7500A E-Cut Hybrid™ and 8000A E-Cut Hybrid™ Fairway Mowers

TECHNICAL MANUAL

7500A E-Cut Hybrid™ 8000A E-Cut Hybrid™ Fairway Mowers

TM124419 07MAY15 (ENGLISH)

For complete service information also see:

Engine Component Technical Manual	**CTM120419**
Service ADVISOR™ Machine Connection Information	**CTM441**

John Deere Turf Care

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

Section 10—General Information
- Group 05—Safety
- Group 10—General Specifications
- Group 15—Fuel and Lubricants
- Group 20—Machine Specifications

Section 20—Engine Repair
- Group 10—Starting Motor Repair
- Group 20—Turbocharger Repair
- Group 30—Engine Repair 3TNV84T
- Group 40—Engine Repair 3TNV86CT

Section 30—Electrical Repair
- Group 10—Alternator and Battery
- Group 20—Wiring Harnesses

Section 40—Power Train Repair
- Group 10—Power Train

Section 50—Hydraulics Repair
- Group 10—Hydraulics
- Group 20—Hydraulic Pumps

Section 60—Steering Repair
- Group 10—Steering

Section 70—Attachments Repair
- Group 10—Reel Motor
- Group 20—QA5 Cutting Unit
- Group 30—QA5 Cutting Unit Attachments

Section 80—Miscellaneous Repair
- Group 10—Miscellaneous
- Group 20—Operator's Station
- Group 30—Fuel System

Section 220—Engine Operation, Tests, and Adjustments
- Group 10—Theory of Operation
- Group 20—Engine Diagnosis
- Group 30—Non-T4 Fuel and Air Operation, Tests, and Adjustments
- Group 40—Turbocharger Operation, Tests, and Adjustments
- Group 50—Engine Tests, and Adjustments

Section 230—Electrical Operation, Tests, and Adjustments
- Group 10—Component Location
- Group 20—Theory of Operation
- Group 30—Diagnosis
- Group 40—Connectors
- Group 50—Schematics
- Group 60—Tests and Adjustments

Section 240—Controller Operation, Tests, and Adjustments
- Group 10—Set Up, PDU
- Group 15—Theory of Operation
- Group 20—DPF Theory and Functions
- Group 30—Diagnose—DTCs, PDU
- Group 40—Diagnose—DTCs, VCU
- Group 50—Diagnose—DTCs, ECU 000001 — 000199
- Group 51—Diagnose—DTCs, ECU 000200 — 000699
- Group 52—Diagnose—DTCs, ECU 000700 — 001999
- Group 53—Diagnose—DTCs, ECU 002000 — 002999
- Group 54—Diagnose—DTCs, ECU 003000 — 003999
- Group 55—Diagnose—DTCs, ECU 004000 — 529999
- Group 60—Diagnose—DTCs, RMC
- Group 70—Tests and Adjustments

Section 250—Power Train Operation, Tests, and Adjustments
- Group 10—Component Location
- Group 20—Theory of Operation
- Group 30—Diagnosis
- Group 40—Tests and Adjustments

Section 260—Hydraulics Operation, Tests, and Adjustments
- Group 10—Component Location
- Group 20—Theory of Operation
- Group 30—Diagnosis
- Group 40—Tests and Adjustments
- Group 50—Hydraulic Schematics

Section 270—Steering and Brake Operation, Tests, and Adjustments
- Group 10—Component Location
- Group 20—Theory of Operation
- Group 30—Diagnosis
- Group 40—Tests and Adjustments

Continued on next page

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.

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Previous Editions
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Section 280—Attachments Operation, Tests, and Adjustments
Group 10—Component Location
Group 20—Theory of Operation
Group 30—Diagnosis
Group 40—Tests and Adjustments

Section 299—Service Tools
Group 10—Tools and Kits

Section 10
General Information

Contents

Page

Group 05—Safety
Recognize Safety Information 10-05-1
Understand Signal Words..... 10-05-1
Replace Safety Signs 10-05-1
Handle Fluids Safely—Avoid Fires..... 10-05-2
Prepare for Emergencies..... 10-05-2
Prevent Battery Explosions 10-05-2
Prevent Acid Burns..... 10-05-3
Wear Protective Clothing..... 10-05-3
Avoid High-Pressure Fluids 10-05-4
Avoid Heating Near Pressurized Fluid Lines 10-05-4
Service Machines Safely 10-05-4
Use Proper Tools..... 10-05-5
Park Machine Safely..... 10-05-5
Support Machine Properly..... 10-05-5
Use Proper Lifting Equipment..... 10-05-6
Work in Clean Area 10-05-6
Using High-Pressure Washers 10-05-6
Protect Against High Pressure Spray 10-05-6
Illuminate Work Area Safely 10-05-7
Work In Ventilated Area..... 10-05-7
WARNING: California Proposition 65 Warning 10-05-7
Remove Paint Before Welding or Heating 10-05-8
Avoid Harmful Asbestos Dust..... 10-05-8
Follow Tire Recommendations 10-05-8
Stay Clear of Rotating Drivelines..... 10-05-9
Service Cooling System Safely 10-05-9
Dispose of Waste Properly 10-05-10
Handle Chemical Products Safely..... 10-05-10
Live With Safety..... 10-05-10

Group 10—General Specifications
Metric Bolt and Screw Torque Values..... 10-10-1
Unified Inch Bolt and Screw Torque Values..... 10-10-2
Metric Cap Screw Torque Values—Grade 7 10-10-2
Service Recommendations for O-Ring Boss Fittings..... 10-10-3
Service Recommendations For Flat Face O-Ring Seal Fittings 10-10-4

Group 15—Fuel and Lubricants
Diesel Fuel..... 10-15-1
Diesel Fuel Storage..... 10-15-1
Engine Oil..... 10-15-2
Oil Filters 10-15-2

Page

Hydrostatic Transmission and Hydraulic Oil 10-15-3
Biodegradable Oil..... 10-15-3
Converting From HY-GARD to BIO HY-GARD 10-15-4
Grease - North America..... 10-15-4
Grease - Europe 10-15-4
Alternative Lubricants..... 10-15-4
Synthetic Lubricants 10-15-4
Lubricant Storage 10-15-5
Mixing of Lubricants..... 10-15-5
Diesel Engine Coolant..... 10-15-5
John Deere COOL-GARD™ II Coolant Extender..... 10-15-6
Diesel Engine Coolant Drain Interval - North America..... 10-15-6
Diesel Engine Coolant Drain Interval - Europe 10-15-6

Group 20—Machine Specifications
Machine Specifications..... 10-20-1
Serial Number Location..... 10-20-2
Product Identification Number 10-20-2
Engine Identification Number 10-20-2
Attachment Identification Number..... 10-20-2

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

OUO1086,1000417 -19-15JUN12-1/1

Understand Signal Words

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

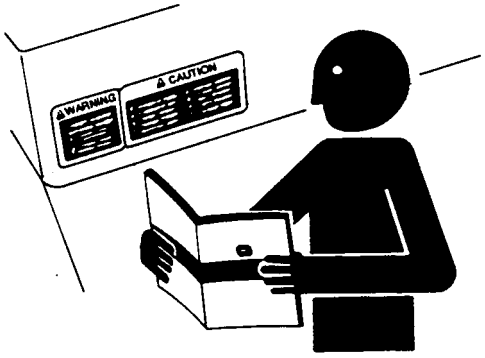
DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

TS187 —19—30SEP88

OUO1086,1000418 -19-15JUN12-1/1

Replace Safety Signs

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



TS201 —UN—15APR13

OUO1086,1000419 -19-15JUN12-1/1

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

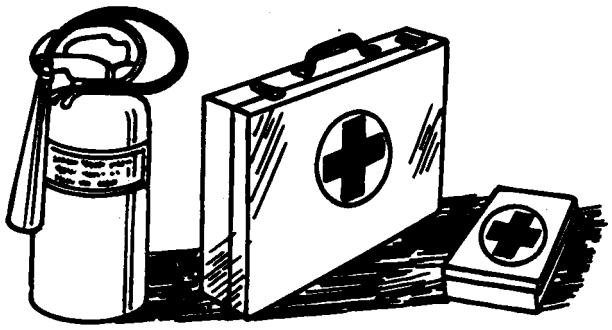
OUO1086,100041A -19-15JUN12-1/1

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

OUO1086,100041B -19-15JUN12-1/1

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

OUO1086,100041C -19-15JUN12-1/1

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:

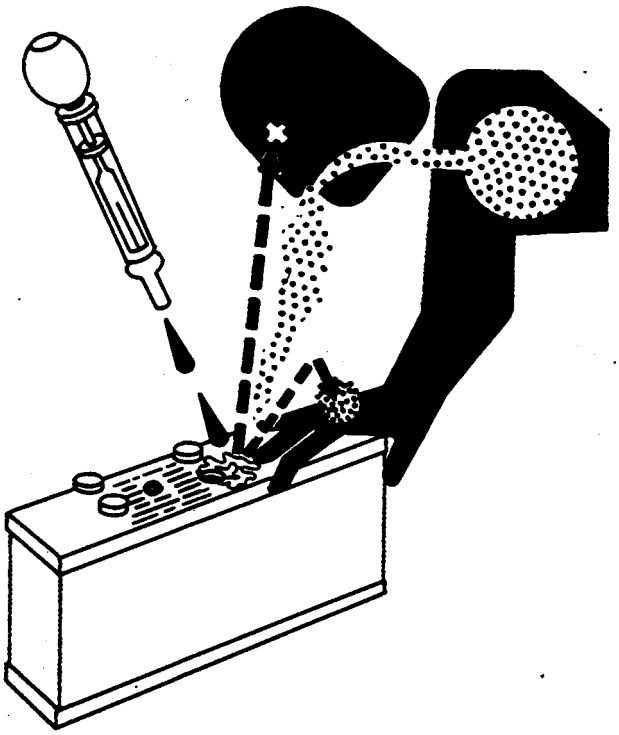
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.
5. Use proper jump start procedure.

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

OUO1086,100041D -19-15JUN12-1/1

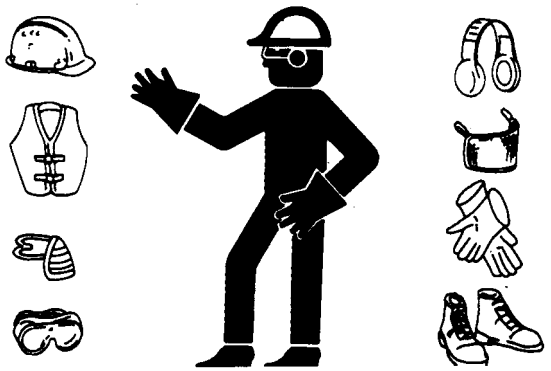
Wear Protective Clothing

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

OUO1086,100041E -19-15JUN12-1/1

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.

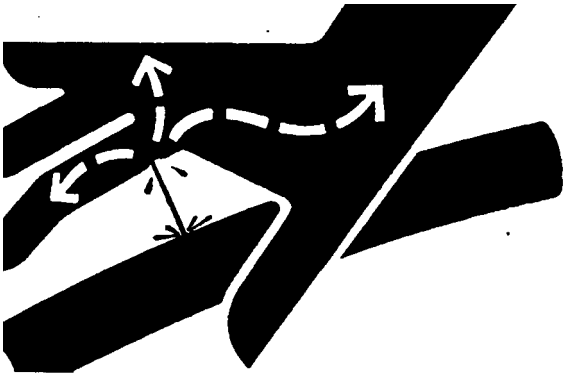
Replace worn or damaged hose assemblies immediately with John Deere approved replacement parts.

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

OUO1086,100041F -19-15JUN12-1/1

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.

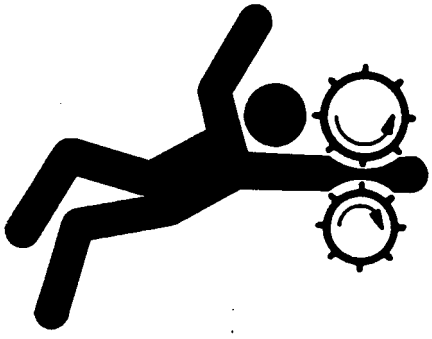
TS953 —UN—15MAY90

OUO1086,1000420 -19-15JUN12-1/1

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

OUO1086,1000421 -19-15JUN12-1/1

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.

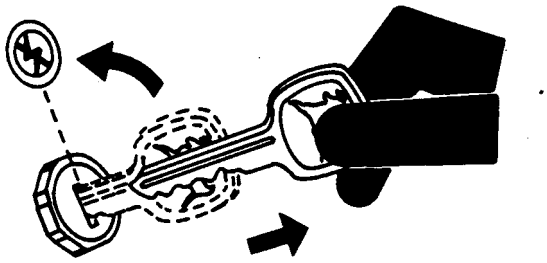
TS779 —UN—08NOV89

OUO1086,1000422 -19-15JUN12-1/1

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

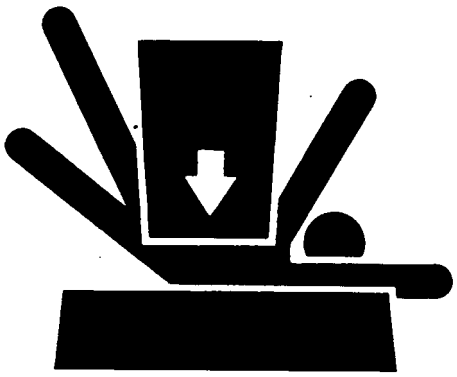
OUO1086,1000423 -19-15JUN12-1/1

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.



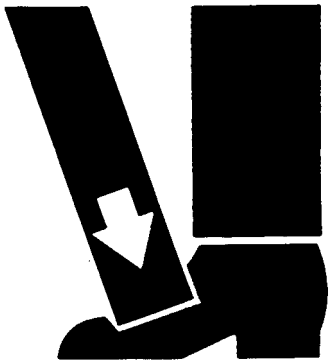
TS229 —UN—23AUG88

OUO1086,1000424 -19-15JUN12-1/1

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.



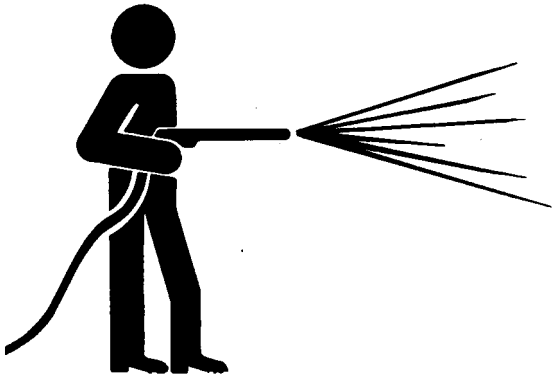
TS226 —UN—23AUG88

OUO1086,1000425 -19-15JUN12-1/1

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

OUO1086,1000426 -19-15JUN12-1/1

Using High-Pressure Washers

Directing pressurized water at electronic/electrical components or connectors, bearings, hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure and spray at a 45 to 90 degree angle.

OUO1086,1000427 -19-15JUN12-1/1

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.

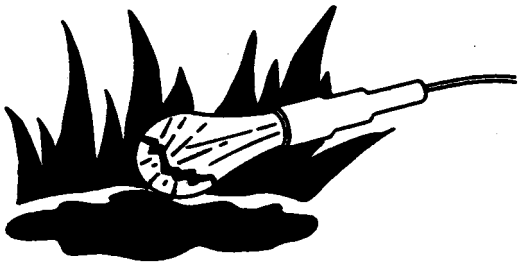
If an accident occurs, see a doctor immediately. Any high pressure spray injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere &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

TS1343 —UN—18MAR92

OUO1086,1000428 -19-15JUN12-1/1

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.



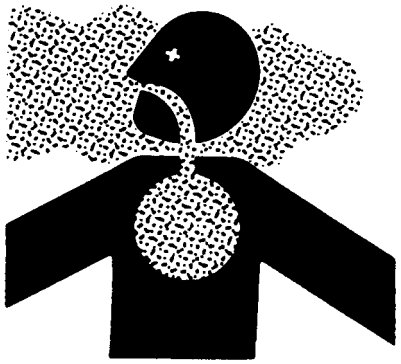
TS223 —UN—23AUG88

OUO1086,1000429 -19-15JUN12-1/1

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

OUO1086,100042A -19-15JUN12-1/1

WARNING: California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Gasoline engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

OUO1086,100042B -19-15JUN12-1/1

Remove Paint Before Welding or Heating

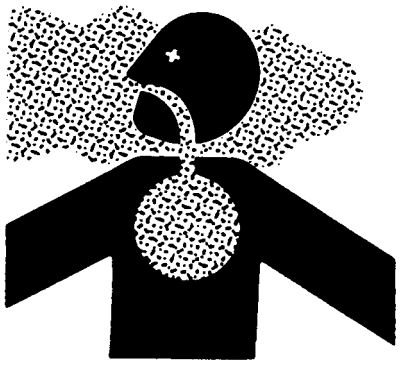
Avoid potentially toxic fumes and dust.

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.

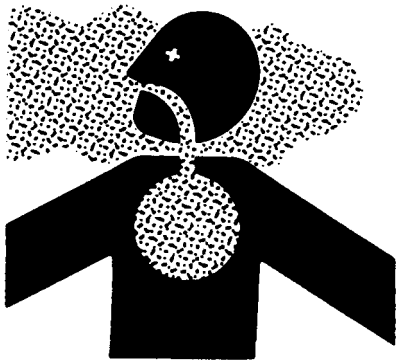
OUO1086,100042C -19-15JUN12-1/1

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.

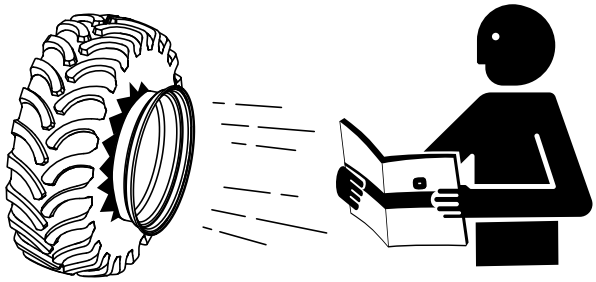
OUO1086,100042D -19-15JUN12-1/1

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.

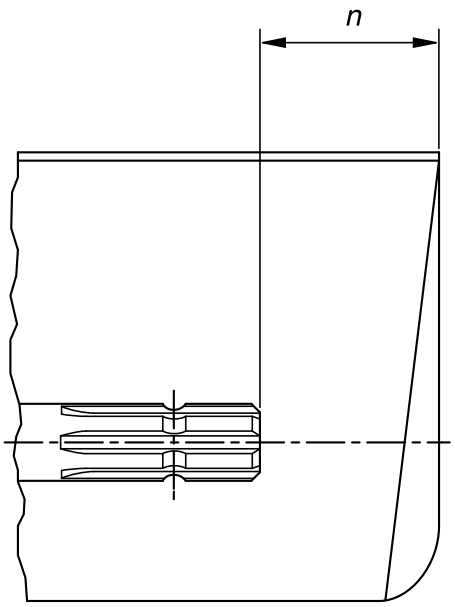
Wear close fitting clothing. Stop the engine and be sure that PTO driveline is stopped before making adjustments, connections, or cleaning out PTO driven equipment.

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

OUO1086,100042F -19-15JUN12-1/1

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

OUO1086,1000430 -19-15JUN12-1/1

Dispose of Waste Properly

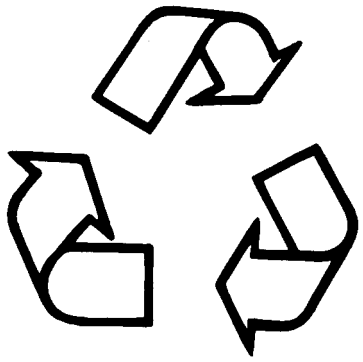
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

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

OUO1086,1000431 -19-15JUN12-1/1

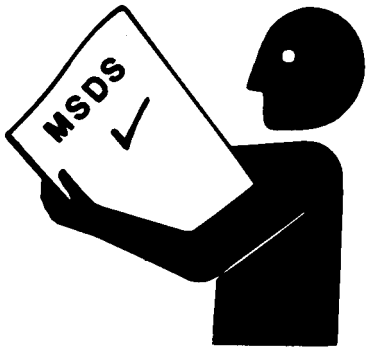
Handle Chemical Products Safely

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

OUO1086,1000432 -19-15JUN12-1/1

Live With Safety

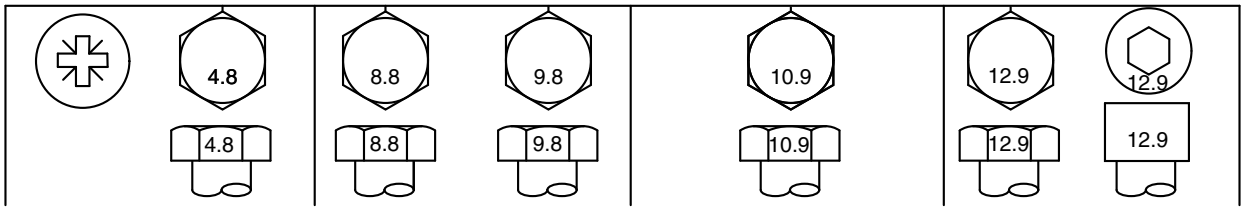
Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

TS231 —19—07OCT88

OUO1086,1000433 -19-15JUN12-1/1

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.

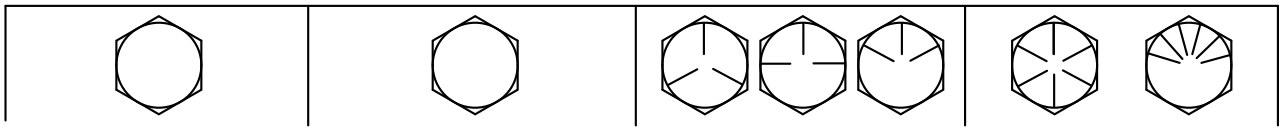
[a] *"Lubricated" means coated with a lubricant such as engine oil, fasteners with phosphate and oil coatings, or M20 and larger fasteners with JDM F13C, F13F or F13J zinc flake coating.*

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

OUO1086,10003FA -19-15JUN12-1/1

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.

OUO1086,10003FB -19-15JUN12-1/1

Metric Cap Screw Torque Values—Grade 7

NOTE: When bolting aluminum parts, tighten to 80% of torque specified in table.

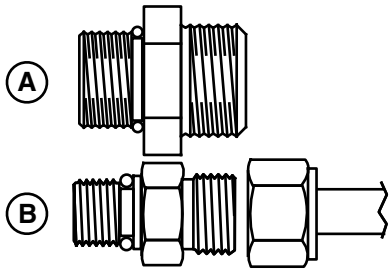
Size	N·m	(lb.-ft.)
M6	9.5—12.2	(7—9)
M8	20.3—27.1	(15—20)
M10	47.5—54.2	(35—40)
M12	81.4—94.9	(60—70)
M14	128.8—146.4	(95—108)
M16	210.2—240	(155—177)

OUO1086,10003FC -19-12JUN14-1/1

Service Recommendations for 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.



TCT008637 —UN—11OCT13

A—Straight Boss Fitting **B—Straight Stud and Tube Nut**

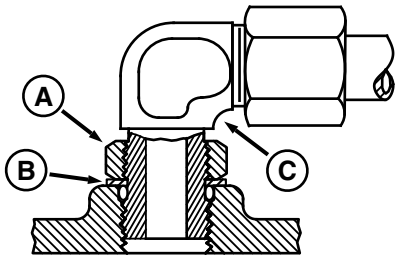
OUMX258,00000F8 -19-15OCT13-1/2

Angle 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. Back-off locknut (A) and back-up washer (B) completely to head-end (C) of fitting.
4. Turn fitting into threaded boss until back-up washer contacts face of boss.
5. Turn fitting head-end counterclockwise to proper index (maximum of one turn).

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

6. Hold fitting head-end with a wrench and tighten locknut and back-up washer to proper torque value.



TCT008638 —UN—11OCT13

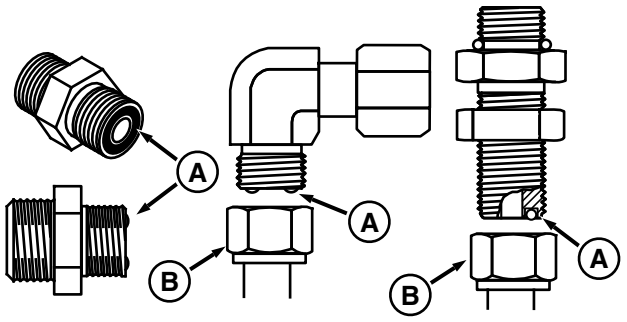
A—Locknut
B—Washer
C—Head-End of Fitting

STUD END O-RING SEAL TORQUE FOR STRAIGHT AND ADJUSTABLE FITTINGS*				
Thread Size	Straight Hex Size	Locknut Hex Size	Straight Fitting or Locknut Toque	
Inch	Inch	Inch	N·m	lb.-ft.
3/8-24	5/8	9/16	18	13
7/16-20	5/8	5/8	24	18
1/2-20	3/4	11/16	30	22
9/16-18	3/4	3/4	37	27
3/4-16	7/8	15/16	75	55
7/8-14	1 1/16	1 1/16	104	76
1 1/16-12	1 1/4	1 3/8	176	130
1 3/16-12	1 3/8	1 1/2	230	170
1 5/16-12	1 1/2	1 5/8	270	199
*Torque tolerance is +15 -20% unless otherwise specified.				

OUMX258,00000F8 -19-15OCT13-2/2

Service Recommendations For Flat Face O-Ring Seal Fittings

1. Inspect the fitting sealing surfaces and O-ring. They must be free of dirt or defects.
2. Lubricate O-ring (A) and install into groove using petroleum jelly to hold in place.
3. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.
4. Unless specified otherwise, tighten fitting or nut (B) to torque value shown on the chart. Do not allow hoses to twist when tightening fittings, use backup wrench on straight hose couplings.



TCT008639 —UN—11OCT13

A—O-ring **B—Nut**

FLAT FACE O-RING SEAL FITTING TORQUE*						
Nominal Tube O.D.		Thread Size	Swivel Nut		Bulkhead Nut	
mm	in.	in.	N·m	lb.-ft.	N·m	lb.-ft.
6.35	0.250	9/16-18	24	18	32	24
9.52	0.375	11/16-16	37	27	42	31
12.70	0.500	13/16-16	63	46	93	69
15.88	0.625	1-14	103	76	118	87
19.05	0.750	1 3/16-12	152	112	175	129
22.22	0.875	1 3/16-12	152	112	175	129
25.40	1.000	1 7/16-12	214	158	247	182
31.75	1.250	1 11/16-12	286	211	328	242
38.10	1.500	2-12	326	240	374	276
*Torque tolerance is +15 -20% unless otherwise specified.						

OUMX258,00000F9 -19-12AUG14-1/1

Diesel Fuel

Use the proper diesel fuel to help prevent decreased engine performance and increased exhaust emissions. Failure to follow the fuel requirements listed can void your engine warranty.

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

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

Diesel fuels specified to ISO EN 590 or ASTM D975 are recommended.

Required fuel properties

In all cases, the fuel shall meet the following properties:

Cetane number of 45 minimum. Cetane number greater than 50 is preferred, especially when temperatures are below -20°C (-4°F) or elevations above 1500 m (5000 ft).

Cold Filter Plugging Point (CFPP) should be at least 5°C (9°F) below the expected lowest temperature or **Cloud Point** below the lowest ambient temperature.

Fuel lubricity should comply with ISO EN 590 or ASTM D975.

IMPORTANT: Avoid damage! Improper fuel additive usage may cause damage on fuel injection equipment of diesel engines.

If a fuel of low or unknown lubricity is used, addition of John Deere PREMIUM DIESEL FUEL CONDITIONER at the specified concentration is recommended.

Sulfur content

- Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.
- Use only ultra low sulfur diesel (ULSD) fuel with a maximum of 0.0015% (15mg/kg) sulfur content.

IMPORTANT: Avoid damage! Do not mix diesel engine oil or any other type of lubricating oil with diesel fuel.

Using BioDiesel Fuel

BioDiesel fuels may be used only if the BioDiesel fuel properties meet the latest edition of ASTM D6751, ASTM D7467, EN14214, or equivalent specification.

The current maximum allowable BioDiesel concentration is a 7% blend (also known as B7) in petroleum diesel fuel.

To learn of any changes to the recommendations for BioDiesel usage with your diesel engine, ask your John Deere dealer.

Handling and Storing Diesel Fuel

CAUTION: Avoid injury! Handle fuel carefully. Do not fill the fuel tank when engine is running.

Do not smoke while you fill the fuel tank or service the fuel system.

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 also forms. The gel and flakes quickly plug fuel filters and damage fuel injectors and fuel pumps.

- Fill the fuel tank at the end of each day's operation to prevent water condensation and freezing during cold weather.
- When fuel is stored for an extended period, or if there is a slow turnover of fuel, add a fuel conditioner to stabilize the fuel and to prevent water condensation. Contact your fuel supplier for recommendations.

OUMX258,00005F3 -19-04NOV14-1/1

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 deicers 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.

OUO1086,1000403 -19-15JUN12-1/1

Engine Oil

Use oil viscosity based on the expected air temperature range during the period between oil changes.

The following John Deere oils are preferred:

- John Deere Plus-50™ II
- John Deere Torq-Gard™ Supreme

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

U.S. and Canada (Models with aftertreatment device)

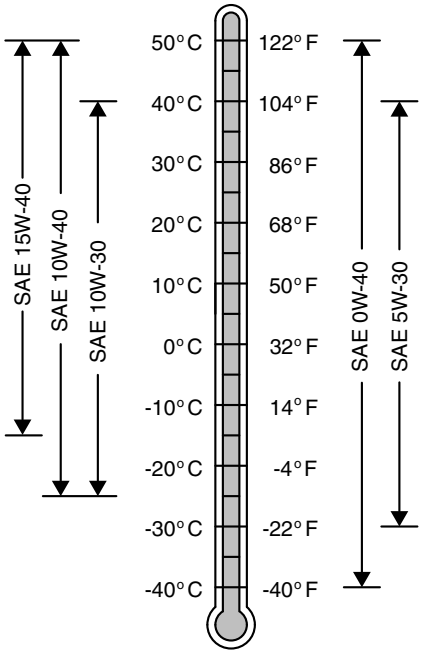
- API Service Classification CJ—4
- ACEA Specification E6 or E9
- JASO Specification DH—2

E.U. (Models without aftertreatment device)

- API Service Classification CD, CF, CF—4, CI—4, CJ—4
- ACEA Specification E—3, E—4, E—5 or E—6
- JASO Specification DH—1 or H—2

Diesel fuel quality and fuel sulfur content must comply with all existing emissions regulations for the area in which the engine operates.

Plus-50 is a trademark of Deere & Company
Torq-Gard is a trademark of Deere & Company



Oil Viscosities for Air Temperature Ranges

OUMX258,00005F4 -19-24APR15-1/1

Oil Filters

IMPORTANT: Avoid 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.**

OUO1086,100040F -19-15JUN12-1/1

Hydrostatic Transmission and Hydraulic Oil

IMPORTANT: Avoid Damage! Machine is filled with John Deere Hy-Gard™ J20C Transmission/Hydraulic Oil at the factory. DO NOT mix oils. DO NOT use type "F" automatic transmission fluid.

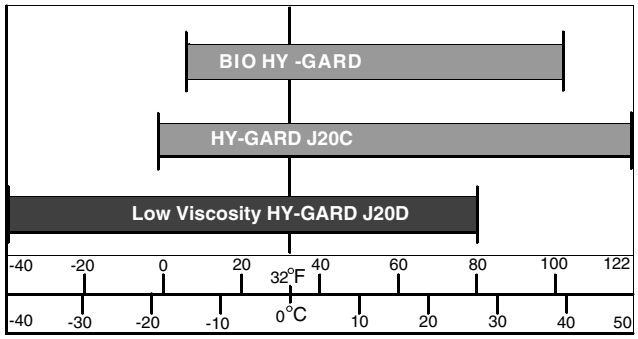
Use oil viscosity based on the expected air temperature range during the period between oil changes.

John Deere J20C HY-GARD Transmission/Hydraulic Oil is recommended.

Use John Deere BIO HY-GARD™ oil when a biodegradable fluid is required.

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

Hy-Gard is a trademark of Deere & Company



- John Deere Standard JDM J20C.

OUO2003,000000B -19-06JUN14-1/1

Biodegradable Oil

Application

IMPORTANT: Avoid Damage! Biodegradable oils, other than BIO HY-GARDHy-Gard™ , are not recommended.

When use of a biodegradable lubricant is desired or required, BIO HY-GARD is recommended. BIO HY-GARD may be used under normal mowing conditions.

DO NOT USE biodegradable lubricants in machines for the following operations:

- Any machine used for scalping procedure.
- Any verticut operation in temperatures exceeding 32°C (90°F).

BIO HY-GARD should be used only in cases where the benefits of its use offset the extra initial cost, the increased oil change cost and the potential increasing maintenance costs for hydraulic systems with high temperatures and heavy loads.

- If the natural color of the fluid has become black, it is possible an overheating problem exists. Change the fluid.
- If the fluid becomes milky, water contamination may be a problem. Investigate the source of the contamination.
- Take fluid level reading when system is cold.
- Mixing of biodegradable oil and mineral oil will reduce the biodegradability of the lubricant in the machine. Mixing of HY-GARD and BIO HY-GARD will not result in performance deterioration.

Hy-Gard is a trademark of Deere & Company

Cold Weather Operation

Precautions should be taken if BIO HY-GARD containers or equipment are stored for long periods of time in extremely cold temperatures. Freezing should be expected if BIO HY-GARD is subjected to the following temperatures:

- Stored for six months at -18° to -23°C (-1° to -10°F)
- Stored for seven days at -23° to -26°C (-10° to -15°F)
- Stored for three days at -26° to -29°C (-15° to -20°F)
- Stored for two days at -29° to -34°C (-20° to -30°F)
- Stored for one day at -34°C (-30°F) and below.

IMPORTANT: Avoid Damage! Equipment should not be started or any operation attempted until BIO HY-GARD has reached a safe operating viscosity.

If freezing of BIO HY-GARD is suspected, the container or equipment MUST be warmed to at least 0°C (32°F) and maintained for 24-48 hours to ensure the fluid has reached a safe operating viscosity.

OUO1086,1000407 -19-15JUN12-1/1

Converting From HY-GARD to BIO HY-GARD

Systems being converted from HY-GARD to BIO HY-GARD should follow the procedure listed below to obtain maximum lubricant biodegradability.

1. Park machine on a level surface.
2. Lower cutting units, stop engine, set park brake and remove key from ignition.
3. Drain hydraulic reservoir.
4. Replace hydraulic filter.
5. Fill reservoir with BIO HY-GARD to appropriate level.
6. Start engine and bring to medium idle.
7. Turn steering wheel full stroke several times and cycle cutting units several times.
8. Stop engine and check hydraulic oil level. Add BIO HY-GARD to appropriate level.
9. Operate machine under normal operating conditions for a minimum of two hours.
10. Repeat steps 1-8.
11. Follow recommended maintenance schedules.

OUO1086,1000408 -19-15JUN12-1/1

Grease - North America

IMPORTANT: Avoid Damage! ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIOGREASE in this application.

The following John Deere greases are preferred for the machine and lift arms:

- **John Deere Special Purpose HD Water Resistant Grease.**
- **John Deere Multi-Purpose HD Lithium Complex Grease.**

The following John Deere greases are preferred for the cutting units and unit attachments:

- **John Deere Golf and Turf Cutting Unit Grease.**
- **John Deere Cornhead Grease.**
- **John Deere Cotton Picker Spindle Grease.**

Other greases may be used if above preferred John Deere greases are not available, provided they meet the following specifications:

- **Polyurea Grease - NLGI Grade 2.**
- **Calcium Complex Grease - NLGI Grade 2.**
- **John Deere Standard JDM J13E4 - NLGI Grade 2.**

OUO1086,1000409 -19-15JUN12-1/1

Grease - Europe

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

IMPORTANT: Avoid Damage! ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIOGREASE in this application.

The following John Deere greases are PREFERRED:

- **GREASE-GARD™ - JDM J13E4, NLGI Grade 2.**
- **Reel Support Grease - JDM J13E6, NLGI Grade 0.**

Other greases may be used if above preferred John Deere greases are not available, provided they meet the following specifications:

Reel Support Grease Applications:

- Polyurea Grease - NLGI Grade 2.
- Calcium Complex Grease - Grade 2.
- Lithium Complex Grease - NLGI Grade 0.
- John Deere Standard JDM J13E4 - NLGI Grade 2.

OUO1086,100040A -19-15JUN12-1/1

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.

OUO1086,100040B -19-15JUN12-1/1

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.

OUO1086,100040C -19-15JUN12-1/1

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.

OUO1086,100040D -19-15JUN12-1/1

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.

OUO1086,100040E -19-15JUN12-1/1

Diesel Engine Coolant

Preferred coolants:

The following pre-mix engine coolants are preferred:

- **John Deere Cool-Gard™ II**
- **John Deere Cool-Gard™ II PG**

Not all Cool-Gard™ II pre-mix products are available in all countries.

Use COOL-GARD™ II PG when a non-toxic coolant formulation is required.

Additional Recommended Coolants

The following engine coolant is also recommended:

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

IMPORTANT: When mixing coolant concentrate with water, do not use less than 40% or greater than 60% concentration of coolant. Less than 40% gives inadequate additives for corrosion protection. Greater than 60% can result in coolant gelation and cooling system problems.

Other Coolants

Other ethylene glycol or propylene glycol base coolants may be used if they meet one of the following specifications:

- Pre-mix coolant meeting ASTM D6210 requirements
- Coolant concentrates meeting ASTM D6210 requirements in a 40% to 60% mixture of concentrate with quality water
- Pre-mix coolant meeting ASTM D3306 requirements
- Coolant concentrates meeting ASTM D3306 requirements in a 40% to 60% mixture of concentrate with quality water

If coolant meeting one of these specifications is unavailable, use a coolant concentrate or pre-mix coolant that has a minimum of the following chemical and physical properties:

- Is formulated with a quality nitrite-free additive package.
- Protects the cooling system metals (cast iron, aluminum alloys, and copper alloys such as brass) from corrosion.

Water Quality

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

Coolant Drain Intervals

Drain and flush the cooling system and refill with fresh coolant at the indicated interval, which varies with the coolant used.

When COOL-GARD™ II or COOL-GARD™ II PG is used, the drain interval is 6 yr. or 6000 operating hours.

If a coolant other than COOL-GARD™ II or COOL-GARD™ II PG is used, reduce the drain interval to 2 yr. or 2000 operating hours.

IMPORTANT: Do not use cooling system sealing additives or antifreeze that contains sealing additives.

IMPORTANT: Do not mix ethylene glycol and propylene glycol base coolants.

IMPORTANT: Do not use coolants that contain nitrites.

Cool-Gard is a trademark of Deere & Company

UP00731,0000022 -19-15APR15-1/1

John Deere COOL-GARD™ II Coolant Extender

Some coolant additives gradually deplete during engine operation. For COOL-GARD™ II pre-mix and COOL-GARD II Concentrate, replenish coolant additives between drain intervals by adding COOL-GARD II Coolant Extender.

COOL-GARD II Coolant Extender should not be added unless indicated by COOL-GARD II Test Strips. These test strips provide a simple, effective method to check the freeze point, additive levels, and pH of your engine coolant.

Test the coolant solution at intervals of 12 months and whenever excessive coolant is lost through leaks or overheating.

IMPORTANT: Do not use COOL-GARD II Test Strips with COOL-GARD II PG.

COOL-GARD II Coolant Extender is a chemically matched additive system for use with all COOL-GARD II coolants.

COOL-GARD is a trademark of Deere & Company

COOL-GARD II Coolant Extender is not intended for use with nitrite-containing coolants.

IMPORTANT: Do not add a supplemental coolant additive when the cooling system is drained and refilled with any of the following:

- **John Deere COOL-GARD II**
- **John Deere COOL-GARD II PG**

The use of non-recommended supplemental coolant additives can result in additive drop-out, gelation of the coolant, or corrosion of cooling system components.

Add the recommended concentration of COOL-GARD II Coolant Extender. DO NOT add more than the recommended amount.

DX,COOL16 -19-15MAY13-1/1

Diesel Engine Coolant Drain Interval - North America

When using John Deere Pre-Diluted (TY16036) Automobile and Light Duty Engine Service coolants, drain and flush the cooling system and refill with fresh coolant mixture every 36 months or 3,000 hours of operation, whichever comes first.

When using John Deere Concentrate (TY16034) Automobile and Light Duty Engine Service coolants, drain and flush the cooling system and refill with fresh coolant mixture every 24 months or 2,000 hours of operation, whichever comes first.

If above John Deere Automobile and Light Duty Engine Service coolants are not being used, drain, flush, and refill the cooling system according to instructions found on product container or in equipment operator's manual or technical manual.

OUO1086,1000411 -19-15JUN12-1/1

Diesel Engine Coolant Drain Interval - Europe

When using John Deere COOL-GARD Coolant Concentrate for Automobile and Light Duty Engine Service, drain and flush the cooling system and refill with fresh coolant mixture every 24 months or 2,000 hours of operation, whichever comes first.

If above John Deere Automobile and Light Duty Engine Service coolant is not being used, drain, flush, and refill the cooling system according to instructions found on product container or in equipment operator's manual or technical manual.

OUO1086,1000413 -19-15JUN12-1/1

Machine Specifications

NOTE: Specifications and design subject to change without notice.

	7500A E-Cut	8000A E-Cut
Ground Speed:		
Forward	0—19.31 km/h (0—12.5 mph)	0—9.66 km/h (0—9 mph)
Reverse	0—9.66 km/h (0—6.0 mph)	0—9.66 km/h (0—6.0 mph)
Mow Speed	12.07—13.7 km/h (7.5—8.5 mph)	8.85—9.66 km/h (5.5—6.5 mph)
Engine Non Tier 4:		
Make	Yanmar	
Engine Model (non-Tier 4 engines)	3TNV84T	
Oil Capacity	5.5 L (5.8 qt.)	
Coolant Capacity	7.3 L (7.75 qt.)	
Bore	84 mm (3.31 in.)	
Stroke	90 mm (3.54 in.)	
Displacement	1.496 L (91.3 cu. in.)	
Engine Tier 4:		
Make	Yanmar	
Engine Model	3TNV86CT	
Oil Capacity	5.3 L (5.5 qt.)	
Coolant Capacity	7.3 L (7.75 qt.)	
Bore	86 mm (3.4 in.)	
Stroke	90 mm (3.54 in.)	
Displacement	1.568 L (95.7 cu. in.)	
Fuel System:		
Type	Diesel	
Tank Capacity	60 L (16 gal.)	43.9 L (11.6 gal.)
Electrical System:		
Type	12 Volt Negative Ground	
Battery	12-volt	
Battery Type	500 CCA	
Power Train:		
Type	Hydrostatic Pump	
Drive	Hydraulic 2 Wheel Drive	Hydraulic 3 Wheel Drive
Hydraulic System Oil Capacity	39.75 L (10.5 gal.)	
Reservoir Oil Capacity	37.85 L (10.0 gal.)	
Transmission Oil	John Deere High Viscosity HY-GARD™ J20C	
Steering and Brakes:		
Steering	Power Steering	
Brake Type	Spring applied, pressure released integrated wet disk brakes	

OUMX258,0000A5A -19-19JUN14-1/1

Serial Number Location

When ordering parts or submitting a warranty claim, it is IMPORTANT that you include the mower product identification number and the component serial numbers.

