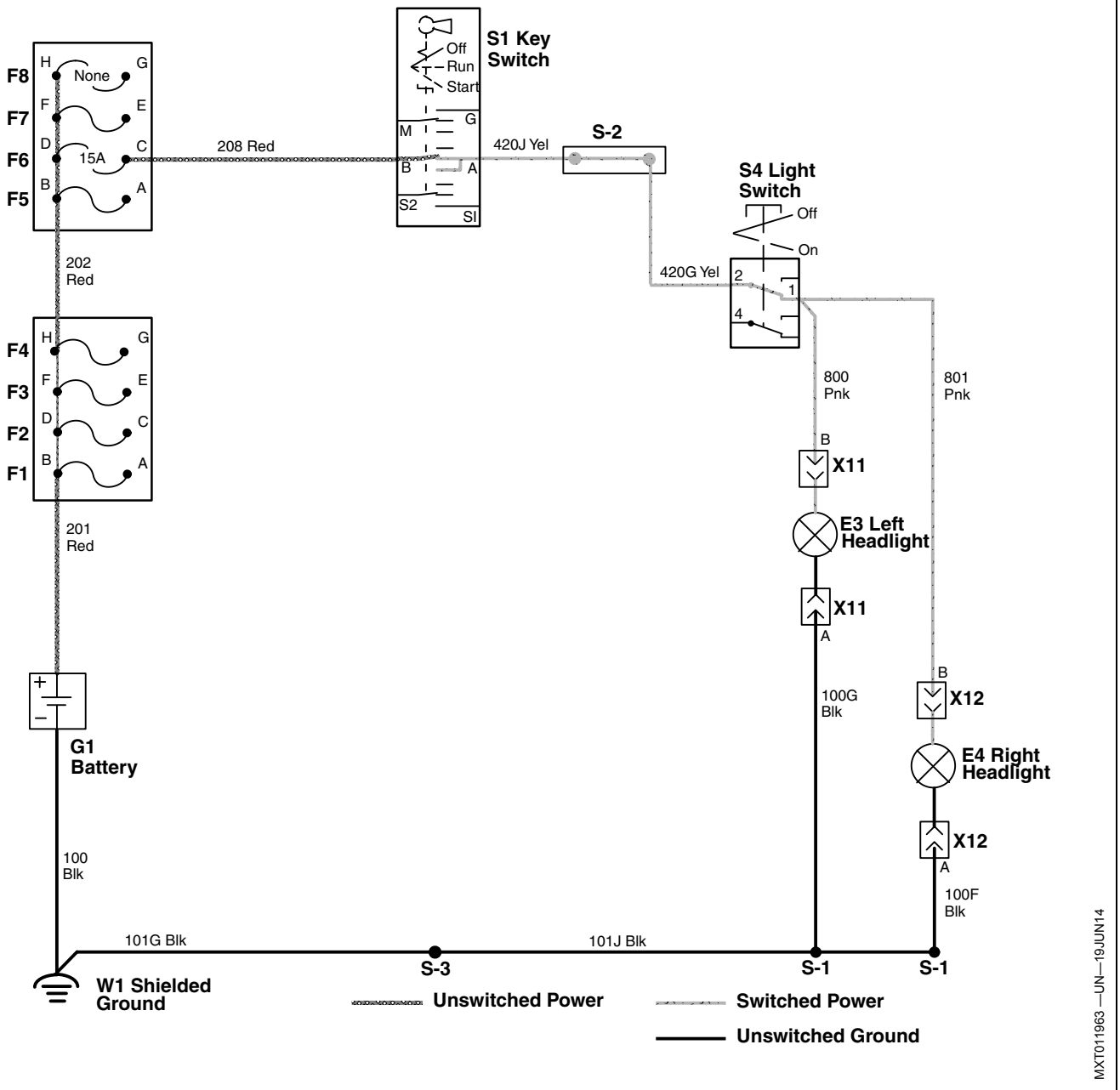
Headlight Circuit Schematic (Diesel SN -080000)



Continued on next page

MX52301,00003DD -19-24OCT14-1/4

Headlight Circuit Schematic (Gas -040000)



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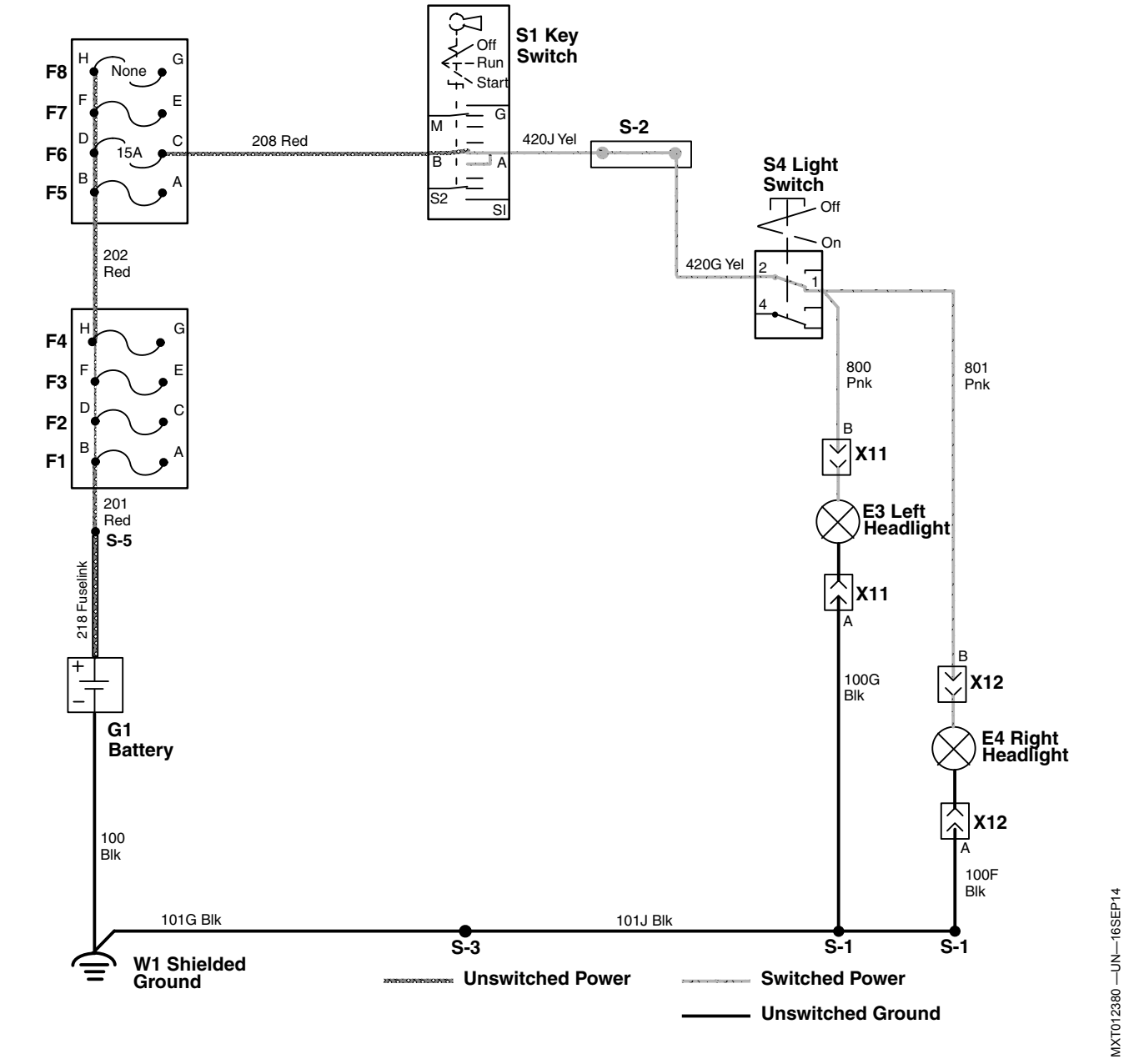
MX52301,00003DD -19-24OCT14-2/4

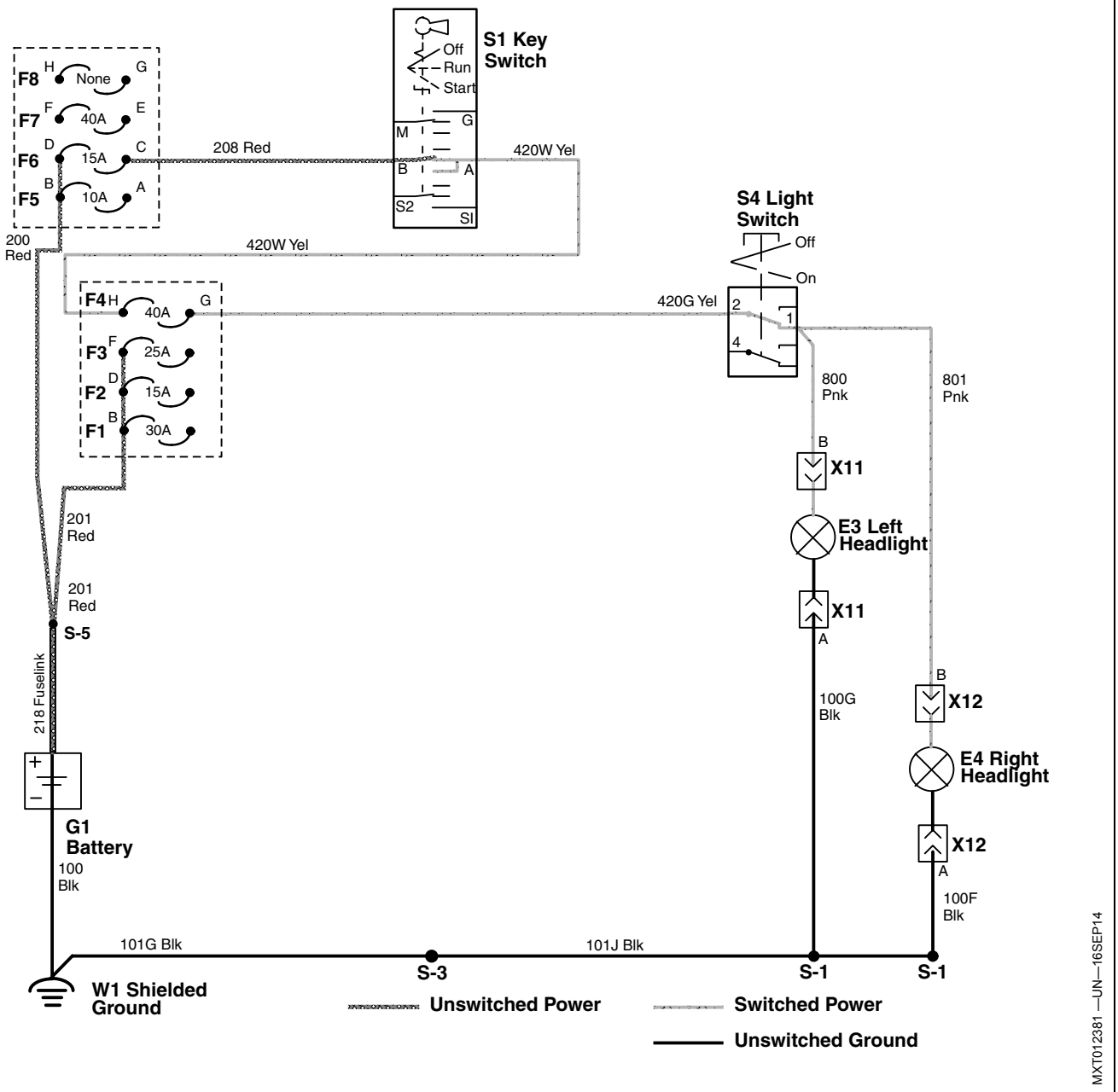
Headlight Circuit Schematic (Gas 040001-110000)



Continued on next page

MX52301,00003DD -19-24OCT14-3/4

Headlight Circuit Schematic (Gas 110001-)



MX52301,00003DD -19-24OCT14-4/4

Headlight Circuit Diagnosis, Gas (All), Diesel (SN -080000)

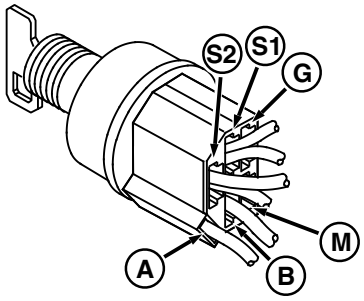
Headlight Circuit Diagnosis (Gas—All) (Diesel SN -080000)

MX52301,00003DE -19-24OCT14-1/6

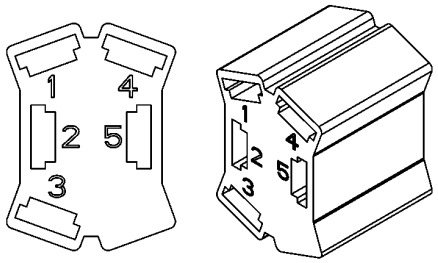
❶ Key Switch Circuit

Continued on next page

MX52301,00003DE -19-24OCT14-2/6

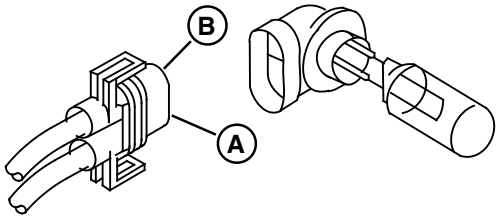
Key Switch	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Open hood and remove storage tray. • Key switch in run position, engine off. • Light switch in on position. • Check wire connections for looseness and corrosion. Is battery voltage present at 420J Yel wire **(A)** of S1 key switch?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Check power circuit to key switch. See Key Switch Test.

MX52301,00003DE -19-24OCT14-3/6

Light Switch	Is battery voltage present at 420G Yel wire of S4 light switch **(2)**?  MXT001666 —UN—10OCT11 **2—420G Yellow Wire**	**YES:** Go to next step. **NO:** Check 420J and 420G Yel wires and connections.

Continued on next page

MX52301,00003DE -19-24OCT14-4/6

Headlight Connectors	Disconnect headlight connectors. Is battery voltage present at **(B)** terminal of X11 (Left), 800 Pnk wire, and X12 (Right), 801 Pnk wire connectors?  MXT011965 —UN—17JUN14 **B—801 Pink Wire** **A—100F Black Wire**	**YES:** Go to next step. **NO:** Test light switch. Depending on option See Headlight Switch Test (2 Position) or SeeHeadlight Switch Test (2 Position) (AM144577) or See Light Switch Test (3 Position) or See Light Switch Test (3 Position) (AM144304).

MX52301,00003DE -19-24OCT14-5/6

Connector	Is continuity to ground present at **(A)** terminal of X11 (Left), 100G Blk wire and X12 (Right) 100F Blk wire connectors?	**YES:** Replace headlight. Connect headlight connector to headlight. **NO:** Check 100G (Left), 100F (Right), 101, and 101G Blk wires and connections.

MX52301,00003DE -19-24OCT14-6/6

Headlight Circuit Operation, Diesel (SN 080001-)

Provides power to the headlights (and or marker lights, when equipped).

Function:

Operating Conditions:

- Key switch in the RUN position.
- Headlight switch in the center position (Marker Lights), or fully on position (Headlight + Marker Lights).

Theory of Operation:

Power for the light switch is supplied by the key switch. See Power Circuit Operation, Diesel (SN 080001-).

Moving the light switch to the center position applies power to the marker lights circuit (830 Pnk wire) of the rear lights connector. In the top (fully on) position, the switch powers the two headlights (800/801 Pnk wires) in addition to the marker lights.

The standard light switch (when present SN 080001-110000) has no center position; the marker light circuit is not used.

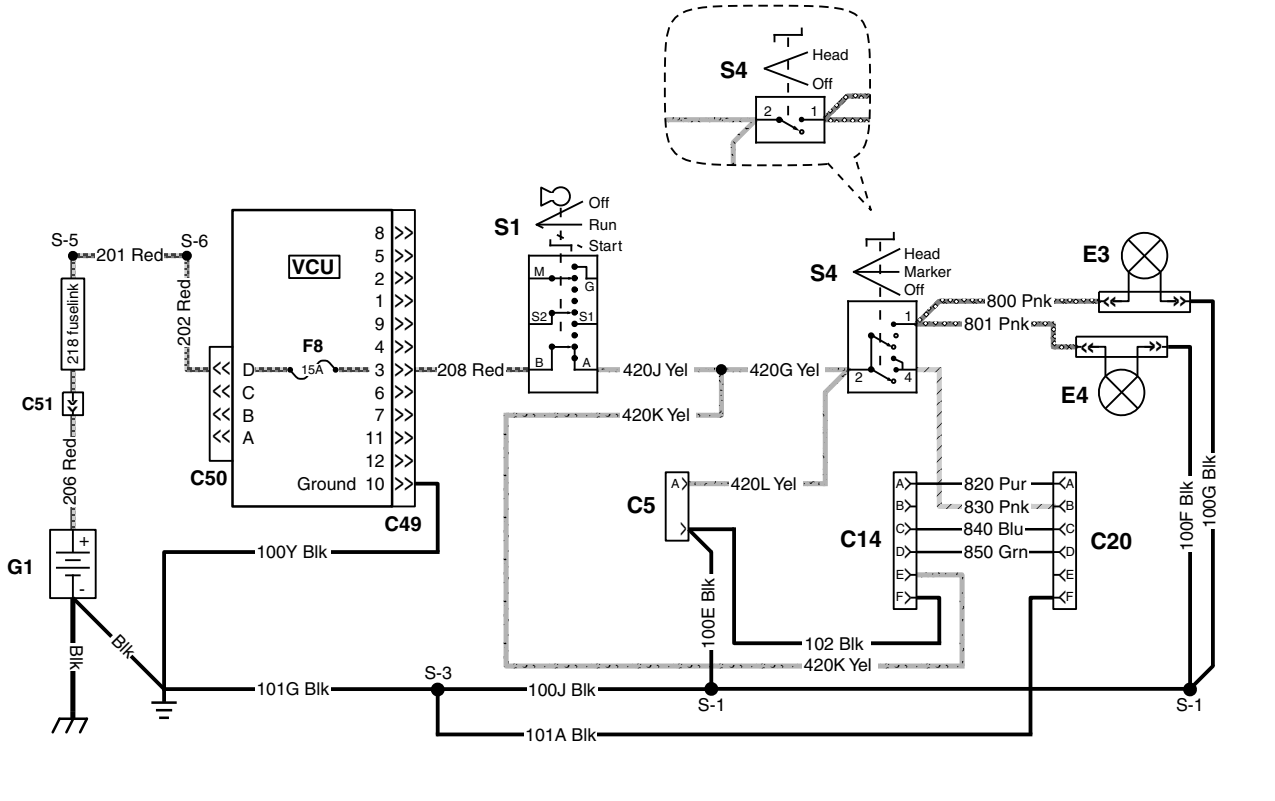
The rear lights connector ground wire runs to splice S-3. Splice S-1 is the ground point for the headlights and (via the front options connector) the front lights connector.

Lighting found on the machine varies with installed options and accessories.

MX52301,00003DF -19-24OCT14-1/1

Headlight Circuit Schematic, Diesel (SN 080001-)

Headlight Circuit Schematic (Diesel SN 080001-110000)

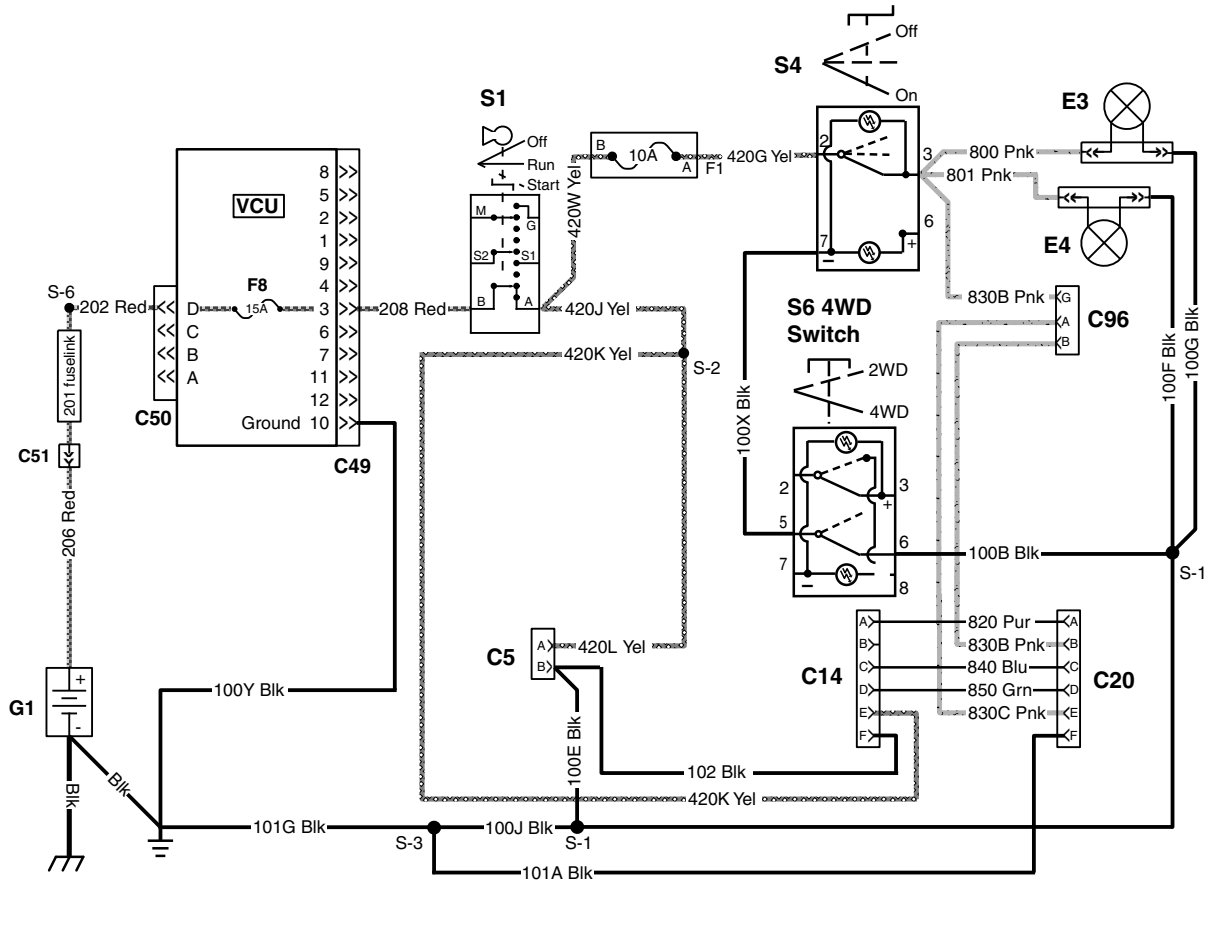


C5—Front Options Connector
C14— Front Lights Connector
C20— Rear Lights Connector
E3—Left Headlight
E4—Right Headlight
G1—Battery
S1—Key Switch
S4—Light Switch
VCU—Vehicle Control Unit

Continued on next page

MX52301,00003E0 -19-23JUN15-1/2

Headlight Circuit Schematic (Diesel SN 110001-)



C5—Front Options Connector
C14— Front Lights Connector
C20— Rear Lights Connector
C96— Light Option
E3— Left Headlight
E4—Right Headlight
G1—Battery
S1—Key Switch
S4—Light Switch
VCU—Vehicle Control Unit

MX52301,00003E0 -19-23JUN15-2/2

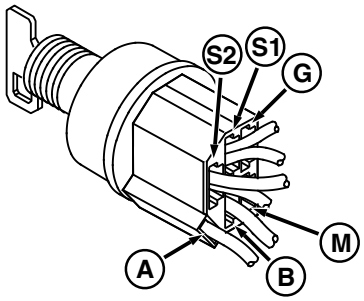
Headlight Circuit Diagnosis, Diesel (SN 080001-)

Headlight Circuit Diagnosis (Diesel SN 080001-)

MX52301,00003E1 -19-23JUN15-1/12

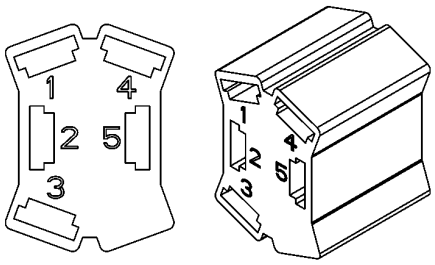
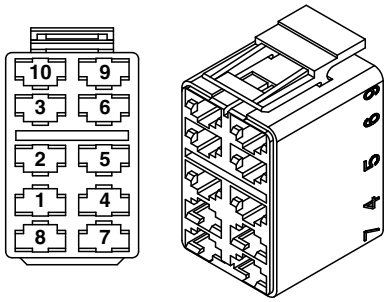
❶ Key Switch Circuit

MX52301,00003E1 -19-23JUN15-2/12

Key Switch	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Open hood and remove storage tray. • Key switch in run position, engine off. • Light switch in on position. • Check wire connections for looseness and corrosion. Is battery voltage present at 420J Yel wire **(A)** of S1 key switch?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire**	**YES:** Go to next step. **NO:** Check power circuit to key switch. See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.

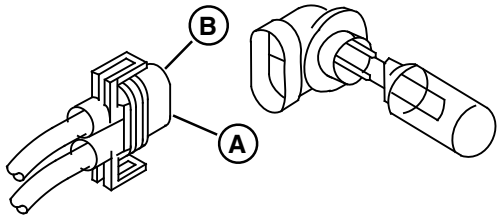
Continued on next page

MX52301,00003E1 -19-23JUN15-3/12

Light Switch	Is battery voltage present at 420G Yel wire of S4 light switch **(2)**?  MXT001666 —UN—10OCT11  MXT014667 —UN—22JUN15 **2—420G Yellow Wire**	**YES:** Go to next step. **NO:** (SN 080001-110000) Check 420J and 420G Yel wires and connections. **NO:** (SN 110001-) Check F1 fuse (See Fuse Test), 420G, and 420W Yel wires and connections.

Continued on next page

MX52301,00003E1 -19-23JUN15-4/12

Headlight Connectors	Disconnect headlight connectors. Is battery voltage present at **(B)** terminal of X11 (Left) 800 Pnk wire and X12 (Right) 801 Pnk wire connectors?  MXT011965 —UN—17JUN14 **B—801 Pink Wire** **A—100F Black Wire**	**YES:** Go to next step. **NO:** Test light switch. See Headlight Switch Test (2 Position), Headlight Switch Test (2 Position) (AM144577), Light Switch Test (3 Position), or Light Switch Test (3 Position) (AM144304).

MX52301,00003E1 -19-23JUN15-5/12

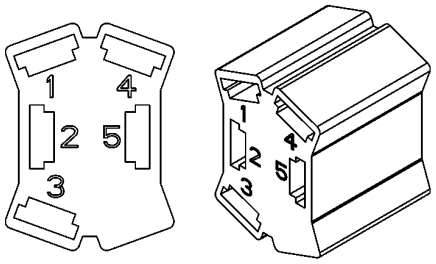
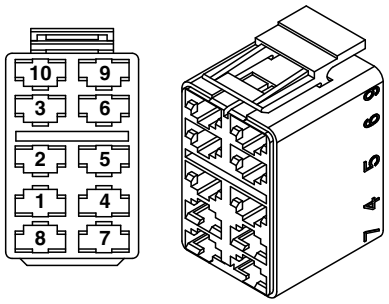
Connector	Is continuity to ground present at **(A)** terminal of X11 (Left), 100G Blk wire and X12 (Right) 100F Blk wire connectors?	**YES:** Replace headlight. Connect headlight connector to headlight. **NO:** Check 100G (Left), 100F (Right), 101, and 101G Blk wires and connections.

MX52301,00003E1 -19-23JUN15-6/12

❶ Marker Lights Circuit

Continued on next page

MX52301,00003E1 -19-23JUN15-7/12

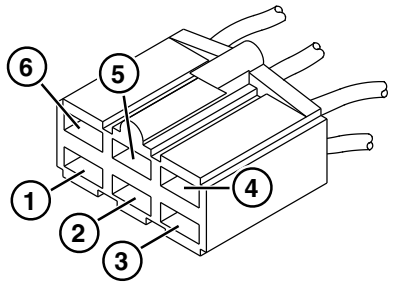
Light Switch OFF	*NOTE: The headlight bulb glass envelope must be free of dirt, oil, and fingerprints. Clean with rubbing alcohol and a soft cloth. Use care when handling bulb.* **Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Open hood and remove storage tray. • Key switch in RUN position, engine off. • Headlight Circuit Test completed; circuit functional. • Light switch in on position. • Check wire connections for looseness and corrosion.	
	S.N. -110000: Place light switch in Center position. Is voltage present at light switch, 830 Pnk wire **(4)**?  MXT001666 —UN—10OCT11 **1— 800 and 801 Pink Wires** **2— 420G and 420L Yellow Wires** **4— 830 Pink Wire**	**YES:** Go to next step.
	S.N. 110001-: Place light switch in Center position. Is voltage present at light switch, 830 Pnk wire **(3)**  MXT014667 —UN—22JUN15 **2— 420G Yellow Wire** **3— 800, 801, 810 Pink Wires**	**NO:** Test light switch. See Light Switch Test (3 Position), or Light Switch Test (3 Position) (AM144304).

MX52301,00003E1 -19-23JUN15-8/12

Light Switch ON	Press light switch to fully ON position. Is voltage present at **(4)**?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position), or Light Switch Test (3 Position) (AM144304).

Continued on next page

MX52301,00003E1 -19-23JUN15-9/12

Rear Lights Connector	Is battery voltage present at C20 Rear Lights connector, 830 Pnk wire **(5)**?  MXT011954 —UN—21OCT14 **1 (C20 rear connector)—101A Black Wire** **1 (C14 front connector)—102 Black Wire** **2 (C14 front connector)—420K Yellow Wire** **5(C20 rear connector)—830 Pink Wire**	**YES:** Go to next step. **NO:** Test 830 Pnk wire.

MX52301,00003E1 -19-23JUN15-10/12

Front Lights Connector	Is battery voltage present at C14 Front Light connector, 420K Yel wire **(2)**?	**YES:** Go to next step. **NO:** Check 420K and 420J Yel wires and connections.

MX52301,00003E1 -19-23JUN15-11/12

Ground Continuity	Is continuity to ground present at C14 Front Light connector, 102 Blk wire **(1)**, and C20 Rear Light connector, 101A Blk wire **(1)**?	**YES:** Press light switch to OFF. Test Complete **NO:** (C14)—Check 102, 100E, 100J and 101G Blk wires. **NO:** (C20)—Check 101A and 101G Blk wires.

MX52301,00003E1 -19-23JUN15-12/12

Park Brake Circuit Operation, Gas (All), Diesel (SN -080000)

Function:

To illuminate a light on the instrument panel and provide a visual indication to the operator that the park brake is engaged.

Operating Conditions:

- Key switch in the RUN position.
- Park brake locked.

Theory of Operation:

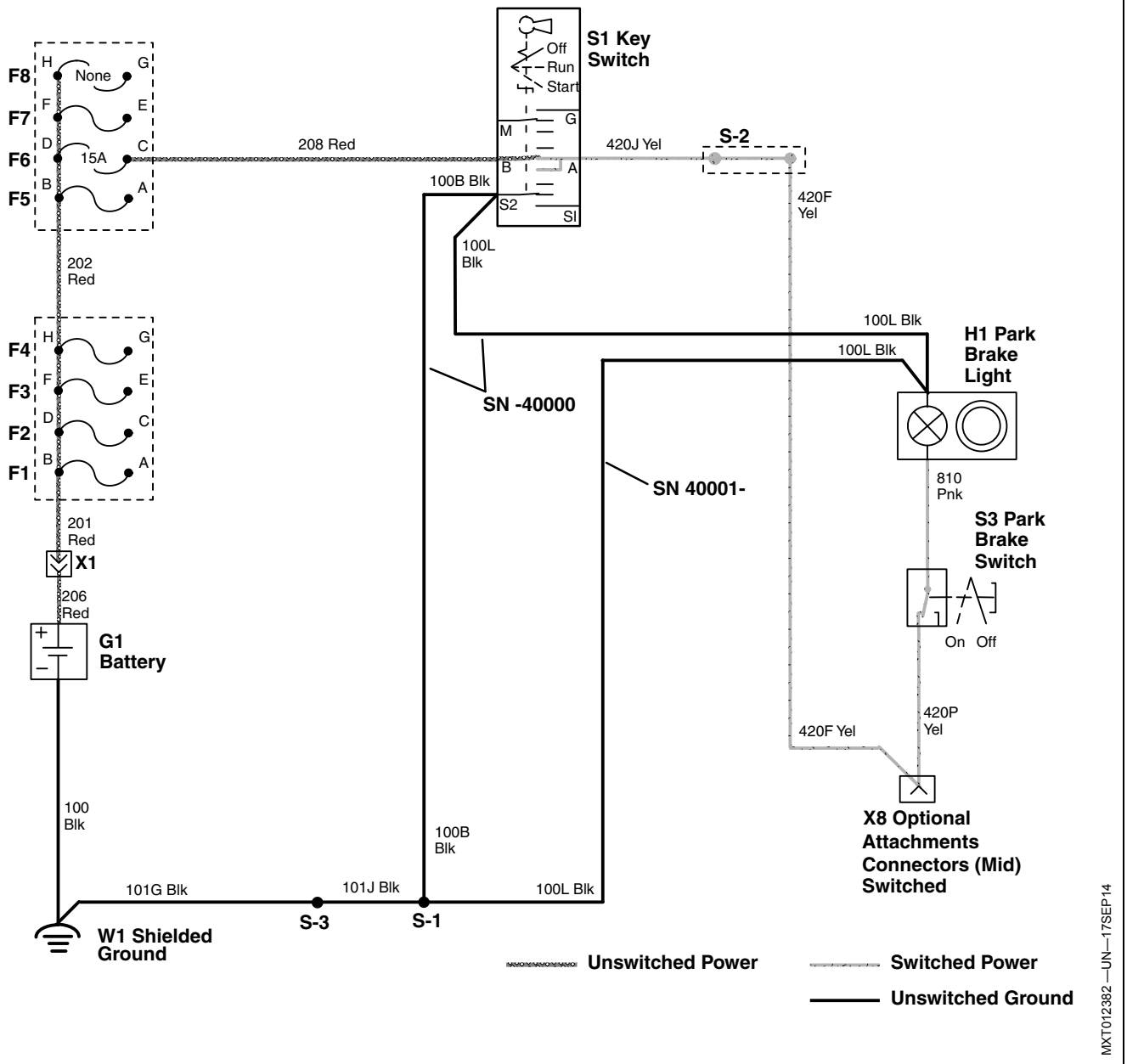
Power flows from the G1 battery through the F6 fuse, S1 key switch, and on to the S-2 power splice. The 420F and 420P Yel wire carries power to the S3 park brake switch. With the switch in the closed (park brake locked) position, current then flows across the 810 Pnk wire to the H1 park brake light, illuminating the park brake light.

The 100L, 100B (SN -040000), 101J, and 101G Blk wires provide ground through the S1 and S3 splices.

MX52301,00003E2 -19-24OCT14-1/1

Park Brake Circuit Schematic, Gas (All), Diesel (SN -080000)

Park Brake Circuit Schematic (Diesel SN -080000)



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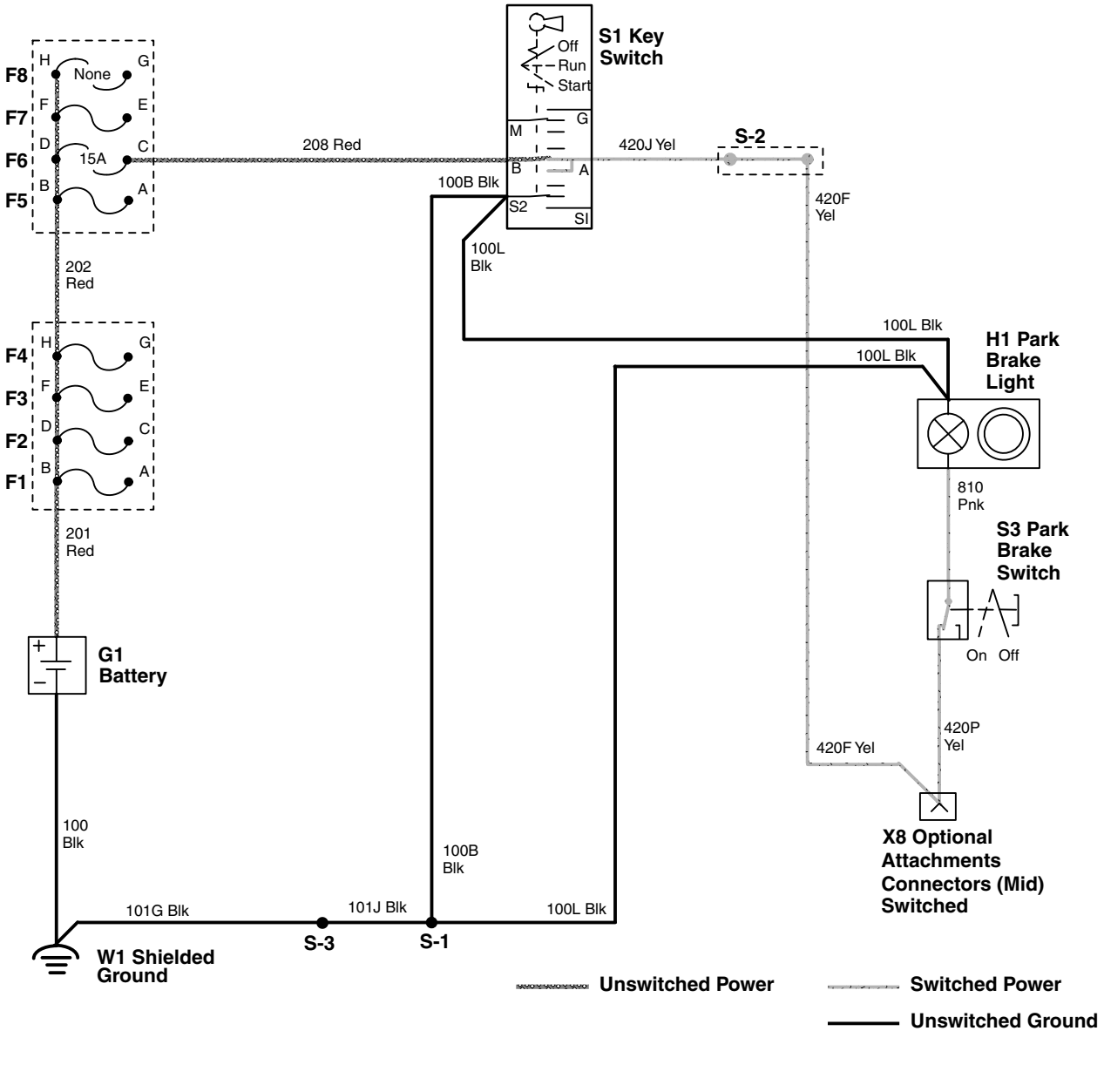
MX52301,00003E3 -19-24OCT14-1/4

Park Brake Circuit Schematic (Gas -040000)



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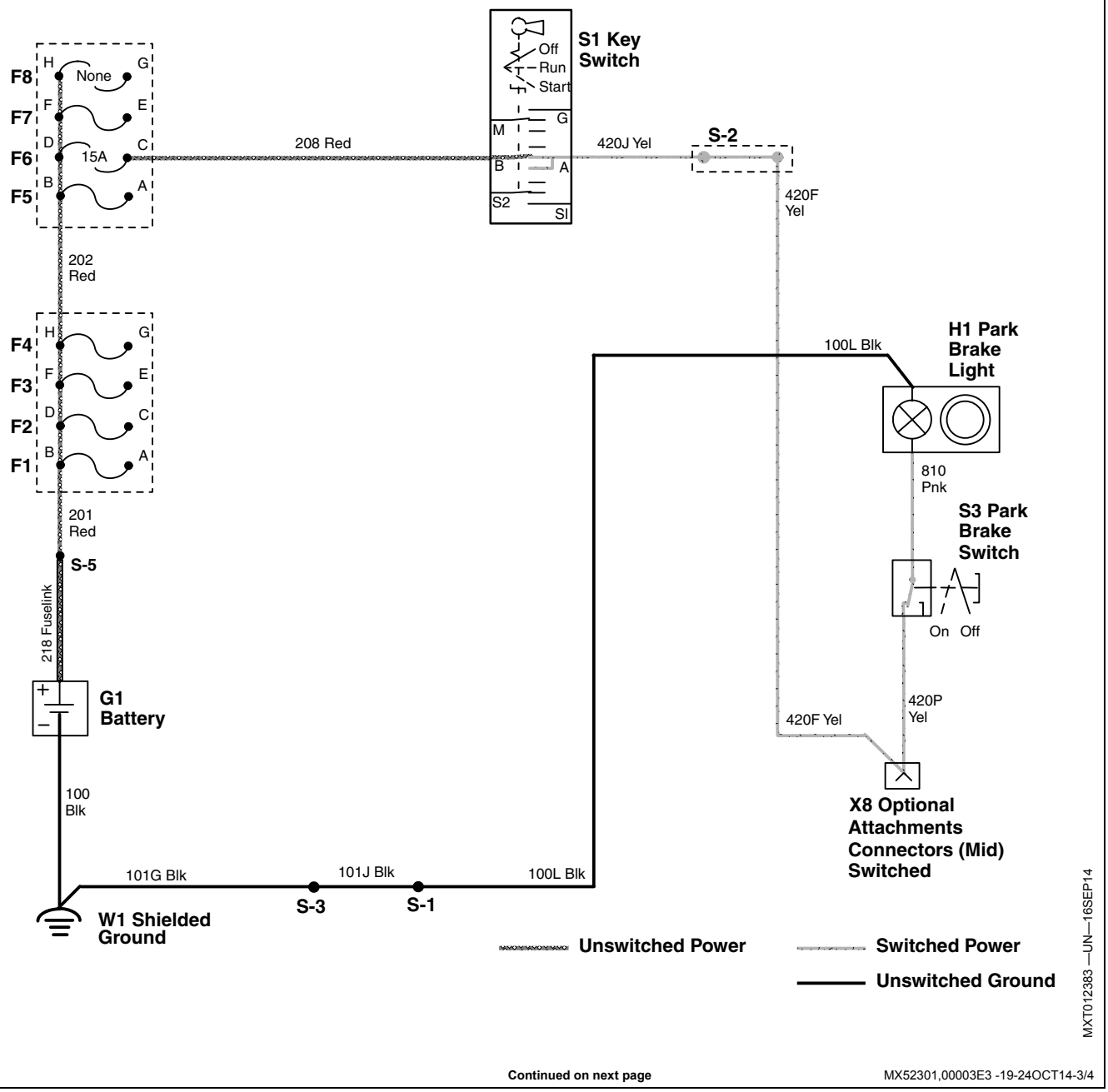
MX52301,00003E3 -19-24OCT14-2/4

Park Brake Circuit Schematic (Gas 040001-110000)



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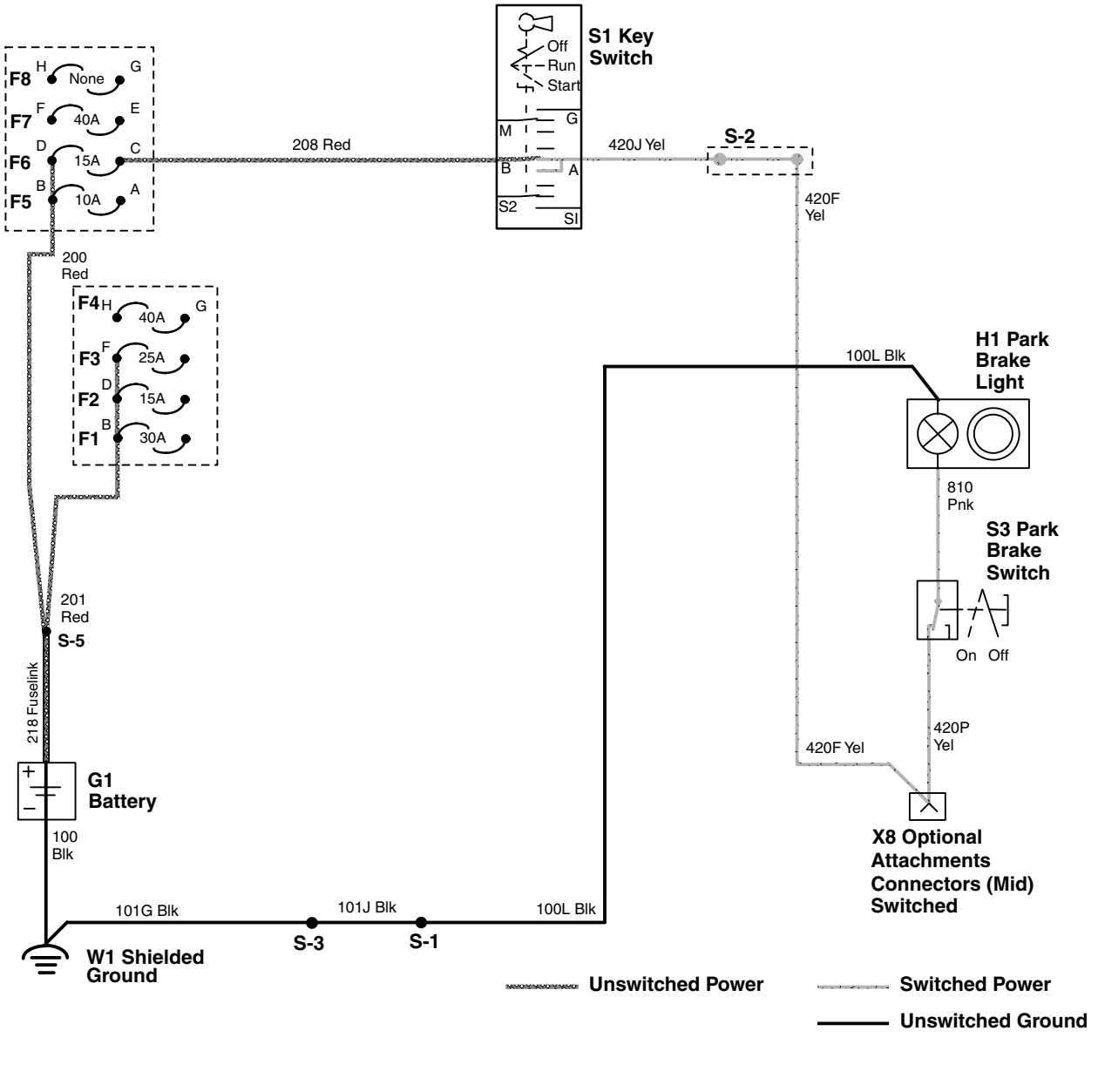
MX52301,00003E3 -19-24OCT14-3/4

Park Brake Circuit Schematic (Gas 110000-)



MX52301,00003E3 -19-24OCT14-4/4

Park Brake Circuit Diagnosis, Gas (All), Diesel (SN -080000)

Park Brake Circuit Diagnosis (Gas—All) (Diesel SN -080000)

MX52301,00003E4 -19-24OCT14-1/6

❶ Park Brake Light Circuit

MX52301,00003E4 -19-24OCT14-2/6

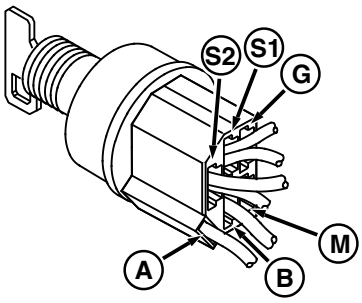
Key Switch

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Hood open
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at 420J Yel wire **(A)** of S1 key switch?



MXT004463 —UN—31MAY12
A—420J Yellow Wire

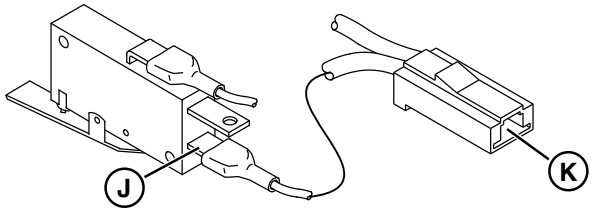
YES: Go to next step.

NO: Test key switch. See Key Switch Test.

MX52301,00003E4 -19-24OCT14-3/6

Park Brake Switch

Is battery voltage present at S3 park brake switch, 420P Yel wire **(J)**?



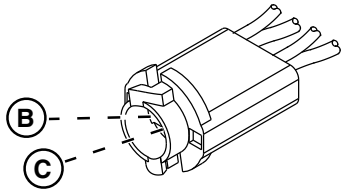
MXT011902 —UN—28MAY14
K—420F, 420P Yellow Wires
J— 420P Yellow Wire

YES: Go to next step.

NO: Check 420P and 420F Yel wires.

Continued on next page

MX52301,00003E4 -19-24OCT14-4/6

Park Brake Light Socket	Remove H1 park brake light socket from instrument panel. Remove bulb. Is battery voltage present at H1 park brake light socket, 810 Pnk wire **(B)**?  MXT011584—UN—16JUN14 **B—810 Pink Wire** **C—100L Black Wire**	**YES:** Go to next step. **NO:** Test park brake switch. See Park Brake Switch Test.

MX52301,00003E4 -19-24OCT14-5/6

Ground Continuity	Is continuity to ground present at H1 park brake light socket, 100L Blk wire **(C)**?	**YES:** Test bulb. See Bulb Test. **NO:** Check 100L, 100B (SN -040000), 101J and 101G Blk wires.

MX52301,00003E4 -19-24OCT14-6/6

Park Brake Circuit Operation, Diesel (SN 080001-)

Function:

To illuminate a light on the instrument panel that indicates the park brake is locked.

Operating Conditions:

- Park brake locked.
- Transmission in neutral.
- Key switch in RUN position.

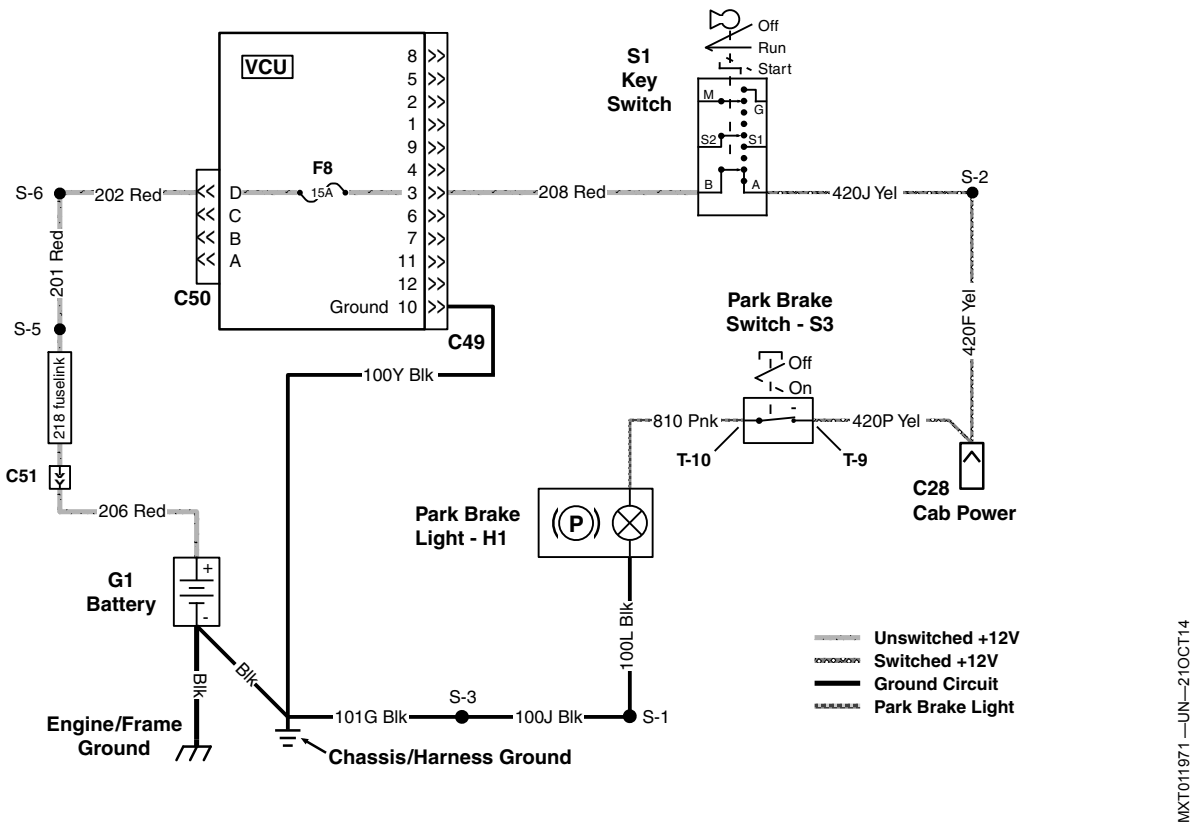
Theory of Operation:

The park brake switch connects the park brake light to the switched power circuit. Engaging the park brake lever closes the park brake switch, thus illuminating the park brake light on the dashboard.

MX52301,00003E5 -19-24OCT14-1/1

Park Brake Circuit Schematic, Diesel (SN 080001-)

Park Brake Circuit Schematic (Diesel SN 080001-110000)



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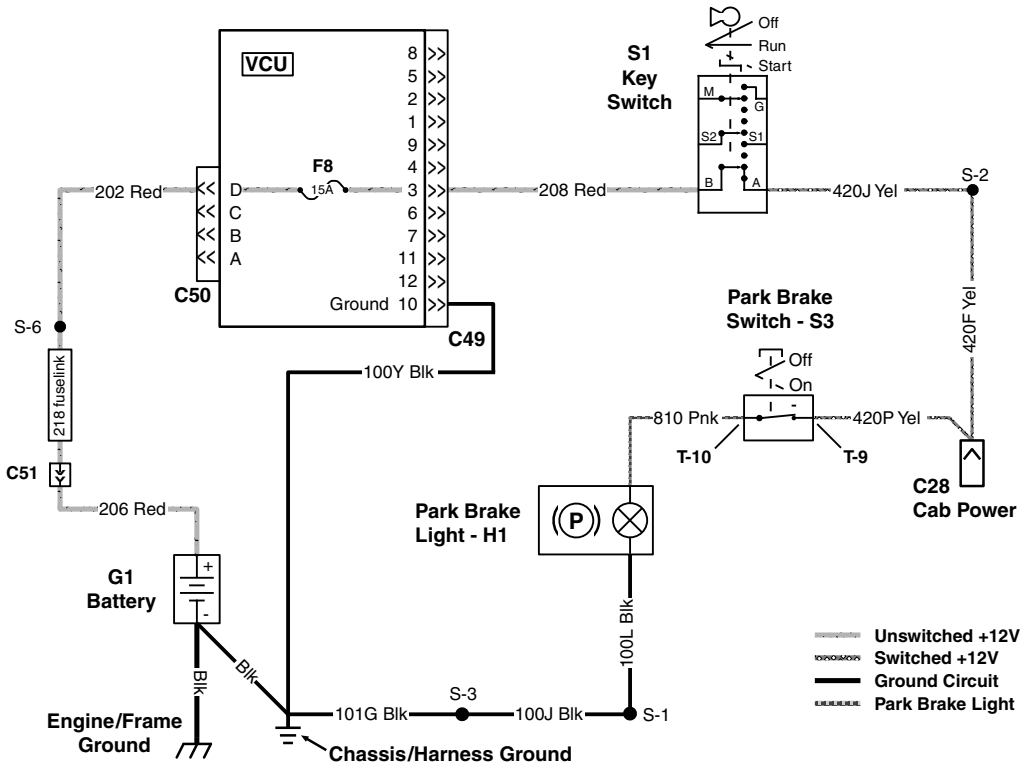
MX52301,00003E6 -19-24OCT14-1/2

Park Brake Circuit Schematic (Diesel SN 110001-)



MX52301,00003E6 -19-24OCT14-2/2

Park Brake Circuit Diagnosis, Diesel (SN 080001-)

Park Brake Circuit Diagnosis (Diesel SN 080001-)

MX52301,00003E7 -19-24OCT14-1/7

❶ Park Brake Circuit

MX52301,00003E7 -19-24OCT14-2/7

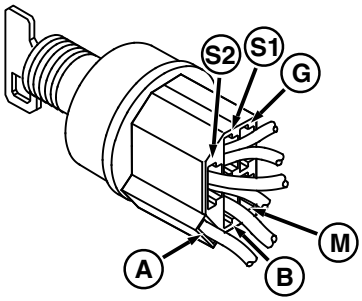
Key Switch

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Transmission in neutral position.
- Open hood and remove storage tray.
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at key switch 420J and 420Y Yel wires **(A)**?



MXT004463 —UN—31MAY12
A—420J and 420Y Yel Wires

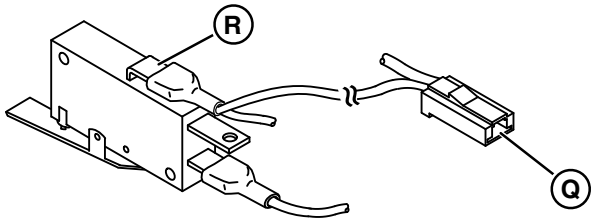
YES: Go to next step.

NO: See Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.

MX52301,00003E7 -19-24OCT14-3/7

Park Brake Power Connector

Is battery voltage present at C28 Power connector, 420F and 420P Yel wires **(Q)**?



MXT011949 —UN—10JUN14
Q—420P Yellow Wire
R—420P Yellow Wire

YES: Go to next step.

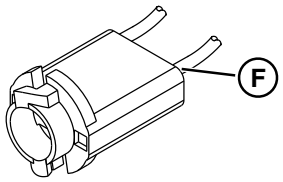
NO: Check 420F and 420J Yel wires.

Continued on next page

MX52301,00003E7 -19-24OCT14-4/7

Park Brake Switch	Is battery voltage present at park brake switch, 420P Yel wire **(R)**?	**YES:** Go to next step. **NO:** Check 420P Yel wire.

MX52301,00003E7 -19-24OCT14-5/7

Park Brake Light Socket	Remove bulb from H1 park brake light socket. Is battery voltage present at the socket 810 Pnk wire **(F)**?  MXT011942 —UN—10JUN14 **E—100L Black Wire** **F—810 Pink Wire**	**YES:** Go to next step. **NO:** Test park brake switch. See Park Brake Switch Test.

MX52301,00003E7 -19-24OCT14-6/7

Ground Continuity	Is continuity to ground present at the socket 100L Blk wire **(E)**?	**YES:** Test bulb. See Bulb Test. **NO:** Check 100L, 100J and 101G Blk wires.

MX52301,00003E7 -19-24OCT14-7/7

Accessory Power Port Circuit Operation, Gas (All), Diesel (SN -080000)

Function:

To provide unswitched 12VDC to power optional accessories.

Theory of Operation:

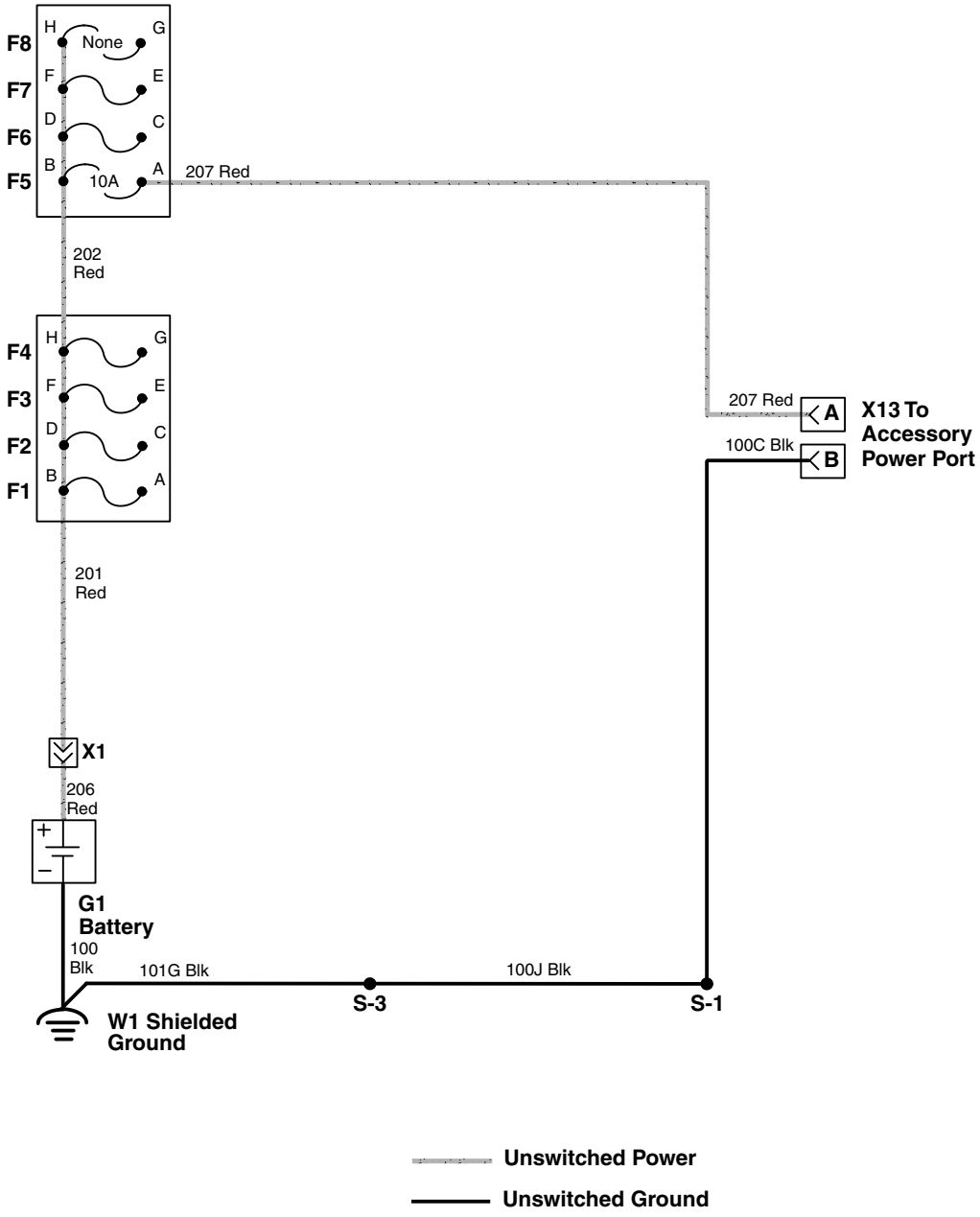
The G1 battery supplies unswitched current through the (206 Red—Diesel Engine) 201 and 202 Red wires, F5 fuse, and 207 Red wire directly to the X13 accessory outlet.

The ground path for the accessory outlet is completed using the 100C, 100J, and 101G Blk wires.

MX52301,00003E8 -19-24OCT14-1/1

Accessory Power Port Circuit Schematic, Gas (All), Diesel (SN -080000)

Accessory Power Port Circuit Schematic (Diesel -080000)



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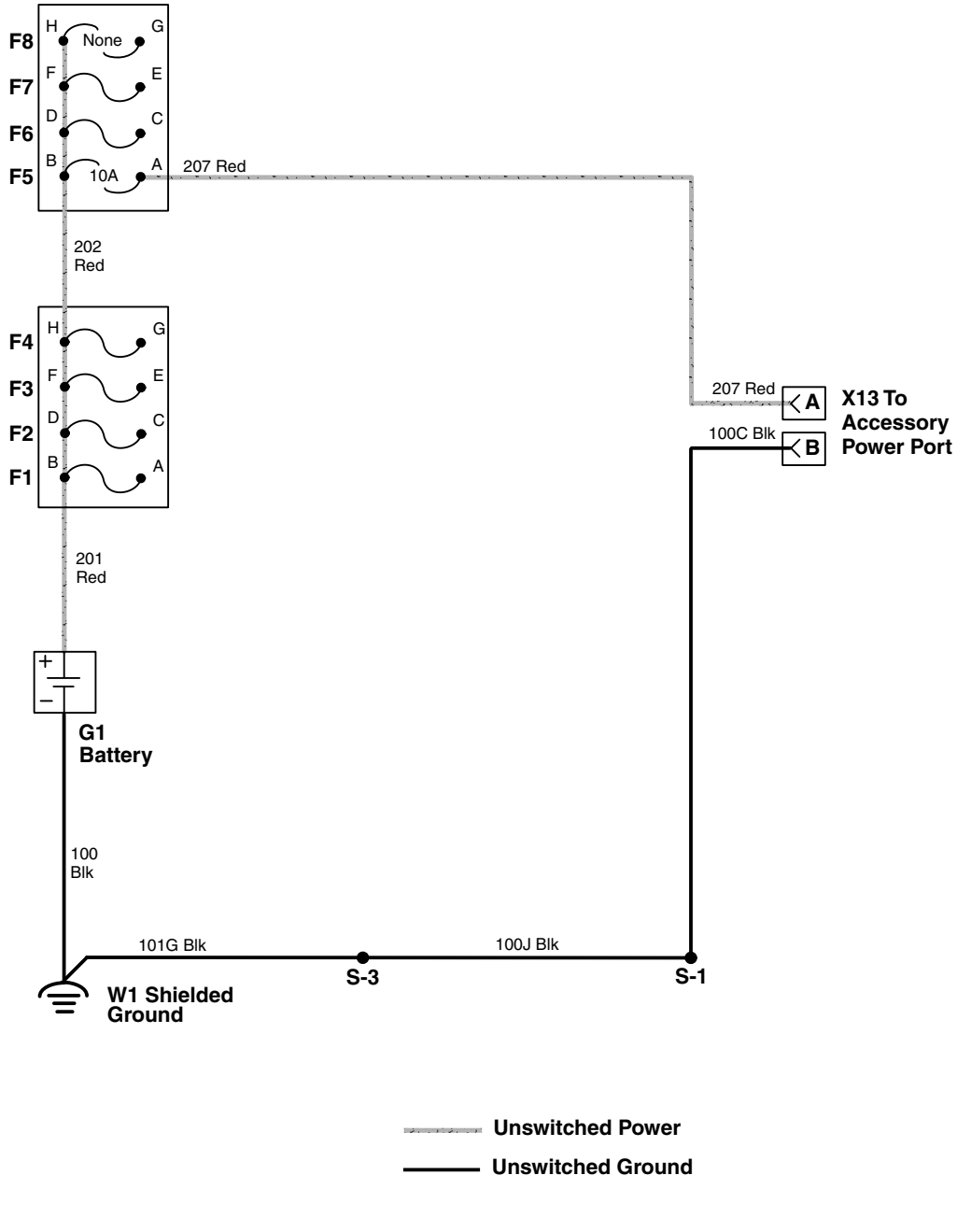
MX52301,00003E9 -19-24OCT14-1/4

Accessory Power Port Circuit Schematic (Gas -040000)



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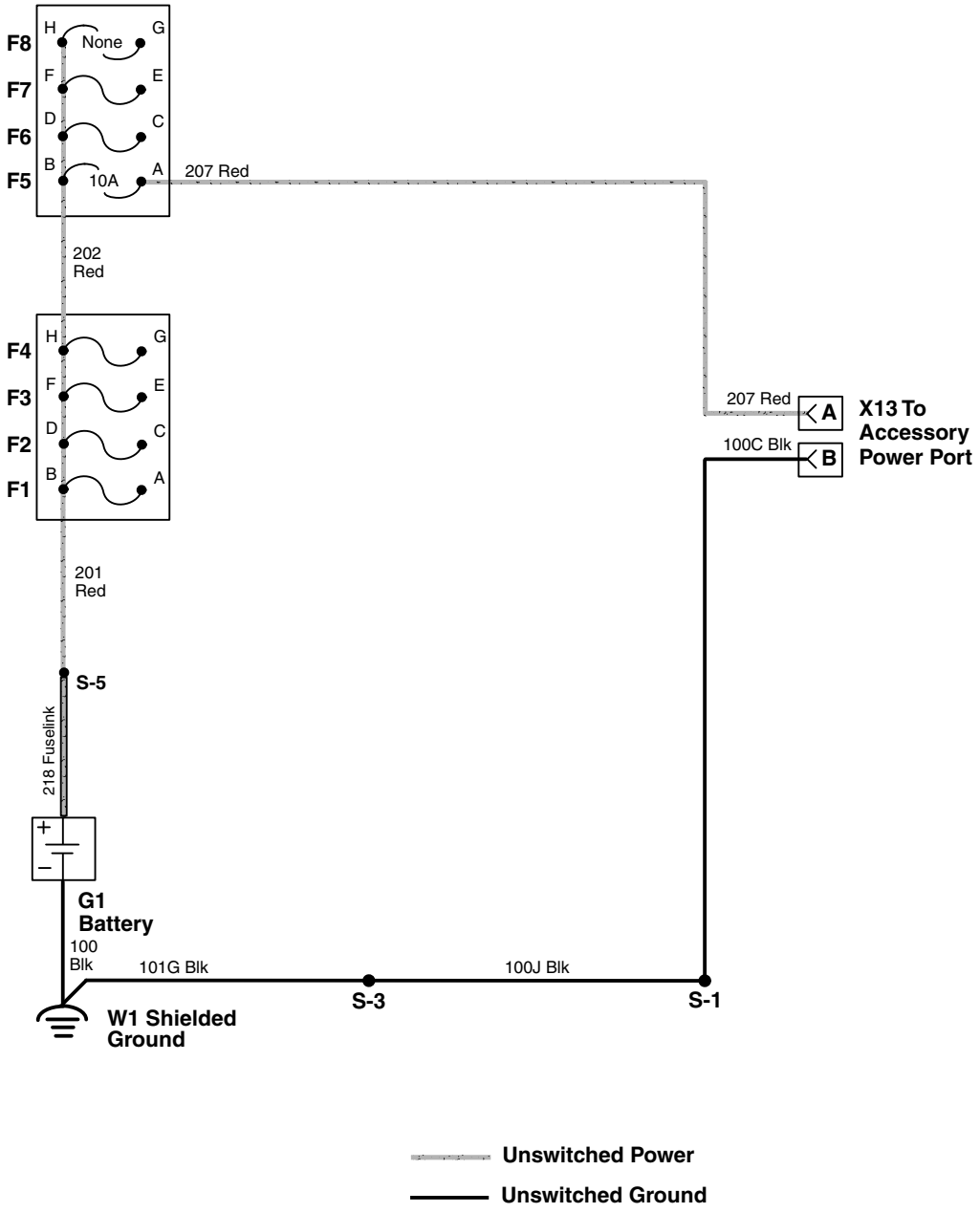
MX52301,00003E9 -19-24OCT14-2/4

Accessory Power Port Circuit Schematic (Gas 040001-110000)



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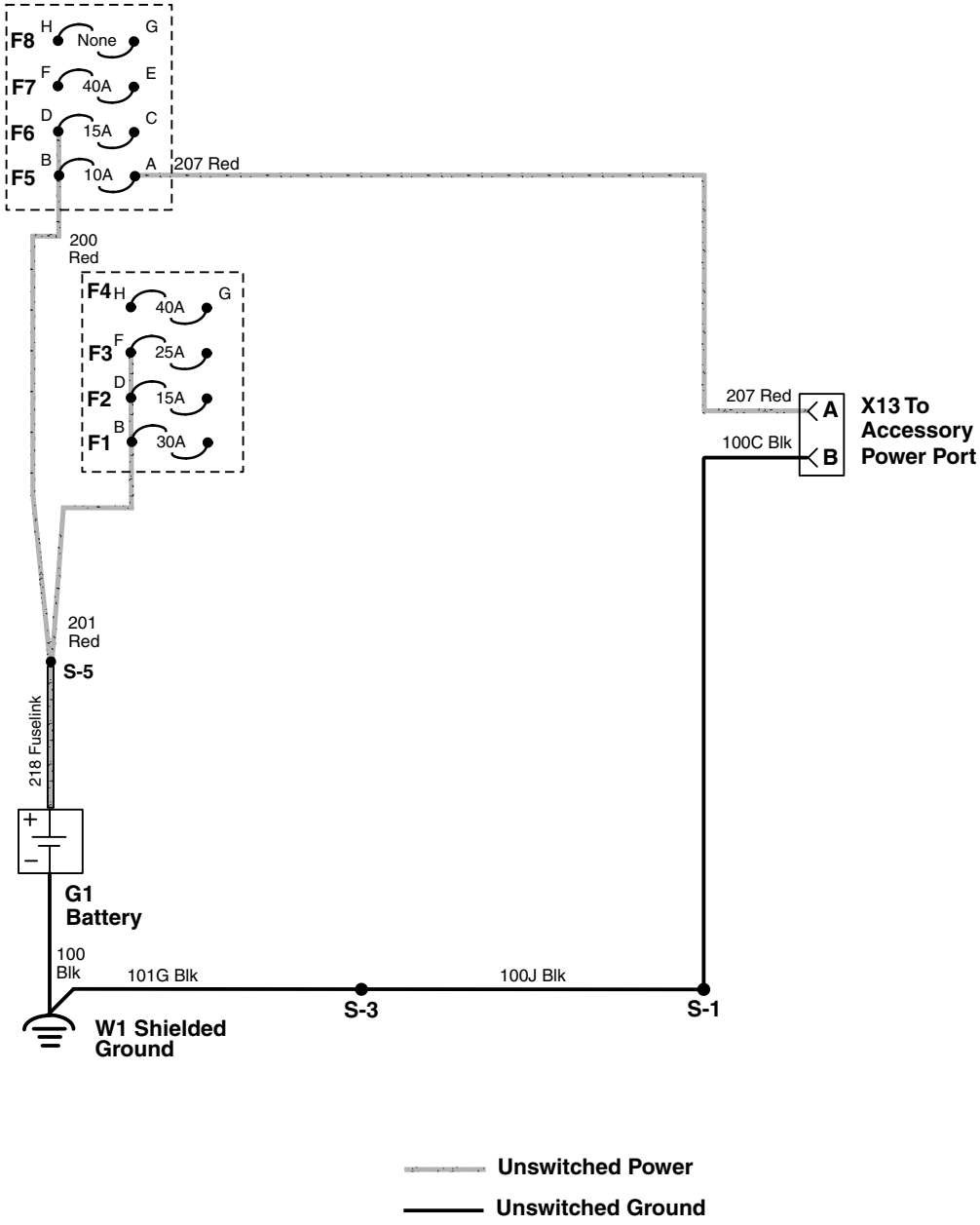
MX52301,00003E9 -19-24OCT14-3/4

Accessory Power Port Circuit Schematic (Gas 110001-)



MX52301,00003E9 -19-24OCT14-4/4

Accessory Power Port Circuit Diagnosis Gas (All), Diesel (SN -080000)

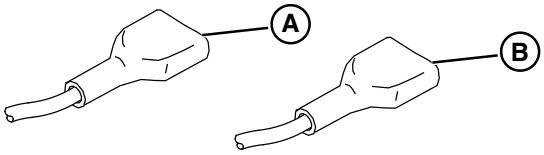
Accessory Power Port Circuit Diagnosis (Gas—All) (Diesel SN -080000)

Continued on next page

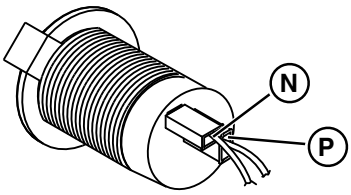
MX52301,00003EA -19-24OCT14-1/4

❶ Accessory Power Port Circuit

MX52301,00003EA -19-24OCT14-2/4

Battery Voltage	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Is battery voltage present at 207 Red wire **(N)** of X13 accessory outlet?  MXT011975 —UN—18JUN14 *Accessory Power Port (SN -040000)* **A (SN -040000)—207 Red Wire** **B (SN -040000)—100 Black Wire**	**YES:** Go to next step. **NO:** Check 201 and 202 Red wires, F5 fuse, and 207 Red wire.

MX52301,00003EA -19-24OCT14-3/4

Ground Continuity	Is there continuity to ground between 100C Blk wire **(P)** of X13 accessory outlet and **ground**?  MXT011913 —UN—10JUN14 *Accessory Power Port (SN 040001-)* **N (SN 040001-)—207 Red Wire** **P (SN 040001-)—100 Black Wire**	**YES:** Replace accessory outlet. **NO:** Check 100C, 101J, and 101G Blk wires and connections.

MX52301,00003EA -19-24OCT14-4/4

Accessory Power Port Circuit Operation, Diesel (SN 080001-)

Function:

To provide 12VDC power to optional equipment and accessories.

Operating Conditions:

Theory of Operation:

Battery power supplied to the accessory outlets and connectors is either unswitched (always on) or switched (key switch in RUN position).

Unswitched power connectors:

- C100/Cab Power (high current)—Red wires protected by 218 fuse link. Separate ground wires direct to chassis.
- C6/Front Power—Supplied by fuse F3 (40 Amp). Grounded at splice S-1.
- C10/Rear Power—Supplied by fuse F4 (40 Amp). Grounded at splice S-3.
- C38/Front Power Port—Supplied by fuse F1 (SN 080001-110000), F2 (SN 110001-) (10 Amp). Grounded at splice S-1.

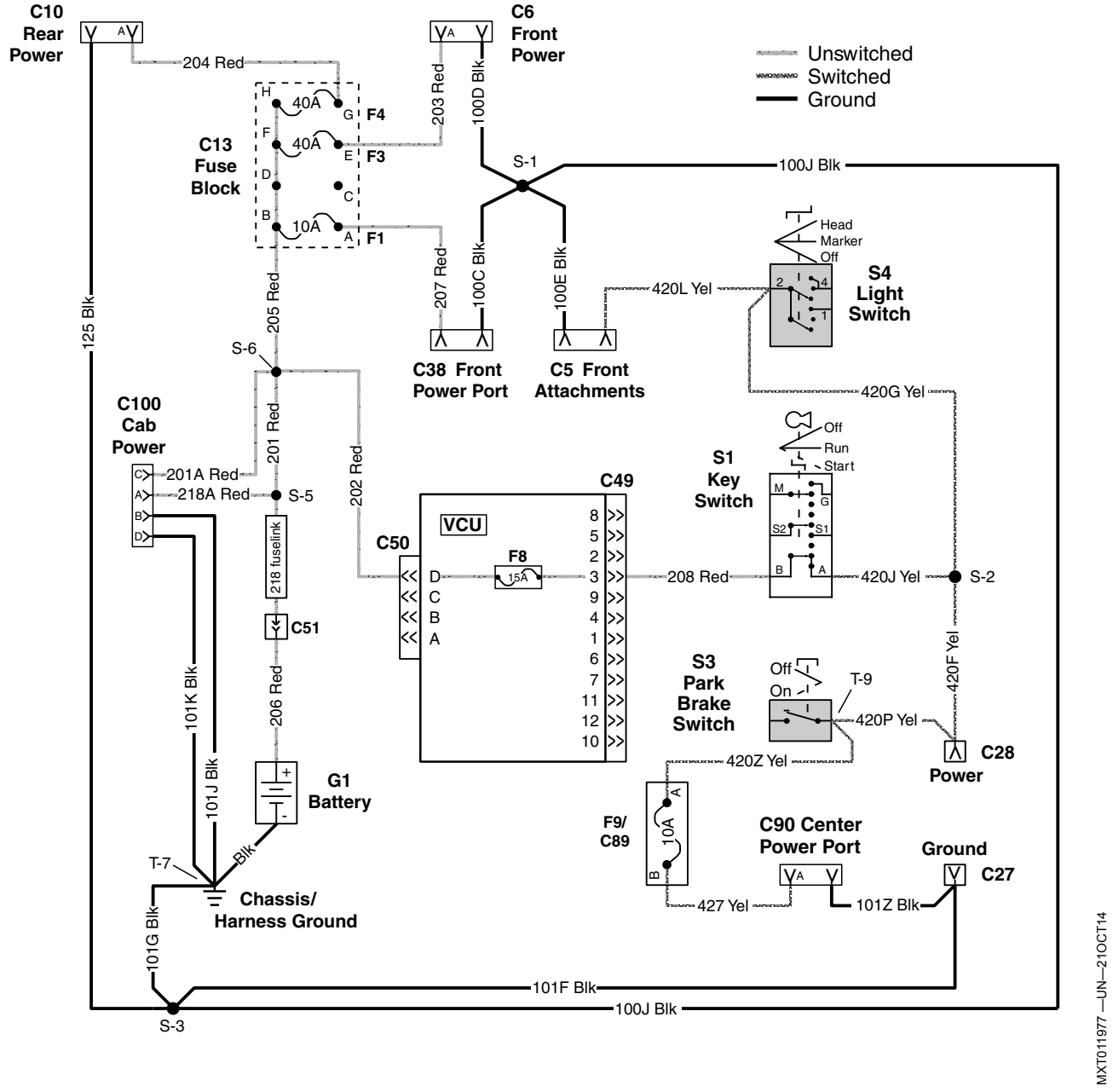
Fuse F8 (15 Amp) and the key switch (at splice S-2) route battery power to switched power connectors:

- C5/Front Attachments—Supplied by the power connection at light switch. Grounded at splice S-1.
- C28/Power (positive)—Splice S-2. Used with connector C27/Ground—splice S-3.
- C90/Center Power Port—Supplied by way of C28, the park brake switch, and fuse F9. Grounded at C27.

MX52301,00003EB -19-24OCT14-1/1

Accessory Power Port Circuit Schematic, Diesel (SN 080001-)

Accessory Power Port Circuit Schematic (Diesel SN 080001-110000)



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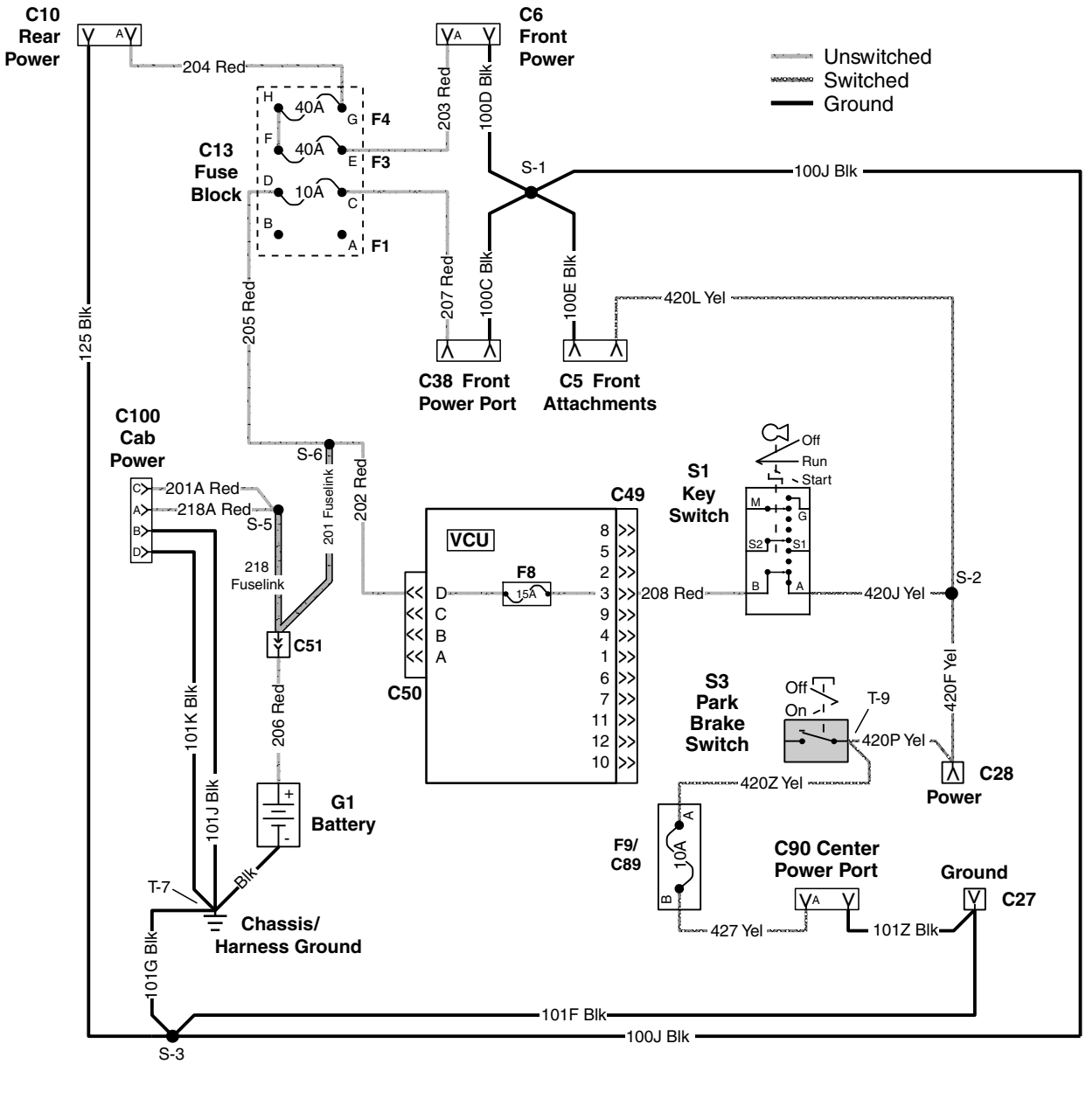
MX52301,00003EC -19-24OCT14-1/2

Accessory Power Port Circuit Schematic (Diesel SN 110001-)



MX52301,00003EC -19-24OCT14-2/2

Accessory Power Port Circuit Diagnosis, Diesel (SN 080001-)

Testing of the accessory outlets and connectors is covered in Power Circuit Diagnosis, Diesel (SN 080001-110000) or (SN 110001-) Section 50 Group 55.

MX52301,00003F8 -19-24OCT14-1/1

Vehicle Control Unit/Relay Module (VCU) Operation (SN 080001-)

Function:

Provides fused power distribution to various components as well as processing certain inputs and outputs for discrete components.

Operating Conditions:

- Ignition switch in run or start position,
- Engine running.

Theory of Operation:

Power is supplied to the vehicle control unit(VCU) when the ignition switch is in the run or start position.

Also, either directly or indirectly, the VCU controls these functions:

- Cooling fan
- Start motor
- 4WD
- Safety interlocks
- Seat belt indicator
- Monitoring of machine speed (display panel)

With the exception of fuse replacement, the VCU is not serviceable.

CB12260,000021F -19-21OCT14-1/1

Summary of References

MX52301,0000447 -19-23JUN15-1/1

Ground Circuit Tests

Reason:

To check for open circuits, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.

Equipment:

- Ohmmeter or Voltmeter

NOTE: The voltmeter method checks ground connections under load.

Procedure—Ohmmeter Method:

1. Park machine safely. (See the “Safety Section”.)
2. Raise and lock cargo box.
3. Connect ohmmeter red lead to ground terminal of circuit or component to be tested that is closest to the battery negative terminal. Work backward from the battery on the ground side of the problem circuit until the resistance reading increases above 0.1 ohms. If the reading is above 0.1 ohms, the problem is between the last two test points. If a problem is indicated, disconnect the wiring harness connector to isolate the wire or component and check resistance again. Maximum allowable resistance in the circuit is 0.1 ohms. Check both sides of the connectors closely, as disconnecting and connection may temporarily solve problem.

Procedure—Voltmeter Method:

1. Park machine safely. (See the “Safety Section”.)
2. Turn key switch to on position.
3. Raise and lock cargo box.
4. Connect voltmeter negative (black) lead to negative (-) terminal of battery.
5. Connect voltmeter positive (Red) lead to ground terminal of circuit or component to be tested. Be sure that the component circuit is activated (key on, switch(es) closed) so that voltage will be present at the component. Record voltage. Voltage must be greater than 0, but less than 1 volt. Some components will have a very small voltage reading on the ground side and still be operating correctly.

Results:

- If voltage is 0, the component is open.
- If voltage is greater than 1 volt, the ground circuit is bad. Check for open wiring, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.

BS62576,0000887 -19-05OCT12-1/1

Battery Voltage and Specific Gravity Tests

Reason:

To check voltage and determine condition of battery.

Procedure:

CAUTION: Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into the eyes. Avoid the hazard by:

- **Filling batteries in a well-ventilated area.**
- **Wearing eye protection and rubber gloves.**
- **Avoiding breathing fumes when electrolyte is added.**
- **Avoid spilling or dripping electrolyte.**
- **Use proper jump-start procedure.**

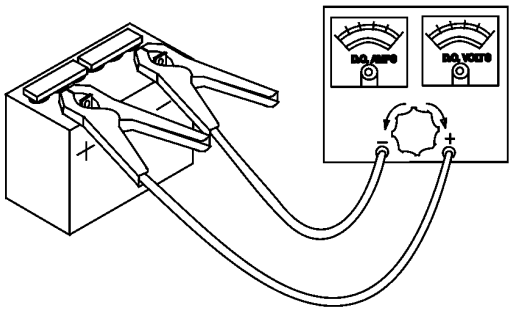
If you spill acid on yourself:

- **Flush your skin with water.**
- **Apply baking soda or lime to help neutralize the acid.**
- **Flush your eyes with water for 10—15 minutes. Get medical attention immediately.**

If acid is swallowed:

- **Drink large amounts of water or milk.**
- **Then drink milk of magnesia, beaten eggs, or vegetable oil.**
- **Get medical attention immediately.**

1. Clean battery terminals and top of battery. Inspect battery terminals and case for breakage or cracks.
2. Check electrolyte level in each battery cell. Add clean, soft water as needed. If water added, charge battery for 20 minutes at 10 amps.
3. Remove surface charge by placing a small load on the battery for 15 seconds.



MXT001931 —UN—22DEC11

4. Check battery voltage with voltmeter or JT05685 Battery Tester or equivalent.
5. Check specific gravity of each cell with JDG1246 hydrometer.

Results:

- Battery voltage less than 12.4 V, charge battery to specification.

Specification	
Battery (Minimum)—Voltage	12.4 V

- Battery voltage more than 12.4 V, test specific gravity to specification.

Specification	
Battery (Minimum)—Electrolyte Specific Gravity	1.225 with less than 50 point variation

- All cells less than 1.175, charge battery at 10 A rate.
- All cells less than 1.225 with less than 50 point variation, charge battery at 10 A rate.
- All cells more than 1.225 with less than 50 point variation, load test battery.
- More than 50 point variation: Replace battery.

OUMX068,000027A -19-24OCT16-1/1

Battery Charge

Reason:

To increase battery charge after battery has been discharged.

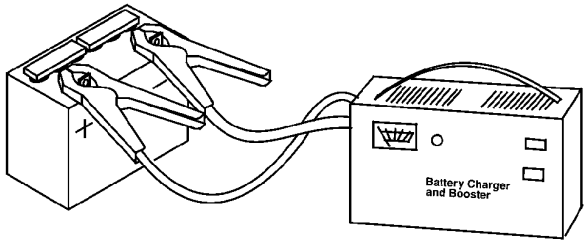
Procedure:

1. Connect variable rate charger to battery.

NOTE: Maximum charge time at boost setting is 10 minutes. Allow an additional 5 minutes for each 10 degrees below 21°C (70°F).

2. Start charger at slow rate. Increase charge rate one setting at a time. Check charger ammeter after 1 minute at each setting. Maintain 10 A charge rate. Use boost setting as necessary.
3. Check if battery is accepting a 10 A charge after 10 minutes at boost setting.
   - Battery will not accept 10 A charge after 10 minutes at boost setting: replace battery.
   - Battery is accepting 10 A charge after 10 minutes at boost setting, and battery did not need water: go to steps 6 and 7.
   - Battery is accepting 10 A charge after 10 minutes at boost setting, but battery did need water or all cells were below 1.175: go to steps 4 and 5.

IMPORTANT: Decrease charge rate if battery gases or bubbles excessively or becomes too warm to touch.



MXT001932 —UN—22DEC11

4. Set charger at 15—25 amps.

NOTE: If battery was discharged at slow or unknown rate, charge at 10—15 amps for 6—12 hours (Maintenance—free battery: 12—24 hours). If battery was discharged at fast rate, charge at 20—25 amps for 2—4 hours (Maintenance—free battery: 4—8 hours).

5. Check specific gravity after 30 minutes (60 minutes for maintenance—free battery).
   - More than 50 point variation between cells: replace battery.
   - Less than 50 point variation between cells: go to steps 6 and 7.
6. Continue charging battery until specific gravity is 1.230—1.265 points.
7. Load test battery. (See “Battery Load Test”.)

OUMX258,00002EA -19-11AUG14-1/1

Battery Load Test

Reason:

To check condition of battery under load.

NOTE: See “Battery Charge” before applying a load to battery.

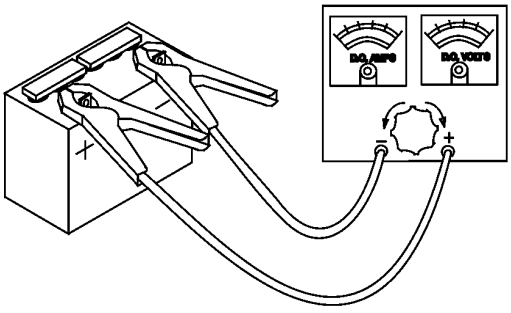
NOTE: Use the procedures given with the tester.

Procedure:

1. Turn load knob of JT05685 battery tester or equivalent clockwise until amperage reading is equal to:
   - One half (1/2) cold cranking amperage rating (use blue scale).

   OR

   - Three times ampere hour rating (use black scale).
2. Hold for 15 seconds and turn load knob of tester off.



MXT001931 —UN—22DEC11

JT05685 Battery Tester or Equivalent

3. Read battery voltage.

Results:

- If the battery does not indicate 9.6 V or more, replace battery.

OUMX068,000027C -19-03SEP15-1/1

Clean Battery

NOTE: Keep cleaning solution out of battery cells.

1. Remove battery from machine.
2. Clean battery case, battery terminals, cable ends, bracket and/or battery box with a solution of one part baking soda and four parts water.
3. Rinse all parts with clean water. Let dry thoroughly.
4. Apply petroleum jelly to battery terminals to prevent corrosion.

OUO1072,000162B -19-20JUN12-1/1

Unregulated Voltage Test (Gas Engine)

Reason

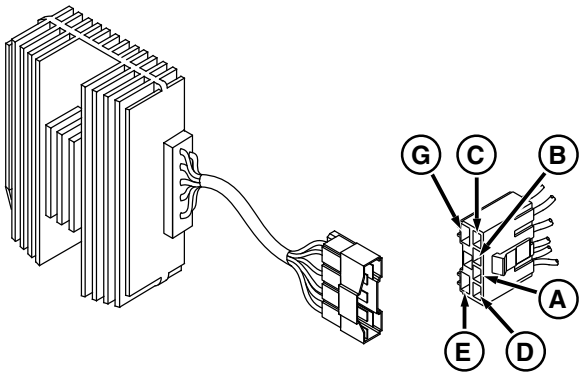
To determine charging output of the alternator stator.

Test Equipment:

- Voltmeter

Procedure

1. Park machine safely. See the “Safety Section”.
2. Cargo box raised and locked.
3. Disconnect connector from voltage rectifier, regulator.
4. Set voltmeter to VAC.
5. Connect voltmeter to each set of stator terminals (A, B and C).
6. Start and run engine at slow idle.
7. Record stator voltage while increasing engine speed to fast idle.



MXT011891 —UN—04JUN14

A—Terminal
B—Terminal
C—Terminal

Specifications

Item	Measurement	Specification
Unregulated Voltage		
Minimum at Low Idle	Voltage	21 VAC
Minimum at High Idle	Voltage	50 VAC

Results:

- If voltage is less than specification, replace stator.

MX52301,0000129 -19-22OCT14-1/1

Stator Resistance Test (Gas Engine)

Reason

- To determine if stator windings are open or grounded.

Test Equipment:

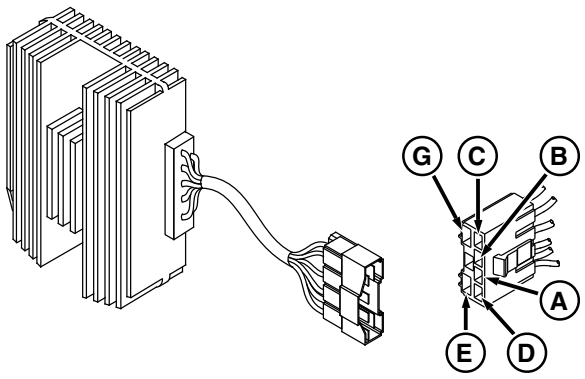
- Voltmeter

Procedure

1. Park machine safely. See the “Safety Section”.
2. Cargo box raised and locked.
3. Disconnect connector from voltage rectifier, regulator.
4. Set voltmeter to ohms.
5. Connect meter across terminals (A, B and C) of alternator.
6. If reading is not within specification, replace stator.

Specification	
Stator Resistance—Resistance	0.5 ohms

7. Connect meter to each terminal of alternator connector and to frame ground.



MXT011891 —UN—04JUN14

A—Terminal
B—Terminal
C—Terminal

8. If continuity is measured, replace stator.

MX52301,000012A -19-22OCT14-1/1

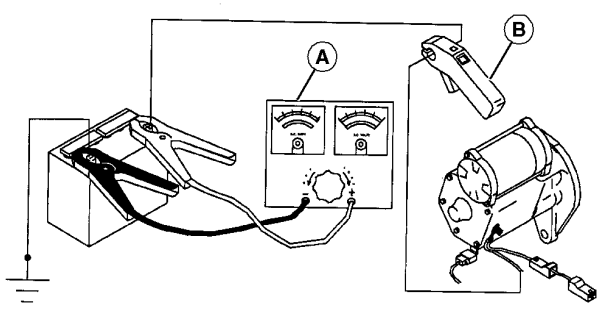
Alternator Regulated Output Test

Prepare Unit for Testing

NOTE: The alternator in this kit is rated at 60 amps. The engine stator output is rated at 20 amps. To test the output of the 60 A alternator, the stator must be disconnected from the voltage regulator.

1. Park machine safely. See the “Safety Section”.
2. Turn off all electrical attachments that would create an additional current draw during the test procedure.
3. Disconnect stator plug connector from the machine voltage regulator, on the right side frame.
4. Attach battery tester JT05685 (A):
   1. Connect red cable on tester to positive (+) terminal on battery.
   2. Connect black cable to negative (-) terminal on battery.
   3. On tester, turn Load Knob fully out (counterclockwise).
5. Attach current gun JT05712 (B):
   1. Clamp current gun over red positive (+) cable at alternator.
   2. Set current gun for DC current.

IMPORTANT: Perform the test quickly to prevent damage to battery tester. DO NOT apply full load to battery for more that 5—10 seconds.



MXT011979 —UN—23JUN14

A—JT05685 Battery Tester **B—JT05712 Current Gun**

6. Run engine at full throttle.
7. Read battery voltage on battery tester, it should be over 12.4 V.
8. On tester, Turn Load Knob in (clockwise) until voltage is reduced to 12.4 V.
9. Read amperage output on current gun, it should be 55 amps minimum.
10. Disconnect and remove test equipment.
11. Connect stator plug to machine voltage regulator.

Item	Measurement	Specification
Battery and Alternator		
Battery Voltage	Voltage	12.4 V
Regulated Amperage and Voltage	Amperage	55 Amps (min.) at 12.2—13.8 V

MX52301,000012B -19-22OCT14-1/1

Alternator Unregulated Amperage Test

Reason

To determine charging output of the alternator stator.

Test Equipment:

- JT05712 Current Gun

Conditions:

1. Put JTO5712 Current Gun over alternator Red wire.
2. Set current gun for DC current.

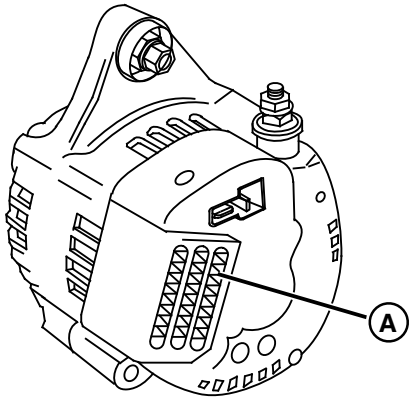
Procedure

IMPORTANT: Perform this test quickly to prevent damage to the battery. Do not apply full load to battery for more than 10 seconds.

1. Park machine safely.
2. Raise and lock cargo box.
3. Start and run engine at fast idle.
4. Insert a small Phillips screwdriver through the hole (A) in rear cover of alternator to ground the regulator to the rear cover. Read amperage on current gun.

Results:

If reading does not meet specifications, verify voltage at the alternator regulated terminal and good alternator ground. If voltage and ground are OK, repair or replace the alternator.



MXT011980 —UN—24JUN14

A—Hole

Specification

Minimum Unregulated Amperage—Voltage..... 40 amps

MX52301,000012C -19-27OCT14-1/1

Starting Motor Solenoid Test

Reason:

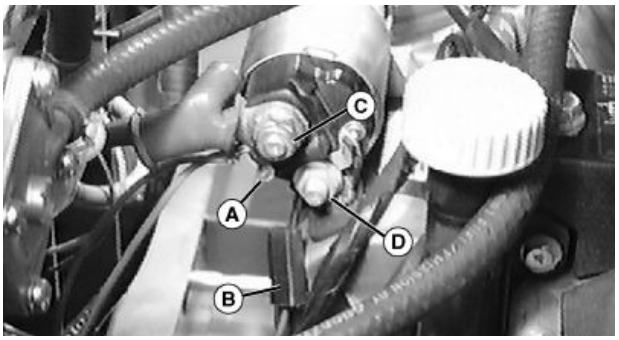
To determine if starting motor solenoid or starting motor is defective.

Equipment:

- Jumper wire.

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Disconnect and ground spark plug lead.
3. Cargo box raised and locked.
4. Disconnect wire (B) from starting motor solenoid terminal (A).
5. Connect jumper wire to positive battery terminal (+) and briefly jump to starting motor solenoid terminal (A).
   - Starting motor runs—solenoid is good, check circuit wiring.
   - Starting motor does not run—go to Step 6
6. Remove rubber boot(s) from terminals (C and D).



MXT011981 —UN—19JUN14

A—Starting Motor Solenoid Terminal
B—Wire
C—Boot
D—Boot

7. Connect a heavy gauge, insulated jumper wire between starting motor solenoid large terminals (C and D).

Results:

- Starting motor runs—replace solenoid.
- Starting motor does not run—check battery and ground cables, then replace starting motor.

MX52301,0000456 -19-22OCT14-1/1

Starting Motor Loaded Amperage Draw Test

Reason:

To determine the amperage required to start the engine and check starting motor operation under load.

Equipment:

- JT05685 Battery Tester

Procedure:

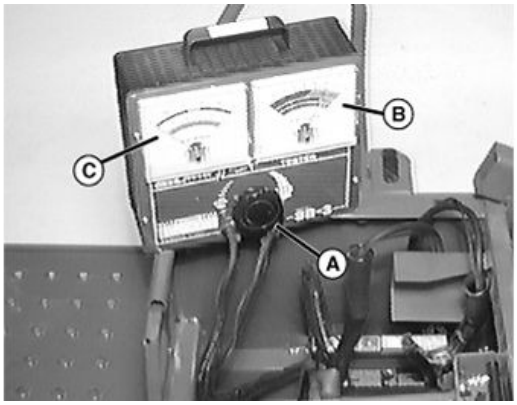
1. Park machine safely. See the “Safety Section”.
2. Cargo box raised and locked.
3. Disconnect and ground spark plug lead(s).

IMPORTANT: Turn load knob (A) fully counter-clockwise (out) into off position before making any test connections.

4. Connect JT05685 Battery Tester to battery.
5. Crank engine—read and record voltage on DC voltage scale (B) of battery tester.
6. Turn key switch to off position.

IMPORTANT: To prevent damage to tester and/or machine components perform following procedure within 15 seconds.

7. Turn load knob (A) clockwise (in) until DC voltage (B) reads the same as when cranking.
8. Read and record DC amperage (C).



MXAL30845 —UN—09JUL12

A—Load Knob
B—Voltage Scale
C—Amperage Scale

9. Turn load knob (A) counterclockwise (out) into off position.

Results:

- Maximum starting motor draw should be 51 amps at 750 rpm.
- If amperage is above specification, perform “Starting Motor No-Load Amperage and RPM Test” to determine if starting motor is binding or damaged.
- If starting motor is good, check internal engine components for binding, wear, or damage.

MX52301,0000307 -19-22OCT14-1/1

Starting Motor No-Load Amperage and RPM Tests

Reason:

To determine if starting motor is binding or has excessive amperage draw under no-load.

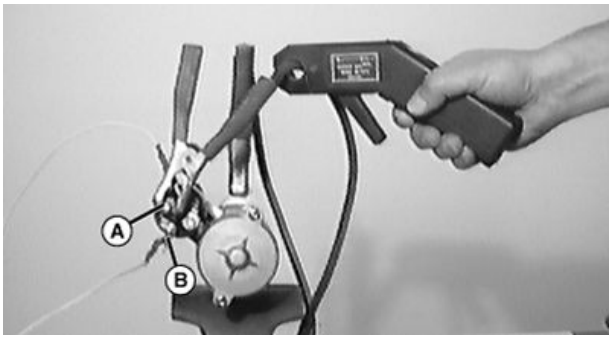
Equipment:

- JT05712 Current Gun
- JT05719 Photo Tachometer

Procedure:

NOTE: To ensure accuracy of test check that battery is fully charged and of proper size.

1. Park machine safely. See the “Safety Section”.
2. Cargo box raised and locked.
3. Remove starting motor assembly to workbench.
4. Connect jumper cables to battery.
5. Connect negative jumper cable to starting motor body and positive cable (Red) to solenoid battery terminal (A).



MXAL30846 —UN—09JUL12

A—Solenoid Battery Terminal **B—Solenoid Engagement Terminal**

6. Use reflective tape on starting motor worm gear and JT05719 Photo Tachometer to measure starting motor rpm.

MX52301,0000308 -19-22OCT14-1/2

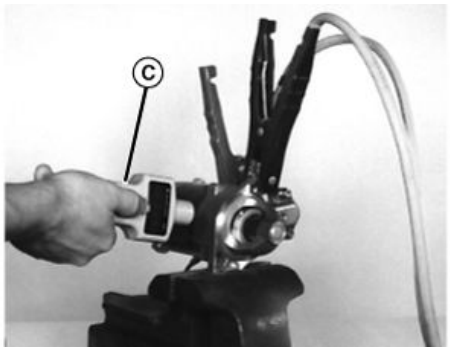
7. Put JT05712 current gun around positive jumper cable (Red).

IMPORTANT: Complete this test in 20 seconds or less to prevent starting motor damage.

8. Use jumper wire to briefly connect terminal (A) and solenoid engagement terminal (B).
9. Measure and record starting motor amperage with current gun and rpm with tachometer (C).

Results:

- A good starting motor should have a maximum amperage reading of 50 amps and a minimum rotational reading 6000 rpm.
- If amperage reading is above 50 amps or starting motor rpm is less than 6000, check for binding or seized bearings, sticky brushes, and dirty or worn commutator.



MXAL30847 —UN—09JUL12

C—Tachometer

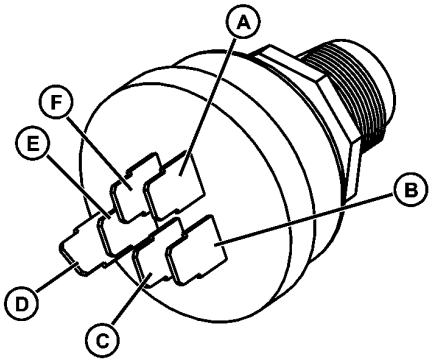
- Repair or replace starting motor.

MX52301,0000308 -19-22OCT14-2/2

Key Switch Test

1. Disconnect switch.
2. Use ohmmeter to check continuity across switch terminals.
   a. If continuity is not present between terminals listed for each switch position, replace switch
   b. If continuity exists between terminals not listed for each switch position, replace switch.

Switch Continuity	
Off	A — B
Run	C — D
Start	C — D and E — F



MXT001139 —UN—03OCT11

A—Terminal
B—Terminal
C—Terminal
D—Terminal
E—Terminal
F—Terminal

OUMX258,0000224 -19-29OCT13-1/1

Headlight Switch Test (2 Position)

Reason:

To make sure the headlight switch terminals have continuity when the headlight switch is in the on position.

Equipment:

- Ohmmeter or Continuity Tester

Procedure:

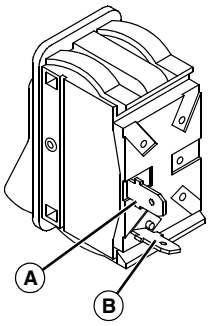
1. Park machine safely. (See the “Safety Section”.)
2. Remove hood and storage tray.
3. Disconnect headlight switch connector.
4. Move headlight switch to the on and then the off position. Check continuity between terminals (A) and (B).

Results:

Compare results with specifications.

Headlight Switch Test (2 Position)—Specification

Headlight Switch in Off Position—Continuity.....No Continuity



LVAL21846 —UN—17APR12

A—Terminal
B—Terminal

Headlight Switch in On Position—Continuity..... A and B

If continuity is not correct, replace switch.

BS62576,000089B -19-05OCT12-1/1

Headlight Switch Test (2 Position) (AM144577)

Reason:

To verify light switch is operating properly.

Equipment:

- Ohmmeter or Continuity Tester
- 12 VDC Power Supply

Procedure:

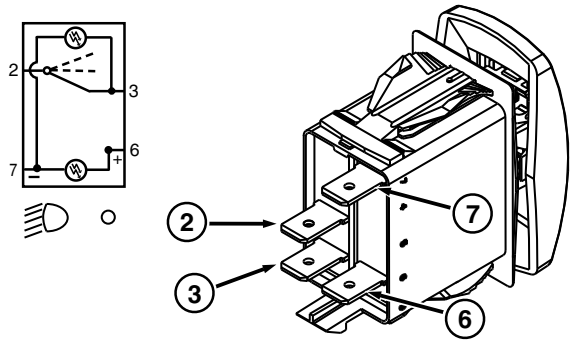
1. Park machine safely. (See the “Safety Section”.)
2. Disconnect headlight switch from harness.

NOTE: The ohmmeter can not be used to check the LED.

3. Use an ohmmeter or continuity tester to test the switch in all positions.

IMPORTANT: LED must be checked with correct polarity on positive and negative terminals.

4. Use 12 volt power supply to test LED.



MXT008022 —UN—31JUL13

2— Common
3— Terminal and LED positive
6— LED positive
7— LED negative

Switch Continuity	
POS 1 ON	2—3
POS 2 NONE	
POS 3 OFF	—

Results:

If continuity is not correct, replace the switch.

OUMX258,000000A -19-03OCT13-1/1

Light Switch Test (3 Position)

Reason:

To make sure the light switch terminals have continuity when the light switch is in the various positions.

Equipment:

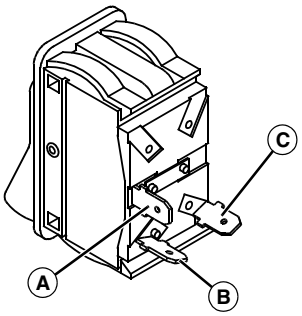
- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Remove hood and storage tray.
3. Disconnect light switch connector.
4. With the light switch in the off position, check continuity between all terminal pairs (A-B), (B-C), and (A-C).
5. Move light switch to the marker lights (middle) position. Check continuity between all terminals (A-B), (B-C), and (A-C).
6. Move light switch headlights position. Check continuity between all terminals (A-B), (B-C), and (A-C).

Results:

Compare results with specifications.



LVAL21847 —UN—17APR12

A—Terminal
B—Terminal
C—Terminal

Light Switch Test (3 Position)—Specification

Light Switch in Off Position—Continuity.....No Continuity
Light Switch in Marker (middle) Position—Continuity..... A and C
Light Switch in Headlights Position—Continuity..... (A—C) (A—B) (B—C)

There should not be continuity between any other terminals. If continuity is not correct, replace switch.

BS62576,000089C -19-05OCT12-1/1

Light Switch Test (3 Position) (AM144304)

Reason:

To verify light switch is operating properly.

Equipment:

- Ohmmeter or Continuity Tester
- 12 VDC Power Supply

Procedure:

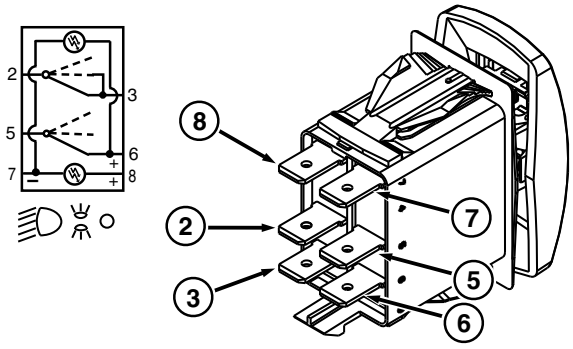
1. Park machine safely. (See the “Safety Section”.)
2. Disconnect light switch from harness.

NOTE: The ohmeter can not be used to check the LED.

3. Use an ohmmeter or continuity tester to test the switch in all positions.

IMPORTANT: LED must be checked with correct polarity on positive and negative terminals.

4. Use 12 volt power supply to test LED.



MXT008021 —UN—31JUL13

2— Common
3— Terminal
5— Common
6— Terminal and LED positive
7— LED negative
8— LED positive

Switch Continuity	
POS 1 ON	2—3 and 5—6
POS 2 ON	2—3
POS 3 OFF	

Results:

If continuity is not correct, replace the switch.

OUMX258,0000006 -19-01AUG13-1/1

4WD Switch Test

Reason:

To verify proper operation of the 4WD switch.

Equipment:

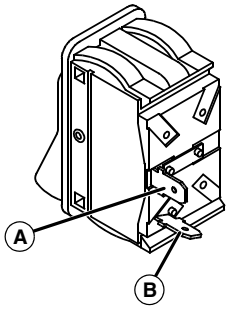
- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Disconnect 4WD switch from connector.
3. Move 4WD switch to the ON and then the OFF position. Check continuity between terminals (A) and (B).

Results:

- Terminals should have continuity with switch ON.



LVAL21857 —UN—17APR12

A—Terminal
B—Terminal

- Terminals should not have continuity with switch OFF.
- If continuity is not correct, replace 4WD switch.

BS62576,00008A5 -19-05OCT12-1/1

4WD Switch Test (AM142314)

Reason:

To verify that 4WD switch is operating properly.

Equipment:

- Ohmmeter or Continuity Tester
- 12 VDC Power Supply

Procedure:

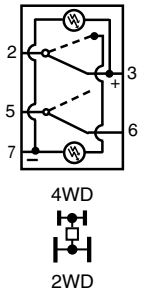
1. Park machine safely. (See the “Safety Section”.)
2. Disconnect 4WD switch from harness.

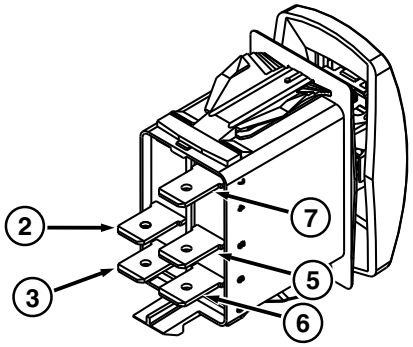
NOTE: The ohmmeter cannot be used to check the LED.

3. Use an ohmmeter or multimeter to test the switch in all positions.

IMPORTANT: LED must be checked with correct polarity on positive and negative terminals.

4. Use 12 V power supply to test LED.





MXT012237 —UN—06AUG14

2— Common
3— Terminal and LED positive
5— Common
6— Terminal
7— LED negative
8— LED positive

Switch Continuity	
POS 1 ON	2—3 and 5—6
POS 2 NONE	none
POS 3 OFF	Off

Results:

Replace the switch if continuity is not correct.

OUMX258,0000009 -19-07AUG14-1/1

Turn Signal Lights Switch Test

Reason:

To verify turn signal lights switch is operating properly.

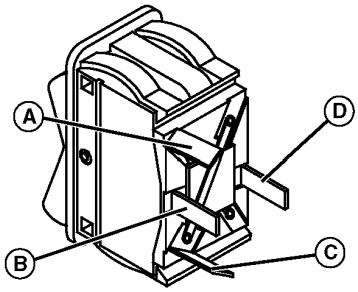
Equipment:

- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Remove hood.
3. Disconnect turn signal lights switch connector from harness.
4. Use an ohmmeter or multimeter to test the switch in the off, left turn, and right turn positions.

- Off Position: A and D, C and D
- Left Turn Position: B and C
- Right Turn Position: A and B



MXAL30862 —UN—09JUL12

A—Terminal A
B—Terminal B
C—Terminal C
D—Terminal D

Results:

- If continuity is not correct, replace turn signal light switch.

MX52301,0000309 -19-22OCT14-1/1

Hazard Lights Switch Test

Reason:

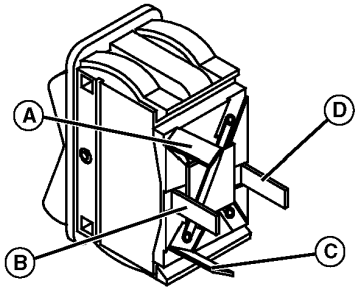
To verify that hazard switch functions are operating properly.

Equipment:

- Ohmmeter

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Remove hood.
3. Disconnect hazard lights switch connector from harness.



MXAL30862 —UN—09JUL12

4. Use an ohmmeter to test switch continuity in the OFF and ON positions.

MX52301,000030A -19-22OCT14-1/2

5. Set the multimeter to measure ohms to sequentially test continuity across each terminal combination (A), (B), and (C).

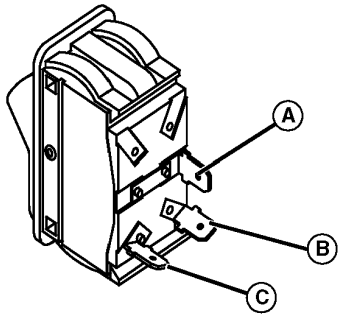
OFF Position Continuity:
No continuity between any terminals.

ON Position Continuity:
Continuity between all terminals.

Results:

- If any continuity is NOT correct, replace the hazard lights switch.

A—Terminal A
B—Terminal B
C—Terminal C



MXAL30863 —UN—09JUL12

MX52301,000030A -19-22OCT14-2/2

Neutral Start Switch Test

Reason:

To verify neutral start switch functions are operating properly.

Equipment:

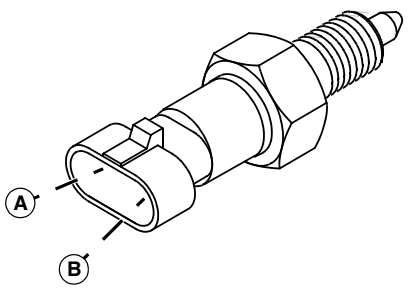
- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Raise and lock cargo box.
3. Disconnect neutral start switch connector.
4. Use an ohmmeter to test switch continuity with transaxle in gear and in neutral.

   Switch Position Terminal Continuity:

   - Forward and reverse gear position (plunger released): (A) to (B)—no continuity
   - Neutral (plunger pressed in): (A) to (B)—continuity
5. If continuity is not correct, remove switch from transaxle.



LVAL21850 —UN—17APR12

A—Terminal **B—Terminal**

6. Use an ohmmeter to test switch continuity in open and closed positions.

Results:

- If any continuity is not correct, replace switch.
- If continuity is correct with switch removed but not with switch installed in transaxle, check transaxle for proper switch contact. See Power Train section.

BS62576,000089F -19-05OCT12-1/1

Park Brake Switch Test

Reason:

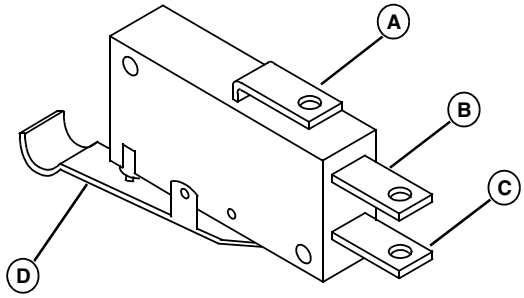
To determine proper operation of park brake switch.

Equipment:

- Ohmmeter

Procedure

1. Park machine safely. (See the “Safety Section”.)
2. Turn all switches to the OFF position.
3. Engage park brake lever, place gear shift in neutral.
4. Remove the console cover located between the seats.
5. Tag and unplug connectors from park brake switch.
6. Connect one meter lead to the COM terminal (A).
7. Connect the other meter lead to terminal (B), and then (C). Note results.
8. Press switch lever (D) and repeat readings between terminals. Note results.
9. **Switch Terminal Continuity:**



LVAL22747 —UN—27APR12

A—COM Terminal **C—Terminal**
B—Terminal **D—Switch Lever**

   a. Lever Not Pressed: A—C

   b. Lever Pressed: A—B

Results:

- If any continuity is NOT correct, replace switch.

OUMX258,0000620 -19-22OCT14-1/1

Fuse Test

Reason:

To verify that the fuse has continuity.

Equipment:

- Ohmmeter or multimeter

Procedure:

1. Remove fuse from connector.
2. Check visually for broken filament (A).
3. Connect ohmmeter or multimeter to each end of fuse.
4. Check for continuity.

Results:

- If continuity is not indicated, replace fuse.

MXAL30870 —UN—09JUL12

A—Filament

MX52301,0000137 -19-19JUN14-1/1

Diode Test

Reason:

To verify that diode has proper continuity.

NOTE: Make sure you have the correct diode for your equipment. Multiple diodes are available and in some the Anode and Cathode positions are Reversed

Equipment:

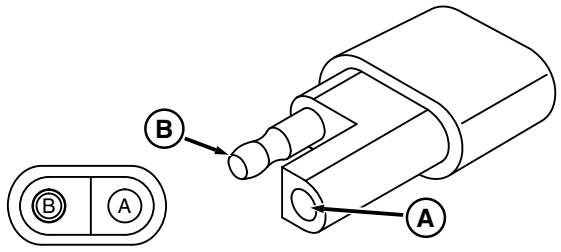
- Digital multimeter with Diode Check function.

Procedure:

1. Park machine safely in neutral with park brake locked.
2. Remove diode from connector.
3. Select diode test and connect multimeter red (+) lead to pin (A) of diode.
4. Connect ohmmeter black (-) lead to pin (B) of diode.
5. Reverse test leads.

Results:

Diode must have conductivity in one direction only; Anode to Cathode (+ to -). Replace defective or wrong diode.



MXT012658 —UN—08OCT14

A—Pin, Anode **B—Pin, Cathode**

OUMX258,00004C6 -19-24OCT14-1/1

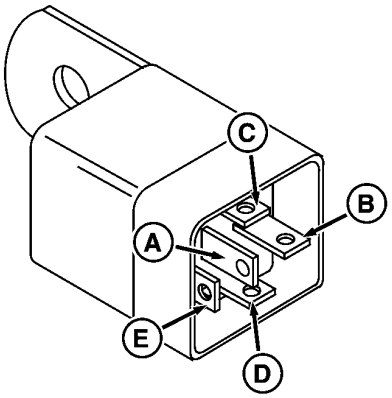
Relay Test

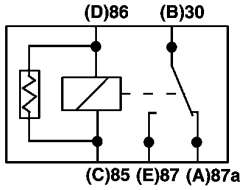
Reason:

To check relay terminal continuity in the energized and de-energized condition.

Procedure:

1. Park machine on level surface.
2. Engage park brake.
3. Turn key switch off.
4. Disconnect relay connector.
5. Check terminal continuity using an ohmmeter or continuity tester.
   - There should be continuity between terminals (A) and (B), and between terminals (C) and (D).
   - There should not be continuity between terminals (E) and (B).
6. Connect a jumper wire from battery positive (+) terminal to relay terminal (C). Connect a jumper wire from relay terminal (D) and ground (—).
   - There should be continuity between terminals (E) and (B).
   - If continuity is not correct, replace relay.





MXT001938 —UN—24JAN12

A—Terminal A (87a)
B—Terminal B (30)
C—Terminal C (85)
D—Terminal D (86)
E—Terminal E (87)

OUMX068,000019D -19-24JAN12-1/1

Radiator Coolant Temperature Switch Test

Reason

To verify that radiator coolant temperature switch is functioning properly to control radiator fan.

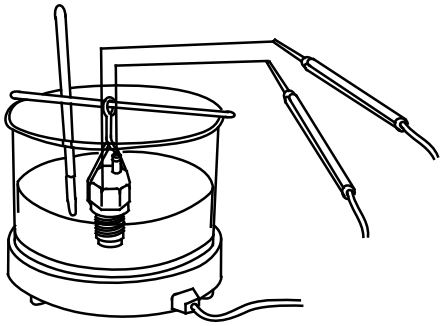
Procedure

NOTE: Perform the test with the engine at room temperature.

1. Park machine safely. (See the Safety section.)
2. Disconnect radiator coolant temperature switch. Check for continuity between the terminal
3. Remove coolant temperature switch.
4. Place switch in antifreeze solution heated to 83—89°C (182—192°F). Measure continuity while switch is heated.

Results:

- Replace switch if continuity does not occur at specified temperature.



MXT011982 —UN—24JUN14

Temperature Switch Specifications—Specification

Radiator Coolant Temperature Switch Open and Close—Temperature	83—89°C (182—192°F)
Radiator Coolant Temperature Switch—Torque	21—27 N·m (185—239 lb·in)

MX52301,000013A -19-25OCT19-1/1

Engine Coolant Temperature Switch Test

Reason

To verify that radiator coolant temperature switch is functioning properly to control radiator fan.

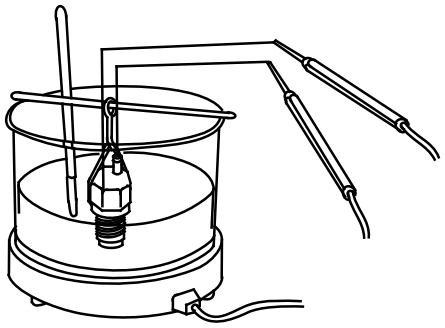
Procedure

NOTE: Perform the test with the engine at room temperature.

1. Park machine safely. (See the Safety section.)
2. Disconnect radiator coolant temperature switch. Check for continuity between the terminal
3. Remove coolant temperature switch.
4. Place switch in antifreeze solution heated to 107—113°C (225—235°F). Measure continuity while switch is heated.

Results:

- Replace switch if continuity does not occur at specified temperature.



MXT011982 —UN—24JUN14

Temperature Switch Specifications—Specification

Engine Coolant Temperature Switch Open and Close—Temperature	107—113°C (225—235°F)
Engine Coolant Temperature Switch—Torque	21—27 N·m (185—239 lb·in)

MX52301,000013B -19-25OCT19-1/1

Flywheel Magnet(s) Test (Gas Engine)

Reason:

To make sure flywheel magnet(s) have enough force to induce current into ignition coil.

Equipment:

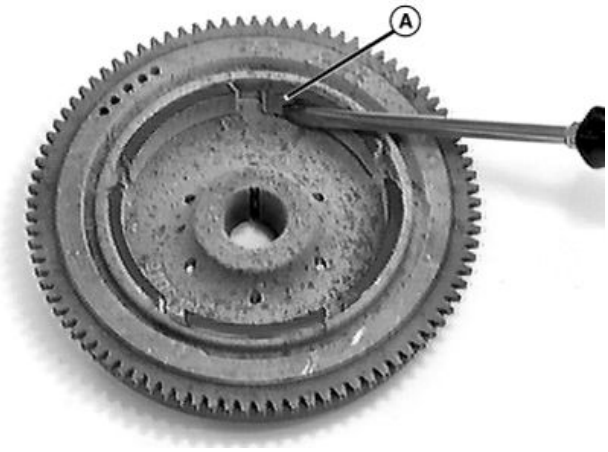
- Screwdriver.

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Cargo box raised and locked.
3. Remove flywheel from engine.
4. Loosely hold screwdriver blade about 25 mm (1.0 in.) away from magnet(s) (A).

Results:

- Each magnet should attract blade to it.
- If blade is not attracted to magnet(s), flywheel must be replaced.



MXAL30854 —UN—09JUL12

A—Magnet(s)

MX52301,000013C -19-22OCT14-1/1

Bulb Test

Reason:

To verify that the bulb has continuity.

Equipment:

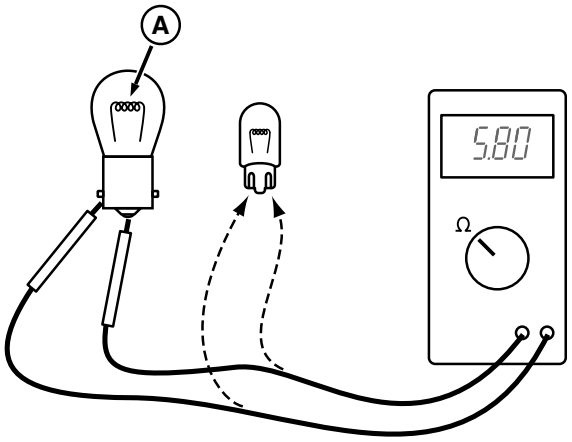
- Ohmmeter

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Remove bulb from socket.
3. Check visually for broken filament (A).
4. Connect ohmmeter to each terminal of bulb.
5. Check for continuity.

Results:

- If continuity is not indicated, replace bulb.



MXT013125 —UN—30DEC14

A—Filament

BS62576,000088C -19-30APR15-1/1

Raise/Lower Switch Test

Reason:

To verify cargo box raise/lower switch functions properly.

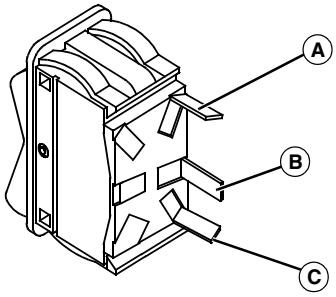
Equipment:

- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Raise hood and storage tray.
3. Unplug cargo box raise/lower switch from connector.
4. Check continuity.

Specification	
Off Position—Continuity	No continuity
Raise Position—Continuity	A and B
Lower Position—Continuity	B and C



LVAL22755 —UN—27APR12

A—Terminal
B—Terminal
C—Terminal

Results:

- Replace switch if continuity is not as specified.

OUMX258,0000628 -19-30APR15-1/1

Raise/Lower Switch Test (AM142315)

Reason:

To verify that raise/lower switch is operating properly.

Equipment:

- Ohmmeter or Continuity Tester
- 12 VDC Power Supply

Procedure:

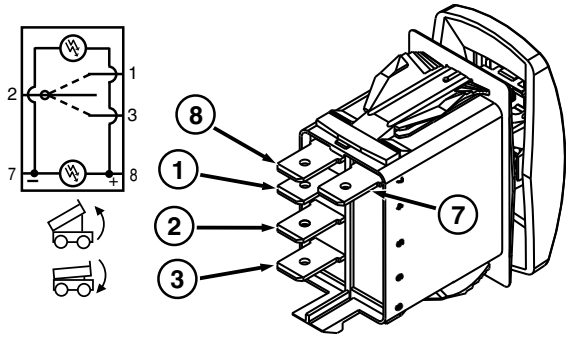
1. Park machine safely. (See the “Safety Section”.)
2. Disconnect raise/lower switch from harness.

NOTE: The ohmmeter cannot be used to check the LED.

3. Use an ohmmeter or multimeter to test the switch in all positions.

IMPORTANT: LED must be checked with correct polarity on positive and negative terminals.

4. Use 12 V power supply to test LED.



MXT012238 —UN—06AUG14

1— Terminal
2— Common
3— Terminal
8— LED positive
7— LED negative

Switch Continuity	
POS 1 UP	2—3
POS 2 NONE	
POS 3 DOWN	2—1

Results:

If continuity is not correct, replace the switch.

OUMX258,0000044 -19-07AUG14-1/1

Spark Test

Reason:

To determine condition of the ignition system.

Equipment:

- D05351ST Spark Tester

Procedure:

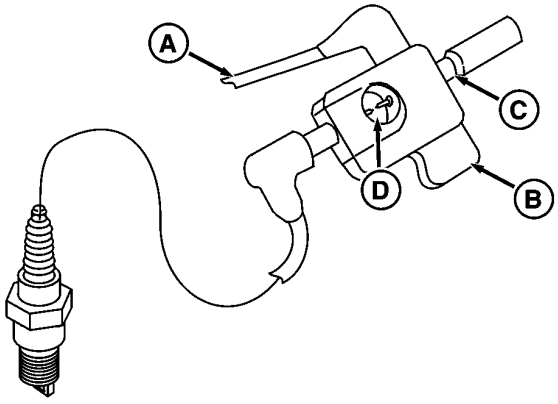
1. Park machine safely.
2. Remove high tension lead (A) from spark plug and connect to spark tester (B).
3. Connect spark tester lead to spark plug.

NOTE: Do not adjust spark tester gap beyond 5.0 mm (0.200 in.) as damage to ignition system components could occur.

4. Adjust spark tester gap to 4.2 mm (0.166 in.) with screw (C).
5. Start engine and watch spark (D) at tester.

Results:

- If engine starts, watch spark with engine running. Look for a strong, steady, blue spark.



MXT001947 —UN—24JAN12

A—High Tension Lead
B—Spark Tester
C—Screw
D—Spark

- If spark is weak, or if no spark, install new spark plug and test again.
- If spark is still weak, or still no spark, run tests on individual components to find cause of malfunction.

OUMX068,000028F -19-30DEC15-1/1

Pulser Coil Test (Gas Engine)

Reason:

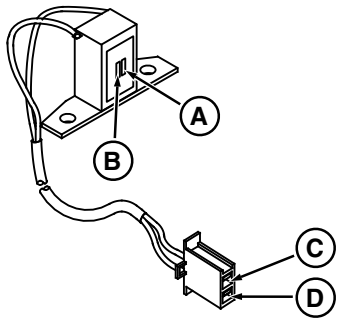
To determine condition of pulser coil windings and verify pulser 12 VDC coil wire continuity.

Equipment:

- Ohmmeter

Procedure:

1. Park machine safely.
2. Cargo box raised and locked.
3. Disconnect 2—pin pulser connector.
4. Measure resistance between Red wire (A) and Blk wire
5. Measure resistance between pickups (C and D).



MXT011992 —UN—12JUN14

A—Red Wire
B—Black Wire
C—Pickup
D—Pickup

MX52301,0000440 -19-22OCT14-1/1

Ignition Module

Reason:

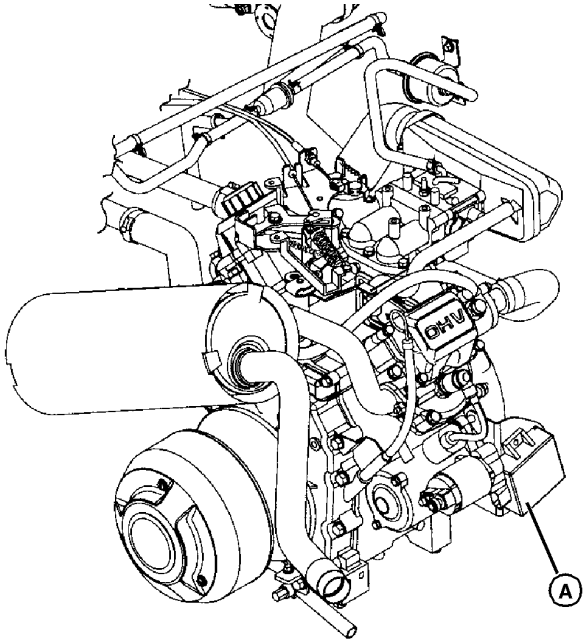
To determine if the ignition module is defective.

Procedure:

1. Park machine safely.
2. Cargo box raised and locked.
3. Locate the ignition module (A) mounted on the back of the engine.
4. The ignition module (A) is sensitive to the type of ohmmeter used to check resistance. Due to variations in ohmmeters, the best way to determine if the ignition module is good is to replace the questionable ignition module with a known good module.

Results:

- If the new ignition module does not solve the problem, check other ignition components.



MXT011993 —UN—24JUN14

A—Ignition Module

MX52301,0000441 -19-20AUG19-1/1

Spark Plug Cap Test

Reason:

To determine if spark plug cap is defective.

Equipment:

- Ohmmeter

Procedure:

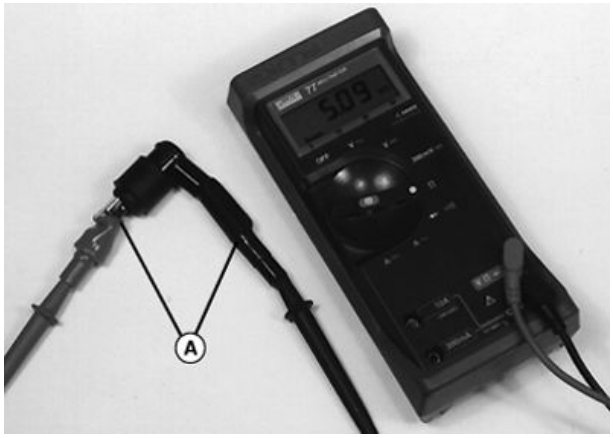
1. Park machine safely.
2. Cargo box raised and locked.
3. Measure resistance across spark plug cap terminals (A).

Results:

- Resistance should be approximately 5000 ohms.

Specification

Spark Plug Cap—Resistance	5000 ohms



MXAL30853 —UN—09JUL12

A—Spark Plug Cap Terminals

- If resistance does not meet specification, replace spark plug cap.

MX52301,000043F -19-19JUN14-1/1

Ignition Coil Test (Gas Engine)

Reason

Check the windings of the ignition coil.

Test Equipment:

- Ohmmeter

Procedure

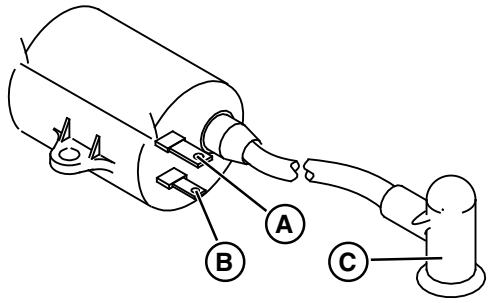
1. Ohmmeter
2. Cargo box RAISED and LOCKED.
3. Disconnect wires from ignition coil terminals.

Primary Windings:

1. Connect one ohmmeter lead to coil positive (+) (wide) terminal (A).
2. Connect other ohmmeter lead to coil negative (-) terminal (B).
3. Measure resistance across primary windings. Resistance should measure approximately 0.2 ohms.
4. Repeat test procedures on other ignition coils.

Secondary Windings

1. Connect one ohmmeter lead to coil positive (+) terminal (A)
2. Connect other ohmmeter lead to high tension lead (C).
3. Measure resistance across secondary windings. Resistance should measure approximately 12,000 ohms.
4. Repeat test procedures on other ignition coils.



MXT011994 —UN—12JUN14

A—Positive (+) Terminal
B—Negative (-) Terminal
C—High Tension Lead

Results:

- If the ohmmeter readings are not within specifications, replace coil.

Resistance—Specification

Primary Winding—Resistance	0.2 ohms
Secondary Winding—Resistance	12,000 ohms

- If ohmmeter readings are within specifications, the coils are probably good. If system still does not perform properly after all tests/checks, replace coil with a good coil.

MX52301,0000140 -19-17MAR16-1/1

Fuel Pump Test (Gas Engine)

See Fuel Pump Circuit Diagnosis, Gas (All)

MX52301,0000141 -19-08JUL14-1/1

Fuel Shutoff Solenoid Test (Gas Engine)

Reason:

To determine if the fuel shutoff plunger retracts when the solenoid is energized.

Equipment:

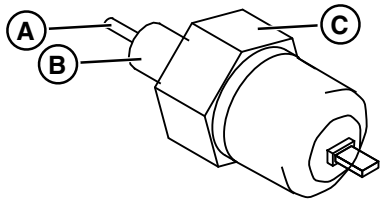
- 2 jumper wires

Procedure:

1. Park machine safely.
2. Cargo box raised and locked.

⚠ CAUTION: Keep gasoline away from sparks, flame, or hot engine parts or personal injury can result.

3. Remove drain screw and spring to drain gasoline from float bowl.
4. Disconnect fuel shutoff solenoid connector.
5. Remove fuel shutoff solenoid, washer, and float bowl.
6. Connect a jumper wire from the battery positive (+) terminal to solenoid terminal (C). It may be necessary to push plunger (A) inward slightly for plunger to retract.



MXT011995 —UN—24JUN14

A—Positive Terminal
B—Negative Terminal
C—Solenoid Terminal

NOTE: It may be necessary to push plunger (A) inward slightly for plunger to retract.

7. Connect a jumper wire from the battery negative (-) terminal to solenoid threads (B). Plunger should now retract with the solenoid energized.
8. Remove jumper wire from the battery negative (-) terminal. Plunger should extend.

Results:

- If plunger does not move, replace solenoid.

MX52301,00003FA -19-19JUN14-1/1

Fuel Shutoff Solenoid Test (Diesel Engine)

Reason

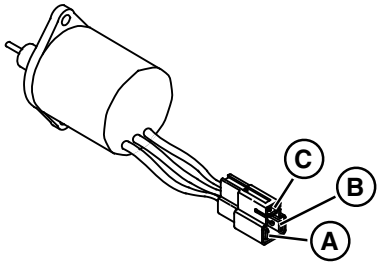
To verify that fuel shutoff solenoid is functioning properly.

Test Equipment:

- Ohmmeter

Procedure

1. Park machine on level surface and turn start switch OFF.
2. Shift lever in NEUTRAL and park brake LOCKED.
3. Cargo box RAISED and LOCKED.
4. Disconnect fuel shutoff solenoid connector.
5. Measure and record the resistance across each combination of terminals.



MXT011996 —UN—24JUN14

	Red Wire (A)	White Wire (B)	Black Wire (C)
Red Wire (A)		12.4 ohms	12 ohms
White Wire (B)	12.4 ohms		0.4 ohms
Black Wire (C)	12 ohms	0.4 ohms	

Results:

- If continuity is not correct, replace fuel shutoff solenoid.

MX52301,0000142 -19-21OCT14-1/1

Glow Plug Test (Diesel Engine)

Reason:

To test operation of glow plugs.

Equipment:

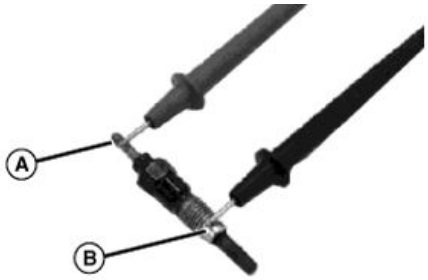
- Ohmmeter

Procedure:

1. Park machine on level surface with park brake locked.
2. Raise and lock cargo box.
3. Place start switch in off position.

NOTE: Cover glow plug hole to prevent debris from entering cylinder when glow plug is removed.

4. Remove glow plug lead. Remove glow plug.
5. Check continuity across terminal (A) and glow plug body (B). The reading should be between 0.3—0.5 ohms.



MXAL30855 —UN—09JUL12

A—Glow Plug Terminal **B—Glow Plug Body**

Results:

- If glow plug does not have proper resistance, replace glow plug.

MX52301,0000143 -19-19JUN14-1/1

Engine Oil Pressure Switch Test

Reason

To determine if the oil pressure switch is functioning properly.

Test Equipment:

- Ohmmeter

Procedure

1. Park machine safely.
2. Cargo box RAISED and LOCKED

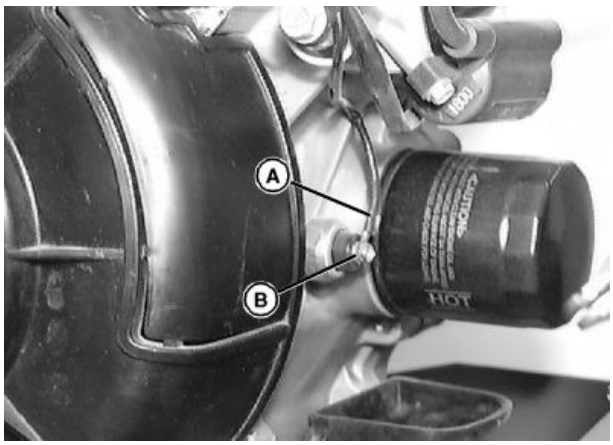
IMPORTANT: Do not allow wire connector to contact engine or frame because there is voltage at that point during the test.

3. Disconnect wiring lead (A) from switch.
4. Connect black lead of meter to engine block and red lead of meter to terminal (B) of switch.
5. Set ohmmeter to low ohm scale.
6. Read meter.

Results:

- There should be continuity to ground.
- If the switch does NOT have continuity to ground, replace the switch.
- Start and run engine.
- Read meter.

TEFLON is a trademark of DuPont Co.



MXT011997 —UN—19JUN14

Picture Note: Gas Engine Shown

A—Wiring Lead **B—Terminal**

NOTE: BE SURE to apply John Deere Pipe Thread Sealant with TEFLON® , or an equivalent to threads of switch anytime it is installed.

- The switch should NOT have continuity to ground.
- If the switch DOES have continuity to ground with the engine running, check engine oil pressure.
- If the oil pressure is to specification, replace the switch.

MX52301,0000144 -19-19JUN14-1/1

Carburetor Heater Test (Gas Engine)

Reason

To test operation of carburetor heater.

Test Equipment:

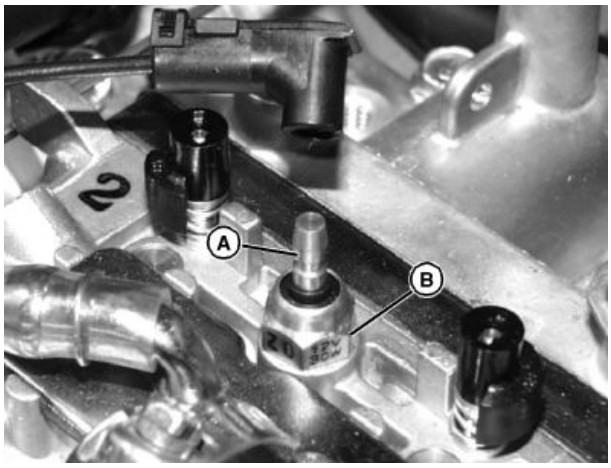
- Ohmmeter

Procedure

1. Park machine safely. See the “Safety Section”.
2. Cargo box RAISED and LOCKED.
3. Remove carburetor heater lead. Remove carburetor heater.
4. Check continuity across terminal (A) and carburetor heater body (B). The reading should be 8.0 ohms ± 0.5

Results:

- If carburetor heater does not have proper resistance, replace carburetor heater.



MXT011998 —UN—19JUN14

A—Terminal **B—Carburetor Heater Body**

Item	Measurement	Specification
Carburetor Heater Resistance	Resistance	7.5 ohms — 8.5 ohms

MX52301,0000145 -19-22OCT14-1/1

Brake Lights Switch Test

Reason:

To make sure the brake lights switch has continuity when plunger is released.

This switch is optional with light kits or back up alarm kit.

Equipment:

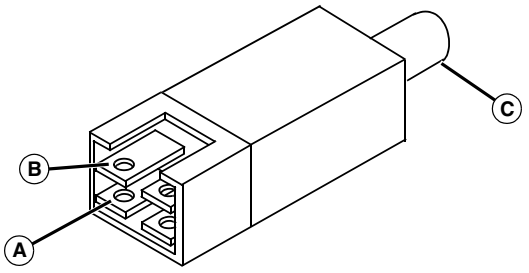
- Ohmmeter

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Open hood and remove under hood storage tray.
3. Remove brake light switch from brake pedal bracket.
4. Disconnect harness connector from brake switch.
5. Check continuity at terminals (A) and (B).

Results:

- There should be continuity between terminals (A) and (B) when plunger (C) is released.



LVAL21852 —UN—17APR12

A—Terminal **B—Terminal**

- There should not be continuity between terminals (A) and (B) when plunger is depressed.
- If continuity is not correct, replace switch.

BS62576,00008A1 -19-05OCT12-1/1

Horn Switch Test, Push

Reason:

To verify that the horn switch is operating properly.

Equipment:

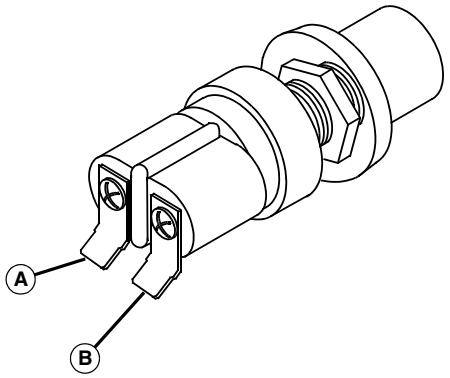
- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Disconnect the horn switch connectors from the switch.
3. With the button released, check continuity across both switch terminals (A) and (B). There should be no continuity.
4. Depress the horn switch button. Continuity should exist between both terminals (A) and (B).

Results:

- If continuity is not correct, replace horn switch.



LVAL21853 —UN—17APR12

A—Terminal **B—Terminal**

BS62576,00008A2 -19-06FEB15-1/1

Seat Belt Switch Test

Reason:

To verify proper operation of the seat belt switch.

Equipment:

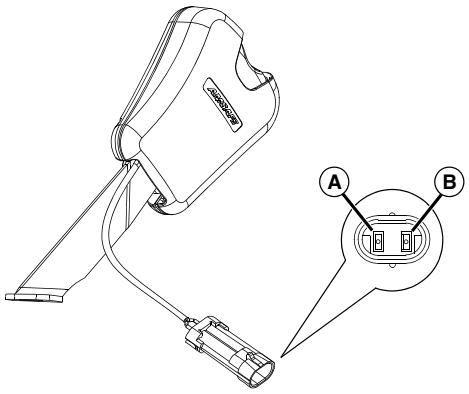
- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Unplug the seat belt latch pigtail from harness.
3. Attach tester leads to connector terminals (A) and (B). Observe switch continuity with the belt buckle installed, then removed, from seat belt latch.

Results:

- There must be continuity with belt buckle installed.
- There must be no continuity with belt buckle removed.



LVAL21858 —UN—26APR12

A—Terminal **B—Terminal**

Replace seat belt latch assembly if results are incorrect.

BS62576,00008A6 -19-05OCT12-1/1

Summary of References

- High Capacity Alternator Removal and Installation.

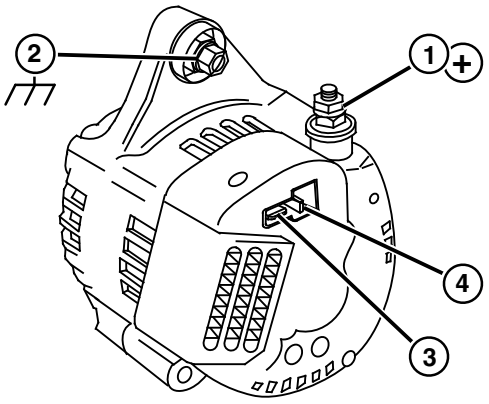
MX52301,0000448 -19-23MAY14-1/1

High Capacity Alternator Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Disconnect negative (-) battery cable from battery
3. Lift red plastic protective cover, and remove the nut, washer, and positive (+) wire (1) from the battery.
4. Disconnect the voltage sensing wire (3).
5. Remove the nut (2) and ground wire.

1— Positive (+) Wire
2— Ground Wire
3— Sensing Wire



MXT011919 —UN—04JUN14

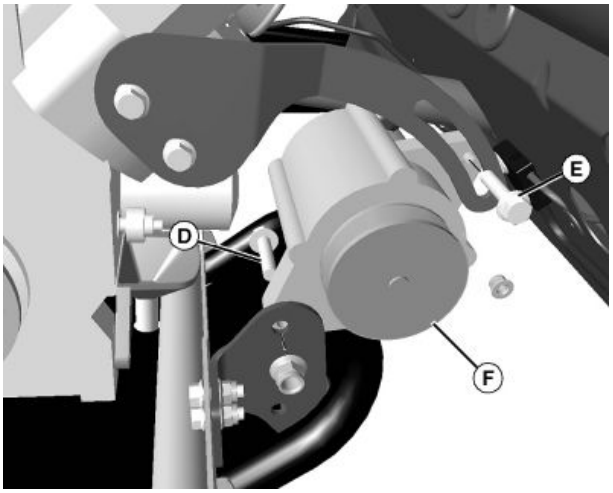
MX52301,0000149 -19-22OCT14-1/22

6. Loosen the lower (D) and upper (E) alternator mounting bolts.
7. Pivot the alternator towards the engine and remove belt from drive pulley (F).
8. Remove the mounting bolts and alternator.

Equipment:

- Multimeter
- Bearing Puller Set

D—Lower Alternator Mounting Bolts
E—Upper Alternator Mounting Bolts
F— Drive Pulley



MXT012001 —UN—19JUN14

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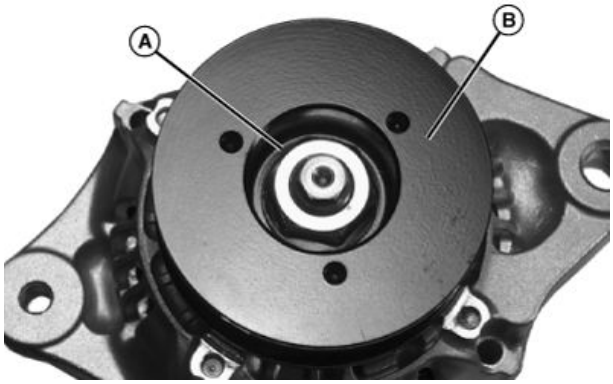
MX52301,0000149 -19-22OCT14-2/22

Disassembly:

1. Clamp the sheave in a soft jaw vise. Remove sheave nut (A).
2. Use puller to remove sheave (B).

A—Sheave Nut **B—Sheave**

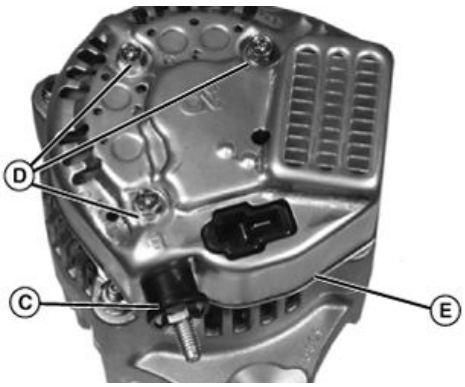


MXAL30871 —UN—09JUL12

MX52301,0000149 -19-22OCT14-3/22

3. Remove nut and insulator (C).
4. Remove screws (D) and cover (E).

C—Screws **E—Cover**
D—Nut and Insulator



MXAL30872 —UN—09JUL12

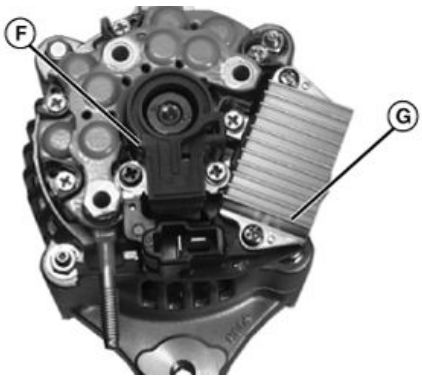
MX52301,0000149 -19-22OCT14-4/22

5. Remove brush holder and cover (F).

NOTE: Remember location of short screw on regulator tab.

6. Remove regulator (G).

F— Brush Holder and Cover **G—Regulator**



MXAL30873 —UN—09JUL12

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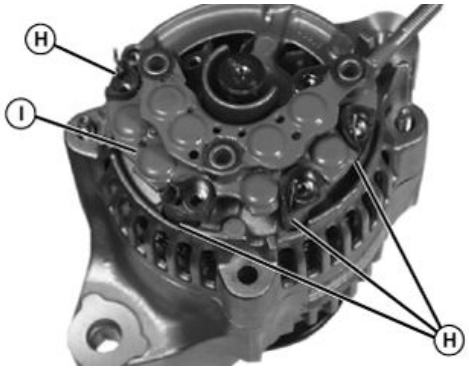
MX52301,0000149 -19-22OCT14-5/22

7. Remove screw and straighten wire leads (H).
8. Remove rectifier (I).

H—Wire Leads **I— Rectifier**

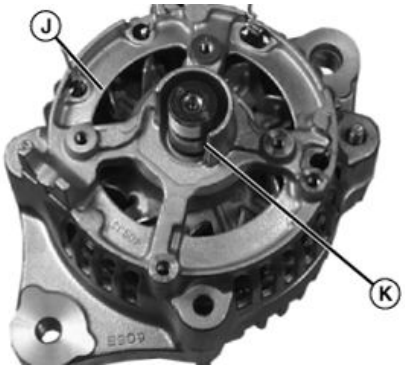


MXAL30874 —UN—09JUL12

MX52301,0000149 -19-22OCT14-6/22

9. Remove rear case assembly (J).
10. Press rotor shaft (K) from rear case.

J— Rear Case Assembly **K—Rotor Shaft**

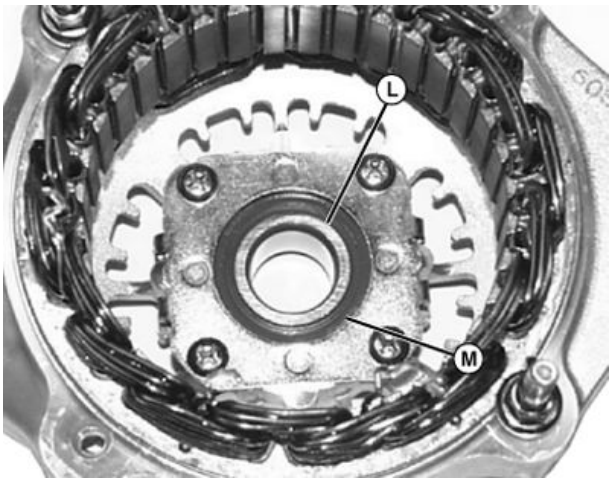


MXAL30875 —UN—09JUL12

MX52301,0000149 -19-22OCT14-7/22

11. Remove retainer plate (L).
12. Press bearing (M) from case.

L— Retainer Plate **M—Bearing**



MXAL30876 —UN—09JUL12

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MX52301,0000149 -19-22OCT14-8/22

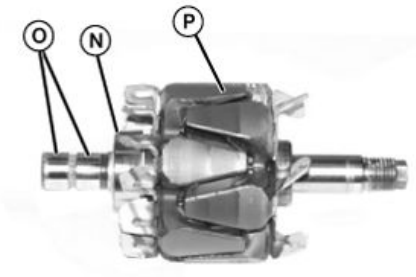
Inspection:

1. Inspect bearing (N) for smooth rotation. Replace if necessary.
2. Inspect slip rings (O) for dirt or rough spots. If necessary, use No. 00 sandpaper or 400-grit silicon carbide paper to polish rings.
3. Measure outer diameter of slip rings (O). Replace rotor if less than specification.

Specification	
Slip Ring OD (Minimum)—Resistance	14.0 mm (0.55 in.)

NOTE: Use an ohmmeter that is sensitive to 0—1 ohm.

4. Check continuity between slip rings (O) using ohmmeter or multimeter. Replace rotor assembly if there is no continuity.
5. Check continuity between slip rings and rotor core (P). Replace rotor assembly if there is continuity.



MXAL30877 —UN—09JUL12

N—Bearing **P—Rotor Core**
O—Slip Rings

6. Inspect stator for defective insulation, discoloration, or burned odor.

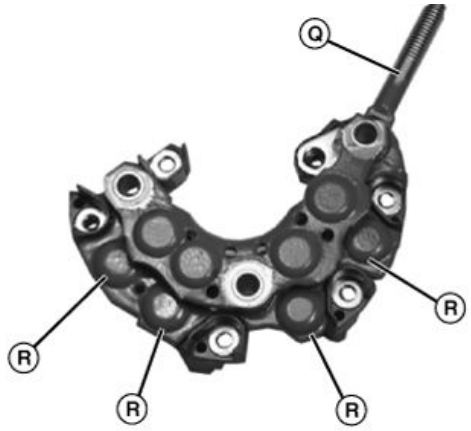
NOTE: Set ohmmeter to the K Ohm range.

7. Check for continuity between each stator lead and body. Replace stator if there is continuity.

MX52301,0000149 -19-22OCT14-9/22

8. Check continuity between lead (Q) and each diode lead (R). Reverse ohmmeter leads and recheck. There must be continuity in one direction, but not the other. Replace diodes or rectifier plate if bad.

Q—Lead **R—Diode Lead**

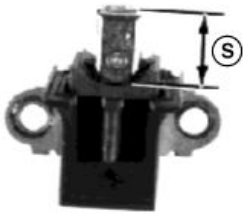


MXAL30878 —UN—09JUL12

MX52301,0000149 -19-22OCT14-10/22

9. Measure length of brush (S) protruding from holder. Dimension must be within specification. Replace brushes if less than minimum specification.

Exposed Brush Length:—Specification	
Minimum—Resistance	4.5 mm (0.17 in.)
Maximum—Resistance	10.5 mm (0.41 in.)



MXAL30879 —UN—09JUL12

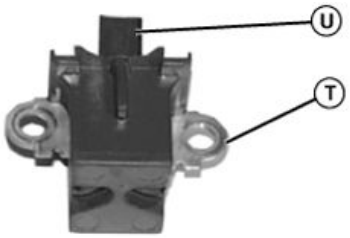
S—Brush

Continued on next page

MX52301,0000149 -19-22OCT14-11/22

10. Check continuity between brush (U) and terminal (T). There must be continuity only at these points. Repeat procedure for other brush and terminal.

T—Terminal **U—Brush**



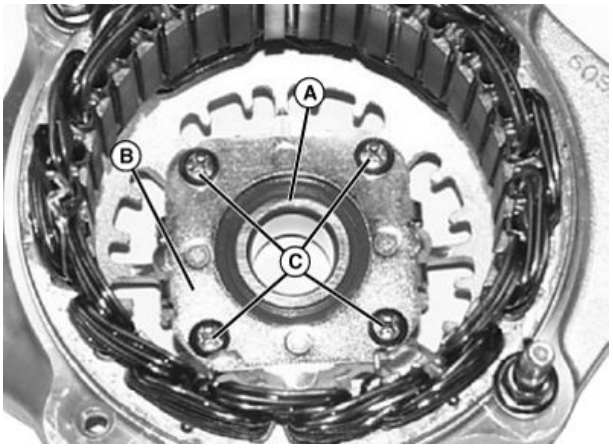
MXAL30880 —UN—09JUL12

MX52301,0000149 -19-22OCT14-12/22

Assembly:

1. Press new bearing (A) into case and install retainer plate (B).
2. Install four screws (C).

A—Bearing **C—Screws**
B—Retainer Plate

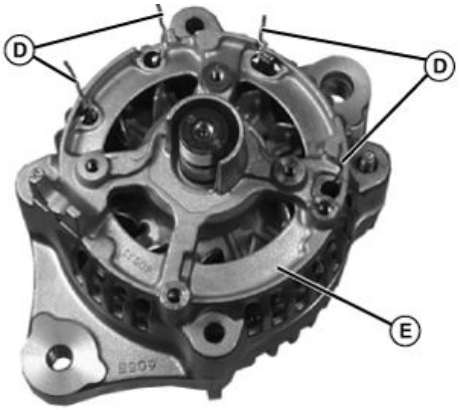


MXAL30881 —UN—09JUL12

MX52301,0000149 -19-22OCT14-13/22

3. Alternator Assembly Route stator leads (D) through holes in rear case (E).

D—Stator Leads **E—Rear Case**



MXAL30882 —UN—09JUL12

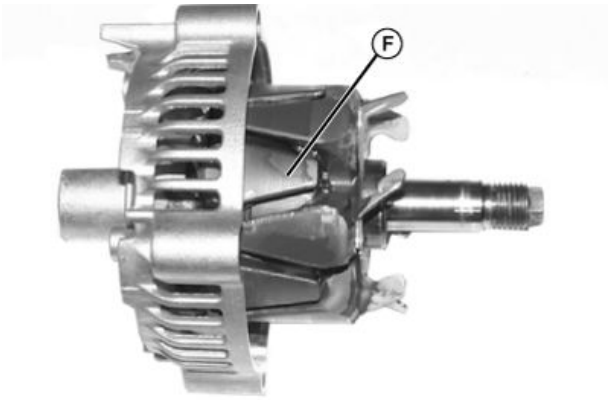
Continued on next page

MX52301,0000149 -19-22OCT14-14/22

NOTE: Check that rotor fan does not contact case and that rotor assembly turns smoothly in bearing.

4. Press rotor shaft (F) into rear case.

F— Rotor Shaft

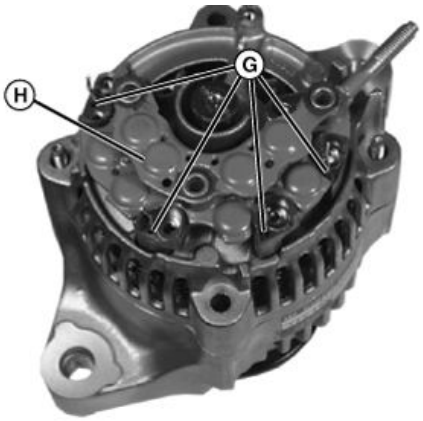


MXAL30883 —UN—09JUL12

MX52301,0000149 -19-22OCT14-15/22

5. Route stator leads (G) through holes in rectifier (H) and install rectifier.

G—Stator Leads **H—Rectifier**

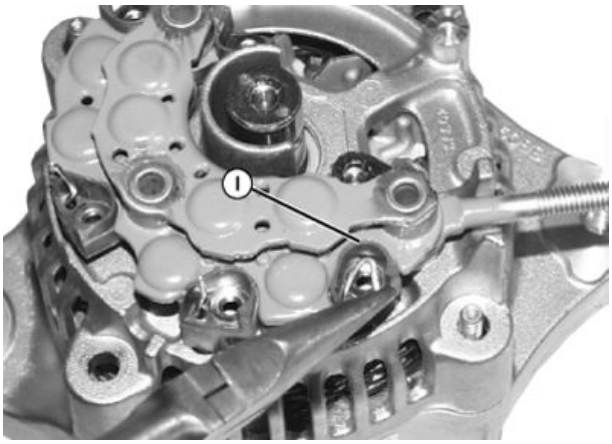


MXAL30884 —UN—09JUL12

MX52301,0000149 -19-22OCT14-16/22

6. Using a needle nose plier, form a loop (I) in each stator wire lead and install screws through the loops.

I— Loop



MXAL30885 —UN—09JUL12

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MX52301,0000149 -19-22OCT14-17/22

IMPORTANT: Check that short screw is installed in regulator tab. The longer screw contacts frame and damages the charging system.

7. Install regulator (J).
8. Using a small screwdriver to hold brushes, install brush holder (K).

J—Regulator **K—Brush Holder**

MXAL30886 —UN—09JUL12

MX52301,0000149 -19-22OCT14-18/22

9. Install brush holder screws as shown; black screw (L) and light screw (M).

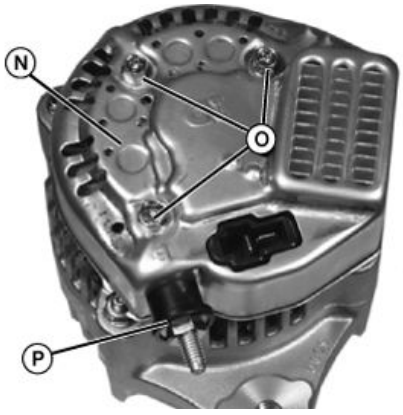
L—Black Screw **M—Light Screw**

MXAL30887 —UN—09JUL12

MX52301,0000149 -19-22OCT14-19/22

10. Install regulator cover (N) and screws (O).
11. Install insulator (P) and nut.
12. Install sheave.

N—Regulator Cover **P—Insulator**
O—Screws



MXAL30888 —UN—09JUL12

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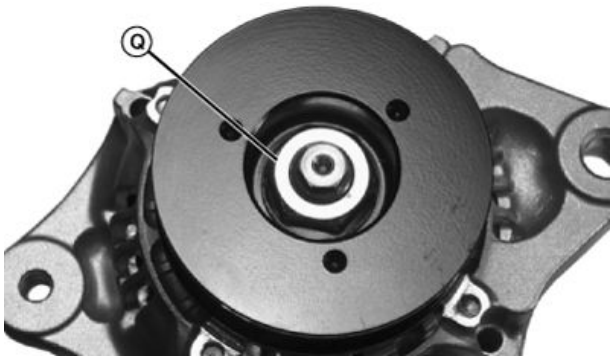
MX52301,0000149 -19-22OCT14-20/22

13. Clamp the sheave in soft jaw vise. Install sheave nut (Q) and tighten to 69 N·m (51 lb.-ft.)

Specification	
Alternator Sheave Nut—Torque	69 N·m (51 lb.-ft.)

Q—Sheave Nut

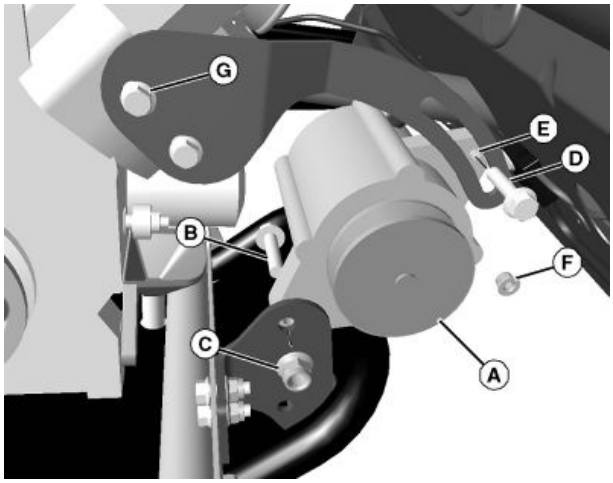


MXAL30889 —UN—09JUL12

MX52301,0000149 -19-22OCT14-21/22

Installation:

1. Position alternator (A) behind the upper and lower brackets, as shown.
2. Install the M10x45 pivot bolt (B) through the alternator and the lower bracket and secure with the M10 locknut (C). Do not tighten.
3. Pivot the alternator in and install the drive belt.
4. Install the M8x35 cap screw (D) through the adjustment slot in the upper bracket and into the threaded alternator hole (E). Do not tighten. Nut (F) is installed on the M8x35 cap screw in a later step. Itis only used to secure the ground strap to the alternator, not to secure the alternator itself.
5. Position the upper bracket as necessary so that the M8x35 cap screw in the upper bracket sweeps properly through the slot. Tighten the M8x16 (G) capscrews.
6. Apply tension on belt and tighten M8x35 bolt (D) in adjustment slot of upper bracket.
7. Tighten alternator pivot hardware.



MXT012002 —UN—19JUN14

A—Alternator
B—M10X45 Pivot Bolt
C—M10 Locknut
D—M8X35 Capscrew
E—Threaded Alternator Hole
F—Nut
G—M8X16 Capscrew (2 Used)

MX52301,0000149 -19-22OCT14-22/22

Summary of References

- Attachments Circuit Theory of Operation

MX52301,0000449 -19-08AUG14-1/1

Attachments Circuit Theory of Operation

Theory of Operation:

Optional attachments circuits are installed using five different methods, depending on their power and control requirements. They are as follows:

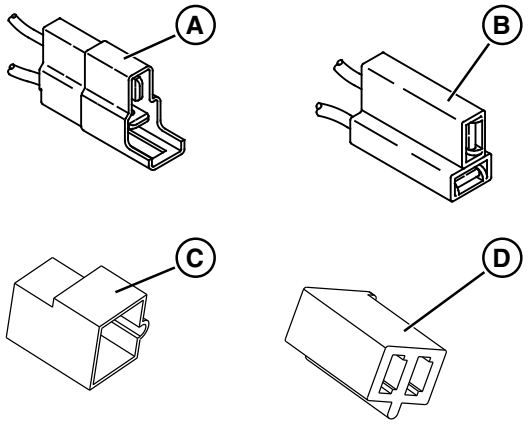
1. Low current control for the circuit is contained in the main wiring harness. The main wiring harness provides high current for the circuit carried by the optional attachment wiring harness.
   - Cargo Box Lift Kit.
2. Low current control for the circuit is contained within the optional attachment wiring harness. The main wiring harness provides high current for the circuit carried by the optional attachment wiring harness.
   - Hydraulic Front Implement Lift Kit.
   - Signal Lights Kit.
3. The main wiring harness provides high current for the circuit carried by the optional attachment wiring harness. Component operation and control is contained in this circuit. There are no low current connections.
   - Back Up Alarm Kit.
   - Accessory Power Port Kit.
4. The main wiring harness provides low current controlled by the optional attachment wiring harness. There are no high current connections.
   - Rear Marker and Brake Lights Kit.
5. High current for the optional attachment is provided by connecting directly to the battery and frame ground. Connecting the optional attachment wiring harness to the main wiring harnessprovides low current control.
   - Auxiliary Alternator Kit.

Operation:

These circuit connections are achieved with the main wiring harness having high current and low current attachment connectors at both the front and the rear of the machine. Multiple attachments are connected in a “piggyback” fashion and are in no particular order. Their connections are determined by their physical location on the machine and proximity to other installed options. Refer to individual attachment circuit descriptions for more information.

Many of these optional attachment wiring harnesses are individually fused in series with the main wiring harness. When diagnosing a problem, it is important to have the option under test as the only circuit connected to the main wiring harness.

Each optional attachment has either a high current, a low current, or both type connectors on its respective harness to pass power along to the next installed attachment.



MXT012003 —UN—24JUN14

A—Female Low Current Connector (Rear of Machine—Main Wiring Harness to Lift Harness OUT)
B—Male Low Current Connector (Front of Machine—Main Wiring Harness or Attachment power OUT)
C—Female High Current Connector (All Attachments—Power IN)
D—Male High Current Connector (Front and Rear of Machine—Main Wiring Harness or All Attachment Power OUT)

MX52301,000014A -19-22OCT14-1/1

Cargo Box Lift Theory of Operation

Function:

To activate and control the direction of current through the hydraulic pump motor to lift and lower the cargo box.

Operating Conditions:

Key switch in the RUN position.

Lift-lower switch in either the LIFT or LOWER position.

Theory of Operation:

The hydraulic motor and cylinder assembly is a closed system. The pump pushes oil into one end of the cylinder to raise the cargo box, and the other end to lower the cargo box.

The cargo box lift-lower electric circuit consists of a low current switched power control circuit and a high current unswitched power circuit. When the lift-lower control switch is held to the lift or lower position, the appropriate directional relay is energized.

The motor ground circuit connects through the other non-operating relay to battery negative.

Switched Power Circuit:

Power flows from the G1 battery to the “B” terminal of the S1 key switch. Power leaves the key switch “A” terminal, through the 420J Yel wire and then the 420H Yel wire, to the S5 cargo box lift-lower switch. The lift-lower switch connects to the machine main wiring harness.

When the cargo box is being raised, power flows through the 670 Org wire, harness connector, and 671 Org wire to the L-K4 lift relay coil. The power activates the relay coil.

When the cargo box is being lowered, power flows through the 675 Grn wire, harness connector, and 676 Grn wire to the L-K3 lower relay coil.

Unswitched Power Circuit:

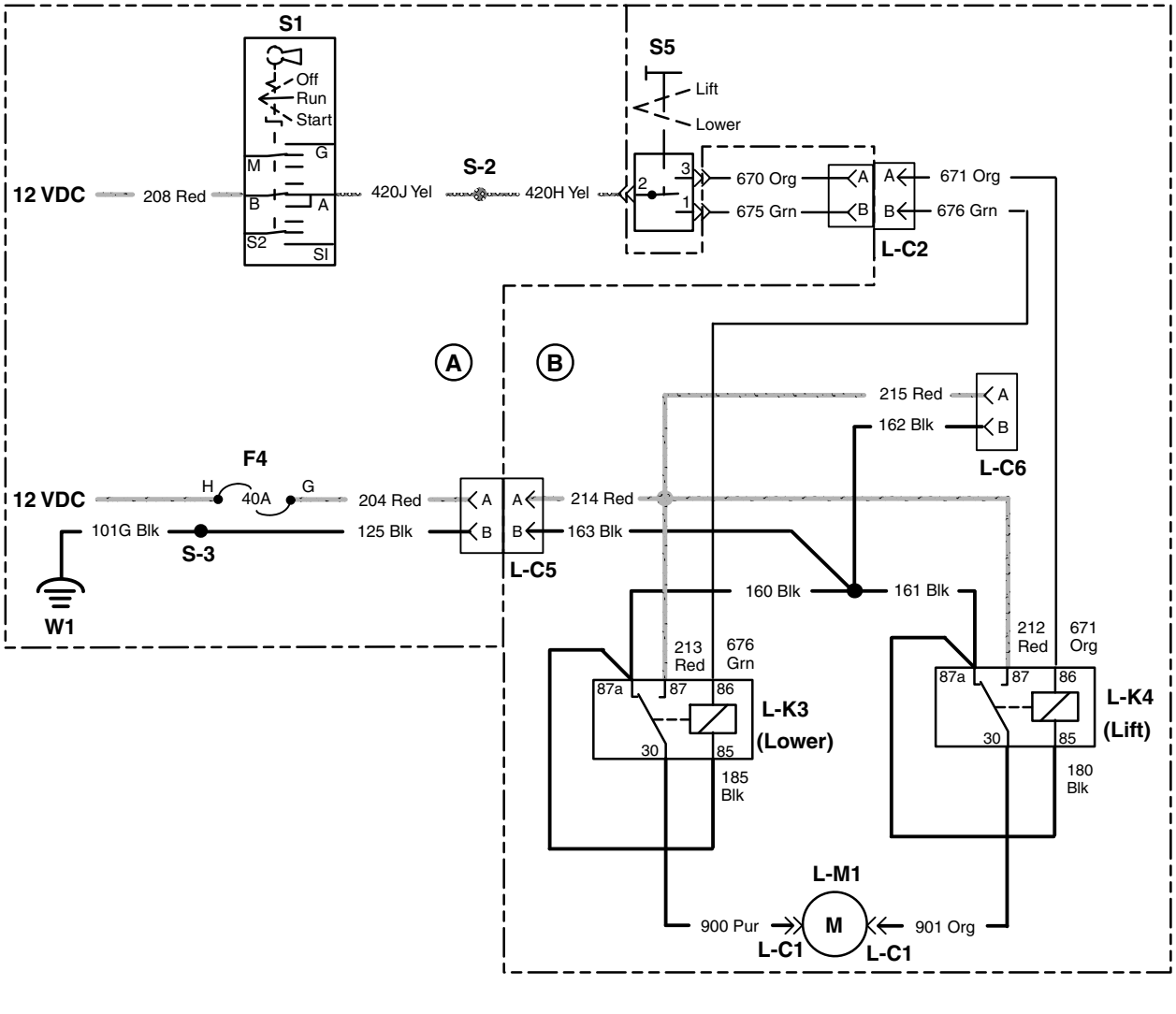
The main wiring harness provides unswitched power to the 204 Red wire, and ground to the 125 Blk wire of the rear accessory connector. The cargo box lift-lower harness plugs into the rear accessory connector.

When the cargo box is being raised, current flows to the L-K4 lift relay contact 87, through the closed contacts to contact 30. The 901 Org wire provides the high current circuit to activate the motor. A ground path to complete the circuit is provided through the 900 Pur wire, L-K3 contacts, and the 160, 163, 125, and 101G Blk wires.

When the cargo box is lowered, current flows to the L-K3 lower relay through the 213 Red wire. The relay is energized to complete the path to the L-M1 motor. The ground circuit is through the 901 Org wire, L-K4 contacts, and the 161, 163, 125, and 101G Blk wires.

OUMX258,0000A14 -19-14MAY15-1/1

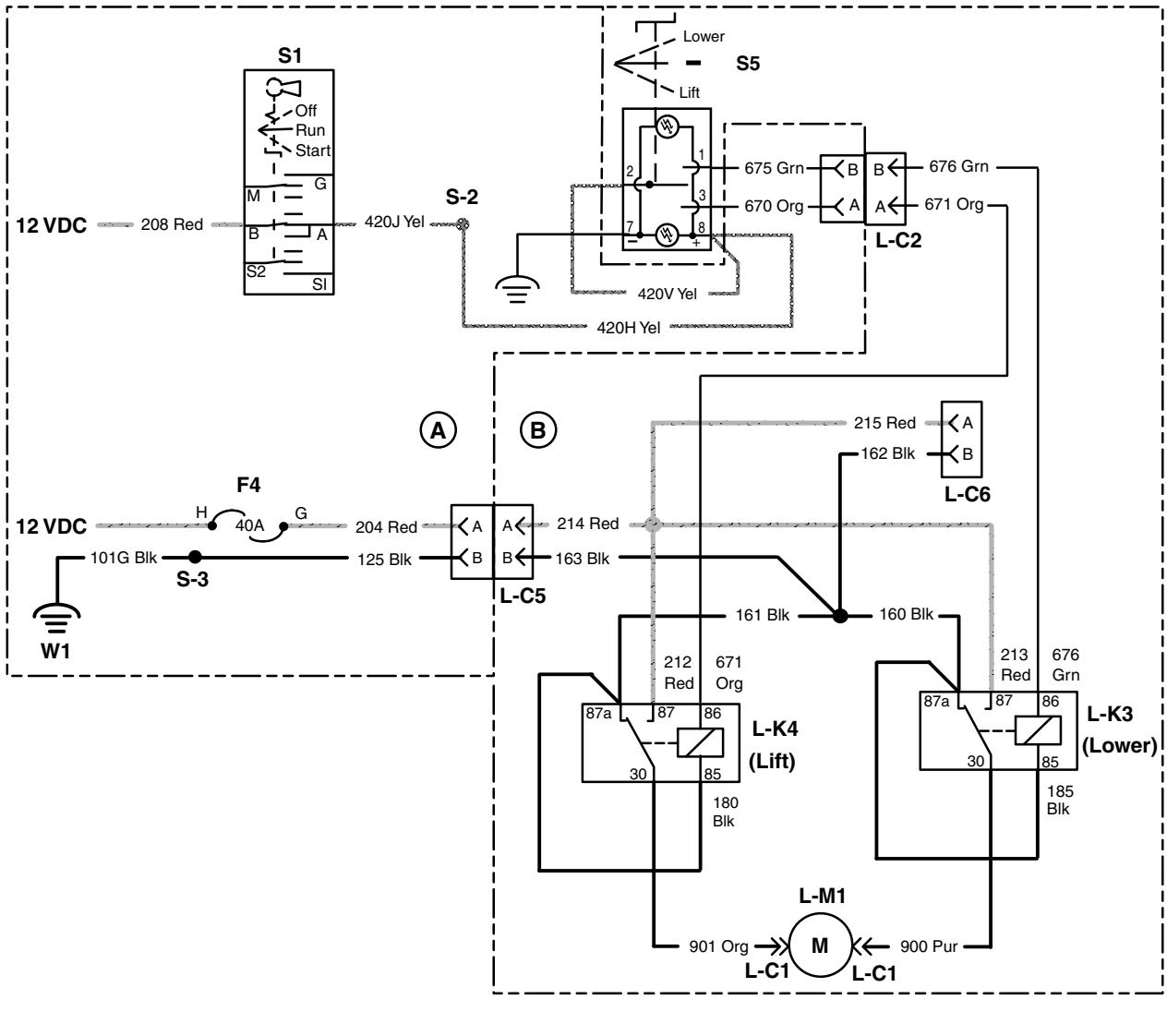
Cargo Box Lift Schematic (SN -120000)



F4— 40 A Fuse
L-C2— Lift-Lower Connector
L-C5— Unswitched Power Connector
L-K3— Lower Relay
L-K4— Lift Relay
L-M1— Hydraulic Motor Assembly
S1—Key Switch
S5—Lift-Lower Switch
A—Main Wiring Harness
B—Lift Kit Wiring Harness

OUMX258,0000A15 -19-13MAY15-1/1

Cargo Box Lift Schematic (SN 120001-)

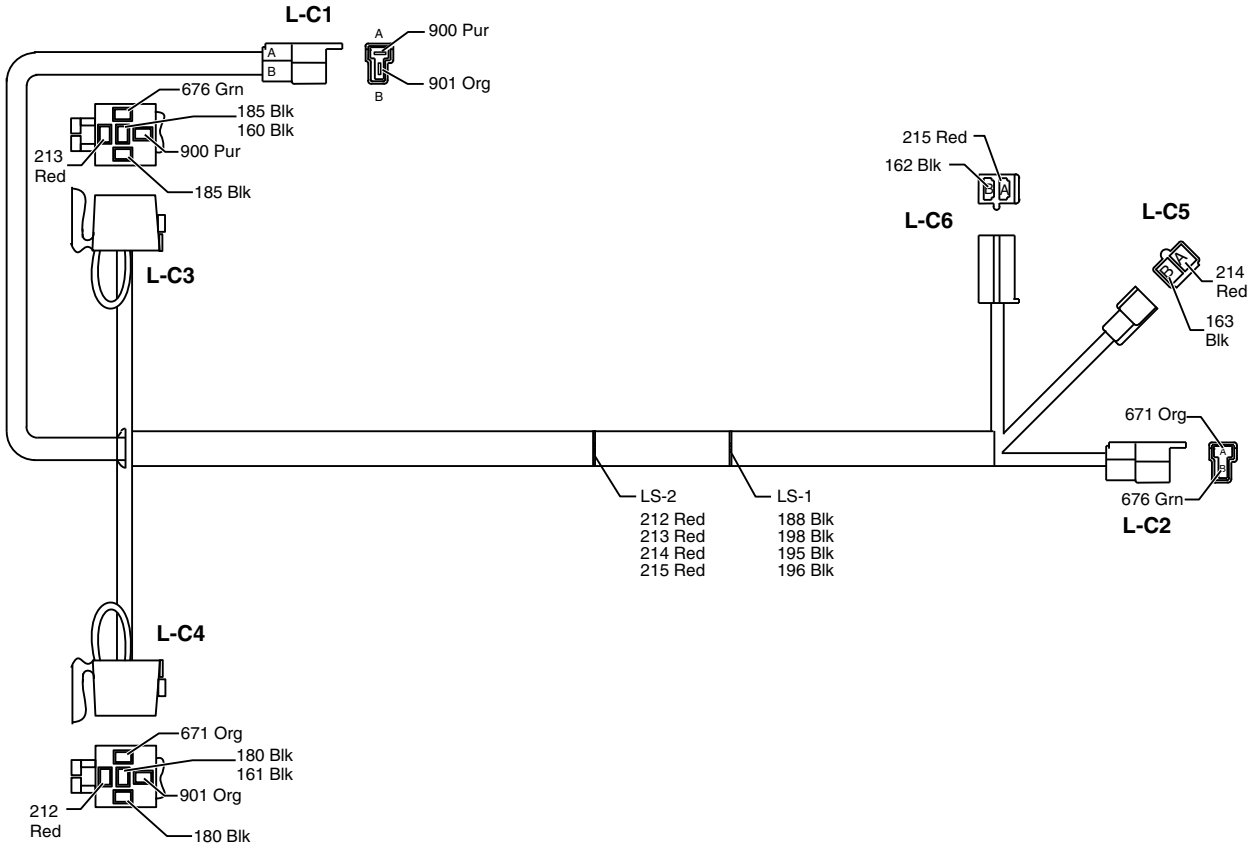


F4— 40 A Fuse
L-C2— Lift-Lower Connector
L-C5— Unswitched Power Connector
L-K3— Lower Relay
L-K4— Lift Relay
L-M1— Hydraulic Motor Assembly
S1— Key Switch
S5— Lift-Lower Switch
A—Main Wiring Harness
B—Lift Kit Wiring Harness

OUMX258,0000A17 -19-13MAY15-1/1

Cargo Box Lift Wiring Harnesses

VGA10797 Harness



MXT013351 —UN—14MAY15

L-C1— Hydraulic Motor Connector
L-C2— Main Harness Switch Connector
L-C3— Lower Relay Connector
L-C4— Lift Relay Connector
L-C5— Power Connector, Unswitched In
L-C6— Power Connector, Unswitched Out
L-S1— Ground Splice
L-S2— Power Splice

Size/No./Color	Wire Connection Points
2.0 160 Blk	L-S1, L-C3 (3)
2.0 161 Blk	L-S1, L-C4 (3)
3.0 162 Blk	L-C6 (B), L-S1
3.0 163 Blk	L-C5 (B), L-S1
0.8 180 Blk	L-C4 (3), L-C4 (2)
0.8 185 Blk	L-C3 (2), L-C3 (3)

Size/No./Color	Wire Connection Points
2.0 212 Red	L-S2, L-C4 (4)
2.0 213 Red	L-S2, L-C3 (4)
3.0 214 Red	L-C5 (A), L-S2
3.0 215 Red	L-C6 (A), L-S2
1.0 671 Org	L-C2 (A), L-C4 (5)
1.0 676 Org	L-C2 (B), L-C3 (5)
2.0 900 Pur	L-C3 (1), L-C1 (A)
2.0 901 Org	L-C4 (1), L-C1 (B)

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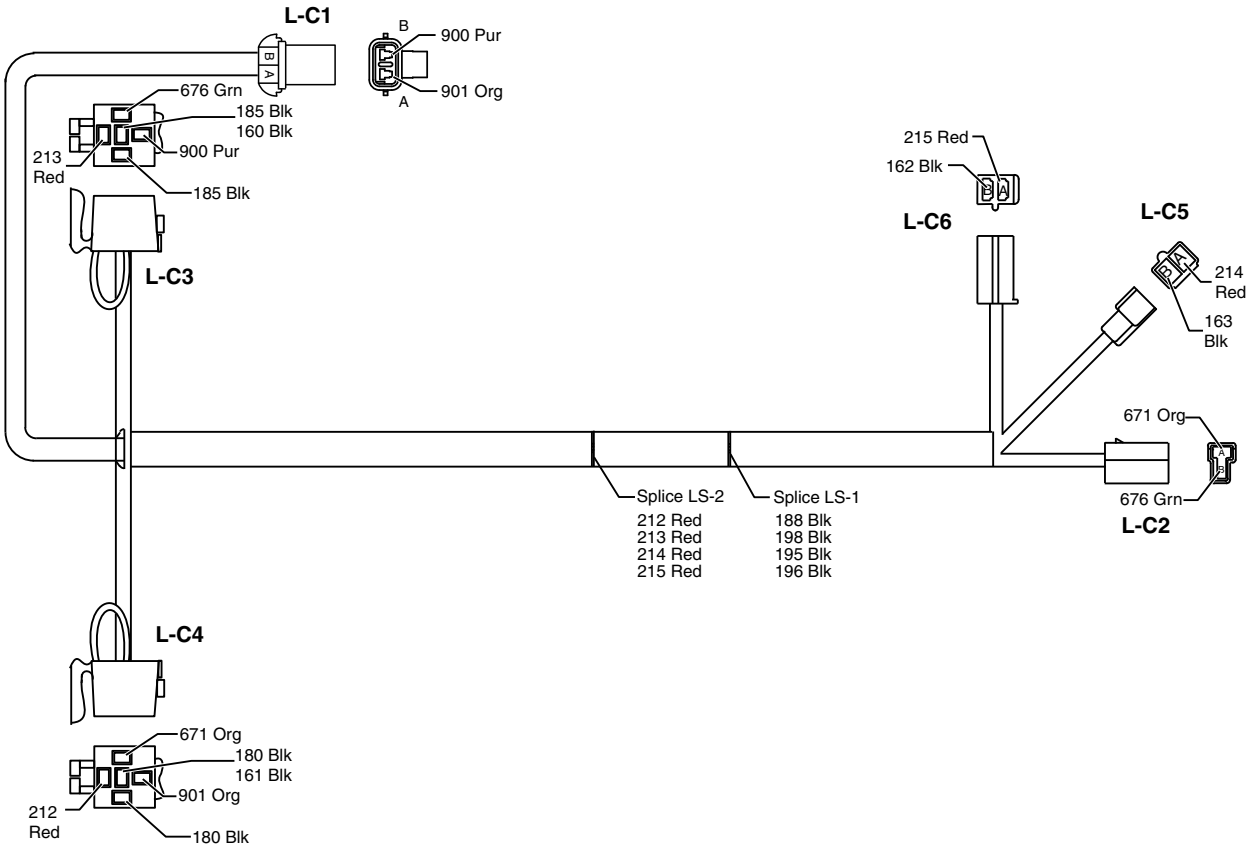
OUMX258,0000A18 -19-14MAY15-1/2

AM136637 Harness



MXT013352 —UN—14MAY15

L-C1— Hydraulic Motor Connector
L-C2— Main Harness Switch Connector
L-C3— Lower Relay Connector
L-C4— Lift Relay Connector
L-C5— Power Connector, Unswitched In
L-C6— Power Connector, Unswitched Out
L-S1— Ground Splice
L-S2— Power Splice

Size/No./Color	Wire Connection Points
2.0 160 Blk	L-S1, L-C3 (3)
2.0 161 Blk	L-S1, L-C4 (3)
3.0 162 Blk	L-C6 (B), L-S1
3.0 163 Blk	L-C5 (B), L-S1
0.8 180 Blk	L-C4 (3), L-C4 (2)
0.8 185 Blk	L-C3 (2), L-C3 (3)

Size/No./Color	Wire Connection Points
2.0 212 Red	L-S2, L-C4 (4)
2.0 213 Red	L-S2, L-C3 (4)
3.0 214 Red	L-C5 (A), L-S2
3.0 215 Red	L-C6 (A), L-S2
1.0 671 Org	L-C2 (A), L-C4 (5)
1.0 676 Org	L-C2 (B), L-C3 (5)
2.0 900 Pur	L-C3 (1), L-C1 (B)
2.0 901 Org	L-C4 (1), L-C1 (A)

OUMX258,0000A18 -19-14MAY15-2/2

Summary of References

- Charging Circuit Operation — Auxiliary Alternator Kit (Gas Engine)
- Auxiliary Alternator Circuit Schematic (Gas Engine)
- Auxiliary Alternator Wiring harness (Gas Engine)
- Auxiliary Alternator Kit Schematic (Gas Engine)
- Auxiliary Alternator Kit Wiring Harness Color Codes (Gas Engine)

MX52301,000044A -19-23OCT14-1/1

Charging Circuit Operation — Auxiliary Alternator Kit (Gas Engine)

Function:

To maintain battery voltage between 12.4 and 13.2 volts.

Operating Conditions:

- The key switch in the RUN position.
- The must engine running for the charging system to

Theory of Operation:

The charging system consists of the G3 auxiliary alternator with an integrated voltage regulator/rectifier. Charging output is controlled by an internal regulator/rectifier.

With the key switch in the RUN position, battery sensing circuit current flows from battery positive terminal through the 201 and 202 Red wires, F6 fuse, 208 Red wire, S1 key switch, 420J, 420F, 425, 426 Yel wires, and connections to the auxiliary alternator internal voltage regulator/rectifier. This battery sensing circuit allows the voltage regulator/rectifier to monitor battery voltage.

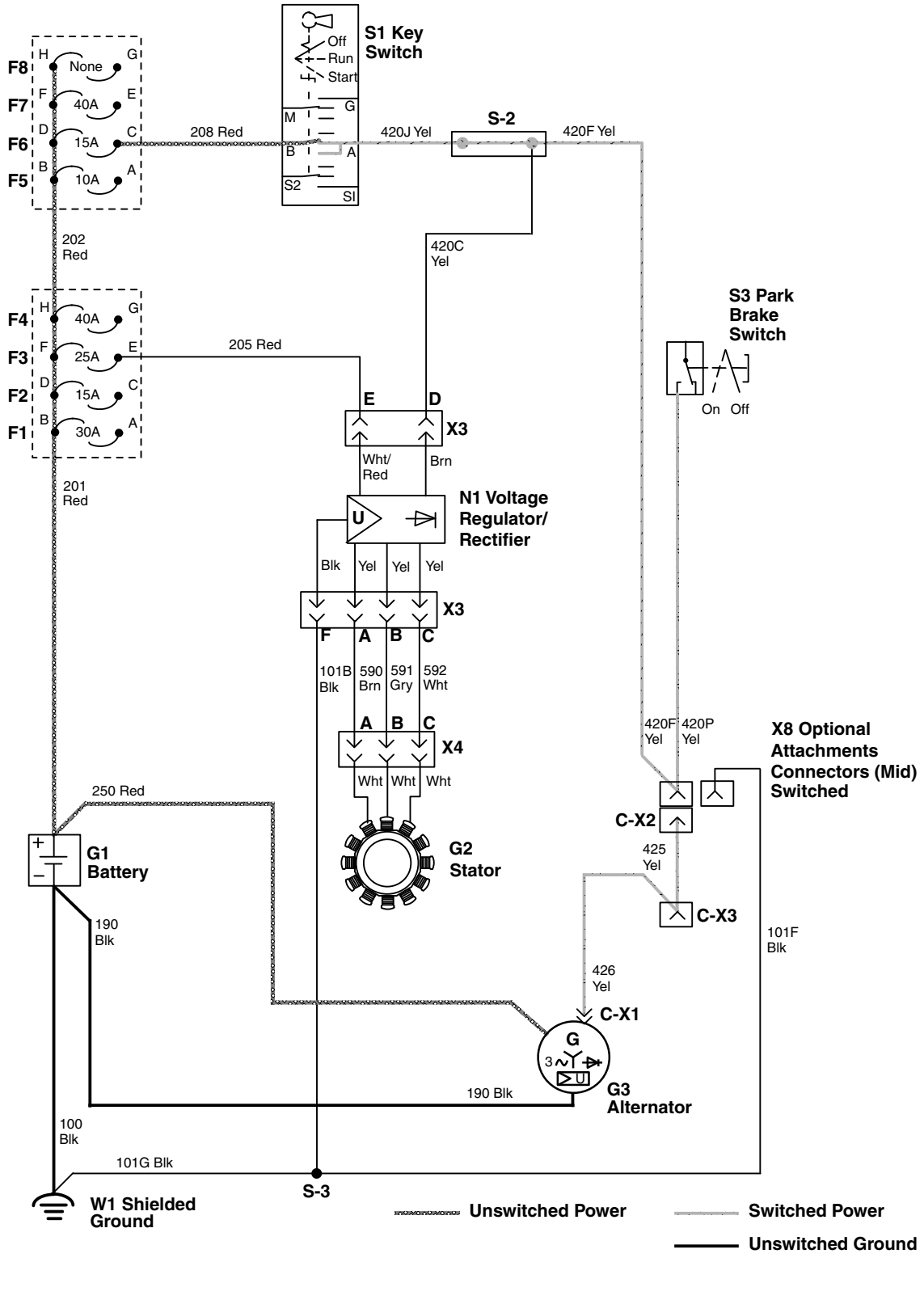
A rotating permanent magnet in the alternator induces AC current in the alternator stator coils. The AC current flows to the internal voltage regulator/rectifier. The voltage regulator/rectifier converts AC current to DC current needed to charge the battery.

If battery voltage is low, the regulator/rectifier allows DC current to flow to the battery to charge it through the battery charging circuit, 250 Red wire. When the battery is fully charged, the voltage regulator/rectifier stops current flow to the battery.

The ground circuit 190 Blk wire provides a path to ground for the internal voltage regulator/rectifier and G3 alternator.

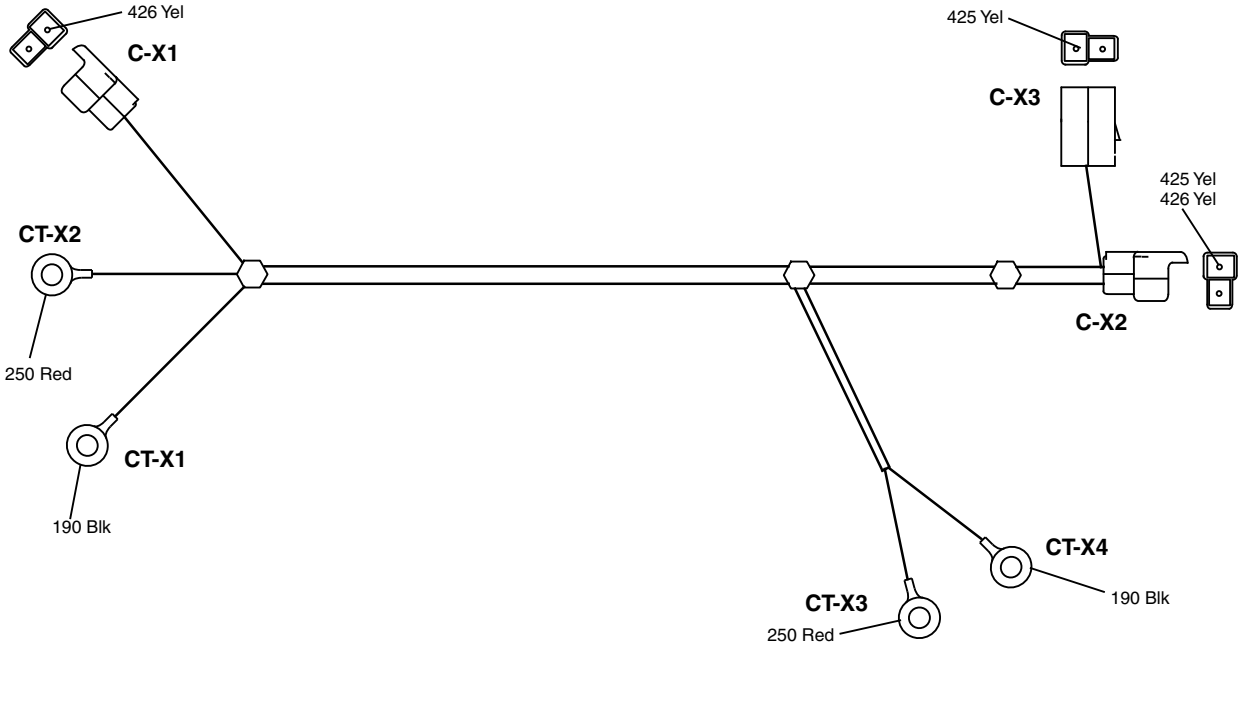
MX52301,000014B -19-28MAY14-1/1

Auxiliary Alternator Circuit Schematic (Gas Engine)



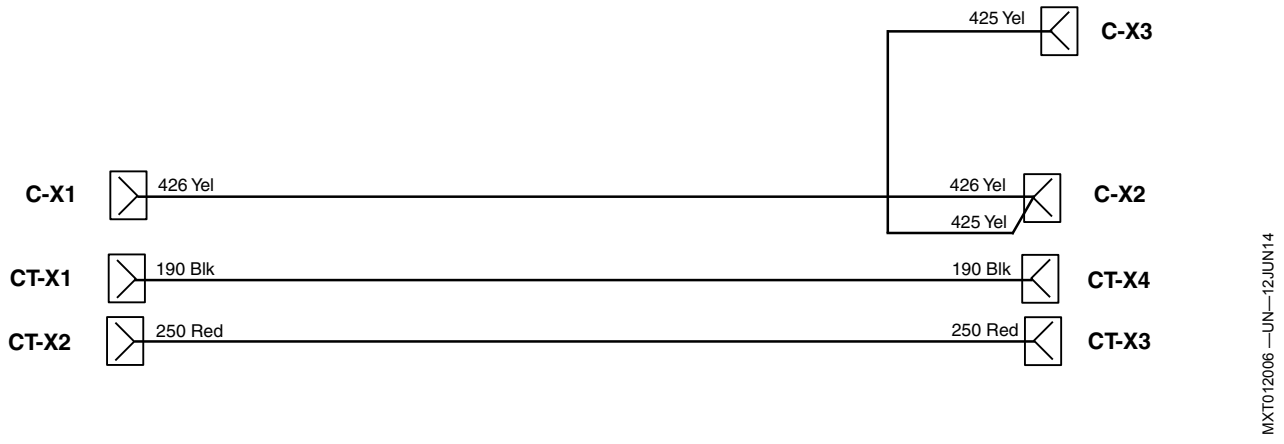
MX52301,000014C -19-08JUL14-1/1

Auxiliary Alternator Wiring harness (Gas Engine)



MX52301,000014D -19-08JUL14-1/1

Auxiliary Alternator Kit Schematic (Gas Engine)



MX52301,000014E -19-08JUL14-1/1

Auxiliary Alternator Kit Wiring Harness Color Codes (Gas Engine)

Size/No./Color	Wire Connection Points
8.0 190 Blk	CT-X1, CT-X4
8.0 250 Red	CT-X2, CT-X3
1.0 425 Yel	C-X3, C-X2
1.0 426 Yel	C-X1, C-X2

MX52301,000014F -19-08JUL14-1/1

Auxiliary Alternator Circuit Diagnosis (Gas Engine)

Auxiliary Alternator Circuit Diagnosis

MX52301,0000150 -19-22OCT14-1/7

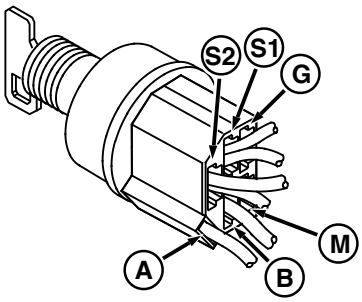
❶ Auxiliary Alternator Circuit Diagnosis (Gas Engine)

MX52301,0000150 -19-22OCT14-2/7

Key Switch

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Open hood and remove storage tray.
- Key switch in run position, engine off.
- DISCONNECT any other attachment option from the main wiring harness.
- Disconnect X3 connector at N1 voltage regulator.
- Battery fully charged.



MXT004463 —UN—31MAY12

A—A Terminal of S1 Key Switch
B—B Terminal of S1 Key Switch

Is battery voltage present at the (B) terminal of the S1 key switch?

YES: Go to next step.

NO: Check F6 fuse, 201, 202, and 208 Red wires, and connections.

MX52301,0000150 -19-22OCT14-3/7

Key Switch

Is battery voltage present at the (A) terminal of the S1 key switch?

YES: Go to next step.

NO: Test key switch. See Key Switch Test

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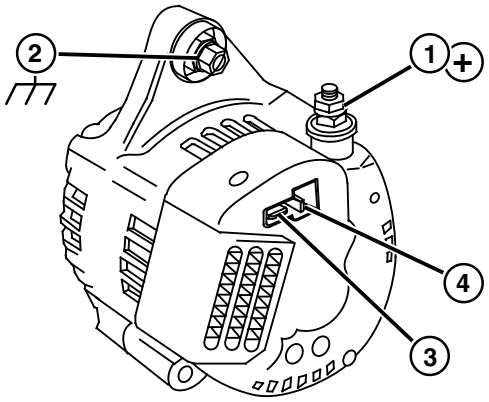
MX52301,0000150 -19-22OCT14-4/7

Alternator	 MXT011919—UN—04JUN14 **1—250 Red Wire** **2—190 Black Wire** **3—426 Yellow Wire** Is battery voltage present at the G3 alternator, 426 Yel wire (3)?	**YES:** Go to next step. **NO:** Check 420J, 420F, 425, and 426 Yel wires, and connections.

MX52301,0000150 -19-22OCT14-5/7

Ground Continuity	Is continuity to ground present at 190 Blk wire (2) of G3 alternator?	**YES:** Go to next step. **NO:** Check 190 Blk wire and connections.

MX52301,0000150 -19-22OCT14-6/7

Voltage Presence	Is battery voltage present at G3 alternator 250 Red wire (1)?	**YES:** Test auxiliary alternator. See Alternator Regulated Output Test **NO:** Check 250 Red wire and connections.

MX52301,0000150 -19-22OCT14-7/7

Winch Theory of Operation

Function:

To provide power and control for the electric winch. The winch can reel-in and reel-out under power.

Operating Conditions:

- The electric winch remote control uses switched power. The key switch must be in the ON position for the winch controls to operate.
- The current to power the electric winch uses unswitched power controlled by the W-K1 relay block.

Theory of Operation:

The winch may be connected to either the front or rear switched power connector of the machine.

Unswitched Power:

The machine power circuit provides power to the B terminal of the S1 key switch.

Current flows from the G1 battery to the K1 relay block, terminal F. A bus on the winch WK-1 relay block carries unswitched power to terminal G as well.

Unswitched ground is provided by a connection directly from terminal C on the W-K1 relay block to the negative terminal on the G1 battery. An external bus on the relay block provides ground to terminal B as well. Internally, ground is provided to terminals E, A, H, and D. Both sides of the W-M1 winch motor are then grounded through the 650 Red and 655 Blk wires (Front connector) or the 651 Red and 656 Blk wires (Rear connector).

Winch Reel-In Operation, Switched Power:

Power flows from the S1 key switch via the switched power circuit to unswitched front accessory power circuit. This is connected to the W-X1 winch wiring harness connector and power is then provided by the 421W Red wire to the W-X3 winch remote control connector. The 423W Red wire carries power to the W-S1 control switch. When the W-S1 remote winch control switch reel-in button is pressed, a connection is made to the 502W Grn wire carrying power back through the W-X3 connector and 500W Grn wire to the W-K1 relay block, connected by the W-X4 bullet connector. This energizes the number 1 solenoid (grounded via 101W Tan wire and 100W Blk ground wire) and causes contact to be made between the F and A terminals on the W-K1 relay block. This provides high current over the 651W Red wire (Rear) or 650W Red wire (Front) to the appropriate winch connector and W-M1 winch motor.

Ground is provided by the 657W Blk wire, and then 655W Blk wire (Front) or 656W Blk wire (Rear) to terminal H of the W-K1 relay block.

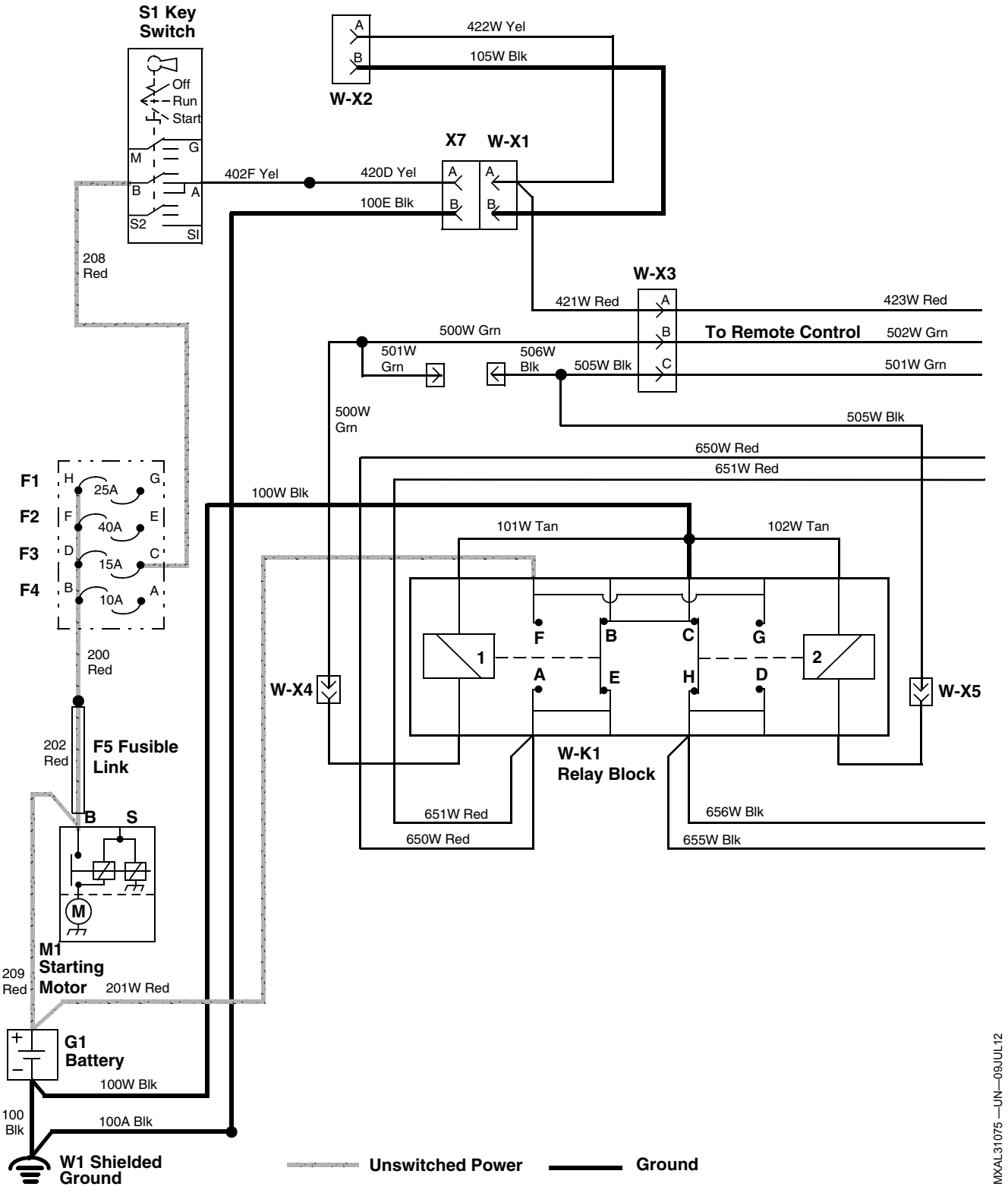
Winch Reel-Out Operation, Switched Power:

Power flows from the S1 key switch via the switched power circuit to unswitched front accessory power circuit.This is connected to the W-X1 winch wiring harness connector and power is then provided by the 421W Red wire to the W-X3 winch remote control connector. The 423W Red wire carries power to the W-S1 control switch. When the W-S1 remote winch control switch reel-out button is pressed, a connection is made to the 507W Blk wire carrying power back through the W-X3 connector and 505W Blk wire to the W-K1 relay block, connected by the W-X5 bullet connector. This energizes the number 2 solenoid (grounded via 102W Tan wire and 100W Blk ground wire) and causes contact to be made between the F and H terminals on the W-K1 relay block. This provides high current over the 655W Blk wire (Front) or 656W Blk wire (Rear) to the appropriate winch connector and W-M1 winch motor.

Ground is provided by the 652W Blk wire, and then 651W Red wire (Rear) or 650W Red wire (Front) to terminal A of the W-K1 relay block.

OUMX258,0000A19 -19-14MAY15-1/1

Winch Circuit Schematic



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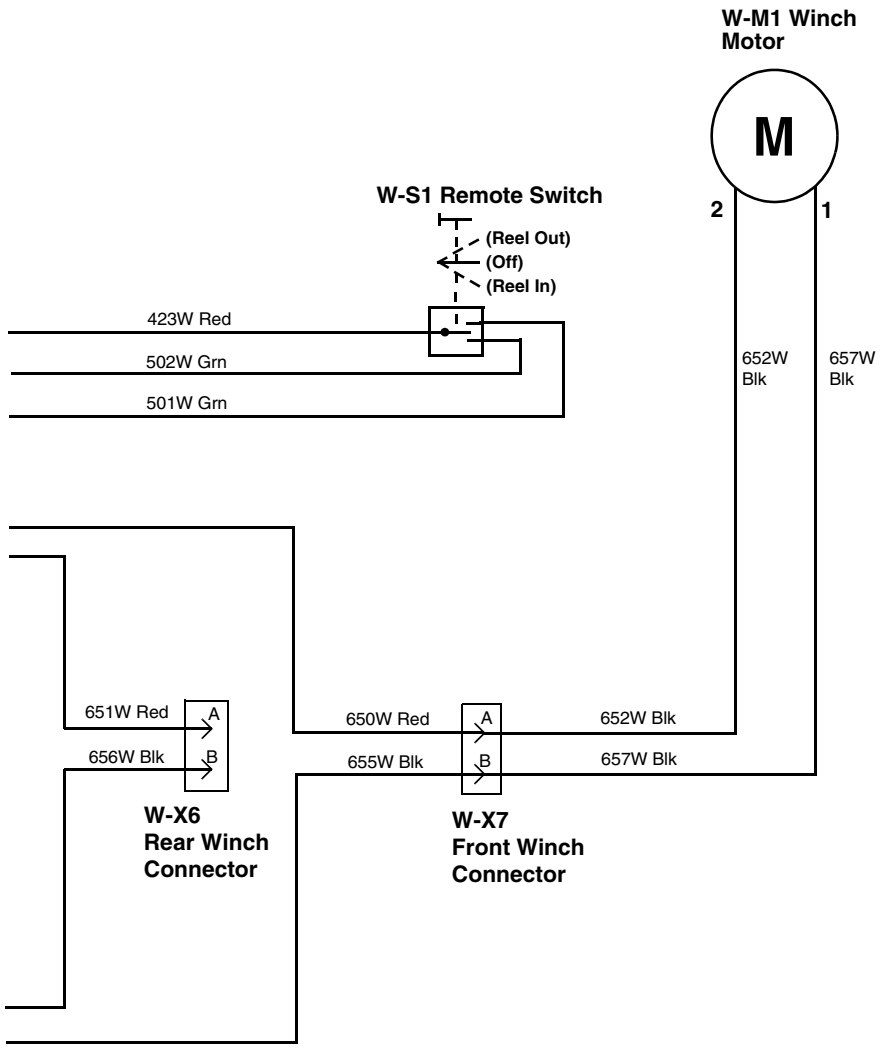
OUMX258,0000A1A -19-14MAY15-1/2

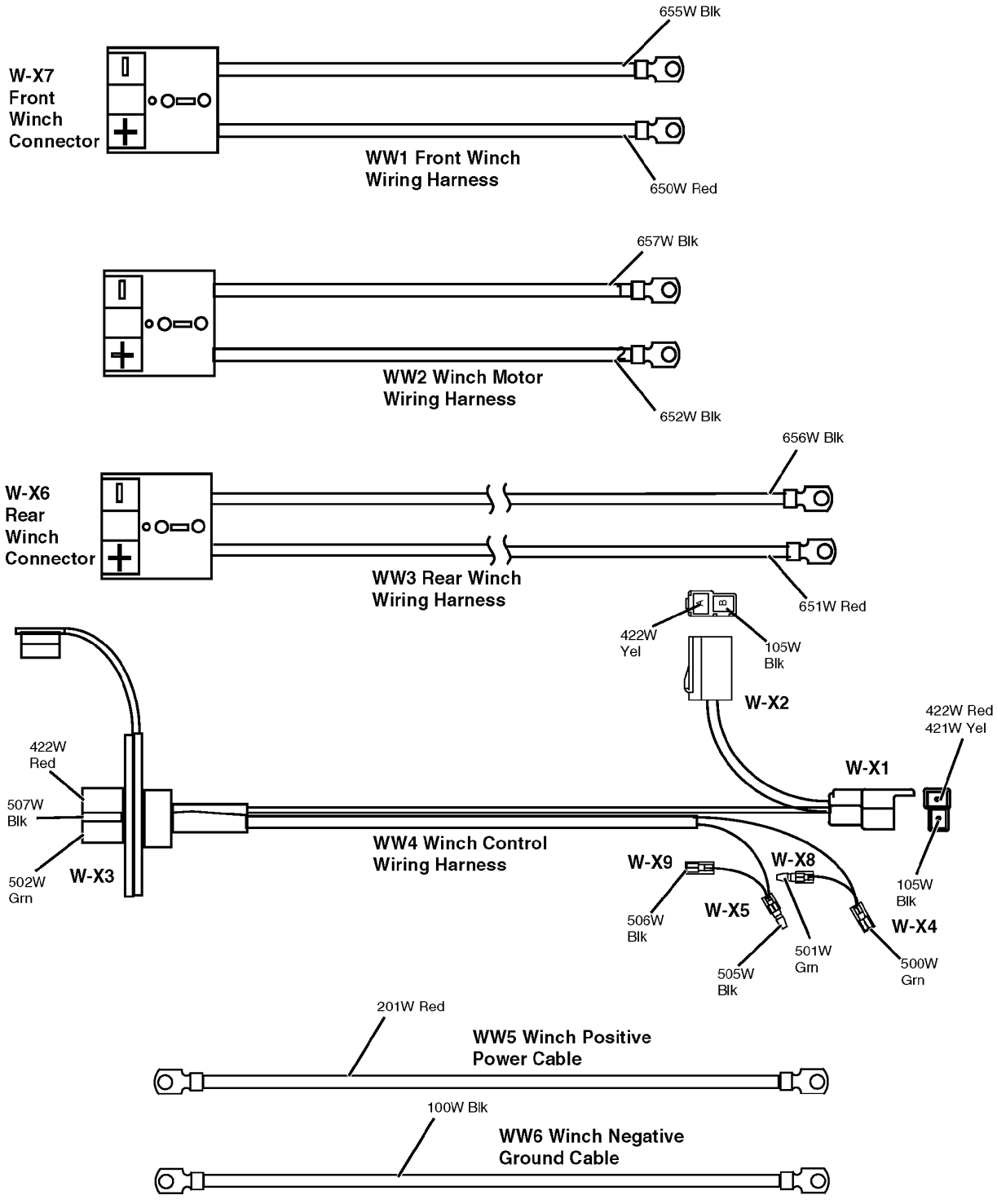


MXAL31076 —UN—09JUL12

W-K1— Relay Block **W-M1—Winch Motor** **W-S1— Remote Switch**

OUMX258,0000A1A -19-14MAY15-2/2

Winch Wiring Harnesses



MXAL31079 —UN—09JUL12

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OUMX258,0000A1B -19-14MAY15-1/2

W-X1— Winch Control Power and Optional Accessories to Main Wiring Harness (Switched)
W-X2— Winch Control Wiring Harness to Optional Accessories
W-X3— Winch Control Wiring Harness to Remote Switch
W-X4— Winch Control Wiring Harness to W-K1 Relay Block
W-X5— Winch Control Wiring Harness to W-K1 Relay Block
W-X6— Rear Winch Wiring Harness to Rear Winch Motor
W-X7— Front Winch Wiring Harness to Rear Winch Motor
W-X8— Winch Control Wiring Harness to Options
W-X9— Winch Control Wiring Harness to Options

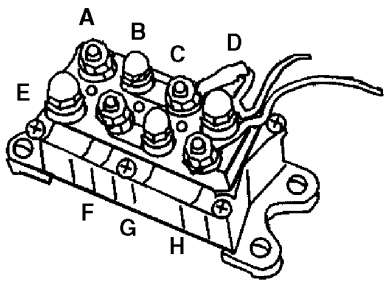
OUMX258,0000A1B -19-14MAY15-2/2

Winch Wiring Harness Color Codes

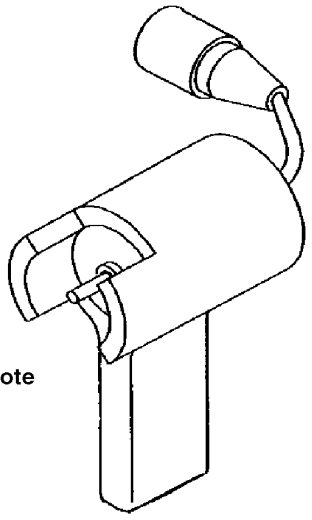
No./Color	Wire Connection Points—Harness
100W Blk	G1, W-K1 (C)—WW6
101W Tan	W-K1 (C), W-K1
102W Tan	W-K1 (C), W-K1
105W Blk	W-X1, W-X2—WW4
201W Red	G1, W-K1 (F)—WW5
421W Red	W-X1, W-X3—WW4
422W Yel	W-X1, W-X2—WW4
423W Red	W-X3, W-S1
500W Grn	W-X3, W-X4—WW4
501W Grn	Splice, W-X8—WW4
502W Grn	W-X3, W-S1
505W Blk	W-X3, W-X5—WW4
506W Blk	Splice, W-X9—WW4
507W Blk	W-X3, W-S1
650W Red	W-K1 (A), W-X7—WW1
651W Red	W-K1 (A), W-X6—WW3
652W Blk	W-X7, W-M1—WW2
655W Blk	W-K1 (H), W-X7—WW1
656W Blk	W-K1 (H), W-X6—WW3
657W Blk	W-X7, W-M1—WW2

OUMX258,0000A1C -19-14MAY15-1/1

Relay Block and Remote Switch



W-K1 Relay Block



W-S1 Remote Switch

MXAL31080 —UN—09JUL12

OUMX258,0000A1D -19-14MAY15-1/1

Winch Circuit Diagnostics

Winch Unswitched Power:

Test Conditions

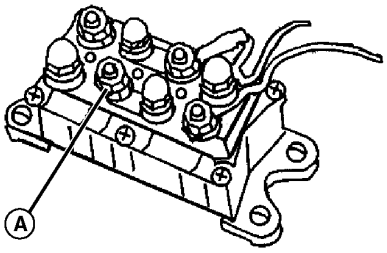
- Park machine safely.
- Power circuits checked and OK. See appropriate power circuit section.
- Cargo box RAISED and LOCKED.
- Hood removed.
- DISCONNECT any other attachment option(s) from the main wiring harness. The winch must be the ONLY installed optional circuit as this will eliminate the possibility of other causes of faults for the circuit under test.
- Key switch in OFF position.
- Battery fully charged.
- Check connections for looseness and corrosion.
- Perform entire procedure in sequence.

OUMX258,0000A1E -19-14MAY15-1/29

Procedure

OUMX258,0000A1E -19-14MAY15-2/29

Step 1



MXAL31081 —UN—09JUL12

A—Terminal F

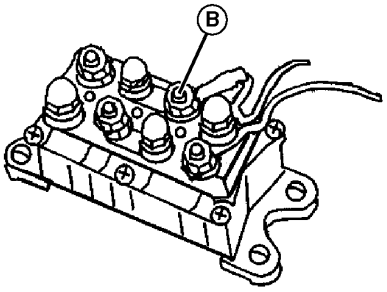
Is battery voltage present at terminal F (A) of W-K1 relay block

YES: Go to next step.

NO: Check 201W Red wire and connections.

OUMX258,0000A1E -19-14MAY15-3/29

Step 2



MXAL31082 —UN—09JUL12

B—Terminal C

Is there continuity between terminal C (B) of W-K1 relay block and ground?

YES: Go to next step.

NO: Check 100W Blk wire and connections.

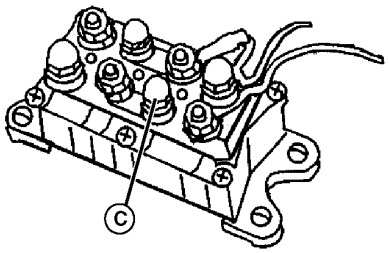
Continued on next page

OUMX258,0000A1E -19-14MAY15-4/29

Step 3	Are 101W and 102W Tan wires on W-K1 relay block in good condition and securely connected to terminal C?	**YES:** Go to next step. **NO:** Clean and secure Tan wires to terminal C or replace relay block.

OUMX258,0000A1E -19-14MAY15-5/29

Step 4



MXAL31083 —UN—09JUL12

C—Terminal G

Is battery voltage present at terminal G (C) of W-K1 relay block?

YES: Go to next procedure.

NO: Replace relay block.

OUMX258,0000A1E -19-14MAY15-6/29

Winch Switched Power:

Test Conditions

- Park machine safely.
- Power circuits checked and OK. See appropriate power circuit section.
- Cargo box RAISED and LOCKED.
- Hood removed.
- DISCONNECT any other attachment option(s) from the main wiring harness. The winch must be the ONLY installed optional circuit as this will eliminate the possibility of other causes of faults for the circuit under test.
- Key switch in OFF position.
- Battery fully charged.
- Check connections for looseness and corrosion.
- Perform entire procedure in sequence.

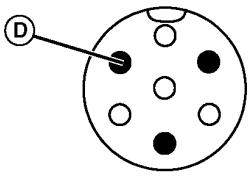
OUMX258,0000A1E -19-14MAY15-7/29

Procedure

Continued on next page

OUMX258,0000A1E -19-14MAY15-8/29

Step 1



MXAL31084 —UN—09JUL12

Shown at female connector end

D—421W Red Wire

Is battery voltage present at 421W Red wire (D) of W-X3 connector?

YES: Go to next step.

NO: Check 423W Red wire, W-X3 connector, 421W Red wire, and W-X1 connector.

OUMX258,0000A1E -19-14MAY15-9/29

Winch Reel-In Operation:

Test Conditions

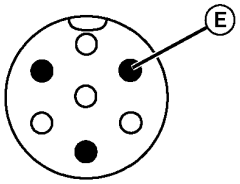
- Machine parked safely on a level surface with park brake locked.
- Key switch in on position, engine off.
- Battery fully charged.
- Machine power circuits working properly.
- Check wires and connections for looseness and corrosion.
- All optional accessories disconnected.
- Ensure winch clutch is engaged.
- Winch Reel-In button depressed during each test step.
- Perform entire procedure in sequence.

OUMX258,0000A1E -19-14MAY15-10/29

Procedure

OUMX258,0000A1E -19-14MAY15-11/29

Step 1



MXAL31085 —UN—09JUL12

E—502W Grn Wire

Is battery voltage present at 502W Grn wire (E) of W-S1 remote switch, W-X3 connector?

YES: Go to next step.

NO: Test remote switch.

OUMX258,0000A1E -19-14MAY15-12/29

Step 2

Is battery voltage present at W-X4 bullet connector, 500W Grn wire?

YES: Go to next step.

NO: Check 500W Grn wire and connections.

OUMX258,0000A1E -19-14MAY15-13/29

Step 3

Is an audible click heard from the W-K1 relay block when the reel-in button is depressed?

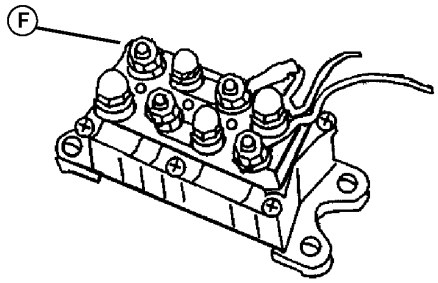
YES: Go to next step.

NO: Replace relay block.

Continued on next page

OUMX258,0000A1E -19-14MAY15-14/29

Step 4



MXAL31086 —UN—09JUL12

F—Terminal A

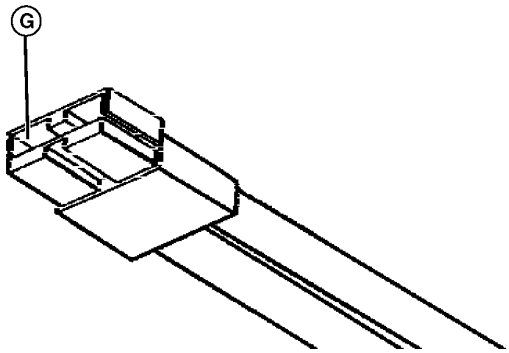
Is battery voltage present at terminal A (F) of W-K1 relay block?

YES: Go to next step.

NO: Replace relay block.

OUMX258,0000A1E -19-14MAY15-15/29

Step 5



MXAL31087 —UN—09JUL12

G—651W Red Wire (W-X6 Rear Connector)

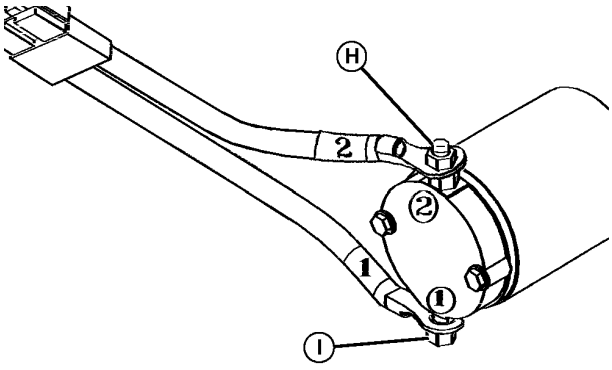
Is battery voltage present at 650W Red wire (W-X7 front connector) or 651W Red wire (W-X6 rear connector) (G)?

YES: Go to next step.

NO: Check 650W or 651W Red wire and connections.

OUMX258,0000A1E -19-14MAY15-16/29

Step 6



MXAL31088 —UN—09JUL12

H—652W Blk Wire
I— 657W Blk Wire

Is battery voltage present at 652W Blk wire (H) at W-M1 winch motor?

YES: Go to next step.

NO: Check 652W Blk wire and connections.

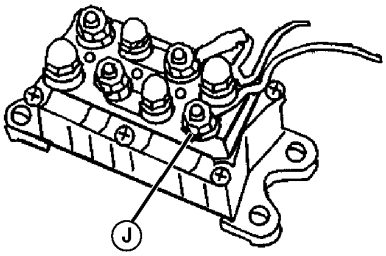
Continued on next page

OUMX258,0000A1E -19-14MAY15-17/29

Step 7	Is continuity to ground present at 657W Blk wire (I) of W-M1 winch motor?	**YES:** Repair or replace winch. **NO:** Check for continuity between 657W Blk wire and terminal H of W-K1 relay block. If OK, go to next step.

OUMX258,0000A1E -19-14MAY15-18/29

Step 8



MXAL31089 —UN—09JUL12

J— Terminal H

Is continuity to ground present at terminal H (J) of W-K1 relay block?

YES: End of test.

NO: Replace relay block.

OUMX258,0000A1E -19-14MAY15-19/29

Winch Reel-Out Operation:

Test Conditions

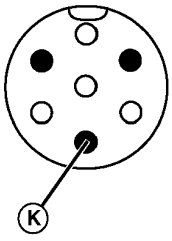
- Machine parked safely on a level surface with park brake locked.
- Key switch in on position, engine off.
- Battery fully charged.
- Machine power circuits working properly.
- Check wires and connections for looseness and corrosion.
- All optional accessories disconnected.
- Ensure winch clutch is engaged.
- Winch Reel-Out button depressed during each test step.
- Perform entire procedure in sequence.

OUMX258,0000A1E -19-14MAY15-20/29

Procedure

OUMX258,0000A1E -19-14MAY15-21/29

Step 1



MXAL31090 —UN—09JUL12

K—507W Blk Wire

Is battery voltage present at 507W Blk wire (K) of W-S1 remote switch, W-X3 connector?

YES: Go to next step.

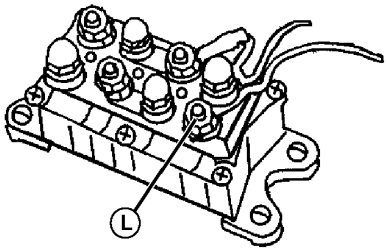
NO: Test remote switch..

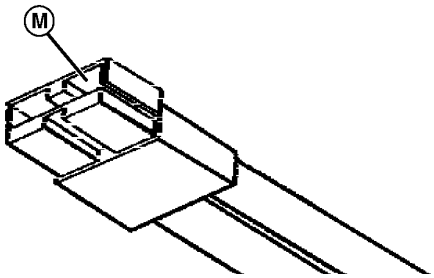
Continued on next page

OUMX258,0000A1E -19-14MAY15-22/29

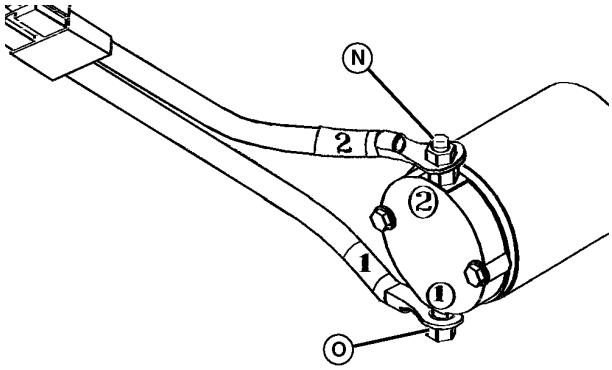
Step 2	Is battery voltage present at W-X5 bullet connector, 505W Blk wire?	**YES:** Go to next step. **NO:** Check 505W Blk wire and connections. OUMX258,0000A1E -19-14MAY15-23/29

Step 3	Is an audible click heard from the W-K1 relay block when the reel-out button is depressed?	**YES:** Go to next step. **NO:** Replace relay block. OUMX258,0000A1E -19-14MAY15-24/29

Step 4	 MXAL31091 —UN—09JUL12 **L—Terminal H** Is battery voltage present at terminal H (L) of W-K1 relay block?	**YES:** Go to next step. **NO:** Replace relay block. OUMX258,0000A1E -19-14MAY15-25/29

Step 5	 MXAL31092 —UN—09JUL12 **M—656W Blk wire (W-X6 rear connector)** Is battery voltage present at 655W Blk wire (W-X7 front connector) or 656W Blk wire (W-X6 rear connector) (M)? **Continued on next page**	**YES:** Go to next step. **NO:** Check 655W or 656W Blk wire and connections. OUMX258,0000A1E -19-14MAY15-26/29

Step 6



MXAL31093 —UN—09JUL12

N—657W Blk Wire
O—657W Blk Wire

Is battery voltage present at 657W Blk wire (O) at W-M1 winch motor?

YES: Go to next step.

NO: Check 657W Blk wire and connections.

OUMX258,0000A1E -19-14MAY15-27/29

Step 7

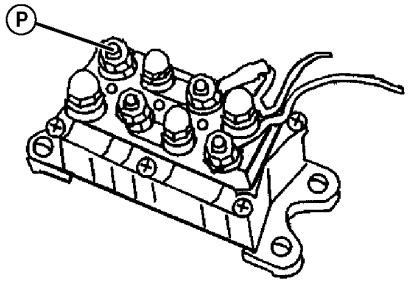
Is continuity to ground present at 657W Blk wire (N) of W-M1 winch motor?

YES: Repair or replace winch.

NO: Check for continuity between 652W Blk wire and terminal A of W-K1 relay block. If OK, go to next step.

OUMX258,0000A1E -19-14MAY15-28/29

Step 8



MXAL31094 —UN—09JUL12

P—Terminal A

Is continuity to ground present at terminal A (P) of W-K1 relay block?

YES: End of test.

NO: Replace relay block.

OUMX258,0000A1E -19-14MAY15-29/29

Summary of References

MX52301,000044B -19-08AUG14-1/1

Backup Alarm Kit Circuit Operation

Function:

To provide power and control for the backup warning alarm.

Operating Conditions:

- The backup alarm uses unswitched power. The key switch and other switches in any safe operating position.
- Machine transmission in REVERSE position (backup alarm switch in CLOSED position).

Theory of Operation:

Current flows from the G1 positive (+) battery terminal to the F4 fuse. The 204 red wire carries the unswitched power to the X17 optional attachments rear connector. .

The 211 Red wire carries power through the A-F1 fuse and to the A-S1 backup alarm switch, through connector A-X3. Power to the A-H1 backup alarm module is supplied from the switch (closed for circuit operation) through the 780 Blu wire, through connector A-X4.

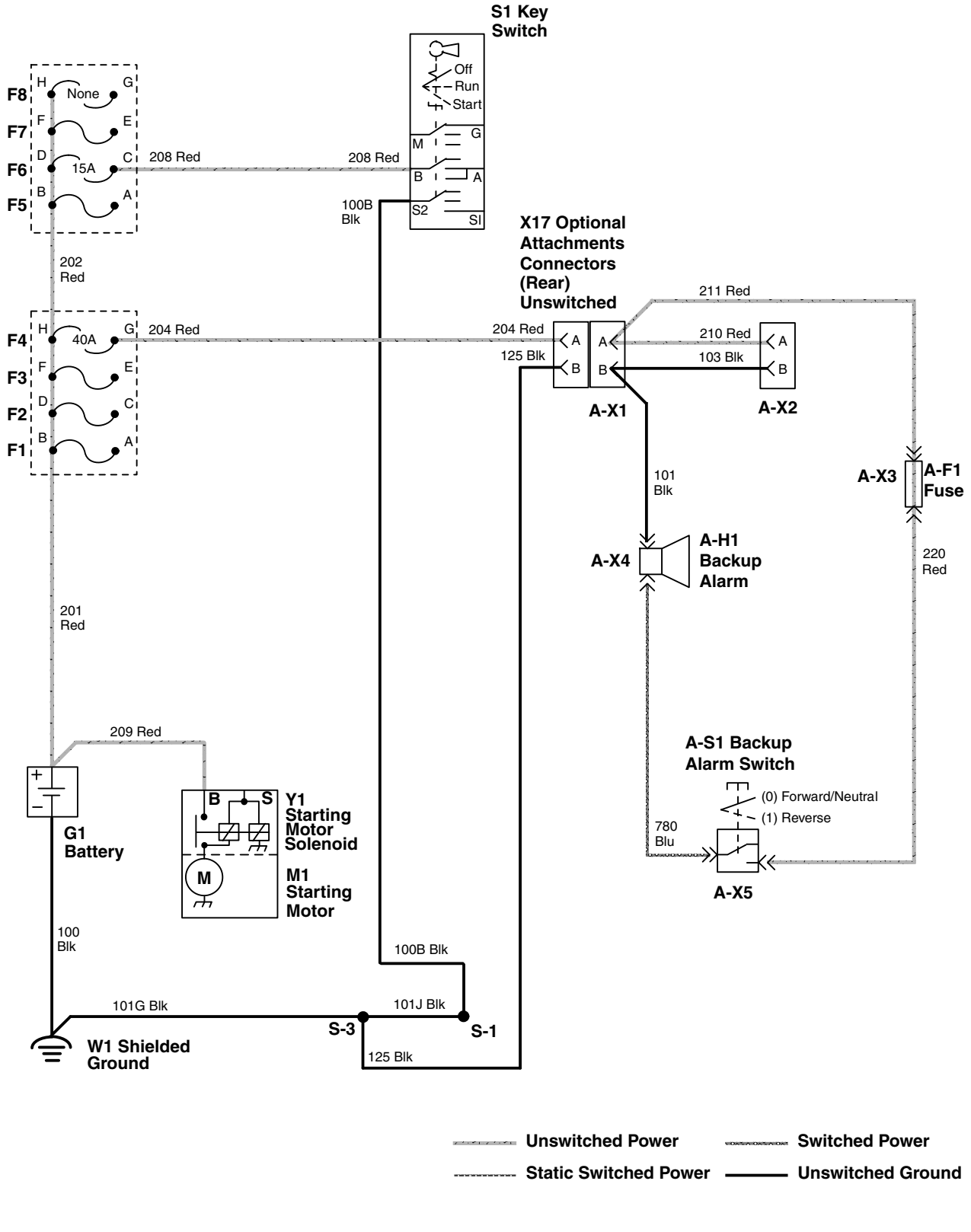
The 101 Blk wire provides a ground path to connector A-X1 which plugs into the W1 main wiring harness optional attachments connector X17. The path to ground is then completed through 125 and 101G Blk wires, and finally to the W1 ground.

The 210 Red and 103 Blk wires, which are spliced into the A-X1 connector and terminate at the A-X2 connector, provide a circuit for a power supply for other optional attachments.

The machine does not need to be running for the backup alarm to sound.

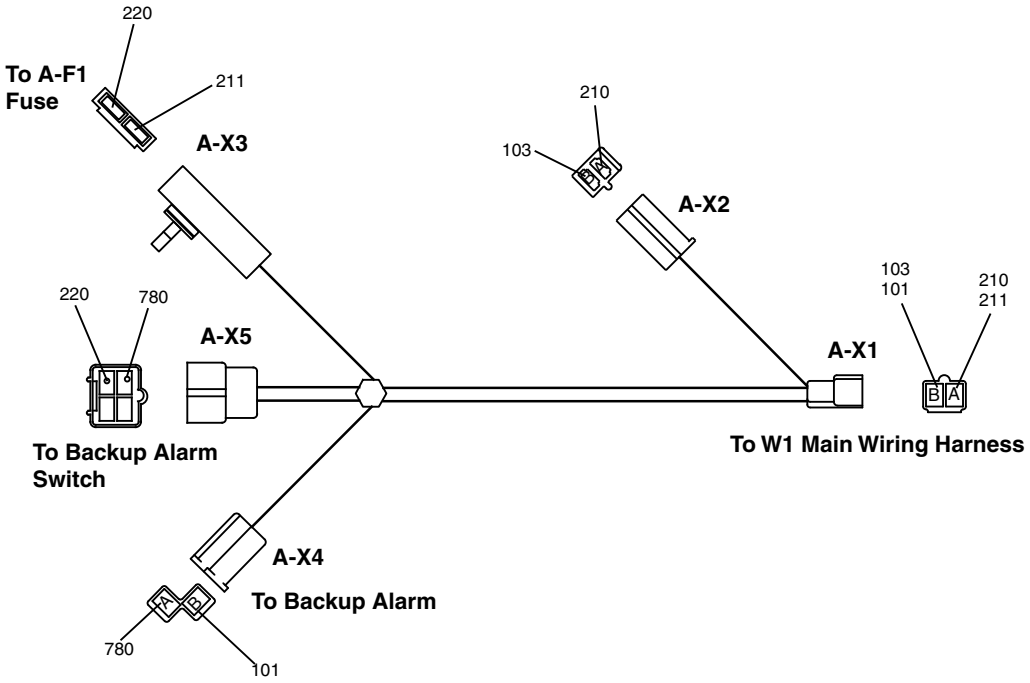
MX52301,00003FB -19-08JUL14-1/1

Backup Alarm Kit Circuit Schematic



MX52301,00003FC -19-20MAY14-1/1

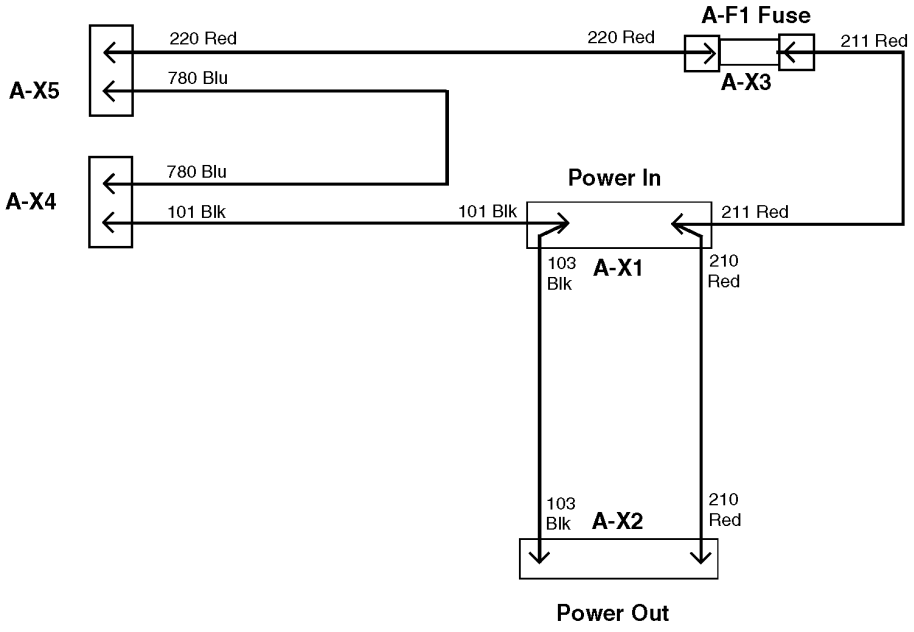
Backup Alarm Kit Wiring Harness



MXT012008 —UN—12JUN14

MX52301,00003FE -19-20MAY14-1/1

Backup Alarm Kit Schematic



MXAL31046 —UN—09JUL12

MX52301,00003FF -19-20MAY14-1/1

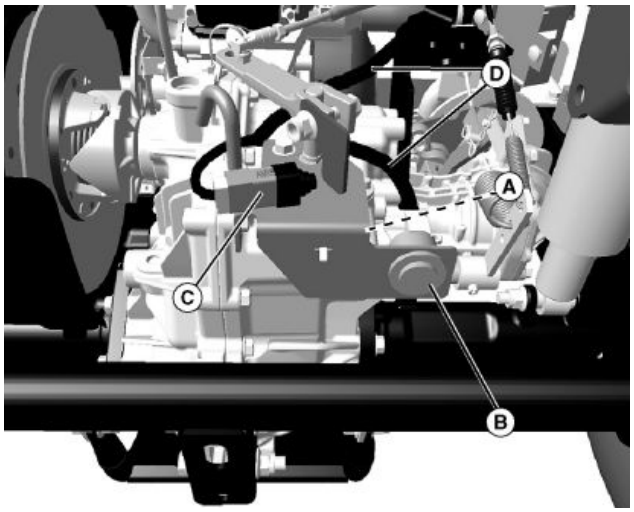
Backup Alarm Kit Wiring Color Codes

Size/No./Color	Wire Connection Points
1.0 101 Blk	A-X1, A-X4
3.0 103 Blk	A-X1, A-X2
3.0 210 Red	A-X1, A-X2
1.0 211 Red	A-X1, A-X3
1.0 220 Red	A-X3, A-X5
1.0 780 Blu	A-X5, A-X4

MX52301,0000400 -19-19MAY14-1/1

Backup Alarm Kit Circuit Component Location

A—A-F1 Backup Alarm Fuse
B—A-H1 Backup Alarm
C—A-S1 Backup Alarm Switch
D—A-X1 AH Backup Alarm Wiring Harness Connector



MXT012010 —UN—19JUN14

MX52301,0000401 -19-19MAY14-1/1

Backup Alarm Kit Circuit Diagnosis

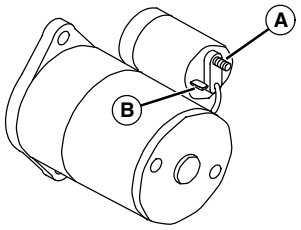
Backup Alarm Kit Diagnosis

MX52301,0000402 -19-22OCT14-1/8

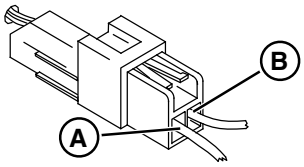
❶ Backup Alarm Circuit

Continued on next page

MX52301,0000402 -19-22OCT14-2/8

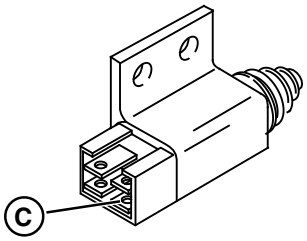
Starting Motor Solenoid	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Disconnect any other attachment option from the main wiring harness. • Battery fully charged. • Key switch in off position. • Transmission in reverse. • Check wire connections for looseness and corrosion. Is battery voltage present at the positive (+) battery terminal of the Y1 starting motor solenoid (A)?  MXT012011 —UN—25JUN14 **A—Positive (+) Terminal**	**YES:** Go to next step. **NO:** Check battery positive (+) cable and connections.

MX52301,0000402 -19-22OCT14-3/8

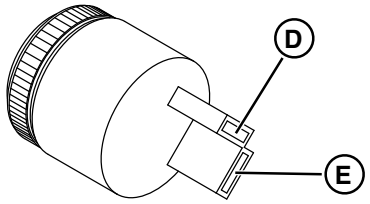
Optional Attachments Connector	Is battery voltage present at 204 Red wire of X17 optional attachments connector (B)?  MXT012012 —UN—25JUN14 **B—207 Red Wire**	**YES:** Go to next step. **NO:** Check 201 Red wire, F4 fuse, 204 Red wire, and connections.

Continued on next page

MX52301,0000402 -19-22OCT14-4/8

Backup Alarm Switch Connector	Is battery voltage present at A-X5 backup alarm switch connector, 220 Red wire (C)?  MXT012013 —UN—25JUN14 **C—220 Red Wire**	**YES:** Go to next step. **NO:** Check 211 Red wire, A-F1 fuse, 220 Red wire, and connections.

MX52301,0000402 -19-22OCT14-5/8

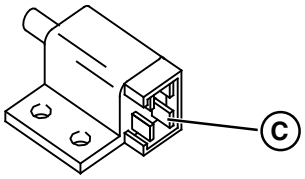
Backup Alarm Module	Is battery voltage present at A-X4 connector, 780 Blu wire of H4 backup alarm module connector (D)?  MXT012014 —UN—25JUN14 **D—780 Blue Wire** **E—101 Black Wire** **F—125 Black Wire**	**YES:** Go to next step. **NO:** Check 780 Blu wire. If OK, replace AS-1 backup alarm switch.

MX52301,0000402 -19-22OCT14-6/8

Backup Alarm Module	Is continuity to ground present at A-X4 connector, 101 Blk wire (E)?	**YES:** Replace A-H1 backup alarm. **NO:** Go to next step.

Continued on next page

MX52301,0000402 -19-22OCT14-7/8

Optional Attachments Connector	Is continuity to ground present at optional attachments connector X17, 125 Blk wire of the W1 main wiring harness (F)?  MXT012015 —UN—25JUN14 **F—125 Black Wire**	**NO:** Check 125, and 101G Blk wires and connections.

MX52301,0000402 -19-22OCT14-8/8

Summary of References

- Hydraulic Front Implement Lift Operation
- Hydraulic Front Implement Lift Circuit Schematic
- Hydraulic Front Implement Lift Wiring Harness
- Hydraulic Front Implement Lift Wiring Color Codes
- Hydraulic Front Implement Lift Circuit Diagnosis

MX52301,000044C -19-23JUN15-1/1

Hydraulic Front Implement Lift Operation

Function:

To activate and control the direction of current through the hydraulic motor and pump to lift and lower optional attachments mounted to the front of the machine.

Operating Conditions:

- Key switch in the RUN position.
- Lift/lower switch in either the LIFT or LOWER position.

Theory of Operation:

The hydraulic implement lift/lower circuit consists of a low current switched power control circuit and a high current unswitched power circuit. When the lift/lower control switch is held to the lift or lower position, it energizes the appropriate directional relay.

The motor ground circuit grounds through the other nonoperating relay to battery negative.

Switched Power Circuit:

Current flows from the G1 battery to the positive (+) terminal through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal and flows over the 420J and 420L Yel wires, X7 attachment connector, to the B-S1 lift/lower switch.

If an implement is being raised, battery current flows over the 680 Grn wire to the B-K2 lift relay. This activates the relay which is grounded by the 193, 195, 198, 100D, 101J, and 101G Blk wires.

If an implement is being lowered, battery current flows over the 685 Org wire to the B-K1 lower relay. This activates the relay which is grounded by the 194, 196, 198, 100D, 101J, and 101G Blk wires.

Unswitched Power Circuit:

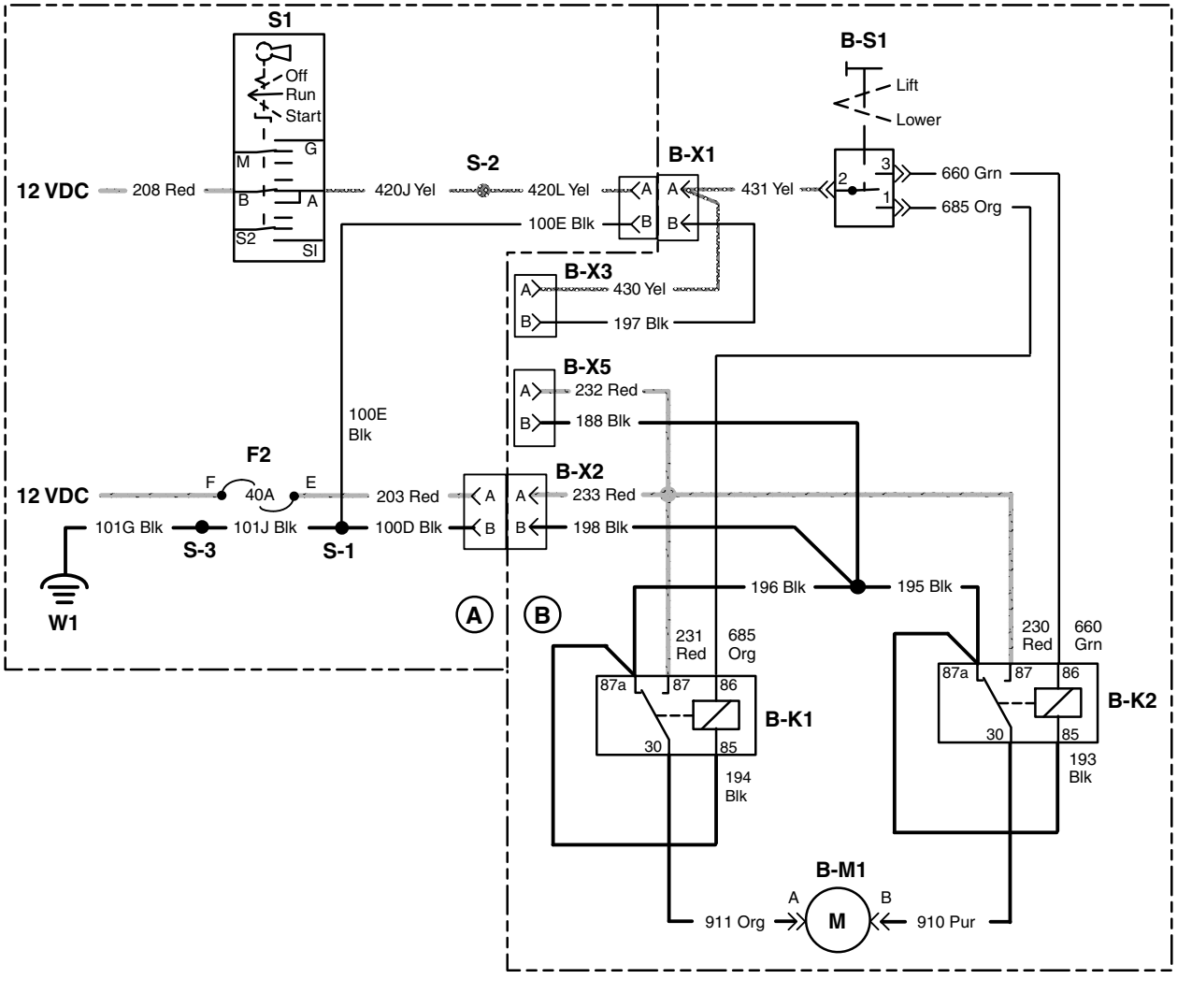
Current flows from the G1 battery to the positive (+) terminal through the 201 and 202 Red wires, F7 fuse, X14 attachment connector, to the 233, 232, 231, and 230 Red wires.

If an implement is being raised, current flows to the B-K2 lift relay from the 230 Red wire. The relay is activated by the switched circuit allowing the motor to be powered in the raise direction. The 910 Pur wire provides the high current necessary to activate the motor. A ground path to complete the circuit is provided through the 911 Org wire leading to the B-K1 lower relay and out to the 196, 198, 100D, 101J, and 101G Blk wires.

If an implement is being lowered, current flows to the B-K1 lower relay over the 231 Red wire. The relay is activated by the switched circuit allowing the motor to be powered in the lower direction. The 911 Org wire provides the high current necessary to activate the motor. A ground path to complete the circuit is provided through the 910 Pur wire leading to the B-K2 lift relay and out to the 195, 198, 100D, 101J, and 101G Blk wires.

MX52301,0000403 -19-20JUN14-1/1

Hydraulic Front Implement Lift Circuit Schematic



B-K1— Relay, Lower
B-K2— Relay, Lift
B-M1— Hydraulic Motor
B-S1— Lift-Lower Switch

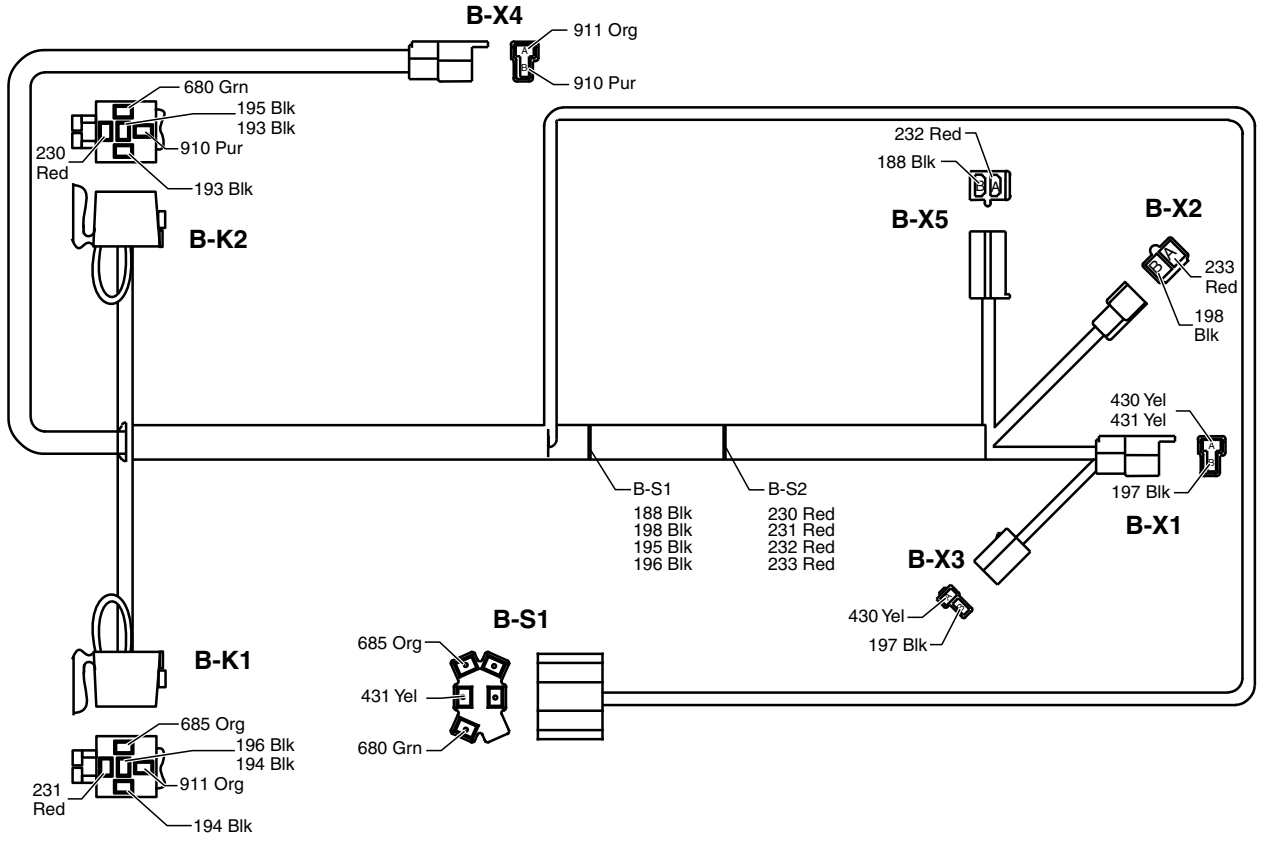
B-X1— Switched Power Connector, In
B-X2— Unswitched Power Connector, In
B-X3— Switched Power Connector, Out

B-X4— Hydraulic Motor Connector
B-X5— Unswitched Power Connector, Out
S1— Key Switch

A—Machine Main Schematic Components
B—Lift Kit Schematic

MX52301,0000404 -19-14MAY15-1/1

Hydraulic Front Implement Lift Wiring Harness



B-K1— Relay Connector, Lower
B-K2— Relay Connector, Lift
B-S1— Lift-Lower Switch Connector
B-X1— Switched Power Connector, In
B-X2— Unswitched Power Connector, In
B-X3— Switched Power Connector, Out
B-X4— Hydraulic Motor Connector
B-X5— Unswitched Power Connector, Out

MX52301,0000405 -19-14MAY15-1/1

Hydraulic Front Implement Lift Wiring Color Codes

Size/No ./Color	Wire Connection Points
3.0 188 Blk	Splice, B-X5
0.8 193 Blk	B-K2, B-K2
0.8 194 Blk	B-K1, B-K1
2.0 195 Blk	Splice, B-K2
2.0 196 Blk	Splice, B-K1
1.0 197 Blk	B-X1, B-X3
3.0 198 Blk	B-X2, Splice
2.0 230 Red	Splice, B-K2
2.0 231 Red	Splice, B-K1
3.0 232 Red	Splice, B-X5
3.0 233 Red	B-X2, Splice
1.0 430 Yel	B-X1, B-X3
1.0 431 Yel	B-X1, B-S1
1.0 680 Grn	B-S1, B-K2
1.0 685 Org	B-S1, B-K1
2.0 910 Pur	B-K2, B-X4
2.0 911 Org	B-K1, B-X4

MX52301,0000407 -19-10JUL14-1/1

Hydraulic Front Implement Lift Circuit Diagnosis

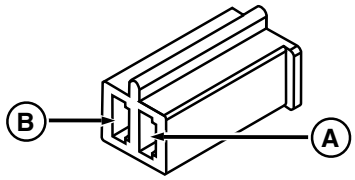
Hydraulic Front Implement Lift Diagnosis

MX52301,0000408 -19-22OCT14-1/18

❶ Hydraulic Front Implement Lift Circuit—Unswitched

Continued on next page

MX52301,0000408 -19-22OCT14-2/18

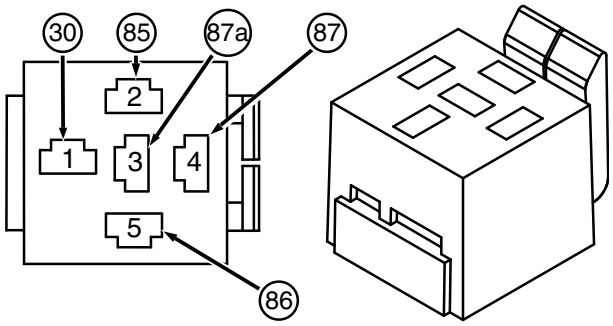
Front Connector	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Hood open and storage tray removed. • Disconnect any other attachment option from the main wiring harness. • Key switch in off position. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Disconnect X14 connector from hydraulic front implement lift wiring harness. Is battery voltage present at pin A of X14 front optional attachments connector, 203 Red wire (A)?  MXT012019—UN—25JUN14 **A—203 Red Wire** **B—100D Black Wire**	**YES:** Go to next step. **NO:** Test F7 fuse. Check 203 Red wire. See Power Circuit Operation, Gas (SN -040000) or See Power Circuit Operation, Gas (SN 040001-) or Power Circuit Operation, Diesel (SN -080000).

MX52301,0000408 -19-22OCT14-3/18

Front Connector	Is continuity to ground present at pin B of X14 front optional attachments connector, 100D Blk wire (B)?	**YES:** Connect X14 connector to hydraulic front implement lift wiring harness. Go to next step. **NO:** Check 100D, 101J, and 101G Blk wires and connections.

Continued on next page

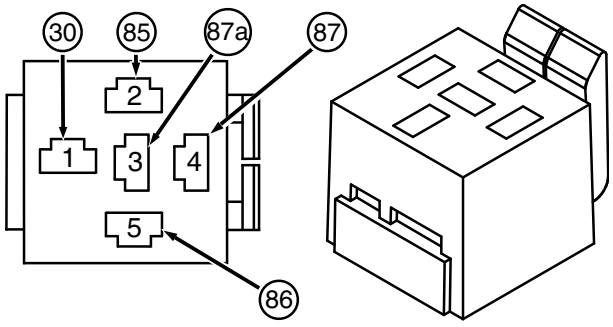
MX52301,0000408 -19-22OCT14-4/18

Lower Relay Power	Remove B-K1 lower relay. Is battery voltage present at terminal 4 (87) of relay connector, 231 Red wire?  MXT011889 —UN—09JUL14 **4 (87)—231 Red Wire** **2 (85)—194 Black Wire**	**YES:** Go to next step. **NO:** Check 231 and 233 Red wires.

MX52301,0000408 -19-22OCT14-5/18

Lower Relay Ground	Is continuity to ground present at terminal 2 (85) of relay connector, 194 Blk wire?	**YES:** Install relay. Go to next step. **NO:** Check 194, 196, and 198 Blk wires.

MX52301,0000408 -19-22OCT14-6/18

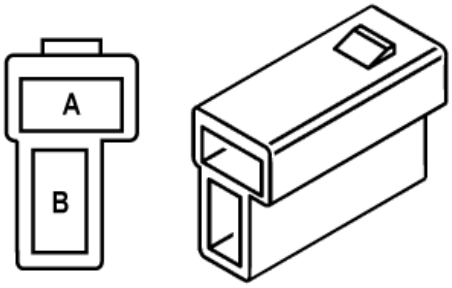
Lift Relay Power	Remove B-K2 lift relay. Is battery voltage present at terminal 4 (87) of relay connector, 230 Red wire?  MXT011889 —UN—09JUL14 **4 (87)—230 Red Wire** **2 (85) —193 Black Wire**	**YES:** Go to next step. **NO:** Check 230 and 233 Red wires.

MX52301,0000408 -19-22OCT14-7/18

Lift Relay Ground	Is continuity to ground present at terminal 2 (85) of relay connector, 193 Blk wire?	**YES:** Install relay. Go to next step. **NO:** Check 193, 195, and 198 Blk wires.

Continued on next page

MX52301,0000408 -19-22OCT14-8/18

Motor Connector Ground	Disconnect B-X4 connector from B-M1 motor. Is continuity to ground present at terminal A of B-X4 connector, 911 Org wire (A)?  MXT001682 —UN—12MAY17 **A—911 Orange Wire** **B—910 Purple Wire**	**YES:** Go to next step **NO:** Test B-K1 lower relay. See Relay Test

MX52301,0000408 -19-22OCT14-9/18

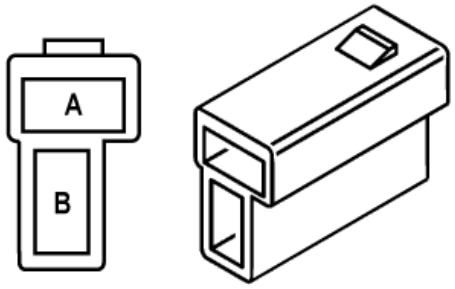
Ground Continuity	Is continuity to ground present at terminal B of B-X4 connector, 910 Pur wire (B)?	**YES:** Connect B-X4 connector to B-M1 motor. Go to next step. **NO:** Test B-K2 lift relay. See Relay Test

MX52301,0000408 -19-22OCT14-10/18

❶ Hydraulic Front Implement Lift Circuit—Switched

Continued on next page

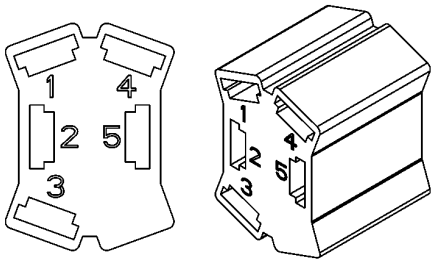
MX52301,0000408 -19-22OCT14-11/18

Front Connector Power	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Check wire connections for looseness and corrosion. Disconnect X7 connector from hydraulic front implement lift wiring harness. Is battery voltage present at pin A of X7 front optional attachments connector, 420L Yel wire (A)?  MXT001682 —UN—12MAY17 **A—420L Yellow Wire** **B—100E Black Wire**	**YES:** Go to next step. **NO:** Check 420J and 420L Yel wires, and connections.

MX52301,0000408 -19-22OCT14-12/18

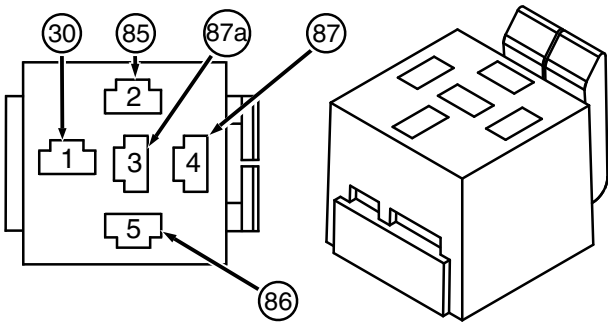
Front Connector Ground	Is continuity to ground present at pin B of X7 front optional attachments connector, 100E Blk wire (B)?	**YES:** Connect X7 connector to hydraulic front implement lift wiring harness. Go to next step. **NO:** 100E, 101J, and 101G Blk wires and connections.

MX52301,0000408 -19-22OCT14-13/18

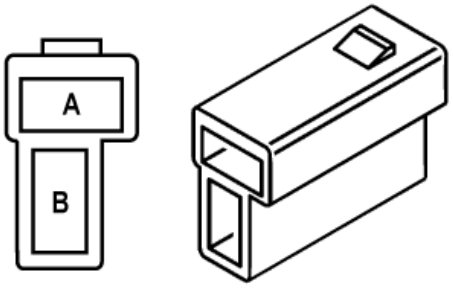
Switch Voltage	Disconnect B-S1 lift and lower switch. Is battery voltage present at pin 2 of switch connector, 431 Yel wire (2)?  MXT001666 —UN—10OCT11 **2—431 Yellow Wire**	**YES:** Connect switch. Go to next step. **NO:** Check 431 Yel wire and connections.

Continued on next page

MX52301,0000408 -19-22OCT14-14/18

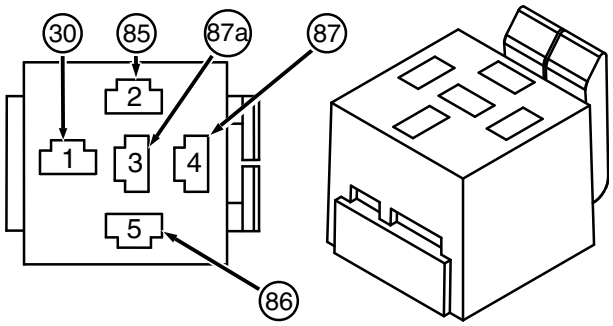
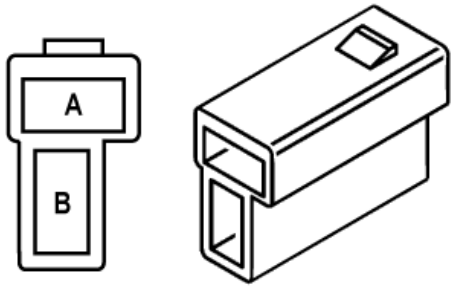
Switch Voltage	Remove B-K1 lower relay. Toggle B-S1 lift and lower switch to the lower position. Is battery voltage present at terminal 5 (86) of relay connector, 685 Org wire?  MXT011889 —UN—09JUL14 **5 (86)—685 Orange Wire**	**YES:** Install relay. Go to next step. **NO:** Check 685 Org wire and connections. If OK, replace lift and lower switch.

MX52301,0000408 -19-22OCT14-15/18

Motor Connector Voltage	Disconnect B-X4 connector from B-M1 motor. Toggle B-S1 lift and lower switch to the lower position. Is battery voltage present at terminal A of B-X4 connector, 911 Org wire (A)?  MXT001682 —UN—12MAY17 **A—911 Orange Wire**	**YES:** Replace hydraulic pump motor. Go to next step. **NO:** Test B-K1 lower relay. See Relay Test .

Continued on next page

MX52301,0000408 -19-22OCT14-16/18

Switch Voltage	Remove B-K2 lift relay. Toggle B-S1 lift and lower switch to the lift position. Is battery voltage present at terminal 5 (86) of relay connector, 680 Grn wire?  MXT011889 —UN—09JUL14 **5 (86)—680 Green Wire**	**YES:** Install relay. Go to next step. **NO:** Check 680 Grn wire and connections. If OK, replace lift and lower switch
		MX52301,0000408 -19-22OCT14-17/18
Motor Connector Voltage	Disconnect B-X4 connector from B-M1 motor. Toggle B-S1 lift and lower switch to the lower position. Is battery voltage present at terminal B of B-X4 connector, 910 Pur wire (B)?  MXT001682 —UN—12MAY17 **B—910 Purple Wire**	**YES:** Replace hydraulic pump motor. Go to next step. **NO:** Test B-K2 lift relay. See Relay Test .
		MX52301,0000408 -19-22OCT14-18/18

Summary of References

- Electrical Specifications
- Cab Canopy Electrical Operation
- Windshield Wiper Schematic
- Lights Schematics
- Cab Canopy Circuit Diagnosis
- Relay Test—Cab Power
- Cargo Box Lift Circuit Operation
- Cargo Box Lift Circuit Schematic
- Cargo Box Lift Wiring Harness
- Cargo Box Lift Schematic
- Cargo Box Lift Kit Wire Color Codes
- Cargo Box Lift Circuit Operation Diesel (SN 080001-)
- Cargo Box Lift Circuit Schematic Diesel (SN 080001-)
- Cargo Box Lift Wiring Harness Diesel (SN 080001-)
- Cargo Box Lift Harness Schematic Diesel (SN 080001-)
- Cargo Box Lift Kit Wire Color Codes Diesel (SN 080001-)

MX52301,000044D -19-22OCT14-1/1

Electrical Specifications

Item	Measurement	Specification
Fuses		
Cab Canopy Power Relay Fuse	Amperage	30 amp
Windshield Wiper	Amperage	7.5 amp
Front Work Lights	Amperage	10 amp
Rear Work Light	Amperage	5 amp
Beacon Light	Amperage	5 amp

MX52301,0000409 -19-08JUL14-1/1

Cab Canopy Electrical Operation

Function:

To activate and control the electrical circuits of kits installed in the machine cab.

Operating Conditions:

- Key switch in the RUN position
- Component switches in the ON position

Theory of Operation:

The power circuit for all of the cab kit components are run through a canopy power wiring harness. When the canopy power wiring harness is installed power is provided to the cab canopy by a two wire power and ground wire harness. The harness is energized only while the key switch is in the RUN position.

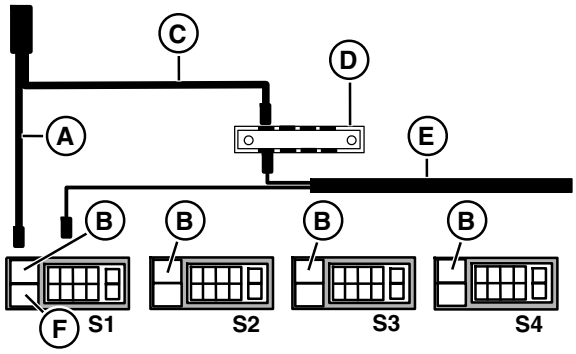
Switched power in the main machine wiring harness controls a relay coil. The relay provides switched battery power to the cab canopy. A common ground terminal in the cab canopy provides a return ground for all of the kits installed in the cab to the battery negative post.

Switched Power Circuit:

Current flows from the G1 battery to the positive (+) terminal through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal and flows over the 420J and 420F Yel wires in the machine main wiring harness to the X8 mid-frame switched power connector.

In the cab canopy power wiring harness current is provided from the main wiring harness to the cab canopy through a red wire, 30 amp fuse, K1 relay contacts, and the wiring harness.

In the cab canopy, the 12 VDC wiring harness Red wire (A) is plugged into a fuse connector (B) of whichever kit switch is installed.



MXT012027 —UN—02JUL14

A—Red Wire
B—Fuse Connector
C—Brown Ground Wire
D—Common Ground Strip
E—Wiring harness
F—Fuse

The cab canopy wiring harness Brn ground wire (C) is connected to a common ground strip (D).

As kit switches are added to the cab, jumper wires are installed from the 12VDC side of the switch fuse to the next switch fuse.

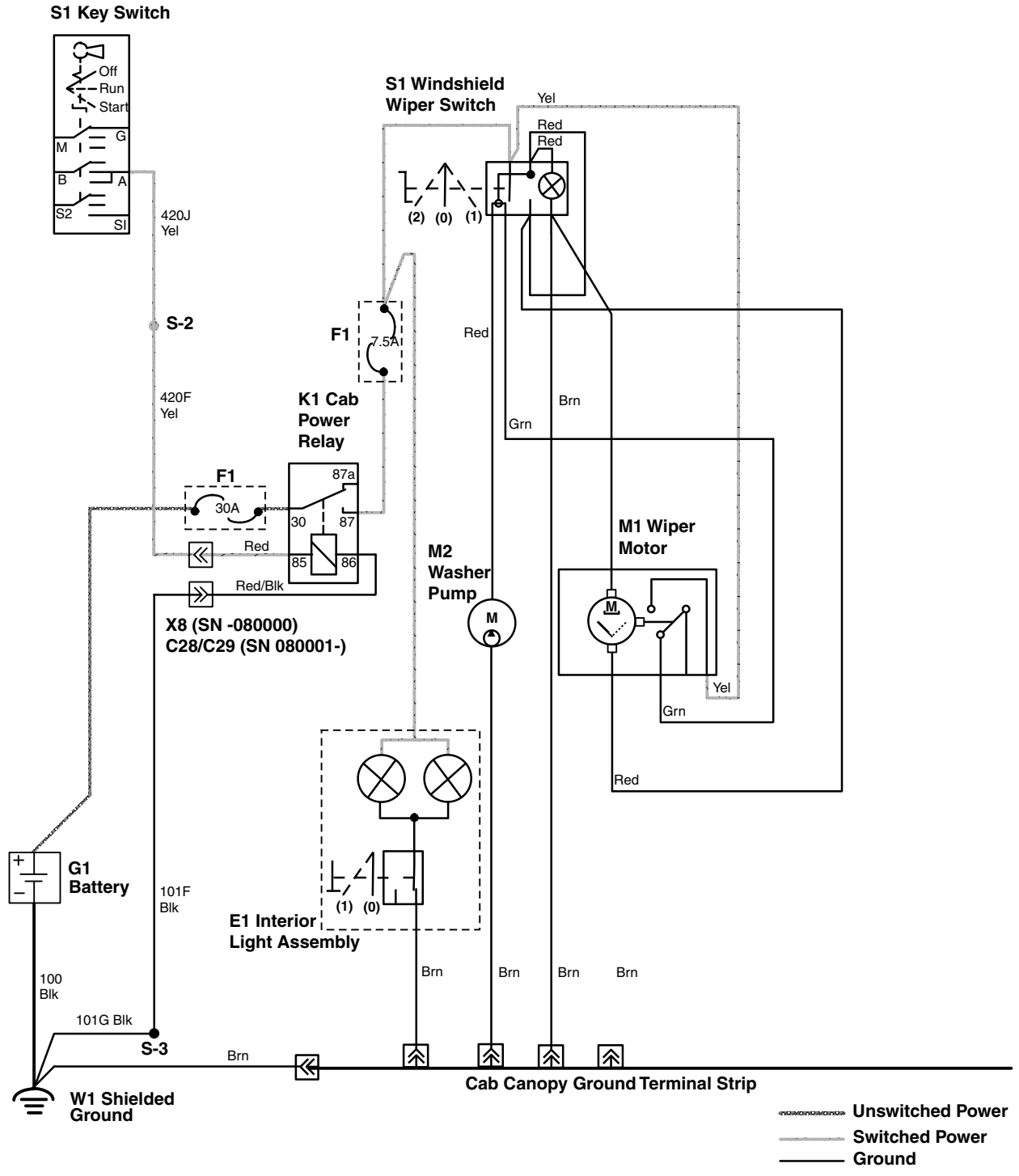
The wiring harness (E) from the kit load device is connected to the opposite side of the fuse (F) and to the common ground strip (D).

The kit load devices are controlled by the switches provided with them.

The cab interior light has a built-in switch and is not provided with a fuse. It is normally powered through one of the other kit fuses. If the cab interior light is installed without one of the other kits, an in-line fuse should be installed.

MX52301,000040A -19-20JUN14-1/1

Windshield Wiper Schematic

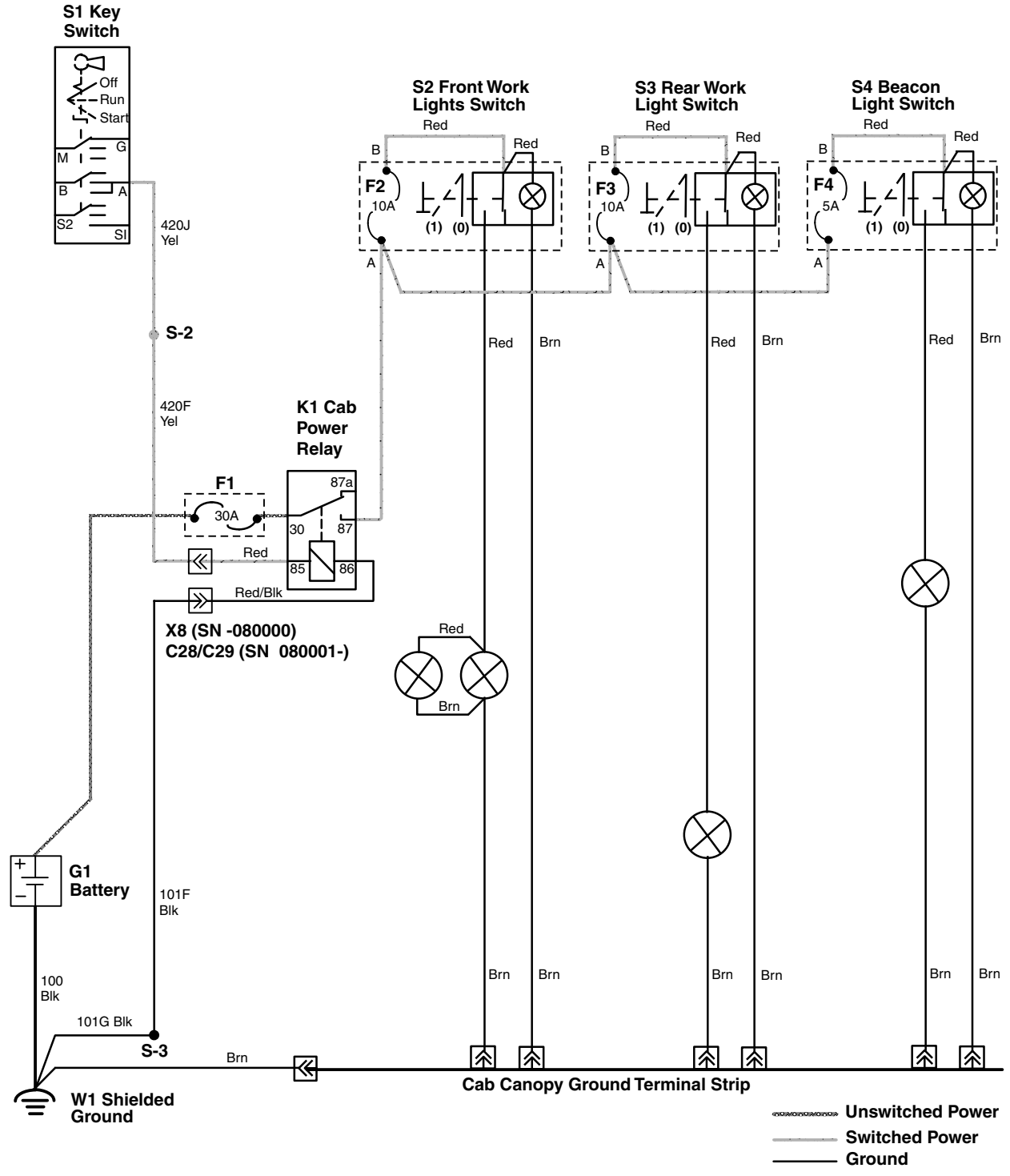


Main Wiring Harness	Cab Canopy Power	Lights Wiring Harnesses

MXT012698 —UN—27OCT14

MX52301,000040B -19-13OCT14-1/1

Lights Schematics



Main Wiring Harness	Cab Canopy Power	Lights Wiring Harnesses

MX52301,000040C -19-19MAY14-1/1

Cab Canopy Circuit Diagnosis

Cab Canopy Diagnosis

MX52301,000040D -19-22OCT14-1/8

❶ Battery Circuit

MX52301,000040D -19-22OCT14-2/8

Fuse and Switch

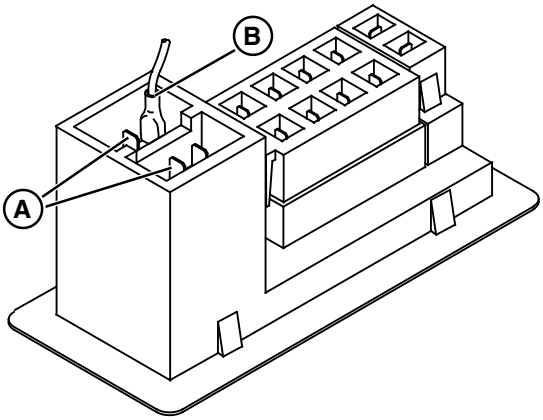
Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at both sides of the fuse (A)?

MXT012029 —UN—25JUN14



MXT011973 —UN—25JUN14

A—Fuse
B—Red Wire

YES: Go to next step.

NO: If battery voltage is present at both sides of the fuse, check continuity of ground circuit from cab canopy common terminal strip to battery negative post.

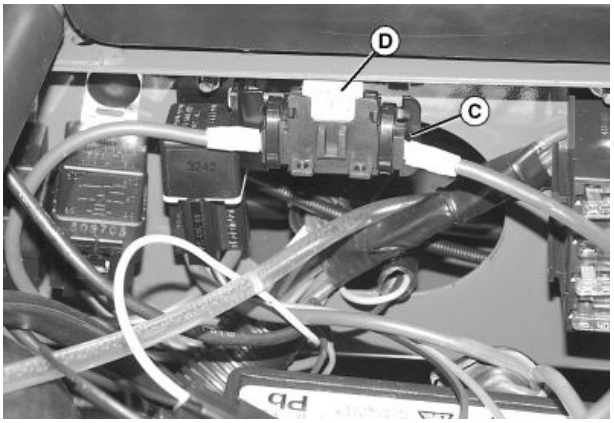
NO: Check that key switch is in ON position. Test fuse. Check Red wire (B) and connections to main fuse. See next step.

Continued on next page

MX52301,000040D -19-22OCT14-3/8

Fuse Terminal

Is battery voltage present at the terminal of F1 fuse?



MXT012030 —UN—25NOV14
C—F1 Fuse
D—F1 Fuse

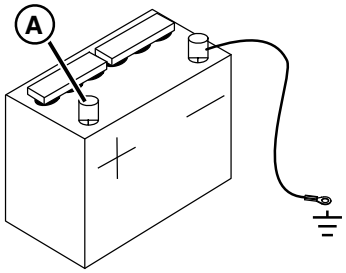
YES: Go to next step.

NO: Test F1 fuse (D). Test relay positive (+) battery cable. See Relay Test—Cab Power.

MX52301,000040D -19-22OCT14-4/8

Battery

Is 12.4 V or above present at battery positive terminal (A)?



MXT011883 —UN—04JUN14
A—Positive Terminal

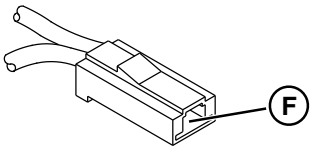
YES: Go to next step.

NO: Test battery.

MX52301,000040D -19-22OCT14-5/8

Optional Attachments Connector

Is battery voltage present at machine main wiring harness X8 mid-frame optional attachments connector, 420F Yel wire (F)?



MXT012031 —UN—25NOV14
F—420F Yellow Wire

YES: Go to next step.

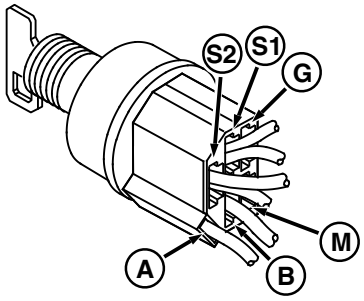
NO: Check that key switch is in ON position. Go to next

Continued on next page

MX52301,000040D -19-22OCT14-6/8

Fuse	Is battery voltage present at both sides of fuse (F6)?	**YES:** Go to next step. **NO:** Check F6 fuse, 201 Red wire, and 202 Red wire (behind fuse blocks).

MX52301,000040D -19-22OCT14-7/8

Key Switch	Is battery voltage present at the switch connector 208 Red wire (B) and 420J Yel wire (A)?  MXT004463 —UN—31MAY12 **A—420J Yellow Wire** **B—208 Red Wire**	**YES:** Connect switch. Go to next step. **NO:** Test battery and positive (+) battery cable. Check 201 and 202 Red wires and connections. Check 208 Red wire and connections. Test key switch. **NO:** Test key switch. See Key Switch Test.

MX52301,000040D -19-22OCT14-8/8

Relay Test—Cab Power

Function:

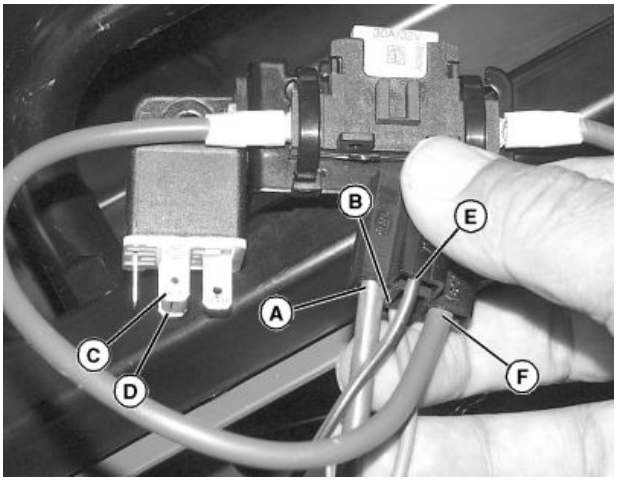
To check relay terminal continuity in the energized and de-energized condition.

Operating Conditions:

- Ohmmeter or multimeter

Procedure

1. Machine parked safely. See the “Safety Section”.
2. Disconnect relay from relay/fuse housing
3. Check for battery voltage at battery cable (A).
4. With machine key switch in ON position, check for battery voltage at Red/Blk wire (B).
   - If battery voltage: Go to next step.
   - If no battery voltage: Check machine F6 fuse. Ensure that key switch is in ON position. Refer to power circuit diagnosis in Technical Manual.



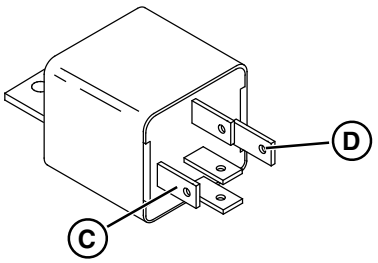
MXT012034 —UN—25NOV14

A—Battery Cable
B—Red/Black Wire
C—Terminal 85
D—Terminal 86
E—Brown Wire
F—Terminal

Continued on next page

MX52301,000043C -19-22OCT14-1/2

5. Disconnect relay and check relay terminal continuity using an ohmmeter or multimeter
   - There should be continuity between terminals (C [85]) and (D [86]) with approximately 80 ohms resistance through the relay coil.
   - There should be continuity between Brn wire (E) and battery negative.
6. Connect relay to wiring harness.
   - With machine key switch in ON position, there should be battery voltage at terminal (F).
7. If any voltage and continuity checks are incorrect, replace the relay.



MXT012035 —UN—25NOV14

C—Terminal 85 **D—Terminal 86**

MX52301,000043C -19-22OCT14-2/2

Cargo Box Lift Circuit Operation

Function:

To activate and control the direction of current through the hydraulic motor and pump to lift and lower the cargo box.

Operating Conditions:

- Key switch in the RUN position
- Lift/lower switch in either the LIFT or LOWER position.

Theory of Operation:

The cargo box lift/lower circuit consists of a low current switched power control circuit and a high current unswitched power circuit. When the lift/lower control switch is held to the lift or lower position, it energizes the appropriate directional relay.

The motor ground circuit grounds through the other nonoperating relay to battery negative.

Switched Power Circuit:

Current flows from the G1 battery to the positive (+) terminal through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal and flows over the 420J and 420H Yel wires, X9 connector, to the S5 cargo box control switch.

If the cargo box is being raised, battery current flows over the 670 Org wire, X10 connector, and 671 Org wire to the L-K1 lift relay. This activates the relay which is grounded by the 180, 161, 163, 125, and 101G Blk wires.

If the cargo box is being lowered, battery current flows over the 675 Grn wire, X10 connector, and 676 Grn wire to the L-K2 lower relay. This activates the relay which is grounded by the 185, 160, 163, 125, and 101G Blk wires.

Unswitched Power Circuit:

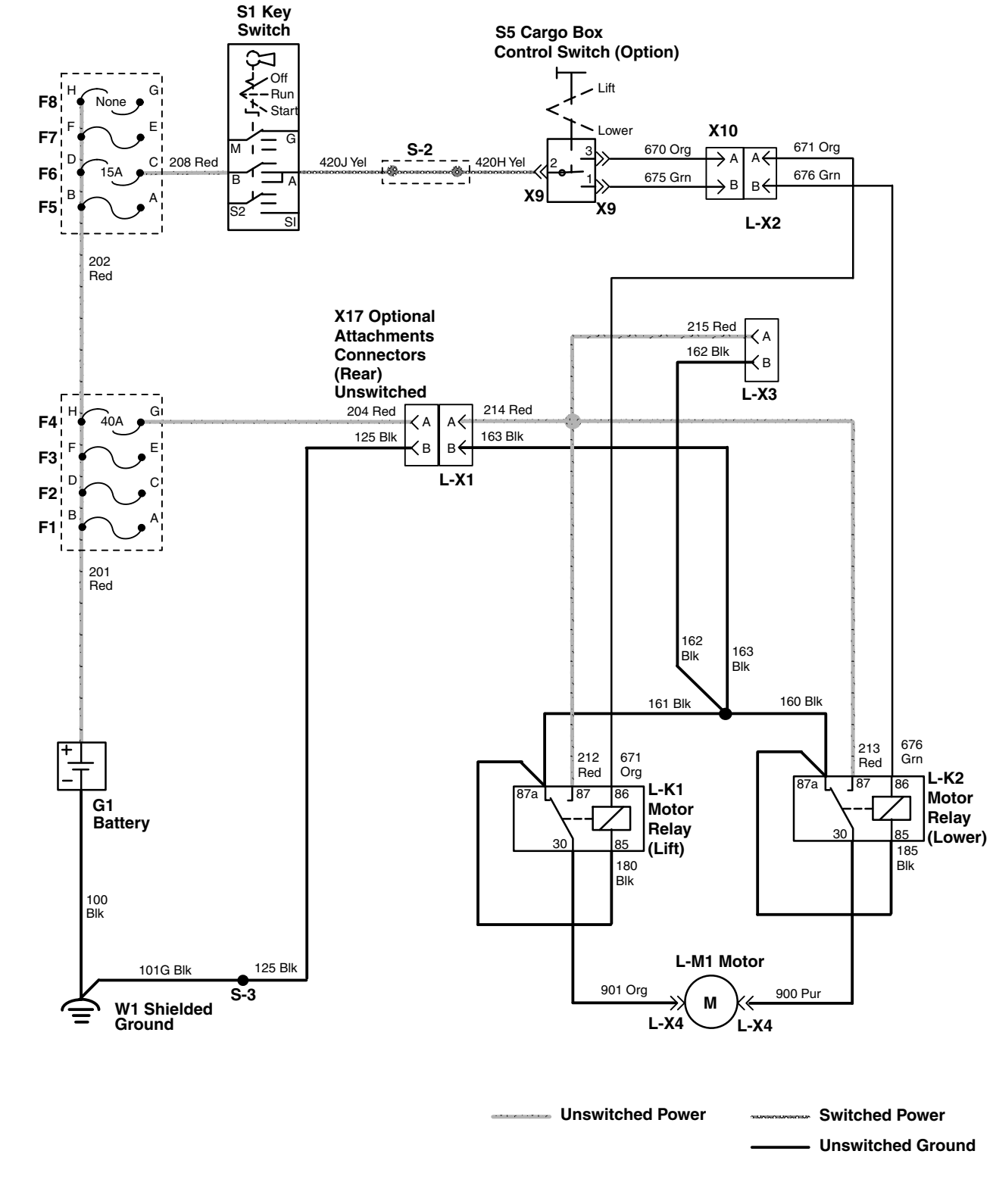
Current flows from the G1 battery to the positive (+) terminal through the 201 Red wire, F4 fuse, X17 attachment connector, to the 214, 213, 212, and 215 Red wires.

If the cargo box is being raised, current flows to the L-K1 lift relay from the 212 Red wire. The relay is activated by the switched circuit allowing the motor to be powered in the raise direction. The 901 Org wire provides the high current necessary to activate the motor. A ground path to complete the circuit is provided through the 900 Pur wire leading to the L-K2 lower relay and out to the 160, 163, 125, and 101G Blk wires.

If an implement is being lowered, current flows to the L-K2 lower relay from the 213 Red wire. The relay is activated by the switched circuit allowing the motor to be powered in the raise direction. The 900 Pur wire provides the high current necessary to activate the motor. A ground path to complete the circuit is provided through the 901 Org wire leading to the L-K1 lift relay and out to the 161, 163, 125, and 101G Blk wires.

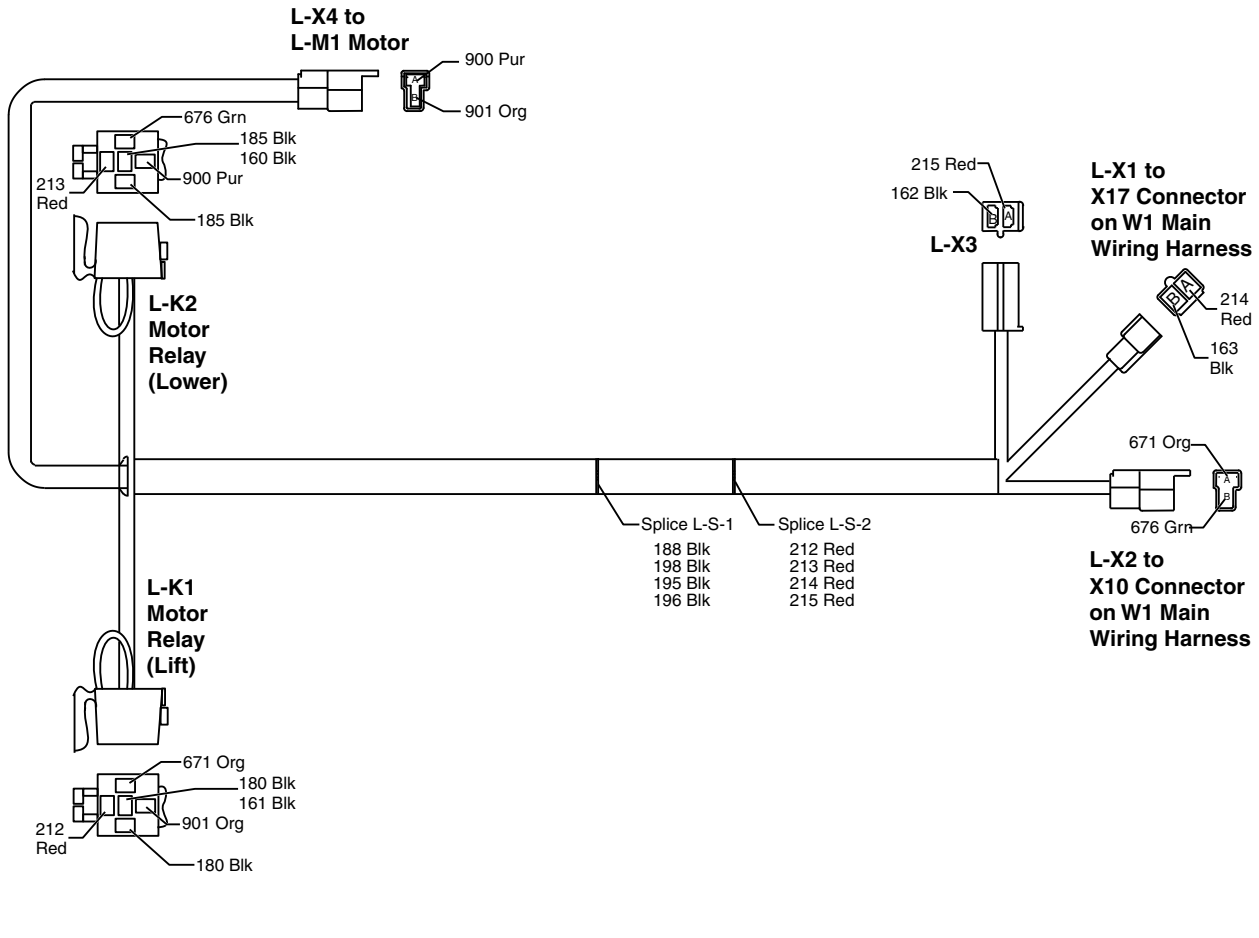
MX52301,000040E -19-20MAY14-1/1

Cargo Box Lift Circuit Schematic



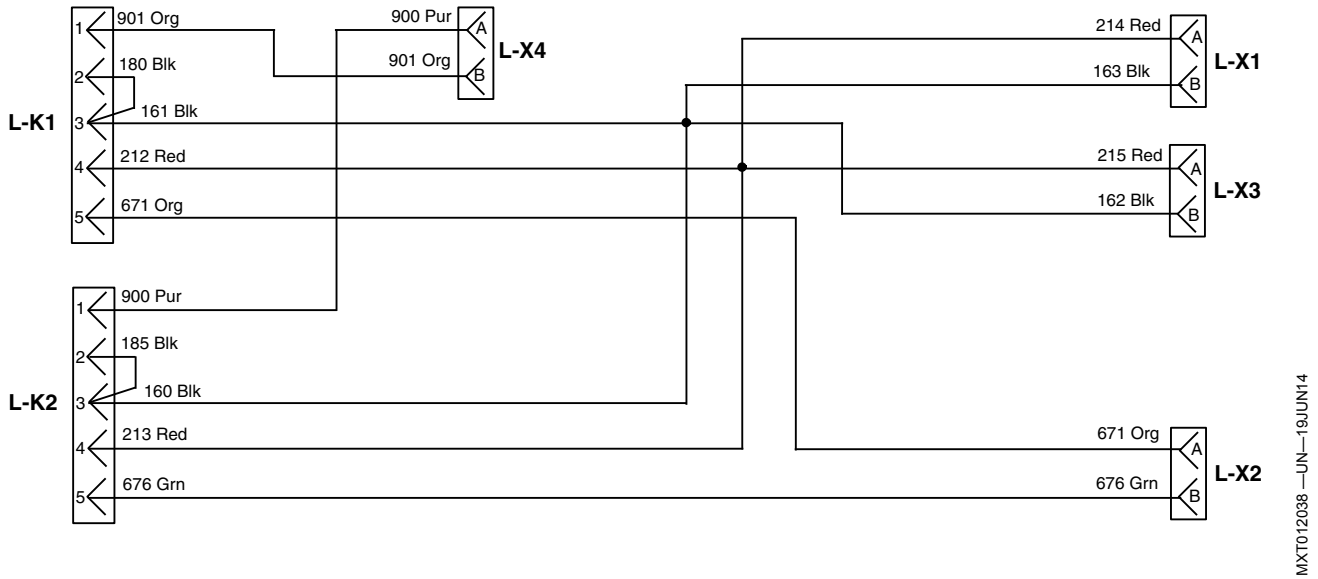
MX52301,000040F -19-20MAY14-1/1

Cargo Box Lift Wiring Harness



MX52301,0000410 -19-19MAY14-1/1

Cargo Box Lift Schematic



MX52301,0000411 -19-20MAY14-1/1

Cargo Box Lift Kit Wire Color Codes

Size/No ./Color	Wire Connection Points
2.0 160 Blk	Splice, L-K2
2.0 161 Blk	Splice, L-K1
3.0 162 Blk	Splice, L-X6
3.0 163 Blk	L-X1, Splice
0.8 180 Blk	L-K1, L-K1
0.8 185 Blk	L-K2, L-K2
2.0 212 Red	Splice, L-K1
2.0 213 Red	Splice, L-K2
3.0 214 Red	L-X1, Splice
3.0 215 Red	Splice, L-X3
1.0 671 Org	L-X2, L-K1
1.0 676 Grn	L-X2, L-K2
2.0 900 Pur	L-X4, L-K2
2.0 901 Org	L-X4, L-K1

MX52301,0000412 -19-19MAY14-1/1

Cargo Box Lift Circuit Diagnosis

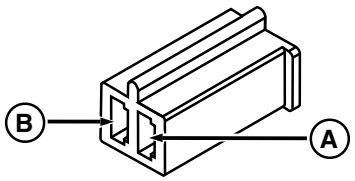
Cargo Box Lift Circuit Diagnosis

MX52301,0000413 -19-22OCT14-1/16

❶ Cargo Box Lift Circuit—Unswitched

Continued on next page

MX52301,0000413 -19-22OCT14-2/16

Connector Voltage	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Disconnect any other attachment option from the main wiring harness. • Battery fully charged. • Key switch in off position. • Check wire connections for looseness and corrosion. Disconnect X17 connector from cargo box lift wiring harness. Is battery voltage present at pin A of X17 rear optional attachments connector, 204 Red wire (A)?  MXT012019 —UN—25JUN14 **A—204 Red Wire** **B—125 Black Wire**	**YES:** Go to next step. **NO:** Test F4 fuse. Check 204 Red wire. See Power Circuit Operation, Gas (SN -040000) or See Power Circuit Operation, Gas (SN 040001-) or Power Circuit Operation, Diesel (SN -080000).

MX52301,0000413 -19-22OCT14-3/16

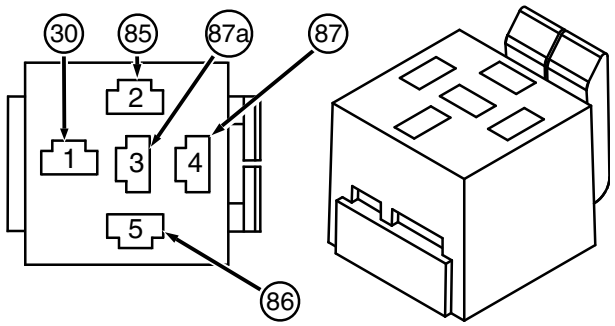
Connector Ground Presence	Is continuity to ground present at pin B of X17 rear optional attachments connector, 125 Blk wire (B)?	**YES:** Connect X17 connector to cargo box lift wiring harness. Go to next step. **NO:** Check 125 (B) and 101G Blk wires and connections.

Continued on next page

MX52301,0000413 -19-22OCT14-4/16

Relay Voltage

Remove L-K1 lift relay. Is battery voltage present at terminal 4 (87) of relay connector, 212 Red wire?



MXT011889 —UN—09JUL14

4 (87)—212 Red Wire
2 (85)—180 Black Wire

YES: Go to next step.

NO: Check 212 and 214 Red wires.

MX52301,0000413 -19-22OCT14-5/16

Relay Ground

Is continuity to ground present at terminal 2 (85) of relay connector, 180 Blk wire?

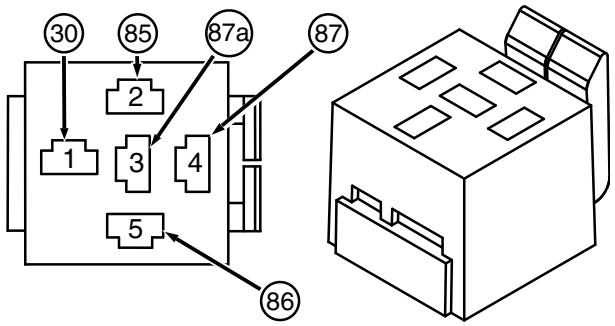
YES: Install relay. Go to next step.

NO: Check 180, 161, and 163 Blk wires.

MX52301,0000413 -19-22OCT14-6/16

Lower Relay Voltage

Remove L-K2 lower relay. Is battery voltage present at terminal 4 (87) of relay connector, 213 Red wire?



MXT011889 —UN—09JUL14

4 (87)—213 Red Wire
2 (85)—185 Black Wire

YES: Go to next step.

NO: Check 213 and 214 Red wires.

MX52301,0000413 -19-22OCT14-7/16

Lower Relay Ground

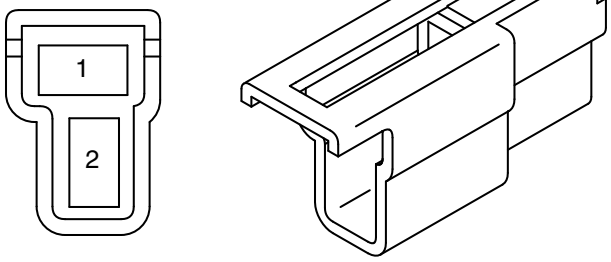
Is continuity to ground present at terminal 2 (85) of relay connector, 185 Blk wire?

YES: Install relay. Go to next step.

NO: Check 185, 160, and 163 Blk wires.

Continued on next page

MX52301,0000413 -19-22OCT14-8/16

Motor Connector Ground	Disconnect L-X4 connector from L-M1 motor. Is continuity to ground present at terminal A of L-X4 connector, 900 Pur wire (A)?  RXA0085865 —UN—17JAN06 **A—900 Purple Wire** **B—901 Orange Wire**	**YES:** Go to next step. **NO:** Test L-K1 lower relay. See Relay Test . Check 671Org wire.

MX52301,0000413 -19-22OCT14-9/16

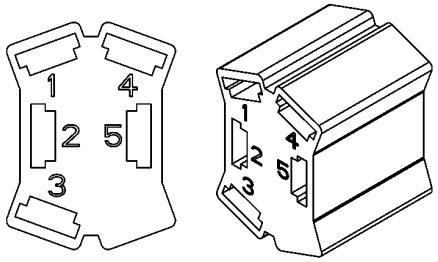
Motor Connector Ground	Is continuity to ground present at terminal B of L-X4 connector, 901 Org wire (B)?	**YES:** Connect L-X4 connector to L-M1 motor. Go to next step. **NO:** Test L-K2 lift relay. See Relay Test . Check 901 Org wire

MX52301,0000413 -19-22OCT14-10/16

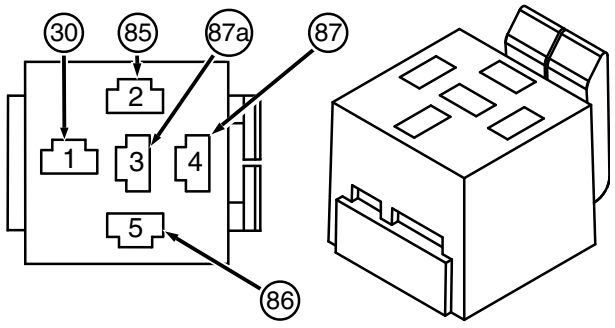
❶ Cargo Box Lift Circuit—Switched

Continued on next page

MX52301,0000413 -19-22OCT14-11/16

Switch Voltage	**Test Procedure B** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Disconnect any other attachment option from the main wiring harness. • Battery fully charged. • Key switch in RUN position, engine NOT running. • Check wire connections for looseness and corrosion. Disconnect S5 cargo box control switch. Is battery voltage present at pin 2 of switch connector, 420H Yel wire?  MXT001666 —UN—10OCT11 **2—420H Yellow Wire**	**YES:** Go to next step. **NO:** Test F4 fuse. Check 204 Red wire. See Power Circuit Operation, Gas (SN -040000) or See Power Circuit Operation, Gas (SN 040001-) or Power Circuit Operation, Diesel (SN -080000).

MX52301,0000413 -19-22OCT14-12/16

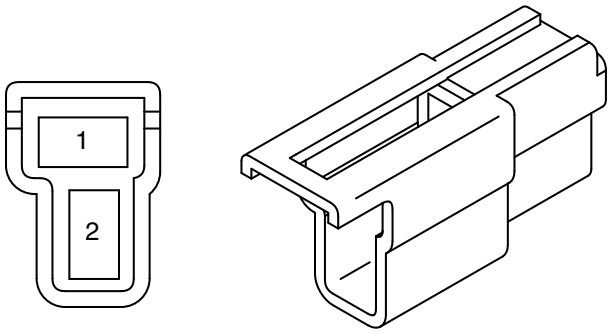
Lift Relay	Remove L-K1 lift relay. Toggle S5 cargo box switch to the lift position. Is battery voltage present at terminal 5 (86) of relay connector, 671 Org wire?  MXT011889 —UN—09JUL14 **5 (86)—671 Orange Wire**	**YES:** Install relay. Go to next step. **NO:** Check 671 Org wire and connections. If OK, replace cargo box switch

Continued on next page

MX52301,0000413 -19-22OCT14-13/16

Motor Connector

Disconnect L-X4 connector from L-M1 motor. Toggle S5 cargo box switch to the lift position. Is battery voltage present at terminal B of L-X4 connector, 901 Org wire?



RXA0085865 —UN—17JAN06

B—901 Orange Wire

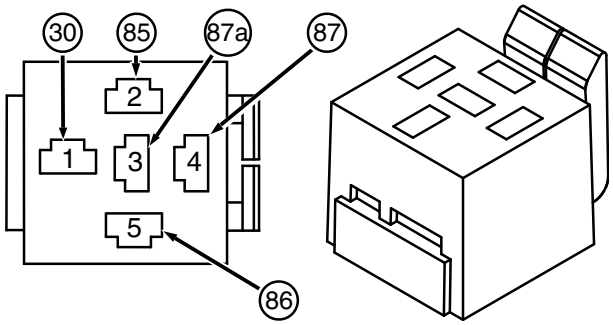
YES: Replace hydraulic pump motor. Go to next step.

NO: Test L-K1 lower relay. See Relay Test .

MX52301,0000413 -19-22OCT14-14/16

Lower Relay

Remove L-K2 lower relay. Toggle S5 cargo box switch to the lower position. Is battery voltage present at terminal 5 (86) of relay connector, 676 Grn wire?



MXT011889 —UN—09JUL14

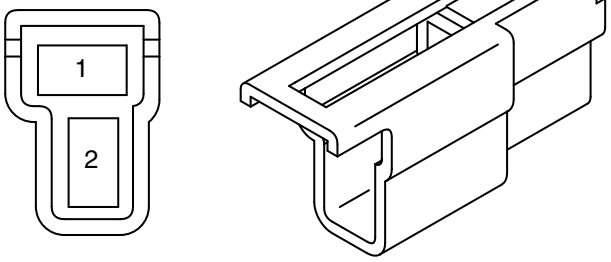
5 (86)—676 Green Wire

YES: Install relay. Go to next step.

NO: Check 676 Grn wire and connections. If OK, replace cargo box switch.

Continued on next page

MX52301,0000413 -19-22OCT14-15/16

Connector	Disconnect L-X4 connector from L-M1 motor. Toggle S5 cargo box switch to the lower position. Is battery voltage present at terminal A of L-X4 connector, 900 Pur wire?  RXA0085865 —UN—17JAN06 **A—900 Purple Wire**	**YES:** Replace hydraulic pump motor. **NO:** Test L-K2 lower relay. See Relay Test .

MX52301,0000413 -19-22OCT14-16/16

Cargo Box Lift Circuit Operation Diesel (SN 080001-)

Function:

To activate and control the hydraulic pump motor to lift and lower the cargo box.

Operating Conditions:

- Key switch in the RUN position.
- Lift/Lower switch in either the LIFT or LOWER position.

Theory of Operation:

switched power control circuit and a high current unswitched power circuit. When the Lift/Lower control switch is moved to the Lift (or Lower) position, it energizes one of two directional relays.

The energized relay applies battery power to one side of the lift motor; the unpowered relay provides the motor's ground path connection.

Moving the control switch to the opposite position swaps the roles of the directional relays, reversing the rotation of the pump motor.

Switched Power Circuit:

Power to the Lift/Lower control switch is supplied by the 420-series Yel wires of the switched power circuit. See Power Circuit Operation, Diesel (SN 080001-).

To raise the cargo box, the control switch sends power over the 670/671 Org wires and activates lift relay L-K4.

To lower the cargo box, the control switch energizes the LK3 lower relay via the 675/676 Grn wires.

The 160/180-family Blk wires of the lift wiring harness provide the ground paths to main wiring harness connector C10.

Unswitched Power Circuit:

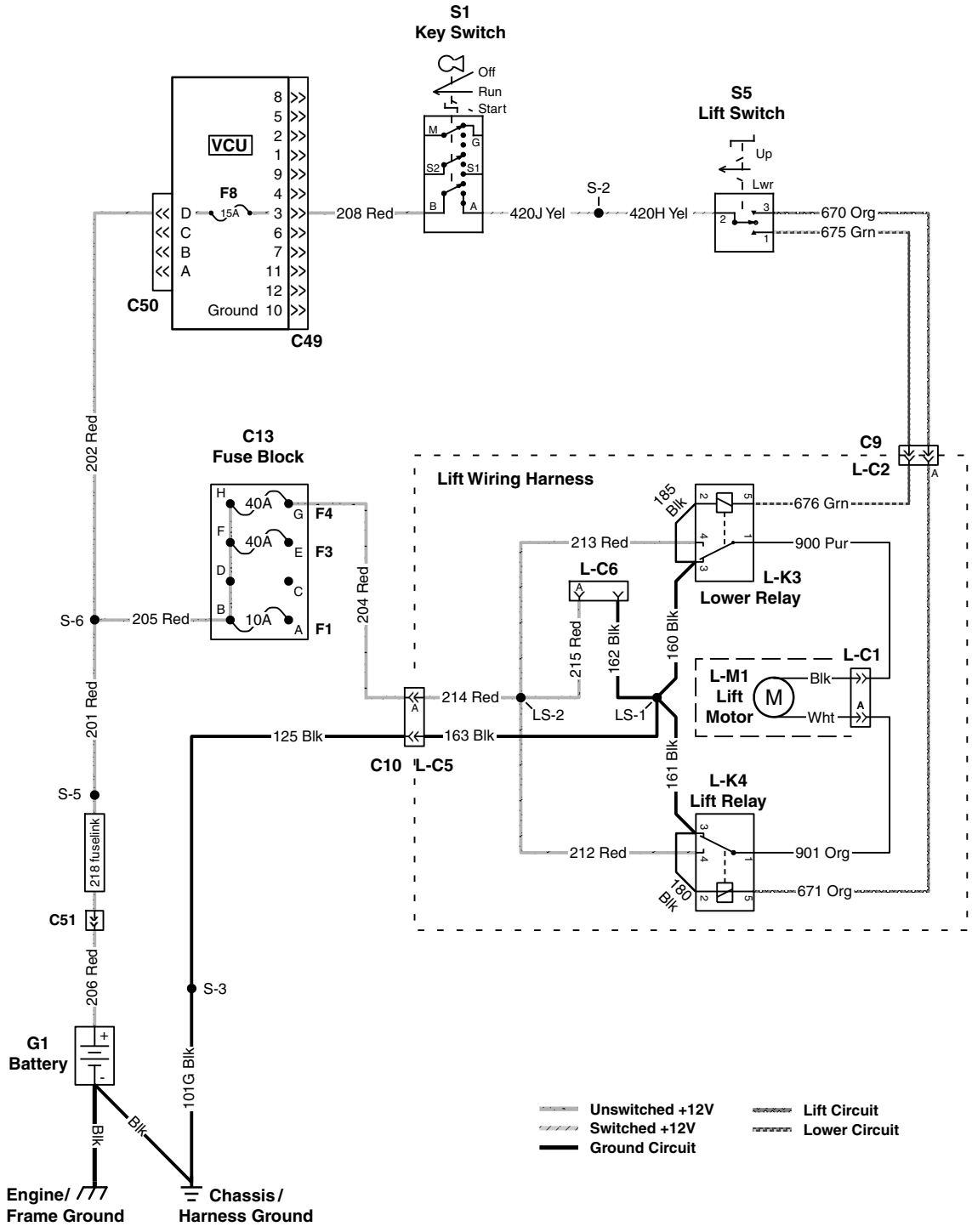
The high current connections to the lift wiring harness Red wires are provided through fuse F4 and Rear Power connector C10. See Power Circuit Operation, Diesel (SN 080001-).

In operation, a directional relay connects one side of the lift motor to either a ground path or the high-current power source. Connector LC-1 link the directional relays to the lift motor.

With the lift wiring harness installed, LC-6 now functions as the Rear Power connector. The 160-family Blk wires provide the high-current ground paths to connector C10.

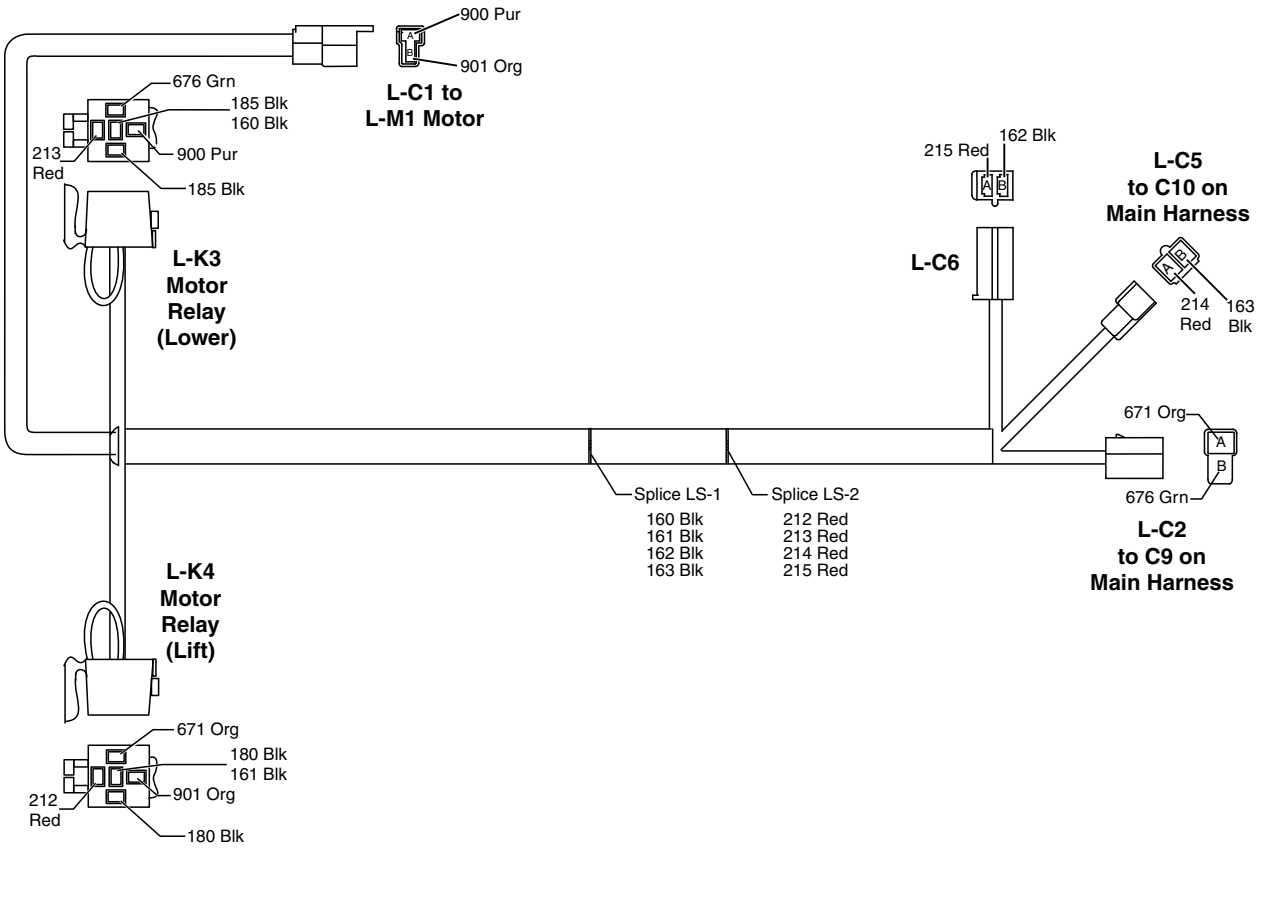
MX52301,0000414 -19-24OCT14-1/1

Cargo Box Lift Circuit Schematic Diesel (SN 080001-)



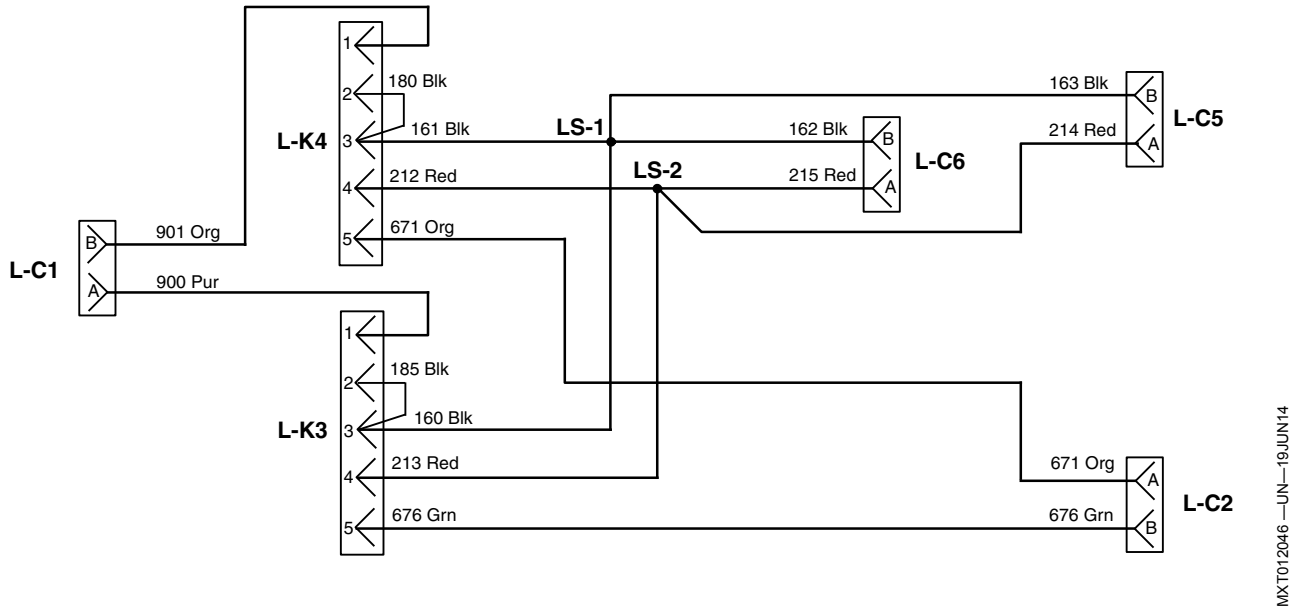
MX52301,0000415 -19-20OCT14-1/1

Cargo Box Lift Wiring Harness Diesel (SN 080001-)



MX52301,0000416 -19-20OCT14-1/1

Cargo Box Lift Harness Schematic Diesel (SN 080001-)



MX52301,0000417 -19-20OCT14-1/1

Cargo Box Lift Kit Wire Color Codes Diesel (SN 080001-)

Size/No ./Color	Wire Connection Points
2.0 160 Blk	Splice 1, L-K3
2.0 161 Blk	Splice 1, L-K4
3.0 162 Blk	Splice 1, L-C6
3.0 163 Blk	Splice1, L-C5
0.8 180 Blk	L-K4, L-K4
0.8 185 Blk	L-K3, L-K3
2.0 212 Red	Splice 2, L-K4
2.0 213 Red	Splice 2, L-K3
3.0 214 Red	Splice 2, L-C5
3.0 215 Red	Splice 2, L-C6
1.0 671 Org	L-C2, L-K4
1.0 676 Grn	L-C2, L-K3
2.0 900 Pur	L-C1, L-K3
2.0 901 Org	L-C1, L-K4

MX52301,0000418 -19-20OCT14-1/1

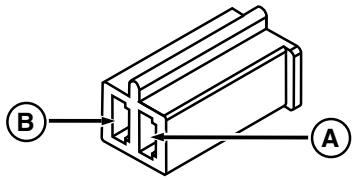
Cargo Box Lift Circuit Diagnosis Diesel (SN 080001-)

Cargo Box Lift Circuit Diesel (SN 080001-)

MX52301,0000419 -19-23OCT14-1/16

❶ Cargo Box Lift Circuit—Unswitched

MX52301,0000419 -19-23OCT14-2/16

Connector Voltage	**Test Procedure A** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Disconnect any other attachment option(s) from the main wiring harness. • Battery fully charged. • Key switch in off position. • Check wire connections for looseness and corrosion. Unplug connector C10 from cargo box lift wiring harness. Is battery voltage present at 204 Red wire (A)?  MXT012019—UN—25JUN14 **A—204 Red Wire** **B—125 Black Wire**	**YES:** Go to next step. **NO:** Test F4 fuse. Check 204 Red wire. See Power Circuit Diagnosis, Diesel (SN 080001-) in Group 55.

MX52301,0000419 -19-23OCT14-3/16

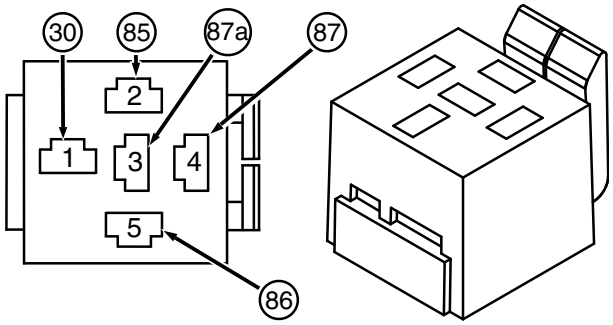
Connector Ground Presence	Is continuity to ground present at pin B of X17 rear optional attachments connector, 125 Blk wire (B)?	**YES:** Connect C10 connector to cargo box lift wiring harness. Go to next step. **NO:** Check 125 (B) and 101G Blk wires and connections.

Continued on next page

MX52301,0000419 -19-23OCT14-4/16

Relay Voltage

Remove L-K1 lift relay. Is battery voltage present at terminal 4 (87) of relay connector, 212 Red wire?



MXT011889—UN—09JUL14
4 (87)—212 Red Wire
2 (85)—180 Black Wire

YES: Go to next step.

NO: Check 212 and 214 Red wires.

MX52301,0000419 -19-23OCT14-5/16

Relay Ground

Is continuity to ground present at terminal 2 (85) of relay connector, 180 Blk wire?

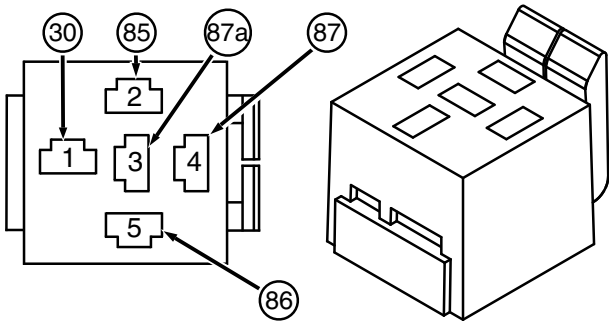
YES: Install relay. Go to next step.

NO: Check 180, 161, and 163 Blk wires.

MX52301,0000419 -19-23OCT14-6/16

Lower Relay Voltage

Remove L-K3 lower relay. Is battery voltage present at terminal 4 (87) of relay connector, 213 Red wire?



MXT011889—UN—09JUL14
4 (87)—213 Red Wire
2 (85)—185 Black Wire

YES: Go to next step.

NO: Check 213 and 214 Red wires.

MX52301,0000419 -19-23OCT14-7/16

Lower Relay Ground

Is continuity to ground present at terminal 2 (85) of relay connector, 185 Blk wire?

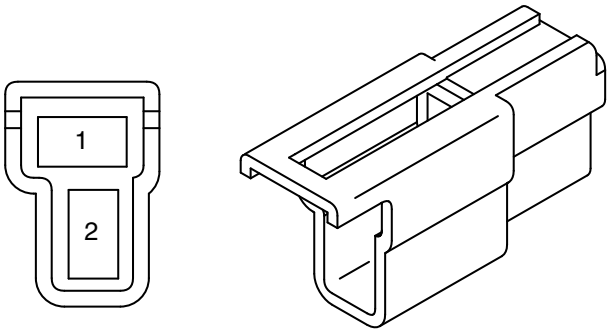
YES: Install relay. Go to next step.

NO: Check 185, 160, and 163 Blk wires.

Continued on next page

MX52301,0000419 -19-23OCT14-8/16

Motor Connector Ground	Detach connector L-C1 from L-M1 motor. Is continuity to ground present at 901 Org wire (A)?	**YES:** Go to next step. **NO:** Test L-K4 lift relay. See Relay Test . Check 901 Org wire



RXA0085865 —UN—17JAN06
A—901 Orange Wire
B—900 Purple Wire

MX52301,0000419 -19-23OCT14-9/16

Motor Connector Ground	Is continuity to ground present at 900 Pur wire (B)?	**YES:** Reattach L-C1 to L-M1 motor. Go to next step. **NO:** Test L-K3 lower relay. See Relay Test . Check 900 Pur wire.

MX52301,0000419 -19-23OCT14-10/16

❶ Cargo Box Lift Circuit—Switched

Continued on next page

MX52301,0000419 -19-23OCT14-11/16

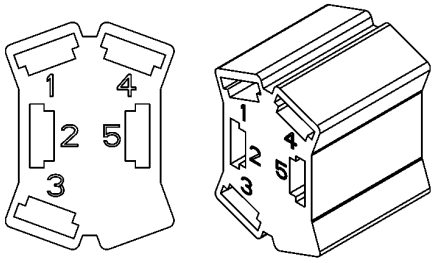
Switch Voltage

Test Procedure B

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Disconnect any other attachment option(s) from the main wiring harness.
- Key switch in run position, engine not running
- Battery fully charged.
- Check wire connections for looseness and corrosion.

Unplug cargo box control switch. Is battery voltage present at switch connector, 420H Yel wire (2)?



MXT001666 —UN—10OCT11
2—420H Yellow Wire

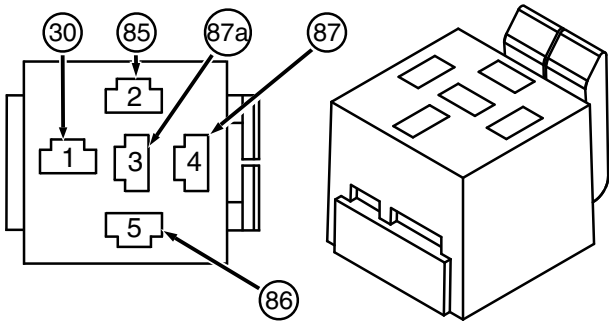
YES: Go to next step.

NO: Check 420H Yel wire and connections. See Power Circuit Diagnosis, Diesel (SN 080001-) in Group 55.

MX52301,0000419 -19-23OCT14-12/16

Lift Relay

Remove L-K4 lift relay. Toggle cargo box switch to the Lift position. Is battery voltage present at terminal 5 (86) of relay connector, 671 Org wire?



MXT011889 —UN—09JUL14
5 (86)—671 Orange Wire

YES: Install relay. Go to next step.

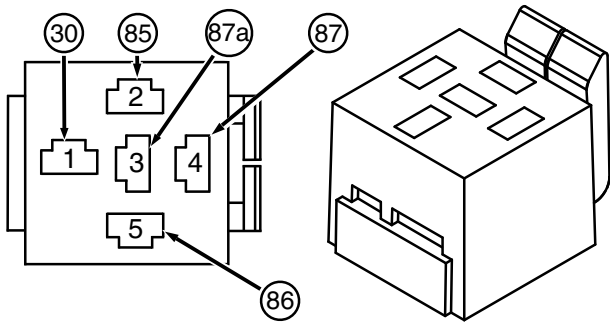
NO: Test cargo box switch. See. Raise/Lower Switch Test or See Raise/Lower Switch Test (AM142315). Check 671 and 670 Org wires. Check connectors C9/L-C2.

Continued on next page

MX52301,0000419 -19-23OCT14-13/16

Motor Connector

Remove L-K3 lower relay. Toggle cargo box switch to the Lower position. Is battery voltage present at terminal 5 (86) of relay connector, 676 Grn wire?



MXT011889 —UN—09JUL14
5 (86)—676 Green Wire

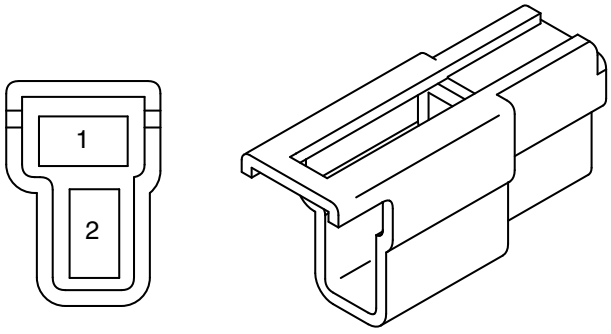
YES: Install relay. Go to next step.

NO: Test cargo box switch. See Raise/Lower Switch Test or See Raise/Lower Switch Test (AM142315). Check 676 and 675 Grn wires. Check connectors C9/L-C2.

MX52301,0000419 -19-23OCT14-14/16

Motor Connector

Detach connector L-C1 from L-M1 motor. Toggle cargo box switch to the Lift position. Is battery voltage present at 901 Org wire (B)?



RXA0085865 —UN—17JAN06
B—901 Orange Wire
A—900 Purple Wire

YES: Go to next step.

NO: Test L-K4 lower relay. See Relay Test . Check 901 Org wire.

MX52301,0000419 -19-23OCT14-15/16

Connector

Toggle cargo box switch to the Lower position. Is battery voltage present at 900 Pur wire (A)?

YES: Replace hydraulic pump motor.

NO: Test L-K2 lower relay. See Relay Test . Check 900 Pur wire.

MX52301,0000419 -19-23OCT14-16/16

Summary of References

- Horn Kit Circuit Operation
- Horn Kit Circuit Wiring Schematic
- Horn Kit Wiring Harness
- Horn Kit Schematic
- Horn Kit Circuit Wiring Harness Color Codes
- Horn Kit Circuit Diagnosis

MX52301,000044E -19-23MAY14-1/1

Horn Kit Circuit Operation

Function:

To provide power and control for the horn.

Operating Conditions:

- Operating machine safely.
- The horn circuit uses unswitched power. The key switch and other switches may be in any safe operating position.

Theory of Operation:

Current flows from the G1 battery positive (+) terminal to the 201 and 202 Red wires, F7 fuse, 203 Red wire, and to X14 optional attachments connector. This plugs into the (depending on installed options) H-X1 connector of the horn wiring harness. The 297 Red wire carries power to the H-F1 horn fuse to the 298 Red wire and to the H-S1 horn switch. Power for the H-H1 horn is supplied out of the switch (closed for horn operation) via the 299 Red wire. A path to ground is provided by 191 Blk wire to connector HX1 which plugs into the W1 main wiring harness optional attachments connector X14.