The locations of mower identification number and component serial numbers are shown.

OUMX068,0000374 -19-15JAN13-1/1

Product Identification Number

The product identification number plate (A) is located on the frame at the operator platform step on the 7500A or on the back of the front axle on the 8000A in nearly the same position.

TCT008876 —UN—22OCT13

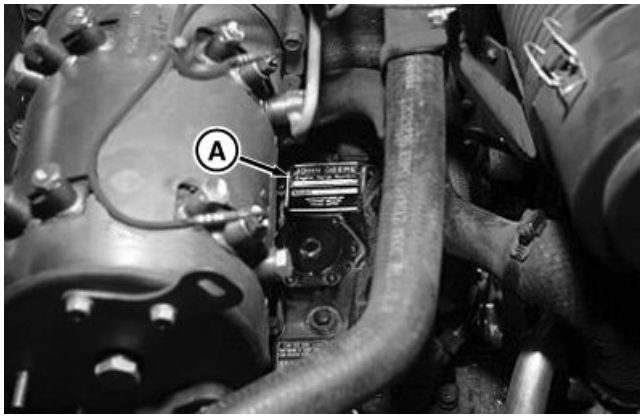
7500A Shown

OUMX258,0000A58 -19-21OCT13-1/1

Engine Identification Number

The engine serial number plate (A) is located on the top of the valve cover.

A—ID Number Plate



TCT008875 —UN—22OCT13

OUMX258,0000A59 -19-21OCT13-1/1

Attachment Identification Number

The attachment serial number plate (A) is located on a crossmember at the motor end of the frame.

A—ID Number Plate

TCT008877 —UN—22OCT13

SW00544,0000038 -19-21OCT13-1/1

Section 20
Engine Repair

Contents

Page

Group 10—Starting Motor Repair
Summary of References ... 20-10-1
Remove and Install Starting Motor ... 20-10-1
Remove Starting Motor—3TNV86CT ... 20-10-1
Install Starting Motor—3TNV86CT ... 20-10-4
Disassemble and Assemble Starting Motor ... 20-10-6
Inspect and Test Starting Motor ... 20-10-8
Disassemble and Assemble Starter Gear Train ... 20-10-10
Disassemble, Inspect, and Assemble Starter Solenoid ... 20-10-13

Group 20—Turbocharger Repair
Summary of References ... 20-20-1
Remove and Install Turbocharger ... 20-20-1
Repair Turbocharger ... 20-20-1
Prelube Turbocharger ... 20-20-2

Group 30—Engine Repair 3TNV84T
Summary of References ... 20-30-1
Remove 12 Volt Alternator Drive Belt ... 20-30-1
Install 12 Volt Alternator Drive Belt ... 20-30-3
Remove 48 Volt Alternator Drive Belt ... 20-30-4
Install 48 Volt Alternator Drive Belt ... 20-30-5
Remove and Install Engine ... 20-30-6
Remove and Install Rocker Arm Cover ... 20-30-9
Remove and Install Rocker Arm Assembly ... 20-30-10
Inspect Rocker Arm Assembly ... 20-30-11
Remove and Install Cylinder Head and Valves ... 20-30-13
Disassemble and Assemble Cylinder Head and Valves ... 20-30-14
Inspect Cylinder Head and Valves ... 20-30-14
Remove and Install Exhaust Manifold ... 20-30-19
Remove and Install Intake Manifold ... 20-30-20
Grind Valve Seats ... 20-30-20
Lap Valves ... 20-30-21
Measure Piston-to-Cylinder Head Clearance ... 20-30-22

Page

Remove and Install Piston and Connecting Rod ... 20-30-23
Disassemble and Assemble Piston and Connecting Rod ... 20-30-25
Inspect Piston and Connecting Rod ... 20-30-27
Inspect Cylinder Bore ... 20-30-31
Inspect Cylinder Bore Taper and Out-of-Round ... 20-30-33
Replace Crankshaft Rear Oil Seal ... 20-30-33
Replace Crankshaft Front Oil Seal ... 20-30-34
Remove and Install Crankshaft and Main Bearings ... 20-30-35
Inspect Crankshaft and Main Bearings ... 20-30-36
Remove and Install Crankshaft Gear ... 20-30-38
Remove and Install Flywheel ... 20-30-38
Remove and Install Camshaft ... 20-30-40
Inspect Camshaft ... 20-30-41
Remove and Install Camshaft Gear ... 20-30-43
Remove and Install Cam Followers ... 20-30-44
Inspect Cam Followers ... 20-30-44
Remove and Install Timing Gear Cover ... 20-30-45
Remove and Install Idler Gear ... 20-30-46
Inspect Idler Gear ... 20-30-47
Remove and Install Timing Gear Cover Mounting Plate ... 20-30-47
Remove and Install Oil Pan, Crankcase Extension, and Strainer ... 20-30-48
Remove and Install Oil Pump ... 20-30-48
Disassemble and Assemble Oil Pump ... 20-30-49
Inspect Oil Pump ... 20-30-49
Remove and Install Oil Cooler ... 20-30-51
Remove and Install Thermostat ... 20-30-51
Inspect Coolant Pump ... 20-30-52
Remove and Install Coolant Pump ... 20-30-52
Disassemble and Assemble Water Separator ... 20-30-53
Remove Fuel Injection Pump ... 20-30-54
Install Fuel Injection Pump ... 20-30-57
Remove and Install Fuel Injection Nozzle ... 20-30-59

Continued on next page

Page

Disassemble and Assemble Fuel Injection Nozzles 20-30-60
Inspect and Clean Fuel Injection Nozzles 20-30-62

Group 40—Engine Repair 3TNV86CT
Summary of References 20-40-1
Engine Information 20-40-1
Service Fuel Filter and Water Separator 20-40-1
Remove Engine 3TNV86CT 20-40-3
Install Engine 3TNV86CT 20-40-10

Summary of References

- Remove and Install Starting Motor
- Remove Starting Motor—3TNV86CT
- Install Starting Motor—3TNV86CT
- Disassemble and Assemble Starting Motor
- Inspect and Test Starting Motor
- Disassemble and Assemble Starter Gear Train
- Disassemble, Inspect, and Assemble Starter Solenoid

OUMX258,00006D3 -19-10MAR14-1/1

Remove and Install Starting Motor

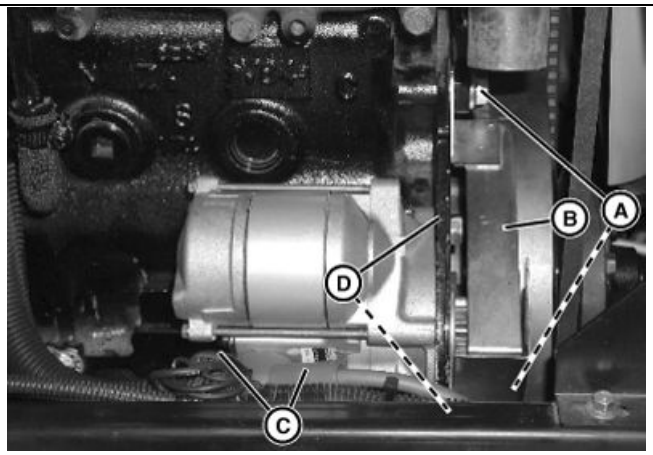
Removal

1. Disconnect battery.
2. Remove shield mounting cap screws (A) and shield (B).
3. Disconnect wires (C) to starting motor.
4. Remove starting motor mounting cap screws (D) and nuts.

Installation

NOTE: One side of the two starting motor nuts is machined flat and should be installed toward the starting motor flange.

Installation is done in the reverse order of removal.



TCAL25398 —UN—15JUN12

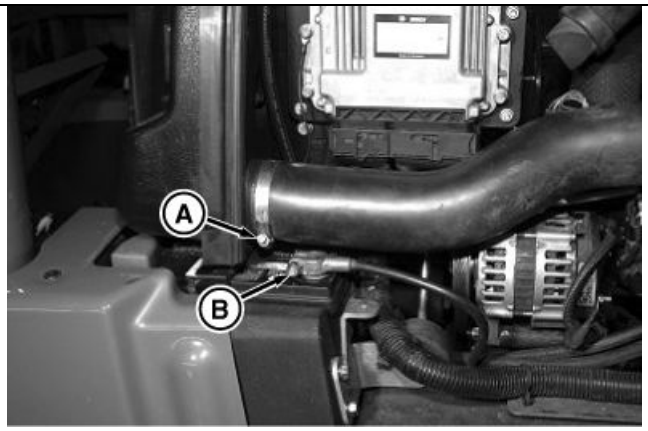
A—Cap Screws
B—Shield
C—Wires
D—Cap Screws

OUMX258,00006A8 -19-05NOV12-1/1

Remove Starting Motor—3TNV86CT

1. Park machine safely. See “Park Machine Safely.”
2. Raise engine cover.
3. Loosen clamp (A) and remove air duct.
4. Loosen nut (B) and remove cable from negative (-) battery terminal.

A—Hose Clamp
B—Battery Connector Nut



TCT009230 —UN—31OCT13

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SW00544,0000040 -19-11NOV13-1/5

5. Loosen clamps (C) and remove air duct.

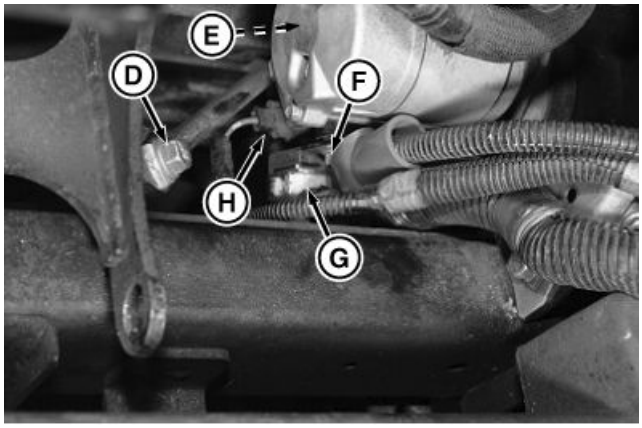
C—Hose Clamp (2 used)

TCT009293 —UN—08NOV13

SW00544,0000040 -19-11NOV13-2/5

6. Remove bolt (D) and loosen bolt (E) securing alternator brace.
7. Retract boot and remove nut (F) securing battery connector and fuse (G) to starter terminal.
8. Remove wire harness connector (H).

D—Hex Bolt
E—Hex Bolt
F—Hex Nut
G—Main Fuse
H—Solenoid Wire Harness Connector

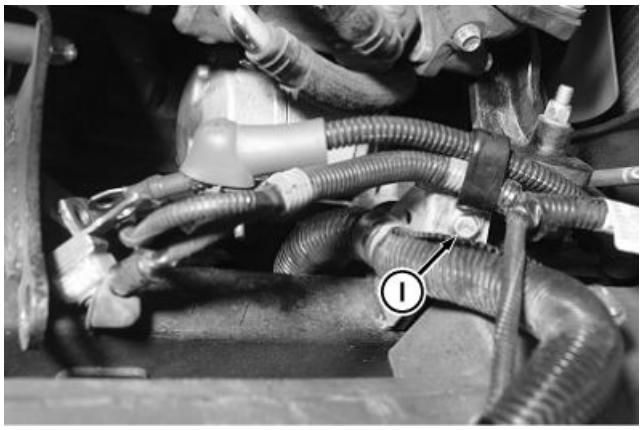


TCT009294 —UN—08NOV13

SW00544,0000040 -19-11NOV13-3/5

9. Remove bolt (I) securing wire harness retainer. Move wire harness from work area.

I— Hex Bolt



TCT009295 —UN—08NOV13

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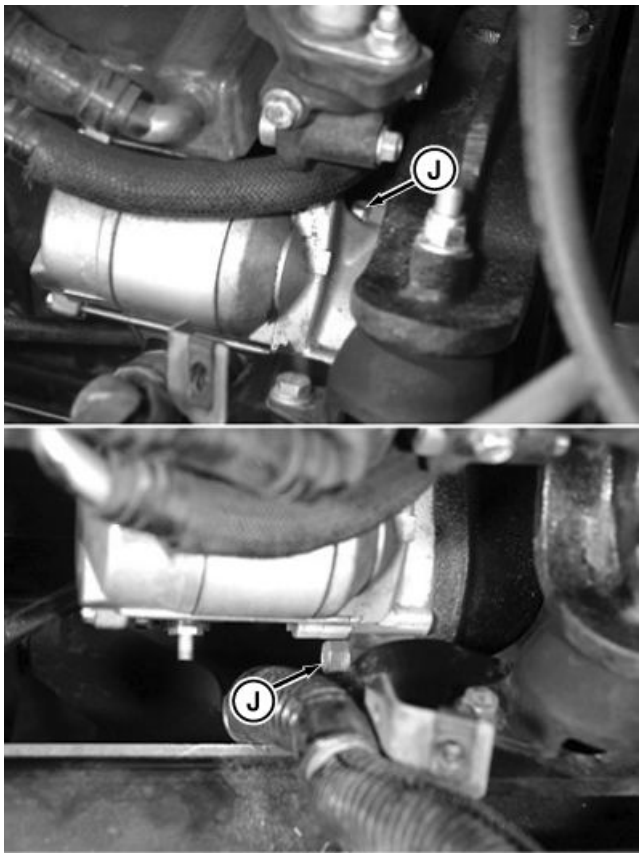
SW00544,0000040 -19-11NOV13-4/5

10. Support starting motor and remove bolts (J). Remove starting motor.

J— Hex Bolt (2 used)

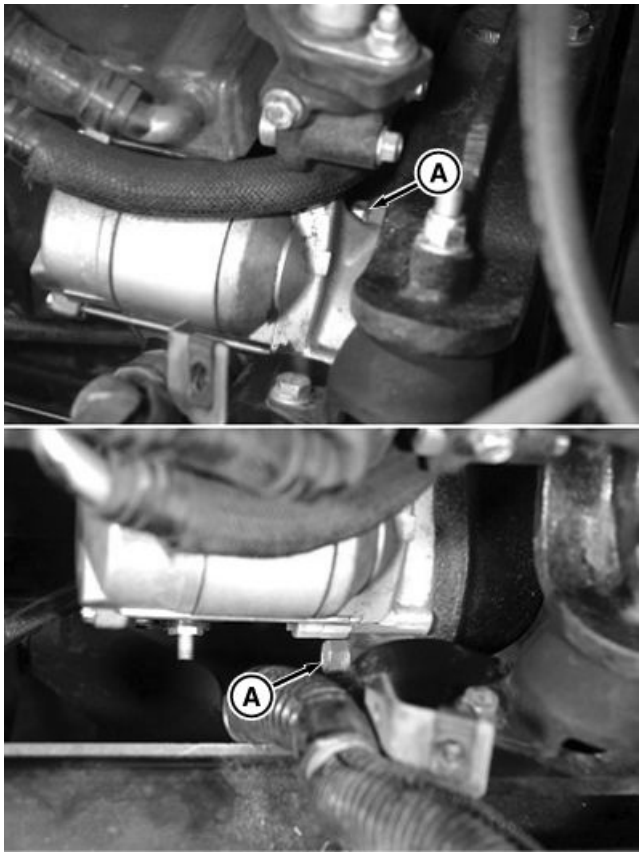


TCT009296 —UN—08NOV13

SW00544,0000040 -19-11NOV13-5/5

Install Starting Motor—3TNV86CT

1. Position starting motor at flywheel housing and secure with bolts (A). Tighten bolts to specification.

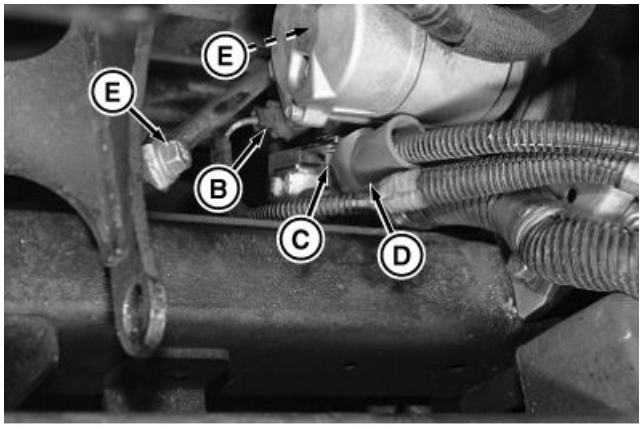


TCT009297 —UN—08NOV13

SW00544,0000041 -19-19NOV13-1/5

2. Install wire harness connector ((B).
3. Install battery connector (C) and fuse (D) to starter terminal. Secure with nut. Cover nut and terminal with boot.
4. Secure alternator brace with bolts (E). Tighten bolts to specification.

B—Solenoid Wire Harness Connector
C—Battery Connector
D—Main Fuse
E—Hex Bolt (2 used)



TCT009298 —UN—08NOV13

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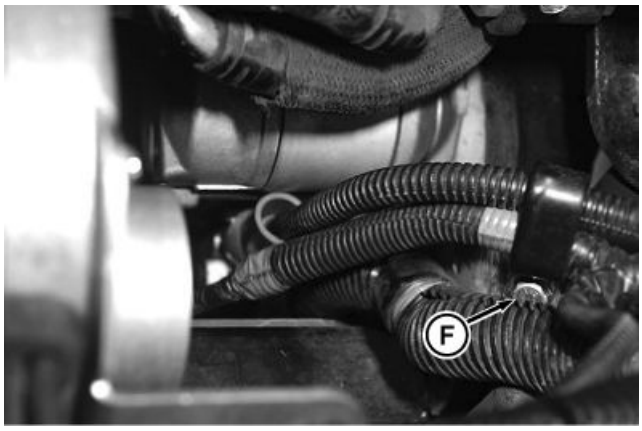
SW00544,0000041 -19-19NOV13-2/5

5. Secure wire harness retainer with bolt (F).

F—Hex Bolt



TCT009311 —UN—13NOV13

SW00544,0000041 -19-19NOV13-3/5

6. Install duct and secure clamps (G).

G—Hose Clamp

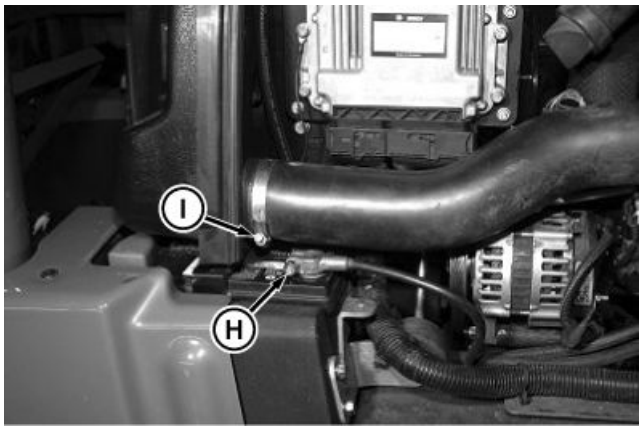
TCT009300 —UN—08NOV13

SW00544,0000041 -19-19NOV13-4/5

7. Install cable to negative battery terminal and tighten nut (H).
8. Install duct and tighten clamp (I).

H—Hex Nut (H)

I— Hose Clamp



TCT009301 —UN—08NOV13

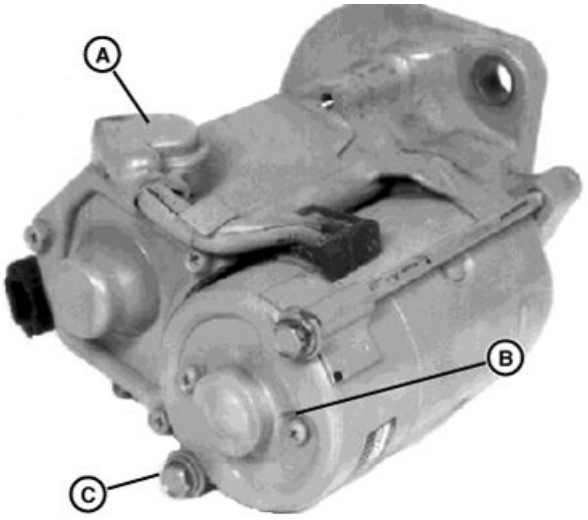
SW00544,0000041 -19-19NOV13-5/5

Disassemble and Assemble Starting Motor

Disassembly

1. Disconnect field lead (A).
2. Remove two cap screws (C) that attach motor to clutch housing. Remove motor.
3. Remove two screws (B) that attach rear cover to brush holder.

A—Field Lead
B—Cap Screws (2 Used)
C—Screws (2 Used)

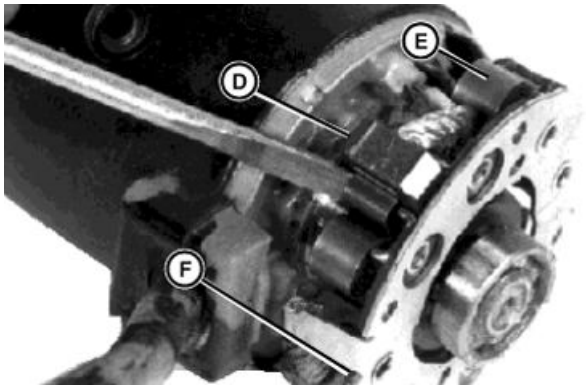


TCAL25399 —UN—15JUN12

OUMX258,00006A9 -19-05NOV12-1/6

4. Remove both field coil brushes (D) from brush holder (F).
5. Pry brush springs (E) away and pull negative brushes up enough to allow spring to hold brush in place.
6. Remove brush holder.

D—Field Coil Brushes
E—Brush Springs
F—Brush Holder

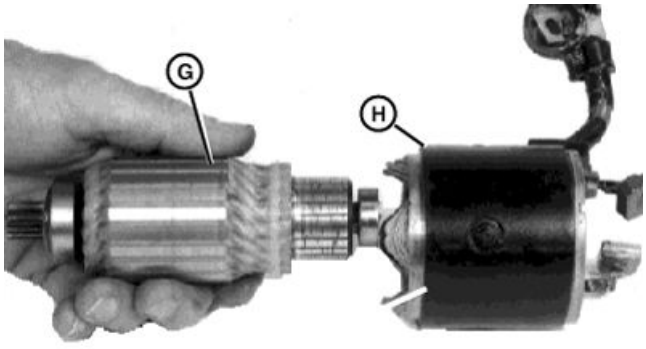


TCAL25400 —UN—15JUN12

OUMX258,00006A9 -19-05NOV12-2/6

7. Remove armature (G) from field coil housing (H).

G—Armature
H—Field Coil Housing



TCAL25401 —UN—15JUN12

1.4 kW shown; 2.0 kW is similar.

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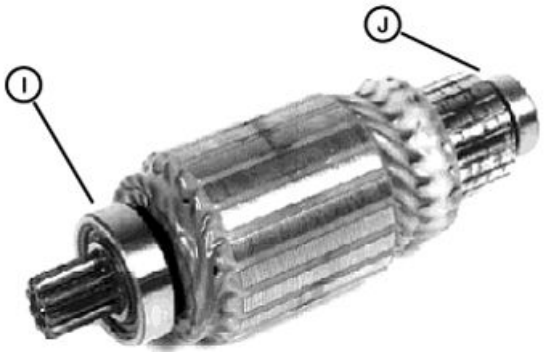
OUMX258,00006A9 -19-05NOV12-3/6

Replace Bearings

1. Bearings are press fit. Remove bearings using a knife-edge puller set.

IMPORTANT: Avoid Damage! Install both bearings with sealed side toward armature.

2. Install new housing bearing (I) tight against shoulder of shaft using a piece of pipe.
3. Install new rear cover bearing (J) tight against shoulder of shaft using a driver set.
4. Inspect and test brushes, holder, field coil, and armature.



TCAL25402 —UN—15JUN12

I— Housing Bearing **J— Rear Cover Bearing**

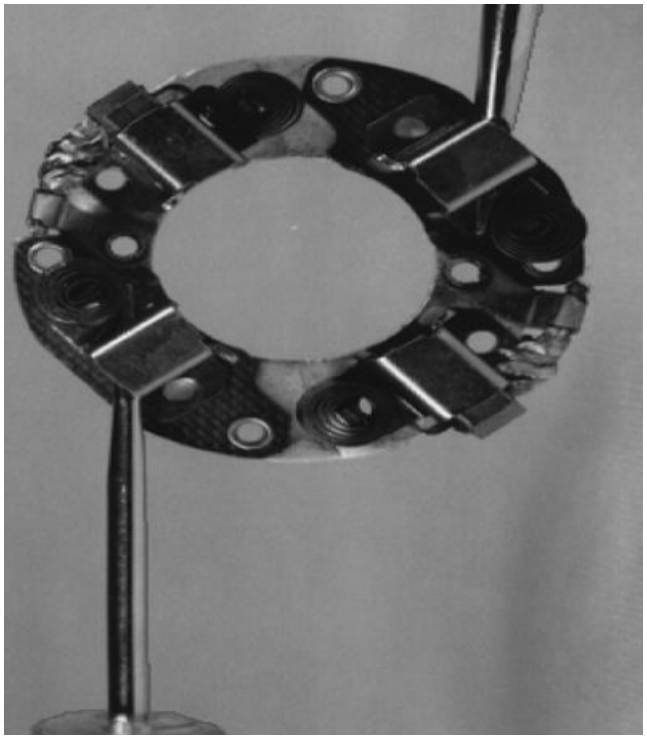
OUMX258,00006A9 -19-05NOV12-4/6

Assembly

Assembly is done in the reverse order of disassembly.

NOTE: A pair of small screwdrivers inserted between the brush springs and the housing before assembly will aid in inserting the brushes.

NOTE: Apply multipurpose grease to bearing cup inside rear cover.



TCAL25403 —UN—15JUN12

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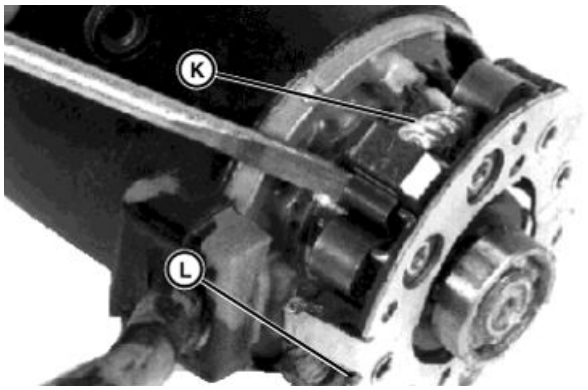
OUMX258,00006A9 -19-05NOV12-5/6

1. Turn brush holder (L) slightly to take up slack in brush wires.

IMPORTANT: Avoid Damage! When installing rear cover, be sure field coil brush wires do not touch cover.

2. Press wires (K) inward to clear rear cover.

K—Wires **L—Brush Holder**



TCAL25404 —UN—15JUN12

OUMX258,00006A9 -19-05NOV12-6/6

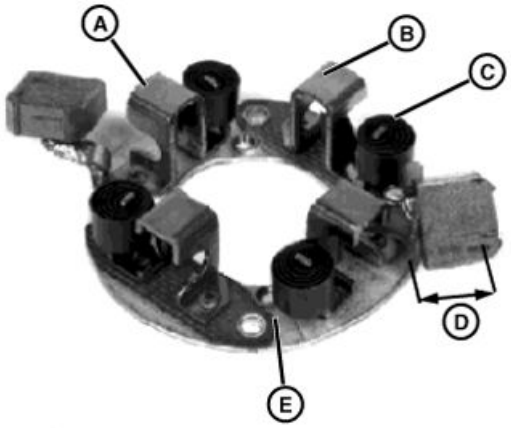
Inspect and Test Starting Motor

1. Measure brush lengths (D). Replace brush if length is below specification.

Specification	
Starting Motor Brush—Length (Minimum)	9.0 mm (0.354 in.)

NOTE: Test brush holder using an ohmmeter or test light.

2. Test brush holder (E):
   - Touch one probe of tester to negative brush holder (A) and other probe to field brush holder (B). If there is continuity, replace the brush holder.
3. Inspect springs (C) for wear or damage. Replace if necessary.



TCAL25405 —UN—15JUN12

A—Brush Holder
B—Field Brush Holder
C—Springs
D—Brush Lengths
E—Brush Holder

Continued on next page

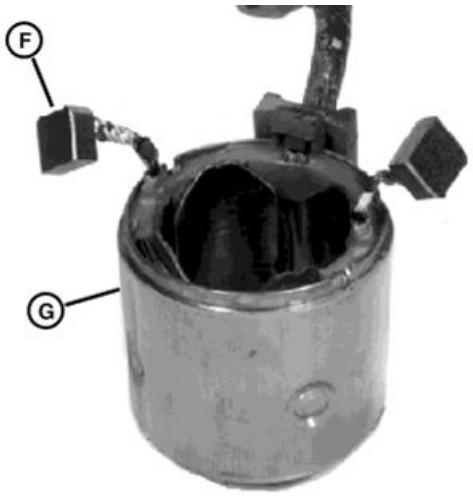
OUMX258,00006AA -19-05NOV12-1/5

NOTE: Test field coil using an ohmmeter or test light.

4. Test for grounded field winding:
   - Touch one probe of tester to field coil brush (F) and other probe to field coil housing (G).
   - Be sure the brush lead is not touching the frame. If there is continuity, the coil is grounded and the field coil housing assembly must be replaced.

IMPORTANT: Avoid Damage! Do not clean armature with solvent. Solvent can damage insulation on windings. Use only mineral spirits and a soft bristle brush.

5. Test for open field coil:
   - Touch one probe of tester to each field coil brush. If there is no continuity, the field coil is open and the field coil housing assembly must be replaced.
6. Inspect armature. Look for signs of dragging against pole shoes.
7. Inspect commutator. Look for roughness, burned bars, or any material that might cause short circuits between bars. If necessary, clean and touch up with 400-grit sandpaper. NEVER use emery cloth. Clean all dust from armature when finished.



TCAL25406 —UN—15JUN12

F—Field Coil Brush **G—Field Coil Housing**

OUMX258,00006AA -19-05NOV12-2/5

NOTE: Test armature windings using an ohmmeter or test light.

8. Test for grounded windings:
   - Touch probes on one commutator bar (H) and armature shaft (I). Armature windings are connected in series, so only one commutator bar needs to be checked. If test shows continuity, a winding is grounded and the armature must be replaced.
9. Test for open circuit windings:
   - Touch probes on two different bars on opposite sides of commutator. If test shows no continuity, there is an open circuit and the armature must be replaced.

TCAL25407 —UN—15JUN12

H—Commutator Bar **I— Armature Shaft**

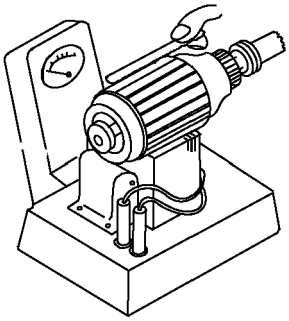
Continued on next page

OUMX258,00006AA -19-05NOV12-3/5

10. Test for short circuit 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 will vibrate on the slot.

NOTE: A short circuit most often occurs because of copper dust or filings between two commutator segments.

11. If test indicates short circuit windings, clean the commutator of dust and filings. Check the armature again. If the test still indicates a short circuit, replace the armature.
12. Inspect armature cover and housing bearings for wear or damage. Replace if necessary.



TCAL25408 —UN—15JUN12

OUMX258,00006AA -19-05NOV12-4/5

13. Replace bearings (J and K) if necessary.

J— Bearing **K—Bearing**

TCAL25409 —UN—15JUN12

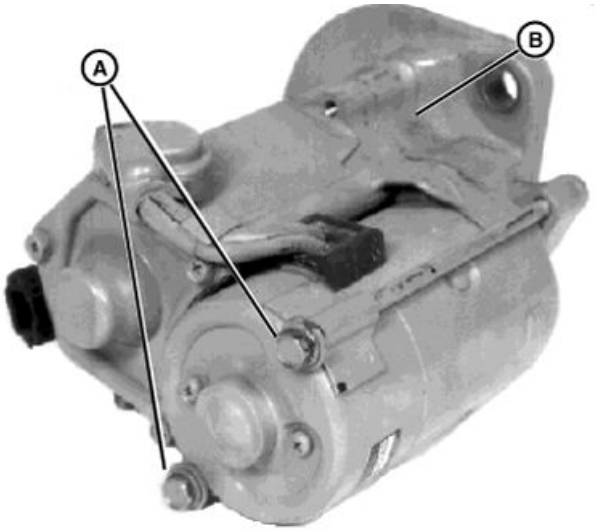
OUMX258,00006AA -19-05NOV12-5/5

Disassemble and Assemble Starter Gear Train

Disassembly

1. Remove field wire and two motor-to-clutch housing cap screws (A).
2. Remove motor from clutch housing (B).

A—Cap Screws (2 Used) **B—Clutch Housing**



TCAL25410 —UN—15JUN12

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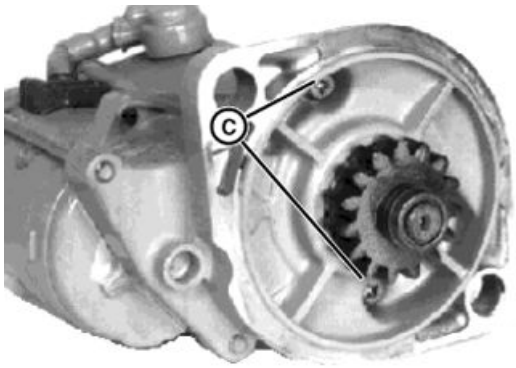
OUMX258,00006AB -19-05NOV12-1/7

3. Remove two clutch housing-to-solenoid housing screws (C) to separate clutch housing from solenoid/motor assembly.

C—Screws (2 Used)

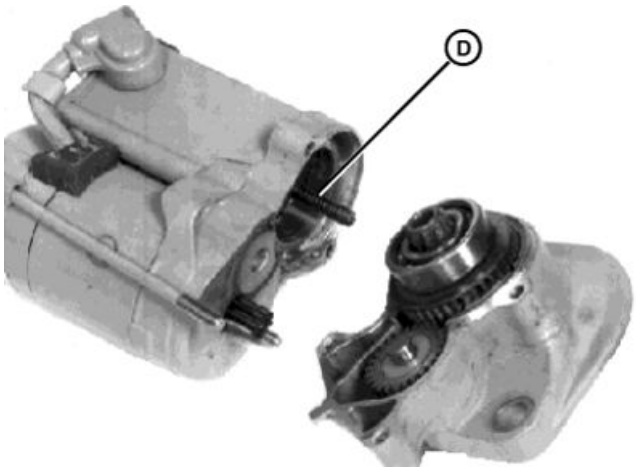


TCAL25411 —UN—15JUN12

OUMX258,00006AB -19-05NOV12-2/7

4. Remove plunger spring (D).

D—Plunger Spring

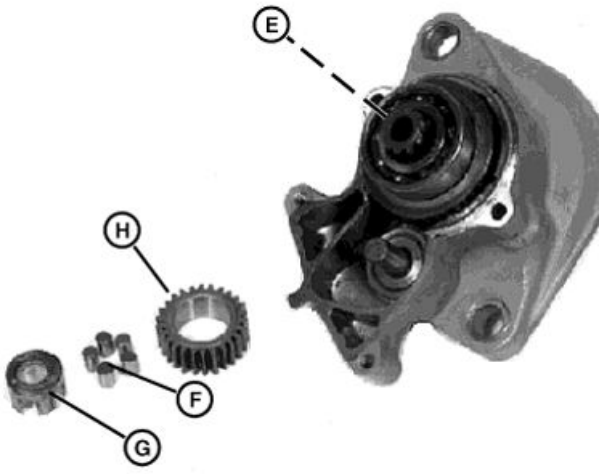


TCAL25412 —UN—15JUN12

OUMX258,00006AB -19-05NOV12-3/7

5. Remove retainer (G), five rollers (F) and pinion gear (H).
6. Remove steel ball (E).

E—Steel Balls
F—Rollers (5 Used)
G—Retainer
H—Pinion Gear



TCAL25413 —UN—15JUN12

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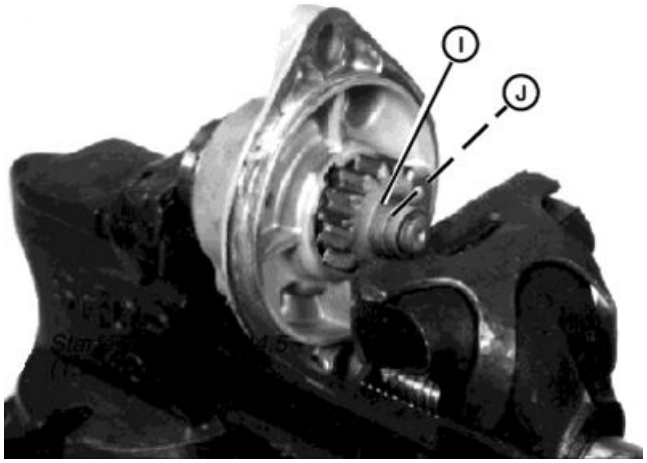
OUMX258,00006AB -19-05NOV12-4/7

7. Place clutch (housing) assembly into a soft-jawed vise, as shown.
8. Tighten vise slowly, until drive gear compresses.
9. Remove retainer (I) and circlip (J).

CAUTION: Avoid Injury! Shaft could be propelled from clutch unit with considerable force if spring is not allowed to extend fully while in vise.

10. While holding clutch assembly, slowly open vise until all spring compression is relieved.

I— Retainer
J— Circlip

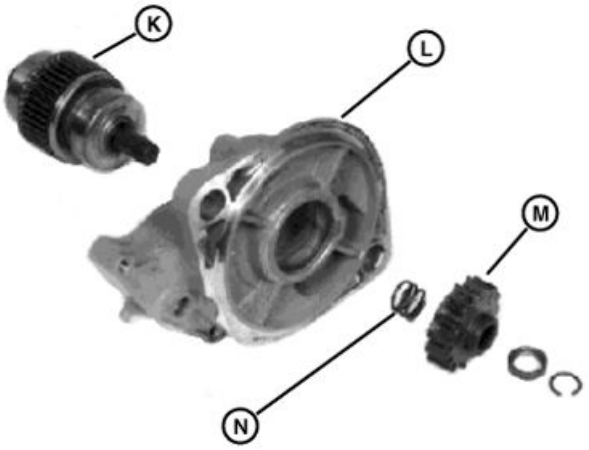


TCAL25414 —UN—15JUN12

OUMX258,00006AB -19-05NOV12-5/7

11. Remove drive gear (M), spring (N) and clutch assembly (K) from housing (L).
12. Remove large washer, toothed washer, spring, and clutch shaft.
13. Inspect all parts for wear or damage. Replace as necessary.

K—Clutch Assembly
L— Housing
M—Drive Gear
N—Spring



TCAL25415 —UN—15JUN12

OUMX258,00006AB -19-05NOV12-6/7

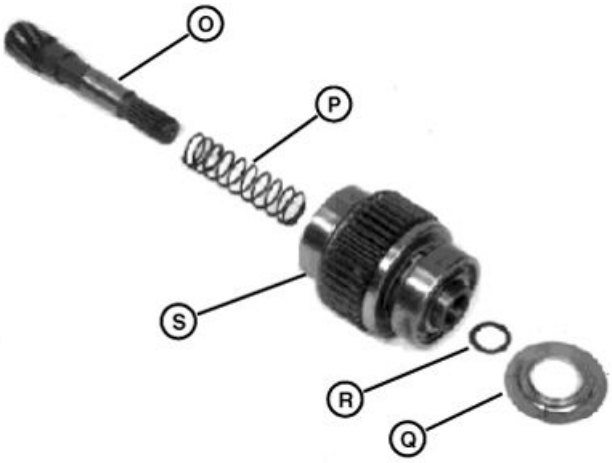
14. Remove large washer (not applicable to all models) (Q), toothed washer (R), spring (P), and clutch shaft (O) from clutch (S).

Assembly

Assembly is done in the reverse order of disassembly.

- Apply multipurpose grease to bearings, clutch shaft, springs, pinion gears, retainer, rollers, and steel ball.
- Install large washer (not applicable to all models) with flat side toward clutch assembly.
- Install retainer with cupped side away from clutch assembly.

O—Clutch Shaft
P—Spring
Q—Large Washer
R—Toothed Washer
S—Clutch



TCAL25416 —UN—15JUN12

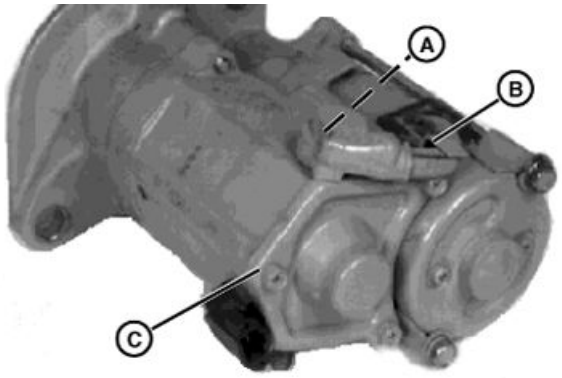
OUMX258,00006AB -19-05NOV12-7/7

Disassemble, Inspect, and Assemble Starter Solenoid

Disassembly

1. Disconnect field lead (A).
2. Remove three screws (C) and clip (B).
3. Remove cover and gasket.

A—Field Lead
B—Clip
C—Screws (3 Used)

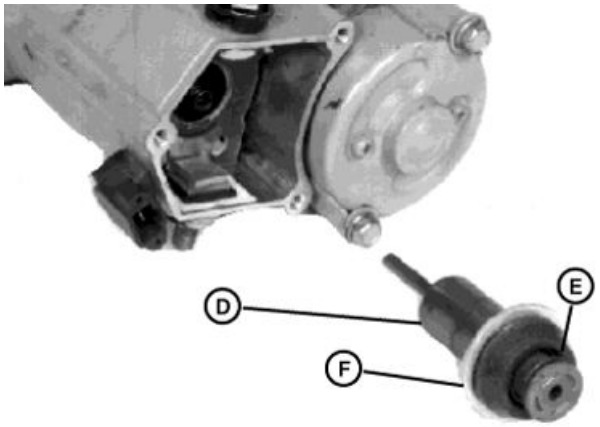


TCAL25417 —UN—15JUN12

OUO1086,10003F5 -19-15JUN12-1/3

4. Remove plunger (D).
5. Inspect the copper washer (F) and spring (E).

D—Plunger
E—Spring
F—Copper Washer



TCAL25418 —UN—15JUN12

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OUO1086,10003F5 -19-15JUN12-2/3

6. Inspect the contact plates (G) for excessive burning or pitting. Contacts and plunger come as a kit. If plunger or contacts are defective, replace all the parts with the kit.