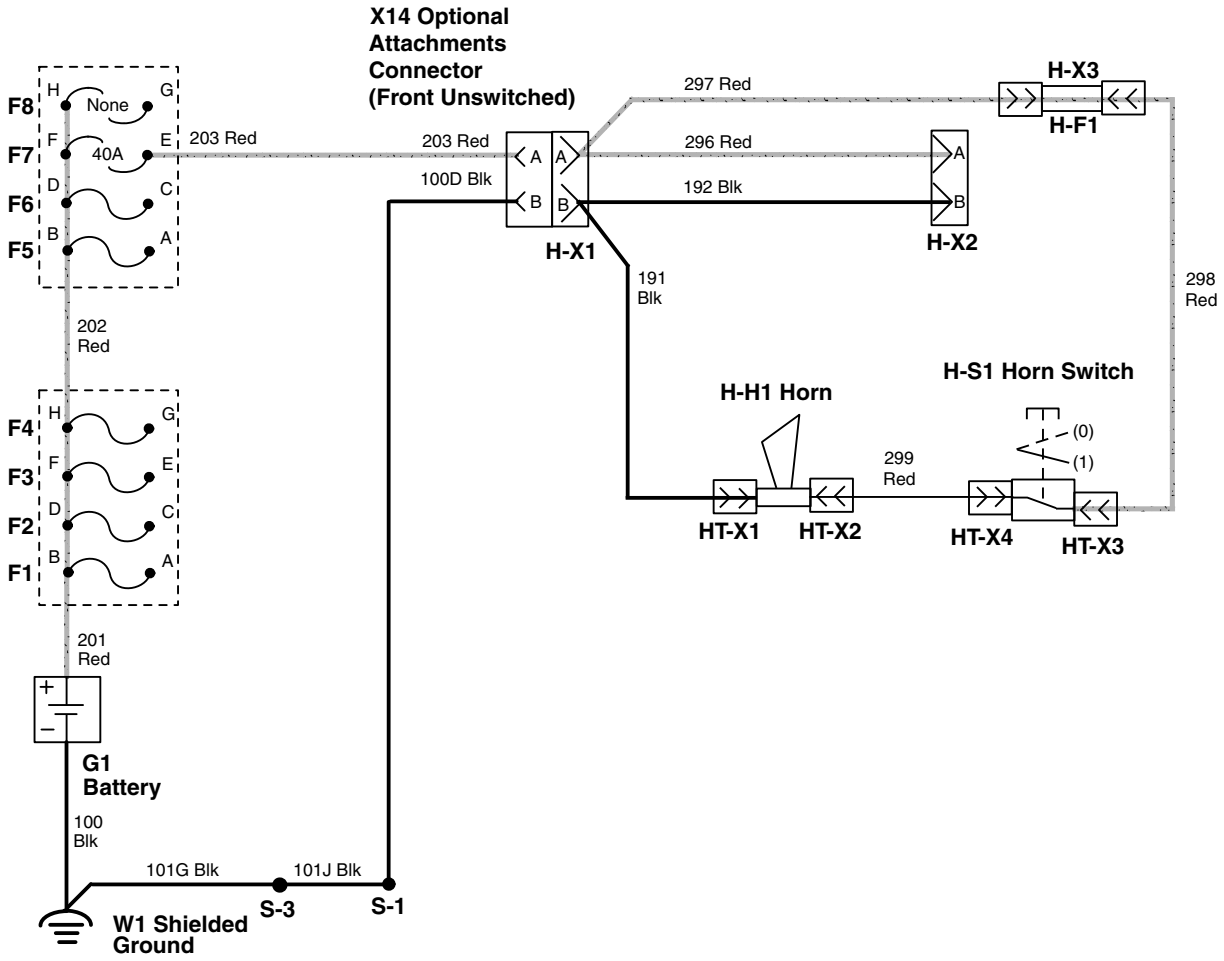
The path to ground is then completed through 100D Blk wire which splices into 101J and 101G Blk wires, and finally to the W1 ground.

The circuit for the power tap for other optional attachments is continued by the 296 Red and 192 Blk wires, which are spliced into the H-X1 connector and terminate at the H-X2 power tap out connector.

The machine does not need to be running for the horn to sound.

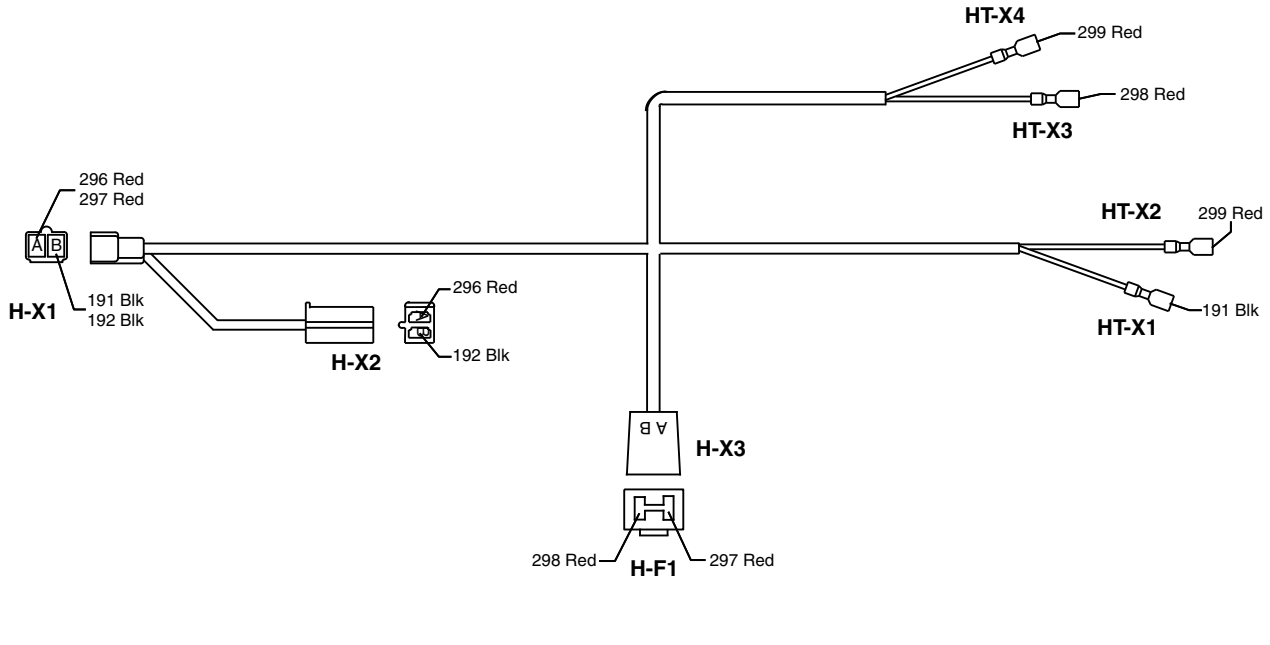
MX52301,000041A -19-08JUL14-1/1

Horn Kit Circuit Wiring Schematic



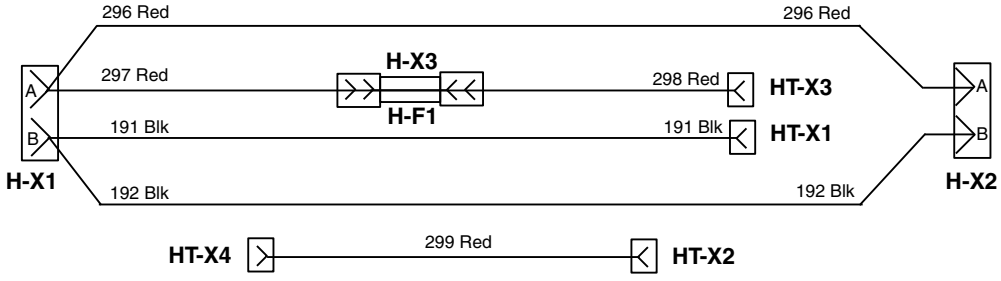
MX52301,000041B -19-20JUN14-1/1

Horn Kit Wiring Harness



MX52301,000041C -19-20JUN14-1/1

Horn Kit Schematic



MX52301,000041D -19-19MAY14-1/1

Horn Kit Circuit Wiring Harness Color Codes

Size/No ./Color	Wire Connection Points
0.8 191 Blk	HT-X1, H-X1
3.0 192 Blk	H-X2, H-X1
3.0 296 Red	H-X2, H-X1
0.8 297 Red	H-F1, H-X1
0.8 298 Red	H-F1, HT-X3
0.8 299 Red	HT-X2, HT-X4

MX52301,000041E -19-19MAY14-1/1

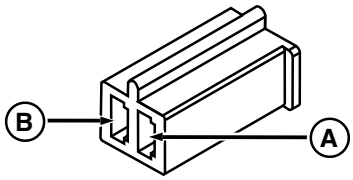
Horn Kit Circuit Diagnosis

Horn Kit Circuit Diagnosis

MX52301,000041F -19-22OCT14-1/7

❶ Horn Kit

MX52301,000041F -19-22OCT14-2/7

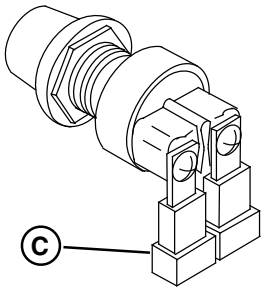
Front Connector Voltage	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Open hood and remove storage tray. • DISCONNECT any other attachment option from the main wiring harness. • Battery fully charged. • Key switch in OFF position. • Check wire connections for looseness and corrosion. Disconnect X14 connector from horn wiring harness. Is battery voltage present at pin A of X14 front optional attachments connector, 203 Red wire (A)?  MXT012019 —UN—25JUN14 **A—203 Red Wire** **B—100D Black Wire**	**YES:** Go to next step **NO:** Test F7 fuse. Check 203 Red wire. See Power Circuit Operation, Gas (SN -040000) or See Power Circuit Operation, Gas (SN 040001-) or Power Circuit Operation, Diesel (SN -080000).

MX52301,000041F -19-22OCT14-3/7

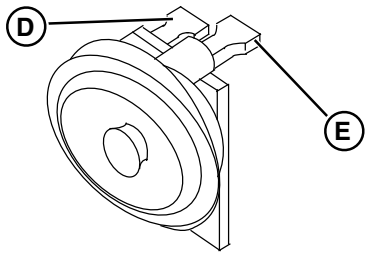
Front Connector Ground	Is continuity to ground present at pin B of X14 front optional attachments connector, 100D Blk wire (B)?	**YES:** Connect X14 connector to horn wiring harness. Go to next step. **NO:** Check 100D, 101J, and 101G Blk wires and connections.

Continued on next page

MX52301,000041F -19-22OCT14-4/7

Horn Switch Voltage	Is battery voltage present at 298 Red wire of H-S1 horn switch (C)?  MXT012052 —UN—26JUN14 **C—298 Red Wire**	**YES:** Go to next step. **NO:** Check 298 Red wire, H-F1 fuse, 297 Red wire, and connections.

MX52301,000041F -19-22OCT14-5/7

Horn Ground	Is continuity to ground present at 191 Blk wire of HH1 horn (D)?  MXT012053 —UN—26JUN14 **D—191 Black Wire** **E—299 Red Wire**	**YES:** Go to next step. **NO:** Check 191 Blk wire and connections.

MX52301,000041F -19-22OCT14-6/7

Horn Voltage	Depress and hold horn switch for test. Is battery voltage present at 299 Red wire of H-H1 horn (E)?	**YES:** Replace horn. **NO:** Check 299 Red wire. If OK, replace H-S1 horn

MX52301,000041F -19-22OCT14-7/7

Summary of References

- Rear Marker/Brake Lights Kit Operation
- Rear Marker/Brake Lights Kit Schematic
- Rear Marker/Brake Lights Circuit Wiring Harness
- Rear Marker/Brake Lights Kit Circuit Schematic
- Rear Marker/Brake Lights Kit Circuit Wiring Harness Color Codes
- Brake Switch Circuit Wiring Harness
- Brake Switch Circuit Schematic
- Brake Switch Circuit Wiring Harness Color Codes
- Rear Marker/Brake Lights Kit Diagnosis

MX52301,000044F -19-23OCT14-1/1

Rear Marker/Brake Lights Kit Operation

Function—Brake Lights:

To provide rear marker and brake lights.

Operating Conditions—Brake Lights:

- Key switch in the RUN position.
- Brake pedal depressed (Brake switch CLOSED).

Theory of Operation—Brake Lights:

Current for the brake lights flows from the G1 battery through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal, over the 420J and 420K Yel wires to the “E” pin on the X15 connector of the W1 main wiring harness. The X15 connector is plugged into the T-X2 connector and current leaves over 421 Yel wire and into the T-F1 brake switch fuse. The 422 Yel wire carries power to the T-S3 brake lights switch and is routed out of the closed switch contacts over the 823 Pur wire to the TX2/ X15 connectors. The W1 main wiring harness carries this power over the 820 Pur wire to the rear marker/brake lights wiring harness X16/T-X5 connectors. The current is then divided over 822 Pur wire for the T-E1 right rear brake light and 821 Pur wire for the T-E2 left rear brake light.

A path to ground is provided by the 116 Blk wire for the TE1 right rear brake light and 115 Blk wire for the T-E2 left rear brake light. These wires are spliced into a common path at the T-X5 connector and to the X16 connector of the W1 main wiring harness. The 101A and 101G Blk wires complete the path to the W1 shielded ground.

Operating Conditions—Rear Marker Lights:

- Key switch in RUN position.
- Light switch in either the CENTER ON or FULL ON positions.

Theory of Operation—Rear Marker Lights:

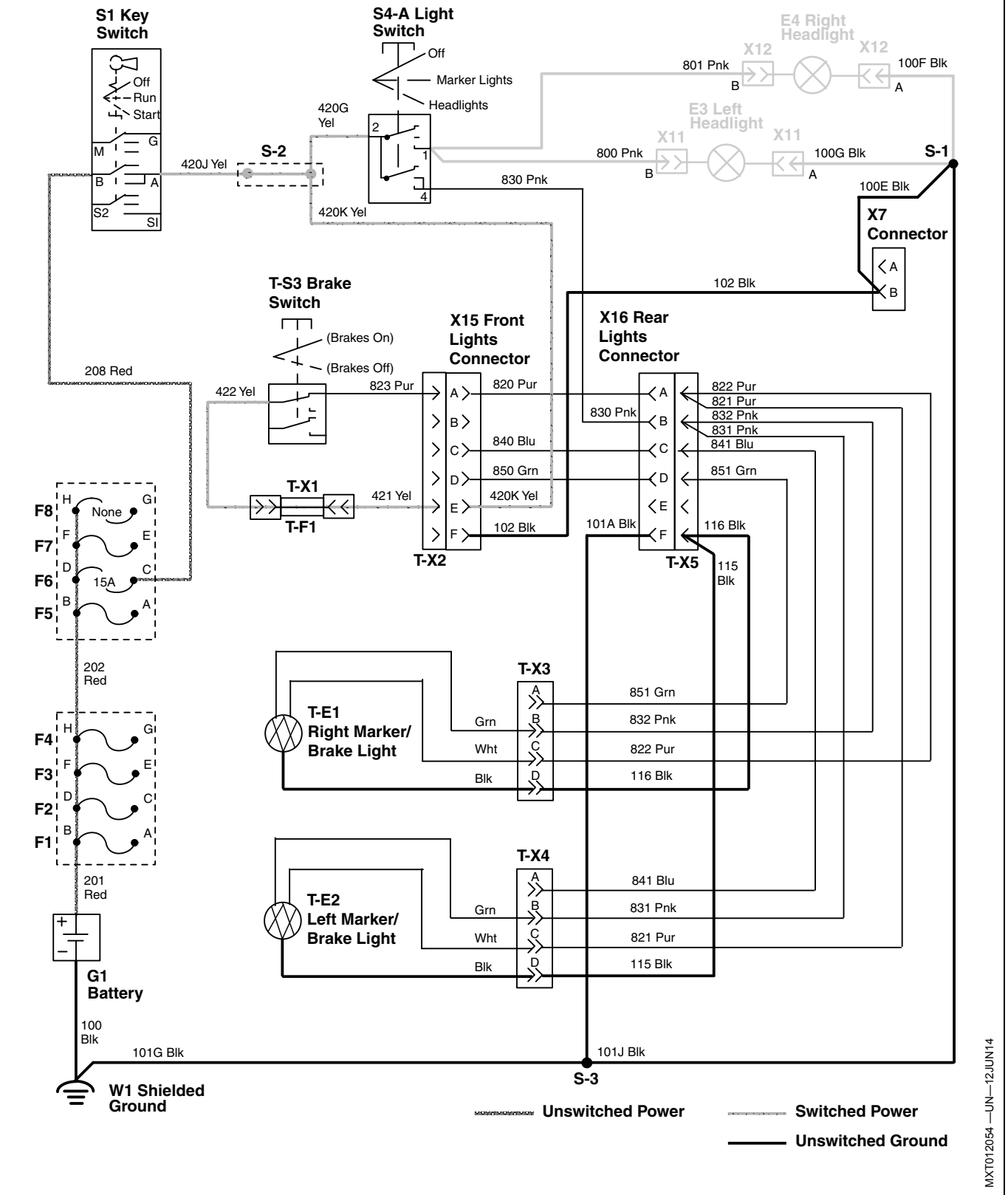
Current for the marker lights flows from the G1 battery through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal over 420J and 420G Yel wires to the S4-A light switch.

With the S4-A light switch in either the center on or full on position, current is supplied to the 830 Pnk wire to the marker/brake lights wiring harness across the B terminal of the X16/T-X5 connectors. At the T-X5 connector, current is then divided over 832 Pnk wire for the T-E1 right rear marker light and 831 Pnk wire for the T-E2 left rear marker light. A path to ground is provided by the 116 Blk wire for the TE1 right rear marker light and 115 Blk wire for the T-E2 left rear marker light. These wires are spliced into a common path at the T-X5 connector and to the X16 connector of the W1 main wiring harness. The 101A and 101G Blk wires complete the path to the W1 shielded ground.

MX52301,0000421 -19-22OCT14-1/1

Rear Marker/Brake Lights Kit Schematic

Rear Marker/Brake Lights Kit Schematic (SN -110000)



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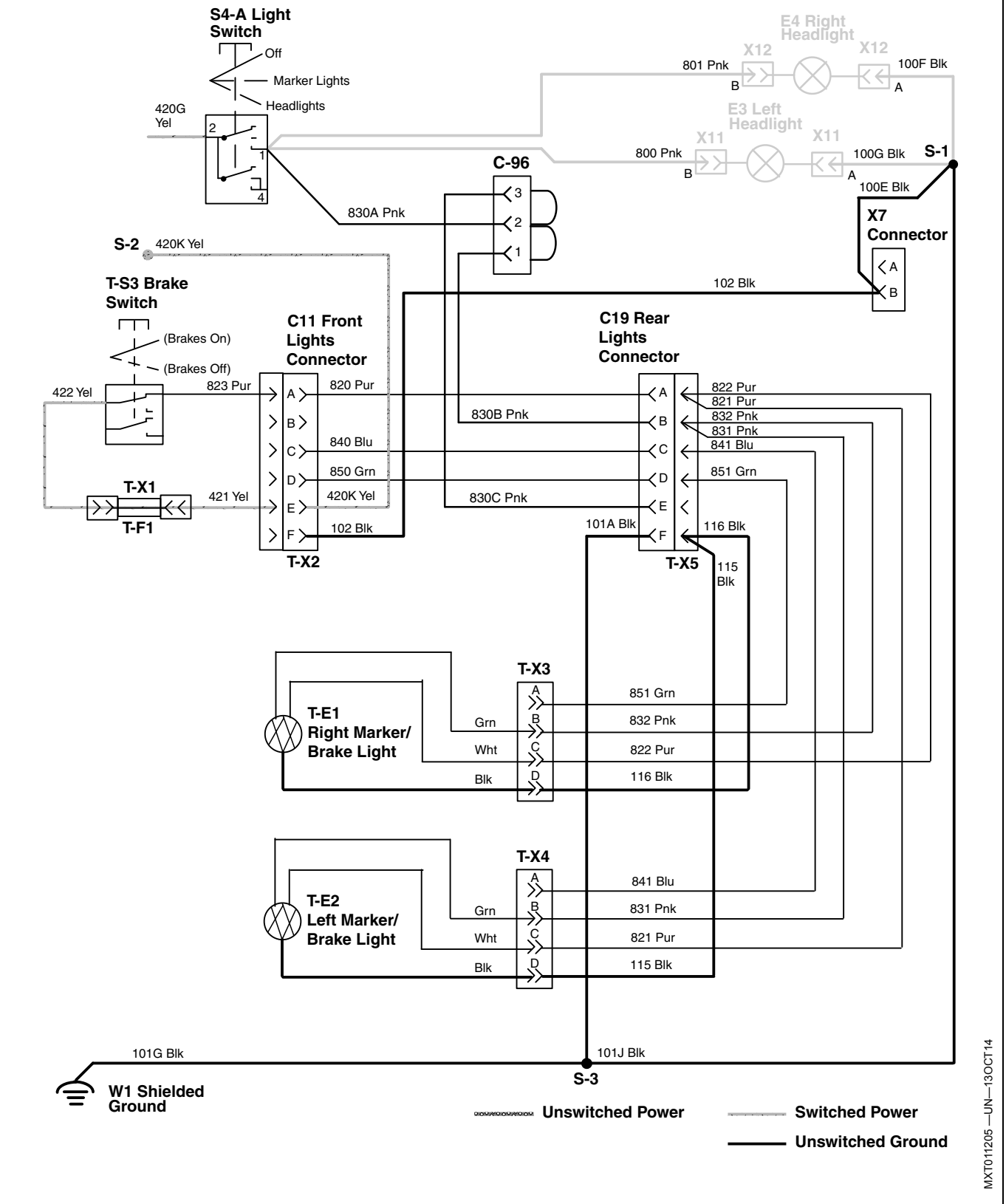
MX52301,0000422 -19-23OCT14-1/3

Rear Marker/Brake Lights Kit Schematic (SN 110001-120000)



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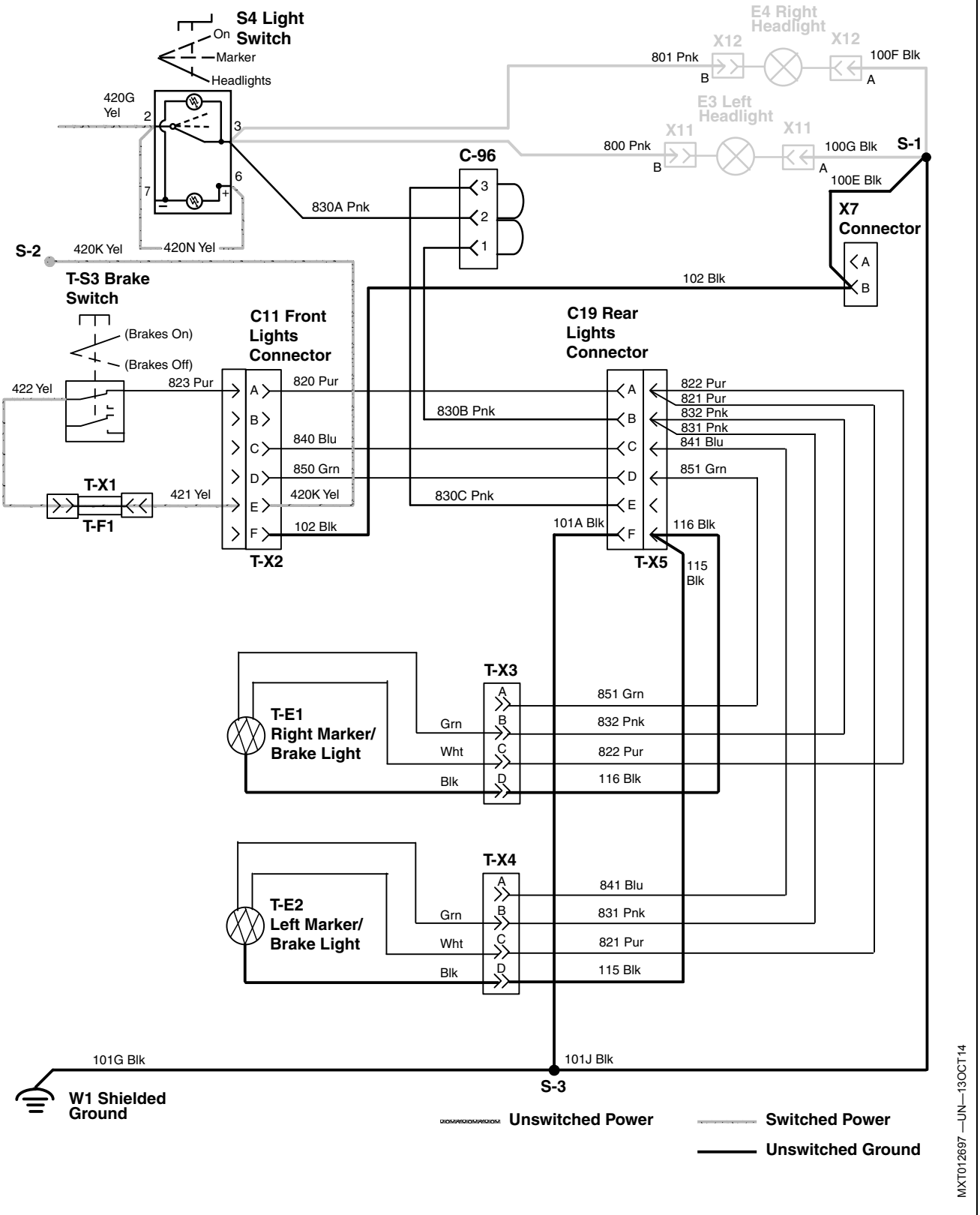
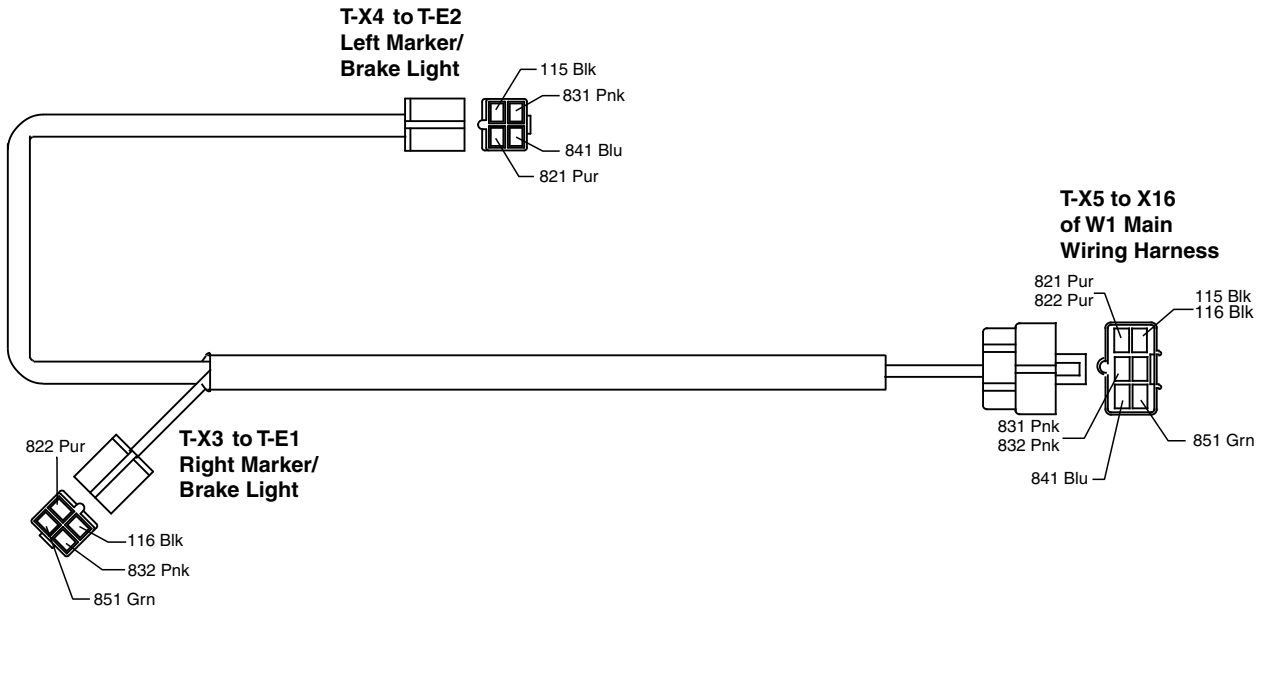
MX52301,0000422 -19-23OCT14-2/3

Rear Marker/Brake Lights Kit Schematic (SN 120001-)



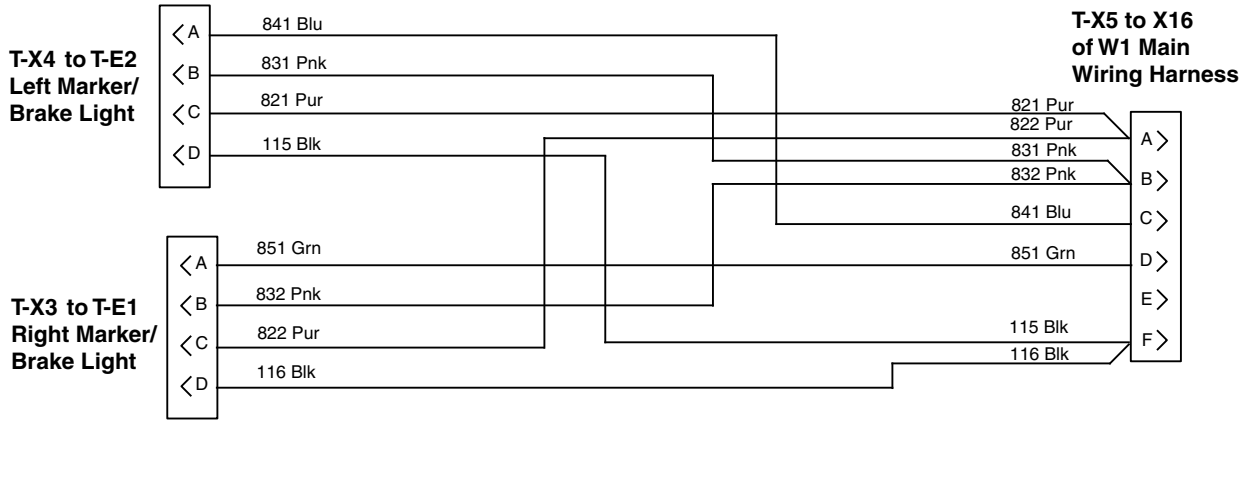
MX52301,0000422 -19-23OCT14-3/3

Rear Marker/Brake Lights Circuit Wiring Harness



MX52301,0000423 -19-23OCT14-1/1

Rear Marker/Brake Lights Kit Circuit Schematic



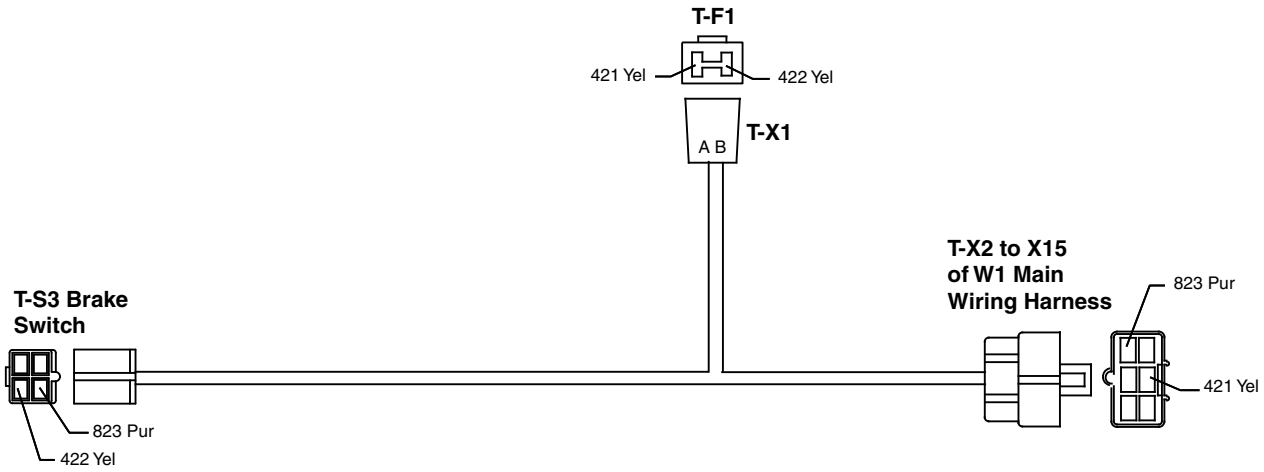
MX52301,0000424 -19-20JUN14-1/1

Rear Marker/Brake Lights Kit Circuit Wiring Harness Color Codes

Size/No./Color	Wire Connection Points
1.0 115 Blk	T-X5, T-X4
1.0 116 Blk	T-X5, T-X3
0.8 821 Pur	T-X5, T-X4
0.8 822 Pur	T-X5, T-X3
0.8 831 Pnk	T-X5, T-X4
0.8 832 Pnk	T-X5, T-X3
0.8 841 Blu	T-X5, T-X4
0.8 851 Grn	T-X5, T-X3

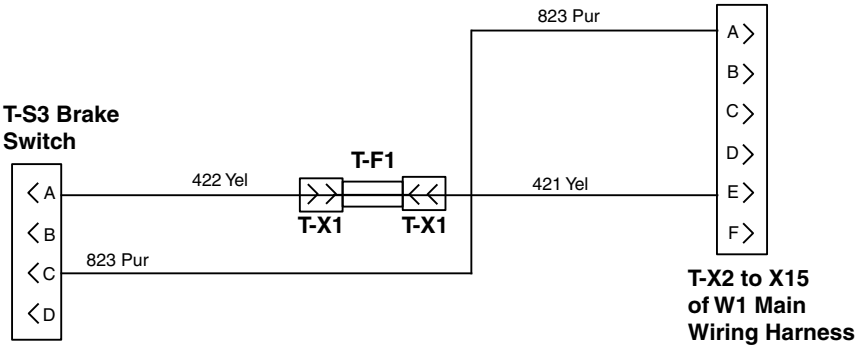
MX52301,0000425 -19-17OCT14-1/1

Brake Switch Circuit Wiring Harness



MX52301,0000426 -19-20JUN14-1/1

Brake Switch Circuit Schematic



MX52301,0000427 -19-20JUN14-1/1

Brake Switch Circuit Wiring Harness Color Codes

Size/No ./Color	Wire Connection Points
0.8 421 Yel	T-X2, T-X1
0.8 422 Yel	T-X1, T-S3
0.8 823 Pur	T-X2, T-S3

MX52301,0000428 -19-19MAY14-1/1

Rear Marker/Brake Lights Kit Diagnosis

Rear Marker/Brake Lights Diagnosis

MX52301,0000429 -19-10OCT14-1/18

❶ Brake Lights Circuit

MX52301,0000429 -19-10OCT14-2/18

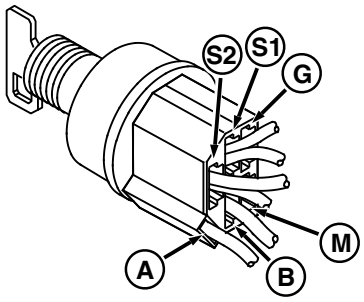
Connector Voltage

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Cargo box raised and locked.
- Open hood and remove storage tray.
- DISCONNECT any other attachment option from the main wiring harness.
- Key switch in RUN position—engine OFF.
- Brake pedal depressed (Switch CLOSED).
- Battery fully charged.
- Check wire connections for looseness and corrosion.

Is battery voltage present at the B terminal of switch connector, 208 Red wire (B)?



MXT004463 —UN—31MAY12

B—208 Red Wire

YES: Go to next step.

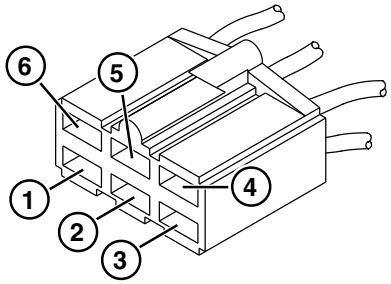
NO: Test F6 fuse. Test battery and positive (+) battery cable. Check 201 and 202 Red wires and connections. Check 208 Red wire and connections.

Continued on next page

MX52301,0000429 -19-10OCT14-3/18

Front Lights Connector Voltage

Is battery voltage present at 420K Yel wire at the X15 front lights connector (2)?



MXT011954 —UN—21OCT14

2— 420K Yellow Wire

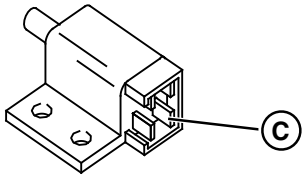
YES: Go to next step.

NO: Test the S1 key switch. See Key Switch Test. Check 420K and 420J Yel wires and connections.

MX52301,0000429 -19-10OCT14-4/18

Brake Light Switch

Is battery voltage present at 421 Yel wire of the T-S3 brake lights switch (C)?



MXT012015 —UN—25JUN14

C—421 Yellow Wire

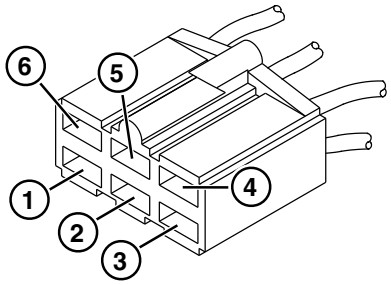
YES: Go to next step.

NO: Test T-F1 fuse. Check 421 and 422 Yel wire and connections.

MX52301,0000429 -19-10OCT14-5/18

Rear Lights Connector Voltage

Is battery voltage present at 820 Pur wire of pin “A” on the X16 rear lights connector (1)?



MXT011954 —UN—21OCT14

1— 820 Purple Wire

YES: Go to next step.

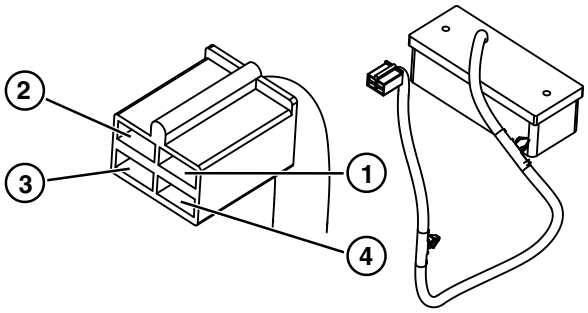
NO: Test brake light switch. See Park Brake Switch Test.Check 823 and 820 Pur wires and connections.

Continued on next page

MX52301,0000429 -19-10OCT14-6/18

Right Marker Light Connector Voltage

Disconnect right marker light connector. Is battery voltage present at terminal of right marker light connector T-X3, 822 Pur wire (1)?



MXT012060 —UN—26JUN14

1— 822 Purple Wire
2— 116 Black Wire

YES: Go to next step.

NO: Check 822 Pur wire and connections.

MX52301,0000429 -19-10OCT14-7/18

Right Marker Light Connector Ground

Is continuity to ground present at terminal of right marker light connector T-X3, 116 Blk wire (2)?

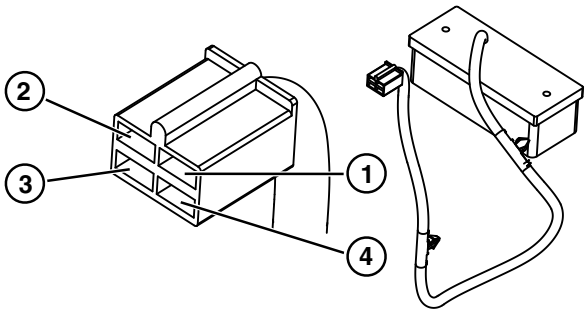
YES: Connect right marker connector. Test bulb. See Bulb Test

NO: Check 116, 101A, and 101G Blk wires and connections.

MX52301,0000429 -19-10OCT14-8/18

Left Marker Light Connector Voltage

Disconnect left marker light connector. Is battery voltage present at C terminal of left marker light connector T-X4, 821 Pur wire (1)?



MXT012060 —UN—26JUN14

1— 821 Purple Wire
2— 115 Black Wire

YES: Go to next step.

NO: Check 821 Pur wire and connections

MX52301,0000429 -19-10OCT14-9/18

Left Marker Light Connector Ground

Is continuity to ground present at D terminal of left marker light connector T-X4, 115 Blk wire (2)?

YES: Connect left marker connector. Test bulb.

NO: Check 115, 101A, and 101G Blk wires and connections.

Continued on next page

MX52301,0000429 -19-10OCT14-10/18

❶ Marker Lights Circuit

MX52301,0000429 -19-10OCT14-11/18

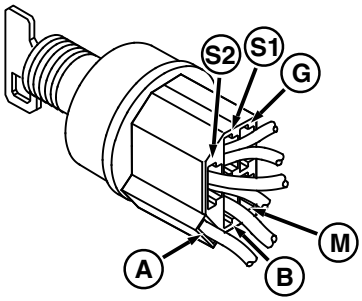
Key Switch

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Check wire connections for looseness and corrosion.

Is battery voltage present at A terminal of S1 key switch (A)?



MXT004463 —UN—31MAY12

A—Key Switch Terminal

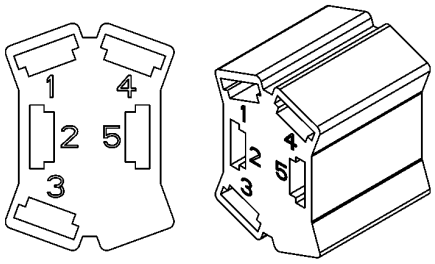
YES: Go to next step

NO: Test key switch. See Key Switch Test. See appropriate power circuit operation.

MX52301,0000429 -19-10OCT14-12/18

Light Switch Voltage (SN -120000)

Is battery voltage present at 420G Yel wire of S4-A light switch (2)?



MXT001666 —UN—10OCT11

2— 420G Yellow Wire

YES: Go to next step.

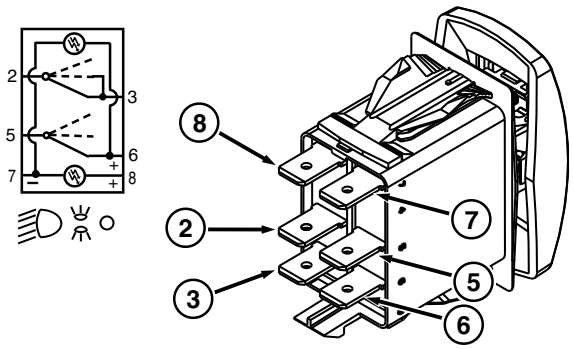
NO: Check 420J and 420G Yel wires and connections.

Continued on next page

MX52301,0000429 -19-10OCT14-13/18

Light Switch Voltage (SN 120001-)

Is battery voltage present at 420G Yel wire of S4 light switch (2)?



MXT008021 —UN—31JUL13

2— 420G Yellow Wire

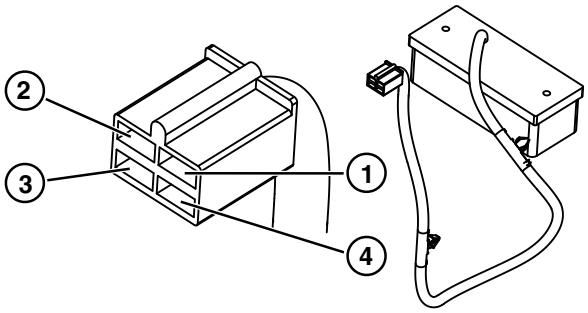
YES: Go to next step.

NO: Check 420J and 420G Yel wires and connections.

MX52301,0000429 -19-10OCT14-14/18

Right Marker Light Connector Voltage

Disconnect right marker light connector. Is battery voltage present at terminal of right marker light connector T-X3, 832 Pnk wire (3)?



MXT012060 —UN—26JUN14

2— 116 Black Wire
3— 832 Pink Wire

YES: Go to next step.

NO: Test light switch. (See Light Switch Test (3 Position), Light Switch Test (3 Position) (AM144304)). Check 830 and 831 Pnk wires and connections.

MX52301,0000429 -19-10OCT14-15/18

Right Marker Light Connector Ground

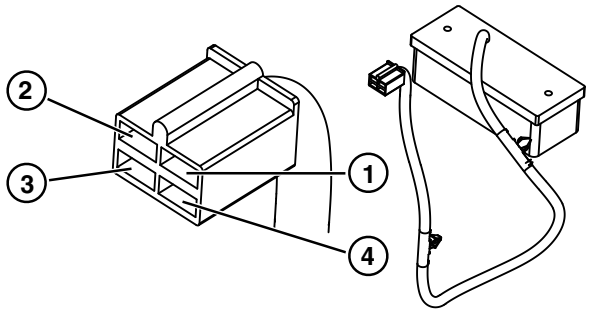
Is continuity to ground present at terminal of right marker light connector T-X3, 116 Blk wire (2)?

YES: Connect right marker connector. Test bulb. See Bulb Test.

NO: Check 116, 101A, and 101G Blk wires and connections.

Continued on next page

MX52301,0000429 -19-10OCT14-16/18

Left Marker Light Connector Voltage	Disconnect left marker light connector. Is battery voltage present at terminal of left marker light connector T-X4, 831 Pnk wire (3)?  MXT012060 —UN—26JUN14 **2— 115 Black Wire** **3— 831 Pink Wire**	**YES:** Go to next step. **NO:** Test light switch. (See Light Switch Test (3 Position), Light Switch Test (3 Position) (AM144304)). Check 830 and 831 Pnk wires and connections.

MX52301,0000429 -19-10OCT14-17/18

Left Marker Light Connector Ground	Is continuity to ground present at terminal of left marker light connector T-X4, 115 Blk wire (2)?	**YES:** Connect left marker connector. Test bulb. See Bulb Test **NO:** Check 115, 101A, and 101G Blk wires and connections.

MX52301,0000429 -19-10OCT14-18/18

Summary of References

- Turn Signal/Hazard/Marker/Brake Lights Operation
- Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic
- Signal Lights Wiring Harness
- Signal Lights Schematic
- Signal Lights Wiring Color Codes
- Rear Marker/Brake Lights Circuit Wiring Harness Deluxe
- Rear Marker/Brake Lights Kit Circuit Schematic Deluxe
- Rear Marker/Brake Lights Kit Circuit Wiring Harness Color Codes Deluxe
- Turn Signal Lights Circuit Diagnosis
- Hazard Lights Circuit Diagnosis
- Rear Marker Lights Diagnosis
- Brake Lights Diagnosis

MX52301,0000450 -19-23OCT14-1/1

Turn Signal/Hazard/Marker/Brake Lights Operation

Function:

To provide control and power to the turn signal, hazard, rear marker, and brake lights.

Operating Conditions:

- The signal lights circuit uses unswitched power. The key switch and other switches may be in any safe operating position.
- Turn signal lights switch in either LEFT or RIGHT position.

Theory of Operation:

Power for the turn signal lights flows from the G1 battery through the 201 and 202 Red wires, F7 fuse, and 203 Red wire to the X14 front optional attachments connector. This plugs into the T-X9 signal lights wiring harness connector and power flows through the 255 Red wire, T-F2 fuse, 256 Red wire, and into the T-K1 flasher. The 470 Yel wire leaves the flasher to the T-S2 turn signal lights switch and the signal is divided to the 471 Yel wire to the T-S1 hazard lights switch.

If the turn signal switch is in the left turn position, current flows through the T-S2 turn signal lights switch, forward biasing an internal indicator LED causing it to illuminate. The signal exits the switch at the number “3” pin and is routed over the 840C Blu wire to the 840 splice. The 840D Blu wire carries power to the T-X6 connector of the T-E5 left front signal light. A path to ground is provided through the 118 Blk wire to the T-X1/X15 connectors, 102, 100E, 101J, and 101G Blk wires to the W1 shielded ground.

At the same time, the 840A Blu wire carries power to the TX1/ X15 connector, 840 Blu wire, X16/T-X2 connector, 841 Blu wire to the T-X4 connector of the T-E4 left rear signal light. A path to ground is provided through the 115 Blk wire to the T-X2/X16 connectors, 101A, 101J, and 101G Blk wires to the W1 shielded ground.

If the turn signal switch is in the right turn position, current flows through the T-S2 turn signal lights switch, forward biasing an internal indicator LED causing it to illuminate. The signal exits the switch at the number “1” pin and is routed over the 850C Grn wire to the 850 splice. The 850D Grn wire carries power to the T-X7 connector of the T-E6 right front signal light. A path to ground is provided through the 119 and 117 Blk wires to the T-X1/X15 connectors, 102, 100E, 101J, and 101G Blk wires to the W1 shielded ground.

At the same time, the 850A Grn wire carries power to the T-X1/X15 connector, 850 Grn wire, X16/T-X2 connector, 851 Grn wire to the T-X3 connector of the T-E3 right rear signal light. A path to ground is provided through the 116 Blk wire to the T-X2/X16 connectors, 101A, 101J, and 101G Blk wires to the W1 shielded ground.

Operating Conditions—Hazard Lights:

- The hazard lights circuit uses unswitched power. The key switch and other switches may be in any safe operating position.
- Hazard switch in the ON position.

Theory of Operation—Hazard Lights:

Power for the hazard lights flows from the G1 battery through the 201 and 202 Red wires, F7 fuse, and 203 Red wire to the X14 front optional attachments connector. This plugs into the T-X9 signal lights wiring harness connector and power flows through the 255 Red wire, T-F2 fuse, 256 Red wire, and into the T-K1 flasher. The 470 Yel wire leaves the flasher to the T-S2 turn signal lights switch and the signal is divided to the 471 Yel wire to the T-S1 hazard lights switch.

When the hazard light switch is in the on position, power is supplied to the 840 Blu wire splice from the number “1” pin of the hazard lights switch using the 840B Blu wire. At the same time, power is supplied to the 850 Grn wire splice from the number “4” pin of the hazard lights switch using the 850B Grn wire.

From these splices, power is supplied to all four signal lights using the left and right turn signal lights circuit. Power is also feed back to the turn signal light switch to illuminate the LEDs within the turn signal switch. This is a visual indicator to the operator that the hazard lights circuit is operational.

Operating Conditions—Rear Marker Lights:

- Key switch in RUN position.
- Light switch in either the CENTER ON or FULL ON positions.

Theory of Operation—Rear Marker Lights:

Current for the marker lights flows from the G1 battery through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal over 420J and 420G Yel wires to the S4-A light switch.

With the S4-A light switch in either the center on or full on position, current is supplied to the 830 Pnk wire to the marker/brake lights wiring harness across the B terminal of the X16/T-X2 connectors. At the T-X2 connector, current is then divided over 832 Pnk wire for the T-E1 right rear marker light and 831 Pnk wire for the T-E2 left rear marker light.

A path to ground is provided by the 116 Blk wire for the TE1 right rear marker light and 115 Blk wire for the T-E2 left rear marker light. These wires are spliced into a common path at the T-X2 connector and to the X16 connector of the W1 main wiring harness. The 101A and 101G Blk wires complete the path to the W1 shielded ground.

Operating Conditions—Brake Lights:

- Key switch in RUN position.

Continued on next page

- Brake pedal depressed (Brake switch CLOSED).

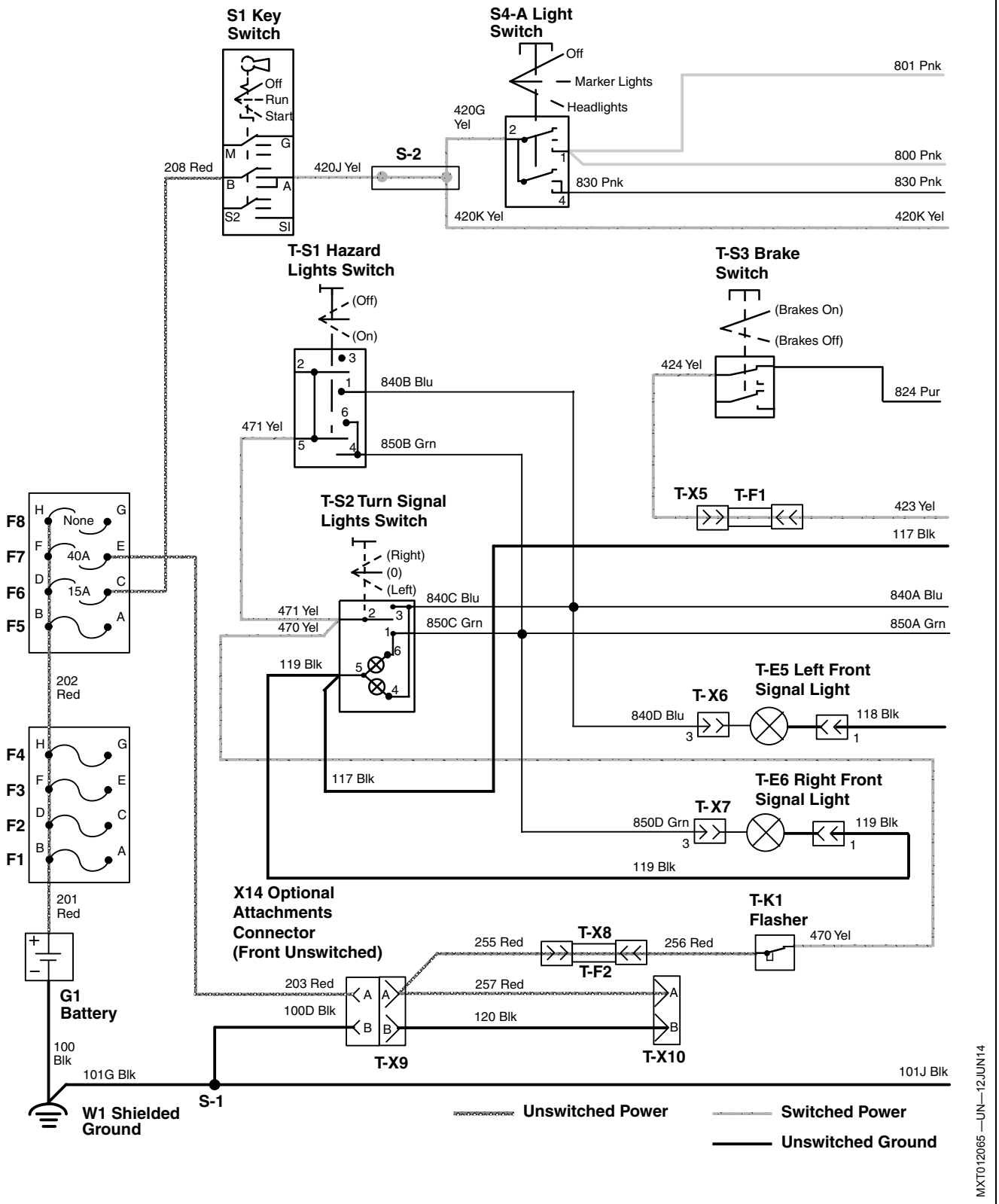
Theory of Operation—Brake Lights:

Current for the brake lights flows from the G1 battery through the 201 and 202 Red wires, F6 fuse, and 208 Red wire to the “B” terminal of the S1 key switch. Current leaves the key switch at the “A” terminal, over the 420J and 420K Yel wires to the “E” pin on the X15 connector of the W1 main wiring harness. The X15 connector is plugged into the T-X1 connector and current leaves over 423 Yel wire and into the T-F1 brake switch fuse. The 424 Yel wire carries power to the T-S3 brake lights switch and is routed out of the closed switch contacts over the 824 Pur wire to the TX1/ X15 connectors. The W1 main wiring harness carries this power over the 820 Pur wire to the rear marker/brake lights wiring harness X16/T-X2 connectors. The current is then divided over 822 Pur wire for the T-E1 right rear brake light and 821 Pur wire for the T-E2 left rear brake light.

A path to ground is provided by the 116 Blk wire for the TE1 right rear brake light and 115 Blk wire for the T-E2 left rear brake light. These wires are spliced into a common path at the T-X2 connector and to the X16 connector of the W1 main wiring harness. The 101A and 101G Blk wires complete the path to the W1 shielded ground.

MX52301,000042A -19-22OCT14-2/2

Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic

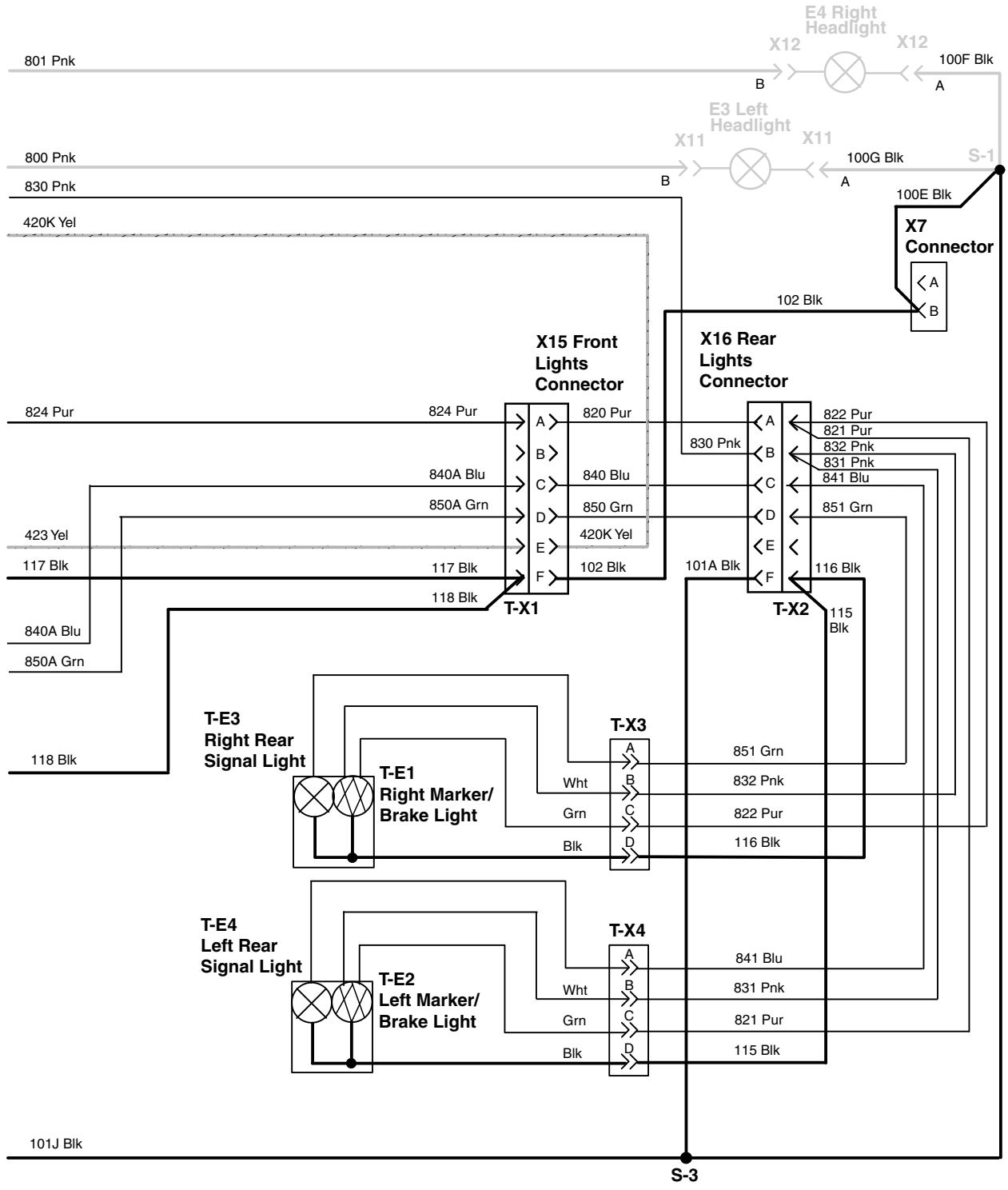


Schematic 1 of 2 (SN -110000)

Continued on next page

MX52301,000042B -19-23JUN15-1/6

Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic (SN -110000) 2 of 2



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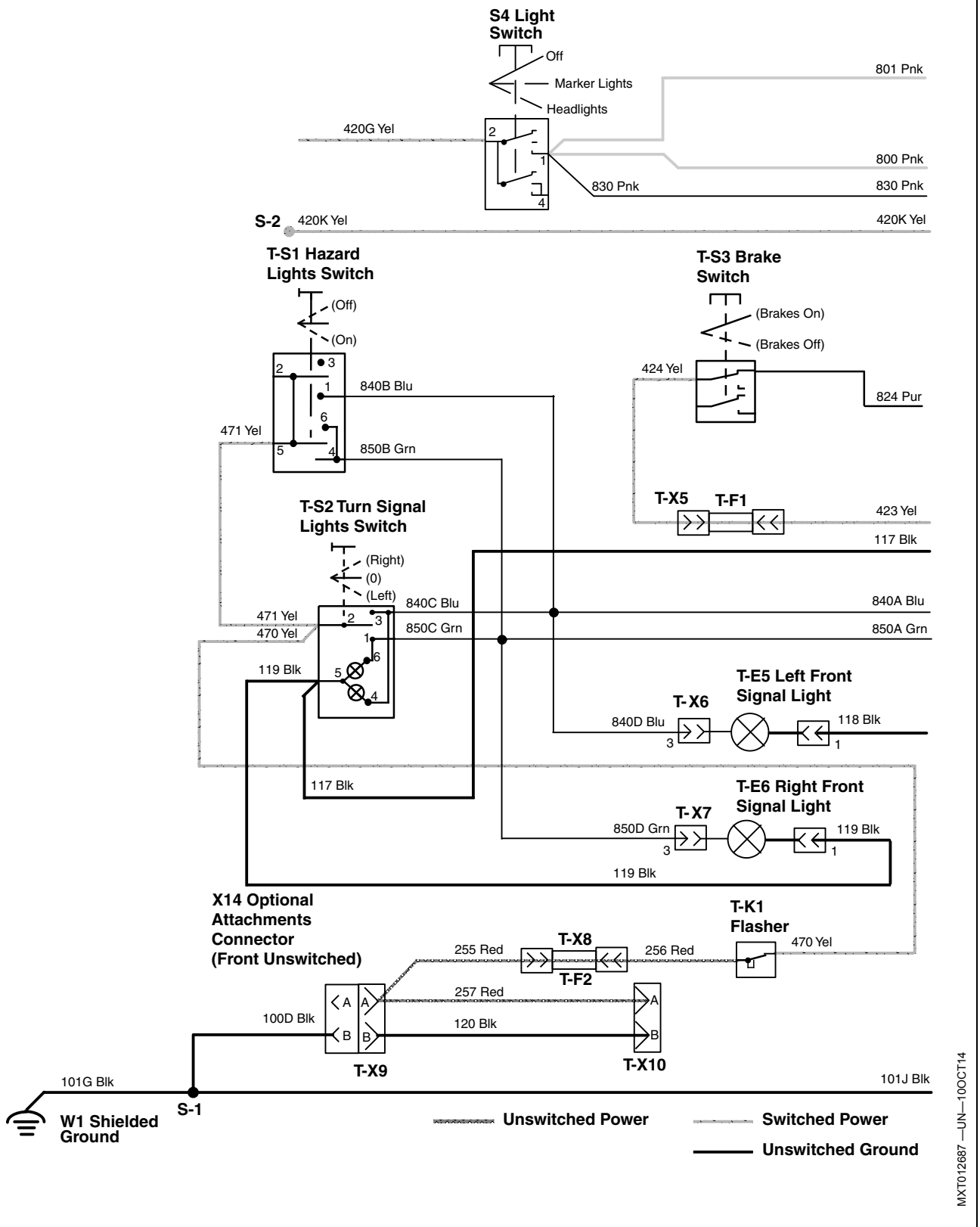
MX52301,000042B -19-23JUN15-2/6

Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic (SN 110001-)



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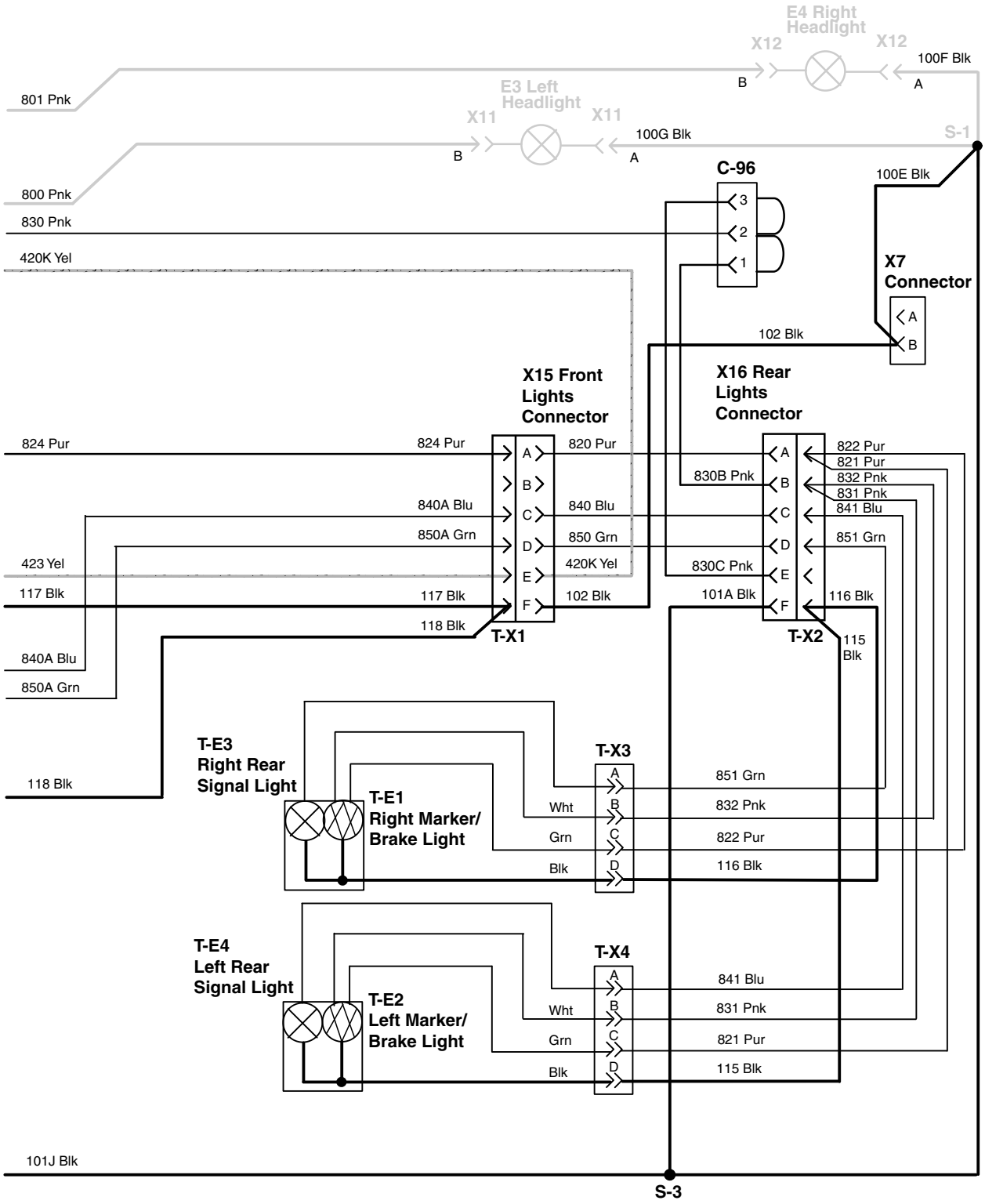
MX52301,000042B -19-23JUN15-3/6

Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic (SN 110001-) 2 of 2



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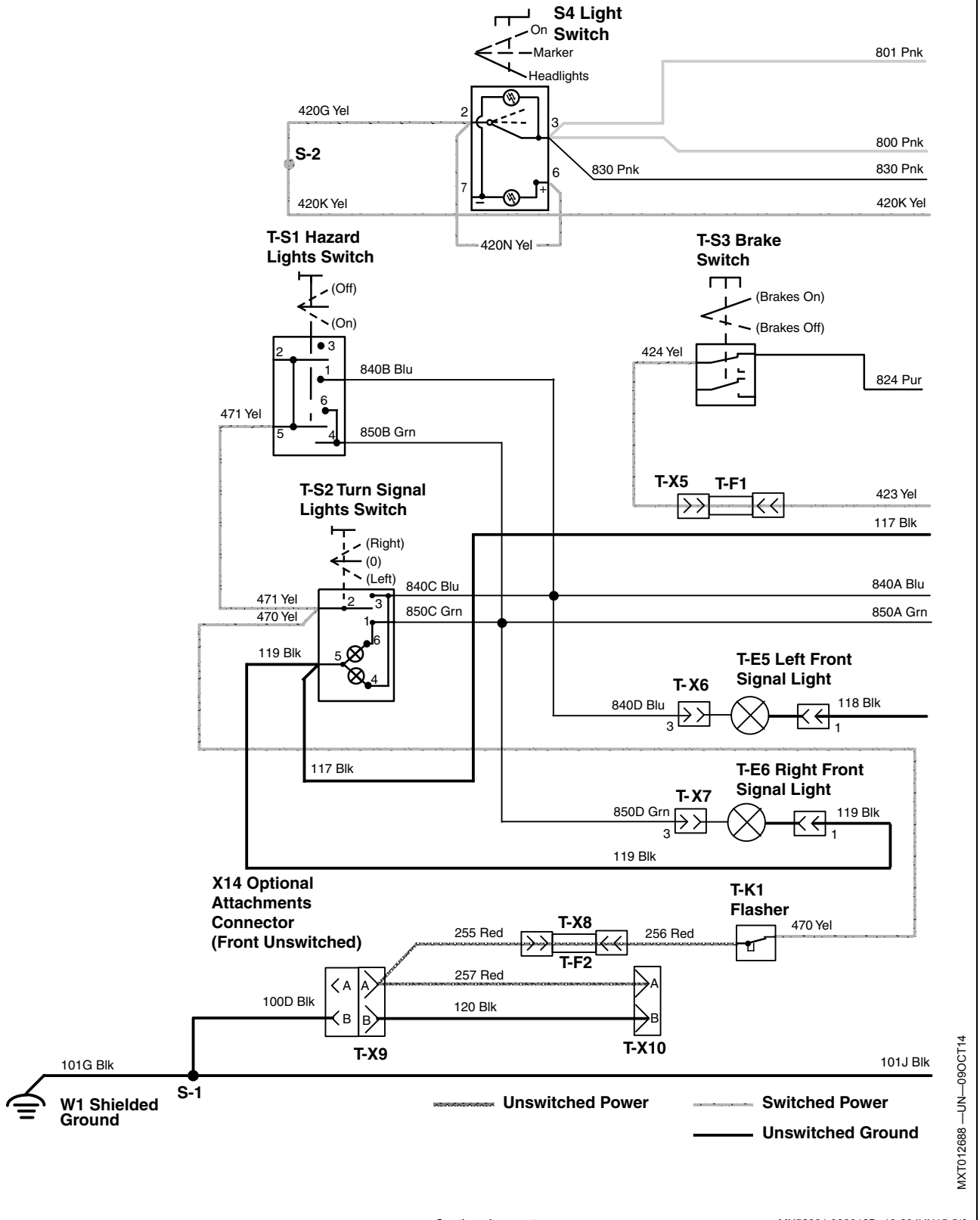
MX52301,000042B -19-23JUN15-4/6

Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic (SN 120001-)



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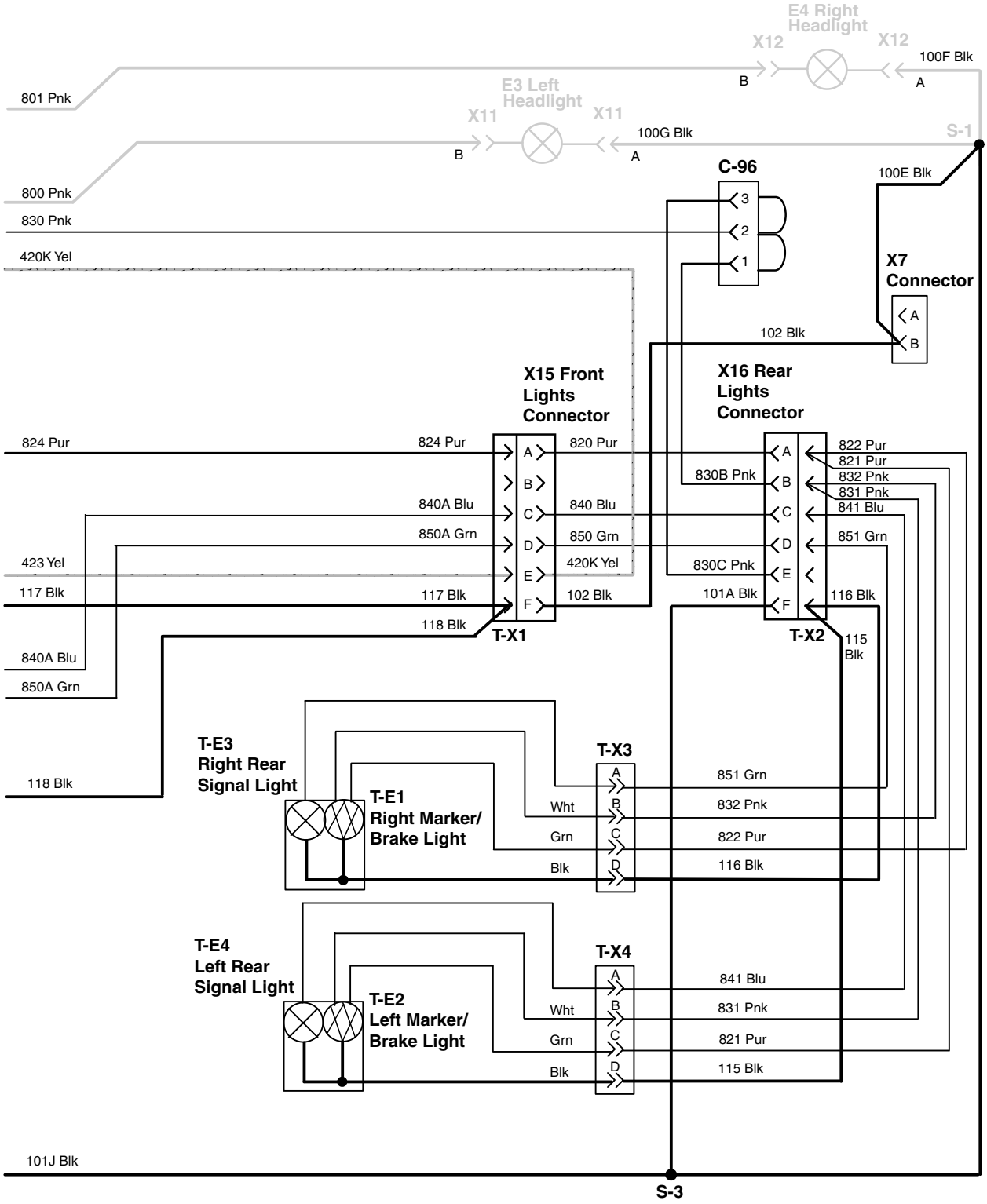
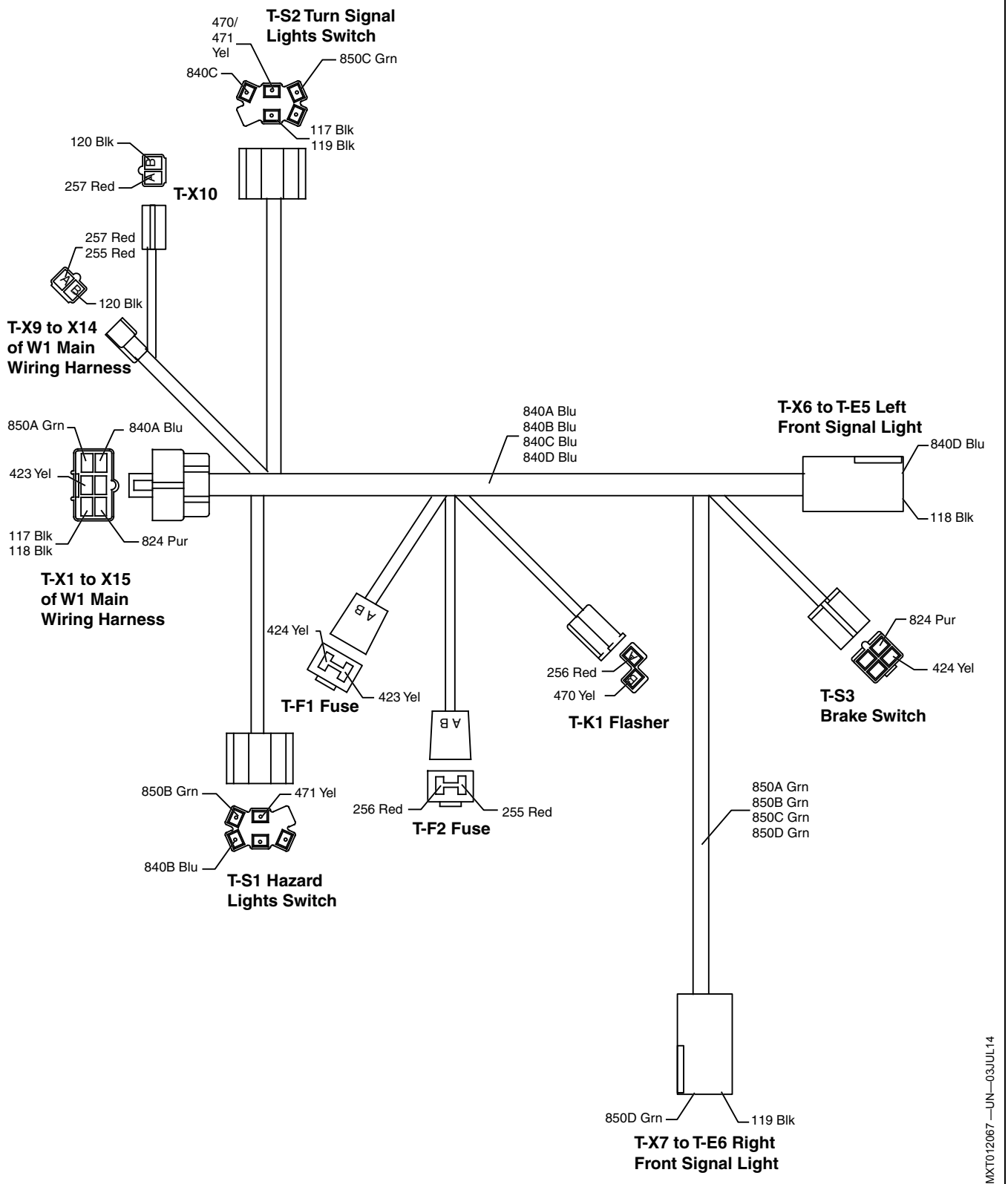
MX52301,000042B -19-23JUN15-5/6

Turn Signal/Hazard/Marker/Brake Lights Kit Circuit Schematic (SN 120001-) 2 of 2



MX52301,000042B -19-23JUN15-6/6

Signal Lights Wiring Harness



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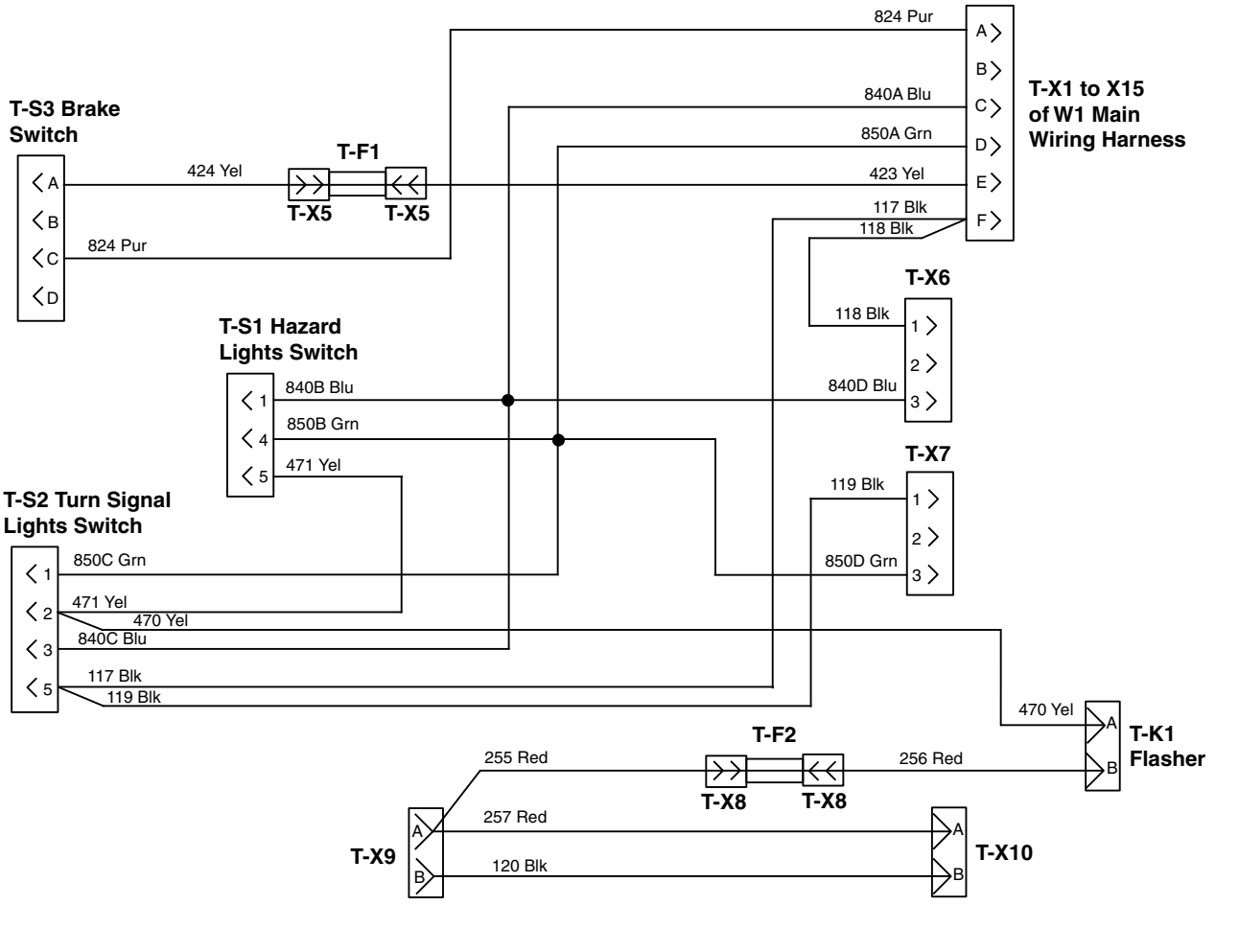
MX52301,000042C -19-20JUN14-1/2

MX52301,000042C -19-20JUN14-2/2

Signal Lights Schematic



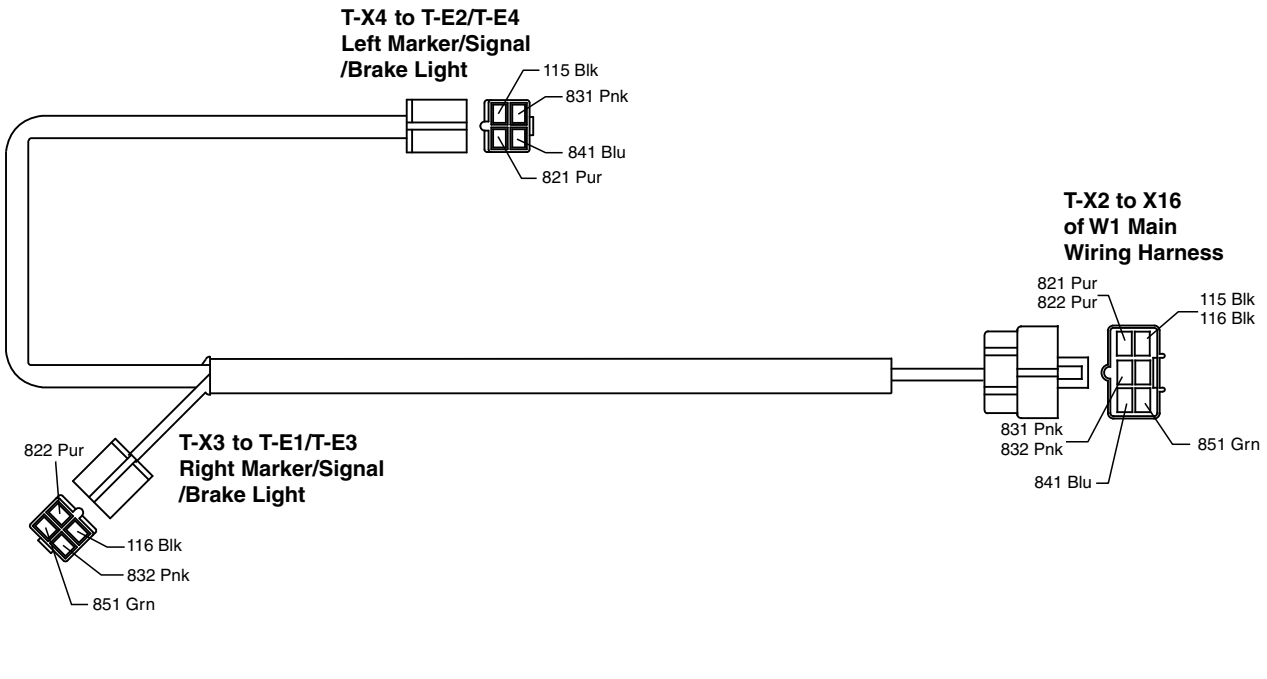
MX52301,000042D -19-20JUN14-1/1

Signal Lights Wiring Color Codes

Size/No./Color	Wire Connection Points
0.8 117 Blk	S-X1, S-X9
0.8 118 Blk	S-X1, S-X4
0.8 119 Blk	S-X4, S-X10
3.0 120 Blk	S-X6, S-X7
0.8 255 Red	S-X6, S-F1
0.8 256 Red	S-F1, S-K1
3.0 257 Red	S-X6, S-X7
0.8 423 Yel	S-X1, S-F2
0.8 424 Yel	S-F2, S-S3
0.8 470 Yel	S-K1, S-X4
0.8 471 Yel	S-X4, S-X5
0.8 824 Pur	S-X1, S-S3
0.8 840A Blue	S-X1, SS-1
0.8 840B Blue	SS-1, S-X5
0.8 840C Blue	SS-1, S-X4
0.8 840D Blue	SS-3, S-X10
0.8 850A Grn	S-X1, SS-2
0.8 850B Grn	S-X5, SS-2
0.8 850C Grn	SS-2, S-X4
0.8 850D Grn	S-X10, SS-2

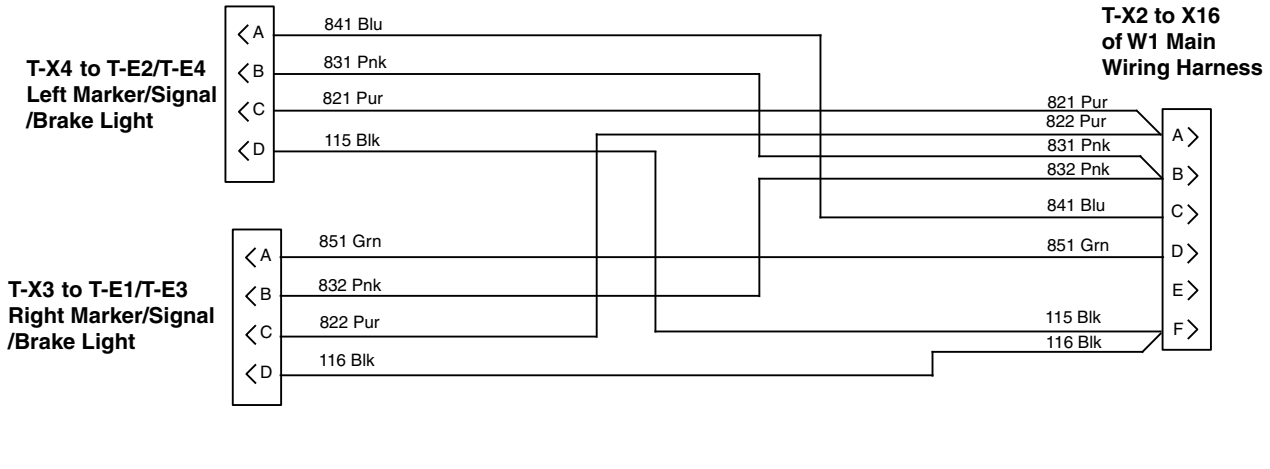
MX52301,000042E -19-17OCT14-1/1

Rear Marker/Brake Lights Circuit Wiring Harness Deluxe



MX52301,000042F -19-23OCT14-1/1

Rear Marker/Brake Lights Kit Circuit Schematic Deluxe



MX52301,0000430 -19-23OCT14-1/1

Rear Marker/Brake Lights Kit Circuit Wiring Harness Color Codes Deluxe

Size/No./Color	Wire Connection Points
1.0 115 Blk	T-X2, T-X4
1.0 116 Blk	T-X2, T-X3
0.8 821 Pur	T-X2, T-X4
0.8 822 Pur	T-X2, T-X3
0.8 831 Pnk	T-X2, T-X4
0.8 832 Pnk	T-X2, T-X3
0.8 841 Blu	T-X2, T-X4
0.8 851 Grn	T-X2, T-X3

MX52301,0000431 -19-23OCT14-1/1

Turn Signal Lights Circuit Diagnosis

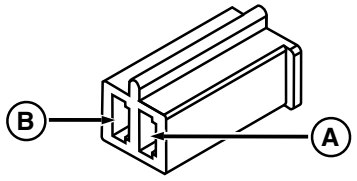
Turn Signal Lights Diagnosis

MX52301,0000432 -19-10OCT14-1/21

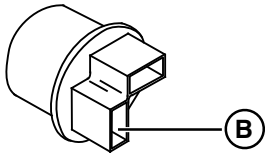
❶ Turn Signal Lights—Power Circuit

Continued on next page

MX52301,0000432 -19-10OCT14-2/21

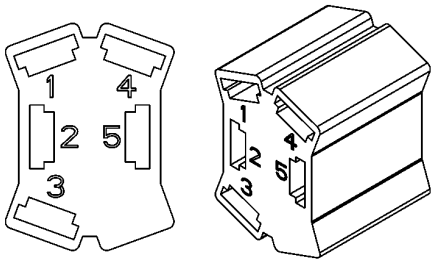
Signal/Harzard Lights Wiring Harness Connector	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Open hood and remove storage tray. • Disconnect any other attachment option from the main wiring harness • Battery fully charged. • Key switch in the off position. • Turn signal lights switch in RIGHT turn position. • Check wire connections for looseness and corrosion. Disconnect X14 connector from turn signal/hazard lights wiring harness. Is battery voltage present at pin A of X14 front optional attachments connector, 203 Red wire (A)?  MXT012019 —UN—25JUN14 **A—203 Red Wire**	**YES:** Connect X14 connector to turn signal/hazard lights wiring harness. Go to next step. **NO:** Test F7 fuse. Check 203 Red wire. See appropriate power circuit operation.

MX52301,0000432 -19-10OCT14-3/21

Flasher Voltage	Is battery voltage present at 256 Red wire of T-K1 flasher (B)?  MXT012072 —UN—27JUN14 **B—256 Red Wire**	**YES:** Go to next step. **NO:** Check 255 Red wire, T-F2 fuse, 256 Red wire, and connections.

Continued on next page

MX52301,0000432 -19-10OCT14-4/21

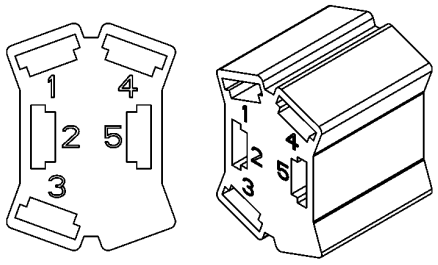
Signal/Hazard Lights Switch	Disconnect connector from turn signal/hazard lights switch. Is battery voltage present at T-S2 turn signal lights switch connector, 470 Yel wire (2)?  MXT001666 —UN—10OCT11 **2— 470 Yellow Wire**	**YES:** Connect the connector to the turn signal lights switch. Go to next step. **NO:** Check 470 Yel wire and connections. If OK, replace T-K1 flasher.

MX52301,0000432 -19-10OCT14-5/21

❶ Turn Signal Lights—Right Turn Circuit

Continued on next page

MX52301,0000432 -19-10OCT14-6/21

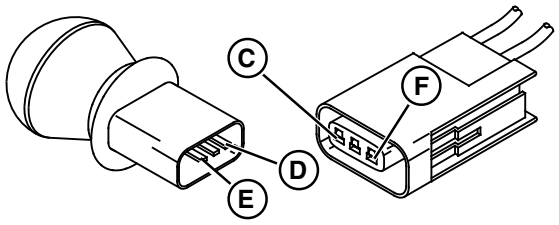
Signal Lights Switch Connector Voltage	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Open hood and remove storage tray. • Disconnect any other attachment option from the main wiring harness • Battery fully charged. • Key switch in the off position. • Turn signal lights switch in RIGHT turn position. • Check wire connections for looseness and corrosion. Disconnect connector from turn signal lights switch. Is pulsing battery voltage present at T-S2 turn signal lights switch connector, 470 Yel wire (2)?  MXT001666 —UN—10OCT11 **1— 850C Green Wire** **2— 470 Yellow Wire**	**YES:** Connect turn signal switch connector. Go to next step. **NO:** Check 470 Yel wire and connections. If OK, replace T-K1 flasher.

MX52301,0000432 -19-10OCT14-7/21

Turn Signal Light Switch Connector Voltage	Is pulsing battery voltage present at T-S2 turn signal lights switch connector, 850C Grn wire (1)?	**YES:** Go to next step. **NO:** Replace T-S2 turn signal lights switch.

Continued on next page

MX52301,0000432 -19-10OCT14-8/21

Right Front Light Turn Signal Connector Voltage	Disconnect right front turn signal light connector. Is pulsing battery voltage present at terminal 3 of T-X7 connector, 850D Grn wire of T-E6 right front turn signal light (C)?  MXT012074 —UN—27JUN14 **C—850D Green Wire** **D—Terminal 1** **E—Terminal 3** **F—119 Black Wire**	**YES:** Go to next step. **NO:** Check 850C Grn wire, splice, 850D Grn wire, and connections.

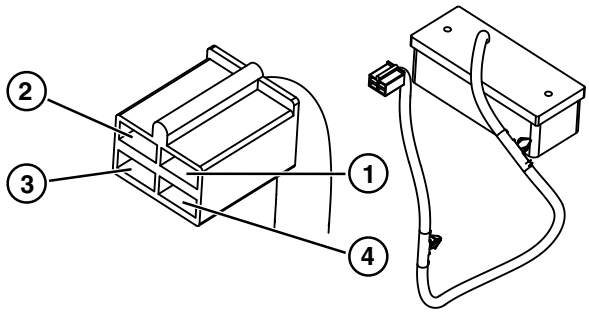
MX52301,0000432 -19-10OCT14-9/21

Right Front Light Turn Signal Connector Continuity	Check for continuity between terminals 1 (D) and 3 (E) of T-E6 right front turn signal light. Is continuity present?	**YES:** Go to next step. **NO:** Replace light.

MX52301,0000432 -19-10OCT14-10/21

Right Front Light Turn Signal Connector Ground	Is continuity to ground present at terminal 1 of T-X7 connector, 119 Blk wire of T-E6 right front turn signal light (F)?	**YES:** Connect right front signal connector. Go to next step. **NO:** Check 119 and 117 Blk wire, T-X1 and X15 connectors, 102 and 100A Blk wires, and connections.

MX52301,0000432 -19-10OCT14-11/21

Right Rear Signal Light Connector Voltage	Disconnect right rear signal light connector. Is pulsing battery voltage present at A terminal of right rear signal light connector T-X3, 851 Grn wire (4)?  MXT012060 —UN—26JUN14 **3—116 Black Wire** **4—851 Green Wire**	**YES:** Go to next step. **NO:** Check 850C, 850A, 850, and 851 Grn wires and connections.

Continued on next page

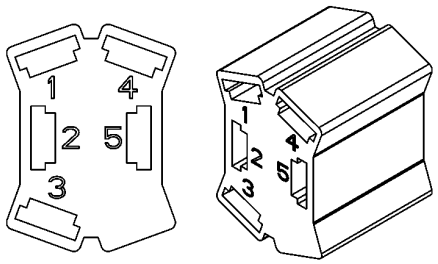
MX52301,0000432 -19-10OCT14-12/21

Right Rear Signal Light Connector Ground	Is continuity to ground present at D terminal of right rear signal light connector T-X3, 116 Blk wire (3)?	**YES:** Connect right marker connector. Test bulb. See Bulb Test **NO:** Check 116, 101A, and 101G Blk wires and connections.

MX52301,0000432 -19-10OCT14-13/21

❶ Turn Signal Lights—Left Turn Circuit

MX52301,0000432 -19-10OCT14-14/21

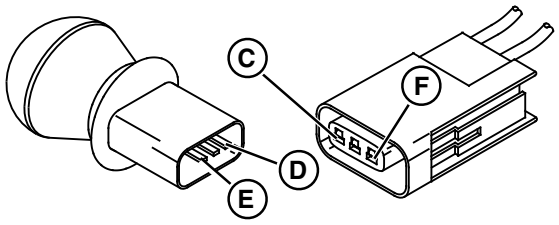
Signal Light Switch Voltage	**Test Procedure** **Test Conditions:** • Machine parked safely. See Park Brake Switch Test • Park brake locked. • Cargo box raised and locked. • Open hood and remove storage tray. • Disconnect any other attachment option from the main wiring harness • Battery fully charged. • Key switch in the off position. • Turn signal lights switch in LEFT turn position. • Check wire connections for looseness and corrosion. Disconnect connector from turn signal lights switch. Is pulsing battery voltage present at T-S2 turn signal lights switch connector, 470 Yel wire (2)?  MXT001666 —UN—10OCT11 **2— 470 Yellow Wire** **3— 840C Blue Wire**	**YES:** Connect turn signal switch connector. Go to next step. **NO:** Check 470 Yel wire and connections. If OK, replace T-K1 flasher.

MX52301,0000432 -19-10OCT14-15/21

Turn Signal Light Switch Connector Voltage	Is pulsing battery voltage present at T-S2 turn signal lights switch connector, 840C Blu wire (3)?	**YES:** Go to next step. **NO:** Replace T-S2 turn signal lights switch.

Continued on next page

MX52301,0000432 -19-10OCT14-16/21

Left Front Light Turn Signal Connector Voltage	Disconnect left front turn signal light connector. Is pulsing battery voltage present at terminal 3 of T-X6 connector, 840D Blu wire of T-E5 left front turn signal light (C)?  MXT012074 —UN—27JUN14 **C—840D Green Wire** **D—Terminal 1** **E—Terminal 3** **F—118 Black Wire**	**YES:** Go to next step. **NO:** Check 840C Blu wire, splice, 840D Blu wire, and connections.

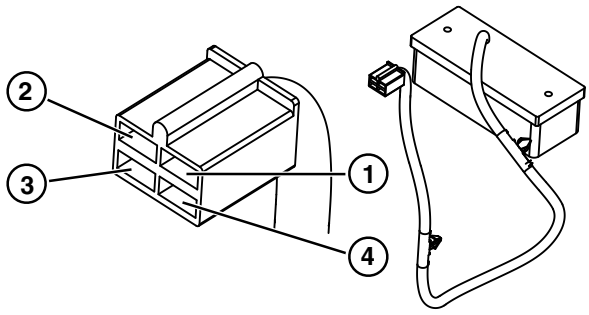
MX52301,0000432 -19-10OCT14-17/21

Left Front Light Turn Signal Connector Continuity	Check for continuity between terminals 1 (D) and 3 (E) of T-E5 left front turn signal light. Is continuity present.	**YES:** Go to next step. **NO:** Replace light.

MX52301,0000432 -19-10OCT14-18/21

Left Front Light Turn Signal Connector Ground	Is continuity to ground present at terminal 1 of T-X6 connector, 118 Blk wire of T-E5 left front turn signal light (F)?	**YES:** Connect left front signal connector. Go to next step. **NO:** Check 118 Blk wire, T-X1 and X15 connectors, 102 and 100A Blk wires, and connections.

MX52301,0000432 -19-10OCT14-19/21

Left Rear Signal Light Connector Voltage	Disconnect left rear signal light connector. Is pulsing battery voltage present at A terminal of left rear signal light connector T-X4, 841 Blu wire (4)?  MXT012060 —UN—26JUN14 **3—115 Black Wire** **4—841 Blue Wire**	**YES:** Go to next step. **NO:** Check 840C, 840A, 840, and 841 Blu wires and connections.

Continued on next page

MX52301,0000432 -19-10OCT14-20/21

Left Rear Signal Light Connector Ground	Is continuity to ground present at D terminal of left rear signal light connector T-X4, 115 Blk wire (3)?	**YES:** Connect right marker connector. Test bulb. See Bulb Test **NO:** Check 115, 101A, and 101G Blk wires and connections.

MX52301,0000432 -19-10OCT14-21/21

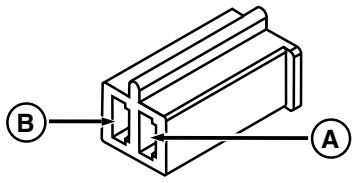
Hazard Lights Circuit Diagnosis

Hazard Lights Diagnosis

MX52301,0000433 -19-22OCT14-1/10

❶ Hazard Lights Power Circuit

MX52301,0000433 -19-22OCT14-2/10

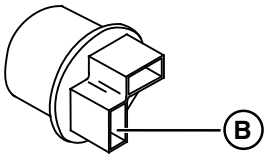
Optional Attachments Connector Voltage	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Open hood and remove storage tray. • Disconnect any other attachment option from the main wiring harness • Hazard lights switch in OFF position. • Battery fully charged. • Key switch in the off position. • Check wire connections for looseness and corrosion. Disconnect X14 connector from turn signal/hazard lights wiring harness. Is battery voltage present at pin A of X14 front optional attachments connector, 203 Red wire (A)?  MXT012019 —UN—25JUN14 **A—203 Red Wire**	**YES:** Connect X14 connector to turn signal/hazard lights wiring harness. Go to next step. **NO:** Test F7 fuse. Check 203 Red wire. See appropriate power circuit operation.

Continued on next page

MX52301,0000433 -19-22OCT14-3/10

Flasher Voltage

Is battery voltage present at 256 Red wire of T-K1 flasher (B)?



MXT012072 —UN—27JUN14

B—256 Red Wire

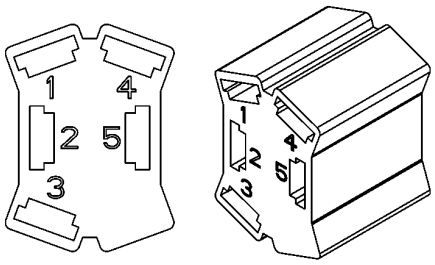
YES: Go to next step.

NO: Check 255 Red wire, T-F2 fuse, 256 Red wire, and connections.

MX52301,0000433 -19-22OCT14-4/10

Hazard Lights Switch Connector Voltage

Is battery voltage present at T-S1 hazard lights switch connector, 471 Yel wire (5)?



MXT001666 —UN—10OCT11

5— 471 Yellow Wire

YES: Go to next step.

NO: Check 471 and 470 Yel wires and connections. If ok, replace T-K1 flasher.

MX52301,0000433 -19-22OCT14-5/10

❶ Hazard Lights Operation Circuit

MX52301,0000433 -19-22OCT14-6/10

Right Turn Signal

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Open hood and remove storage tray.
- Disconnect any other attachment option(s) from the main wiring harness
- Hazard lights switch in ON position.
- Battery fully charged.
- Key switch in the off position.
- Check wire connections for looseness and corrosion.

Is the right turn signal operational?

YES: Go to next step.

NO: See test conditions.

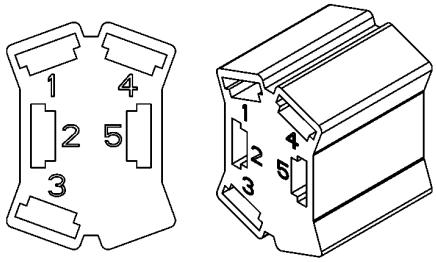
Continued on next page

MX52301,0000433 -19-22OCT14-7/10

Optional Deluxe Light Kit

Left Turn Signal	Is the left turn signal operational?	**YES:** Go to next step. **NO:** See test conditions.

MX52301,0000433 -19-22OCT14-8/10

Hazard Light Switch Connector	Is pulsing battery voltage present at T-S1 hazard lights switch connector, 840B Blu wire (1)?  MXT001666 —UN—10OCT11 **1— 840B Blue Wire** **4— 850B Green Wire**	**YES:** Go to next step. **NO:** Replace hazard switch.

MX52301,0000433 -19-22OCT14-9/10

Hazard Lights Switch Connector Voltage	Is pulsing battery voltage present at T-S1 hazard lights switch connector, 850B Grn wire (4)?	**YES:** Test complete. **NO:** Replace hazard switch.

MX52301,0000433 -19-22OCT14-10/10

Rear Marker Lights Diagnosis

Rear Marker Lights Circuit Diagnosis

MX52301,0000434 -19-22OCT14-1/9

❶ Marker Lights Circuit

Continued on next page

MX52301,0000434 -19-22OCT14-2/9

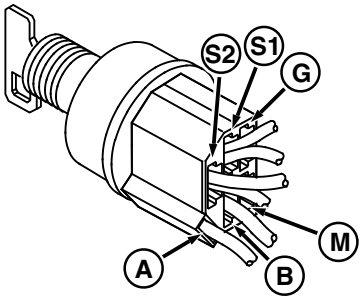
Key Switch

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Open hood and remove storage tray.
- Disconnect any other attachment option(s) from the main wiring harness
- Battery fully charged.
- Key switch in the run position, engine off
- Light switch in CENTER ON position.
- Check wire connections for looseness and corrosion.

Is battery voltage present at A terminal of S1 key switch (A)?



MXT004463 —UN—31MAY12

A—Terminal of S1 Key Switch

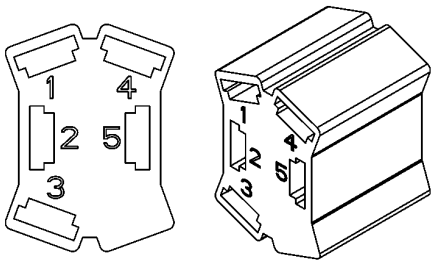
YES: Go to next step.

NO: Test key switch. See Key Switch Test.

MX52301,0000434 -19-22OCT14-3/9

Light Switch (SN -110000)

Is battery voltage present at 420G Yel wire of S4-A light switch (2)?



MXT001666 —UN—10OCT11

2— 420G Yellow Wire

YES: Go to next step.

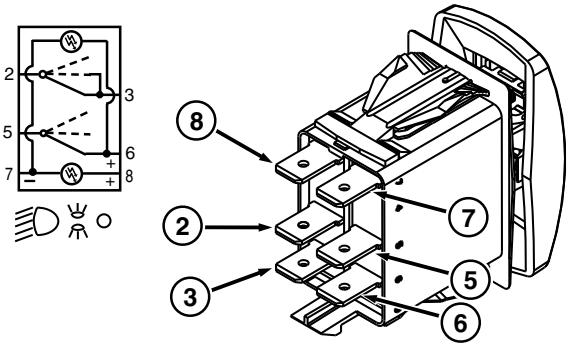
NO: Check 420J and 420G Yel wires and connections.

Continued on next page

MX52301,0000434 -19-22OCT14-4/9

Light Switch (SN 110001-)

Is battery voltage present at 420G Yel wire of S4 light switch (2)?



MXT008021 —UN—31JUL13

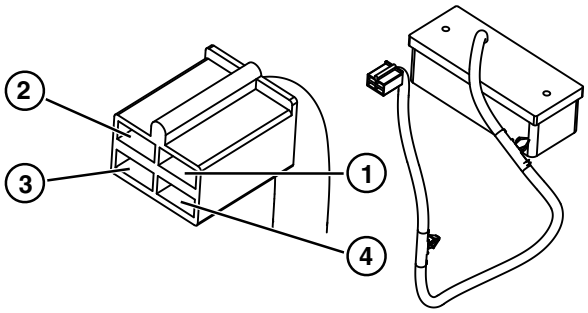
YES: Go to next step.

NO: Check 420G Yel wire and connections.

MX52301,0000434 -19-22OCT14-5/9

Right Marker Light Connector Voltage

Disconnect right marker light connector. Is battery voltage present at terminal of right marker light connector T-X3, 832 Pnk wire (3)?



MXT012060 —UN—26JUN14

2— 116 Black Wire
3— 832 Pink Wire

YES: Go to next step.

NO: Test light switch. (See Light Switch Test (3 Position), Light Switch Test (3 Position) (AM144304)) Check 830 and 831 Pnk wires and connections.

MX52301,0000434 -19-22OCT14-6/9

Right Marker Light Connector Ground

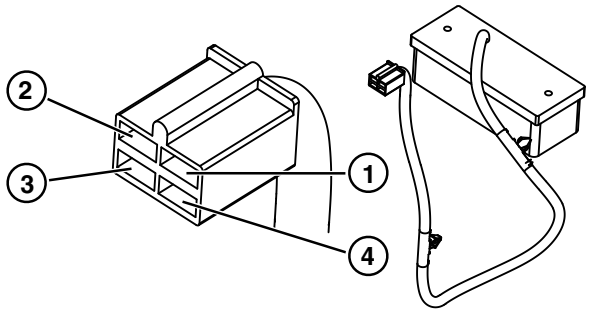
Is continuity to ground present at terminal of right marker light connector T-X3, 116 Blk wire (2)?

YES: Connect right marker connector. Test bulb. See Bulb Test.

NO: Check 116, 101A, and 101G Blk wires and connections.

Continued on next page

MX52301,0000434 -19-22OCT14-7/9

Left Marker Light Connector Voltage	Disconnect left marker light connector. Is battery voltage present at B terminal of left marker light connector T-X4, 831 Pnk wire (3)?  MXT012060 —UN—26JUN14 **2— 115 Black Wire** **3— 831 Pink Wire**	**YES:** Go to next step. **NO:** Test light switch. (See Light Switch Test (3 Position), Light Switch Test (3 Position) (AM144304)) Check 830 and 831 Pnk wires and connections.

MX52301,0000434 -19-22OCT14-8/9

Left Marker Light Connector Ground	Is continuity to ground present at D terminal of left marker light connector T-X4, 115 Blk wire (2)?	**YES:** Connect left marker connector. Test bulb. See Bulb Test. **NO:** Check 115, 101A, and 101G Blk wires and connections.

MX52301,0000434 -19-22OCT14-9/9

Brake Lights Diagnosis

Brake Lights Diagnosis

MX52301,0000435 -19-22OCT14-1/10

❶ Brake Lights Circuit

Continued on next page

MX52301,0000435 -19-22OCT14-2/10

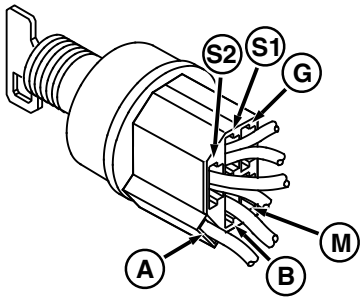
Key Switch

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Open hood and remove storage tray.
- Disconnect any other attachment option(s) from the main wiring harness
- Battery fully charged.
- Key switch in the run position, engine off
- Brake pedal depressed (Switch CLOSED).
- Light switch in CENTER ON position.
- Check wire connections for looseness and corrosion.

Is battery voltage present at the B terminal of switch connector, 208 Red wire (B)?



MXT004463 —UN—31MAY12

B—208 Red Wire

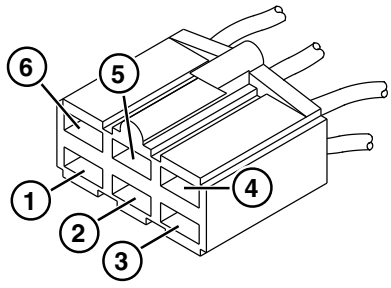
YES: Go to next step.

NO: Test F6 fuse. Test battery and positive (+) battery cable. Check 201 and 202 Red wires and connections. Check 208 Red wire and connections.

MX52301,0000435 -19-22OCT14-3/10

Front Lights Connector

Is battery voltage present at 420K Yel wire at the X15 front lights connector (2)?



MXT011954 —UN—21OCT14

2— 420K Yellow Wire

YES: Go to next step.

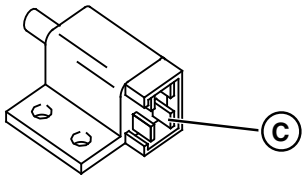
NO: Test the S1 key switch. See Key Switch Test. Check 420K and 420J Yel wires and connections.

Continued on next page

MX52301,0000435 -19-22OCT14-4/10

Brake Light Switch Voltage

Is battery voltage present at 421 Yel wire of the T-S3 brake lights switch (C)?



MXT012015 —UN—25JUN14

C—421 Yellow Wire

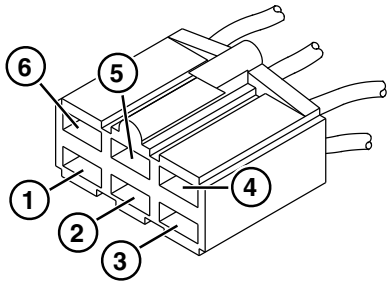
YES: Go to next step.

NO: Test T-F1 fuse. Check 421 and 422 Yel wire and connections.

MX52301,0000435 -19-22OCT14-5/10

Rear Lights Connector

Is battery voltage present at 820 Pur wire on the X16 rear lights connector (6)?



MXT011954 —UN—21OCT14

6— 820 Purple Wire

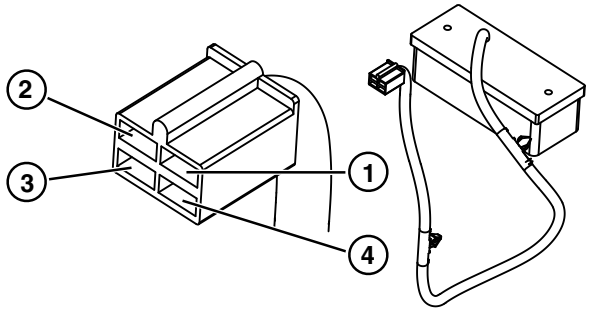
YES: Go to next step.

NO: Test brake light switch. See Brake Lights Switch Test. Check 823 and 820 Pur wires and connections.

MX52301,0000435 -19-22OCT14-6/10

Right Marker Light Connector Voltage

Disconnect right marker light connector. Is battery voltage present at terminal of right marker light connector T-X3, 822 Pur wire (1)?



MXT012060 —UN—26JUN14

1— 822 Purple Wire
2— 116 Black Wire

YES: Go to next step.

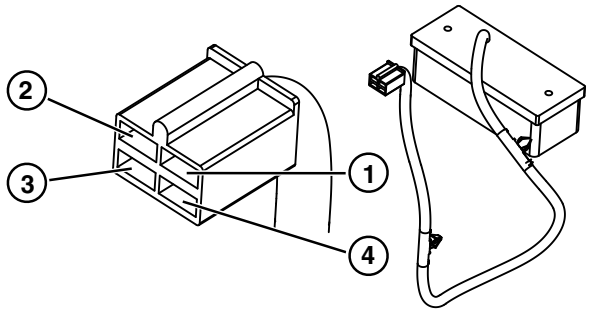
NO: Check 822 Pur wire and connections.

Continued on next page

MX52301,0000435 -19-22OCT14-7/10

Right Marker Light Connector Ground	Is continuity to ground present at terminal of right marker light connector T-X3, 116 Blk wire (2)?	**YES:** Connect right marker connector. Test bulb. See Bulb Test. **NO:** Check 116, 101A, and 101G Blk wires and connections.

MX52301,0000435 -19-22OCT14-8/10

Left Marker Light Connector Voltage	Disconnect left marker light connector. Is battery voltage present at terminal of left marker light connector T-X4, 821 Pur wire (1)?  MXT012060 —UN—26JUN14 **1— 821 Purple Wire** **2— 115 Black Wire**	**YES:** Go to next step. **NO:** Check 821 Pur wire and connections.

MX52301,0000435 -19-22OCT14-9/10

Left Marker Light Connector Voltage	Is continuity to ground present at terminal of left marker light connector T-X4, 115 Blk wire (2)?	**YES:** Connect left marker connector. Test bulb **NO:** Check 115, 101A, and 101G Blk wires and connections.

MX52301,0000435 -19-22OCT14-10/10

Summary of References

- Homologated Light and Horn Kit Wiring Harness Legend (SN -110000)
- Homologated Light and Horn Circuit Schematic (SN -110000)
- Homologated Light and Horn Wiring Harness (SN -110000)H
- Homologated Light and Horn Wiring Harness Color Codes (SN -110000)
- Homologated Lights Schematic Legend (SN 110001-)
- Homologated Lights Schematic (SN 110001-)
- Homologated Lights Wiring Harness (SN 110001-)
- Homologated Lights Harness Wire Color Codes (SN 110000-)

MX52301,0000451 -19-23OCT14-1/1

Homologated Light and Horn Kit Wiring Harness Legend (SN -110000)

Electrical Components:

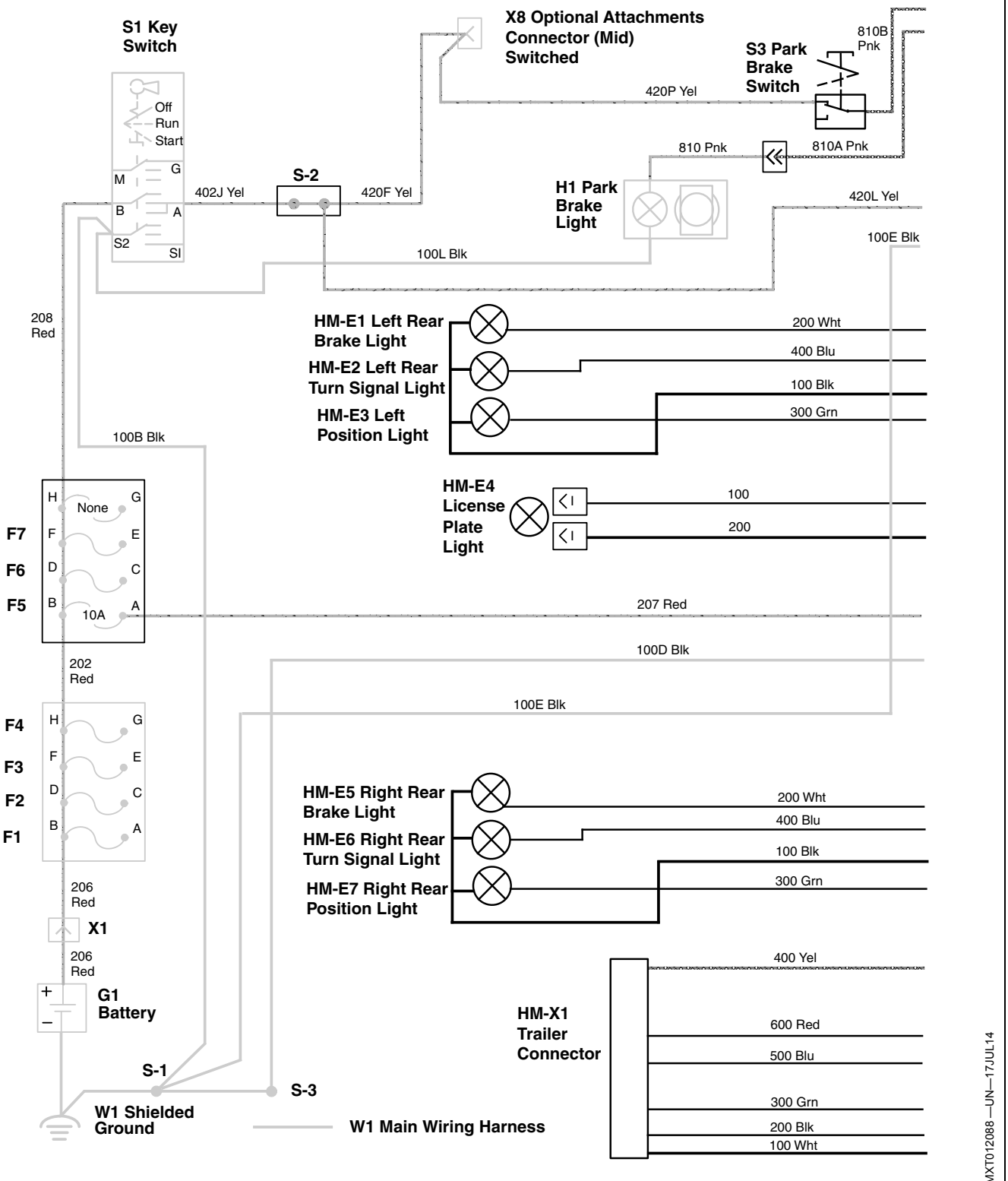
HM-E1 — Left Rear Brake Light
HM-E2 — Left Rear Turn Signal Light
HM-E3 — Left Rear Position Light
HM-E4 — License Plate Light
HM-E5 — Right Rear Brake Light
HM-E6 — Right Rear Turn Signal Light
HM-E7 — Right Rear Position Light
HM-E8 — Vehicle Bulb Integrity Light
HM-E9 — Trailer Bulb Integrity Light
HM-E10 — Left Front Position Light
HM-E11 — Left Front Turn Light
HM-E12 — Left Headlight
HM-E13 — Right Headlight
HM-E14 — Right Front Turn Light
HM-E15 — Right Front Position Light
HM-F1 — Flasher Fuse (15A)
HM-F2 — Brake Lights Fuse (10A)
HM-F3 — Horn Fuse (10A)
HM-F4 — Not Used (15A)
HM-F5 — Left Position Lights Fuse (10A)
HM-F6 — Right Position Lights Fuse (10A)
HM-F7 — Right Headlight Fuse (10A)
HM-F8 — Left Headlight Fuse (10A)
HM-H1 — Horn
HM-K1 — Brake Switch
HM-R1 — 91 Ohm 2 Watt Resistor
HM-S1 — Flasher
HM-S2 — Light Switch
HM-S3 — Turn Switch
HM-S4 — Flasher Switch
HM-S5 — Horn Switch
HM-V1 — Diode
HM-V2 — Diode
HMS-1 — Switched Power Splice
HMS-2 — Flasher Circuit Ground Splice
HMS-3 — Rear Lights Ground Splice
HMS-4 — Front Lights Ground Splice

Connectors:

HM-X1 — Trailer Connector
HM-X2 — Optional Front Attachment Connector
HM-X3 — Wiring Harness to Left Rear Lights Wiring Harness
HM-X4 — Wiring Harness to License Plate Light Wiring Harness
HM-X5 — Wiring Harness to Optional Attachments
HM-X6 — Wiring Harness to Right Rear Lights Wiring Harness
HM-X7 — Wiring Harness to Trailer Wiring Harness
HM-X8 — Wiring Harness to W? Trailer Wiring Harness
HM-X9 — Wiring Harness to Trailer Wiring Harness
HM-X10 — Wiring Harness to Left Front Position Light
HM-X11 — Wiring Harness to Left Front Turn Light
HM-X12 — Wiring Harness to Left Headlight
HM-X13 — Wiring Harness to Right Headlight
HM-X14 — Wiring Harness to Right Front Turn Light
HM-X15 — Wiring Harness to Right Front Position Light

MX52301,0000436 -19-24OCT14-1/1

Homologated Light and Horn Circuit Schematic (SN -110000)



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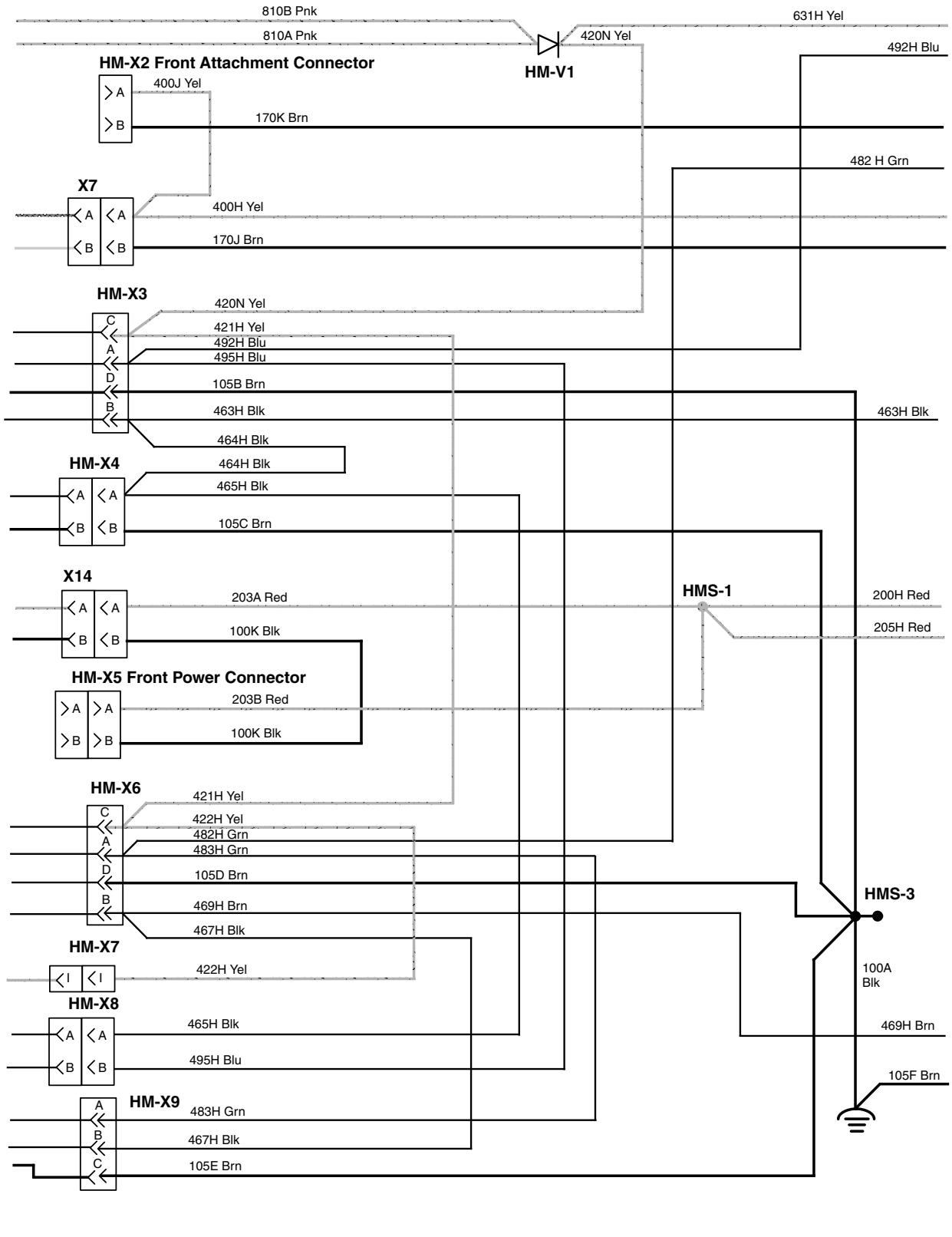
MX52301,0000437 -19-24OCT14-1/4

Homologated Light and Horn Circuit Schematic 2of 4



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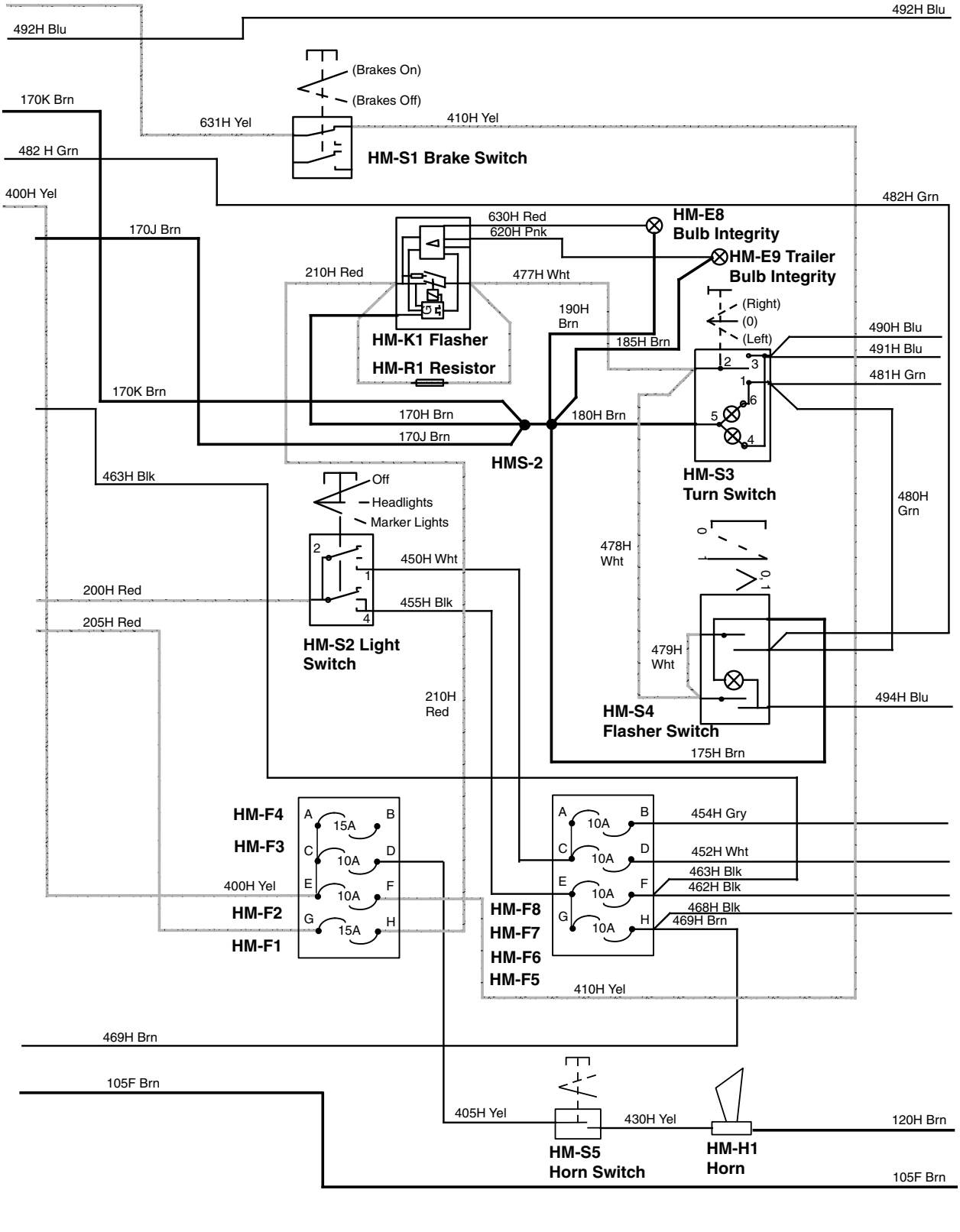
MX52301,0000437 -19-24OCT14-2/4

Homologated Light and Horn Circuit Schematic 3of 4



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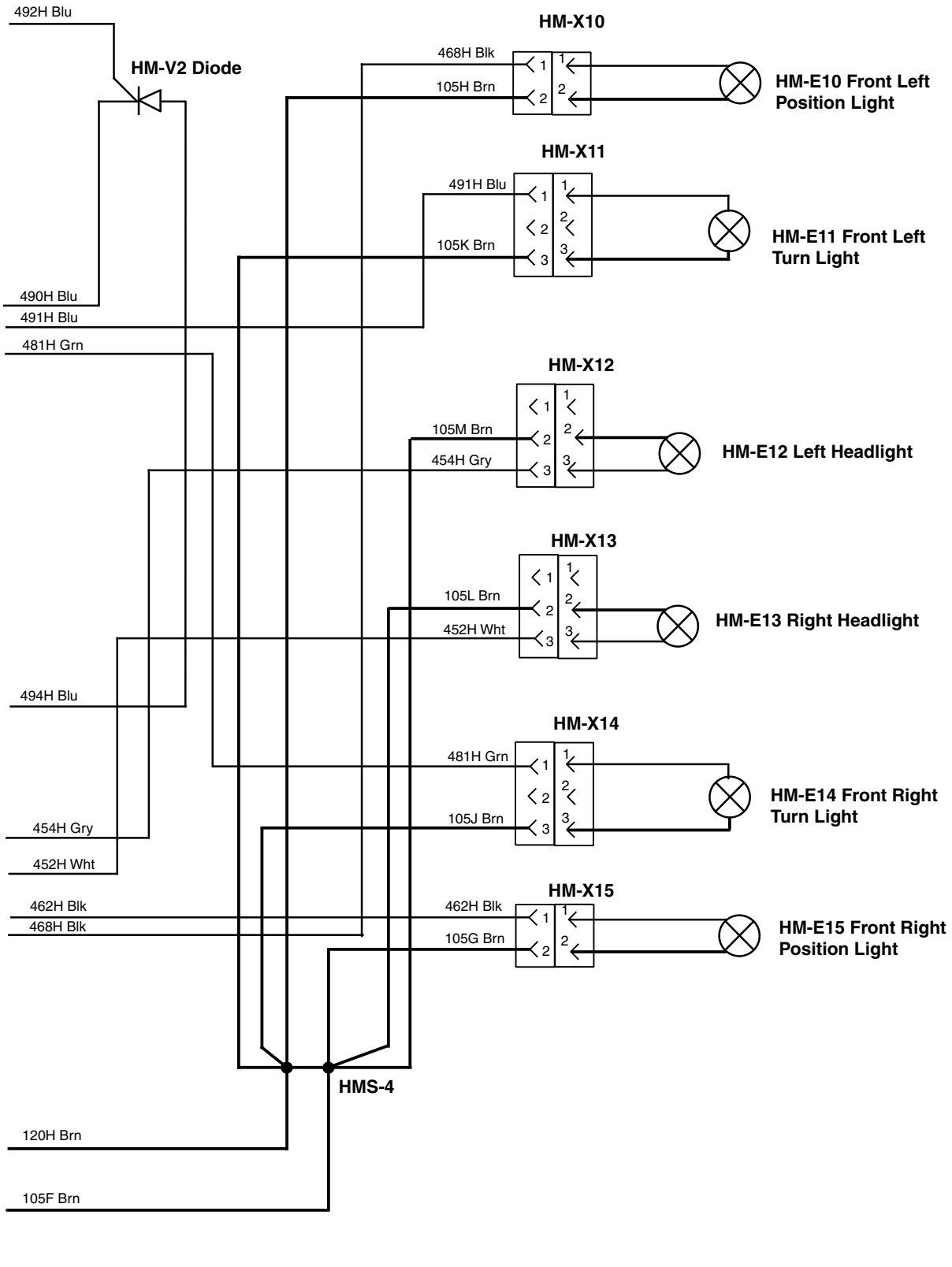
MX52301,0000437 -19-24OCT14-3/4

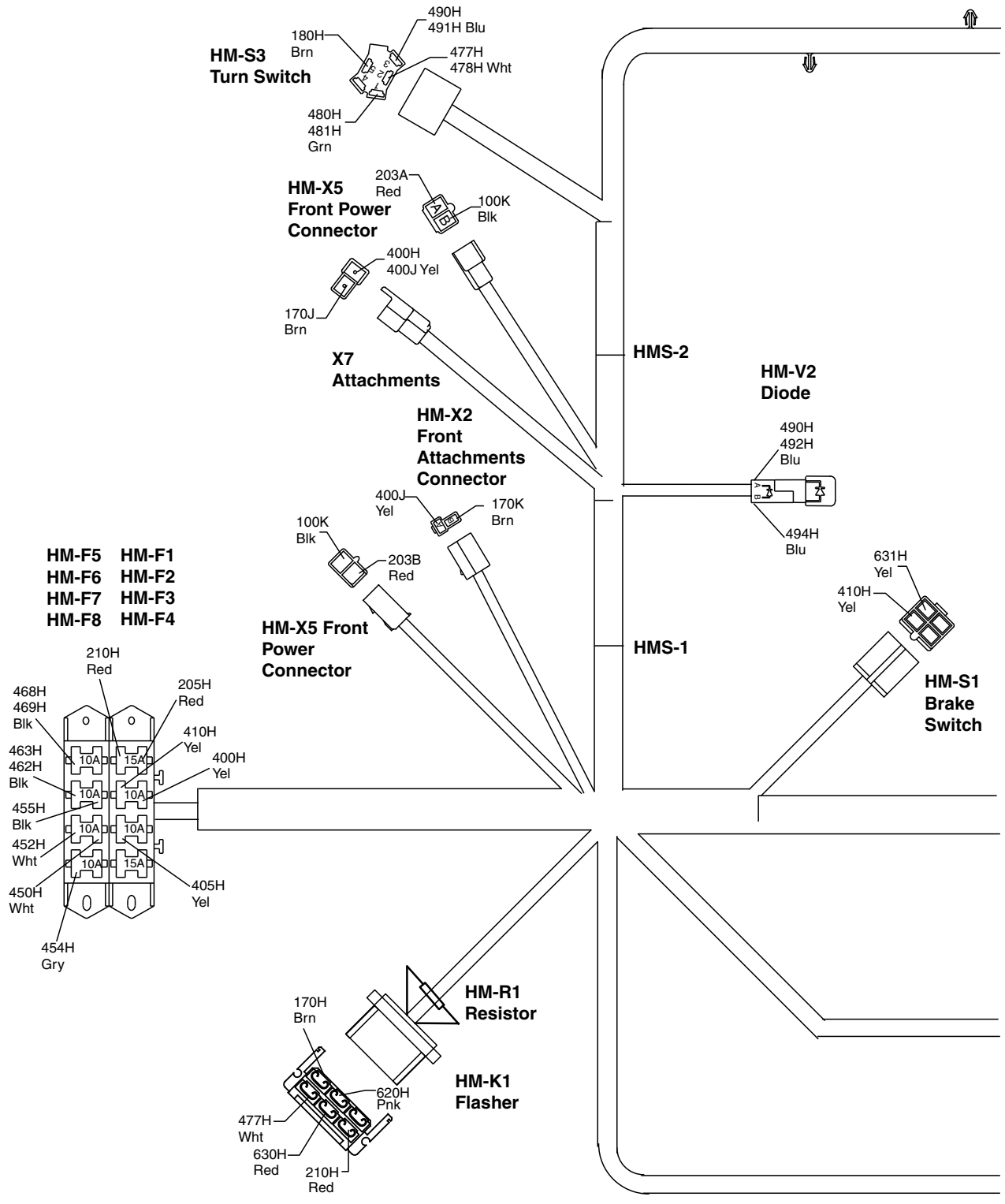
Homologated Light and Horn Circuit Schematic 4 of 4



MXT0012091 —UN—22MAY14

MX52301,0000437 -19-24OCT14-4/4

Homologated Light and Horn Wiring Harness (SN -110000)



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MX52301,0000438 -19-24OCT14-1/5

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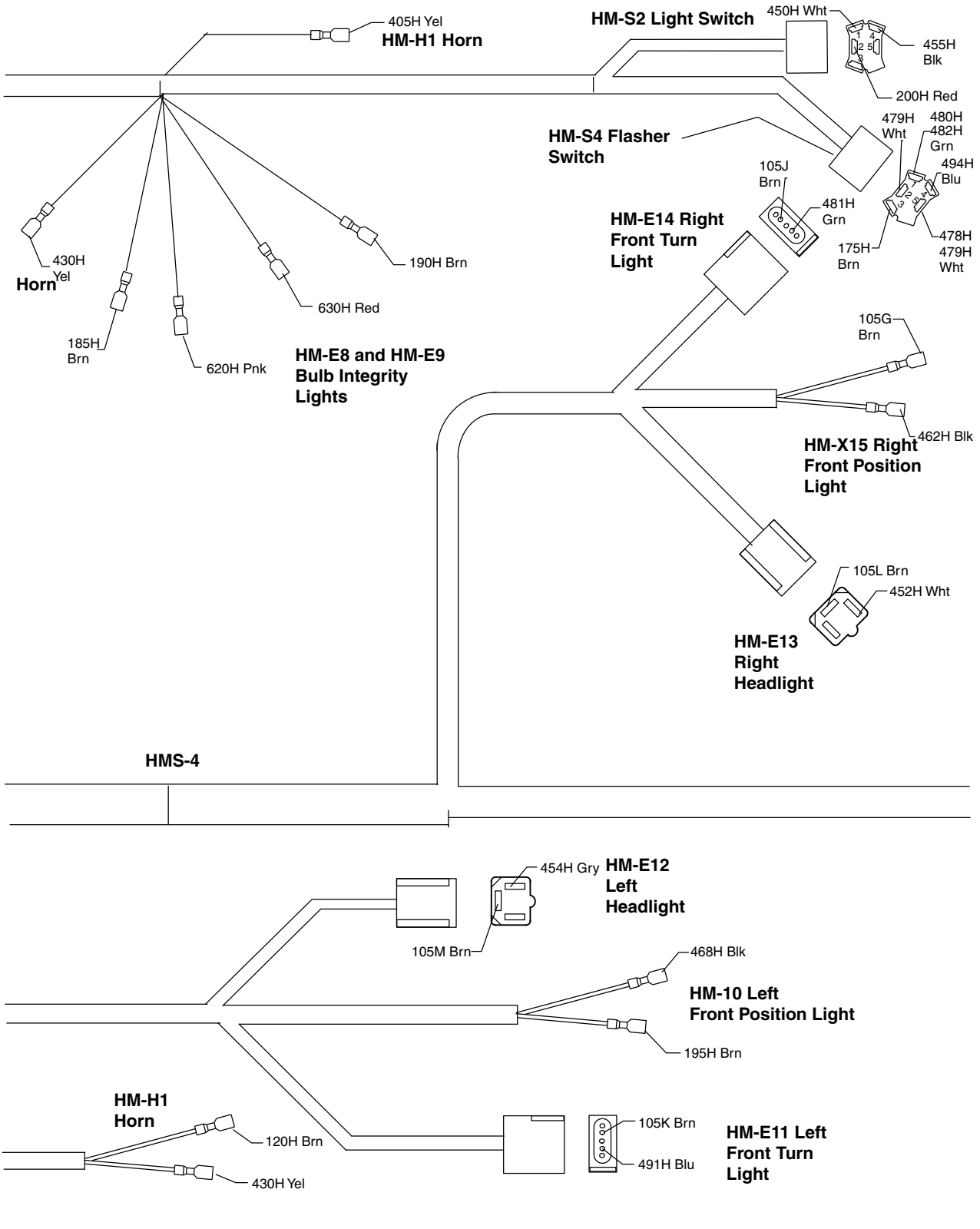
Homologated Light and Horn Wiring Harness 2of 4



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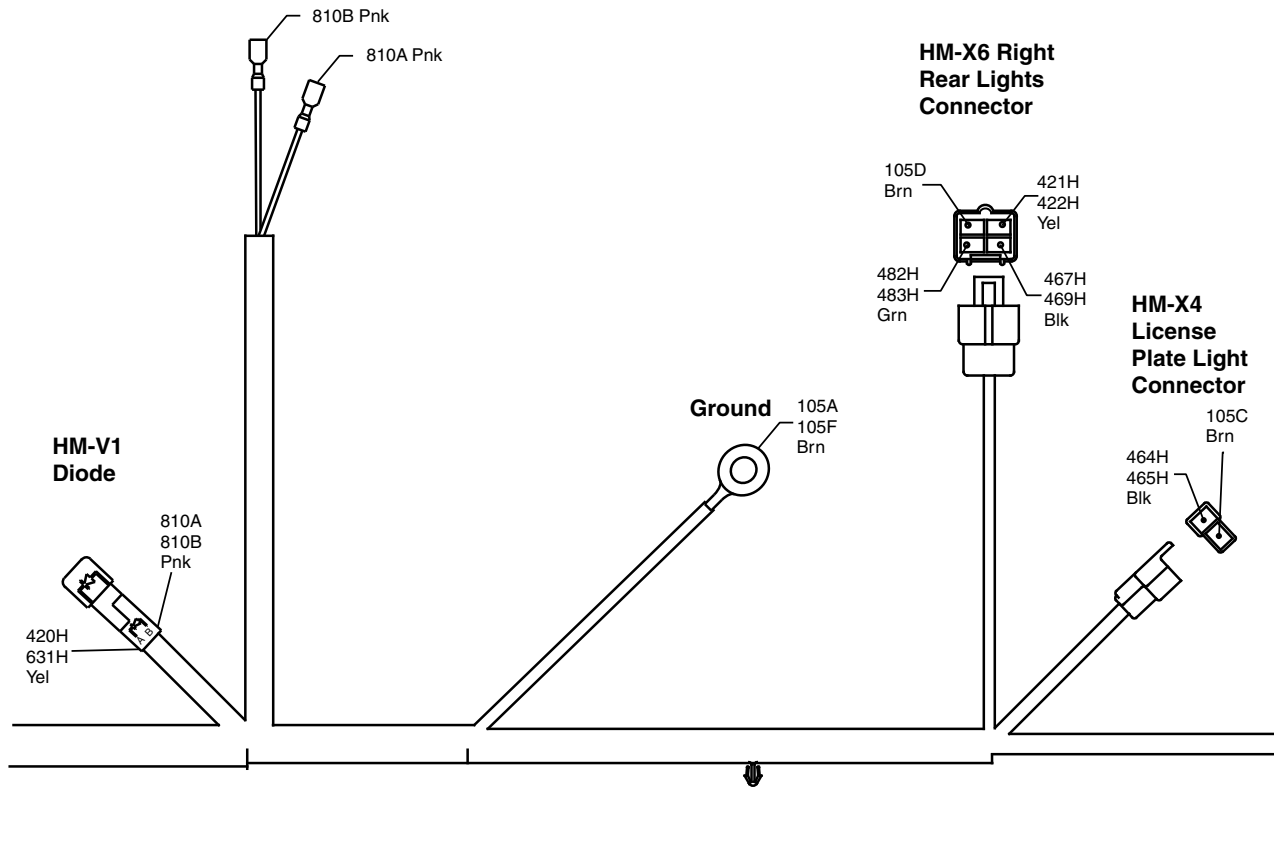
MX52301,0000438 -19-24OCT14-3/5

Homologated Light and Horn Wiring Harness 3of 4



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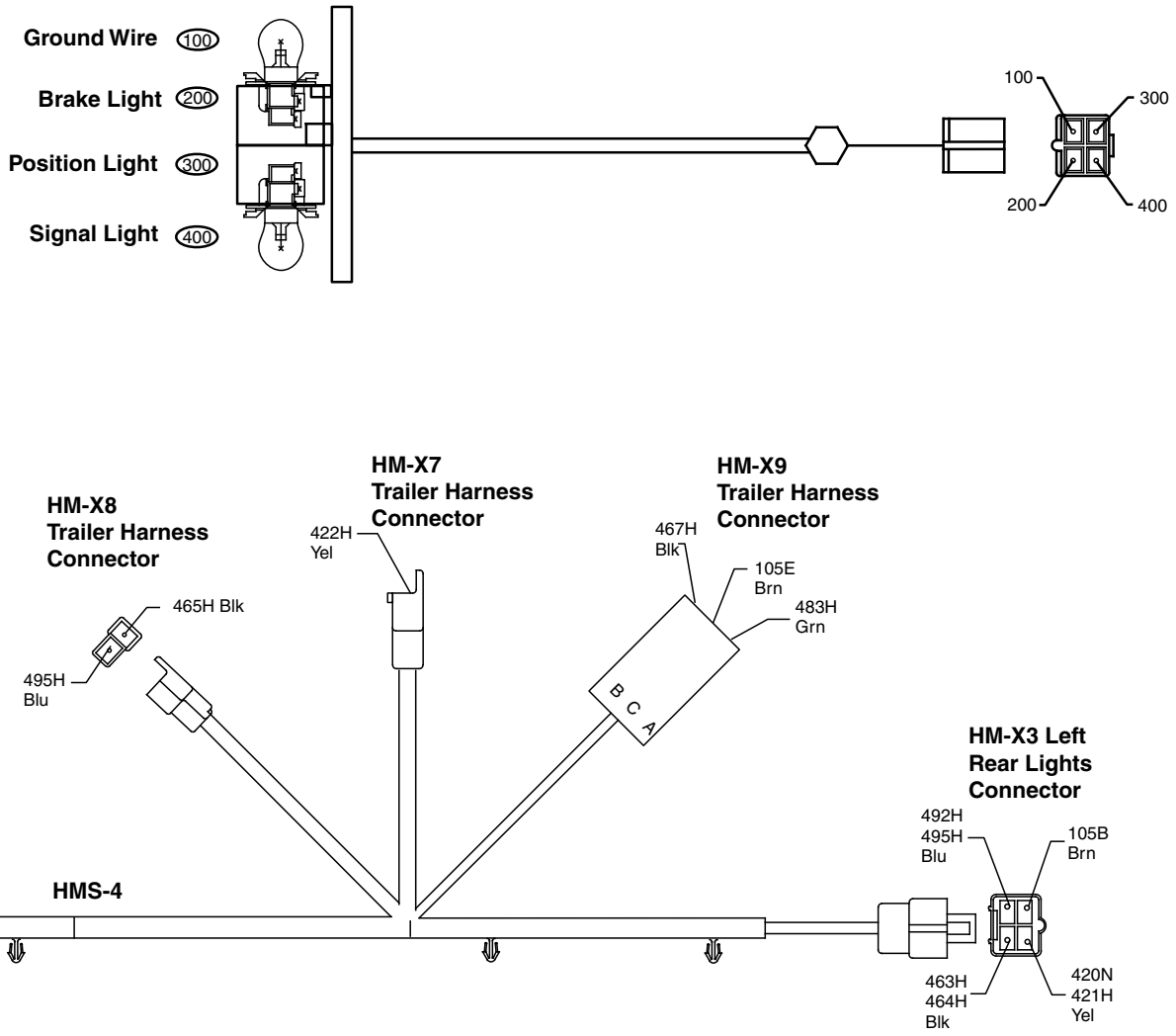
MX52301,0000438 -19-24OCT14-4/5

Homologated Light and Horn Wiring Harness 4 of 4



MX52301,0000438 -19-24OCT14-5/5

Homologated Light and Horn Wiring Harness Color Codes (SN -110000)

Size/No./Color	Wire Connection Points
3.0 100K Blk	X14, HM-X5
1.0 105A Brn	Splice, HMS-3
0.8 105B Brn	HMS-3, HM-X3
0.8 105C Brn	HMS-3, HM-X4
0.8 105D Brn	HMS-3, HM-X6
1.0 105E Brn	HMS-3, HM-X9
3.0 105F Brn	Splice, HMS-4
0.8 105G Brn	HMS-4, HM-X15
0.8 105H Brn	HMS-4, HM-X10
0.8 105J Brn	HMS-4, HM-X14
0.8 105K Brn	HMS-4, HM-X11
0.8 105L Brn	HMS-4, HM-X13
0.8 105M Brn	HMS-4, HM-X12
0.8 120H Brn	HM-H1, HMS-4
0.8 170H Brn	HMS-2, HM-K1
1.0 170J Brn	HMS-2, HM-X2
1.0 170K Brn	HMS-2, HM-X2
0.8 175H Brn	HMS-2, HM-S4
0.8 180H Brn	HMS-2, HM-S3
0.5 185H Brn	HMS-2, HM-E9
0.5 190H Brn	HMS-2, HM-E8
2.0 200H Red	HMS-1, HM-S2
3.0 203A Red	HMS-1, X14
3.0 203B Red	HMS-1, HM-X5
2.0 205H Red	HM-F1, HMS-1
1.0 210H Red	HM-F1, HM-K1
1.0 400H Yel	HM-F2, X7
1.0 400J Yel	HM-X2, X7
0.8 405H Yel	X7, HM-F2
1.0 410H Yel	HM-S1, HM-F2
1.0 420N Yel	HM-X3, HM-V1
1.0 421H Yel	HM-X3, HM-X6
1.0 422H Yel	HM-X6, HM-X7
0.8 430H Yel	HM-S5, HM-H1
2.0 450H Wht	HM-S2, HM-F7
0.8 452H Wht	HM-X13, HM-F7
0.8 454H Gry	HM-X12, HM-F8
2.0 455H Blk	HM-S2, HM-F6
0.8 462H Blk	HM-F6, HM-X15
1.0 463H Blk	HM-X3, HM-F6
1.0 464H Blk	HM-X3, HM-X4
1.0 465H Blk	HM-X4, HM-X8
1.0 467H Blk	HM-X6, HM-X9
0.8 468H Blk	HM-X10, HM-F5
0.8 469H Blk	HM-X6, HM-F5
1.0 477H Wht	HM-K1, HM-S3
1.0 478H Wht	HM-S4, HM-S3
1.0 479H Wht	HM-S4, HM-S4
1.0 480H Grn	HM-S3, HM-S4
0.8 481H Grn	HM-X14, HM-S3
1.0 482H Grn	HM-X6, HM-S4
1.0 483H Grn	HM-X6, HM-X9
1.0 490H Blu	HM-S3, HM-V2
0.8 491H Lt. Blu	HM-X11, HM-S3
1.0 492H Blu	HM-X3, HM-V2
1.0 494H Blu	HM-S4, HM-V2
1.0 495H Blu	HM-X3, HM-X8
0.5 620H Pnk	HM-E8, HM-K1
0.5 630H Red	HM-E9, HM-K1
0.8 631 Yel	HM-V1, HM-S1
1.0 810A Pnk	H1, HM-V1
1.0 810B Pnk	S3, HM-V1

MX52301,0000439 -19-24OCT14-1/1

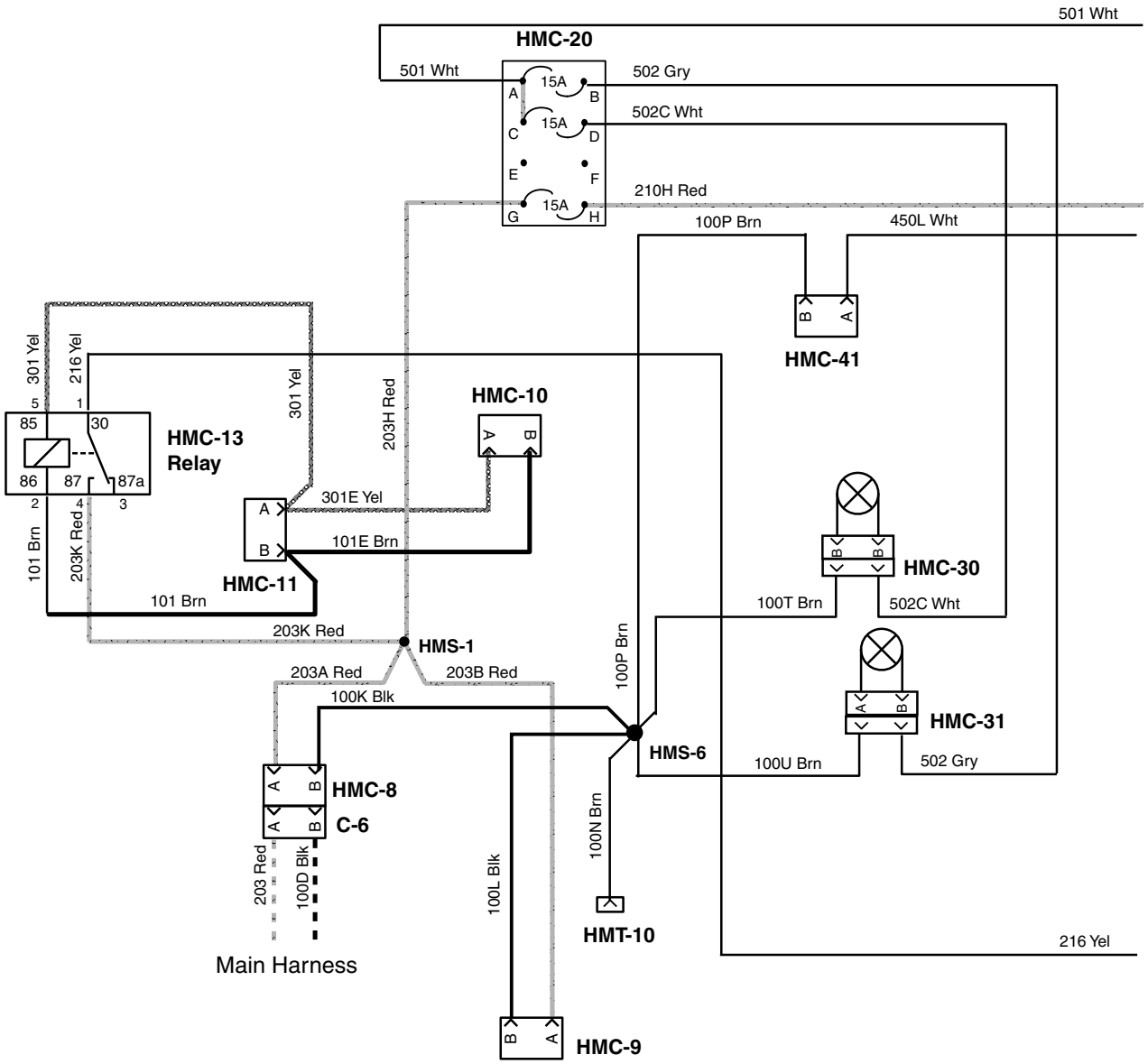
Homologated Lights Schematic Legend (SN 110001-)

Harness Connectors:

HMC-7 — Marker Light Connector
HMC-8 — Unswitched Implement Power Connector
HMC-9 — Unswitced Front Power Connector
HMC-10 — Switched Power Connector
HMC-11 — Attachments Switched Power Connector
HMC-12 — Power and Ground Connector (Not Used)
HMC-13 — Relay
HMC-15 — Headlight Switch Connector (Low Beam)
HMC-17 — Turn Signal Switch Connector
HMC-18 — Hazard Switch Connector
HMC-19 — Flasher Connector
HMC-20 — Load Center
HMC-21 — Load Center
HMC-25 — High Beam Switch Connector
HMC-30 — Left Headlight Connector (Not Used)
HMC-31 — Right Headlight (Not Used)
HMC-40 — Brake Switch Connector
HMC-41 — Rear Fog Light Connector (Not Used)
HMC-42 — Left Light Connector (Not Used)
HMC-43 — Right Light Connector (Not Used)
HMC-44 — Left Light Connector (Not Used)
HMC-45 — Left Light Connector (Not Used)
HMC-46 — Right Light Connector (Not Used)
HMC-47 — Right Light Connector (Not Used)
HMC-50 — Right Front Signal Light Connector
HMC-51 — Right Headlight Connector
HMC-52 — Left Headlight Connector
HMC-53 — Left Front Signal Light Connector
HMC-54 — Rear Lighting Connector
HMT-3 — Trailer Integrity Light Terminal (Power)
HMT-4 — Trailer Integrity Light Terminal (Ground)
HMT-5 — Machine Integrity Light Terminal (Power)
HMT-6 — Machine Integrity Light Terminal (Ground)
HMT-10 — Right Position Light Terminal
HMT-11 — Right Position Light Ground Terminal
HMT-12 — Left Position Light Terminal
HMT-13 — Left Position Light Ground Terminal
HM-R1 — Resistor, 91 ohm, 2 Watt
HRC-1 — Rear Harness to Main Harness Connector
HRC-2 — Right Rear Signal Light Connector
HRC-3 — Trailer Harness Connector
HRC-4 — Trailer Harness Connector
HRC-5 — Trailer Harness Connector
HRC-6 — License Plate Light Connector
HRC-7 — Left Rear Signal Light Connector

OUMX258,00006C5 -19-24OCT14-1/1

Homologated Lights Schematic (SN 110001-)



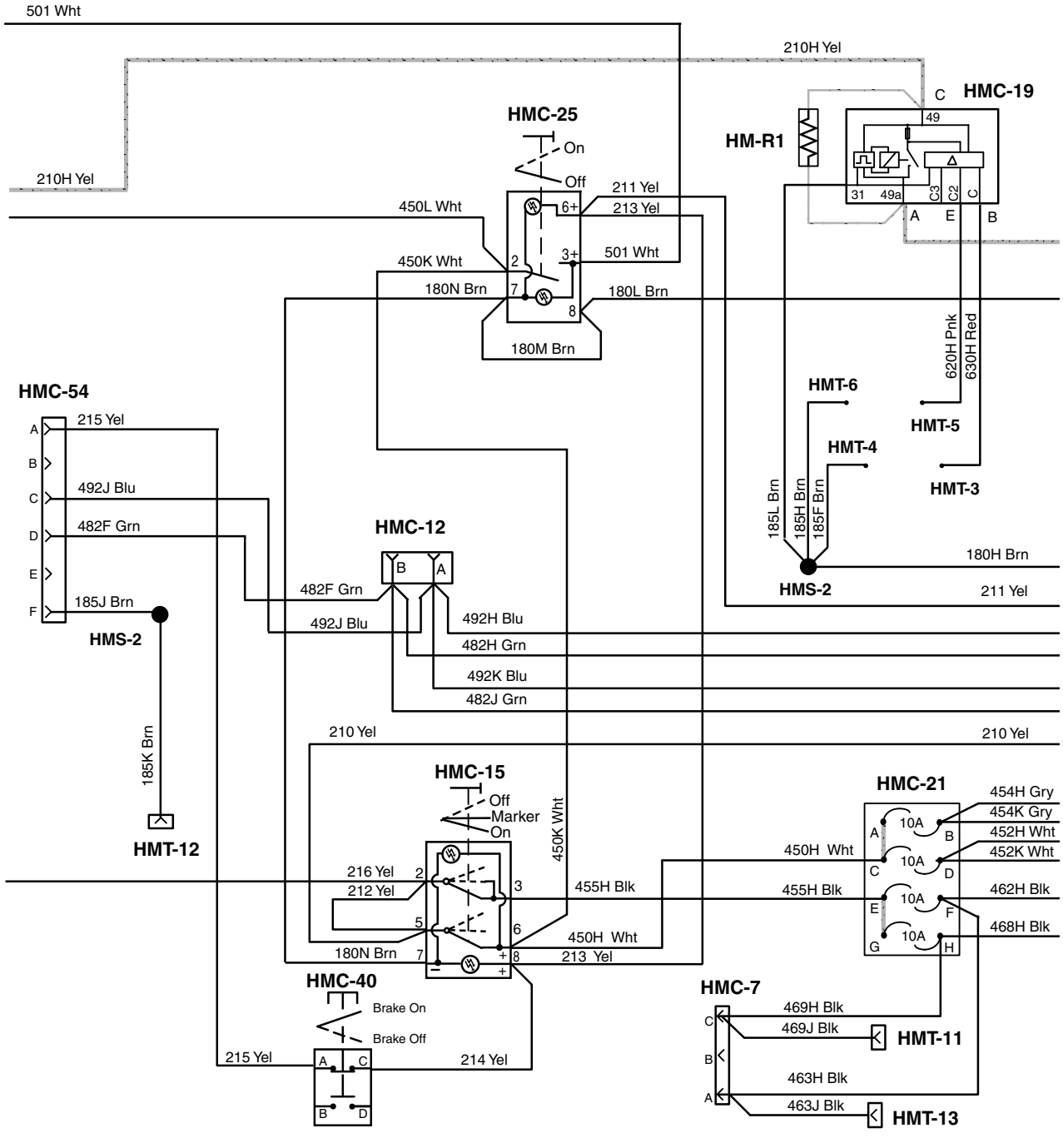
MXT011055 —UN—25SEP14

HMC-8—Unswitched Power Connector
HMC-9—Unswitched Power Connector
HMC-10—Switched Power Connector
HMC-11—Switched Power Connector
HMC-13—Relay
HMC-20—Load Center
HMC-30—Headlight
HMC-31—Headlight
HMC-41—Connector
HMT-10—Terminal

Continued on next page

OUMX258,00006C6 -19-24OCT14-1/3

Homologated Lights Schematic (2 of 3)

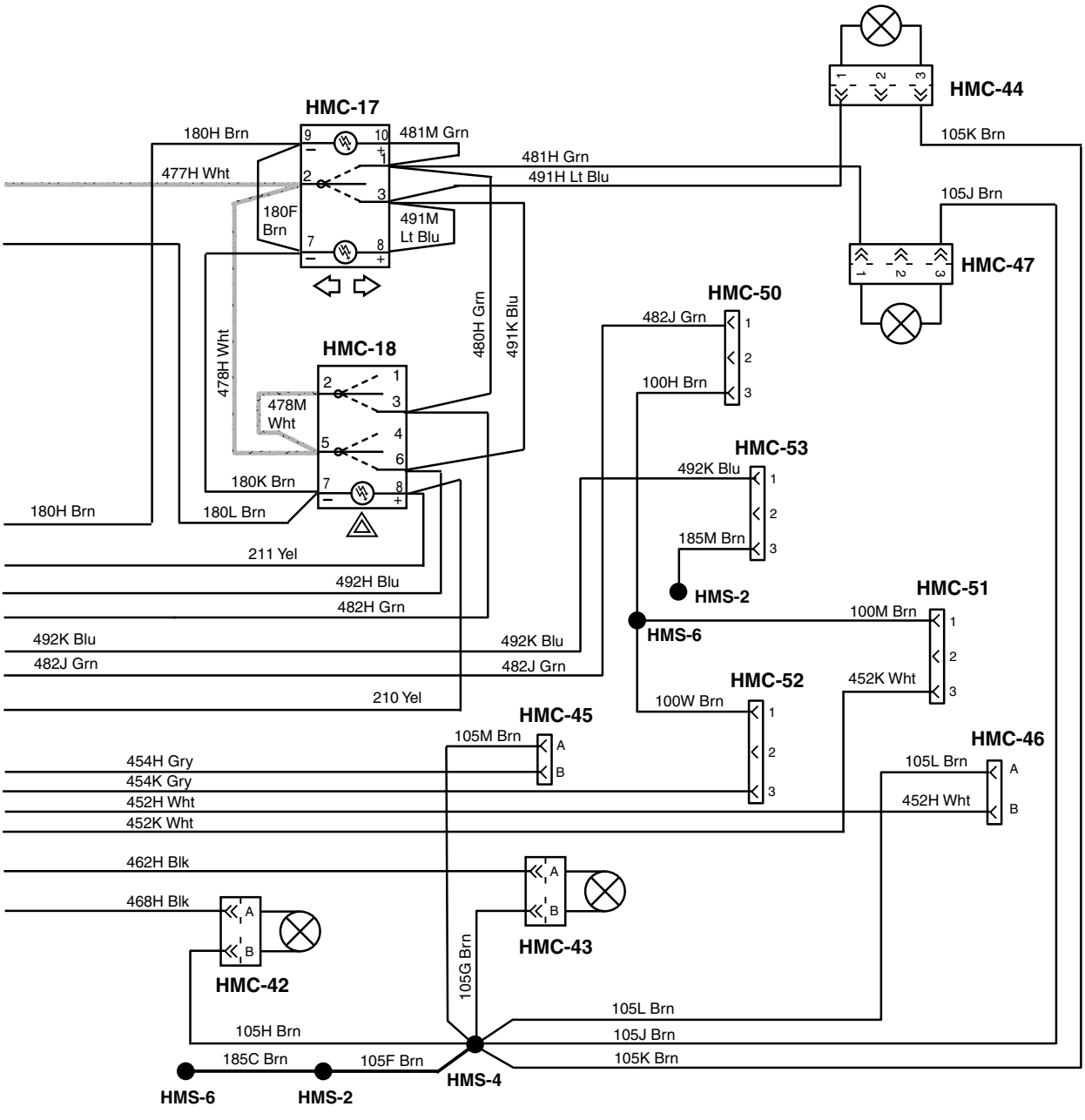


HMC-7—Connector
HMC-12—Lights Connector
HMC-15—Switch Connector (not used)
HMC-18—Hazard Switch Connector
HMC-19—Flasher Connector
HMC-21—Load Center
HMC-25—Switch Connector (not used)
HMC-40—Reverse Switch Connector
HMC-54—Connector
HMT-11—Terminal
HMT-12—Ground Terminal
HMT-13—Terminal
HM-R1—Resistor

Continued on next page

OUMX258,00006C6 -19-24OCT14-2/3

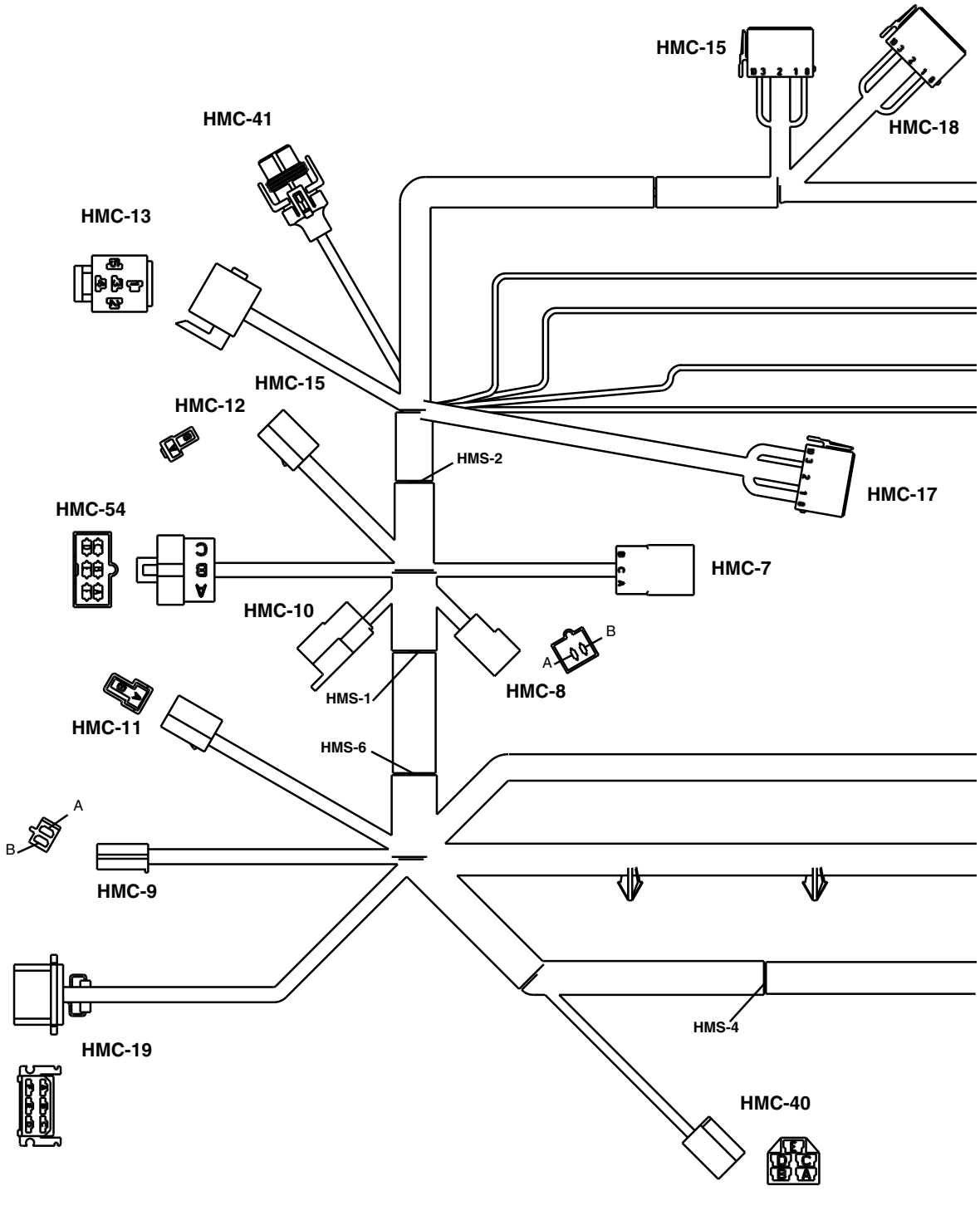
Homologated Lights Schematic (3 of 3)



HMC-17—Turn Signal Switch Connector
HMC-18—Hazard Switch Connector
HMC-42—Light Connector
HMC-43—Light Connector
HMC-44—Light Connector
HMC-45—Connector
HMC-46—Connector
HMC-47—Light Connector
HMC-50—Connector
HMC-51—Connector
HMC-52—Connector
HMC-53—Connector

OUMX258,00006C6 -19-24OCT14-3/3

Homologated Lights Wiring Harness (SN 110001-)



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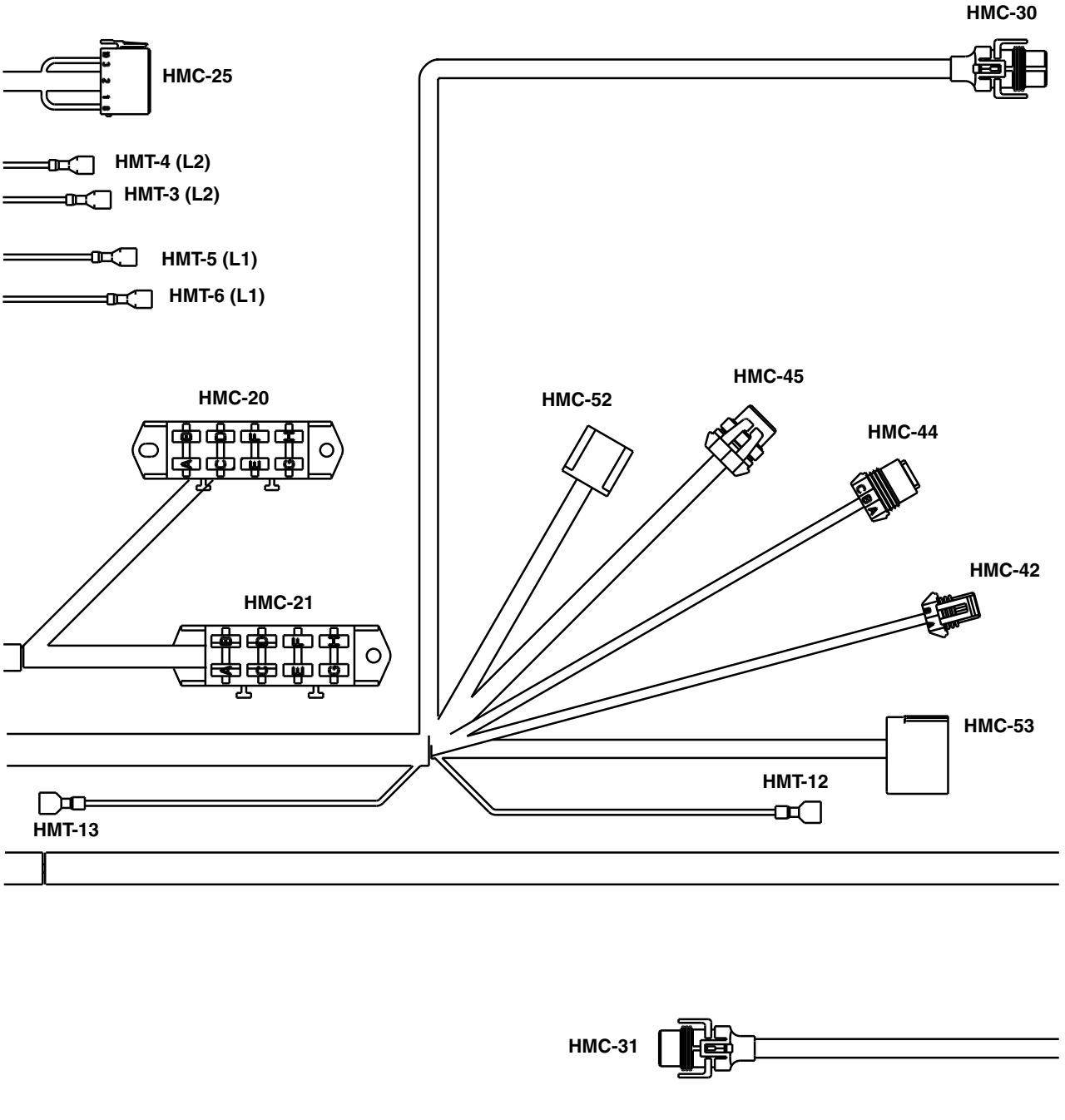
OUMX258,00006C1 -19-22OCT14-1/3

Homologated Lights Wiring Harness (2 of 3)



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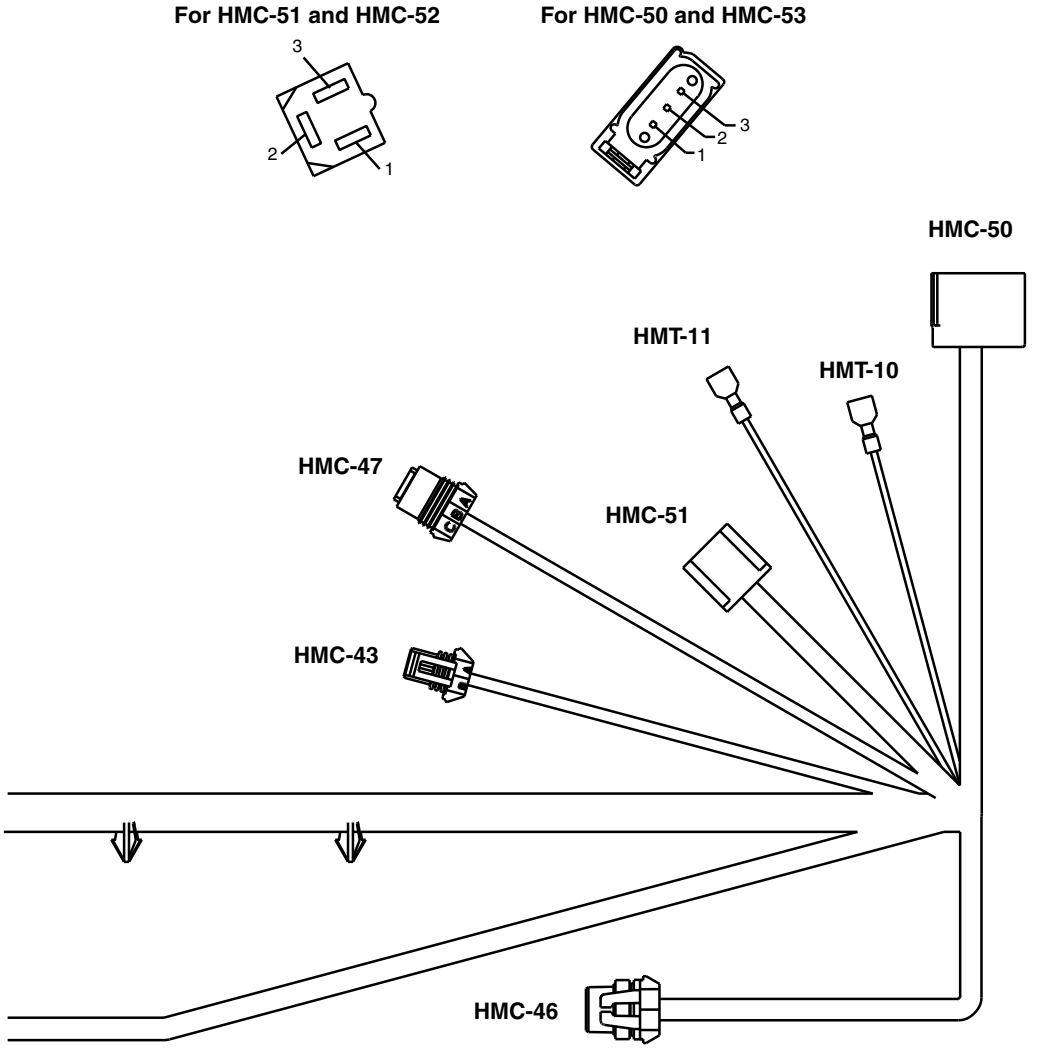
OUMX258,00006C1 -19-22OCT14-2/3

Homologated Lights Wiring Harness (3 of 3)



OUMX258,00006C1 -19-22OCT14-3/3

Homologated Lights Harness Wire Color Codes (SN 110000-)

Size/No./Color	Wire Connection Points
0.8 100H Brn	HMC-50 (3), HMS-6 (1)
3.0 100K Brn	HMS-6 (2), HMC-8 (B)
3.0 100L Brn	HMC-9 (B), HMS-6 (2)
0.8 100M Brn	HMS-6 (2), HMC-51 (1)
0.8 100N Brn	HMS-6 (1), HMT-10 (1)
0.8 100P Brn	HMS-6 (2), HMC-41 (B)
1.0 100T Brn	HMC-30 (A), HMS-6 (1)
1.0 100U Brn	HMC-31 (A), HMS-6 (2)
0.8 100W Brn	HMS-6 (1), HMC-52 (1)
0.8 101 Brn	HMC-11 (B), HMC-13 (2)
0.8 101E Brn	HMC-11 (B), HMC-10 (B)
3.0 105F Brn	HMS-4 (1), HMS-2 (1)
0.8 105G Brn	HMS-4 (1), HMC-43 (B)
0.8 105H Brn	HMS-4 (2), HMC-42 (B)
0.8 105J Brn	HMS-4 (1), HMC-47 (3)
0.8 105K Brn	HMS-4 (2), HMC-44 (3)
0.8 105L Brn	HMS-4 (1), HMC-46 (A)
0.8 105M Brn	HMS-4 (2), HMC-45 (A)
1.0 105N Brn	HRC-6 (B), HRC-7 (D)
1.0 105U Brn	HRC-2 (D), HRC-3 (C)
1.0 105W Brn	HRC-2 (D), HRC-1 (F)
1.0 105Z Brn	HRC-6 (B), HRC-3 (C)
0.8 180F Brn	HMC-17 (7-NEG), HMC-17 (9-NEG)
0.8 180H Brn	HMS-2 (2), HMC-17 (9-NEG)
1.0 180K Brn	HMC-17 (7-NEG), HMC-18 (7-NEG)
1.0 180L Brn	HMC-25 (8-NEG), HMC-18 (7-NEG)
0.8 180M Brn	HMC-25 (8-NEG), HMC-25 (7-NEG)
0.8 180N Brn	HMC-25 (7-NEG), HMC-15 (7-NEG)
2.0 185C Brn	HMS-2 (1), HMS-6 (1)
0.8 185F Brn	HMS-2 (2), HMT-4 (1)
0.8 185H Brn	HMS-2 (2), HMT-6 (1)
1.0 185J Brn	HMS-2 (1), HMC-54 (F)
0.8 185K Brn	HMS-2 (2), HMT-12 (1)
0.8 185L Brn	HMS-2 (1), HMC-19 (F)
0.8 185M Brn	HMS-2 (1), HMC-53 (3)
0.5 190H Brn	HMS-2, HMT-4
3.0 203A Red	HMS-1 (2), HMC-8 (A)
3.0 203B Red	HMC-9 (A), HMS-1 (1)
2.0 205H Red	HMS-1 (1), HMC-20 (G)
2.0 205H Red	HMS-1 (2), HMC-13 (4)
0.8 210 Yel	HMC-18 (8-POS), HMC-15 (5)
1.0 210H Yel	HMC-19 (C), HMC-20 (H)
0.8 211Yel	HMC-25 (6-POS), HMC-18 (8-POS)
0.8 212 Yel	HMC-15 (2), HMC-15 (5)
0.8 213 Yel	HMC-25 (6-POS), HMC-15 (5)

Continued on next page

Size/No./Color	Wire Connection Points
0.8 214 Yel	HMC-15 (8-POS), HMC-40 (C)
0.8 215 Yel	HMC-54 (A), HMS-40 (A)
0.8 216 Yel	HMC-13 (1), HMC-15 (2)
0.8 301 Yel	HMC-11 (A), HMC-13 (5)
0.8 301E Yel	HMC-11 (A), HMC-10 (A)
0.8 405H Yel	HMC-20, HMT-8
1.0 424L Yel	HRC-7 (C), HRC-5 (1)
1.0 424M Yel	HRC-2 (C), HRC-5 (1)
1.0 424N Yel	HRC-2 (C), HRC-1 (A)
2.0 450H Wht	HMC-15 (6), HMC-21 (C)
2.0 450K Wht	HMC-25 (2), HMC-15 (6)
0.8 450L Wht	HMC-25 (2), HMC-41 (A)
0.8 452H Wht	HMC-46 (B), HMC-21 (D)
0.8 452K Wht	HMC-21 (D), HMC-51 (3)
0.8 454H Gry	HMC-45 (B), HMC-21 (B)
0.8 454K Gry	HMC-21 (B), HMC-52 (3)
2.0 455H Blk	HMC-15 (3), HMC-21 (E)
0.8 462H Blk	HMC-21 (F), HMC-43 (A)
0.8 463H Blk	HMC-21 (F), HMC-7 (A)
0.8 463J Blk	HMC-7 (A), HMT-13 (1)
1.0 465C Blk	HRC-6 (A), HRC-4 (A)
1.0 465E Blk	HRC-1 (B), HRC-4 (A)
1.0 465H Blk	HMC-4, HMC-6
0.8 468H Blk	HMC-21 (H), HMC-42 (A)
0.8 469H Blk	HMC-21 (H), HMC-7 (C)
0.8 469J Blk	HMC-7 (C), HMT-11 (1)
1.0 470C Blk	HRC-2 (B), HRC-3 (B)
1.0 470E Blk	HRC-2 (B), HRC-1 (E)
1.0 477H Wht	HMC-19 (A), HMC-17 (2)
1.0 478H Wht	HMC-17 (2), HMC-18 (5)
1.0 478M Wht	HMC-18 (2), HMC-18 (5)
1.0 480H Grn	HMC-17 (1), HMC-18 (3)
0.8 481H Grn	HMC-17 (1), HMC-47 (1)
0.8 481M Grn	HMC-17 (1), HMC-17 (10-POS)
1.0 482F Grn	HMC-54 (D), HMC-12 (B)
1.0 482H Grn	HMC-18 (3), HMC-12 (B)
1.0 482J Grn	HMC-50 (1), HMC-12 (B)
0.8 484C Grn	HRC-2 (A), HRC-3 (A)
0.8 484E Grn	HRC-2 (A), HRC-1 (D)
0.8 491H Lt Blu	HMC-17 (3), HMC-44 (1)
1.0 491K Blu	HMC-17 (3), HMC-18 (6)
0.8 491M Lt Blu	HMC-17 (3), HMC-17 (8-POS)
1.0 492H Blu	HMC-18 (6), HMC-12 (A)
1.0 492J Blu	HMC-54 (C), HMC-12 (A)
1.0 492K Blu	HMC-53 (1), HMC-12 (A)
0.8 496C Lt Blu	HRC-4 (B), HRC-7 (A)
0.8 496E Lt Blu	HRC-4 (B), HRC-1 (C)

OUMX258,00006C2 -19-22OCT14-2/2

Size/No./Color	Wire Connection Points
2.0 501 Wht	HMC-25 (3), HMC-20 (A)
1.0 502 Wht	HMC-31 (B), HMC-20 (B)
1.0 502C Wht	HMC-30 (B), HMC-20 (D)
0.8 620H Pnk	HMC-19 (E), HMT-5 (1)
0.8 630H Red	HMC-19 (B), HMT-3 (1)
2-W Resistor Gry	HMC-19 (A), HMC-19 (C)

OUMX258,00006C2 -19-22OCT14-3/2

Homologated Lights Circuit Diagnosis (SN -110000)

Headlight Circuit

Homologated Lights Diagnosis

MX52301,000043A -19-24OCT14-1/90

❶ Left Headlight Circuit

MX52301,000043A -19-24OCT14-2/90

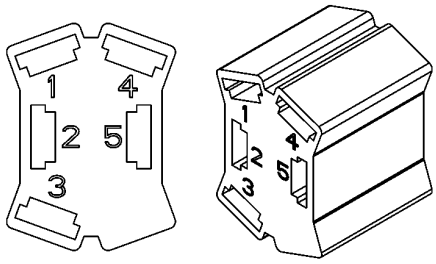
Light Switch Voltage

Test Procedure

Test Conditions:

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Power circuits working properly. See appropriate power circuit operation.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wire connections for looseness and corrosion.
- Light switch in the on position.