Assembly

Assembly is done in the reverse order of disassembly.

NOTE: The assembly sequence of the left and right terminals is similar. Make sure smaller contact plate is on the left side.

- Install solenoid terminal lead (H) between terminal bolt (I) and contact plate (J).

G—Contact Plates

H—Solenoid Terminal Lead
I— Terminal Bolt
J— Contact Plate

TCAL25419 —UN—15JUN12

TCAL25420 —UN—15JUN12

OUO1086,10003F5 -19-15JUN12-3/3

Summary of References

- Remove and Install Turbocharger
- Repair Turbocharger
- Prelube Turbocharger

OUMX258,00006D4 -19-05NOV12-1/1

Remove and Install Turbocharger

Removal

CAUTION: Avoid Injury! Muffler may be hot. Allow muffler to cool before removing. A hot muffler can cause serious burns.

IMPORTANT: Avoid Damage! When cleaning turbocharger, DO NOT spray directly into compressor turbine housing. If inspection of turbocharger is required, do not clean exterior prior to removal. Doing so may wash away evidence of a potential failure mode.

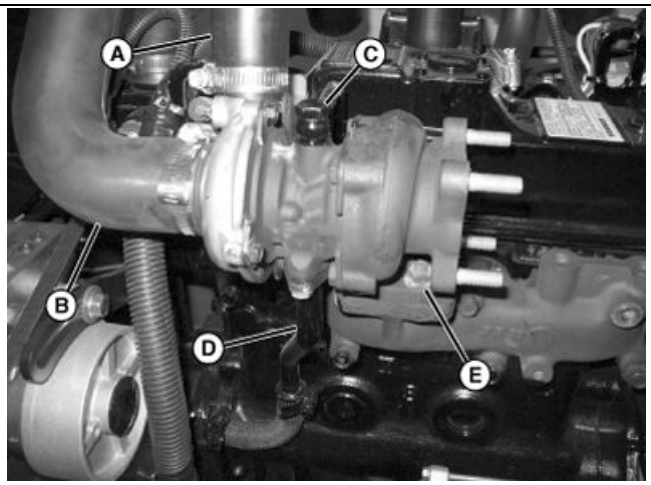
If inspection is not required, thoroughly clean exterior of turbocharger and surrounding area to prevent entry of dirt into the air intake system during removal.

1. Remove muffler and exhaust gasket.
2. Remove turbocharger-to-intake manifold or intercooler hose (A).
3. Remove air cleaner-to-turbocharger hose (B).
4. Remove oil supply line (C) with copper washers on top and bottom surface of oil supply line.
5. Remove oil drain line (D).
6. Remove three nuts (E).
7. Remove turbocharger and gasket.
8. Close all openings using caps and plugs to prevent contamination.

Installation

Installation is done in the reverse order of removal.

- Prelube turbocharger: Fill oil inlet or drain port with clean oil while turning rotating assembly (by hand) to properly lubricate bearings.



TCAL25422 —UN—15JUN12

A—Intercooler Hose
B—Air Cleaner-to-Turbocharger Hose
C—Oil Supply Line
D—Oil Drain Line
E—Nuts (3 Used)

- Install new gasket between exhaust manifold and turbocharger.
- Install new O-ring on oil drain line.
- Install new copper washers on oil supply line.

IMPORTANT: Avoid Damage! A new or repaired turbocharger does not have an adequate oil supply for immediate start-up of engine. Perform the following steps to prevent damage to turbocharger bearings.

1. Disconnect fuel shutoff connector.
2. Crank engine over with starter until oil pressure light goes out. DO NOT crank engine longer than 30 seconds at a time to avoid damaging the starter.

OUO1086,10003F7 -19-15JUN12-1/1

Repair Turbocharger

Turbochargers used on the engines covered in this manual are available through service parts as a complete assembly only. Individual components for repair are not available.

OUO1086,10003F8 -19-15JUN12-1/1

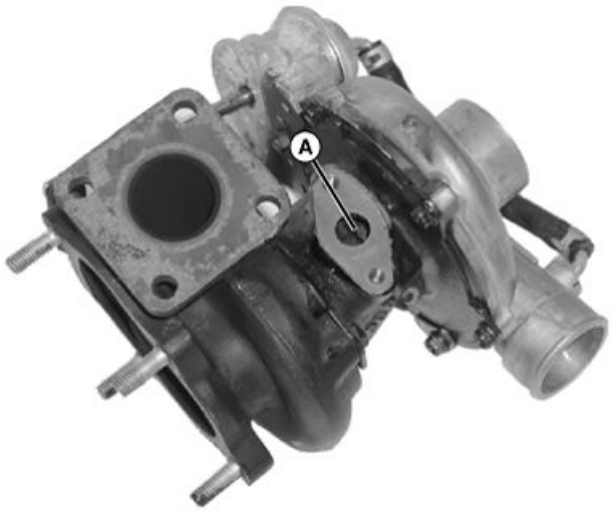
Prelube Turbocharger

IMPORTANT: Avoid Damage! DO NOT spin the rotor assembly with compressed air. Damage to bearings can occur when using compressed air.

Fill oil inlet or drain port (A) with clean engine oil and turn rotating assembly (by hand) to properly lubricate bearings.

If turbocharger is to be stored for an extended period of time, lubricate internally and install protective covers on all openings.

A—Drain Port



TCAL25423 —UN—15JUN12

OUO1086,10003F9 -19-15JUN12-1/1

Summary of References

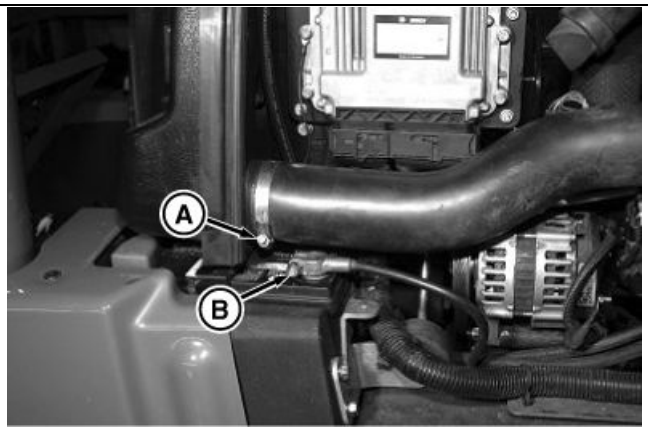
- Remove 12 Volt Alternator Drive Belt
- Install 12 Volt Alternator Drive Belt
- Remove 48 Volt Alternator Drive Belt
- Install 48 Volt Alternator Drive Belt
- Remove and Install Engine
- Remove and Install Rocker Arm Cover
- Remove and Install Rocker Arm Assembly
- Inspect Rocker Arm Assembly
- Remove and Install Cylinder Head and Valves
- Disassemble and Assemble Cylinder Head and Valves
- Inspect Cylinder Head and Valves
- Remove and Install Exhaust Manifold
- Remove and Install Intake Manifold
- Grind Valve Seats
- Lap Valves
- Measure Piston-to-Cylinder Head Clearance
- Remove and Install Piston and Connecting Rod
- Disassemble and Assemble Piston and Connecting Rod
- Inspect Piston and Connecting Rod
- Inspect Cylinder Bore
- Inspect Cylinder Bore Taper and Out-of-Round
- Replace Crankshaft Rear Oil Seal
- Replace Crankshaft Front Oil Seal
- Remove and Install Crankshaft and Main Bearings
- Inspect Crankshaft and Main Bearings
- Remove and Install Crankshaft Gear
- Remove and Install Flywheel
- Remove and Install Camshaft
- Inspect Camshaft
- Remove and Install Camshaft Gear
- Remove and Install Cam Followers
- Inspect Cam Followers
- Remove and Install Timing Gear Cover
- Remove and Install Idler Gear
- Inspect Idler Gear
- Remove and Install Timing Gear Cover Mounting Plate
- Remove and Install Oil Pan, Crankcase Extension, and Strainer
- Remove and Install Oil Pump
- Disassemble and Assemble Oil Pump
- Inspect Oil Pump
- Remove and Install Oil Cooler
- Remove and Install Thermostat
- Inspect Coolant Pump
- Remove and Install Coolant Pump
- Disassemble and Assemble Water Separator
- Remove Fuel Injection Pump
- Install Fuel Injection Pump
- Remove and Install Fuel Injection Nozzle
- Disassemble and Assemble Fuel Injection Nozzles
- Inspect and Clean Fuel Injection Nozzles

OUMX258,00006D5 -19-12NOV13-1/1

Remove 12 Volt Alternator Drive Belt

1. Park machine safely. Remove key from key switch and secure. See “Park Machine Safely”.
2. Raise engine cover.
3. Loosen clamp (A) and remove duct from bulkhead inlet. Secure duct away from work area.
4. Loosen nut (B) and remove negative (-) connector from battery terminal.

A—Hose Clamp **B—Battery Connector Nut**



TCT009230 —UN—31OCT13

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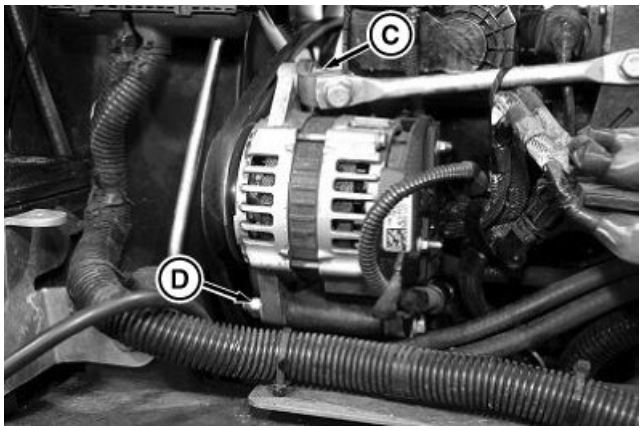
OUMX068,0000450 -19-15NOV13-1/4

5. Loosen bolt (C) and nut (D securing alternator. Remove drive belt from sheave.

C—Hex Bolt **D—Lock Nut**

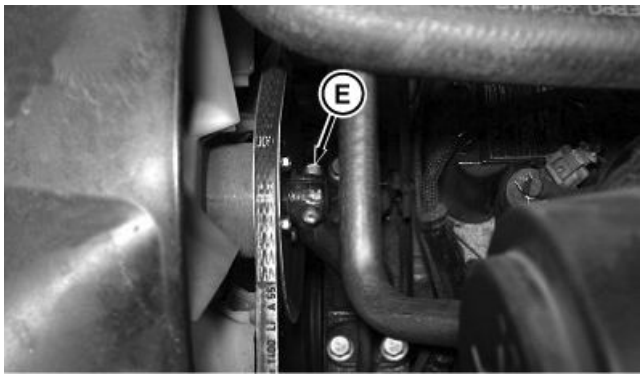


TCT009231 —UN—31OCT13

OUMX068,0000450 -19-15NOV13-2/4

6. Remove nut (E) and bolt securing cooling fan shaft to bracket. Remove fan and sheave assembly from bracket.
7. Remove belt from fan sheave.

E—Lock Nut



TCT009232 —UN—31OCT13

OUMX068,0000450 -19-15NOV13-3/4

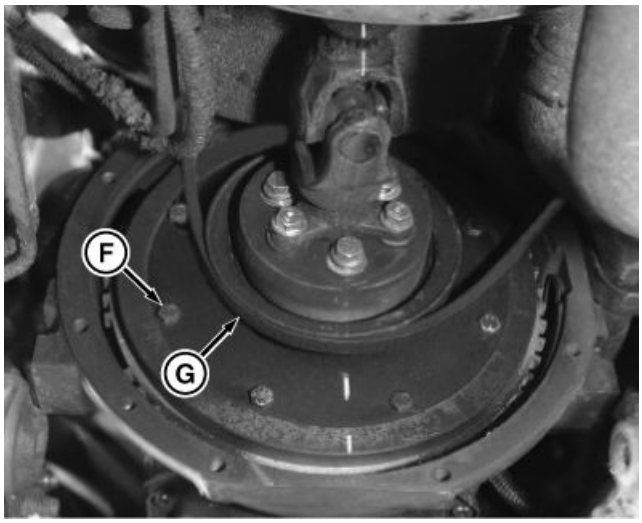
8. Mark flywheel, flywheel plate, and drive shaft components for proper alignment at reassembly.

IMPORTANT: Avoid Damage! Do not hold the flywheel by the outer tone ring teeth when removing or installing fasteners. Damage to the tone ring may affect engine controller performance.

NOTE: Drive shaft splined sections will separate if the driveline components are not supported. Mark drive shaft for correct alignment at reassembly, or support flywheel end components to prevent separation.

9. Support components, and remove bolts (F) securing flywheel plate to flywheel.
10. Move flywheel plate away from flywheel far enough to remove fan belt (G).

F—Hex Bolt M8x16 (8 used) **G—Fan Belt**



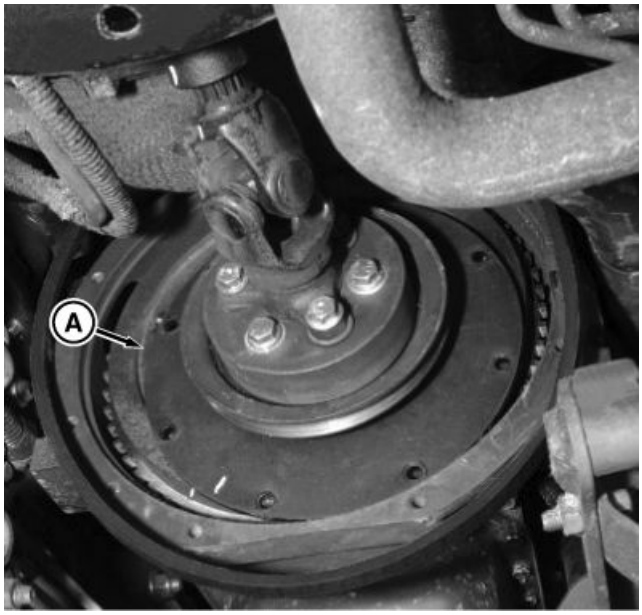
TCT009233 —UN—31OCT13

OUMX068,0000450 -19-15NOV13-4/4

Install 12 Volt Alternator Drive Belt

1. Pass new drive belt between flywheel plate (A) and flywheel.

A—Flywheel Plate



TCT009234 —UN—31OCT13

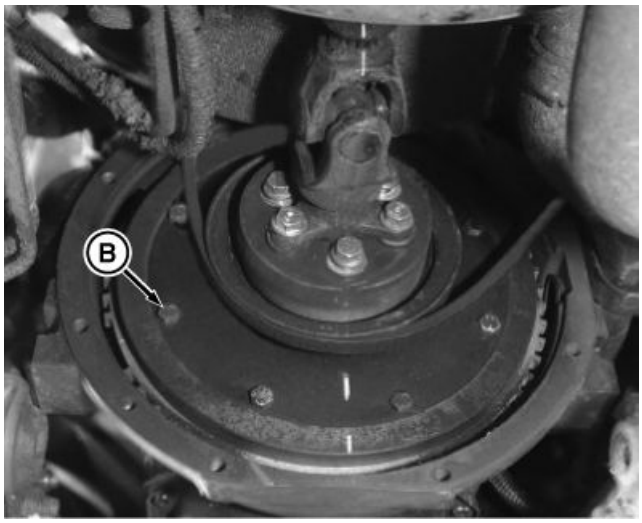
SW00544,0000046 -19-15NOV13-1/4

2. Align match marks and attachment holes. Secure plate to flywheel with bolts (B). Tighten bolts in a cross pattern to specification.

Specification

Flywheel Plate to Flywheel Bolts—Torque.....28 N·m (20 lb.-ft.)

B—Hex Bolt M8x16 (8 used)



TCT009237 —UN—31OCT13

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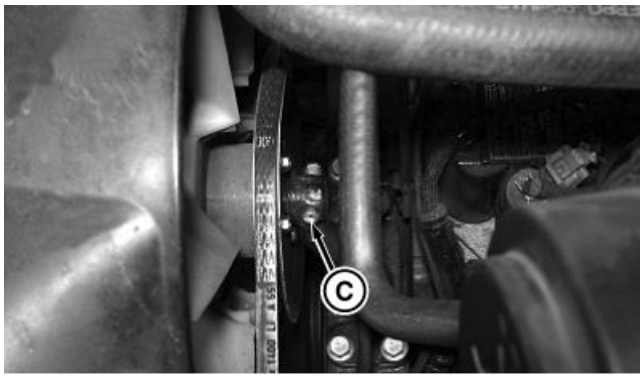
SW00544,0000046 -19-15NOV13-2/4

3. Install belt to cooling fan sheave.
4. Install fan assembly to mounting bracket. Insert bolt (C) and secure with lock nut. Tighten nut to specification.

Specification	
Cooling Fan Shaft Pinch Bolt—Torque	28 N·m (20 lb.-ft.)

5. Install belt to drive shaft sheave.
6. Install belt to alternator sheave and adjust belt tension. (See Test and Adjust 12 Volt Alternator and Cooling Fan Drive Belt Tension.)



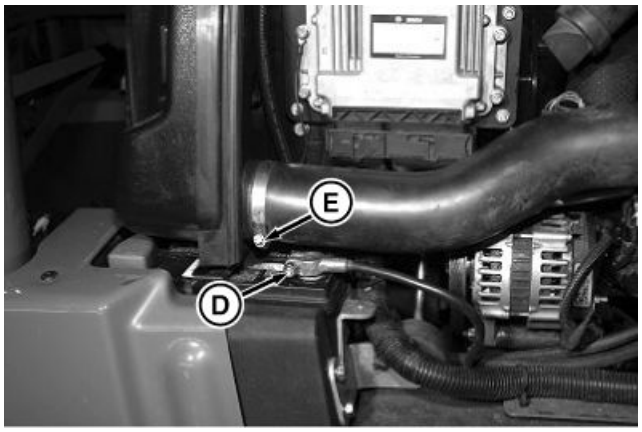
TCT009235 —UN—31OCT13

C—Hex Bolt

SW00544,0000046 -19-15NOV13-3/4

7. Install negative battery connector and tighten nut (D).
8. Install air duct and tighten clamp (E).
9. Close engine cover.

D—Battery Connector Nut **E—Hose Clamp**



TCT009236 —UN—31OCT13

SW00544,0000046 -19-15NOV13-4/4

Remove 48 Volt Alternator Drive Belt

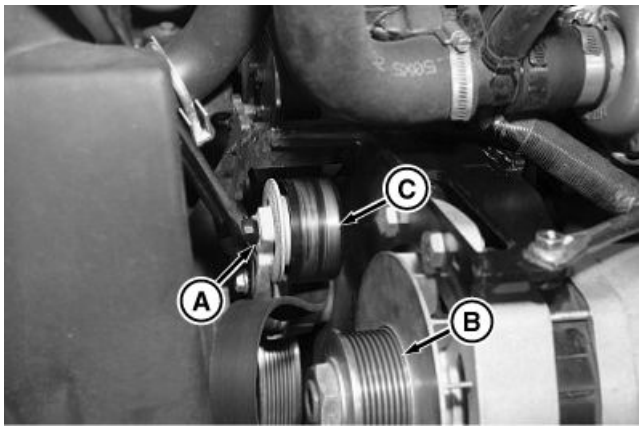
1. Park machine safely.
2. Raise engine cover.

CAUTION: Avoid injury! Touching hot surfaces can burn skin. The engine, components, and fluids will be hot if the engine has been running. Allow the engine to cool before servicing or working near the engine and components.

3. Allow machine to cool.

CAUTION: Avoid injury! Components are installed under spring tension. Wear eye protection and use proper tools when installing and removing components with spring tension.

4. Insert square drive tool into tension arm socket (A). Rotate arm against spring tension and remove drive belt from alternator sheave (B).



TCT009306 —UN—12NOV13

A—Square Socket
B—Alternator Sheave
C—Tension Sheave

5. Pass belt between tension sheave (C) and mounting plate. Carefully release tension arm.

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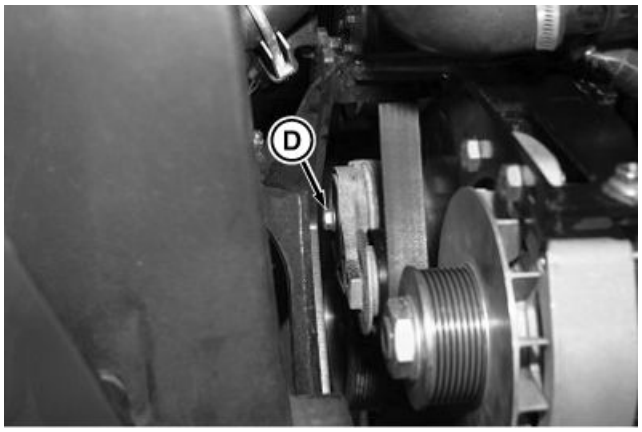
SW00544,0000047 -19-12NOV13-1/2

6. Pass belt between tensioner bolt head (D) and mounting bracket. Remove belt.
7. Check tension and idler sheaves for bearing condition. Replace if needed.
8. Inspect all sheave belt contact surfaces for damage. Replace if needed.

D—Bolt, Belt Tension Assembly



TCT009307 —UN—12NOV13

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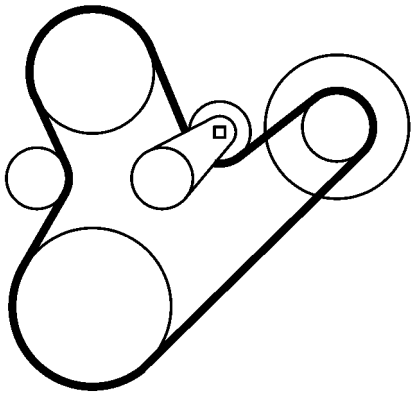
Install 48 Volt Alternator Drive Belt

1. Install new drive belt as per belt routing diagram.



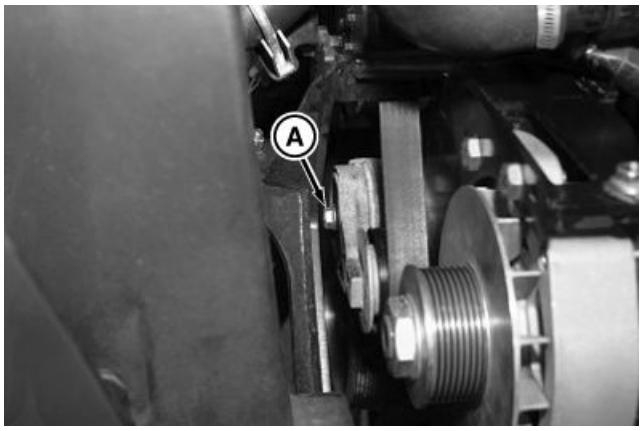
TCT009305 —UN—12NOV13

Water pump and 48 volt alternator drive belt routing

SW00544,0000048 -19-12NOV13-1/3

2. Pass belt between tension assembly bolt head (A) and mounting bracket.

A—Bolt Head



TCT009308 —UN—12NOV13

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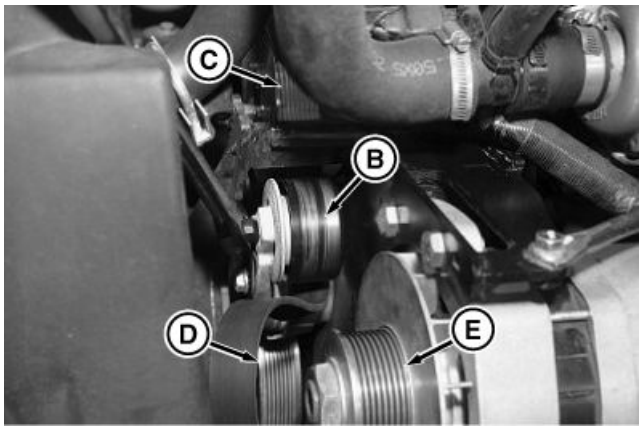
SW00544,0000048 -19-12NOV13-2/3

3. Pass belt between tension sheave (B) and mounting plate.
4. Rotate tension sheave against spring tension and install belt to water pump sheave (C), crankshaft sheave (D), and alternator sheave (E).
5. Carefully release belt tensioner, making sure that belt is properly installed to all sheaves.

B—Tension Sheave
C—Water Pump Sheave
D—Crankshaft Sheave
E—Alternator Sheave



TCT009309 —UN—12NOV13

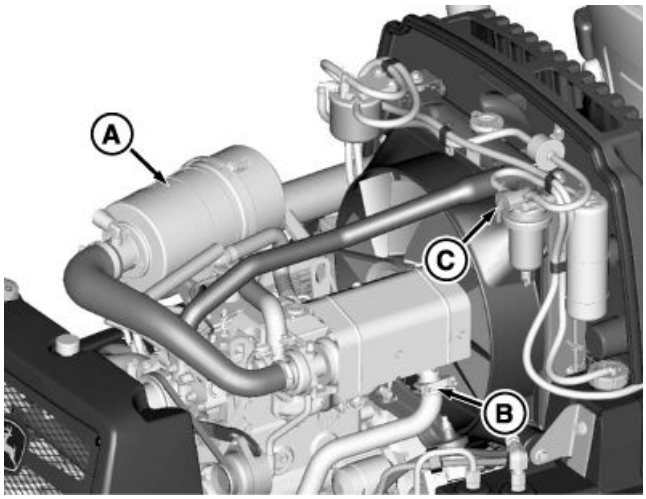
SW00544,0000048 -19-12NOV13-3/3

Remove and Install Engine

Removal

1. Disconnect negative (-) cable from battery.
2. Remove air cleaner assembly (A) and related hoses.
3. Remove tailpipe assembly (B).
4. Drain coolant. Disconnect upper and lower hoses from radiator.
5. Disconnect drive shaft from flywheel of engine to hydraulic pump.
6. Close fuel valve (C).
7. Remove alternator. (See Remove 12 Volt Alternator.)

A—Air Cleaner Assembly
B—Tailpipe Assembly
C—Fuel Shutoff Valve



TCT006374 —UN—13FEB13

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OUMX068,0000451 -19-01MAR13-1/4

NOTE: Label supply and return fuel lines.

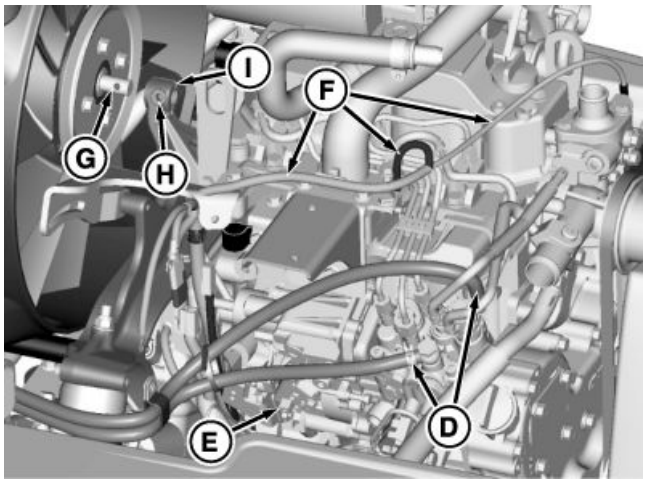
8. Disconnect and plug fuel lines (D) from fuel injection pump.
9. Disconnect throttle cable (E) from fuel injection pump.

NOTE: To aid in the installation of the engine, label the wiring harness ends.

10. Disconnect wiring harness (F): fuel solenoid, oil pressure switch, glow plugs, air intake pre-heater, coolant temperature switch, and ground terminals.

NOTE: Ground strap is located on the left side, under the engine mount bracket that holds alternator.

11. Disconnect engine ground strap.
12. Remove the bolt securing bearing shaft (G) of fan assembly to bracket (H). Using a small pry bar, slightly pry open the slot (I) in the bracket. Slide bearing shaft out of bracket. Remove fan assembly and shaft.
13. Attach a suitable hoist to engine lifting eyes.



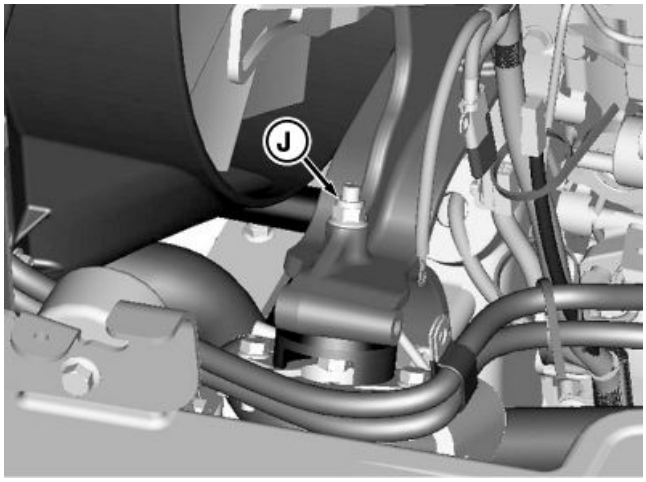
TCT006376 —UN—13FEB13

D—Fuel Lines
E—Throttle Cable
F—Wiring Harness
G—Bearing Shaft
H—Bracket
I— Slot

OUMX068,0000451 -19-01MAR13-2/4

14. Remove left front mounting bolt and locknut (J).

J— Locknut



TCT006377 —UN—13FEB13

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OUMX068,0000451 -19-01MAR13-3/4

15. Disconnect cable (K) and wiring harness (L) from starter.
16. Remove right front and rear mounting bolts and locknuts (M). Remove engine.
17. Inspect rubber isolators for wear. If necessary, replace isolators.
18. Disassemble, inspect, and replace parts as required.

Installation

1. Carefully lower engine into place and loosely install mounting bolts and nuts. Do not tighten.
2. Install drive shaft from hydraulic pump to engine. Tighten cap screws to specification.

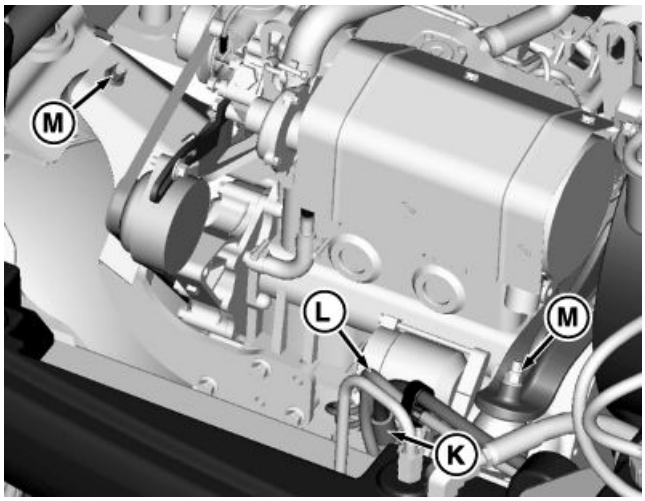
Specification	
Driveshaft Cap Screw—Torque	80 N·m (60 lb.-ft.)

3. Tighten engine mounting hardware to specification.

Specification	
Engine Mount Nut—Torque	80 N·m (60 lb.-ft.)

NOTE: The ground strap is installed under the engine mount and alternator bracket on the left side.

4. Connect engine ground strap.
5. Place the drive belt on the pulley of the fan assembly. Install the fan assembly bearing shaft into the mounting bracket. Pry open the slot, and use a drift pin to align the hole in the bearing shaft with the bracket hole. Secure fan assembly with bolt.
6. Connect wiring harness: ground terminals, coolant temperature switch, air intake pre-heater, oil pressure switch, fuel solenoid, and glow plugs.



TCT006379 —UN—13FEB13

K—Positive Battery Cable **M—Locknuts**
L—Main Wiring Harness

7. Connect throttle cable to fuel injection pump.
8. Install alternator. (See Install 12 Volt Alternator.)
9. Route and connect fuel lines to injection pump.

NOTE: If needed, replace radiator hoses at this time.

10. Connect upper and lower radiator hoses. Add coolant.
11. Open fuel shutoff valve at fuel filter.
12. Install tailpipe assembly.
13. Install air cleaner assembly and related hoses.
14. Service engine oil.
15. Connect negative (-) battery cable.

OUMX068,0000451 -19-01MAR13-4/4

Remove and Install Rocker Arm Cover

Removal

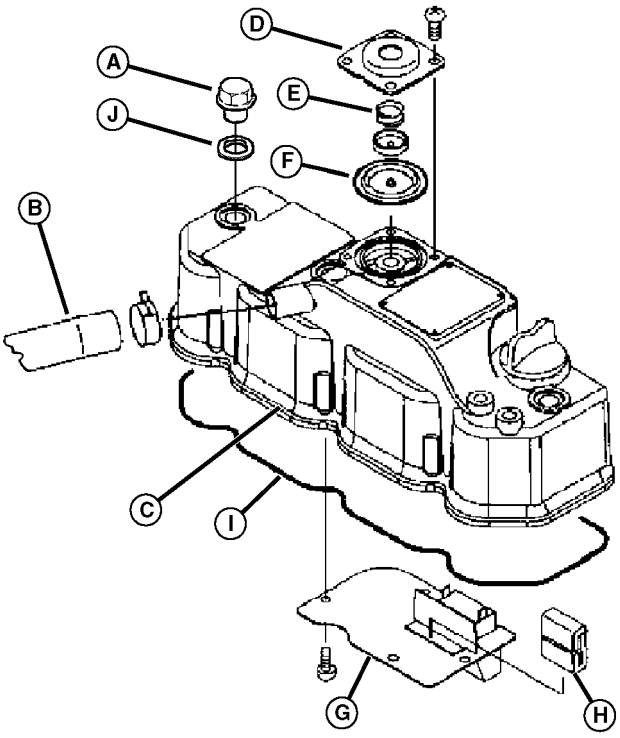
1. Remove three rocker cover nuts (A).
2. Remove breather hose (B).
3. Remove rocker cover (C) from the cylinder head.
4. Remove diaphragm cover (D).
5. Remove and inspect spring (E) and diaphragm (F). Replace as needed.
6. Remove baffle plate (G) and baffle (H).
7. Wash the baffle in a safe solvent and blow dry with air. Replace the baffle if it comes apart or is deteriorated.

Installation

1. Install baffle and baffle plate.
2. Install diaphragm, plate, spring, and diaphragm cover.
3. Inspect the rocker cover gasket (I) and O-rings (J). Replace if damaged.
4. Clean the cylinder head surface and install rocker cover to cylinder head. Tighten rocker cover nuts to specification.

Specification	
Rocker Arm Cover Nut—Torque	16.7—22.5 N·m (148—199 lb.-in.)

5. Install breather hose.



TCAL25305 —UN—15JUN12

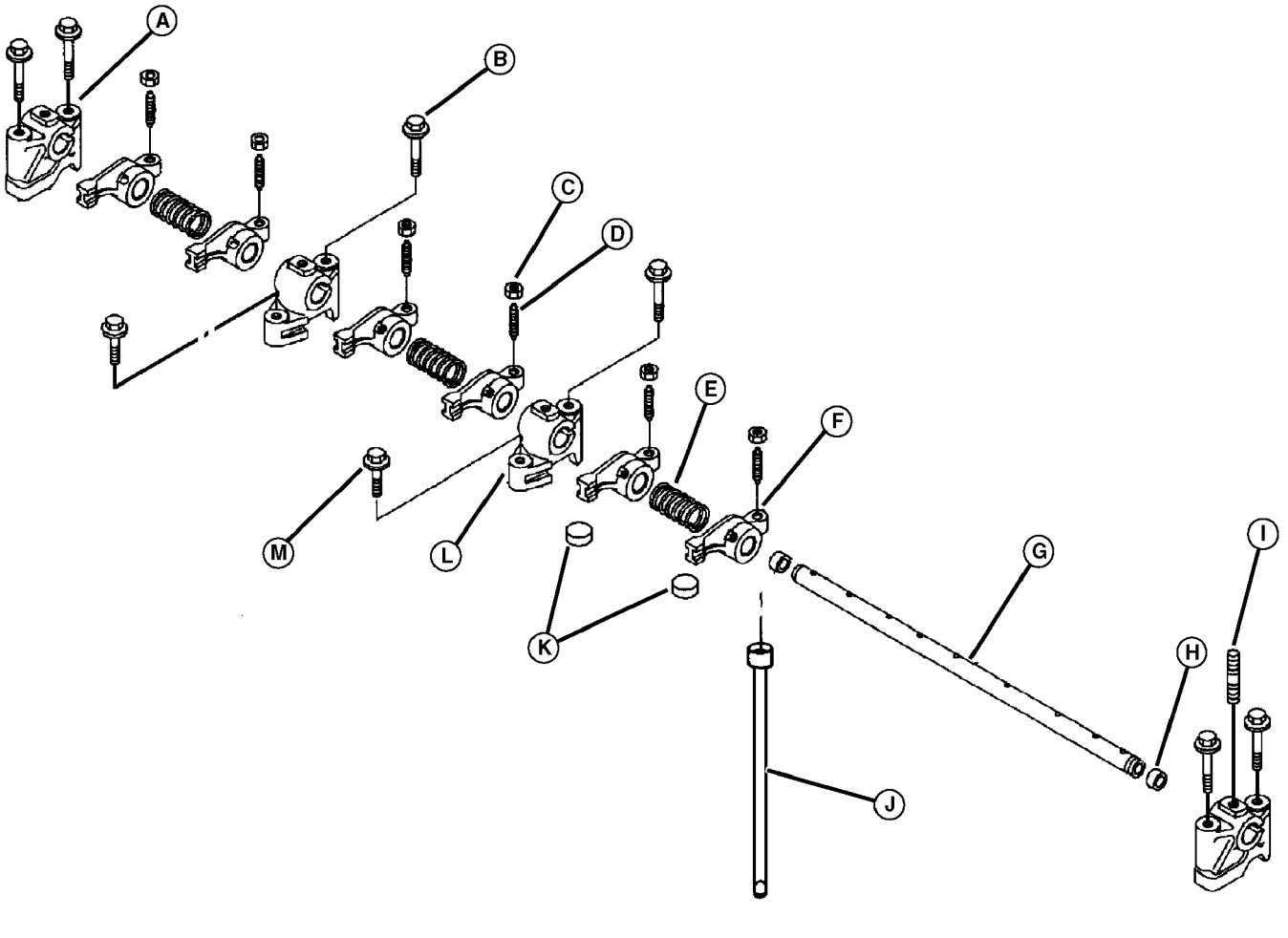
A—Rocker Cover Nuts (3 Used)
B—Breather Hose
C—Rrocker Arm Cover
D—Diaphragm Cover
E—Spring
F—Diaphragm
G—Baffle Plate
H—Baffle
I— Gasket
J— O-Ring (3 Used)

OUMX258,0000675 -19-05NOV12-1/1

Remove and Install Rocker Arm Assembly

Removal

1. Remove the rocker arm cover. (See Remove and Install Rocker Arm Cover.)



A—Shaft End Support (2 Used))
B—Cap Screw, M8x50 (6 Used)
C—Jam Nut (6 Used)
D—Adjuster Screw (6 Used)
E—Spring (3 Used)
F—Rocker Arm
G—Rocker Arm Shaft
H—Plug (2 Used)
I— Stud
J—Push Rod (6 Used)
K—Valve Cap (6 Used)
L—Center Support (2 Used)
M—Cap Screw, M8x25 (2 Used)

2. Remove the rocker arm end supports (A) and rocker arm center support mounting cap screws (B and M).
3. Lift the rocker arm assembly from the cylinder head and set the assembly on a bench.

NOTE: If the rocker arm shaft assembly is to be disassembled, replace components in same location on the rocker arm shaft they were removed from.

4. Note the positions of the rocker arm assembly components. Slide the components off the rocker arm shaft.
5. Lift the push rods from the cylinder head and note the order of removal for reassembly.
6. Inspect the rocker arm components and push rods.

Installation

1. Install the push rods in their original locations in the cylinder head, with the ball shaped end down in head.
2. Lubricate all parts with clean oil during assembly.
3. Assemble the rocker arm assembly components in the reverse order of removal.
4. Place the rocker arm assembly on the cylinder head.

   a. Align the rocker arms with the valves and push rods.

Continued on next page

b. Align the rocker arm end supports and center supports with the corresponding holes in the head.

5. Install the rocker arm support cap screws. Tighten the cap screws to specification.

Specification	
Rocker Arm Support Cap Screw—Torque	26 N·m (19 lb.-ft.)

6. Adjust the valve clearance. (See Adjust Valve Clearance.)

OUMX258,0000676 -19-05NOV12-2/2

Inspect Rocker Arm Assembly

1. Measure the rocker arm shaft OD and compare with specifications. Replace rocker arm shaft if below wear limit.

Specification	
Rocker Arm Shaft—OD	15.97—15.98 mm (0.628—0.629 in.)
Rocker Arm Shaft—OD—Wear Limit	15.94 mm (0.628 in.)

TCAL25307 —UN—15JUN12

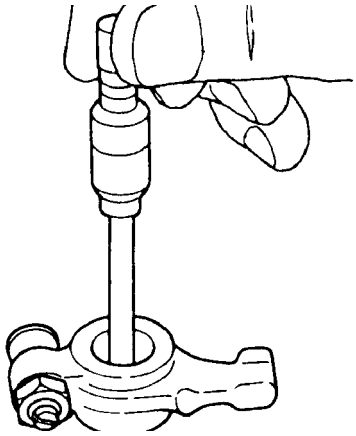
OUMX258,0000677 -19-21MAY14-1/4

2. Measure the inner diameters of the rocker arms and supports. Compare with specifications. Replace rocker arms or supports if greater than wear limit.

Specification	
Rocker Arm and Support—ID	16.00—16.02 mm (0.630—0.631 in.)
Rocker Arm and Support—ID—Wear Limit	16.07 mm (0.633 in.)

3. Measure the rocker arm shaft-to-rocker arm bushing oil clearance. Oil clearance is the difference between the OD of the rocker arm shaft and the ID of the rocker arms. If oil clearance is not within specifications, replace parts as necessary.

Specification	
Rocker Arm Shaft-to-Rocker Arm Bushing—Oil Clearance	0.02—0.05 mm (0.001—0.002 in.)



TCAL25308 —UN—15JUN12

Rocker Arm Shaft-to-Rocker Arm Bushing—Oil Clearance—Wear Limit	0.13 mm (0.005 in.)

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OUMX258,0000677 -19-21MAY14-2/4

4. Place the push rod on a flat surface. Use a feeler gauge to measure any gaps between the push rod and flat surface. Replace push rod(s) if not within specification.

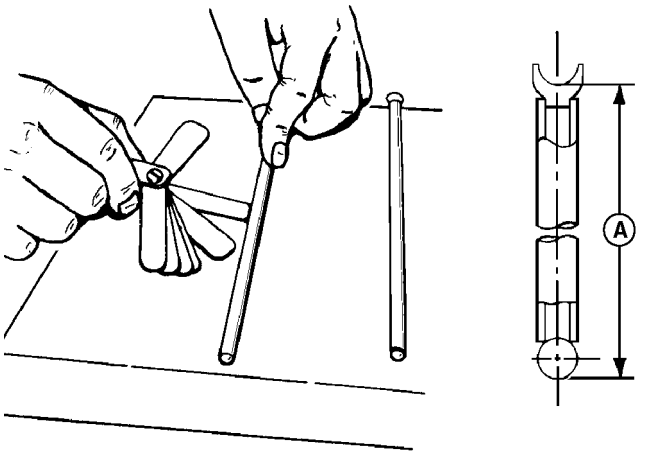
Specification

Push Rods—Maximum Bend ..... 0.03 mm (0.001 in.)

5. Measure push rod length (A). If not within specification, replace push rod.

Specification

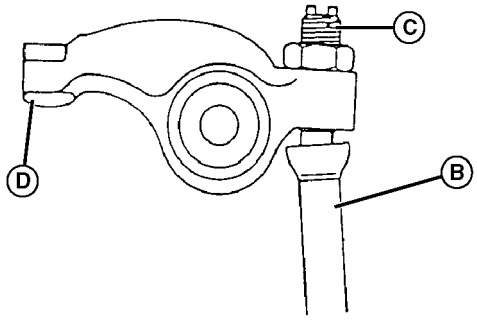
Push Rods—Length ..... 178.25—178.75 mm (7.018—7.037 in.)



A—Length

OUMX258,0000677 -19-21MAY14-3/4

6. Check the surface of the adjusting screw that contacts the push rod (B) for wear. Replace the adjusting screw (C) if it is worn or damaged.
7. Check the surface (D) of the rocker arm that comes in contact with the valve cap for wear. Replace rocker arm if necessary.
8. Check the socket portion of the push rod where the valve clearance adjusting screw contacts the push rod. Replace the push rod if it is worn or damaged.



B—Push Rod
C—Adjusting Screw
D—Adjusting Screw Mating Surface

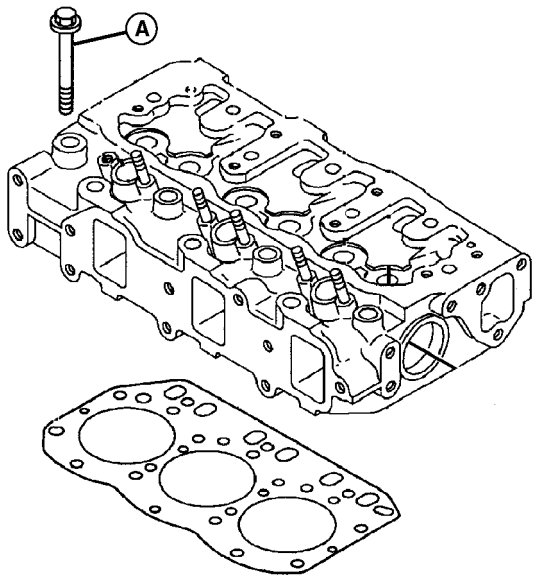
OUMX258,0000677 -19-21MAY14-4/4

Remove and Install Cylinder Head and Valves

Removal

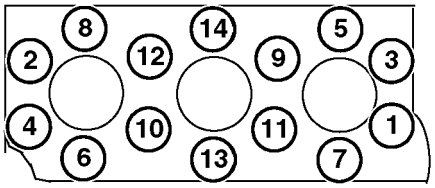
1. Remove the rocker arm cover. (See Remove and Install Rocker Arm Cover.)
2. Remove the rocker arm assembly, push rods, and valve caps. (See Remove and Install Rocker Arm Assembly.)
3. Remove the exhaust and intake manifolds. (See Remove and Install Exhaust Manifold and Remove and Install Intake Manifold.)
4. Remove the coolant pump. (See Remove and Install Coolant Pump.)
5. Remove the fuel injection nozzles. (See Remove and Install Fuel Injection Nozzle.)
6. Remove the cylinder head cap screws (A) in the order shown.
7. Remove the cylinder head from the engine block.
8. Disassemble and inspect the cylinder head and valves. (See Disassemble and Assemble Cylinder Head and Valves.)

A—Cap Screws (14 Used)



TCAL25311 —UN—15JUN12

TCAL25312 —UN—15JUN12



OUMX258,0000678 -19-05NOV12-1/2

Installation

1. Reassemble cylinder head and valves. (See Disassemble and Assemble Cylinder Head and Valves.)

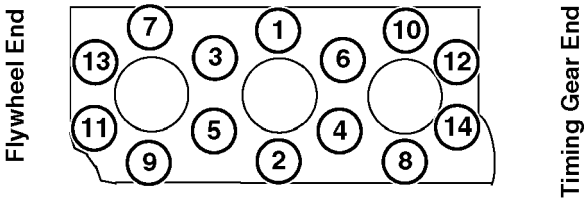
IMPORTANT: Avoid Damage! The oil passage in the gasket must be located over the oil passage in cylinder block.

2. Place a new cylinder head gasket on the engine block. Dowels in the engine block will assist in aligning the gasket.
3. Place the cylinder head on the engine block. Dowels in the engine block will again assist in alignment.
4. Dip the cylinder head cap screws in clean engine oil. Install and tighten in the sequence shown, using the three stages of torque values listed in specifications.

Cylinder Head Bolts—Specification

Initial Stage—Torque.....44 N·m (33 lb.-ft.)
Second Stage—Torque.....62 N·m (45 lb.-ft.)

Exhaust Manifold Side



Cylinder Head Bolt-Tightening Order

TCAL25313 —UN—15JUN12

Final Stage—Torque.....88 N·m (65 lb.-ft.)

5. Install the fuel injection nozzles.
6. Install the coolant pump.
7. Install the exhaust and intake manifolds.
8. Install rocker arm assembly, push rods, and valve caps.
9. Install rocker arm cover.

OUMX258,0000678 -19-05NOV12-2/2

Disassemble and Assemble Cylinder Head and Valves

Removal

1. Remove the valve caps from the valves. The valve caps should be installed on the valves they were removed from.
2. Compress the valve spring using a valve spring compressor and remove the collet halves, retainer, valve spring and valve stem seal for each valve.
3. The intake and exhaust valve guides are press fit. Remove the guides only if necessary.

Installation

IMPORTANT: Avoid Damage! Do not reuse stem seals if removed. Used seals will leak.

1. Install new valve stem seals over the valve guides.
2. Apply clean engine oil on intake and exhaust valve stems during assembly.
3. Install the valve springs with smaller pitch end or paint mark toward cylinder head.
4. Compress the valve springs and retainer until the collet halves are able to be installed in the grooves of the valve stem.
5. Carefully release the tension on the spring compressor.
6. Tap on the end of the valve with a plastic hammer to ensure the collet halves have seated properly on the valve stem.
7. Repeat for the remaining valves.
8. Measure valve recession if new valves were installed. (See Inspect Cylinder Head and Valves.)

OUMX258,0000679 -19-05NOV12-1/1

Inspect Cylinder Head and Valves

Special or Required Tools

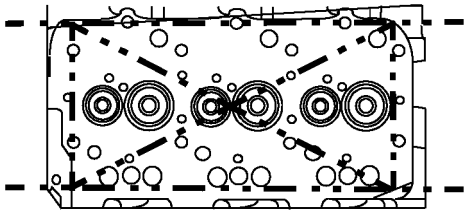
- D20021WI Valve Guide Reamer
- JDE118 Valve Guide Driver

IMPORTANT: Avoid Damage! Before inspection, thoroughly clean all components of carbon or dirt.

Cylinder Head

1. To measure cylinder head flatness, place a straightedge along each of the four sides and each diagonal. Measure clearance between straightedge and combustion surface with a feeler gauge and compare with specifications.

Specification	
Cylinder Head—Out-of-Flat (Allowable Distortion Without Resurfacing)	0.05 mm (0.002 in.)
Cylinder Head—Out-of-Flat (Resurface Range)	0.00—0.05 mm (0.000—0.002 in.)
Cylinder Head—Out-of-Flat (Wear Limit)	0.15 mm (0.006 in.)
Cylinder Head—Out-of-Flat (Maximum Distortion)	0.15 mm (0.006 in.)



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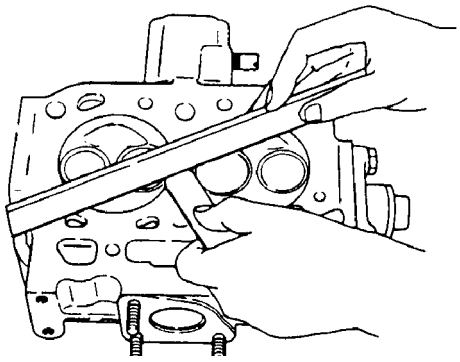


TCAL25315 —UN—15JUN12

2. If the cylinder head was resurfaced:
   - Measure piston-to-cylinder head clearance. (See Measure Piston-to-Cylinder Head Clearance.)
   - Measure valve recession. (See Inspect Cylinder Head and Valves.)
   - Measure valve seat width in this procedure.

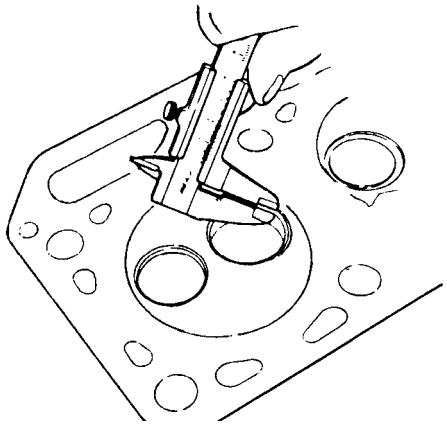
Continued on next page

OUMX258,000067A -19-16MAY14-1/9

Valve Seats

1. Measure the valve seat widths and compare with specifications.

Specification	
Intake Valve Seat—Width—Standard	1.77 mm (0.070 in.)
Intake Valve Seat—Width—Wear Limit	2.27 mm (0.089 in.)
Exhaust Valve Seat—Width—Standard	1.34 mm (0.053 in.)
Exhaust Valve Seat—Width—Wear Limit	1.84 mm (0.072 in.)



TCAL25316 —UN—15JUN12

2. If necessary, grind or replace the valve seats to meet specifications. (See Grind Valve Seats.)

OUMX258,000067A -19-16MAY14-2/9

Valves

1. Check valves for out-of-round, bent or warped condition using a valve inspection center. Replace valve if necessary.

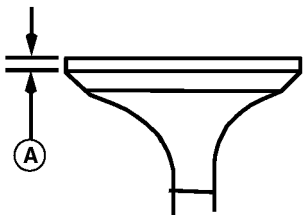
TCAL25317 —UN—15JUN12

OUMX258,000067A -19-16MAY14-3/9

2. If the valve faces are worn, burned, or pitted, grind valves to proper face angle.
3. Measure valve head thickness (A). If measurement is less than specifications after grinding, replace valve.

Specification	
Valve Head—Thickness (Minimum)	0.50 mm (0.020 in.)

TCAL25318 —UN—15JUN12



A—Valve Head Thickness

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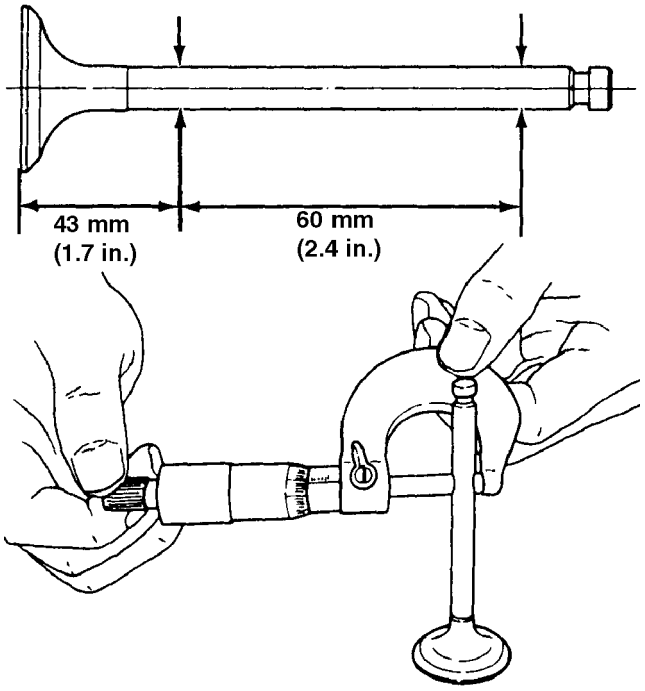
OUMX258,000067A -19-16MAY14-4/9

4. Measure the valve stem diameter at two locations, as shown. If valve stem diameter is less than specifications, replace the valve.

Valve Stem OD—Specification

Intake and Exhaust Valve Stem—OD—Standard	7.96—7.97 mm (0.3134—0.3138 in.)
Intake and Exhaust Valve Stem—OD—Wear Limit	7.90 mm (0.311 in.)



TCAL25319 —UN—15JUN12

OUMX258,000067A -19-16MAY14-5/9

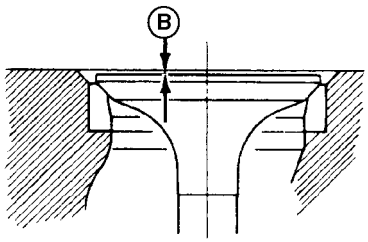
Valve Recession

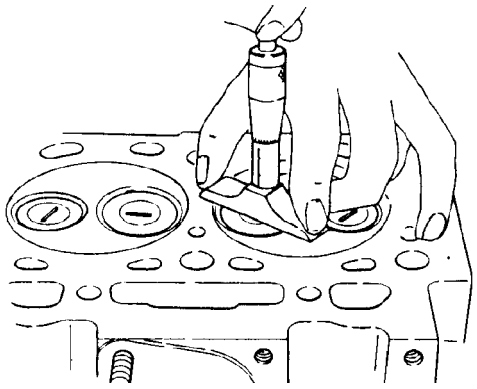
Measure valve recession (B) using a depth gauge. If recession is not within specifications, repair or replace parts as needed.

Valve Recession—Specification

Intake and Exhaust Valve—Recess—Standard	0.30—0.50 mm (0.012—0.020 in.)
Intake and Exhaust Valve—Recess—Wear Limit	0.08 mm (0.031 in.)

B—Valve Recession





TCAL25320 —UN—15JUN12

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OUMX258,000067A -19-16MAY14-6/9

Valve Guides

1. Clean the valve guides using a valve guide brush.
2. Measure the valve guide inside diameter and compare with specifications.

Valve Guide ID—Specification

Valve Guide—ID	8.010—8.025 mm (0.3154—0.3160 in.)
Valve Guide—ID—Wear Limit	8.10 mm (0.319 in.)

3. Subtract the valve stem OD from the valve guide ID to obtain the oil clearance and compare with specifications.

Valve Guide Oil Clearance—Specification

Valve Guide—Oil Clearance—Standard	0.035—0.070 mm (0.001—0.003 in.)
Valve Guide—Oil Clearance—Knurling Range	Oil clearance exceeds 0.15 mm (0.006 in.) but is less than 0.20 mm (0.008 in.)
Valve Guide—Oil Clearance—Wear Limit	0.20 mm (0.008 in.)

4. Determine the guide-to-stem oil clearance (guide diameter minus stem diameter).
   - If the oil clearance exceeds 0.15 mm (0.006 in.) but is less than 0.20 mm (0.008 in.) knurl the valve guides.
   - If clearance exceeds wear limit specification, replace valve guides using JDE118 Valve Guide Driver.

IMPORTANT: Avoid Damage! New valve guides must be cooled in a container of liquid nitrogen, or equivalent, before driving into cylinder head.

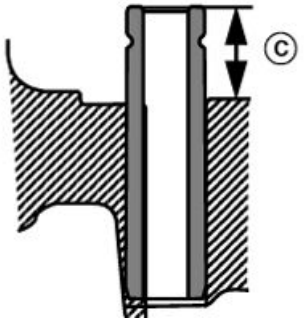
The intake and exhaust valve guides are different. The exhaust valve guide has one groove and the intake valve guide has none.

5. If replacing valve guide, install the valve guides with the tapered ends down. Push the valve guides into the cylinder head until the valve guide projection (C) is within specification.

Specification

Valve Guide—Protrusion	15 mm (0.591 in.)

6. Ream the inside diameter of valve guides using D20021WI Valve Guide Reamer.



TCAL25321 —UN—15JUN12

C—Valve Guide Installation Height

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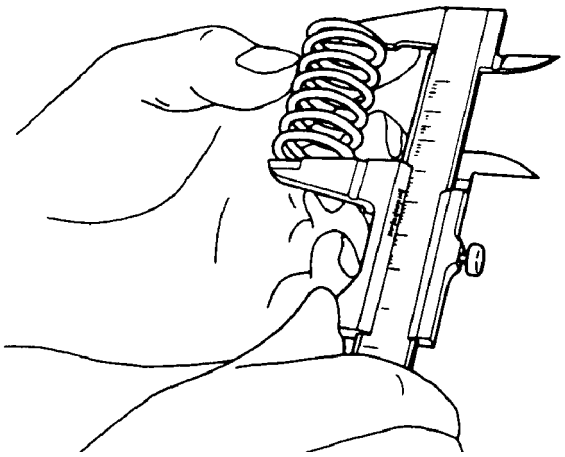
OUMX258,000067A -19-16MAY14-7/9

Springs

1. Measure the valve spring free length and compare with specifications.

Valve Springs—Specification

Valve Spring—Free Length	44.4 mm (1.748 in.)
Valve Spring—Free Length—Wear Limit	43.9 mm (1.730 in.)
Valve Spring—Inclination	1.40 mm (0.055 in.)

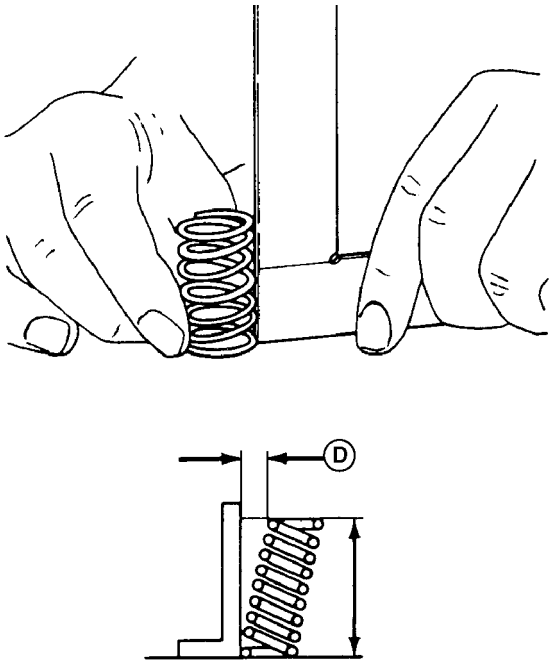


TCAL25322 —UN—15JUN12

OUMX258,000067A -19-16MAY14-8/9

2. Measure the spring inclination (D) and compare with valve spring specifications.

D—Spring Inclination



TCAL25323 —UN—15JUN12

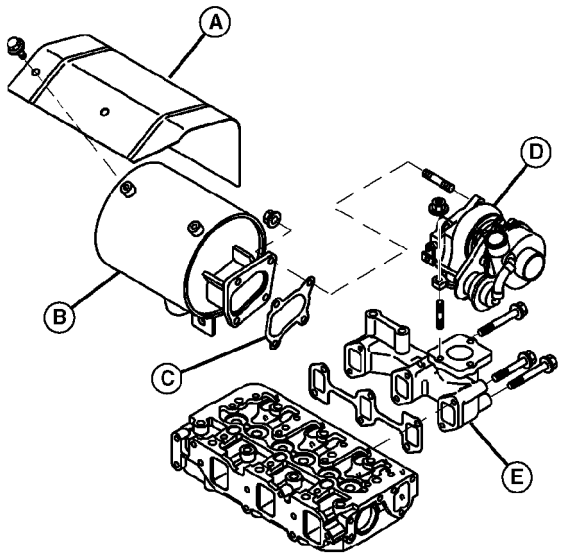
OUMX258,000067A -19-16MAY14-9/9

Remove and Install Exhaust Manifold

1. Remove heat shield (A), muffler (B), and gasket (C). Discard gasket.
2. Disconnect intake tube from turbo (not shown).
3. Remove the oil supply and return lines from turbo (not shown).
4. Remove turbo (D) and gasket. Discard gasket.
5. Remove exhaust manifold (E) and gasket. Discard gasket.
6. Clean mating surfaces and install exhaust manifold with new gasket. Tighten all fasteners to specification.

Specification	
Exhaust Manifold Cap Screw and Nut—Torque	26 N·m (19 lb.-ft.)

7. Install new gasket and turbo.
8. Connect oil drain and supply lines to turbo.
9. Connect intake tube to turbo.
10. Install new gasket, muffler, and heat shield.



TCAL25324 —UN—15JUN12

A—Heat Shield
B—Muffler
C—Gasket
D—Turbocharger
E—Exhaust Manifold

OUMX258,000067B -19-05NOV12-1/1

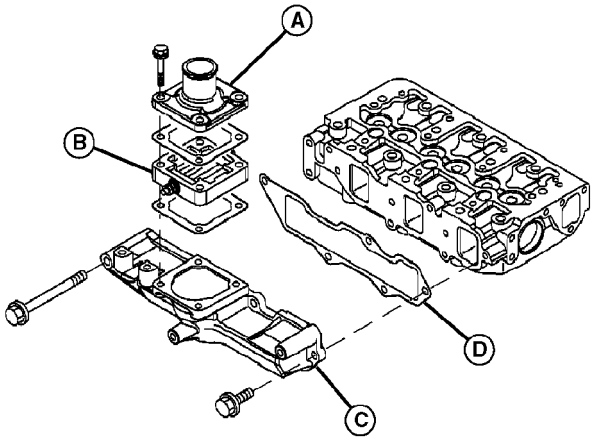
Remove and Install Intake Manifold

1. Disconnect negative battery cable.
2. Remove air cleaner assembly and related plumbing (not shown).
3. Disconnect intake tube from air heater intake (A).
4. Remove air cleaner bracket (not shown).
5. Disconnect wire from air heater (not shown).
6. Remove air heater intake, air heater (B), and gaskets. Discard gaskets.
7. Remove top two cap screws and spacers from the alternator bracket (not shown).
8. Remove fuel injection lines (not shown).
9. Remove the intake manifold (C) and gasket (D). Discard gasket.
10. Clean the mating surfaces and install intake manifold with new gasket. Tighten all fasteners to specification.

Specification	
Intake Manifold Cap Screw—Torque	26 N·m (19 lb.-ft.)

11. Install fuel injection lines. (See Bleed Fuel System.) Tighten tube nuts to specification.

Specification	
Fuel Injector Tube Nut—Torque	29—34 N·m (21—25 lb.-ft.)



TCAL25325 —UN—15JUN12

A—Air Heater Intake
B—Air Heater
C—Intake Manifold
D—Gasket

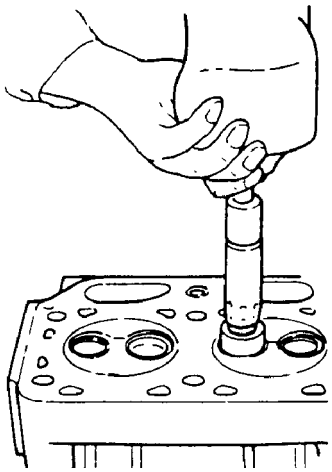
12. Install spacers and cap screws for alternator bracket.
13. Install air heater with new gaskets.
14. Connect wire for air heater.
15. Install air cleaner bracket.
16. Connect intake tube to air heater.
17. Install air cleaner assembly and related plumbing.
18. Connect negative battery cable.

OUMX258,000067C -19-05NOV12-1/1

Grind Valve Seats

NOTE: LIGHTLY grind the valve seats for only a few seconds to avoid excessive valve seat width.

1. Grind the intake valve seat using a 30° seat grinder and the exhaust valve seat using a 45° seat grinder. Follow the tool manufacturer's instructions.
2. Measure the valve seat width after grinding and compare with specifications.



TCAL25326 —UN—15JUN12

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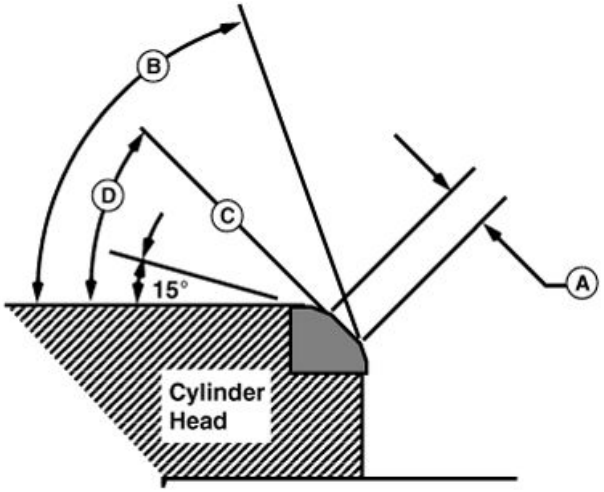
OUMX258,000067D -19-05NOV12-1/2

3. If the seat width (A) is too wide after grinding, grind the lower seat surface (B) using a 70° seat grinder until the seat width is close to specifications.

Specification	
Intake Valve Seat—Width	1.34 mm (0.053 in.)
Intake Valve Seat—Width—Wear Limit	1.84 mm (0.072 in.)
Exhaust Valve Seat—Width	1.77 mm (0.070 in.)
Exhaust Valve Seat—Width—Wear Limit	2.27 mm (0.089 in.)

4. Grind the upper seat surface (C) using a 15° seat grinder until the seat width is narrowed to specifications.
5. If the valve seats (D) are ground, measure valve recession. (See Inspect Cylinder Head and Valves.) Check the contact pattern between the seat and valve with blueing dye.
6. Lap the valves.



TCAL25327 —UN—15JUN12

A—Seat Width
B—Lower Seat Surface (70°)
C—Upper Seat Surface (15°)
D—Valve Seats

7. If the valve recession exceeds the maximum specifications or if the seats cannot be reconditioned, replace the valves or the cylinder head.

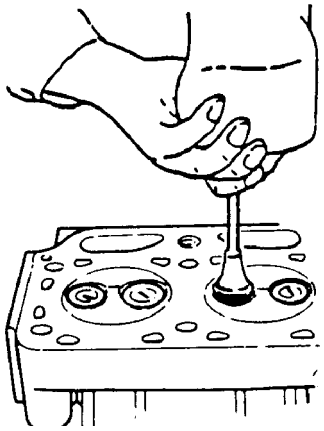
OUMX258,000067D -19-05NOV12-2/2

Lap Valves

NOTE: Use a rubber-type lapping tool for valves without a lapping tool groove slit.

If the seat does not make proper contact, lap the valve into the seat:

1. Apply a small amount of fine lapping compound to the face of the valve.
2. Turn the valve to lap the valve to the seat.
3. Lift the valve from the seat every 8 to 10 strokes. Lap until a uniform ring appears around the surface of the valve face.
4. Wash all parts in solvent to remove lapping compound. Dry all parts.



TCAL25328 —UN—15JUN12

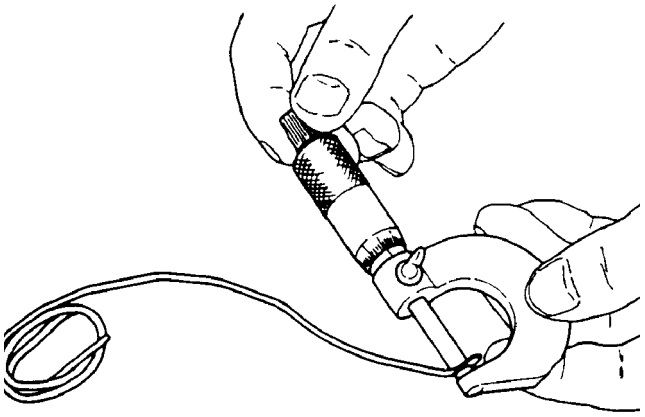
5. Check the position of the lap mark on the valve face. Lap marks must be on or near the center of the valve face.

OUMX258,000067E -19-05NOV12-1/1

Measure Piston-to-Cylinder Head Clearance

1. Place three 10 mm (0.4 in.) long pieces of 1.5 mm (0.06 in.) diameter soft wire in three positions on the flat part of the piston head.
2. Install the cylinder head and old gasket. Install cylinder head bolts and tighten in proper sequence. (See Remove and Install Cylinder Head and Valves.)
3. Slowly turn the crankshaft one complete revolution.
4. Remove the cylinder head and gasket.
5. Measure the thickness of the flattened section of each piece of wire. Calculate the average thickness of the wires to obtain the piston-to-cylinder head clearance specification.

Specification	
Piston-to-Cylinder Head—Clearance	0.72 ± 0.06 mm (0.025 ± 0.002 in.)



- If the clearance is less than specification, replace cylinder head.

OUMX258,000067F -19-05NOV12-1/1

Remove and Install Piston and Connecting Rod

Removal

1. Remove the oil pan and oil pickup tube.
2. Remove the cylinder head. (See Remove and Install Cylinder Head and Valves.)
3. Check the cylinder bore for ridges. These ridges can cause damage to piston if ridge is not removed.
4. If necessary, remove any ridge from the top of the cylinder bore using a ridge reamer.
5. Measure the connecting rod side play. (See Inspect Cylinder Head and Valves.)
6. Measure the crankshaft end play. (See Check Crankshaft End Play.)
7. Measure the connecting rod bearing clearance. (See Check Connecting Rod Bearing Clearance.)

IMPORTANT: Avoid Damage! Keep the connecting rods and rod caps together. Rods and caps are a matched set. Note the alignment marks on each part.

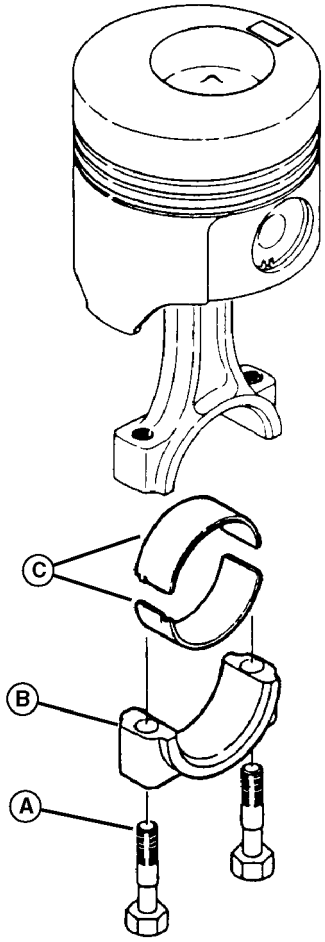
8. Remove the rod cap screws (A), connecting rod cap (B), and bearing inserts (C).

IMPORTANT: Avoid Damage! The pistons and cylinders are matched. Pistons must be installed in the cylinders from which they were removed.

9. Note the connecting rod alignment mark in relation to the cylinders. Start at the flywheel end with cylinder No. 1, then No. 2, etc.
10. Push the piston and connecting rod out of the cylinder bore using a wooden dowel.
11. Disassemble and inspect all parts for wear or damage.
12. Inspect the cylinder bore. (See Inspect Cylinder Bore and Inspect Cylinder Bore Taper and Out-of-Round.)

Installation

- Apply clean engine oil to all parts during installation.
- Always replace the connecting rod cap screws. DO NOT reuse the cap screws.



TCAL25330 —UN—15JUN12

A—Cap Screws
B—Connecting Rod Cap
C—Bearing Inserts

IMPORTANT: Avoid Damage! Pistons must be installed in the cylinders from which they were removed and in the same direction. Be careful not to damage the crankshaft rod journals while installing pistons.

1. Assemble the piston and connecting rod. (See Disassemble and Assemble Piston and Connecting Rod.)

Continued on next page

OUMX258,0000680 -19-05NOV12-1/2

2. Install the piston and connecting rod into the cylinder from which it was removed. The alignment mark on the connecting rod (D) and/or the piston size mark (E) on top of piston should point toward the fuel injection pump.

IMPORTANT: Avoid Damage! Do not touch bearing insert surfaces. Oil and acid from your finger will corrode the bearing surface.

3. Install the bearing inserts to the connecting rod and rod cap, aligning tangs (F) with grooves (G).

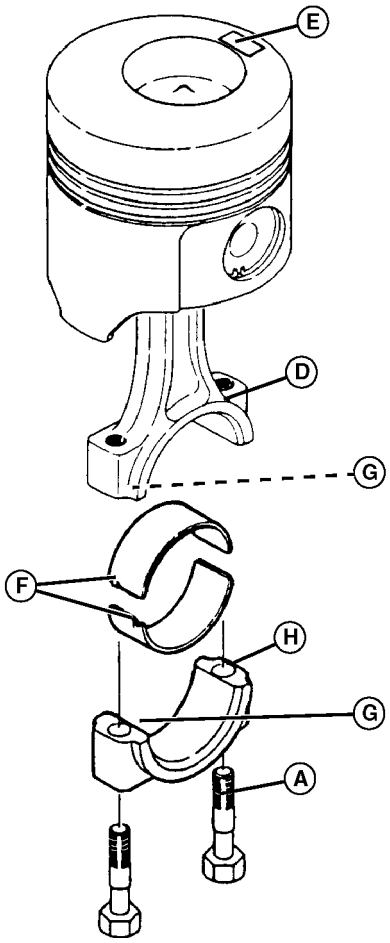
IMPORTANT: Avoid Damage! Connecting rod caps must be installed on the same connecting rods they were removed from.

4. Match the connecting rods to caps using alignment marks (H). Install the rod caps.
5. Dip the entire connecting rod cap screw in clean engine oil. Install new cap screws (A) and tighten to specification.

Specification

Connecting Rod Cap Screw—Torque.....47 N·m (35 lb.-ft.)

6. If a new piston and connecting rod were installed, stamp a number corresponding to the cylinder number on the connecting rod and rod cap.
7. Install the cylinder head. (See Remove and Install Cylinder Head and Valves.)
8. Install oil pan and oil pickup tube.



TCAL25331 —UN—15JUN12

A—Cap Screws
D—Alignment Mark on the Connecting Rod
E—Piston Size Mark
F—Aligning Tangs
G—Grooves
H—Alignment Marks

OUMX258,0000680 -19-05NOV12-2/2

Disassemble and Assemble Piston and Connecting Rod

Disassembly

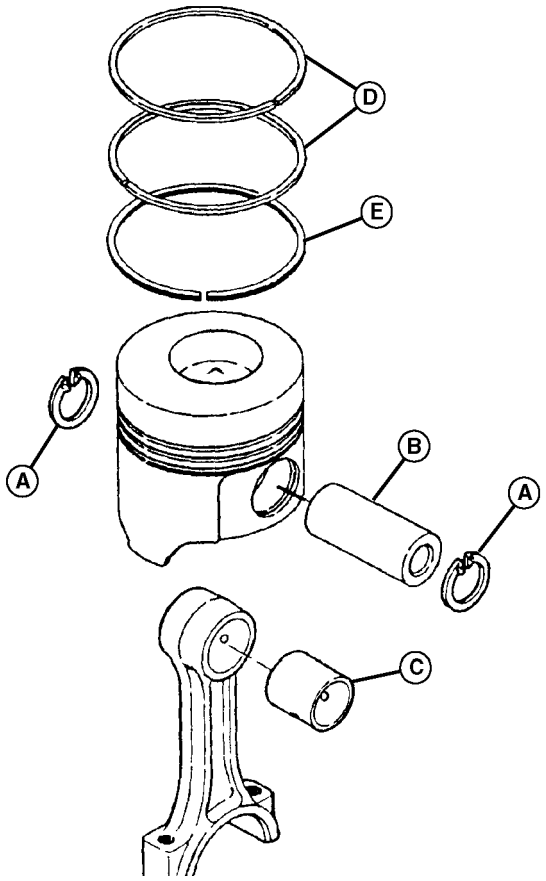
IMPORTANT: Avoid Damage! Pistons must be installed on the same connecting rod they were removed from.

1. Put a mark on each piston and connecting rod to aid in assembly.
2. Remove snap rings (A) from piston pin (B) and remove pin.
3. The piston pin bushing (C) is a press fit in the connecting rod. Remove the bushing only if replacement is necessary
4. Inspect all parts for wear or damage. Replace as necessary.
5. Remove the 1st and 2nd compression rings (D) and oil ring with expander (E).

Assembly

- Apply clean engine oil to all parts during assembly.

IMPORTANT: Avoid Damage! The pistons must be installed on the same connecting rod they were removed from.



TCAL25332 —UN—15JUN12

A—Snap Rings (2 Used)
B—Piston Pin
C—Bushing
D—1st and 2nd Compression Rings
E—Oil Ring with Expander

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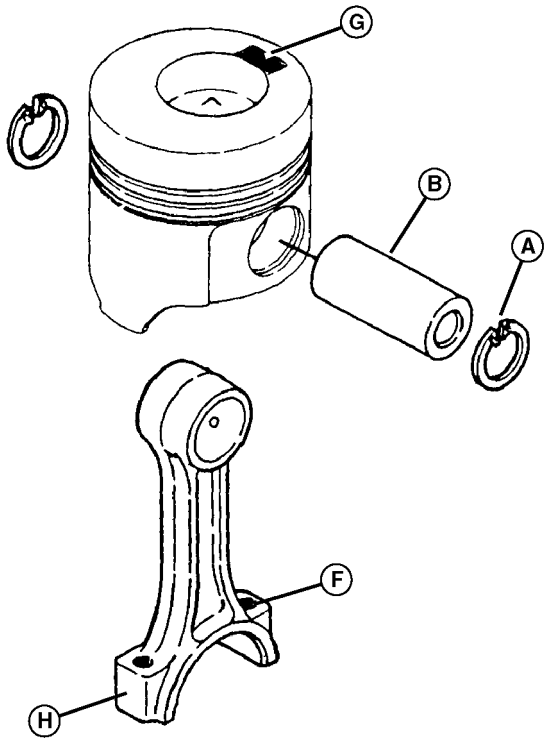
OUMX258,0000681 -19-05NOV12-1/4

1. Assemble the piston to the connecting rod with piston mark (G) on the same side as the connecting rod stamped mark (F). If a new connecting rod is used, assemble the piston to the connecting rod with piston mark opposite the connecting rod bearing insert groove (H). Be sure the oil hole in the piston pin bushing is aligned with the hole in the connecting rod.
2. Install the piston pin (B) and retaining rings (A).
3. Install an oil ring expander (E) in the bottom ring groove of the piston, with the ends above either end of the piston pin.

A—Retaining Rings (2 Used)
B—Piston Pin
F—Connecting Rod Stamped Mark
G—Piston Mark
H—Connecting Rod Bearing Insert Groove

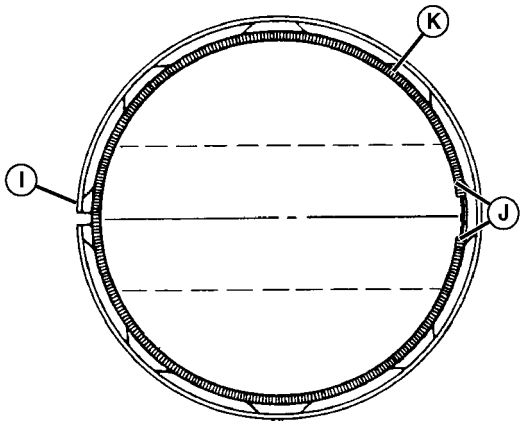


TCAL25333 —UN—15JUN12

OUMX258,0000681 -19-05NOV12-2/4

4. Install the oil ring over the expander with the ring gap (I) opposite (180°) of the expander ends (J).
5. Install the second compression ring, with the small diameter of taper toward top of piston, in the middle groove. Turn the ring until the gap (K) is 120° away from the oil ring gap (I).

I— Oil Ring Gap
J— Oil Expander Ring Gap
K—Second Compression Ring End Gap



TCAL25334 —UN—15JUN12

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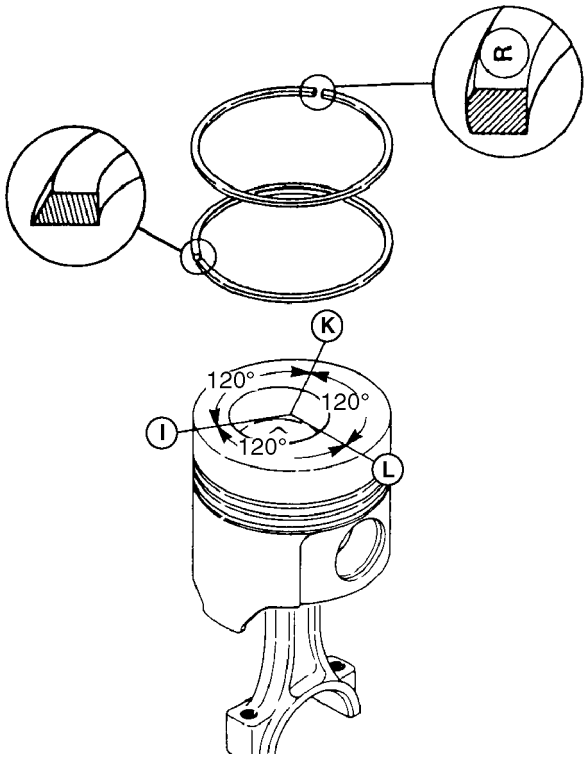
OUMX258,0000681 -19-05NOV12-3/4

6. Install the first compression ring (chrome plated), with the manufacturer's mark "R", "T", or "RN" (near the ring gap) toward the top of the piston, in the top groove. Turn the ring until the gap (L) is 120° away from the second ring gap (K) and 120° away from the oil ring gap (I).

I— Oil Expander Ring Gap
K—Second Compression Ring End Gap
L—First Compression Ring End Gap



TCAL25335 —UN—15JUN12

OUMX258,0000681 -19-05NOV12-4/4

Inspect Piston and Connecting Rod

Connecting Rod Bearing

1. Install the connecting rod cap and bearing inserts on the connecting rod. Install the old connecting rod cap screws and tighten to specification.

Specification

Connecting Rod Cap Screw—Torque.....47 N·m (35 lb.-ft.)

2. Measure the connecting rod bearing inside diameter and compare with specifications. Replace bearing if bearing ID is greater than wear limit.