Is battery voltage present at 200H Red wire (2) of HM-S2 light switch?



MXT001666 —UN—10OCT11

1— 450H White Wire
2— 200H Red Wire
4— 455H Black Wire

YES: Go to next step.

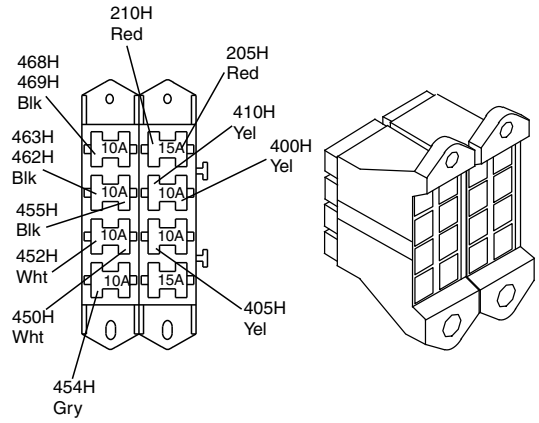
NO: Check X14 connector, 203H and 200H Red wires, splice, and connections.

Continued on next page

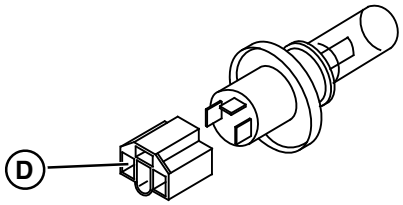
MX52301,000043A -19-24OCT14-3/90

Light Switch Voltage	Is battery voltage present at 450H Wht wire (1) of HM-S2 light switch?	**YES:** Go to next step. **NO:** Test light switch. See See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

MX52301,000043A -19-24OCT14-4/90

Fuse Block Voltage	Is battery voltage present at 454H Gry wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 450H Wht wire and connections. Test HM-F8 fuse.

MX52301,000043A -19-24OCT14-5/90

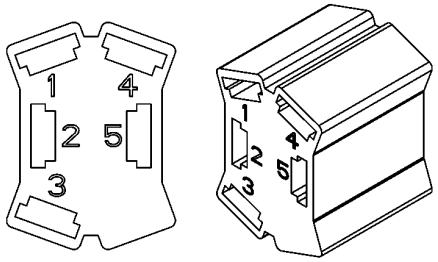
Left Headlight Voltage	Is battery voltage present at 454H Gry wire (D) of HM-E12 Left headlight?  MXT012059 —UN—27JUN14 **D—454H Gray Wire**	**YES:** Test headlight bulb. If OK, test 105M and 105F Brn ground circuit wires, splices, and connections. **NO:** Check 454H Gry wire and connections.

MX52301,000043A -19-24OCT14-6/90

❷ Right Headlight Circuit

Continued on next page

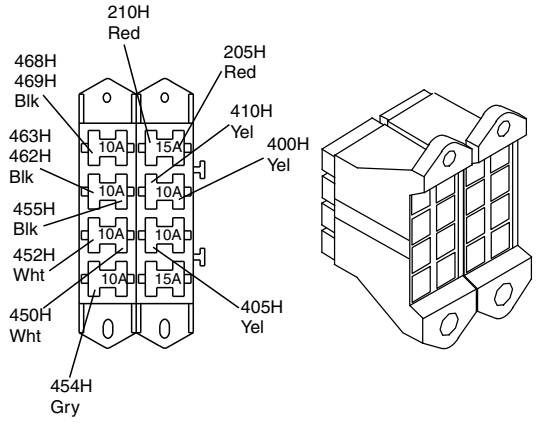
MX52301,000043A -19-24OCT14-7/90

Light Switch Voltage	Is battery voltage present at 200H Red wire (2) of HM-S2 light switch?  MXT001666 —UN—10OCT11 **1— 450H White Wire** **2— 200H Red Wire** **4— 455H Black Wire**	**YES:** Go to next step. **NO:** Check X14 connector, 203H and 200H Red wires, splice, and connections.

MX52301,000043A -19-24OCT14-8/90

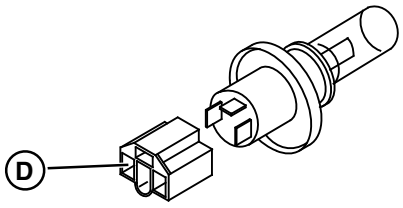
Light Switch Voltage	Is battery voltage present at 455H Blk wire (4) of HM-S2 light switch?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304)

MX52301,000043A -19-24OCT14-9/90

Fuse Block	Is battery voltage present at 452H Wht wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step **NO:** Check 450H Wht wire and connections. Test HMF7 fuse

Continued on next page

MX52301,000043A -19-24OCT14-10/90

Right Headlight Voltage	Is battery voltage present at 452H Wht wire (D) of HM-E13 Right headlight?  MXT012059 —UN—27JUN14 **D—452H White Wire**	**YES:** Test headlight bulb. If OK, test 105M and 105F Brn ground circuit wires, splices, and connections. **NO:** Check 452H Wht wire and connections.

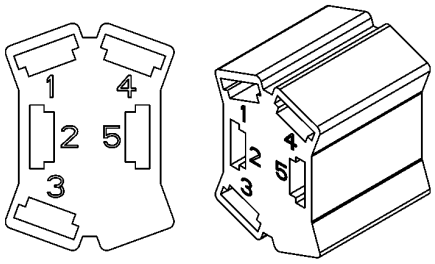
MX52301,000043A -19-24OCT14-11/90

Front Position Light Circuit

MX52301,000043A -19-24OCT14-12/90

❶ Left Front Position Light Circuit

MX52301,000043A -19-24OCT14-13/90

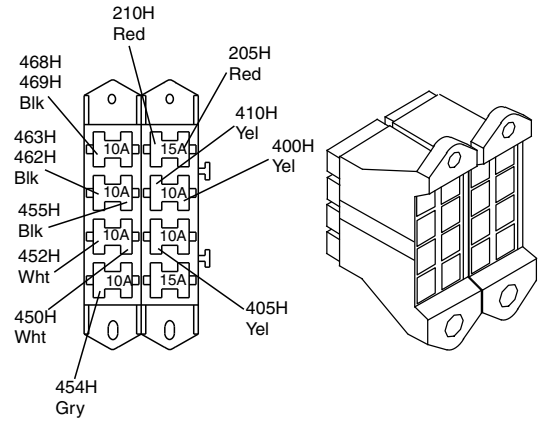
Light Switch Voltage	Is battery voltage present at 200H Red wire (2) of HM-S2 light switch?  MXT001666 —UN—10OCT11 **1— 450H White Wire** **2— 200H Red Wire** **4— 455H Black Wire**	**YES:** Go to next step. **NO:** Check X14 connector, 203H and 200H Red wires, splice, and connections.

MX52301,000043A -19-24OCT14-14/90

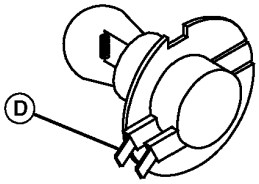
Light Switch Voltage	Is battery voltage present at 450H Wht wire (1) of HM-S2 light switch?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304)

Continued on next page

MX52301,000043A -19-24OCT14-15/90

Fuse Block Voltage	Is battery voltage present at 468H Blk wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 455H Blk wire and connections. Test HM-F5 fuse.

MX52301,000043A -19-24OCT14-16/90

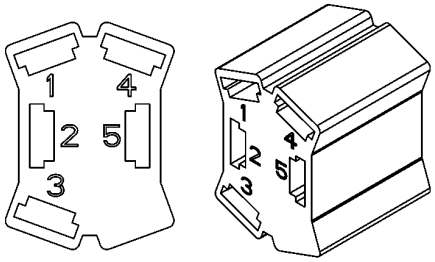
Left Headlight Voltage	Is battery voltage present at 468H Blk wire (D) of HM-E10 Left front position light?  MXAL30984 —UN—09JUL12 **D—468H Black Wire**	**YES:** Test headlight bulb. If OK, test 105H and 105F Brn ground circuit wires, splices, and connections. **NO:** Check 468H Blk wire and connections.

MX52301,000043A -19-24OCT14-17/90

❷ Right Front Position Light

Continued on next page

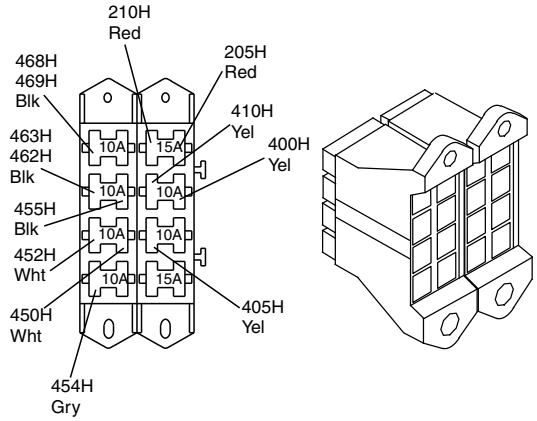
MX52301,000043A -19-24OCT14-18/90

Light Switch Voltage	Is battery voltage present at 200H Red wire (2) of HM-S2 light switch?  MXT001666 —UN—10OCT11 **1— 450H White Wire** **2— 200H Red Wire** **4— 455H Black Wire**	**YES:** Go to next step. **NO:** Check X14 connector, 203H and 200H Red wires, splice, and connections.

MX52301,000043A -19-24OCT14-19/90

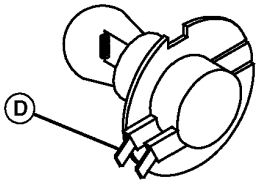
Light Switch Voltage	Is battery voltage present at 455H Blk wire (4) of HM-S2 light switch?	**YES:** Go to next step **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304)

MX52301,000043A -19-24OCT14-20/90

Fuse Block Voltage	Is battery voltage present at 462H Blk wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 455H Blk wire and connections. Test HM-F6 fuse.

Continued on next page

MX52301,000043A -19-24OCT14-21/90

Right Front Position Light Voltage	Is battery voltage present at 462H Blk wire (D) of HM-E15 Right front position light?  MXAL30984 —UN—09JUL12 **D—462H Black Wire**	**YES:** is battery voltage present at 462H Blk wire (D) of HM-E15 Right front position light? **NO:** Check 462H Blk wire and connections.

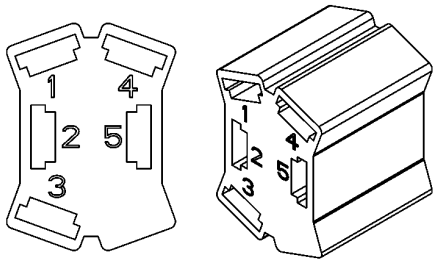
MX52301,000043A -19-24OCT14-22/90

Rear Position Light Circuit

MX52301,000043A -19-24OCT14-23/90

❶ Left Rear Position Light Circuit

MX52301,000043A -19-24OCT14-24/90

Switch Voltage	Is battery voltage present at 200H Red wire (2) of HM-S2 light switch?  MXT001666 —UN—10OCT11 **1— 450H White Wire** **2— 200H Red Wire** **4— 455H Black Wire**	**YES:** Go to next step. **NO:** Check X14 connector, 203H and 200H Red wires, splice, and connections.

MX52301,000043A -19-24OCT14-25/90

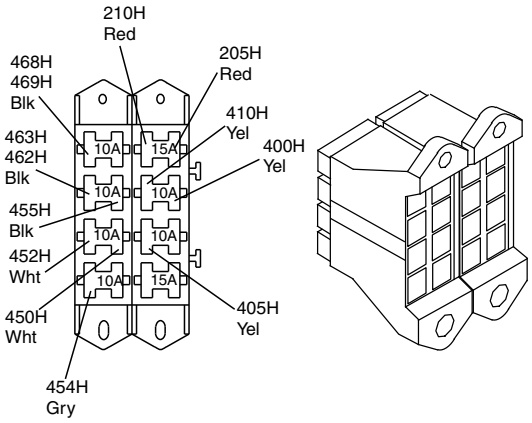
Switch Voltage	Is battery voltage present at 455H Blk wire (4) of HM-S2 light switch?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304)

Continued on next page

MX52301,000043A -19-24OCT14-26/90

Fuse Block

Is battery voltage present at 463H Wht wire of fuse block?



MXT012097 —UN—30JUN14

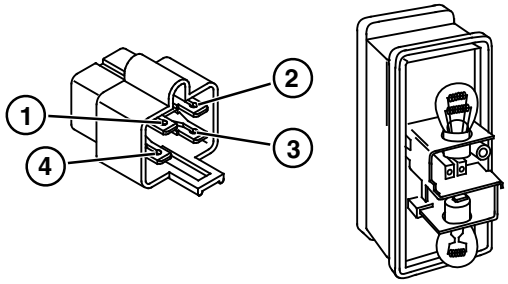
YES: Go to next step.

NO: Check 455H Blk wire and connections. Test HM-F6 fuse.

MX52301,000043A -19-24OCT14-27/90

Left Position Light Voltage

Is battery voltage present at HM-E3 Left rear position light 300 Blk wire (3)?



MXT012096 —UN—01JUL14

3— 300 Black Wire

YES: Test light bulb. If OK, check 100 Wht, 105B and 105A Brn ground wires, splices and HM-X3 connector.

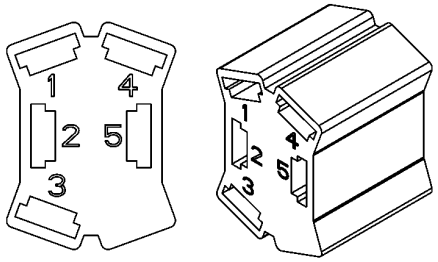
NO: Check 463H and 300 Blk wires and HM-X3 connector.

MX52301,000043A -19-24OCT14-28/90

❷ Right Rear Position Light Circuit

Continued on next page

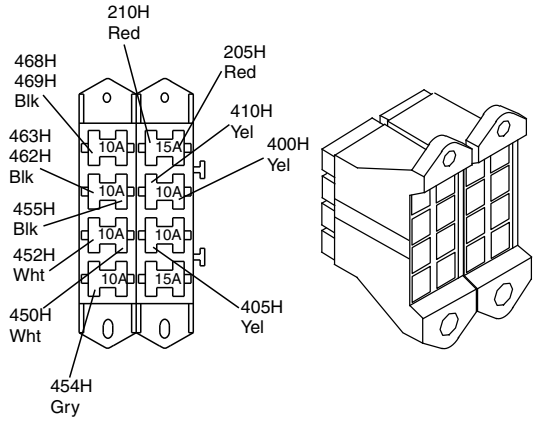
MX52301,000043A -19-24OCT14-29/90

Light Switch Voltage	Is battery voltage present at 200H Red wire (2) of HM-S2 light switch?  MXT001666 —UN—10OCT11 **1— 450H White Wire** **2— 200H Red Wire** **4— 455H Black Wire**	**YES:** Go to next step. **NO:** Check X14 connector, 203H and 200H Red wires, splice, and connections.

MX52301,000043A -19-24OCT14-30/90

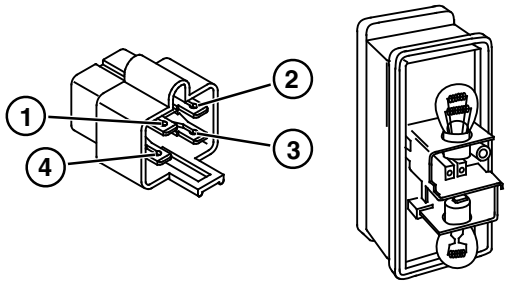
Light Switch Voltage	Is battery voltage present at 455H Blk wire (4) of HM-S2 light switch?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304)

MX52301,000043A -19-24OCT14-31/90

Fuse Block	Is battery voltage present at 469H Brn wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 455H Blk wire and connections. Test HM-F5 fuse.

Continued on next page

MX52301,000043A -19-24OCT14-32/90

Right Rear Position Light	Is battery voltage present at 300 Blk wire (3) of HM-E7 Right rear position light?  MXT012096 —UN—01JUL14 **3— 300 Black Wire**	**YES:** Test light bulb. If OK, check 100 Wht, 105D and 105A Brn ground wires, splices and HM-X6 connector. **NO:** Check 469H Brn and 300 Blk wires and HM-X6 connector.

MX52301,000043A -19-24OCT14-33/90

Brake Lights

MX52301,000043A -19-24OCT14-34/90

❶ Left Brake Lights

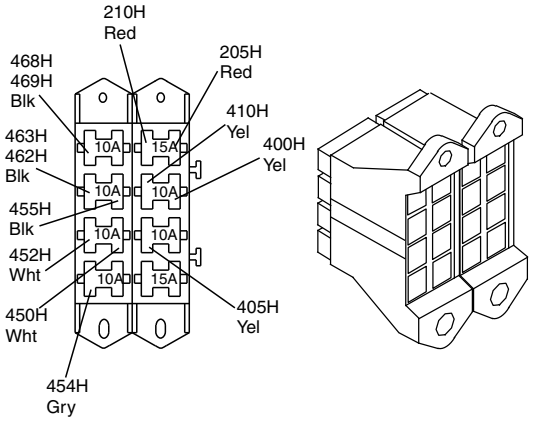
Continued on next page

MX52301,000043A -19-24OCT14-35/90

Fuse Block

- Machine parked safely on a level surface.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Power circuits working properly. See appropriate power circuit operation.
- Key switch in run position, engine off.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wire connections for looseness and corrosion.
- Brake switch in the closed (depressed) position.

Is battery voltage present at 410H Yel wire at fuse block?



MXT012097 —UN—30JUN14

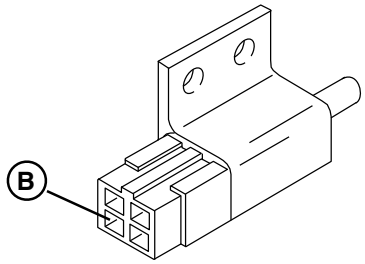
YES: Go to next step.

NO: Check 400H Yel wire and connections. If OK, test HM-F2 fuse

MX52301,000043A -19-24OCT14-36/90

Brake Switch Voltage

Is battery voltage present at 631H Yel wire (B) of HM-S1 brake switch?



MXT012099 —UN—02JUL14

B—631H Yellow Wire

YES: Go to next step.

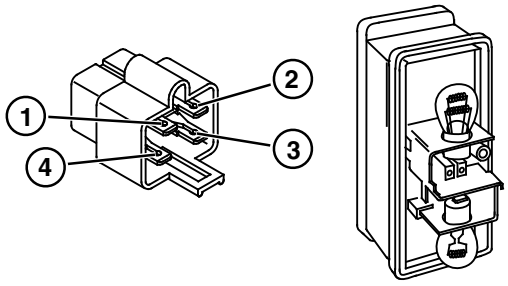
NO: Check 410H Yel wire and connections. If OK, test brake switch. See Brake Lights Switch Test

Continued on next page

MX52301,000043A -19-24OCT14-37/90

Left Brake Light Voltage

Is battery voltage present at HM-E1 Left brake light 200 Blu wire (2)?



MXT012096 —UN—01JUL14

2— 200 Blue Wire

YES: Test light bulb. If OK, check 100 Wht, 105B and 105A Brn ground wires, splices, and HM-X3 connector.

NO: Check 631H and 420N Yel wires, HM-X3 connector, 200 Blu wire, and connections.

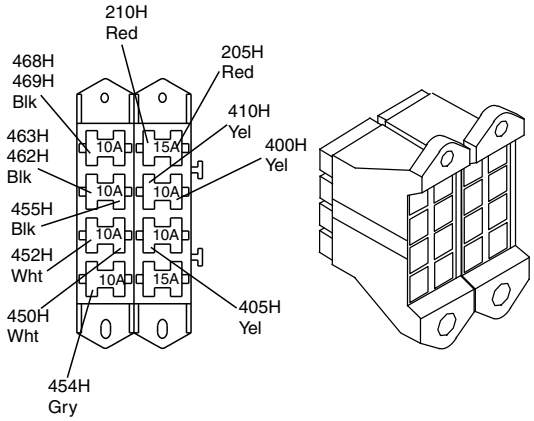
MX52301,000043A -19-24OCT14-38/90

❷ Right Brake Light Circuit

MX52301,000043A -19-24OCT14-39/90

Fuse Block Voltage

Is battery voltage present at 410H Yel wire at fuse block?



MXT012097 —UN—30JUN14

YES: Go to next step.

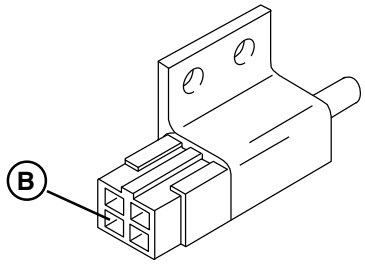
NO: Check 400H Yel wire and connections. If OK, test HM-F2 fuse.

Continued on next page

MX52301,000043A -19-24OCT14-40/90

Brake Switch Voltage

Is battery voltage present at 631H Yel wire (B) of HM-S1 brake switch?



MXT012099 —UN—02JUL14

B—631H Yellow Wire

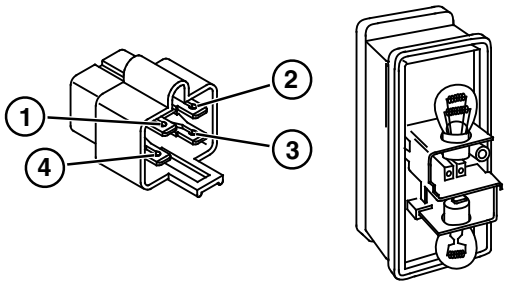
YES: Go to next step.

NO: Check 410H Yel wire and connections. If OK, test brake switch. See Brake Lights Switch Test

MX52301,000043A -19-24OCT14-41/90

Right Brake Light Voltage

Is battery voltage present at HM-E5 Right brake light 200 Blu wire (2)?



MXT012096 —UN—01JUL14

2— 200 Blue Wire

YES: Test light bulb. If OK, check 100 Wht, 105D and 105A Brn ground wires, splices, and HM-X6 connector.

NO: Check 631H , 420N, and 421H Yel wires, HM-X6 connector, 200 Blu wire, and connections.

MX52301,000043A -19-24OCT14-42/90

Rear Turn Lights Circuit

MX52301,000043A -19-24OCT14-43/90

❶ Left Rear Turn Light Circuit

Continued on next page

MX52301,000043A -19-24OCT14-44/90

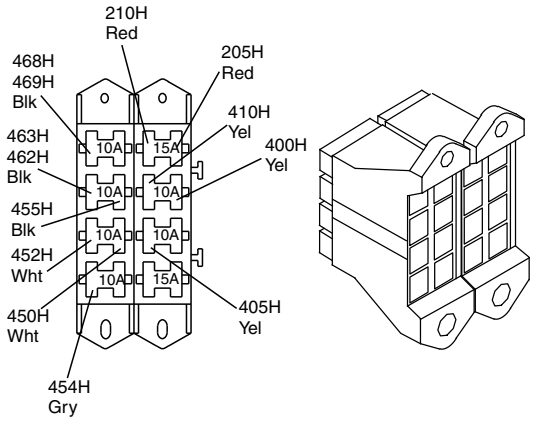
Fuse Block Voltage

- Machine parked safely on a level surface.
- Park brake locked.
- Battery fully charged.
- Power circuits working properly. See appropriate power circuit operation.
- Key switch in run position, engine off.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wire connections for looseness and corrosion.
- Turn switch in either the Left or Right position, depending on the test being performed.

Is battery voltage present at 210H Red wire of fuse block?

YES: Go to next step.

NO: Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.



MXT012097 —UN—30JUN14

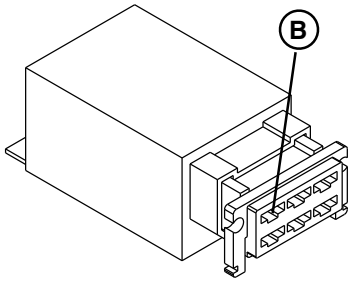
MX52301,000043A -19-24OCT14-45/90

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?

YES: Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step.

NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher.



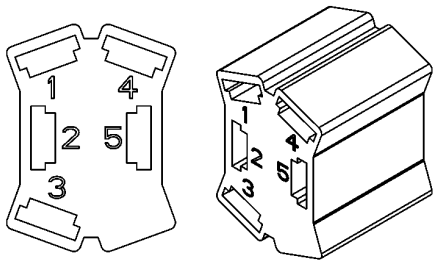
MXT012100 —UN—02JUL14

B—477H White Wire

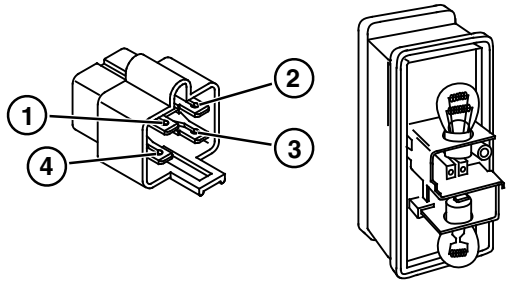
NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-46/90

Turn Switch Voltage	Is intermittent battery voltage present at 490H Blu wire (3) of HM-S3 turn switch?  MXT001666 —UN—10OCT11 **1— 480H and 481H Green Wire** **3— 490H and 491H Blue Wire**	**YES:** Go to next step. **NO:** Check 477H Wht wire (C) and connections. If OK, test turn switch. See Turn Signal Lights Switch Test.

MX52301,000043A -19-24OCT14-47/90

Left Rear Turn Light Voltage	Is intermittent battery voltage present at 400 Grn wires (3) of HM-E2 Left rear turn light?  MXT012096 —UN—01JUL14 **1— 100 White Wire** **3— 400 Green Wire**	**YES:** Go to next step. **NO:** Check 490H and 492H Blu wires, HM-X3 connector, and 400 Grn wire.

MX52301,000043A -19-24OCT14-48/90

Left Rear Turn Light Ground	Is continuity present between 100 Wht wire (1) of HME2 Left rear turn light and ground?	**YES:** Test bulb. **NO:** Check 100 Wht wire, HM-X3 connector, 105B and 105A Brn wires, and splices.

MX52301,000043A -19-24OCT14-49/90

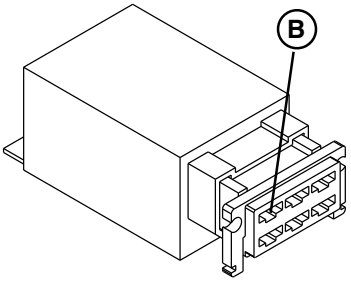
❷ Right Rear Turn Light Circuit

Continued on next page

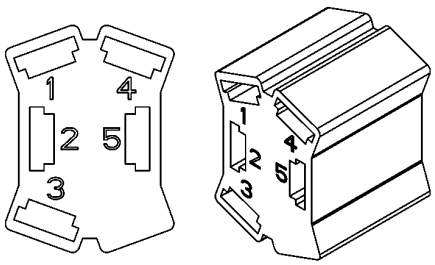
MX52301,000043A -19-24OCT14-50/90

Fuse Block Voltage	Is battery voltage present at 210H Red wire of fuse block	**YES:** Go to next step. **NO:** Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-51/90

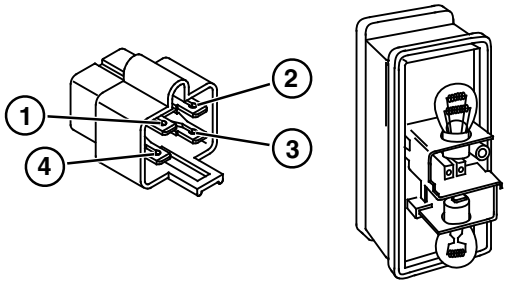
Flasher Voltage	Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?  MXT012100 —UN—02JUL14 **B—477H White Wire**	**YES:** Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step. **NO:** Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher. **NO:** Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000043A -19-24OCT14-52/90

Turn Switch Voltage	Is intermittent battery voltage present at 480H Grn wire (1) of HM-S3 turn switch?  MXT001666 —UN—10OCT11 **1— 480H and 481H Green Wire** **3— 490H and 491H Blue Wire**	**YES:** Go to next step. **NO:** Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test

Continued on next page

MX52301,000043A -19-24OCT14-53/90

Right Rear Turn Light Voltage	Is intermittent battery voltage present at 400 Grn wire (4) of HM-E6 Right rear turn light?  MXT012096 —UN—01JUL14 **1— 100 White Wire** **4— 400 Green Wire**	**YES:** Go to next step. **NO:** Check 480H and 482H Grn wires, HM-X6 connector, and 400 Grn wire.

MX52301,000043A -19-24OCT14-54/90

Right Rear Turn Signal Light Ground	Is continuity present between 100 Wht wire of HM-E6 Right rear turn signal light and ground?	**YES:** Test bulb. **NO:** Check 100Wht wire, HM-X6 connector, 105D and 105A Brn wires, and splices.

MX52301,000043A -19-24OCT14-55/90

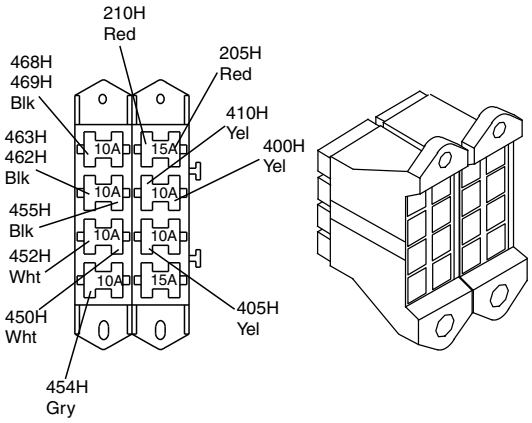
Turn Light Circuit

MX52301,000043A -19-24OCT14-56/90

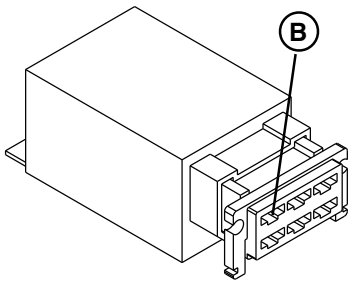
❶ Left Front Turn Light Circuit

Continued on next page

MX52301,000043A -19-24OCT14-57/90

Fuse Block	Is battery voltage present at 210H Red wire (A) of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-58/90

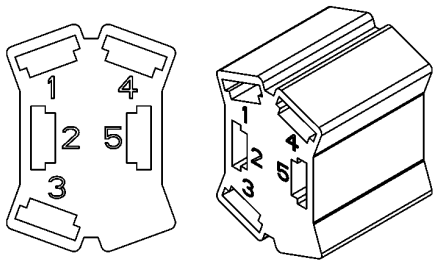
Flasher	Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?  MXT012100 —UN—02JUL14 **B—477H White Wire**	**YES:** Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step. **NO:** Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher. **NO:** Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-59/90

Switch

Is intermittent battery voltage present at 491H Blu wire (3) of HM-S3 turn switch?



MXT001666 —UN—10OCT11

1—480H and 481H Green Wire
3—490H and 491H Blue Wire

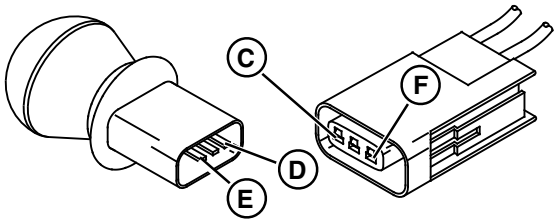
YES: Go to next step.

NO: Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test on page 376.

MX52301,000043A -19-24OCT14-60/90

Light Connector

Is intermittent battery voltage present at 491H Blu wire (F) of HM-X11 Left front turn light connector?



MXT012074 —UN—27JUN14

F—491h Blue Wire

YES: Check for continuity between 105K and 105F Brn wires and ground. If OK, test bulb.

NO: Check 491H wire and connections

MX52301,000043A -19-24OCT14-61/90

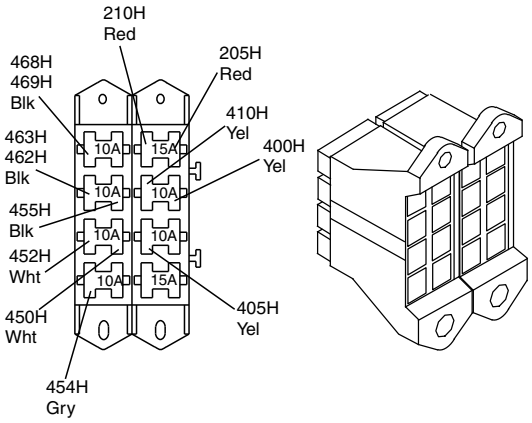
❷ Right Front Turn Light Circuit

Continued on next page

MX52301,000043A -19-24OCT14-62/90

Fuse Block

Is battery voltage present at 210H Red wire of fuse block?



MXT012097 —UN—30JUN14

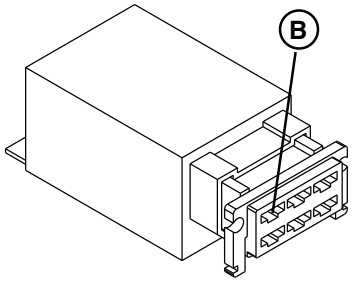
YES: Go to next step.

NO: Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-63/90

Flasher

Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?



MXT012100 —UN—02JUL14

B—477H White Wire

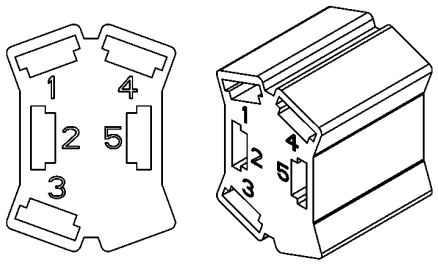
YES: Yes: Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step.

NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher.

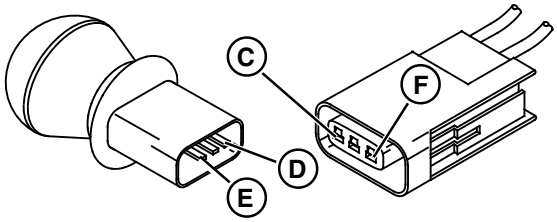
NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-64/90

Turn Switch	Is intermittent battery voltage present at 481H Grn wire (1) of HM-S3 turn switch?  MXT001666 —UN—10OCT11 **1—480H and 481H Green Wire** **3—490H and 491H Blue Wire**	**YES:** Go to next step **NO:** Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test

MX52301,000043A -19-24OCT14-65/90

Light Voltage	Is intermittent battery voltage present at 481H Grn wire (F) of HM-X14 Right front turn light connector?  MXT012074 —UN—27JUN14 **F—481H Green Wire**	**YES:** Check for continuity between 105J and 105F Brn wires and ground. If OK, test bulb. **NO:** Check 481H Grn wire and connections.

MX52301,000043A -19-24OCT14-66/90

Rear Hazard Lights

MX52301,000043A -19-24OCT14-67/90

❶ Left Rear Hazard Light Circuit

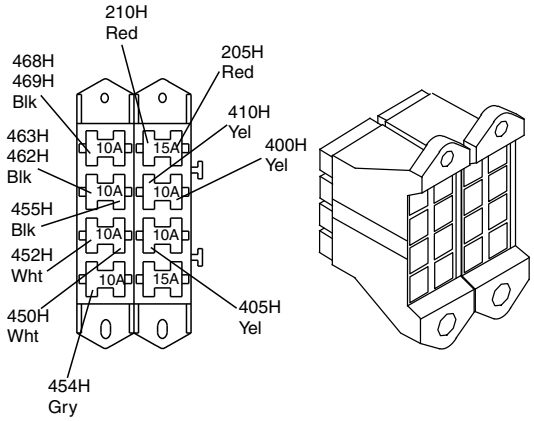
Continued on next page

MX52301,000043A -19-24OCT14-68/90

Fuse Block

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Battery fully charged.
- Power circuits working properly. See appropriate power circuit operation.
- Key switch in run position, engine off.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wire connections for looseness and corrosion.
- Hazard switch in the on position.

Is battery voltage present at 210H Red wire of fuse block?



MXT012097 —UN—30JUN14

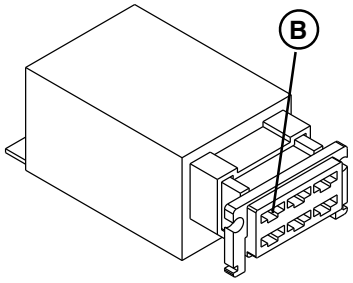
YES: Go to next step.

NO: Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-69/90

Flasher

Is intermittent battery voltage present at 477H Wht (B) wire of HM-K1 flasher?



MXT012100 —UN—02JUL14

B—477H White Wire

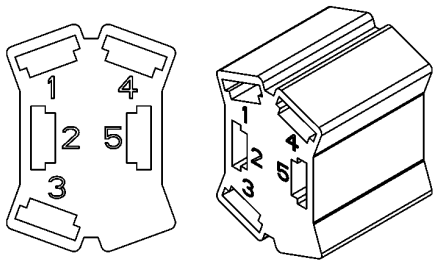
YES: Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step.

NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher.

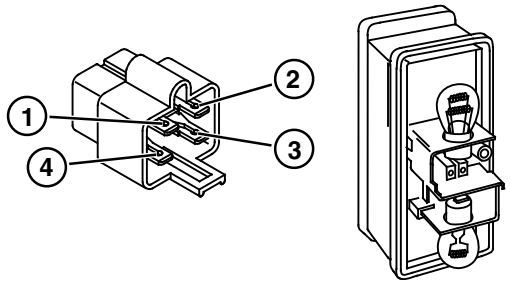
NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-70/90

Switch	Is intermittent battery voltage present at 494H Blu wire (4) of HM-S4 flasher switch?  MXT001666 —UN—10OCT11 **1— 480H and 482H Green Wire** **4— 494H Blue Wire**	**YES:** Go to next step. **NO:** Go to next step. No: Check 477H, 478H, and 479H Wht wires and connections. If OK, replace flasher switch.

MX52301,000043A -19-24OCT14-71/90

Light Voltage	Is intermittent battery voltage present at 400 Grn wire (3) of HM-E2 Left rear flasher light?  MXT012096 —UN—01JUL14 **1— 100 White Wire** **3— 400 Green Wire**	**YES:** Go to next step. **NO:** Check 494H and 492H Blu wires, HM-V2 diode, HM-X3 connector, and 400 Grn wire.

MX52301,000043A -19-24OCT14-72/90

Light Continuity	Is continuity present between 100 Wht wire (1) of HM-E2 Left rear turn light and ground?	**YES:** Test bulb **NO:** Check 100 Wht wire (1), HM-X3 connector, 105B and 105A Brn wires, and splices.

MX52301,000043A -19-24OCT14-73/90

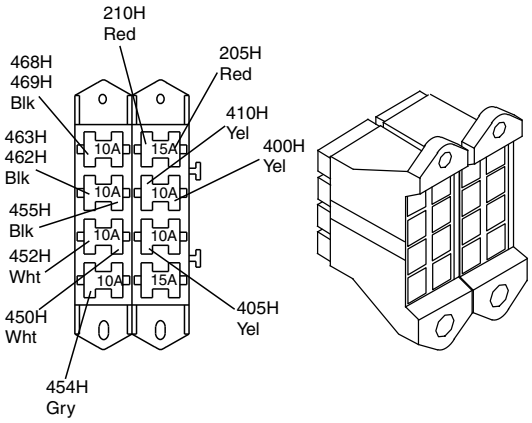
❷ Right Rear Hazard Light Circuit

Continued on next page

MX52301,000043A -19-24OCT14-74/90

Fuse Block

Is battery voltage present at 210H Red wire of fuse block



MXT012097 —UN—30JUN14

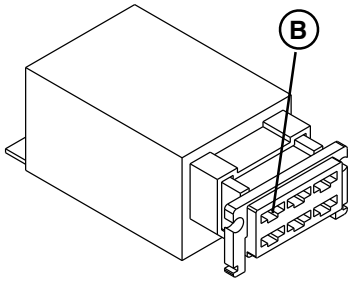
YES: Go to next step.

NO: Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-75/90

Flasher

Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?



MXT012100 —UN—02JUL14

B—477H White Wire

YES: Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step.

NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher.

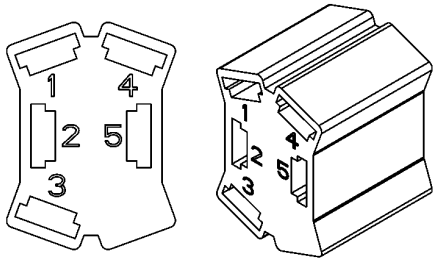
NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-76/90

Switch

Is intermittent battery voltage present at 482H Grn wire (1) of HM-S4 flasher switch?



MXT001666 —UN—10OCT11

1—480H and 482H Green Wire
4—494H Blue Wire

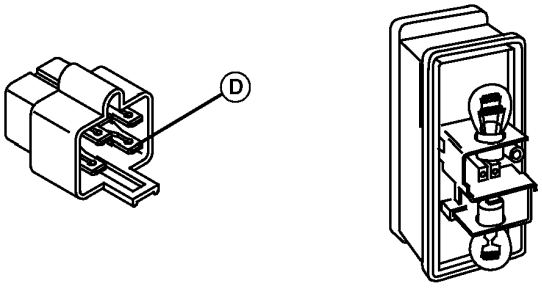
YES: Go to next step.

NO: Check 477H and 478H Wht wires and connections. If OK, test flasher switch. See Hazard Lights Switch Test

MX52301,000043A -19-24OCT14-77/90

Flasher Light Voltage

Is intermittent battery voltage present at 400 Grn wire of HM-E6 Right rear flasher light?



MXAL31006 —UN—09JUL12

D—400 Green Wire

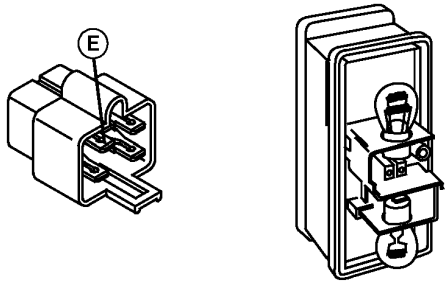
YES: Go to next step.

NO: Check 482H Grn wire, HM-X6 connector, and 400 Grn wire.

MX52301,000043A -19-24OCT14-78/90

Flasher Light Ground

Is continuity present between 100 Wht wire of HME6 Right rear flasher light and ground?



MXAL31007 —UN—09JUL12

E—100 White Wire

YES: Test bulb.

NO: Check 100 Wht wire, HM-X6 connector, 105D and 105A Brn wires, and splices.

Continued on next page

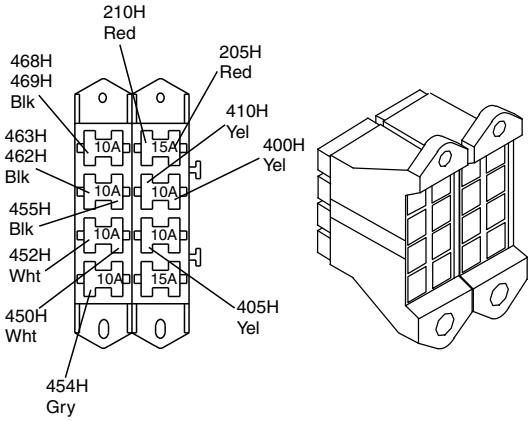
MX52301,000043A -19-24OCT14-79/90

Front Hazard Lights

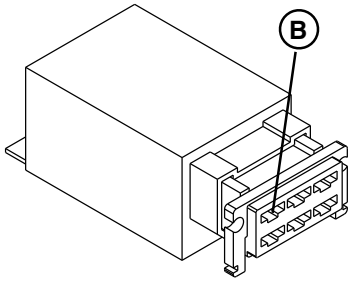
MX52301,000043A -19-24OCT14-80/90

❶ Left Front Hazard Light Circuit

MX52301,000043A -19-24OCT14-81/90

Fuse Block	Is battery voltage present at 210H Red wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-82/90

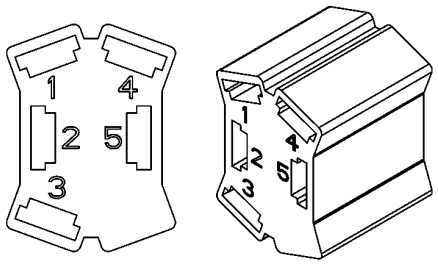
Flasher	Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?  MXT012100 —UN—02JUL14 **B—477H White Wire**	**YES:** Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step. **NO:** Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher. **NO:** Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-83/90

Switch

Is intermittent battery voltage present at 494H Blu wire (4) of HM-S4 flasher switch?



MXT001666 —UN—10OCT11

1—480H and 482H Green Wire
4—494H Blu Wire

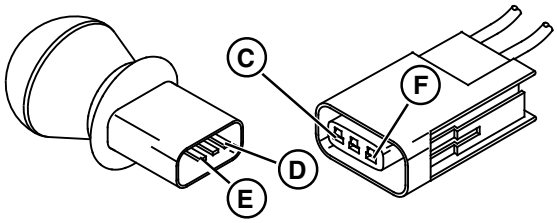
YES: Go to next step.

NO: Check 477H, 478H, and 479H Wht wires and connections. If OK, test flasher switch. See Hazard Lights Switch Test.

MX52301,000043A -19-24OCT14-84/90

Flasher Light Voltage

Is intermittent battery voltage present at 491H Blu wire (D) of HM-X11 Left front flasher light?



MXT012074 —UN—27JUN14

F—491H Blue Wire

YES: Check for continuity between 105K and 105F Brn wires and ground. If OK, test bulb.

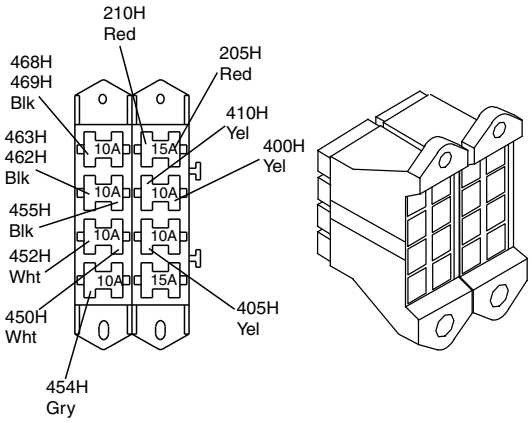
NO: Check 491 and 490H Blu wires, HM-V2 diode, 494H Blu wire, and connections.

MX52301,000043A -19-24OCT14-85/90

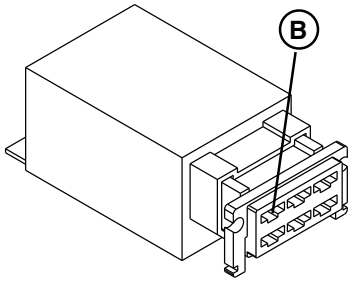
❷ Right Front Hazard Light Circuit

Continued on next page

MX52301,000043A -19-24OCT14-86/90

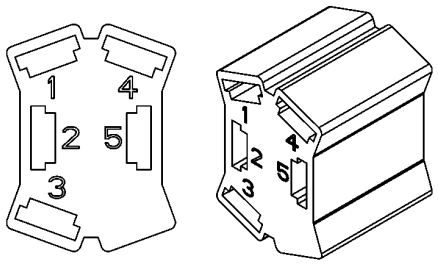
Fuse Block	Is battery voltage present at 210H Red wire of fuse block?  MXT012097 —UN—30JUN14	**YES:** Go to next step. **NO:** Check 203A and 205H Red wires, splices, and X14 connector. If OK, test HM-F1 fuse.

MX52301,000043A -19-24OCT14-87/90

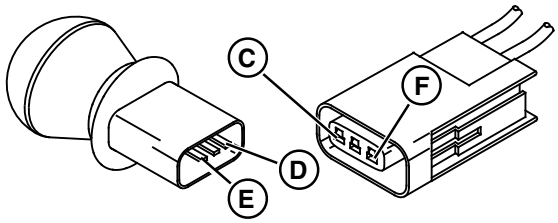
Flasher	Is intermittent battery voltage present at 477H Wht wire (B) of HM-K1 flasher?  MXT012100 —UN—02JUL14 **B—477H White Wire**	**YES:** Check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, go to next step. **NO:** Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 170H and 170J Brn wires, 100E Blk wire, splices, and X7 connector. If OK, replace flasher. **NO:** Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000043A -19-24OCT14-88/90

Switch	Is battery voltage present at 480H Grn wire (1) of HM-S4 flasher switch?  MXT001666 —UN—10OCT11 **1—480H and 482H Green Wire** **4—494H Blue Wire**	**YES:** Go to next step. **NO:** Check 477H, 478H, and 479H Wht wires and connections. If OK, test flasher switch. See Hazard Lights Switch Test.

MX52301,000043A -19-24OCT14-89/90

Light Connection Voltage	Is battery voltage present at 481H Grn wire (D) of HM-X14 Right front flasher light?  MXT012074 —UN—27JUN14 **F—481H Green Wire**	**YES:** Check for continuity between 105J and 105F Brn wires and ground. If OK, test bulb. **NO:** Check 481H and 480H wires and connections.

MX52301,000043A -19-24OCT14-90/90

Homologated Horn Circuit Diagnosis

Homologated Horn Diagnosis

MX52301,000043B -19-23JUN15-1/6

❶ Horn Circuit

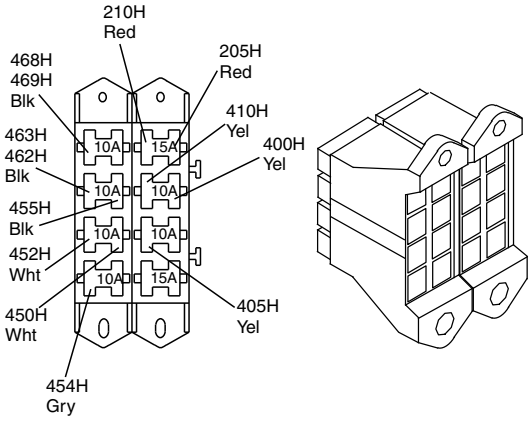
Continued on next page

MX52301,000043B -19-23JUN15-2/6

Fuse Block

- Machine parked safely on a level surface.
- Park braked locked.
- Key switch in run position, engine off.
- Battery fully charged.
- Power circuits working properly. See Power Circuit Operation, Gas (SN -040000) or See Power Circuit Operation, Gas (SN 040001-) or Power Circuit Operation, Diesel (SN -080000).
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wires and connections for looseness and corrosion.

Is battery voltage present at HM-F3 fuse, 405H Yel wire?



MXT012097 —UN—30JUN14

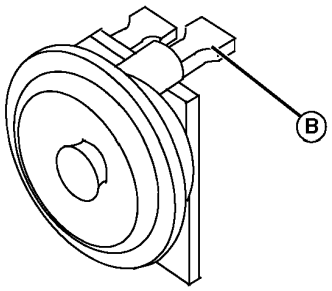
YES: Go to next step.

NO: Check HM-F3 fuse, 400H Yel wire, X7 connector, and connections.

MX52301,000043B -19-23JUN15-3/6

Horn Voltage

With horn switch depressed, is battery voltage present at 430H Yel wire (B)?



MXAL31019 —UN—09JUL12

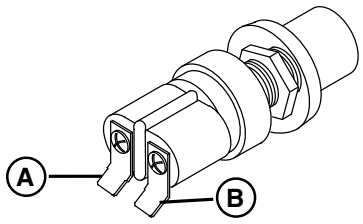
B—430H Yellow Wire

YES: Go to next step.

NO: Test horn switch. See Horn Switch Test, Push.

Continued on next page

MX52301,000043B -19-23JUN15-4/6

Horn Switch Voltage	Is battery voltage present at HM-H1 horn, 430H Yel wire (C) ?  MXT012083 —UN—02JUL14 **C—430H Yellow Wire** **D—120H Brown Wire**	**YES:** Go to next step. **NO:** Check 430H Yel wire and connections.

MX52301,000043B -19-23JUN15-5/6

Horn Switch Ground	Is continuity present between 120H Brn wire and ground?	**YES:** Replace horn. **NO:** Check 120H and 105F Brn wires, HMS-4 splice, and connections.

MX52301,000043B -19-23JUN15-6/6

Homologated Lights Circuit Diagnosis (SN 110001-)

Headlight Circuit

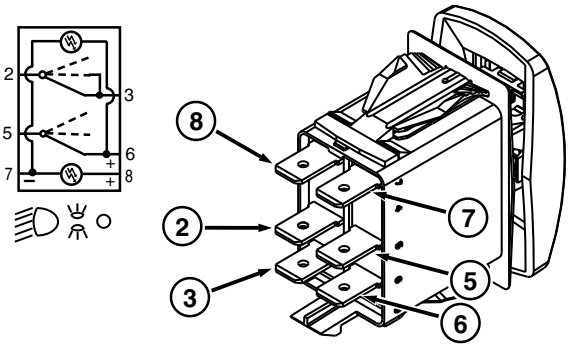
Homologated Lights Diagnosis

MX52301,000071B -19-24OCT14-1/98

❶ Left Headlight and Pilot Light Circuit

Continued on next page

MX52301,000071B -19-24OCT14-2/98

Light Switch Voltage	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Power circuits working properly. See appropriate power circuit operation. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wire connections for looseness and corrosion. • Light switch in the on position.	**YES:** Go to next step. **NO:** Check HMC-13 relay. See Relay Test.
	 MXT008021 —UN—31JUL13	
	Is battery voltage present at 216 Yel wire (2) of HMC-15 light switch?	**NO:** Check HMC-10 connector, 203 series Red wires, splice, and connections.

MX52301,000071B -19-24OCT14-3/98

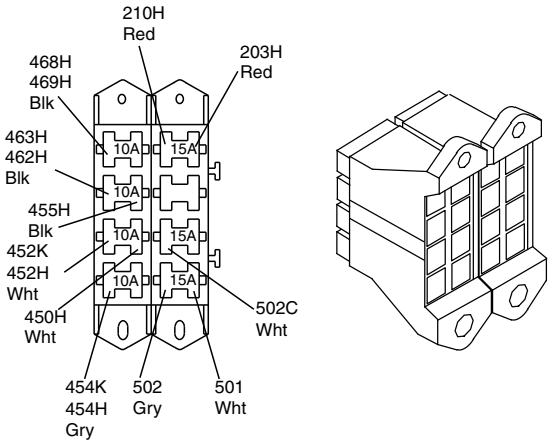
Light Switch Voltage	Is battery voltage present at 450H Wht wire (6) of HMC-15 light switch?	**YES:** Go to next step. **NO:** Check battery voltage at 212 Yel wire (5) of HMC-15 light switch, replace if necessary. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

Continued on next page

MX52301,000071B -19-24OCT14-4/98

Fuse Block Voltage

Is battery voltage present at 454 series Gry wires of fuse block?



MXT012413 —UN—03OCT14

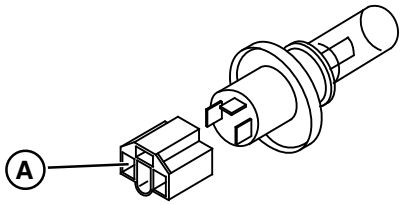
YES: Go to next step.

NO: Check 450H Wht wire and connections. Test F8 fuse.

MX52301,000071B -19-24OCT14-5/98

Left Headlight Voltage

Is battery voltage present at 454K Gry wire (A) of HMC-52 Left headlight?



MXT012680 —UN—07OCT14

A—454K Gray Wire

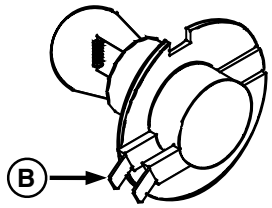
YES: Test headlight bulb. If OK, test 100W, 185C, and 185J Brn ground circuit wires, splices, and connections.

NO: Check 454K Gry wire and connections.

MX52301,000071B -19-24OCT14-6/98

Left Pilot Light Voltage

Is battery voltage present at 454H Gry wire (B) of HMC-45 Left Pilot light?



MXT012683 —UN—07OCT14

B—484H Gry wire

YES: Test pilot light bulb. If OK, test 105M, 105F, and 185J Brn ground circuit wires, splices, and connections.

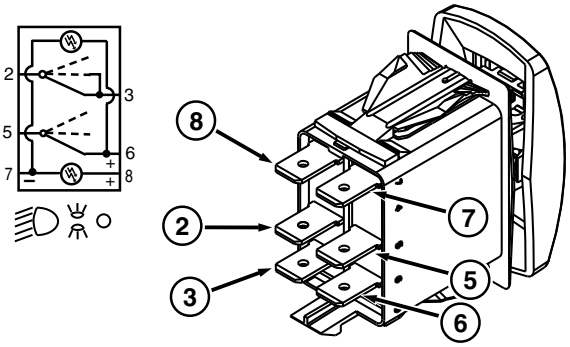
NO: Check 454H Gry wire and connections.

Continued on next page

MX52301,000071B -19-24OCT14-7/98

❷ Right Headlight and Pilot Light Circuit

MX52301,000071B -19-24OCT14-8/98

Light Switch Voltage	Is battery voltage present at 216 Yel wire (5) of HMC-15 light switch?  MXT008021 —UN—31JUL13	**YES:** Go to next step. **NO:** Check HMC-13 relay. See Relay Test. **NO:** Check HMC-10 connector, 203 series Red wires, splice, and connections.

MX52301,000071B -19-24OCT14-9/98

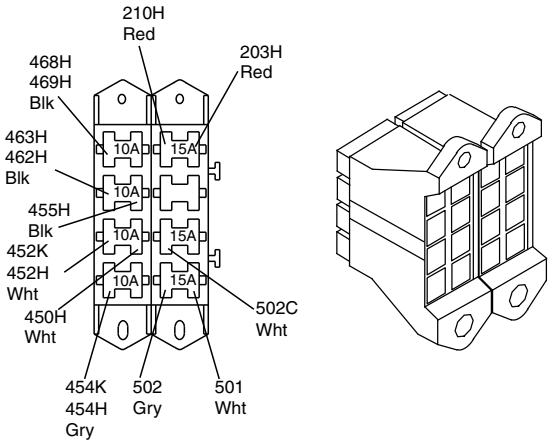
Light Switch Voltage	Is battery voltage present at 450H Wht wire (6) of HMC-15 light switch?	**YES:** Go to next step. **NO:** Check battery voltage at 212 Yel wire (5) of HMC-15 light switch, replace if necessary. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

Continued on next page

MX52301,000071B -19-24OCT14-10/98

Fuse Block Voltage

Is battery voltage present at 452 series Wht wires of fuse block?



MXT012413 —UN—03OCT14

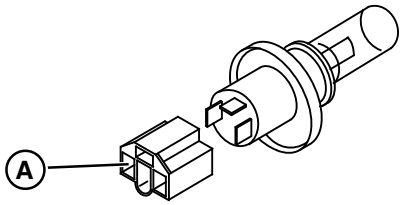
YES: Go to next step.

NO: Check 450H Wht wire and connections. Test F7 fuse. See Fuse Test.

MX52301,000071B -19-24OCT14-11/98

Right Headlight Voltage

Is battery voltage present at 452K Wht wire (A) of HMC-51 Right headlight?



MXT012680 —UN—07OCT14

A—452K Wht Wire

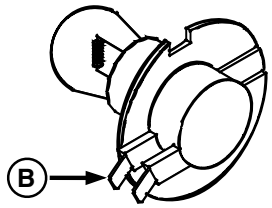
YES: Test headlight bulb. If OK, test 100M, 185C, and 185J Brn ground circuit wires, splices, and connections.

NO: Check 452K Wht wire and connections.

MX52301,000071B -19-24OCT14-12/98

Right Pilot Light Voltage

Is battery voltage present at 452H Wht wire (B) of HMC-46 Left pilot light?



MXT012683 —UN—07OCT14

B—452H Wht wire

YES: Test pilot light bulb. If OK, test 105M, 105F, and 185J Brn ground circuit wires, splices, and connections.

NO: Check 452K Wht wire and connections.

MX52301,000071B -19-24OCT14-13/98

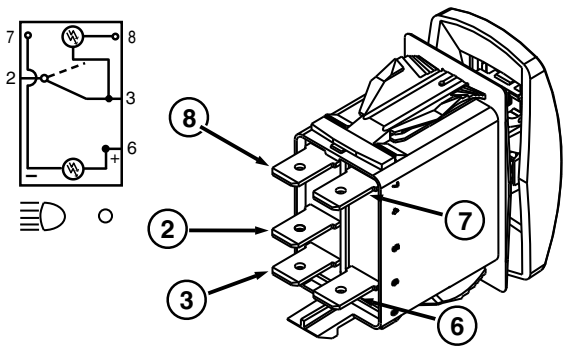
High Beam Lights Circuit

Continued on next page

MX52301,000071B -19-24OCT14-14/98

❶ High Beam Switch

MX52301,000071B -19-24OCT14-15/98

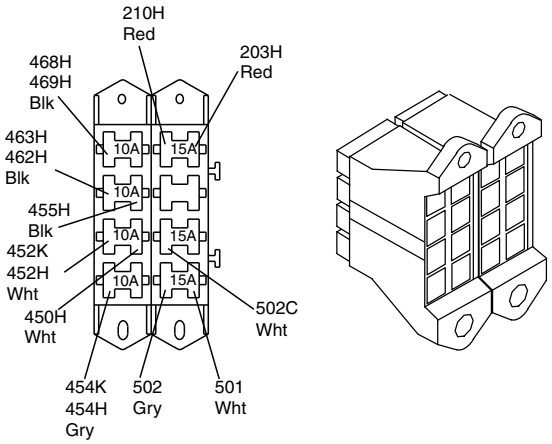
High Beam Light	**Test Procedure** **Test Conditions:** • Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Power circuits working properly. See appropriate power circuit operation. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wire connections for looseness and corrosion. • Light switch in the on position and functioning properly. • High beam switch in the on position. Is battery voltage present at 501 Wht wire (3) of HMC-25 high beam light switch?  MXT012679 —UN—06OCT14	**YES:** Go to next step. **NO:** Check 450K Wht wire (2) to light switch, replace if necessary. **NO:** Check HMC-15 light switch.

Continued on next page

MX52301,000071B -19-24OCT14-16/98

Fuse Block

Is battery voltage present at 502 series wires at HMC-20 fuse block?



MXT012413 —UN—03OCT14

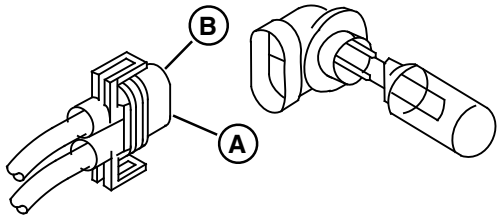
YES: Go to next step.

NO: Check 501 Wht wire. If OK, check respective fuses. See Fuse Test.

MX52301,000071B -19-24OCT14-17/98

Left High Beam Light

Is battery voltage present at 502 Gry wire of HMC-31 left headlight?



MXT011965 —UN—17JUN14

A—100U Brn Wire
B—502 Gry Wire

YES: Replace light bulb.

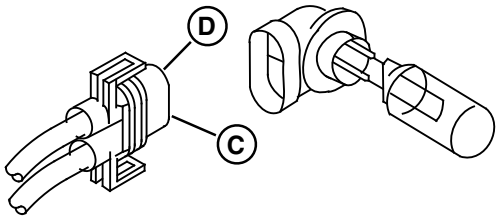
NO: Check continuity of ground between 502 Gry wire, 100U Brn wires, and connections, replace as necessary.

Continued on next page

MX52301,000071B -19-24OCT14-18/98

Right High Beam Light

Is battery voltage present at 502C Wht wire of HMC-30 right headlight?



MXT012681 —UN—06OCT14

C—100T Brn Wire
D—502C Wht Wire

YES: Replace light bulb.

NO: Check continuity of ground between 502C Wht wire, and 100T Brn wires and connections, replace as necessary.

MX52301,000071B -19-24OCT14-19/98

Front Position Light Circuit

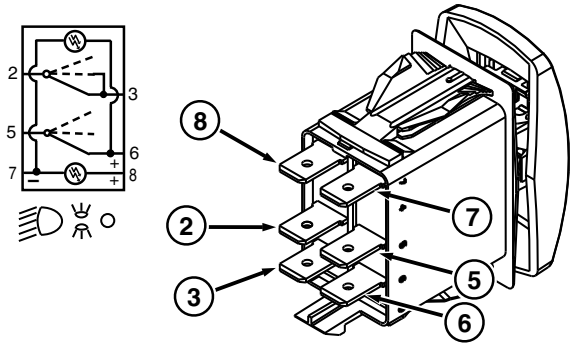
MX52301,000071B -19-24OCT14-20/98

❶ Left Front Position Light Circuit

MX52301,000071B -19-24OCT14-21/98

Light Switch Voltage

Is battery voltage present at 216 Yel wire (5) of HMC-15 light switch?



MXT008021 —UN—31JUL13

YES: Go to next step.

NO: Check HMC-13 relay. See Relay Test.

NO: Check HMC-10 connector, 203 series Red wires, splice, and connections.

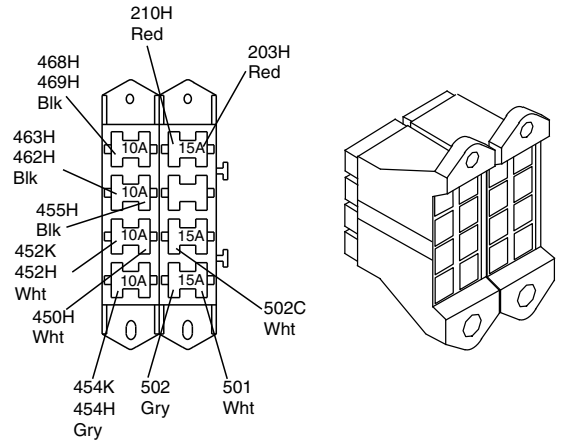
Continued on next page

MX52301,000071B -19-24OCT14-22/98

Light Switch Voltage	Is battery voltage present at 455H Blk wire (3) of HMC-15 light switch?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

MX52301,000071B -19-24OCT14-23/98

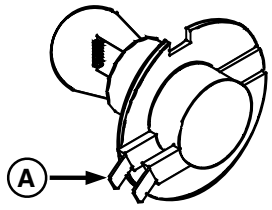
Fuse Block Voltage	Is battery voltage present at 468H Blk wire of fuse block?	**YES:** Go to next step. **NO:** Check 455H Blk wire and connections. Test F5 fuse.



MXT012413 —UN—03OCT14

MX52301,000071B -19-24OCT14-24/98

Left position light Voltage	Is battery voltage present at 468H Blk wire (A) of HCM-42 Left front position light?	**YES:** Test position light bulb. If OK, test 105H and 105F Brn ground circuit wires, splices, and connections.



MXT012686 —UN—07OCT14

A—468H Black Wire

NO: Check 468H Blk wire and connections.

MX52301,000071B -19-24OCT14-25/98

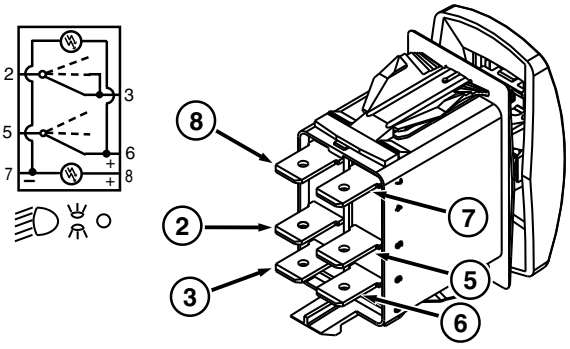
❷ Right Front Position Light

Continued on next page

MX52301,000071B -19-24OCT14-26/98

Light Switch Voltage

Is battery voltage present at 216 Yel wire (5) of HMC-15 light switch?



MXT008021 —UN—31JUL13

YES: Go to next step.

NO: Check HMC-13 relay. See Relay Test.

NO: Check HMC-10 connector, 203 series Red wires, splice, and connections.

MX52301,000071B -19-24OCT14-27/98

Light Switch Voltage

Is battery voltage present at 455H Blk wire (3) of HMC-15 light switch?

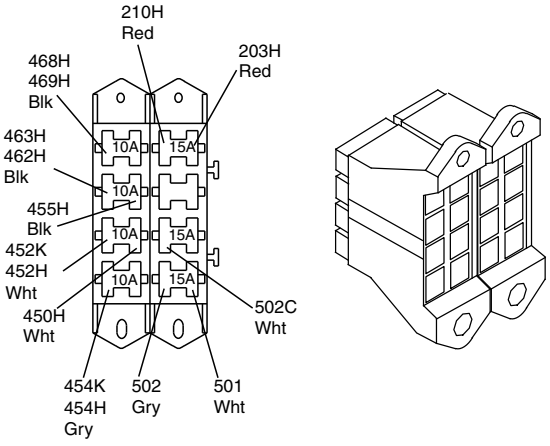
YES: Go to next step.

NO: Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

MX52301,000071B -19-24OCT14-28/98

Fuse Block Voltage

Is battery voltage present at 462H Blk wire of fuse block?



MXT012413 —UN—03OCT14

YES: Go to next step.

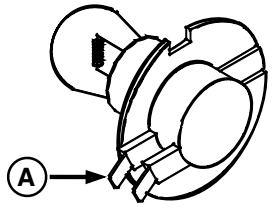
NO: Check 455H Blk wire and connections. Test F6 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-29/98

Right Front Position Light Voltage

Is battery voltage present at 462H Blk wire (A) of HCM-43 Right front position light?



MXT012686 —UN—07OCT14

A—462H Black Wire

YES: is battery voltage present at 462H Blk wire (A) of HM-E15 Right front position light?

NO: Check 462H Blk wire and connections.

MX52301,000071B -19-24OCT14-30/98

Rear Position Light Circuit

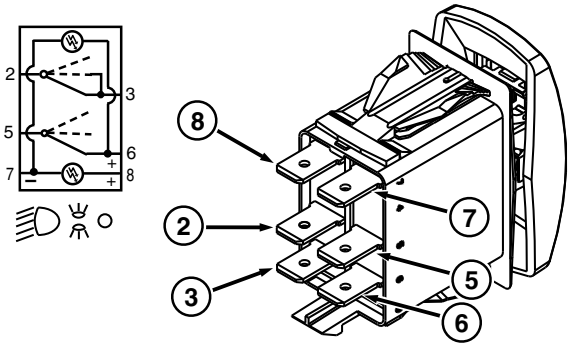
MX52301,000071B -19-24OCT14-31/98

❶ Left Rear Position Light Circuit

MX52301,000071B -19-24OCT14-32/98

Light Switch Voltage

Is battery voltage present at 216 Yel wire (5) of HMC-15 light switch?



MXT008021 —UN—31JUL13

YES: Go to next step.

NO: Check HMC-13 relay. See Relay Test.

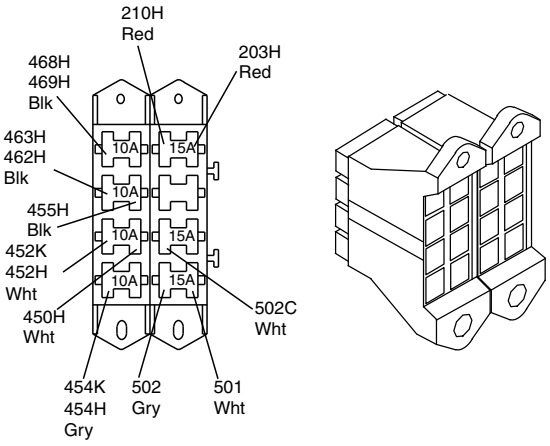
NO: Check HMC-10 connector, 203 series Red wires, splice, and connections.

Continued on next page

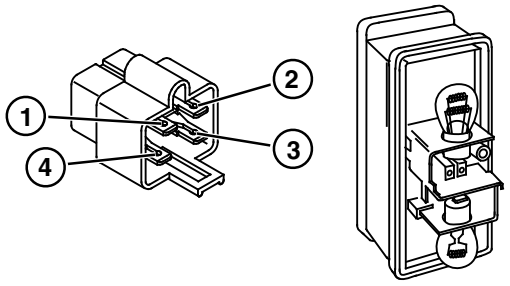
MX52301,000071B -19-24OCT14-33/98

Light Switch Voltage	Is battery voltage present at 455H Blk wire (3) of HMC-15 light switch?	**YES:** Go to next step. **NO:** Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

MX52301,000071B -19-24OCT14-34/98

Fuse Block Voltage	Is battery voltage present at 468H Blk wire of fuse block?  MXT012413 —UN—03OCT14	**YES:** Go to next step. **NO:** Check 455H Blk wire and connections. Test F5 fuse.

MX52301,000071B -19-24OCT14-35/98

Left Position Light Voltage	Is battery voltage present at HM-E3 Left rear position light 300 Blk wire (3)?  MXT012096 —UN—01JUL14 **3— 300 Black Wire**	**YES:** Test light bulb. If OK, check 100 Wht, 105B and 105A Brn ground wires, splices and HRC-2 connector. **NO:** Check 469H and 300 Blk wires and HRC-7 connector.

MX52301,000071B -19-24OCT14-36/98

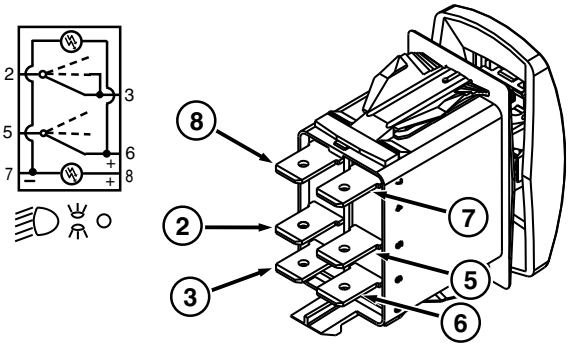
❷ Right Rear Position Light Circuit

Continued on next page

MX52301,000071B -19-24OCT14-37/98

Light Switch Voltage

Is battery voltage present at 216 Yel wire (5) of HMC-15 light switch?



MXT008021 —UN—31JUL13

YES: Go to next step.

NO: Check HMC-13 relay. See Relay Test.

NO: Check HMC-10 connector, 203 series Red wires, splice, and connections.

MX52301,000071B -19-24OCT14-38/98

Light Switch Voltage

Is battery voltage present at 455H Blk wire (3) of HMC-15 light switch?

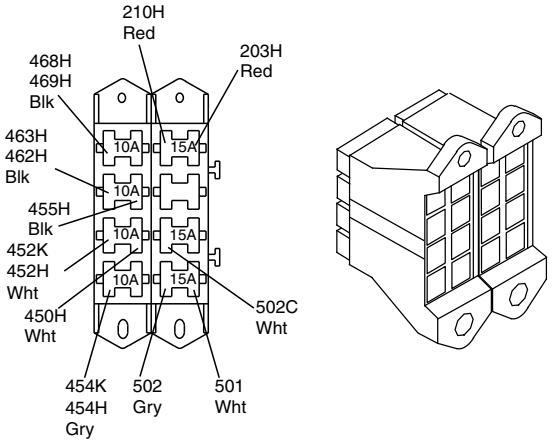
YES: Go to next step.

NO: Test light switch. See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

MX52301,000071B -19-24OCT14-39/98

Fuse Block Voltage

Is battery voltage present at 463H Blk wire of fuse block?



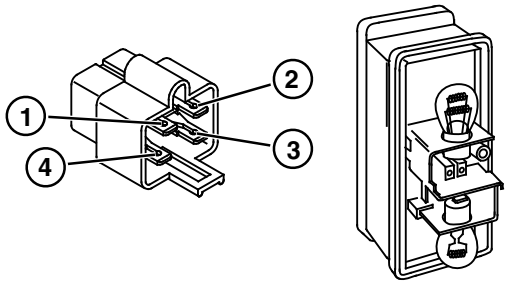
MXT012413 —UN—03OCT14

YES: Go to next step.

NO: Check 455H Blk wire and connections. Test F5 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-40/98

Right Rear Position Light	Is battery voltage present at 300 Blk wire (3) of HRC-2 Right rear position light?  MXT012096 —UN—01JUL14 **3— 300 Black Wire**	**YES:** Test light bulb. If OK, check 100 Wht, 105D and 105A Brn ground wires, splices and HM-X6 connector. **NO:** Check 463H Brn and 300 Blk wires and HM-X6 connector.

MX52301,000071B -19-24OCT14-41/98

Brake Lights

MX52301,000071B -19-24OCT14-42/98

❶ Left Brake Lights

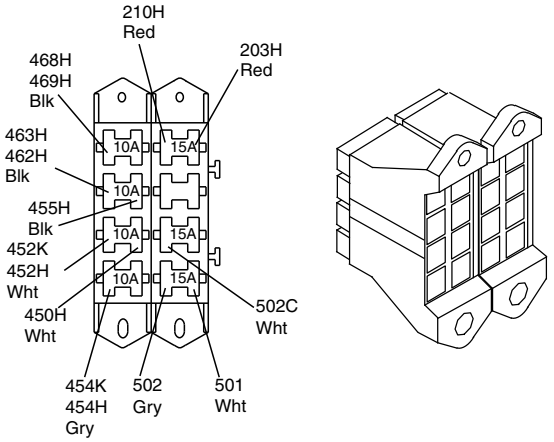
Continued on next page

MX52301,000071B -19-24OCT14-43/98

Fuse Block

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Power circuits working properly. See appropriate power circuit operation.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wire connections for looseness and corrosion.
- Brake switch in the closed (depressed) position.

Is battery voltage present at 214 Yel wire of HMC-40 brake switch?



MXT012413 —UN—03OCT14

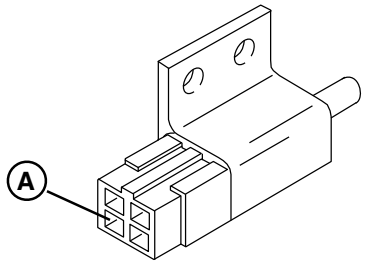
YES: Go to next step.

NO: Check 214 Yel wire and connections. If OK, test headlight switch. See See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

MX52301,000071B -19-24OCT14-44/98

Brake Switch Voltage

Is battery voltage present at 215 Yel wire (A) of HMC-40 brake switch?



MXT012685 —UN—07OCT14

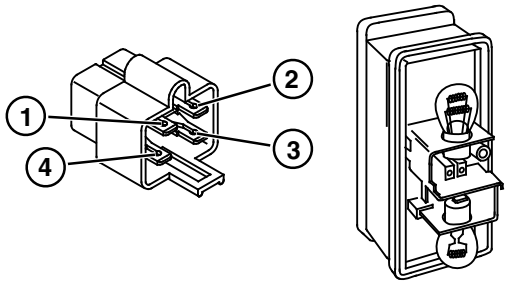
A—215 Yellow Wire

YES: Go to next step.

NO: Check 214 Yel wire and connections. If OK, test brake switch. See Brake Lights Switch Test.

Continued on next page

MX52301,000071B -19-24OCT14-45/98

Left Brake Light Voltage	Is battery voltage present at HM-E1 Left brake light 200 Blu wire (2)?  MXT012096 —UN—01JUL14 **2— 200 Blue Wire**	**YES:** Test light bulb. If OK, check 100 Wht, 105B and 105A Brn ground wires, splices, and HM-X3 connector. **NO:** Check 631H and 420N Yel wires, HM-X3 connector, 200 Blu wire, and connections.

MX52301,000071B -19-24OCT14-46/98

❷ Right Brake Light Circuit

MX52301,000071B -19-24OCT14-47/98

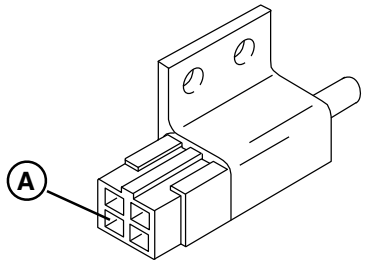
Fuse Block	• Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Power circuits working properly. See appropriate power circuit operation. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wire connections for looseness and corrosion. • Brake switch in the closed (depressed) position. Is battery voltage present at 214 Yel wire of HMC-40 brake switch?	**YES:** Go to next step. **NO:** Check 214 Yel wire and connections. If OK, test headlight switch. See See Light Switch Test (3 Position) or Light Switch Test (3 Position) (AM144304).

Continued on next page

MX52301,000071B -19-24OCT14-48/98

Brake Switch Voltage

Is battery voltage present at 215 Yel wire (A) of HMC-40 brake switch?



MXT012685 —UN—07OCT14

A—215 Yellow Wire

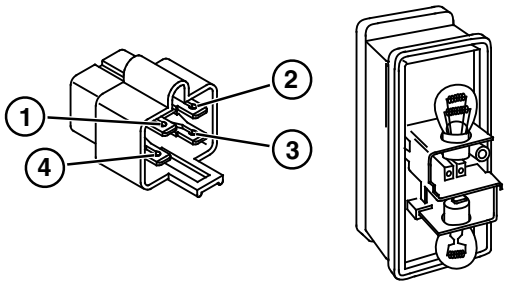
YES: Go to next step.

NO: Check 214 Yel wire and connections. If OK, test brake switch. See Brake Lights Switch Test.

MX52301,000071B -19-24OCT14-49/98

Right Brake Light Voltage

Is battery voltage present at HM-E5 Right brake light 200 Blu wire (2)?



MXT012096 —UN—01JUL14

2— 200 Blue Wire

YES: Test light bulb. If OK, check 100 Wht, 105D and 105A Brn ground wires, splices, and HM-X6 connector.

NO: Check 631H , 420N, and 421H Yel wires, HM-X6 connector, 200 Blu wire, and connections.

MX52301,000071B -19-24OCT14-50/98

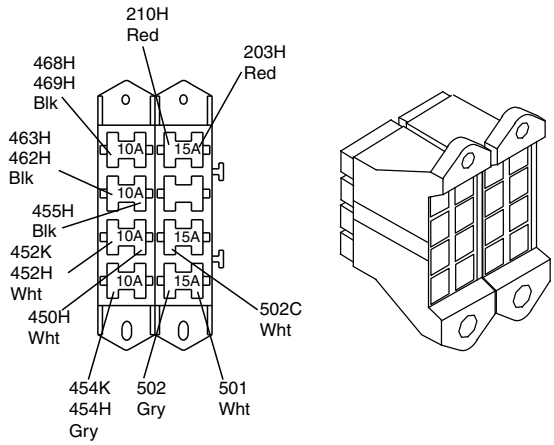
Rear Turn Lights Circuit

MX52301,000071B -19-24OCT14-51/98

❶ Left Rear Turn Light Circuit

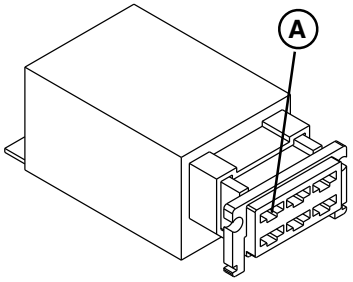
Continued on next page

MX52301,000071B -19-24OCT14-52/98

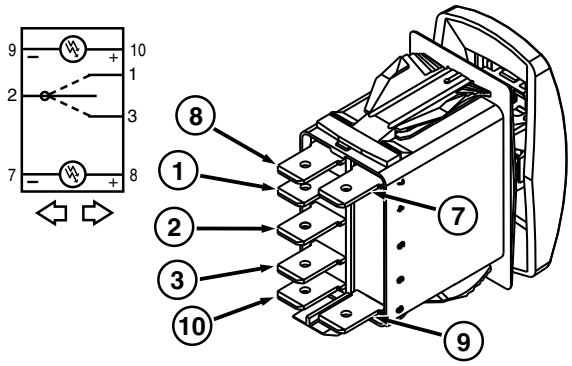
Fuse Block Voltage	• Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Power circuits working properly. See appropriate power circuit operation. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wire connections for looseness and corrosion. • Turn switch in either the Left or Right position, depending on the test being performed. Is battery voltage present at 210H Red wire of fuse block?  MXT012413 —UN—03OCT14	**YES:** Go to next step. **NO:** Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-53/98

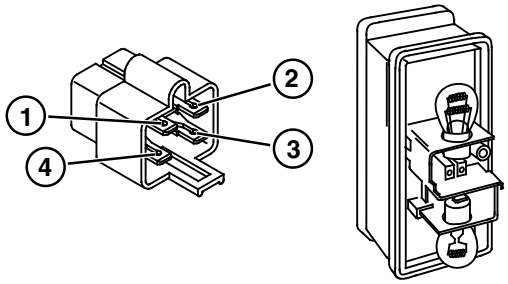
Flasher Voltage	Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?  MXT012684 —UN—07OCT14 **A—477H White Wire**	**YES:** Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step. **NO:** Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher. **NO:** Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000071B -19-24OCT14-54/98

Turn Switch Voltage	Move turn switch to left position. Is intermittent battery voltage present at 491H Lt. Blu wire (3) of HMC-17 turn switch?  MXT008020 —UN—31JUL13	**YES:** Go to next step. **NO:** Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test.

Continued on next page

MX52301,000071B -19-24OCT14-55/98

Left Rear Turn Light Voltage	Is intermittent battery voltage present at 400 Grn wires (3) of HM-E2 Left rear turn light?  MXT012096 —UN—01JUL14 **1— 100 White Wire** **3— 400 Green Wire**	**YES:** Go to next step. **NO:** Check 491H and 491K Blu wires, HM-X3 connector, and 400 Grn wire.

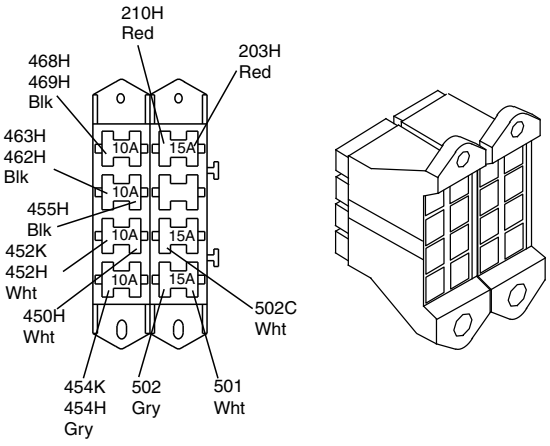
MX52301,000071B -19-24OCT14-56/98

Left Rear Turn Light Ground	Is continuity present between 100 Wht wire (1) of HME2 Left rear turn light and ground?	**YES:** Test bulb. **NO:** Check 100 Wht wire, HMR-7 connector, 105 series Brn wires, and splices.

MX52301,000071B -19-24OCT14-57/98

❷ Right Rear Turn Light Circuit

MX52301,000071B -19-24OCT14-58/98

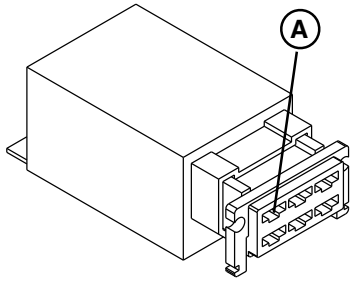
Fuse Block Voltage	Is battery voltage present at 210H Red wire of fuse block  MXT012413 —UN—03OCT14	**YES:** Go to next step. **NO:** Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-59/98

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?



MXT012684 —UN—07OCT14

A—477H White Wire

YES: Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step.

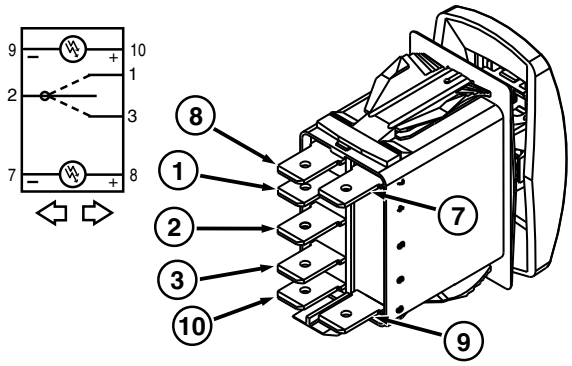
NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher.

NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000071B -19-24OCT14-60/98

Turn Switch Voltage

Move turn switch to left position. Is intermittent battery voltage present at 491H Lt. Blu wire (3) of HMC-17 turn switch?



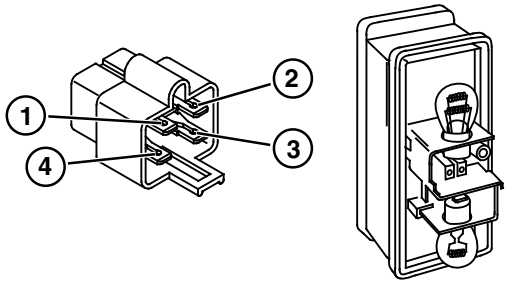
MXT008020 —UN—31JUL13

YES: Go to next step.

NO: Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test.

Continued on next page

MX52301,000071B -19-24OCT14-61/98

Right Rear Turn Light Voltage	Is intermittent battery voltage present at 400 Grn wire (4) of HM-E6 Right rear turn light?  MXT012096 —UN—01JUL14 **1— 100 White Wire** **4— 400 Green Wire**	**YES:** Go to next step. **NO:** Check 480H and 484E Grn wires, HM-X6 connector, and 400 Grn wire.

MX52301,000071B -19-24OCT14-62/98

Right Rear Turn Signal Light Ground	Is continuity present between 100 Wht wire of HM-E6 Right rear turn signal light and ground?	**YES:** Test bulb. **NO:** Check 100Wht wire, HM-X6 connector, 105 series Brn wires, and splices.

MX52301,000071B -19-24OCT14-63/98

Turn Light Circuit

MX52301,000071B -19-24OCT14-64/98

❶ Left Front Turn Light Circuit

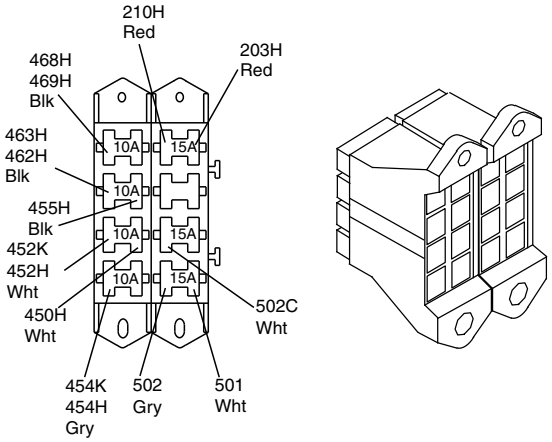
Continued on next page

MX52301,000071B -19-24OCT14-65/98

Fuse Block Voltage

- Machine parked safely. See the “Safety Section”.
- Park brake locked.
- Cargo box raised and locked.
- Battery fully charged.
- Key switch in run position, engine off.
- Power circuits working properly. See appropriate power circuit operation.
- Ensure that frame, harness, and engine grounds are clean and secure with good continuity.
- Check wire connections for looseness and corrosion.
- Turn switch in either the Left or Right position, depending on the test being performed.

Is battery voltage present at 210H Red wire of fuse block?



MXT012413 —UN—03OCT14

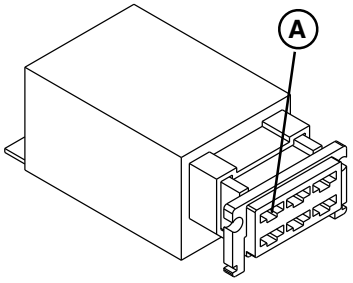
YES: Go to next step.

NO: Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

MX52301,000071B -19-24OCT14-66/98

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?



MXT012684 —UN—07OCT14

A—477H White Wire

YES: Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step.

NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher.

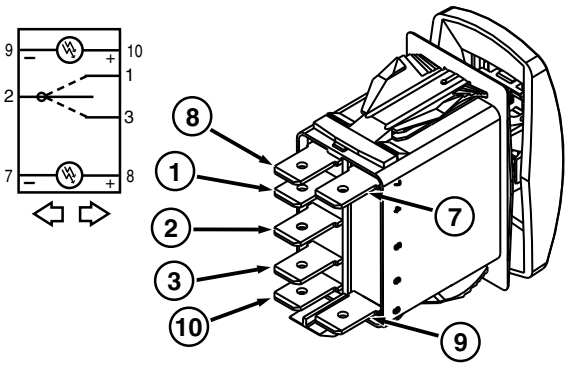
NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000071B -19-24OCT14-67/98

Turn Switch Voltage

Move turn switch to left position. Is intermittent battery voltage present at 491H Lt. Blu wire (3) of HMC-17 turn switch?



MXT008020 —UN—31JUL13

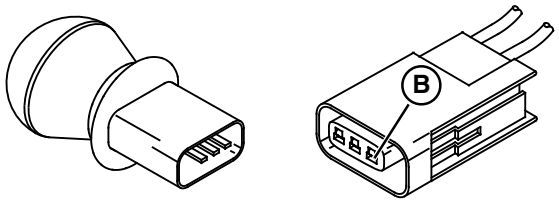
YES: Go to next step.

NO: Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test.

MX52301,000071B -19-24OCT14-68/98

Light Connector

Is intermittent battery voltage present at 491H Lt. Blu wire (B) of HMC-44 Left front turn light connector?



MXT012682 —UN—08OCT14

B—491H Blue Wire

YES: Check for continuity between 105 series Brn wires and ground. If OK, test bulb.

NO: Check 491H wire and connections

MX52301,000071B -19-24OCT14-69/98

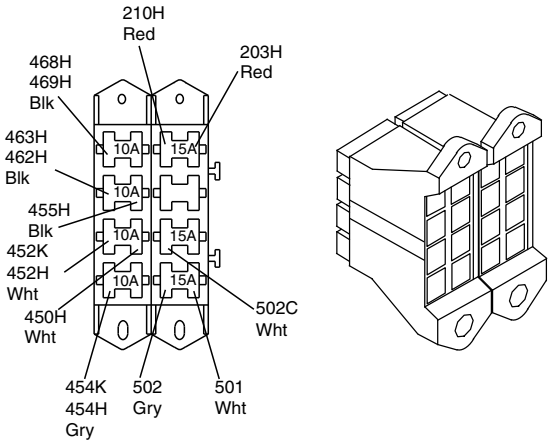
❷ Right Front Turn Light Circuit

Continued on next page

MX52301,000071B -19-24OCT14-70/98

Fuse Block Voltage

Is battery voltage present at 210H Red wire of fuse block?



MXT012413 —UN—03OCT14

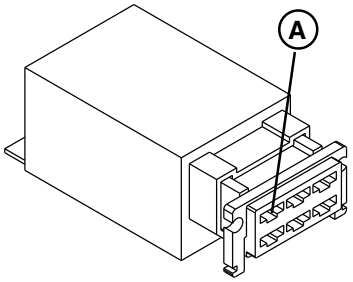
YES: Go to next step.

NO: Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

MX52301,000071B -19-24OCT14-71/98

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?



MXT012684 —UN—07OCT14

A—477H White Wire

YES: Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step.

NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher.

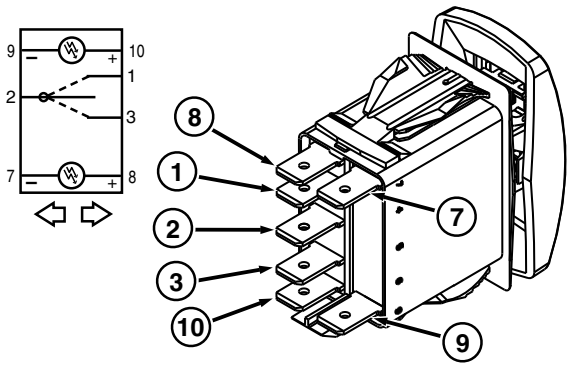
NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

Continued on next page

MX52301,000071B -19-24OCT14-72/98

Turn Switch

Is intermittent battery voltage present at 481H Grn wire (1) of HMC-17 turn switch?



MXT008020 —UN—31JUL13

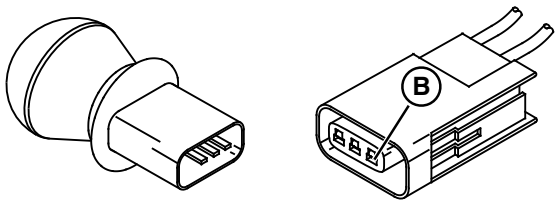
YES: Go to next step

NO: Check 477H Wht wire and connections. If OK, test turn switch. See Turn Signal Lights Switch Test.

MX52301,000071B -19-24OCT14-73/98

Light Voltage

Is intermittent battery voltage present at 481H Grn wire (B) of HMC-47 Right front turn light connector?



MXT012682 —UN—08OCT14

B—481H Green Wire

YES: Check for continuity between 105 series Brn wires and ground. If OK, test bulb.

NO: Check 481H Grn wire and connections.

MX52301,000071B -19-24OCT14-74/98

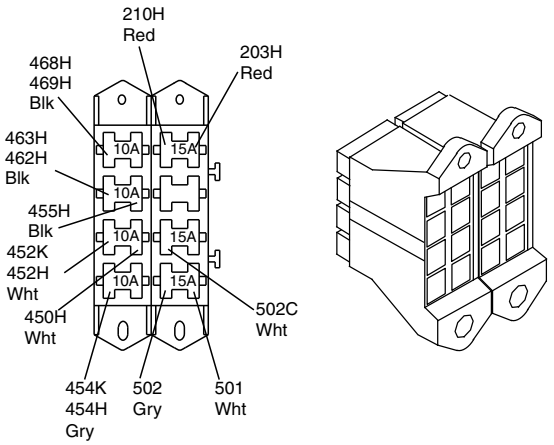
Rear Hazard Lights

MX52301,000071B -19-24OCT14-75/98

❶ Left Rear Hazard Light Circuit

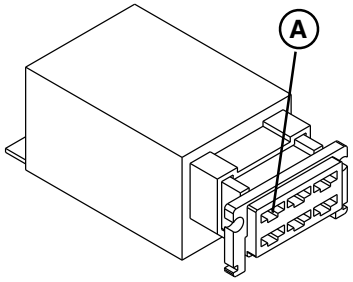
Continued on next page

MX52301,000071B -19-24OCT14-76/98

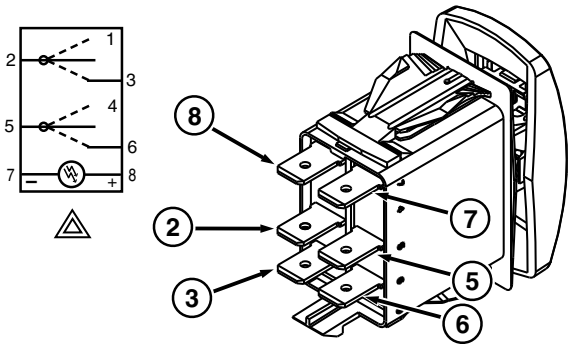
Fuse Block Voltage	• Machine parked safely. See the “Safety Section”. • Park brake locked. • Cargo box raised and locked. • Battery fully charged. • Key switch in run position, engine off. • Power circuits working properly. See appropriate power circuit operation. • Ensure that frame, harness, and engine grounds are clean and secure with good continuity. • Check wire connections for looseness and corrosion. • Turn switch in either the Left or Right position, depending on the test being performed. Is battery voltage present at 210H Red wire of fuse block?  MXT012413 —UN—03OCT14	**YES:** Go to next step. **NO:** Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-77/98

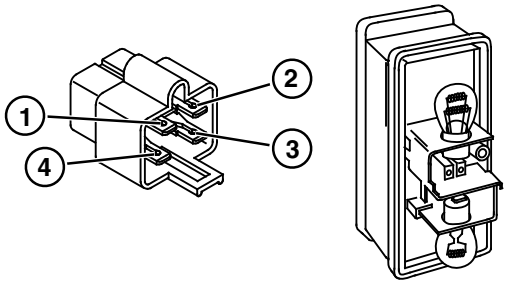
Flasher Voltage	Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?  MXT012684 —UN—07OCT14 **A—477H White Wire**	**YES:** Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step. **NO:** Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher. **NO:** Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000071B -19-24OCT14-78/98

Switch	Is intermittent battery voltage present at 492H Blu wire (6) of HMC-18 hazard lights switch?  MXT008019 —UN—01AUG13	**YES:** Go to next step. **NO:** Go to next step. No: Check 477H, 478H, and 479H Wht wires and connections. If OK, replace flasher switch.

Continued on next page

MX52301,000071B -19-24OCT14-79/98

Light Voltage	Is intermittent battery voltage present at 400 Grn wire (3) of HM-E2 Left rear flasher light?  MXT012096 —UN—01JUL14 **1— 100 White Wire** **3— 400 Green Wire**	**YES:** Go to next step. **NO:** Check 496 series and 492H wires, HRC-7 connector, and 400 Grn wire.

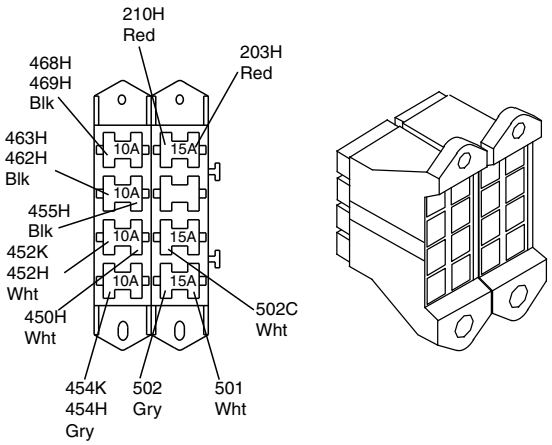
MX52301,000071B -19-24OCT14-80/98

Light Continuity	Is continuity present between 100 Wht wire (1) of HM-E2 Left rear turn light and ground?	**YES:** Test bulb **NO:** Check 100 Wht wire (1), HRC-7 connector, 105 series Brn wires, and splices.

MX52301,000071B -19-24OCT14-81/98

❷ Right Rear Hazard Light Circuit

MX52301,000071B -19-24OCT14-82/98

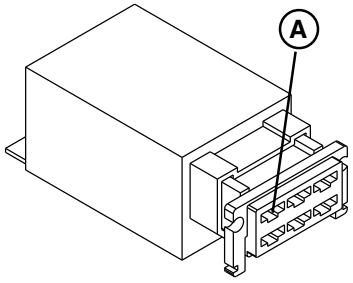
Fuse Block Voltage	Is battery voltage present at 210H Red wire of fuse block?  MXT012413 —UN—03OCT14	**YES:** Go to next step. **NO:** Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-83/98

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?



MXT012684 —UN—07OCT14

A—477H White Wire

YES: Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step.

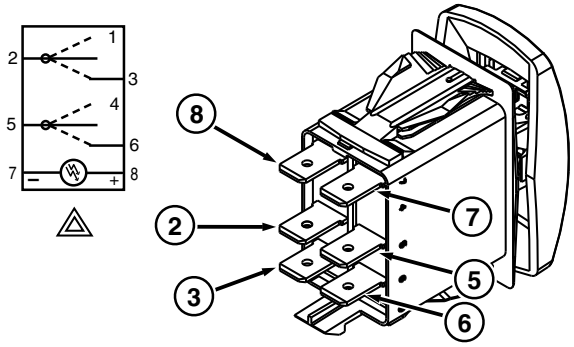
NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher.

NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000071B -19-24OCT14-84/98

Switch

Is intermittent battery voltage present at 482H Grn wire (3) of HMC-18 hazard switch?



MXT008019 —UN—01AUG13

YES: Go to next step.

NO: Check 477H and 478H Wht wires and connections. If OK, test flasher switch. See Hazard Lights Switch Test.

MX52301,000071B -19-24OCT14-85/98

Flasher Light Voltage

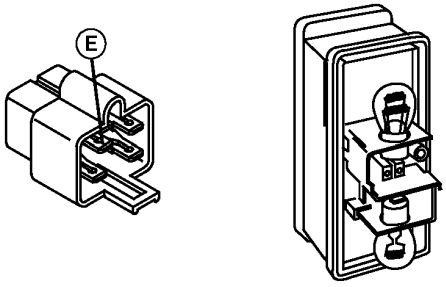
Is intermittent battery voltage present at 400 Grn wire of HM-E6 Right rear flasher light?

YES: Go to next step.

NO: Check 482H Grn wire, HRC-2 connector, and 400 Grn wire.

Continued on next page

MX52301,000071B -19-24OCT14-86/98

Flasher Light Ground	Is continuity present between 100 Wht wire (E) of HME6 Right rear flasher light and ground?  MXAL31007 —UN—09JUL12 **E—100 White Wire**	**YES:** Test bulb. **NO:** Check 100 Wht wire, HRC-2 connector, 105 series Brn wires, and splices.

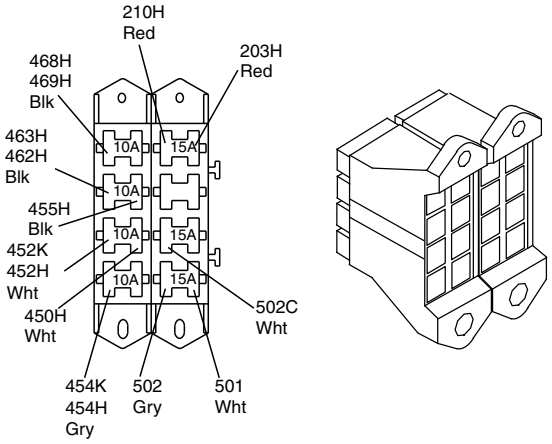
MX52301,000071B -19-24OCT14-87/98

Front Hazard Lights

MX52301,000071B -19-24OCT14-88/98

❶ Left Front Hazard Light Circuit

MX52301,000071B -19-24OCT14-89/98

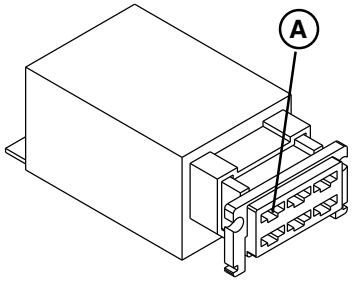
Fuse Block Voltage	Is battery voltage present at 210H Red wire of fuse block?  MXT012413 —UN—03OCT14	**YES:** Go to next step. **NO:** Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-90/98

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?



MXT012684 —UN—07OCT14

A—477H White Wire

YES: Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step.

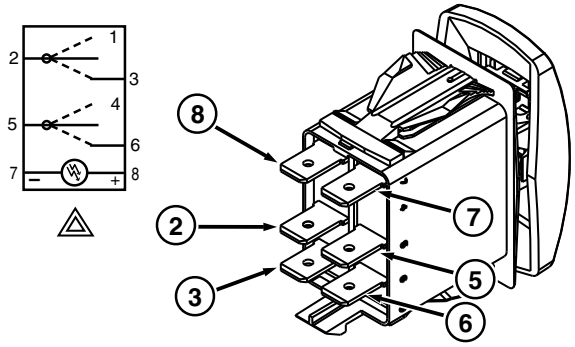
NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher.

NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000071B -19-24OCT14-91/98

Switch

Is intermittent battery voltage present at 494H Blu wire (4) of HMC-18 hazard switch?



MXT008019 —UN—01AUG13

YES: Go to next step.

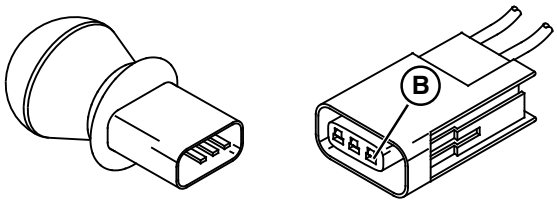
NO: Check 477H, 478H, and 479H Wht wires and connections. If OK, test flasher switch. See Hazard Lights Switch Test.

Continued on next page

MX52301,000071B -19-24OCT14-92/98

Flasher Light Voltage

Is intermittent battery voltage present at 491H Lt. Blu wire (B) of HMC-44 Left front flasher light?



MXT012682 —UN—08OCT14

B—491H Lt. Blue Wire

YES: Check for continuity between 105 series Brn wires and ground. If OK, test bulb.

NO: Check 491 series wires, HMC-44, and connections.

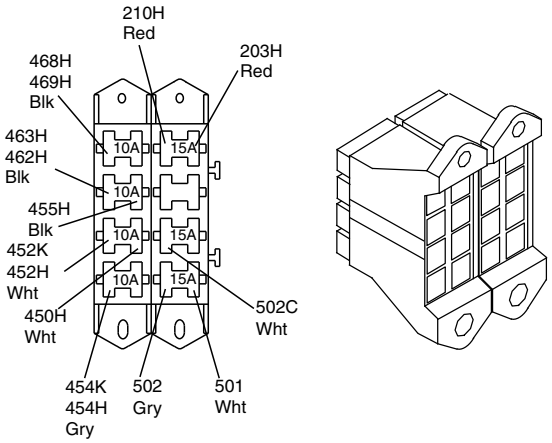
MX52301,000071B -19-24OCT14-93/98

❷ Right Front Hazard Light Circuit

MX52301,000071B -19-24OCT14-94/98

Fuse Block Voltage

Is battery voltage present at 210H Red wire of fuse block?



MXT012413 —UN—03OCT14

YES: Go to next step.

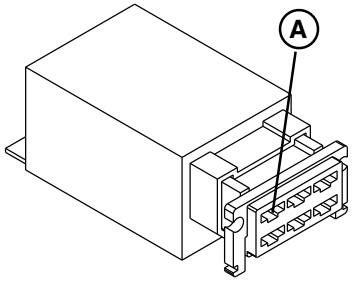
NO: Check 203A and 203H Red wires, splices, and HMC-9 connector. If OK, test F1 fuse.

Continued on next page

MX52301,000071B -19-24OCT14-95/98

Flasher Voltage

Is intermittent battery voltage present at 477H Wht wire (A) of HMC-19 flasher?



MXT012684 —UN—07OCT14

A—477H White Wire

YES: Check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, go to next step.

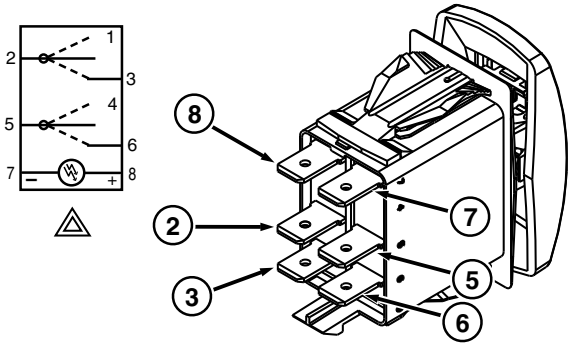
NO: Check 210H Red wire and connections. If OK, check for flasher continuity to ground through 185L and 185J Brn wires, splices, and X54 connector. If OK, replace flasher.

NO: Check HM-R1 resistor for 91 ohms of resistance. If not OK, replace resistor.

MX52301,000071B -19-24OCT14-96/98

Switch

Is battery voltage present at 480H Grn wire (1) of HMC-18 flasher switch?



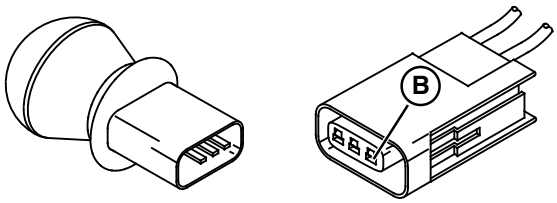
MXT008019 —UN—01AUG13

YES: Go to next step.

NO: Check 477H, 478H, and 479H Wht wires and connections. If OK, test flasher switch. See Hazard Lights Switch Test.

Continued on next page

MX52301,000071B -19-24OCT14-97/98

Light Connection Voltage	Is battery voltage present at 481H Grn wire (B) of HMC-47 Right front flasher light?  MXT012682 —UN—08OCT14 **B—481H Green Wire**	**YES:** Check for continuity between 105 series Brn wires and ground. If OK, test bulb. **NO:** Check 481H and 480H wires and connections.

MX52301,000071B -19-24OCT14-98/98

Section 60
Power Train

Contents

Specifications

Type ..... Continuous Variable Transmission (CVT) with Gear-Driven Transaxle
Gear Ranges ..... Forward HI and LO—Neutral—Reverse
Travel Speed Maximum (Forward HI) ..... 40 km/h (25 mph)
Transaxle Oil and MFWD ..... Low Viscosity Hy-Gard™ JDM J20C
EMFWD (Electric Engagement) ..... Low Viscosity Hy-Gard™ JDM J20C
Clutch Engagement ..... 1350 rpm
Clutch Disengagement ..... 1250 rpm

Item	Measurement	Specification
Fluid Capacities		
MFWD Differential Oil Level (SN -040000)	Capacity	0.9 L (0.95 qt.)
EMFWD Differential Oil Fill Level (SN 040001-)	Capacity	150 mL (5 oz.)
Transaxle Oil Level 4x2	Capacity	4.0 L (4.2 qt.)
Transaxle Oil Level 4x4	Capacity	4.5 L (4.8 qt.)
Torque Specifications		
Mounting Cap Screw	Torque	50 N·m (37 lb.-ft.)
Cap Screw and Nut	Torque	30—44 N·m (22—32 lb.-ft.)
Drain Plug	Torque	12 N·m (110 lb.- in.)
Fill Plug Torque	Torque	13.5 N·m (120 lb.-in.)
Clutch Bolt	Torque	37 N·m (26 lb.-ft.)
Spider	Torque	135 N·m (100 lb.-ft.)
Driven Clutch to Transaxle Cap Screw	Torque	73 N·m (53 lb.-ft.)
Rear Shock to Frame	Torque	102—150 N·m (75—111 lb.-ft.)
Ring Gear Bolt	Torque	70—80 N·m (52—59 lb.-ft.)
Brake Disc to Drive Shaft Collar Nuts	Torque	58—88 N·m (43—65 lb.-ft.)
Helical Spline Halfshaft Castle Nut	Torque	251 +119/-23 N·m (185 +88/-17 lb.-ft.)
Non-helical Halfshaft Castle Nut	Torque	170 +119/-23 N·m (125 +88/-17 lb.-ft.)
Ball Joint to A-Arm Locknut	Torque	54 N·m (40 lb.-ft.)

Continued on next page
MX52301,0000470 -19-22OCT14-1/2

Item	Measurement	Specification
Differential to Frame Bolts	Torque	43 N·m 32 (lb.-ft.)
Ball Joint Nuts	Torque	54 N·m 40 (lb.-ft.)
Ring Gear to Differential Carrier Bolt	Torque	70—80 N·m (52—59 lb.-ft.)
Pinion Cover Bolt	Torque	23 N·m (17 lb.- ft.)
Front Differential Cover Bolts	Torque	23 N·m (17 lb.-ft.)
Drain Bolt	Torque	12 N·m (110 lb.-in.)
Coil Test Specifications		
Coil Resistance	Resistance	24.7—27.3 Ohms
Coil Temperature at Time of Test	Temperature	20 °C (68 °F)
Endplay, Backlash, Gap, and Belt Width		
Front Gearbox Maximum	End Play	0.05 mm (0.002 in.)
Front Differential	Backlash	0.12—0.19 mm (0.004—0.007 in.)
Housing to Gear	Gap	28.05—29.05 mm (1.140—1.144 in.)
Minimum Belt	Width	27 mm (1.1 in.)

Hy-Gard is a trademark of Deere & Company

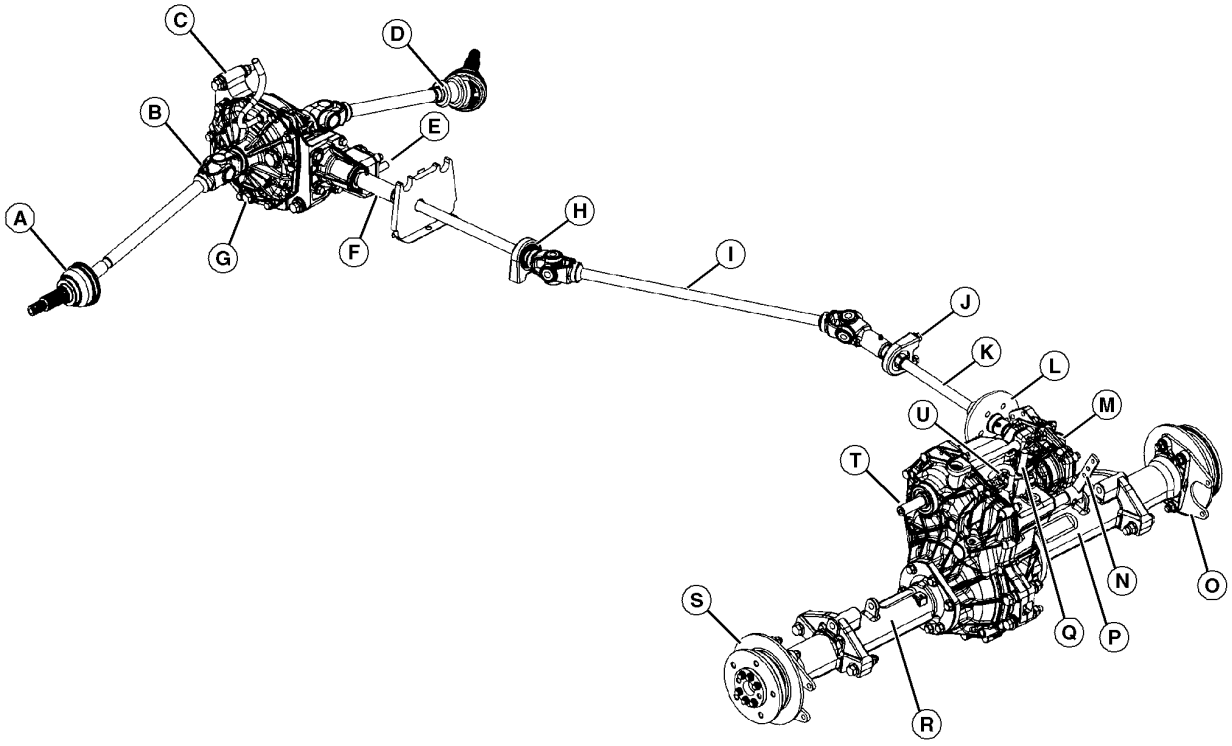
MX52301,0000470 -19-22OCT14-2/2

Summary of References

- Differential Components
- Drive Clutch Components
- Driven Clutch
- EMFWD Front Differential Components
- Front Drive Gear Box Components
- MFWD Driveline Components
- MFWD Front Differential Components
- MFWD Shift Linkage Componentss
- Power Train Components (SN -040000)
- Power Train Components (SN 040001-)
- Shift Linkage Components (SN -090000)
- Shift Linkage Components (SN 090001-)
- Differential Lock Linkage Components
- Transaxle Control Components
- Transaxle Input Components
- Transaxle Gear Components

MX52301,000046E -19-23OCT14-1/1

Power Train Components (SN -040000)



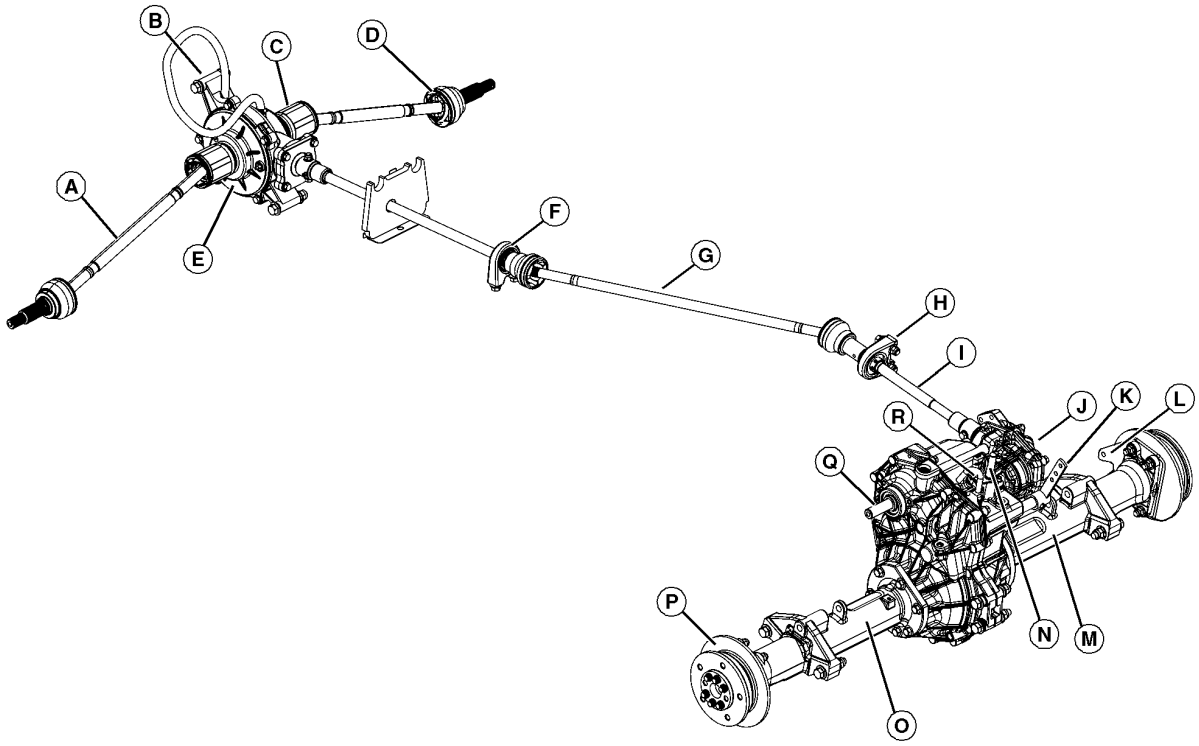
MXT011206 —UN—20MAY14

A—Left Front Hub[1]
B—U—Joint
C—Housing
D—CV
E—MFWD Shift Shaft
F—Coupler
G—Drain Plug
H—Cast Bearing Housing
I— MFWD Drive Shaft
J—Cast Bearing Housing
K—Stub Shaft
L—Park Brake Disk
M—MFWD Drive Gear Housing
N—Differential Lock Lever
O—Brake Caliper Mounting Bracket
P—Right Axle Housing
Q—Shift Shaft
R—Left Axle Housing
S—Brake Disk
T—Input Shaft
U—Neutral Switch

[1]*Components A—M are for MFWD machines only*

MX52301,000006F -19-17OCT14-1/1

Power Train Components (SN 040001-)

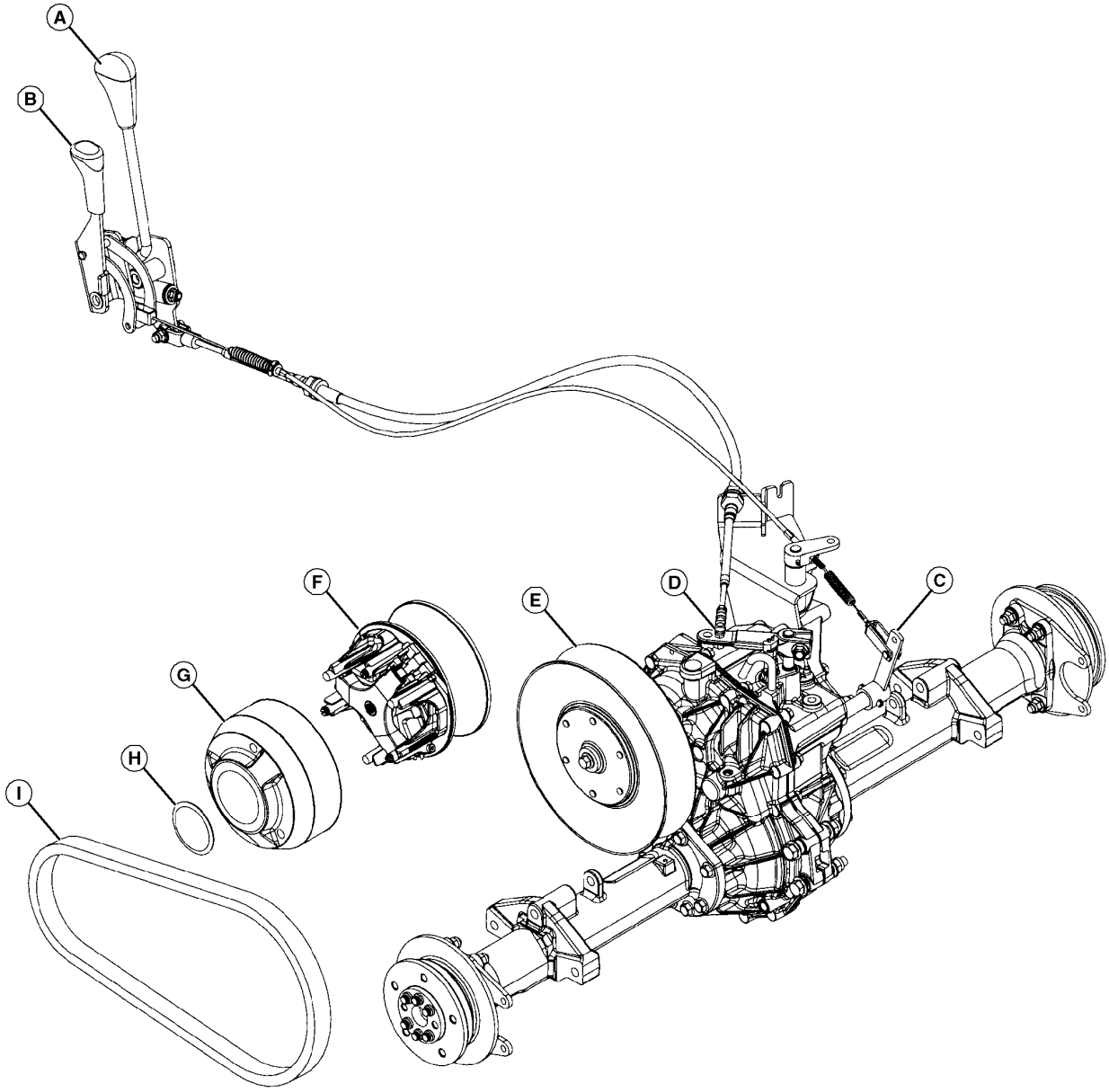


A—Left Half-shaft[1]
B—Housing
C—Inner CV Joint
D—Outer CV Joint
E—Cover with Coil
F—Pillow Block Bearing
G—EMFWD Drive Shaft
H—Pillow Block Bearing
I— Stub Shaft
J—MFWD Drive Gear Housing
K—Differential Lock Lever
L—Brake Caliper Mounting Bracket
M—Right Axle Housing
N—Shift Shaft
O—Left Axle Housing
P—Brake Disk
Q—Input Shaft
R—Neutral Switch

[1]*Components A—J are for MFWD machines only*

MX52301,0000070 -19-22OCT14-1/1

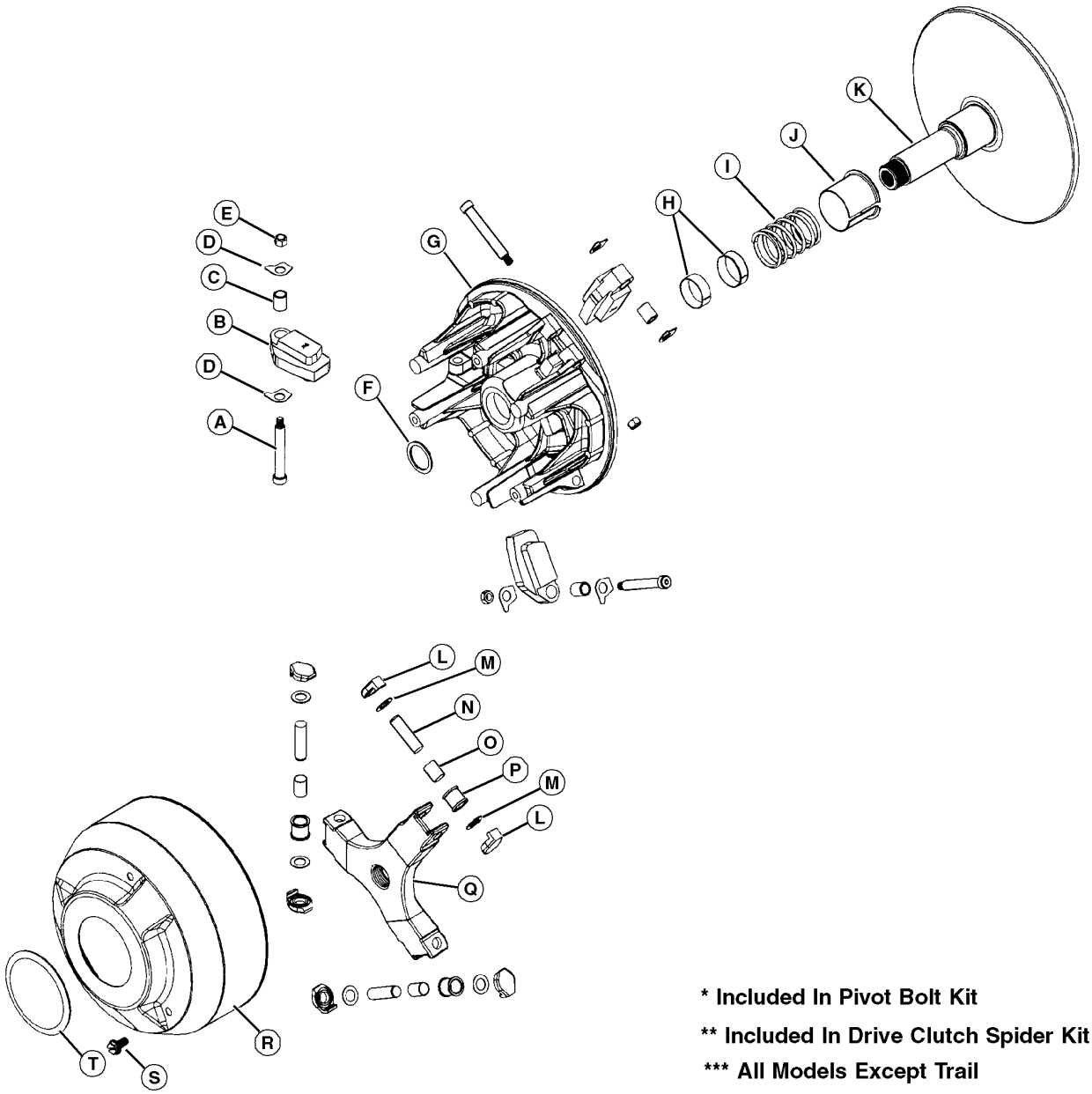
Transaxle Control Components



A—Gear Shift Handle
B—Differential Lock Handle
C—Differential Lock Arm
D—Gear Shift Arm
E—Driven Clutch
F—Drive Clutch
G—Drive Clutch Cover
H—Clutch Cover Plug
I— Drive Belt

MX52301,0000071 -19-05JUN14-1/1

Drive Clutch Components



*** Included In Pivot Bolt Kit**

**** Included In Drive Clutch Spider Kit**

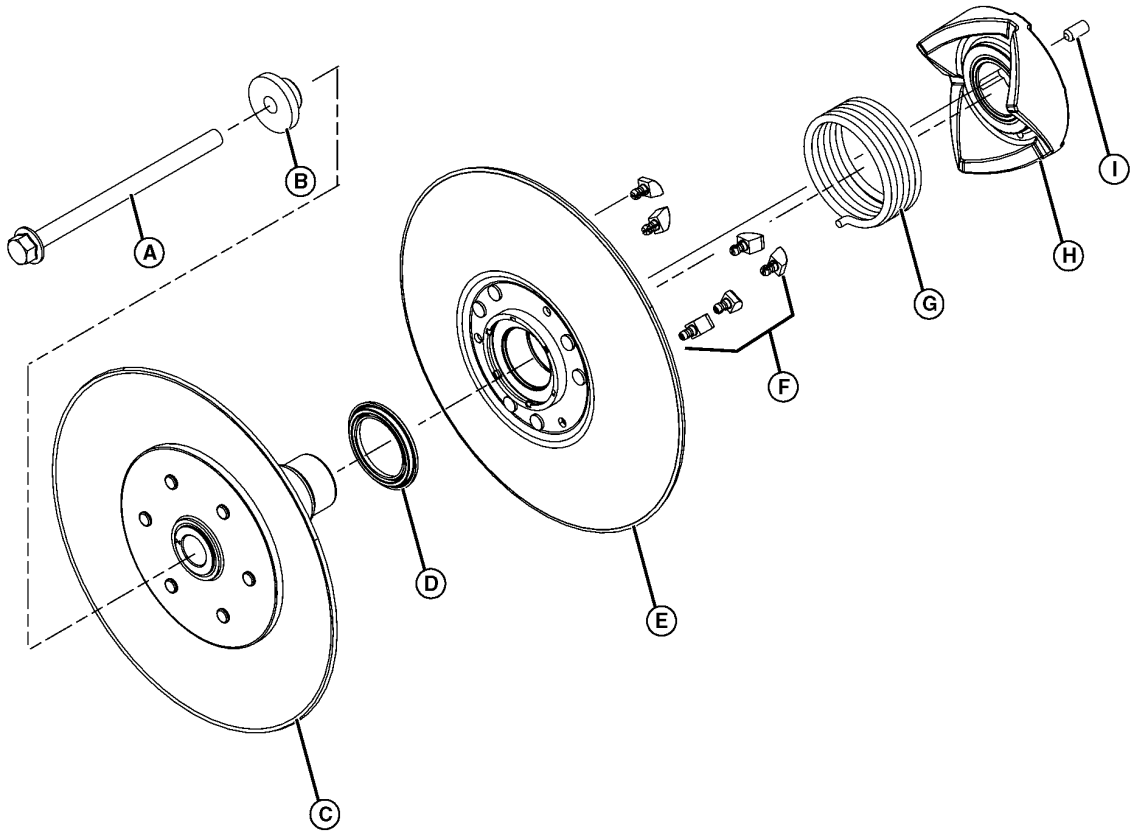
***** All Models Except Trail**

MXT011209 —UN—20MAY14

A—Pivot Bolt*
B—Cam Arm
C—Bushing
D—Special Washer*
E—Lock Nut*
F—Washer
G—Half Sheave
H—Bushings
I— Spring
J— Bushing
K—Half Sheave (Fixed)
L—Button**
M—Thrust Washer**
N—Pin**
O—Bushing**
P—Roller**
Q—Spider***
R—Cover***
S—Screw***
T—Plug***

MX52301,0000072 -19-05JUN14-1/1

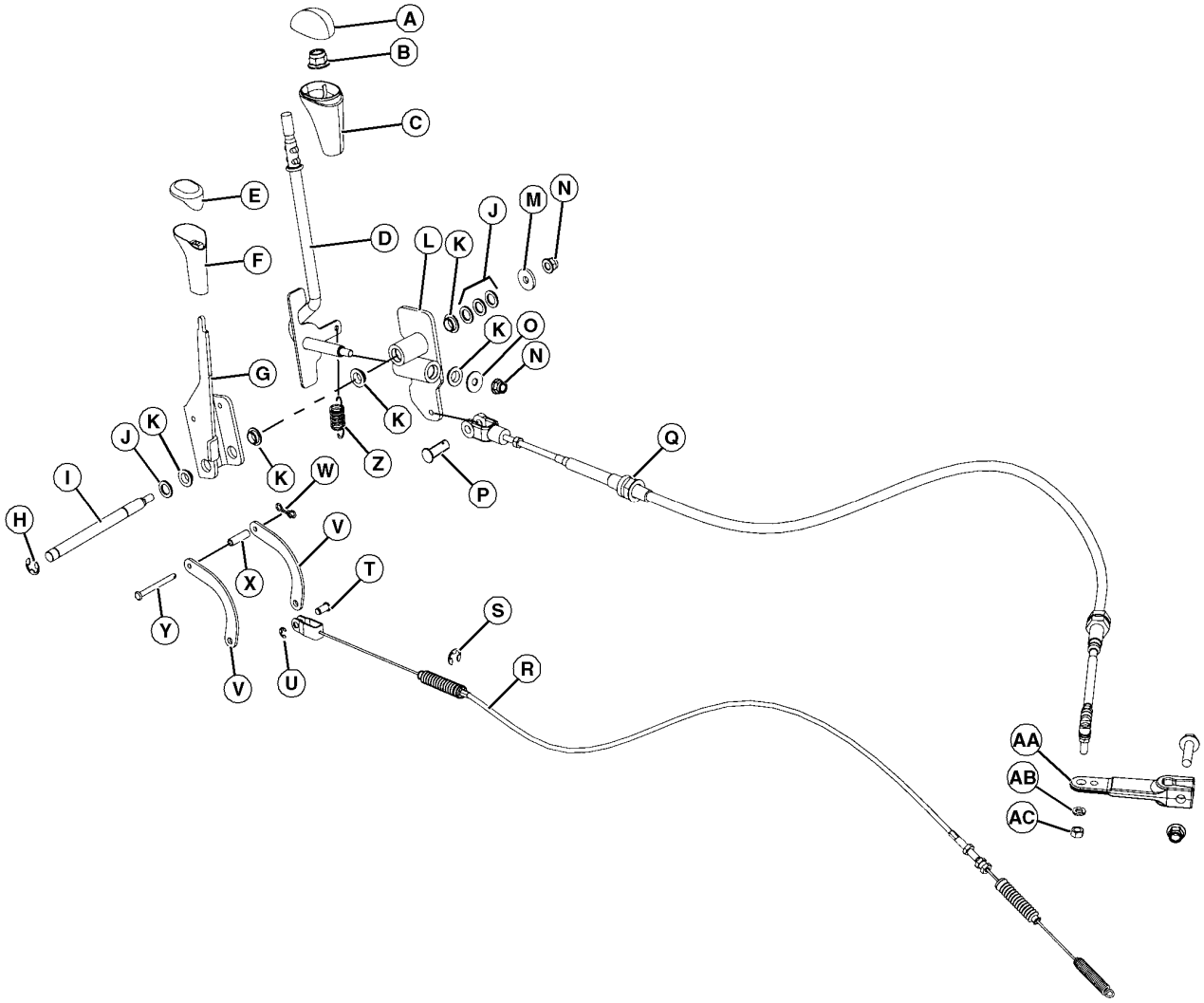
Driven Clutch



A—Screw
B—Bushing and Washer
C—Clutch Plate, Stationary
D—Wiper Seal
E—Clutch Plate, Moveable
F—Set Screw
G—Wear Buttons
H—Spring
I— Clutch Ramp

MX52301,0000073 -19-05JUN14-1/1

Shift Linkage Components (SN -090000)

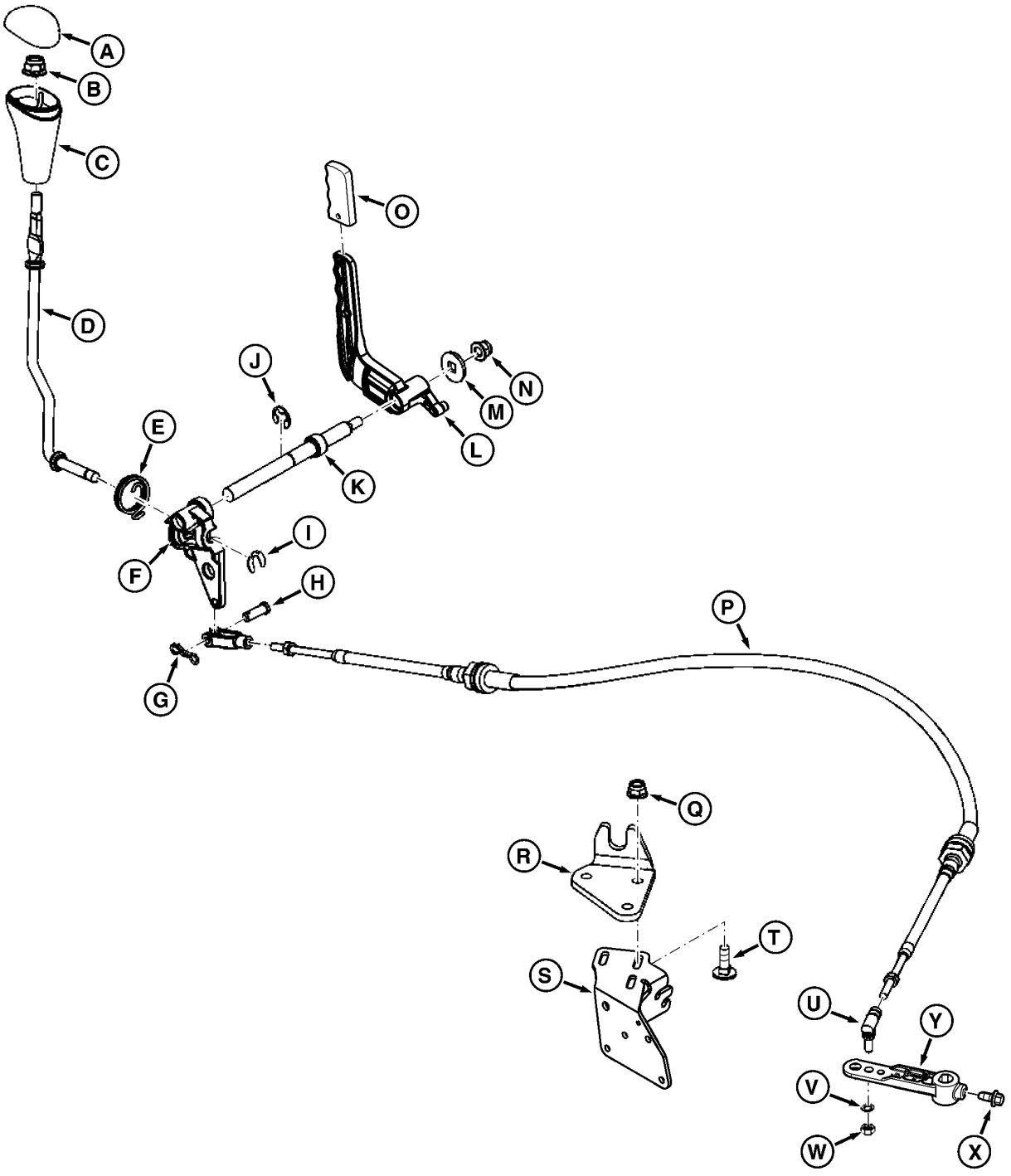


A—Cap
B—Nut
C—Gear Shift Handle
D—Gear Shift Arm
E—Cap
F—Differential Lock Handle
G—Differential Shift Arm
H—E—Clip
I— Shaft
J— Spacer
K—Busing
L—Shift Bracket
M—Washer
N—Nut
O—Washer
P—Pin[1]
Q—Gear Shift Cable Assembly
R—Differential Lock Cable Assembly
S—E—Clip
T—Pin
U—E—Clip
V—Differential Lock Linkage Arm
W—Clip
X—Spacer
Y—Drilled Pin
Z—Spring
AA—Transaxle Shift Arm
AB—Lock Washer
AC—Nut

[1]Pin secured by spring and (Z)

MX52301,0000074 -19-17OCT14-1/1

Shift Linkage Components (SN 090001-)



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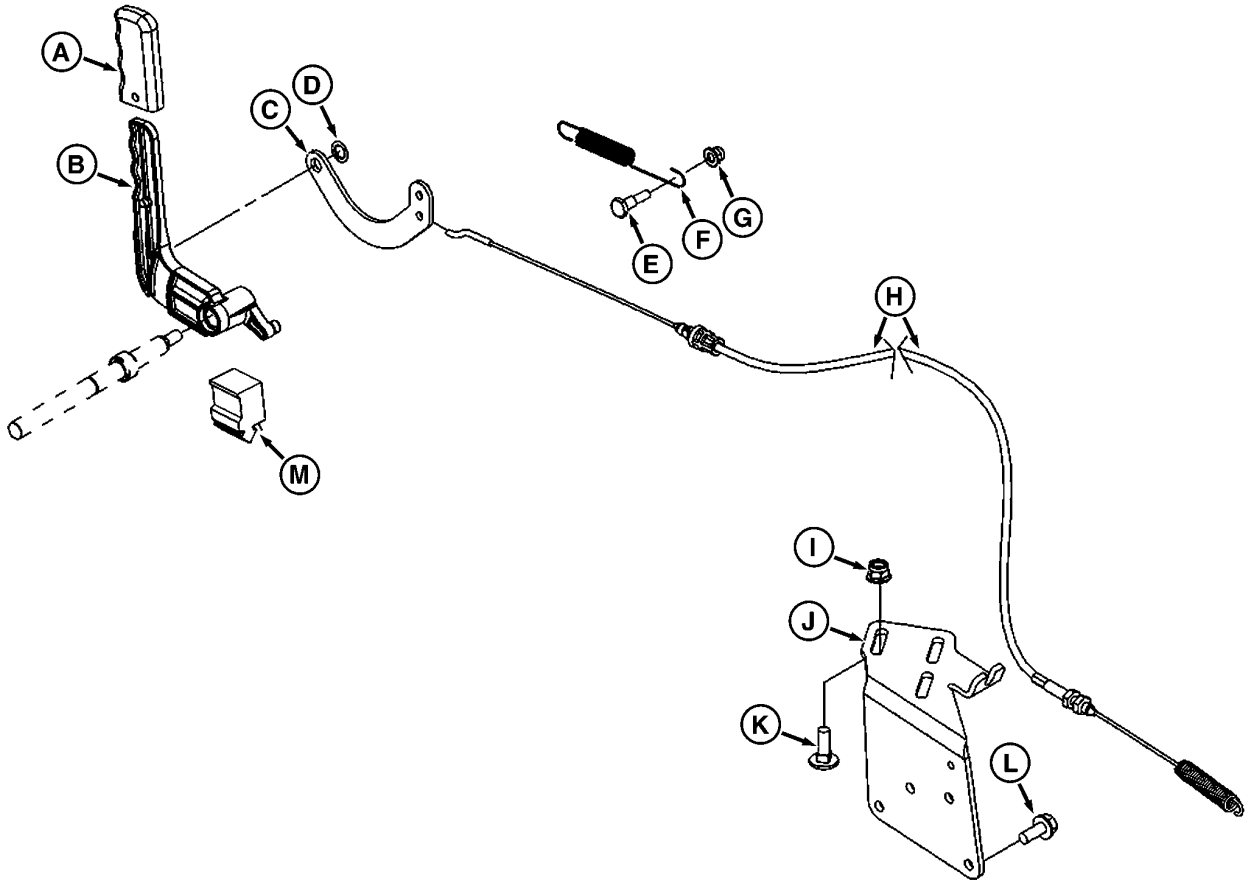
BS62576,00017F8 -19-17OCT14-1/2

A—Cap
B—Nut
C—Gear Shift Handle
D—Gear Shift Lever
E—Torsion Spring
F—Gear Shift Lever
G—Spring Pin
H—Pin
I— E-Ring
J— E-Ring
K—Shaft
L—Control Lever
M—Washer
N—Nut
O—Grip
P—Push Pull Cable
Q—Lock Nut
R—Bracket
S—Bracket
T—Bolt
U—Ball Joint
V—Lock Washer
W—Nut
X—Screw
Y—Lever

BS62576,00017F8 -19-17OCT14-2/2

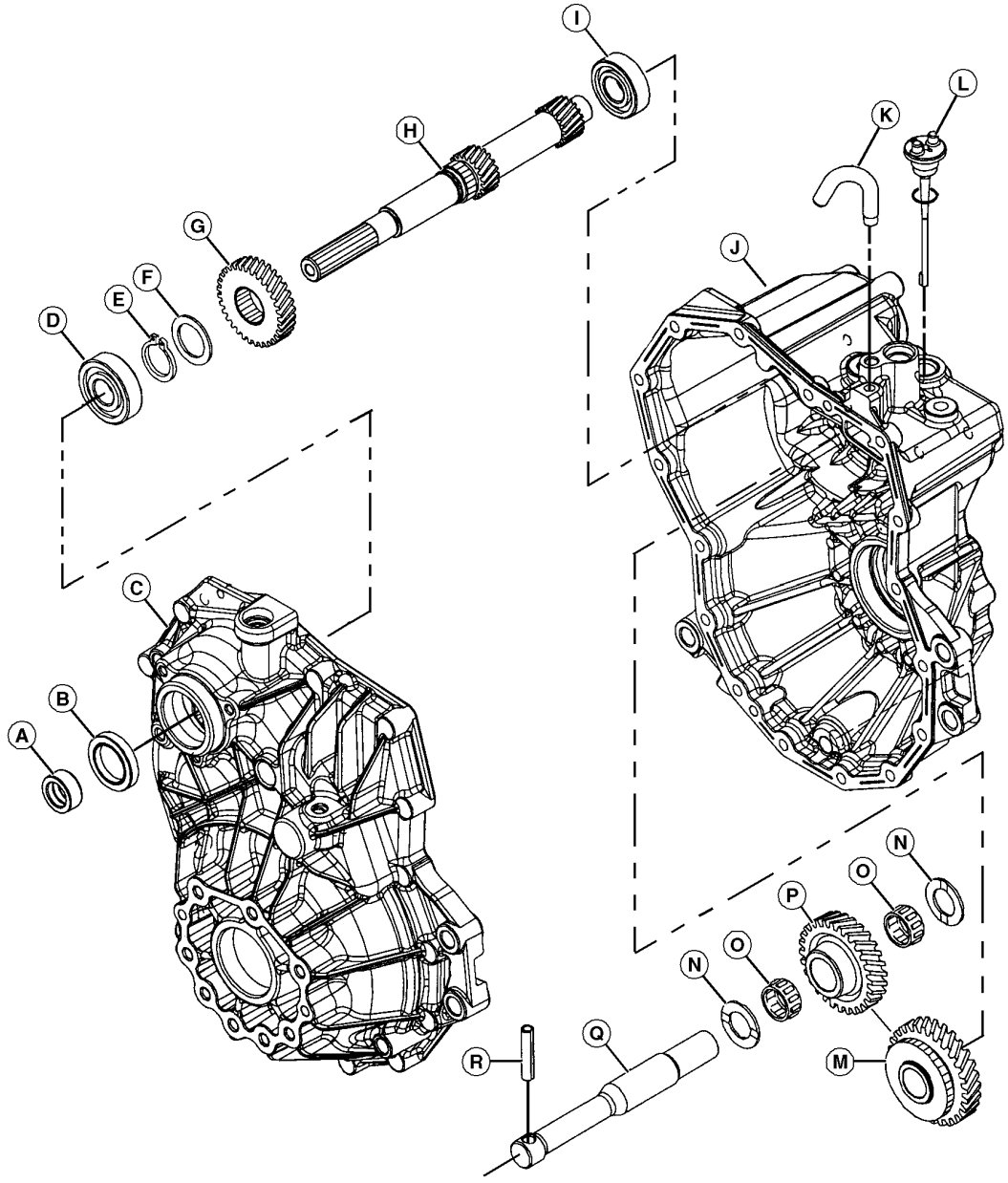
Differential Lock Linkage Components



A—Grip
B—Control Lever
C—Linkage
D—Retainer
E—Bolt
F—Spring
G—Lock Nut
H—Cable
I— Lock Nut
J—Bracket
K—Bolt
L—Screw
M—Bumper

BS62576,00017F9 -19-17OCT14-1/1

Transaxle Input Components



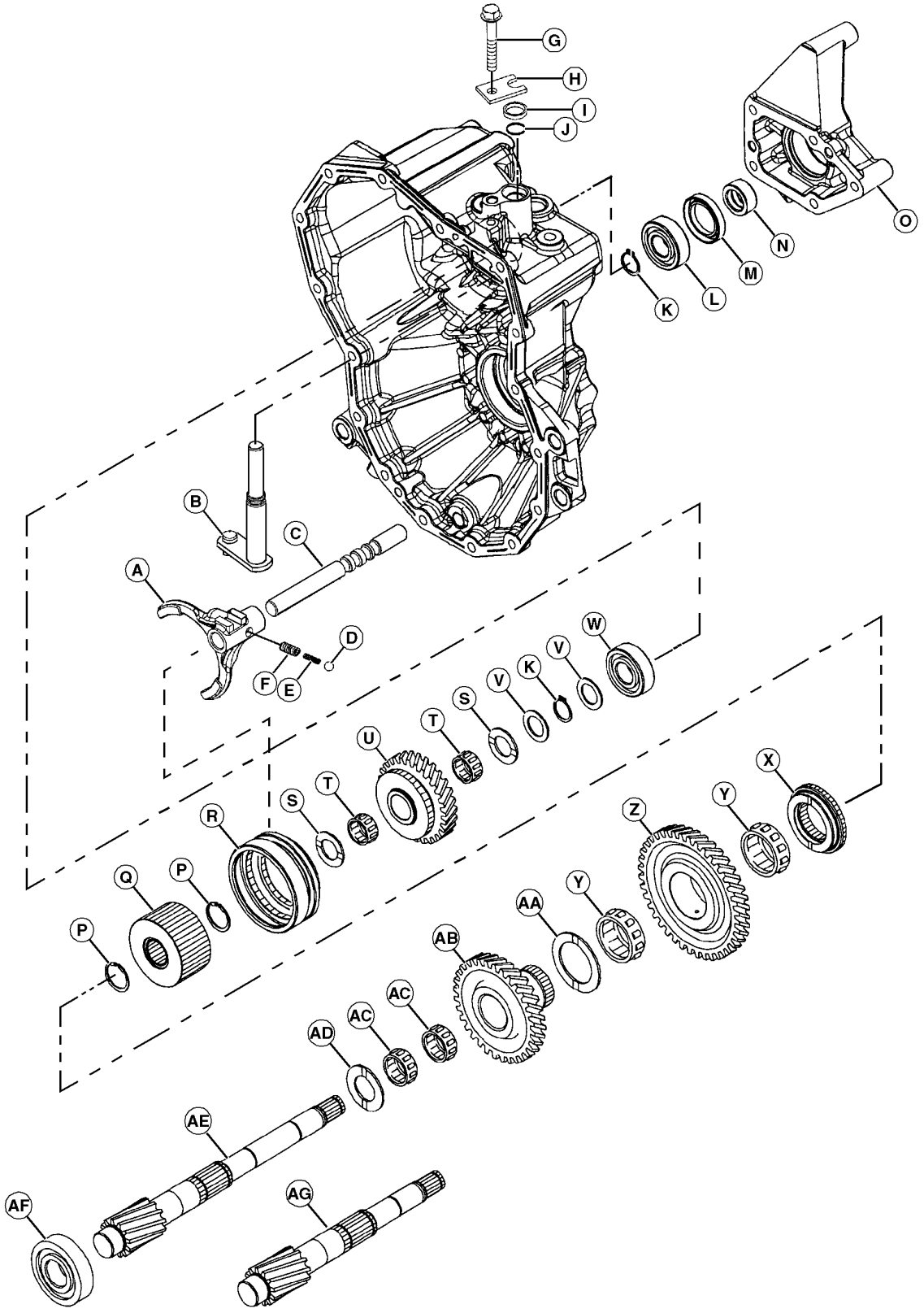
MXT011211 —UN—04JUN14

A—Sleeve
B—Seal
C—Transaxle Housing Cover
D—Bearing
E—Snap Ring
F—Washer
G—Input Gear
H—Input Shaft
I— Bearing
J— Transaxle Housing
K—Breather
L— Dipstick
M—Reverse Reduction Gear[1]
N—Washer
O—Needle Bearing
P—Reverse Idler Gear
Q—Reverse Idler Shaft
R—Spring Pin

[1]*Part U on next page*

MX52301,0000075 -19-05JUN14-1/1

Transaxle Gear Components



Continued on next page

MX52301,0000076 -19-05JUN14-1/2

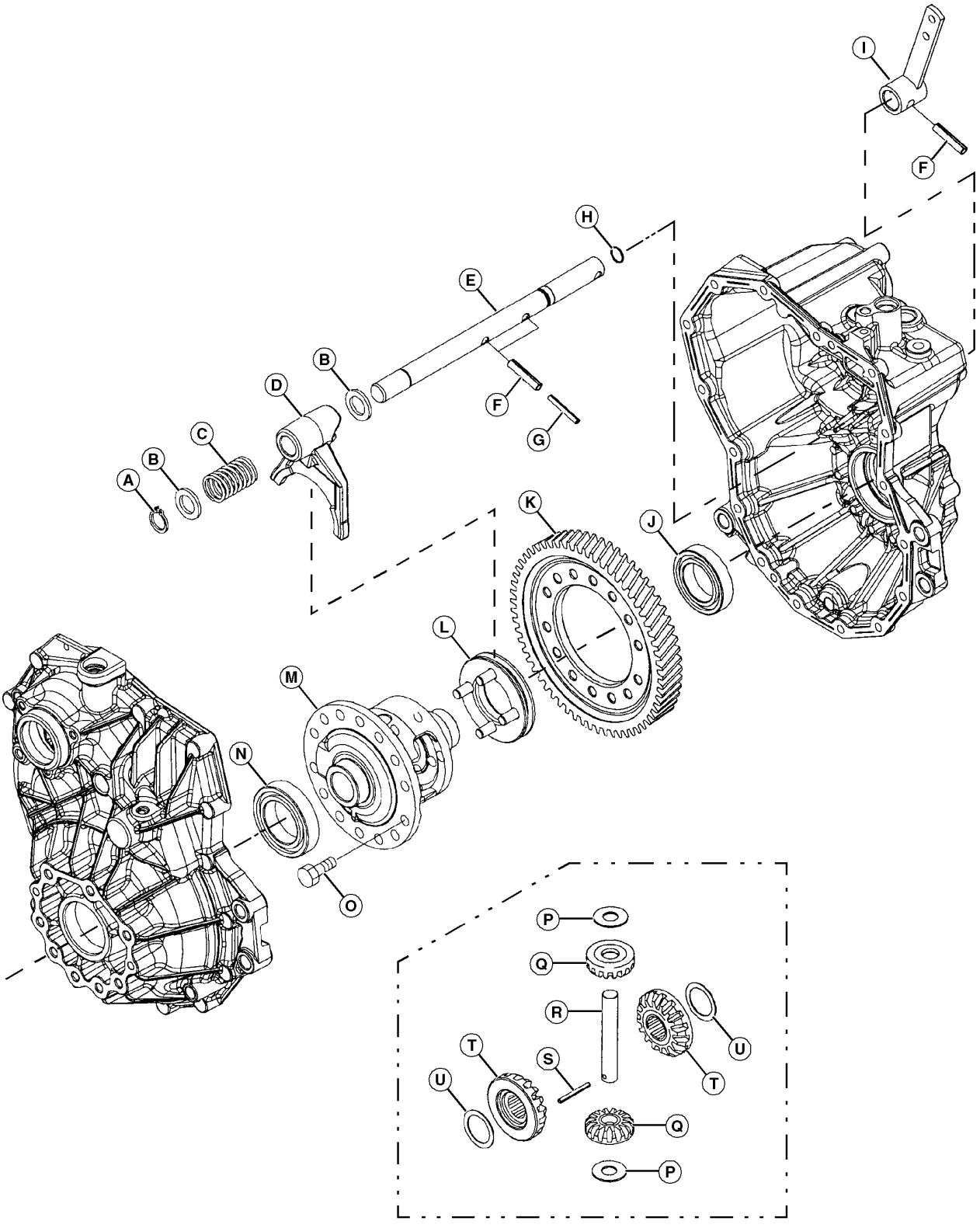
Component Location

A—Shift Fork
B—Shift Arm
C—Shift Shaft
D—Ball
E—Spring, Inner
F—Spring
G—Bolt
H—Keeper Plate
I— Collar
J— Packing
K—Snap Ring
L—Bearing
M—Seal
N—Sleeve
O—Front Drive Cover (2WD Machines)*
P—Snap Ring
Q—Spline Collar
R—Shifter
S—Washer
T—Needle Bearing
U—Reverse Reduction Gear
V—Washer
W—Bearing
X—Reduction Collar (High)
Y—Needle Bearing
Z—Reduction Gear (Low)
AA—Washer
AB—Reduction Gear (High)
AC—Needle Bearing
AD—Washer
AE—Reduction Shaft (2WD)
AF—Bearing
AG—Reduction Shaft (MFWD)

* SEE “MFWD Rear Gear Case Components” for MFWD machines.