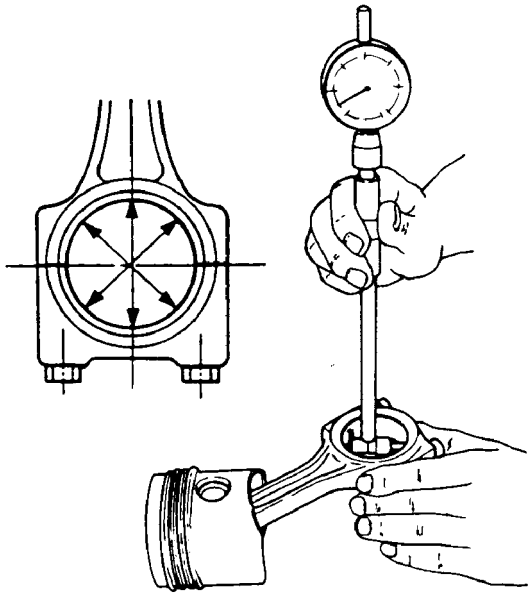
Connecting Rod Bearing—Specification

Connecting Rod Bearing—ID.....47.952—47.962 mm (1.887—1.888 in.)

Connecting Rod Bearing—ID—Wear Limit.....48.07 mm (1.893 in.)

Connecting Rod Bearing—Oil Clearance.....0.038—0.074 mm (0.001—0.003 in.)

3. Measure the oil clearance between the bearing inserts and the crankshaft. Compare measurement with specification.



TCAL25336 —UN—15JUN12

- If the bearing oil clearance exceeds the wear limit, grind the crankshaft connecting rod journals and install undersized bearing inserts, or replace the bearing inserts and the crankshaft.

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OUMX258,0000682 -19-05NOV12-1/8

Piston Ring Groove Clearance

1. With the rings installed on the piston, measure the piston ring groove side clearance. Measure at several places around each piston and compare with specification.
2. Replace the rings or the piston if the clearances exceed specification.

Piston Ring Side Clearance—Specification

First Compression Ring—Side Clearance....0.075—0.11 mm (0.003—0.004 in.)

First Compression Ring—Side Clearance—Wear Limit....0.025 mm (0.010 in.)

Second Compression Ring—Side Clearance....0.045—0.080 mm (0.002—0.003 in.)

Second Compression Ring—Side Clearance—Wear Limit....0.025 mm (0.010 in.)

TCAL25337 —UN—15JUN12

Oil Control Ring—Side Clearance....0.025—0.060 mm (0.001—0.002 in.)

Oil Control Ring—Side Clearance—Wear Limit....0.020 mm (0.008 in.)

OUMX258,0000682 -19-05NOV12-2/8

Piston Ring End Gap

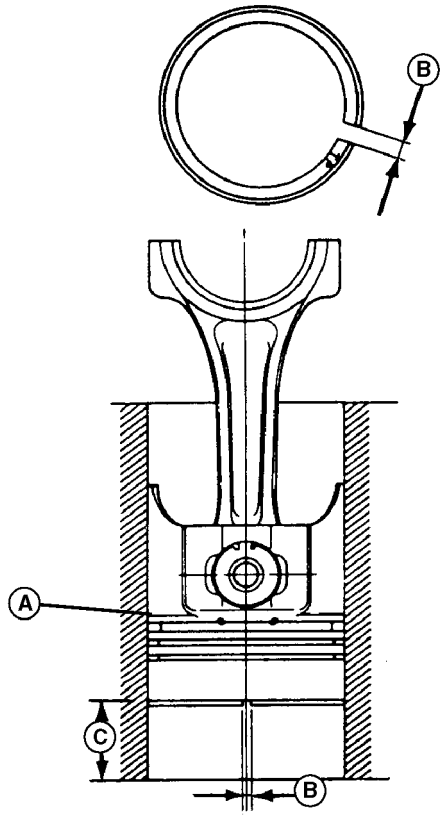
Use a piston to push the ring (A) approximately 30 mm (1.18 in.) (C) from the bottom of the cylinder bore. Measure the piston ring end gap (B) and compare with specifications.

Piston Ring End Gap—Specification

Piston Ring—End Gap....0.20—0.40 mm (0.008—0.016 in.)

Piston Ring—Gap—Wear Limit....1.50 mm (0.059 in.)

A—Piston Ring
B—End Gap
C—30 mm (1.18 in.)



TCAL25338 —UN—15JUN12

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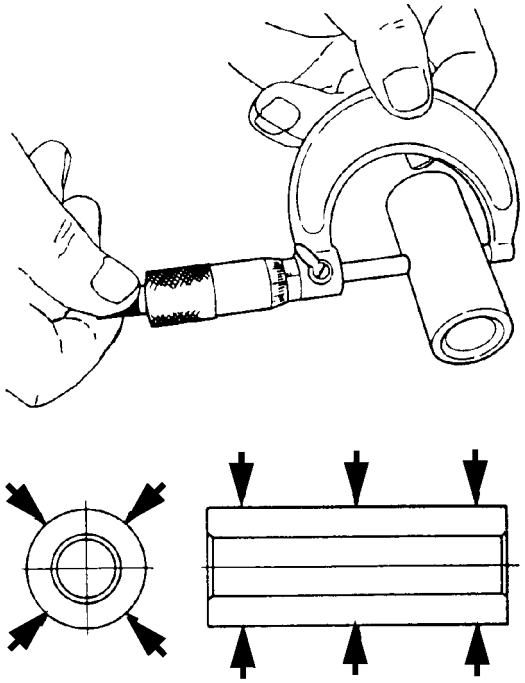
OUMX258,0000682 -19-05NOV12-3/8

Piston Pin Diameter

Measure the piston pin diameter at six places and compare with specifications. Replace any pin that is not within specification.

Piston Pin OD—Specification

Piston Pin—OD	25.99—26.00 mm (1.023—1.024 in.)
Piston Pin—OD—Wear Limit	25.97 mm (1.022 in.)



TCAL25339 —UN—15JUN12

OUMX258,0000682 -19-05NOV12-4/8

Piston Pin Bore

1. Measure the pin bore diameter in the piston and compare with specifications.

Piston Pin Bore ID—Specification

Piston Pin Bore—ID	26.00—26.01 mm (1.0236—1.0240 in.)
Piston Pin Bore—ID—Wear Limit	26.04 mm (1.025 in.)

2. Piston pin-to-piston oil clearance is the bore ID minus the pin OD. Compare piston pin-to-piston clearance with specifications.
   - If the piston pin bore exceeds the wear limit, replace the piston.
   - If the piston pin is less than the wear limit, replace the piston pin.
   - If the bore clearance exceeds the wear limit, replace the piston, piston pin, or both.

TCAL25340 —UN—15JUN12

Piston Pin Clearance—Specification

Piston Pin-to-Piston—Oil Clearance	0.00—0.02 mm (0.00—0.001 in.)
Piston Pin-to-Piston—Oil Clearance—Wear Limit	0.12 mm (0.005 in.)

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OUMX258,0000682 -19-05NOV12-5/8

Piston Pin Bushing

NOTE: The piston pin bushing is press fit. Replace the bushing using a driver set. When installing the bushing, make sure to align the oil hole in the bushing with the hole in the connecting rod.

1. Measure the piston pin bushing diameter in the connecting rod and compare with specifications.
   - If the bushing diameter exceeds the wear limit, replace bushing.

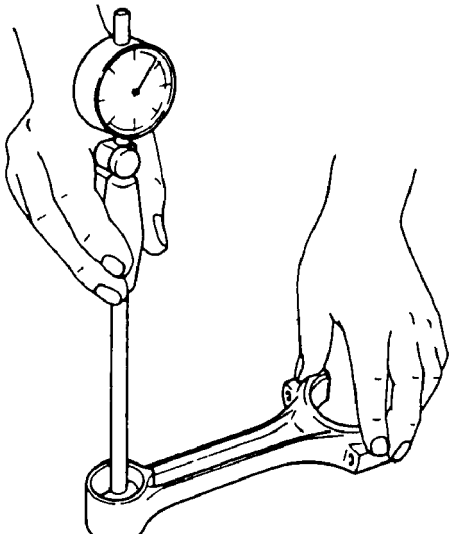
Piston Pin Bushing ID—Specification

Piston Pin Bushing—ID	26.025—26.038 mm (1.0246—1.0251 in.)
Piston Pin Bushing—ID—Wear Limit	26.07 mm (1.026 in.)

2. Piston pin-to-rod bore oil clearance is the bore ID minus the pin OD.
   - If the bushing clearance (bushing ID minus pin OD) exceeds specification, replace the bushing or the piston pin.

Piston Pin Bushing Clearance—Specification

Piston Pin Bushing-to-Rod Bore—Oil Clearance	0.03—0.05 mm (0.001—0.002 in.)
Piston Pin Bushing-to-Rod Bore—Oil Clearance—Wear Limit	0.10 mm (0.004 in.)



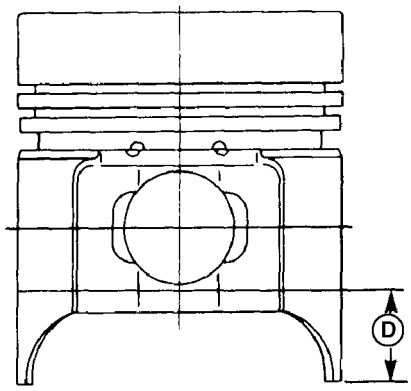
TCAL25341 —UN—15JUN12

OUMX258,0000682 -19-05NOV12-6/8

Piston Diameter

NOTE: If the engine has had a previous major overhaul, oversize pistons and rings may have been installed. Pistons and rings are available in 0.25 mm (0.010 in.) oversize.

D—23 mm (0.905 in.)



TCAL25342 —UN—15JUN12

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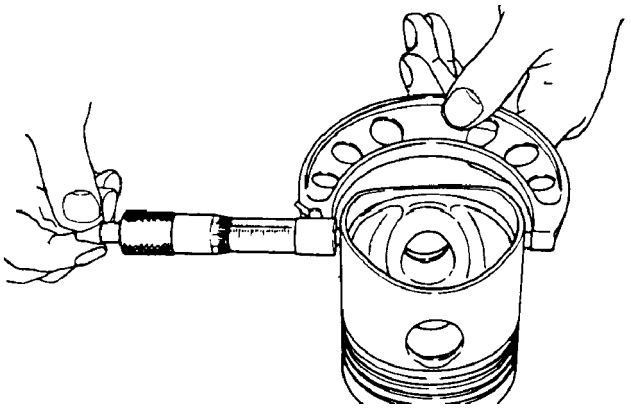
OUMX258,0000682 -19-05NOV12-7/8

Measure the piston diameter perpendicular to the piston pin bore 23 mm (0.905 in.) (D) from the bottom of the piston skirt and compare with specifications.

Piston OD—Specification

Standard Piston—OD	83.95—83.98 mm (3.305—3.306 in.)
Standard Piston—OD—Wear Limit	83.90 mm (3.303 in.)
Oversize Piston—OD	84.20—84.23 mm (3.315—3.316 in.)
Oversize Piston—OD—Wear Limit	84.10 mm (3.311 in.)

- If piston diameter is less than wear limit, install a new piston.



TCAL25343 —UN—15JUN12

OUMX258,0000682 -19-05NOV12-8/8

Inspect Cylinder Bore

NOTE: If the engine has had a previous major overhaul, the cylinders may have been bored oversize. Pistons and rings are available in 0.25 mm (0.010 in.) oversize.

Cylinder Bore Diameter

NOTE: Slight uneven wear, flaws, or minor damage may be corrected by deglazing.

1. Measure the cylinder bore diameter at three positions: top, middle and bottom. At these three positions, measure in both directions: along the crankshaft centerline and the direction of the crankshaft rotation. Compare measurements with specifications.

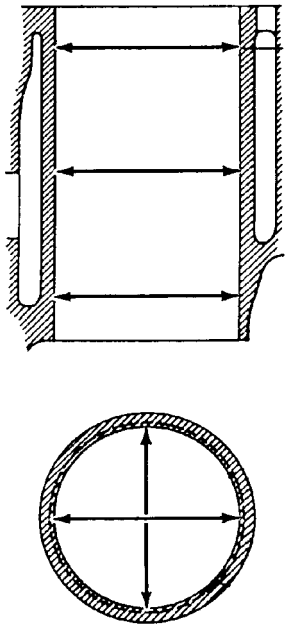
   a. If the cylinder bore standard ID exceeds the wear limit, have the cylinder rebored.

   b. If the cylinder is rebored, oversize pistons and rings must be installed.

   c. If the cylinder bore exceeds the oversize bore ID, replace the cylinder block.

Cylinder Bore—Specification

Standard Cylinder Bore—ID	84.00—84.03 mm (3.307—3.308 in.)
Standard Cylinder Bore—ID—Wear Limit	84.20 mm (3.315 in.)
Oversize Cylinder Bore—ID	84.25—84.28 mm (3.317—3.318 in.)
Oversize Cylinder Bore—ID—Wear Limit	84.45 mm (3.325 in.)
Piston-to-Cylinder Bore—Clearance	0.040—0.070 mm (0.001—0.003 in.)



TCAL25344 —UN—15JUN12

2. Determine piston-to-cylinder bore clearance (cylinder bore ID minus piston OD). If piston-to-cylinder bore clearance exceeds specifications, replace the cylinder block, piston, or both, or rebore cylinder and install oversize piston and rings.

Continued on next page

OUMX258,0000683 -19-05NOV12-1/3

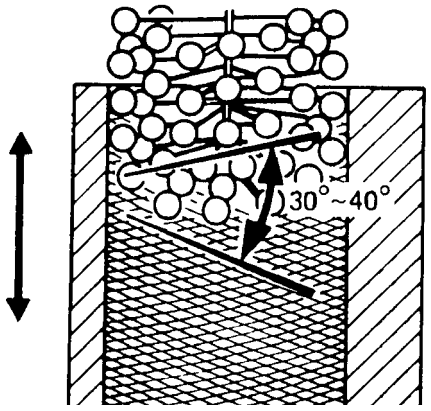
Deglazing

IMPORTANT: Avoid Damage! If the cylinder bores are to be deglazed with crankshaft installed in engine, put clean shop towels over crankshaft to protect journal and bearing surfaces from any abrasives.

1. Deglaze the cylinder bores using a flex-hone with 180 grit stones.
2. Use the flex-hone as instructed by the manufacturer to obtain a 30-40° crosshatch pattern as shown.

IMPORTANT: Avoid Damage! Do not use gasoline, kerosene, or commercial solvents to clean cylinder bores. Solvents will not remove all abrasives from cylinder walls.

3. Remove excess abrasive residue from the cylinder walls using a clean, dry rag. Clean the cylinder walls using clean white rags and warm soapy water. Continue to clean the cylinder until white rags show no discoloration.



TCAL25345 —UN—15JUN12

OUMX258,0000683 -19-05NOV12-2/3

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.

1. Align the center of bore to the drill press center.

IMPORTANT: Avoid Damage! Check stone for wear or damage. Use a rigid hone with 300-grit stones.

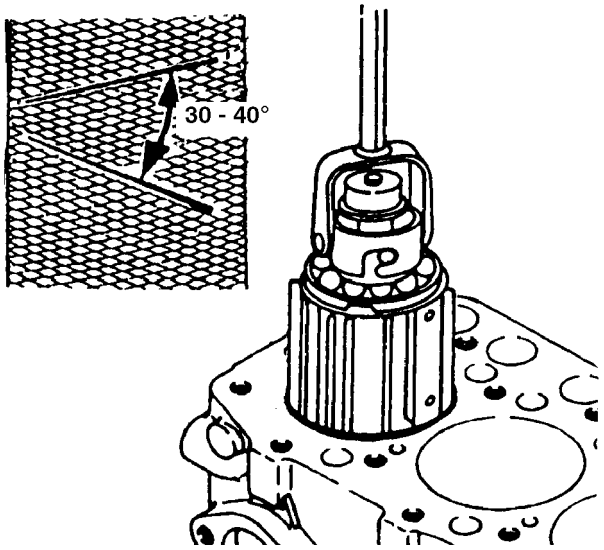
2. Adjust the hone so the lower end is even with the lower end of cylinder bore.
3. Adjust the rigid hone stones until they contact the narrowest point of the cylinder.
4. Coat the cylinder with honing oil. The hone should turn by hand. Adjust the hone if it is too tight.
5. Run the drill press at about 250 rpm. Move the hone up and down in order to obtain a 30—40° crosshatch pattern.

NOTE: Measure the bore when the cylinder is cool.

6. Stop the press and check the cylinder diameter.

NOTE: Finish should not be smooth. It should have a 30—40° crosshatch pattern.

7. Remove the rigid hone when the 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 the bore for size.



TCAL25346 —UN—15JUN12

10. Check bore for taper and out-of-round. (See Inspect Cylinder Bore Taper and Out-of-Round.)

IMPORTANT: Avoid Damage! Do not use solvents to clean the cylinder bores. Solvents will not remove all the metal particles and abrasives produced during honing.

11. Clean the cylinder thoroughly using warm, soapy water until clean white rags show no discoloration.
12. Dry the cylinder and apply engine oil.

OUMX258,0000683 -19-05NOV12-3/3

Inspect Cylinder Bore Taper and Out-of-Round

1. Use a cylinder dial gauge and inside micrometer, or a telescope gauge and outside micrometer, to measure cylinder bore.
2. Measure the bore parallel to the crankshaft at the top end of the ring travel zone.
3. Measure the bore in the same position at the bottom end of the ring travel zone.
4. Measure the bore at right angles to the crankshaft at the top end of the ring travel zone.
5. Measure the bore in the same position at the bottom end of the ring travel zone.
6. Compare measurements from steps 2 and 4 to find the out-of-round wear at the top end of the bore.
7. Compare measurements from steps 3 and 5 to find the out-of-round wear at the bottom end of the bore.
8. Compare results of measurements from steps 2, 3, 4, and 5 to find out whether the bore has worn tapered.

Specification

Cylinder Bore —Out-of-Round	0.00—0.01 mm (0.0000—0.0004 in.)
Cylinder Bore—Out-of-Round—Wear Limit	0.03 mm (0.001 in.)
Cylinder Bore—Taper	0.00—0.01 mm (0.0000—0.0004 in.)
Cylinder Bore—Taper—Wear Limit	0.03 mm (0.001 in.)

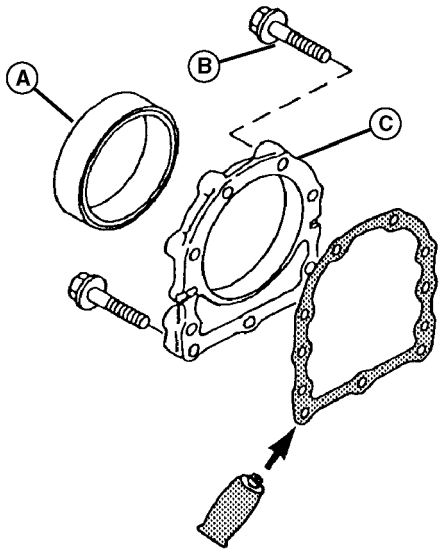
OUMX258,0000684 -19-05NOV12-1/1

Replace Crankshaft Rear Oil Seal

1. Remove flywheel. (See Remove and Install Flywheel.)
2. Remove the rear oil seal (A), case-to-crankcase extension cap screws, and the oil seal case-to-crankcase cap screws (B).
3. Remove the rear oil seal case (C).
4. Replace the oil seal using an appropriate seal driver, with the lip toward the cylinder block, flush with the surface of the oil seal case.

NOTE: If the crankshaft is grooved at the oil seal contact point, the seal can be installed 3 mm (0.12 in.) farther into the oil seal case.

5. Install the oil seal case to the crankcase and crankcase extension.



TCAL25347 —UN—15JUN12

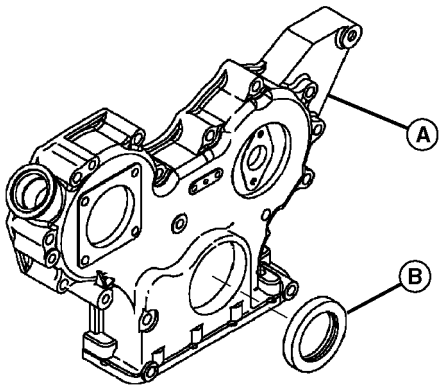
A—Rear Oil Seal
B—Cap Screws
C—Rear Oil Seal Case

OUMX258,0000685 -19-05NOV12-1/1

Replace Crankshaft Front Oil Seal

1. Remove the timing gear cover (A). (See Remove and Install Timing Gear Cover.)
2. Replace the oil seal (B). Install new seal with the lip toward inside of gear housing cover, flush with the surface of the cover.

A—Timing Gear Cover **B—Oil Seal**



TCAL25348 —UN—15JUN12

OUMX258,0000686 -19-05NOV12-1/1

Remove and Install Crankshaft and Main Bearings

Removal

1. Check the crankshaft end play. (See Check Crankshaft End Play.)
2. Remove the cylinder head. (See Remove and Install Cylinder Head and Valves.)
3. Remove rear oil seal. (See Replace Crankshaft Rear Oil Seal.)
4. Remove timing gear cover mounting plate. (See Remove and Install Timing Gear Cover Mounting Plate.)
5. Check the crankshaft rod bearing clearance. (See Check Connecting Rod Bearing Clearance.)

IMPORTANT: Avoid Damage! Connecting rod caps must be installed on the same connecting rods from which they were removed. Note the alignment marks on the caps and rods.

6. Check the crankshaft main bearing clearance. (See Check Crankshaft Main Bearing Clearance.)

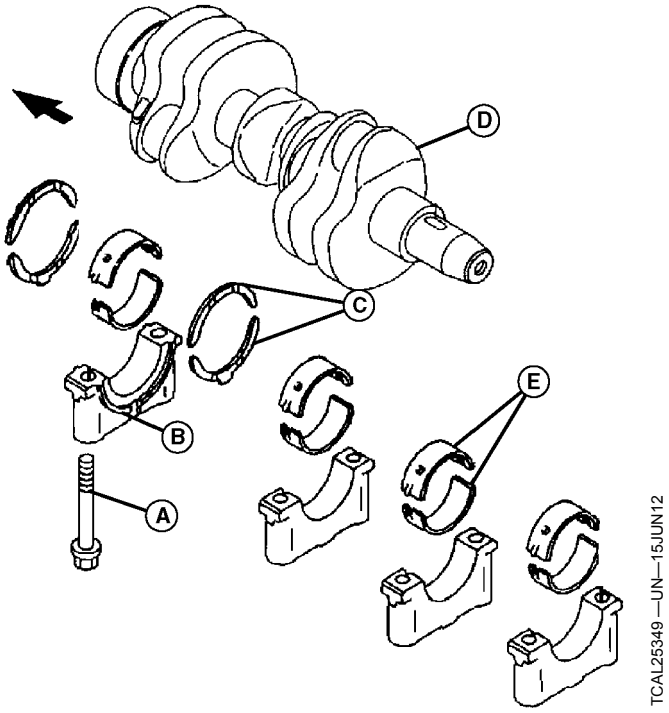
IMPORTANT: Avoid Damage! Main bearing caps must be installed on the same main bearings from which they were removed.

7. Remove the connecting rod cap screws and rod caps. Discard the connecting rod cap screws.
8. Push the pistons and connecting rods away from crankshaft.
9. Remove the main bearing cap screws (A), main bearing caps (B) and thrust bearings (C).
10. Remove the crankshaft (D).
11. Remove the block thrust bearings and main bearing inserts (E).
12. Inspect all parts for wear or damage.

Installation

IMPORTANT: Avoid Damage! Do not touch bearing insert surfaces. Oil and acid from your finger will corrode the bearing surface.

1. Apply clean engine oil to all parts during installation.
2. Install the grooved bearing inserts in the crankshaft bearing bores, aligning the tangs with the slots in the bores.
3. Install the thrust bearings with the oil grooves facing away from the engine block.
4. Install the crankshaft.



A—Cap Screws
B—Main Bearing Caps
C—Thrust Bearings
D—Crankshaft
E—Main Bearing Inserts

5. Install the bearing inserts in the main bearing caps, aligning the tangs with the slots in the caps.

NOTE: The main bearing caps have raised arrows that are stamped with numbers. Both correspond to their location on the engine block. Install all bearing caps with the arrow toward the flywheel end of the engine. Install the bearing caps, beginning with the thrust bearing cap (no number), number 1, then 2, etc. The main bearing cap at the gear train end does not have a number.

6. Install the thrust bearings, with the oil grooves facing away from the cap, in the number 1 main bearing cap.
7. Install the main bearing caps in their original locations with arrows pointing toward the flywheel side of the engine.

IMPORTANT: Avoid Damage! DO NOT use high-speed power tools or air wrenches to tighten main bearing cap screws.

8. Dip each main bearing cap screw entirely in clean engine oil. Install the cap screws but do not tighten.
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.

Continued on next page

10. Tighten the main bearing cap screws to specification. When tightening, start at the center main bearing cap and work your way out, alternating to the ends. Turn the crankshaft by hand. If it does not turn easily, disassemble the parts and find the cause.

Specification

Main Bearing Cap
Screw—Torque.....98 N·m
(72 lb.-ft.)

IMPORTANT: Avoid Damage! The connecting rod caps must be installed on the same connecting rods they were removed from. Never reuse connecting rod cap screws; replace with new.

11. Match the connecting rod caps to the rods using alignment marks. Install the caps to the rods.
12. Dip entire connecting rod cap screw in clean engine oil. Install new cap screws and tighten to specification. Turn crankshaft by hand. If it does not turn easily, disassemble the parts and find the cause.

Specification

Connecting Rod Cap
Screw—Torque.....47 N·m
(35 lb.-ft.)

13. Install the timing gear cover mounting plate.
14. Install the rear oil seal.
15. Install the flywheel.
16. Install the timing gear cover.
17. Install the front oil seal.
18. Install the oil pan.

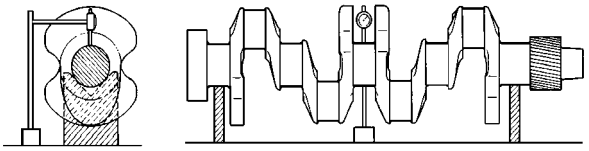
OUMX258,0000687 -19-06NOV12-2/2

Inspect Crankshaft and Main Bearings

1. Inspect the crankshaft gear for chipped or broken teeth. Replace if necessary.
2. Inspect the crankshaft for bend using V-blocks and a dial indicator. Turn the crankshaft slowly and read variations on the indicator. If the variation is greater than specification, replace the crankshaft.

Specification

Crankshaft—Axial
Runout (Wobble)..... 0.02 mm
(0.001 in.)



TCAL25350 —UN—15JUN12

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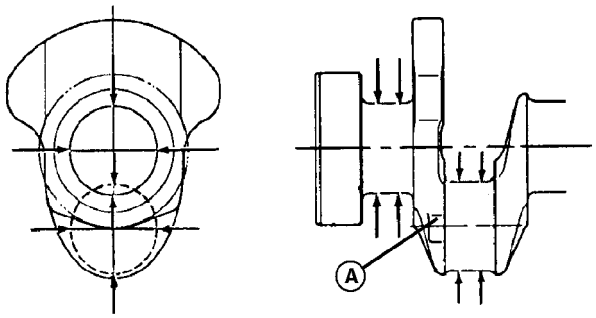
OUMX258,0000688 -19-05NOV12-1/3

3. Measure the crankshaft connecting rod journal and main bearing journal diameters at several places around each journal.
   - If the journal diameter (A) is less than the specification but greater than the wear limit, have the journals ground undersize 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.
   - If the journal diameter is less than the wear limit, replace the crankshaft.

Connecting Rod and Main Bearing Journals—Specification

Connecting Rod Journal—OD	47.95—47.96 mm (1.8878—1.8882 in.)
Connecting Rod Journal—OD—Wear Limit	47.91 mm (1.886 in.)
Main Bearing Journal—OD	53.95—53.96 mm (2.1240—2.1244 in.)
Main Bearing Journal—OD—Wear Limit	53.91 mm (2.122 in.)



TCAL25351 —UN—15JUN12

A—Journal Diameter

4. Install the bearing inserts and main bearing caps on the main bearings. Tighten the main bearing cap screws to specification.

Specification

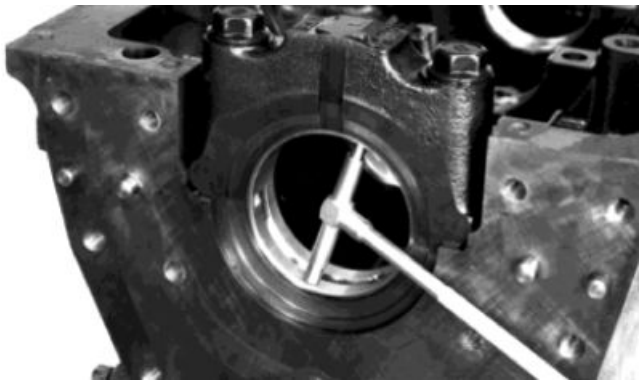
Main Bearing Cap Screw—Torque	98—100 N·m (71—74 lb.-ft.)

OUMX258,0000688 -19-05NOV12-2/3

5. Measure the main bearing inner diameter.
6. Subtract the main bearing journal OD of the crankshaft from the main bearing ID to obtain the main bearing oil clearance.
   a. If the crankshaft is within specification but the main bearing oil clearance exceeds the wear limit, replace the bearing inserts.
   b. If the crankshaft is not within specification, have crankshaft journals ground undersize by a qualified machine shop and install undersized bearing inserts.
   c. If the crankshaft is worn past the wear limit, replace the crankshaft.

Main Bearing Clearance—Specification

Main Bearing—Oil Clearance	0.038—0.074 mm (0.001—0.003 in.)
Main Bearing—Oil Clearance—Wear Limit	0.15 mm (0.006 in.)



TCAL25352 —UN—15JUN12

7. Clean and inspect the oil passages in the main bearing journals, connecting rod journals, and main bearing bores in cylinder block.
8. Inspect the crankshaft for cracks or damage. Replace if necessary.

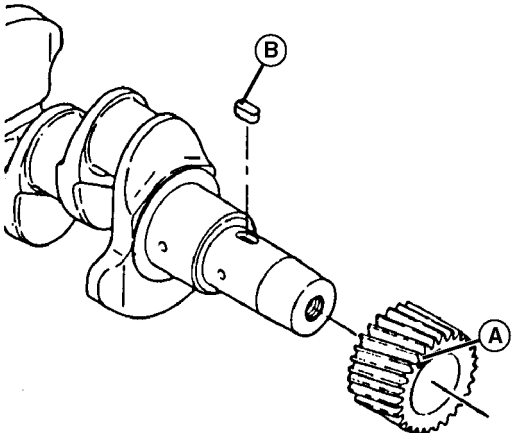
OUMX258,0000688 -19-05NOV12-3/3

Remove and Install Crankshaft Gear

1. Remove the gear from crankshaft using a knife-edge puller and a press.

CAUTION: Avoid Injury! 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.

2. Heat new gear to approximately 150°C (302°F). Install gear with timing mark (A) toward press table. Align slot in gear with key (B) in shaft. Press crankshaft into gear until gear is tight against crankshaft shoulder.



TCAL25353 —UN—15JUN12

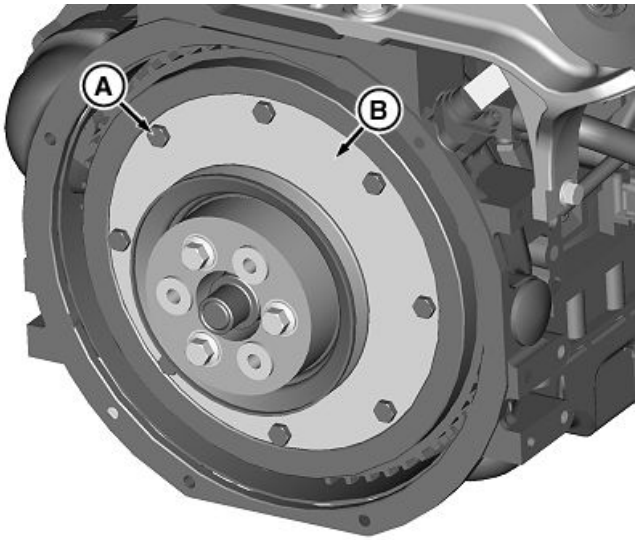
A—Timing Mark **B—Key**

OUMX258,0000689 -19-05NOV12-1/1

Remove and Install Flywheel

1. Flywheel can be removed without removing engine from machine. If removing flywheel in machine, remove engine driveshaft first.
2. Remove eight cap screws (A) and flex plate (B).

A—Cap Screws (8 Used) **B—Flex Plate**



TCT010666 —UN—25MAR14

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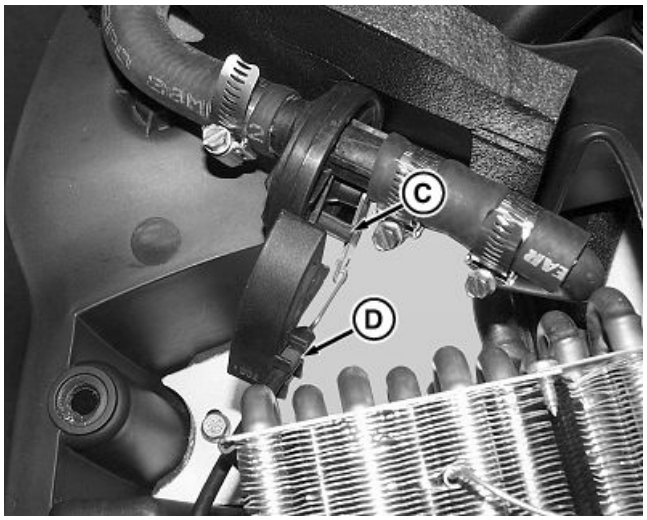
BS62576,0001707 -19-25MAR14-1/3

IMPORTANT: Avoid Damage! Always install new flywheel mounting cap screws.

3. Remove the flywheel mounting cap screws (C) and remove the flywheel (D) from crankshaft.

C—Cap Screws (6 Used) **E—Pin**
D—Flywheel



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BS62576,0001707 -19-25MAR14-2/3

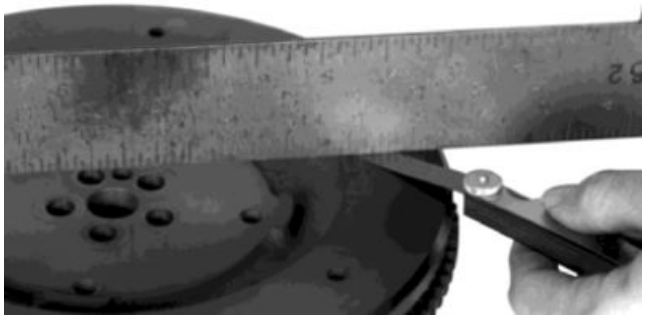
Installation

1. Use pin (E) in crankshaft to correctly locate the flywheel on the crankshaft.
2. Install the flywheel. Apply lubrication oil to the mounting cap screws and tighten to specification.

Specification

Flywheel Mounting Cap Screw—Torque ..... 83—88 N·m (62—65 lb.-ft.)

3. Install flex plate with raised hub facing away from flywheel.
4. Install cap screws and tighten to specification.
5. Measure flywheel flatness. Place a straightedge across the flywheel surface opposite of ring gear. Measure the clearance between the straightedge and the flywheel surface with a feeler gauge. Replace the flywheel if the clearance exceeds specification.



TCAL25356 —UN—15JUN12

Specification

Flywheel—Out-of-Flat (Maximum) ..... 0.02 mm (0.001 in.)

BS62576,0001707 -19-25MAR14-3/3

Remove and Install Camshaft

Special or Required Tools

- D15001NU Magnetic Follower Holder Kit

Removal

1. Remove the rocker arm assembly and push rods. (See Remove and Install Rocker Arm Assembly.)
2. Remove the timing gear cover. (See Remove and Install Timing Gear Cover.)
3. Check the camshaft end play. (See Check Camshaft End Play.)
4. Check the backlash of the timing gears. (See Check Timing Gear Backlash.)

NOTE: If a magnetic follower holder kit is not available, turn engine until oil pan is upward to hold cam followers away from camshaft.

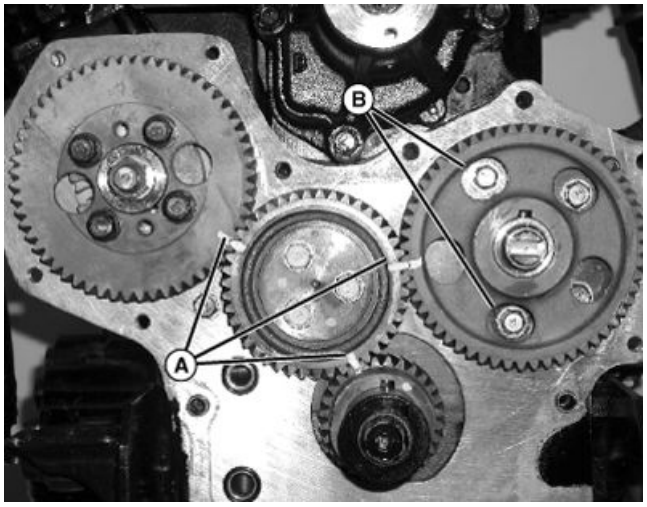
5. Hold the cam followers away from the camshaft using D15001NU Magnetic Follower Holder Kit, or equivalent.

NOTE: Several rotations may be required to line up all timing marks.

6. Rotate the crankshaft and align the timing marks (A).

IMPORTANT: Avoid Damage! DO NOT allow the camshaft lobes to hit any bearing surfaces while removing the camshaft. Machined surfaces can be damaged.

7. Remove two thrust plate mounting cap screws (B), the thrust plate, and the camshaft.



TCAL25357 —UN—15JUN12

A—Timing marks

B—Thrust Pate Mounting Cap Screws (2 Used)

8. Inspect all parts for wear or damage.

Installation

Apply clean engine oil on all parts during installation.

IMPORTANT: Avoid Damage! DO NOT allow camshaft lobes to hit bearing surfaces while installing camshaft. Machined surfaces and bearings can be damaged.

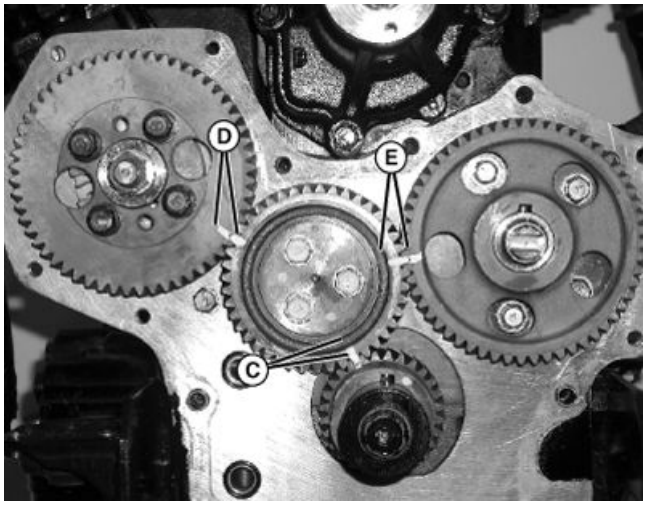
NOTE: Several rotations may be required to line up all timing marks.

OUMX258,000068B -19-12JUN14-1/2

1. Rotate the crankshaft to align the timing marks (C, D, and E).
2. Install the camshaft.
3. Install the thrust plate and thrust plate mounting cap screws. Tighten cap screws to specification.

Specification	
Thrust Plate Mounting Cap Screw—Torque	26 N·m (226 lb.-in.)

4. Install the timing gear cover.
5. Install push rods and rocker arm assembly.



TCAL25358 —UN—15JUN12

C—Timing Mark
D—Timing Mark
E—Timing Mark

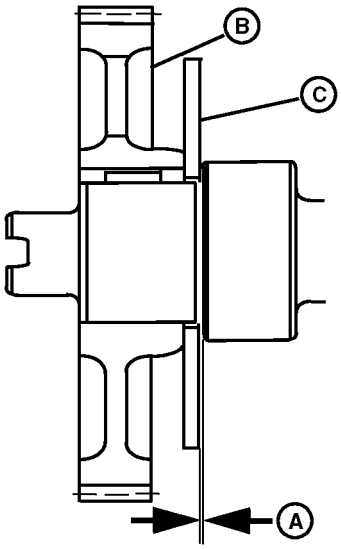
OUMX258,000068B -19-12JUN14-2/2

Inspect Camshaft

Camshaft End Play

1. Check the camshaft end play (A) using a feeler gauge.
2. If the end play exceeds specification, remove the camshaft gear (B) and replace thrust plate (C). (See Remove and Install Camshaft Gear.)

Specification	
Camshaft—End Play	0.05—0.20 mm (0.002—0.010 in.)
Camshaft—End Play—Wear Limit	0.30 mm (0.012 in.)



TCAL25359 —UN—15JUN12

A—Camshaft End Play
B—Camshaft Gear
C—Thrust Plate

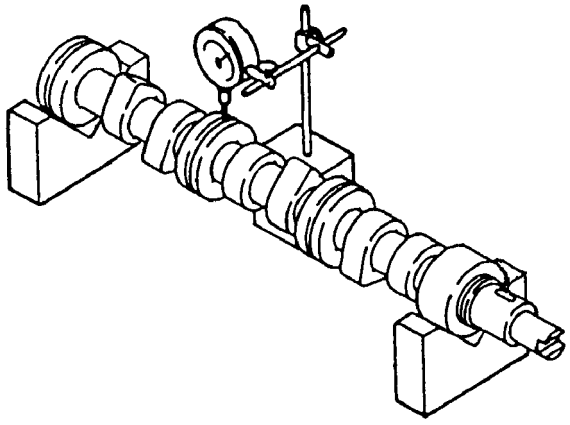
OUMX258,000068C -19-12JUN14-1/7

Camshaft Bend

Inspect the camshaft for bend using V-blocks and a dial indicator. Turn the camshaft slowly and read variation on the indicator.

- If the variation is greater than specification, replace the camshaft.

Specification	
Camshaft—Bending (Maximum)	0.05 mm (0.002 in.)



TCAL25360 —UN—15JUN12

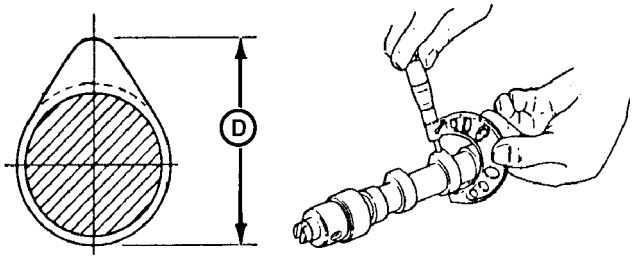
OUMX258,000068C -19-12JUN14-2/7

Camshaft Lobe Height

Measure the camshaft lobe height (D) and compare with specifications.

- If the lobe height is less than wear limit, replace the camshaft.

Specification	
Camshaft Lobe—Height	38.64—38.77 mm (1.521—1.526 in.)
Camshaft Lobe—Height—Wear Limit	38.40 mm (1.512 in.)



TCAL25361 —UN—15JUN12

D—Camshaft Lobe Height

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OUMX258,000068C -19-12JUN14-3/7

Camshaft Journals

1. Measure gear housing (G) and flywheel end (E) camshaft journal outside diameters and compare with specifications.

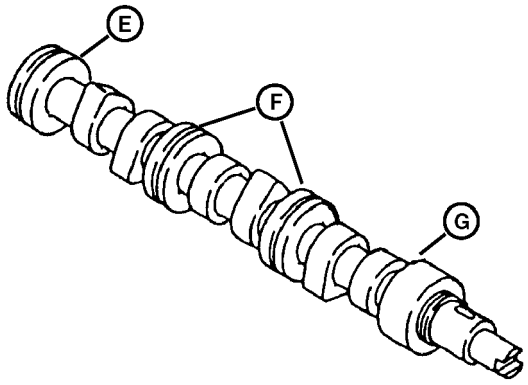
Specification	
Camshaft—Gear Housing and Flywheel End Journals—OD	44.93—44.95 mm (1.769—1.770 in.)

2. Measure intermediate (F) camshaft journal outside diameters and compare with specifications.

Specification	
Camshaft—Intermediate Journals—OD	44.91—44.94 mm (1.768—1.769 in.)

3. If journal diameters are less than wear limit, replace the camshaft.

Specification	
Camshaft Journals—OD—Wear Limit	44.85 mm (1.766 in.)



TCAL25362 —UN—15JUN12

E—Flywheel End Journal
F—Intermediate Journals
G—Gear Housing End Journal

OUMX258,000068C -19-12JUN14-4/7

Camshaft Bushings

1. Measure the camshaft bushing (H) inside diameter at the gear housing end and compare with specifications.

Specification	
Camshaft Bushing—Gear Housing—ID	44.990—45.055 mm (1.771—1.774 in.)

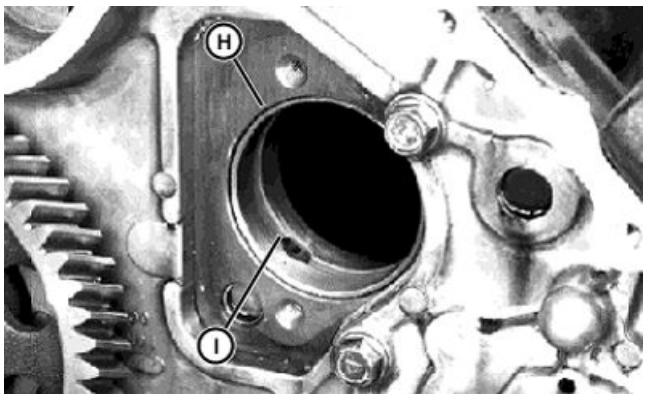
2. If bushing diameter exceeds wear limit, replace bushing.

Specification	
Camshaft Bushing—ID—Wear Limit	45.10 mm (1.776 in.)

3. If bushing clearance (bushing ID minus camshaft journal OD) exceeds specification, replace bushing, camshaft, or both.

Specification	
Camshaft Bushing-to-Journal—Clearance	0.23 mm (0.009 in.)

4. If replacing the camshaft bushing:
   a. Use a chisel to remove the bushing. Be careful not to push the bushing inside the engine.



TCAL25363 —UN—15JUN12

H—Camshaft Bushing
I— Oil Holes

   b. Align the oil holes (I) in new bushing and cylinder block. Install bushing using a driver set.

NOTE: Flywheel plate must be removed to measure camshaft intermediate and flywheel end bearing diameters.

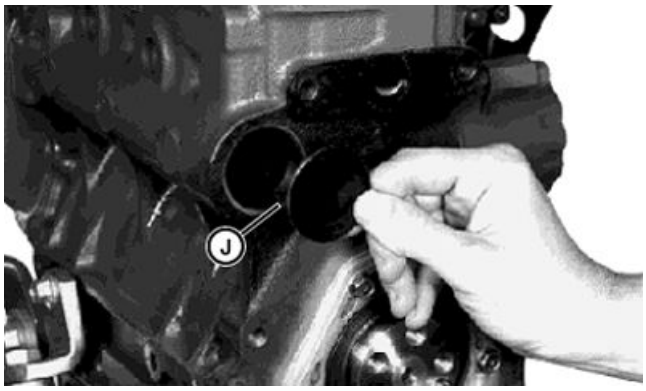
5. Remove flywheel plate.

Continued on next page

OUMX258,000068C -19-12JUN14-5/7

6. Remove plug (J) using a long wooden dowel. Insert wooden dowel through gear housing side.

J— Plug



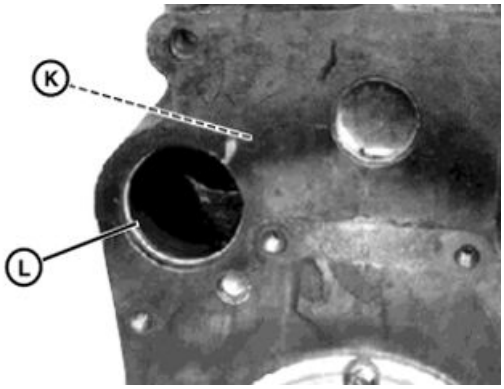
TCAL25364 —UN—15JUN12

OUMX258,000068C -19-12JUN14-6/7

7. Measure the intermediate (K) and flywheel end (L) camshaft bore diameters and compare with specifications.

Specification	
Camshaft Bushing—Intermediate and Flywheel End—ID	45.004—5.025 mm (1.772—1.773 in.)

8. Apply John Deere™ Form-In-Place Gasket, or an equivalent, on the outer edge of the plug. Install the plug until it bottoms in the bore.



TCAL25365 —UN—15JUN12

K—Intermediate Bore **L— Flywheel End Bore**

John Deere is a trademark of Deere & Company

OUMX258,000068C -19-12JUN14-7/7

Remove and Install Camshaft Gear

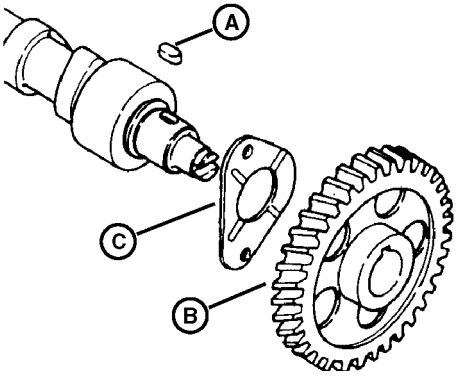
⚠ CAUTION: Avoid Injury! DO NOT heat oil over 182°C (360°F). Oil fumes or oil can ignite above 193°C (380°F). Use a thermometer. Do not allow a flame or heating element to come in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

1. Heat the gear in oil to approximately 150°C (300°F).

IMPORTANT: Avoid Damage! Be sure thrust plate is not between camshaft gear and camshaft shoulder while installing gear.

NOTE: Thrust plate must spin freely on camshaft.

2. Install the thrust plate (C) if removed. Install the gear (B) with timing mark “C” side toward press table. Align the slot in the gear with key (A) in shaft. Press the camshaft into gear until gear is tight against camshaft shoulder.



TCAL25366 —UN—15JUN12

A—Key **C—Thrust Plate**
B—Gear

OUMX258,000068D -19-05NOV12-1/1

Remove and Install Cam Followers

Removal

1. Remove camshaft. (See Remove and Install Camshaft.)
2. Remove the oil pan and strainer. (See Remove and Install Oil Pan, Crankcase Extension, and Strainer.)

IMPORTANT: Avoid Damage! Cam followers must be installed in the same bores from which they were removed.

3. Put a mark on each cam follower and cylinder block bore to aid in installation.
4. Remove cam followers.
5. Inspect all parts for wear or damage.
6. Apply clean engine oil to all parts during installation.

Installation

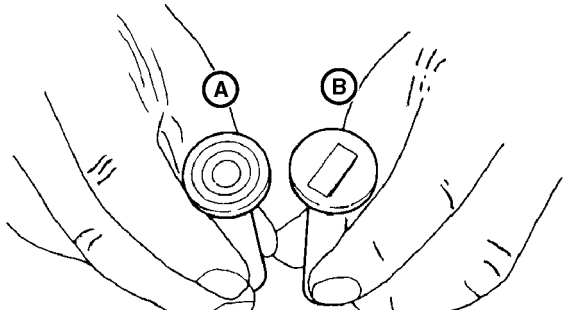
Installation is done in the reverse order of removal.

OUMX258,000068E -19-05NOV12-1/1

Inspect Cam Followers

1. Inspect the cam follower contact surface for normal contact (A) or abnormal wear (B). Replace if necessary.

A—Normal Contact **B—Abnormal Wear**



TCAL25367 —UN—15JUN12

OUMX258,000068F -19-05NOV12-1/2

2. Measure the cam follower stem diameter and compare with specifications. If stem diameter is less then wear limit, replace cam follower.

Specification

Cam Follower Stem—OD..... 11.98—11.99 mm (0.471—0.472 in.)

Cam Follower Stem—OD—Wear Limit.....11.96 mm (0.470 in.)

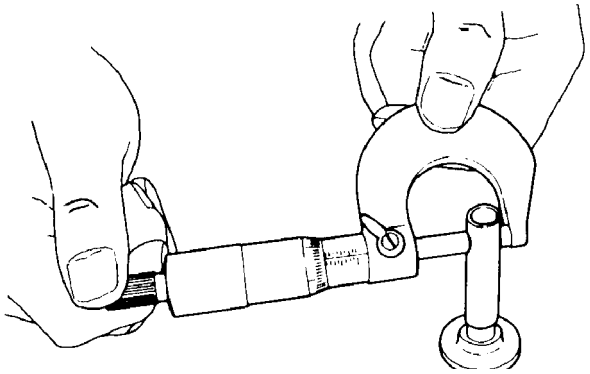
3. Measure the cam follower bore diameter in the cylinder block and compare with specifications. If the cam follower bore diameter exceeds wear limit, replace the cylinder block.

Specification

Cam Follower Bore—ID.....12.00—12.02 mm (0.472—0.473 in.)

Cam Follower Bore—ID—Wear Limit..... 12.04 mm (0.474 in.)

4. If the bore clearance (bore ID minus follower stem OD) exceeds specification, replace the cam follower, cylinder block, or both.



TCAL25368 —UN—15JUN12

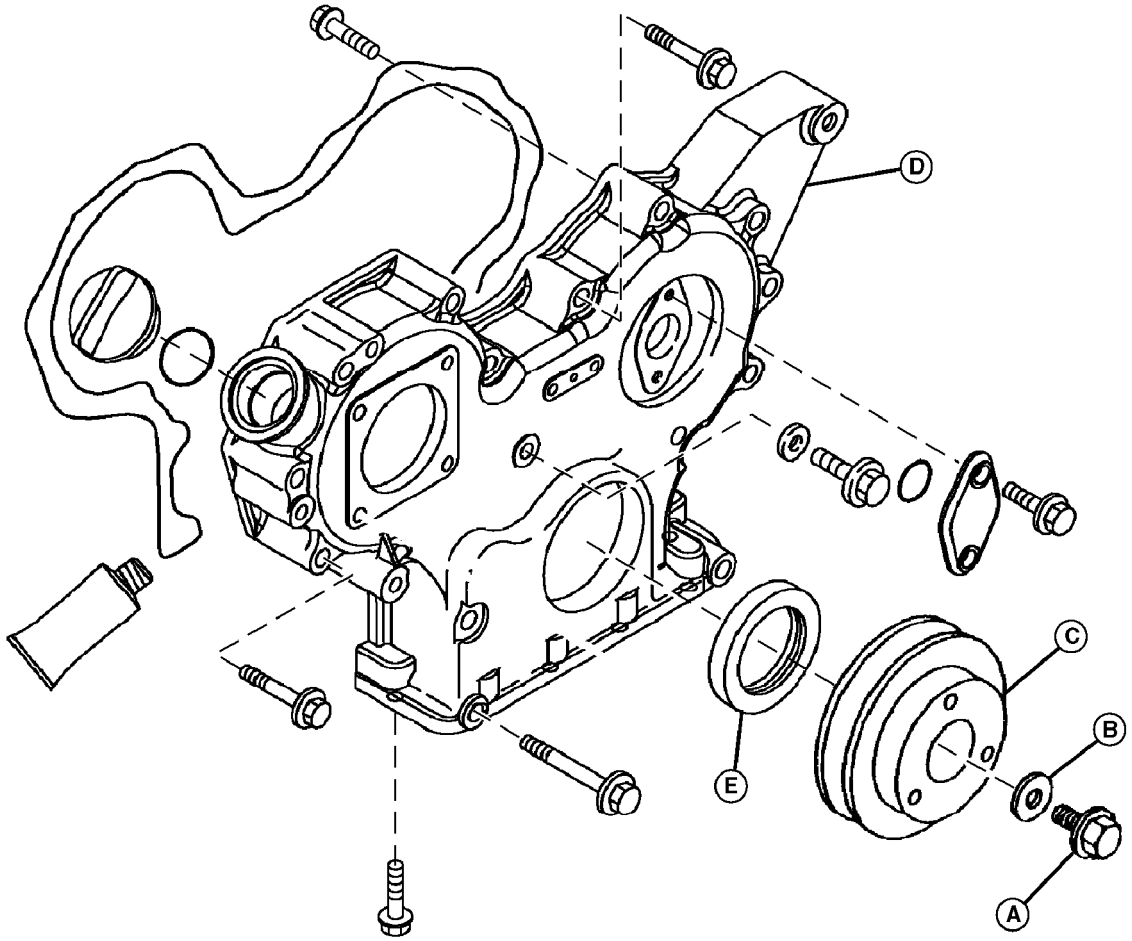
Specification

Cam Follower Stem-to-Bore—Clearance.....0.010—0.043 mm (0.0.001—0.002 in.)

OUMX258,000068F -19-05NOV12-2/2

Remove and Install Timing Gear Cover

Removal



TCAL25369 —UN—15JUN12

A—Crankshaft Pulley Cap Screw **B—Washer** **C—Crankshaft Pulley** **D—Timing Gear Cover** **E—Oil Seal**

1. Remove engine. (See Remove and Install Engine.)
2. Remove oil pan and pan extension. (See Remove and Install Oil Pan, Crankcase Extension, and Strainer.)
3. Remove crankshaft pulley cap screw (A) and washer (B).
4. Remove crankshaft pulley (C) using a puller.

NOTE: It is not necessary to remove end cover and O-ring or fuel injection pump gear cover to remove timing gear cover.

5. Remove mounting cap screws and timing gear cover (D).
6. Inspect crankshaft oil seal (E) for wear or damage. Replace if necessary.

Installation

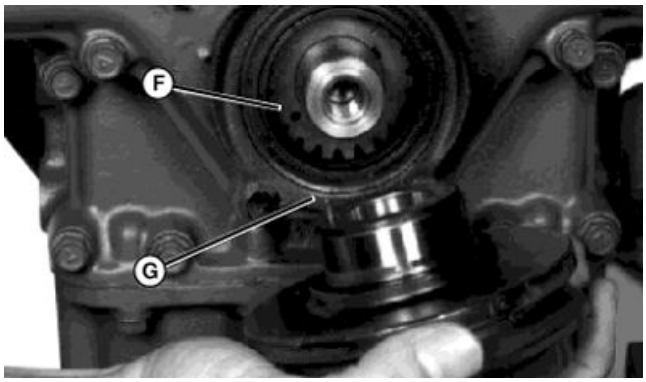
Installation is done in the reverse order of removal.

1. Replace oil seal using a driver set. Install seal with lip toward inside of gear housing cover. Install seal flush with surface of cover.
2. Clean surfaces and apply a bead of PM37465 RTV Form-in-Place Gasket to timing cover.
3. Tighten all timing gear cover mounting cap screws to specifications.

Continued on next page

OUMX258,0000690 -19-05NOV12-1/2

4. Align pin (G) in crankshaft pulley with hole (F) in crankshaft gear. Install crankshaft pulley.
5. Adjust coolant pump drive belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)



TCAL25370 —UN—15JUN12

F—Hole in Crankshaft Gear **G—Pin**

OUMX258,0000690 -19-05NOV12-2/2

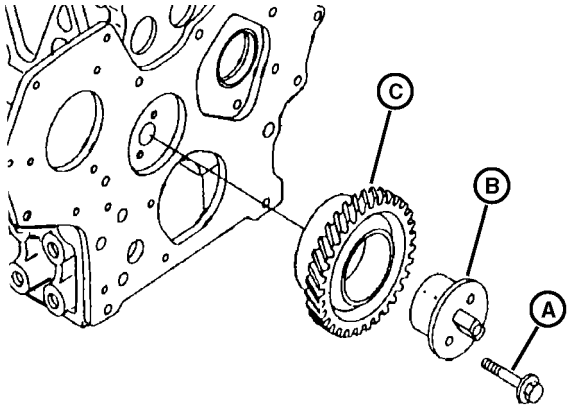
Remove and Install Idler Gear

Removal

1. Remove the timing gear cover. (See Remove and Install Timing Gear Cover.)
2. Check the backlash of timing gears. (See Check Timing Gear Backlash.)

NOTE: Due to the odd number of teeth on the idler gear, timing marks will only align periodically. When all timing marks on gears align, the piston closest to the coolant pump is at TDC on compression stroke. No. 1 cylinder is closest to the flywheel.

3. Rotate the crankshaft and align the timing marks.
4. Remove two cap screws (A), shaft (B), and gear (C).
5. Inspect all parts for wear or damage.



TCAL25371 —UN—15JUN12

A—Cap Screws (2 Used) **C—Gear**
B—Shaft

Installation

- Installation is done in the reverse order of removal.

OUMX258,0000691 -19-05NOV12-1/1

Inspect Idler Gear

1. Inspect the gear for chipped or broken teeth. Replace if necessary.
2. Measure the idler gear shaft diameter and compare with specifications.

Specification	
Idler Gear Shaft—OD	45.950—45.975 mm (1.809—1.810 in.)
Idler Gear Shaft—OD—Wear Limit	45.93 mm (1.808 in.)

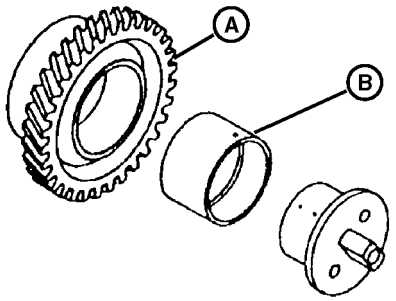
3. Measure the idler gear bushing diameter and compare with specifications.

Specification	
Idler Gear Bushing—ID	46.000—46.025 mm (1.811—1.812 in.)
Idler Gear Bushing—ID—Wear Limit	46.08 mm (1.814 in.)

4. If the bore clearance (bushing ID minus shaft OD) exceeds specification, replace the bushing, shaft, or both.

Specification	
Idler Gear Shaft and Bushing—Clearance	0.18 mm (0.007 in.)

5. Remove and install bushing:
   a. Replace the bushing using a driver set.



TCAL25372 —UN—15JUN12

A—Idler Gear **B—Bushing**

   b. Align the oil holes in bushing (B) and idler gear (A).
   c. Install the bushing flush with surface of idler gear.

OUMX258,0000692 -19-05NOV12-1/1

Remove and Install Timing Gear Cover Mounting Plate

Removal

1. Remove the camshaft. (See Remove and Install Camshaft.)
2. Remove the idler gear. (See Remove and Install Idler Gear.)
3. Remove the fuel injection pump.
4. Remove the oil pump. (See Remove and Install Oil Pump.)
5. Remove the mounting cap screws and plate.
6. Replace the O-rings.

Installation

Installation is done in the reverse order of removal.

OUMX258,0000693 -19-05NOV12-1/1

Remove and Install Oil Pan, Crankcase Extension, and Strainer

Removal

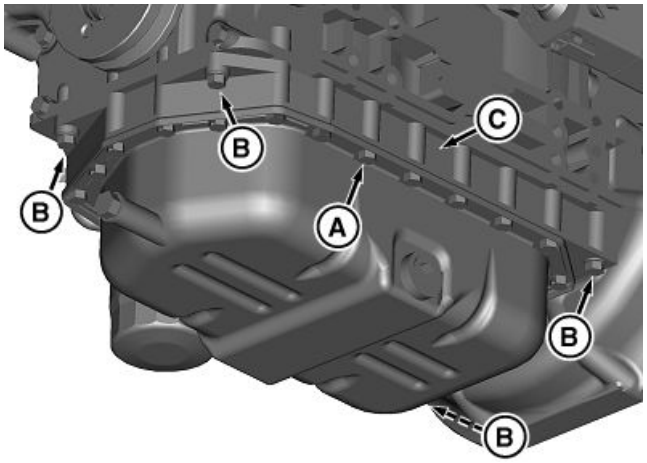
NOTE: Engine must be removed from machine to remove the oil pan.

1. Remove twenty-two cap screws (A) securing oil pan. Remove oil pan.
2. Remove cap screws for strainer and remove strainer and gasket.
3. If crankcase extension (C) is being removed, remove flywheel, three lower cap screws in rear oil seal housing, four flywheel housing cap screws, and four remaining cap screws (B) securing extension. Remove crankcase extension.

Installation

Installation is done in the reverse order of removal.

- Clean all mounting surfaces.
- Replace strainer gasket.



TCT010668 —UN—24MAR14

A—Cap Screws (22 Used)
B—Cap Screws
C—Crankcase Extension

- Apply PM37465 Ultra-Blue RTV Silicone Form-in-Place Gasket to oil pan and crankcase extension.

BS62576,0001706 -19-24MAR14-1/1

Remove and Install Oil Pump

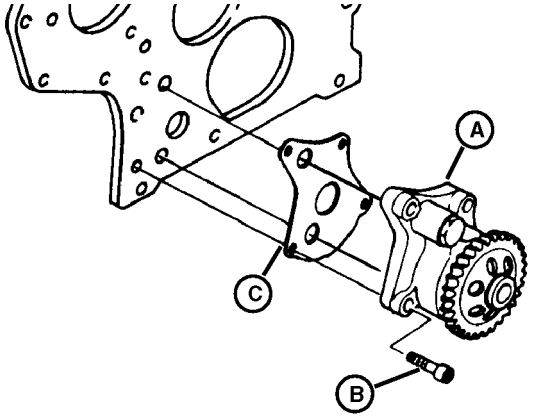
1. Remove timing gear cover. (See Remove and Install Timing Gear Cover.)
2. Check oil pump gear backlash. Replace the entire oil pump if backlash is more than specification.

Specification	
Oil Pump Gear—Backlash	0.07—0.15 mm (0.0028—0.0059 in.)
Oil Pump Gear—Backlash—Wear Limit	0.17 mm (0.0067 in.)

3. Remove three mounting cap screws (B).
4. Remove oil pump (A) and gasket (C).
5. Inspect all parts for wear or damage.

Installation

- Installation is done in the reverse order of removal.



TCAL25374 —UN—15JUN12

A—Oil Pump
B—Cap Screws (3 Used)
C—Gasket

- Use a new gasket for installation.

OUMX258,0000695 -19-11APR13-1/1

Disassemble and Assemble Oil Pump

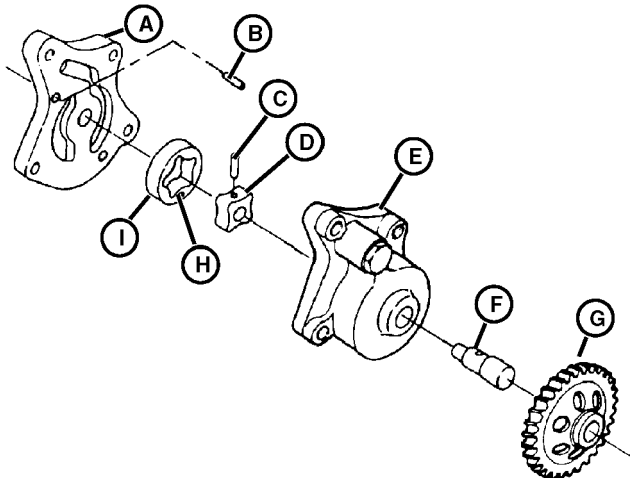
NOTE: The oil pump drive gear is press fit to the shaft.

1. Remove drive gear (G) using a knife-edge puller and a press.
2. Remove backing plate (A)
3. Remove outer rotor (I).
4. Remove pin (C) and inner rotor (D).
5. Remove rotor shaft (F).
6. Inspect all parts for wear or damage.

Assembly

Assembly is done in the reverse order of disassembly.

- Coat all parts with a light coat of clean engine oil before assembly.
- Install the outer rotor with the alignment mark (H) facing toward the pump body (E).



TCAL25375 —UN—15JUN12

A—Backing Plate
B—Alignment Pin (2 Used)
C—Pin
D—Inner Rotor
E—Pump Body
F—Rotor Shaft
G—Drive Gear
H—Alignment Mark
I— Outer Rotor

OUMX258,0000696 -19-05NOV12-1/1

Inspect Oil Pump

1. Measure the rotor shaft outside diameter. Record the measurement.

Specification

Rotor Shaft—OD ..... 9.940 mm (0.3913 in.)

2. Measure the inside diameter of the rotor shaft bore. Record the measurement.

Specification

Rotor Shaft Bore—ID ..... 9.955—9.967 mm (0.3919—0.3924 in.)

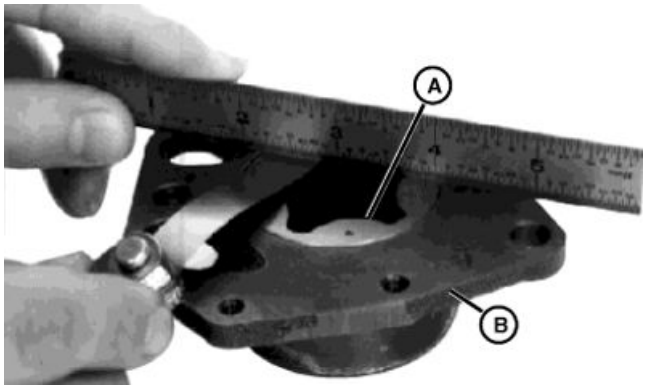
3. Subtract the rotor shaft outside diameter from the rotor shaft bore inside diameter to determine the rotor shaft-to-bore clearance. Replace the pump if the clearance is greater than specification.

Specification

Rotor Shaft—Clearance ..... 0.033—0.060 mm (0.0013—0.0024 in.)

Rotor Shaft—Clearance—Wear Limit ..... 0.100 mm (0.0039 in.)

4. Install outer rotor (A) in pump body (B).
5. Place a straightedge across the pump body mounting surface and measure outer rotor recess using a feeler gauge. Replace the entire pump if clearance is greater than specification.



TCAL25376 —UN—15JUN12

A—Outer Rotor **B—Pump Body**

Specification

Outer Rotor to Housing—Side Clearance ..... 0.02—0.07 mm (0.0008—0.0028 in.)

Outer Rotor to Housing—Side Clearance—Wear Limit ..... 0.12 mm (0.0047 in.)

Continued on next page

OUMX258,0000697 -19-11APR13-1/3

6. Check outer rotor-to-pump body clearance using a feeler gauge. Replace the entire pump if clearance is greater than specification.

Specification

Outer Rotor-to-Pump Body—Clearance	0.12—0.21 mm (0.0047—0.0083 in.)
Outer Rotor-to-Pump Body—Clearance—Wear Limit	0.30 mm (0.0118 in.)

TCAL25377 —UN—15JUN12

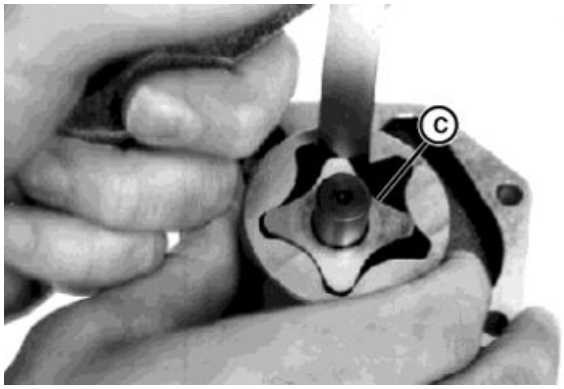
OUMX258,0000697 -19-11APR13-2/3

7. Install the inner rotor (C) in the outer rotor.
8. Check clearance between the tip of the inner rotor and the outer rotor. Replace the entire pump if clearance is greater than specification.

Specification

Outer Rotor-to-Inner Rotor Tip—Clearance (Limit)	0.16 mm (0.0063 in.)

C—Inner Rotor



TCAL25378 —UN—15JUN12

OUMX258,0000697 -19-11APR13-3/3

Remove and Install Oil Cooler

Removal

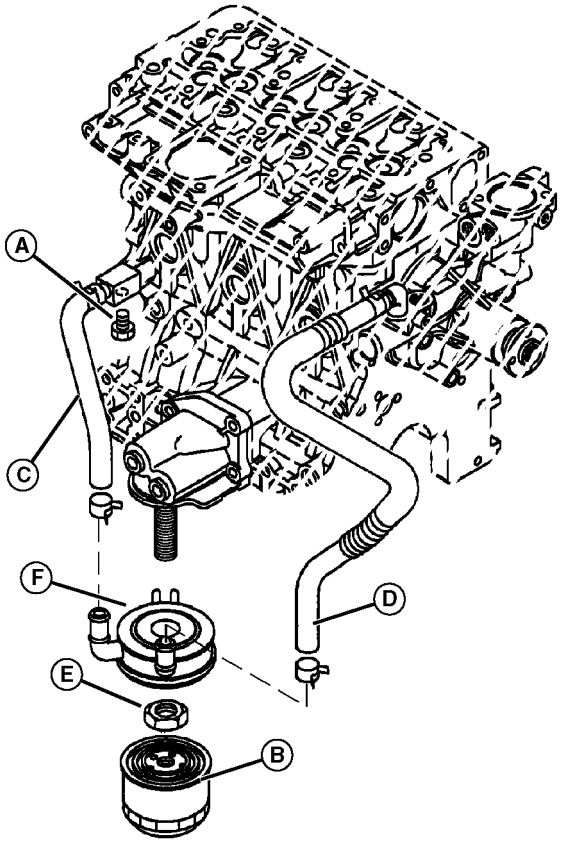
1. Remove drain plug (A) to drain engine cooling system.
2. Remove oil filter (B).
3. Disconnect coolant hoses (C and D).
4. Remove nut (E) and oil cooler (F).
5. Pressure test oil cooler for leakage by applying 206-483 kPa (30-70 psi) of compressed air to oil cooler and submersing in water.

Installation

Installation is done in the reverse order of removal.

- Replace O-rings.

A—Drain Plug
B—Oil Filter
C—Coolant Hose
D—Coolant Hose
E—Nut
F—Oil Cooler



TCAL25379 —UN—15JUN12

OUMX258,0000698 -19-05NOV12-1/1

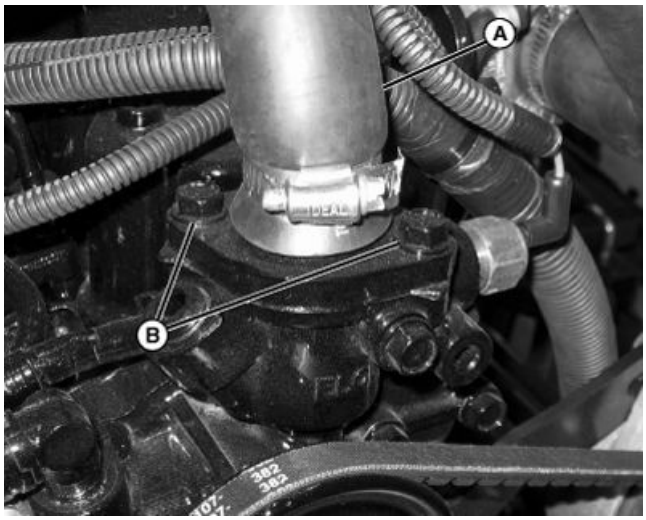
Remove and Install Thermostat

Removal

1. Drain coolant from radiator.
2. Remove upper radiator hose (A).
3. Remove cap screws (B), thermostat flange, and gasket.
4. Remove thermostat from housing.
5. Inspect all parts for wear or damage. Replace as necessary.
6. Test thermostat. (See Test Thermostat Opening.)

Installation

Installation is done in the reverse order of removal.



TCAL25380 —UN—15JUN12

A—Upper Radiator Hose **B—Cap Screws**

OUMX258,0000699 -19-05NOV12-1/1

Inspect Coolant Pump

1. Inspect coolant pump for coolant leakage. If origin of leak cannot be determined, pressurize coolant system. (See Test Cooling System Pressure.)
   - If coolant leaks at pulley flange, shaft seal is defective. Replace coolant pump.
   - If coolant leaks between plate and pump housing, gasket between plate and pump housing is defective. Remove plate and replace gasket.
   - If coolant leaks between plate and engine block, remove coolant pump and replace gasket.
2. Inspect coolant pump for worn bearing shaft by removing alternator belt and checking for excessive movement of pulley. Replace coolant pump if excessive movement is noticed.
   - If bearing shaft is making noise when operating, check alternator belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

OUMX258,000069A -19-21MAY14-1/1

Remove and Install Coolant Pump

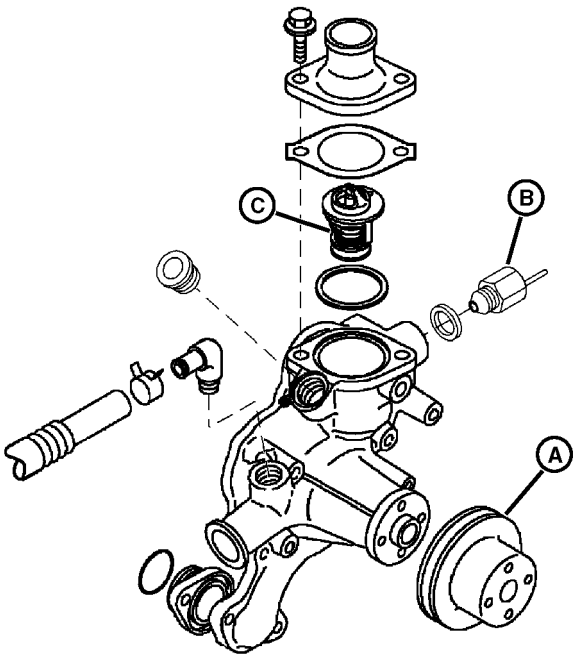
Removal

1. Drain engine coolant.
2. Remove the coolant pump drive belt. (See Remove 48 Volt Alternator Drive Belt.)
3. Remove the coolant pump pulley (A).
4. Disconnect the upper and lower radiator hoses.
5. Disconnect electrical connector from coolant temperature sensor (B).
6. Remove coolant lines from pump.
7. Remove the mounting cap screws and pump. Discard gasket.
8. Inspect the pump for wear or damage.
9. Test the thermostat (C) for proper operation. (See Test Thermostat Opening.)

Installation

Installation is done in the reverse order of removal.

- Clean mating surfaces and replace the pump gasket.
- Adjust the coolant pump drive belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)



TCAL25381 —UN—15JUN12

A—Coolant Pump Pulley
B—Coolant Temperature Sensor
C—Thermostat

OUMX258,000069B -19-19NOV13-1/1

Disassemble and Assemble Water Separator

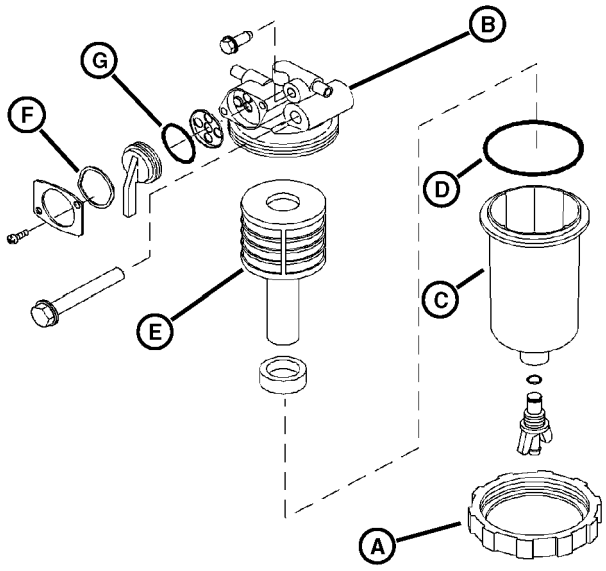
IMPORTANT: Avoid Damage! Replace all copper washers on injection pump fittings. Damaged or used washers will leak.

Always use new O-ring seals when replacing separator.

1. Remove the retaining ring (A) from the mounting base (B) while holding on to the separator bowl (C).
2. Remove the separator bowl from the mounting base.
3. Remove and replace O-ring (D) and strainer (E).
4. Remove shutoff valve cover. Inspect and replace wave washer (F) and O-ring (G) as necessary.
5. Before installing the bowl and strainer in the mounting base, verify the O-ring is in the groove inside the mounting base.
6. Install the separator bowl and the strainer in the mounting base.

IMPORTANT: Avoid Damage! Tighten only enough to keep the filter assembly from leaking. Overtightening the retaining nut may damage the filter cover or retaining ring.

7. Place the retaining ring over separator bowl and screw on the mounting base to retain bowl to mounting base.



TCAL25382 —UN—15JUN12

A—Retaining Ring
B—Mounting Base
C—Separator Bowl
D—O-Ring
E—Strainer
F—Wave Washer
G—O-Ring

OUMX258,000069C -19-05NOV12-1/1

Remove Fuel Injection Pump

CAUTION: Avoid Injury! Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other 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.

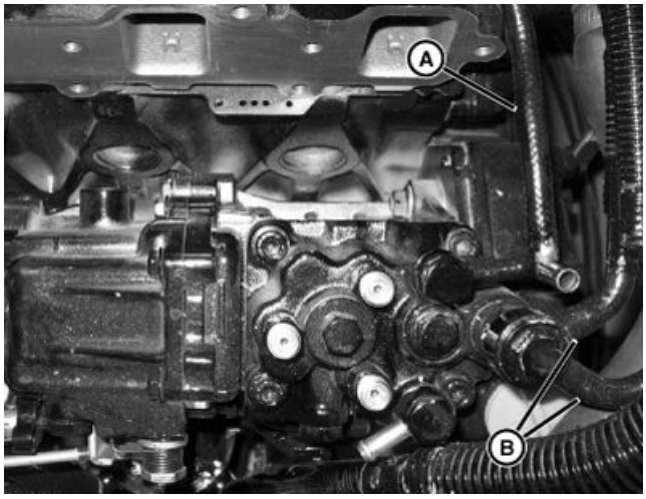
If an accident occurs, see a doctor immediately. Any fluid injected into the skin, must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable source. Such information is available from the Deere & Company Medical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

IMPORTANT: Avoid Damage! DO NOT attempt to service the injection pump or governor. If unit is in need of repair, it must be serviced by a qualified fuel injection repair shop. If replacement is necessary, replace entire unit.

DO NOT rotate engine while injection pump is removed. If engine is rotated, timing gear cover must be removed to ensure correct timing.

IMPORTANT: Avoid Damage! Never steam clean or pour cold water on injection pump while the pump is running or warm. Doing so can damage the pump.

1. Clean injection pump lines and area around pump using a parts cleaning solvent or steam cleaner.
2. Remove intake manifold. (See Remove and Install Intake Manifold.)
3. Disconnect throttle cable.
4. Drain coolant from radiator.
5. Disconnect leak-off line (A).
6. Disconnect coolant lines (B).



TCAL25383 —UN—15JUN12

A—Leak-Off Line **B—Coolant Lines**

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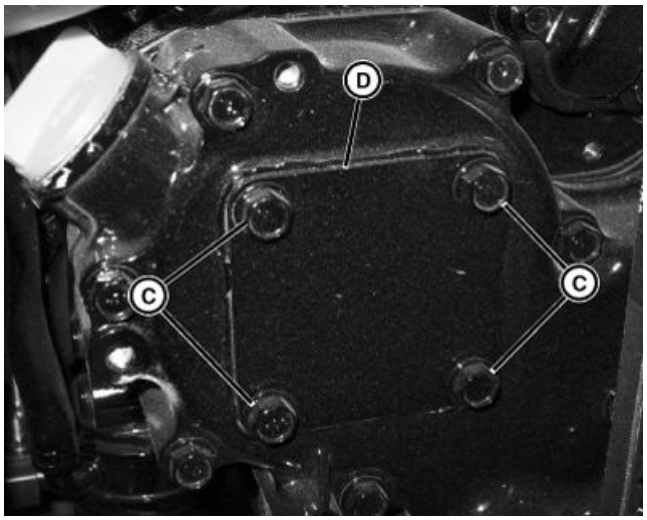
OUMX258,000069D -19-05NOV12-1/6

7. Remove four cap screws and washers (C), cover (D), and gasket.

C—Cap Screws and Washers (4 Used) **D—Cover**

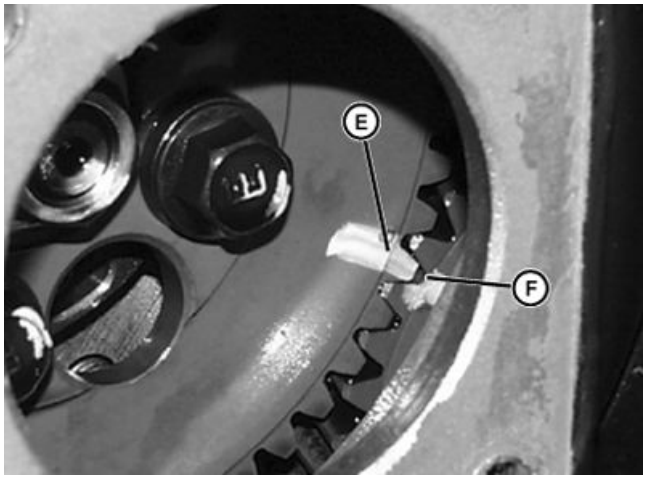


TCAL25384 —UN—15JUN12

OUMX258,000069D -19-05NOV12-2/6

8. Rotate engine in direction of rotation until timing mark (E) on pump gear aligns with mark on idler gear (F).

E—Timing Mark **F—Idler Gear**



TCAL25385 —UN—15JUN12

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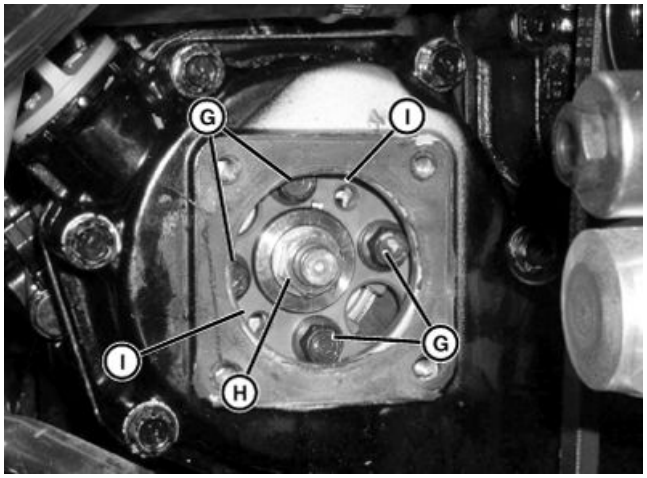
OUMX258,000069D -19-05NOV12-3/6

IMPORTANT: Avoid Damage! DO NOT loosen or disturb cap screws (G) securing gear to hub. This gear/hub assembly times the injection pump camshaft in relation to the crankshaft for precise timing of EPA engines. This procedure is done at the pump manufacturing plant and cannot be duplicated in the field!