MX52301,0000076 -19-05JUN14-2/2

Differential Components



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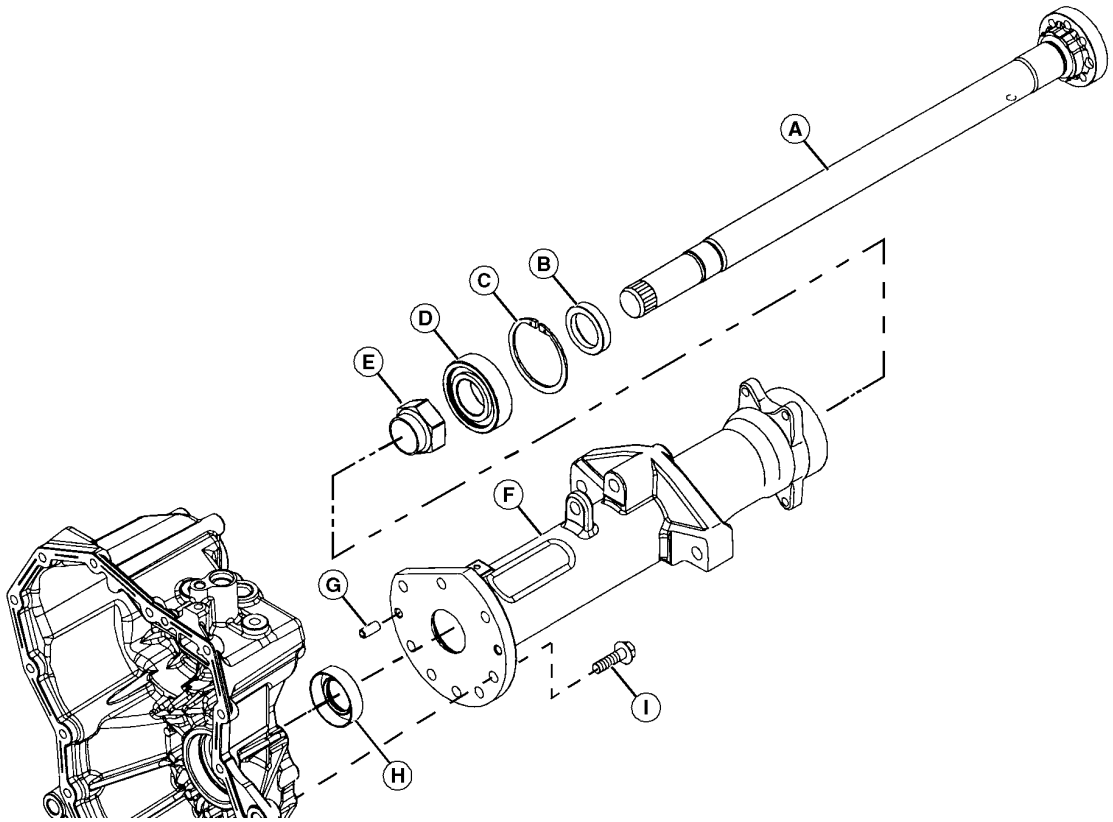
MX52301,0000077 -19-05JUN14-1/2

A—Snap Ring
B—Spacer
C—Spring
D—Differential Lock Shift Fork
E—Differential Lock Shaft
F—Spring Pin (Outer)
G—Spring Pin (Inner)
H—Packing
I— Differential Lock Arm
J— Bearing
K—Ring Gear
L—Differential Lock Slider
M—Differential Case
N—Bearing
O—Bolt (14 used)
P—Washer, Differential Pinion[1]
Q—Differential Pinion Gear
R—Differential Pinion
S—Spring Pin
T—Differential Side Gear
U—Washer

[1]*Components P—U are inside the differential case*

MX52301,0000077 -19-05JUN14-2/2

Rear Axle Components



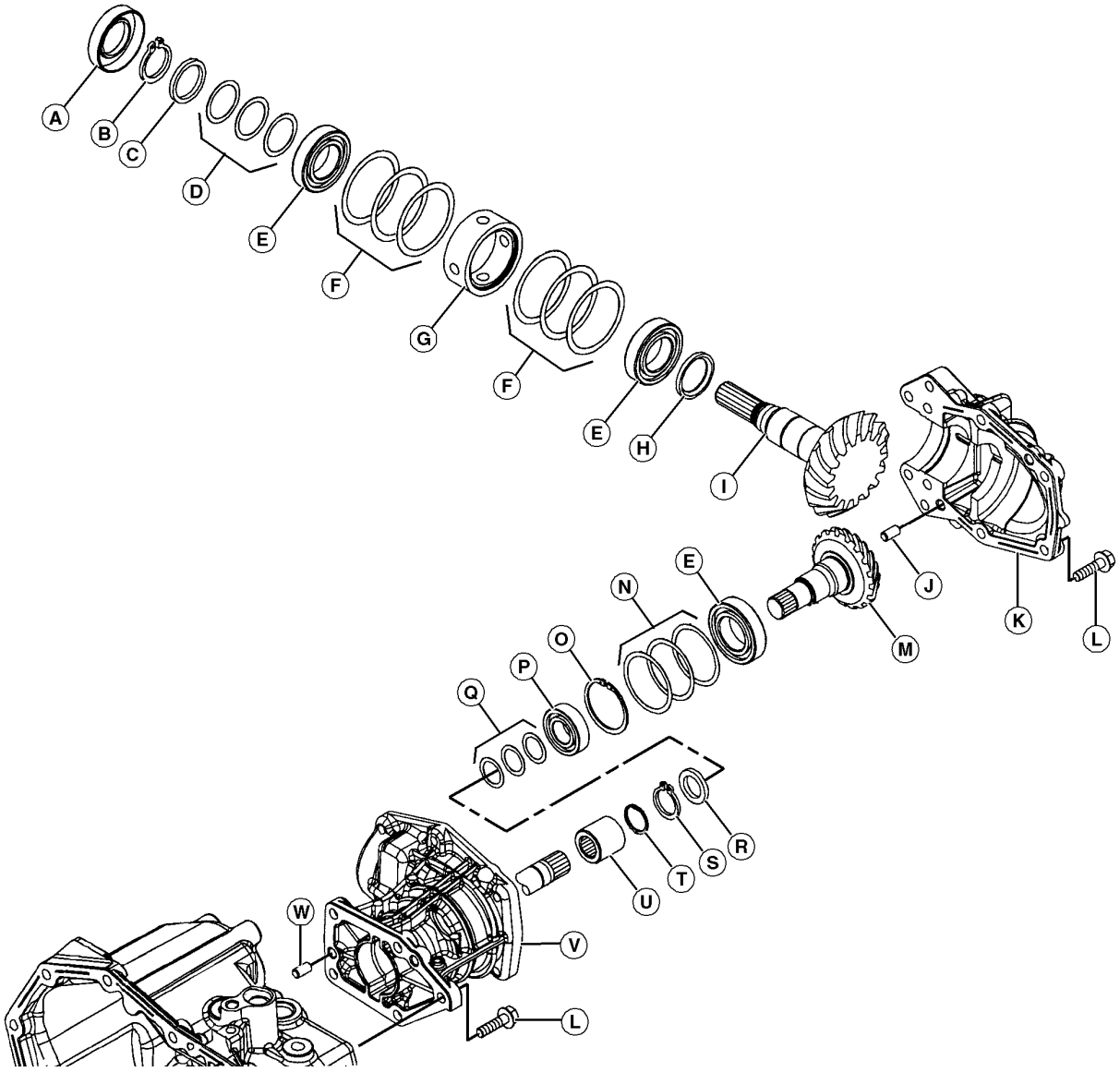
MXT011214 —UN—04JUN14

A—Axle Shaft[1]
B—Collar
C—Internal Snap Ring
D—Bearing
E—Lock Nut
F—Axle Housing
G—Pin (2 used on each axle housing)
H—Oil Seal
I— Bolt (8 used on each axle housing)

[1]*Axle components, including axle housing, are identical on each side of machine*

MX52301,0000078 -19-05JUN14-1/1

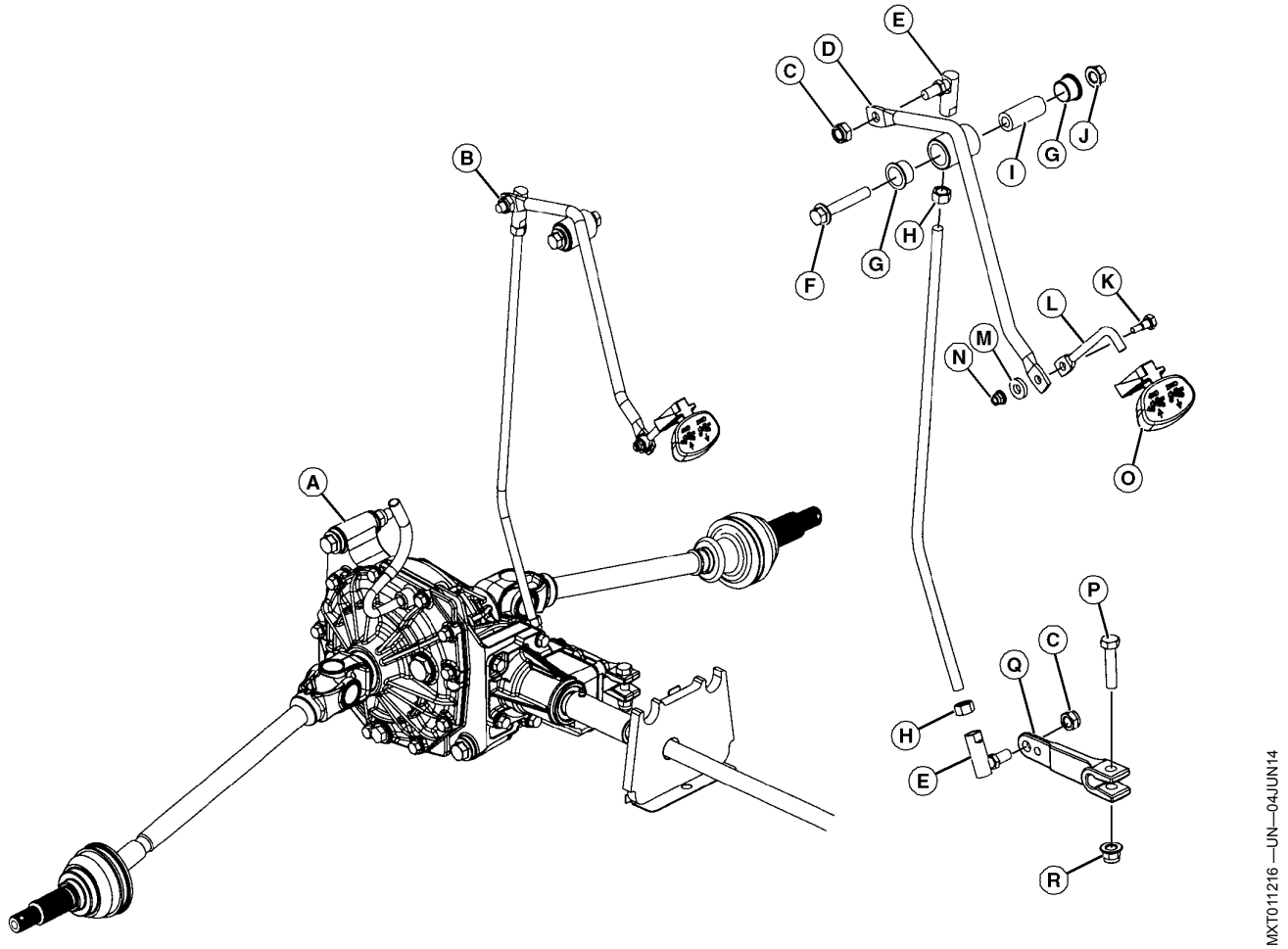
Front Drive Gear Box Components



A—Seal
B—Snap Ring
C—Collar
D—Shims, Assorted (Use as needed)
E—Bearing
F—Shims Assorted (Use as needed)
G—Collar
H—Collar
I— MFWD Front Drive Shaft
J— Pin (2 used)
K—Drive Case Cover
L—Bolt (11 used)
M—Front Drive Shaft
N—Shims, Assorted (Use as needed)
O—Snap Ring
P—Bearing
Q—Shims, Assorted (Use as needed)
R—Collar
S—Snap Ring
T—Ring
U—Coupler
V—MFWD Front Drive Case
W—Pin (2 used)

MX52301,0000079 -19-05JUN14-1/1

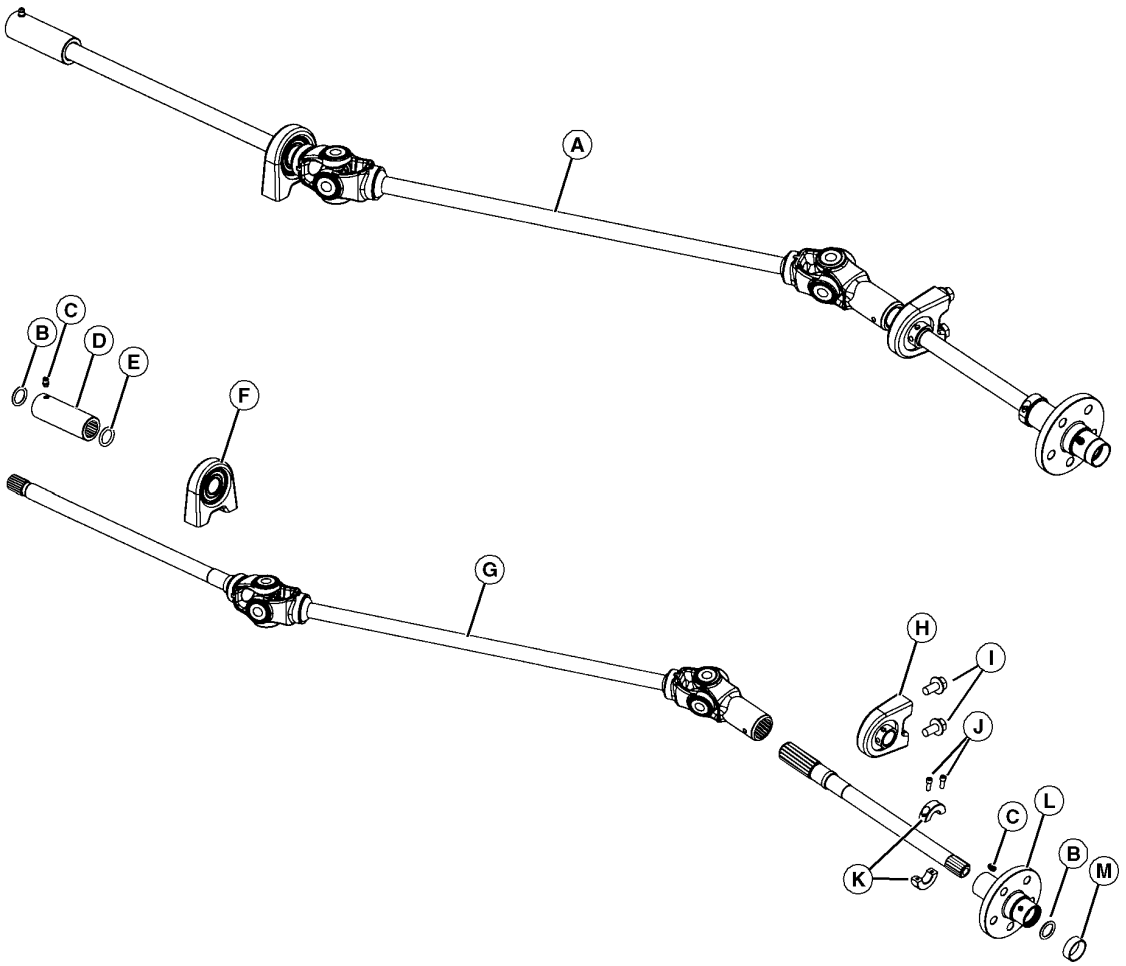
MFWD Shift Linkage Components



A—MFWD Front Axle Assembly
B—MFWD Shift Assembly
C—Nut
D—Shift Lever
E—Ball Joint
F—Bolt
G—Bushing
H—Nut
I— Spacer
J— Flange Nut
K—Shoulder Bolt
L—Bracket
M—Spacer
N—Nut
O—Handle
P—Bolt
Q—MFWD Shift Arm
R—Flange Nut

MX52301,000007A -19-05JUN14-1/1

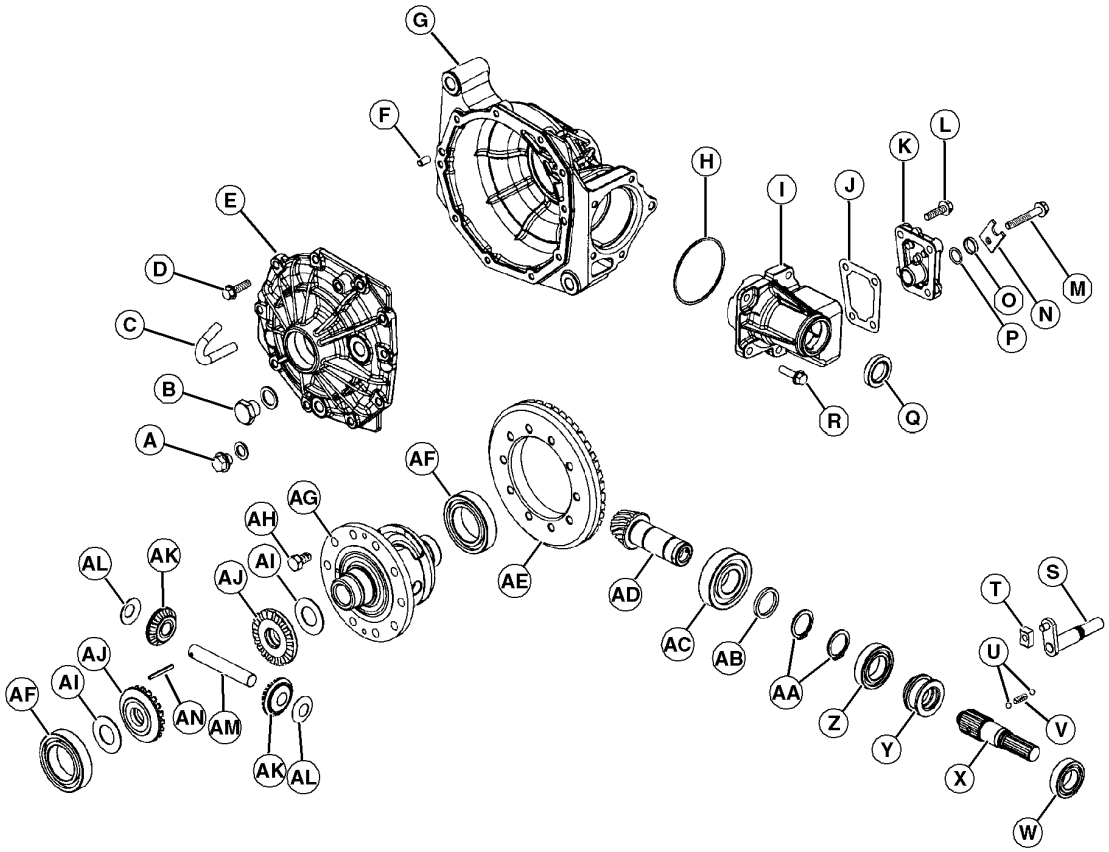
MFWD Driveline Components



A—Driveline Assembly
B—O-ring
C—Zerk
D—Splined Coupler (to front gear case input shaft)
E—O-ring
F—Cast Bearing
G—Drive Shaft
H—Cast Bearing
I— Bolts
J— Cap Screws
K—Clamp
L—Brake Disc
M—Spacer

MX52301,000007B -19-05JUN14-1/1

MFWD Front Differential Components



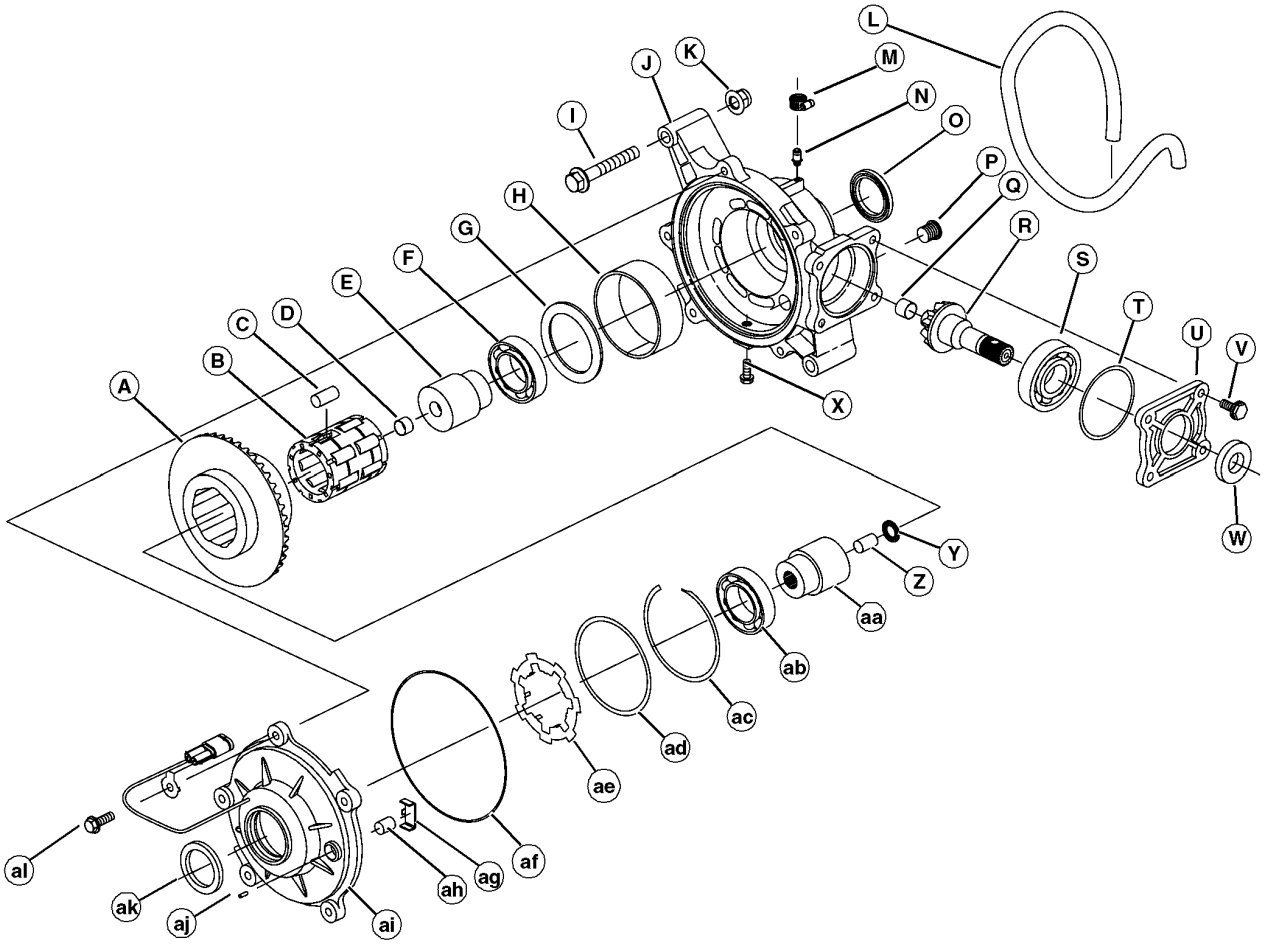
MXT011218 —UN—04JUN14

A—Bolt and Washer
B—Plug and Packing
C—Breather
D—Bolt (15 used)
E—Housing Cover
F—Pin (2 used)
G—Housing
H—Packing
I— Input Housing
J—Shift Cover Gasket
K—Shift cover
L—Bolt (3 used)
M—Bolt (1 used)
N—Keeper Plate
O—Collar
P—Packing
Q—Seal
R—Bolt (5 used)
S—Shift Shaft
T—Shift Block
U—Ball (2 used)
V—Spri9ng
W—Bearing
X—Input Shaft
Y—Shift Collar
Z—Bearing
AA—Snap Ring (2 used)
AB—Collar
AC—Bearing
AD—Pinion Shaft
AE—Ring Gear
AF—Bearing (2 used)
AG—Differential Case
AH—Bolt (10 used)
AI— Liner (side gear) (2 used)[1]
AJ—Differential Slide Gear (2 used)
AK—Differential Pinion Gear (2 used)
AL—Washer (2 used)
AM—Differential Pinion Shaft
AN—Spring Pin

[1]*Components AI—AN are inside the differential case.*

MX52301,000007C -19-05JUN14-1/1

EMFWD Front Differential Components



A—Ring Gear
B—Bolt Cage
C—Roller
D—Bushing
E—Race—Output Hub Female
F—Bearing
G—Shim
H—Bushing
I— Bolt
J— Gear Case
K—Nut
L—Vent Hose
M—Clamp
N—Hose Fitting
O—Seal
P—Fill Plug
Q—Bushing
R—Pinion Gear
S—Bearing
T—O-ring
U—Pinion Cover
V—Bolt
W—Oil Seal
X—Drain Plug
Y—Thrust Bearing
Z—Dowel Pin
AA—Race—Output Hub Male
AB—Bearing
AC—Retaining Ring
AD—Shim
AE—Armature Plate
AF—O-ring
AG—Thrust Bearing
AH—Thrust Button
AI— Cover with Coil
AJ—Set Screw
AK—Oil Seal
AL—Bolt

MX52301,000007D -19-05JUN14-1/1

Summary of References

- Power Transfer Operation
- Drive Clutch Operation
- Clutch Operation
- EMFWD Operation

MX52301,000046F -19-04JUN14-1/1

Power Transfer Operation

Drive Clutch:

The primary clutch is mounted on the engine crankshaft and is engine speed sensitive. It operates on the principle of centrifugal force. See “Drive Clutch Operation.”

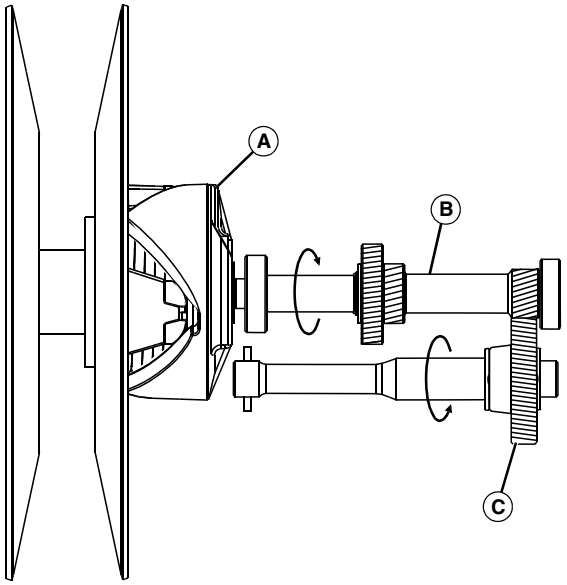
Driven Clutch:

The secondary clutch, mounted on the transaxle input shaft, is load sensitive to the rear drive wheels. The drive belt powers the secondary clutch.

Transaxle:

The transaxle is a gear drive, fork shift, 2-speed forward and single speed reverse transmission.

The driven clutch (A) is splined to the input shaft (B). The reverse idler shaft gear C) is in constant engagement to the input shaft.



LVAL21920 —UN—11APR12

A—Driven Clutch
B—Input Shaft
C—Reverse Idler Shaft Gear

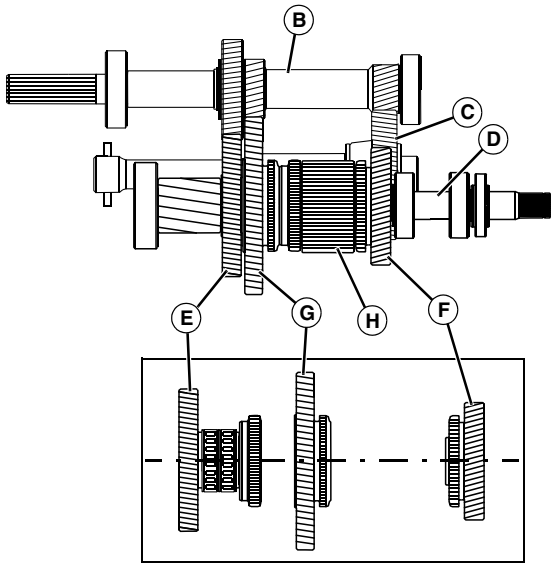
MX52301,000007E -19-04JUN14-1/7

The input shaft is also in constant engagement to the low speed and high-speed gears on the reduction shaft (D).

The high-speed gears (E) and reverse gear (F) spin freely on the reduction shaft. The low speed gear (G) spins freely on the high-speed gear (E) hub and bearings.

The reverse gear (F) is in constant engagement to the reverse idler shaft gear (C). The low speed and high-speed gears are in constant engagement with the input shaft (B) gears.

A collar gear (H) is splined to the reduction shaft. Input shaft rotation is transferred to the reduction shaft through the splined gear (H) when forward or reverse is selected.



LVAL21921 —UN—11APR12

B—Input Shaft
C—Reverse Idler Shaft Gear
D—Reduction Shaft
E—High-Speed Gear
F—Reverse Gear
G—Low Speed Gear

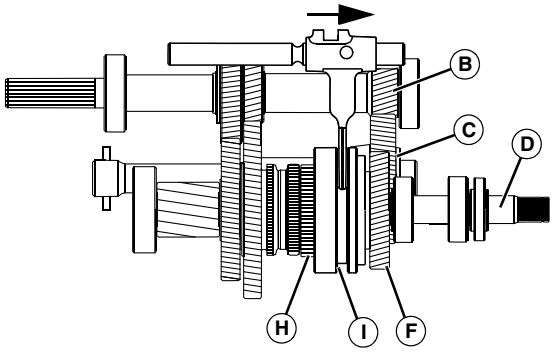
Continued on next page

MX52301,000007E -19-04JUN14-2/7

A shift collar (I) is shifted from side-to-side to select gears. In the neutral position the shift collar (I) is centered on the collar gear (H).

Reverse: In reverse the inside set of splines of the shift collar (I) engage the collar gear (H) to the reverse gear (F). Power is transferred from the input shaft (B) through the reverse idler gear (C), reverse gear (F), shift collar (I) and collar gear (H) to the reduction shaft (D).

B—Input Shaft
C—Reverse Idler Shaft Gear
D—Reduction Shaft
F—Reverse Gear
H—Collar Gear
I— Shift Collar



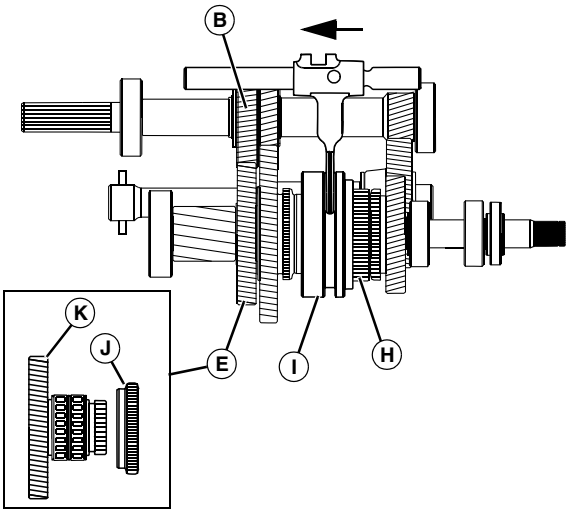
LVAL21922 —UN—11APR12

Shown in Reverse

MX52301,000007E -19-04JUN14-3/7

High Forward: In high forward the inside set of splines of the shift collar (I) engage the collar gear (H) to the forward high gear assembly (E). The shift collar engages the gear collar (J) which is splined to the gear (K). The gear is a set of gears (J and K) that separate to allow the removal and installation of the low speed gear and bearings to the hub of gear (K). Power is transferred from the input shaft (B) through the high-speed gearset (E), shift collar (I), and collar gear (H) to the reduction shaft.

B—Input Shaft
E—High-Speed Gear
H—Collar Gear
I— Shift Collar
J— Gear Collar
K—Gear



LVAL21923 —UN—11APR12

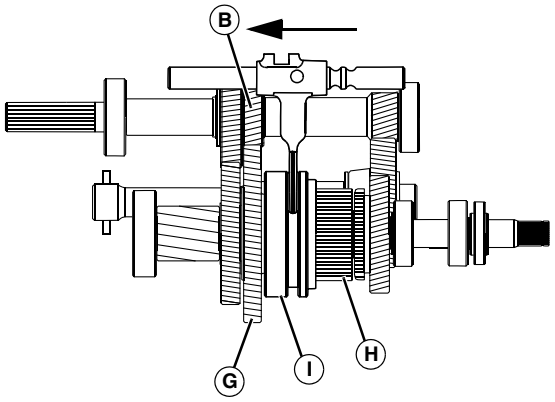
Shown in High Forward

MX52301,000007E -19-04JUN14-4/7

Low Forward: In low forward the inside set of splines of the shift collar (I) engage the collar gear (H) to the forward low gear (G). Power is transferred from the input shaft (B) through the low speed gear (G), shift collar (I), and collar gear (H) to the reduction shaft.

The higher gear ratio produces a lower speed rotation of the reduction shaft.

B—Input Shaft
G—Low Speed Gear
H—Collar Gear
I— Shift Collar



LVAL21924 —UN—11APR12

Shown in Low Forward

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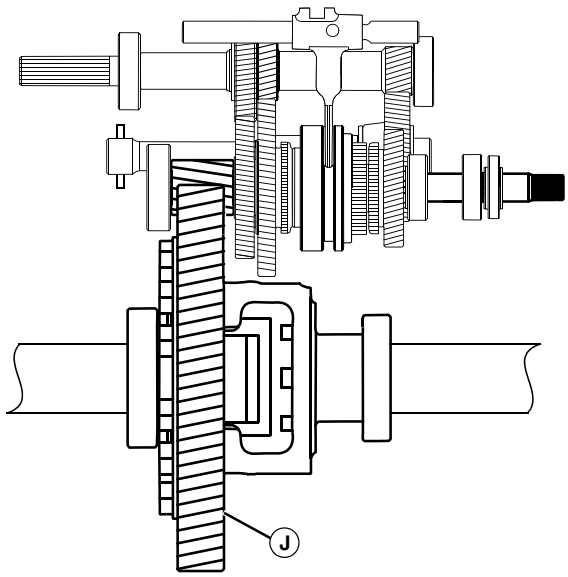
MX52301,000007E -19-04JUN14-5/7

The reduction shaft gears transfer power to the differential ring gear (J) and then to the axles.

J— Differential Ring Gear



LVAL21925 —UN—11APR12

MX52301,000007E -19-04JUN14-6/7

Differential Lock:

The rear wheels are locked together by a fork shift differential. The differential is engaged with the operator station shift lever, or when the park brake lever is set. The differential is locked in the first 12 degrees of park brake lever movement, before the park brake is set.

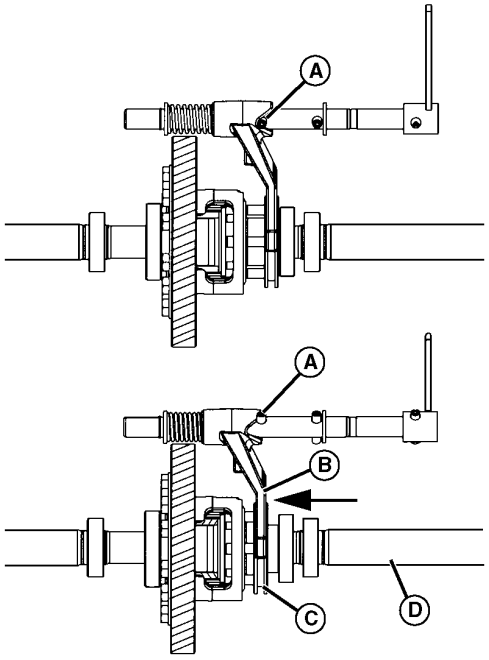
As the differential shaft is rotated forward a spring pin (A) moves the shift fork (B) to the left. The left movement engages the differential lock slider (C) to the differential and locks the right axle (D) to the differential gears and left axle.

Mechanical Four-Wheel Drive (MFWD):

The transaxle reduction shaft is coupled to a direct drive right angle gear case bolted to the side of the transaxle for MFWD output.

A drive shaft connects the right angle gear case output shaft to an input shaft of the front axle MFWD gear case. The drive shaft turns any time forward or reverse gears are selected.

A shift fork in the gear case engages the input shaft to a pinion shaft and ring gear of the front axle differential. The differential transfers power to the front wheels. There is no differential lock for the front axle.



LVAL21926 —UN—11APR12

A—Spring Pin
B—Shift Fork
C—Differential Lock Slider
D—Right Axle

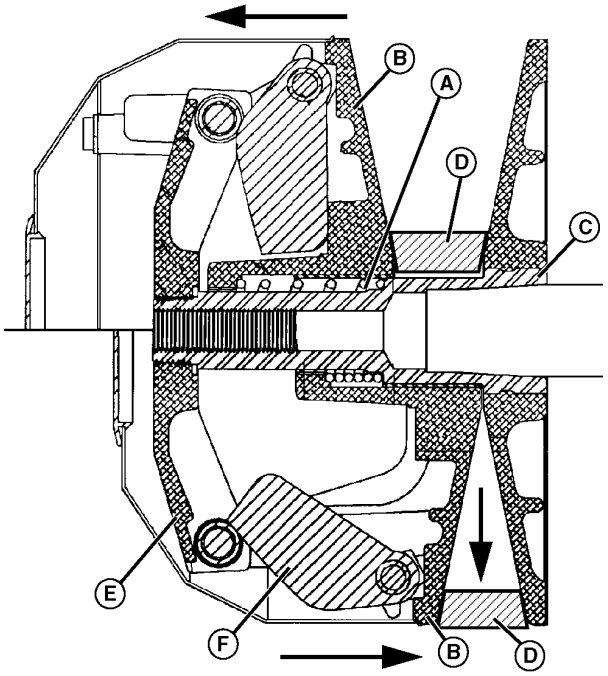
MX52301,000007E -19-04JUN14-7/7

Drive Clutch Operation

The drive clutch sheave opens and closes based on the actions of two opposing forces. At rest, with no rotation, the compression spring (A) pushes the movable half of the sheave (B) away from the hub (C) on the crankshaft. The drive belt (D) rides low in the separated sheave halves.

As the engine rpm increases, the centrifugal force rotates the weights (F) out. The weights ride on rollers attached to the spider (E) which is fixed to the hub (C). This action forces the movable half of the sheave (B) toward the fixed half. This movement compresses the spring (A) and forces the drive belt (D) toward the outside of the sheave.

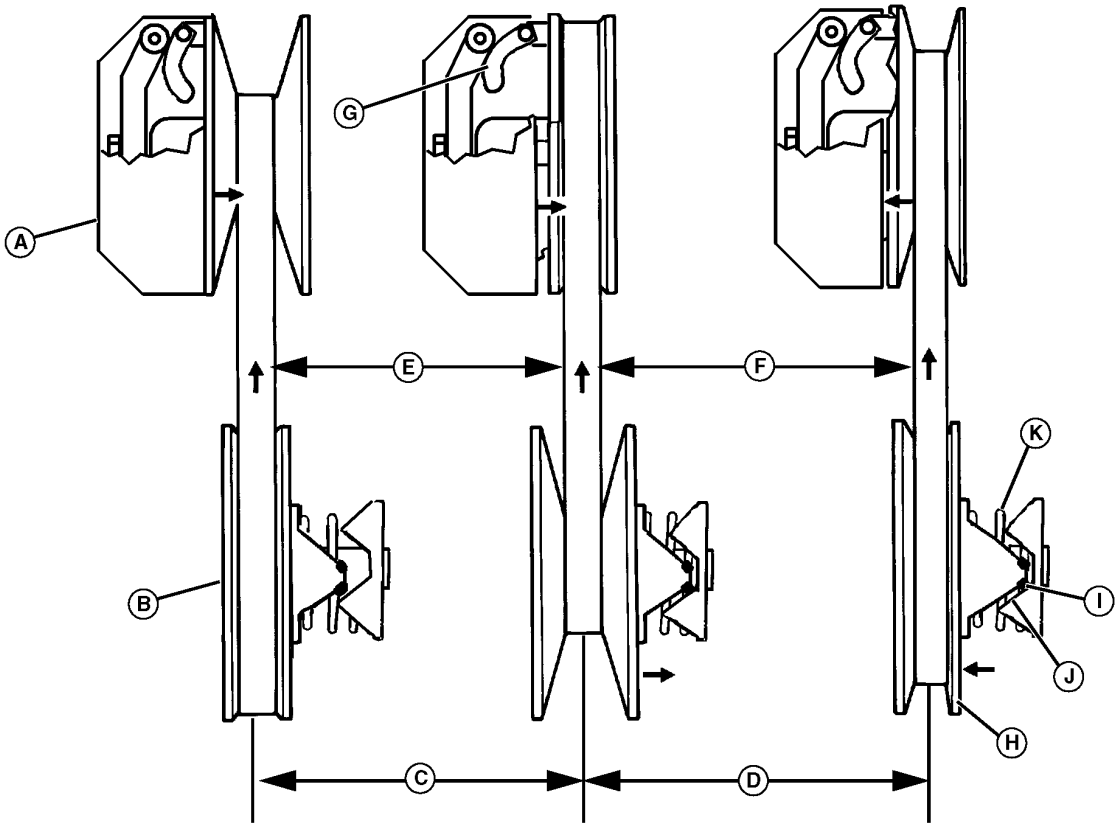
A—Compression Spring
B—Sheave
C—Hub
D—Drive Belt
E—Spider
F—Weights



Top—Low Engine rpm, Bottom—High Engine rpm

MX52301,000007F -19-22OCT14-1/1

Clutch Operation



LVAL21928 —UN—11APR12

A—Primary Clutch
B—Secondary Clutch
C—Up–shifting
D—Back–Shifting
E—Low Output Speed
F—High Output Speed
G—Flyweights
H—Moveable Sheave
I— Ramp Button
J— Ramp
K—Spring

Theory of Operation:

The variable clutch system is speed and load sensitive. The primary (A) and secondary (B) clutches work together, automatically up-shifting (C), and back-shifting (D) as load and speed change. This shifting changes the ratio between the clutches, allowing the engine to operate at optimum efficiency, at the peak of its power curve.

The primary clutch is engine speed sensitive, and is mounted on the engine crankshaft. It operates on the principle of centrifugal force. The secondary clutch, mounted on the transaxle input shaft, is load sensitive to the rear drive wheels.

Engagement RPM, Minimum Load, Low Output Speed (E):

Primary clutch sheaves are moving closer together, just starting to move drive belt. Drive belt is running at the top of secondary clutch. A high ratio between the clutches exists, similar to a low gear, as long as there is a minimum load.

High Engine RPM, Light Load, High Output Speed (F):

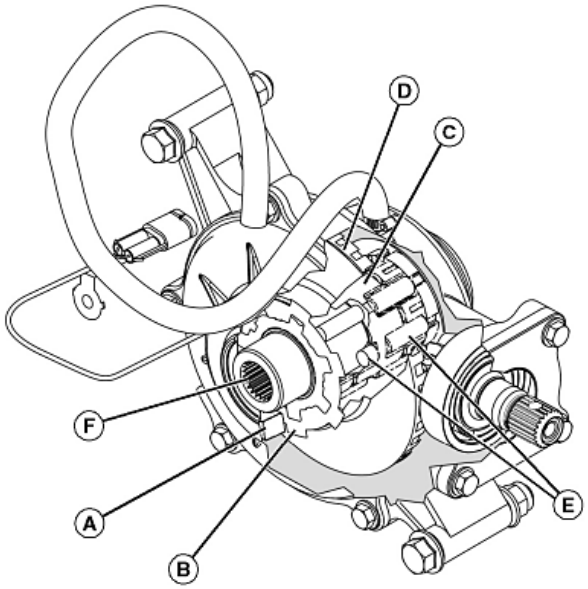
As engine speed increases, centrifugal force of the flyweights (G) force the primary clutch to up-shift, moving the drive belt to outer pulley diameter, overcoming secondary clutch spring. The drive belt is then pulled deep into the secondary clutch giving a low ratio, similar to a high gear.

High Engine RPM, Increasing Load, Lower Output Speed:

Back-shifting occurs as a load is encountered, such as a hill or soft terrain. The stationary side of the secondary clutch resists forward movement of the wheels, at the same time, torque from the drive belt moves the moveable sheave (H) up the ramp. The ramp buttons (I), ramp (J), and spring (K) force the belt to the outside diameter of the secondary clutch, and overcomes centrifugal forces of the primary clutch causing the back-shifting.

MX52301,0000080 -19-04JUN14-1/1

EMFWD Operation



MXT011220 —UN—04JUN14

A—Solenoid
B—Actuating Washer
C—Wave Washer
D—Inner Washer
E—Roller Brake Assembly
F—Roller Cage
G—Ring Gear Hub
H—Cylindrical Rollers

Function:

With the 4WD switch in the ON position the front differential engages and provide drive to the front wheels if the rear wheels slip. The 4WD switch does not lock and engage the front wheels for constant drive. The front differential is in an on-demand mode that transfers power to the front wheels if the rear wheels slip.

Proper operation and actuation of the front differential requires the front differential be driven from the transmission at a lower speed than the ground is turning the front tires. With the ground speed turning the front wheels slightly faster than the input from the transmission, the front differential does not engage the front wheels and the machine is driven by the rear wheels only. Then the front axle is being “underdriven.”

The front differential is designed to engage and only when the rear wheels slip and lose traction, and only when the 4WD switch is in the ON position.

Operation:

With the 4WD switch in the ON position and the transmission in either forward or reverse, voltage is supplied to a solenoid (A) in the differential case. The voltage is stopped when the machine is shifted into neutral. When the electromagnet is energized a drag is imposed on the armature plate (B), and through direct contact with the plate, to the roller cage (C).

The roller cage lies inside the ring gear (D). Each side of the roller cage contains cylindrical rollers (E) that roll around the output hub (F)to each axle.

The drag imposed on the roller cage from the electromagnet forces the rollers slightly off center in the openings of the roller cage. When the rear tires slip and spin more than 15% faster than the front tires, the rollers move against ramps in the rotating ring gear and are forced inward. The inward movement presses the rollers against the left and right output hubs. All components begin rotating together and relative motion begins between the armature plate and the electromagnet.

The drag imposed on the armature plate by the electromagnet keeps the roll cage positioned such that at the point where the rear wheels slip and spin more than 15% faster than the front tires, and the transmission speed increases, the ring gear speeds up to rotate at the same speed as the output hubs, and the clutch mechanism begins to transmit torque. Even though the rollers are in position to transmit torque, until the rotation speeds become the same, the front wheels and output hubs are rotating slightly faster than the ring gear, and the clutch freewheels (overruns) .

When the machine stops and the transmission is shifted from forward to reverse, the voltage to the electromagnet is momentarily stopped (neutral switch opened). The de-energized electromagnet allows the springs on each roller to rotate the roll cage and rollers into a neutral position.

As the machine moves in reverse, the roll cage is momentarily slowed by the electromagnet. As the ring gear and output hubs begin to rotate in a reverse direction, the rollers are again forced in to contact the output hubs.

Continued on next page

MX52301,0000081 -19-04JUN14-1/2

All components begin rotating together and relative motion occurs between the electromagnet and armature plate.

The clutch mechanisms overrun in the reverse direction until the ground speed slows due to rear wheel slip.

MX52301,0000081 -19-04JUN14-2/2

Diagnostic Check Points:

Diagnostics:

MX52301,0000082 -19-05JUN14-1/15

❶ Drive Train:

MX52301,0000082 -19-05JUN14-2/15

Drive Belt:	**Test Conditions:** • Engine Off • Rear wheels supported off floor. • Air pressure equal in driving tires. Driving tires close to same radius. Drive belt is in good condition?	 **YES:** Go to next step. **NO:** Replace drive belt.

MX52301,0000082 -19-05JUN14-3/15

Shift Linkage:	Shift linkage shifts into forward high and low, neutral, and reverse and stays in gear during operation?	**YES:** Go to next step. **NO:** Adjust shift linkage. See Transaxle Shift Adjustments.

MX52301,0000082 -19-05JUN14-4/15

Axles:	Axles rotate smoothly and quietly; no free play in axles, bearings, or housings?	**YES:** Go to next step. **NO:** Check axles and housings.

MX52301,0000082 -19-05JUN14-5/15

Brakes:	Brakes not dragging?	**YES:** Go to next step. **NO:** Adjust or repair brakes. See Brakes section.

MX52301,0000082 -19-05JUN14-6/15

Differential:	Differential lock engages and disengages?	**YES:** Go to next step. **NO:** Adjust differential lock. See Differential Lock Adjustments.

MX52301,0000082 -19-05JUN14-7/15

Differential:	Differential lock produces no ratcheting sound in transaxle?	**NO:** Check internal components.

MX52301,0000082 -19-05JUN14-8/15

❷ Engine primary Clutch:

Continued on next page

MX52301,0000082 -19-05JUN14-9/15

Clutch Engagement Static:	**Test Conditions:** • Engine running at operating temperature and brakes set. • Transmission in neutral position • Ensure that engine is at correct slow idle speed. See appropriate engine specifications. Primary clutch disengaged (drive belt not moving)?	**YES:** Go to next check. **NO:** Repair or replace primary clutch.

MX52301,0000082 -19-05JUN14-10/15

Clutch Engagement Variable:	**Test Conditions:** • Engine running at operating temperature and brakes set. • Transmission in neutral position. • Accelerate engine Primary clutch engages drive belt at 1350—1600 rpm?	**YES:** Go to next check. **NO:** Replace drive belt. Repair or replace primary clutch.

MX52301,0000082 -19-05JUN14-11/15

❸ Primary and Secondary Clutch:

MX52301,0000082 -19-05JUN14-12/15

Primary Clutch Sheave Movement	**Test Conditions:** • Engine running at operating temperature and brakes set. • Transmission in neutral position • Ensure that engine is at correct fast idle speed. Primary clutch sheave (movable clutch sheave) moves toward stationary sheave?	**YES:** Go to next step. **NO:** Repair or replace primary clutch.

MX52301,0000082 -19-05JUN14-13/15

Secondary Clutch Sheave	Secondary clutch sheaves separate?	**YES:** Go to next step. **NO:** Repair or replace secondary clutch.

MX52301,0000082 -19-05JUN14-14/15

Secondary Clutch Sheave Closure	Secondary clutch fully up-shifted, primary clutch sheaves close completely?	**YES:** Checks Complete **NO:** Repair or replace drive and secondary clutches.

MX52301,0000082 -19-05JUN14-15/15

Summary of References

- Transaxle Shift Adjustments
- Differential Lock Adjustments
- MFWD Linkage Adjustment
- EMFWD Ring and Pinion Backlash Adjustment
- Drive to Secondary (Driven) Clutch Adjustment
- Checking Drive Belt

MX52301,0000454 -19-27MAY14-1/1

Transaxle Shift Adjustments

Purpose:

To adjust shift lever to center of shift quadrant.

To insure both forward and reverse gears are fully engaged.

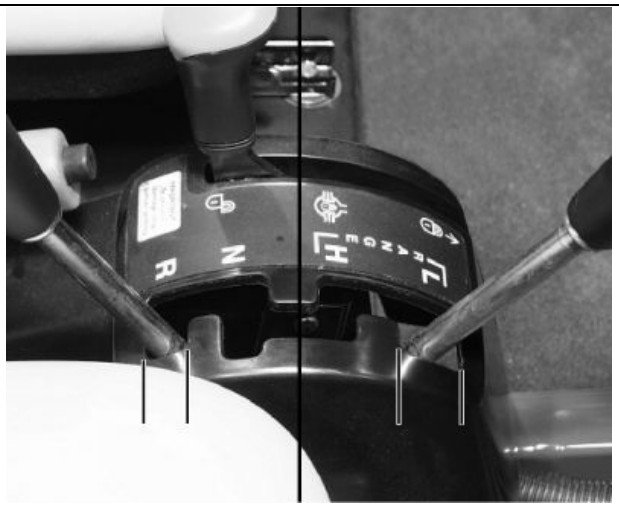
To help prevent shifter from disengaging from gear during operation.

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise and lock cargo box.

NOTE: It may be necessary to rock the machine to fully shift into Forward or Reverse.

4. Shift into forward and reverse. There should be an even gap between the lever and quadrant in both forward and reverse positions. The shift lever should NOT contact the shift quadrant in either forward or reverse.

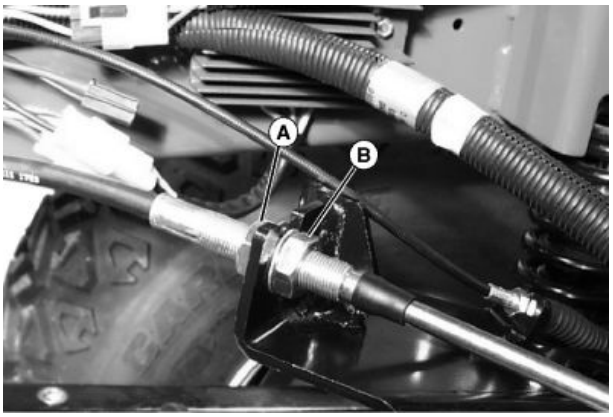


MXT011221 —UN—04JUN14

Picture Note: Split picture used to show shift lever centered in both Forward and Reverse positions.

MX52301,0000084 -19-22OCT14-1/3

5. If necessary, adjust cable to position shift lever in quadrant.
   - Place shift lever in the Neutral “N” position.
   - Verify that the transaxle clicks firmly into the center Neutral position.
   - To move shift lever forward in shift quadrant: Loosen nut (B) and tighten nut (A).
   - To move shift lever toward the rear in shift quadrant: Loosen nut (A) and tighten nut (B).
   - Adjust nuts until the shift lever is centered in the Neutral position of the shift quadrant opening. Make sure it does not touch the quadrant when placed fully in Reverse or Range L.
6. Move shift lever until detent inside transaxle clicks firmly into the center neutral position.



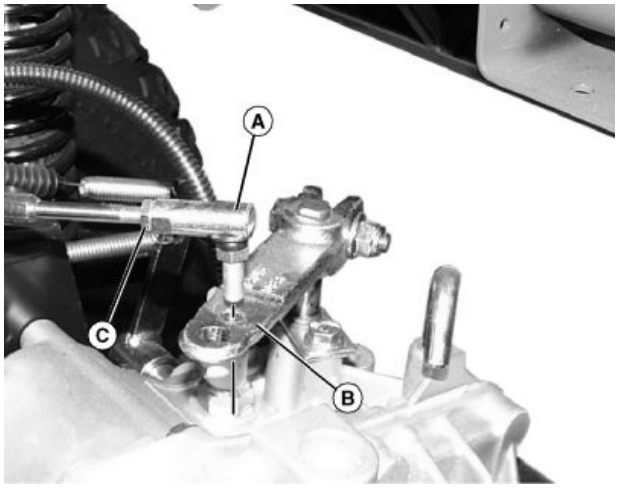
MXT011222 —UN—04JUN14

A—Nut **B—Nut**

Continued on next page

MX52301,0000084 -19-22OCT14-2/3

7. Remove nut and lock washer securing shift cable end (A) to transaxle shift arm (B).
8. Place transaxle shift arm in NEUTRAL position.
9. Check that shift cable end can be inserted and removed from transaxle shift arm easily. Adjust cable end if necessary.
   - Loosen jam nut (C).
   - While holding shift cable screw or unscrew shift cable end (A) until it can be inserted and removed from transaxle shift arm easily.
   - Tighten jam nut (C).
10. Install lock washer and nut securing shift cable end (A) to transaxle shift arm (B).
11. Shift into forward and reverse. There should be an even gap between the lever and quadrant in both forward and reverse positions. The shift lever should NOT contact the shift quadrant in either forward or reverse.
12. Shift into neutral and check neutral start.
13. Drive machine over rough ground to check adjustments.



MXT011223 —UN—04JUN14

A—Shift Cable End
B—Transaxle Shift Arm
C—Jam Nut

MX52301,0000084 -19-22OCT14-3/3

Differential Lock Adjustments

Purpose:

- To insure differential shift lever fully engages and disengages differential lock.
- To insure differential lock works with park brake.

Procedure

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box.
3. Block wheels to prevent machine from rolling.
4. Unlock park brake.

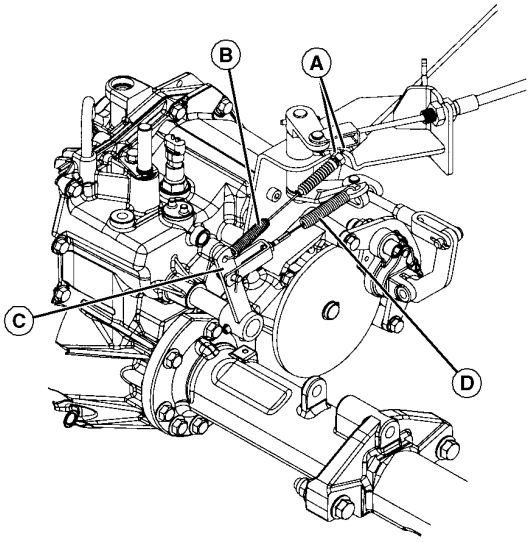
NOTE: Setting the park brake engages the differential lock and locks the rear wheels together before the park brake is engaged.

5. Loosen jam nuts (A). Adjust nuts until differential cable places tension on spring (B) but does not move differential lock arm (C).
6. Check park brake-to-differential lock arm spring (D) for
   - If slight tension is there without the differential lock arm moving, no adjustment is needed.
   - If there is no tension but the cable through the spring is taut, no adjustment is needed.
   - If there is no tension and the cable through the spring is loose, adjust park brake-to-differential arm cable. See Two-Wheel Drive Park Brake Adjustment (SN -040000) or MFWD Park Brake Adjustment (SN -040000).

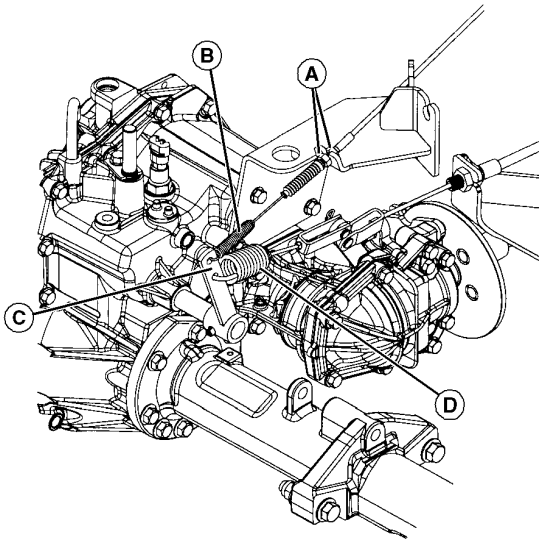
Results:

Engage and disengage differential lock several times.

- Check that the differential cable places slight tension on spring (B) but does not move differential lock arm (C) with the differential lock released
- Check that the differential lock arm moves to engaged position with either the differential lock lever or the park brake engaged. You may have to push the machine a short distance with the wheels turned until the differential lock engages.



MXT011224 —UN—04JUN14



MXT011225 —UN—04JUN14

A—Jam Nuts
B—Spring
C—Lock Arm
D—Brake-to-Differential Lock Arm Spring.

MX52301,0000085 -19-22OCT14-1/1

MFWD Linkage Adjustment

Purpose:

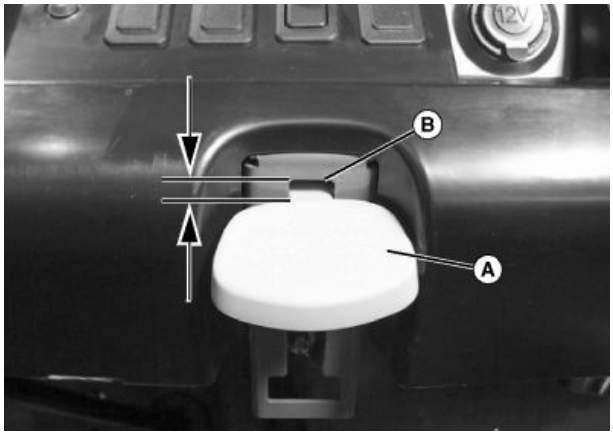
- To set MFWD engagement and disengagement properly and to avoid preload being applied to front differential shift fork. Preload being applied to the shift fork can cause damage if left uncorrected.
- If the following complaints or symptoms are noted, the MFWD linkage needs adjustment:
  - Four-wheel drive does not stay engaged under load.
  - Noise from front axle transfer case.

Check Adjustment:

1. Engage the MFWD.
2. Park machine safely. See the “Safety Section”.
3. Lock park brake.

NOTE: It may be necessary to wiggle the MFWD linkage to set it in a “free-float” position.

4. Check that the top of the MFWD lever (A), when allowed to “free-float”, is 1—6 mm (0.4—0.24 in.) from the top of the lever slot (B).



MXT011226 —UN—04JUN14

A—MFWD Lever **B—Lever Slot**

Results:

- If the MFWD lever is positioned correctly no adjustment is needed.
- If the MFWD lever is too close or too far from the top of the lever follow the Adjustment Procedure.

MX52301,0000086 -19-22OCT14-1/2

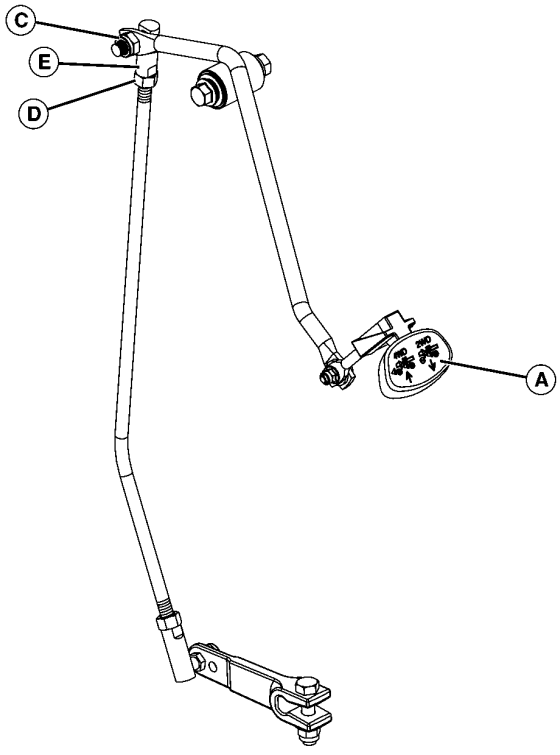
Adjustment Procedure:

1. Remove lock nut (C) and disconnect adjustment rod from MFWD shift lever rod.
2. Loosen jam nut (D).

NOTE: It may be necessary to adjust both the top and bottom ball joints to ensure proper thread engagement at both ends.

3. Unscrew ball joint (E) to increase gap or screw ball joint onto rod to decrease gap. Adjust as necessary.
4. Tighten jam nut (D).
5. Connect ball joint to shift lever and install lock nut (C).

A—MFWD Lever **D—Jam Nut**
C—Lock Nut **E—Ball Joint**



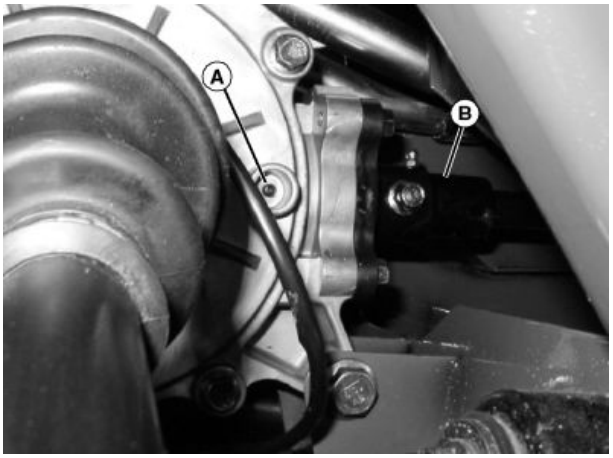
MXT011227 —UN—22MAY14

MX52301,0000086 -19-22OCT14-2/2

EMFWD Ring and Pinion Backlash Adjustment

Procedure:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Jack up front of machine and place on jack stands.
4. Turn steering wheel to full left turn position.
5. Using a 3/32 in. hex key wrench, turn set screw (A) clockwise until tight. (Do not apply a lot of torque). At this point, you should not be able to turn the pinion shaft (B).
6. While trying to turn the pinion shaft, slowly loosen the set screw (counter clockwise) until the pinion shaft starts to turn. Keep loosening the set screw in small increments until the pinion shaft can be rotated four times freely (one revolution of the ring gear) without any tight spots. You should only have to loosen the setscrew between 3/8 and 3/4 of a turn to obtain proper backlash setting.



MXT011228 —UN—21MAY14

A—Set Screw **B—Pinion Shaft**

MX52301,0000087 -19-22OCT14-1/1

Drive to Secondary (Driven) Clutch Adjustment

MX52301,0000088 -19-24JUL14-1/6

Center Distance Gauge JDG1749	Setting Center Distance Between Engine and Transaxle.

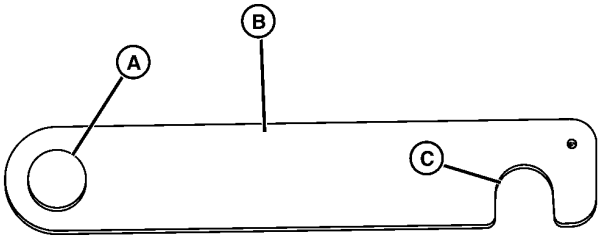
MX52301,0000088 -19-24JUL14-2/6

1. Remove fifth isolator hardware and washers.
2. Loosen four main mounting cap screws through main isolators and engine mounting brackets.
3. Lift engine 5—10 mm (0.2—0.4 in.) to release strain on isolators.
4. Lower engine fully onto isolators. Tighten four main mounting cap screws to specification.

Specification	
Mounting Cap Screw—Torque	50 N·m (37 lb.-ft.)

5. Place the closed end (A) of clutch center distance gauge (B) (JDG1749) over the end of the secondary clutch. Position the open end (C) over the center shaft of the engine drive clutch.

NOTE: The engine may need to be pushed toward the driven clutch to allow the gauge to drop onto the clutch shaft.



MXT011116 —UN—22MAY14

A—Closed-End **C—Open End**
B—Center Distance Gauge (JDG1749)

6. Make sure closed end (A) is seated completely over bushing end at transmission driven clutch.

Continued on next page

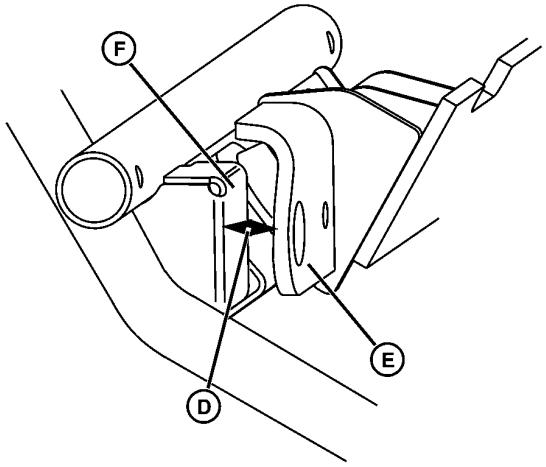
MX52301,0000088 -19-24JUL14-3/6

NOTE: The gap is defined as the distance between the frame and engine snubber brackets when the center distance tool is in place and properly positioning the engine relative to the driven clutch. Isolator parts are not installed during this measurement.

7. Measure the distance (D) between the engine isolator bracket (E) and the frame bracket (F).
8. Compare the measurement with the GAP column of the Diesel Engine Isolator Shim Washer Chart. Determine the approximate number of 1.5 mm shim washers to be installed with the isolator mounting hardware.

Diesel Engine Isolator Shim Washers	
Gap (mm)	**Number of Shims**
21.10—22.75 mm	0
22.75—24.40 mm	1
24.40—26.05 mm	2
26.05—27.70 mm	3
27.70—29.35 mm	4

9. Remove center distance gauge.



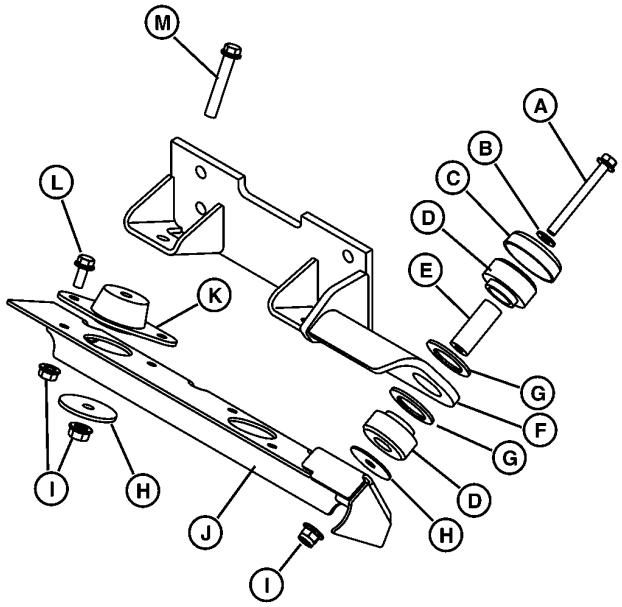
MXT011117 —UN—22MAY14

D—Distance
E—Isolator Bracket
F—Frame Bracket

MX52301,0000088 -19-24JUL14-4/6

10. Install fifth isolator parts in order shown.
11. Install correct number shim washers (G) as determined.
12. The washer (H), one rubber mounting (D), and shim washers (G), and are installed between the frame mounting bracket (J) and engine mounting bracket (F).

A—Capscrew
B—Washer
C—Metal Cup
D—Rubber Mount
E—Bushing
F—Engine Mount
G—Washer
H—Shim Washer (as required)
I— Flange Nut
J—Frame Mount
K—Isolator (4 used)
L—Cap Screw
M—Cap Screw



MXT011118 —UN—22MAY14

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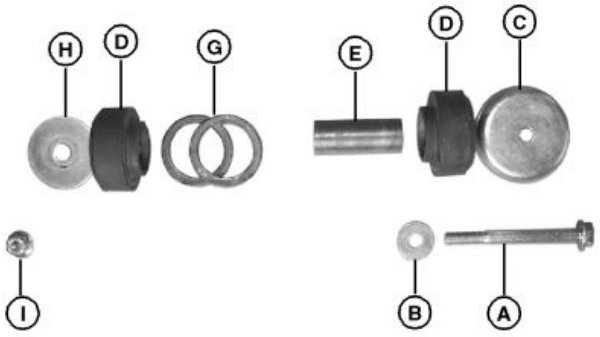
MX52301,0000088 -19-24JUL14-5/6

13. Assemble bushing (E), rubber mount (D), metal cup (C), washer (B), and cap screw (A) onto engine mount (F).
14. Install second rubber mount (D), metal cup (H), washer (B), and fifth isolation mounting cap screw (A). Install nut (I).
15. Tighten fifth isolation mounting cap screw (A) and nut (I) to specification.

Specification

Cap Screw and Nut—Torque ..... 30—44 N·m (22—32 lb.-ft.)

16. Verify center distance again by placing the center distance gauge on the primary clutch first and verify that the closed end of the gauge easily slips onto the secondary clutch bearing. Remove or add shims as necessary.
17. Install drive belt.
18. Connect battery negative (-) cable.



MXT011119 —UN—16MAY14

A—Cap Screw
B—Washer
C—Metal Cup
D—Rubber Mount
E—Bushing
F—Engine Mount
G—Shim Washers (as required
H—Metal Cup
I— Nut

19. Install belt and clutch enclosure where used.

MX52301,0000088 -19-24JUL14-6/6

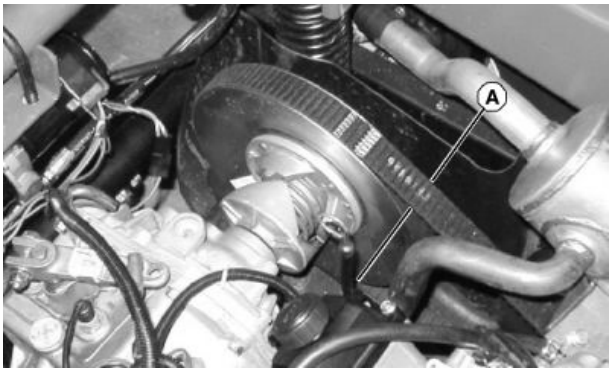
Checking Drive Belt

CAUTION: Rotating parts can catch fingers or loose clothing. Stop engine and wait for all moving parts to stop before servicing.

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise and lock cargo box.
4. HPX Trail Gator 4x4: Remove clutch enclosure.
5. Rotate and inspect belt for wear or damage.
6. Measure the top surface of the belt width at (A). Replace belt if worn beyond limit

Specification

Belt—Width (minimum) ..... 27 mm (1.1 in.)



MXT011229 —UN—21MAY14

7. HPX Trail Gator 4x4: Install clutch enclosure.
8. Lower the cargo box.

MX52301,0000089 -19-22OCT14-1/1

Summary of References

- Changing MFWD Differential Oil (SN -040000)
- Changing EMFWD Differential Oil (SN 040001-)
- Changing Transaxle Oil
- Removing and Installing Clutch Enclosure Cover—Trail HPX 4x4
- Primary Drive Clutch Removal
- Primary Drive Clutch Repair
- Cleaning Primary Drive Clutch
- Driven Clutch Removal and Installation
- Driven Clutch Disassembly and Assembly
- Transaxle Removal and Installation
- Transaxle Disassembly
- Transaxle Assembly
- Hub Removal
- Hub Installation
- Front Drive Gearbox Disassembly and Assembly
- MFWD Driveshaft Removal and Installation (SN -040000)
- MFWD Driveshaft Removal and Installation (SN 040001-)
- Front Axle Driveshaft Removal and Installation
- Front Differential Removal and Installation (SN -040000)
- Front Differential Assembly (SN -040000)
- Front Differential Removal and Installation (SN 040001-)
- Front Differential Disassembly (SN 040001-)
- Front Differential Assembly (SN 040001-)
- CV Joint (Front or Rear Axle Drive Shafts) Disassembly and Assembly

MX52301,0000453 -19-22OCT14-1/1

Changing MFWD Differential Oil (SN -040000)

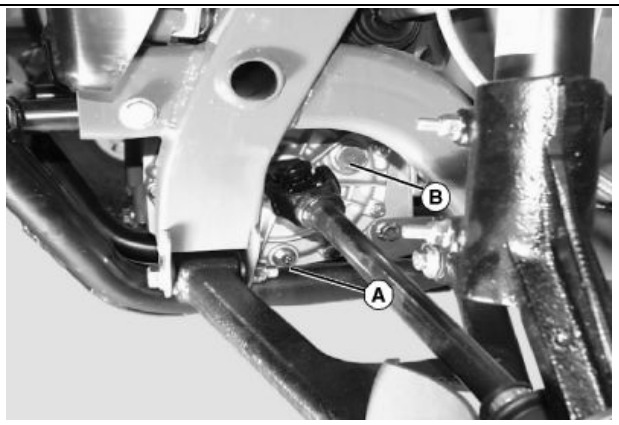
1. Operate machine to warm MFWD differential oil.
2. Park machine safely. See the “Safety Section”.
3. Lock park brake.

IMPORTANT: Dirt and debris in oil may cause damage to the MFWD differential. Clean area round opening before removing plug.

4. Position drain pan under MFWD differential drain plug (A).
5. Remove fill plug (B) on left side of MFWD differential.
6. Remove MFWD differential drain plug (A) and allow oil to drain.
7. Install and tighten drain plug after all oil has drained.
8. Add J20C low viscosity Hy-Gard™ oil until the level is even with the bottom of the fill port.

Specification	
MFWD Differential Oil—Capacity	0.9 L (0.95 qt.)

Hy-Gard is a trademark of Deere & Company



MXT011230 —UN—21MAY14

A—Drain Plug **B—Fill Plug**

9. Install and tighten fill plug.
10. Check MFWD differential oil level again after the first several hours of operation.

MX52301,000008A -19-24OCT14-1/1

Changing EMFWD Differential Oil (SN 040001-)

1. Operate machine to warm EMFWD differential oil.
2. Park machine safely. See the “Safety Section”.
3. Lock park brake.

IMPORTANT: Dirt and debris in oil may cause damage to the MFWD differential. Clean area around opening before removing plug.

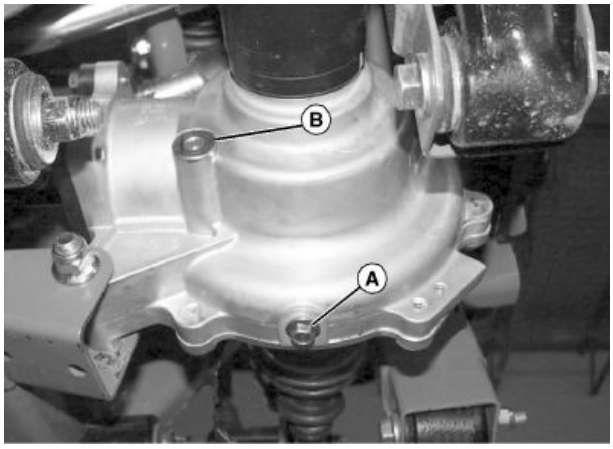
4. Place a drain pan under front differential and remove drain plug (A) and allow oil to drain.
5. Clean drain plug and install with new nylon sealing washer. Tighten to specification.

Specification	
Drain Plug—Torque	12 N·m (110 lb.-in.)

6. Remove fill plug (T) and fill gearcase with of J20D low viscosity Hy-Gard™ oil.

Specification	
Oil Fill Level—Capacity	150 mL (5 oz.)

Hy-Gard is a trademark of Deere & Company



MXT011231 —UN—21MAY14

7. Install fill plug and tighten to specification.

Specification	
Fill Plug—Torque	13.5 N·m (120 lb.-in.)

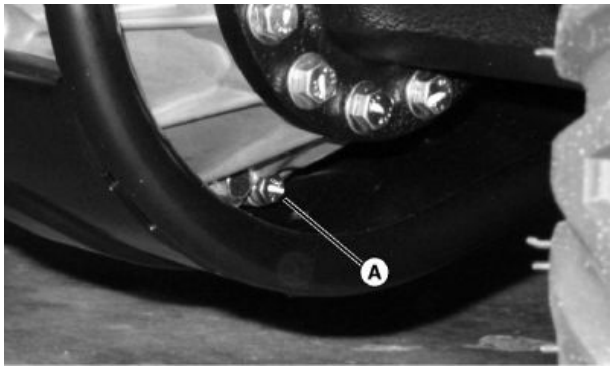
MX52301,000008B -19-24OCT14-1/1

Changing Transaxle Oil

1. Operate machine to warm transaxle oil.
2. Park machine safely. See the “Safety Section”.
3. Lock park brake.
4. Raise and lock cargo box.

IMPORTANT: Dirt and debris in oil may cause damage to the transaxle. Clean area around opening before removing plug or dipstick.

5. Position drain pan under transaxle drain plug (A).
6. Remove plug and drain oil.
7. Check O-ring on drain plug. Replace if missing or in poor condition.
8. Install and tighten drain plug.



MXT011232 —UN—21MAY14

A—Drain Plug

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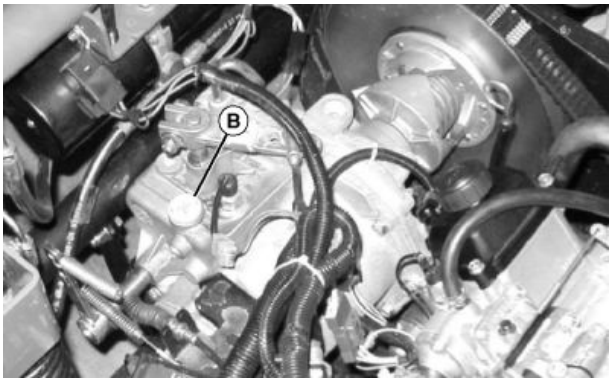
MX52301,000008C -19-22OCT14-1/2

9. Remove dipstick (B) on top of transaxle housing. Wipe dipstick clean.
10. Fill transaxle housing with oil to specification.

Specification	
Oil Level 4x4 —Capacity	4.5 L (4.8 qt.)
Oil Level 4x2—Capacity	4.0 L (4.2 qt.)

11. Check oil level by setting dipstick on threads in transaxle case, then removing and checking oil level.
12. Wait for two minutes then check oil level. Add oil if necessary.
13. Install dipstick and tighten.
14. Lower the cargo box.



MXT011233 —UN—21MAY14

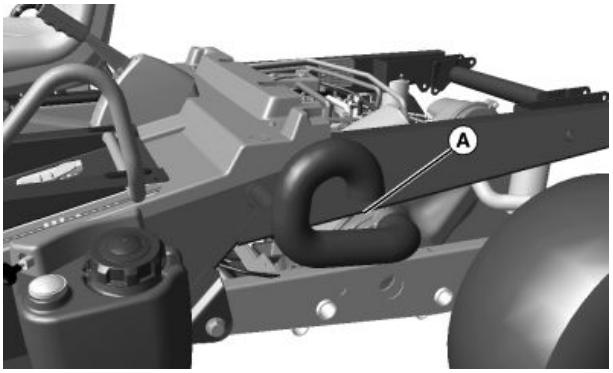
MX52301,000008C -19-22OCT14-2/2

Removing and Installing Clutch Enclosure Cover—Trail HPX 4x4

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise and secure cargo box.
3. Remove breather intake hose (A).

A—Breather Intake Hose

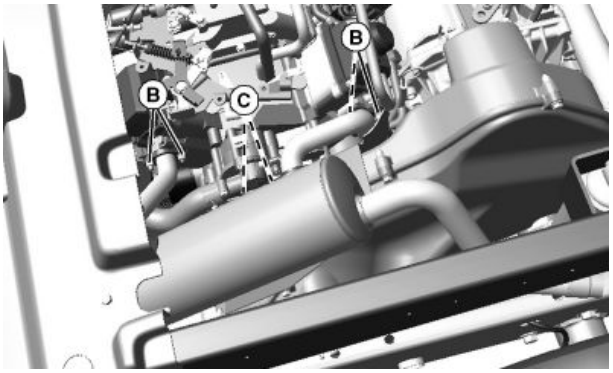


MXT011234 —UN—21MAY14

MX52301,000008D -19-22OCT14-1/4

4. Remove the nuts (B) securing the muffler to engine block and cap screws (C) securing the muffler to the mounting bracket.
5. Remove muffler.

B—Nuts **C—Cap Screws**



MXT011235 —UN—21MAY14

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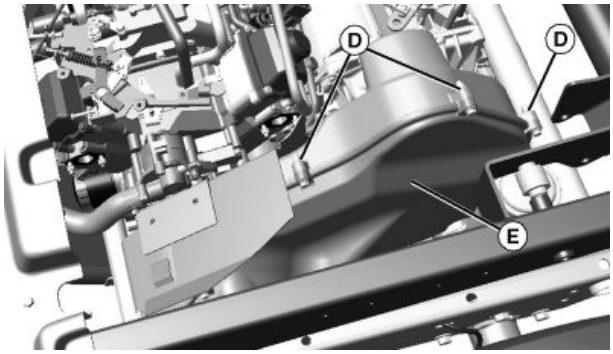
MX52301,000008D -19-22OCT14-2/4

6. Remove the ten cap screws and nuts (D) (three shown),

   securing the enclosure cover (E) to the enclosure.

7. Remove the enclosure cover (E).

D—Cap Screws and Nuts **E—Enclosure Cover**



MXT011236 —UN—21MAY14

MX52301,000008D -19-22OCT14-3/4

8. Remove and inspect the seal gasket (F) for cracks or damage.

Installation:

1. Install seal gasket (F) onto enclosure.
2. Install the enclosure cover (E) and secure with ten cap screws and nuts (D) (three shown).
3. Install muffler and secure with nuts (B) to engine block and cap screws (C) to the mounting bracket.
4. Install breather intake hose (A).
5. Lower the cargo box.

MXT011237 —UN—21MAY14

F—Seal Gasket

MX52301,000008D -19-22OCT14-4/4

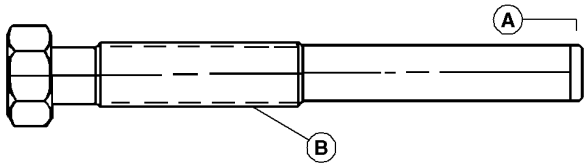
Primary Drive Clutch Removal

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise and lock cargo box.
4. Raise and safely support rear axle.
5. Remove left rear wheel.
6. Remove drive belt.

IMPORTANT: Lightly grease end of puller (A) to help prevent puller wear. To prevent clutch thread damage, DO NOT thread bolt in any farther than necessary to remove clutch.

7. Remove plastic plug from clutch cover.
8. Remove clutch mounting bolt and washers.
9. Use JDG1641 Clutch Removal Tool (B). Thread puller into clutch and against crankshaft. Tighten until clutch pops free from crankshaft taper.

MXT011238 —UN—21MAY14



A—Tool End **B—JDG1641 Clutch Removal Tool**

NOTE: An air impact wrench works well to remove the primary clutch.

10. Install clutch in reverse order of removal. Tighten clutch bolt to specification.

Specification	
Clutch Bolt—Torque	37 N·m (26 lb.-ft.)

MX52301,000008F -19-22OCT14-1/1

Primary Drive Clutch Repair

Procedure:

MX52301,0000090 -19-24JUL14-1/4

Clutch Servicing Kit .. JDG813A Kit, Comet Clutch Service	Use to remove and service the Comet drive clutches.

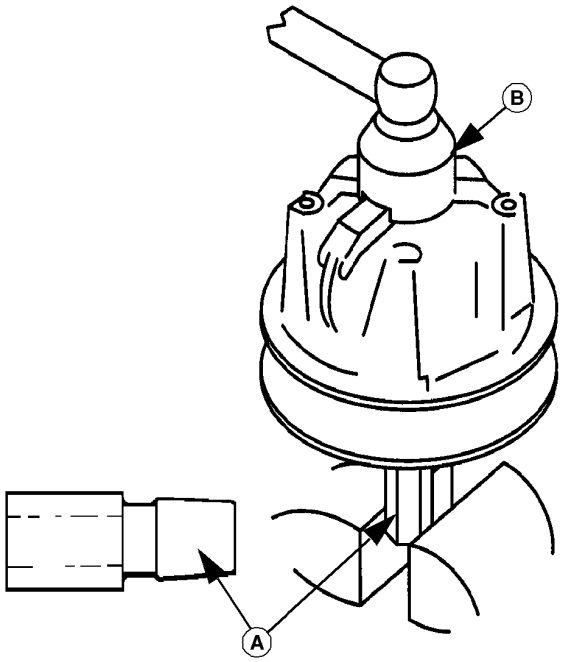
MX52301,0000090 -19-24JUL14-2/4

1. Remove clutch cover bolts. Remove cover. (Cover should pop off; do not pry on cover).
2. Install JDG813-3 Tapered Holding Tool (A) and retain it with a M10 X 1.5 X 150 mm hex-head bolt.

IMPORTANT: Always use spider wrench to remove spider. Unequal pressure on clutch towers could cause stress fractures or break them off. A medium strength thread lock is used on spider threads.

3. Use JDG813-2 Spanner Wrench (B) to remove spider.

A—Tapered Holding Tool **B—Spanner Wrench**



MXT011239 —UN—21MAY14

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MX52301,0000090 -19-24JUL14-3/4

Inspection

NOTE: The cam weights (G) have plastic thrust washers (M) inserted on each side of the cam weight.

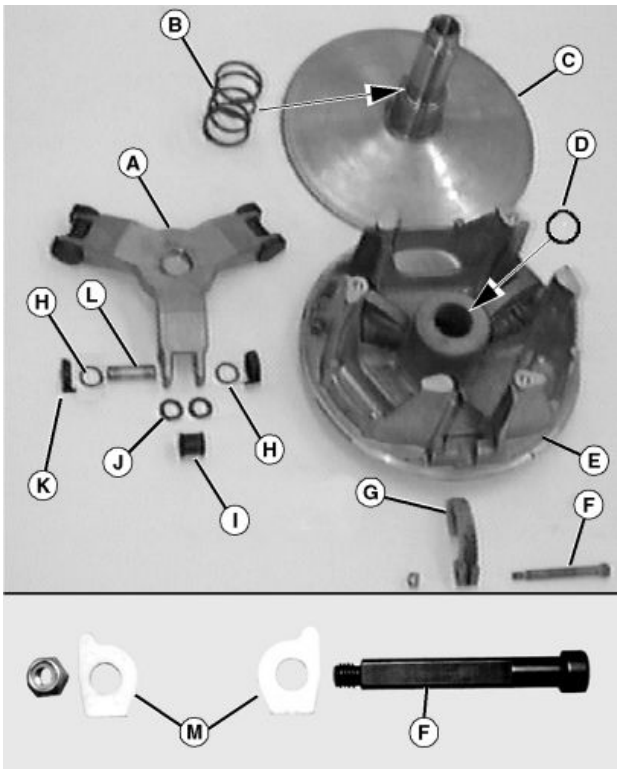
1. Check spider rollers for flat spots or binding.
2. Reassemble components. Tighten spider to specification.

Specification

Spider—Torque.....135 N·m (100 lb.-ft.)

- Use medium strength thread lock on threads.

A—Spider
B—Spring
C—Stationary Sheave
D—Washer
E—Clutch Sheave
F—Pivot Ball
G—Cam Weight
H—O-ring
I— Roller
J— Thrust Washers
K—Button
L—Pin
M—Plastic Thrust Washers



MXT011240 —UN—21MAY14

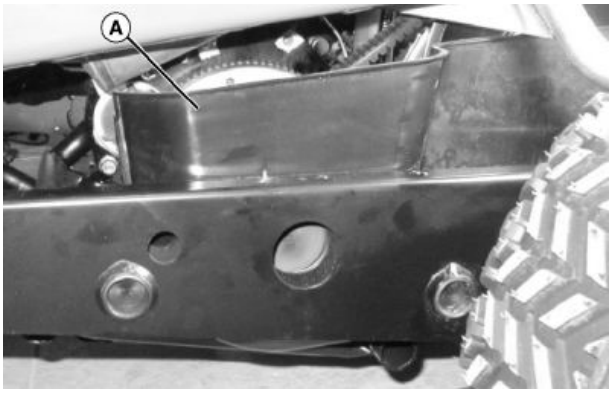
MX52301,0000090 -19-24JUL14-4/4

Cleaning Primary Drive Clutch

IMPORTANT: Never lubricate any part of the primary drive clutch.

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. If installed, remove outer clutch enclosure (A). See Removing and Installing Clutch Enclosure Cover—Trail HPX 4x4.

A—Clutch Enclosure



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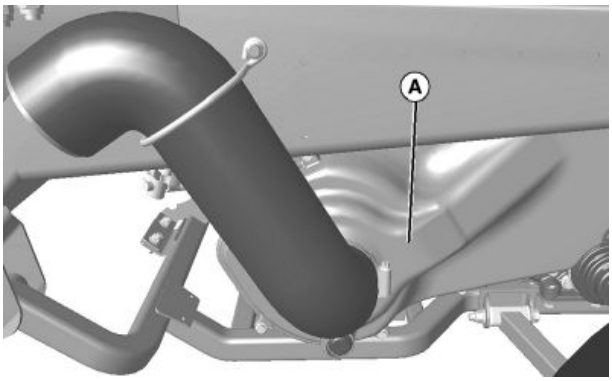

MXT011242 —UN—21MAY14

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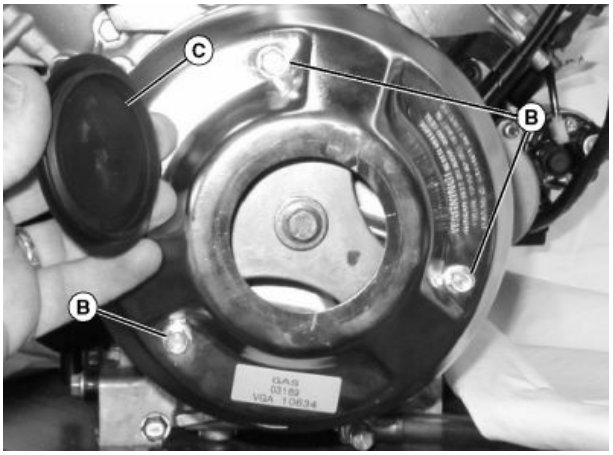
MX52301,0000091 -19-22OCT14-1/3

4. Remove three screws (B) securing clutch cover. Remove cover from clutch.

IMPORTANT: Do not lubricate cam pivot weights.

5. Use compressed air to blow dust and debris out of clutch and from around clutch cam weights.
6. Install clutch cover and tighten screws (B).
7. Install clutch cover plug (C).

B—Clutch Cover Screws **C—Clutch Cover Plug**

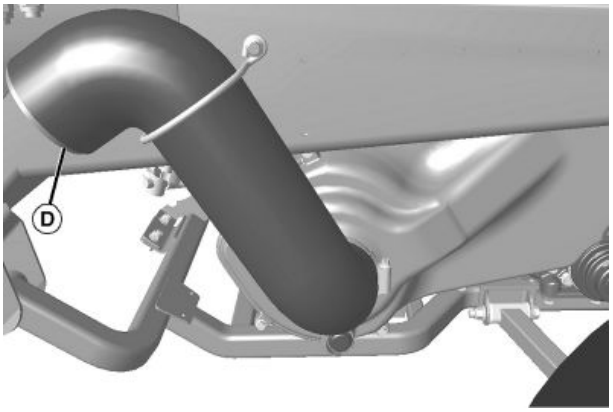


MXT011243 —UN—21MAY14

MX52301,0000091 -19-22OCT14-2/3

8. Before installing outer clutch cover, remove foam filter (D) from intake hose. Clean filter and allow to dry.
9. Install components in reverse order.

D—Foam Filter



MXT011244 —UN—21MAY14

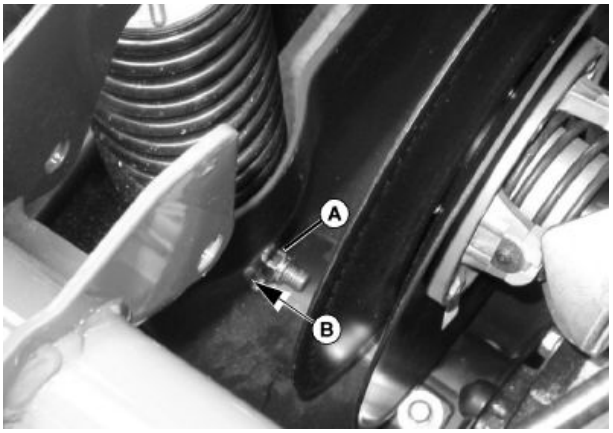
MX52301,0000091 -19-22OCT14-3/3

Driven Clutch Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise and lock cargo box.
4. Remove drive belt.
5. Remove nut (A) from lower shock mounting cap screw.
6. Slide the cap screw toward the outside (B) until the end of the cap screw is even with the axle mounting tab. Do not remove the cap screw.

A—Nut **B—Cap screw location**



MXT011245 —UN—21MAY14

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MX52301,0000092 -19-28JUL20-1/2

7. Remove cap screw and washer (C) and remove driven clutch.
8. Disassemble and repair the clutch as needed. See Driven Clutch Disassembly and Assembly.

Installation:

1. Install in reverse order of removal.
2. Tighten clutch and lower shock bolts to specification.

Bolt Specifications—Specification	
Driven Clutch to Transaxle Cap Screw—Torque	73 N·m (54 lb·ft)
Rear Shock to Frame—Torque	102—150 N·m (75—111 lb·ft)

3. Check drive belt and drive clutch to driven clutch distance. Adjust as necessary. See Checking Drive Belt.

MXT011246 —UN—21MAY14

C—Cap Screw and Washer

MX52301,0000092 -19-28JUL20-2/2

Driven Clutch Disassembly and Assembly

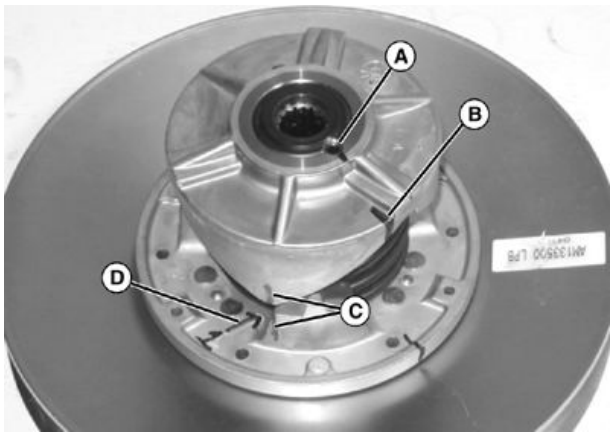
Disassembly:

1. Mark location of set screw (A) on the outer edge of the cam (B).
2. Place alignment marks (C) on cam and movable sheave to aid in assembly.
3. Mark the location of the spring tab in the movable sheave (D).
4. Remove set screw (A).

CAUTION: Hold cam securely to prevent sudden spring release

NOTE: Cam is press fit on shaft. Use a three-jaw puller and an impact wrench, at low speed, to remove cam from shaft.

5. Use a three-jaw puller to pull the cam off the shaft.
6. Remove cam, spring, and movable sheave from shaft.



MXAL31132 —UN—10JUL12

A—Set Screw
B—Cam
C—Alignment MARKS
D—Movable Sheave

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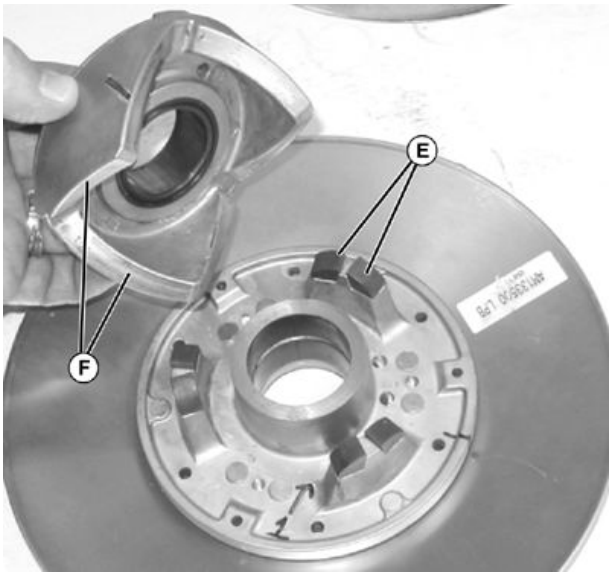
MX52301,0000093 -19-05JUN14-1/6

Inspection:

NOTE: Ramp buttons are mounted with tabs on backside. Tabs are interference fit into holes on face of ramps. Remove buttons only if replacement is necessary.

1. Inspect ramp buttons (E) for wear or cracks.
2. Inspect the ramps (F) for nicks or scratches.

E—Ramp Buttons **F—Ramps**

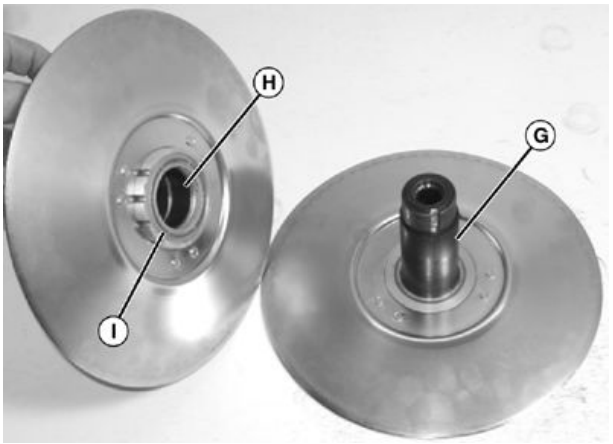


MXAL31133 —UN—10JUL12

MX52301,0000093 -19-05JUN14-2/6

3. Inspect sheave shaft (G) and bore (H) for wear, nicks, or scratches.
4. Inspect movable sheave seal (I) for wear or damage.
5. Replace any damaged components as needed.

G—Sheave Shaft **I— Seal**
H—Bore



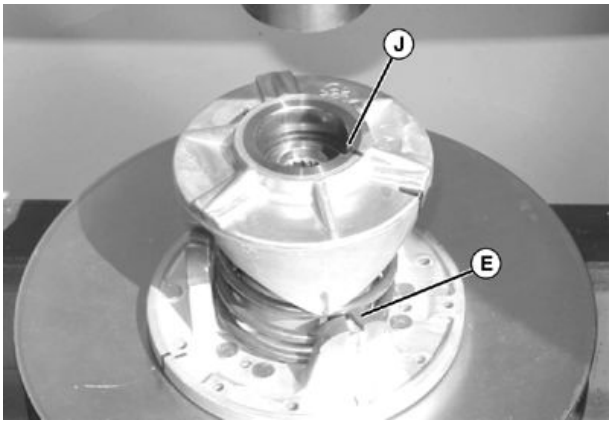
MXAL31134 —UN—10JUL12

MX52301,0000093 -19-05JUN14-3/6

Assembly:

1. Install movable sheave on fixed sheave.
2. Install spring. Insert spring tab into previously marked hole in movable sheave and hole in cam.
3. Align set screw bores (J) and press cam on shaft until cam lobe almost touch ramp buttons (E).

E—Ramp Buttons **J— Set Screw Bores**



MXAL31135 —UN—10JUL12

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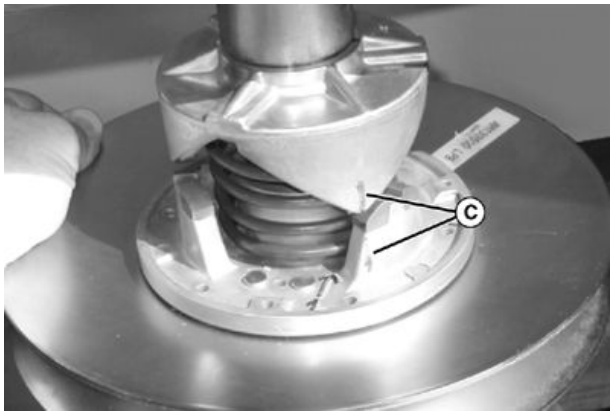
MX52301,0000093 -19-05JUN14-4/6

4. Rotate the movable sheave until the marks (C) are aligned and continue to press the cam onto the shaft until fully seated.

C—MARKS

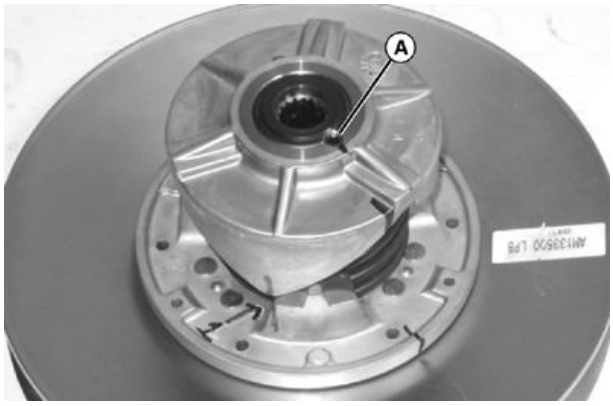


MXAL31136 —UN—10JUL12

MX52301,0000093 -19-05JUN14-5/6

5. Apply thread lock and sealer (medium strength) to threads of set screw (A) and install.
6. After clutch in installed, check clutch operation.

A—Set Screw



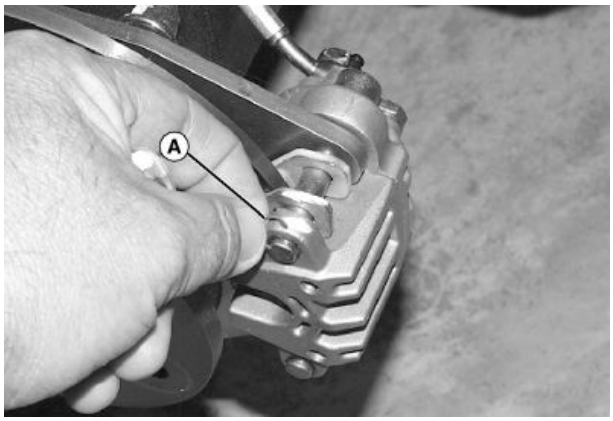
MXAL31137 —UN—10JUL12

MX52301,0000093 -19-05JUN14-6/6

Transaxle Removal and Installation

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Block wheels to prevent machine from rolling.
4. Remove cargo box from machine.
5. Jack up rear of machine and place on stands.
6. Remove rear wheels.
7. Remove circlips (A) from brake caliper bolts.

A—Circlip



MXT011247 —UN—21MAY14

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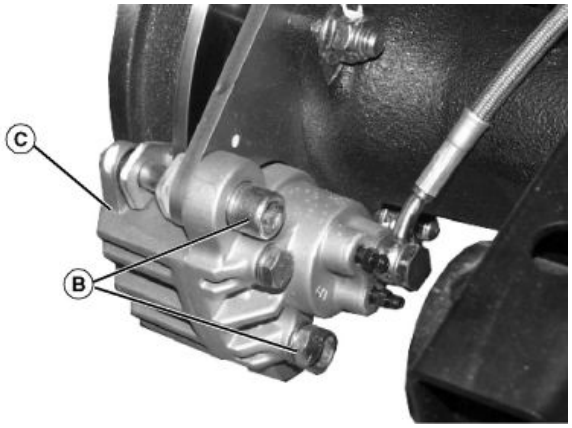
MX52301,0000094 -19-05JUN14-1/9

8. Remove brake caliper bolts (B) and caliper (C) from each side of machine.

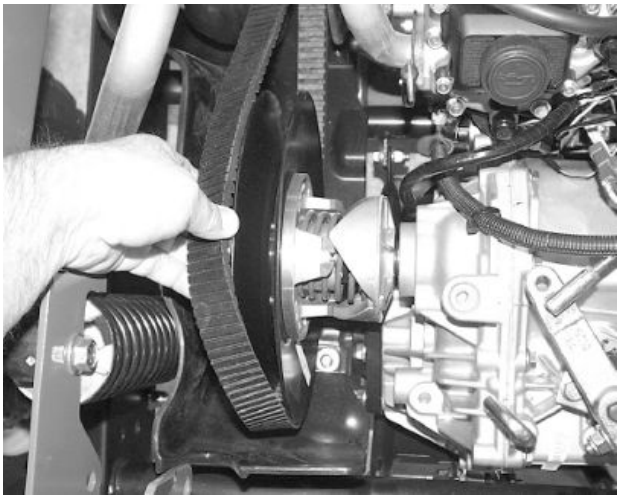
B—Bolts **C—Caliper**



MXT011248 —UN—21MAY14

MX52301,0000094 -19-05JUN14-2/9

9. Remove drive belt.

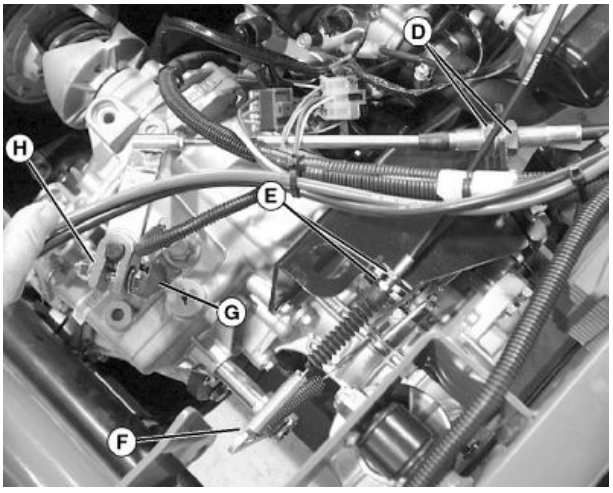


MXT011249 —UN—21MAY14

MX52301,0000094 -19-05JUN14-3/9

10. Loosen cable adjusting nuts (D and E) and lift cables out of brackets.
11. Disconnect spring (F) from lever.
12. Loosen pinch bolt (H) and slide lever off shaft.

D—Adjusting Nut **F—Spring**
E—Adjusting Nut **H—Pinch Bolt**



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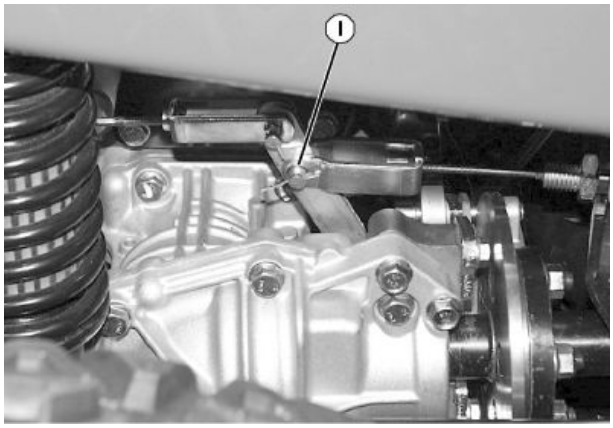
MX52301,0000094 -19-05JUN14-4/9

13. Remove cotter pin and pin (I) from park brake cable.

I— Cotter Pin

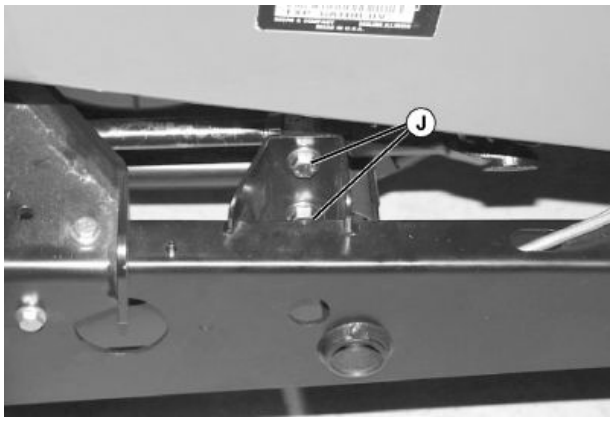


MXT011251 —UN—21MAY14

MX52301,0000094 -19-05JUN14-5/9

14. If unit is equipped with MFWD remove the two bolts (J) from the MFWD drive shaft support. bearing.

J— Bolts (2 used)

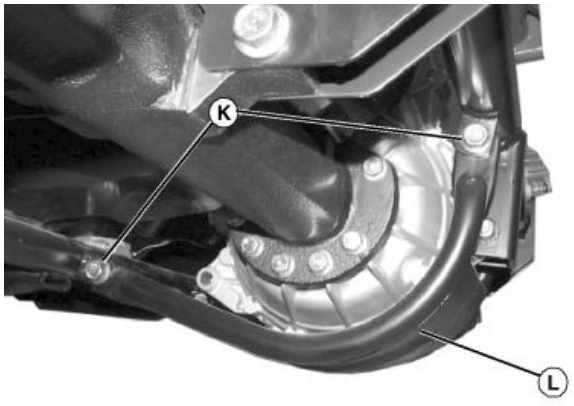


MXT011252 —UN—21MAY14

MX52301,0000094 -19-05JUN14-6/9

15. Remove four cap screws and nuts (K) from skid plate (L) and remove skid plate.

K—Cap Screws and Nuts **L—Skid Plate**



MXT011253 —UN—21MAY14

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MX52301,0000094 -19-05JUN14-7/9

16. Remove the two rear transaxle mounting cap screws and nuts (M). Note location of spacer (N).

M—Cap Screws and Nuts **N—Spacer**

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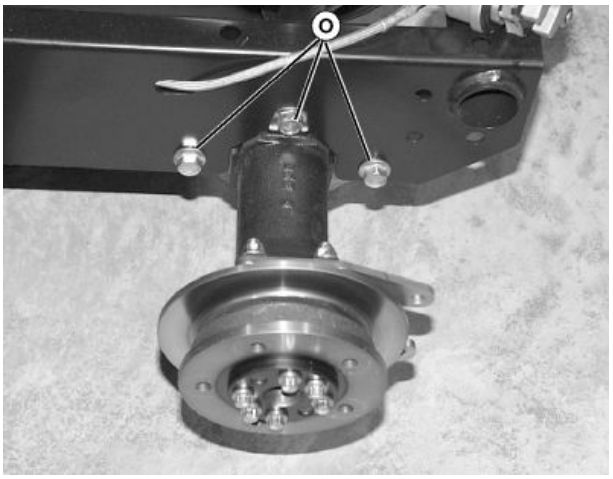
17. Support transaxle assembly with a floor jack and remove three axle mounting bolts (O) from each side.
18. Secure the lower swinging frame to the upper frame to keep it from coming down with the transaxle.

NOTE: Remove driven clutch from transaxle before removing transaxle from machine to avoid possible damage to driven clutch guard.

19. Remove the driven clutch from the transaxle. See Driven Clutch Removal and Installation.
20. Lower transaxle from machine.
21. Check drive belt and drive clutch to driven clutch distance after installation. Adjust as necessary. See Checking Drive Belt.

O—Axle Mounting Bolts (3 used)



MXT011255 —UN—21MAY14

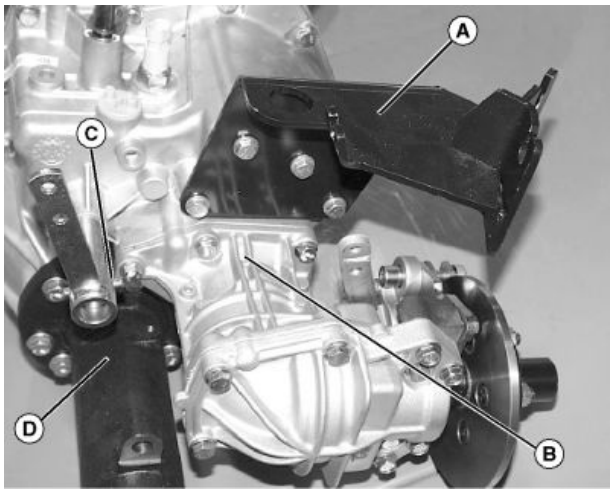
MX52301,0000094 -19-05JUN14-9/9

Transaxle Disassembly

Disassembly

1. Remove cap screws and left axle housing from transaxle.
2. Remove cable support bracket (A), front drive bevel gearbox (B) MFWD only, differential lock lever (C), and right axle housing (D).

A—Cable Support Bracket
B—Gear Box
C—Differential Lock Lever
D—Right Axle Housing



MXT011256 —UN—21MAY14

Picture Note: Cable support bracket (A) from SN -040000 shown, SN 040001- similar

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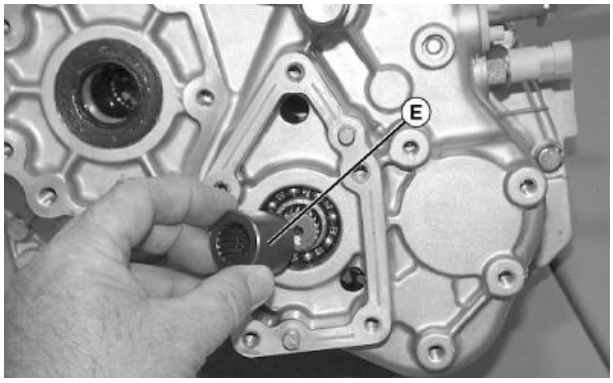
3. Remove splined collar (E) MFWD only.

E—Splined Collar

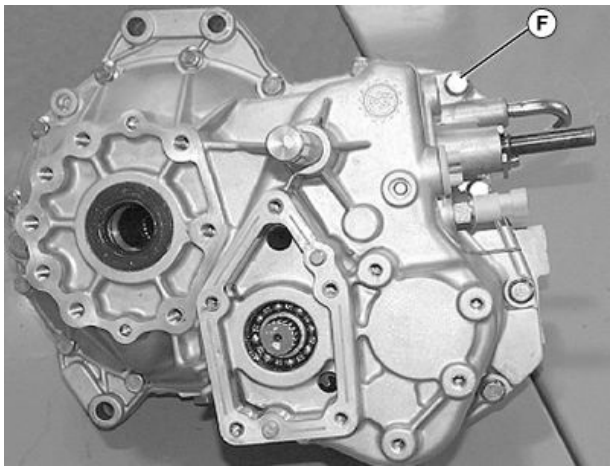


MXT011257 —UN—21MAY14

MX52301,0000095 -19-22OCT14-2/43

4. Remove 16 cap screws (F) from transaxle case.

F—Cap Screws (16 used)



MXT011258 —UN—21MAY14

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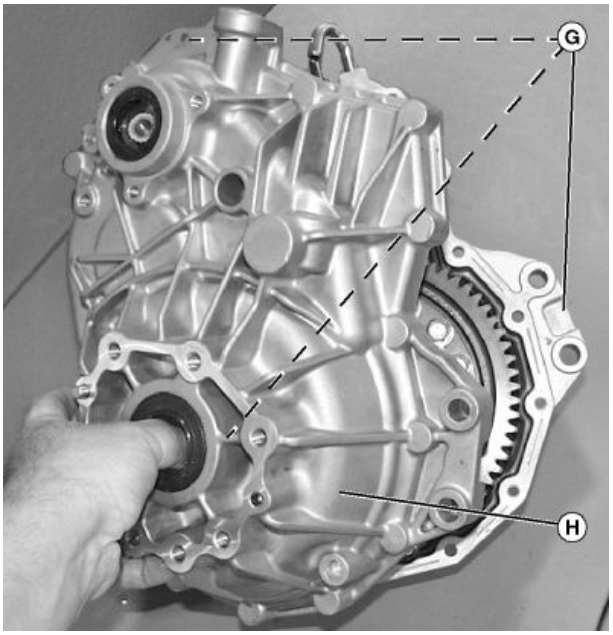
MX52301,0000095 -19-22OCT14-3/43

5. Use pry areas provided (G) and gently pry apart case halves. Remove left case half (H).

G—Pry Areas

H—Left Case Half



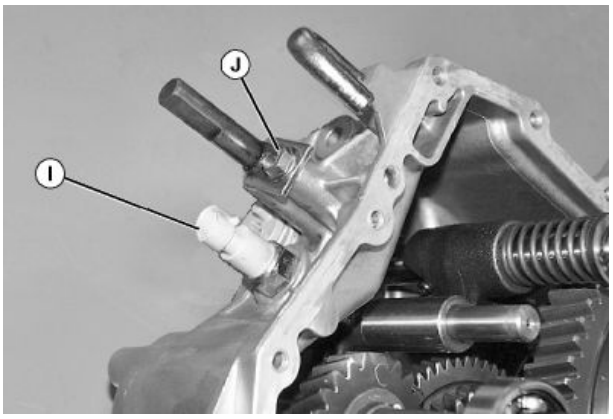
MXT011259 —UN—21MAY14

MX52301,0000095 -19-22OCT14-4/43

6. Remove neutral switch (I) and cap screw and keeper plate (J).

I— Neutral Switch

J— Cap Screw and Keeper Plate



MXT011260 —UN—21MAY14

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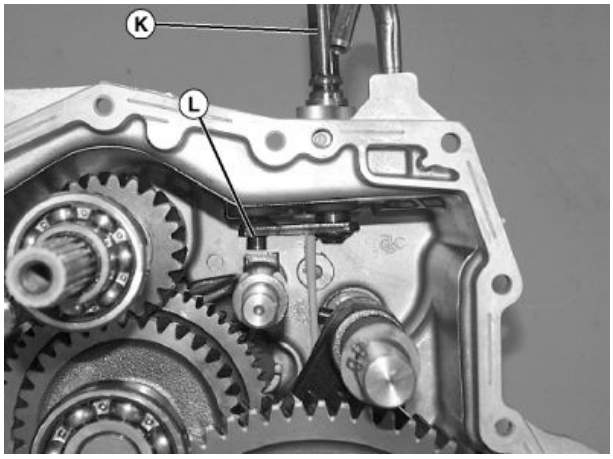
MX52301,0000095 -19-22OCT14-5/43

7. Pull shaft (K) up until pin (L) is out of slot in shift fork.

K—Shaft **L—Pin**

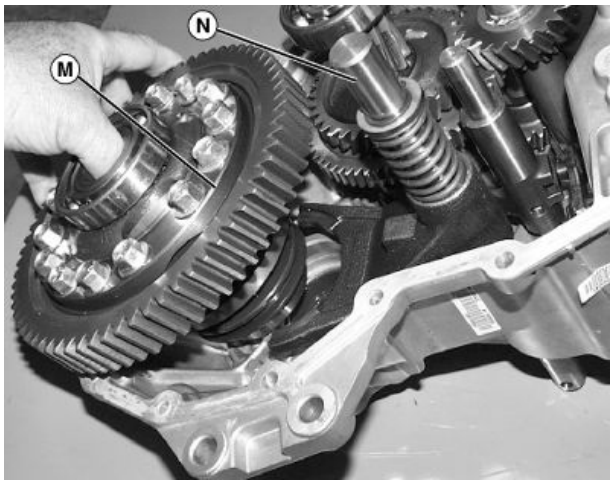


MXT011261 —UN—21MAY14

MX52301,0000095 -19-22OCT14-6/43

8. Simultaneously lift differential assembly (M) and differential lock shaft (N) until bearing on differential clears bore in case. Differential can then be lowered out of fork and removed.

M—Differential Assembly **N—Differential Lock Shaft**

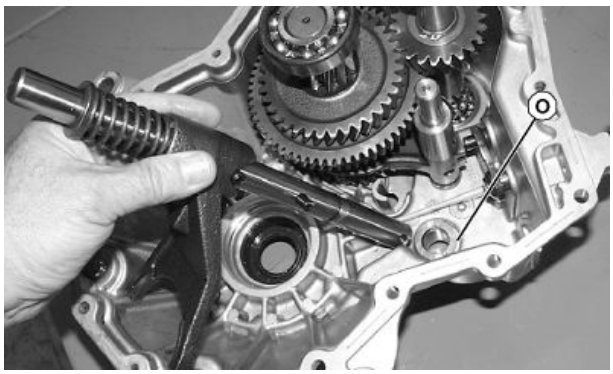


MXT011262 —UN—21MAY14

MX52301,0000095 -19-22OCT14-7/43

9. Pull differential lock shaft and washer (O) out of case.

O—Washer



MXT011263 —UN—21MAY14

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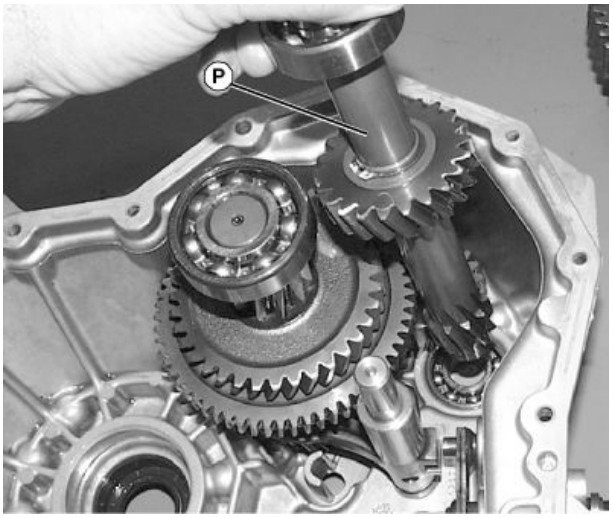
MX52301,0000095 -19-22OCT14-8/43

10. Remove input shaft (P).

P—Input Shaft



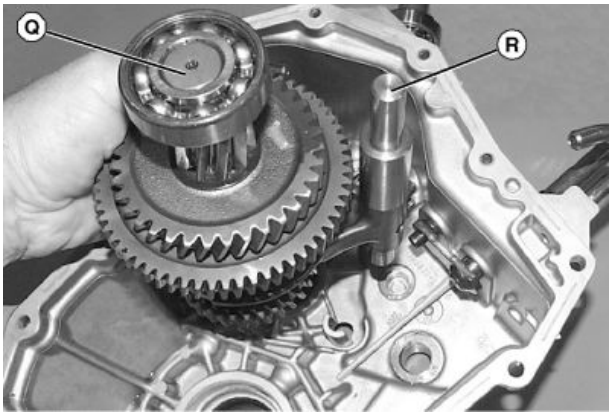
MXT011264 —UN—21MAY14

MX52301,0000095 -19-22OCT14-9/43

11. Remove reduction shaft (Q) and shift fork and shaft assembly (R).

Q—Reduction Shaft

R—Shift Fork and Shaft Assembly

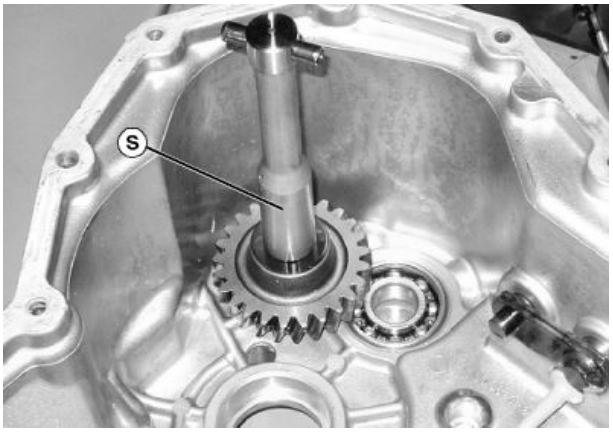


MXT011265 —UN—21MAY14

MX52301,0000095 -19-22OCT14-10/43

12. Remove reverse idler shaft and gear (S).

S—Reverse Idler Shaft and Gear



MXT011266 —UN—21MAY14

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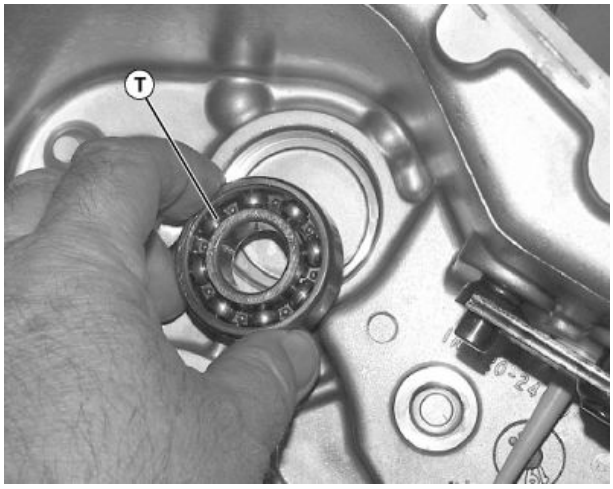
MX52301,0000095 -19-22OCT14-11/43

13. Remove input shaft bearing (T) from case.

T—Input Shaft Bearing

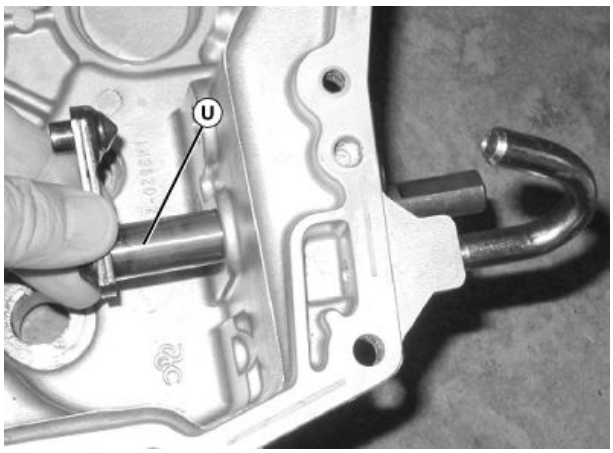


MXT011267 —UN—21MAY14

MX52301,0000095 -19-22OCT14-12/43

14. Pull shift shaft (U) into case and then push back in.

U—Shift Shaft

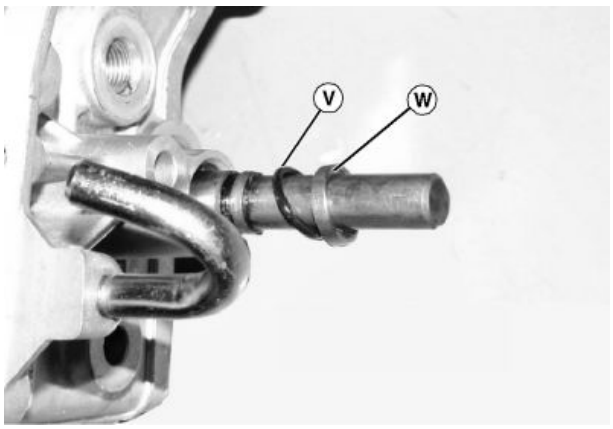


MXT011268 —UN—21MAY14

MX52301,0000095 -19-22OCT14-13/43

15. O-ring (V) and spacer (W) should come out on shaft, if not, remove shaft and pull them out with a small hook tool.

V—O-ring **W—Spacer**



MXT011269 —UN—21MAY14

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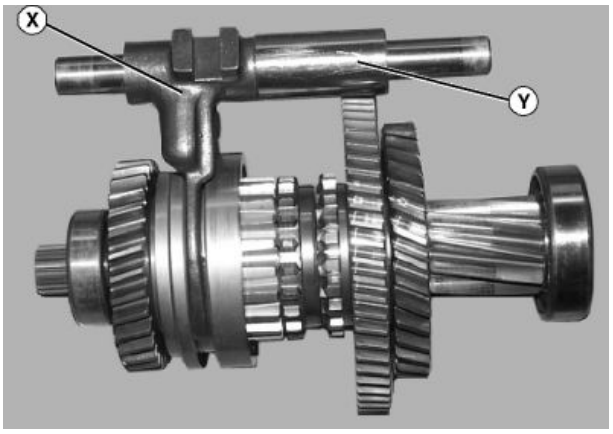
MX52301,0000095 -19-22OCT14-14/43

16. Remove shift fork (X) and spacer (Y).

X—Shift Fork **Y—Spacer**

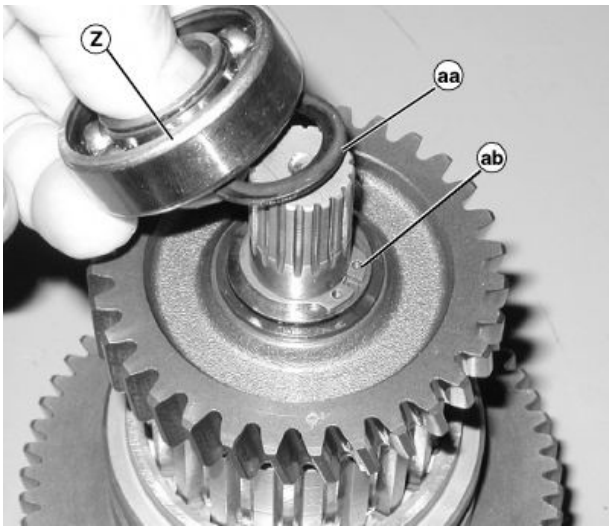


MXT011270 —UN—21MAY14

MX52301,0000095 -19-22OCT14-15/43

17. Remove bearing (Z), washer (aa), and snap ring (ab).

Z—Bearing **ab—Snap Ring**
aa—Washer

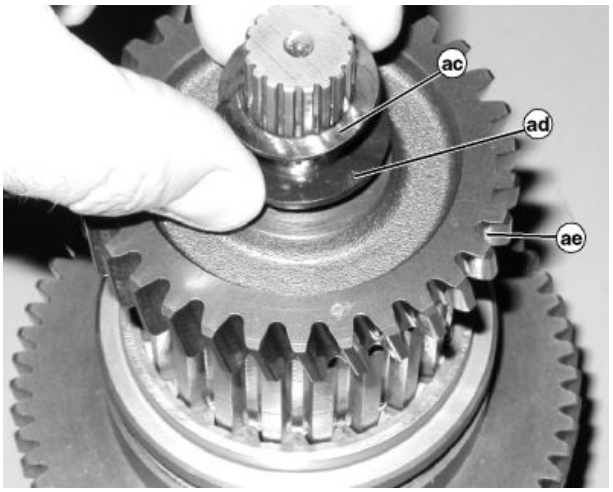


MXT011271 —UN—21MAY14

MX52301,0000095 -19-22OCT14-16/43

18. Remove washer (ac) and thrust washer (ad).
19. Remove reverse gear (ae).

ac—Washer **ae—Reverse Gear**
ad—Thrust Washer



MXT011272 —UN—21MAY14

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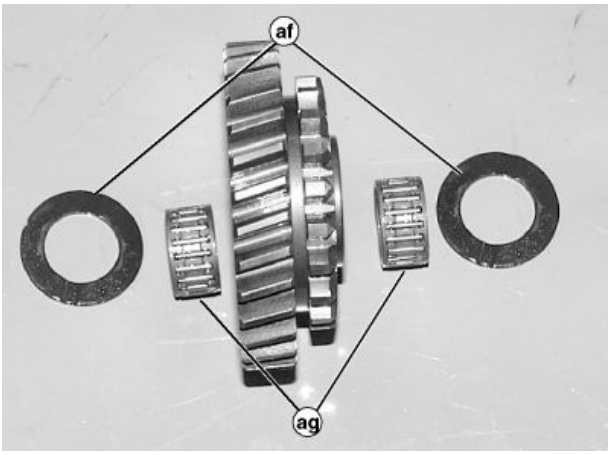
MX52301,0000095 -19-22OCT14-17/43

20. Inspect thrust washers (af) and bearings (ag).

af— Thrust Washers (2 used) **ag— Bearings (2 used)**

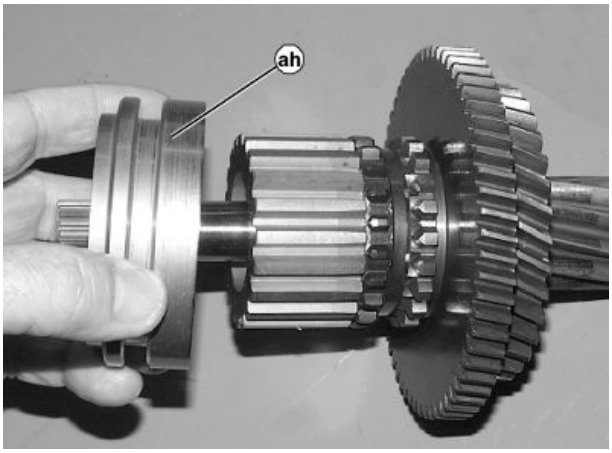


MXT011273 —UN—21MAY14

MX52301,0000095 -19-22OCT14-18/43

21. Remove shift collar (ah).

ah— Shift Collar

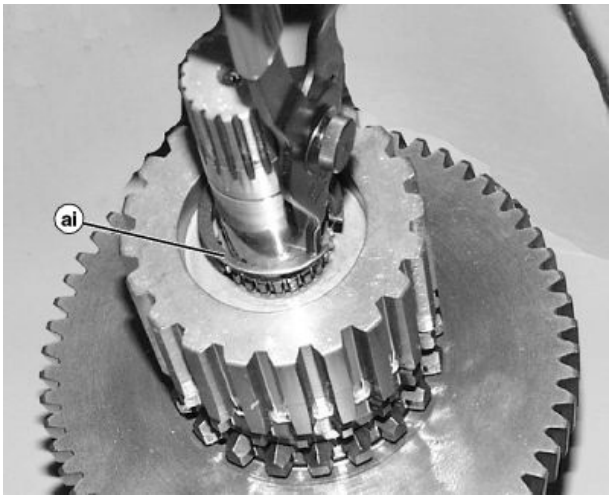


MXT011274 —UN—21MAY14

MX52301,0000095 -19-22OCT14-19/43

22. Remove snap ring (ai).

ai— Snap Ring



MXT011275 —UN—21MAY14

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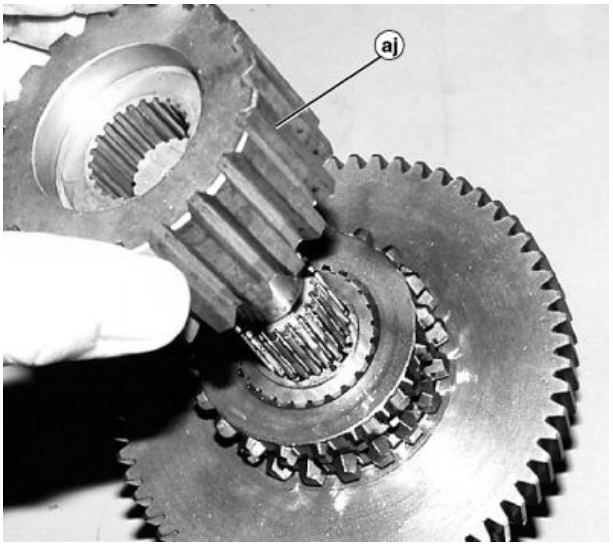
MX52301,0000095 -19-22OCT14-20/43

23. Remove splined collar (aj).

aj— Splined Collar

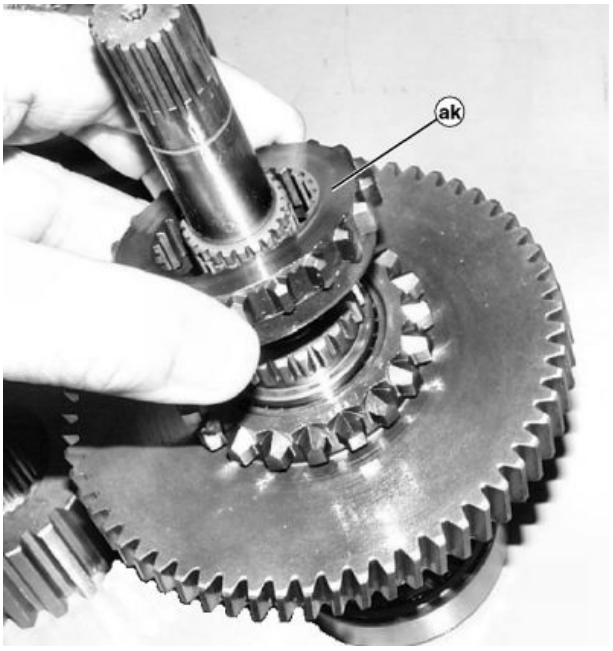


MXT011276 —UN—21MAY14

MX52301,0000095 -19-22OCT14-21/43

24. Remove high gear collar (ak).

ak— High Gear Collar



MXT011277 —UN—21MAY14

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MX52301,0000095 -19-22OCT14-22/43

25. Remove snap ring (al).

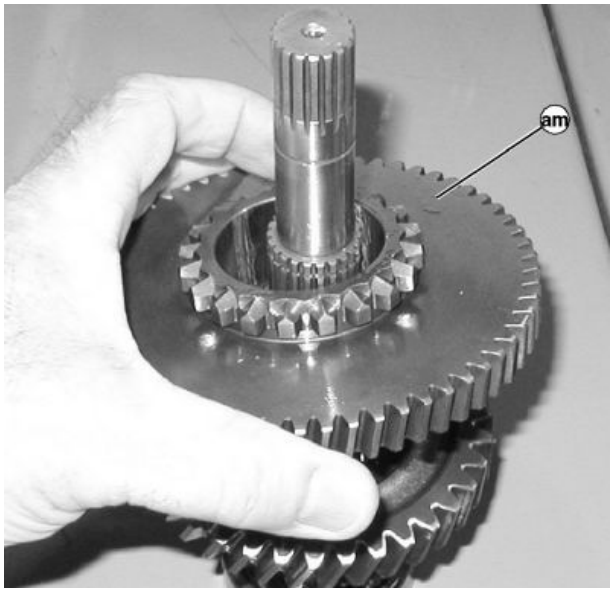
al— Snap Ring

MXT011278 —UN—21MAY14

MX52301,0000095 -19-22OCT14-23/43

26. Remove low gear (am).

am—Low Gear



MXT011279 —UN—21MAY14

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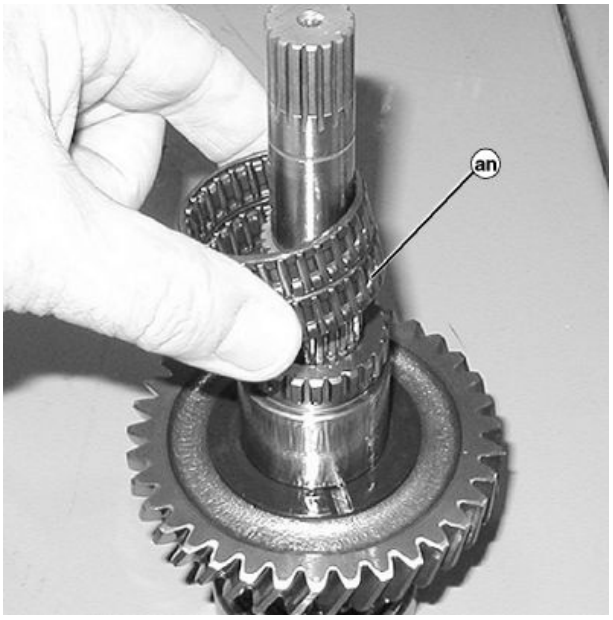
MX52301,0000095 -19-22OCT14-24/43

27. Remove bearings (an).

an— Bearings

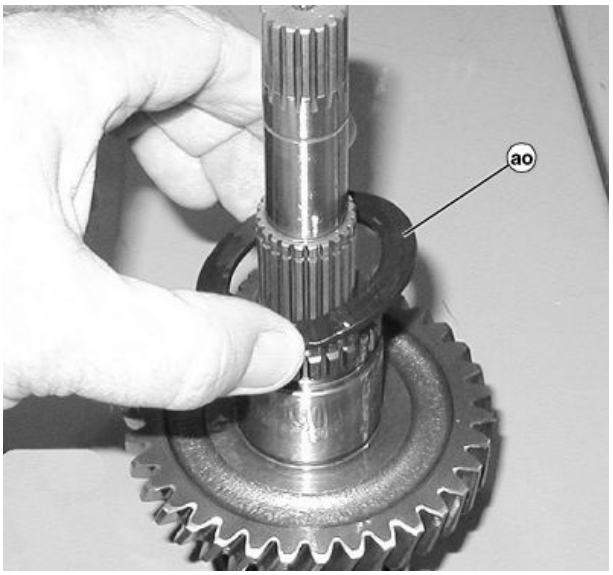


MXT011280 —UN—21MAY14

MX52301,0000095 -19-22OCT14-25/43

28. Remove thrust washer (ao).

ao— Thrust Washer



MXT011281 —UN—21MAY14

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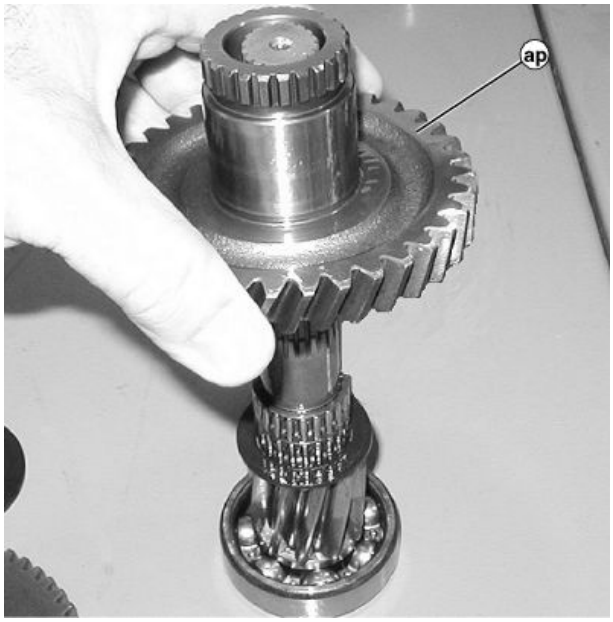
MX52301,0000095 -19-22OCT14-26/43

29. Remove high gear (ap).

ap— High Gear

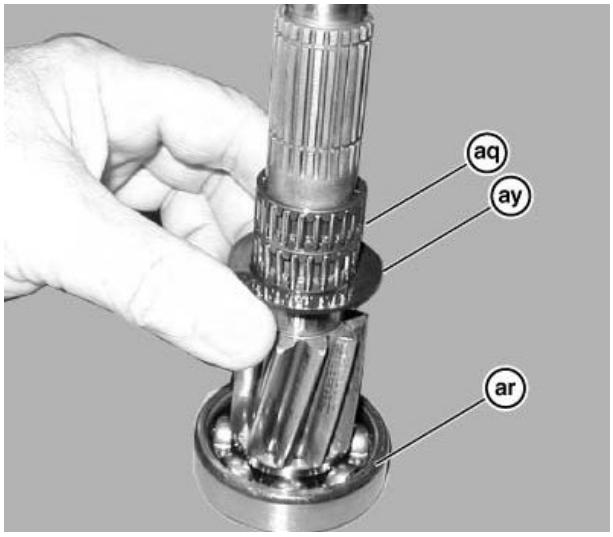


MXT011282 —UN—21MAY14

MX52301,0000095 -19-22OCT14-27/43

30. Remove bearings (aq) and thrust washer (aY).
31. Inspect bearing (ar). If bearing needs replacement, press bearing off shaft.

aq— Bearings
ar— Bearing
ay— Thrust Washer



MXT011283 —UN—21MAY14

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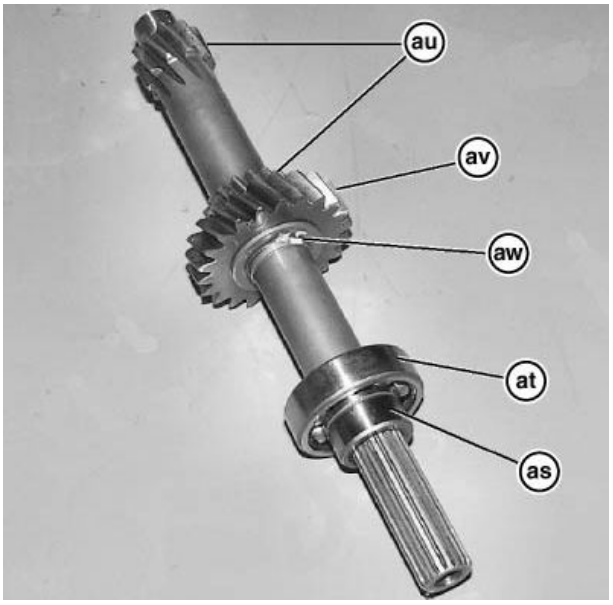
MX52301,0000095 -19-22OCT14-28/43

32. Inspect seal sleeve (as) and bearing (at) for wear or damage. Replace if necessary. Inspect gears (au) and (av) for missing or damaged teeth. Gears (ay) are part of shaft, if damaged replace shaft. Gear (av) can be replaced by removing bearing, seal sleeve, snap ring (aw) and washer. Bearing and seal sleeve can be pressed off together in a press. Do not reuse seal sleeve, rubber seal on inside diameter is damaged whenever sleeve is removed.

as— Seal Sleeve
at— Bearing
au— Gears
av— Gear
aw—Snap Ring



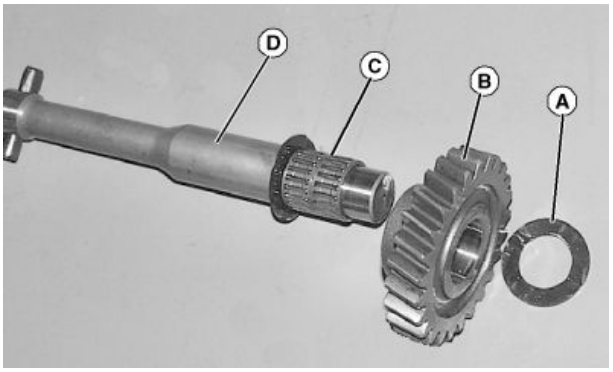
MXT011284 —UN—21MAY14

MX52301,0000095 -19-22OCT14-29/43

Rear Idler Shaft Disassembly:

1. Remove thrust washer (A), reverse idler gear (B), bearings (C), and second thrust washer from reverse idler shaft (D).

A—Thrust Washer
B—Reverse idler Gear
C—Bearings
D—Reverse Idler Shaft



MXT011285 —UN—21MAY14

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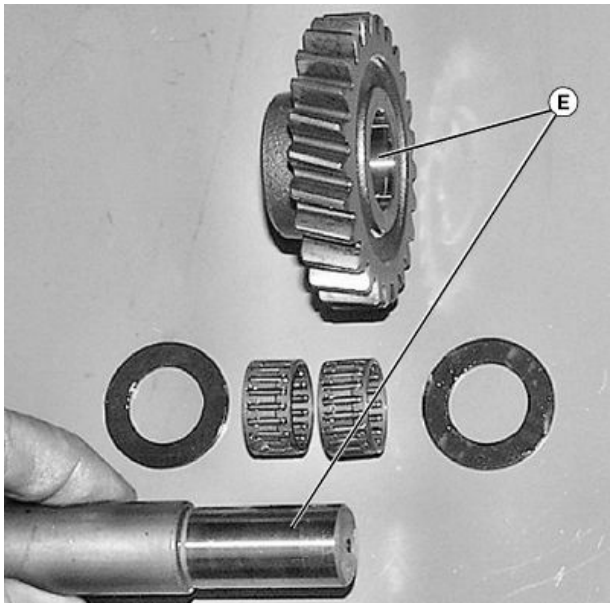
MX52301,0000095 -19-22OCT14-30/43

2. Inspect parts for wear or damage. Bearing race areas on OD of shaft and ID of gear (E) should be smooth with no nicks or scratches. Bearing rollers should be smooth with no discoloration. Replace any worn or damaged parts as needed.

E—Bearing Race areas



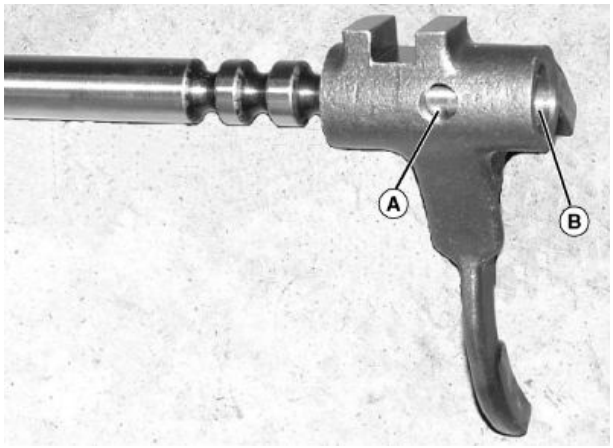
MXT011286 —UN—21MAY14

MX52301,0000095 -19-22OCT14-31/43

Shift Shaft Disassembly:

1. Slide shift fork near end of shaft, but not beyond detent ball hole (A). Cover holes (A and B) with your fingers before shaft is pulled beyond detent ball to avoid loosing ball.

A—Detent Ball Hole **B—Hole**



MXT011287 —UN—21MAY14

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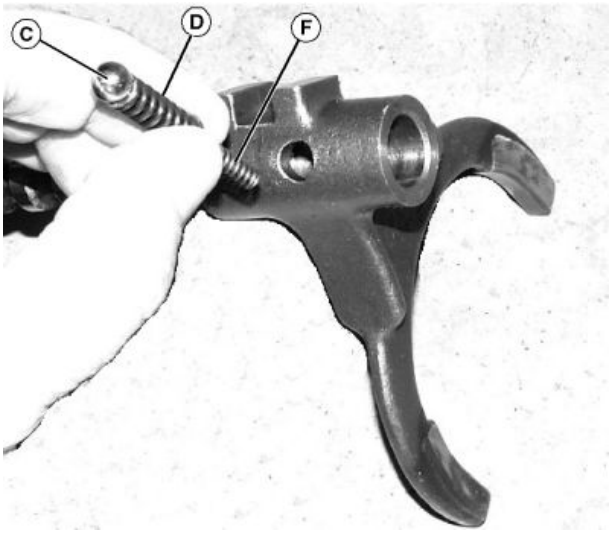
MX52301,0000095 -19-22OCT14-32/43

2. Remove ball (C), outer spring (D), and inner spring (F).
3. Inspect parts for wear or damage. Replace worn or damaged parts.

C—Ball
D—Outer Spring
F—Inner Spring



MXT011288 —UN—21MAY14

MX52301,0000095 -19-22OCT14-33/43

4. When assembling shift fork to shaft, press ball against spring tension with a punch as shown, until shaft is in far enough to hold the detent ball. Then remove the punch and push the shaft in to a detent notch.

MXT011289 —UN—21MAY14

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MX52301,0000095 -19-22OCT14-34/43

Differential Disassembly:

1. Remove 14 cap screws (A).

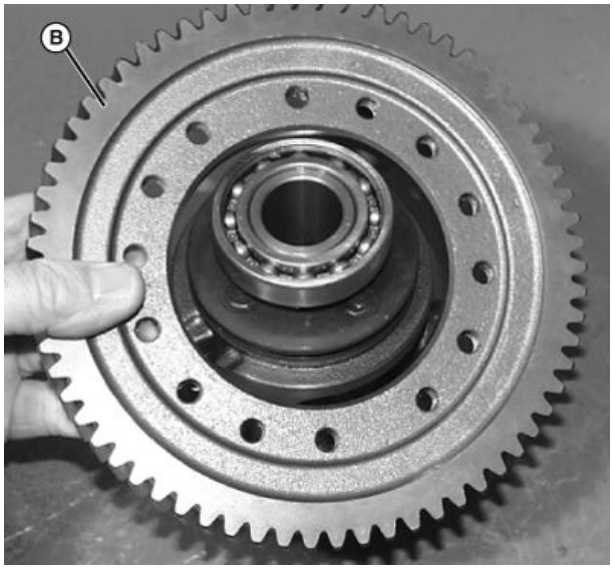
A—Cap Screw

LVAL22004 —UN—11APR12

MX52301,0000095 -19-22OCT14-35/43

2. Remove ring gear (B) from differential case.

B—Ring Gear



LVAL22005 —UN—11APR12

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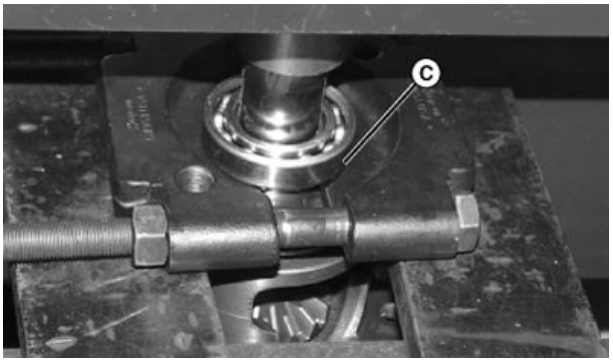
MX52301,0000095 -19-22OCT14-36/43

3. Press bearing (C) off each side of differential case.

C—Bearing

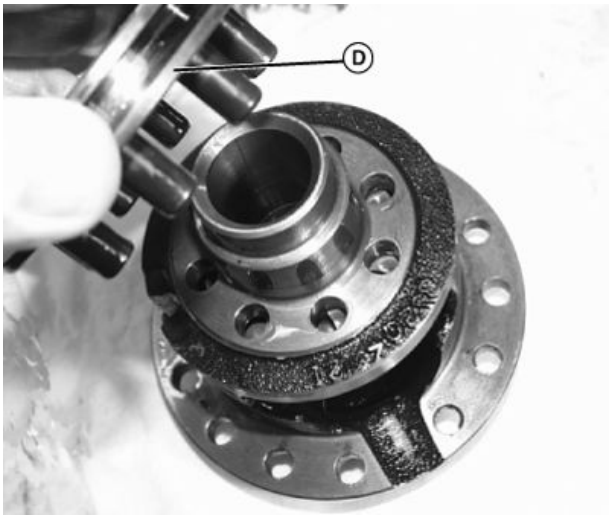


LVAL22006 —UN—11APR12

MX52301,0000095 -19-22OCT14-37/43

4. Remove differential lock slider (D).

D—Differential Lock Slider

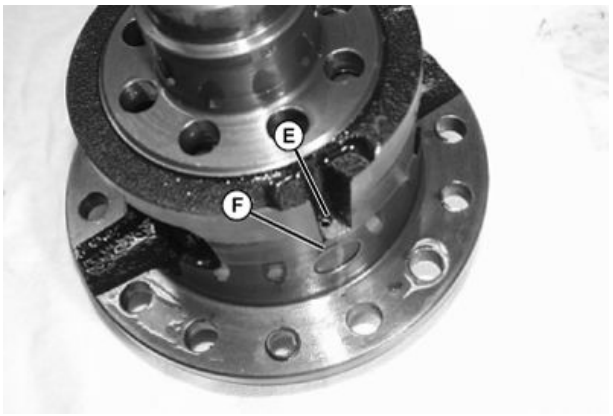


LVAL22007 —UN—11APR12

MX52301,0000095 -19-22OCT14-38/43

5. Drive roll pin (E) into differential case until it is through pinion shaft (F).

E—Roll Pin **F—Pinion Shaft**



LVAL22008 —UN—11APR12

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MX52301,0000095 -19-22OCT14-39/43

6. Remove pinion shaft (F) from case.

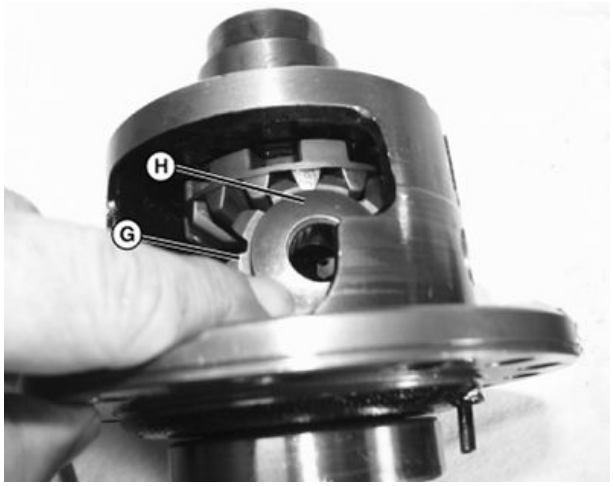
F—Pinion Shaft

LVAL22009 —UN—11APR12

MX52301,0000095 -19-22OCT14-40/43

7. Turn differential gears to line up with openings in case. Remove pinion gears (G) and washers (H).

G—Pinion Gear **H—Washer**

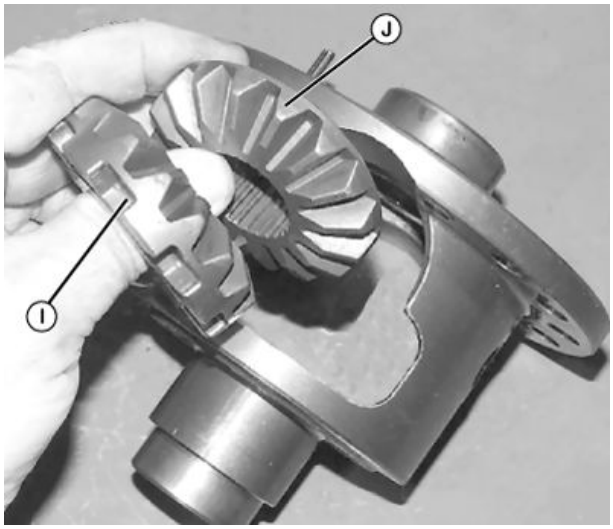


LVAL22010 —UN—11APR12

MX52301,0000095 -19-22OCT14-41/43

8. Remove differential side gears (I and J).

I— Differential Side Gear **J—Differential Side Gear**



LVAL22011 —UN—11APR12

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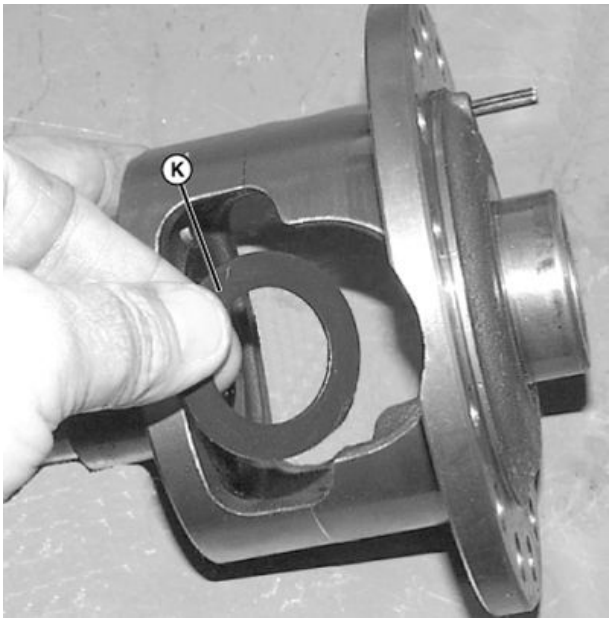
MX52301,0000095 -19-22OCT14-42/43

9. Remove two side gear thrust washers (K) from case.

K—Thrust Washer



LVAL22012 —UN—11APR12

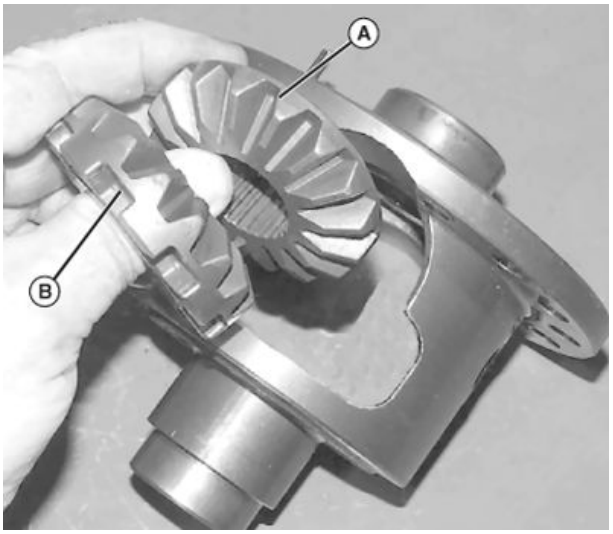
MX52301,0000095 -19-22OCT14-43/43

Transaxle Assembly

Differential Assembly

1. Clean and inspect all parts. Replace any worn or damaged parts.
2. Apply grease to thrust washers to hold them in place during assembly.
3. Install side gear thrust washers into differential case.
4. Install differential side gear (A) first, then side gear (B). Note notches in side gear (B) for differential lock.

A—Differential Side Gear **B—Differential Side Gear**



LVAL22013 —UN—11APR12

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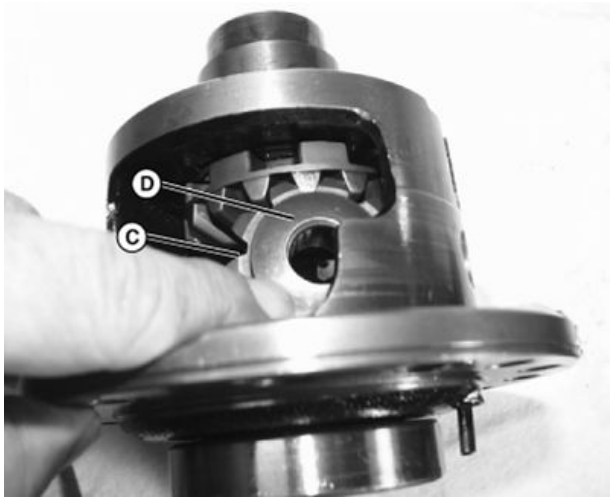
MX52301,0000096 -19-05JUN14-1/19

5. Install the differential pinion gears (C) and washers (D) straight across from each other. Turn gears to align with pinion shaft holes.

C—Differential Pinion Gear **D—Washer**



LVAL22014 —UN—11APR12

MX52301,0000096 -19-05JUN14-2/19

6. Check that thrust washers have not moved out of place and install pinion shaft (F), carefully aligning hole in pinion shaft with hole in differential case. Install roll pin (E).