Gear-to-hub 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 gear-to-hub adjustment may result in severe fines or penalties. If hub or gear is damaged, the entire engine must be replaced.

9. Remove nut (H) and lock washer from pump shaft.
10. Install puller using tapped M8 holes (I) in gear.
11. Remove gear from pump shaft. The gear will remain in timing cover.

G—Cap Screws
H—Nut
I— Tapped M8 Holes in Gear



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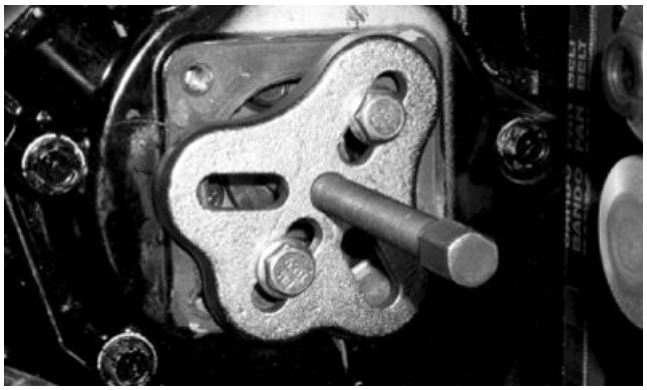


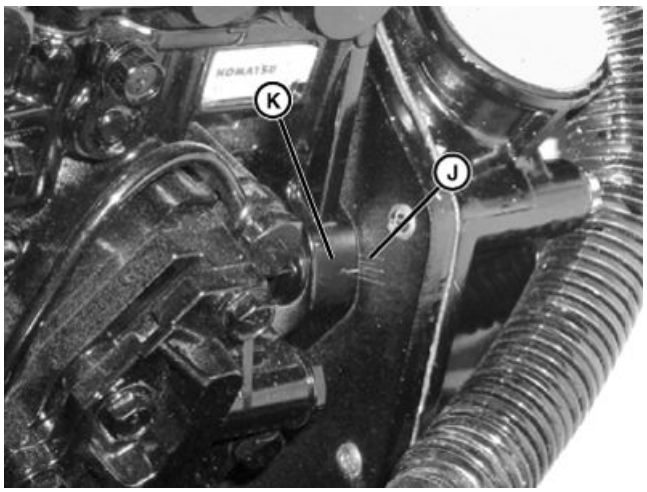
TCAL25387 —UN—15JUN12

OUMX258,000069D -19-05NOV12-4/6

IMPORTANT: Avoid Damage! Pump must be installed at exact location where it was removed.

12. Note the position of timing marks on gear cover mounting plate (J) and injection pump (K).

J— Gear Cover Mounting Plate
K—Injection Pump



TCAL25388 —UN—15JUN12

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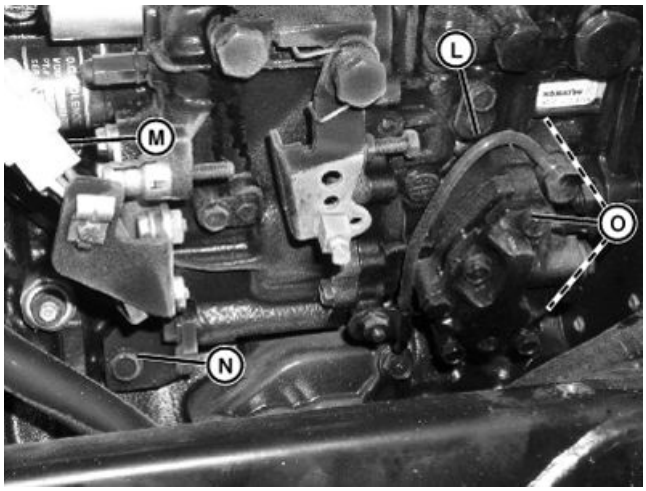
OUMX258,000069D -19-05NOV12-5/6

13. Remove lube line (L) from pump.
14. Disconnect fuel shutoff solenoid wire connector (M).
15. Remove cap screw (N) from bracket.

IMPORTANT: Avoid Damage! Do not attempt to service the injection pump or governor. If unit is in need of repair, it must be serviced by a qualified fuel injection repair shop. If replacement is necessary, replace the entire unit.

16. Remove three pump mounting nuts (O) and remove pump.



TCAL25389 —UN—15JUN12

L—Lube Line
M—Fuel Shutoff Solenoid Wire Connector
N—Cap Screw
O—Nuts (3 Used)

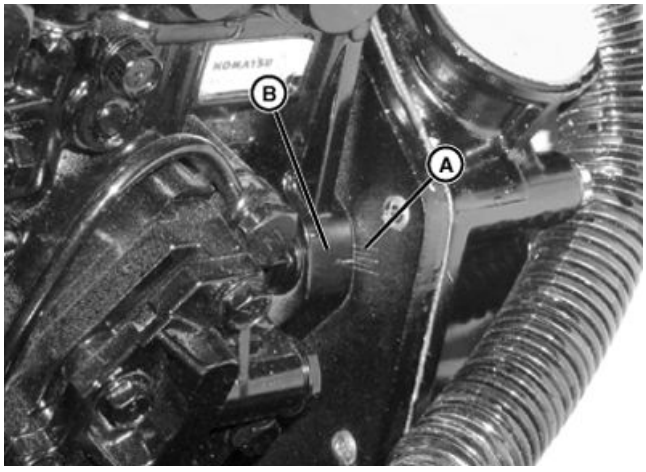
OUMX258,000069D -19-05NOV12-6/6

Install Fuel Injection Pump

1. Install new O-ring on injection pump.
2. Put injection pump onto back of gear cover mounting plate. Install three mounting nuts and one cap screw through bracket. Do not tighten. Align key on shaft with keyway in gear. Be sure to align marks on gears made during removal.
3. Install nut on timing gear. Tighten to specification.

Specification	
Fuel Injection Pump Drive Gear Nut—Torque (No Lubricant)	78—88 N·m (58—65 lb.-ft.)

4. Align marks on mounting plate (A) and injection pump (B) to the exact location as when removed. Tighten nuts and cap screw securely.
5. Place a thin bead of form-in-place gasket on access cover and install.
6. Connect fuel shutoff solenoid wire connector.



TCAL25390 —UN—15JUN12

A—Timing Marks on Mounting Plate
B—Injection Pump

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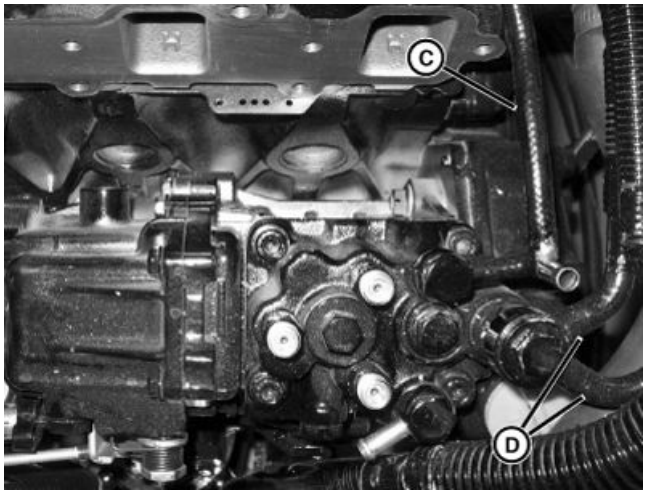
OUMX258,000069E -19-05NOV12-1/2

7. Connect leak-off line (C).
8. Install coolant lines (D).
9. Install intake manifold. (See Remove and Install Intake Manifold.)
10. Install and adjust throttle cable. (See Adjust Throttle Cable.)

IMPORTANT: Avoid Damage! If oil has been drained out of fuel injection pump housing, add oil as necessary. Fuel injection pump can become damaged if operated dry or without proper amount of oil.

11. Add oil through external lube line inlet until oil begins to drip out of inlet hole.
12. Install external lube line. When installing line, put one copper washer between mounting cap screw head and lube line and the other between lube line and housing.
13. Fill engine coolant to proper level.



TCAL25391 —UN—15JUN12

C—Leak-Off Line **D—Coolant Lines**

OUMX258,000069E -19-05NOV12-2/2

Remove and Install Fuel Injection Nozzle

IMPORTANT: Avoid Damage! Never steam clean or pour cold water on injection pump while the pump is running or warm. Doing so can damage the pump.

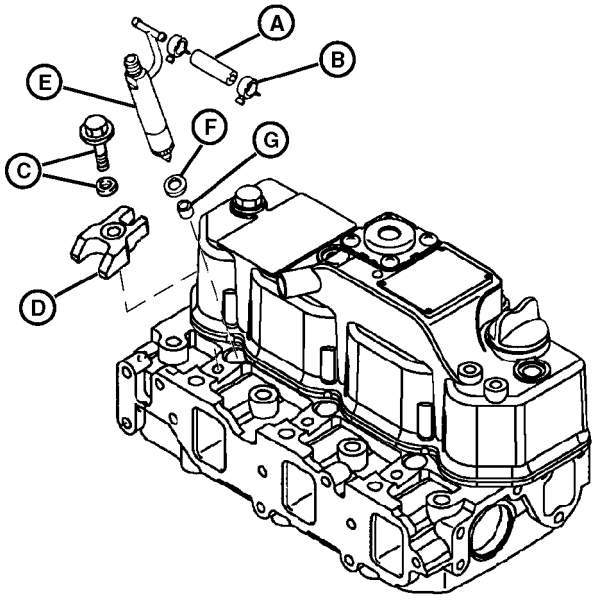
1. Clean the injection pump lines and area around the pump using a parts cleaning solvent or steam cleaner.

CAUTION: Avoid Injury! 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.

2. Loosen fuel injection line connector to nozzle slightly to relieve pressure in the fuel system.

NOTE: Nozzles are matched to the cylinders. If removing more than one nozzle, tag each one, according to the cylinder from which it was removed.

3. Loosen line clamp(s) and remove fuel injection lines.
4. Remove clamps (A) and leak-off hoses (B).



TCAL25392 —UN—15JUN12

A—Clamps
B—Leak-Off Hoses
C—Cap Screw and Washer
D—Retaining Plate
E—Injection Nozzle
F—Ring
G—Heat Protector

5. Remove cap screw and washer (C) and retaining plate (D).
6. Remove injection nozzle (E), ring (F), and TEFLON® heat protector (G). If ring and protector stay in cylinder head, thread a cap screw into protector and pull from cylinder head.

TEFLON is a trademark of Du Pont Co.

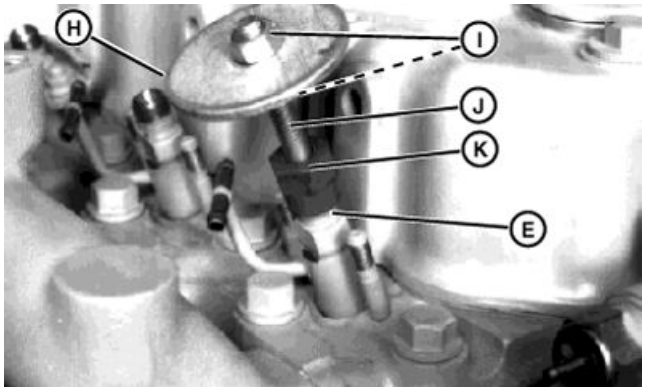
OUMX258,000069F -19-05NOV12-1/2

7. If nozzle is stuck in cylinder head:
   - Grind the head of a cap screw (J) so it fits inside a nut from an old injection line (K).
   - Use two nuts (I) to attach a large flat washer (H) to the cap screw.
   - Install assembly onto nozzle (E) and use a puller and slide hammer to pull nozzle from cylinder head.
8. Test injection nozzles. (See Test Fuel Injection Nozzles.)

Installation

Installation is done in the reverse order of removal.

- Install a new ring and heat protector when installing injection nozzles.



TCAL25393 —UN—15JUN12

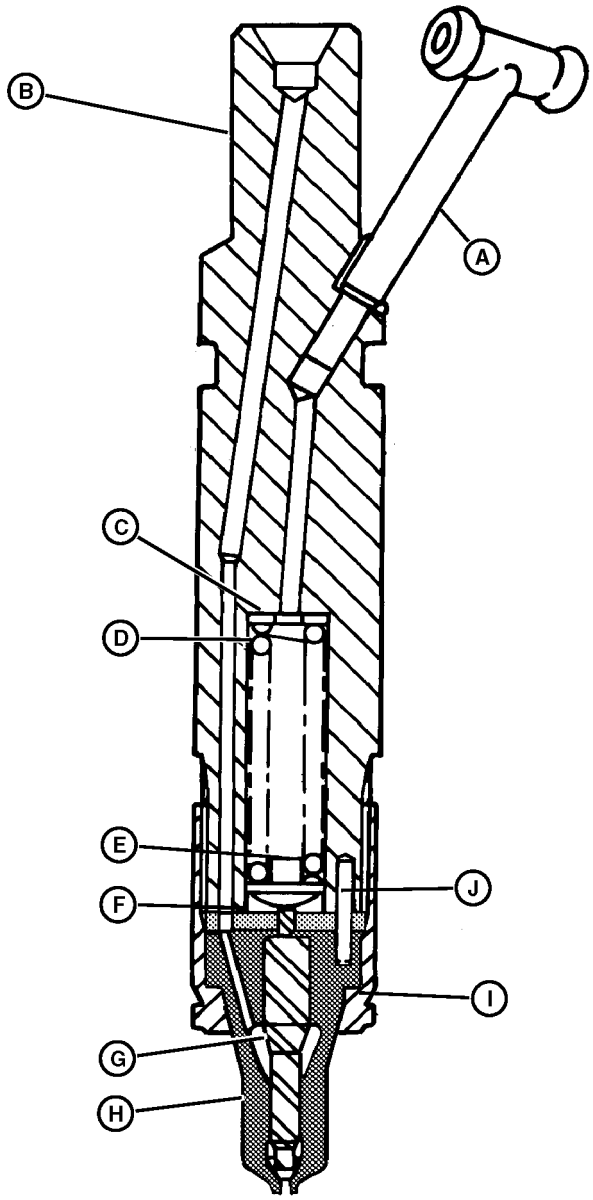
E—Nozzle
H—Large Flat Washer
I— Nuts (2 Used)
J— Cap Screw
K—Nut from an Old Injection Line

OUMX258,000069F -19-05NOV12-2/2

Disassemble and Assemble Fuel Injection Nozzles

Cross Section

A—Return Pipe
B—Injector Body
C—Shim(s)
D—Spring
E—Spring Seat
F—Separator Plate
G—Nozzle Valve
H—Nozzle Body
I— Retaining Nut
J—Index Pin



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OUMX258,00006A0 -19-05NOV12-1/2

Disassembly

NOTE: If servicing more than one nozzle, keep parts for each nozzle separate from one another.

1. Remove retaining nut (I) and disassemble internal parts of injection nozzle. Keep parts organized for ease of assembly.
2. Clean and inspect nozzle assembly.

Assembly

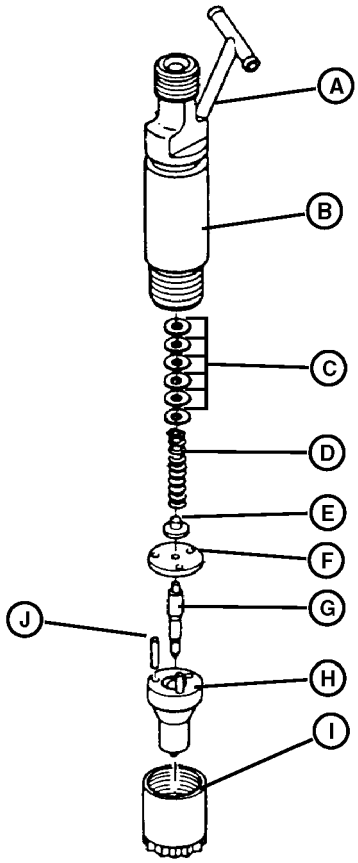
1. Carefully clamp injector body (B) in a soft-jawed vice.

NOTE: Insert the same number of shims (C) that were removed from the injector. The number of shims will affect the opening pressure of the fuel nozzle and will be tested after assembly.

2. Assemble fuel nozzle in the order shown.
3. Tighten retaining nut to specification.

Specification	
Fuel Injector Retaining Nut —Torque	8 N·m (70 lb.-in.)

4. After assembly is complete, test injection nozzle. (See Test Fuel Injection Nozzles.)



TCAL25395 —UN—15JUN12

A—Return Pipe
B—Injector Body
C—Shim(s)
D—Spring
E—Spring Seat
F—Separator Plate
G—Nozzle Valve
H—Nozzle Body
I— Retaining Nut
J—Index Pin

OUMX258,00006A0 -19-05NOV12-2/2

Inspect and Clean Fuel Injection Nozzles

Special or Required Tools

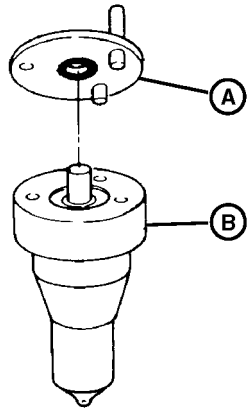
- JDF13 Fuel Injection Nozzle Cleaning Kit
- 16487 Inspection Magnifier

NOTE: To clean nozzles properly, JDF13 Fuel Injection Nozzle Cleaning Kit is recommended. The Cleaning Kit is available through the John Deere SERVICEGARD™ Catalog.

1. Remove anti-corrosive grease from new or reconditioned nozzles by washing them thoroughly in diesel fuel.

IMPORTANT: Avoid Damage! Never use a steel brush to clean nozzles as this will distort 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 JDF13 Fuel Injection Nozzle Cleaning Kit).
3. After removing carbon or lacquer from the exterior of nozzle, inspect sealing surfaces between separator plate (A) and nozzle body (B) for nicks or scratches.
4. 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.



TCAL25396 —UN—15JUN12

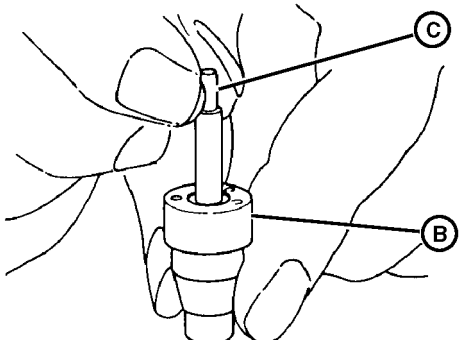
A—Separator Plate **B—Nozzle Body**

5. Check nozzle contact surface on separator plate for wear. If contact surface is more than specification, replace nozzle assembly.

Specification	
Fuel Injector Nozzle—Contact Surface	0.10 mm (0.004 in.)

OUMX258,00006A1 -19-12JUN14-1/2

6. Inspect the piston (large) part of nozzle valve (C) 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.
7. Further inspect the nozzle assembly by performing a slide test. Use the following procedure:
   - Dip the nozzle valve (C) in clean diesel fuel. Insert valve in nozzle body (B).
   - Hold nozzle vertical, and pull valve out about 1/3 of its engaged length.
   - Release valve. Valve should slide down to its seat.
8. Replace nozzle assembly if the valve does not slide freely to its seat.



TCAL25397 —UN—15JUN12

B—Nozzle Body **C—Nozzle Valve**

OUMX258,00006A1 -19-12JUN14-2/2

Summary of References

- Engine Information
- Service Fuel Filter and Water Separator
- Remove Engine 3TNV86CT
- Install Engine 3TNV86CT

BS62576,000158A -19-04APR14-1/1

Engine Information

This vehicle specific technical manual has only engine information which is specific to the vehicle. Most of the engine information is found in the relevant engine component technical manual. Use this manual in conjunction with the relevant component technical manual (CTM) for engine information.

- Diesel Engines (Final Tier 4 Stage IV platform) CTM120419.

M44215 —UN—07SEP88

BS62576,000158B -19-08JAN14-1/1

Service Fuel Filter and Water Separator

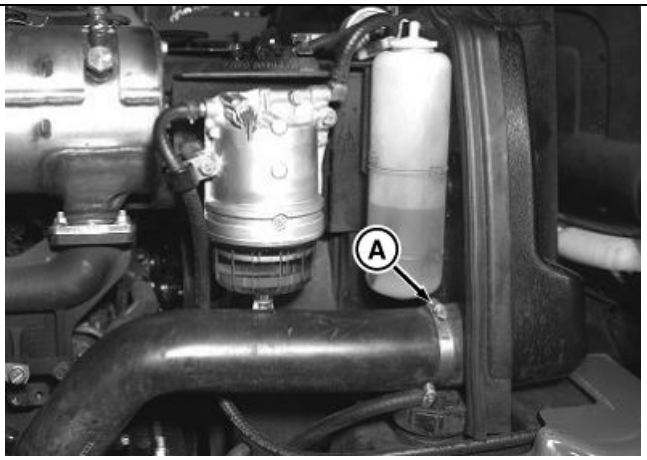
CAUTION: Avoid injury! Fuel vapors are explosive and flammable:

- **Do not smoke while handling fuel.**
- **Keep fuel away from flames or sparks.**
- **Shut off engine before servicing.**
- **Cool engine before servicing.**
- **Work in a well-ventilated area.**
- **Clean up spilled fuel immediately.**

1. Park machine safely. See “Park Machine Safely.”

CAUTION: Avoid injury! Touching hot surfaces can burn skin. The engine, components, and fluids will be hot if the engine has been running. Allow the engine to cool before servicing or working near the engine and components.

2. Open engine cover.
3. Allow machine to cool.



TCT009321 —UN—20NOV13

A—Hose Clamp

4. Loosen clamp (A) securing duct. Remove duct end and secure away from work area.
5. Thoroughly clean outside surfaces of filter housing and separator bowl.

Continued on next page

SW00544,0000051 -19-14MAR14-1/4

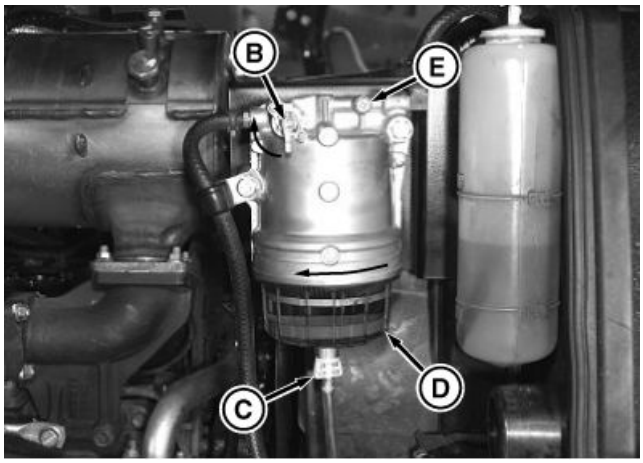
6. Rotate valve (B) to closed (OFF) position.

NOTE: The container used to receive drained fuel must have a capacity of at least 450 mL (15.2 fl. oz.)

7. Install hose to valve (C), and place a suitable container under drain.
8. Open valve to drain separator bowl (D).
9. Remove screw (E) to vent housing.

IMPORTANT: Avoid Damage! Use a strap wrench to remove or install the fuel filter bowl. Use of a pipe wrench or other hard faced tool may damage the plastic bowl.

10. Turn bowl to remove from separator body.
11. Clean bowl and inspect for damage.



TCT009322 —UN—20NOV13

B—Fuel Shutoff Valve
C—Fuel Drain Valve
D—Separator Bowl
E—Vent Screw

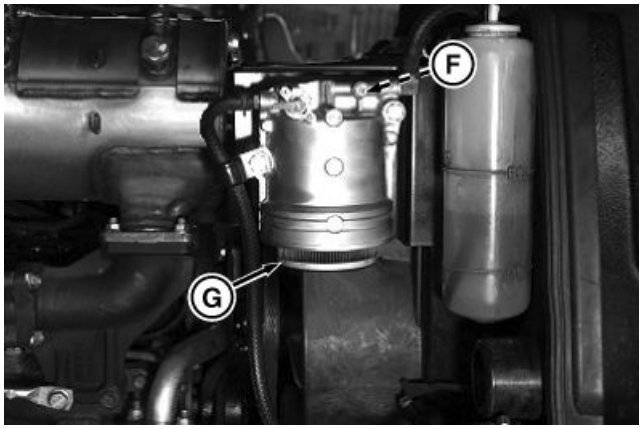
SW00544,0000051 -19-14MAR14-2/4

12. Install new O ring (F) to vent screw. Install and secure screw to housing.

NOTE: The filter inlet seal is a friction fit to the filter housing. Turn the filter and move it downward to remove.

13. Remove filter (G) from separator body.
14. Install new filter, fitting filter inlet seal securely to housing port.

F—O ring
G—Fuel Filter Element



TCT009323 —UN—20NOV13

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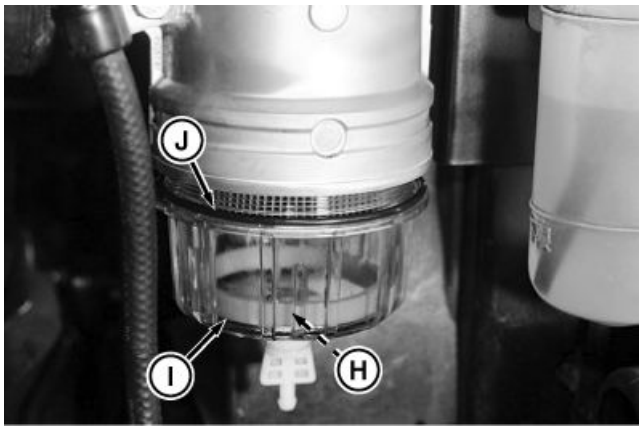
SW00544,0000051 -19-14MAR14-3/4

15. Install new O ring (H) to drain valve. Install valve to bowl and close valve.
16. Make sure that separator band (I) is in place at bottom of bowl.
17. Install new O ring (J) to bowl.
18. Install bowl assembly to separator body, making sure that O ring fits inside lip at bottom of body.
19. Rotate fuel shutoff valve to open (ON) position.
20. Prime fuel system.
    a. Turn key switch to RUN position for 2 minutes to remove air from and pressurize fuel system.
    b. Turn key switch to OFF position.
    c. Check to see if separator bowl fills with fuel. Check for fuel in tank, leaks at fuel hose connections, or fuel pump operation if separator bowl does not fill.
21. Check for leaks at separator bowl when separator is filled with fuel.



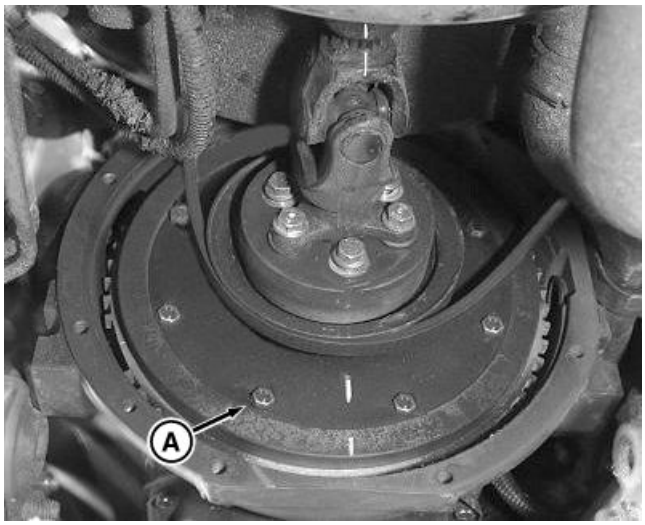
TCT009324 —UN—20NOV13

H—O ring
I— Separator Band
J— O ring

SW00544,0000051 -19-14MAR14-4/4

Remove Engine 3TNV86CT

1. Park machine safely.
2. Allow engine to cool.
3. Loosen radiator cap. Locate radiator drain valve on bottom right side of radiator and drain coolant into appropriate container.
4. Remove air hose between air filter housing and radiator cover.
5. Remove air hose between 48 volt alternator and radiator cover.
6. Remove back cover from 48 volt alternator and disconnect wires. See (Remove 48 Volt Alternator). Alternator can remain attached to engine if desired.
7. Remove 12 volt alternator. See (Remove 12 Volt Alternator).
8. Remove eight bolts (A) from flywheel plate and slide plate away from flywheel. Secure plate and drive shaft away from flywheel.



TCT009365 —UN—02JAN14

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BS62576,00015AE -19-14JAN14-1/13

CAUTION: Be careful when sliding fan assembly out of bracket to avoid damage to radiator.

9. Remove bolt (B) and carefully slide fan and shaft assembly out of bracket. Secure fan inside radiator shroud.

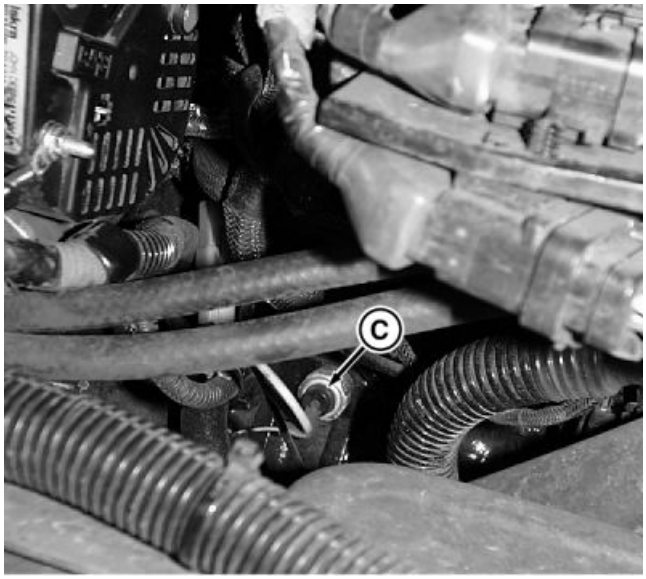
B—Bolt

TCT009366 —UN—02JAN14

BS62576,00015AE -19-14JAN14-2/13

10. Disconnect oil pressure switch (C).

C—Switch



TCT009367 —UN—02JAN14

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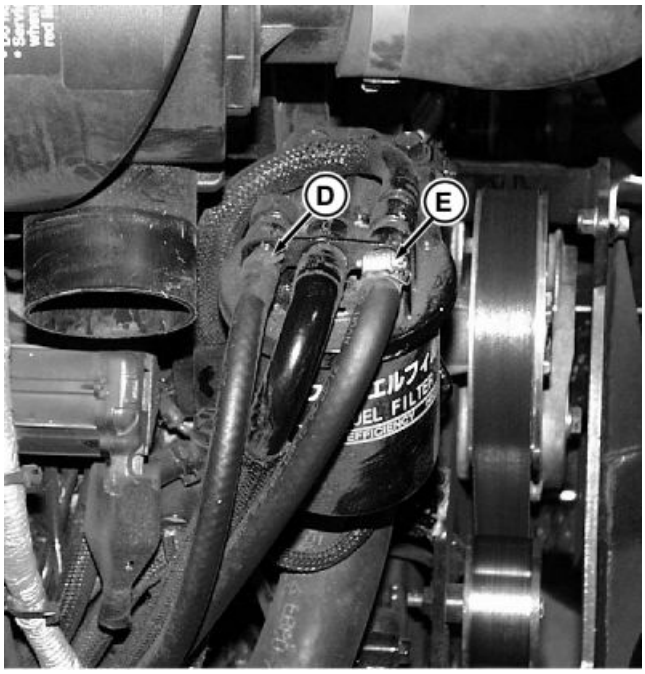
BS62576,00015AE -19-14JAN14-3/13

11. Mark and disconnect fuel hoses (D) and (E). Plug hoses and fittings to prevent dirt from entering system.

D—Fuel Hose **E—Fuel Hose**

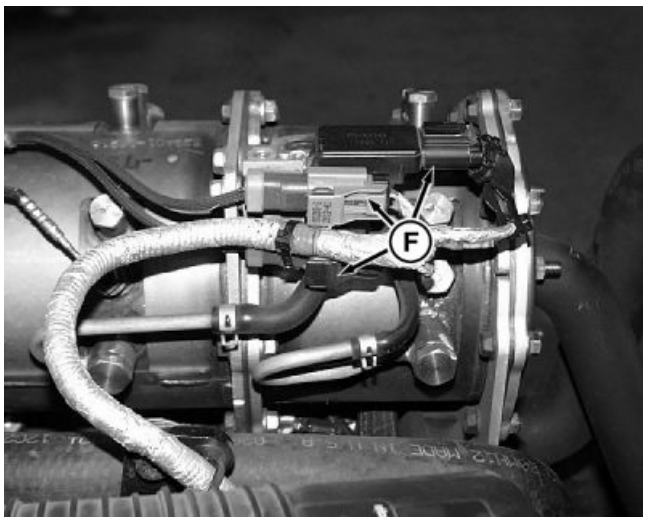


TCT009368 —UN—02JAN14

BS62576,00015AE -19-14JAN14-4/13

12. Disconnect wiring (F) to aftertreatment System sensors.

F—Aftertreatment System Connectors



TCT009369 —UN—02JAN14

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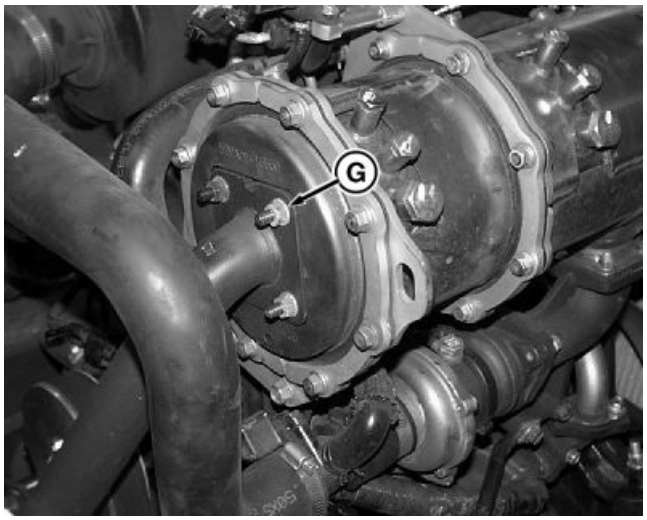
BS62576,00015AE -19-14JAN14-5/13

13. Remove four nuts (G) from exhaust pipe flange. Remove clamp from exhaust pipe bracket and remove exhaust pipe.

G—Nuts



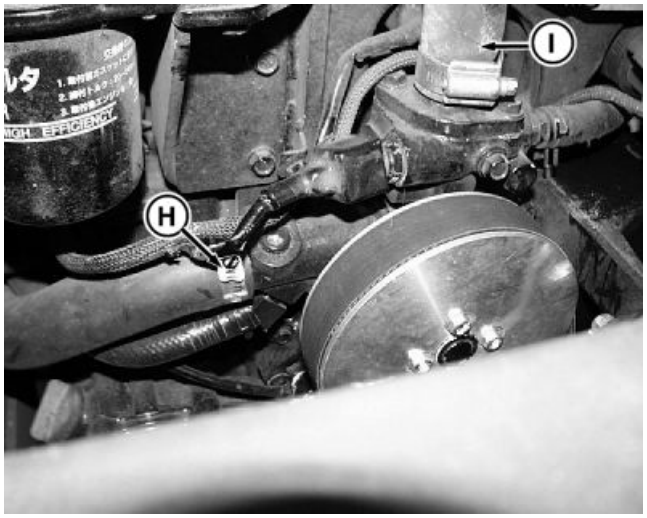
TCT009370 —UN—02JAN14

BS62576,00015AE -19-14JAN14-6/13

14. Disconnect coolant hoses (H) and (I) from water pump and thermostat housing. Remove bolt from hose support at engine bracket.

H—Inlet Hose

I— Outlet Hose



TCT009371 —UN—02JAN14

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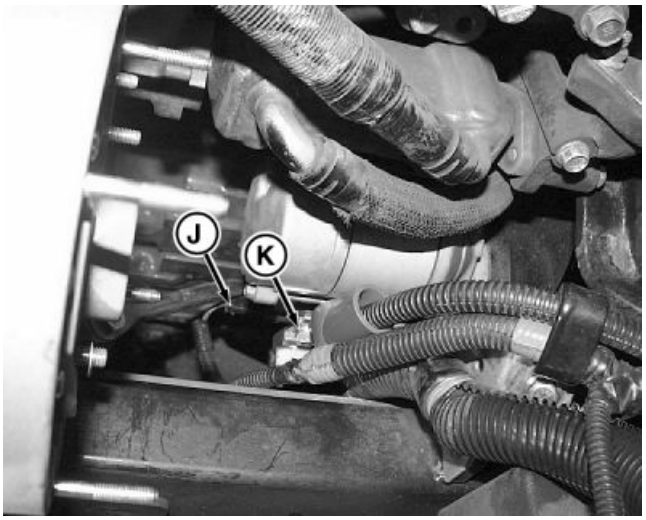
BS62576,00015AE -19-14JAN14-7/13

15. Disconnect wire (J) and cable (K) from starter.

J— Exciter Wire **K—Positive Cable**

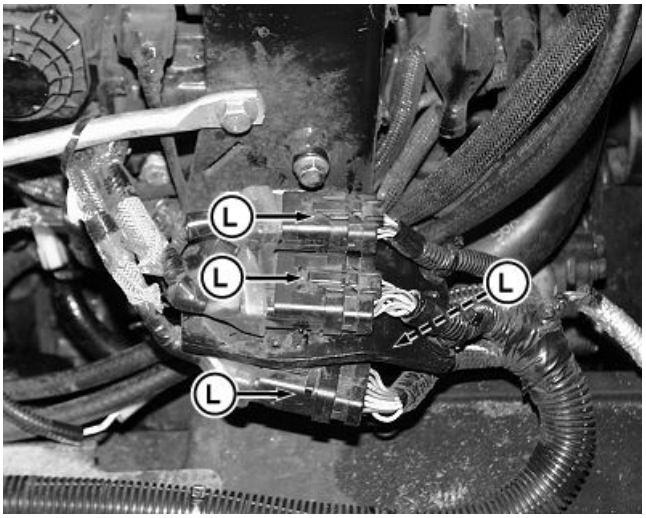


TCT009372 —UN—02JAN14

BS62576,00015AE -19-14JAN14-8/13

16. Disconnect four engine wiring harness to machine wiring harness connectors (L) on left side of engine.

L— Connectors



TCT009375 —UN—07JAN14

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BS62576,00015AE -19-14JAN14-9/13

17. Remove bolt (M) securing fuel hoses to bracket.

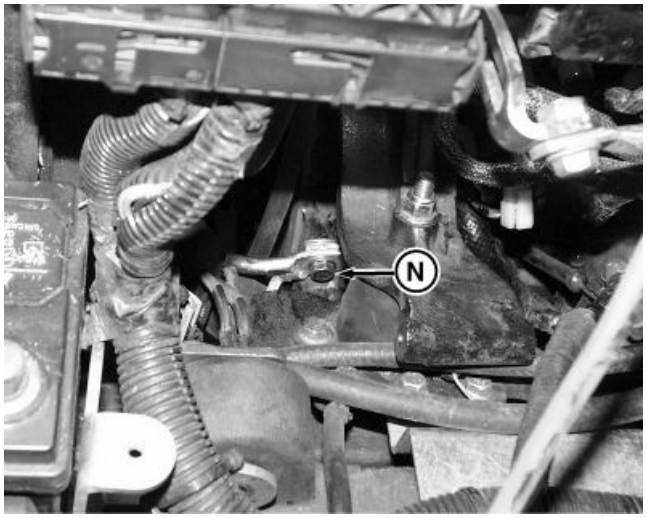
M—Bolt

TCT009376 —UN—07JAN14

BS62576,00015AE -19-14JAN14-10/13

18. Remove bolt (N) securing engine ground cable, belt guide, and coolant hose support.

N—Bolt



TCT009377 —UN—07JAN14

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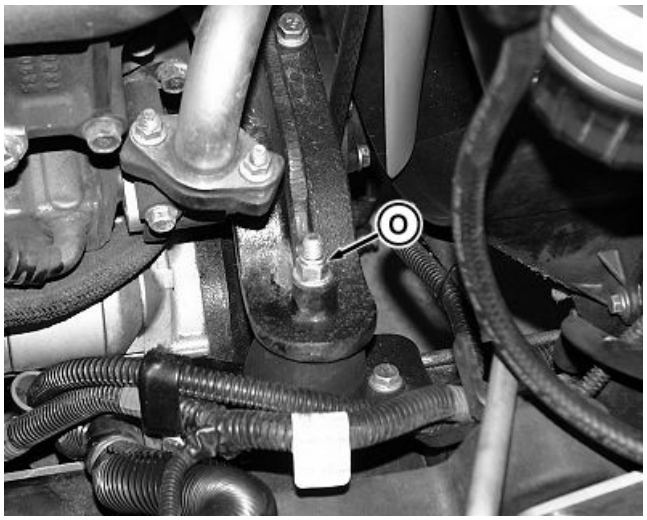
BS62576,00015AE -19-14JAN14-11/13

19. Remove bolt and nut (O) from right and left front engine mounts.

O—Bolt

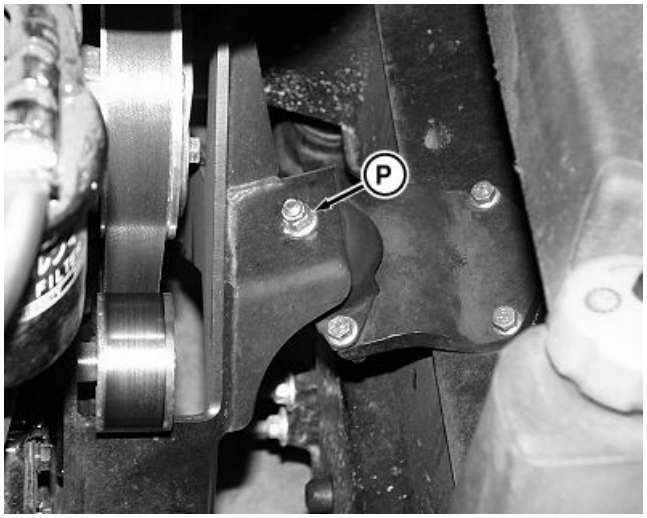


TCT009373 —UN—07JAN14

BS62576,00015AE -19-14JAN14-12/13

20. Remove bolt and nut (P) from rear engine mount.
21. Attach hoist to engine lift brackets.
22. Slowly lift engine from machine checking occasionally for anything that may have been left connected or is interfering with removal.