E—Roll Pin **F—Pinion Shaft**

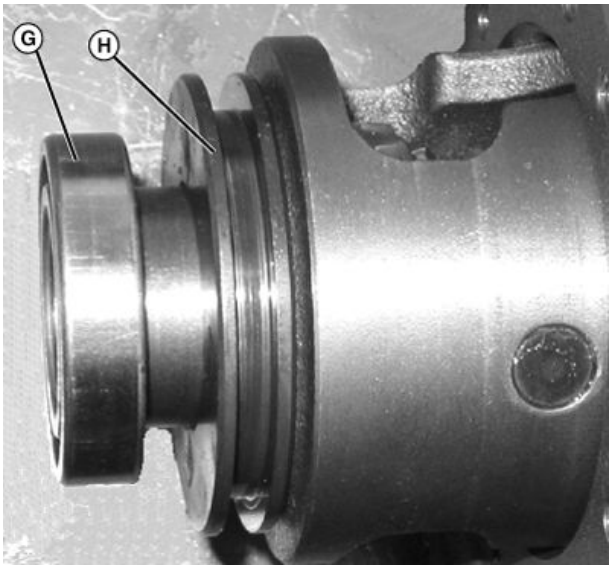
LVAL22015 —UN—11APR12

Continued on next page

MX52301,0000096 -19-05JUN14-3/19

7. Install differential lock slider (H) and bearing (G).

G—Bearing **H—Differential Lock Slider**



LVAL22016 —UN—11APR12

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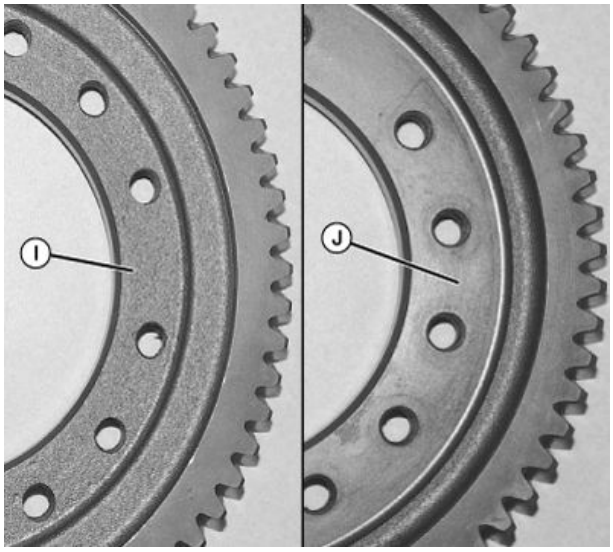
MX52301,0000096 -19-05JUN14-4/19

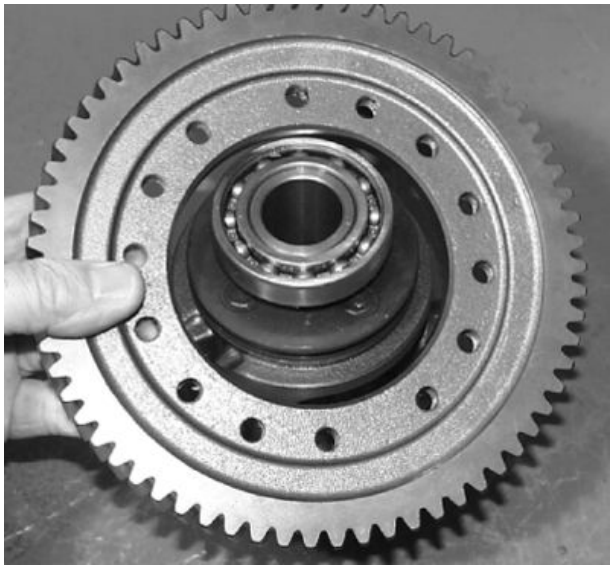
8. Install ring gear with smooth side against differential housing.

I— Rough Side of Ring Gear **J— Machined Side of Ring Gear**



LVAL22017 —UN—11APR12

Note difference in surface on different sides of ring gear Side (I) is rough, side (J) is machined smooth and has a larger diameter flat area.



LVAL22018 —UN—11APR12

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MX52301,0000096 -19-05JUN14-5/19

9. Apply high strength thread locking compound to threads of bolts. Install bolts and tighten in a cross-pattern to specification.

Specification

Ring Gear Bolt—Torque ..... 70—80 N·m (52—59 lb.-ft.)

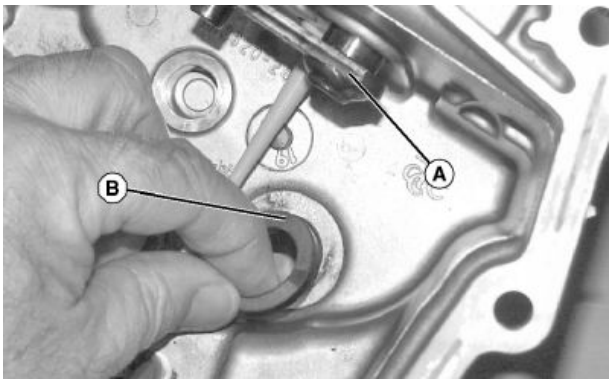
LVAL22019 —UN—11APR12

MX52301,0000096 -19-05JUN14-6/19

Assembly:

1. Clean and inspect all parts. Replace any worn or damaged parts.
2. Lubricate and install shift arm (A) into transaxle case. Apply some grease to differential lock shaft washer (B) and position over hole.

A—Shift Arm **B—Washer**

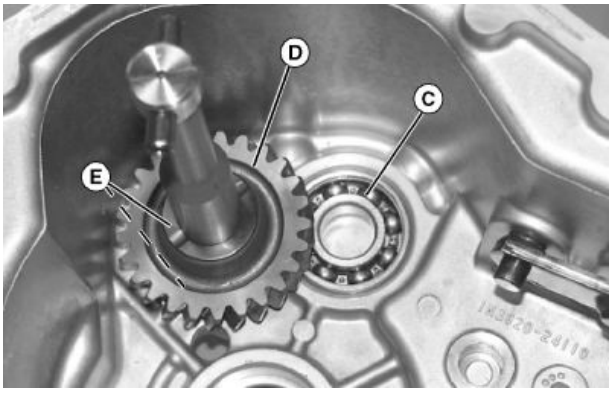


MXT011290 —UN—21MAY14

MX52301,0000096 -19-05JUN14-7/19

3. Install bearing (C) and reverse idler shaft assembly. Reverse idler gear (D) is installed with raised side of hub toward you and thrust washers (E) on each side.

C—Bearing **E—Thrust Washer**
D—Reverse Idler Gear



MXT011291 —UN—21MAY14

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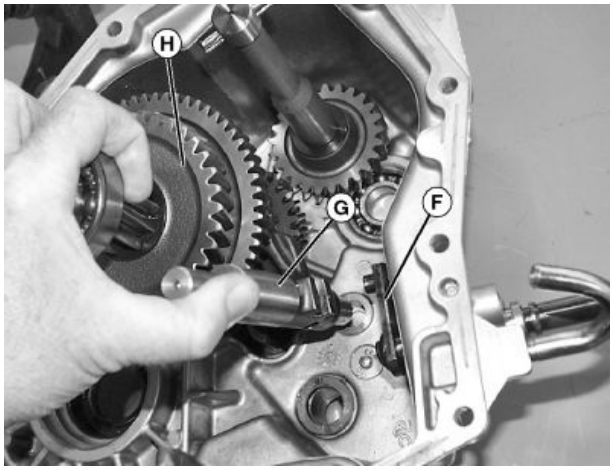
MX52301,0000096 -19-05JUN14-8/19

4. Make sure shift arm (F) is up against case. Engage the fork on shift shaft (G) into the shift collar on reduction shaft (H). Hold (G and H) together and slide them into position together.

F—Shift Arm
G—Shift Shaft
H—Reduction Shaft

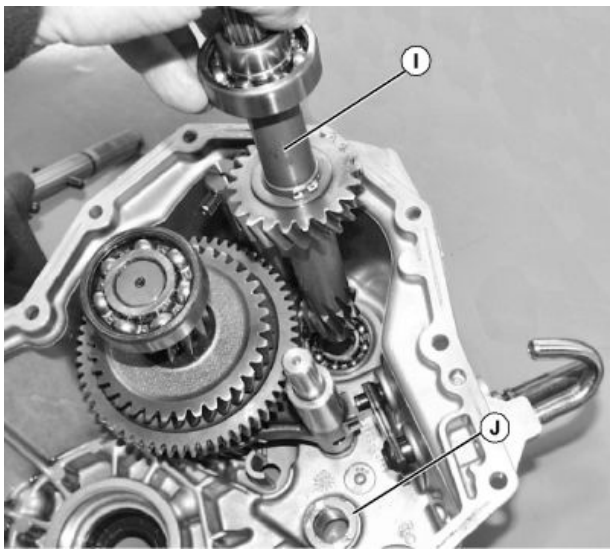


MXT011292 —UN—21MAY14

MX52301,0000096 -19-05JUN14-9/19

5. Install input shaft (I). Install washer (J) if not already installed.

I— Input Shaft
J—Washer



MXT011293 —UN—21MAY14

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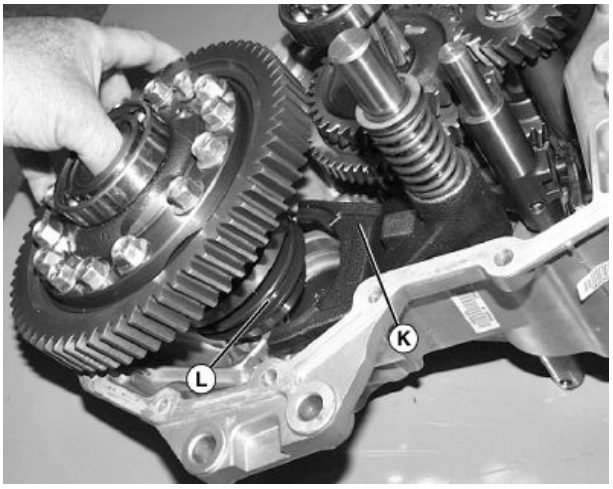
MX52301,0000096 -19-05JUN14-10/19

6. Install differential lock fork and shaft (K) into case. Leave fork up far enough to engage fork into groove of differential lock collar (L). Slide fork shaft and differential down together until differential bearing is seated in bearing bore.

K—Differential Lock Fork and Shaft **L—Differential Lock Collar**

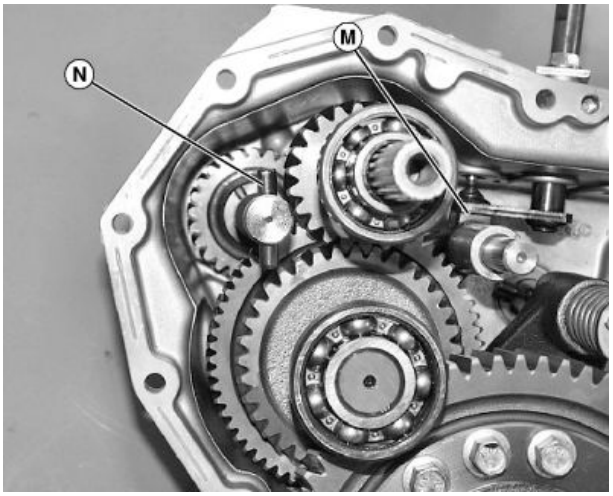


MXT011294 —UN—21MAY14

MX52301,0000096 -19-05JUN14-11/19

7. Engage the shift arm into the slot in the shift fork (M). Position roll pin (N) in reverse idler shaft as shown so it aligns with slot in other half of transmission case.

M—Shift Fork **N—Roll Pin**

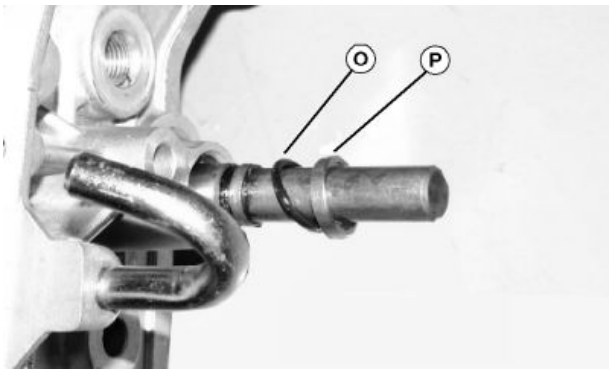


MXT011295 —UN—21MAY14

MX52301,0000096 -19-05JUN14-12/19

8. Lubricate and install the O-ring (O) and spacer (P) into the recess in the transaxle case.

O—O-ring **P—Spacer**



MXT011296 —UN—21MAY14

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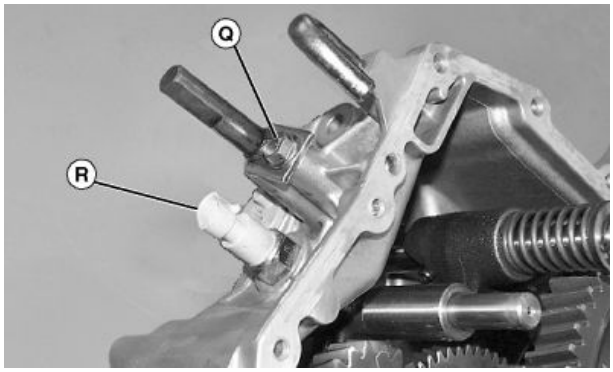
MX52301,0000096 -19-05JUN14-13/19

9. Install the keeper plate and cap screw (Q), and neutral switch (R).

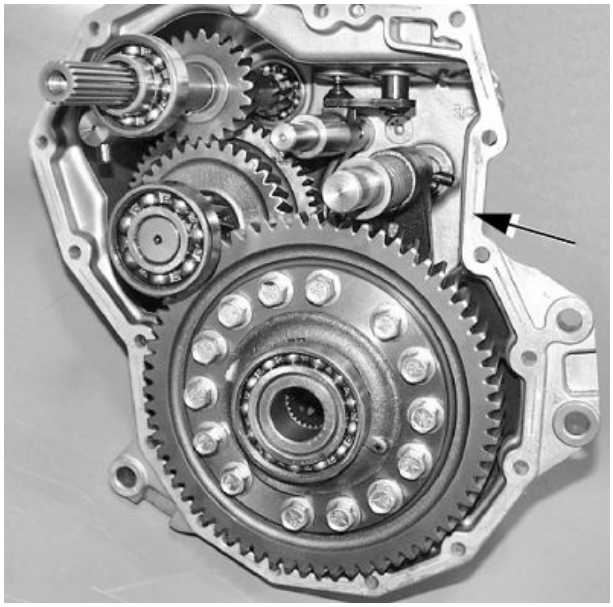
Q—Cap Screw **R—Neutral Switch**



MXT011297 —UN—21MAY14

MX52301,0000096 -19-05JUN14-14/19

10. Make sure that gasket surfaces are clean. Install new input shaft and axle shaft seals. Apply a thin bead of John DeereTY16021 form in place gasket around mating surfaces of transmission case. Assemble case halves.

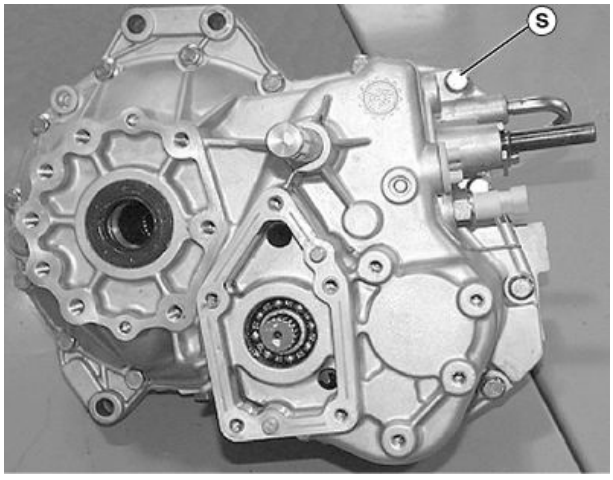


MXT011298 —UN—21MAY14

MX52301,0000096 -19-05JUN14-15/19

11. Install 16 cap screws (S) to transaxle case.

S—Cap Screws (16 used)



MXT011299 —UN—21MAY14

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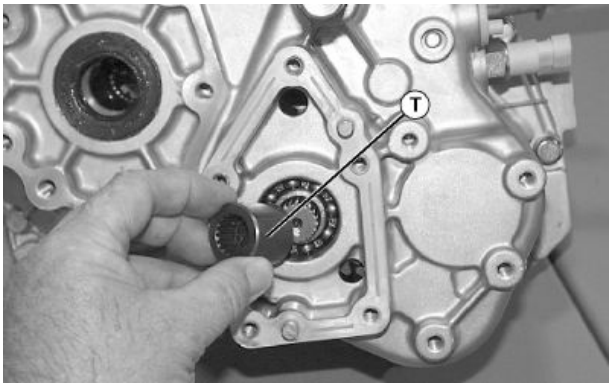
MX52301,0000096 -19-05JUN14-16/19

12. Install splined collar (T) MFWD machines only.

T—Splined Collar

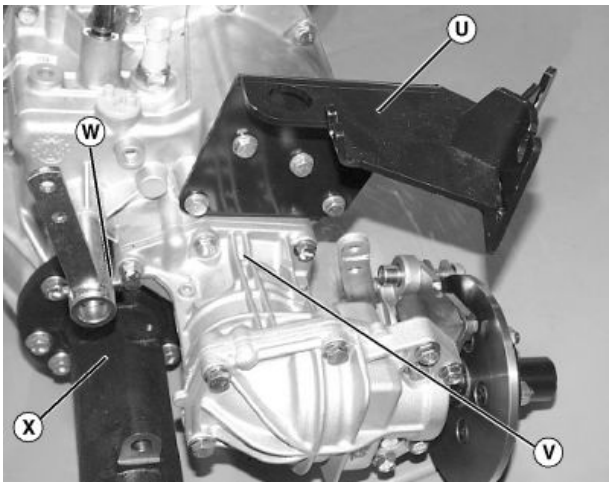


MXT011300 —UN—21MAY14

MX52301,0000096 -19-05JUN14-17/19

13. Install cable support bracket (U), front drive bevel gearbox (V) MFWD only, differential lock lever (W), and right axle housing (X).

U—Support Bracket
V—Bevel Gear Box
W—Differential Lock Lever
X—Right Axle Housing



MXT011301 —UN—21MAY14

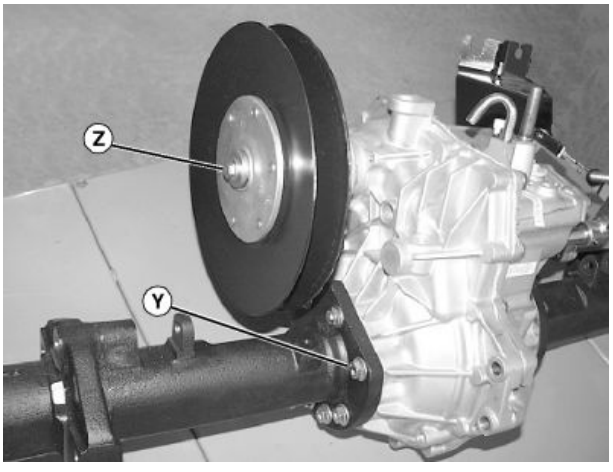
MX52301,0000096 -19-05JUN14-18/19

14. Install axle (Y) housing to left side of transaxle. Install driven clutch and secure with cap screw and washer (Z). Tighten cap screw to specification.

Specification

Driven Clutch to Transaxle Cap Screw—Torque.....73 N·m (53 lb.-ft.)

Y—Axle
Z—Washer



MXT011302 —UN—21MAY14

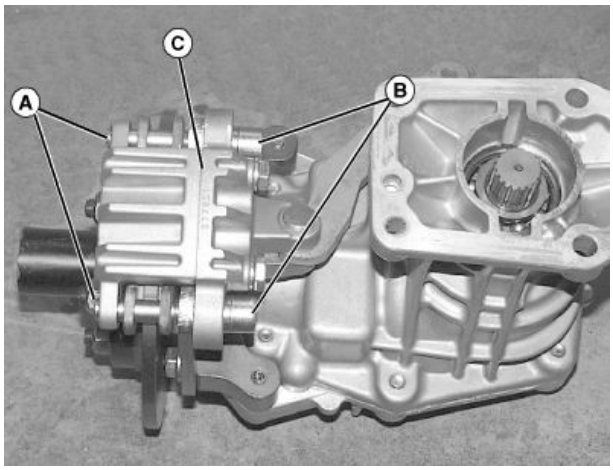
MX52301,0000096 -19-05JUN14-19/19

Front Drive Gearbox Disassembly and Assembly

Disassembly:

1. Remove C clips (A) and then anchor bolts (B) to remove park brake caliper (C).

A—C Clips
B—Anchor Bolts
C—Park Brake Caliper

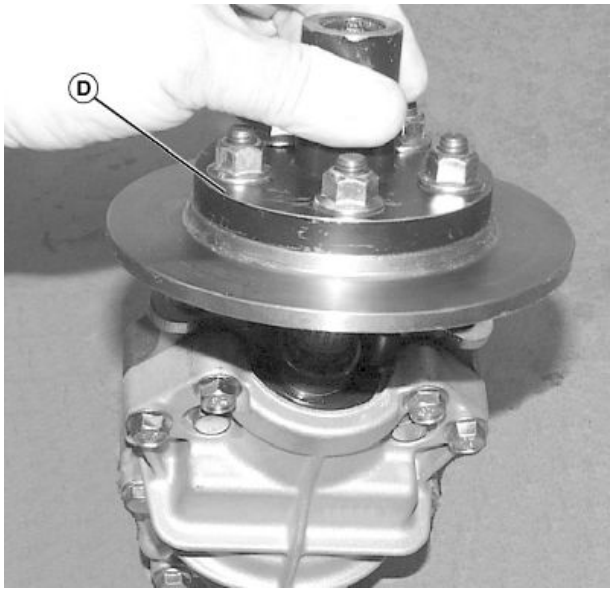


MXT011303 —UN—21MAY14

MX52301,0000097 -19-05JUN14-1/29

2. Remove brake rotor and drive hub assembly (D).

D—Drive Hub Assembly



MXT011304 —UN—21MAY14

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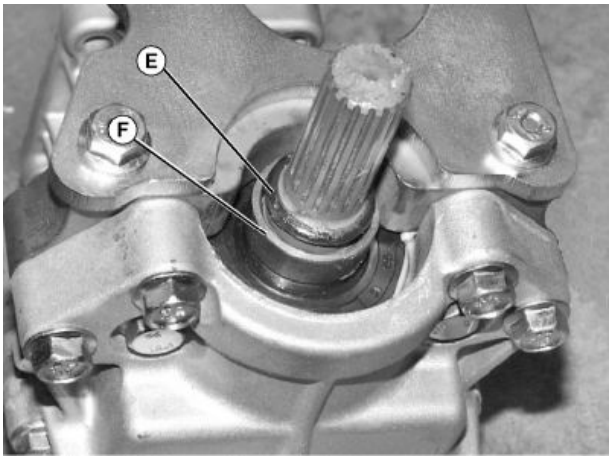
MX52301,0000097 -19-05JUN14-2/29

3. Remove O-ring (E) and spacer (F).

E—O-ring **F—Spacer**

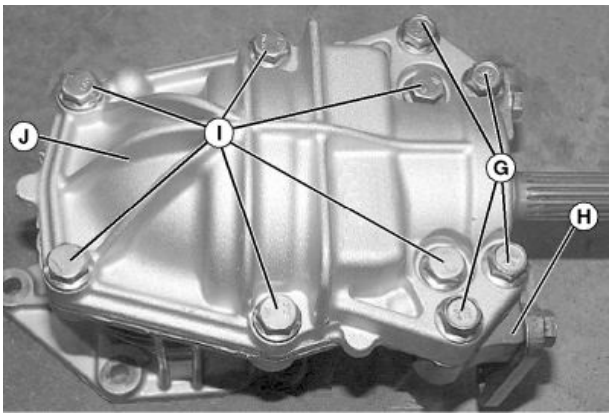


MXT011305 —UN—21MAY14

MX52301,0000097 -19-05JUN14-3/29

4. Remove four cap screws (G) securing park brake anchor assembly (H) and remove assembly (H).
5. Remove six cap screws (I) and cover (J).

G—Cap Screws **I— Cap Screws (6 used)**
H—Park Brake Anchor Assembly **J—Cover**



MXT011306 —UN—21MAY14

MX52301,0000097 -19-05JUN14-4/29

6. Remove output shaft assembly (K).

K—Shaft Assembly

MXT011307 —UN—21MAY14

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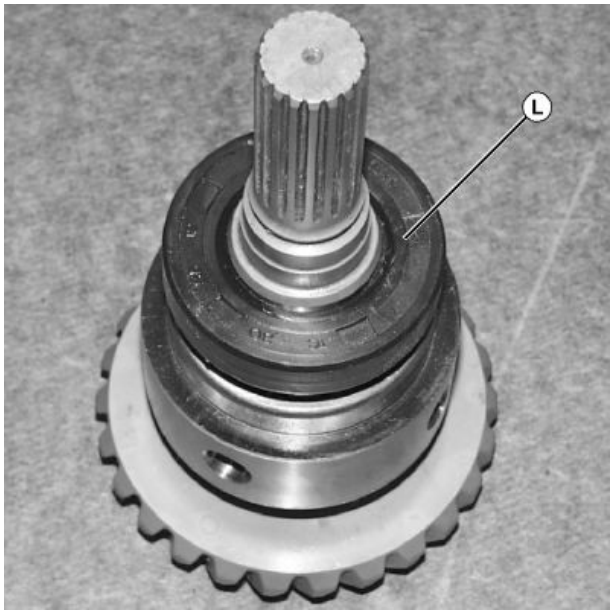
MX52301,0000097 -19-05JUN14-5/29

7. Remove oil seal (L).

L—Oil Seal

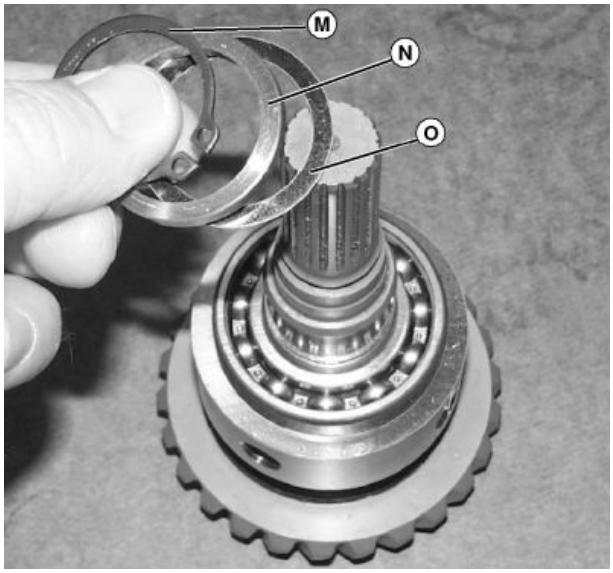


MXT011308 —UN—21MAY14

MX52301,0000097 -19-05JUN14-6/29

8. Remove snap ring (M), spacer, (N) and shims (O).

M—Snap Ring
N—Spacer
O—Shims



MXT011309 —UN—21MAY14

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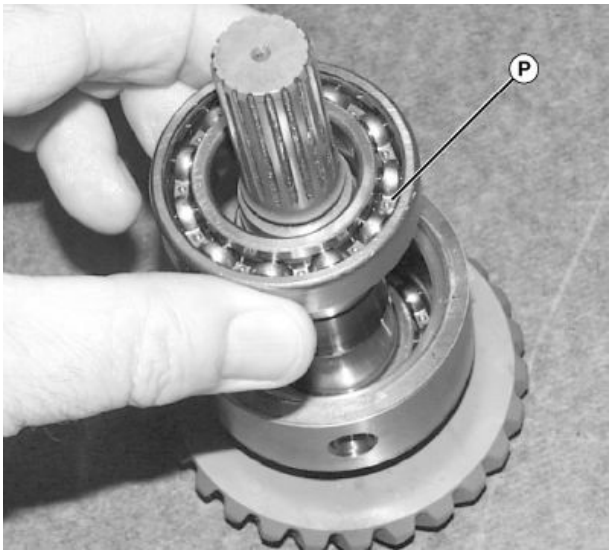
MX52301,0000097 -19-05JUN14-7/29

9. Remove bearing (P).

P—Bearing

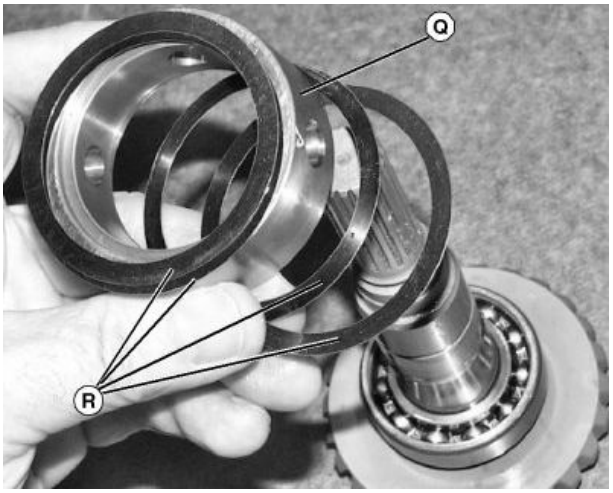


MXT011310 —UN—21MAY14

MX52301,0000097 -19-05JUN14-8/29

10. Remove collar (Q) and shims (R). Note position and number of shims. Shims must be installed their original positions.

Q—Collar **R—Shims**



MXT011311 —UN—22MAY14

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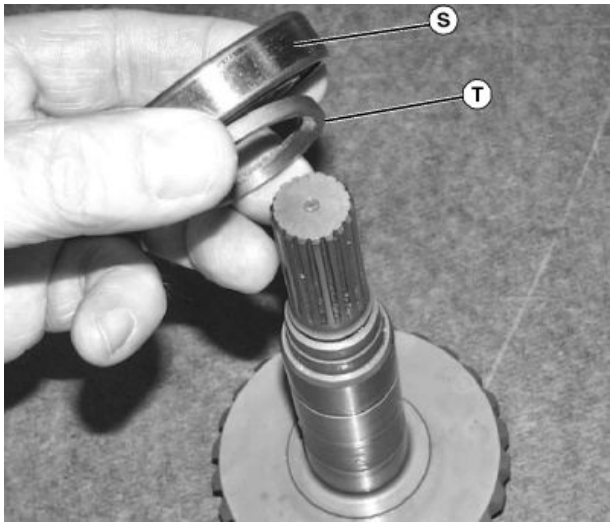
MX52301,0000097 -19-05JUN14-9/29

11. Remove bearing (S) and washer (T). Make sure that washer (T) has bevel that goes toward gear.

S—Bearing **T—Washer**

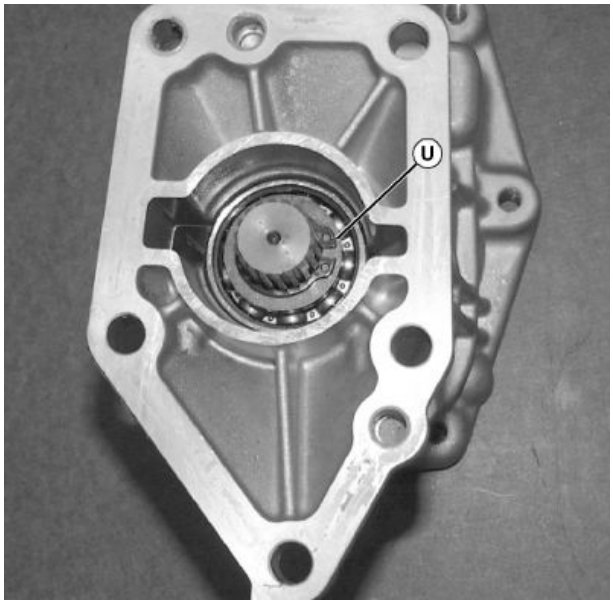


MXT011312 —UN—21MAY14

MX52301,0000097 -19-05JUN14-10/29

12. Remove snap ring (U).

U—Snap Ring



MXT011313 —UN—21MAY14

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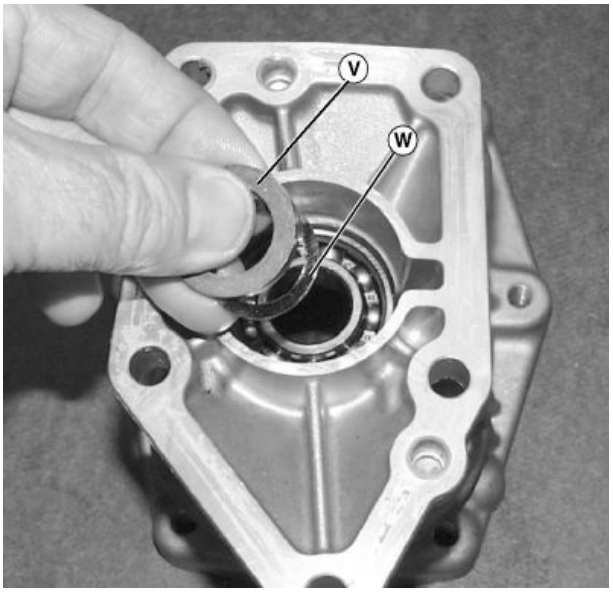
MX52301,0000097 -19-05JUN14-11/29

13. Remove spacer (V) and shims (W).

V—Spacer **W—Shims**

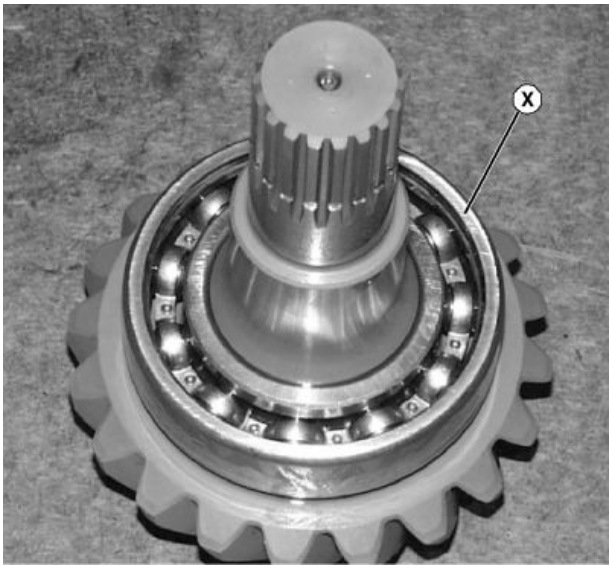


MXT011314 —UN—21MAY14

MX52301,0000097 -19-05JUN14-12/29

14. Inspect bearing (X). If bearing needs replacement, remove with a bearing puller or press.

X—Bearing



MXT011315 —UN—21MAY14

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MX52301,0000097 -19-05JUN14-13/29

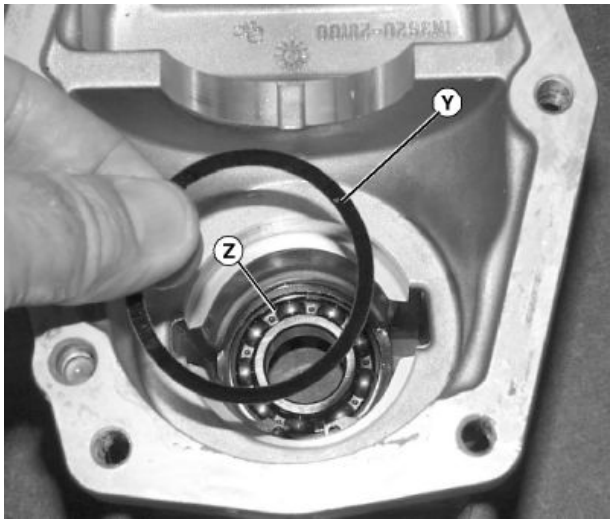
15. Remove shims (Y) and retain for possible re use during assembly.
16. Inspect bearing (Z). Replace bearing if necessary.

Assembly

NOTE: If reusing original gears and housings, install shims in original locations and check backlash. If housings or gearset have been changed, assemble gearbox using following procedure.

1. Clean and inspect all parts. Replace any worn or damaged parts. Clean all old gasket material from mating surfaces.

Y—Shimss **Z—Bearing**

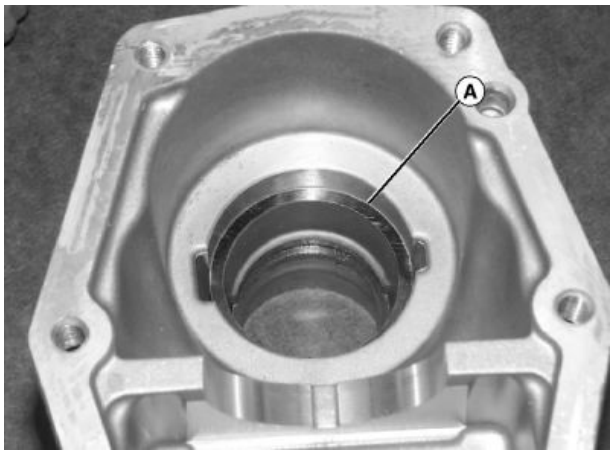


MXT011316 —UN—21MAY14

MX52301,0000097 -19-05JUN14-14/29

2. Install original shim (A) into bearing bore.

A—Shims



MXT011317 —UN—21MAY14

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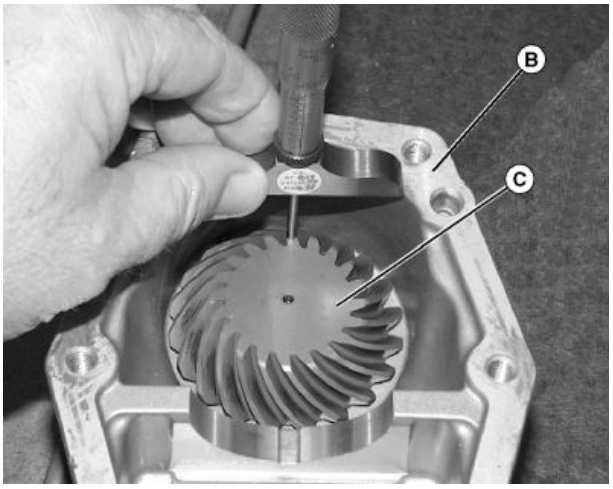
MX52301,0000097 -19-05JUN14-15/29

3. Install gear and bearing into housing. Use a depth micrometer and check distance between top of housing (B) and flat face of gear (C) as shown. Dimension should be to specification.

Specification

Housing to Gear—Gap.....28.05—29.05 mm (1.140—1.144 in.)

B—Top of Housing **C—Gear Face**

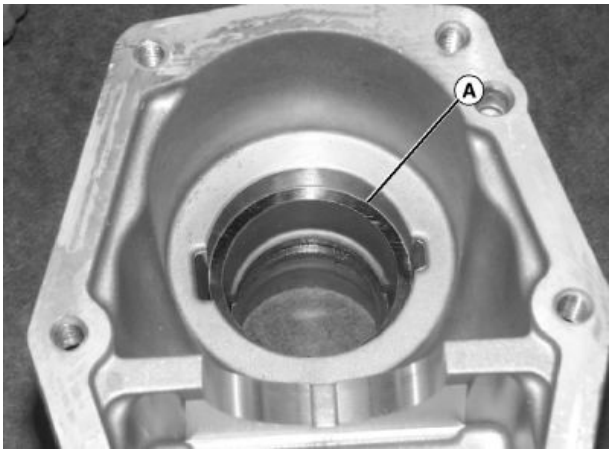


MXT011318 —UN—21MAY14

MX52301,0000097 -19-05JUN14-16/29

4. If dimension is not to specification, add, or remove shims (A) until correct dimension is obtained.

A—Shims

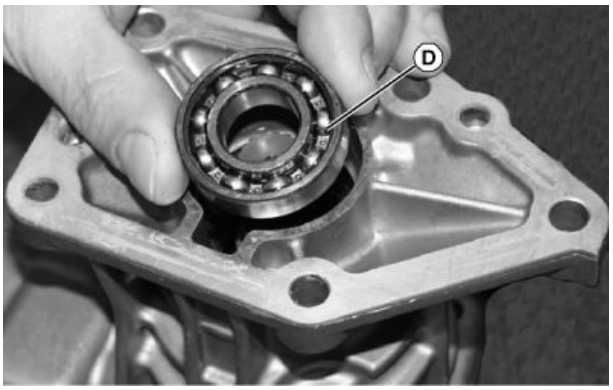


MXT011317 —UN—21MAY14

MX52301,0000097 -19-05JUN14-17/29

5. Install bearing (D).

D—Bearing



MXT011320 —UN—21MAY14

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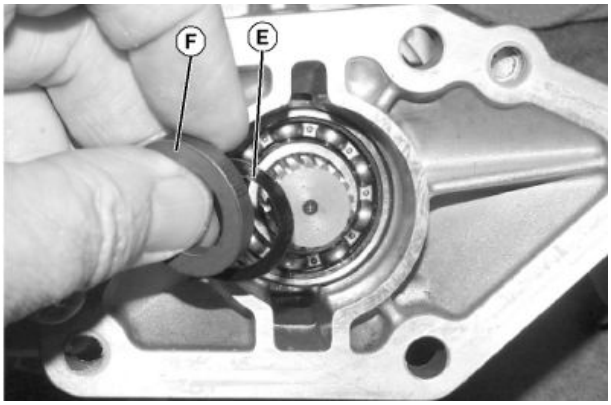
MX52301,0000097 -19-05JUN14-18/29

6. Install shims (E), spacer (F), and the snap ring.

E—Shims **F—Spacer**



MXT011321 —UN—21MAY14

MX52301,0000097 -19-05JUN14-19/29

7. Measure shaft end play. End play should be less than 0.05 mm (0.002 in.). To adjust end play, remove snap ring and washer and add or remove shims until proper end play is obtained.

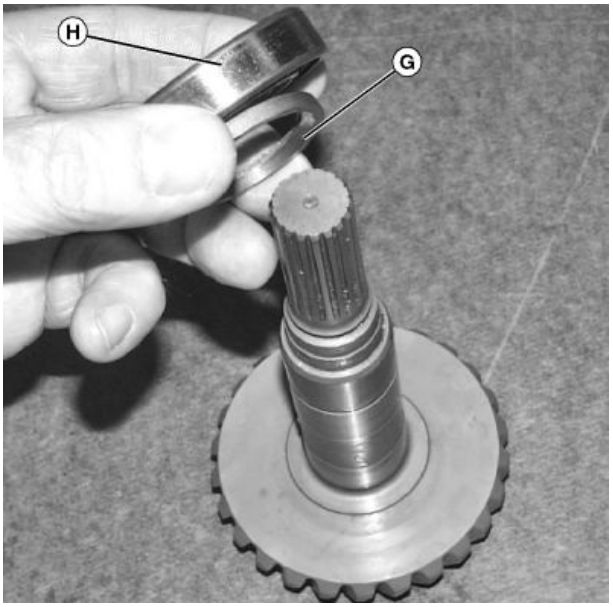
MXT011613 —UN—05JUN14

Continued on next page

MX52301,0000097 -19-05JUN14-20/29

8. Install spacer with chamfer (G) toward gear. Install bearing (H).

G—Spacer Chamfer **H—Bearing**

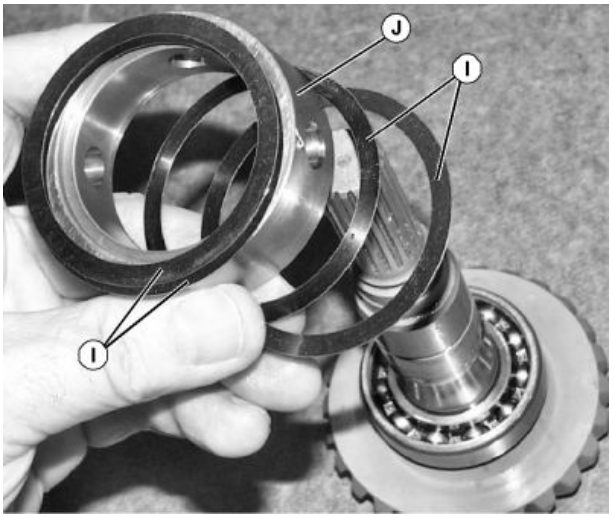


MXT011323 —UN—21MAY14

MX52301,0000097 -19-05JUN14-21/29

9. Install original shims (I) and spacer (J) onto shaft and bearing. If original shim thickness is unknown or you are using new gears or case, start with 0.5 mm (0.020 in.) shim.

I— Original Shims **K—Gear and shaft**
J— Collar **L—Gear**



MXT011324 —UN—21MAY14

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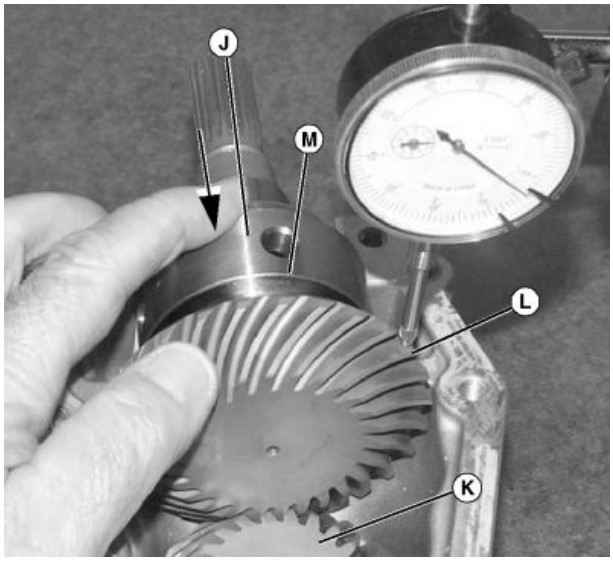
MX52301,0000097 -19-05JUN14-22/29

10. Push collar (J) in direction of arrow. Hold gear and shaft (K) from moving. Turn gear (L) back and forth. Measure backlash on dial indicator. Backlash should be 0.2—0.3 mm (0.008—0.012 in.) If backlash is not within specification, adjust thickness of shims (M). Adding shims decreases backlash, removing shims increases backlash.

J— Collar
M—Shims

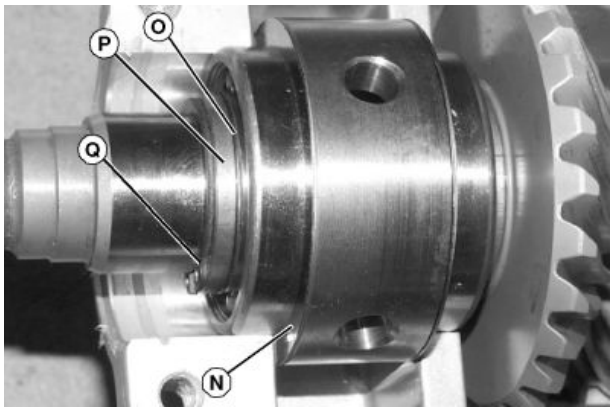


MXT011325 —UN—21MAY14

MX52301,0000097 -19-05JUN14-23/29

11. Place shims (N) on other side of collar until the collar has no end play.
12. Install shims (O), spacer (P), and snap ring (Q).

N—Collar Side Shims
O—Spacer Side Shims
P—Spacer
Q—Snap ring



MXT011326 —UN—21MAY14

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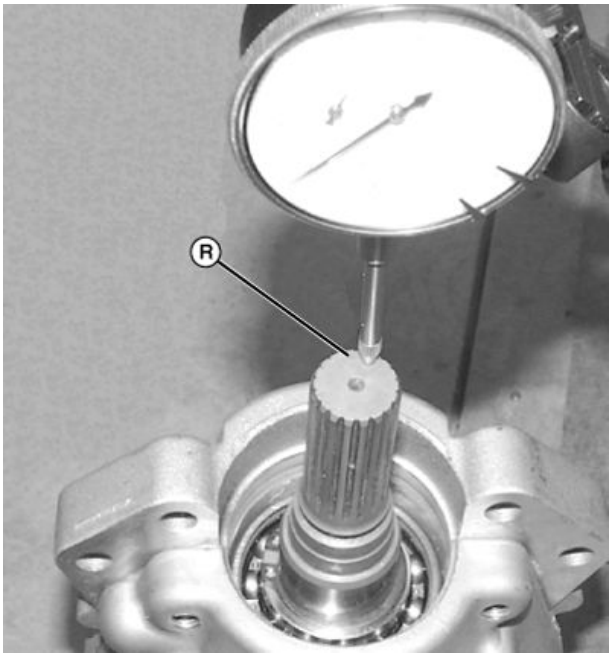
MX52301,0000097 -19-05JUN14-24/29

13. Apply a thin bead of form in place gasket around mating surfaces of case halves. Assemble case and check end play of shaft (R) with dial indicator. End play should be to specification.

Specification

Front Gearbox
Maximum—End Play..... 0.05 mm (0.002 in.)

R—Shaft

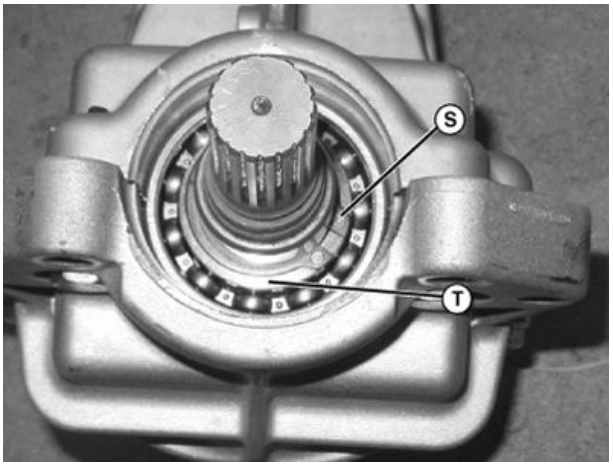


LVAL22061 —UN—11APR12

MX52301,0000097 -19-05JUN14-25/29

14. If shaft end play is not to specification, remove snap ring (S) and spacer (T). Add or remove shims under spacer until end play is correct.
15. Install the seal with an appropriate seal driver.

S—Snap Ring **T—Spacer**



LVAL22062 —UN—11APR12

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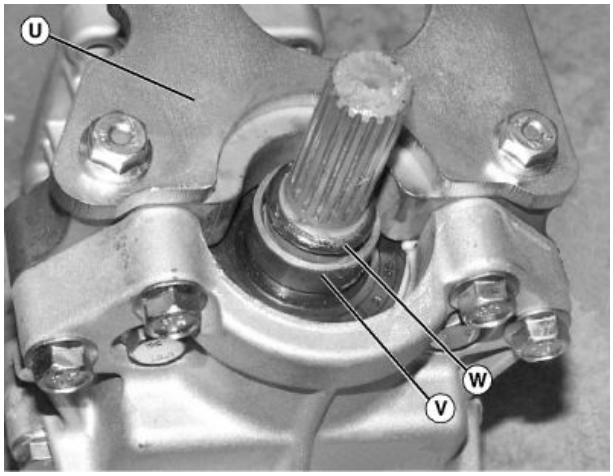
MX52301,0000097 -19-05JUN14-26/29

16. Install the parking brake bracket (U), spacer (V), and O-ring (W).

U—Parking Brake Bracket
V—Spacer
W—O-ring

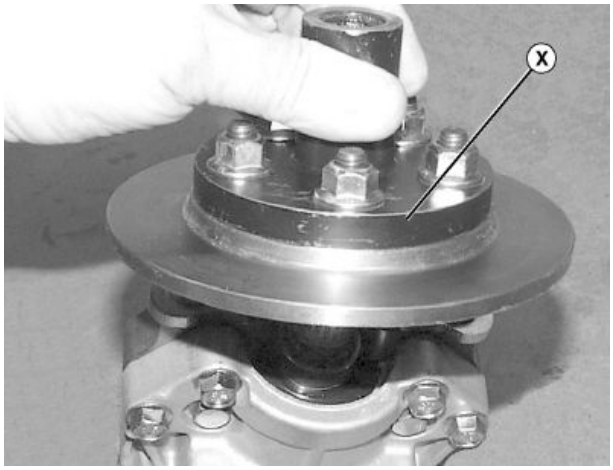


MXT011327 —UN—21MAY14

MX52301,0000097 -19-05JUN14-27/29

17. Install park brake rotor and hub assembly (X).

X—Park Brake Rotor and Hub Assembly
Y—Socket Head Bolts

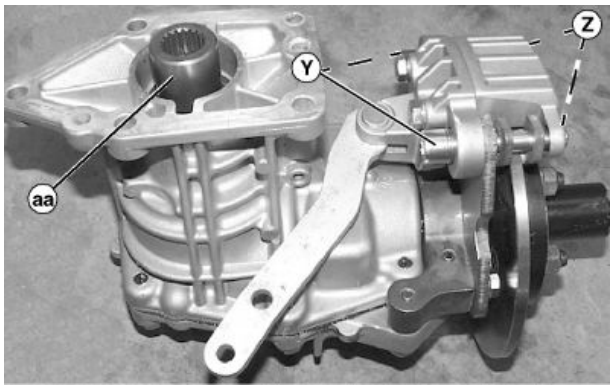


MXT011328 —UN—21MAY14

MX52301,0000097 -19-05JUN14-28/29

18. Install park brake caliper with socket head bolts (Y). Install C clips (Z) on end of bolts. Make sure splined coupling (aa) is either on gearbox or transaxle before installing gearbox.

Z—C Clips
aa— Splined Coupling



MXT011329 —UN—21MAY14

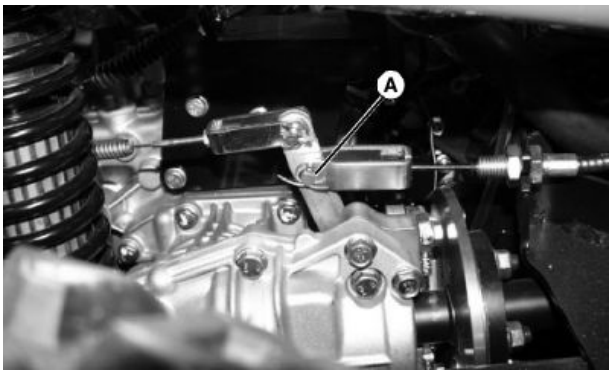
MX52301,0000097 -19-05JUN14-29/29

MFWD Driveshaft Removal and Installation (SN -040000)

NOTE: Engine removed for clarity in photos.

Removal

1. Park machine safely. See the “Safety Section”.
2. Raise and lock cargo box
3. Block wheels to prevent movement.
4. Unlock park brake.
5. Remove cotter pin from park brake actuator pivot pin.



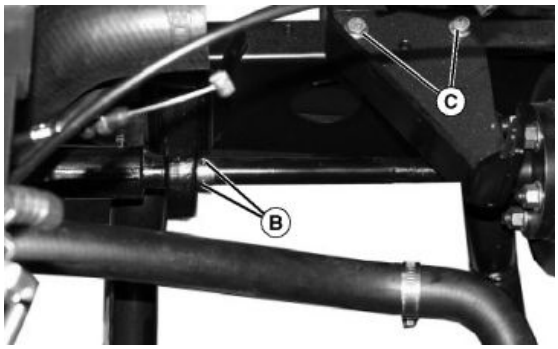
MXT011330 —UN—21MAY14

A—Pivot Pin

MX52301,0000098 -19-24OCT14-1/7

6. Loosen two set screws (B) on drive shaft near yoke.

B—Set Screws (2 used)

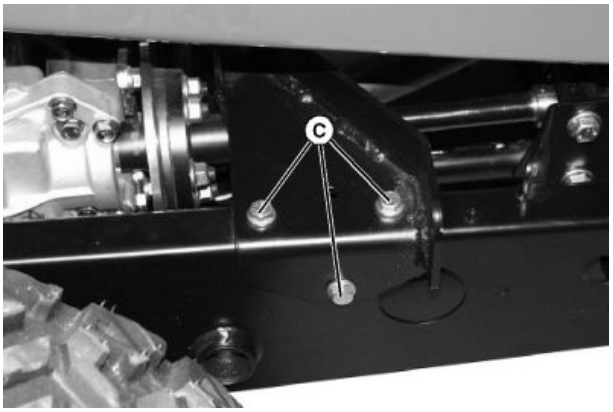


MXT011331 —UN—21MAY14

MX52301,0000098 -19-24OCT14-2/7

7. Remove three bolts (C) securing park brake cable.

C—Bolts (3 used)



MXT011332 —UN—21MAY14

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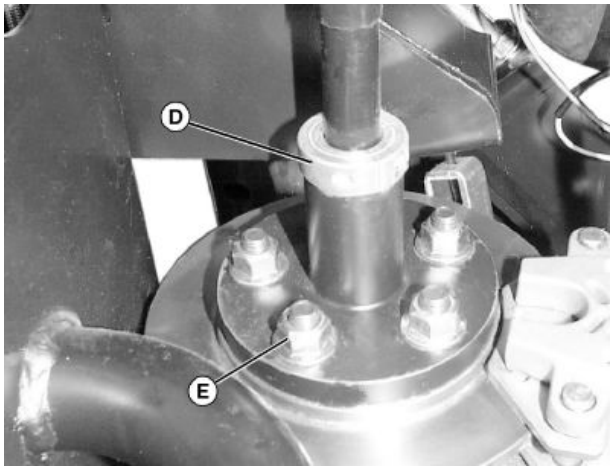
MX52301,0000098 -19-24OCT14-3/7

8. Loosen screws in collar (D) and slide collar forward on drive shaft.
9. Remove five nuts (E) securing drive shaft collar plate to park brake disk.

D—Collar **E—Nuts (5 used)**



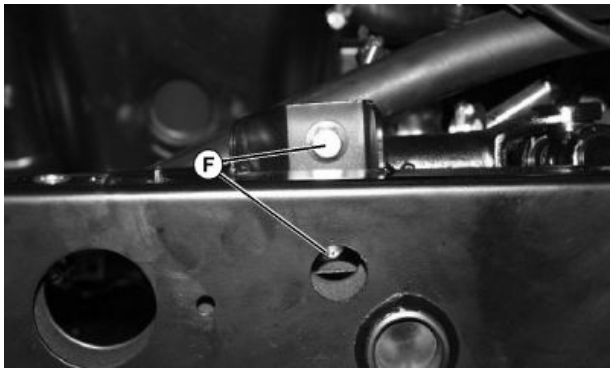
MXT011333 —UN—21MAY14

Picture Note: Shown from bottom.

MX52301,0000098 -19-24OCT14-4/7

10. Remove two bolts (F) securing rear drive shaft cast support bearing to frame.

F—Bolts (2 used)

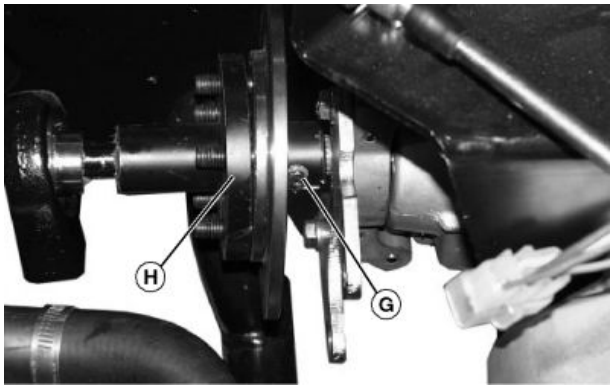


MXT011334 —UN—21MAY14

MX52301,0000098 -19-24OCT14-5/7

11. Remove grease fitting (G) from drive shaft collar.
12. Using a pry bar, carefully separate drive shaft collar (H) from brake disk.

G—Grease Fitting **H—Drive Shaft Collar**



MXT011335 —UN—21MAY14

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MX52301,0000098 -19-24OCT14-6/7

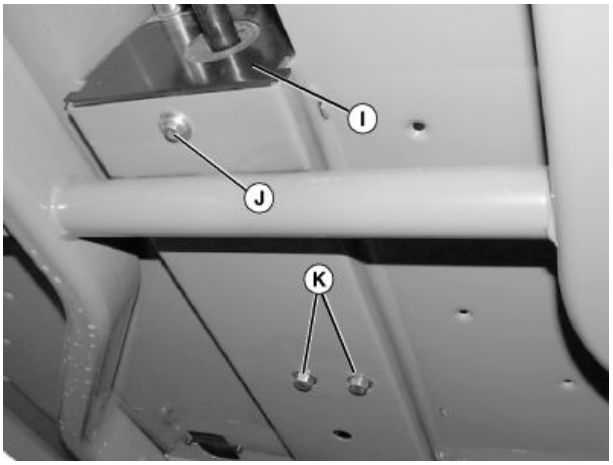
13. Locate tunnel cover (I) under chassis. Remove cap screw (J) securing cover. Slide cover forward.
14. Remove two cap screw (K) securing front drive shaft cast support bearing.
15. Pull drive shaft out of splined coupling on MFWD differential.
16. Remove drive shaft assembly from machine.

Installation:

1. Installation is in the reverse of removal.
2. Ensure that spacer and O-ring behind brake disk (on transaxle output shaft) are in place.
3. Ensure that disk and drive shaft collar assembly are fully seated over O-ring on transaxle output shaft.
4. Slide locking collar against disk and drive shaft collar assembly and tighten collar screws to specification.

Specification	
Brake Disc to Drive Shaft Collar Nuts —Torque	58—88 N·m (43—65 lb.-ft.)

5. Apply one or two pumps of grease to grease fitting on drive shaft collar.



MXT011336 —UN—21MAY14

I— Tunnel Cover
J— Cap Screw
K—Cap Screws (2 used)

6. Apply one or two pumps of grease to grease fitting on splined coupling on front differential.

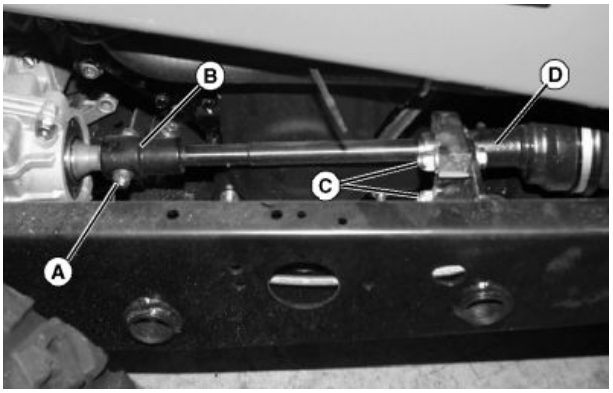
MX52301,0000098 -19-24OCT14-7/7

MFWD Driveshaft Removal and Installation (SN 040001-)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise and lock cargo box.
4. Remove battery. See Battery Removal and Installation.
5. Remove bolt (A) from splined collar (B). Remove bolts (C) from support bearing. Slide splined collar forward on stub shaft until it disconnects from transmission. Pull stub shaft and support bearing out of CV joint (D).

   Remove bolt (A) from splined collar (B). Remove bolts (C) from support bearing. Slide splined collar forward on stub shaft until it disconnects from transmission. Pull stub shaft and support bearing out of CV joint (D).



MXT011319 —UN—21MAY14

A—Bolt
B—Splined Collar
C—Bolts (2 used)
D—CV Joint

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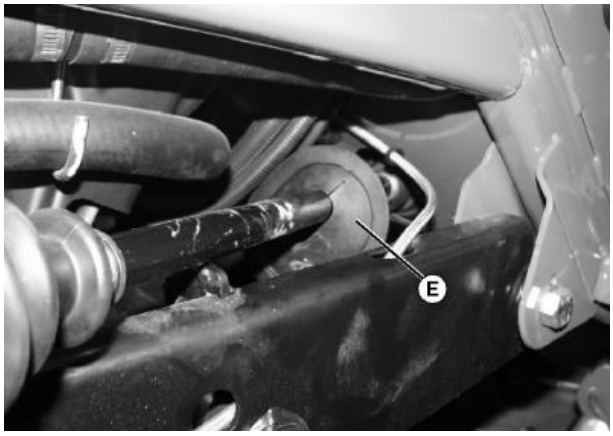
MX52301,0000099 -19-24OCT14-1/3

6. Remove cover (E) from opening and slide cover back on drive shaft.

E—Cover



MXT011322 —UN—21MAY14

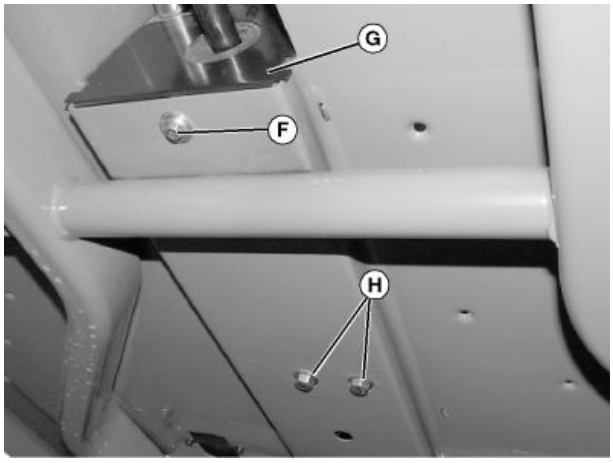
MX52301,0000099 -19-24OCT14-2/3

7. Remove tunnel cover retaining bolt (F) and slide cover (G) away from tunnel. Remove center bearing bolts (H).
8. Slide the drive shaft back until the splines of the shaft are out of the splined coupling on the EMFWD unit.
9. Pull the drive shaft out from the rear of the machine.

Installation:

- Install drive shaft in the reverse order of removal.

F—Retaining Bolt
G—Cover
H—Bolts (2 used)



MXT011337 —UN—21MAY14

MX52301,0000099 -19-24OCT14-3/3

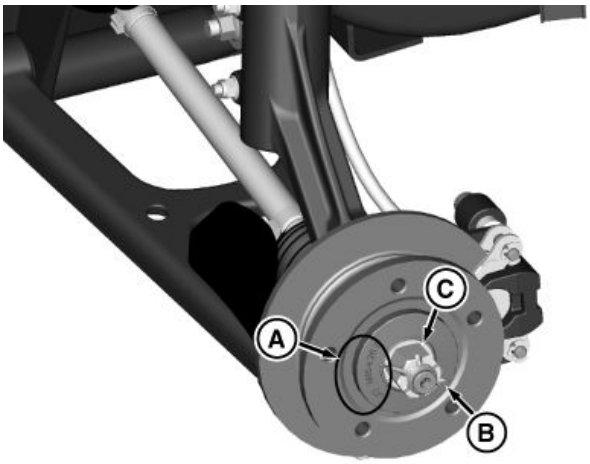
Hub Removal

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise machine and support with jack stands.
4. Remove wheel. (See Wheel Removal and Installation.)
5. Remove brake caliper. (See Brake Caliper Removal and Installation.)

NOTE: The hub part number (A) is cast into the outboard face of the hub. The half shaft part number (D) is printed on the mid section of the shaft.

6. Identify the part number of the hub (A) and the half shaft (D).
7. Remove pin (B) and castle nut (C).
8. Remove hub.

A—Hub Part Number
B—Pin
C—Castle Nut
D—Half Shaft Part Number



MXT010512 —UN—22OCT14

MXT012121 —UN—20JUN14

BS62576,0001801 -19-23OCT14-1/1

Hub Installation

NOTE: The hub part number is cast into the outboard face of the hub. The half shaft part number is printed on the mid section of the shaft.

NOTE: The following hub and half shaft part numbers have a helical spline and are **not** *interchangeable with hubs or half shafts containing other part numbers.*

Helical Halfshaft Part Numbers:
- *AM142355*
- *AM142357*
- *AM142358*
- *AM142359*
- *AM142360*

Helical Hub Part Numbers:
- *M164365*
- *M164367*

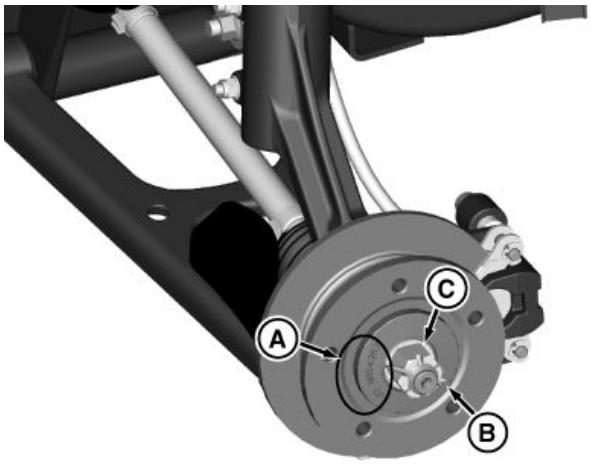
1. Identify the part number of the hub (A) and the half shaft (D).
2. Install hub (A) onto half shaft.
3. Install castle nut (C) onto half shaft.

IMPORTANT: Avoid damage! The torque spec listed with the target value and a plus or minus tolerance. The plus tolerance is larger to allow the nut to be tightened to line up the cotter pin slots with the holes in the half shaft. Always tighten the nut to the target value, and if necessary, tightened more to align the cotter pin slots. Never loosen the nut to align the slots.

4. Tighten castle nut to specification.

Castle Nut—Specification

Helical Spline Half Shaft
Castle Nut—Torque.....251 +119/-23 N·m (185 +88/-17 lb.-ft.)



MXT010512 —UN—22OCT14

MXT012121 —UN—20JUN14

A—Hub and Hub Part Number
B—Cotter Pin
C—Castle Nut
D—Half Shaft part number

Non-helical Half Shaft
Castle Nut—Torque.....170 +119/-23 N·m (125 +88/-17 lb.-ft.)

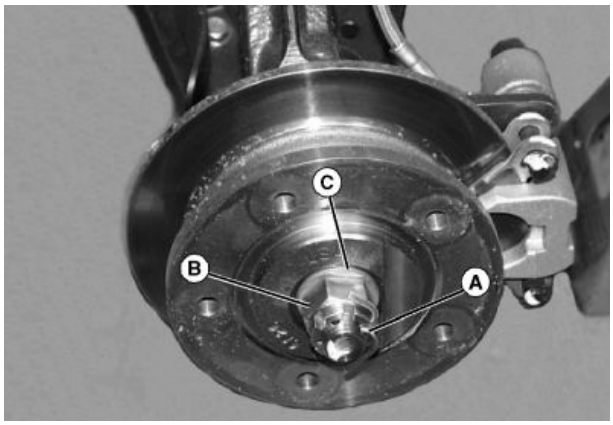
5. Install cotter pin (B)

BS62576,0001802 -19-22OCT14-1/1

Front Axle Driveshaft Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise front of machine and support machine with jackstands on machine frame. Do not support machine by front suspension.
3. Remove front wheels.
4. Remove cotter pin (A), castle nut (B), and washer (C) from axle end.



MXT011338 —UN—21MAY14

A—Cotter Pin
B—Castle Nut
C—Washer

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MX52301,000009A -19-22OCT14-1/5

5. Remove nut (D) from ball joint.

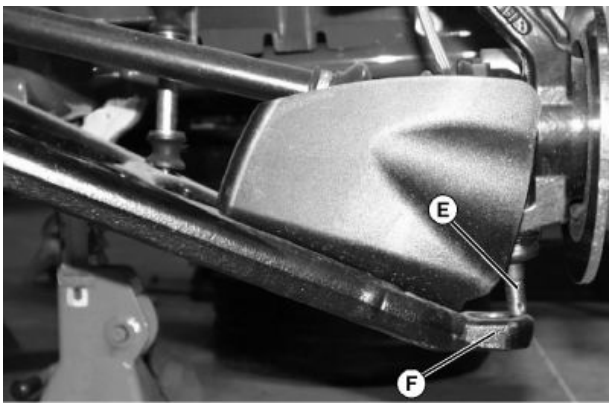
D—Nut

MXT011339 —UN—21MAY14

MX52301,000009A -19-22OCT14-2/5

6. Use a ball joint separator and separate ball joint stud (E) from A-arm (F).

E—Ball Joint Stud **F—A-Arm**

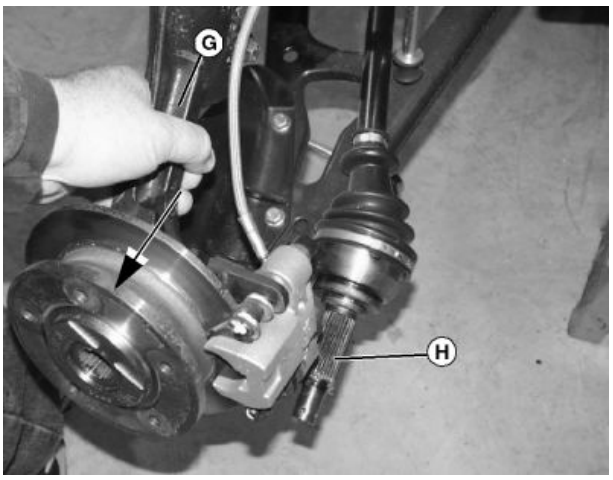


MXT011340 —UN—21MAY14

MX52301,000009A -19-22OCT14-3/5

7. If working on the left side, turn steering wheel all the way to the right. If working on the right side turn steering wheel all the way to the left. Pull strut and brake rotor assembly (G) outward (arrow) until end of shaft (H) is out of brake rotor and bearing.

G—Brake rotor Assembly **H—Shaft**



MXT011341 —UN—21MAY14

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MX52301,000009A -19-22OCT14-4/5

8. Insert large screwdriver (I) between inner CV joint and front differential housing and pry out on CV joint until shaft moves easily. Then pull out the shaft.

Installation:

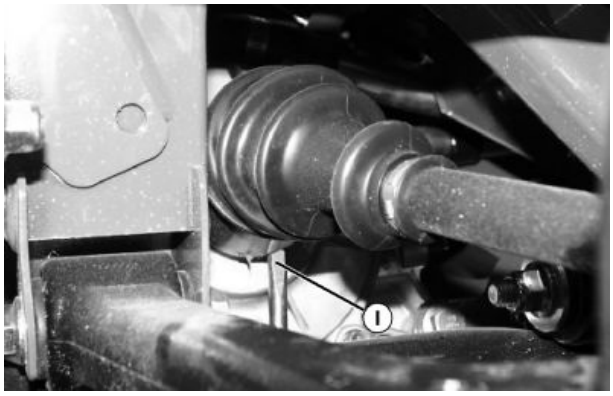
1. Apply a light coat of grease to shaft splines before installing shaft.
2. To install the shaft reverse the procedure of removal. See Hub Installation.
3. Tighten fasteners to specification.

Castle Nut—Specification

Helical Spline Halfshaft
Castle Nut—Torque.....251 +119/-23 N·m (185 +88/-17 lb.-ft.)
Non-helical Halfshaft
Castle Nut—Torque.....170 +119/-23 N·m (125 +88/-17 lb.-ft.)

Specification

Ball Joint to A-Arm
Locknut—Torque.....54 N·m (40 lb.-ft.)



MXT011342 —UN—21MAY14

I— Screwdriver Location

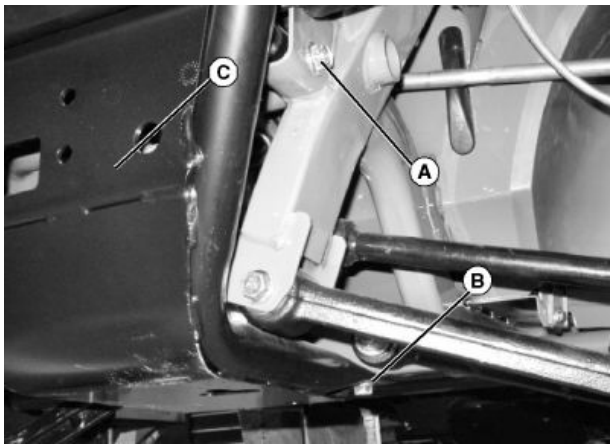
MX52301,000009A -19-22OCT14-5/5

Front Differential Removal and Installation (SN -040000)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Jack up front of machine and place on jack stands.
4. Remove front tires.
5. Remove cap screws and nuts (A) and cap screws (B) on each side of machine. Remove front guard (C).

A—Cap Screws and Nuts
B—Cap Screws
C—Front Guard



MXT011343 —UN—21MAY14

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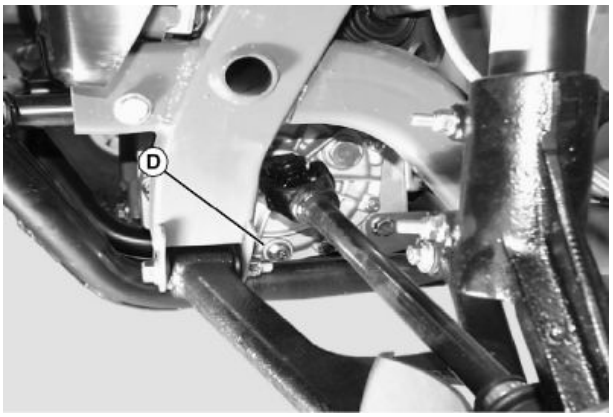
MX52301,000009B -19-24OCT14-1/7

6. Place a drain pan under differential. Remove drain plug (D) and drain oil from differential case.

D—Drain Plug



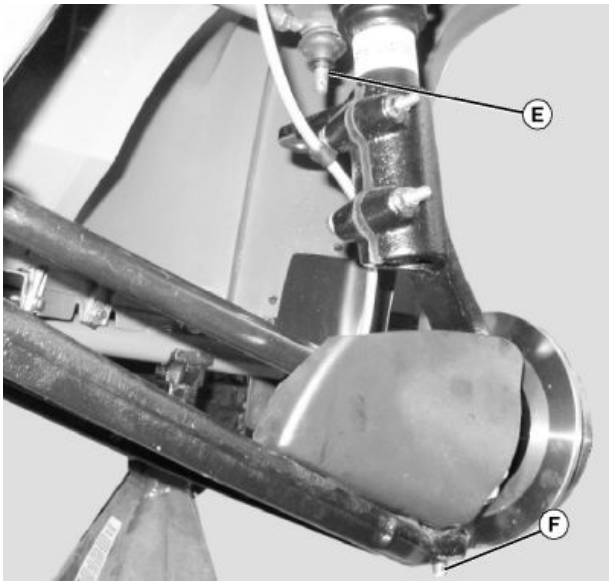
MXT011344 —UN—21MAY14

MX52301,000009B -19-24OCT14-2/7

7. On both sides of machine, disconnect tie rod end (E) from steering knuckle. Disconnect ball joint (F) from A arm.

E—Tie Rod End

F—Half Shaft Ball Joint

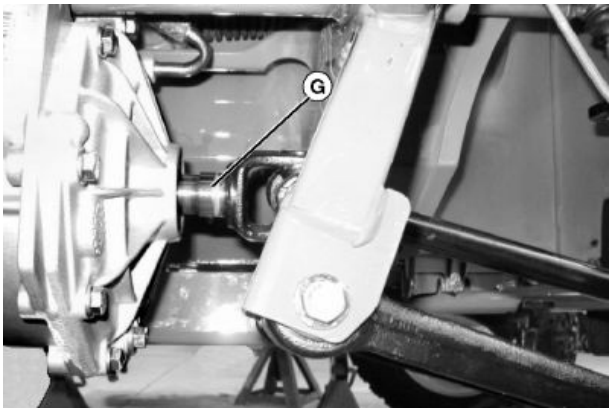


MXT011345 —UN—21MAY14

MX52301,000009B -19-24OCT14-3/7

8. Apply outward pressure on steering strut and pull half shaft (G) out of differential. Repeat on other side.

G—Half Shaft



MXT011346 —UN—21MAY14

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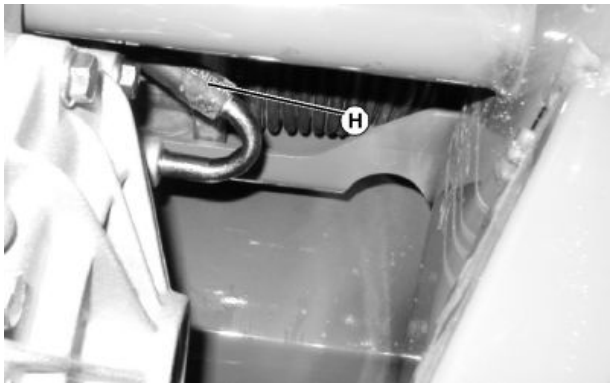
MX52301,000009B -19-24OCT14-4/7

9. Disconnect vent hose (H).

H—Vent Hose

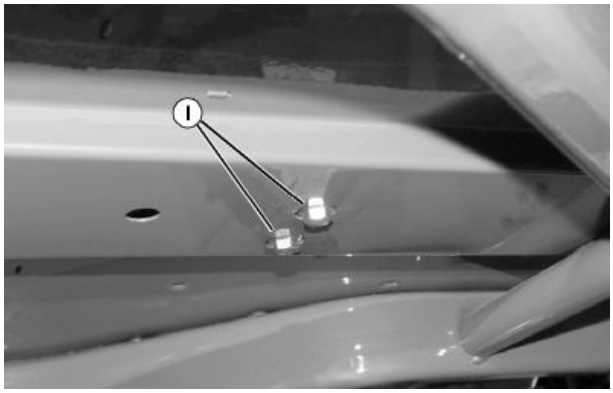


MXT011347 —UN—21MAY14

MX52301,000009B -19-24OCT14-5/7

10. On bottom front of tunnel, remove two cap screws (I) from front drive shaft support bearing.

I— Cap Screws (2 used)



MXT011348 —UN—22MAY14

MX52301,000009B -19-24OCT14-6/7

11. Remove nut (J) and disconnect shift linkage from lever.
12. Support differential and remove cap screws and nuts (K). Pull differential forward and out of machine.

Installation:

1. Install unit in the reverse order of removal.
2. Tighten differential to frame bolts to specification.

Specification	
Differential to Frame Bolts —Torque	43 N·m 32 (lb.-ft.)

3. Tighten ball joint nuts to specification.

Specification	
Ball Joint Nuts—Torque	54 N·m 40 (lb.-ft.)

MXT011349 —UN—21MAY14

J— Nut **K—Cap Screws and Nuts**

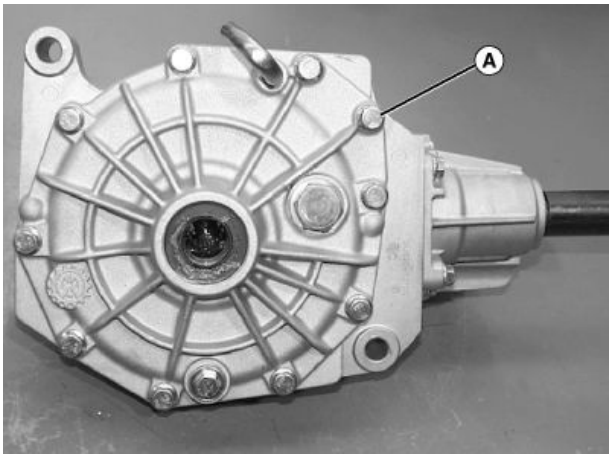
MX52301,000009B -19-24OCT14-7/7

Front Differential Disassembly (SN -040000)

Disassembly:

1. Remove ten cap screws (A) holding side cover to differential case and remove side cover.

A—Cap Screws (10 used)

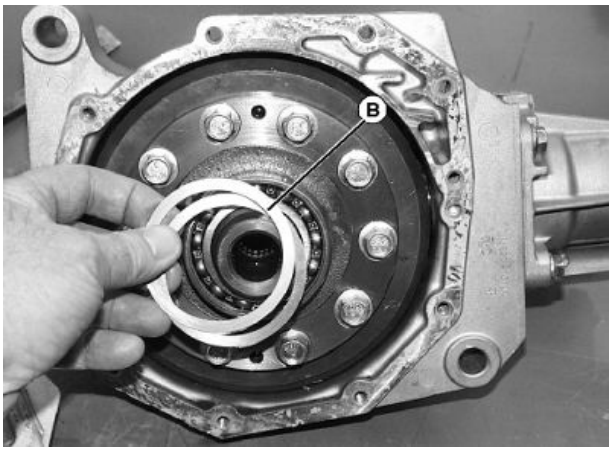


MXT011350 —UN—21MAY14

MX52301,000009C -19-24OCT14-1/23

2. Remove retaining shims (B). Shims may be on the bearing or in the bearing bore in the cover.

B—Shims

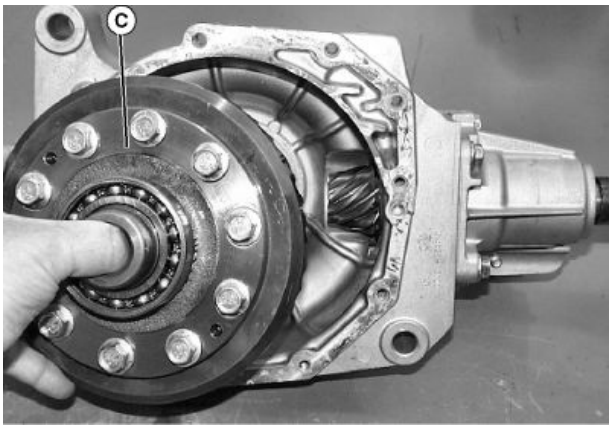


MXT011351 —UN—21MAY14

MX52301,000009C -19-24OCT14-2/23

3. Remove differential carrier assembly (C).

C—Differential Carrier Assembly



MXT011352 —UN—21MAY14

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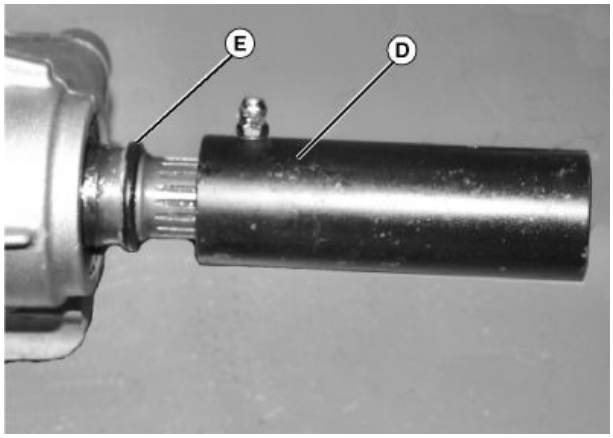
MX52301,000009C -19-24OCT14-3/23

4. Remove splined coupling (D) and O-ring (E).

D—Spline Coupling **E—O-ring**

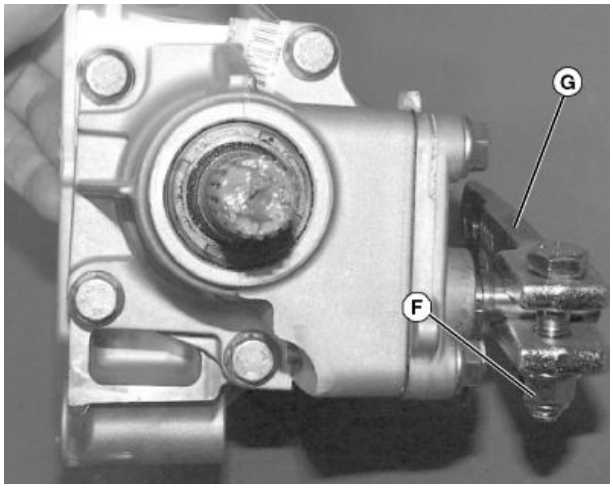


MXT011353 —UN—21MAY14

MX52301,000009C -19-24OCT14-4/23

5. Remove cap screw and nut (F). Remove engagement lever (G).

F—Cap Screw and Nut **G—Engagement Lever**

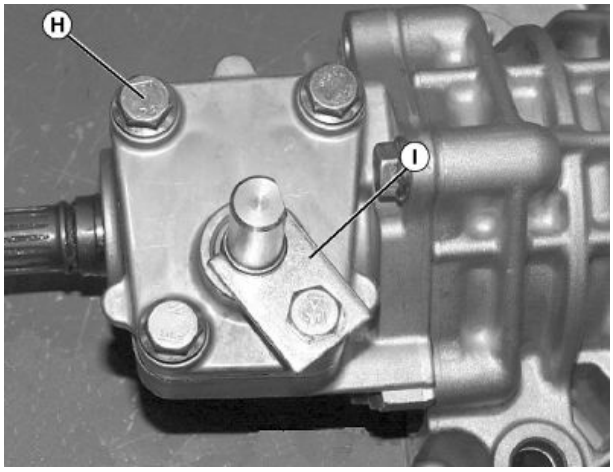


MXT011354 —UN—21MAY14

MX52301,000009C -19-24OCT14-5/23

6. Remove four cap screws (H) and shift shaft retainer (I).

H—Cap Screws (4 used) **I— Shift Shaft Retainer**



MXT011355 —UN—21MAY14

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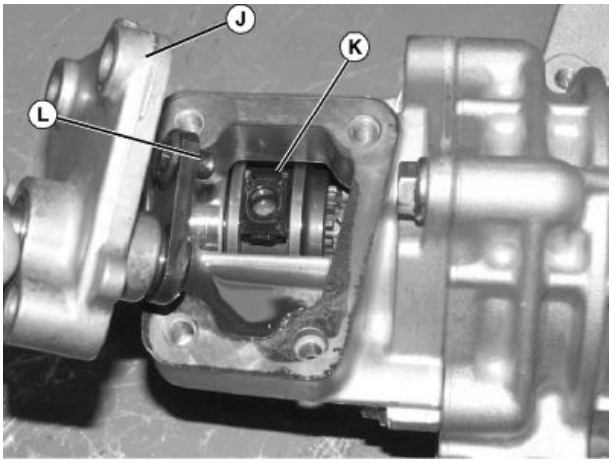
MX52301,000009C -19-24OCT14-6/23

7. Remove cover (J). Shift block (K) may be on shift collar as shown, or it may remain on shift arm (L).

J—Cover
K—Shift Block
L—Shift Arm

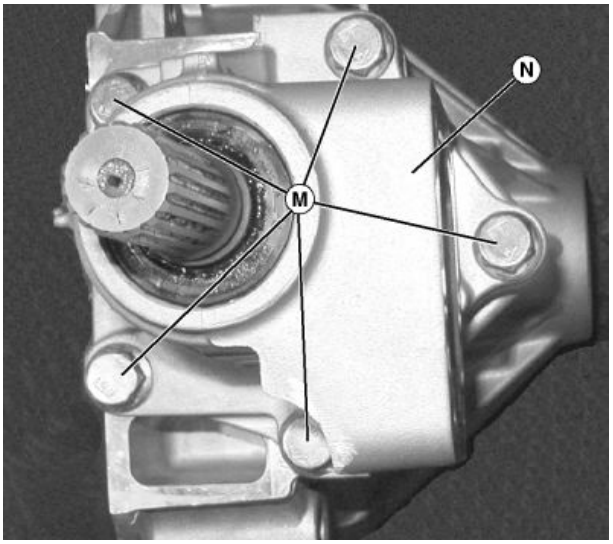


MXT011356 —UN—21MAY14

MX52301,000009C -19-24OCT14-7/23

8. Remove five cap screws (M) and input shaft housing.

M—Cap Screws (5 used)
N—Input Shaft Housing



MXT011357 —UN—21MAY14

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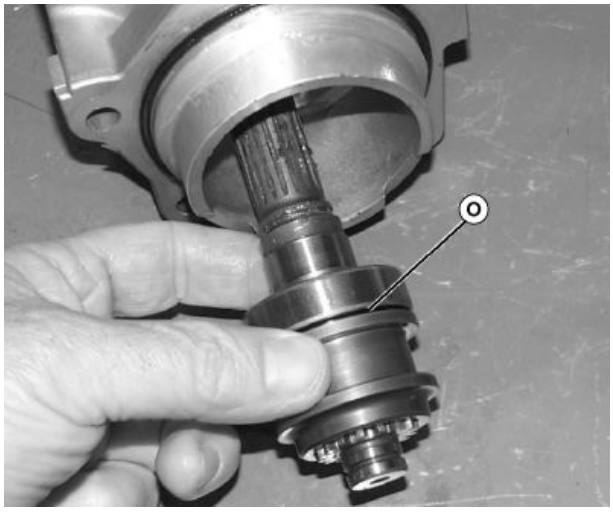
MX52301,000009C -19-24OCT14-8/23

9. Remove input shaft (O) from housing.

O—Input Shaft

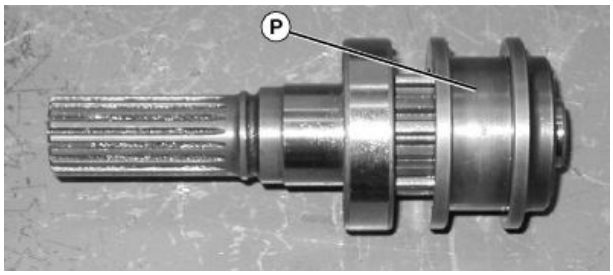


MXT011358 —UN—21MAY14

MX52301,000009C -19-24OCT14-9/23

10. Position shift collar (P) as shown. Wrap a shop cloth around the shaft assembly to capture spring loaded detent balls when they are released from under the collar. Remove shift collar.

P—Shift Collar

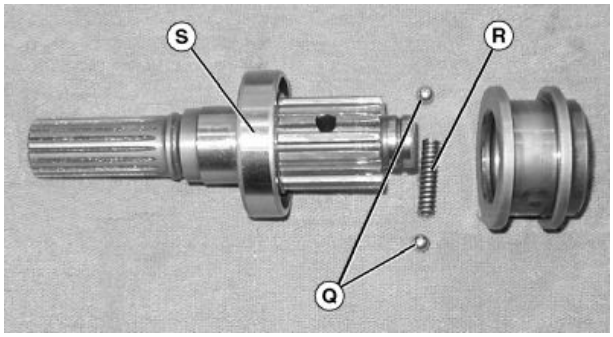


MXT011359 —UN—21MAY14

MX52301,000009C -19-24OCT14-10/23

11. Inspect splines on shaft and inside collar. Inspect detent balls (Q), spring (R), and bearing (S). Replace any worn or damaged parts.
    - Assemble in the reverse order of disassembly.

Q—Detent Balls
R—Spring
S—Bearings



MXT011360 —UN—21MAY14

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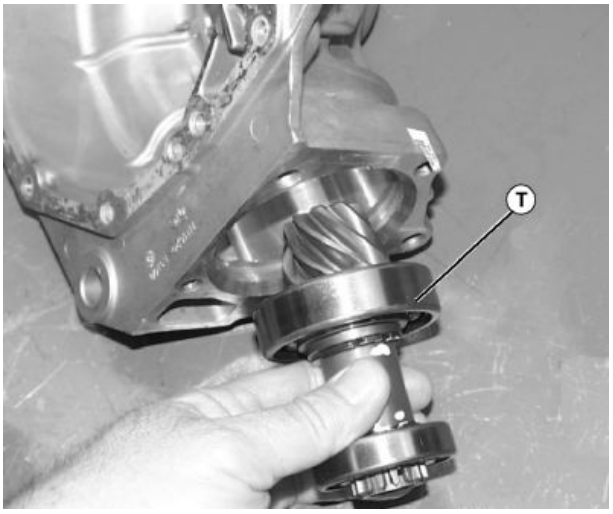
MX52301,000009C -19-24OCT14-11/23

12. Remove pinion shaft assembly (T) from differential.

T—Pinion Shaft Assembly

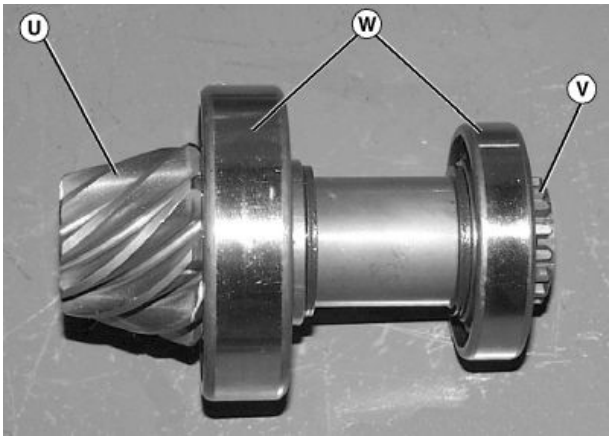


MXT011361 —UN—21MAY14

MX52301,000009C -19-24OCT14-12/23

13. Inspect all gear teeth (U), splines (V), and bearings (W) on pinion shaft for wear or damage. Replace all worn or damaged parts.

U—Gear Teeth
V—Splines
W—Bearings

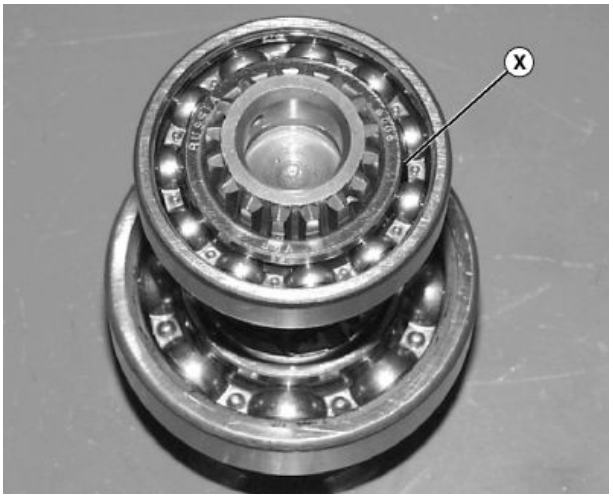


MXT011362 —UN—21MAY14

MX52301,000009C -19-24OCT14-13/23

14. If bearings or shaft need replacement, remove outer bearing (X).

X—Outer Bearing



MXT011363 —UN—21MAY14

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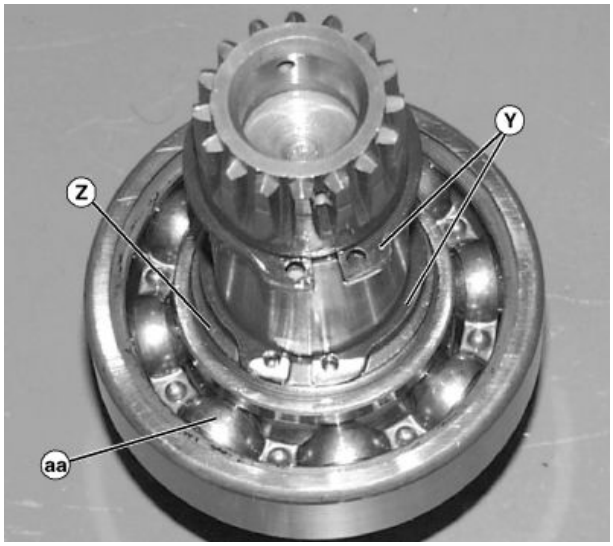
MX52301,000009C -19-24OCT14-14/23

15. Remove snap rings (Y), spacer (Z), and bearing (aa).
    - Replace any worn or damaged parts and assemble in the reverse order of disassembly.

Y—Snap Rings
Z—Spacer
aa— Bearing

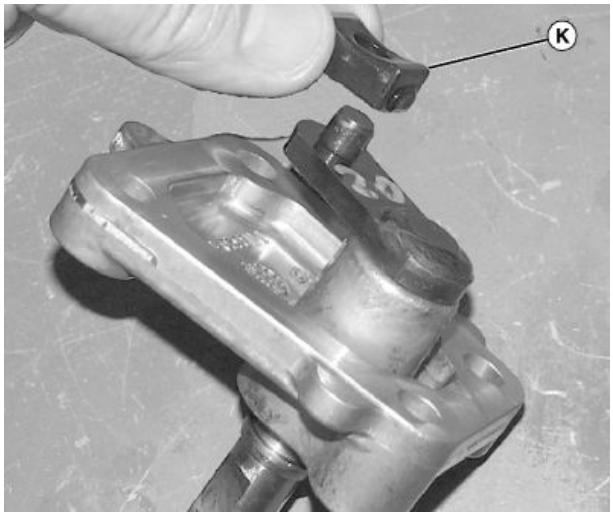


MXT011601 —UN—21MAY14

MX52301,000009C -19-24OCT14-15/23

16. If shift block (K) remained on shift arm, remove shift block.

K—Shift Block



MXT011602 —UN—21MAY14

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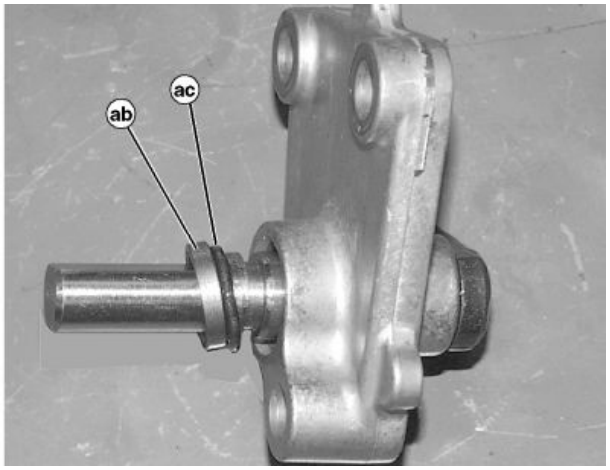
MX52301,000009C -19-24OCT14-16/23

17. Remove spacer (ab) and O-ring (ac) from shaft.

ab— Spacer **ac— O-ring**

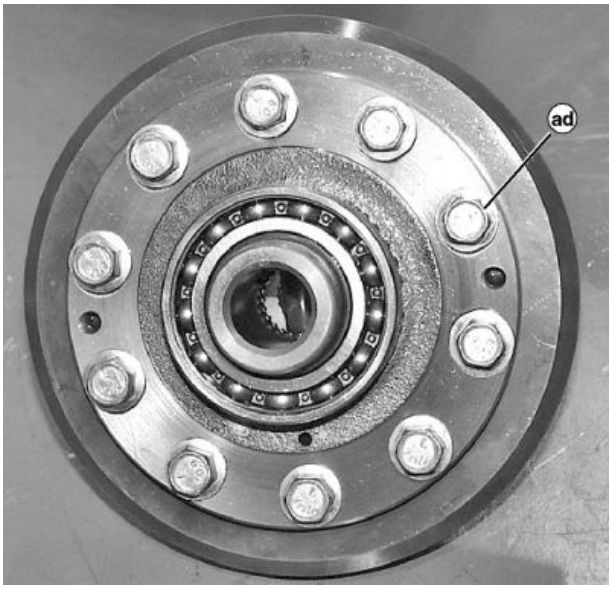


MXT011603 —UN—21MAY14

MX52301,000009C -19-24OCT14-17/23

18. Remove cap screws (ad) from ring gear.

ad— Cap Screws



MXT011604 —UN—21MAY14

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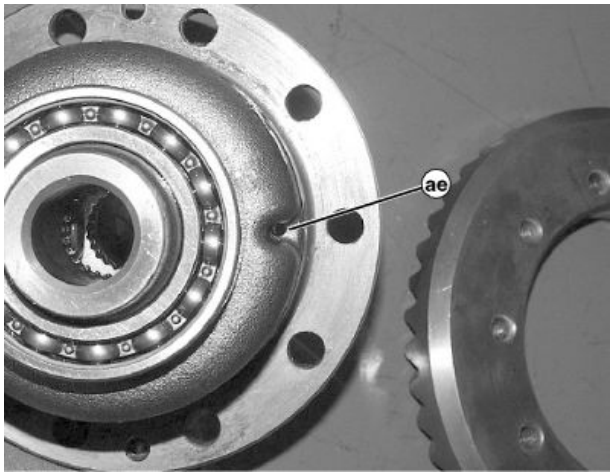
MX52301,000009C -19-24OCT14-18/23

19. From either side of differential carrier, use a long pin punch in hole (ae) and drive out roll pin from pinion shaft.

ae— Hole Location

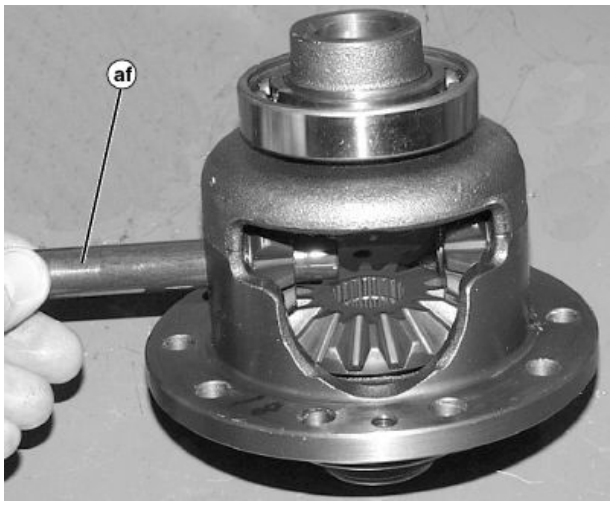


MXT011605 —UN—21MAY14

MX52301,000009C -19-24OCT14-19/23

20. Remove pinion shaft (af).

af— Pinion Shaft



MXT011606 —UN—21MAY14

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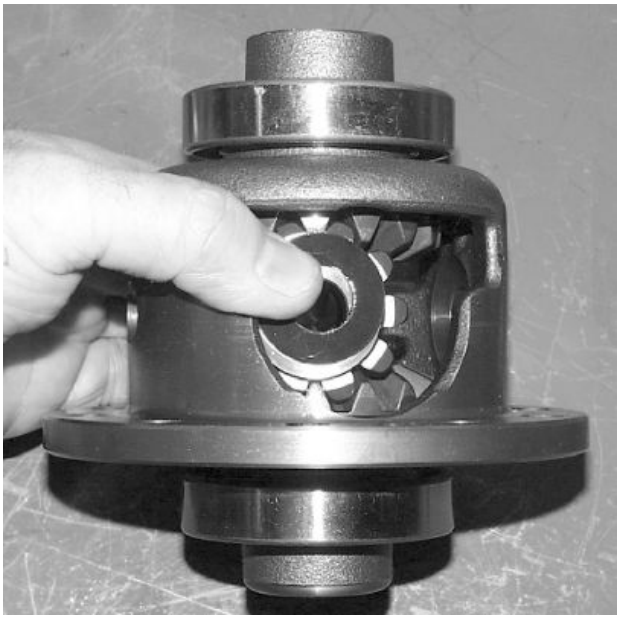
MX52301,000009C -19-24OCT14-20/23

21. Turn the gears to the opening in the differential carrier and remove all gears and thrust washers.

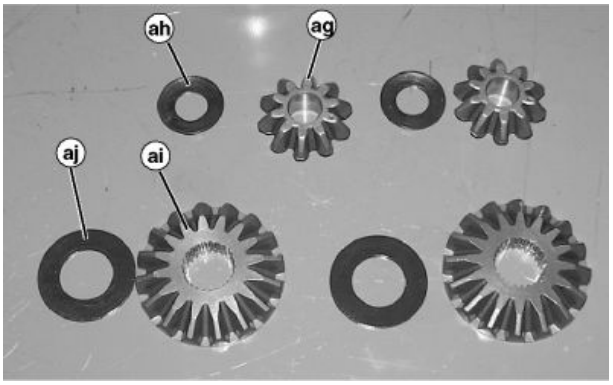


MXT011607 —UN—21MAY14

MX52301,000009C -19-24OCT14-21/23

22. Inspect pinion gears (ag) and thrust washers (ah). Inspect differential side gears (ai) and thrust washers (aj). Replace any worn or damaged parts.

ag— Pinion Gears
ah— Thrust Washers
ai— Side Gears
aj— Thrust Washers



MXT011608 —UN—21MAY14

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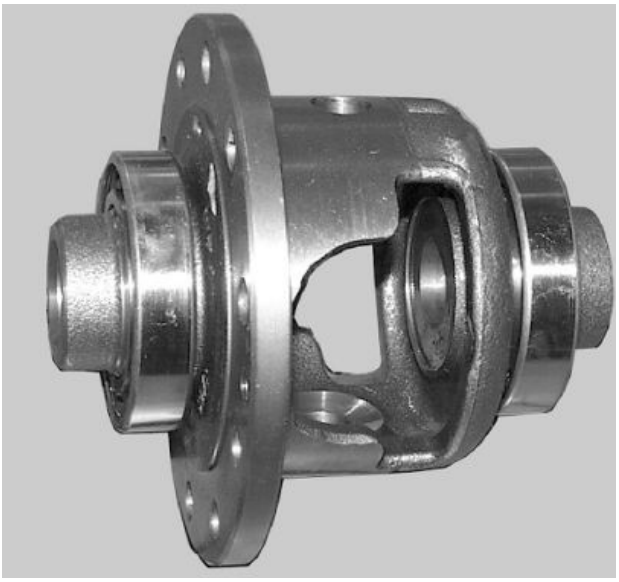
MX52301,000009C -19-24OCT14-22/23

23. Inspect differential carrier and bearings for wear or damage. Replace any worn or damaged parts.



MXT011609 —UN—21MAY14

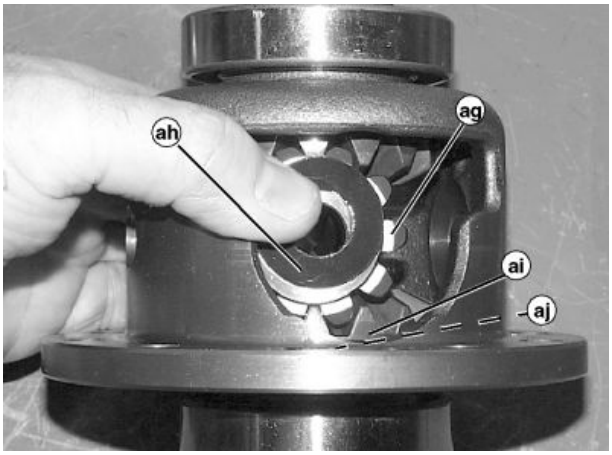
MX52301,000009C -19-24OCT14-23/23

Front Differential Assembly (SN -040000)

Assembly:

1. Apply grease to thrust washers to help keep them in place during assembly.
2. Install thrust washers (aj) and side gears (ai), then pinion gears (ag) and thrust washers (ah).

ag— Pinion Gear
ah— Thrust Washers
aj— Thrust Washers
al— Side Gears



MXT011610 —UN—21MAY14

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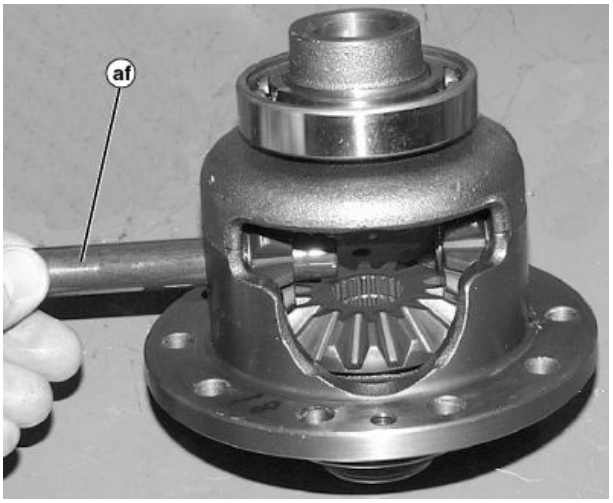
MX52301,000009D -19-24OCT14-1/15

3. Align pinion gears and thrust washers with pinion shaft hole. Install pinion shaft (af) and align hole for roll pin with hole in differential carrier.

af— Pinion Shaft

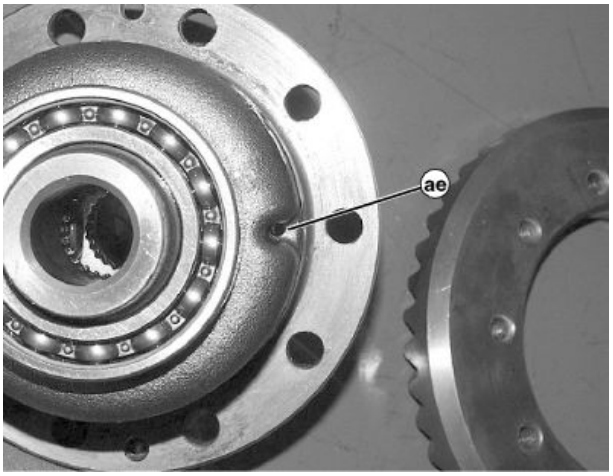


MXT011606 —UN—21MAY14

MX52301,000009D -19-24OCT14-2/15

4. Install roll pin into hole (ae) and through pinion shaft.

ae— Hole Location



MXT011605 —UN—21MAY14

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MX52301,000009D -19-24OCT14-3/15

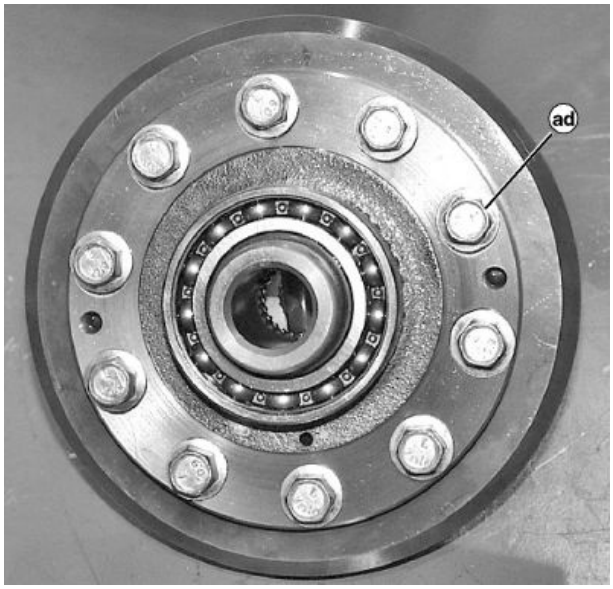
5. Install ring gear on differential carrier. Apply high strength thread locking compound to threads of bolts. Install bolts (ad) and tighten in a cross pattern to specification.

Specification

Ring Gear to Differential Carrier Bolt—Torque ..... 70—80 N·m (52—59 lb.-ft.)

6. Clean all gasket material from mating surfaces.

ad— Bolts

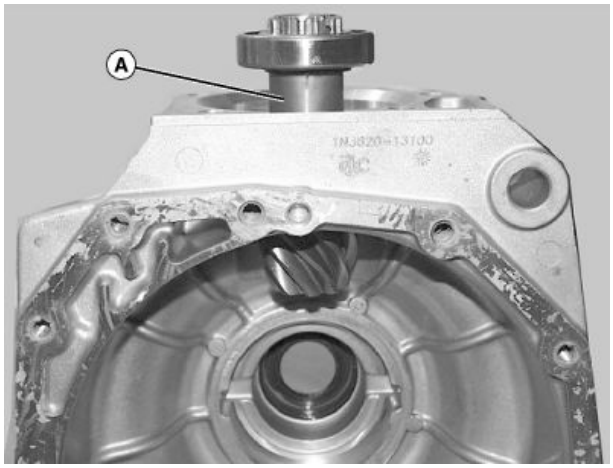


MXT011604 —UN—21MAY14

MX52301,000009D -19-24OCT14-4/15

7. Install the pinion shaft assembly (A) into the differential.

A—Pinion Shaft Assembly



MXT011614 —UN—21MAY14

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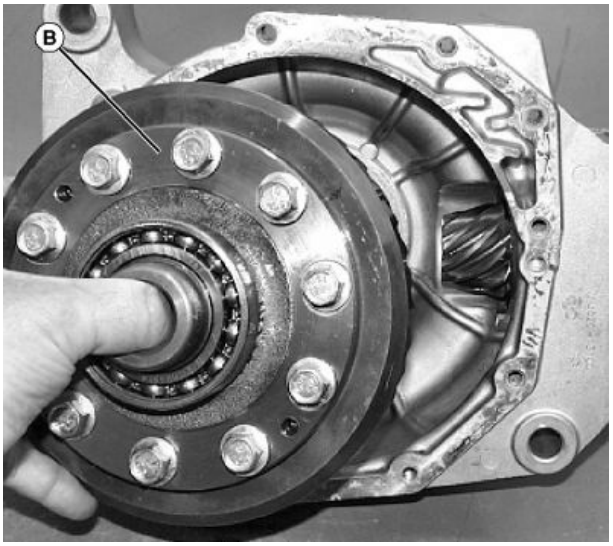
MX52301,000009D -19-24OCT14-5/15

8. Install the differential carrier assembly (B) onto the differential housing.

B—Differential Carrier Assembly

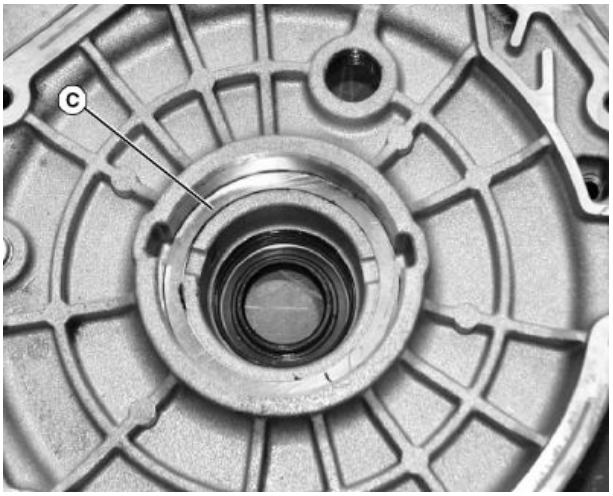


MXT011615 —UN—21MAY14

MX52301,000009D -19-24OCT14-6/15

9. Apply a light film of grease to original shims (C) to hold them in place in differential cover.

C—Original Shims



MXT011619 —UN—21MAY14

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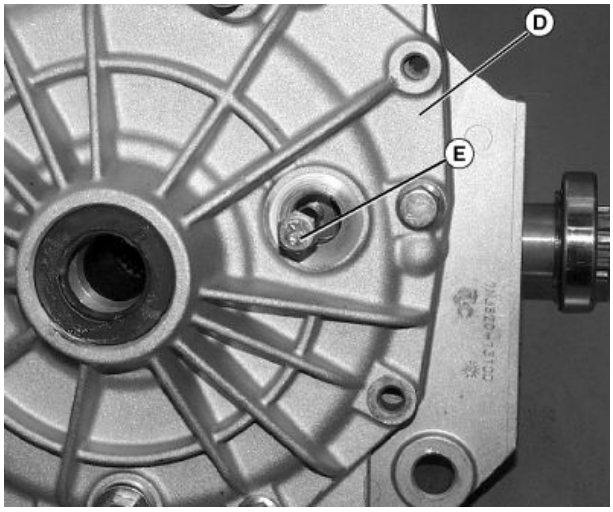
MX52301,000009D -19-24OCT14-7/15

10. Install differential side cover (D) with four cap screws tightened to specification. Turn gears and locate threaded hole in differential carrier. Install M8 bolt (E) into differential carrier through oil fill hole as shown. Tighten bolt enough to keep it from wiggling in the threads and causing a false reading on the dial indicator.

D—Differential Side Cover **E—M8 Bolt**



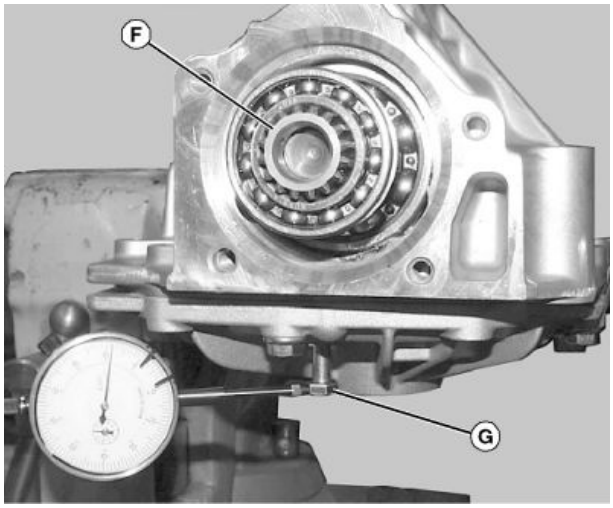
MXT011617 —UN—21MAY14

MX52301,000009D -19-24OCT14-8/15

11. Place differential assembly in a fixture or vice with the cover facing down. The position keeps the weight of the differential carrier against the shims. Tap on the case to make sure that the differential has seated on the shims. Set up dial indicator as shown to read movement of bolt (G). Hold pinion shaft (F) in toward case and continue to hold to keep shaft from turning during measurement.
12. While holding shaft (F) move bolt (G) back and forth and record reading on dial indicator.
13. Backlash should be to specification.

Specification	
Front Differential—Backlash	0.12—0.19 mm (0.004—0.007 in.)

F—Pinion Shaft **G—Bolt**



MXT011618 —UN—21MAY14

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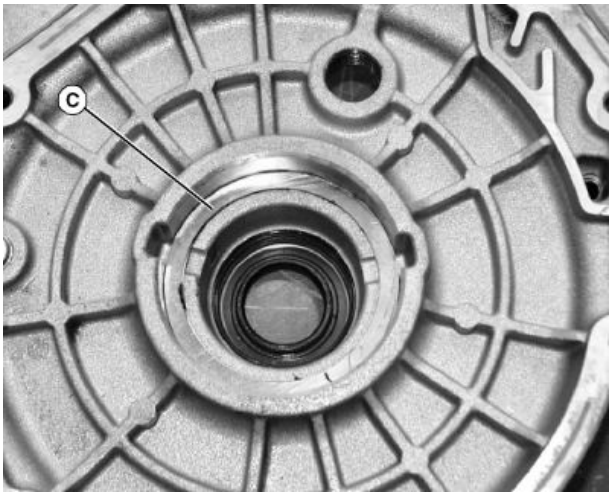
MX52301,000009D -19-24OCT14-9/15

14. If backlash is not to the 0.12—0.19 mm (0.004—0.007 in.) specification, remove differential side cover and adjust the shim pack thickness until backlash is correct. Adding shims decreases backlash, removing shims increases backlash.
15. When backlash meets specification, apply a thin bead of John Deere Form In Place Gasket on mating surface and install cover.
16. Replace the oil seals.

C—Shims

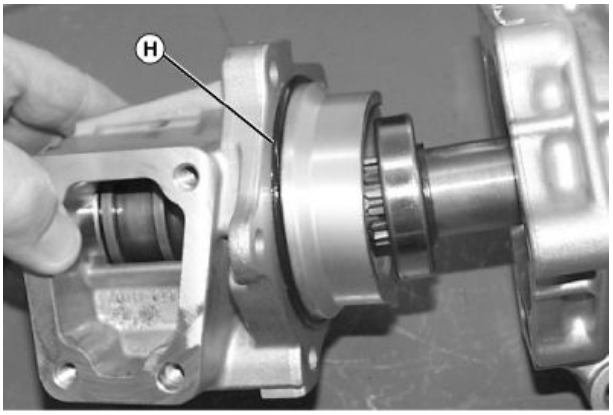


MXT011619 —UN—21MAY14

MX52301,000009D -19-24OCT14-10/15

17. Install new O-ring (H) on nose cone and install nose cone.

H—O-ring

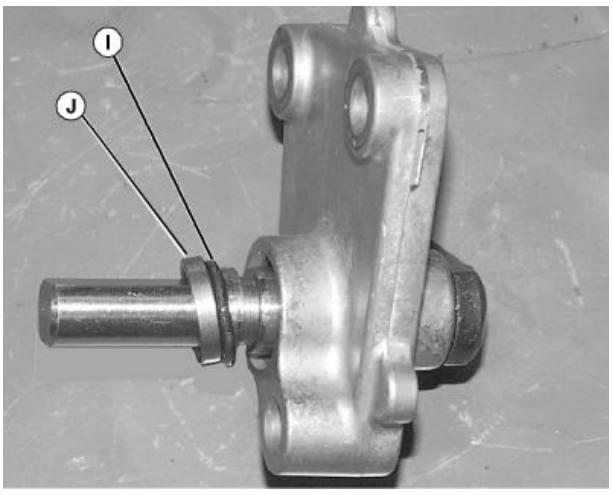


MXT011620 —UN—22MAY14

MX52301,000009D -19-24OCT14-11/15

18. Install new O-ring (I) and the spacer (J) onto the shift shaft.

I— O-ring **J— Spacer**



MXT011621 —UN—22MAY14

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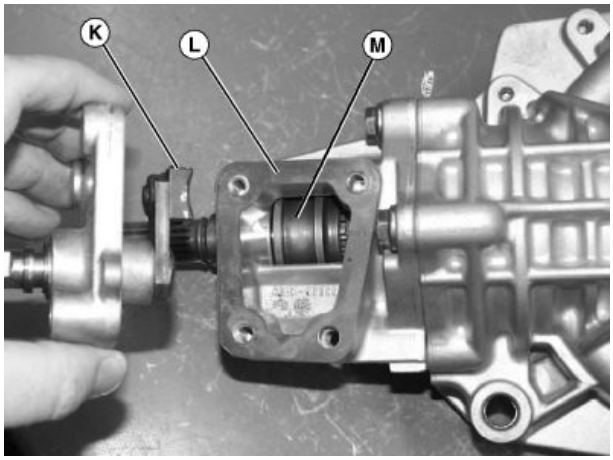
MX52301,000009D -19-24OCT14-12/15

19. Lightly grease the back of the shift block (K) to keep it from falling off the lever.
20. Install new gasket (L). Make sure that shift block engages properly in shift collar slot (M) when installing cover.

K—Shift Block
L—New Gasket
M—Shift Collar Slot

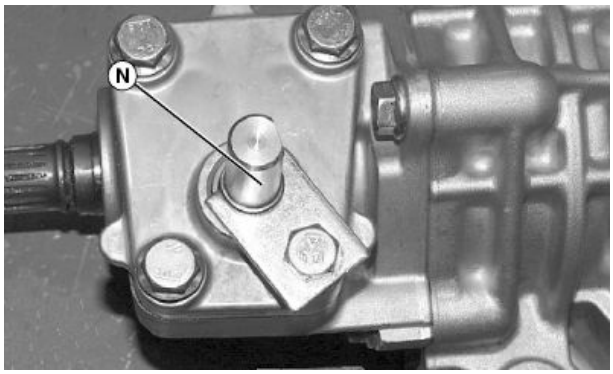


MXT011622 —UN—22MAY14

MX52301,000009D -19-24OCT14-13/15

21. Install keeper tab (N) into slot in shaft as shown.

N—Keeper Tab

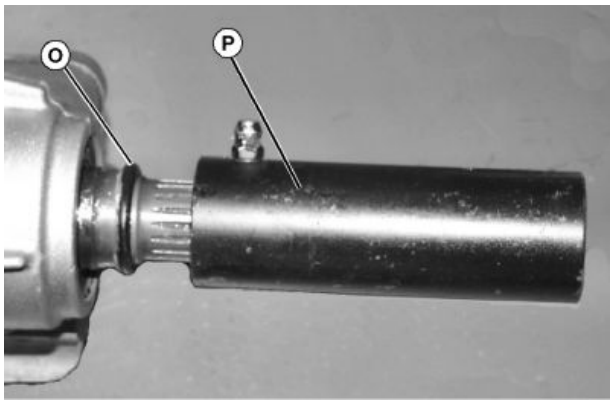


MXT011623 —UN—22MAY14

MX52301,000009D -19-24OCT14-14/15

22. Install O-ring (O) and splined collar (P).

O—O-ring
P—Splined Collar



MXT011624 —UN—22MAY14

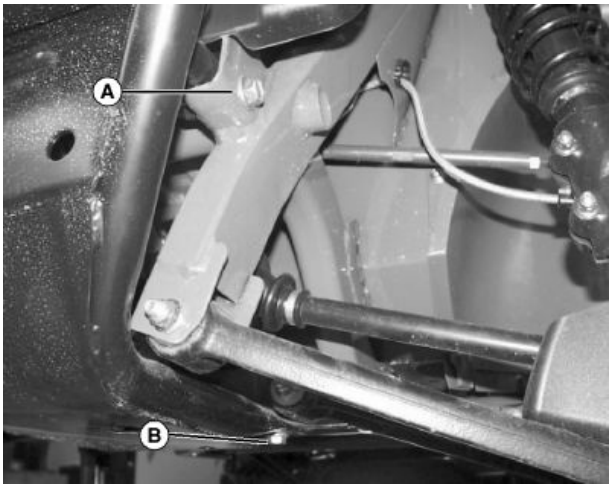
MX52301,000009D -19-24OCT14-15/15

Front Differential Removal and Installation (SN 040001-)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Jack up front of machine and place on jack stands.
4. Remove front tires.
5. Remove upper bolts (A) and lower bolts (B) from each side of front guard and remove guard.

A—Upper Bolts **B—Lower Bolts**

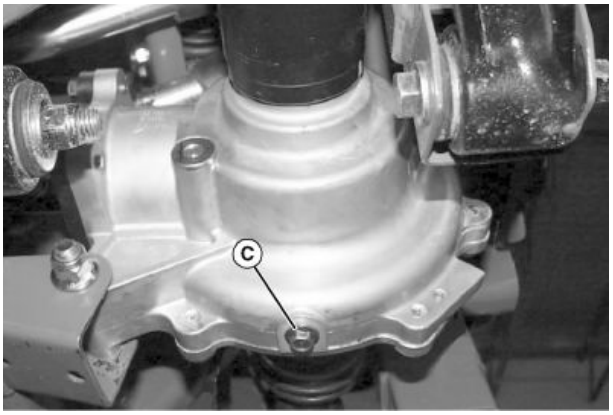


MXT011625 —UN—22MAY14

MX52301,000009E -19-24OCT14-1/5

6. Place a drain pan under the EMFWD. Remove drain bolt (C) and drain oil from unit.

C—Drain Bolt

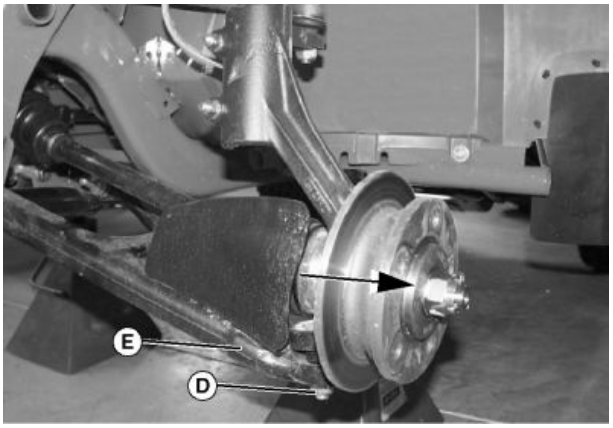


MXT011626 —UN—22MAY14

MX52301,000009E -19-24OCT14-2/5

7. Remove nut (D) from ball joint on each side of machine. Use a ball joint separator and disconnect ball joint from A-arm (E).
8. Pull suspension and halfshafts away from machine until halfshafts come out of differential case.

D—Nut **E—A-arm**



MXT011627 —UN—22MAY14

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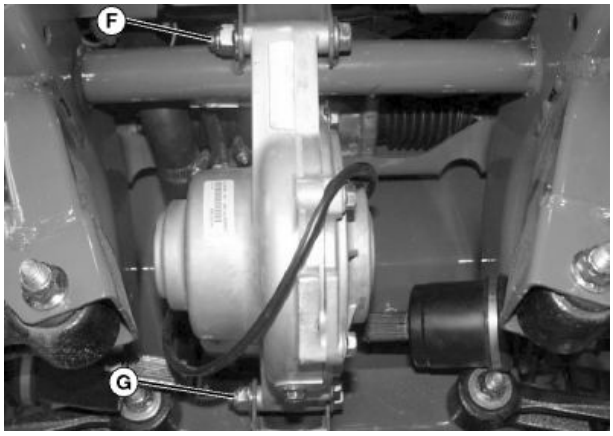
MX52301,000009E -19-24OCT14-3/5

9. Remove upper and lower mounting bolts (F) and (G).

F—Upper Mounting Bolts **G—Lower Mounting Bolts**



MXT011628 —UN—22MAY14

MX52301,000009E -19-24OCT14-4/5

10. Disconnect wire connector (H) and vent hose (I).
11. Remove differential from machine.

Installation:

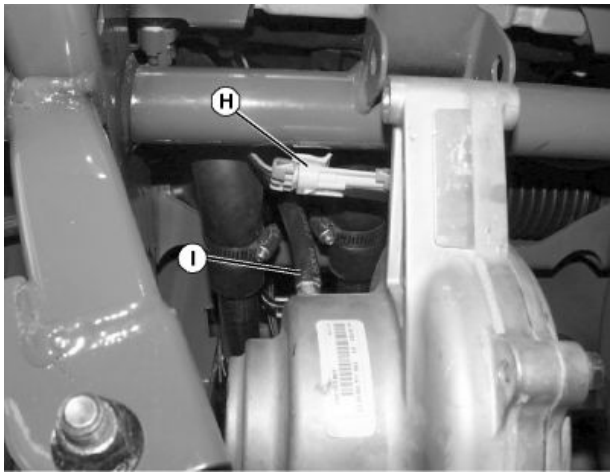
1. Install unit in the reverse order of removal.
2. Tighten differential to frame bolts to specification.

Specification	
Differential to Frame Bolts —Torque	43 N·m 32 (lb.-ft.)

3. Tighten ball joint nuts to specification.

Specification	
Ball Joint Nuts—Torque	54 N·m 40 (lb.-ft.)

H—Wire Connector **I— Vent Hose**



MXT011629 —UN—22MAY14

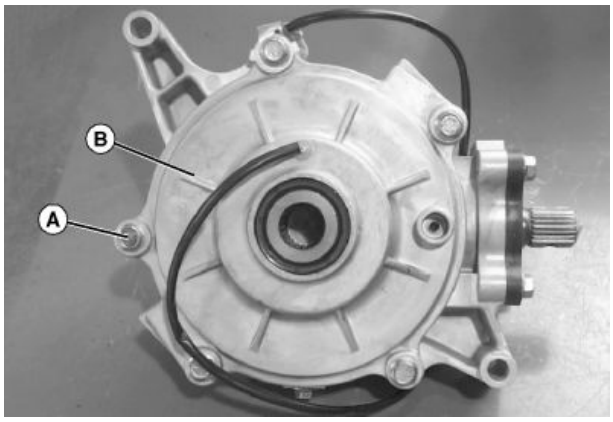
MX52301,000009E -19-24OCT14-5/5

Front Differential Disassembly (SN 040001-)

Disassembly

1. Remove five cover bolts (A) and remove cover (B).

A—Cover Bolts (5 used) **B—Cover**



MXT011630 —UN—22MAY14

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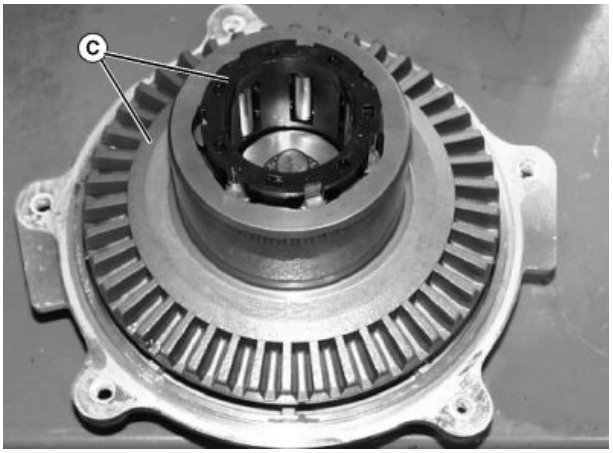
MX52301,000009F -19-24OCT14-1/19

2. Lift ring gear and roll cage assembly (C) out of cover.

C—Roll Cage Assembly

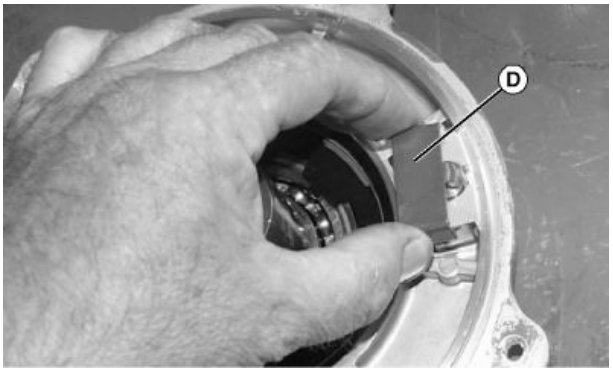


MXT011631 —UN—22MAY14

MX52301,000009F -19-24OCT14-2/19

3. Remove thrust plate (D).

D—Thrust Plate

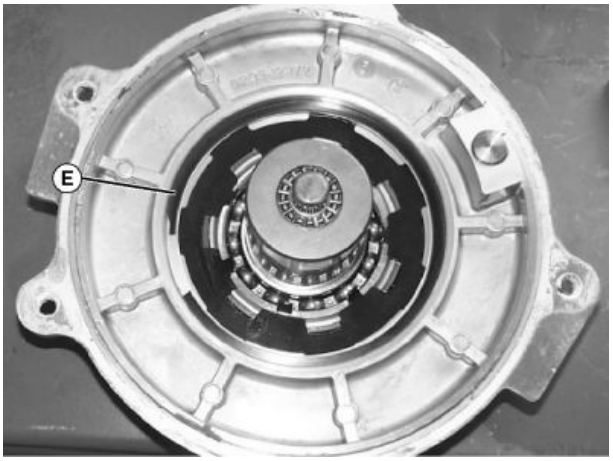


MXT011632 —UN—22MAY14

MX52301,000009F -19-24OCT14-3/19

4. Remove retaining ring (E).

E—Retaining Ring



MXT011633 —UN—22MAY14

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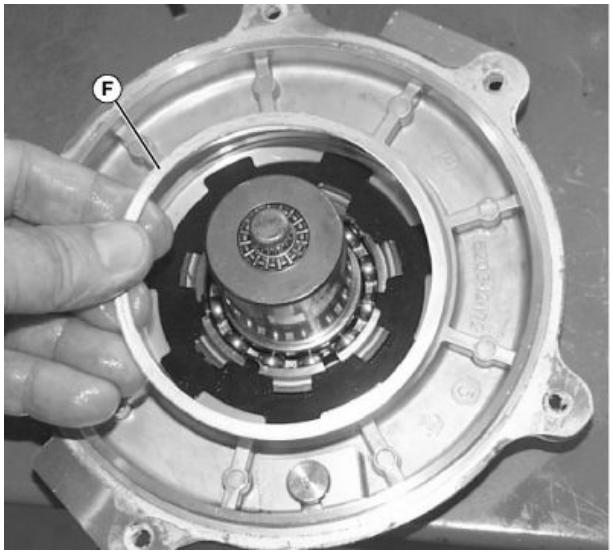
MX52301,000009F -19-24OCT14-4/19

5. Remove shim (F).

F—Shim

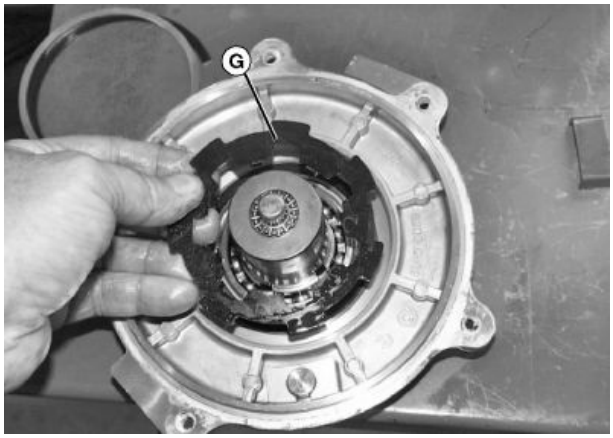


MXT011634 —UN—22MAY14

MX52301,000009F -19-24OCT14-5/19

6. Remove armature plate (G).

G—Armature Plate



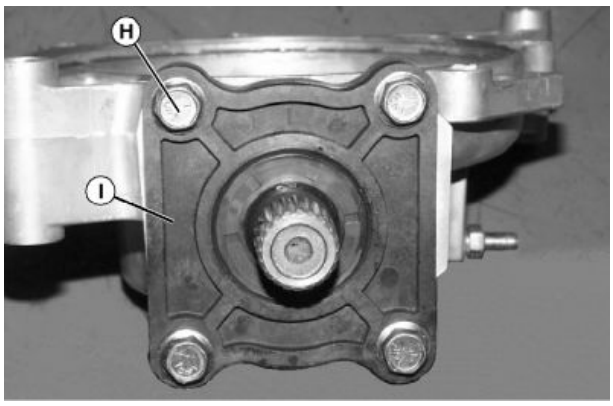
MXT011635 —UN—22MAY14

MX52301,000009F -19-24OCT14-6/19

7. Remove four bolts (H) and pinion cover (I).

H—Bolts (4 used)

I— Pinion Cover



MXT011636 —UN—22MAY14

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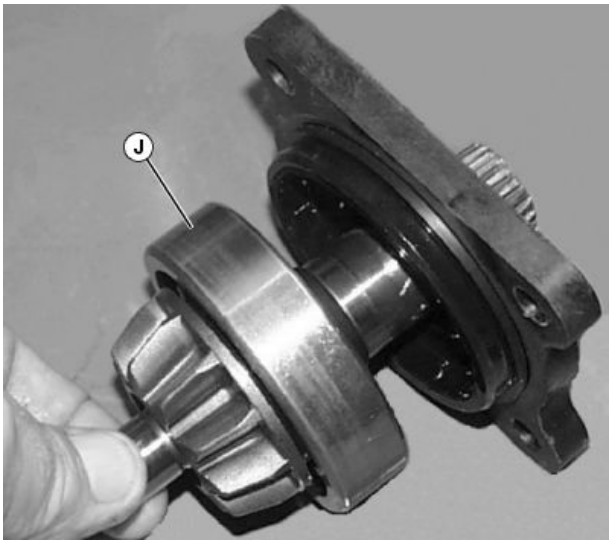
MX52301,000009F -19-24OCT14-7/19

8. Remove pinion shaft (J) from cover, or if pinion shaft remained in housing, remove it from housing.

J—Pinion Shaft

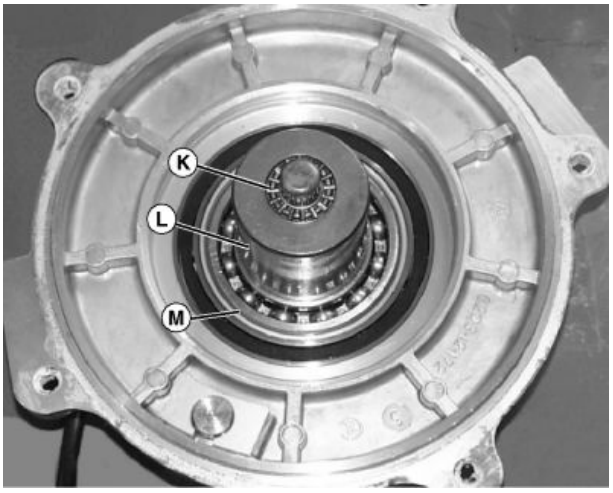


MXT011637 —UN—22MAY14

MX52301,000009F -19-24OCT14-8/19

9. Remove thrust bearing (K), and output hub (L) from the EMFWD cover. Bearing (M) will usually stay on the output hub. Remove the opposite output hub and bearing from the EMFWD case.

K—Thrust Bearing
L—Output Hub
M—Bearing



MXT011638 —UN—22MAY14

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MX52301,000009F -19-24OCT14-9/19

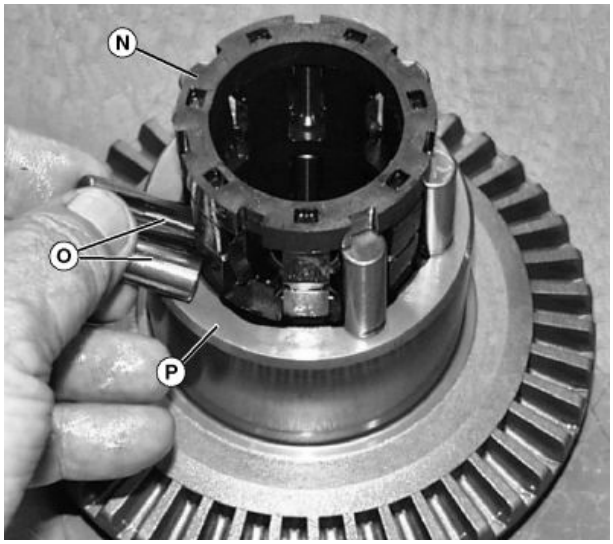
10. Slide roll cage (N) up out of the ring gear until about one half of the first set of rollers is exposed. Prepare to catch the rollers (O) as cage is lifted from the housing (P), as they are spring loaded. There are two rows of seven rollers.

Inspection:

CAUTION: Use safety glasses and protective clothing when using compressed air.

1. Clean all parts in an approved solvent and dry with compressed air.

N—Roll Cage
O—Rollers
P—Housing

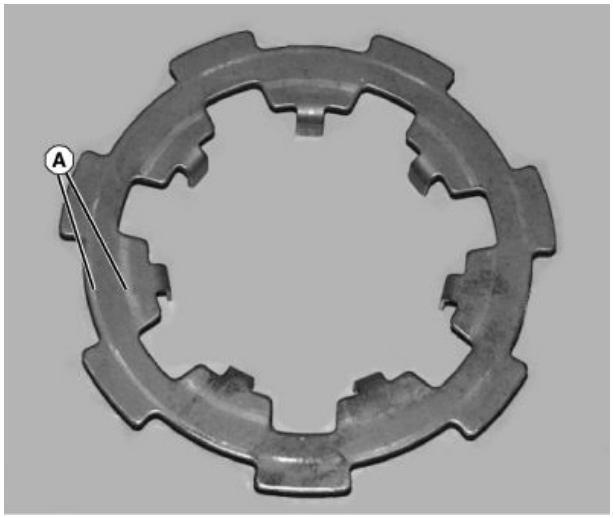


MXT011639 —UN—22MAY14

MX52301,000009F -19-24OCT14-10/19

2. Inspect the wear marks (A) on the flat side of the armature for a consistent wear pattern. If wear pattern is uneven check for warpage by laying flat side of armature on a piece of glass or other flat surface and try to rock it. If armature is warped, replace it.

A—Wear MARKS



MXT011640 —UN—22MAY14

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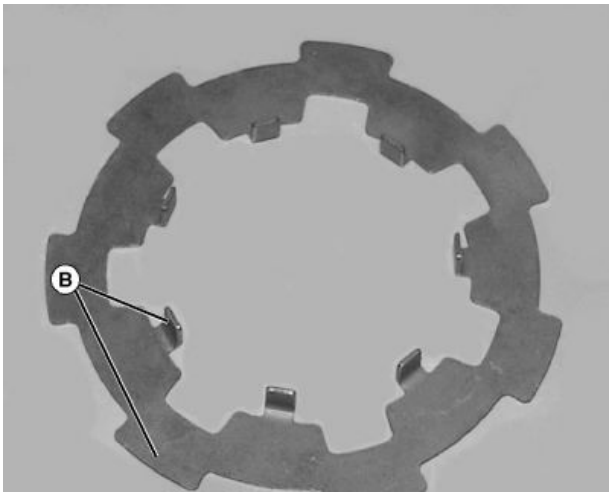
MX52301,000009F -19-24OCT14-11/19

3. Check for worn or broken tangs (B). If tangs are bent or worn replace armature.

B—Tangs

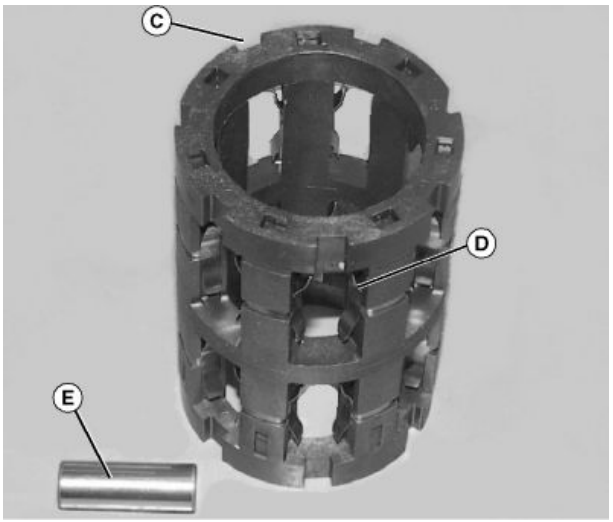


MXT011641 —UN—22MAY14

MX52301,000009F -19-24OCT14-12/19

4. Inspect the slots (C) in the end of the roll cage for wear or damage. Check springs (D) in each roller slot. If any springs are bent or missing, or any slots are damaged, replace cage.
5. Inspect all rollers (E). If there are excessive scratches, nicks, or any flat spots replace rollers.

C—Slots
D—Springs
E—Rollers

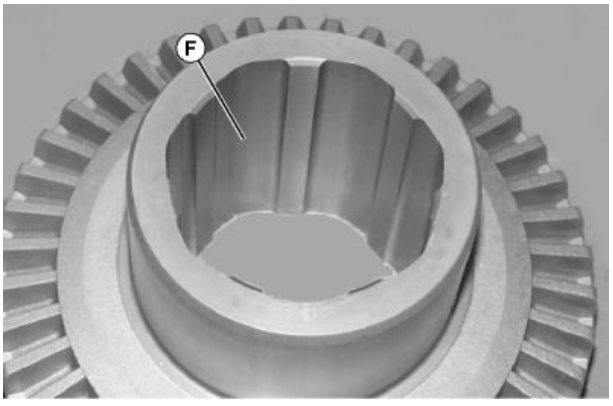


MXT011642 —UN—22MAY14

MX52301,000009F -19-24OCT14-13/19

6. Inspect inside of ring gear (F). If there are excessive scratches, nicks, or any flat spots replace ring gear.

F—Ring Gear



MXT011643 —UN—22MAY14

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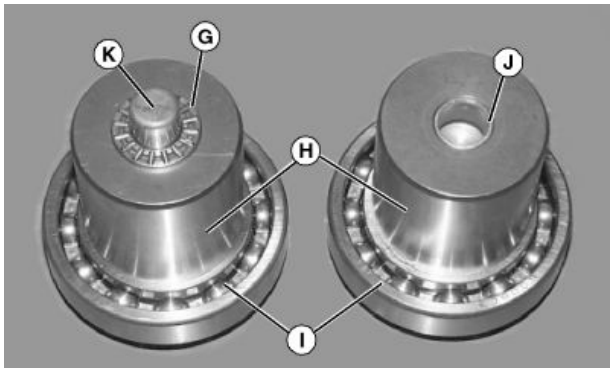
MX52301,000009F -19-24OCT14-14/19

7. Inspect thrust bearing (G) and the ends of both drive hubs where the thrust bearing runs for any scratches or damage. Inspect clutch roller races (H) for any scratches, nicks, or flat spots. Inspect bearings (I) for smooth operation and no excessive play. Inspect bushing (J) and dowel pin (K) for wear or damage. Replace worn or damaged parts as needed.

G—Thrust Bearing
H—Roller Races
I— Bearings
J— Bushing
K—Dowel Pin

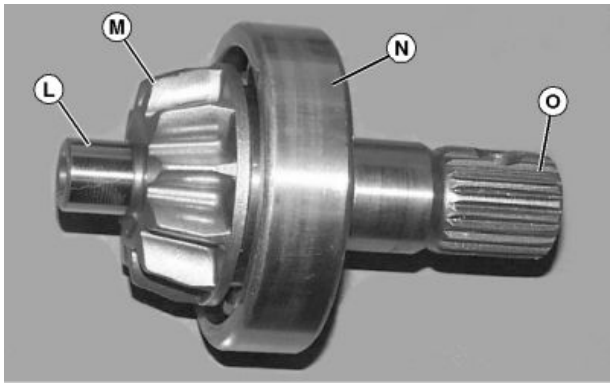


MXT011644 —UN—22MAY14

MX52301,000009F -19-24OCT14-15/19

8. Inspect pinion shaft wear and damage. Inspect bearing area (L) for wear. Inspect gear teeth (M) for wear and damaged or broken teeth. Inspect bearing (N) for smooth operation and wear. Inspect splines (O) for wear or broken splines. Replace any worn or damaged parts.

L—Bearing Area
M—Gear Teeth
N—Bearing
O—Splines

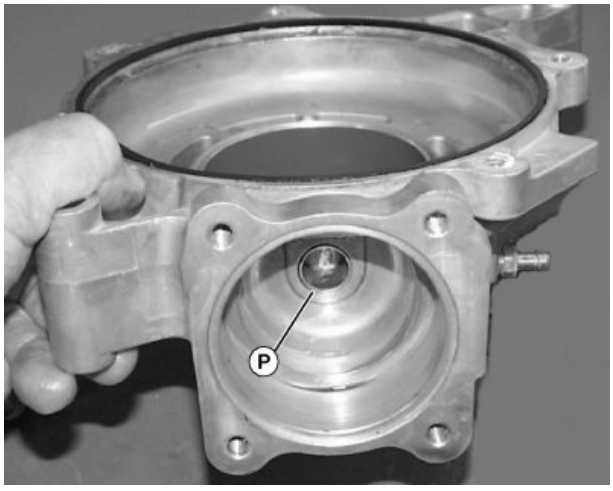


MXT011645 —UN—22MAY14

MX52301,000009F -19-24OCT14-16/19

9. Inspect pinion bushing (P). Replace if worn or damaged.

P—Pinion Bushing



MXT011646 —UN—22MAY14

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MX52301,000009F -19-24OCT14-17/19

10. Inspect bushing (Q). Replace if worn or damaged.

Q—Bushing

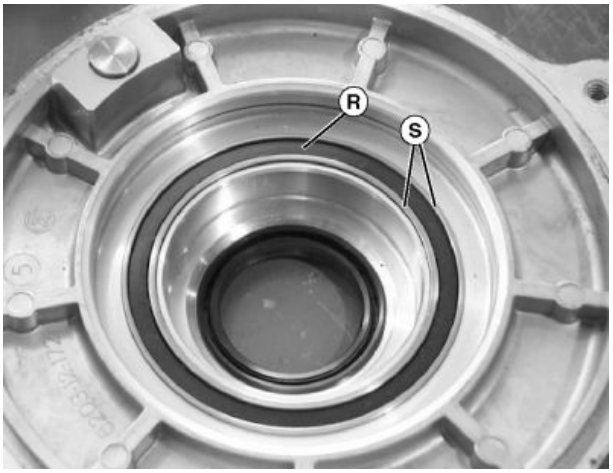
MXT011647 —UN—22MAY14

MX52301,000009F -19-24OCT14-18/19

11. Check the coil depth. The black colored coil (R) should be below the pole faces (S) of the coil pocket insert in the cover. Go around the coil with your finger and if the coil is above the pole faces in any area, replace the entire cover.
12. Check the resistance of the coil with an Ohm meter. Attach the leads of the meter to the two connections in the coil plug. Replace cover if not within specification.

Coil Tests—Specification

Coil Resistance—Resistance	24.7—27.3 Ohms
Coil Temperature at Time of Test—Temperature	20 °C (68 °F)



MXT011648 —UN—22MAY14

R—Colored Coil **S—Pole Faces**

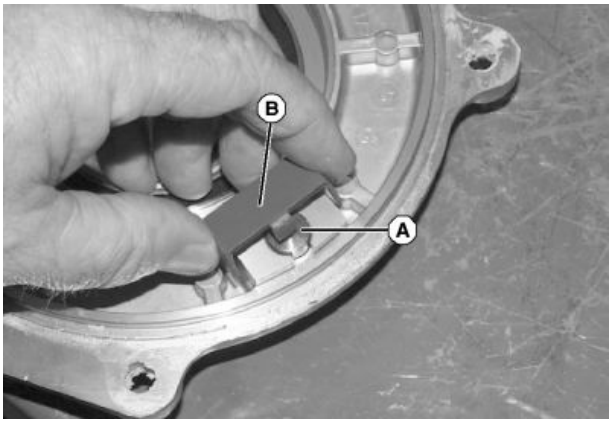
MX52301,000009F -19-24OCT14-19/19

Front Differential Assembly (SN 040001-)

NOTE: Always use new seals and O-ring when assembling unit.

1. Make sure that all parts are clean and dry.
2. Install the thrust button (A) and thrust plate (B).

A—Thrust Button **B—Thrust Plate**



MXT011649 —UN—22MAY14

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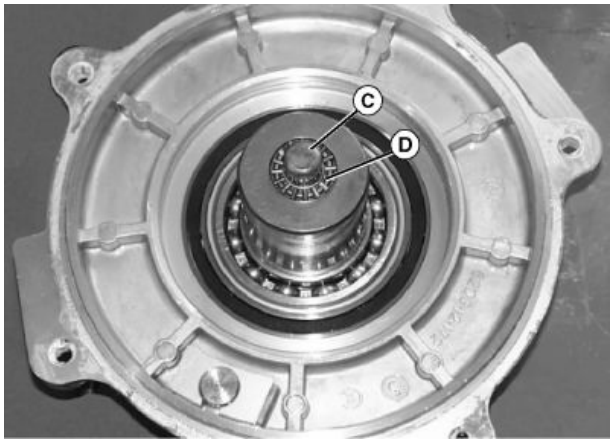
MX52301,00000A0 -19-24OCT14-1/11

3. Install the output hub and bearing assembly with the dowel pin (C) into the cover assembly. Install thrust bearing (D).

C—Dowel Pin **D—Thrust Bearing**

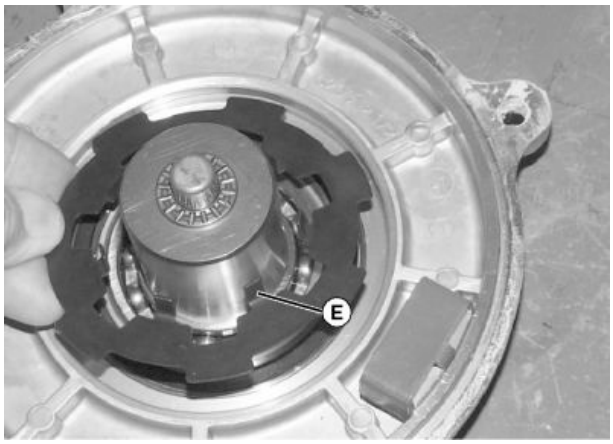


MXT011650 —UN—22MAY14

MX52301,00000A0 -19-24OCT14-2/11

4. Install the armature plate (E) with tangs facing up.

E—Armature Plate

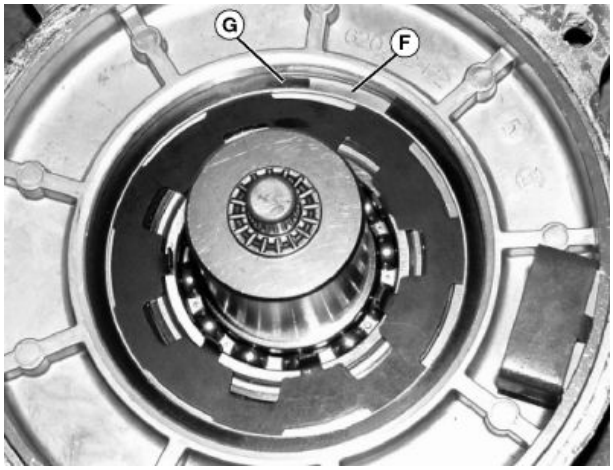


MXT011651 —UN—22MAY14

MX52301,00000A0 -19-24OCT14-3/11

5. Install the brass shim (F) and retaining ring (G).

F—Brass Shim **G—Retaining Ring**



MXT011652 —UN—22MAY14

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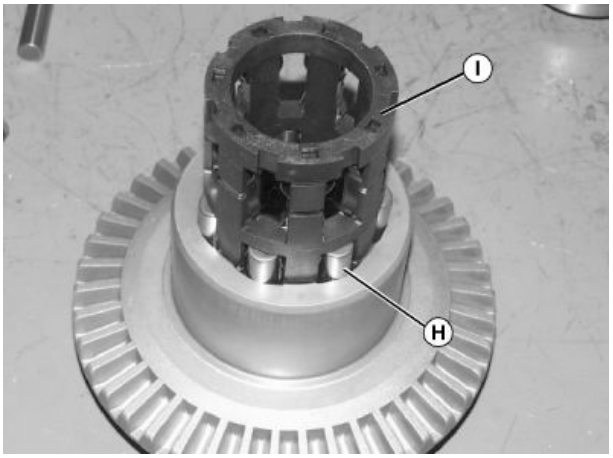
MX52301,00000A0 -19-24OCT14-4/11

6. Install seven rollers (H) into first row of slots in roll cage (I) and slide cage and rollers half way into clutch housing of ring gear. Install next seven rollers and slide cage the rest of the way into clutch housing.

H—Rollers (7 used) **I— Roll Cage**

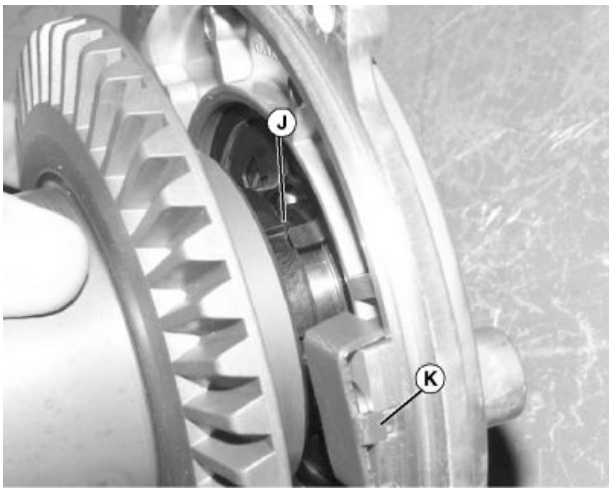


MXT011653 —UN—22MAY14

MX52301,00000A0 -19-24OCT14-5/11

7. Install the ring gear and clutch assembly onto the output hub of the cover assembly. Make sure the slots in the roll cage (J) are lined up with the tangs on the armature. Make sure tang (K) on thrust plate stays in place during assembly.
8. Install shim on center hub or the ring gear.

J— Slot **K—Tang**



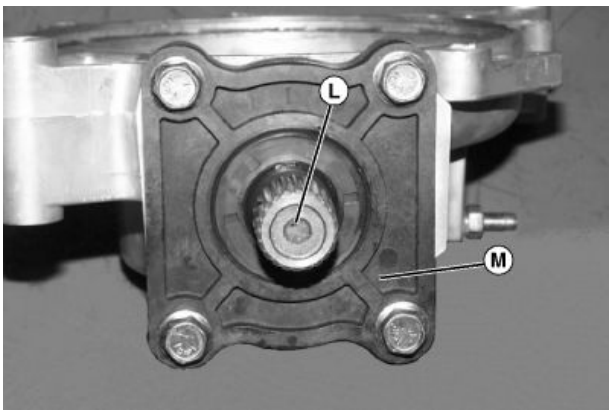
MXT011654 —UN—22MAY14

MX52301,00000A0 -19-24OCT14-6/11

9. Install pinion shaft (L) with bearing into gearcase. Install pinion cover (M) and tighten bolts to specification.

Specification	
Pinion Cover Bolt—Torque	23 N·m (17 lb.-ft.)

L—Pinion Shaft **M—Pinion Cover**



MXT011655 —UN—22MAY14

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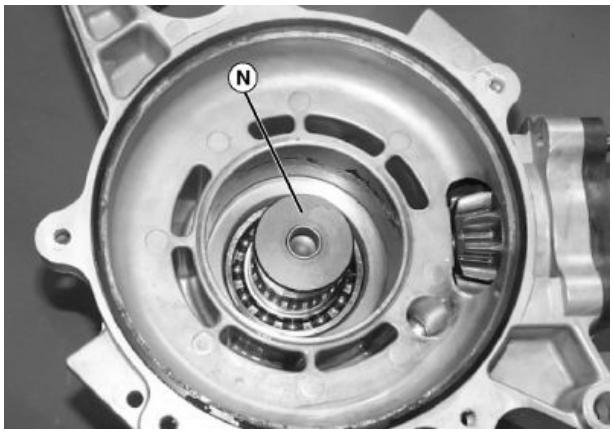
MX52301,00000A0 -19-24OCT14-7/11

10. Install female output hub assembly (N) into the gearcase.

N—Output Hub Assembly

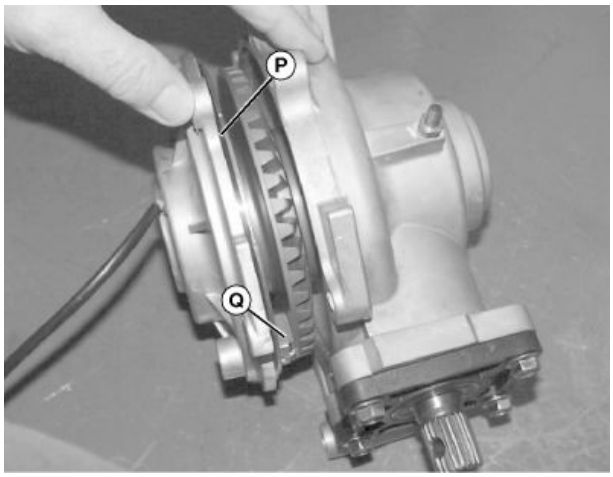


MXT011656 —UN—22MAY14

MX52301,00000A0 -19-24OCT14-8/11

11. Lubricate and install new square O-ring (P) on cover. Make sure thrust plate (Q) stays in position ring and pinion gears mesh properly as cover is installed.

P—O-ring **Q—Thrust Plate**



MXT011657 —UN—22MAY14

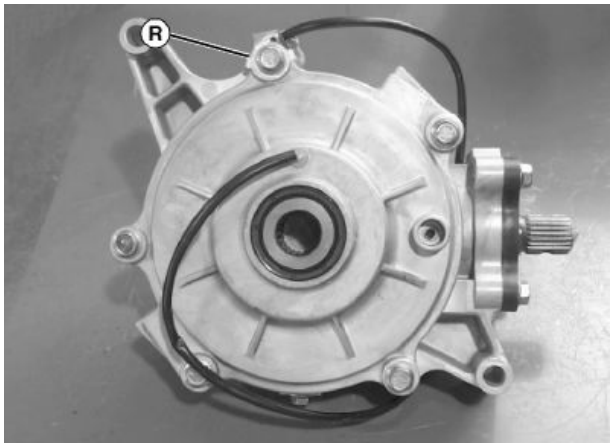
MX52301,00000A0 -19-24OCT14-9/11

12. Install cover bolts with wire clamp (R) in position shown. Tighten bolts in a star pattern to specification.

Specification

Front Differential Cover Bolts—Torque.....23 N·m (17 lb.-ft.)

R—Wire Clamp



MXT011658 —UN—22MAY14

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MX52301,00000A0 -19-24OCT14-10/11

13. Install drain bolt (S) with new nylon sealing washer. Tighten to specification.

Specification

Drain Bolt—Torque.....12 N·m (110 lb.-in.)

14. Remove fill plug (T) and fill gearcase to specification with of J20C low viscosity Hy-Gard™ oil.

Specification

Gear Case Oil—Capacity.....150 mL (5 oz.)

15. Install fill plug and tighten to specification.

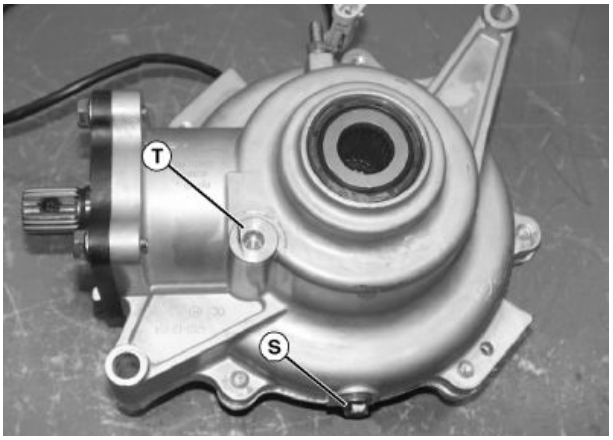
Specification

Fill Plug—Torque.....13.5 N·m (120 lb.-in.)

16. Adjust gear backlash. See EMFWD Ring and Pinion Backlash Adjustment.

17. Install drive shaft coupler.

Hy-Gard is a trademark of Deere & Company



MXT011659 —UN—22MAY14

S—Drain Bolt **T—Fill Plug**

MX52301,00000A0 -19-24OCT14-11/11

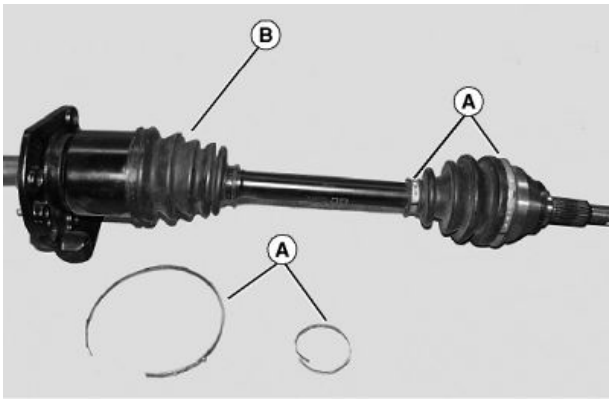
CV Joint (Front or Rear Axle Drive Shafts) Disassembly and Assembly

NOTE: If CV joint boots have been leaking grease, clean grease from machine, especially the parking brake assembly.

Disassembly

1. Remove clamps (A) from boots (B). Slide boot off CV joint and onto shaft.

A—Clamps **B—Boots**



MXT011660 —UN—22MAY14

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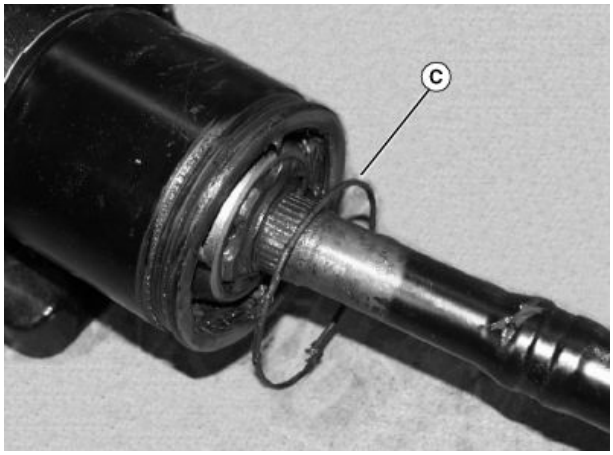
MX52301,00000A1 -19-05MAY14-1/5

2. Remove retaining ring (C) from inside of CV joint and pull joint out.

C—Retaining Ring

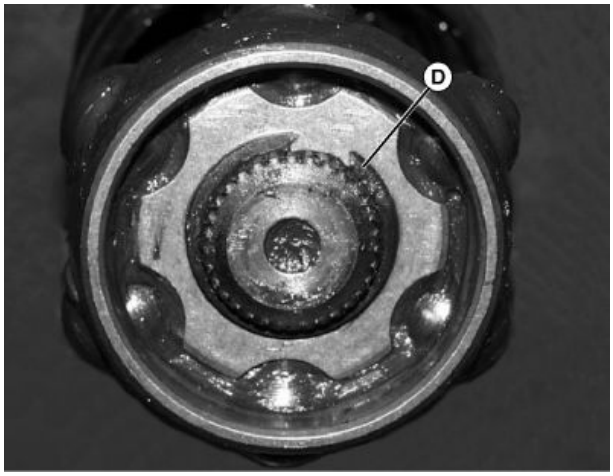


MXT011661 —UN—22MAY14

MX52301,00000A1 -19-05MAY14-2/5

3. Remove snap ring (D).

D—Snap Ring



MXT011662 —UN—22MAY14

MX52301,00000A1 -19-05MAY14-3/5

4. Remove CV joint. The joint is tapered and larger end (E) faces the outer end of shaft.

E—Larger End

MXT011663 —UN—22MAY14

Continued on next page

MX52301,00000A1 -19-05MAY14-4/5

5. Remove snap ring (F). Slide outer boot (G) off shaft.
6. Clean all metal parts with solvent and dry with compressed air.
7. Inspect all parts for wear or damage. Replace any worn or damaged parts.

Assembly

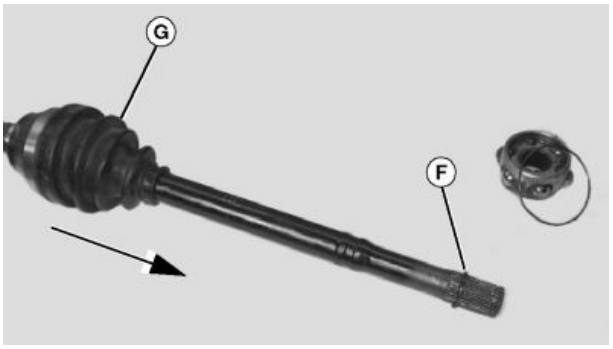
NOTE: Grease is available in correct quantity containers for each joint. Pack the CV joint with half of the grease and apply other half to the inside of the boot.

1. Use new boots and clamps when assembling.

NOTE: If shaft has more than one groove that small end of boot could go in, measure length of uninstalled new boot and use groove which will keep it as close as possible to the new uninstalled length.

2. Pack CV joints and boots with grease.

NOTE: Before clamping either boot, equalize pressure between inside of boot and atmosphere by inserting a small screwdriver between boot and shaft. This prevents boot from getting a vacuum in it and being drawn in against moving parts.



MXT011664 —UN—22MAY14

F—Snap Ring **G—Outer Boot**

3. Install wheel end boot. Install one clamp, equalize air pressure in boot and install other clamp.
4. Slide inner end boot onto shaft. Install snap ring. Install CV joint with larger side of ball retainer toward end of shaft. Install snap ring. Install one clamp, equalize air pressure in boot and install other clamp.

MX52301,00000A1 -19-05MAY14-5/5

Section 70
Steering

Contents

Specifications

Item	Measurement	Specification
Toe-Out Specification		
Toe-Out Specification	Distance	25—35 mm (1.16—1.20 in.)
Hardware Torques		
Steering Wheel Nut	Torque	31—45 N·m (23—33 lb.-ft.)
Knuckle Nut	Torque	54 N·m (40 lb.-ft.)
Steering Shaft to Pinion	Torque	68 N·m (50 lb.-ft.)
Steering Rack to Frame Nuts	Torque	23—34 N·m (17—25 lb.-ft.)
Tie Rod End to Steering Arm Lock Nut	Torque	54 N·m (40 lb.-ft.)
Caliper Sliding Pins to Steering Knuckle	Torque	41—52 N·m (30—38 lb.-ft.)
A—Arm to Frame	Torque	68—100 N·m (50—74 lb.-ft.)
Ball Joint to A—Arm Lock Nut	Torque	54 N·m (40 lb.-ft.)
Helical Spline Halfshaft Castle Nut	Torque	251 +119/-23 N·m (185 +88/-17 lb.-ft.)
Non-helical Halfshaft Castle Nut	Torque	170 +119/-23 N·m (125 +88/-17 lb.-ft.)

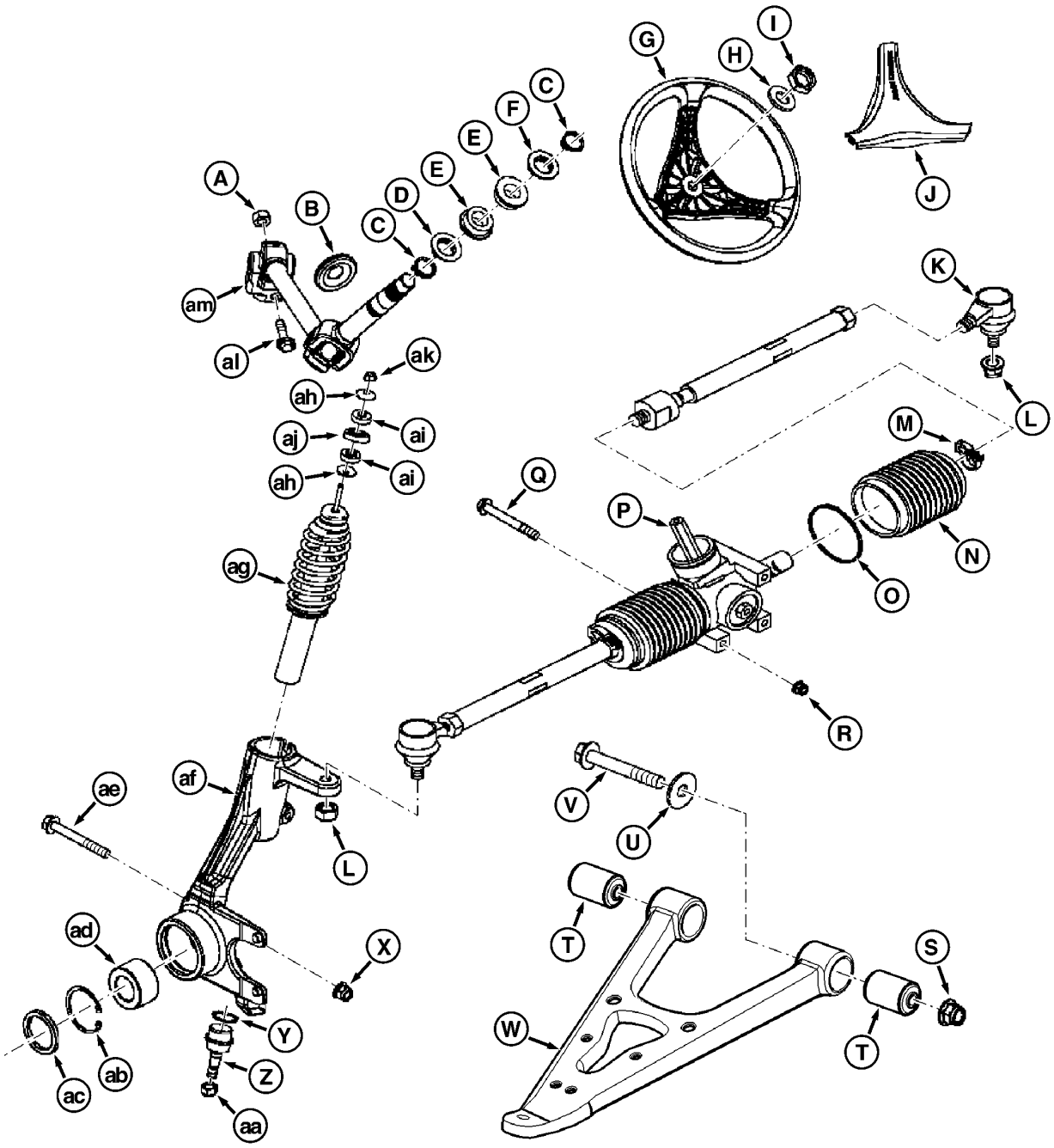
MX52301,0000465 -19-08AUG14-1/1

Summary of References

- Steering System (SN -090000)
- Steering System (SN 090001-)

MX52301,0000466 -19-23OCT14-1/1

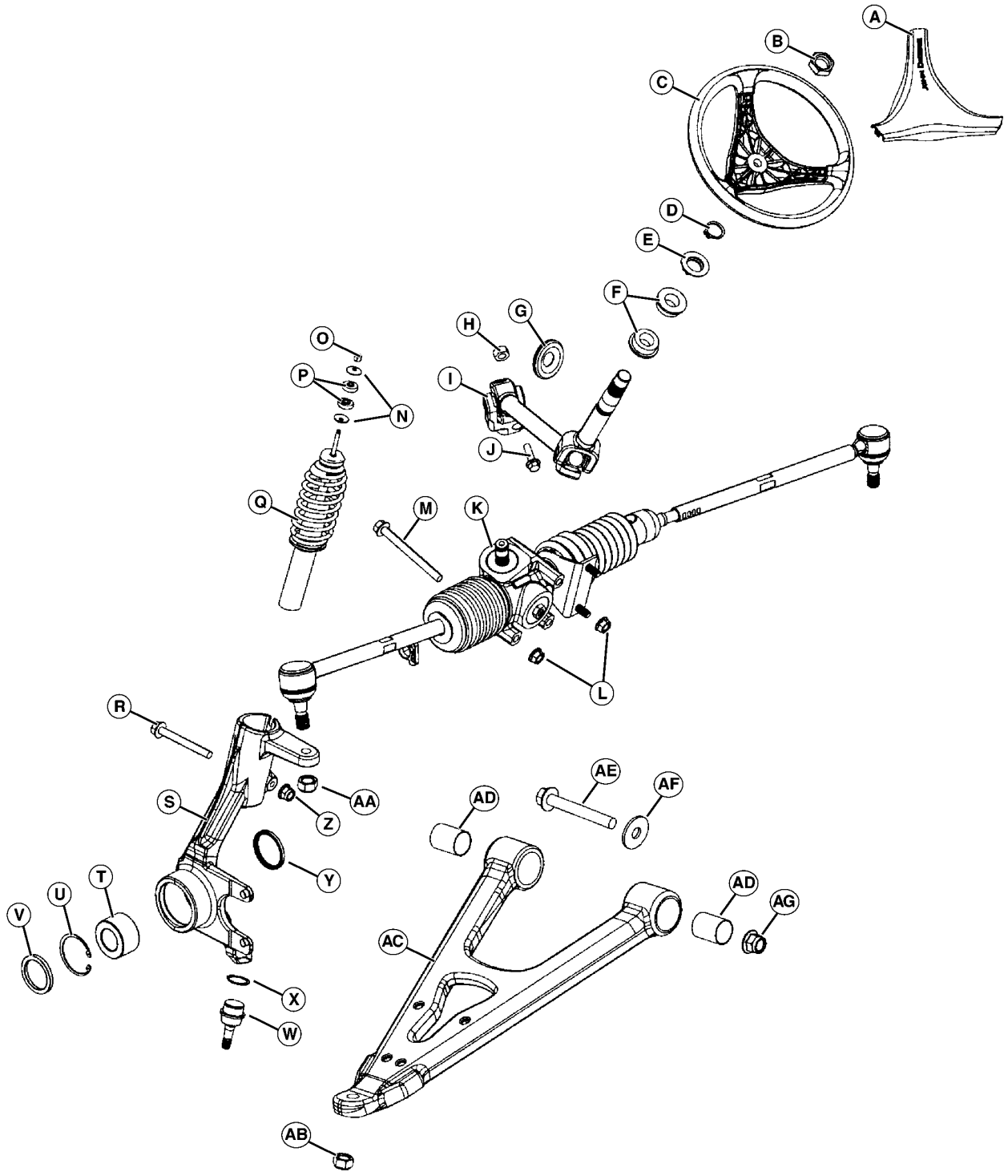
Steering System (SN -090000)



A—Lock Nut
B—Grommet
C—Snap Ring
D—Washer
E—Bushing
F—Washer
G—Steering Wheel
H—Washer
I— Nut
J—Cover
K—Tie Rod End
L—Lock Nut
M—Tie Band
N—Boot
O—Tie Band
P—Rack Assembly
Q—Bolt
R—Nut
S—Nut
T—Isolator
U—Washer
V—Bolt
W—Lower Control Arm
X—Nut
Y—Snap RIng
Z—Ball Joint
aa— Nut
ab— Snap Ring
ac— Seal
ad— Bearing
ae— Bolt
af— Knuckle
ag— Shock Absorber
ah— Retainer
ai— Bumper
aj— Spacer
ak— Nut
al— Bolt
am—Steering Shaft

BS62576,00017FA -19-20OCT14-1/1

Steering System (SN 090001-)



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MX52301,000005E -19-02JUN14-1/2

A—Cover
B—Nut M16
C—Steering Wheel
D—Snap Ring
E—Washer
F—Bearing
G—Grommet
H—Lock Nut
I— Steerign Shaft
J— Screw M10x35
K—Steering Rack
L—Nut
M—Screw M8x90
N—Washer
O—Lock Nut
P—Cushion
Q—Shock Absorber
R—Screw M8x70
S—Knuckle (LH Shown)
T—Bearing
U—Snap Ring
V—Seal
W—Ball Joint
X—Snap Ring
Y—Seal
Z—Lock Nut
AA—Lock Nut
AB—Lock Nut
AC—Arm
AD—Bushing
AE—Screw M12x90
AF—Washer 13x37x3 mm
AG—Lock Nut M12

MX52301,000005E -19-02JUN14-2/2

Steering System Operation

Function:

The steering system provides a means of turning the machine when in motion.

Theory of Operation

The machine uses a manual rack and pinion type steering system. The steering rack is a sealed unit with no serviceable parts. Input for the steering rack is provided by the steering wheel connected via a shaft and two U-joints. The rack has an adjustable tie rod end for each of the front wheels. These tie rod ends are sealed units which allow the toe-in geometry of the front wheels to be adjusted for proper machine tracking.

The front wheels are attached to struts which rotate on strut mounting washers. Caster and camber are fixed and not adjustable.

MX52301,000005F -19-02JUN14-1/1

System Diagnosis

Steering Symptoms

MX52301,0000061 -19-22OCT14-1/59

❶ Steering Pulls In One Direction

MX52301,0000061 -19-22OCT14-2/59

Tire Pressure	Are the tires out of round or have improper air pressure?	**YES:** Inflate to proper air pressure. Replace tire(s) as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-3/59

Tie Rods	Are the tie rods bent or loose?	**YES:** Repair or replace as needed. See Tie Rod End Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-4/59

Wheel Bearings	Are wheel bearings worn or lost lubrication?	**YES:** Replace as needed. See Front Wheel Bearing Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-5/59

Tire Size	Have the wrong size tire(s) been installed?	**YES:** Replace with correct size tires. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-6/59

Toe-out	Is toe-out out of specification?	**YES:** Adjust toe-out as needed. See Toe-Out Adjustment. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-7/59

King Pins, King Pin A-frame Bearings	Do spindles, king pins, or king pin A-frame bearings require lubrication?	**YES:** Lubricate as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-8/59

Rack and Pinion	Is the rack and pinion assembly worn or broken?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

Continued on next page

MX52301,0000061 -19-22OCT14-9/59

Rack and Pinion	Is the steering shaft to rack and pinion assembly snap ring dislodged or missing?	**YES:** Install or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-10/59

A-arm	Are the A-arm bushings worn, or is A-arm bent?	**YES:** Repair or replace as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-11/59

Shock Absorber	Are the shock absorber mounts bent, or have worn, loose, broken, or missing hardware?	**YES:** Repair or replace as needed. See Front Strut/Shock Removal and Installation.

MX52301,0000061 -19-22OCT14-12/59

❷ Steering Wanders or Vibrates

MX52301,0000061 -19-22OCT14-13/59

Tire Pressure	Are the tires out of round or have improper air pressure?	**YES:** Inflate to proper air pressure. Replace tire(s) as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-14/59

Tie Rods	Are the tie rods bent or loose?	**YES:** Repair or replace as needed. See Tie Rod End Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-15/59

Wheel Bearings	Are wheel bearings worn or lost lubrication?	**YES:** Replace as needed. See Front Wheel Bearing Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-16/59

Tire Size	Have the wrong size tire(s) been installed?	**YES:** Replace with correct size tires. **NO:** Go to next step.

Continued on next page

MX52301,0000061 -19-22OCT14-17/59

Toe-out	Is toe-out out of specification?	**YES:** Adjust toe-out as needed. See Toe-Out Adjustment. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-18/59

King Pins, King Pin A-frame Bearings	Do spindles, king pins, or king pin A-frame bearings require lubrication?	**YES:** Lubricate as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-19/59

Rack and Pinion	Is the rack and pinion assembly worn or broken?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-20/59

Shock Absorber	Are the shock absorber mounts bent, or have worn, loose, broken, or missing hardware?	**YES:** Repair or replace as needed. See Front Strut/Shock Removal and Installation.

MX52301,0000061 -19-22OCT14-21/59

❸ Wheel Bearing Noise

MX52301,0000061 -19-22OCT14-22/59

Bearings	Are wheel bearings worn or lost lubrication?	**YES:** Replace as needed. See Front Wheel Bearing Removal and Installation.

MX52301,0000061 -19-22OCT14-23/59

❹ Steering Hard Left, Right, or Both

MX52301,0000061 -19-22OCT14-24/59

Steering	Are optional accessories (cab, blade, etc.) installed?	**YES:** Install heavy-duty shock absorber kit. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-25/59

Tie Rods	Are the tie rods bent or loose?	**YES:** Repair or replace as needed. See Tie Rod End Removal and Installation. **NO:** Go to next step.

Continued on next page

MX52301,0000061 -19-22OCT14-26/59

Bearings	Are wheel bearings worn or lost lubrication?	**YES:** Replace as needed. See Front Wheel Bearing Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-27/59

Tire Size	Have the wrong size tire(s) been installed?	**YES:** Replace with correct size tires. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-28/59

Toe-out	Is toe-out out of specification?	**YES:** Adjust toe-out as needed. See Toe-Out Adjustment. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-29/59

King Pins, King Pin A-frame Bearings	Do spindles, king pins, or king pin A-frame bearings require lubrication?	**YES:** Lubricate as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-30/59

Rack and Pinion	Is the rack and pinion assembly worn or broken?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-31/59

A-arm	Are the A-arm bushings worn, or is A-arm bent?	**YES:** Repair or replace as needed **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-32/59

Shock Absorber	Are the shock absorber mounts bent, or have worn, loose, broken, or missing hardware?	**YES:** Repair or replace as needed. See Front Strut/Shock Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-33/59

Steering Wheel and Shaft	Are the steering wheel or shaft splines worn or stripped?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

Continued on next page

MX52301,0000061 -19-22OCT14-34/59

Rubber Boot	Is the rubber boot cracked or torn?	**YES:** Replace as needed. See Steering Rack Removal and Installation.

MX52301,0000061 -19-22OCT14-35/59

❺ Steering Locks in Hard Left or Right Turn

MX52301,0000061 -19-22OCT14-36/59

King Pins, King Pin A-frame Bearings	Do spindles, king pins, or king pin A-frame bearings require lubrication?	**YES:** Lubricate as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-37/59

Rack and Pinion	Is the rack and pinion assembly worn or broken?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-38/59

A-arm	Are the A-arm bushing worn, or is A-arm bent?	**YES:** Repair or replace as needed **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-39/59

Shock Absorber	Are the shock absorber mounts bent, or have worn, loose, broken, or missing hardware?	**YES:** Repair or replace as needed. See Front Strut/Shock Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-40/59

Steering Wheel and Shaft	Are the steering wheel or shaft splines worn or stripped?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-41/59

Rubber Boot	Is the rubber boot cracked or torn?	**YES:** Replace as needed. See Steering Rack Removal and Installation.

MX52301,0000061 -19-22OCT14-42/59

❻ Steering Wheel Pulls Upward

Continued on next page

MX52301,0000061 -19-22OCT14-43/59

Steering Wheel	Is the steering wheel nut loose, stripped, or missing?	**YES:** Tighten or replace as needed. See Steering Wheel Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-44/59

Steering Shaft	Is the steering shaft to rack and pinion assembly snap ring dislodged or missing?	**YES:** Install or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-45/59

❼ Steering Wheel Spins Freely

MX52301,0000061 -19-22OCT14-46/59

Steering Wheel	Is the steering wheel nut loose, stripped, or missing?	**YES:** Tighten or replace as needed. See Steering Wheel Removal and Installation **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-47/59

Steering Wheel Splines	Are the steering wheel or shaft splines worn or stripped?	**YES:** Replace as needed. See Steering Rack Removal and Installation **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-48/59

Steering Shaft	Is the steering shaft to rack and pinion assembly snap ring dislodged or missing?	**YES:** Install or replace as needed. See Steering Rack Removal and Installation

MX52301,0000061 -19-22OCT14-49/59

❽ Noise During Turns Over Rough Terrain

MX52301,0000061 -19-22OCT14-50/59

Tie Rods	Are the tie rods bent or loose?	**YES:** Repair or replace as needed. See Tie Rod End Removal and Installation **NO:** Go to next step.

Continued on next page

MX52301,0000061 -19-22OCT14-51/59

Wheel Bearings	Are wheel bearings worn or lost lubrication?	**YES:** Replace as needed. See Front Wheel Bearing Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-52/59

Toe-out	Is toe-out out of specification?	**YES:** Adjust toe-out as needed. See Toe-Out Adjustment. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-53/59

King Pins, King Pin A-frame Bearings	Do spindles, king pins, or king pin A-frame bearings require lubrication?	**YES:** Lubricate as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-54/59

Rack and Pinion	Is the rack and pinion assembly worn or broken?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-55/59

A-arm	Are the A-arm bushings worn, or is A-arm bent?	**YES:** Repair or replace as needed. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-56/59

Shock Absorber	Are the shock absorber mounts bent, or have worn, loose, broken, or missing hardware?	**YES:** Repair or replace as needed. See Front Strut/Shock Removal and Installation.

MX52301,0000061 -19-22OCT14-57/59

Steering Wheel and Shaft	Are the steering wheel or shaft splines worn or stripped?	**YES:** Repair or replace as needed. See Steering Rack Removal and Installation. **NO:** Go to next step.

MX52301,0000061 -19-22OCT14-58/59

Rubber Boot	Is the rubber boot cracked or torn?	**YES:** Replace as needed. See Steering Rack Removal and Installation.

MX52301,0000061 -19-22OCT14-59/59

Summary of References

- Toe-Out Adjustment

MX52301,0000467 -19-02JUN14-1/1

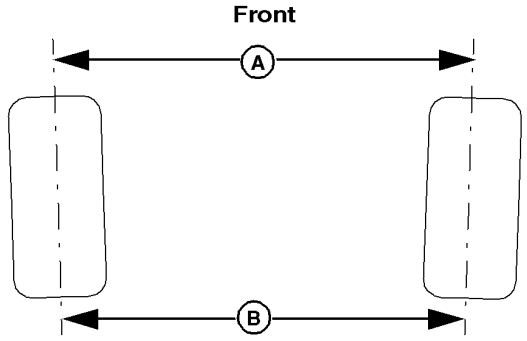
Toe-Out Adjustment

Procedure:

1. Park machine safely on a level surface
2. Lock park brake
3. Ensure that all suspension components are in good condition.
4. Ensure that tire pressure is correct on all wheels.
5. Remove any cargo or passengers from machine.

NOTE: Toe-out must be checked and adjusted with the front tires elevated off the ground and front suspension fully extended.

6. Turn steering wheel until the rack is centered on the vehicle. Centering of the rack can be checked by measuring the distance from the outer tie rod tube end to the outer surface of the main frame tube on each side of the machine. The distances must be equal before checking or adjusting the toe out. Secure the steering wheel when rack has been centered.
7. After rack is centered, make sure that there are an equal number of threads showing between the tie rod jam nut and the outer tie rod ball joint on both sides.
8. At hub height and center of tire tread, measure front distance (A) and rear distance (B) at center of tire.



MXT011666 —UN—22MAY14

A—Front Distance **B—Measurement**

Subtract measurement (B) from measurement (A). The difference is the toe out.

9. Compare toe out measurement to specification and adjust if not within specification.

Specification

Toe-Out Specification—Distance.....25—35 mm (1.16—1.20 in.)

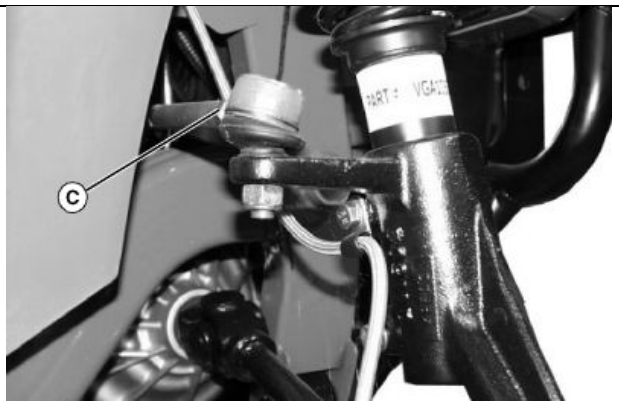
MX52301,0000062 -19-02JUN14-1/2

Adjustment Procedure:

1. Loosen jam nut (C).

NOTE: The rubber boot on steering rack may turn with the tie rod if boot tie strap is too tight. If this happens, unlatch tie strap and hold with hand enough to allow the rubber boot to remain stationary.

2. Turn tie rod until front to rear measurement is within specification. Make sure that the rack has stayed centered during adjustment, and that an equal number of threads are showing between the tie rod jam nut and the outer tie rod ball joint on both sides after adjusting.
3. Tighten jam nut.



MXT011667 —UN—22MAY14

C—Jam Nut

MX52301,0000062 -19-02JUN14-2/2

Summary of References

- Steering Wheel Removal and Installation
- Tie Rod End Removal and Installation
- Steering Rack Removal and Installation
- Steering Shaft Removal and Installation
- Front Strut/Shock Removal and Installation
- Front Wheel Bearing Removal and Installation
- Ball Joint Removal and Installation
- Front A-Arm Removal and Installation
- A-Arm Bushing Removal and Installation

MX52301,0000468 -19-04JUN14-1/1

Steering Wheel Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Remove cover from steering wheel by gently prying up on center cover at three points (C).

C—Steering Wheel Cover

MXT011668 —UN—22MAY14

MX52301,0000063 -19-04JUN14-1/2

4. Remove nut (D) securing steering wheel to shaft.
5. Note position of steering wheel by marking spline and wheel for proper positioning during assembly.
6. Gently tap bottom of steering wheel up and off shaft splines.

Installation:

1. Installation is in the reverse of removal.
2. Ensure that wheel is installed in the same position as it was removed.
3. Tighten nut to specification.

Specification	
Steering Wheel Nut—Torque	31—45 N•m (23—33 lb.-ft.)

D—Nut

MXT011669 —UN—22MAY14

MX52301,0000063 -19-04JUN14-2/2

Tie Rod End Removal and Installation

Removal:

1. Park machine safely on a level surface
2. Lock park brake.
3. Block wheels and raise front of machine. Support with jack stands.
4. Remove front wheel(s).
5. Remove nut (A) securing tie rod end to steering knuckle.
6. Separate tie rod end from steering knuckle.

MXT011670 —UN—22MAY14

A—Nut

MX52301,0000064 -19-04JUN14-1/2

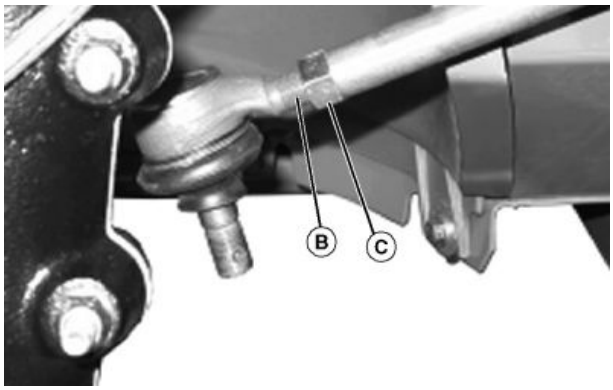
7. Mark or count exposed threads (B) on tie rod end to provide a rough alignment guide when installing new tie rod end.
8. Repeat for other tie rod end if necessary.
9. Loosen jam nut (C) and unscrew tie rod end.

Installation:

1. Install new tie rod end and screw into tie rod, exposing the same number of threads as the one removed. Repeat for other side of machine if necessary.
2. Install tie rod end onto steering knuckle.
3. Install tie rod end to steering knuckle nut and tighten to specification.

Specification	
Knuckle Nut—Torque	54 N•m (40 lb.-ft.)

4. Install wheel(s).
5. Lower machine.



MXT011671 —UN—22MAY14

B—Exposed Threads **C—Jam Nut**

6. Perform toe-out adjustment. See Toe-Out Adjustment.

MX52301,0000064 -19-04JUN14-2/2

Steering Rack Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Block rear wheels and raise front of machine. Support with jack stands.
4. Remove front wheel(s).
5. Remove hood. See Hood Removal and Installation.
6. Remove front grille. See Front Grille Removal and Installation.
7. Remove Radiator. See Radiator Removal and Installation.
8. Remove nuts (A) and separate both tie rod ends from steering knuckles.

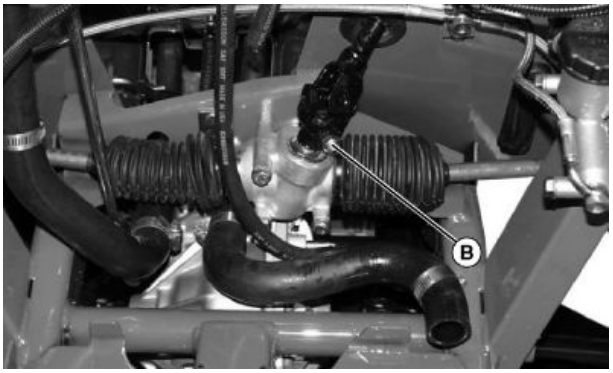
MXT011672 —UN—22MAY14

A—Nuts

MX52301,0000065 -19-22OCT14-1/5

9. Remove bolt and nut (B) on steering shaft U-joint.
10. Remove center console. See Remove and Install Center Console (SN -090000) or Remove and Install Center Console (SN 090001-).

B—Bolt and Nut



MXT011673 —UN—22MAY14

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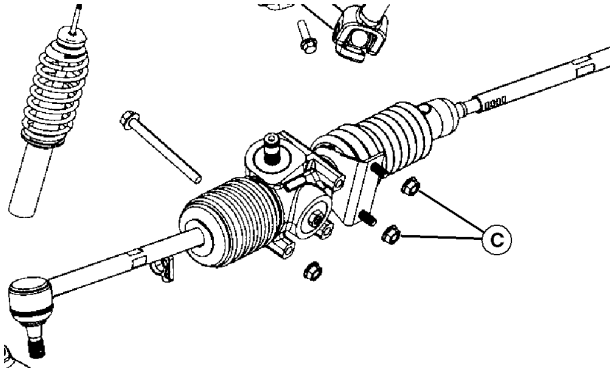
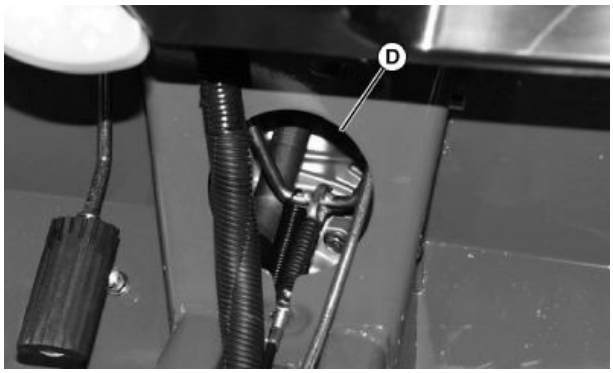
MX52301,0000065 -19-22OCT14-2/5

11. Remove steering rack alignment stud nuts (C) through access hole (D) behind firewall.

D—Access Hole



MXT011675 —UN—22MAY14

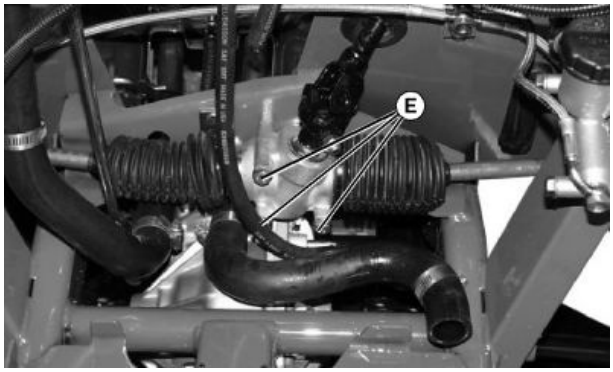


MXT011674 —UN—22MAY14

MX52301,0000065 -19-22OCT14-3/5

12. Remove three nuts and bolts (E) securing steering rack to firewall.
13. Disconnect steering shaft U-joint from rack input.
14. Remove steering rack from machine.

E—Nuts and Bolts (3 used)



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Installation:

1. Align flats (F) on splines of steering rack and steering shaft U-joint.
2. Install retaining bolt and nut. Tighten to specification.

Specification	
Steering Shaft to Pinion—Torque	68 N•m (50 lb.-ft.)

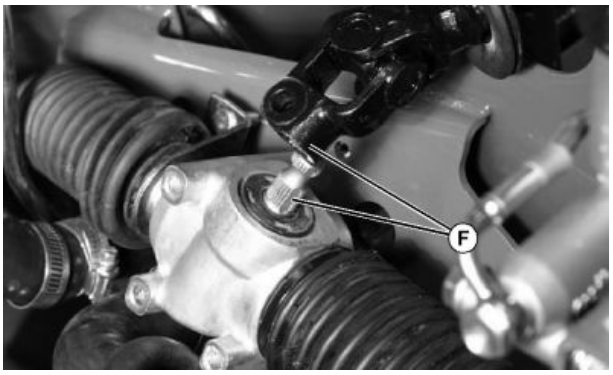
3. Insert steering rack alignment studs into holes in firewall.
4. Install bolts and nuts securing steering rack to firewall. Tighten to specification.

Specification	
Steering Rack to Frame Nuts—Torque	23—34 N•m (17—25 lb.-ft.)

5. Attach tie rod ends to steering knuckles. Tighten nuts to specification.

Specification	
Tie Rod End to Steering Arm Lock Nut—Torque	54 N•m (40 lb.-ft.)

6. Install radiator. See Radiator Removal and Installation.



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F—Spline Alignment

7. Install front grille. See Front Grille Removal and Installation.
8. Install hood. See Hood Removal and Installation.
9. Install wheels.
10. Lower machine.
11. Check toe-out adjustment. See Toe-Out Adjustment.

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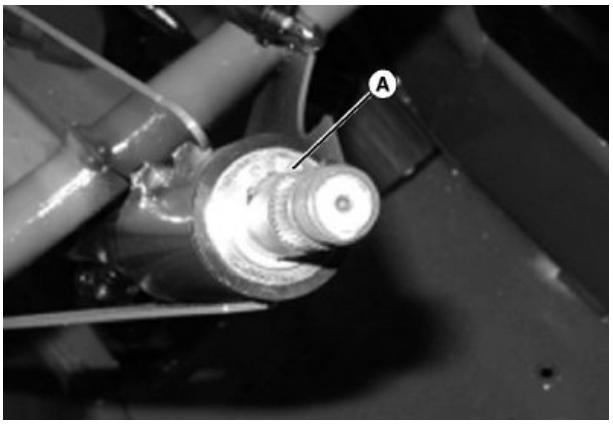
Steering Shaft Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Remove dash panel. See Dash Panel Removal and Installation.
4. Remove upper steering shaft outside snap ring (A) and washer.

A— Upper Steering Shaft Snap Ring



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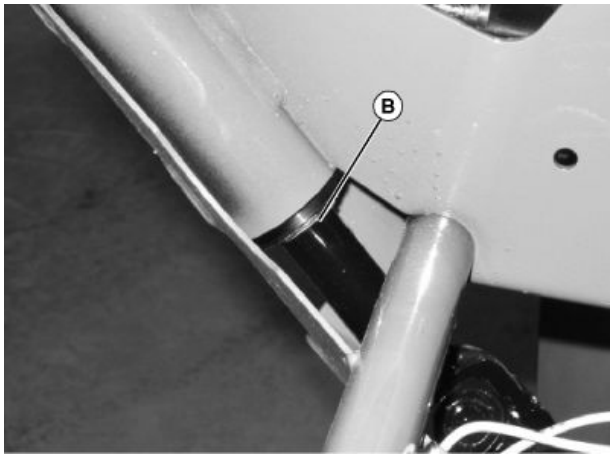
5. Remove lower steering shaft snap ring (B) and let down ring and washer slide steering shaft.

B—Lower Steering Shaft Snap Ring



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6. Remove bolt and nut (C) on steering shaft U-joint.
7. Slide shaft up and toward steering column to remove from steering rack splines.
8. Pull shaft down toward steering rack and slide out of steering column.

Installation:

- Installation is in the reverse of removal.
- Tighten to specification.

Specification	
Steering Shaft to Pinion (Torque Prevailing Lock Nut to Bolt)—Torque	68 N•m (50 lb.-ft.)

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C—Bolt and Nut

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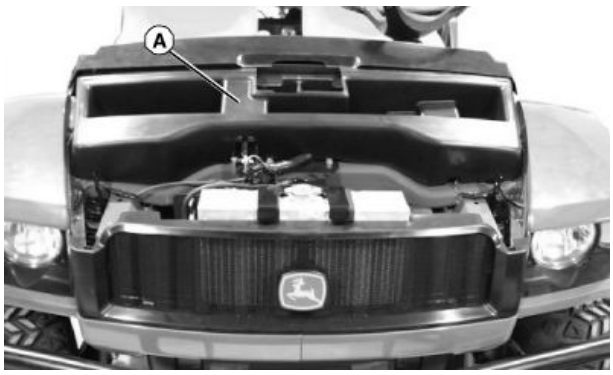
Front Strut/Shock Removal and Installation

Strut Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Raise hood and remove utility box (A).
4. Block rear wheels on both sides.
5. Raise front of vehicle and support with jack stands.
6. Remove front wheels. See Wheel Removal and Installation.
7. Remove cotter pin (B) from castle nut at wheel hub. Discard cotter pin.
8. Remove hub. See Hub Removal. It may be necessary for an assistant to apply pressure to the brake pedal in order to keep the brake disc assembly from turning.



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A—Utility Box

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9. Remove nut and bolt (C) on steering knuckle holding brake line support.

C—Nut and Bolt

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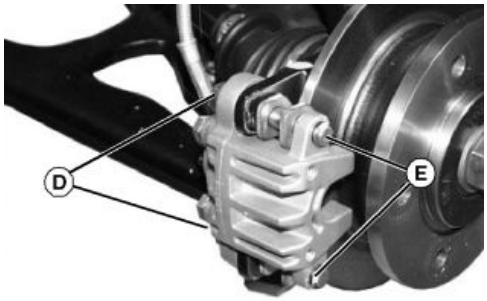
10. Remove two C-clips (E) and two sliding pins (D) securing brake caliper.
11. Remove caliper and secure out of the way ensuring the stress is taken off the brake line.
12. Remove brake disc.

D—Sliding Pins (2 used) **E—C-clips (2 used)**



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13. Remove nut (F) securing tie rod end to steering knuckle.
14. Separate tie rod end from steering knuckle.

F—Nut

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Continued on next page

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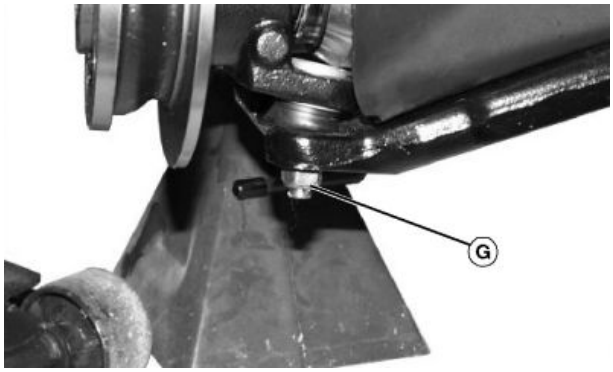
15. Remove nut (G) securing ball joint to A-arm.
16. Separate ball joint from A-arm.
17. Hold or support strut to prevent it from falling.

G—Nut



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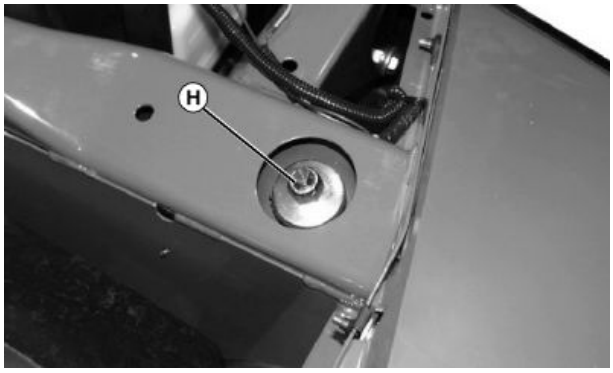
18. Remove strut retaining nut (H) from top of machine.
19. Lower strut and remove from machine.

H—Strut Retaining Nut



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Shock Removal:

1. Remove two bolts and nuts (I) securing shock to steering knuckle.
2. Remove shock from steering knuckle.

I— Bolts and Nuts (2 used)

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Continued on next page

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Installation:

1. If shock was removed, install into steering knuckle until it fully seats. Tighten steering knuckle bolt.
2. Insert strut, bushings, and washers into strut mounting hole.
3. Install strut retaining nut.
4. Insert drive shaft into steering knuckle.
5. Install ball joint and nut onto steering knuckle.

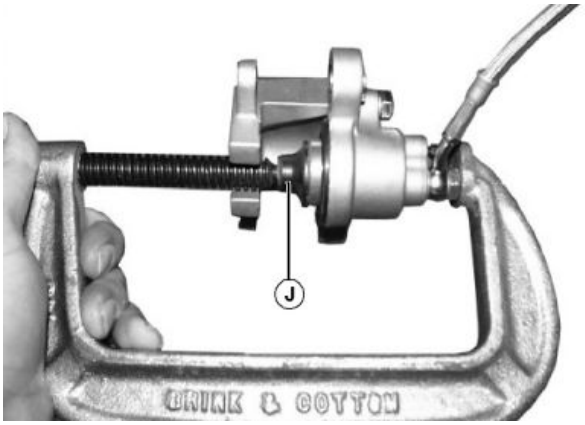
Specification	
Ball Joint to A-Arm Lock Nut—Torque	54 N·m (40 lb.-ft.)

6. Install tie rod end and nut onto steering knuckle.

Specification	
Tie Rod End to Steering Arm Lock Nut—Torque	54 N·m (40 lb.-ft.)

7. Install hub. See Hub Installation.
8. Install brake caliper. It may be necessary to press caliper cylinder into it's bore with a C-clamp (J) to allow clearance for brake pads.
9. Install brake pads, two caliper sliding pins, and two C-clips. Tighten to specification.

Specification	
Caliper Sliding Pins to Steering Knuckle—Torque	41—52 N•m (30—38 lb.-ft.)



MXT011689 —UN—22MAY14

10. Tighten castle nut and install a new cotter pin. Bend ends of cotter pin in opposite directions.

Castle Nut—Specification	
Helical Spline Halfshaft Castle Nut—Torque	251 +119/-23 N·m (185 +88/-17 lb.-ft.)
Non-helical Halfshaft Castle Nut—Torque	170 +119/-23 N·m (125 +88/-17 lb.-ft.)

11. Check for free rotation of wheel with no binding.
12. Ensure that brake pedal is firm when pressed.
13. Test brake pedal for proper operation.
14. Install wheel. See Wheel Removal and Installation.
15. Lower machine.

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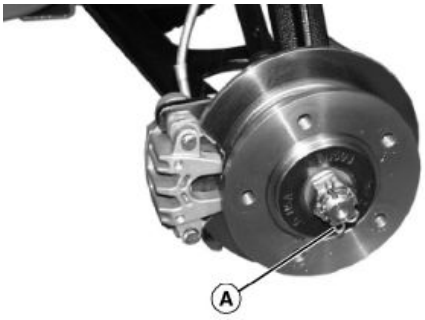
Front Wheel Bearing Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Block rear wheels on both sides.
4. Raise front of vehicle and support with jack stands.
5. Remove front wheels. See Wheel Removal and Installation.
6. Remove cotter pin (A) from castle nut at wheel hub. Discard cotter pin.
7. Remove castle nut and washer. It may be necessary for an assistant to apply pressure to the brake pedal in order to keep the brake disc assembly from turning.



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A—Cotter Pin

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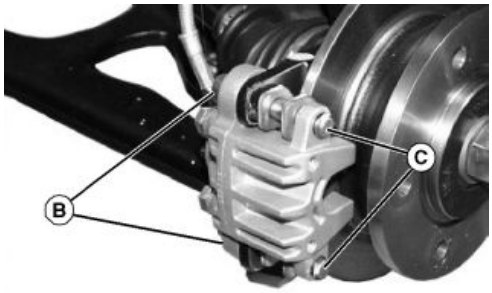
8. Remove two C-clips (C) and two sliding pins (B) securing brake caliper.
9. Remove caliper and secure out of the way ensuring the stress is taken off the brake line.
10. Remove brake disc.

B—Sliding Pins (2 used) **C—C-clips (2 used)**



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11. Remove nut (D) securing tie rod end to steering knuckle.
12. Separate tie rod end from steering knuckle.

D—Nut

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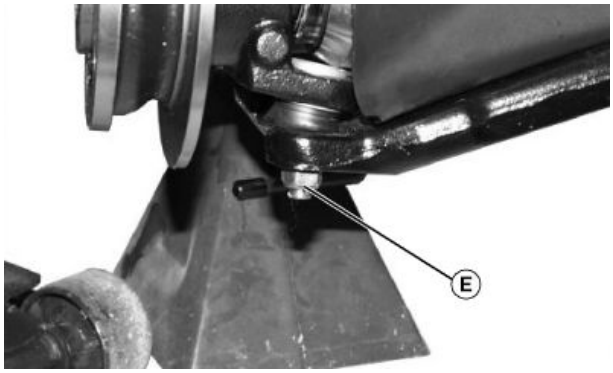
13. Remove nut (E) securing ball joint to A-arm.
14. Separate ball joint from A-arm.
15. Pull strut assembly away from drive shaft.

E—Nut



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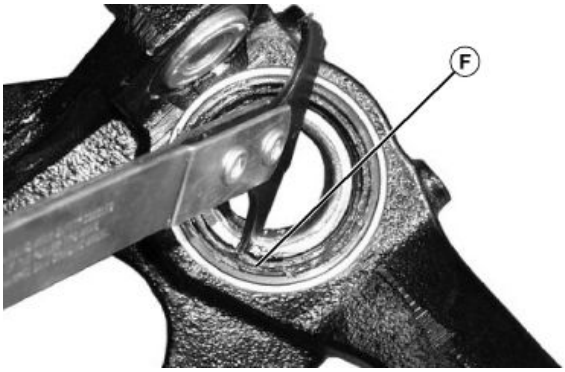
16. Using a suitable puller, remove inner (F) and outer (G) bearing seals.

G—Outer Bearing Seal



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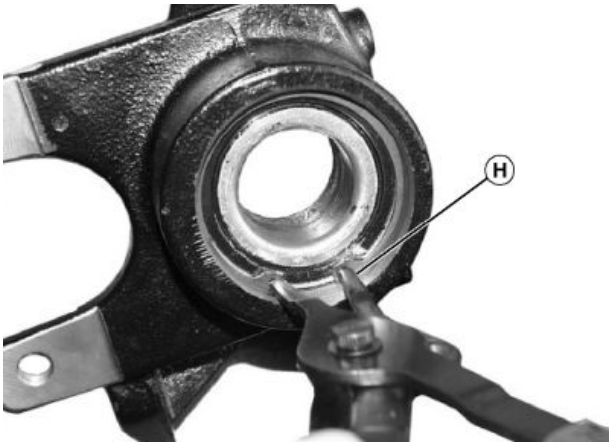
17. Remove inside snap ring (H) from steering knuckle.
18. Using a suitable press, remove wheel bearing from front of steering knuckle.

H—Snap Ring



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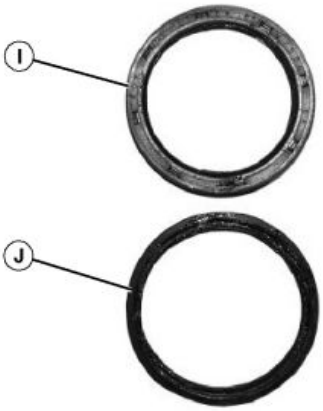
Installation

1. Clean steering knuckle bearing surface, ensuring that it is free of grease and debris.
2. Press new bearing into steering knuckle from the front until it seats.
3. Install new inner (J) and outer (I) seals, ensuring they seat properly.
4. Coat inner bearing race and seals with grease.
5. Insert drive shaft into steering knuckle.
6. Install ball joint and nut onto steering knuckle.

Specification	
Ball Joint to A-Arm Lock Nut—Torque	54 N·m (40 lb.-ft.)

7. Install tie rod end and nut onto steering knuckle.

Specification	
Tie Rod End to Steering Arm Lock Nut—Torque	54 N·m (40 lb.-ft.)



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J— Outer Seal **I— Inner Seal**

8. Install brake disc on drive shaft splines.
9. Install hub. See Hub Installation

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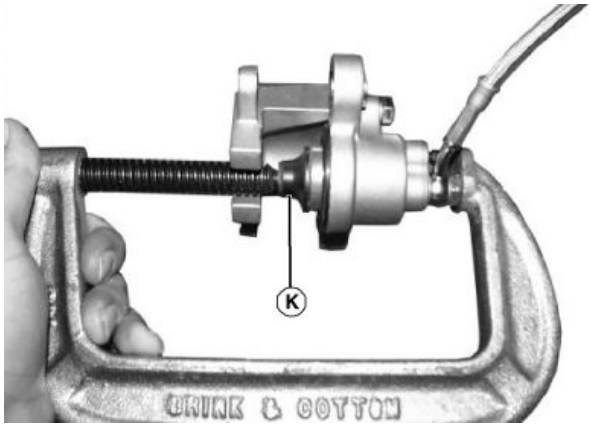
10. Install brake caliper. It may be necessary to press caliper cylinder into it's bore with a C-clamp (K) to allow clearance for brake pads.
11. Install brake pads, two caliper sliding pins, and C-clips. Tighten to specification.

Specification	
Caliper Sliding Pins to Steering Knuckle—Torque	41—52 N•m (30—38 lb.-ft.)

K—C-clamp



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MX52301,0000068 -19-18JUL14-8/9

12. Tighten castle nut to specification and install a new cotter pin (L). Bend ends of cotter pin in opposite directions.

Castle Nut—Specification

Helical Spline Halfshaft
Castle Nut—Torque.....251 +119/-23 N·m (185 +88/-17 lb.-ft.)
Non-helical Halfshaft
Castle Nut—Torque.....170 +119/-23 N·m (125 +88/-17 lb.-ft.)

13. Check for free rotation of wheel with no binding.
14. Ensure that brake pedal is firm when pressed.
15. Install wheel. See Wheel Removal and Installation.
16. Lower machine.

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L—Cotter Pin

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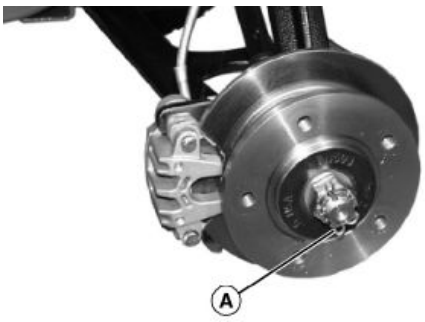
Ball Joint Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Block rear wheels on both sides.
4. Raise front of vehicle and support with jack stands.
5. Remove front wheels. See Wheel Removal and Installation.
6. Remove cotter pin (A) from castle nut at wheel hub. Discard cotter pin.
7. Remove castle nut and washer. It may be necessary for an assistant to apply pressure to the brake pedal in order to keep the brake disc assembly from turning.



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A—Cotter Pin

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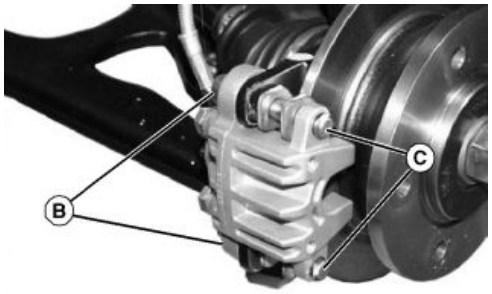
8. Remove two C-clips (C) and two sliding pins (B) securing brake caliper.
9. Remove caliper and secure out of the way ensuring the stress is taken off the brake line.
10. Remove brake disc.

B—Sliding Pins (2 used) **C—C-clips (2 used)**



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11. Remove nut (D) securing tie rod end to steering knuckle.
12. Separate tie rod end from steering knuckle.

D—Nut

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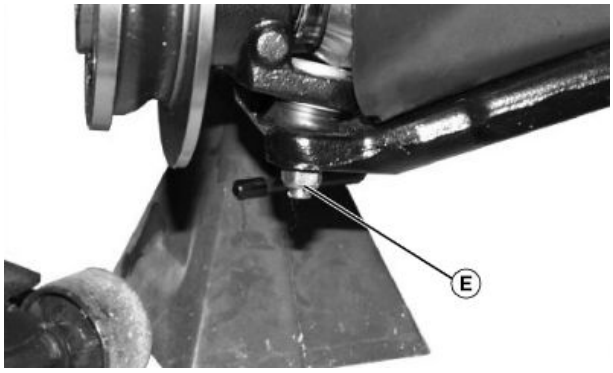
MX52301,0000069 -19-18JUL14-3/6

13. Remove nut (E) securing ball joint to A-arm.
14. Separate ball joint from A-arm.
15. Pull strut assembly away from drive shaft.

E—Nut



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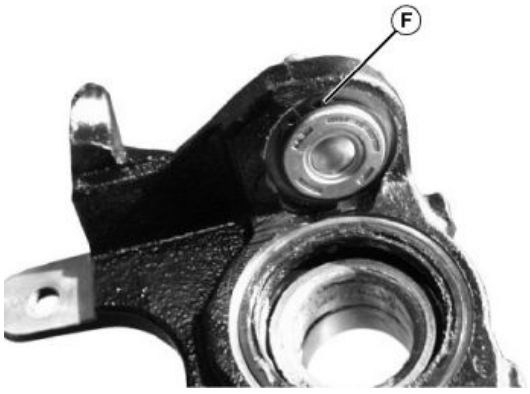
MX52301,0000069 -19-18JUL14-4/6

16. Remove outside snap ring (F) from ball joint.
17. Using a suitable press, press ball joint out of steering knuckle.

F—Snap Ring



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MX52301,0000069 -19-18JUL14-5/6

Installation:

1. Ensure that steering knuckle ball joint receptacle is clean and free of grease and debris.
2. Using a suitable press, press new ball joint into steering knuckle until it seats.
3. Install outside snap ring onto ball joint.
4. Insert drive shaft into steering knuckle.
5. Install ball joint and nut onto steering knuckle.

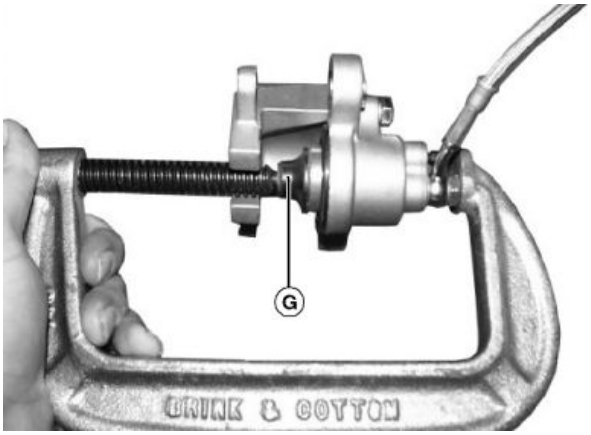
Specification	
Ball Joint to A-Arm Locknut—Torque	54 N•m (40 lb.-ft.)

6. Install tie rod end and nut onto steering knuckle.

Specification	
Tie Rod End to Steering Arm Lock Nut—Torque	54 N•m (40 lb.-ft.)

7. Install brake disc onto drive shaft splines.
8. Install hub. See Hub Installation.
9. Install brake caliper. It may be necessary to press caliper cylinder into it's bore with a C-clamp (G) to allow clearance for brake pads.
10. Install brake pads, two caliper sliding pins, and two C-clips. Tighten to specifications.

Specification	
Caliper Sliding Pins to Steering Knuckle—Torque	41—52 N•m (30 —38 lb.-ft.)



MXT011702 —UN—22MAY14

G—C-clamp

11. Tighten castle nut and install a new cotter pin. Bend ends of cotter pin in opposite directions.

Specification	
Helical Spline Halfshaft Castle Nut—Torque	251 +119/-23 N·m (185 +88/-17 lb.-ft.)
Non-helical Halfshaft Castle Nut—Torque	170 +119/-23 N·m (125 +88/-17 lb.-ft.)

12. Check for free rotation of wheel with no binding.
13. Ensure that brake pedal is firm when pressed.
14. Install wheel. See Wheel Removal and Installation.
15. Lower machine.

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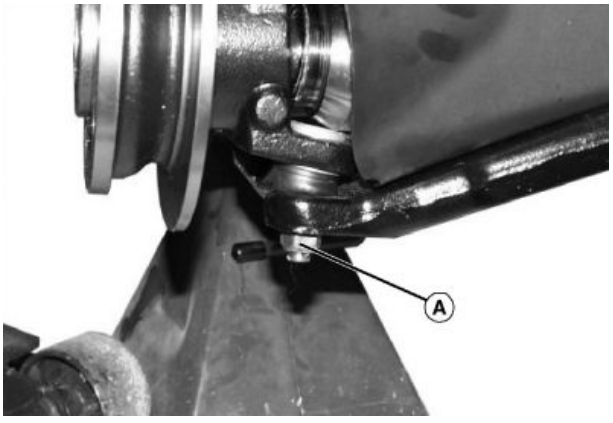
Front A-Arm Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Block rear wheels, raise front of machine, and support with jack sands.
4. Remove front wheels. See Wheel Removal and Installation.
5. Remove nut (A) securing ball joint.
6. Separate ball joint from steering assembly.



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A—Nut

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7. Remove two bolts and nuts (C) securing A-arm to machine frame. Remove washer (B) from rear A-arm bushing. An access hole (D) for the rear A-arm nut is located in the frame.

NOTE: Support hub assembly as necessary.

8. Remove A-arm.

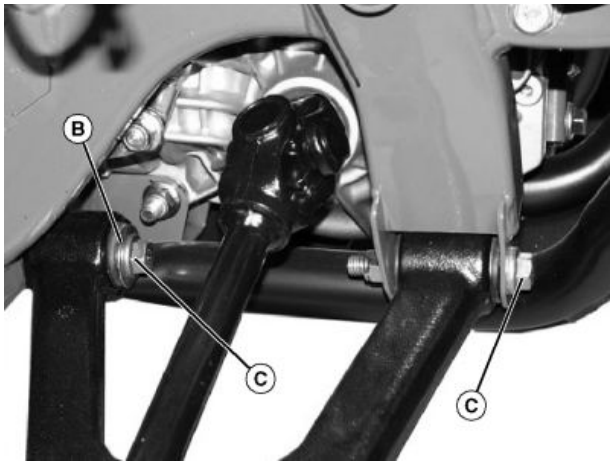
Installation:

- Installation is in the reverse of removal.
- Tighten all hardware to specification.

Hardware Torques—Specification

A-arm to Frame—Torque	68—100 N•m (50—74 lb.-ft.)
Ball Joint to A-Arm Lock Nut—Torque	54 N•m ((40 lb.-ft.)

D—Access Hole



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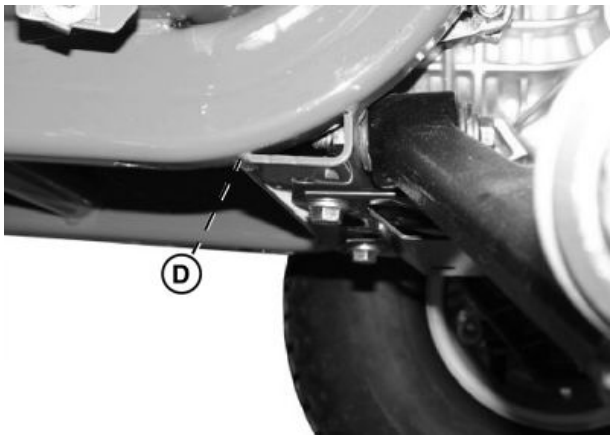

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MX52301,000006A -19-04JUN14-2/2

A-Arm Bushing Removal and Installation

Removal

1. Remove A-arm. See Front A-Arm Removal and Installation.
2. Using proper size bushing driver (A), remove A-arm bushings.

Installation

1. Using a proper size bushing driver, install A-arm bushings.
2. Install A-arm. See Front A-Arm Removal and Installation.

A—Bushing Driver

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Section 80
Brakes

Contents

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Specifications

Item	Measurement	Specification
Type		Four Wheel Hydraulic Disc
Park Brake		Mechanical Disc
Brake Fluid		DOT3
Brake Arm to Stop Bar	Distance	1—2 mm (0.039—0.079 in.)
Brake Rod Jam Nut	Torque	20 N•m (15 lb.-ft.)
Cable Adjust Jam Nut	Torque	54—61 N•m (40—45 lb.-ft.)
Park Brake Specifications		
Park Brake Lever Movement for Differential Lock	Angle	0—12°
Minimum Lever Angle for Full Differential Lock	Angle	16°
Park Brake Lever Travel Angle	Angle	0—36°
Detent Increment Angle (12 total)	Angle	2°
Park Brake Handle Bolts	Torque	30—44 N•m (22—32 lb.-ft.)
Brake Line to Master Cylinder	Torque	15—24 N•m (10—18 lb.-ft.)
Rubber Bellows	Length	63 mm (2.5 in.)
Friction Material	Thickness	1 mm (0.040 in.)
Actuator Lever Nut	Torque	46 N•m (34 lb.-ft.)
Adjustment Nut	Torque	5 N•m (4 lb.-ft.)
Jam Nut	Torque	30 N•m (22 lb.-ft.)
Brake Rotor	Thickness (minimum)	4.76 mm (0.187 in.)
Caliper Sliding Pins	Torque	41—52 N•m (30—38 lb.-ft.)
Brake Rod Jam Nut	Torque	20 N•m (15 lb.-ft.)
Brake Line to Caliper	Torque	15—24 N•m (10—18 ft.-lb.)
Brake Line 3-Way Valve to Firewall	Torque	(92 lb.-in.)
Caliper Banjo Bolt		15—24 N•m (10—18 lb.-ft.)
Brake Rotor to Drive Shaft Collar Nuts	Torque	58—88 N•m (43—65 lb.-ft.)

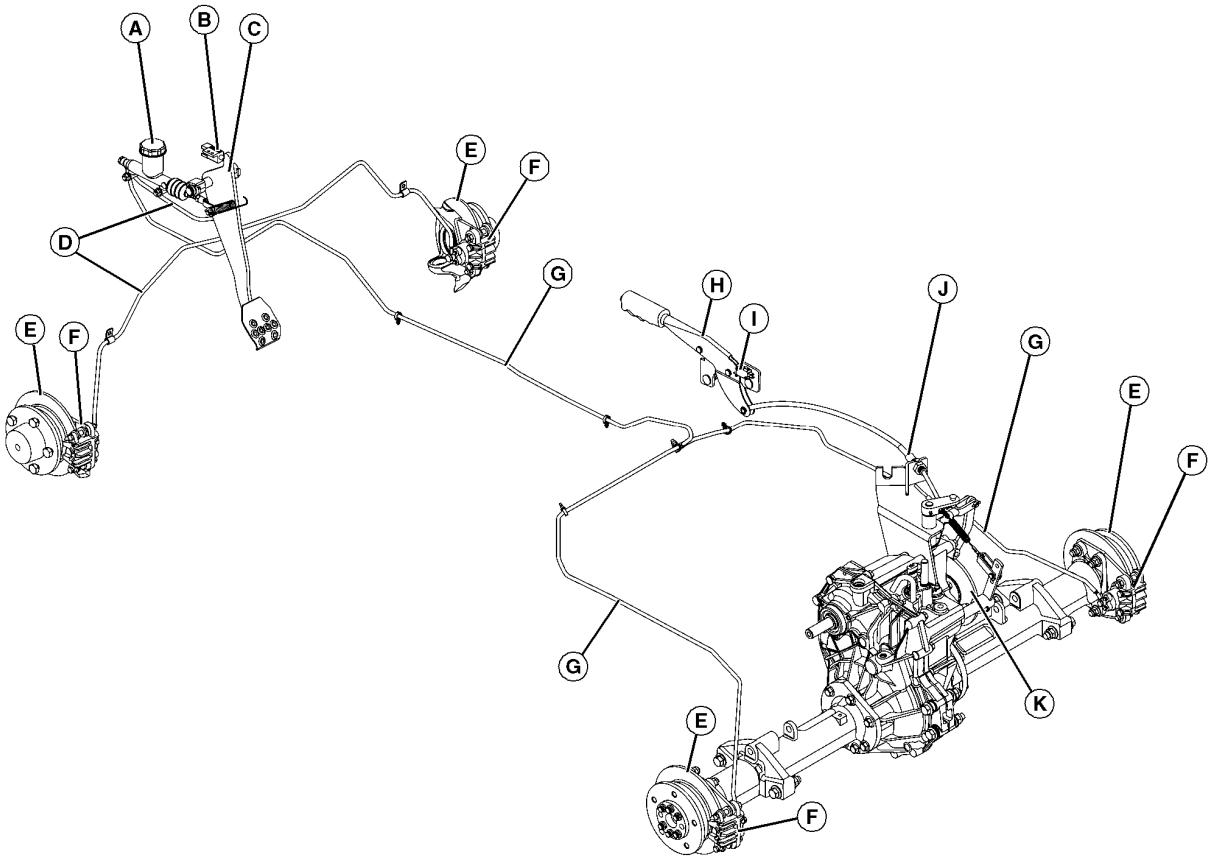
MX52301,000045F -19-24OCT14-1/1

Summary of References

- Brake System (SN -040000)
- Brake System Components, Front (SN -040000)
- Brake System Components, Rear (SN -040000)
- Park Brake System (SN -040000)
- Two Wheel Drive Park Brake Components (SN -040000)
- MFWD Park Brake Components (SN -040000)

MX52301,0000459 -19-29MAY14-1/1

Brake System (SN -040000)

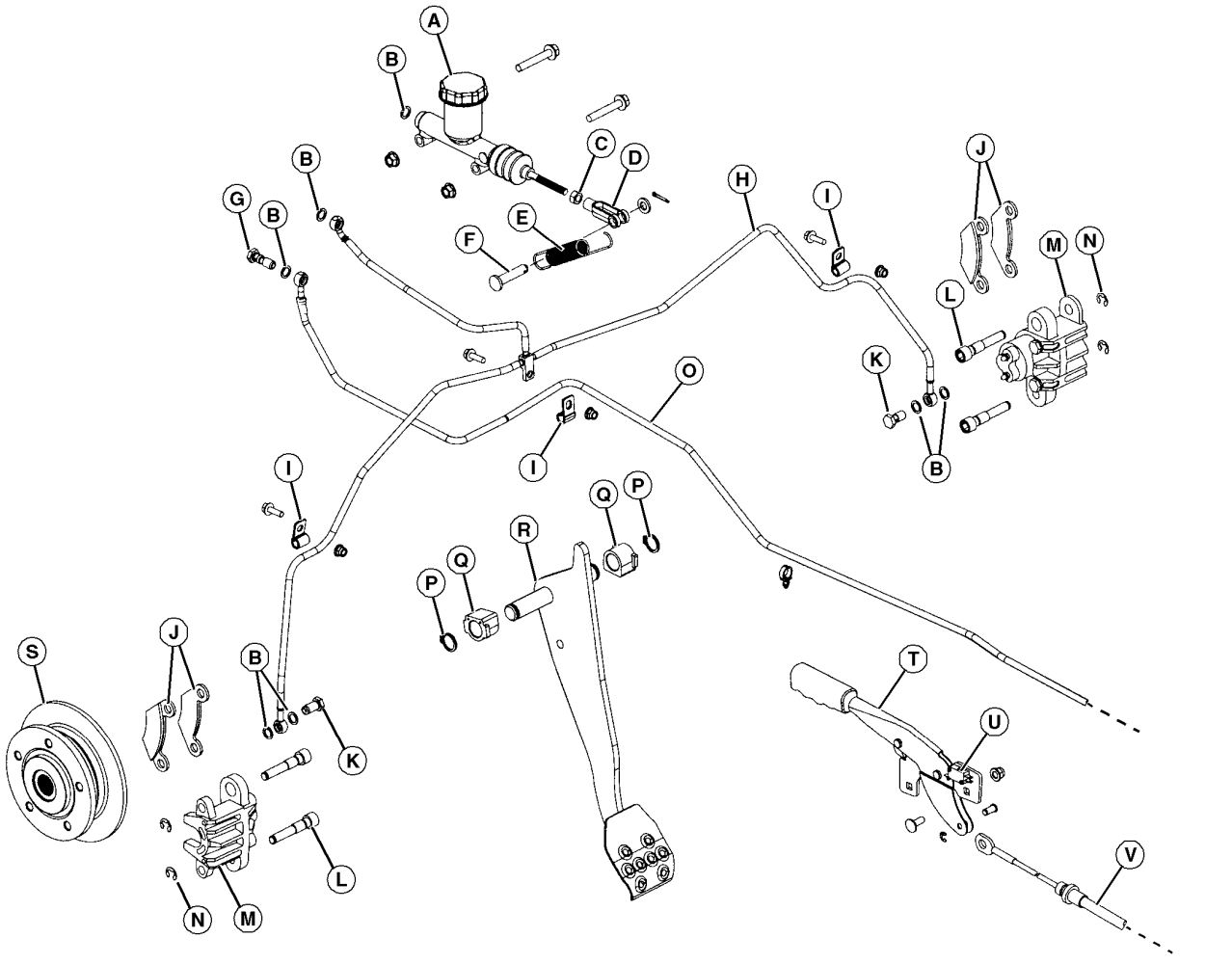


A—Master Cylinder
B—Brake Switch
C—Brake Pedal Assembly
D—Front Brakes Hydraulic Line
E—Brake Disc
F—Brake Caliper
G—Rear Brakes Hydraulic Line
H—Park Brake Handle Assembly
I— Park Brake Switch
J— Park Brake Cable
K—Park Brake Disc (2WD Shown)[1]

[1]See Park Brake System.

MX52301,0000038 -19-22OCT14-1/1

Brake System Components, Front (SN -040000)

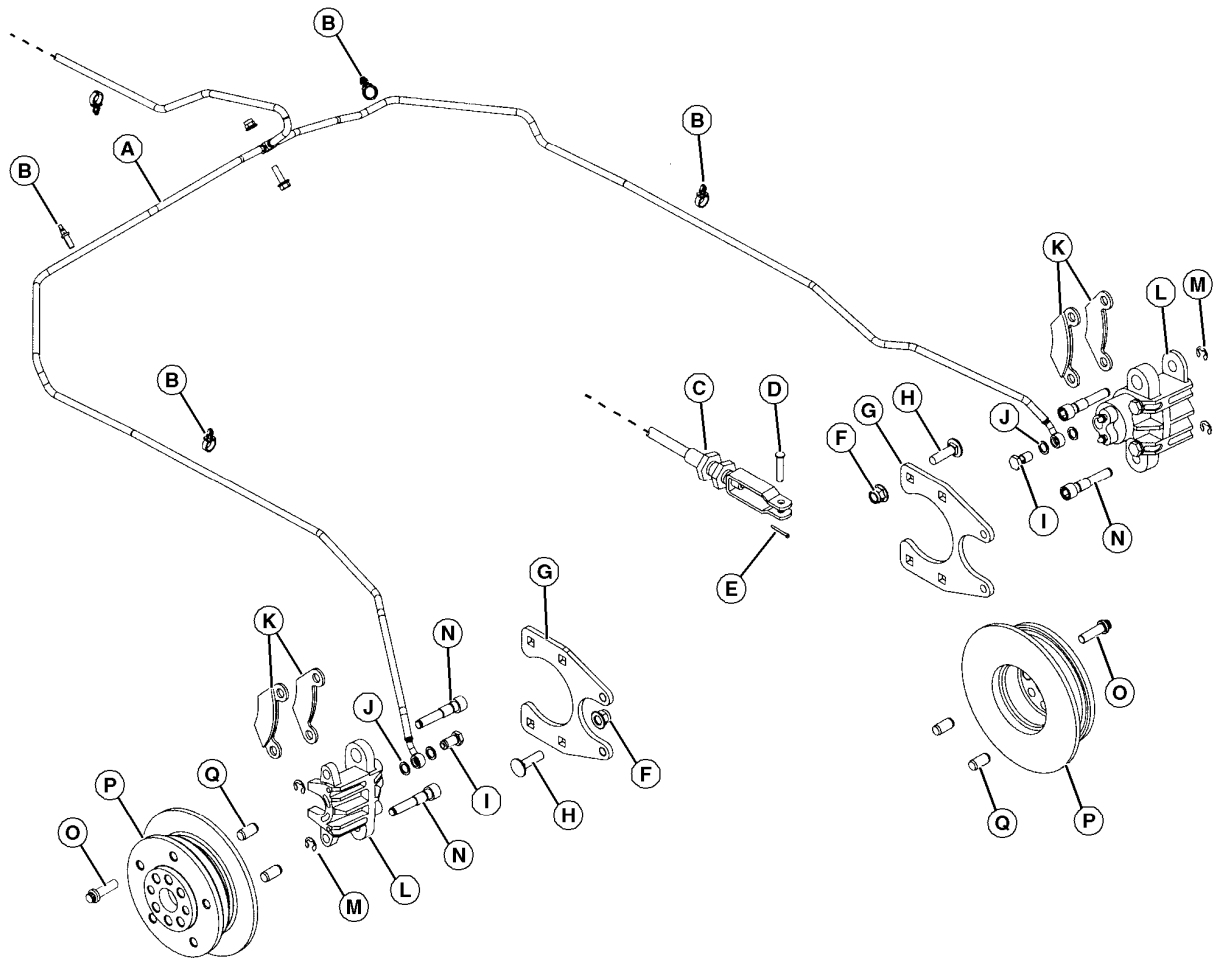


Picture Note: 2-Wheel Drive Machine Shown

A—Master Cylinder
B—Seal
C—Jam Nut
D—Yoke
E—Spring
F—Drilled Pin
G—Hydraulic Brake Line Bolt
H—Front Brake Line
I— Retainer Clip
J— Brake Pad
K—Hydraulic Caliper Bolt
L— Brake Sliding Pins
M—Brake Caliper Assembly
N—Snap Ring
O—Rear Brake Line
P—Snap Ring
Q—Bearings
R—Brake Pedal
S—Front Rotor
T— Park Brake Handle Assembly
U—Park Brake Switch
V—Park Brake Cable (Front Shown)

MX52301,0000039 -19-29MAY14-1/1

Brake System Components, Rear (SN -040000)

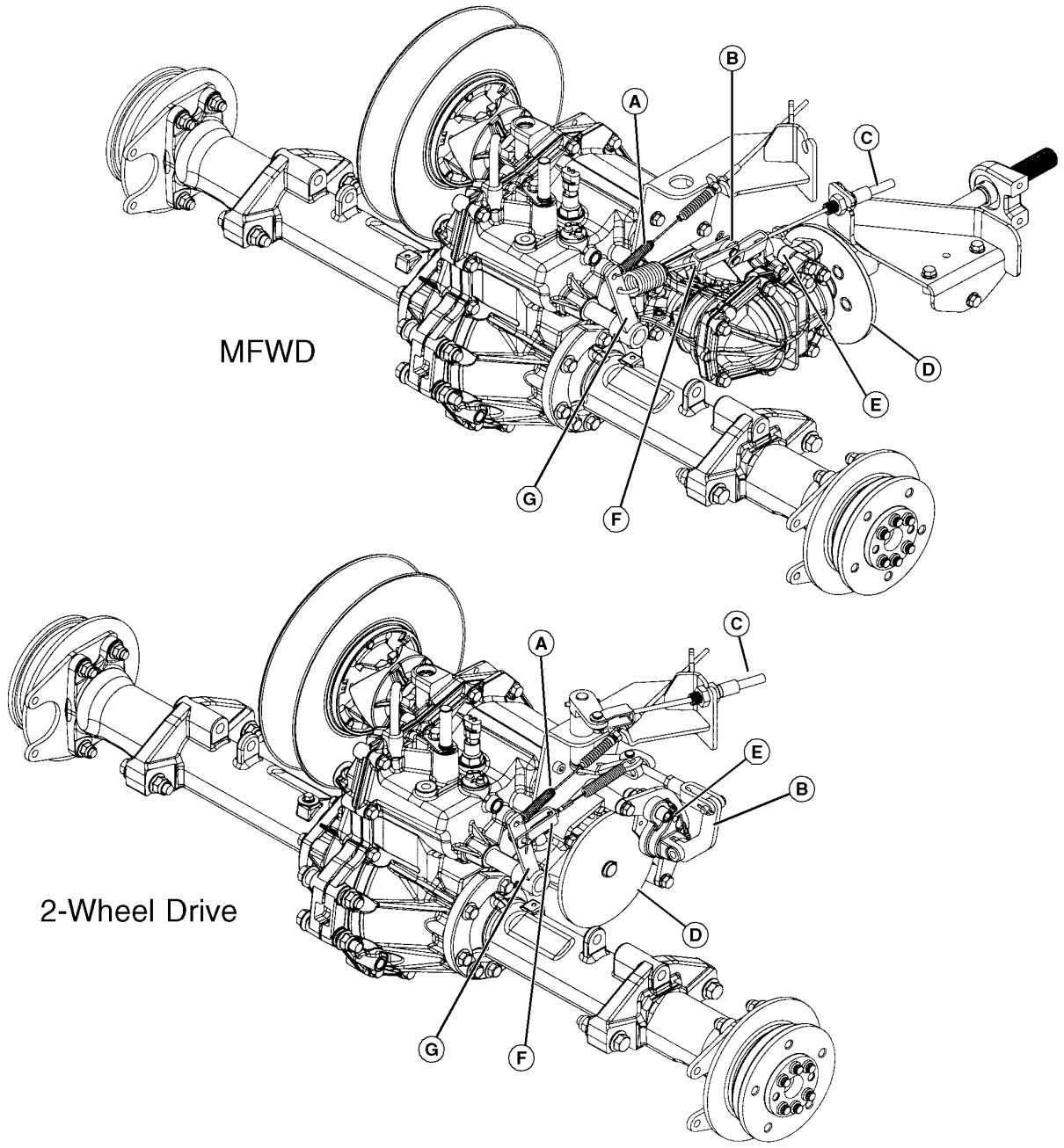


Picture Note: 2-Wheel Drive Machine Shown

A—Rear Brake Line
B—Retainer Clip
C—Park Brake Cable (Rear Shown)
D—Drilled Pin
E—Cotter Pin
F—Flange Nut (4 used on each side)
G—Caliper Mounting Bracket (1 used on each side)
H—Carriage Bolt (4 used on each side)
I— Hydraulic Caliper Bolt
J—Seal
K—Brake Pad
L—Brake Caliper Assembly
M—Snap Ring
N—Brake Sliding Pins
O—Wheel Mounting Bolts
P—Rear Rotor
Q—Alignment Pins

MX52301,000003A -19-29MAY14-1/1

Park Brake System (SN -040000)

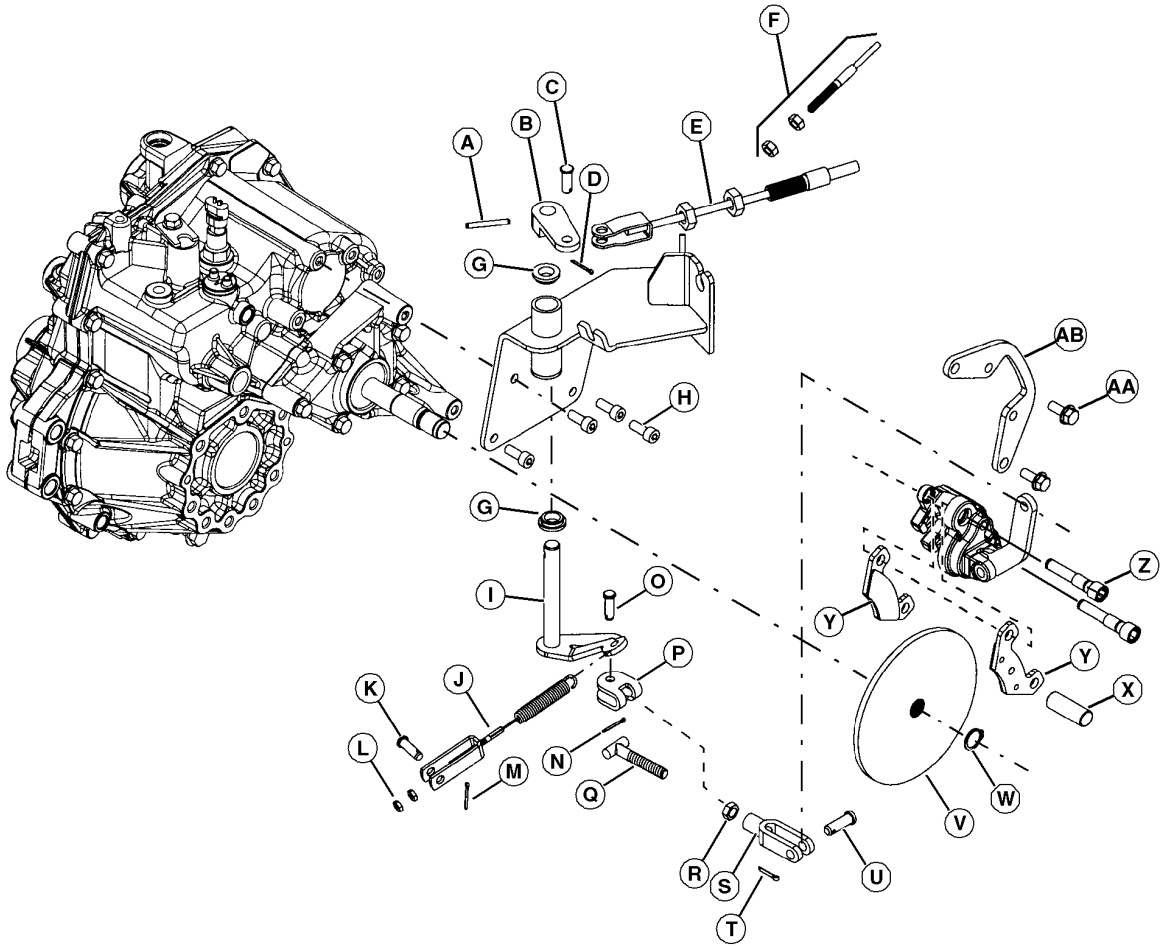


MXT011710 —UN—20MAY14

A—Differnetial Lock Cable
B—Park Brake Actuator Arm
C—Park Brake Cable
D—Park Brake Disc
E—Brake Caliper
F—Park Brake Arm to Differential Lock Arm Linkage
G—Differential Lock Arm

MX52301,000003B -19-29MAY14-1/1

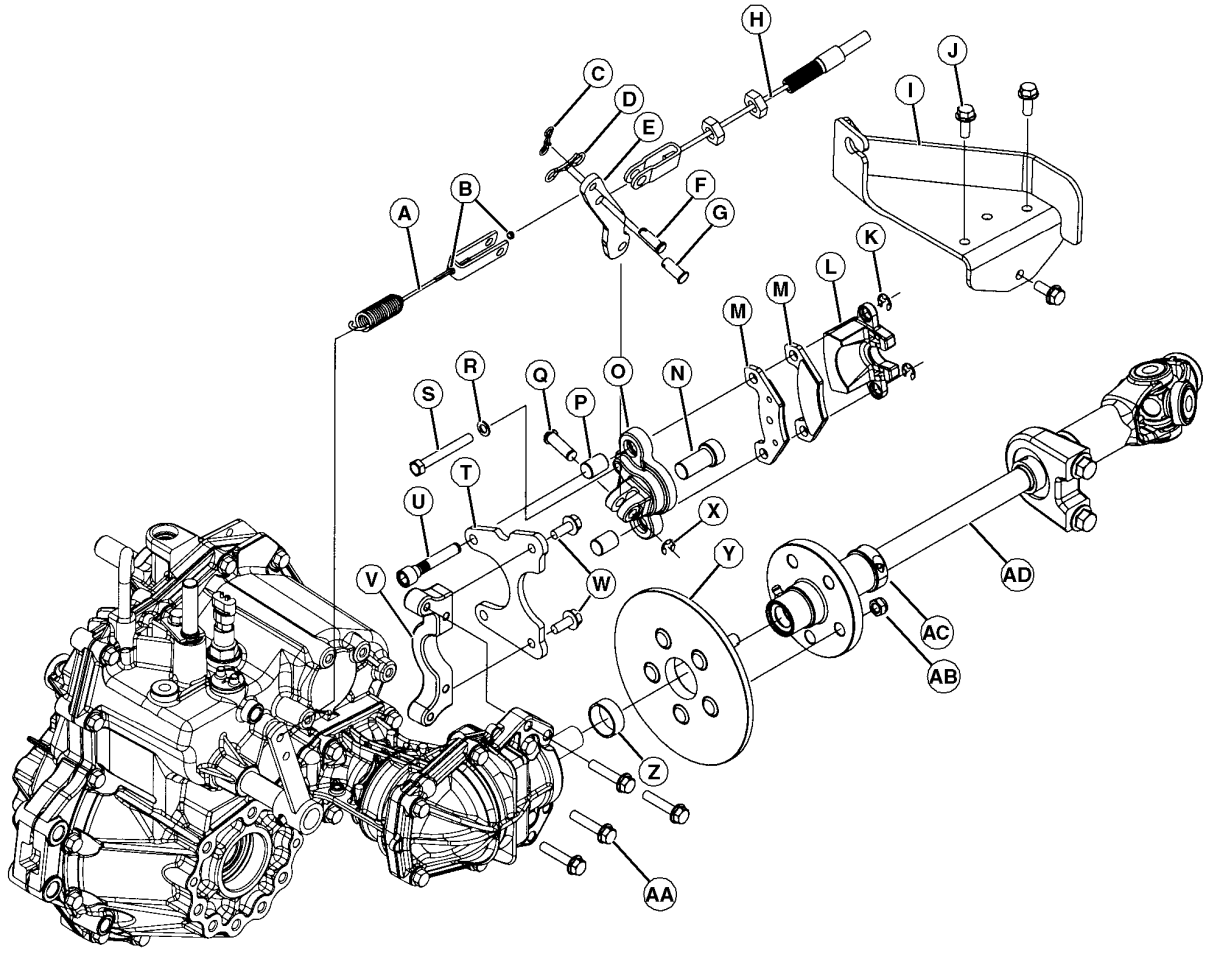
Two Wheel Drive Park Brake Components (SN -040000)



A—Roll Pin
B—Park Brake Arm
C—Pin
D—Cotter Pin
E—Park Brake Cable
F—Differential Lock Cable
G—Bushing
H—Bolt (4 used)
I— Park Brake Arm Shaft
J—Park Brake Arm to Differential Arm Spring
K—Pin
L—Nut (2 used)
M—Cotter Pin
N—Cotter Pin
O—Pin
P—Bracket
Q—T-Bolt
R—Jam Nut
S—Clevis
T—Cotter Pin
U—Pin
V—Park Brake Disc
W—Snap Ring
X—Brake Actuator Pin
Y—Brake Pad (2 used)
Z—Caliper Sliding Pin Screw (2 used)
AA—Bolt (2 used)
AB—Caliper Mounting Bracket

MX52301,000003C -19-29MAY14-1/1

MFWD Park Brake Components (SN -040000)



MXT011712 —UN—20MAY14

A—Park Brake Arm to Differential Arm Spring
B—Nut (2 used
C—Spring Locking Pin
D—Spring Locking Pin
E—Park Brake Arm
F—Pin
G—Pin
H—Park Brake Cable
I—Bracket
J—Bolt (3 used)
K—E-Clip (2 used)
L—Brake Caliper Housing (half)
M—Brake Pad (2 used)
N—Brake Actuator Pin
O—Brake Caliper Housing (half)
P—Bushing (2 used)
Q—Pin
R—Washer (2 used)
S—Bolt (2 used)
T—Caliper Mounting Bracket
U—Caliper Sliding Pin Screw (2 used)
V—Bracket
W—Bolt (2 used)
X—E-Clip
Y—Park Brake Disc
Z—Spacer
AA—Bolt (4 used)
AB—Nut (5 used)
AC—Locking Collar
AD—Driveline Assembly

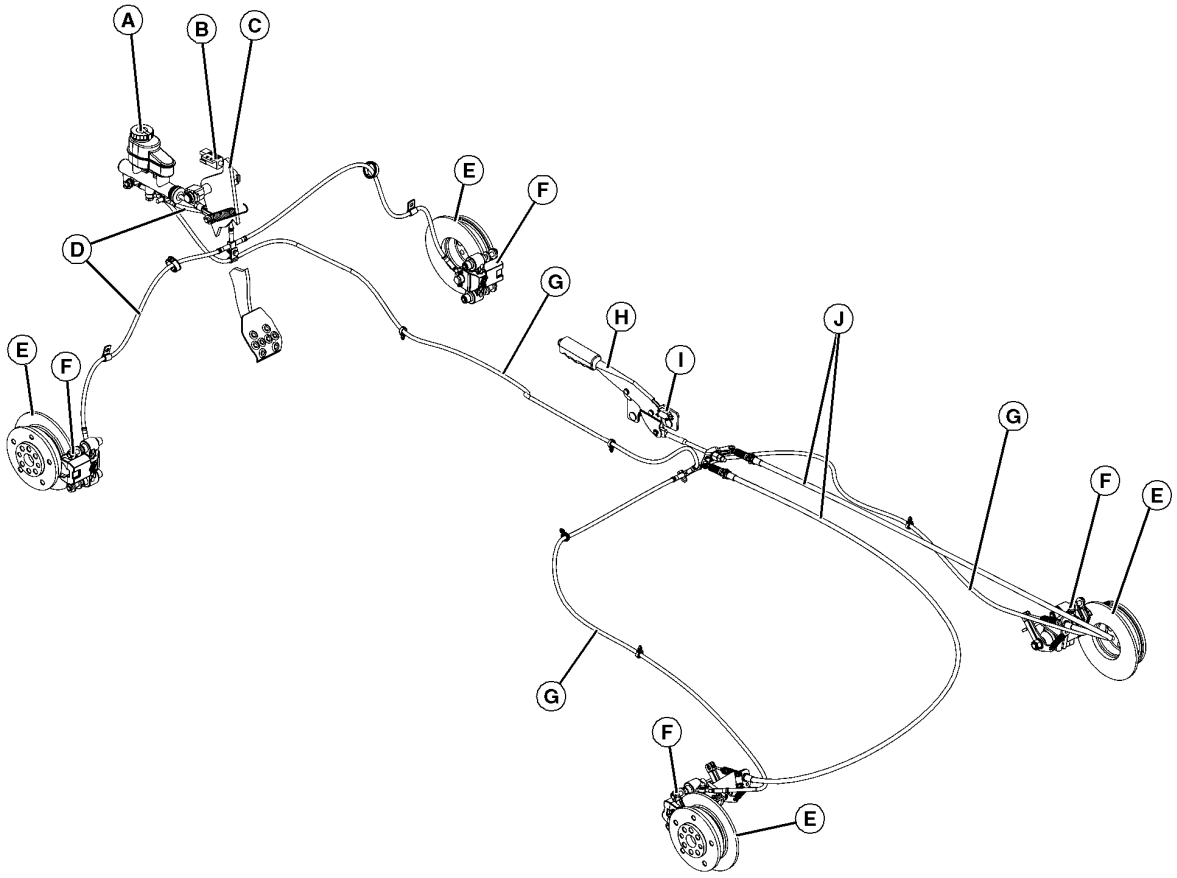
MX52301,000003D -19-29MAY14-1/1

Summary of References

- Brake System (SN 040001-)
- Brake System Components, Front (SN 040001-)
- Brake System Components, Rear (SN 040001-)
- Park Brake System (SN 040001-)

MX52301,000045A -19-29MAY14-1/1

Brake System (SN 040001-)

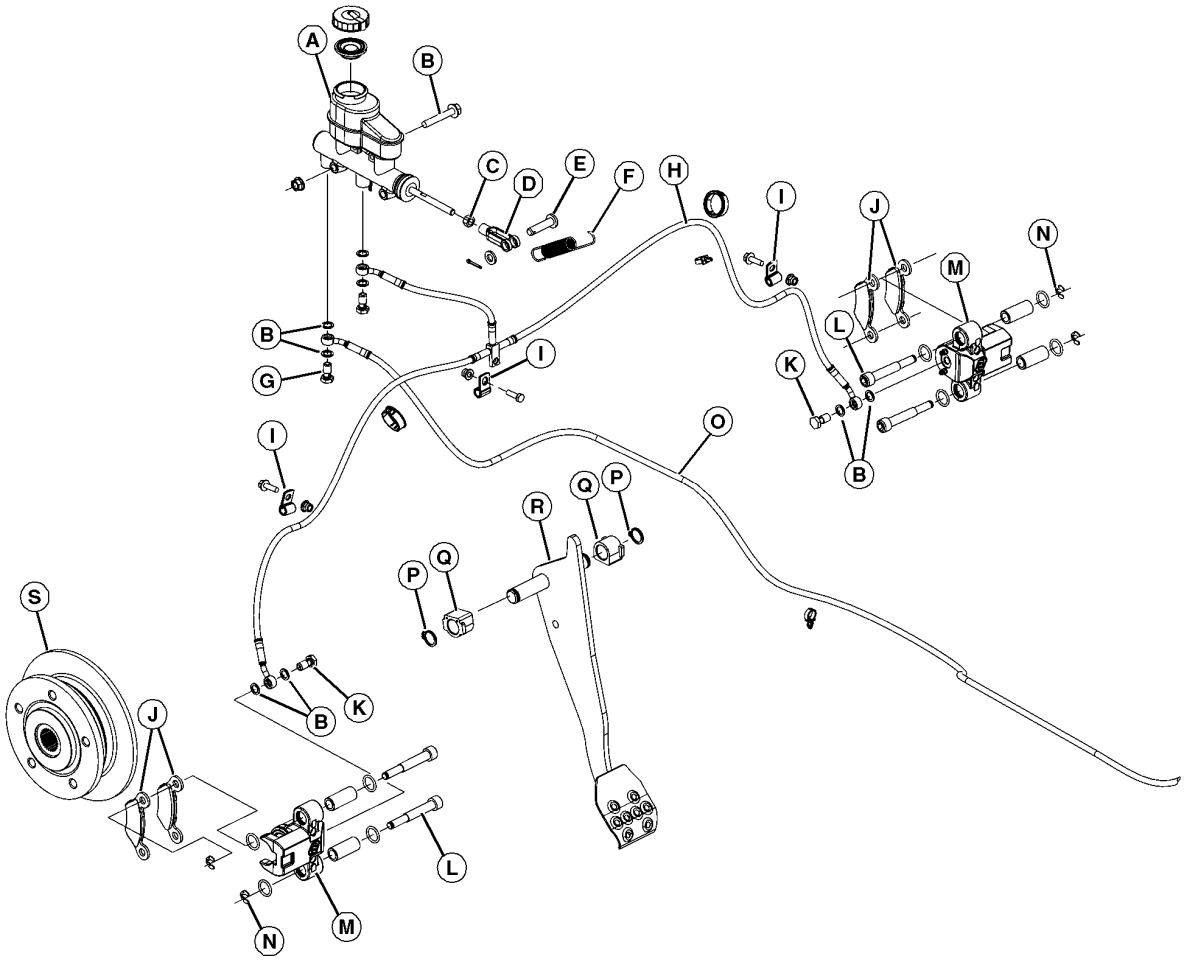


MXT011713 —UN—20MAY14

A—Master Cylinder
B—Brake Switch
C—Brake Pedal Assembly
D—Front Brakes Hydraulic Line
E—Brake Disc
F—Brake Caliper
G—Rear Brakes Hydraulic Line
H—Park Brake Handle Assembly
I— Park Brake Switch
J— Park Brake Cable

MX52301,000003E -19-10JUL14-1/1

Brake System Components, Front (SN 040001-)



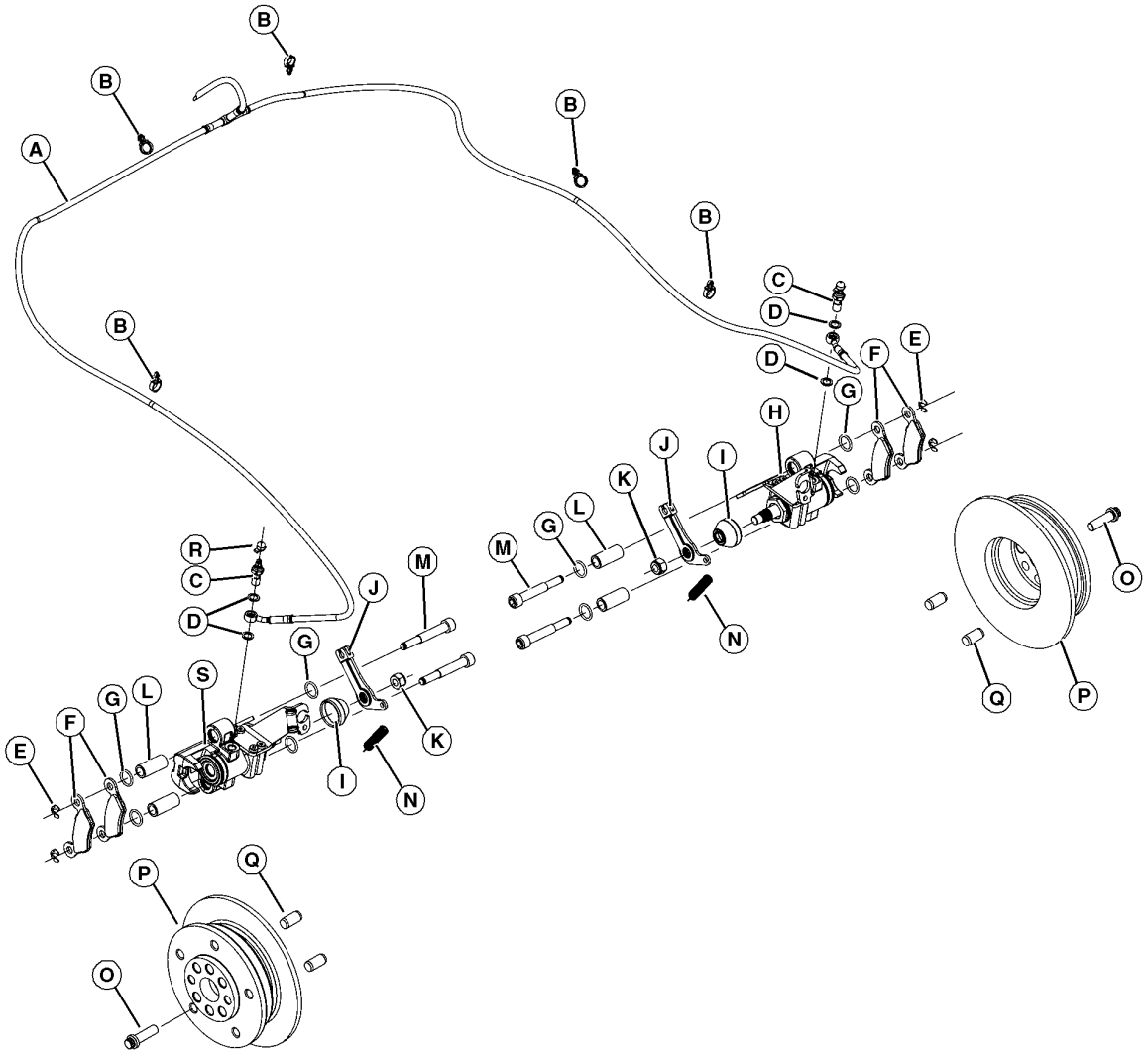
MXT011714 —UN—20MAY14

Picture Note: 2-Wheel Drive Machine Shown

A—Master Cylinder
B—Seal
C—Jam Nut
D—Yoke
E—Drilled Pin
F—Spring
G—Hydraulic Brake Line Bolt
H—Front Brake Line
I— Retainer Clip
J— Brake Pad
K—Hydraulic Caliper Bolt
L—Brake Sliding Pins
M—Brake Caliper Assembly
N—Snap Ring
O—Rear Brake Line
P—Snap Ring
Q—Bearing
R—Brake Pedal
S—Front Rotor

MX52301,000003F -19-20OCT14-1/1

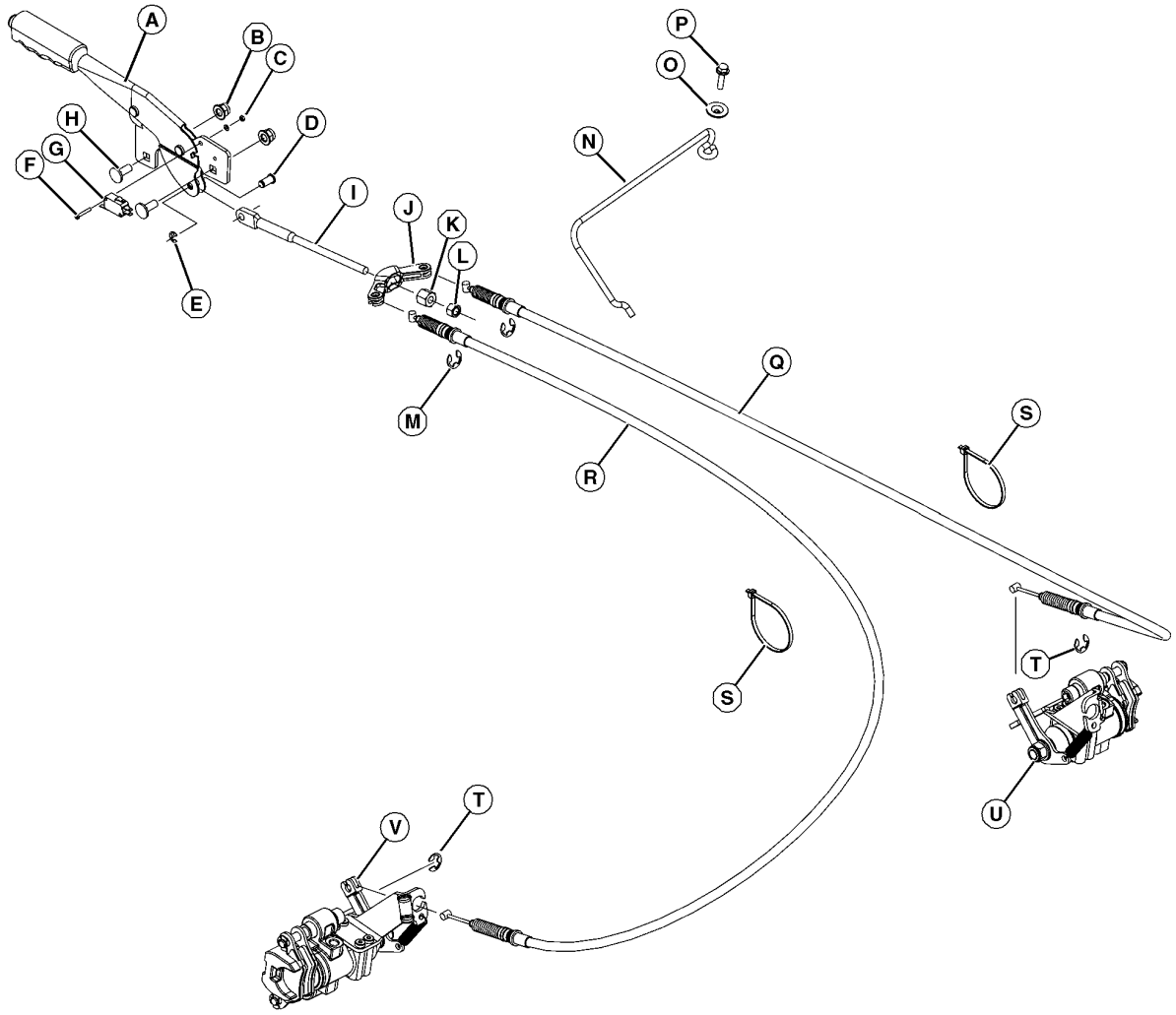
Brake System Components, Rear (SN 040001-)



A—Rear Brake Line
B—Retainer Clip
C—Bleed Valve
D—Seal
E—Snap Ring
F—Brake Pad
G—Seal
H—RH Brake Caliper Assembly
I— Boot
J— Park Brake Arm
K—Flange Nut
L—Sleeve
M—Brake Sliding Pin
N—Spring
O—Wheel Mounting Bolts
P—Rear Rotor
Q—Alignment Pins
R—Bleed Valve Cover
S—LH Brake Caliper Assembly

MX52301,0000040 -19-20OCT14-1/1

Park Brake System (SN 040001-)



A—Park Brake Arm Assembly
B—Nut (2 used)
C—Nut and Washer (2 used)
D—Pin
E—E-Clip
F—Screw (2 used)
G—Switch
H—Bolt (2 used)
I— E-Clip (2 used)
J—Park Brake Cable Balancer
K—Nut
L—Jam Nut
M—E-Clip (2 used)
N—Brake Caliper Housing (half)
O—Bracket
P—Washer
Q—RH Park Brake Cable
R—LH Park Brake Cable
S—Tie Wrap
T—E-Clip (2 used)
U—RH Brake Assembly
V—LH Brake Assembly

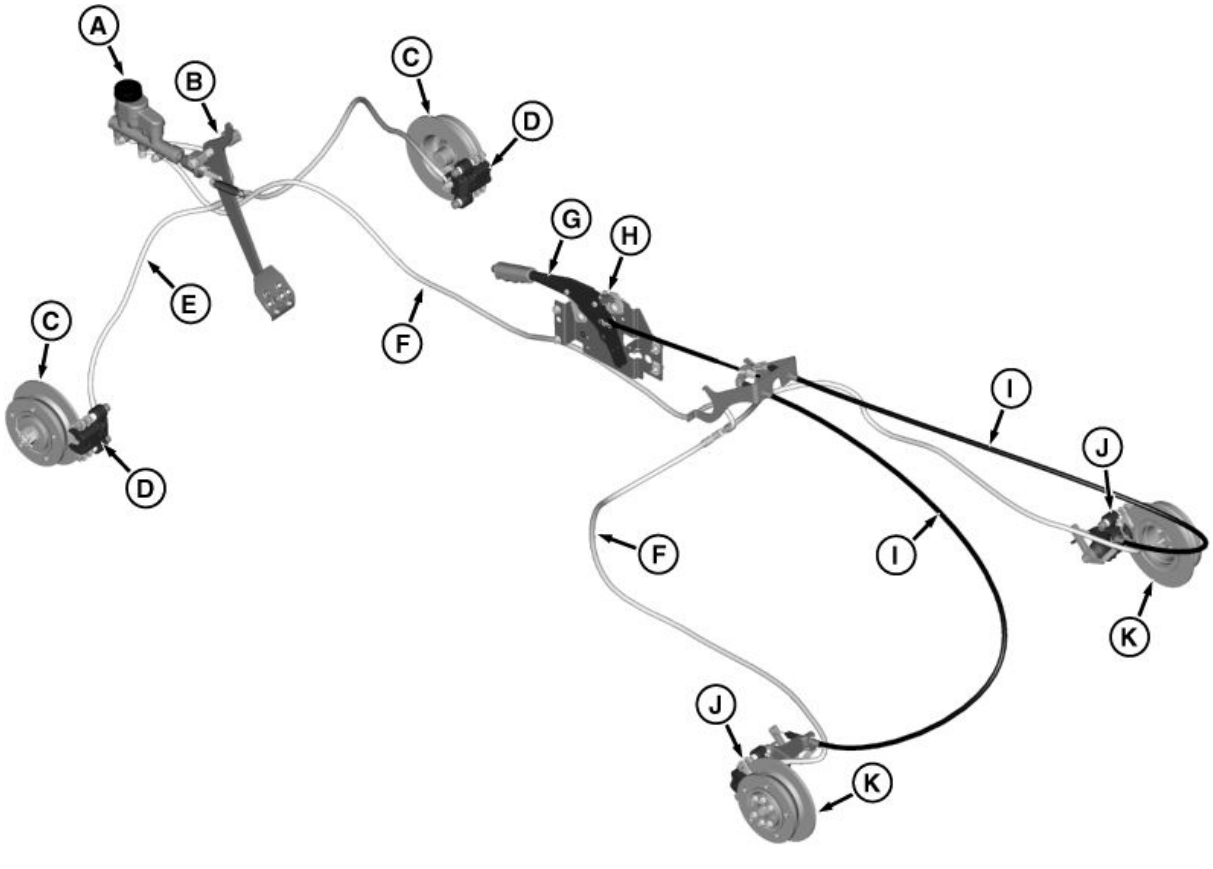
MX52301,0000041 -19-10JUL14-1/1

Summary of References

- Brake System (SN 090001-)
- Brake System Components (SN 090001-)
- Park Brake System (SN 090001-)

BS62576,00017FB -19-20OCT14-1/1

Brake System (SN 090001-)

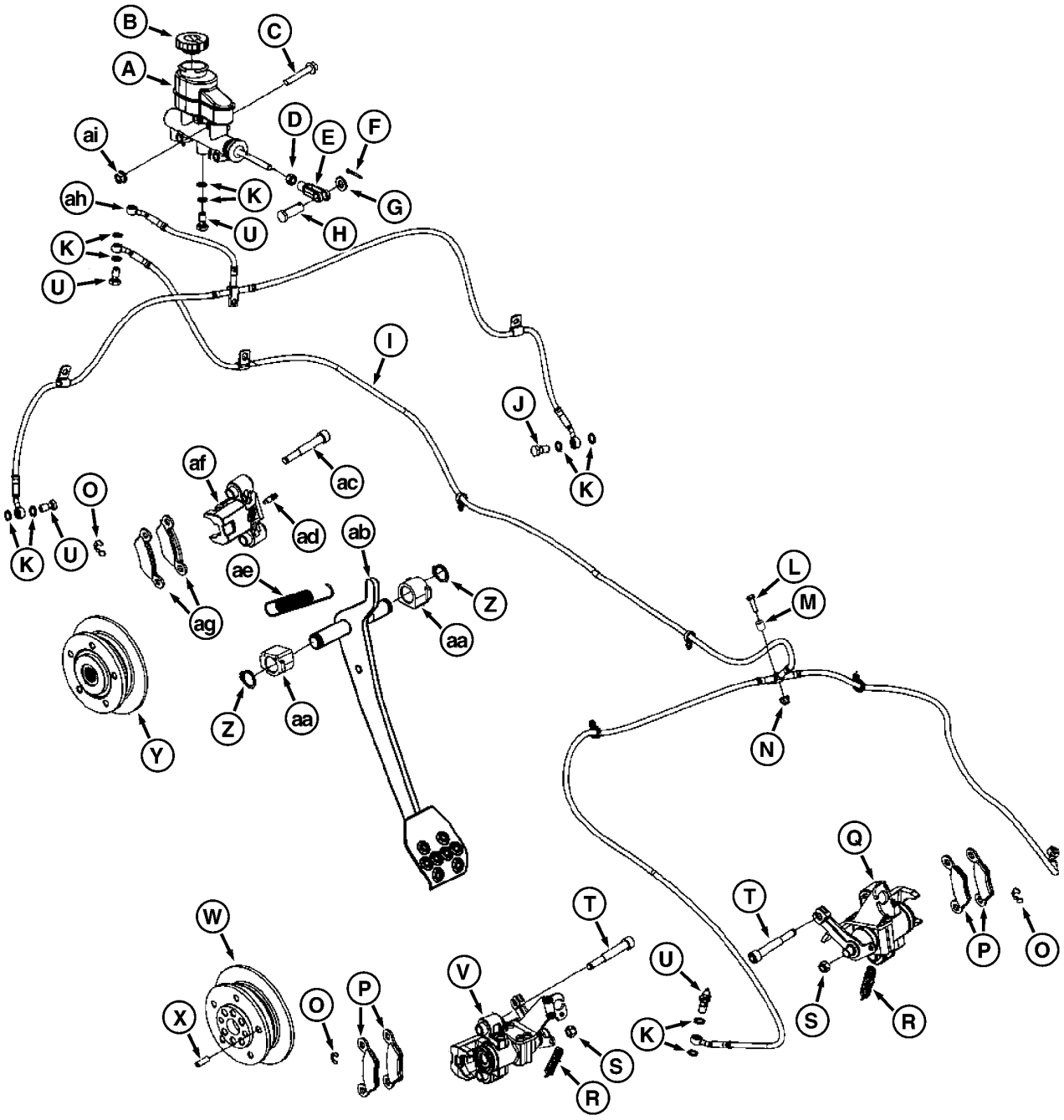


MXT010507 —UN—21OCT14

A—Master Cylinder
B—Brake Pedal Assembly
C—Brake Disc, Front
D—Brake Caliper, Front
E—Brake Line, Front
F—Brake Line, Rear
G—Park Brake Handle Assembly
H—Park Brake Switch
I— Park Brake Cable
J— Brake Caliper, Rear
K—Brake Disc, Rear

BS62576,00017FC -19-21OCT14-1/1

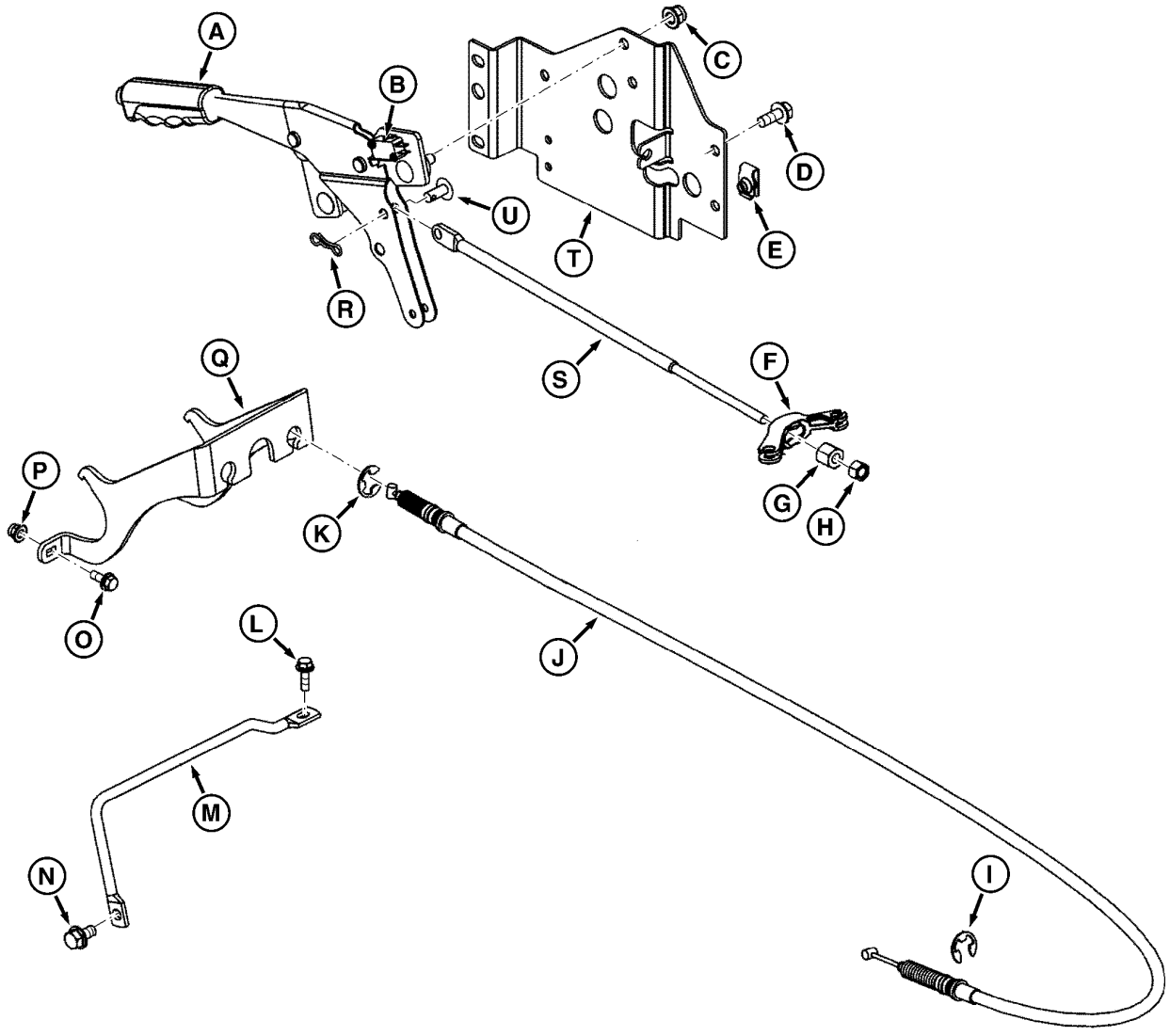
Brake System Components (SN 090001-)



A—Master Cylinder
B—Cover
C—Bolt
D—Jam Nut
E—Yoke
F—Cotter Pin
G—Washer
H—Drilled Pin
I— Brake Line, Rear
J— Hydraulic Caliper Bolt
K—Copper Washer
L—Bolt
M—Spacer
N—Nut
O—E-Ring
P—Brake Pads, Rear
Q—Caliper, Rear
R—Spring
S—Nut
T—Slide Pin
U—Hydraulic Bolt
V—Caliper, Rear
W—Brake Disc, Rear
X—Wheel Mount Bolt
Y—Brake Disc, Front
Z—Snap Ring
aa—Bearing
ab—Brake Pedal Assembly
ac—Slide Pin
ad—Bleed Valve
ae—Spring
af—Brake Caliper, Front
ag—Brake Pads, Front
ah—Brake Line, Front
ai—Nut

BS62576,00017FD -19-21OCT14-1/1

Park Brake System (SN 090001-)



A—Handle
B—Switch
C—Lock Nut
D—Bolt
E—Fastener
F—Balancer
G—Nut
H—Lock Nut
I— E-Ring
J—Cable
K—E-Ring
L—Bolt
M—Support
N—Bolt
O—Bolt
P—Nut
Q—Bracket
R—Spring Pin
S—Rod
T—Bracket
U—Pin

BS62576,00017FE -19-20OCT14-1/1

Brake System

Function:

The brakes provide a means of stopping or slowing the unit when in motion. The park brakes prevent movement when the unit is not in use.

Theory of Operation:

The machine uses an automotive style, self adjusting, hydraulic, four wheel disc brake system. The piston of the master cylinder supplies brake fluid to the front and rear brakes.

When the brake pedal is depressed, the top of the pedal pulls a pivot plate through a clevis, which pivots on a bolt pushing the rod into the brake master cylinder. As the rod is pushed into the master cylinder it pressurizes the brake fluid inside the master cylinder. The pressure is transferred through the brake lines and hoses to the brake caliper, where it presses outward on the pistons. The caliper pistons press outward on the brake shoes causing them to contact the brake discs.

The friction between the brake shoes and brake discs slows or stops wheel rotation.

SN -040000 Machines:

On 2-wheel drive machines the park brake disc is splined to the transaxle reduction shaft.

On MFWD machines the transaxle has a right angle direct drive output shaft connected to the transaxle reduction shaft. A brake disc is mounted to the output shaft.

The park brake system is cable operated. When the park brake lever is raised into its locked position, the park brake cable pulls a transaxle mounted lever. The lever mechanically pushes a brake caliper piston. The piston presses on a caliper mounted brake shoe, clamping the output shaft brake disc, locking the transaxle output shaft.

SN 040001-

The park brake system is cable operated. When the park brake lever is raised into its locked position, the park brake cable pulls a brake caliper assembly mounted lever. The lever mechanically pushes the brake caliper piston. The piston presses on the brake shoes causing them to contact the brake discs.

The friction between the brake shoes and brake discs slows or stops wheel rotation.

MX52301,0000042 -19-22OCT14-1/1

Brake Pedal

MX52301,000039F -19-29MAY14-1/12

❶ Brake Pedal

MX52301,000039F -19-29MAY14-2/12

Brake Pedal	Is the brake pedal adjusted correctly?	**YES:** Go to next step. **NO:** Adjust rear and/or front brake cable. See "Brake Pedal Travel Excessive".

MX52301,000039F -19-29MAY14-3/12

Brake Components	Are the components loose, worn, or damaged?	**YES:** Repair or replace as necessary. **NO:** Go to next step.

MX52301,000039F -19-29MAY14-4/12

Springs	Are the springs broken or stretched?	**YES:** Repair or replace as necessary. **NO:** Go to next check.

MX52301,000039F -19-29MAY14-5/12

❷ Mid-frame Components

MX52301,000039F -19-29MAY14-6/12

Mid-frame	Are any components loose, worn, or damaged?	**YES:** Repair or replace as necessary. **NO:** Go to next step.

MX52301,000039F -19-29MAY14-7/12

Boots	Are rubber boot and clamps loose or damaged?	**YES:** Repair or replace as necessary. **NO:** Go to next step.

MX52301,000039F -19-29MAY14-8/12

Springs	Are load springs broken or compressed?	**YES:** Repair or replace as necessary. **NO:** Go to next check.

MX52301,000039F -19-29MAY14-9/12

❸ Park Brake:

Continued on next page

MX52301,000039F -19-29MAY14-10/12

Park Brake	Is the park brake incorrectly adjusted, or damaged?	**YES:** Adjust linkage and brake adjuster pawl. **NO:** Go to next step.

MX52301,000039F -19-29MAY14-11/12

Park Brake	Is the linkage worn or damaged?	**YES:** Repair or replace as necessary.

MX52301,000039F -19-29MAY14-12/12

Hydraulic Brakes Checks

Hydraulic Brakes

MX52301,00003A0 -19-22OCT14-1/5

❶ Brakes Checks

MX52301,00003A0 -19-22OCT14-2/5

Function	Brakes working properly? Is the brake fluid level correct?	**YES:** Go to next step. **NO:** Add brake fluid. Check system for leaks.

MX52301,00003A0 -19-22OCT14-3/5

System Fluid	Is there air in the brake system?	**YES:** Bleed the brake system. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-). See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-) **NO:** Go to next step.

MX52301,00003A0 -19-22OCT14-4/5

System Fluid	Do brake system components leak?	**YES:** Repair or replace components as necessary. Bleed the brake system. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-). See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-).

MX52301,00003A0 -19-22OCT14-5/5

Brakes Will Not Engage or Show Poor Response

Brakes Response

Continued on next page

MX52301,00003A1 -19-22OCT14-1/7

❶ Brake Response

MX52301,00003A1 -19-22OCT14-2/7

Fluid	Is the brake fluid low?	**YES:** Add fluid. See Check Brake Fluid Level (SN -040000) or Check Brake Fluid Level (SN 040001-). **NO:** Go to next step.

MX52301,00003A1 -19-22OCT14-3/7

Check for Leaks	Do the master cylinder seal, brake lines, or brake calipers leak?	**YES:** Repair or replace components. **NO:** Go to next step.

MX52301,00003A1 -19-22OCT14-4/7

Check for Air	Is there air in the brake system?	**YES:** Bleed brake lines. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-). See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-). **NO:** Go to next step.

MX52301,00003A1 -19-22OCT14-5/7

Master Cylinder	Is the master cylinder push rod adjusted correctly?	**YES:** Go to next step. **NO:** Adjust brake rod. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).

MX52301,00003A1 -19-22OCT14-6/7

Brake Pedal	Is the brake pedal or pivot bent, broken or worn?	**YES:** Repair or replace components as needed. **NO:** Go to next step.

MX52301,00003A1 -19-22OCT14-7/7

Brake Effort Excessive

Brake Effort

MX52301,00003A2 -19-22OCT14-1/7

❶ Brake Effort

Continued on next page

MX52301,00003A2 -19-22OCT14-2/7

Fluid	Is the brake fluid low?	**YES:** Add fluid. See Check Brake Fluid Level (SN -040000) or Check Brake Fluid Level (SN 040001-). **NO:** Go to next step.

MX52301,00003A2 -19-22OCT14-3/7

Check for Leaks	Do the master cylinder seal, brake lines, or brake calipers leak?	**YES:** Repair or replace components. **NO:** Go to next step.

MX52301,00003A2 -19-22OCT14-4/7

Master Cylinder	Is the master cylinder push rod adjusted correctly?	**YES:** Go to next step. **NO:** Adjust brake rod. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).

MX52301,00003A2 -19-22OCT14-5/7

Brake Pedal	Is the brake pedal or pivot bent, broken or worn?	**YES:** Repair or replace components as needed. **NO:** Go to next step.

MX52301,00003A2 -19-22OCT14-6/7

Brake Pad Wear	Are the brake pads excessively worn?	**YES:** Replace brake pads. See Brake Pad Replacement.

MX52301,00003A2 -19-22OCT14-7/7

Wheel Brakes Will Not Release

Brake Release

MX52301,00003A3 -19-22OCT14-1/4

❶ Wheel Brakes

MX52301,00003A3 -19-22OCT14-2/4

Master Cylinder	Is the master cylinder push rod adjusted correctly?	**YES:** Go to next step. **NO:** Adjust brake rod. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).

MX52301,00003A3 -19-22OCT14-3/4

Brake Pedal	Is the brake pedal or pivot bent, broken or worn?	**YES:** Repair or replace components as needed.

MX52301,00003A3 -19-22OCT14-4/4

Brake Noisy or Chattering

Brake Noise

MX52301,00003A4 -19-02SEP15-1/4

❶ Brake Noise

MX52301,00003A4 -19-02SEP15-2/4

Brake Calipers	Do brake calipers leak?	**YES:** Repair or replace components **NO:** Go to next step.

MX52301,00003A4 -19-02SEP15-3/4

Brake Pads	Do the brake pads have loose or missing hardware?	**YES:** Repair or replace hardware.

MX52301,00003A4 -19-02SEP15-4/4

Excessive Brake Pad Wear

Brake Pad Wear

MX52301,00003A5 -19-22OCT14-1/5

❶ Brake Pad Wear

MX52301,00003A5 -19-22OCT14-2/5

Brake return Spring	Is the brake return spring stretched, broken, or missing?	**YES:** Replace spring. **NO:** Go to next step.

MX52301,00003A5 -19-22OCT14-3/5

Master Cylinder	Is the master cylinder push rod adjusted correctly?	**YES:** Go to next step. **NO:** Adjust brake rod. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).

MX52301,00003A5 -19-22OCT14-4/5

Brake Pedal	Is the brake pedal or pivot bent, broken or worn?	**YES:** Repair or replace components as needed.

MX52301,00003A5 -19-22OCT14-5/5

Brake Pedal Travel Excessive

Brake Pedal Travel

Continued on next page

MX52301,00003A6 -19-22OCT14-1/5

❶ Brake Pedal Travel

MX52301,00003A6 -19-22OCT14-2/5

Fluid	Is the brake fluid low?	**YES:** Add fluid. See Check Brake Fluid Level (SN -040000) or Check Brake Fluid Level (SN 040001-). **NO:** Go to next step.

MX52301,00003A6 -19-22OCT14-3/5

Check for Leaks	Do the master cylinder seal, brake lines, or brake calipers leak?	**YES:** Repair or replace components. **NO:** Go to next step.

MX52301,00003A6 -19-22OCT14-4/5

Air in the Brake system	Is there air in the brake system?	**YES:** Bleed brake lines. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-). See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-).

MX52301,00003A6 -19-22OCT14-5/5

Brakes Pull Left or Right

Brake Pull

MX52301,00003A7 -19-22OCT14-1/5

❶ Brakes Pull

MX52301,00003A7 -19-22OCT14-2/5

Fluid Level	Is the brake fluid low?	**YES:** Add fluid. See Check Brake Fluid Level (SN -040000) or Check Brake Fluid Level (SN 040001-). **NO:** Go to next step.

MX52301,00003A7 -19-22OCT14-3/5

Check for Leaks	Do the master cylinder seal, brake lines, or brake calipers leak?	**YES:** Repair or replace components. **NO:** Go to next step.

Continued on next page

MX52301,00003A7 -19-22OCT14-4/5

Check for Air	Is there air in the brake system?	**YES:** Bleed brake lines. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-). See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-). **NO:** Go to next step.

MX52301,00003A7 -19-22OCT14-5/5

Pedal Feels Hard With Little Travel

Pedal Travel

MX52301,00003A8 -19-22OCT14-1/4

❶ Pedals Feel Hard with Little Travel

MX52301,00003A8 -19-22OCT14-2/4

Master Cylinder	Is the master cylinder push rod adjusted correctly?	**YES:** Go to next step. **NO:** Adjust brake rod. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).

MX52301,00003A8 -19-22OCT14-3/4

Brake Pedal	Is the brake pedal or pivot bent, broken or worn?	**YES:** Repair or replace components as needed.

MX52301,00003A8 -19-22OCT14-4/4

Park Brake Will Not Engage or Hold

Park Brake Engagement

MX52301,00003A9 -19-22OCT14-1/5

❶ Park Brake Engagement

MX52301,00003A9 -19-22OCT14-2/5

Park Brake Cable	Is the park brake cable incorrectly adjusted, stretched, worn, or binding?	**YES:** Adjust or replace brake cable. See MFWD Park Brake Cable Removal and Installation (SN -040000) or Park Brake Cable Removal and Installation (SN 040001-). **NO:** Go to next step.

Continued on next page

MX52301,00003A9 -19-22OCT14-3/5

Park Brake Linkage	Is the park brake lever or locking pawl bent, broken, binding, or worn?	**YES:** Repair or replace components as needed. **NO:** Go to next step.

MX52301,00003A9 -19-22OCT14-4/5

Park Brake Mechanism	Does the park brake mechanism have missing or worn components?	**YES:** Replace components.

MX52301,00003A9 -19-22OCT14-5/5

Park Brake Will Not Release (SN -040000)

Park Brake Release (SN -040000)

MX52301,00003AA -19-24OCT14-1/5

❶ Park Brake

MX52301,00003AA -19-24OCT14-2/5

Park Brake Cable	Is the park brake cable incorrectly adjusted, stretched, worn, or binding?	**YES:** Adjust or replace brake cable. See MFWD Park Brake Adjustment (SN -040000) or Park Brake Adjustment (SN 040001-) and MFWD Park Brake Cable Removal and Installation (SN -040000) or Park Brake Cable Removal and Installation (SN 040001-). **NO:** Go to next step.

MX52301,00003AA -19-24OCT14-3/5

Park Brake Lever	Is the park brake lever or locking pawl bent, broken, binding, or worn?	**YES:** Repair or replace components as needed. **NO:** Go to next step.

MX52301,00003AA -19-24OCT14-4/5

Park Brake Spring	Is the transaxle park brake spring broken, out of adjustment, or missing?	**YES:** Adjust spring. See MFWD Park Brake Return Spring Adjustment (SN -040000). **YES:** Replace spring.

MX52301,00003AA -19-24OCT14-5/5

Park Brake Will Not Release (SN 040001-)

Park Brake Release (SN 040001-)

MX52301,00003AB -19-24OCT14-1/5

Park Brake

Continued on next page

MX52301,00003AB -19-24OCT14-2/5

❶ **Cable**	Is the park brake cable incorrectly adjusted, stretched, worn, or binding?	**YES:** Adjust or replace brake cable. **NO:** Go to next step.

MX52301,00003AB -19-24OCT14-3/5

❷ **Brake Lever**	Is the park brake lever or locking pawl bent, broken, binding, or worn?	**YES:** Repair or replace components as needed. **NO:** Go to next step.

MX52301,00003AB -19-24OCT14-4/5

❸ **Components**	Are the caliper park brake springs broken or missing?	**YES:** Replace spring(s).

MX52301,00003AB -19-24OCT14-5/5

Summary of References

- Check Brake Fluid Level (SN -040000)
- Master Cylinder Rod Adjustment (SN -040000)
- Bleeding Brakes (SN -040000)
- Bleeding Master Cylinder (SN -040000)
- Two-Wheel Drive Park Brake Adjustment (SN -040000)
- MFWD Park Brake Adjustment (SN -040000)
- MFWD Park Brake Return Spring Adjustment (SN -040000)

MX52301,000045C -19-22OCT14-1/1

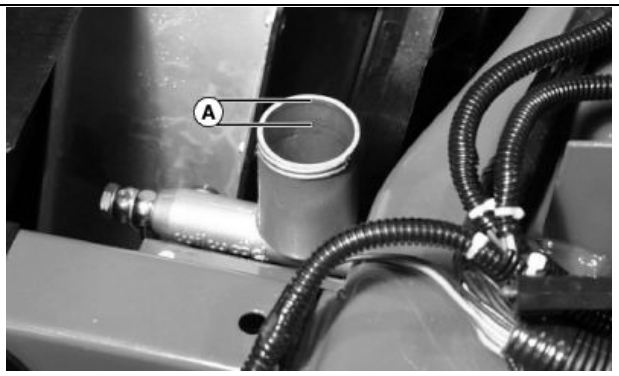
Check Brake Fluid Level (SN -040000)

IMPORTANT: Avoid Damage! Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing. Do not open the brake fluid reservoir cap unless necessary.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

Use only DOT3 brake fluid from a sealed container.

1. Park machine safely. See the “Safety Section”.
2. Open hood
3. Carefully clean area around reservoir cap.
4. Remove reservoir cap and visually check fluid level.
   - Fluid levels must be maintained to 12—13 mm (0.47—0.51 in.) below top of filler (A).
5. If fluid is low:
   - Add fluid to maintain level to 12—13 mm (0.47—0.51 in.) below top of filler (A).



MXT011717 —UN—20MAY14

A—Fill Level Mark

6. Install reservoir cap.
7. Close hood.

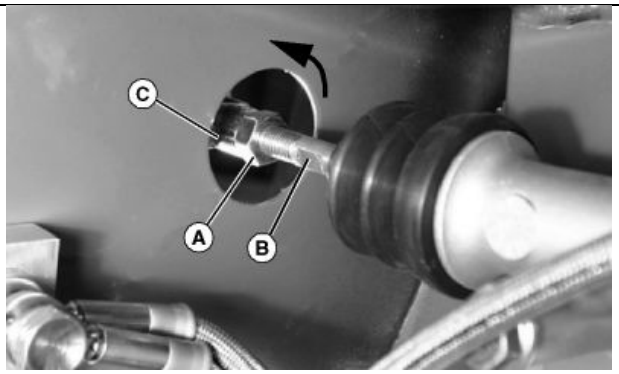
MX52301,0000044 -19-24OCT14-1/1

Master Cylinder Rod Adjustment (SN -040000)

1. Park machine safely. See the “Safety Section”.
2. Raise hood.
3. Loosen jam nut (A), in direction shown by arrow.
4. Slide rubber boot forward to expose flats (B) on master cylinder rod.
5. Turn the master cylinder rod in the clevis (C) attached to the brake pedal to adjust brake pedal.
   - Adjustment is correct when the return spring has pulled the back to specification from the stop bar, and the master cylinder primary piston is fully destroked and resting against the retaining washer.

Specification	
Brake Arm to Stop Bar—Distance	1—2 mm (0.039—0.079 in.)

6. Tighten the jam nut, and verify brake pedal operation.



MXT011718 —UN—20MAY14

A—Jam Nut
B—Flats
C—Clevis

Specification	
Brake Rod Jam Nut—Torque	20 N•m (15 lb.-ft.)

MX52301,0000045 -19-24OCT14-1/1

Bleeding Brakes (SN -040000)

IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

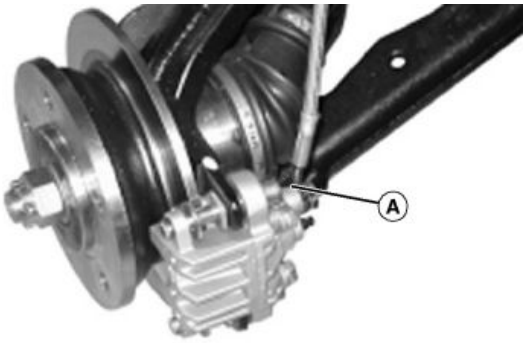
Use only DOT3 brake fluid from a sealed container.

NOTE: The brake hydraulic system must be bled any time a new component is installed, or any time the system has been breached. If only one component has been repaired or replaced it may only be necessary to bleed that component. If bleeding all four wheels, start at the wheel furthest away from the master cylinder and finish at the wheel closest to the master cylinder (right rear, left rear, right front, left front).

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.

NOTE: Each caliper has two bleeder screws. Use only top screw.

3. Remove the wheel to access the bleeder screw (A).
4. Attach one end of a clear piece of tubing to the bleeder screw. Put the other end into a clear container with approximately 13 mm (1/2 in.) of fresh brake fluid.
5. With the bleeder screw closed, have an assistant slowly pump the brake pedal to build pressure in the system.
6. After several pumps have the assistant stop pumping, but keep pressure on the brake pedal.
7. Open the brake bleeder screw, allowing brake fluid and air to escape.



MXT011719 —UN—20MAY14

A—Bleeder Screw

- Watch the fluid entering the container through the tube. The fluid should be clear, without any air bubbles.

8. Close the bleeder screw. The assistant can now release the pedal.
9. Check the fluid level in the master cylinder, topping off as required.
10. Repeat as required until the fluid running into the container is clear, and there is no evidence of air or bubbles. The pedal should have a firm feel and should not “sink” toward the floor with constant pressure.
11. Make sure that all bleeder screws are closed securely and the master cylinder has the correct amount of brake fluid.
12. Install the wheel(s).

MX52301,0000046 -19-24OCT14-1/1

Bleeding Master Cylinder (SN -040000)

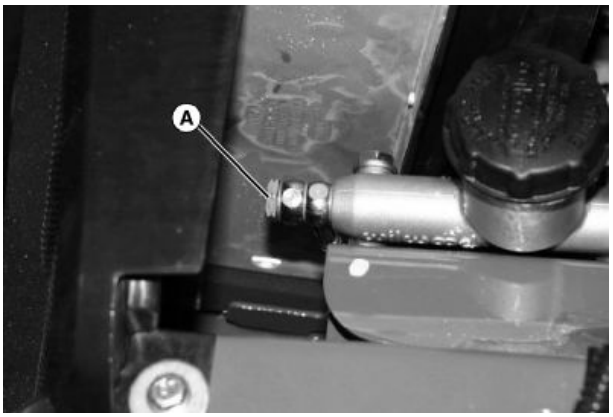
IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

Use only DOT3 brake fluid from a sealed container.

NOTE: The master cylinder must be bled anytime it is replaced or allowed to run completely out of fluid.

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Remove cap and check the level in the master cylinder. Top off if necessary.
4. Disconnect brake line (A) from master cylinder.
5. Connect master cylinder bleeding adaptor and clear tubing to master cylinder.
6. Insert tubing in master cylinder reservoir so that end is completely submerged in brake fluid.
7. Slowly depress brake pedal completely and release while observing for bubbles in reservoir.
8. Repeat procedure until bubbles no longer appear. Top off reservoir as needed.



MXT011720 —UN—20MAY14

A—Brake Line

9. Remove bleeding adaptor and connect brake line. Tighten to specification.

Specification	
Brake Line to Master Cylinder—Torque	15—24 N·m (10—18 lb.-ft.)

10. Bleed brake system. See Bleeding Brakes (SN -040000).

MX52301,0000047 -19-24OCT14-1/1

Two-Wheel Drive Park Brake Adjustment (SN -040000)

NOTE: Park brake lever should be able to be raised two to three "clicks" with reasonable effort.

1. Park machine safely. See the "Safety Section".
2. Block wheels to prevent machine from rolling.
3. Park brake released.

NOTE: Setting the park brake engages the differential lock to lock the rear wheels together before the park brake is engaged.

4. Loosen jam nuts (A). Adjust nuts until park brake cable (B) slack is removed but before park brake arm (C) or differential lock arm (D) move.
5. Tighten jam nuts.

Specification

Cable Adjust Jam Nut—Torque.....54—61 N•m (40—45 lb.-ft.)

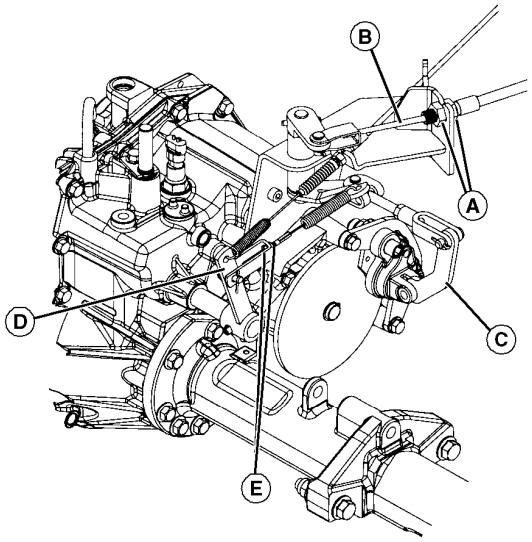
NOTE: If cable slack cannot be removed without differential arm movement the differential cable needs to be adjusted to lengthen the cable between the park brake arm and differential arm.

6. Adjust differential cable if necessary:
   - Loosen nuts (E).
   - Adjust nuts to remove slack and until there is no movement in the differential arm with the park brake handle released and immediate movement when the park brake handle is pulled up.
   - Tighten nuts to specification:

Specification

Cable Adjust Jam Nut—Torque.....54—61 N•m (40—45 lb.-ft.)

7. Recheck park brake operation



MXT011721—UN—20MAY14

A—Jam Nuts
B—Park Brake Cable
C—Park Brake Arm
D—Differential Lock Arm
E—Nuts

Park Brake Specifications—Specification

Park Brake Lever Movement for Differential Lock—Angle..... 0—12°
Minimum Lever Angle for Full Differential Lock—Angle.....16°
Park Brake Lever Travel Angle—Angle..... 0—36°
Detent Increment Angle (12 total)—Angle.....2°

8. Check park brake return spring adjustment. See MFWD Park Brake Return Spring Adjustment (SN -040000).

MX52301,0000048 -19-24OCT14-1/1

MFWD Park Brake Adjustment (SN -040000)

NOTE: Park brake lever should be able to be raised two to three "clicks" with reasonable effort.

1. Park machine safely. See the "Safety Section".
2. Block wheels to prevent machine from rolling.
3. Park brake released.

NOTE: Setting the park brake engages the differential lock to lock the rear wheels together before the park brake is engaged.

4. Loosen jam nuts (A). Adjust nuts until park brake cable (B) slack is removed but before park brake arm (C) or differential lock arm (D) move.
5. Tighten jam nuts to specification:

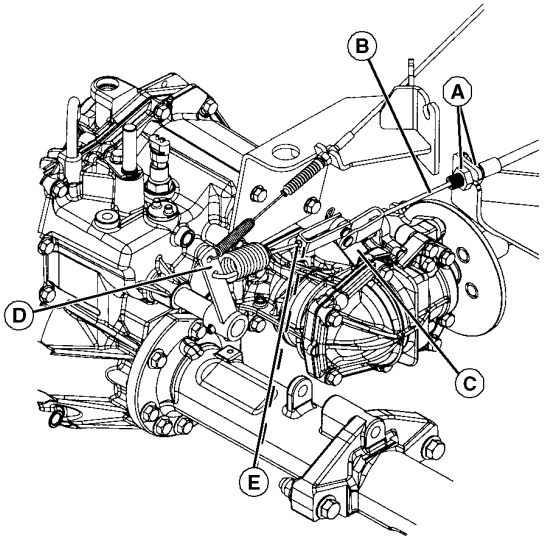
Specification	
Cable Adjust Jam Nut—Torque	54—61 N•m (40—45 lb.-ft.)

NOTE: If cable slack cannot be removed without differential arm movement the differential cable needs to be adjusted to lengthen the cable between the park brake arm and differential arm.

6. Adjust differential cable if necessary:
   - Loosen nuts (E).
   - Adjust nuts to remove slack and until there is no movement in the differential arm with the park brake handle released and immediate movement when the park brake handle is pulled up.
   - Tighten nuts to specification:

Specification	
Cable Adjust Jam Nut—Torque	54—61 N•m (40—45 lb.-ft.)

7. Recheck park brake operation



MXT011722 —UN—20MAY14

A—Jam Nut
B—Park Brake Cable
C—Park Brake Arm
D—Differential Lock Arm
E—Nuts

Park Brake Specifications—Specification	
Park Brake Lever Movement for Differential Lock—Angle	0—12°
Minimum Lever Angle for Full Differential Lock—Angle	16°
Park Brake Lever Travel Angle—Angle	0—36°
Detent Increment Angle (12 total)—Angle	2°

8. Check park brake return spring adjustment. See MFWD Park Brake Return Spring Adjustment (SN -040000).

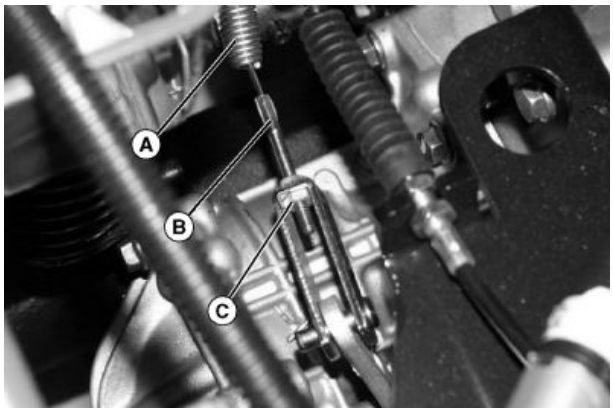
MX52301,0000049 -19-24OCT14-1/1

MFWD Park Brake Return Spring Adjustment (SN -040000)

1. Park machine safely. See the “Safety Section”.
2. Block wheels and park brake must be off.
3. Park bake return spring (A) and cable (B) should be taut but with no stretching of spring with park brake off.
4. Loosen jam nut (C) and adjust spring and cable tension if necessary.
5. Tighten jam nut and test park brake to specification

Park Brake Specifications—Specification

Cable Adjust Jam Nut—Torque	54—61 N•m (40—45 lb.-ft.)
Park Brake Lever Movement for Differential Lock—Angle	0—12°
Minimum Lever Angle for Full Differential Lock—Angle	16°
Park Brake Lever Travel Angle—Angle	0—36°



MXT011723 —UN—20MAY14

A—Brake Return Spring
B—Brake Cable
C—Jam Nut

Detent Increment Angle (12 total)—Angle	2°

MX52301,000004A -19-24OCT14-1/1

Summary of References

- Check Brake Fluid Level (SN 040001-)
- Master Cylinder Rod Adjustment (SN 040001-)
- Bleeding Brakes (SN 040001-)
- Bleeding Master Cylinder (SN 040001-)
- Burnish Brakes (SN 040001-)
- Park Brake Adjustment (SN 040001-)

MX52301,000045E -19-22OCT14-1/1

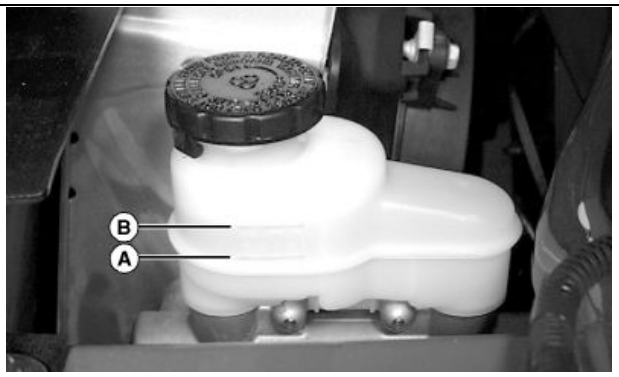
Check Brake Fluid Level (SN 040001-)

IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing. Do not open the brake fluid reservoir cap unless absolutely necessary.

Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing. Do not open the brake fluid reservoir cap unless absolutely necessary.

Use only DOT3 brake fluid from a sealed container.

1. Park machine safely. See the “Safety Section”.
2. Open hood.
3. Visually check fluid level
   - Fluid levels must be maintained between low (A) and high (B) level marks.
4. If fluid is low, carefully clean area around reservoir cap and remove cap:
   - Add fluid to maintain level within specification.
5. Install reservoir cap.
6. Close hood.



MXT011724 —UN—20MAY14

A—Low Fluid Level Mark **B—High Fluid Level Mark**

MX52301,000004B -19-24OCT14-1/1

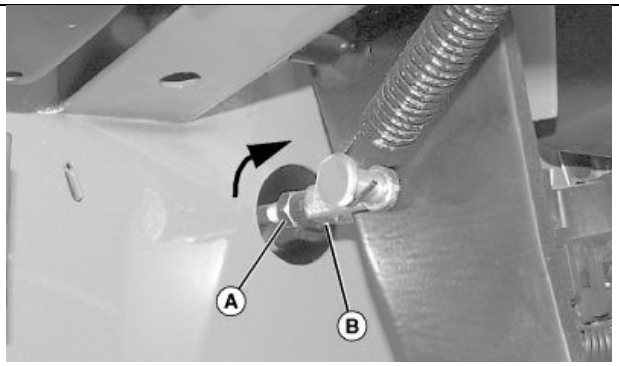
Master Cylinder Rod Adjustment (SN 040001-)

1. Park machine safely. See the “Safety Section”.
2. Raise hood
3. Loosen jam nut (A), in direction shown by arrow.
4. Turn the master cylinder rod in the clevis (B) attached to the brake pedal to adjust brake pedal.
   - Adjustment is correct when the return spring has pulled the back of the brake arm to specification from the stop bar, and the master cylinder primary piston is fully destroked and resting against the retaining washer.

Specification

Brake Arm to Stop Bar—Gap.....1—2 mm (0.39—0.079 in.)

5. Tighten the jam nut to specification and verify brake pedal operation.



MXT011725 —UN—20MAY14

A—Jam Nut **B—Clevis**

Specification

Brake Rod Jam Nut—Torque.....20 N·m (15 lb.-ft.)

MX52301,000004C -19-24OCT14-1/1

Bleeding Brakes (SN 040001-)

IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

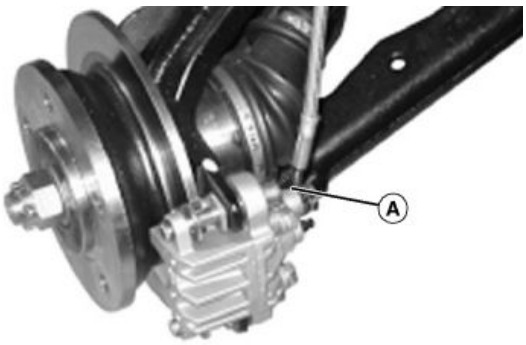
Use only DOT3 brake fluid from a sealed container.

NOTE: The brake hydraulic system must be bled any time a new component is installed, or any time the system has been breached. If only one component has been repaired or replaced it may only be necessary to bleed that component. If bleeding all four wheels, start at the wheel furthest away from the master cylinder and finish at the wheel closest to the master cylinder (right rear, left rear, right front, left front).

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.

NOTE: Each caliper has two bleeder screws. Use only top screw.

3. Remove the wheel to access the bleeder screw (A).
4. Attach one end of a clear piece of tubing to the bleeder screw. Put the other end into a clear container with approximately 13 mm (1/2 in.) of fresh brake fluid.
5. With the bleeder screw closed, have an assistant slowly pump the brake pedal to build pressure in the system.
6. After several pumps have the assistant stop pumping, but keep pressure on the brake pedal.
7. Open the brake bleeder screw, allowing brake fluid and air to escape.



MXT011719 —UN—20MAY14

Picture Note: Right front brake shown.

A—Bleeder Screw

- Watch the fluid entering the container through the tube. The fluid should be clear, without any air bubbles.

8. Close the bleeder screw. The assistant can now release the pedal.
9. Check the fluid level in the master cylinder, topping off as required.
10. Repeat as required until the fluid running into the container is clear, and there is no evidence of air or bubbles. The pedal should have a firm feel and should not “sink” toward the floor with constant pressure.
11. Make sure that all bleeder screws are closed securely and the master cylinder has the correct amount of brake fluid.
12. Install the wheel(s).

MX52301,000004D -19-24OCT14-1/1

Bleeding Master Cylinder (SN 040001-)

IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

Use only DOT3 brake fluid from a sealed container.

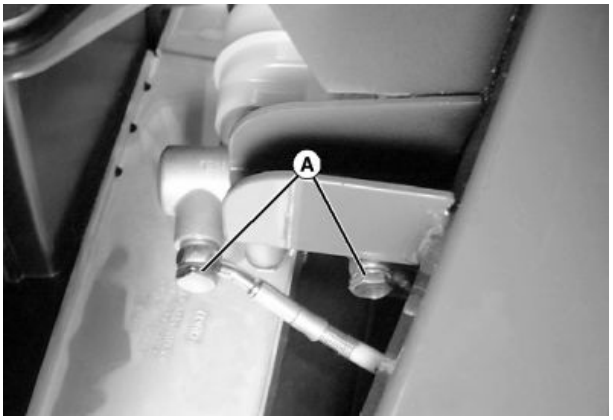
NOTE: The master cylinder must be bled anytime it is replaced or allowed to run completely out of fluid.

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Remove cap and check the level in the master cylinder. Top off if necessary.

CAUTION: Wear eye protection when bleeding brakes to avoid eye injury from escaping fluid.

NOTE: Keep brake fluid from contacting painted surfaces. Clean all brake fluid immediately.

4. Have an assistant depress and keep pressure on brake pedal while loosening brake lines (A). Observe fluid for air bubbles at line connections. Hold brake pedal down and tighten brake lines to specification.



MXT011726 —UN—20MAY14

A—Brake Lines

Specification	
Brake Line to Master Cylinder—Torque	15—24 N·m (10—18 lb.-ft.)

5. Repeat procedure until air or bubbles no longer appear. Tighten to bolts to specification.
6. Top off reservoir as needed during and after procedure.
7. Bleed brake system. See Bleeding Brakes (SN 040001-).

MX52301,000004E -19-24OCT14-1/1

Burnish Brakes (SN 040001-)

Proper burnishing prepares the rotor and pad surfaces, prolongs the rotor’s life and make the components more resistant to thermal checking or cracking under severe braking conditions. Burnishing also burns the rust prohibitive off the rotors and mates the pad surface to the rotor surface.

CAUTION: Avoid Injury! Test a machine under safe conditions. Perform this procedure in a clear open area. Keep bystanders away. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to machine damage, serious personal injury, or death.

1. Check tire pressure
2. Check brake fluid level; add if necessary.
3. Start machine, and shift transmission to low range.
4. Disengage traction assist.
5. Disengage all-wheel drive.
6. On a straight, hard surface, accelerate up to full throttle in high gear, 40 kph (25 mph).

IMPORTANT: Use care to avoid overheating brakes while performing the next step. Do not allow brakes to lock.

7. Apply brakes to bring the vehicle to a rolling stop with medium deceleration.
8. Repeat steps six and seven 20 more times.
9. Set park brake to 10 clicks, 267 N (60 lbf). Select low gear, drive full throttle, 19 kph (12 mph) for 30 seconds with park brake applied. Release park brake.

JK79365,0000664 -19-18JUL16-1/1

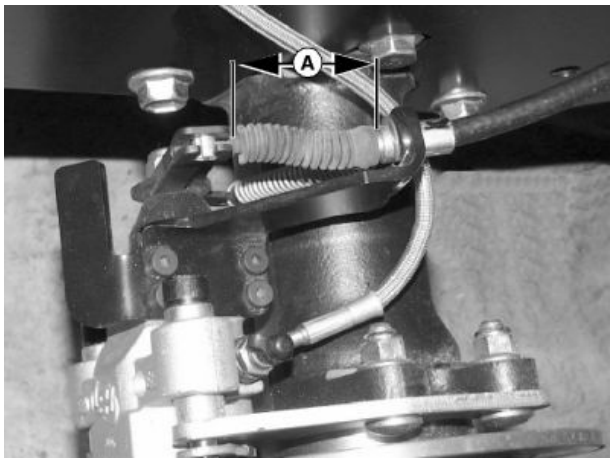
Park Brake Adjustment (SN 040001-)

NOTE: The park brake should be adjusted when the hand lever reaches the top of its travel (12 clicks) and will not hold the vehicle in place.

1. Park machine safely. See the “Safety Section”.
2. Raise or remove cargo box.
3. Block front wheels to prevent machine from rolling and safely raise rear wheels off surface. Remove wheels.
4. If cables were replaced, cycle the park brake handle from fully locked to fully unlocked several times to stretch and seat cables.
5. Pull the park brake lever all the way up and measure the length of the rubber bellows (A) on the end of each brake cable. If the measurement exceeds specification proceed to step 15.

Specification

Rubber Bellows—Length ..... 63 mm (2.5 in.)



MXT011727 —UN—20MAY14

A—Rubber Bellows

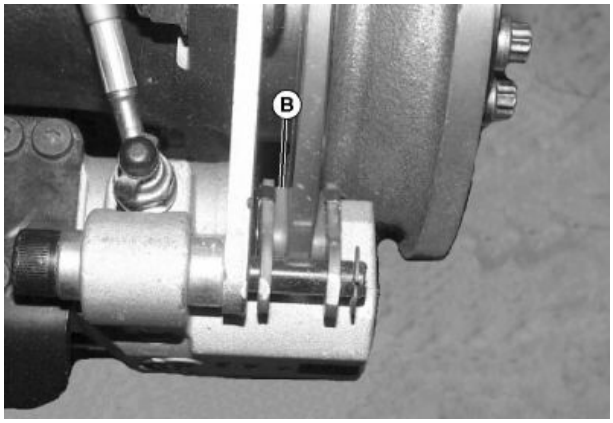
MX52301,0000050 -19-24OCT14-1/7

6. If the rubber bellows length (A) is less than specification, check if brake pads are worn out. If friction material (B) on any brake pad is less than specification, replace brake pads. See Brake Pad Replacement.

Specification

Friction Material—Thickness (minimum) ..... 1 mm (0.040 in.)

7. Place the park brake lever in the off position.



MXT011728 —UN—20MAY14

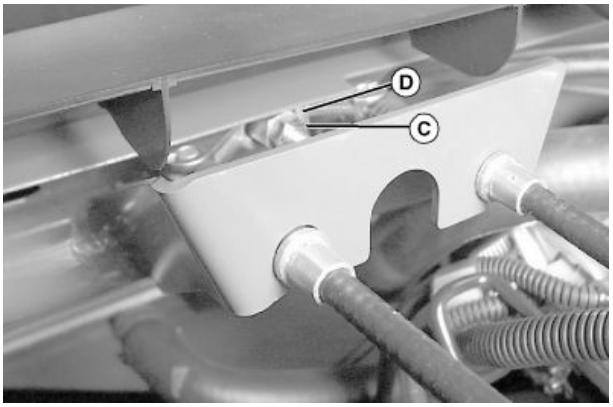
A—Rubber Bellows **B—Friction Material**

Continued on next page

MX52301,0000050 -19-24OCT14-2/7

8. Loosen jam nut (C). Back off jam nut and adjusting nut (D) 30 mm (1.25 in.).

C—Jam Nut **D—Adjustment Nut**

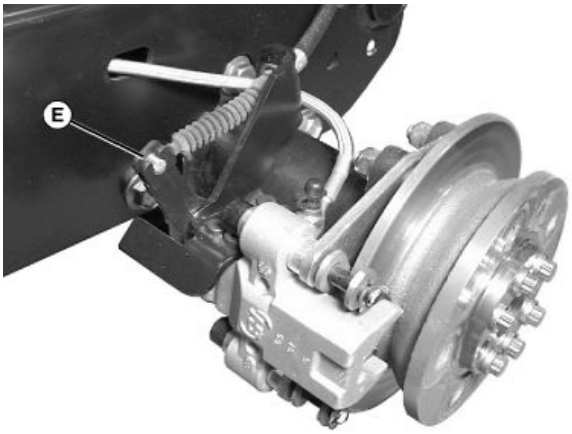


MXT011729 —UN—20MAY14

MX52301,0000050 -19-24OCT14-3/7

9. Pull forward on brake lever (E) to ensure that the park brake is fully released.

E—Brake Lever

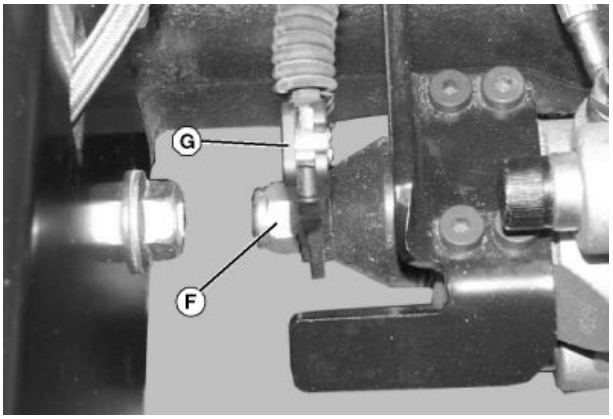


MXT011730 —UN—20MAY14

MX52301,0000050 -19-24OCT14-4/7

10. Remove the actuator nut (F) and actuator lever (G) from the actuator screw.

F—Actuator Nut **G—Actuator Lever**



MXT011731 —UN—20MAY14

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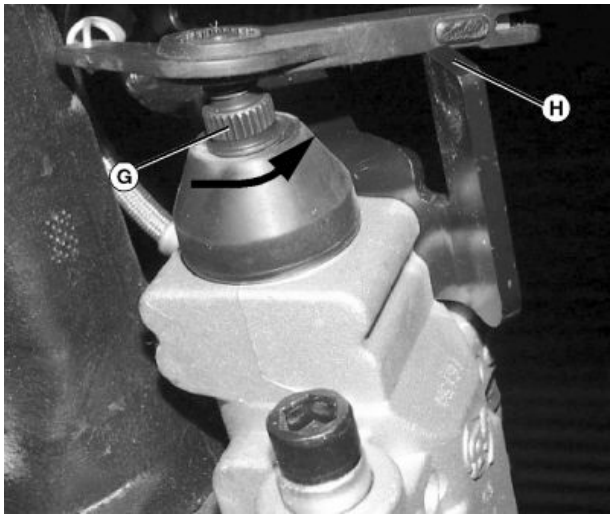
MX52301,0000050 -19-24OCT14-5/7

11. On the left side caliper, turn the actuator screw (G) counter clockwise until it is hand tight.
12. Rotate the actuator lever as close to the leverstop (H) as possible and engage it back on the actuator screw splines.
13. Install actuator nut and tighten to specification.

Specification	
Actuator Lever Nut—Torque	46 N·m (34 lb.-ft.)

14. Repeat steps 9-13 on right side of machine. On the right side caliper, turn the actuator screw clockwise until it is hand tight.



MXT011732 —UN—20MAY14

G—Actuator Lever **H—Leaver Stop**

Picture Note: Left side caliper shown.

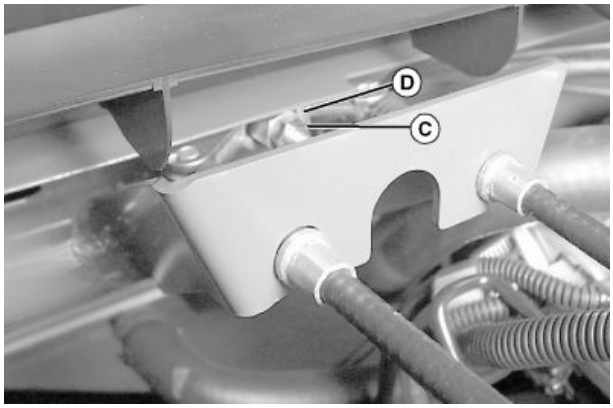
MX52301,0000050 -19-24OCT14-6/7

15. Adjust nut (D) until cables are tightened to specification:

Specification	
Adjustment Nut—Torque	5 N·m (4 lb.-ft.)

16. Check the park brake lever movement. It should move 2-4 clicks with a medium pull (about 50 lbs.) force on the handle. Move the adjuster nut accordingly.
17. Hold adjuster nut and tighten jam nut (C) to specification.

Specification	
Jam Nut—Torque	30 N·m (22 lb.-ft.)



MXT011729 —UN—20MAY14

C—Jam Nut **D—Adjustment Nut**

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Summary of References

- Brake Pad Replacement
- Master Cylinder Removal and Installation
- Brake Line Removal and Replacement
- Brake Caliper Removal and Installation
- MFWD Park Brake Pad Replacement (SN -040000)
- MFWD Park Brake Rotor Removal and Installation (SN -040000)
- Brake Pedal Removal and Installation
- MFWD Park Brake Cable Removal and Installation (SN -040000)
- Park Brake Cable Removal and Installation (SN 040001-)
- Park Brake Lever Removal and Installation (SN -090000)
- Park Brake Lever Removal and Installation (SN 090001-)

MX52301,000045D -19-30MAY14-1/1

Brake Pad Replacement

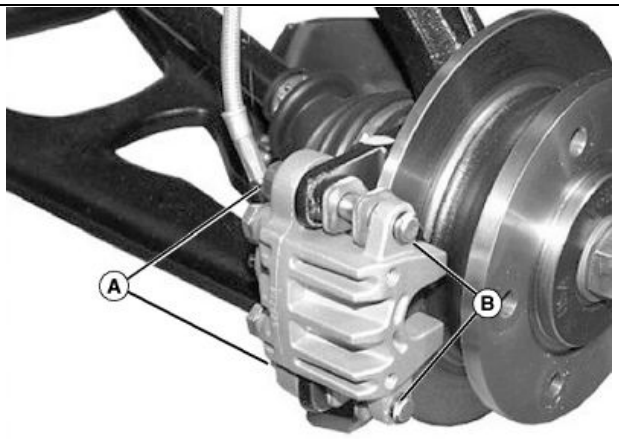
NOTE: Brake pads must be replaced when the brake material thickness is 1mm (0.040 in.) or less.

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Raise machine and support with jack stands.
4. Remove wheels. See Wheel Removal and Installation
5. Remove two C-clips (B) and two sliding pins (A) securing brake caliper.
6. Remove caliper and secure out of the way ensuring the stress is taken off the brake line.
7. Clean all dirt and corrosion off brake hardware components.
8. Measure the thickness or the brake rotors at the wear area. Replace rotors if worn below minimum specification.

Specification

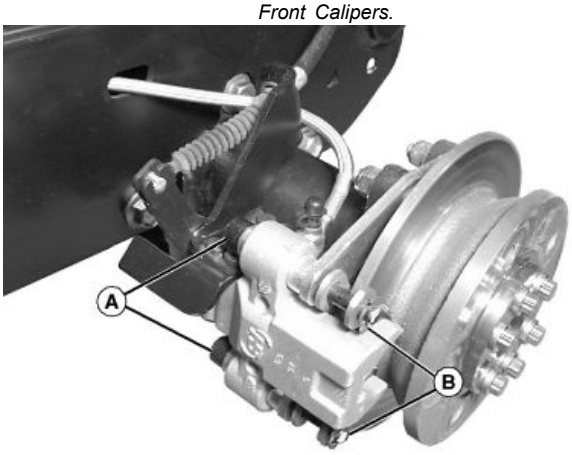
Brake Rotor—Thickness (minimum)..... 4.76 mm (0.187 in.)

A—Sliding Pins (2 used) **B—C-clips (2 used)**



MXT011734 —UN—20MAY14

Front Calipers.



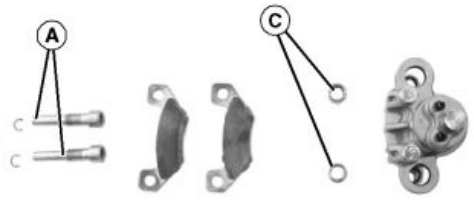
MXT011735 —UN—20MAY14

Picture Note: SN 40001- machine rear calipers shown. SN -40000 similar

MX52301,0000051 -19-22OCT14-1/3

9. Lubricate brake sliding pins (A) and sleeves (C) with ANTI-SEIZE compound.

A—Sliding Pins **C—Sleeves**



MXT011736 —UN—20MAY14

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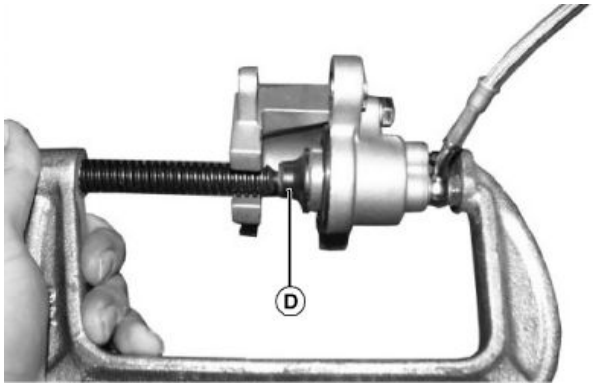
MX52301,0000051 -19-22OCT14-2/3

10. Install brake calipers onto rotor. It may be necessary to press caliper piston into it's bore with a C-clamp (D) to allow clearance for brake pads.
11. Insert new brake pads, friction material sides toward rotor.
12. Install sleeves, sliding pins, and C-clips. Tighten sliding pins to specification.

Specification

Caliper Sliding Pins—Torque ..... 41—52 N·m (30—38 lb.-ft.)

13. Bleed brake lines if necessary. See Bleeding Brakes (SN -040000) orBleeding Brakes (SN 040001-).
14. Install wheels.



MXT011737 —UN—20MAY14

D—C Clamp

MX52301,0000051 -19-22OCT14-3/3

Master Cylinder Removal and Installation

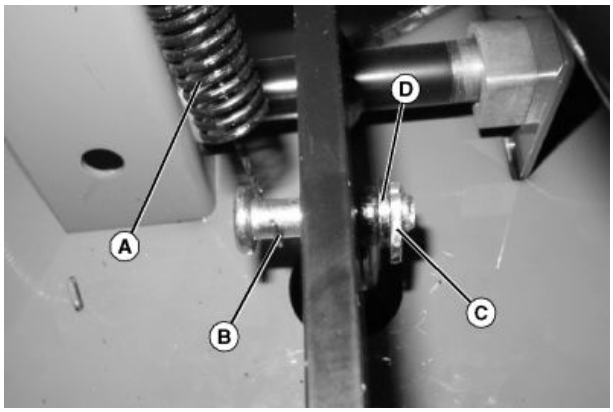
IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap before removing. Do not open the brake fluid reservoir cap unless absolutely necessary.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

Use only DOT3 brake fluid from a sealed container.

Removal:

1. Park machine safely. See the "Safety Section".
2. Raise hood.
3. Disconnect brake pedal return spring (A) from pivot pin
4. Remove cotter pin (C), clevis pin, and washer (D) from master cylinder rod clevis.



MXT011738 —UN—20MAY14

Picture Note: Under Dash

A—Return Spring
B—Pivot Pin
C—Cotter Pin
D—Washer

Continued on next page

MX52301,0000052 -19-22OCT14-1/2

5. Disconnect brake lines (E) from the master cylinder.
6. Turn the master cylinder rod counterclockwise to remove it from the brake pedal clevis.
7. Remove cap screws (F) and remove the master cylinder.

Installation

1. Connect the master cylinder rod clevis to the brake pedal using the clevis pin and washer.
2. Install a new cotter pin in the master cylinder rod clevis pin.
3. Connect the brake pedal return spring to the clevis pin.
4. Install the master cylinder and secure with cap screws (F).

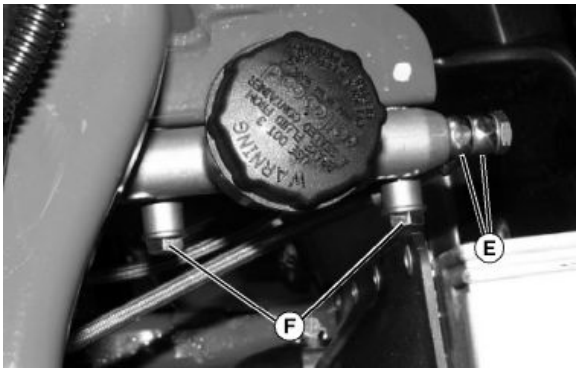
NOTE: If installing a new or completely dry master cylinder, perform master cylinder bleeding procedure. See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-).

5. Connect brake lines (E) to the master cylinder. Tighten to specification.

Specification	
Brake Line to Master Cylinder—Torque	15—24 N·m (10—18 lb.-ft.)

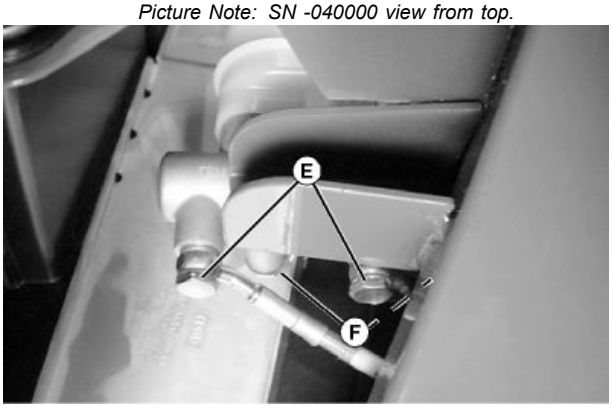
6. Adjust the master cylinder rod length. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).

Specification	
Brake Rod Jam Nut—Torque	20 N·m (15 lb.-ft.)



MXT011739 —UN—20MAY14

Picture Note: SN -040000 view from top.



MXT011740 —UN—20MAY14

Picture Note: SN 040001- view from bottom

E—Brake Lines **F—Cap Screws**

7. Bleed brake system. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-).

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Brake Line Removal and Replacement

IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap and brake lines before removing. Do not open the brake fluid reservoir cap unless absolutely necessary.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

Use only DOT3 brake fluid from a sealed container.

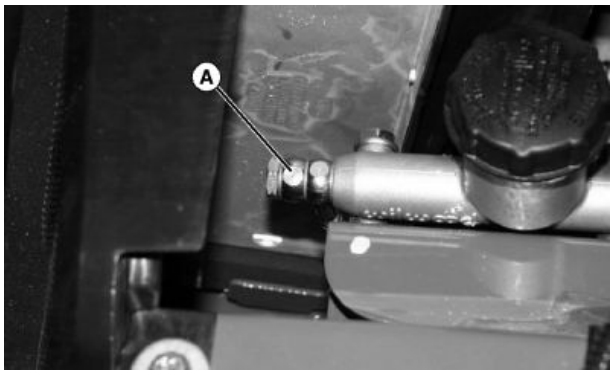
Setup:

1. Park machine safely. See the “Safety Section”.
2. Lock park brake.
3. Machine may be raised and wheels removed. (Brake line removal and installation procedure shown with wheels removed for clarity.)

Front Brake Line Removal:

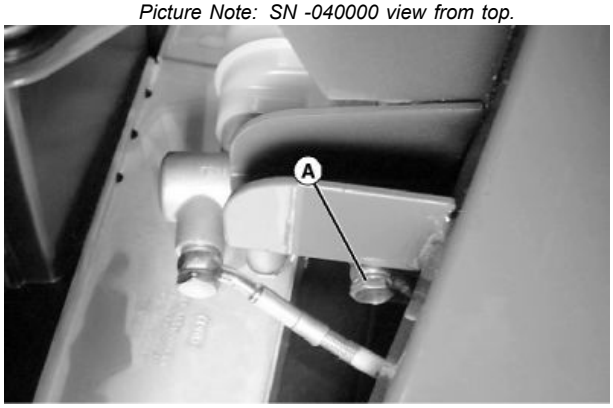
1. Disconnect front brake line (A) from master cylinder.

A—Brake Line



MXT011741 —UN—20MAY14

Picture Note: SN -040000 view from top.



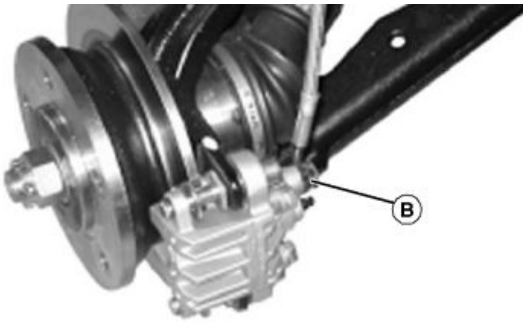
MXT011742 —UN—20MAY14

Picture Note: SN 040001- view from bottom.

MX52301,0000053 -19-22OCT14-1/8

2. Disconnect brake line (B) from each front brake caliper.

B—Front Brake Line



MXT011743 —UN—20MAY14

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MX52301,0000053 -19-22OCT14-2/8

3. Remove bolt (C) securing brake line and retainer to each strut. (One on each side.)

C—Bolt

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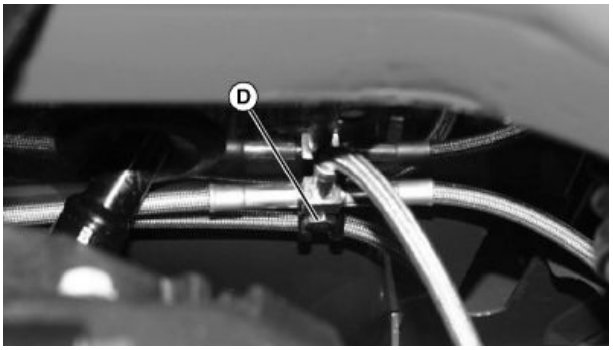
MX52301,0000053 -19-22OCT14-3/8

4. Remove bolt and nut (D) securing brake line assembly to front firewall.

NOTE: Observe the path taken by the front brake line before disassembly for reassembly.

5. Remove front brake line assembly from machine.

D—Bolt and Nut



MXT011745 —UN—20MAY14

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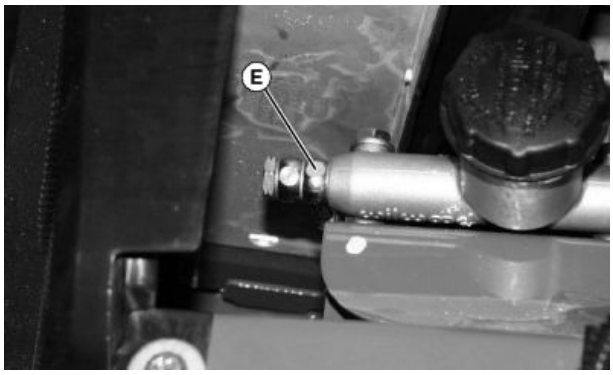
MX52301,0000053 -19-22OCT14-4/8

Rear Brake Line Removal:

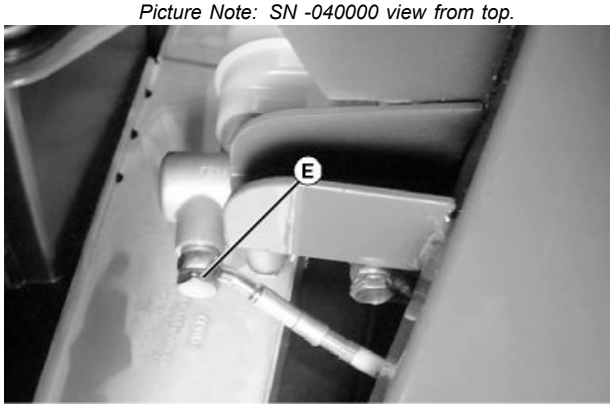
1. Disconnect rear brake line (E) from master cylinder.
2. Remove center console. See Remove and Install Center Console (SN -090000) or Remove and Install Center Console (SN 090001-).
3. Remove transaxle control lever housing. See Remove and Install Transaxle Control Lever Housing (SN -090000) or Remove and Install Transaxle Control Lever Housing (SN 090001-).

E—Rear Brake Line



MXT011746 —UN—20MAY14

Picture Note: SN -040000 view from top.



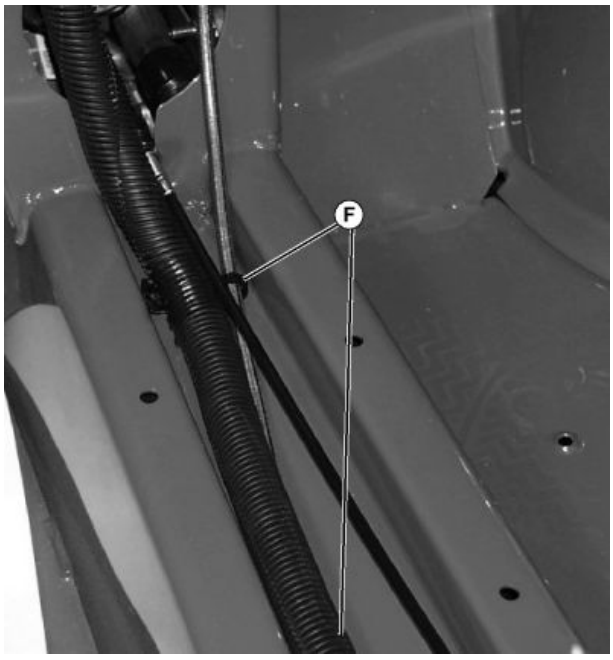
MXT011747 —UN—20MAY14

Picture Note: SN 040001- view from bottom.

MX52301,0000053 -19-22OCT14-5/8

4. Remove plastic straps (F) securing brake line to frame

F—Plastic Straps



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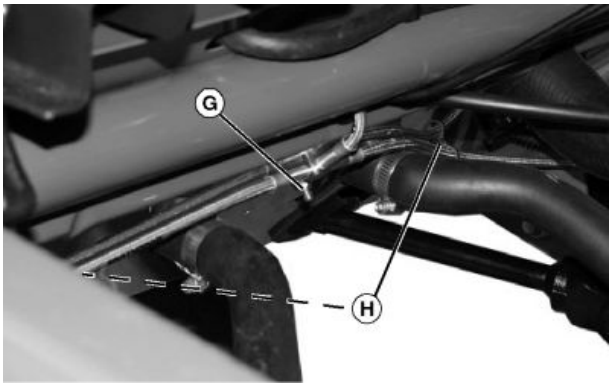
MX52301,0000053 -19-22OCT14-6/8

5. Remove bolt and nut (G) securing rear brake line to rear firewall. Remove plastic straps (H) securing brake lines to frame.

G—Bolt and Nut **H—Plastic Straps**



MXT011749 —UN—20MAY14

MX52301,0000053 -19-22OCT14-7/8

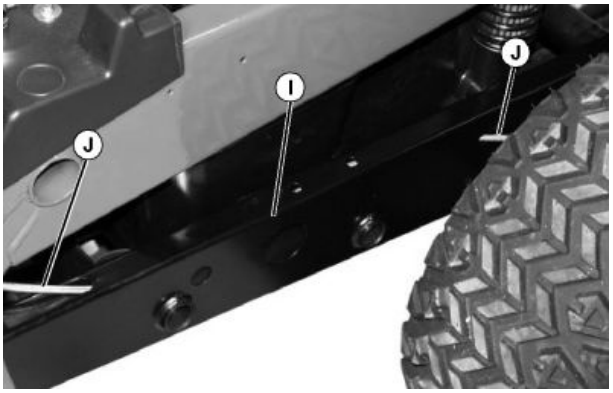
6. Remove plastic straps (I) securing brake lines to subframe. (One on each side.)
7. Disconnect brake lines from each rear brake caliper.

NOTE: Observe the path taken by the rear brake line (J) through the frame and subframe

8. Remove rear brake line (J) assembly.

Installation:

1. Installation is in the reverse of removal.
2. Ensure that brake lines are routed correctly. Rear brake line must be routed through the rear firewall towards the front of machine first.
3. Ensure that plastic straps are installed in correct locations.
4. Insure that all crush washers are installed onto brake line banjo bolts.
5. Bleed master cylinder if necessary. See Bleeding Master Cylinder (SN -040000) or Bleeding Master Cylinder (SN 040001-).
6. Bleed brake system. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-).
7. Tighten Brake lines to specification.



MXT011750 —UN—20MAY14

I— Plastic Straps **J— Rear Brake Line**

Brake Line Torques—Specification

Brake Line to Master Cylinder—Torque	15—24 N·m (10—18 ft.-lb.)
Brake Line to Caliper—Torque	15—24 N·m (10—18 ft.-lb.)
Brake Line 3-Way Valve to Firewall—Torque	10.4 N·m (92 lb-in.)

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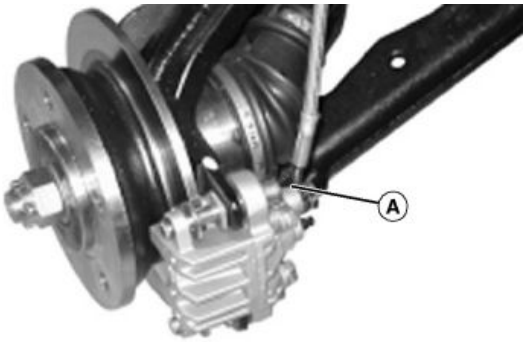
Brake Caliper Removal and Installation

IMPORTANT: Avoid contamination of the brake fluid. Thoroughly clean area around the filler cap and brake lines before removing. Do not open the brake fluid reservoir cap unless absolutely necessary.

Use extreme care when filling the reservoir. Fluid spilled on painted surfaces can cause damage.

Use only DOT3 brake fluid from a sealed container.



MXT011719 —UN—20MAY14

Picture Note: Front Caliper.

A—Banjo Bolt

Removal:

NOTE: Front and rear calipers removal and installation is the same. Front caliper removal shown.

1. Park machine safely. See the “Safety Section”.
2. Lock park brake
3. Remove wheels. See Wheel Removal and Installation.
4. Remove banjo bolt (A), and crush washers securing brake line to front caliper.

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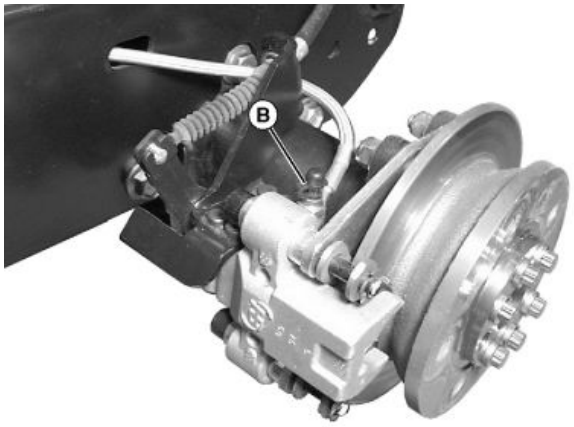
5. Remove bleed valve/brake line (B) from rear caliper.

B—Bleed Valve/Brake Line



MXT011751 —UN—20MAY14

Picture Note: SN 040001- machine rear calipers shown, SN -040000 similar

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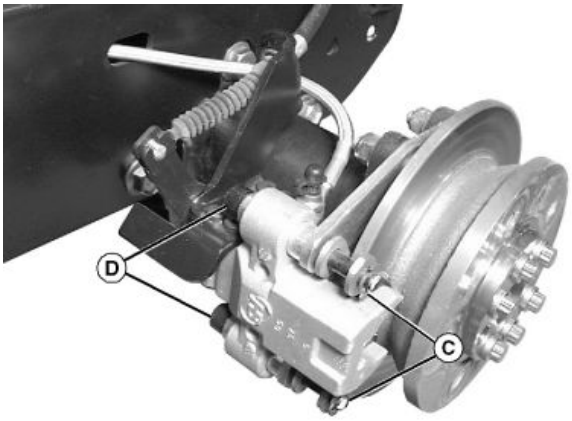
MX52301,0000054 -19-22OCT14-2/5

6. Remove two C-clips (C) and two sliding pins (D) securing brake caliper.
7. Remove caliper and secure out of the way ensuring the stress is taken off of the brake line.
8. Remove brake pads from calipers.
9. Clean all dirt and corrosion off of brake hardware components.
10. Remove caliper from machine.

C—C-Clips **D—Sliding Pins (2 used)**



MXT011753 —UN—20MAY14

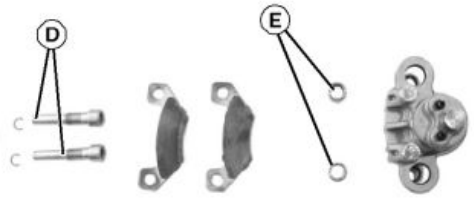
Picture Note: SN 040001- machines rear calipers shown, SN -040000 similar

MX52301,0000054 -19-22OCT14-3/5

Installation:

1. Installation is in the reverse of removal.
2. Lubricate brake sliding pins (D) and sleeves (E) with ANTI-SEIZE compound.

D—Sliding Pins (2 used) **E—Sleeves (2 used)**



MXT011754 —UN—20MAY14

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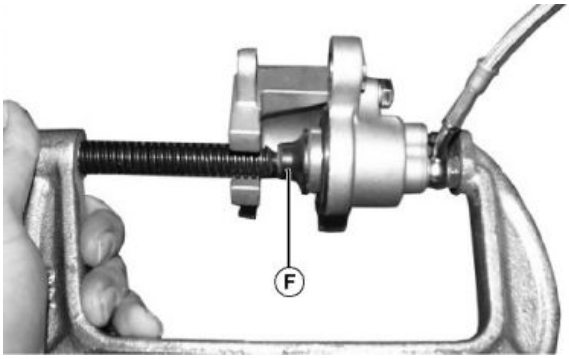
3. Install brake calipers onto rotor. It may be necessary to press caliper piston into it's bore with a C-clamp (F) to allow clearance for brake pads.
4. Insert new brake pads, friction material sides toward
5. Install sleeves, sliding pins, and C-clips. Tighten sliding pins to specification.

Specification	
Caliper Sliding Pins—Torque	41—52 N·m (30—38 lb.-ft.)

6. Ensure that all crush washers are installed in their correct locations. Tighten banjo bolt to specification.

Specification	
Caliper Banjo Bolt—Torque	15—24 N·m (10—18 lb.-ft.)

7. Bleed brake system. See Bleeding Brakes (SN -040000) or Bleeding Brakes (SN 040001-).



MXT011755 —UN—20MAY14

F—C-clamp

8. Install wheels.

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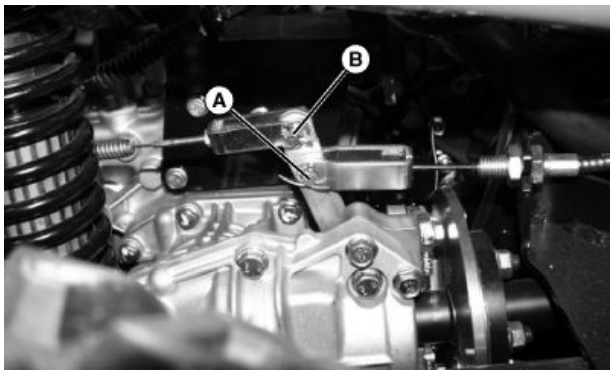
MFWD Park Brake Pad Replacement (SN -040000)

NOTE: Engine removed for clarity in photos.

1. Park machine safely. See the “Safety Section”.
2. Block wheels and leave off park brake.
3. Remove cotter pin from park brake adjuster pivot pin (A).
4. Remove cotter pin from park brake adjuster pivot pin (B).

A—Cotter Pin **B—Clevis Pin**



MXT011756 —UN—20MAY14

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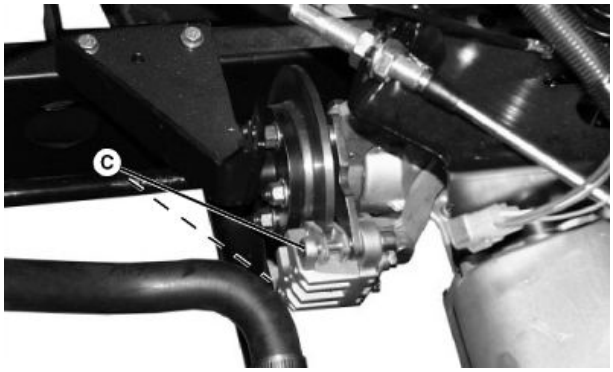
5. Remove C-clips (C) from park brake caliper sliding pins.
6. Remove sliding pins.
7. Remove caliper from machine.
8. Clean all dirt and corrosion off of brake hardware components.

C—C-clips

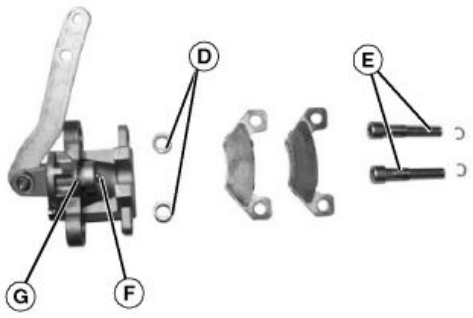


MXT011757 —UN—20MAY14

MX52301,0000055 -19-24OCT14-2/5

9. Lubricate brake sliding pins (E) and sleeves (D) with ANTI-SEIZE compound.
10. Lubricate caliper piston shaft (G) with lithium grease

D—Sleeves **F—Caliper Nipple**
E—Sliding Pins (2 used) **G—Caliper Piston Shaft**



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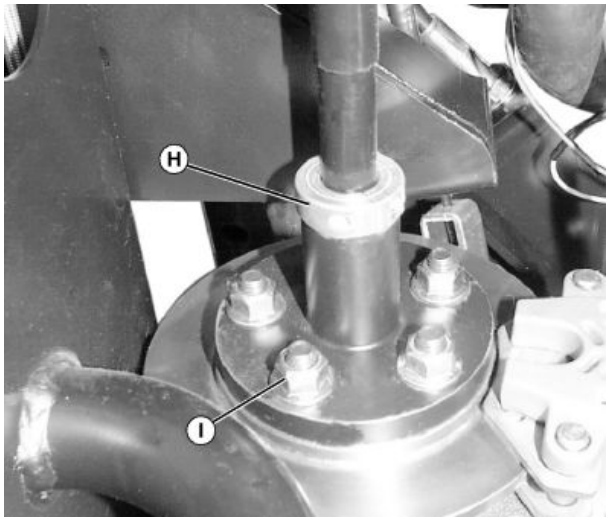
MX52301,0000055 -19-24OCT14-3/5

11. Loosen collar (H) screws and slide collar forward on drive shaft.
12. Loosen five retaining nuts (I) on rotor to allow rotor to slide back and forth on drive shaft collar.
13. Install caliper onto rotor.

H—Collar **I— Retaining Nuts (5 used)**



MXT011759 —UN—29MAY14

Picture Note: Shown from bottom

MX52301,0000055 -19-24OCT14-4/5

14. Insert new brake pads, friction material sides toward rotor. Ensure that nipple (F) on caliper fits into hole on back of brake pad.
15. Install sleeves, sliding pins, and C-clips. Tighten sliding pins to specification.

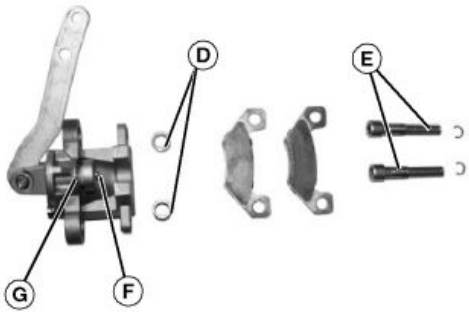
Specification	
Caliper Sliding Pins—Torque	41—52 N·m (30—38 lb.-ft.)

16. Tighten five rotor retaining nuts to specification.

Specification	
Brake Rotor to Drive Shaft Collar Nuts—Torque	58—88 N·m (43—65 lb.-ft.)

IMPORTANT: If using a soft mallet to seat rotor and drive shaft collar assembly, only strike drive shaft collar. Do not strike brake rotor.

17. Ensure that rotor and drive shaft collar assembly are fully seated over O-ring on transaxle output shaft.
18. Slide collar (H) against rotor and drive shaft collar assembly and tighten collar screws.



MXT011758 —UN—20MAY14

D—Sleeves **F— Caliper Nipple**
E—Sliding Pins (2 used) **G—Caliper Piston Shaft**

19. Install clevis pin and new cotter pin into park brake adjuster clevis.
20. Adjust park brake. See Two-Wheel Drive Park Brake Adjustment (SN -040000).

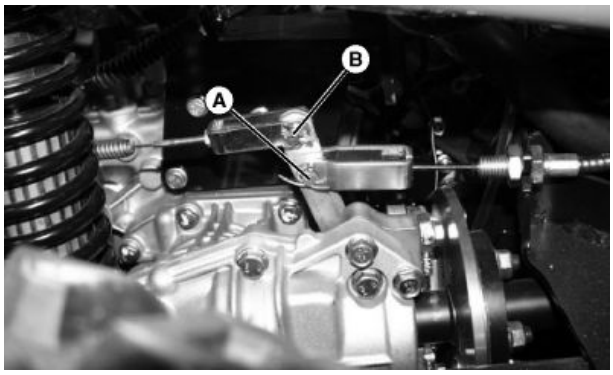
MX52301,0000055 -19-24OCT14-5/5

MFWD Park Brake Rotor Removal and Installation (SN -040000)

Removal

NOTE: Engine removed for clarity in photos.

1. Park machine safely. See the “Safety Section”.
2. Block wheels and unlock park brake.
3. Remove cotter pin from park brake actuator pivot pin (B).
4. Remove cotter pin from park brake adjuster pivot pin (A).



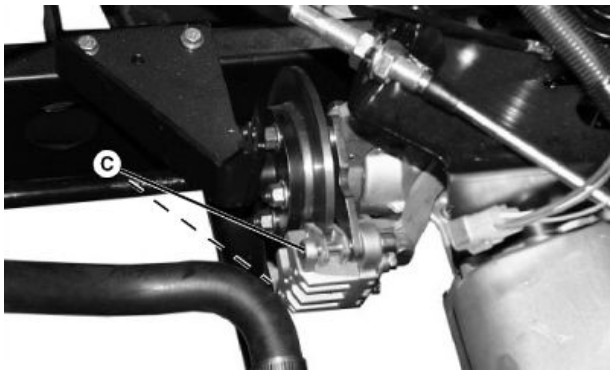
MXT011756 —UN—20MAY14

A—Pivot Pin **B—Pivot Pin**

MX52301,0000056 -19-24OCT14-1/8

5. Remove C-clips (C) from park brake caliper sliding pins.
6. Remove sliding pins.
7. Remove caliper from machine.

C—C-clips

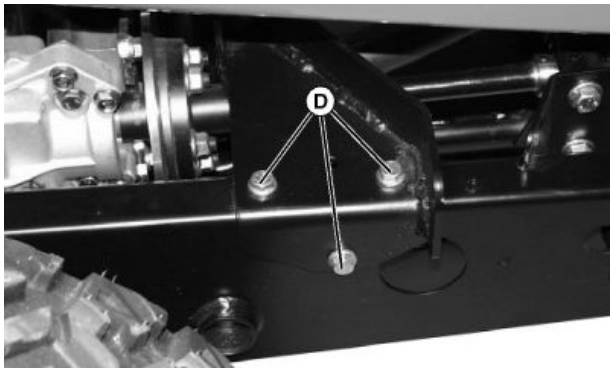


MXT011757 —UN—20MAY14

MX52301,0000056 -19-24OCT14-2/8

8. Remove three bolts (D) securing park brake cable

D—Bolts (3 used)



MXT011760 —UN—20MAY14

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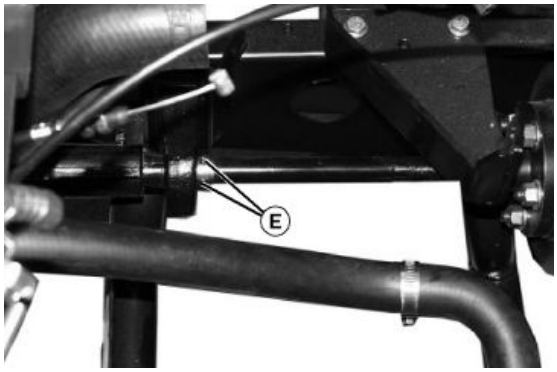
MX52301,0000056 -19-24OCT14-3/8

9. Loosen two set screws (E) on drive shaft near yoke.

E—Set Screws (2 used)

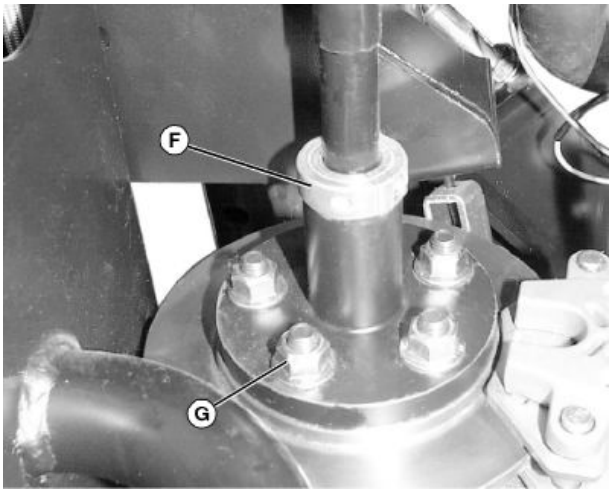


MXT011761 —UN—20MAY14

MX52301,0000056 -19-24OCT14-4/8

10. Loosen set screws and slide collar (F) forward on drive
11. Remove five nuts (G) securing drive shaft collar to park brake rotor.

F—Collar **G—Nuts (5 used)**



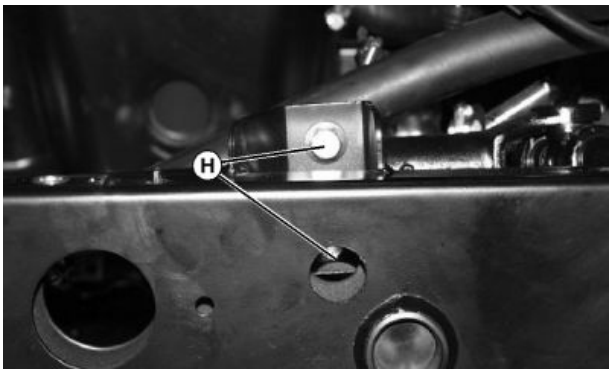
Picture Note: Shown from bottom

MXT011762 —UN—20MAY14

MX52301,0000056 -19-24OCT14-5/8

12. Remove two bolts (H) securing drive shaft cast bearing to frame.

H—Bolts (2 used)



MXT011763 —UN—20MAY14

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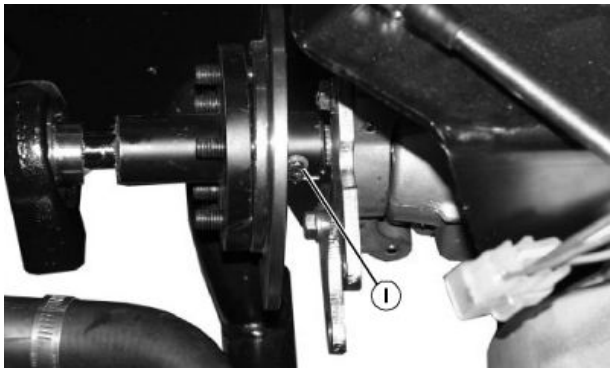
MX52301,0000056 -19-24OCT14-6/8

13. Remove grease fitting (I) from drive shaft collar.

I— Grease Fitting



MXT011764 —UN—20MAY14

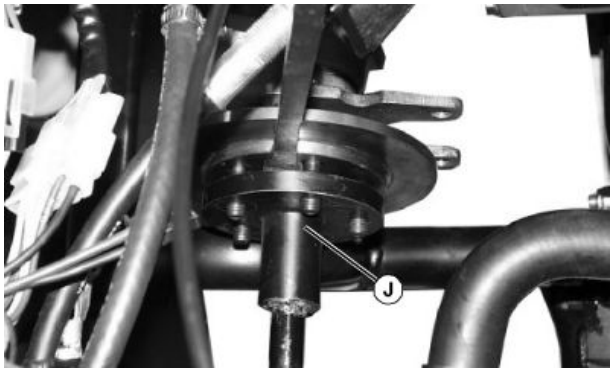
MX52301,0000056 -19-24OCT14-7/8

14. Using a prybar, carefully separate drive shaft collar (J) from brake rotor.
15. Remove brake rotor from machine by sliding drive shaft

Installation

1. Installation is in the reverse of removal. See MFWD Park Brake Pad Replacement (SN -040000).
2. Ensure that spacer and O-ring behind rotor (on transaxle output shaft) are in place.
3. Ensure that rotor and drive shaft collar assembly are fully seated over O-ring on transaxle output shaft.
4. Slide locking collar against rotor and drive shaft collar assembly and tighten collar screws.

Specification	
Brake Rotor to Drive Shaft Collar Nuts—Torque	58—88 N·m (43—66 lb.-ft.)



MXT011765 —UN—20MAY14

J— Drive Shaft Collar

5. Apply one or two pumps of grease to grease fitting on drive shaft collar.

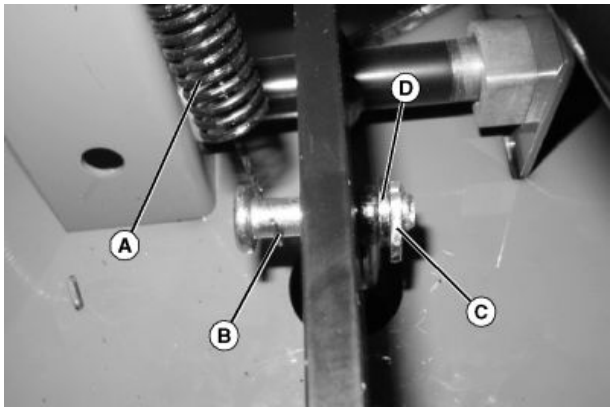
MX52301,0000056 -19-24OCT14-8/8

Brake Pedal Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Disconnect brake pedal return spring (A) from pivot pin (B).
3. Remove cotter pin (C), clevis pin, and washer (D) from master cylinder rod clevis.

A—Pedal Return Spring
B—Pivot Pin
C—Cotter Pin
D—Washer



MXT011766 —UN—20MAY14

Picture Note: Under dash

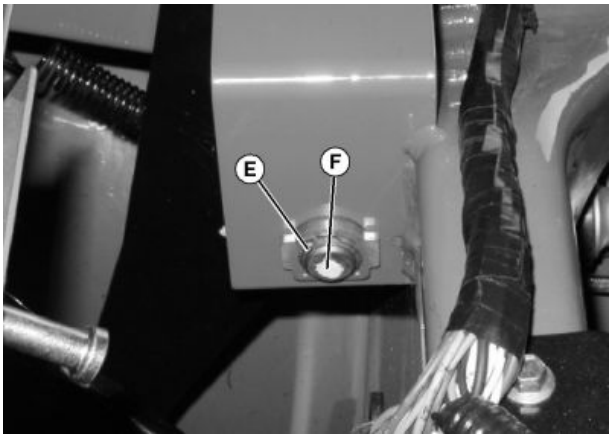
Continued on next page

MX52301,0000057 -19-22OCT14-1/2

4. Remove outside snap rings (E) on brake pedal pivot shaft (one on each side).
5. Remove bushings (F) from brake pedal pivot shaft (one on each side).
6. Remove brake pedal from machine.

Installation:

1. Installation is in the reverse of removal
2. Install a new cotter pin in the master cylinder rod clevis
3. Adjust master cylinder rod. See Master Cylinder Rod Adjustment (SN -040000) or Master Cylinder Rod Adjustment (SN 040001-).



MXT011767 —UN—20MAY14

E—Snap Rings **F—Bushings**

MX52301,0000057 -19-22OCT14-2/2

MFWD Park Brake Cable Removal and Installation (SN -040000)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Block wheels to prevent machine from rolling.
3. Unlock park brake.
4. Remove transaxle control lever housing. See Remove and Install Transaxle Control Lever Housing (SN -090000) or Remove and Install Transaxle Control Lever Housing (SN 090001-).
5. Remove cotter pin and clevis pin (A) at park brake caliper lever clevis.

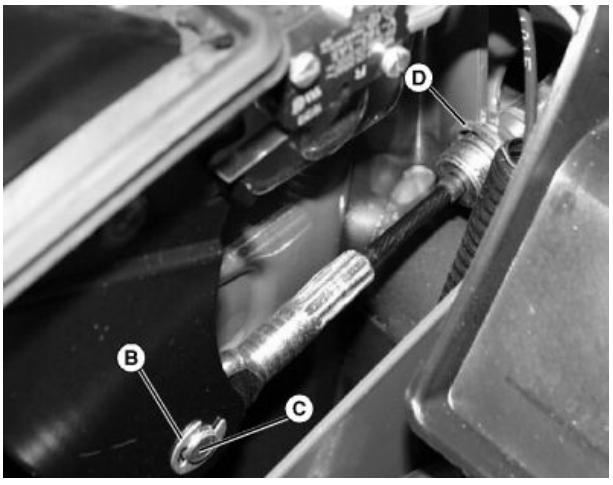
MXT011768 —UN—20MAY14

A—Clevis Pin

MX52301,0000058 -19-24OCT14-1/3

6. Remove C-clip (B) at park brake lever.
7. Lift park brake lever up and remove pivot pin (C).
8. Remove C-clip (D) at front cable bracket.

B—C-clip **D—C-clip**
C—Pivot Pin



MXT011769 —UN—20MAY14

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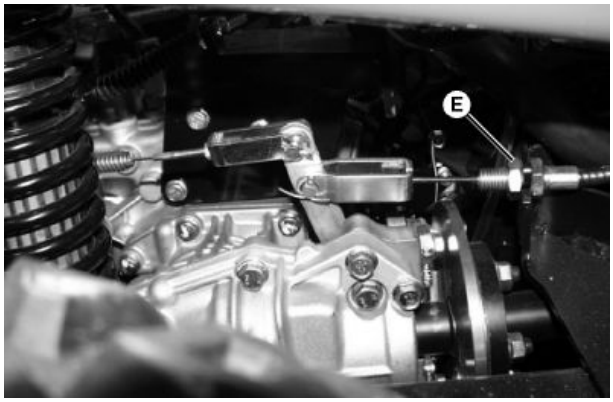
MX52301,0000058 -19-24OCT14-2/3

9. Completely unscrew park brake jam nut (E).
10. Slide park brake cable out of front and rear brackets
11. Remove cable from machine.

Installation:

1. Route cable through front and rear brackets
2. Install C-clip at front frame bracket.
3. Install cable, pivot pin, and C-clip at park brake lever.
4. Fully lower park brake lever.
5. Install clevis pin and new cotter pin at park brake caliper lever clevis.
6. Install jam nut finger tight.
7. Adjust park brake. See Two-Wheel Drive Park Brake Adjustment (SN -040000)
8. Install transaxle control lever cover. See Remove and Install Transaxle Control Lever Housing (SN -090000) or Remove and Install Transaxle Control Lever Housing (SN 090001-).



MXT011770 —UN—20MAY14

E—Jam Nut

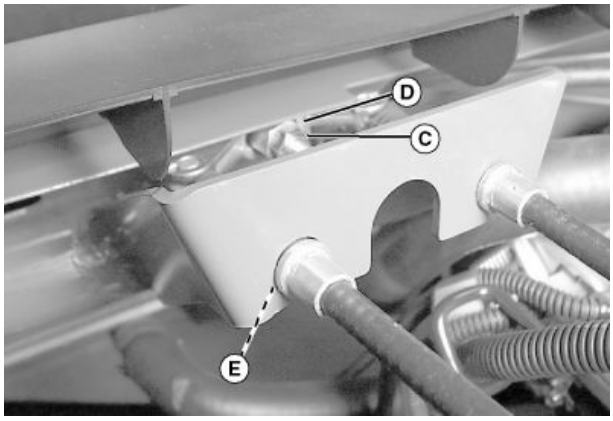
MX52301,0000058 -19-24OCT14-3/3

Park Brake Cable Removal and Installation (SN 040001-)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise and lock or remove cargo box.
3. Block front wheels to prevent machine from rolling and safely raise rear wheels off surface. Remove wheels.
4. Unlock park brake.
5. Loosen jam nut (C). Back off jam nut and adjusting nut (D) 30 mm (1.25 in.).

C—Jam Nut
D—Adjusting Nut
E—C-clip

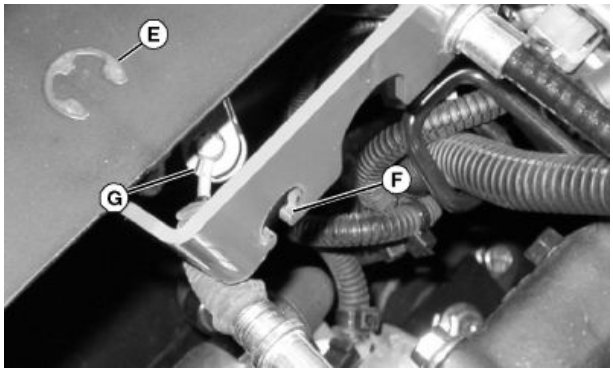


MXT011771 —UN—20MAY14

MX52301,000005A -19-24OCT14-1/3

6. Remove C-clip (E) at the backside of the mounting bracket.
7. Pull the cable sheath rearward to remove from mounting bracket slot (F).
8. Pivot the cable outward to disconnect the cable from the equalizer slot (G).

F—Mounting Bracket Slot
G—Equalizer slot



MXT011772 —UN—20MAY14

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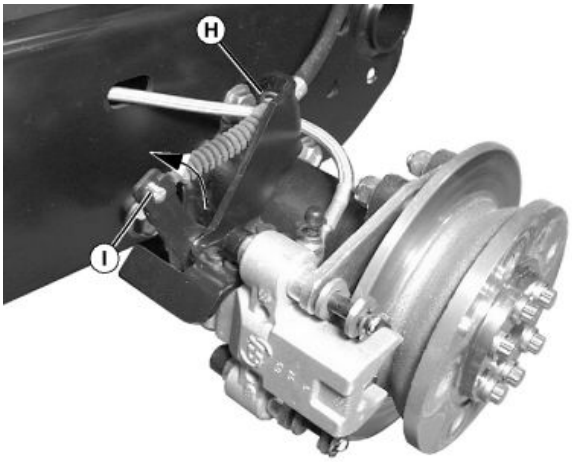
MX52301,000005A -19-24OCT14-2/3

9. Remove C-clip (H) at axle mounting bracket
10. Pull the cable sheath rearward to remove from mounting bracket.
11. Pivot the cable outward to disconnect the cable from the actuator lever slot (I).
12. Route the cable through the cable ties used at the rear frame cross-member, or cut the cable ties and replace with new during installation. Remove the cables from machine.

Installation:

1. Installation is in the reverse of removal.
2. Adjust park brake. See Park Brake Adjustment (SN 040001-).



MXT011773 —UN—20MAY14

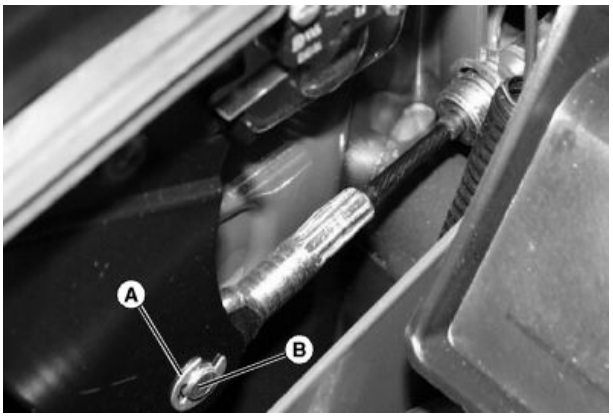
H—C-clip **I— Actuator Lever Slot**

MX52301,000005A -19-24OCT14-3/3

Park Brake Lever Removal and Installation (SN -090000)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Block wheels to prevent machine from rolling.
3. Unlock park brake.
4. Remove transaxle control lever housing. See Remove and Install Transaxle Control Lever Housing (SN -090000) or Remove and Install Transaxle Control Lever Housing (SN 090001-).
5. Remove C-clip (A) at park brake lever.
6. Lift park brake lever up and remove pivot pin (B).



MXT011774 —UN—20MAY14

A—C-clip **B—Pivot Pin**

Continued on next page

MX52301,000005B -19-22OCT14-1/2

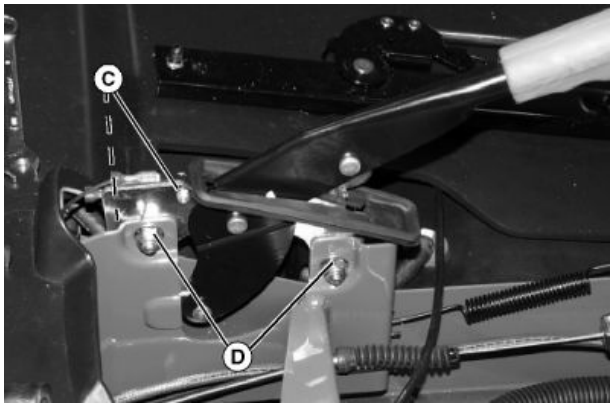
7. Remove park brake switch screws (C). Remove switch.
8. Remove two bolts and nuts (D) securing park brake lever to frame
9. Remove park brake lever from machine.

Installation:

1. Installation is in the reverse of removal
2. Tighten bolts to specification.

Specification	
Park Brake Handle Bolts—Torque	30—44 N·m (22—32 lb.-ft.)

3. Park brake may have to be adjusted. See Two-Wheel Drive Park Brake Adjustment (SN -040000).



MXT011775 —UN—20MAY14

C—Screws **D—Bolts and Nuts (2 used)**

MX52301,000005B -19-22OCT14-2/2

Park Brake Lever Removal and Installation (SN 090001-)

Removal:

1. Park machine safely. See the “Safety Section”.
2. Block wheels to prevent machine from rolling.
3. Unlock park brake.
4. Remove transaxle control lever housing. See Remove and Install Transaxle Control Lever Housing (SN 090001-).
5. Remove C-clip (A) at park brake lever.
6. Lift park brake lever up and remove pivot pin (B).

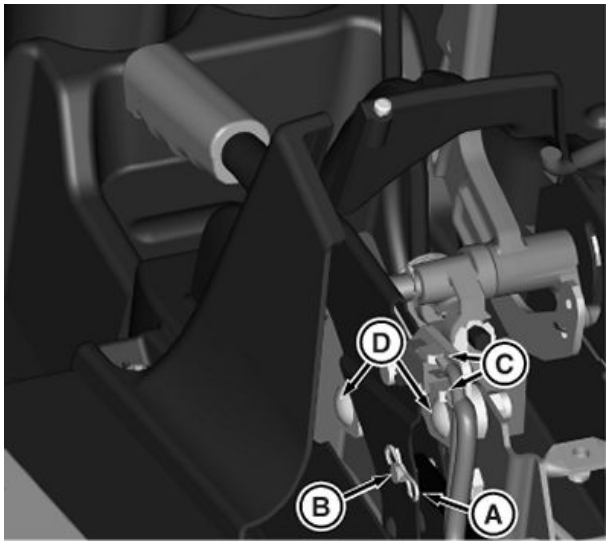
NOTE: Before removing switch connectors (C), mark connectors and their terminals.

7. Remove park brake switch connectors(C).
8. Remove two bolts and nuts (D) securing park brake lever to frame.
9. Remove park brake lever from machine.

Installation:

1. Installation is in the reverse of removal
2. Tighten bolts to specification.

Specification	
Park Brake Handle Bolts—Torque	30—44 N·m (22—32 lb.-ft.)



MXT012712 —UN—24OCT14

A—Cotter Pin **C—Switch connectors**
B—Pivot Pin **D—Bolts and Nuts (2 used)**

3. Park brake may have to be adjusted. See Park Brake Adjustment (SN 040001-).

BS62576,0001803 -19-31OCT14-1/1

Section 90
Miscellaneous

Contents

Specifications

Width (overall) ..... 1.52 m (59.8 in.)
Length (without bumper) ..... 2.67 m (105.0 in.)
Length (with bumper) ..... 2.69 m (106.0 in.)
Height (overall) ..... 1.11 m (43.6 in.)
Weight HPX Gross Vehicle Weight Rating ..... 1383 kg (3050 lb.)
Weight HPX 4x4 Gas Engine (includes fuel/fluids) ..... 612 kg (1350 lb.)
Weight HPX 4x4 Diesel Engine (includes fuel/fluids) ..... 689 kg (1519 lb.)
Ground Clearance (under transaxle) ..... 17.0 cm (6.7 in.)
Cargo Box Capacity (MY -2008) ..... 409 kg (900 lb.)
Cargo Box Capacity (All Export) ..... 409 kg (900 lb.)
Cargo Box Capacity (Domestic MY 2008-) ..... 454 kg (1000 lb.)
Towing Capacity ..... 590 kg (1300 lb.)
Tongue Weight (maximum) ..... 59 kg (130 lb.)

Machine Specifications

Front ..... 22.5 x 10.00-8
Rear ..... 25 x 12.00-9

Knobby, Bar-Type, and Turf Tires

Front ..... 22.5 x 10.00-8
Rear ..... 25 x 13.00-9

Heavy Duty All Purpose Tires

Specifications

Item	Measurement	Specification
Fluid Capacities:		
Fuel Tank	Capacity	20.0 L (5.3 gal.)
Crankcase (with filter)	Capacity	1.3 L (1.37 qt.)
Transaxle (4X2)	Capacity	4.0 L (4.25 qt.)
Transaxle (4X4)	Capacity	4.5 L (4.8 qt.)
MFWD Transaxle (4x4 Only)	Capacity	0.9 L (0.95 qt.)
Cooling system (Including Reservoir)	Capacity	5.0 L (5.3 qt.)
Tire Pressure:		
Front SN -40000	Pressure	41—47 kPa (6—7 psi)
Front SN 40001-	Pressure	90—97 kPa (13—14 psi)
Rear Tires	Pressure	90—97 kPa (13—14 psi)

Continued on next page
MX52301,0000462 -19-23JUL14-1/2

Item	Measurement	Specification
Torque Specifications:		
Seat Bracket to Seat	Torque	10 N·m (88 lb.-in.)
Wheel Bolt	Torque	108 N·m (80 lb.-ft.)
Hood Latch Bolts	Torque	10 N·m (88 lb.-in.)
Hood-to-Hinge Fasteners:	Torque	10 N·m (88 lb.-in.)
Rear Shock Torques:		
Rear Shock to Axle:	Torque	102—150 N·m (75—111 lb.-ft.)
Rear Shock to Frame:	Torque	102—150 N·m (75—111 lb.-ft.)

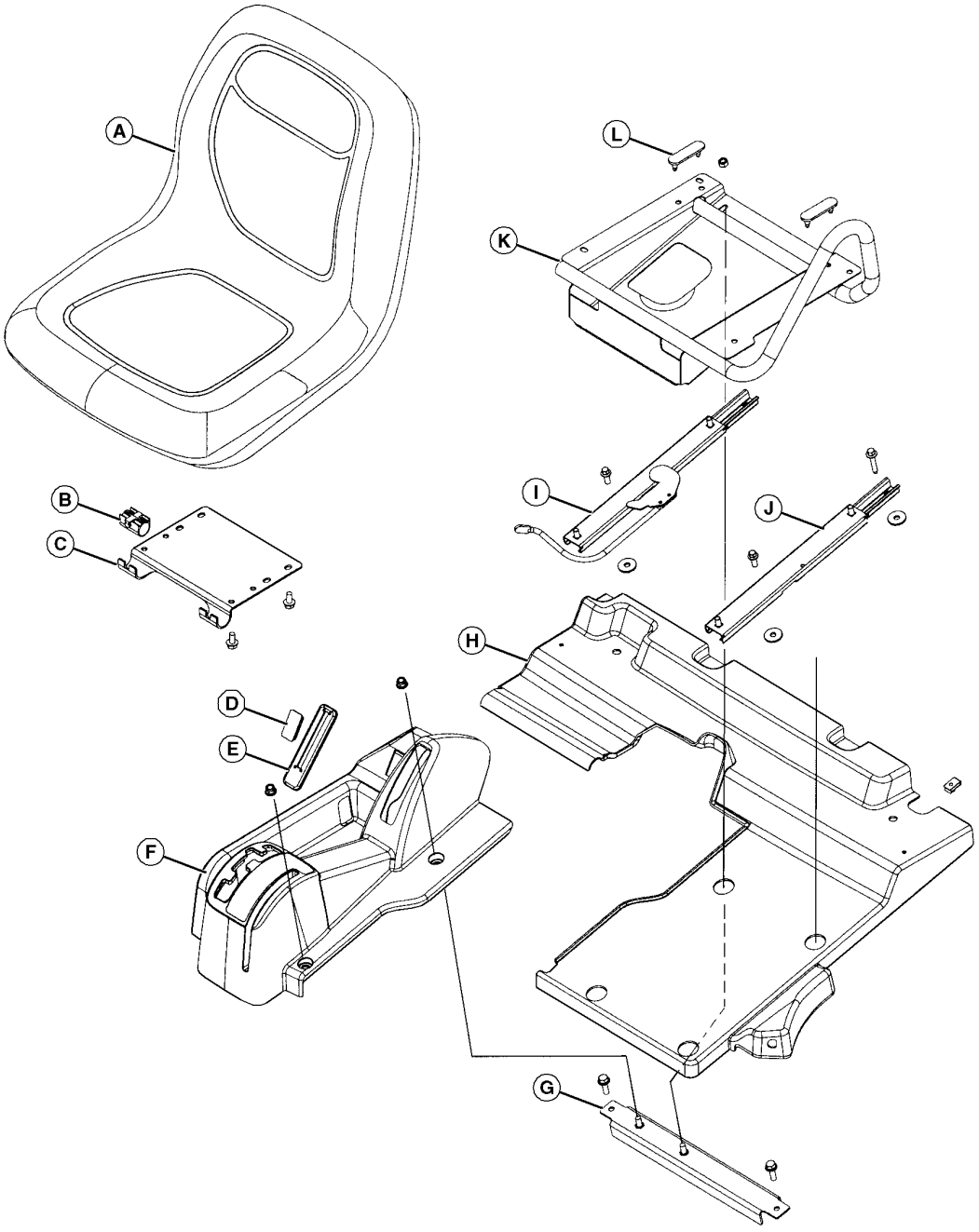
MX52301,0000462 -19-23JUL14-2/2

Summary of References

- Seat and Seat Support Components (SN -090000)
- Seat and Seat Support Components (SN 090001-)
- Fuel System Components—Gas
- Fuel System Components—Diesel
- Coolant System Components—Gas
- Coolant System Components—Diesel

MX52301,0000463 -19-02JUN14-1/1

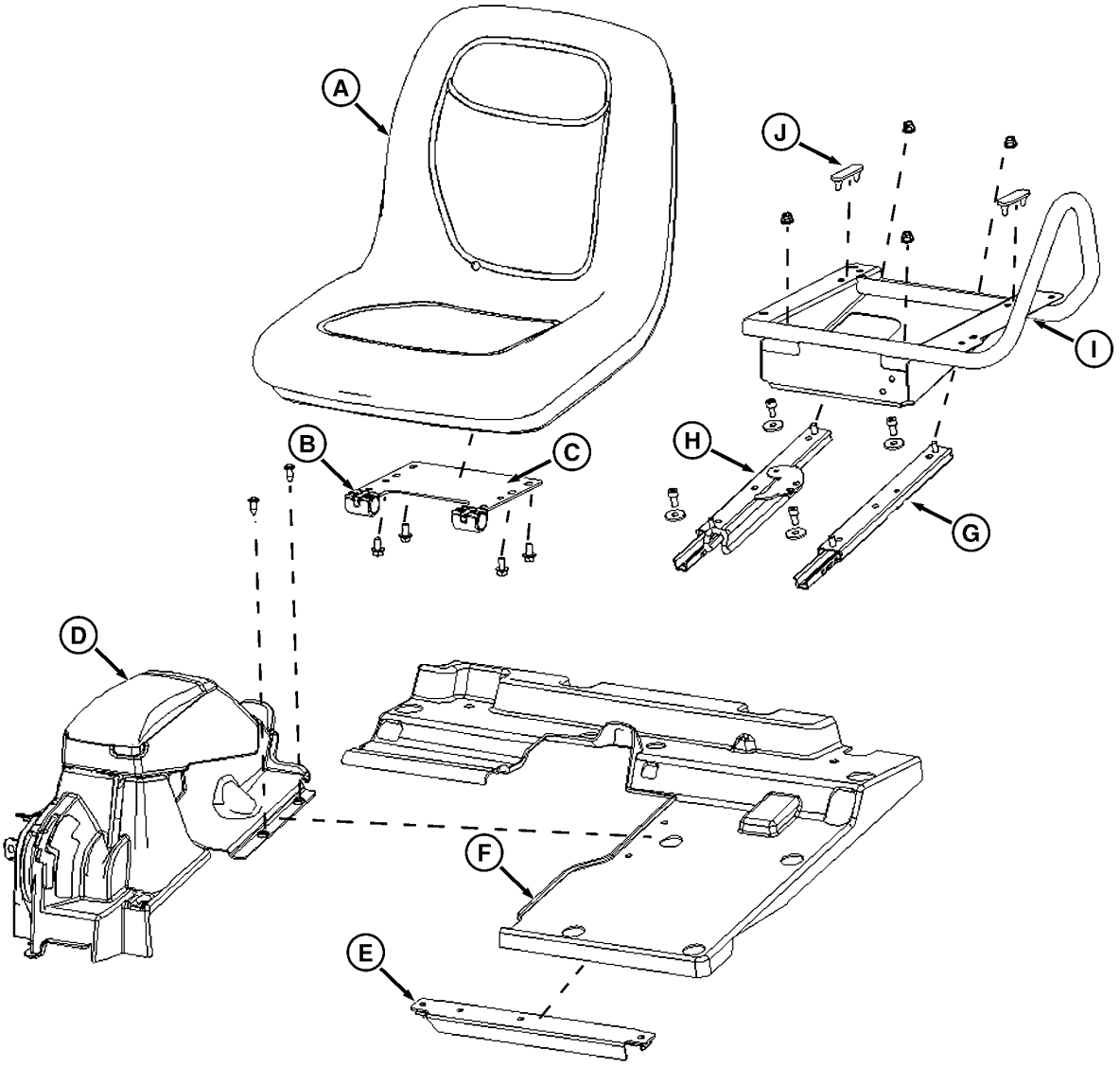
Seat and Seat Support Components (SN -090000)



A—Seat (2 used)
B—Bushing (4 used)
C—Bracket (2 used)
D—Plug
E—Boot
F—Console
G—Bracket
H—Cover
I— Seat Adjuster with Latch
J— Seat Rail
K—Seat Base
L—Bumper (4 used)

MX52301,0000006 -19-11APR14-1/1

Seat and Seat Support Components (SN 090001-)

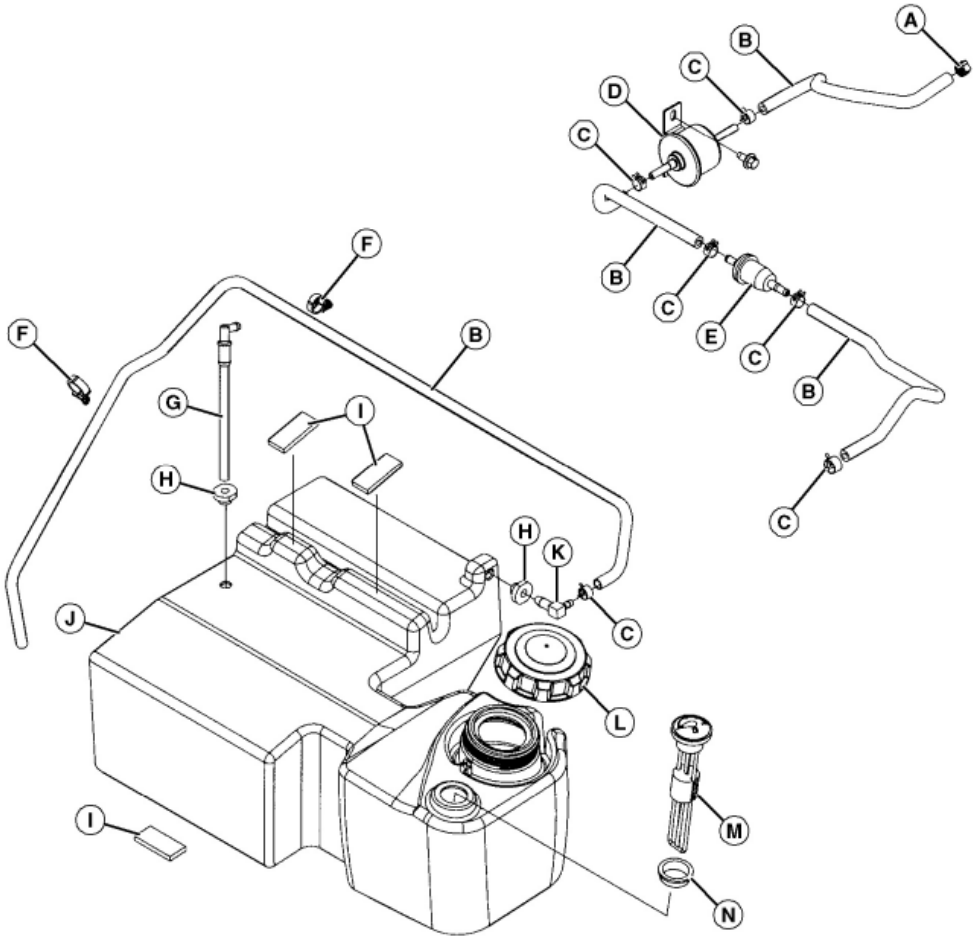


A—Seat (2 used)
B—Bushing (4 used)
C—Bracket (2 used)
D—Center Console
E—Bracket
F—Cover
G—Seat Rail
H—Seat Adjuster with Latch
I— Seat Base
J— Bumper (4 used)

BS62576,0001804 -19-24OCT14-1/1

Fuel System Components—Gas

Fuel System Components, Gas (SN -130000)



MXT010286 —UN—15MAY14

A—Clamp
B—Hose (TY22551)
C—Clip
D—Fuel Pump
E—Fuel Filter
F—Retainer
G—Pick Up Tube
H—Bushing
I— Pad
J—Fuel Tank
K—Elbow Fitting
L—Filler Cap
M—Fuel Gauge
N—Bushing

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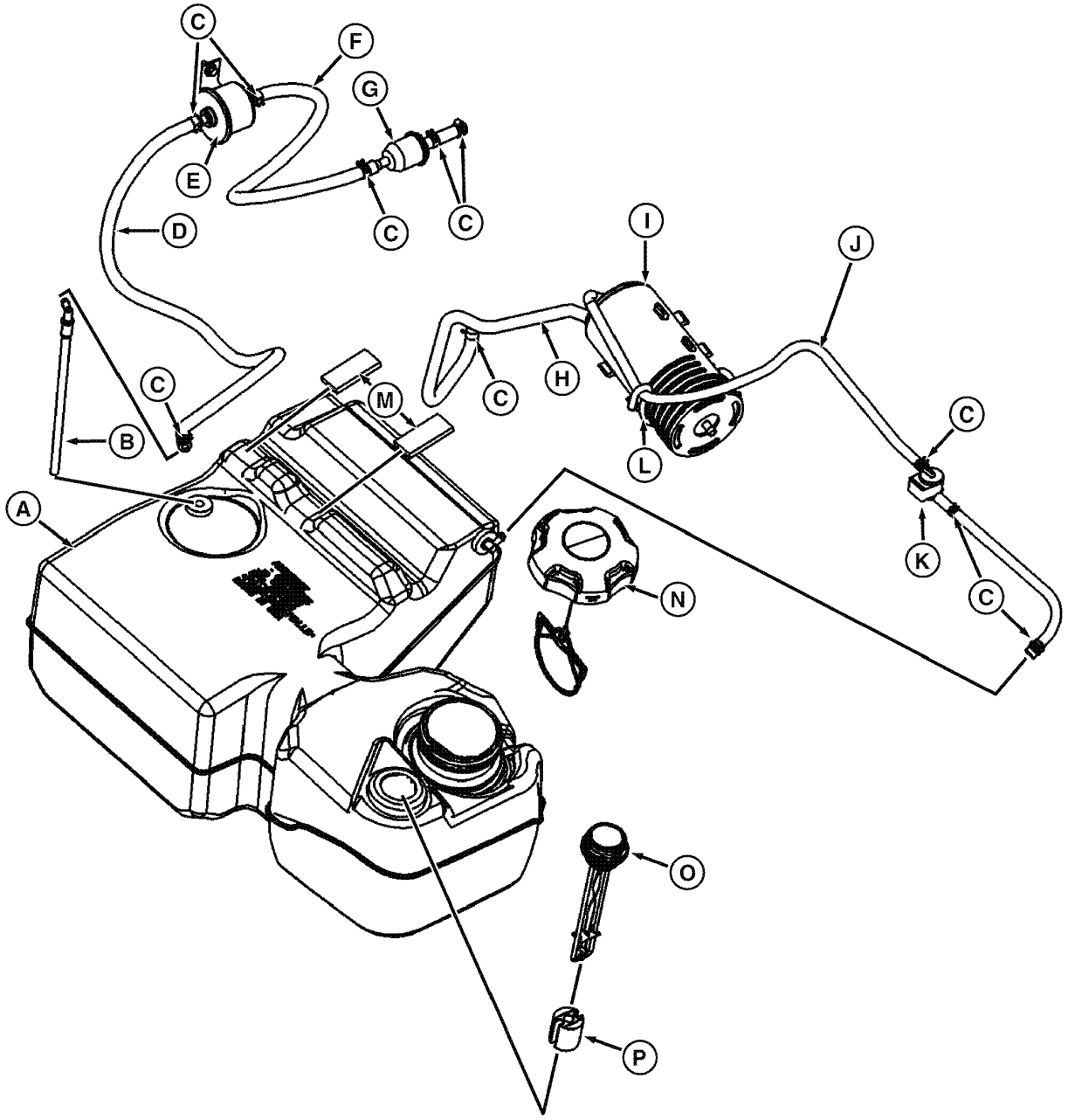
MX52301,0000007 -19-22OCT14-1/2

Fuel System Components, Gas (SN 130000-)

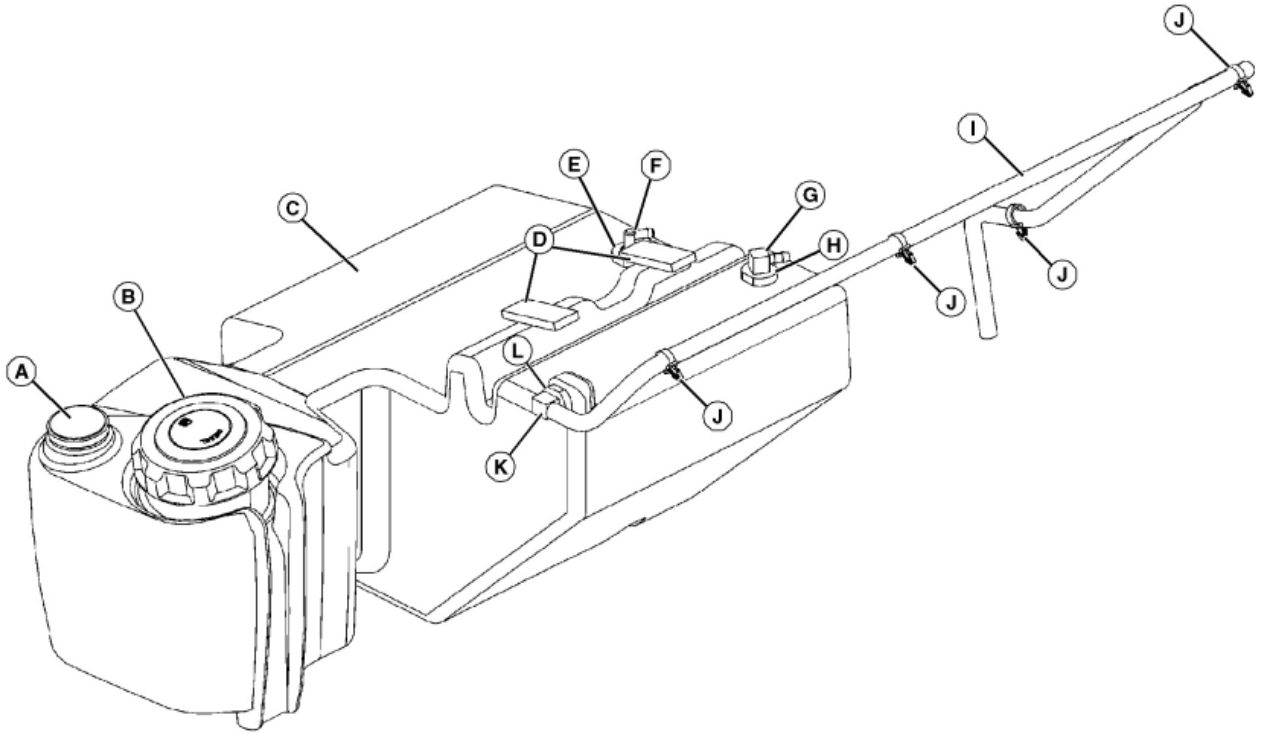


A—Fuel Tank
B—Pick Up Tube
C—Hose Clamp
D—Fuel Hose
E—Fuel Pump
F—Fuel Hose
G—Fuel Filter
H—Purge Hose
I— Carbon Canister
J—Vent Hose
K—Rollover Valve
L—Carbon Canister Bracket
M—Pad
N—Filler Cap
O—Fuel Gage
P—Fuel Gage Float

MX52301,0000007 -19-22OCT14-2/2

Fuel System Components—Diesel

Fuel System Components, Diesel (SN -130000)



MXT011092 —UN—15MAY14

A—Fuel Gauge
B—Filler Cap
C—Fuel Tank
D—Pad
E—Bushing
F—Pick Up Tube
G—Elbow Fitting
H—Bushing
I— Vent Hose
J—Retainer
K—Elbow Fitting
L—Bushing

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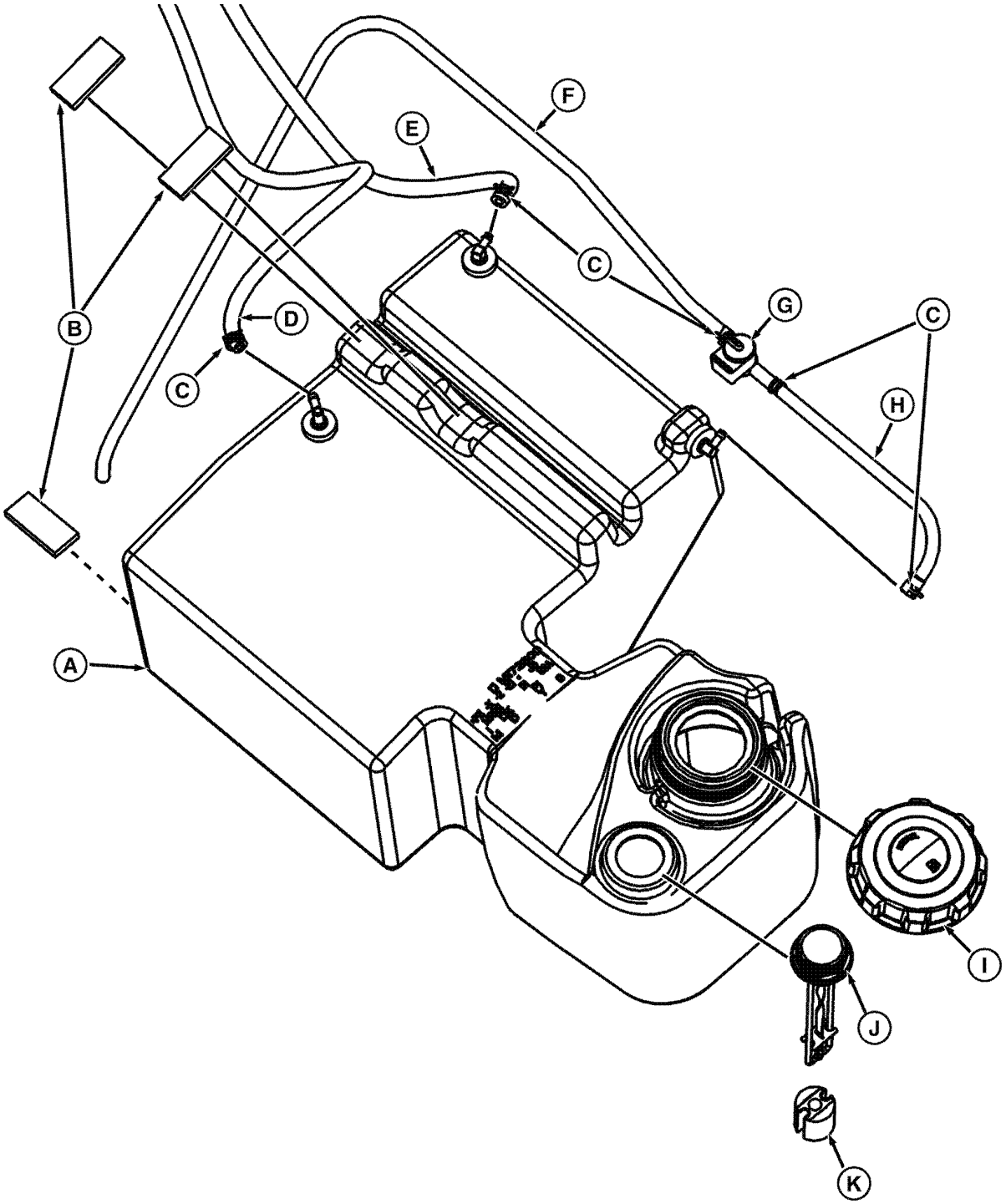
MX52301,0000008 -19-22OCT14-1/2

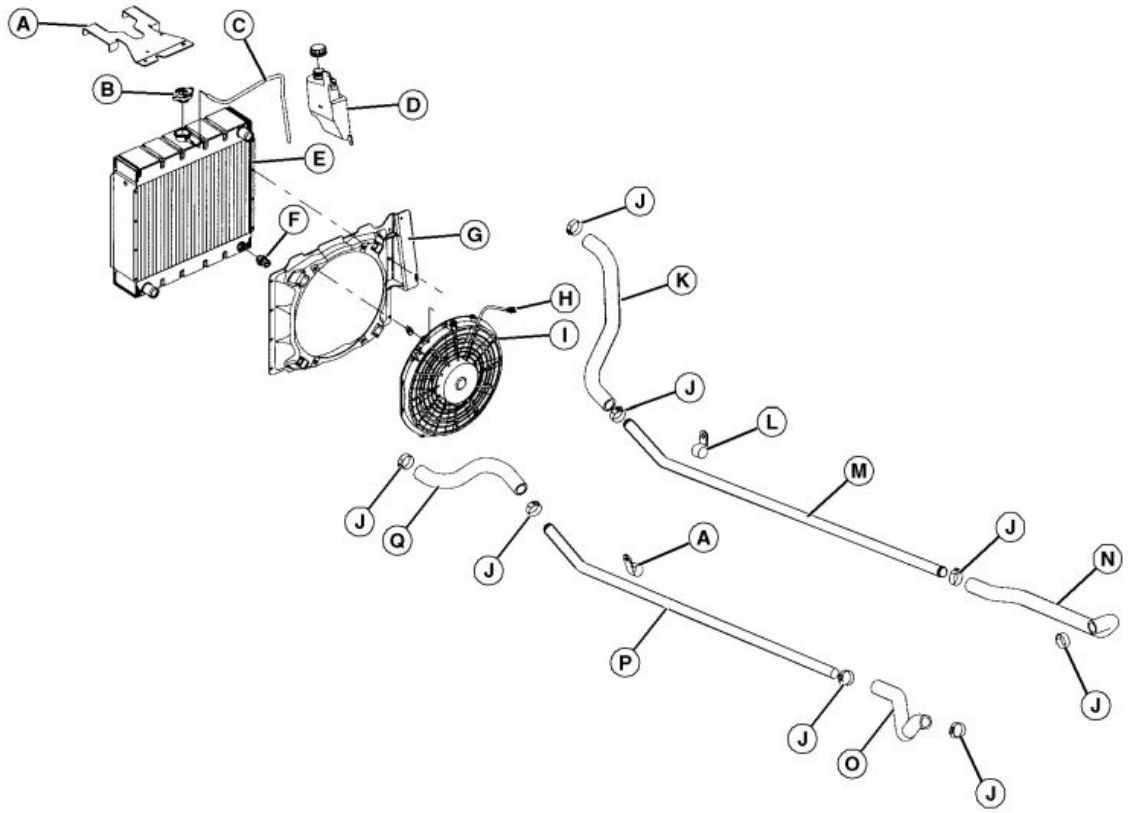
Fuel System Components, Diesel (SN 130000-)



A—Fuel Tank
B—Pad
C—Hose Clamp
D—Fuel Intake Hose
E—Fuel Return Hose
F—Vent Tube
G—Rollover Valve
H—Rollover Valve-to-Fuel Tank Hose
I— Filler Cap
J— Fuel Gage
K—Fuel Gage Float

MX52301,0000008 -19-22OCT14-2/2

Coolant System Components—Gas

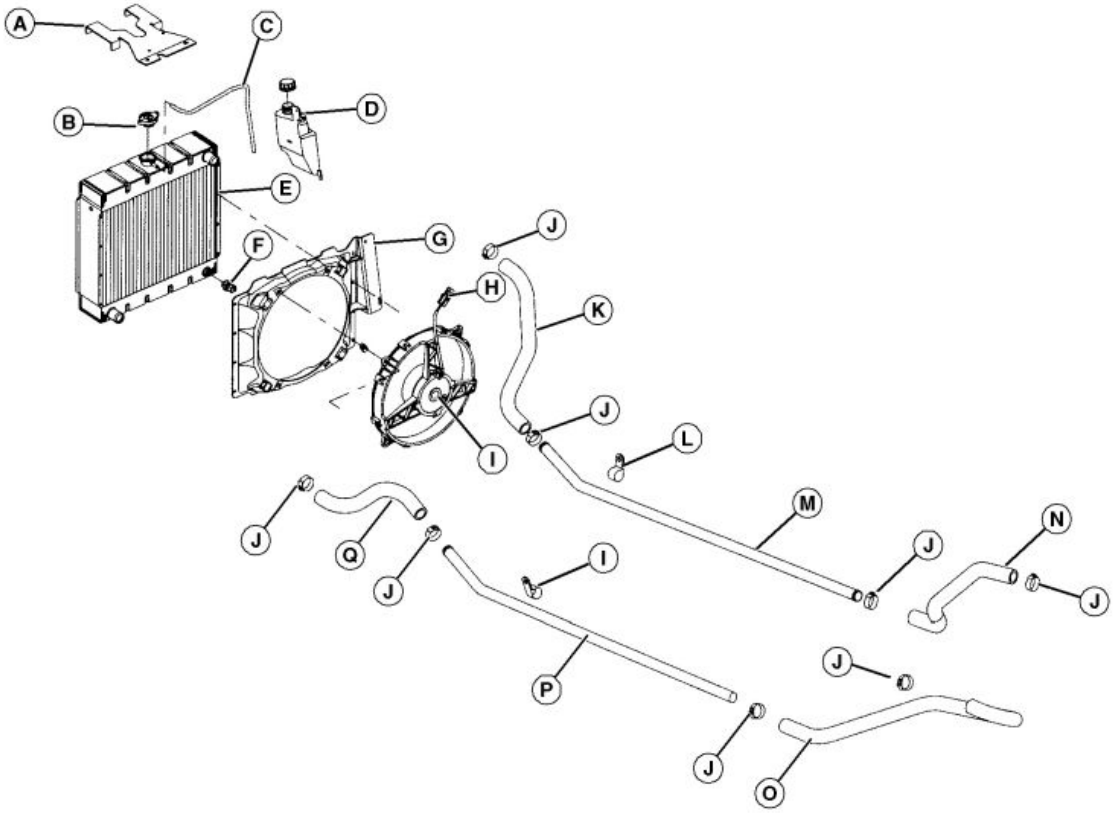


MXT010287 —UN—15MAY14

A—Support Bracket
B—Radiator Cap
C—Vent Tube
D—Overflow Reservoir
E—Radiator
F—Temperature Sensor
G—Shroud
H—Cooling Fan Electrical Connector
I—Cooling Fan
J—Clamp
K—Upper Radiator Hose
L—Retainer
M—Coolant Supply Tube
N—Coolant Supply Hose
O—Coolant Return Hose
P—Coolant Return Tube
Q—Lower Radiator Hose

MX52301,0000009 -19-11APR14-1/1

Coolant System Components—Diesel



MXT011093 —UN—15MAY14

A—Support Bracket
B—Radiator Cap
C—Vent Tube
D—Overflow Reservoir
E—Radiator
F—Temperature Sensor
G—Shroud
H—Cooling Fan Electrical Connector
I—Cooling Fan
J—Clamp
K—Upper Radiator Hose
L—Retainer
M—Coolant Supply Tube
N—Coolant Supply Hose
O—Coolant Return Hose
P—Coolant Return Tube
Q—Lower Radiator Hose

MX52301,000000A -19-11APR14-1/1

Summary of References

- Wheel Removal and Installation
- Hood Latch Removal and Installation
- Hood Removal and Installation
- Front Grille Removal and Installation
- Front Fender Removal and Installation
- Rear Fender Removal and Installation
- Dash Panel Removal and Installation
- Headlight Removal and Installation
- Remove and Install Center Console (SN -090000)
- Remove and Install Center Console (SN 090001-)
- Remove and Install Transaxle Control Lever Housing (SN -090000)
- Remove and Install Transaxle Control Lever Housing (SN 090001-)
- Seat Removal and Installation
- Seat Base Cover Removal and Installation
- Seat Adjuster Removal and Installation
- Fuel Tank Removal and Installation
- Cargo Box Removal and installation
- Rear Shock Absorber Removal and Installation
- Front Bumper/Skid Plate Removal and Installation
- Battery Removal and Installation
- Radiator Drain Procedure — Gas
- Radiator Drain Procedure — Diesel
- Radiator Removal and Installation
- Cooling Fan Removal and Installation
- Radiator Fill and Bleed Procedure — Gas
- Radiator Fill and Bleed Procedure — Diesel
- Adjust Doors and Door Catch/Locking Bolts

MX52301,0000455 -19-17JUN14-1/1

Wheel Removal and Installation

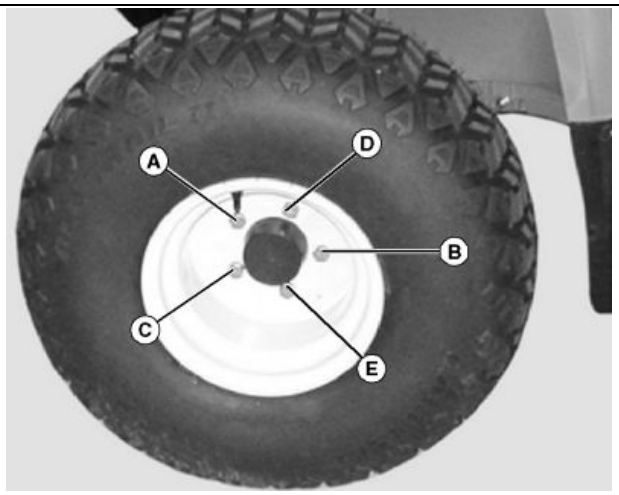
Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise and support machine.
3. Remove wheel bolts.
4. Remove wheel from hub.

Installation:

1. Installation is done in the reverse order of removal.
2. Tighten wheel bolts evenly in proper sequence (A), (B), (C), (D), and (E) until snug.
3. Finish tightening to specification using a torque wrench.

Specification	
Wheel Bolt—Torque	108 N·m (80 lb.-ft.)



MXT011611 —UN—02JUN14

A—Nut
B—Nut
C—Nut
D—Nut
E—Nut

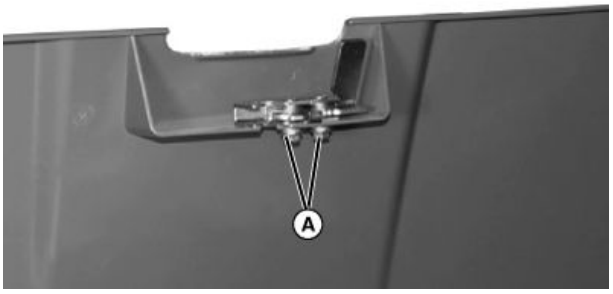
MX52301,000000B -19-22OCT14-1/1

Hood Latch Removal and Installation

Removal:

1. Park machine safely. See the “Safety Section”.
2. Raise hood
3. Remove two bolts (A) securing hood latch.
4. Remove hood latch.

A—Bolts (2 used)



LVAL22337 —UN—17APR12

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MX52301,000000C -19-22OCT14-1/2

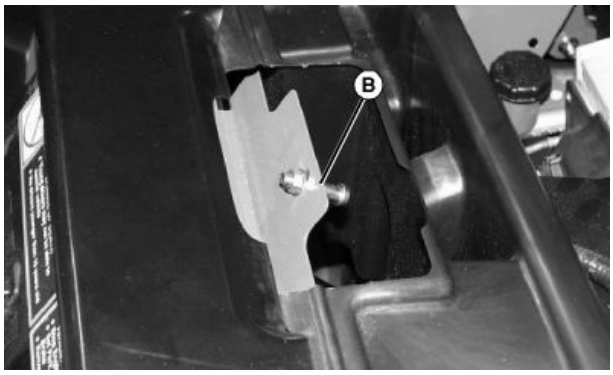
Installation:

1. Installation is in the reverse of removal.
2. Install hood latch bolts and tighten to specification:

Specification	
Hood Latch Bolts—Torque	10 N·m (88 lb.-in.)

3. Check for proper latch operation
4. If hood does not fit properly when closed, adjust latch post (B).

B—Latch Post



MXT011777 —UN—15MAY14

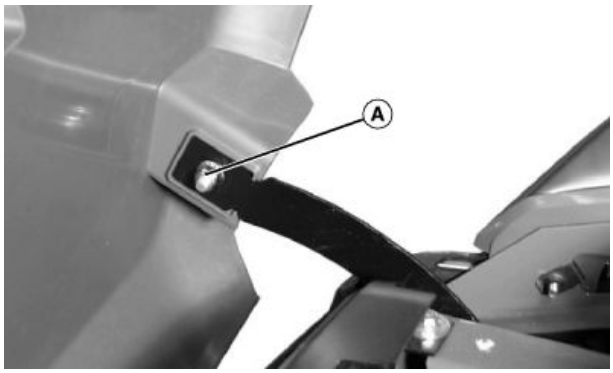
MX52301,000000C -19-22OCT14-2/2

Hood Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Raise hood.
3. Remove bolt and nut (A) attaching one side of hood and repeat for the other side.
4. Remove hood.

A—Bolt and Nut

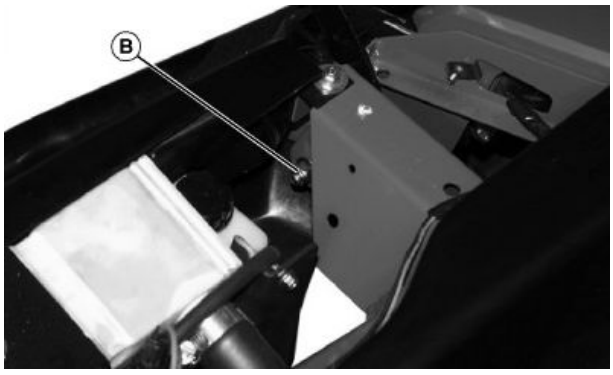


MXT011778 —UN—15MAY14

MX52301,000000D -19-02JUN14-1/3

5. If hood hinges are to be removed:
   - Remove bolt and nut (B) securing hinge on one side. Remove hinge.
   - Repeat for second side.

B—Bolt and Nut



MXT011779 —UN—15MAY14

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MX52301,000000D -19-02JUN14-2/3

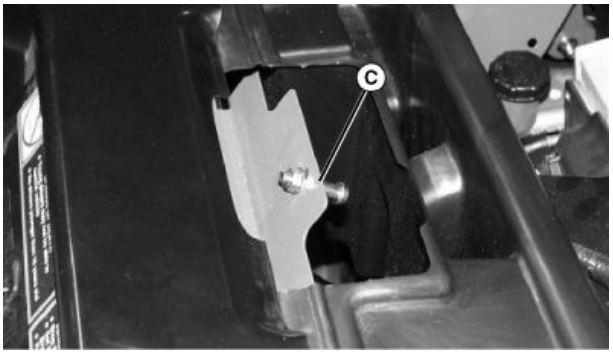
Installation:

1. Installation is in the reverse of removal.
2. Tighten fasteners to specification:

Specification	
Hood-to-Hinge Fasteners—Torque	10 N·m (88 lb.-in.)

3. Check for proper hood operation.
4. If hood does not fit properly when closed, adjust latch post (C).

C—Latch Post



MXT011780 —UN—15MAY14

MX52301,000000D -19-02JUN14-3/3

Front Grille Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Raise and remove hood.
3. Remove two bolts (A) securing lower section of front

A—Lower Bolts

LVAL22345 —UN—17APR12

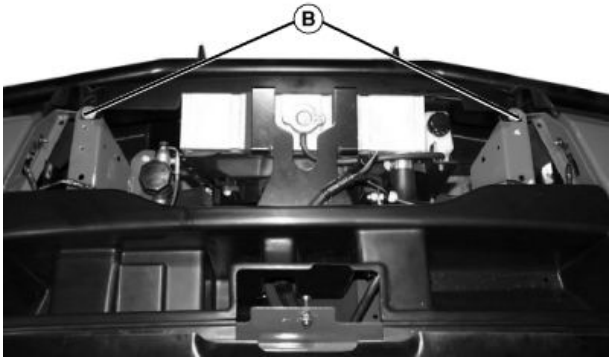
MX52301,000000E -19-30MAY14-1/2

4. Remove two upper bolts (B) securing upper section of front grille.
5. Remove grille.

Installation:

- Installation is in the reverse of removal.

B—Upper Bolts



MXT011781 —UN—15MAY14

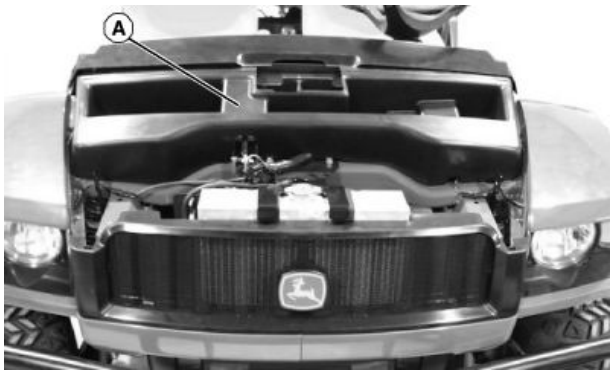
MX52301,000000E -19-30MAY14-2/2

Front Fender Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Raise hood.
3. Turn steering wheel in opposite direction of fender being

   removed. This will allow easier access to fasteners securing fender.
4. Remove utility box (A) by lifting up and out towards front of machine.



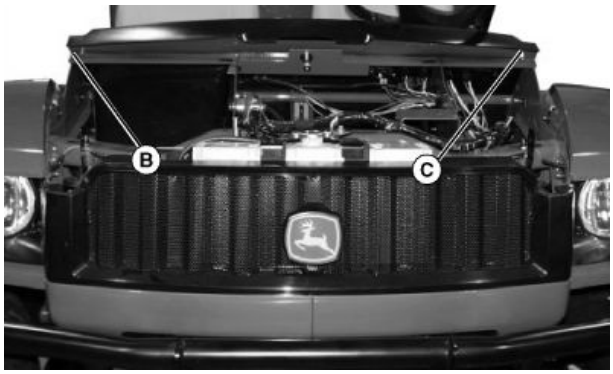
MXT011782 —UN—15MAY14

A—Utility Box

MX52301,000000F -19-02JUN14-1/6

5. Remove bolt securing dash on side of machine (B) for right side and (C) for left side] on which fender is being removed.

B—Right Side Bolt **C—Left Side Bolt**

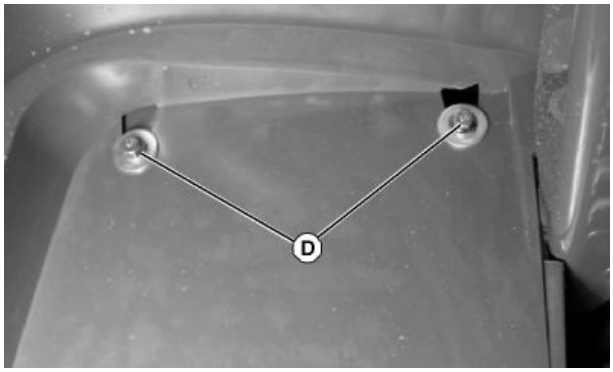


MXT011783 —UN—15MAY14

MX52301,000000F -19-02JUN14-2/6

6. Remove two upper bolts (D) securing fender to frame.

D—Upper Bolts (2 used)



MXT011784 —UN—15MAY14

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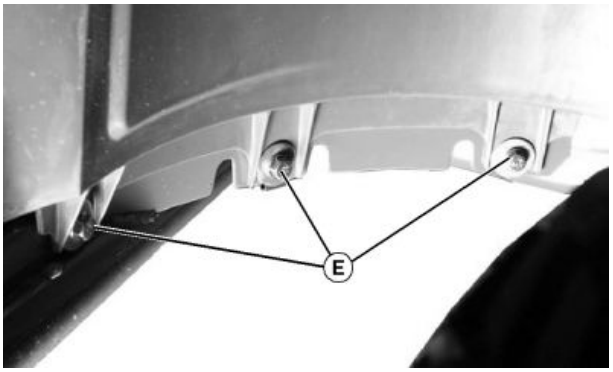
MX52301,000000F -19-02JUN14-3/6

7. Remove three lower bolts (E) securing fender to frame.

E—Lower Bolts (3 used)

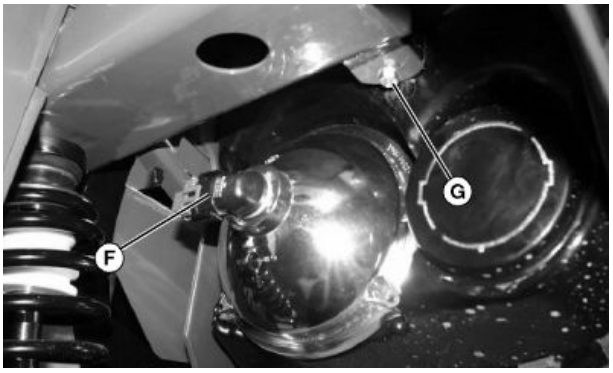


MXT011785 —UN—15MAY14

MX52301,000000F -19-02JUN14-4/6

8. Disconnect headlight connector (F).
9. Remove inner bolt (G) securing fender to frame near headlight.

F—Headlight Connector **G—Inner Bolt**



MXT011786 —UN—15MAY14

MX52301,000000F -19-02JUN14-5/6

10. Remove outer bolt (H) securing fender to frame near headlight.
11. Remove fender.

Installation:

1. Installation is in the reverse of removal.
2. Install fender bolts loosely.
3. Check alignment of fender.
4. Tighten mounting bolts.

H—Outer Bolt

MXT011787 —UN—15MAY14

MX52301,000000F -19-02JUN14-6/6

Rear Fender Removal and Installation

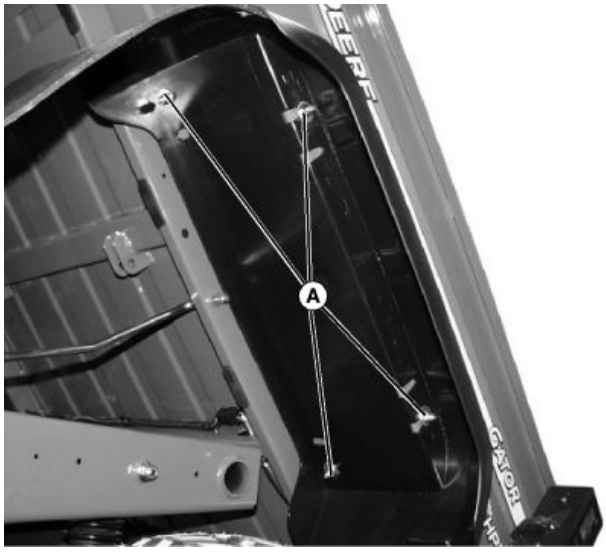
Removal:

1. Park machine safely.
2. Lock park brake.
3. Raise and lock cargo box.
4. Remove four nut (A) s securing rear fender
5. On left-hand fender, it will be necessary to remove inner bolts in order for fender to clear prop rod.
6. Remove fender.

Installation:

- Installation is in the reverse of removal.

A—Nuts (4 used)



MXT011788 —UN—15MAY14

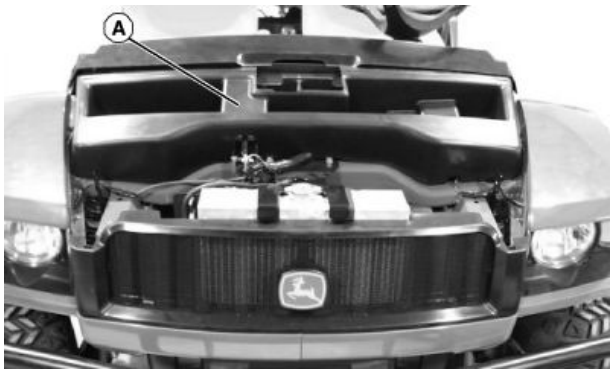
MX52301,0000010 -19-30MAY14-1/1

Dash Panel Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Disconnect battery negative (-) cable.
3. Raise hood.
4. Remove utility box (A) by lifting up and out toward front of machine.

A—Utility Box

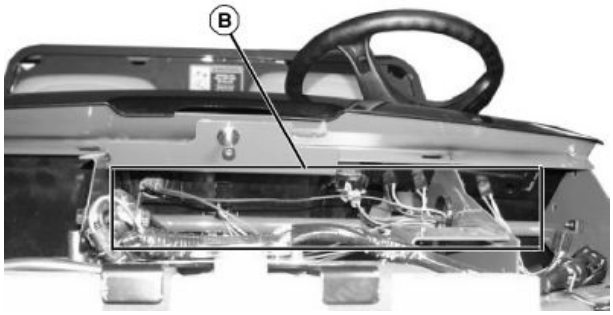


MXT011782 —UN—15MAY14

MX52301,0000011 -19-02JUN14-1/7

5. Disconnect all electrical connectors (B) from rear of dash panel. (Connectors and locations vary depending on installed options.) See Electrical section for more information.

B—Electrical Connectors



MXT011789 —UN—15MAY14

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MX52301,0000011 -19-02JUN14-2/7

6. Remove cover from steering wheel by gently prying up on center cover at three points (C).

C—Cover Pry Points

LVAL22364 —UN—17APR12

MX52301,0000011 -19-02JUN14-3/7

7. Remove nut (D) securing steering wheel to shaft.
8. Note position of steering wheel by marking spline and wheel for proper positioning during assembly.
9. Gently tap bottom of steering wheel up and off of shaft.

D—Nut

LVAL22365 —UN—17APR12

MX52301,0000011 -19-02JUN14-4/7

10. Remove passenger hand hold recess from dash by removing two screws (E).

E—Screws (2 used)

MXT011612 —UN—02JUN14

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MX52301,0000011 -19-02JUN14-5/7

11. Remove one screw (F) securing dash to steering.

F—Screw

MXT011790 —UN—15MAY14

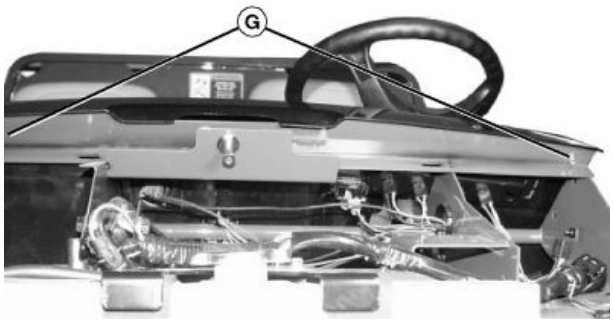
MX52301,0000011 -19-02JUN14-6/7

12. Remove two bolts (G) securing dash at front of machine.
13. Lift dash up and over steering column towards rear of

Installation:

1. Installation is in the reverse of removal.
2. Install steering wheel as marked during removal.
3. Ensure that all electrical lights and components work correctly.

G—Bolts (2 used)



MXT011791 —UN—15MAY14

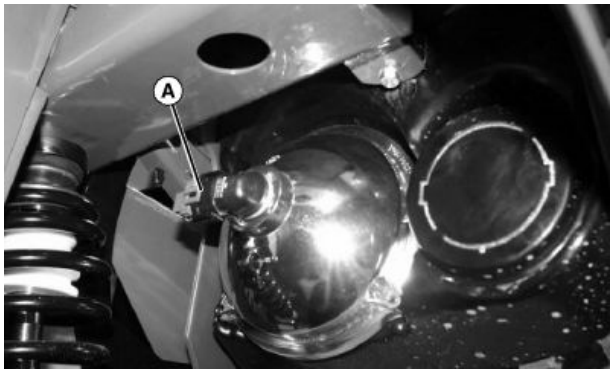
MX52301,0000011 -19-02JUN14-7/7

Headlight Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Ensure that key is in the OFF position.
3. Disconnect headlight connector (A) from underneath

A—Headlight Connector



MXT011792 —UN—15MAY14

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MX52301,0000012 -19-30MAY14-1/2

IMPORTANT: If headlight is not held when removing screws, the headlight may fall and shatter.

4. While holding headlight from underneath fender, remove three screws (B) securing headlight to bezel.
5. Remove headlight from rear of fender.

Installation:

- Installation is in the reverse of removal.

B—Screws (3 used)

MXT011793 —UN—15MAY14

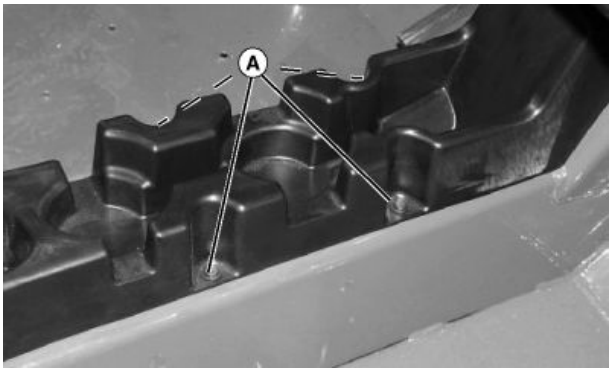
MX52301,0000012 -19-30MAY14-2/2

Remove and Install Center Console (SN -090000)

Removal:

1. Park machine safely on a level surface.
2. Using a small screwdriver, pry up the four expansion rivets (A) from center console.

A—Expansion Rivets (4 used)



MXT011794 —UN—15MAY14

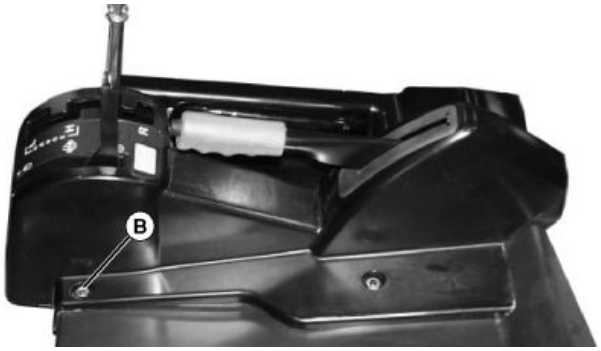
MX52301,0000013 -19-30MAY14-1/2

3. Remove nut (B) from control lever housing.
4. Remove center console.

Installation:

- Installation is in the reverse of removal.

B—Nut



MXT011795 —UN—15MAY14

MX52301,0000013 -19-30MAY14-2/2

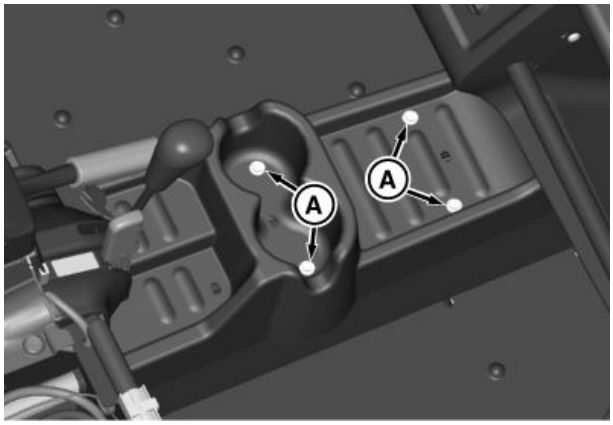
Remove and Install Center Console (SN 090001-)

1. Park machine safely. See the “Safety Section”.
2. Using a small screwdriver, pry up the four expansion rivets (A) from center console.
3. Remove center console.

Installation:

- Installation is in the reverse of removal.

A—Expansion Rivets (4 used)



MXT010511 —UN—21OCT14

BS62576,00017FF -19-21OCT14-1/1

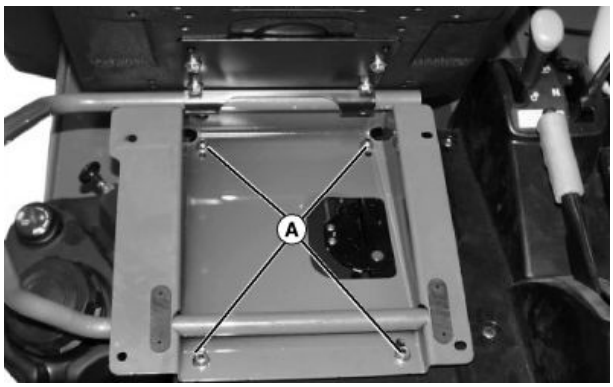
Remove and Install Transaxle Control Lever Housing (SN -090000)

Removal:

1. Park machine safely on a level surface.
2. Tip seats forward.

NOTE: The driver’s seat and base may be removed as an assembly.

3. Remove the four nuts (A) securing the seat base to the machine and remove seat and base.
4. Remove the seat adjustment rails.



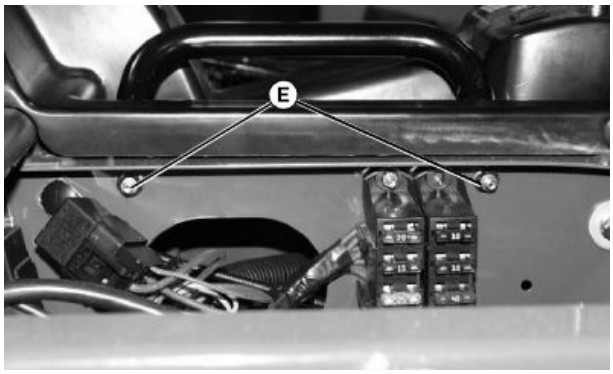
MXT011796 —UN—15MAY14

A—Nuts (4 used)

MX52301,0000014 -19-30MAY14-1/5

5. Remove two nut (E) s securing passenger seat handle and remove handle.

E—Nuts (2 used)



MXT011797 —UN—15MAY14

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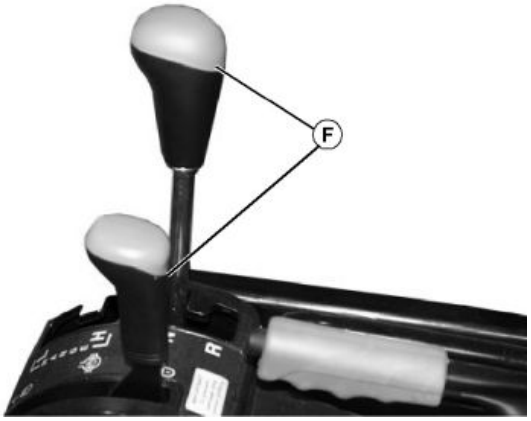
MX52301,0000014 -19-30MAY14-2/5

6. Using a small screwdriver, gently pry the caps (F) off of the traction lock and shift levers.

F—Caps



MXT011798 —UN—15MAY14

MX52301,0000014 -19-30MAY14-3/5

7. Remove the retaining nuts (G) securing the traction lock and shift lever handles.

⚠ CAUTION: Exposed threads are sharp. Cover the treads of the traction control and shift levers with tape or other protective material.

8. Remove handles. It may be necessary to gently tap the handles up and off of the levers with a soft faced hammer.

G—Nuts

MXT011799 —UN—15MAY14

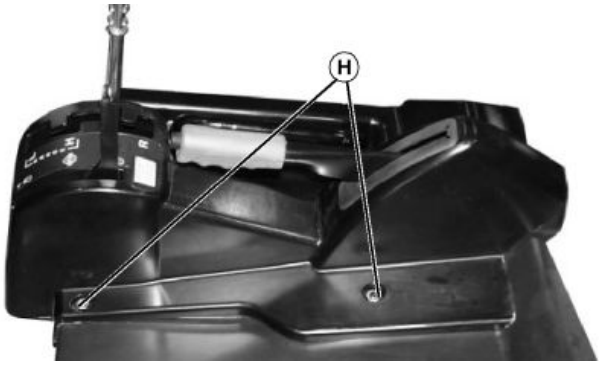
MX52301,0000014 -19-30MAY14-4/5

9. Remove the two nuts (H) securing shifter housing.
10. Lift shifter housing up and off of levers and park brake handle. Note that the rear of the housing is attached by tangs.

Installation:

1. Installation is in the reverse of removal.
2. Remove tape or protective material from control levers before installing handles and retaining nuts.

H—Nuts (2 used)



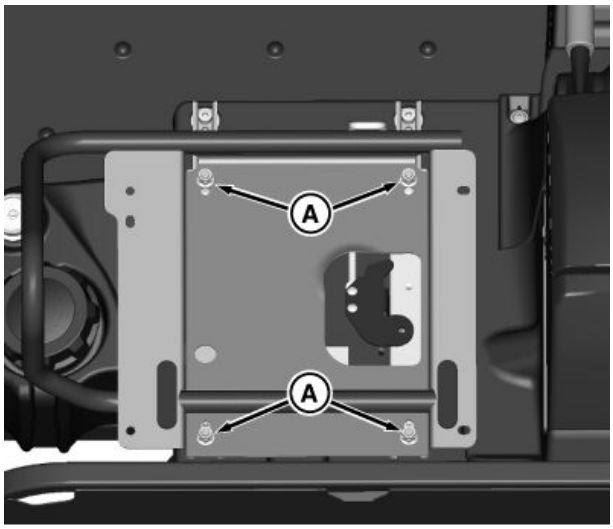
MXT011800 —UN—15MAY14

MX52301,0000014 -19-30MAY14-5/5

Remove and Install Transaxle Control Lever Housing (SN 090001-)

1. Park machine safely. See the “Safety Section”.
2. Tip seats forward.
3. Remove the four nuts (A) securing the seat base to the machine and remove seat and base.

A—Nuts

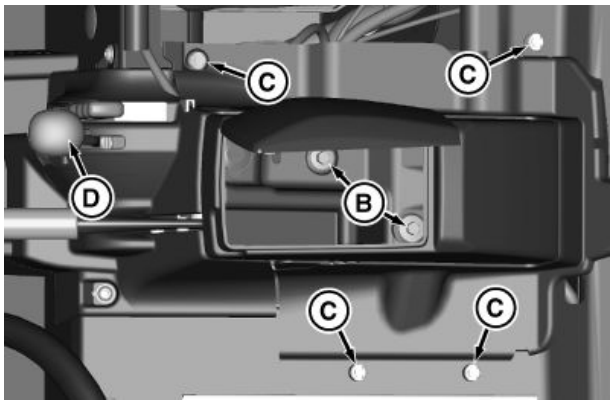


MXT010508 —UN—21OCT14

BS62576,0001800 -19-21OCT14-1/3

4. Open console lid, remove bolts (B) securing console to bracket.
5. Using a small screwdriver, pry up the four expansion rivets (C) from housing.
6. Gently pry the cap (D) off the shift lever.

B—Bolts
C—Expansion Rivets
D—Cap



MXT010509 —UN—21OCT14

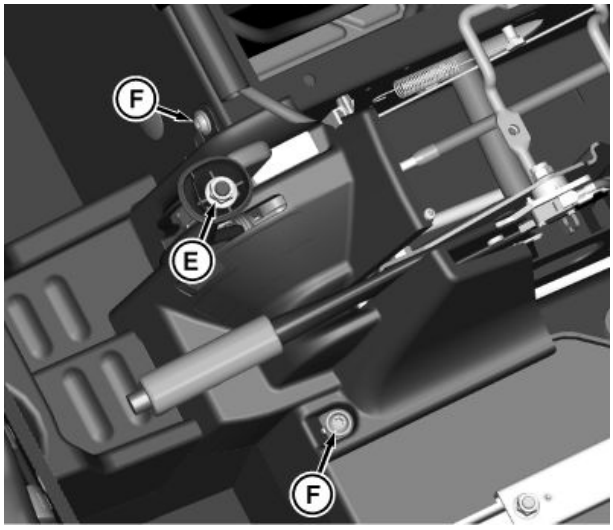
BS62576,0001800 -19-21OCT14-2/3

7. Remove the retaining nut (E) securing the shift lever handle.
8. Remove screws (F) securing shifter housing.
9. Lift shifter housing up and off levers and park brake handle.

Installation:

- Installation is in the reverse of removal.

E—Nut
F—Screws



MXT010510 —UN—21OCT14

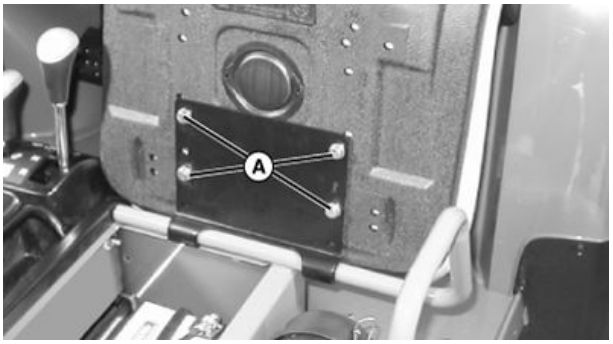
BS62576,0001800 -19-21OCT14-3/3

Seat Removal and Installation

Removal:

1. Tip seat forward.
2. Hold onto seat and remove all screws (A).
3. Remove seat and seat bracket from support rail.

A—Screws



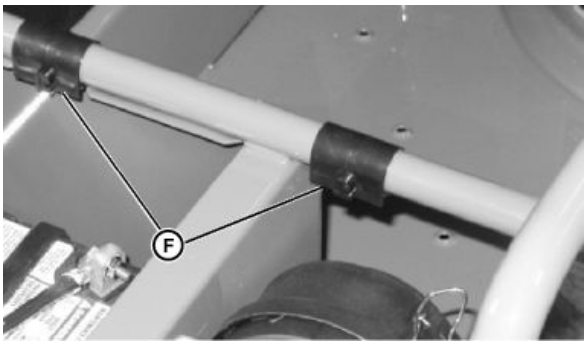
LVAL22369 —UN—17APR12

MX52301,0000015 -19-10JUL14-1/4

Installation:

1. Position seat bushings (F) on support rail so tabs face toward rear of vehicle.

F—Bushings

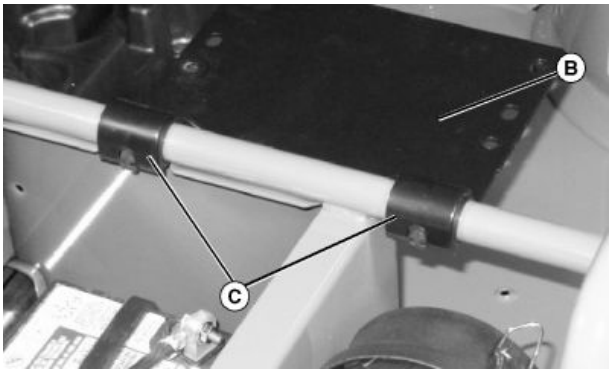


MXT011801 —UN—02JUN14

MX52301,0000015 -19-10JUL14-2/4

2. Position seat bracket (B) onto support rail so hinges (C) fit around rubber bushing tabs.

B—Bracket **C—Hinges**



MXT011802 —UN—15MAY14

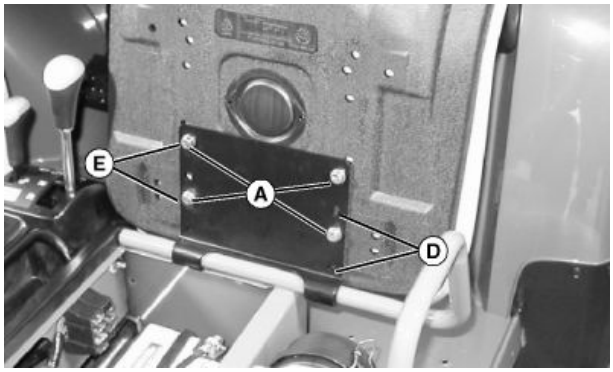
Continued on next page

MX52301,0000015 -19-10JUL14-3/4

3. Rotate seat bracket upward. Position bottom of seat against bracket and align correct holes with holes in seat.
4. Slide seat to the forward (D) or rearward (E) position.
5. Install original hardware to secure seat.
6. Tighten seat bracket hardware to specification.

Specification

Seat Bracket to Seat—Torque.....10 N·m (88 lb.-in.)



MXT011803 —UN—15MAY14

A—Screws
D—Forward Position
E—Rearward Position

MX52301,0000015 -19-10JUL14-4/4

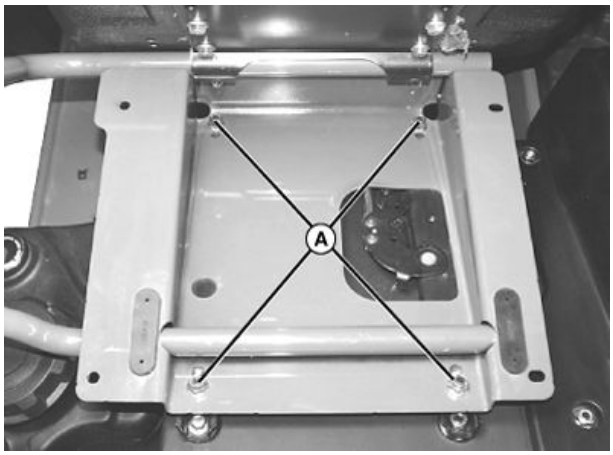
Seat Base Cover Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Tip seats forward.
3. Remove passenger seat. See Seat Removal and Installation.

NOTE: The driver's seat and base may be removed as an assembly.

4. Remove the four nuts (A) securing the seat base to the machine and remove seat and base.

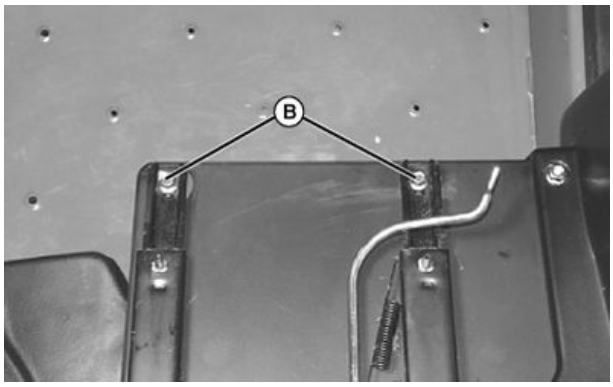


LVAL22385 —UN—17APR12

A—Nuts (4 used)

MX52301,0000016 -19-02JUN14-1/10

5. Push seat adjustment rails fully to the rear of machine to expose front mounting bolts (B). Remove bolts.



LVAL22386 —UN—17APR12

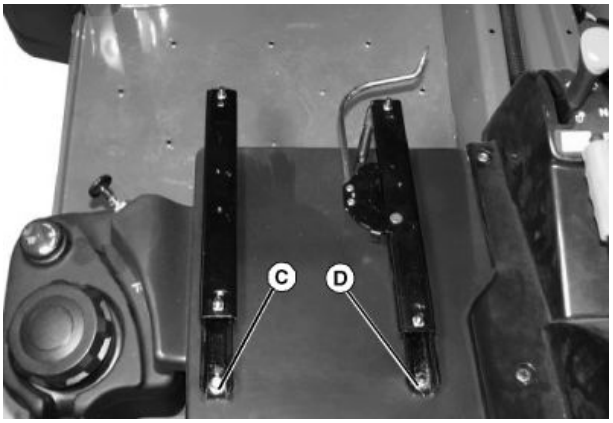
B—Mounting Bolts

Continued on next page

MX52301,0000016 -19-02JUN14-2/10

6. Push seat adjustment rails fully to the front of machine to expose seat adjustment rail bolt (C) and nut (D). Remove bolt, nut, seat rails, and washers.
7. Remove the seat adjustment rails.

C—Rail Bolt **D—Rail Nut**

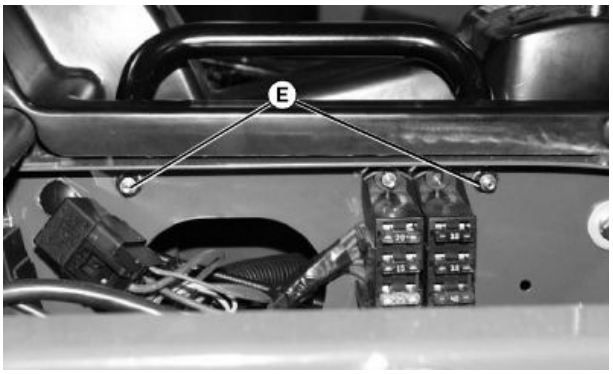


MXT011805 —UN—15MAY14

MX52301,0000016 -19-02JUN14-3/10

8. Remove two nuts (E) securing passenger seat handle and remove handle.

E—Nuts (2 used)

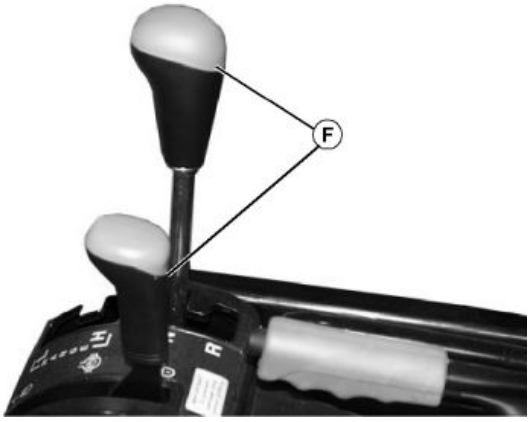


MXT011806 —UN—15MAY14

MX52301,0000016 -19-02JUN14-4/10

9. Using a small screwdriver, gently pry the caps (F) off of the traction assist and shift levers.

F—Caps



MXT011798 —UN—15MAY14

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MX52301,0000016 -19-02JUN14-5/10

10. Remove the retaining nuts (G) securing the traction assist and shift lever handles.

CAUTION: Exposed threads are sharp. Cover the treads of the traction control and shift levers with tape or other protective material.

11. Remove handles. It may be necessary to gently tap the handles up and off the levers with a soft faced hammer.

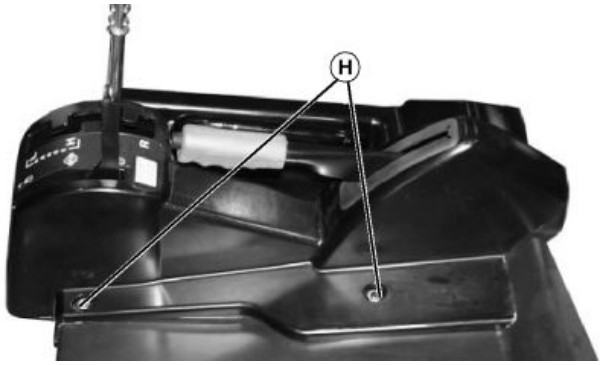
G—Nuts

MXT011799 —UN—15MAY14

MX52301,0000016 -19-02JUN14-6/10

12. Remove the two nuts (H) securing shifter housing.
13. Lift shifter housing up and off of levers and park brake handle. Note that the rear of the housing is attached by tabs.

H—Nuts (2 used)

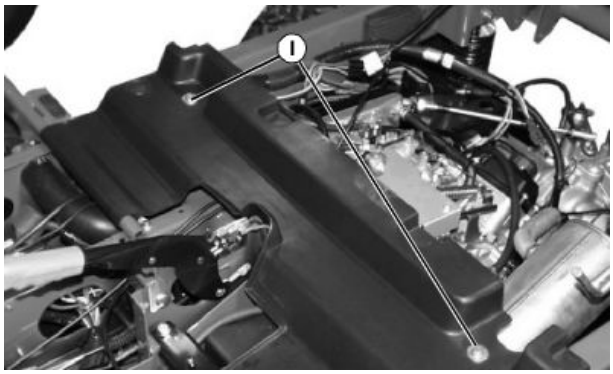


MXT011800 —UN—15MAY14

MX52301,0000016 -19-02JUN14-7/10

14. Remove two nuts (I) securing seat base cover to frame.

I— Nuts (2 used)



MXT011807 —UN—15MAY14

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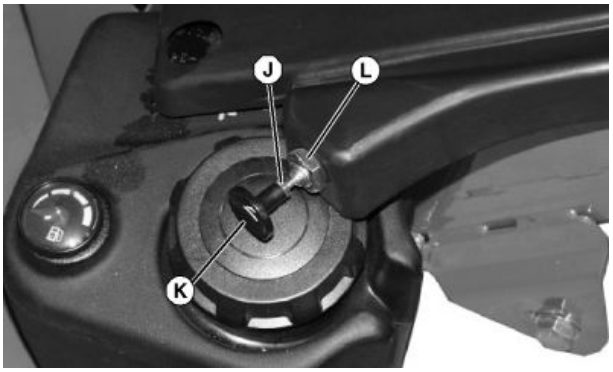
MX52301,0000016 -19-02JUN14-8/10

15. Using an open-end wrench, hold nut (J) on choke cable while unscrewing choke control knob (K).
16. Remove nut (L) securing choke cable assembly.
17. Remove seat base cover from machine.

J—Nut
K—Control Knob
L—Nut

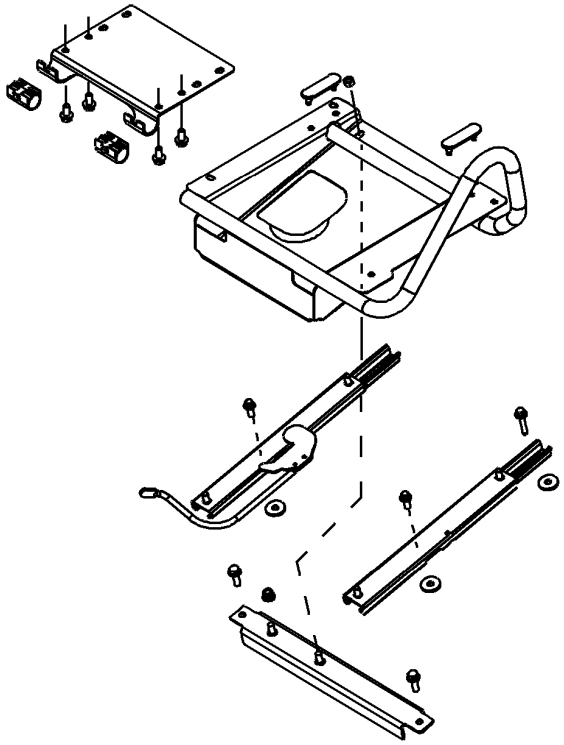


MXT011808 —UN—15MAY14

MX52301,0000016 -19-02JUN14-9/10

Installation:

1. Installation is in the reverse of removal.
2. Remove tape or protective material from control levers before installing handles and retaining nuts.
3. When installing seat, rails must be in the same position. Push rails to either furthest forward or furthest back positions before installing driver seat.



MXT011733 —UN—02JUN14

MX52301,0000016 -19-02JUN14-10/10

Seat Adjuster Removal and Installation

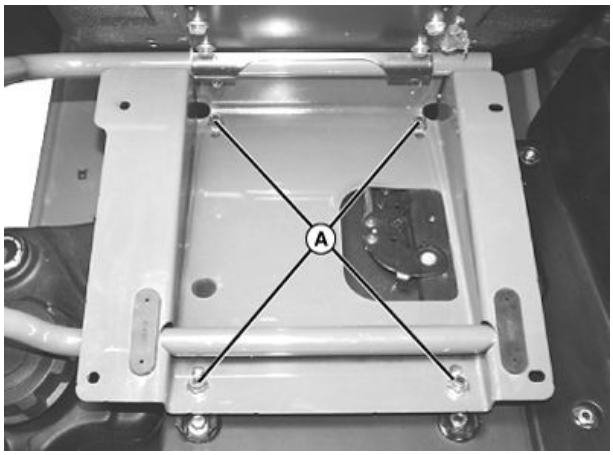
Removal:

1. Park machine safely on a level surface.
2. Tip seats forward.
3. Remove passenger seat. See Seat Removal and Installation.

NOTE: The driver's seat and base may be removed as an assembly.

4. Remove the four nuts (A) securing the seat base to the machine and remove seat and base.

A—Nuts (4 used)

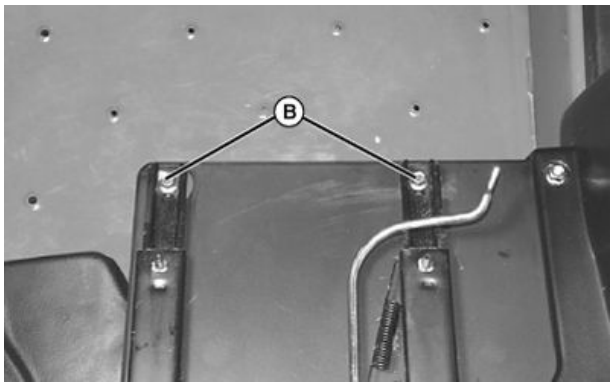


LVAL22385 —UN—17APR12

MX52301,0000017 -19-30MAY14-1/3

5. Push seat adjustment rails fully to the rear of machine to expose front mounting bolts (B). Remove bolts.

B—Mounting Bolts



LVAL22386 —UN—17APR12

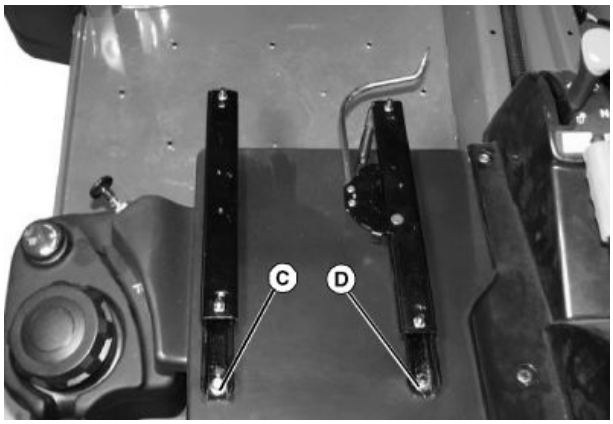
MX52301,0000017 -19-30MAY14-2/3

6. Push seat adjustment rails fully to the front of machine to expose seat adjustment rail bolt (C) and nut (D). Remove bolt, nut, seat rails, and washers.

Installation:

1. Installation is in the reverse of removal.
2. When installing seat, rails must be in the same position. Push rails to either furthest forward or furthest back positions before installing seat.

C—Rail Bolt **D—Rail Nut**



MXT011805 —UN—15MAY14

MX52301,0000017 -19-30MAY14-3/3

Fuel Tank Removal and Installation

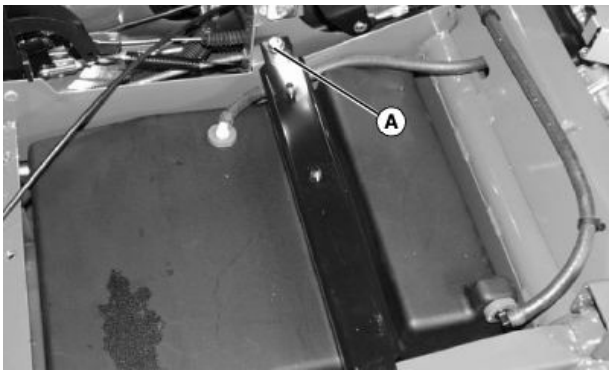
Removal:

1. Park machine safely on a level surface.

NOTE: Observe the routing of the fuel lines for reassembly.

2. Remove seat base cover. See Seat Base Cover Removal and Installation.
3. Remove bolt (A) from fuel tank retaining bracket. Remove bracket.

A—Bolt



MXT011809 —UN—15MAY14

MX52301,0000018 -19-30MAY14-1/2

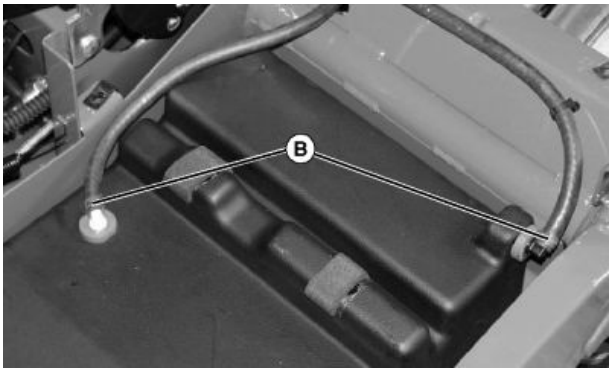
CAUTION: Gasoline is explosive. Do not expose to open flame or spark. Serious injury can result. Store in a proper container. Wipe up any spills immediately.

4. Disconnect fuel lines to tank by compressing spring clamps (B). Plug fuel lines to prevent spills.
5. Remove fuel tank by lifting from machine.

Installation:

- Installation is in the reverse of removal.

B—Spring Clamps



MXT011810 —UN—15MAY14

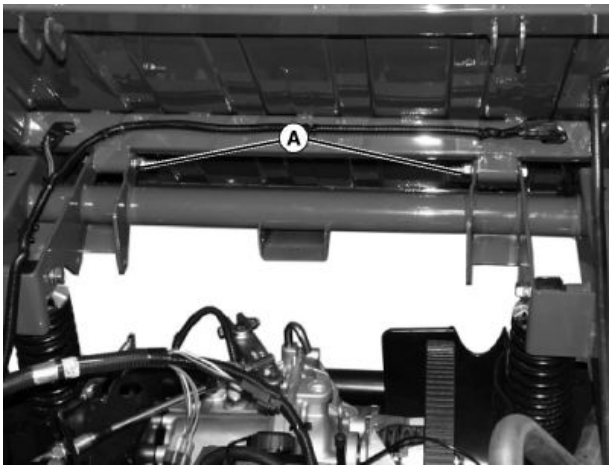
MX52301,0000018 -19-30MAY14-2/2

Cargo Box Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Raise and lock cargo box.
4. Disconnect any optional accessory wiring that is installed.
5. Loosen two nuts (A) at cargo box pivot points.
6. Remove prop rod from left frame rail track by pulling out and up.

A—Nuts (2 used)



MXT011811 —UN—15MAY14

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MX52301,0000019 -19-30MAY14-1/3

7. Raise cargo box (B) until the bottom rests on rear

B—Cargo Box

MXT011812 —UN—15MAY14

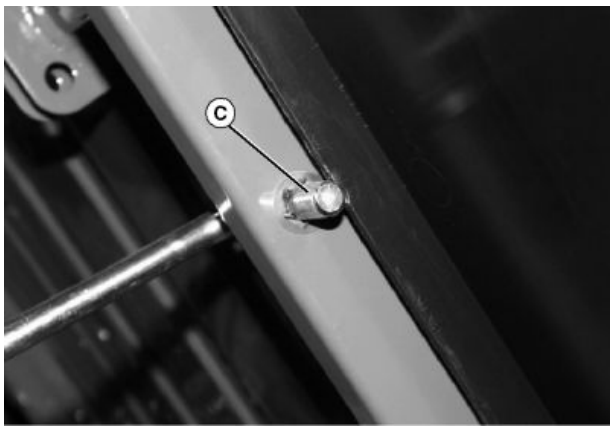
MX52301,0000019 -19-30MAY14-2/3

8. Tap outside of prop rod (C) attached at cargo box with a punch to remove prop rod and push-on nut. Remove prop rod from cargo box and left frame rail.
9. Lower cargo box to normal (horizontal) position.
10. Remove two nuts and bolts at cargo box pivot points.
11. Along with an assistant, remove cargo box from machine.

Installation:

- Installation is in the reverse of removal.

C—Prop Rod



MXT011813 —UN—15MAY14

MX52301,0000019 -19-30MAY14-3/3

Rear Shock Absorber Removal and Installation

Removal:

NOTE: Only remove and replace one shock absorber at a time.

1. Park machine safely on a level surface.
2. Lock park brake.
3. Install a jack (A) under main frame as shown (do not raise machine).

A—Jack

MXT011814 —UN—15MAY14

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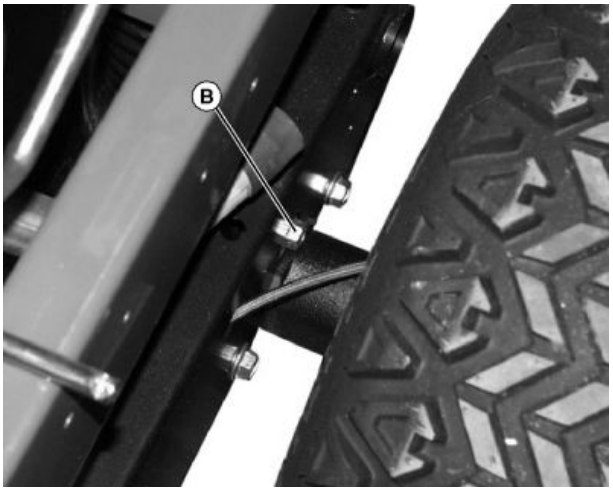
MX52301,000001A -19-02JUN14-1/3

4. Remove lower nut and bolt (B) securing shock.

B—Lower Nut and Bolt



MXT011815 —UN—15MAY14

MX52301,000001A -19-02JUN14-2/3

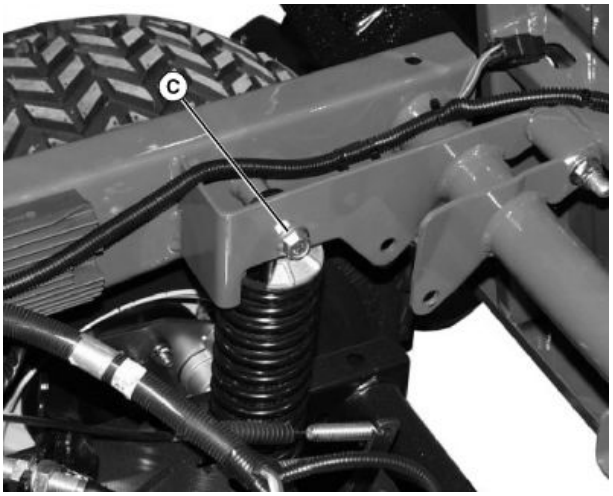
5. Remove upper nut and bolt (C) securing shock. It may be necessary to use jack to raise or lower machine in order to level the frame and swing arm frame to ease bolt removal.
6. Remove shock from frame.

Installation:

1. Installation is in the reverse of removal.
2. It may be necessary to use jack to raise or lower machine in order to level the frame and swing arm frame to ease bolt installation.
3. Tighten bolts to specification.

Rear Shock Torques:—Specification

Rear Shock to Axle—Torque	102—150 N·m (75—111 lb.-ft.)
Rear Shock to Frame—Torque	102—150 N·m (75—111 lb.-ft.)



MXT011816 —UN—15MAY14

C—Upper Nut and Bolt

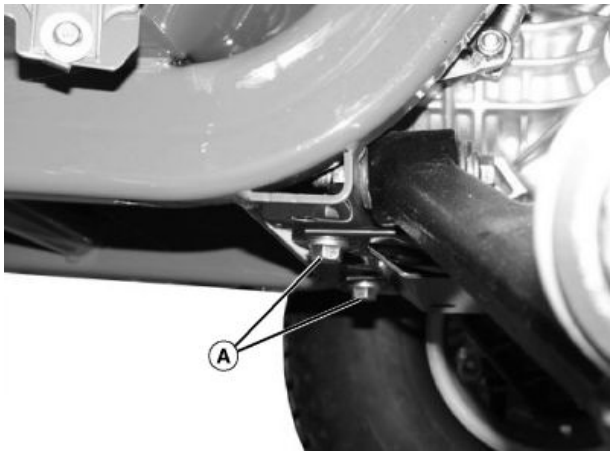
MX52301,000001A -19-02JUN14-3/3

Front Bumper/Skid Plate Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Remove two lower bolts (A) securing skid plate.

A—Bolts (2 used)



MXT011817 —UN—15MAY14

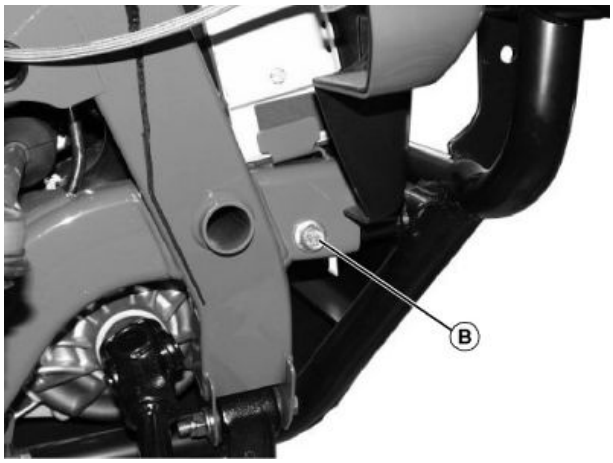
MX52301,000001B -19-30MAY14-1/2

4. Remove two upper bolts and nuts (B) securing front bumper (located on both sides of machine).

Installation:

- Installation is in the reverse of removal.

B—Upper Bolts



MXT011818 —UN—15MAY14

MX52301,000001B -19-30MAY14-2/2

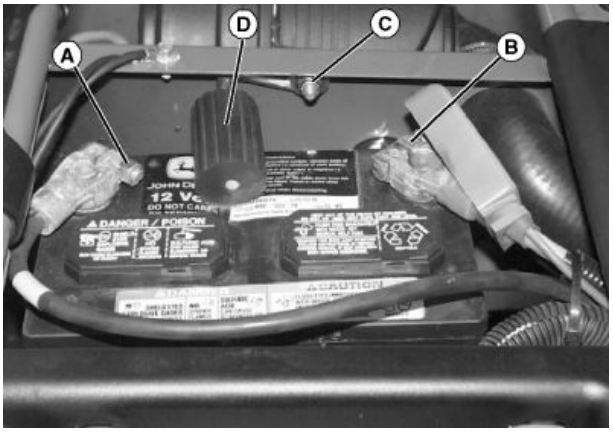
Battery Removal and Installation

Removal

1. Park machine safely and raise passenger seat.
2. Disconnect negative – battery terminal (A) first, then positive + terminal (B).
3. Remove nut and washer (C) from battery hold down (D) and remove battery hold down.
4. Remove battery.

Installation

1. Install battery with negative – terminal toward front of machine.
2. Install battery hold down. Keep downward pressure on hold down while tightening hold down bolt.
3. Connect and tighten positive + cable first, then negative – cable.



MXT011819 —UN—15MAY14

A—Negative (-) Battery Terminal
B—Positive (+) Battery Terminal
C—Nut and Washer
D—Hold Down.

MX52301,000001C -19-30MAY14-1/1

Radiator Drain Procedure — Gas

Draining Cooling System

1. Park the vehicle safely. See the “Safety Section”.
2. Raise cargo box.
3. Open hood.
4. Remove storage tray.

IMPORTANT: Allow engine and cooling system to cool completely.

5. Make sure engine has cooled completely

IMPORTANT: BE SURE to wipe-up and wash-off any spilled coolant IMMEDIATELY.

6. Place a large drain pan under left side of engine to catch coolant.
7. Slowly open radiator cap (A) to the first stop to release all pressure.

MXT011820 —UN—15MAY14

A—Radiator Cap

8. Remove cap after all pressure is released.

Continued on next page

MX52301,000001D -19-22OCT14-1/4

9. Disconnect radiator hoses (B) from intermediate tubes.
10. Route radiator hoses over the drain pan and allow coolant to drain into drain pan.

B—Radiator Hoses

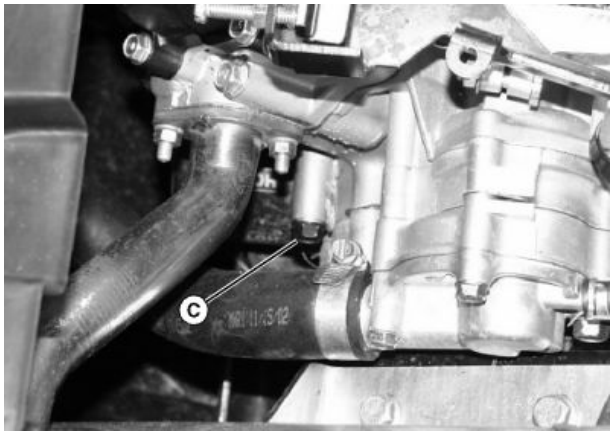
MXT011821 —UN—15MAY14

MX52301,000001D -19-22OCT14-2/4

NOTE: Engine block drain screws may be black in color.

11. Loosen engine block drain screw (C) on left side of engine. Allow coolant to drain into a drain pan.
12. After all coolant has drained, connect radiator hoses and tighten the engine block drain screw.

C—Block Drain Screw



MXT011822 —UN—15MAY14

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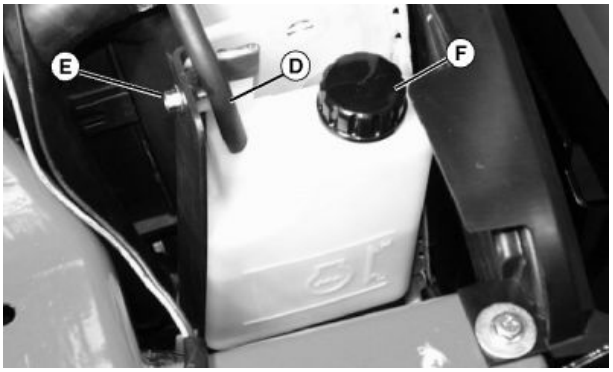
MX52301,000001D -19-22OCT14-3/4

13. Remove overflow hose (D) from recovery tank.
14. Remove the screw (E) and lift recovery tank out of
15. Remove cap and empty recovery tank into drain pan.
16. Check condition of all hoses. Replace as needed. Check all hose clamps and tighten as needed.
17. Install recovery tank in machine and secure with screw

IMPORTANT: Install overflow hose properly to ensure proper function of the cooling system. Position hose slightly above bottom of reservoir. Do not allow hose to contact bottom of reservoir or bend upwards out of the coolant.

18. Install overflow hose (D) and cap (F).
19. Fill and bleed cooling system.



MXT011823 —UN—15MAY14

D—Overflow Hose
E—Screw
F—Cap

Flushing Cooling System

1. Drain cooling system.
2. Prepare a cooling system flushing solution using clean water and John Deere Cooling System Cleaner, John Deere Cooling System Quick Flush, or an equivalent.
3. Fill radiator completely with flushing solution. Install and tighten radiator cap.
4. Start and run engine until it reaches operating temperature.
5. Stop engine.

CAUTION: Engine and coolant will be hot. Use a thick rag or gloves to protect your skin.

6. Turn radiator cap slowly to the stop to release system pressure. Remove radiator cap.
7. Drain cooling system immediately into a container before rust and dirt settle:
   - Disconnect radiator hoses from engine.
   - Loosen engine block drain screws.
8. After all solution has drained, connect radiator hoses and tighten engine block drain screws.
9. Remove and clean recovery tank.
10. Install the recovery tank.
11. Fill cooling system with recommended coolant mixture.

MX52301,000001D -19-22OCT14-4/4

Radiator Drain Procedure — Diesel

Draining Cooling System

1. Park the vehicle safely. See the “Safety Section”.
2. Raise cargo box.
3. Open hood.
4. Remove storage tray.

IMPORTANT: Allow engine and cooling system to cool completely.

5. Make sure engine has cooled completely

IMPORTANT: BE SURE to wipe-up and wash-off any spilled coolant IMMEDIATELY.

6. Place drain pan under engine
7. Slowly open radiator cap (A) to the first stop to release all pressure.
8. Remove cap after all pressure is released.

MXT011824 —UN—15MAY14

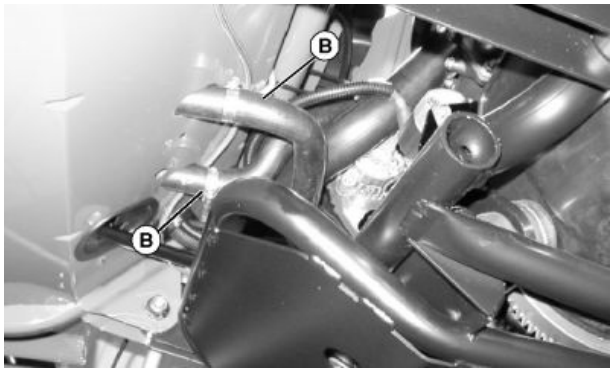
A—Radiator Cap

Continued on next page

MX52301,000001E -19-22OCT14-1/4

9. Disconnect radiator hoses (B) from intermediate tubes.
10. Route radiator hoses over the drain pan and allow coolant to drain into drain pan.

B—Radiator Hoses



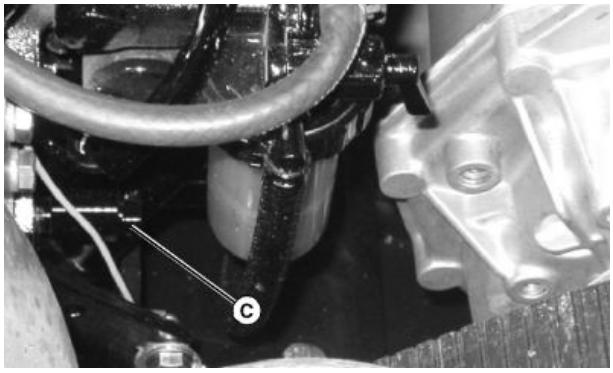
MXT011825 —UN—15MAY14

MX52301,000001E -19-22OCT14-2/4

NOTE: Engine block drain screws may be black in color.

11. Loosen engine block drain screw (C) on left side of engine. Allow coolant to drain into a drain pan.
12. After all coolant has drained, connect radiator hoses and tighten the engine block drain screw.

C—Block Drain Screw



MXT011826 —UN—15MAY14

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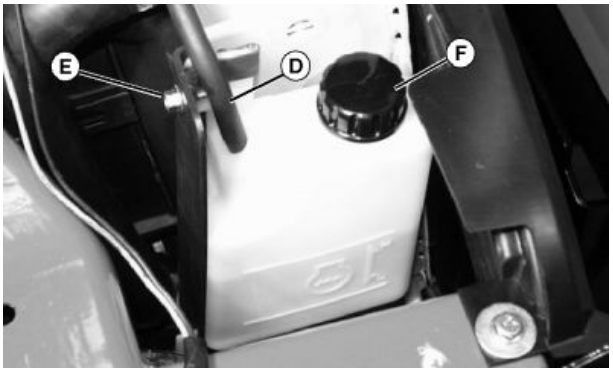
MX52301,000001E -19-22OCT14-3/4

13. Remove overflow hose (D) from recovery tank.
14. Remove the screw (E) and lift recovery tank out of
15. Remove cap and empty recovery tank into drain pan.
16. Check condition of all hoses. Replace as needed. Check all hose clamps and tighten as needed.
17. Install recovery tank in machine and secure with screw

IMPORTANT: Install overflow hose properly to ensure proper function of the cooling system. Position hose (C) slightly above bottom of reservoir. Do not allow hose to contact bottom of reservoir or bend upwards out of the coolant.

18. Install overflow hose (D) and cap (F).
19. Fill and bleed cooling system.



MXT011823 —UN—15MAY14

D—Overflow Hose
E—Screw
F—Cap

Flushing Cooling System

1. Drain cooling system.
2. Prepare a cooling system flushing solution using clean water and John Deere Cooling System Cleaner, John Deere Cooling System Quick Flush, or an equivalent.
3. Fill radiator completely with flushing solution. Install and tighten radiator cap.
4. Start and run engine until it reaches operating temperature.
5. Stop engine.

CAUTION: The radiator will be hot and can burn skin. Built-up pressure may cause explosive release of coolant when the radiator cap is removed:

- **Slowly loosen the cap to the first stop to release all pressure. Then remove the drain plug.**

6. Turn radiator cap slowly to the stop to release system pressure. Remove radiator cap.
7. Drain cooling system immediately into a container before rust and dirt settle:
   - Disconnect radiator hoses from engine.
   - Loosen engine block drain screws.
8. After all solution has drained, connect radiator hoses and tighten engine block drain screws.
9. Remove and clean recovery tank.
10. Install the recovery tank.
11. Fill cooling system with recommended coolant mixture.

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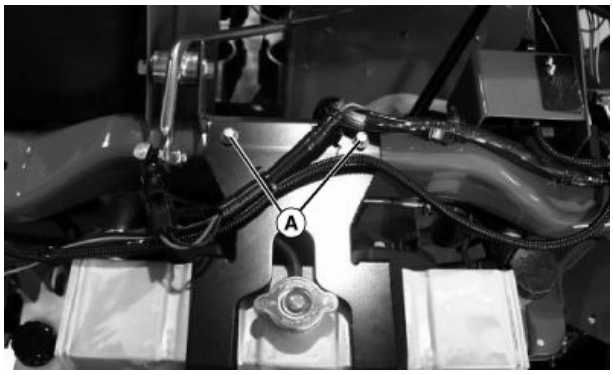
Radiator Removal and Installation

CAUTION: Coolant may be above boiling temperature and under pressure in cooling system. DO NOT remove pressure cap when system is hot. Escaping steam will burn unprotected skin. Always wear protective clothing and goggles when servicing cooling system

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Remove hood. See Hood Removal and Installation
4. Remove front grille. See Front Grille Removal and Installation.
5. Remove two bolts (A) securing radiator bracket to frame.



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A—Bolts (2 used)

6. Remove electrical harness tie down point on bracket by compressing nipple with a long-nosed pliers.

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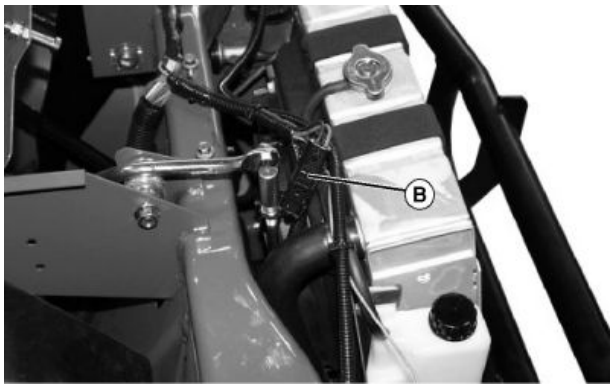
7. Disconnect cooling fan motor connector (B).
8. Place a suitable container under machine for coolant recovery.
9. Loosen clamp on lower radiator hose and carefully separate hose from radiator. Allow coolant to drain.
10. Loosen clamp on upper radiator hose and separate from radiator.

B—Cooling Fan Motor Connector



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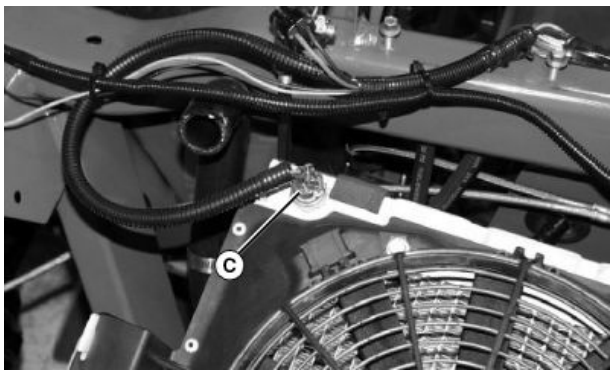
11. Disconnect temperature sensor connector (C).
12. Remove radiator from machine.

Installation:

1. Installation is in the reverse of removal.
2. Replace coolant
3. Bleed air from cooling system. See Radiator Fill and Bleed Procedure — Gas or Radiator Fill and Bleed Procedure — Diesel

C—Temperature Sensor Connector



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Cooling Fan Removal and Installation

Removal:

1. Park machine safely on a level surface.
2. Lock park brake.
3. Remove radiator. See Radiator Removal and Installation.
4. Remove four screws (A) securing cooling fan to radiator.

Installation:

- Installation is in the reverse of removal.

A—Screws (4 used)

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Radiator Fill and Bleed Procedure — Gas

Filling and Bleeding Cooling System

IMPORTANT: Using incorrect coolant mixture can damage the radiator:

- **Do not operate engine with plain water.**
- **Use antifreeze approved for use in aluminum engines.**
- **Do not exceed a 50% antifreeze mixture for the coolant.**
- **Do not pour coolant or water into the radiator when the engine is hot.**

NOTE: John Deere COOL-GARD coolant is recommended when adding coolant to the cooling system. Follow the directions on the container for correct mixture ratio.

Cooling system capacity is approximately 5.0 L (5.2 qt.) including recovery tank.

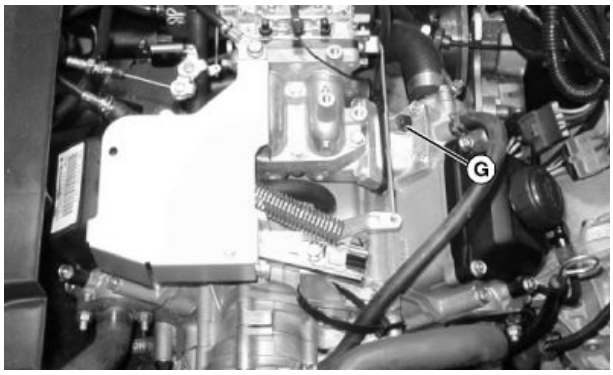
1. Check that all hose clamps are secured and tight.

IMPORTANT: Bleed screw uses a special aluminum seal washer. Do not lose or substitute with any other type of washer.

2. Remove bleed screw and seal washer (G) located by carburetor.
3. Remove radiator cap and add recommended coolant mixture to radiator until coolant flows out of bleed port.
4. Install and tighten bleed screw with seal washer.
5. Add additional coolant mixture to radiator until coolant flows out of overflow port and into the recovery tank.
6. Install radiator cap.

IMPORTANT: Position hose slightly above bottom of recovery tank. Do not allow hose to contact bottom of recovery tank or bend upwards out of the coolant.

7. Remove recovery tank cap and add coolant mixture to recovery tank until it is approximately half full.
8. Install recovery tank cap.



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G—Bleed Screw and Seal Washer

IMPORTANT: If coolant temperature indicator comes on while engine is running, stop engine and add more coolant mixture to radiator.

9. Start and run engine at medium speed until upper and lower radiator hoses have become warm (10—15 minutes), indicating thermostat has opened and coolant is circulating.
10. Allow engine to cool.
11. Loosen bleed screw and allow air to bubble out until air bubbles are no longer visible at bleed port. Tighten bleed screw completely.
12. Remove radiator cap and add recommended coolant mixture to radiator until coolant runs out of overflow port and into the recovery tank.
13. Install radiator cap.
14. Run engine until cooling fan starts, indicating the engine and coolant has reached operating temperature.
15. Stop engine and remove key.
16. Allow engine to cool and suction back any needed coolant from overflow recovery tank. Fill recovery tank as needed to lower line.

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Radiator Fill and Bleed Procedure — Diesel

Filling and Bleeding Cooling System

IMPORTANT: Using incorrect coolant mixture can damage the radiator:

- **Do not operate engine with plain water.**
- **Use antifreeze approved for use in aluminum engines.**
- **Do not exceed a 50% antifreeze mixture for the coolant.**
- **Do not pour coolant or water into the radiator when the engine is hot.**

NOTE: John Deere COOL-GARD coolant is recommended when adding coolant to the cooling system. Follow the directions on the container for correct mixture ratio.

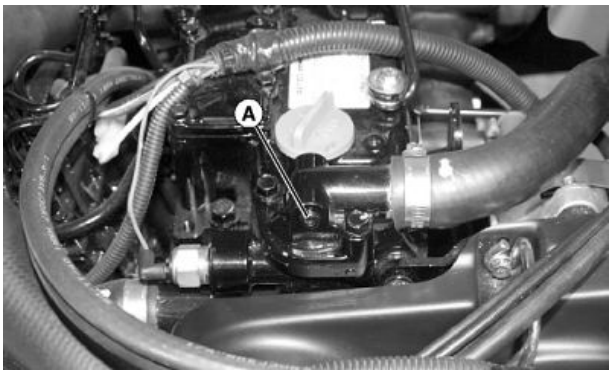
Cooling system capacity is approximately 5.0 L (5.2 qt.) including recovery tank.

1. Check that all hose clamps are secured and tight.
2. Remove bleed screw (A) located on the thermostat housing.
3. Remove radiator cap and add recommended coolant mixture to radiator until coolant flows out of bleed port.
4. Install and tighten bleed screw.
5. Add additional coolant mixture to radiator until coolant runs out of overflow port and into the recovery tank
6. Install radiator cap.

IMPORTANT: Position hose slightly above bottom of recovery tank. Do not allow hose to contact bottom of recovery tank or bend upwards out of the coolant.

7. Remove recovery tank cap and add coolant mixture to recovery tank until it is approximately half full.
8. Install recovery tank cap.

IMPORTANT: If coolant temperature indicator comes on while engine is running, stop engine and add more coolant mixture to radiator.



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A—Bleed Screw and Seal Washer

9. Start and run engine at medium speed until upper and lower radiator hoses have become warm (10—15 minutes), indicating thermostat has opened and coolant is circulating.
10. Allow engine to cool.
11. Loosen bleed screw and allow air to bubble out until air bubbles are no longer visible at bleed port. Tighten bleed screw completely.
12. Remove radiator cap and add recommended coolant mixture to radiator until coolant runs out of overflow port and into the recovery tank.
13. Install radiator cap.
14. Run engine until cooling fan starts, indicating the engine and coolant has reached operating temperature.
15. Stop engine and remove key.
16. Allow engine to cool and suction back any needed coolant from overflow recovery tank. Fill recovery tank as needed to lower line.

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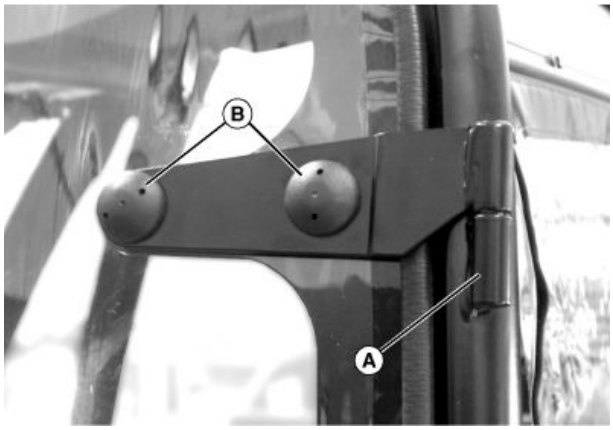
Adjust Doors and Door Catch/Locking Bolts

Soft Doors:

1. Install the left door on the hinges, aligning the top hinge pin first. Work the door to fully seat the hinge pins in the hinges (A). If necessary, loosen the hardware (B) attaching the hinges to the door, align the door and tighten hardware using the special tools provided, then install nut caps.

A—Hinges

B—Hardware



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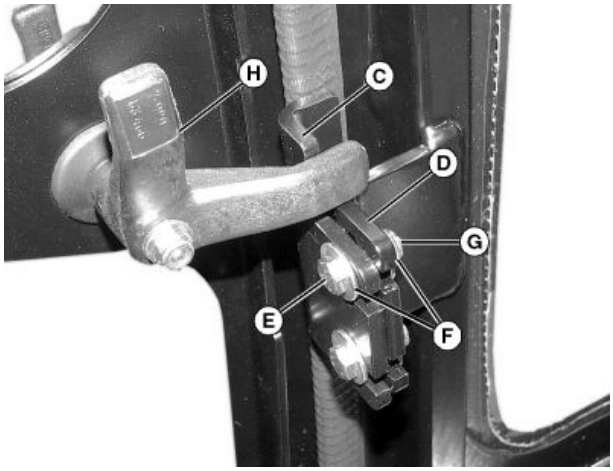
2. Secure door latch bracket (C) to the door frame bracket (D) with M6x20 capscrews (E), M6x14 washers (F) and M6 nylock nuts (G).
3. Position the door latch bracket on the canopy bracket so that the door seals securely when the latch lever (H) is in the closed position, as shown. Tighten hardware.

C—Latch Bracket
D—Frame Bracket
E—M6x20 Capscrews
F—M6x14 Washers
G—M6 Nylock Nuts
H—Latch Lever



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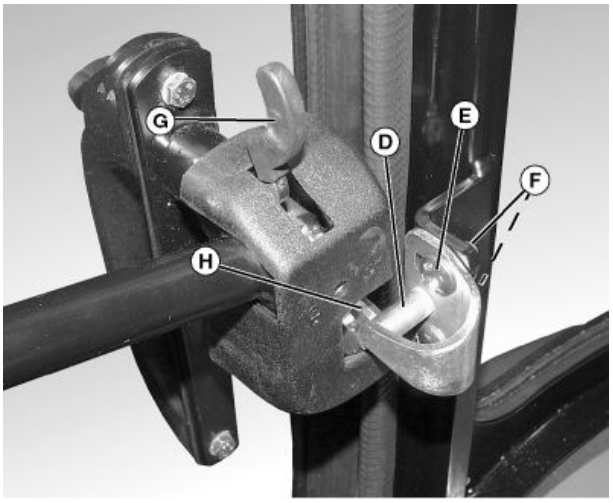
Hard Doors

1. Work the door until the pins are fully seated in the hinges, as shown.
2. Align the door and hinges so that the door will latch, then tighten hinge hardware, holding the rounded fasteners (C) with the special tools provided. Install nut caps.
3. Secure door catch/locking bolt (D) to the door frame bracket with M8x25 carriage bolts (E), M8x24 washers and M8 nylock nuts (F). Do not tighten.
4. Check the door latching mechanism for proper operation, alignment and adjustment. The door latch is a two-stage mechanism with a safety catch. Properly adjusted, the second locking latch should engage without undue effort. A push-button operates the latch from the outside, a lever (G) operates the latch from the inside. There are keyed locks for both doors, but an inside lock only for the passenger side door.
    1. Check the alignment of the locking bolt (D) with the door latch (H). The locking bolt should strike the center of the door latch for proper operation. To adjust, loosen the two retaining nuts (F) and move the locking bolt up or down as necessary.
    2. Adjust the closing pressure as necessary by moving the locking bolt in or out as necessary.



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C—Rounded Fasteners
D—Catch/Locking Bolt
E—M8x25 Carriage Bolts
F—Washers and M8 Nylock Nuts
G—Lever
H—Door Latch

3. Tighten hardware and verify proper operation.

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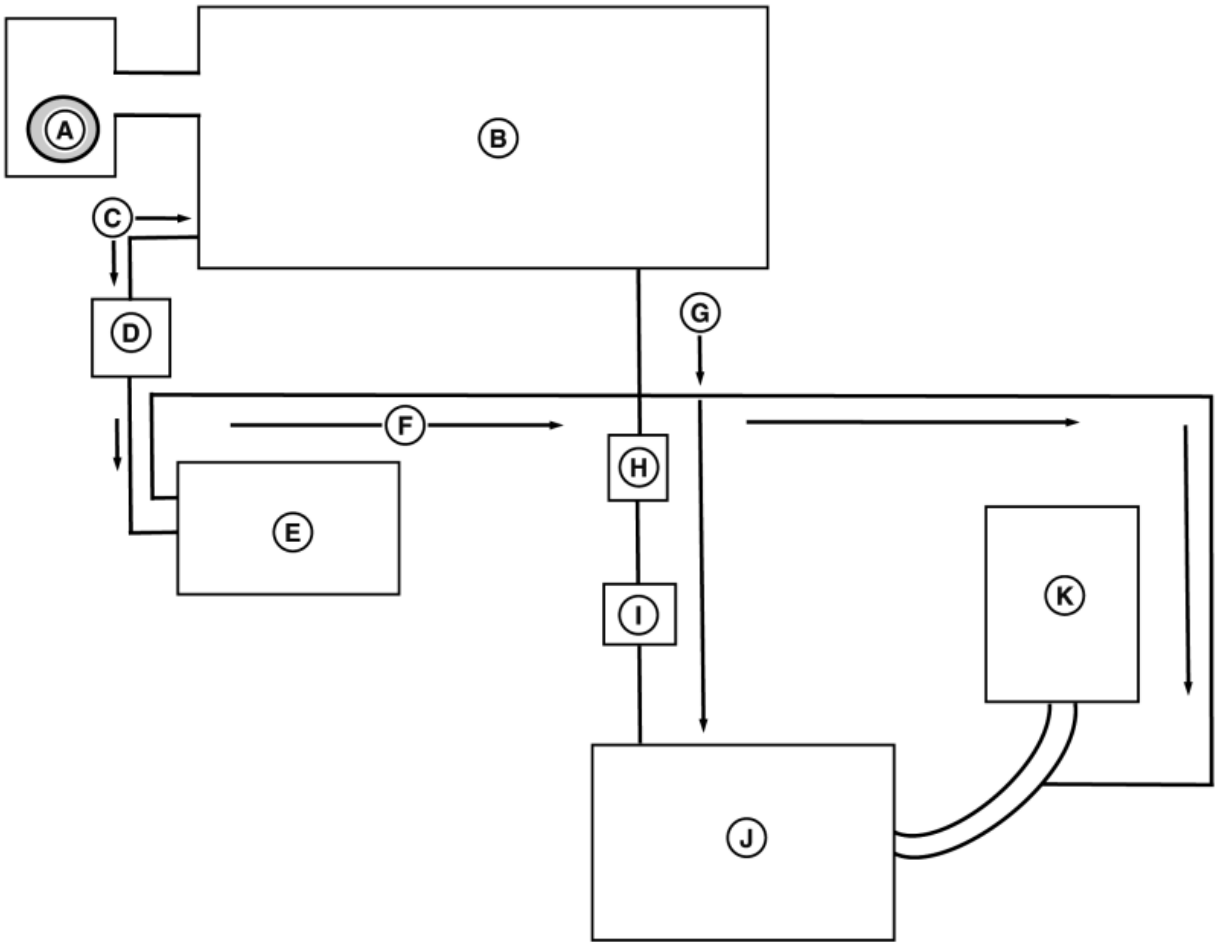
Evaporative Emissions System Operation (SN -130000)



MXT011544 —UN—17OCT14

A—Fuel Filler Cap (Sealed)
B—Fuel Tank
C—Vent Hose
D—Rollover Valve
E—Carbon Canister
F—Purge Line
G—Fuel Supply Hose
H—Fuel Pump
I— Fuel Filter
J— Engine
K—Air Filter Canister

Function

The evaporative emissions system reduces the amount of fuel vapors that are vented into the atmosphere. The vapors are captured utilizing a sealed fuel filler cap, an evaporative canister of activated charcoal, and appropriate hoses. The vapors are captured, drawn into the engine, and burned normally, reducing evaporative emissions.

Theory of Operation

The evaporative emissions system components consist of a sealed fuel filler cap, a rollover valve, an evaporative canister with activated charcoal, and the following hoses:

- Vent hose from the rollover valve on the fuel tank to the evaporative canister.
- Fuel supply hose from the fuel tank to the fuel pump.
- Purge hose from the evaporative canister to the engine air intake.

Fuel vapors are vented to the evaporative canister, and then captured by the activated charcoal in the canister. When the engine is running, vacuum in the purge hose pulls the captured fuel from the activated charcoal in the canister. It is drawn into the engine and burned normally.

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