P—Rear Mount Bolt



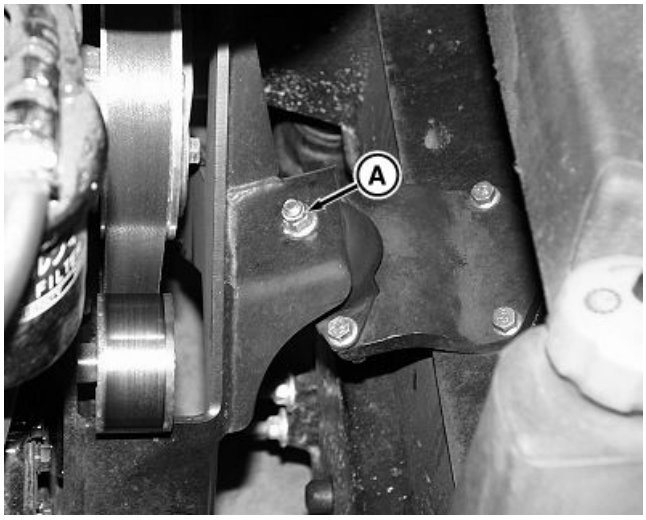
TCT009374 —UN—07JAN14

BS62576,00015AE -19-14JAN14-13/13

Install Engine 3TNV86CT

1. Slowly lower engine into machine checking occasionally for anything that may be interfering with installation.
2. Install rear engine mount bolt and nut (A).

A—Rear Mount

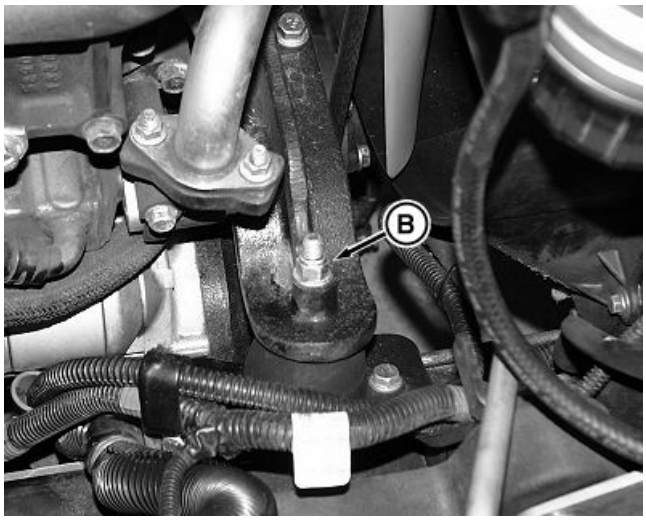


TCT009378 —UN—15JAN14

OUO2003,000000B -19-14JAN14-1/11

3. Install front engine mount bolts and nuts (B) on each side of engine.

B—Front Engine Mounts

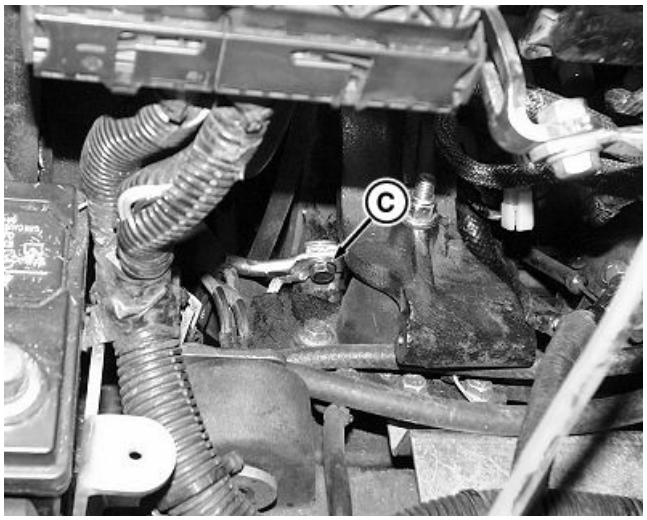


TCT009379 —UN—15JAN14

Continued on next page

OUO2003,000000B -19-14JAN14-2/11

4. Install bolt (C) through coolant hose support, belt guide, and ground cable. Tighten bolt.



TCT009380 —UN—15JAN14

OUO2003,000000B -19-14JAN14-3/11

5. Connect fuel hoses to fuel filter. Install bolt (D) into bracket.

D—Bolt

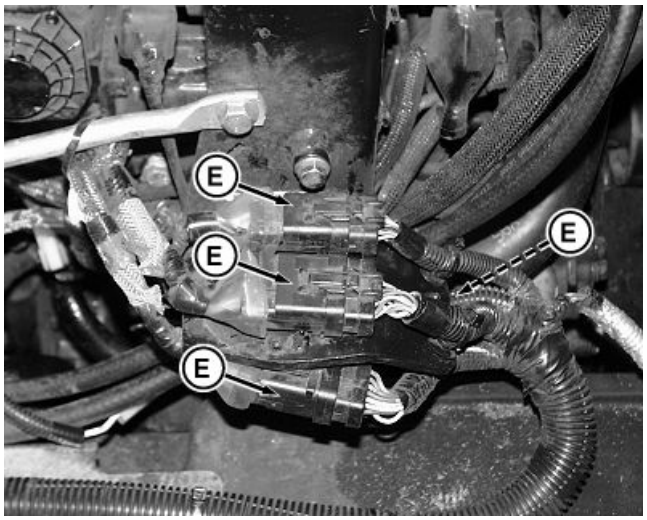
TCT009381 —UN—15JAN14

Continued on next page

OUO2003,000000B -19-14JAN14-4/11

6. Connect four engine wiring harness connectors (E).

E—Connectors

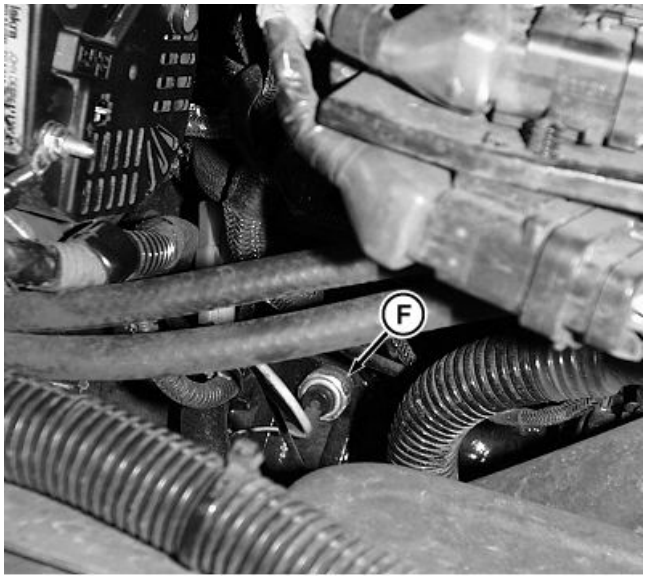


TCT009382 —UN—15JAN14

OUO2003,000000B -19-14JAN14-5/11

7. Connect oil pressure switch (F).

F—Oil Pressure Switch



TCT009383 —UN—15JAN14

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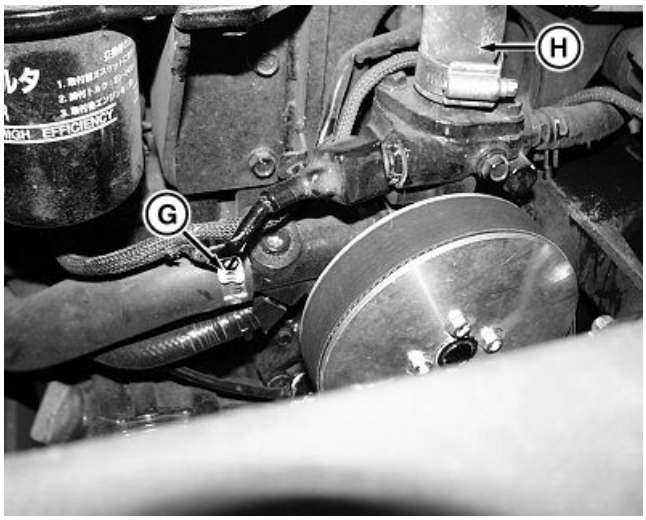
OUO2003,000000B -19-14JAN14-6/11

8. Connect coolant hoses (G) and (H) to water pump and thermostat housing. Install bolt securing hose support to engine bracket.

G—Inlet Hose **H—Outlet Hose**

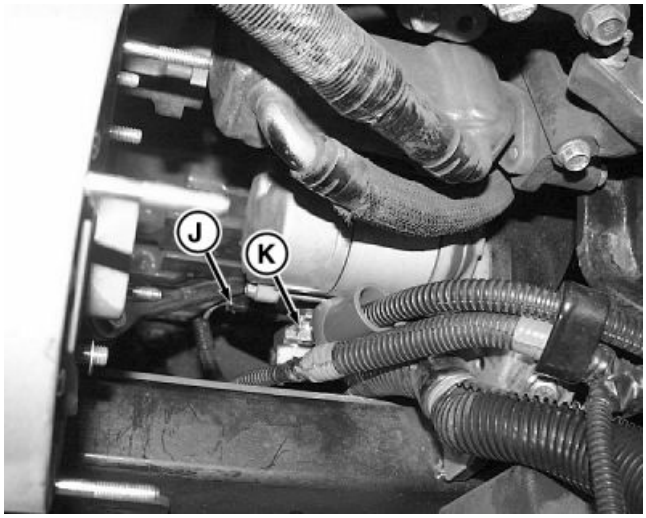


TCT009384 —UN—15JAN14

OUO2003,000000B -19-14JAN14-7/11

9. Connect wire (J) and cable(s) (K) to starter.
10. Place a new gasket on aftertreatment system outlet and install exhaust pipe. Install exhaust clamp on bracket. Tighten flange nuts first and then exhaust clamp.

J— Exciter Wire **K—Positive Cable**



TCT009372 —UN—02JAN14

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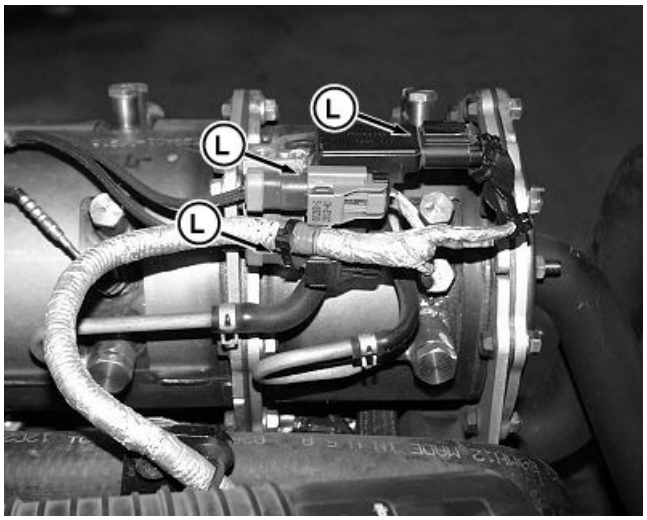
OUO2003,000000B -19-14JAN14-8/11

11. Connect aftertreatment system sensor wiring (L).

L—Connectors



TCT009386 —UN—15JAN14

OUO2003,000000B -19-14JAN14-9/11

12. Slide fan shaft into bracket. Align hole in fan shaft with hole in bracket and install bolt (M).

M—Bolt

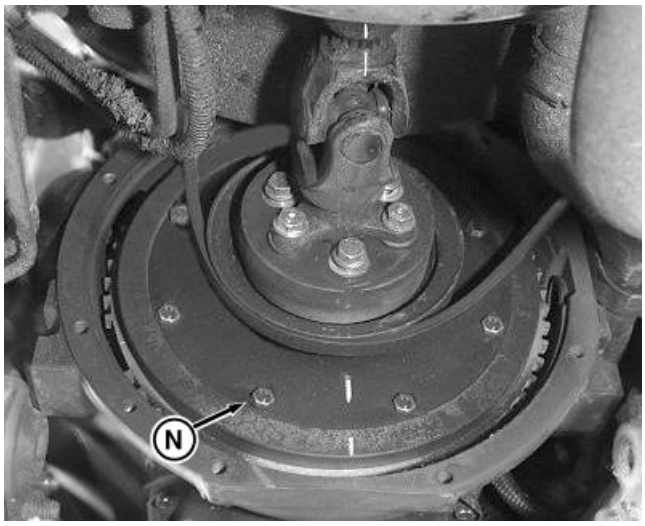
TCT009387 —UN—15JAN14

Continued on next page

OUO2003,000000B -19-14JAN14-10/11

13. Install flywheel plate with eight bolts (N) and tighten to specification.
14. Install 12 volt alternator and adjust belt tension.
15. Fill cooling system with approved coolant.
16. Check/Fill engine oil.
17. Connect battery cable.

N—Bolts



TCT010036 —UN—15JAN14

OUO2003,000000B -19-14JAN14-11/11

Section 30
Electrical Repair

Contents

Page

Group 10—Alternator and Battery
Summary of References 30-10-1
Remove Battery 30-10-1
Install Battery 30-10-2
Remove 12 Volt Alternator 30-10-3
Install 12 Volt Alternator 30-10-4
Remove 48 Volt Alternator 30-10-5
Install 48 Volt Alternator 30-10-6
Remove 48 Volt Voltage Regulator 30-10-8
Install 48 Volt Voltage Regulator 30-10-10

Group 20—Wiring Harnesses
Summary of References 30-20-1
Main Wiring Harness Connectors, Non-T4 30-20-1
Main Wiring Harness Connectors, T4 30-20-2
Command Arm Wiring Harness Connectors 30-20-2
Reel 48V Wiring Harness Connectors 30-20-2
Reel Motor Controller Harness and Connectors 30-20-3
Load Center, Non-T4 30-20-4
Load Center, T4 30-20-5
Main Wiring Harness, Non-T4 30-20-6
Main Wiring Harness, T4 30-20-12
Command Arm Wiring Harness 30-20-19
Reel 48V Power Wiring Harness 30-20-21
Main Wiring Harness, Non-T4 Color Codes 30-20-23
Main Wiring Harness, T4 Color Codes 30-20-25
Command Arm Wiring Harness Color Codes 30-20-28
Reel 48V Power Wiring Harness Color Codes 30-20-29

Summary of References

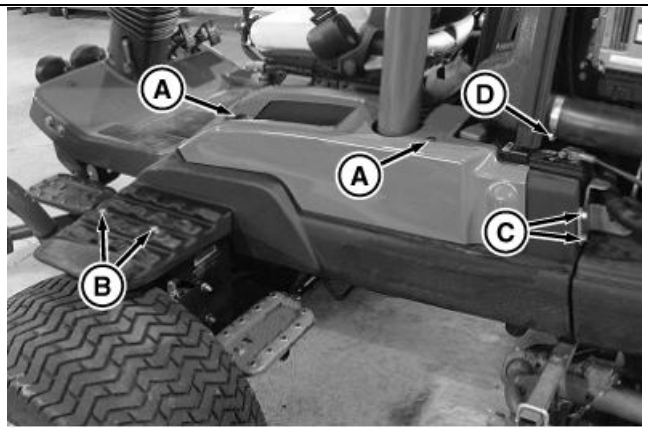
- Remove Battery
- Install Battery
- Remove 12 Volt Alternator
- Install 12 Volt Alternator
- Remove 48 Volt Alternator
- Install 48 Volt Alternator
- Remove 48 Volt Voltage Regulator
- Install 48 Volt Voltage Regulator

OUMX258,00006EC -19-11NOV13-1/1

Remove Battery

1. Park machine safely. See “Safety Section”.
2. Raise engine cover.
3. Remove screws (A) securing fender cover. Remove cover.
4. Remove bolts (B) and (C) securing fender. Remove fender.
5. Loosen clamp (D) securing engine air intake hose. Remove hose end and secure away from battery.

A—Screw (2 used)
B—Hex Bolt M10x25 (2 used)
C—Hex Bolt M8x20 (2 used)
D—Hose Clamp



TCT008878 —UN—22OCT13

OUMX258,00006E8 -19-22OCT13-1/3

6. Release clamps (E) at left and right sides of radiator cover. Remove cover.

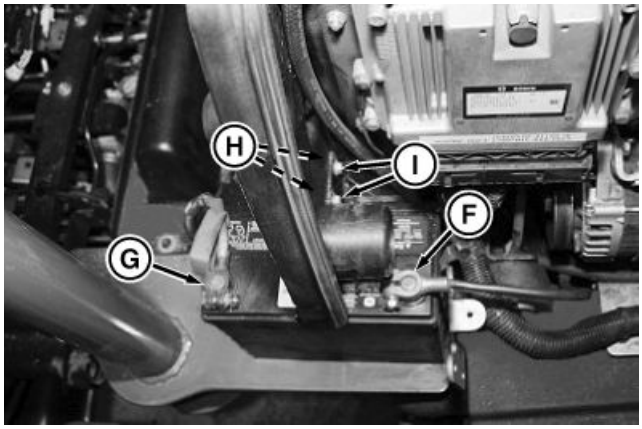
E—Over Center Clamp

TCT008879 —UN—07MAY14

OUMX258,00006E8 -19-22OCT13-2/3

7. Remove negative (-) connector (F) from battery.
8. Displace boot and remove positive (+) connector (G) from battery.
9. Hold nuts (H) in place.
10. Remove bolts (I) securing battery clamp. Remove clamp.
11. Remove battery.

F— Negative Battery Connector
G—Positive Battery Connector
H—Hex Nut M6 (2 used)
I— Hex Bolt M6x16 (2 used)



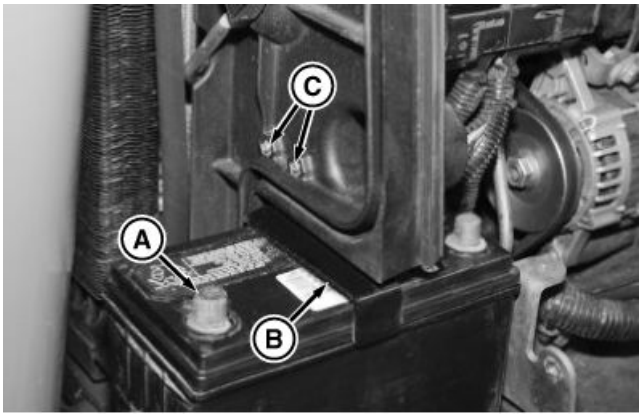
TCT008880 —UN—22OCT13

OUMX258,00006E8 -19-22OCT13-3/3

Install Battery

1. Install battery to machine with positive terminal (A) nearest OPS post..
2. Install battery hold down (B) under bulkhead.
3. Install nuts (C) to bulkhead.

A—Battery Positive Terminal
B—Battery Hold Down
C—Hex Nut M6 (2 used)

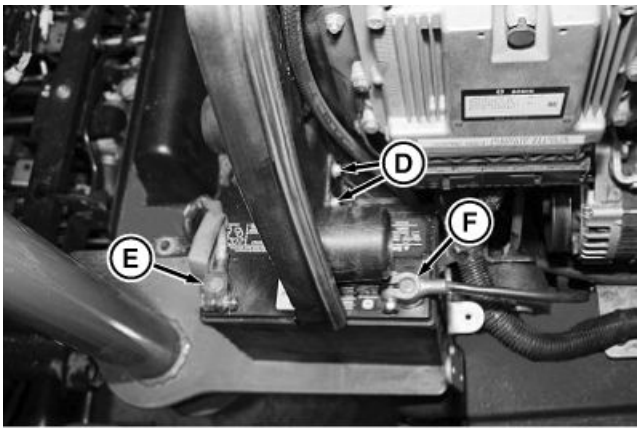


TCT008881 —UN—23OCT13

OUMX258,00006E9 -19-23OCT13-1/4

4. Hold nuts in place and install screws (D) through hold down.
5. Install and secure positive (+) battery cable (E). Cover terminal with boot.
6. Install and secure negative (-) battery cable (F).

D—Screw M6x16 (2 used)
E—Positive Battery Cable
F—Negative Battery Cable



TCT008882 —UN—23OCT13

OUMX258,00006E9 -19-23OCT13-2/4

7. Install radiator cover and secure with clamps (G) at left and right sides.

G—Over Center Clamp

TCT008883 —UN—07MAY14

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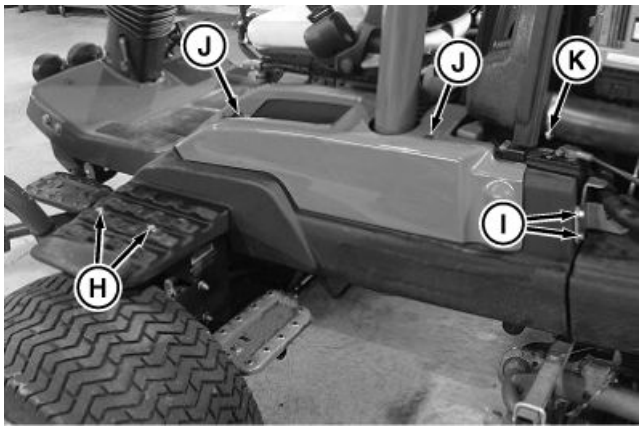
OUMX258,00006E9 -19-23OCT13-3/4

8. Install fender. Align holes and secure fender with bolts (H) and (I).
9. Install fender cover and secure with screws (J).
10. Install engine air intake hose and tighten clamp (K).
11. Close and secure engine cover.

H—Hex Bolt M10x25 (2 used)
I— Hex Bolt M8x20 (2 used)
J— Screw M6x16 (2 used)
K—Hose Clamp



TCT008451 —UN—23OCT13

OUMX258,00006E9 -19-23OCT13-4/4

Remove 12 Volt Alternator

1. Park machine safely. See Safety Section.

CAUTION: Avoid injury! Touching hot surfaces can burn skin. The engine, components, and fluids will be hot if the engine has been running. Allow the engine to cool before servicing or working near the engine and components.

2. Open engine cover.
3. Allow machine to cool.
4. Loosen clamps (A) and remove engine air intake duct.
5. Remove connector (B) from negative (-) battery terminal.

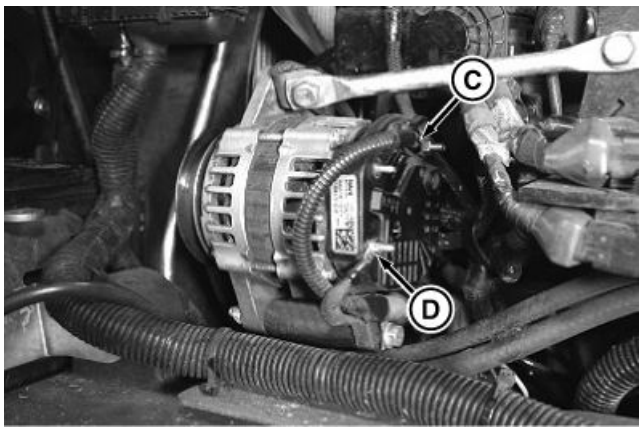
TCT009208 —UN—23OCT13

A—Hose Clamp (2 used)
B—Battery Cable Connector

OUMX258,00006EA -19-06NOV13-1/3

6. Retract boot and remove wire harness terminal (C) from alternator.
7. Remove wire harness ground terminal (D).

C—12 Volt Terminal
D—Ground Terminal



TCT009209 —UN—23OCT13

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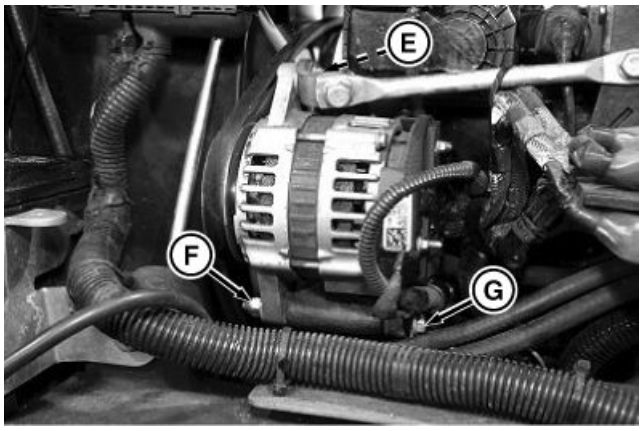
OUMX258,00006EA -19-06NOV13-2/3

8. Loosen bolt (E) and nut (F).
9. Rotate alternator toward engine and remove belt from sheave.
10. Remove bolt (E), nut (F), and bolt (G). Remove alternator.

E—Hex Bolt
F—Hex Nut
G—Hex Bolt



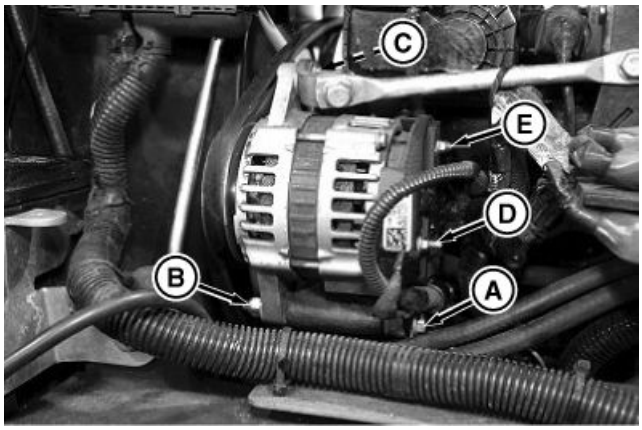
TCT009210 —UN—23OCT13

OUMX258,00006EA -19-06NOV13-3/3

Install 12 Volt Alternator

1. Align alternator with mounting bracket. Insert pivot bolt (A) and loosely secure with nut (B).
2. Install bolt (C) through bracket to alternator.
3. Install ground wire terminal to lower stud (D) and secure with nut.
4. Install 12 V wire terminal to upper stud (E). Secure with nut and cover with boot.
5. Install belt to sheave and adjust belt tension. (See Test and Adjust 12 Volt Alternator and Cooling Fan Drive Belt Tension.)

A—Hex Bolt
B—Hex Nut
C—Hex Bolt
D—Stud
E—Stud

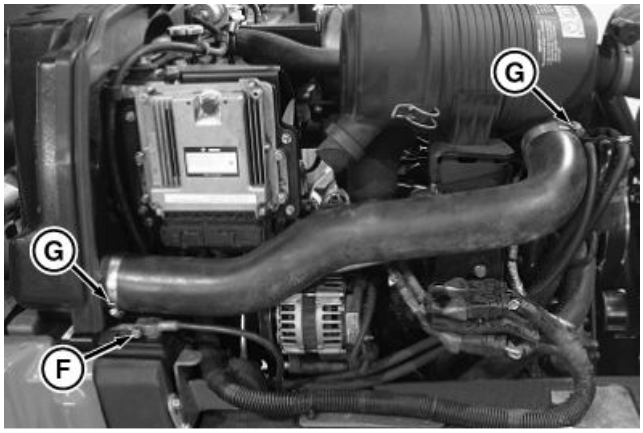


TCT009211 —UN—23OCT13

OUMX258,00006EB -19-21MAY14-1/2

6. Install and secure cable connector (F) to negative battery terminal.
7. Install engine air duct and secure clamps (G).
8. Close and secure engine cover.

F—Battery Cable Connector
G—Hose Clamp



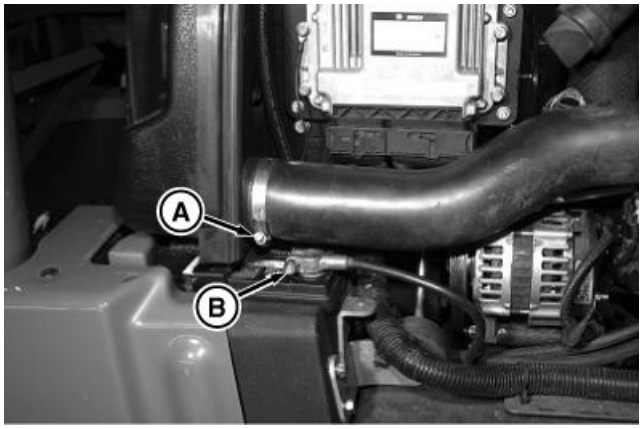
TCT009212 —UN—23OCT13

OUMX258,00006EB -19-21MAY14-2/2

Remove 48 Volt Alternator

1. Park machine safely. See “Park Machine Safely.”
2. Raise engine cover.
3. Loosen clamp (A) securing air duct. Remove duct from bulkhead inlet.
4. Loosen nut (B) and remove cable from negative (-) battery terminal.

A—Hose Clamp
B—Battery Negative Terminal



TCT009230 —UN—31OCT13

SW00544,000003E -19-11NOV13-1/5

5. Loosen clamps (C) and remove air duct.
6. Remove nuts (D) securing alternator end cover. Remove cover.

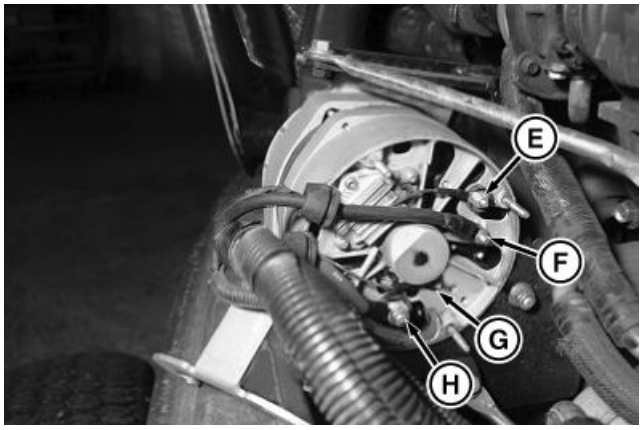
C—Hose Clamp (2 used)
D—Lock Nut (4 used)

TCT009283 —UN—07NOV13

SW00544,000003E -19-11NOV13-2/5

7. Note position of wire harness connectors (E), (F), (G), and (H) for reassembly. Remove nuts and washers securing wire harness connectors. Remove wire harness from work area.

E—Wire Connector
F—Wire Connector
G—Wire Connector
H—Wire Connector



TCT009284 —UN—07NOV13

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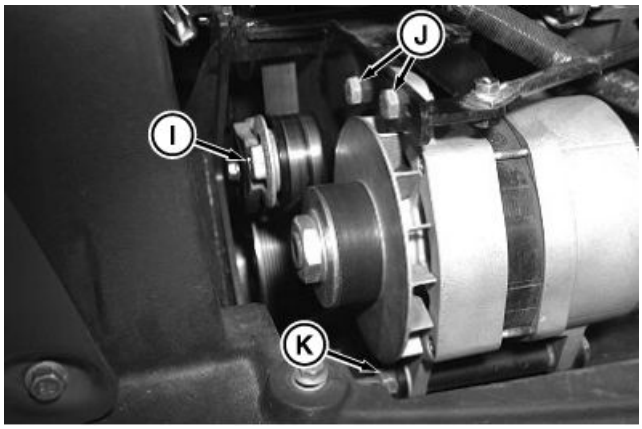
SW00544,000003E -19-11NOV13-3/5

CAUTION: Avoid injury! Components are installed under spring tension. Wear eye protection and use proper tools when installing and removing components with spring tension.

8. Insert square drive tool into opening (I) in belt tension arm. Rotate arm against spring tension and remove belt from alternator pulley.
9. Loosen bolts (J) and remove nut (K) securing pivot bolt.

I— Tension Arm Tool Socket
J— Hex Bolt M12x25 (2 used)
K—Hex Nut M12

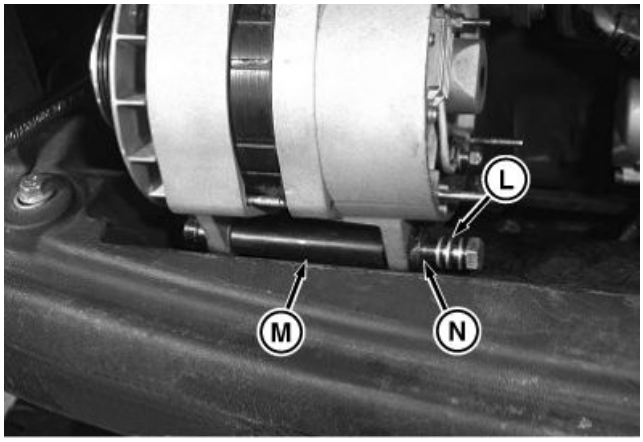


TCT009285 —UN—07NOV13

SW00544,000003E -19-11NOV13-4/5

10. Remove pivot bolt with spacers (L).
11. Remove spacer (M).
12. Tap bushing (N) from mounting bracket until flush with alternator bracket.
13. Remove bolts (J) securing alternator.
14. Remove alternator from mounting brackets.

L— Spacer (3 used)
M—Spacer
N—Bushing



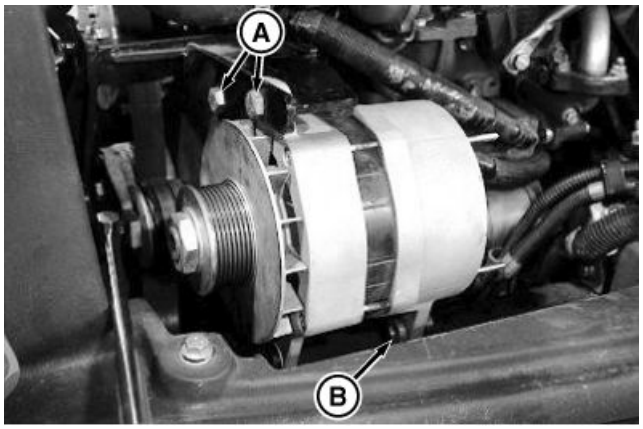
TCT009286 —UN—07NOV13

SW00544,000003E -19-11NOV13-5/5

Install 48 Volt Alternator

1. Install alternator to mounting brackets. Loosely secure alternator with bolts (A).
2. Align lower mounting brackets and press bushing (B) into engine mounting bracket until bushing is flush with inner face of alternator bracket.

A—Hex Bolt M12x25 (2 used)
B—Bushing



TCT009287 —UN—07NOV13

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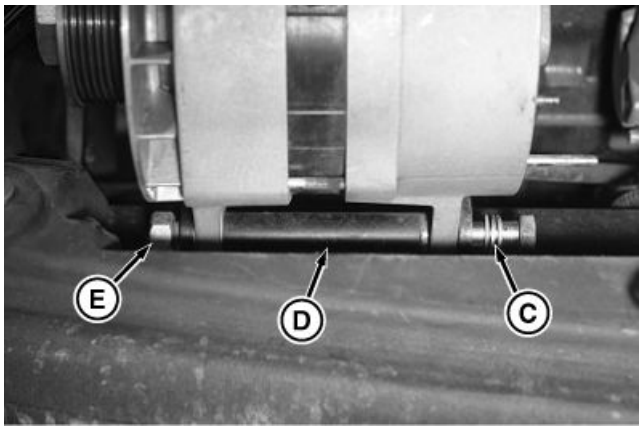
SW00544,000003F -19-08NOV13-1/6

3. Install spacers (C) to pivot bolt. Insert bolt through mounting brackets with bushing, spacer (D), and rear mounting brackets.
4. Secure bolt with nut (E). Make sure that spacers (C) are aligned with mounting bracket opening, and tighten nut to specification.
5. Tighten upper mounting bolts to specification.

CAUTION: Avoid injury! Components are installed under spring tension. Wear eye protection and use proper tools when installing and removing components with spring tension.

6. Insert square drive tool into opening in belt tension arm. Rotate tension arm against spring tension and install drive belt to alternator pulley.



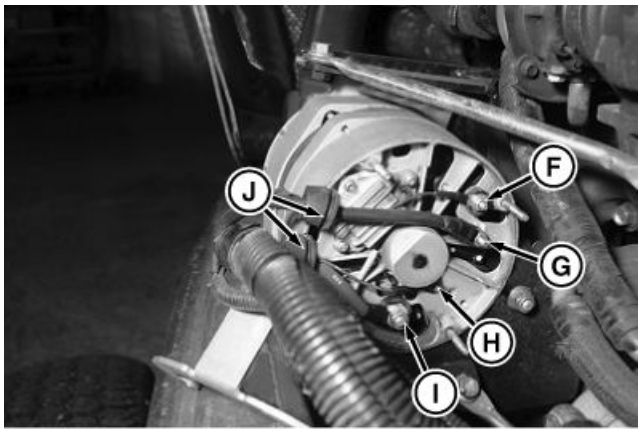
TCT009288 —UN—07NOV13

C— Spacer (3 used)
D— Spacer
E— Hex Nut M12

SW00544,000003F -19-08NOV13-2/6

7. Install wire harness terminals (F), (G), (H), and (I) and secure with washers and nuts.
8. Position grommets so that grooves (J) are aligned with housing edge.

F— Wire Terminal
G— Wire Terminal
H— Wire Terminal
I— Wire Terminal
J— Wire Seal Groove

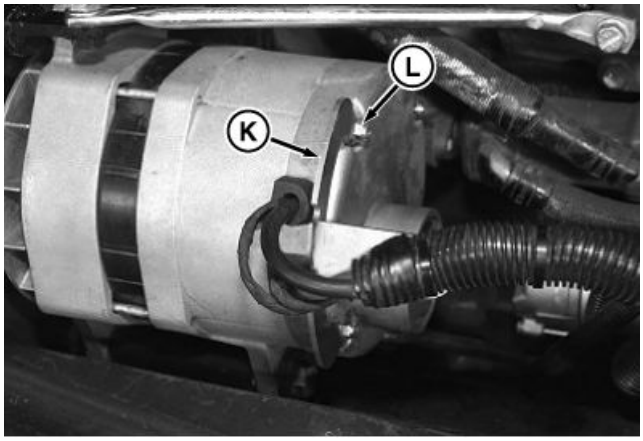


TCT009289 —UN—07NOV13

SW00544,000003F -19-08NOV13-3/6

9. Install end cover. Take care that cover fits into grooves in wire harness grommets.
10. Install support (K) to studs. Secure cover and support with nuts (L).

K— Wire Harness Support
L— Lock Nut (4 used)



TCT009290 —UN—07NOV13

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SW00544,000003F -19-08NOV13-4/6

11. Install duct and tighten clamps (M).

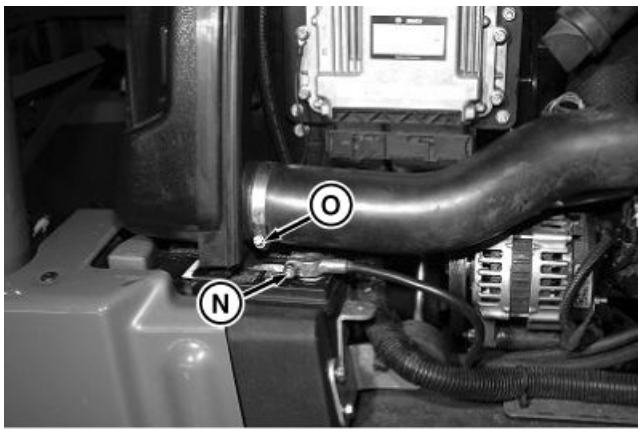
M— Hose Clamp

TCT009291 —UN—07NOV13

SW00544,000003F -19-08NOV13-5/6

12. Install cable to battery negative terminal and tighten nut (N).
13. Install engine air duct to bulkhead inlet and tighten clamp (O).

N— Battery Connector Nut **O— Hose Clamp**



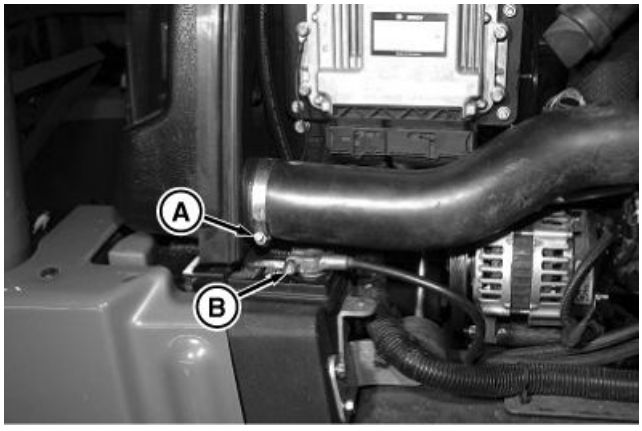
TCT009292 —UN—07NOV13

SW00544,000003F -19-08NOV13-6/6

Remove 48 Volt Voltage Regulator

1. Park machine safely. See “Park Machine Safely.”
2. Raise engine cover.
3. Loosen clamp (A) securing air duct. Remove duct from bulkhead inlet.
4. Loosen nut (B) and remove cable from negative (-) battery terminal.

A—Hose Clamp **B—Battery Negative Terminal**



TCT009230 —UN—31OCT13

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SW00544,0000044 -19-11NOV13-1/4

5. Loosen clamps (C) and remove air duct.
6. Remove nuts (D) securing alternator end cover. Remove cover.

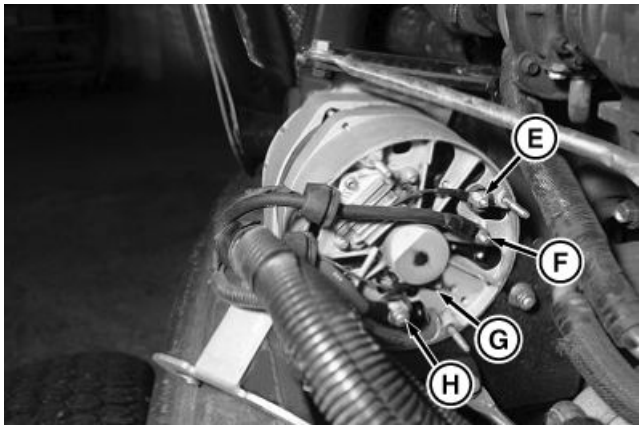
C—Hose Clamp (2 used)
D—Lock Nut (4 used)

TCT009283 —UN—07NOV13

SW00544,0000044 -19-11NOV13-2/4

7. Note position of wire harness connectors (E), (F), (G), and (H) for reassembly. Remove nuts and washers securing wire harness connectors. Remove wire harness from work area.

E—Wire Connector
F—Wire Connector
G—Wire Connector
H—Wire Connector

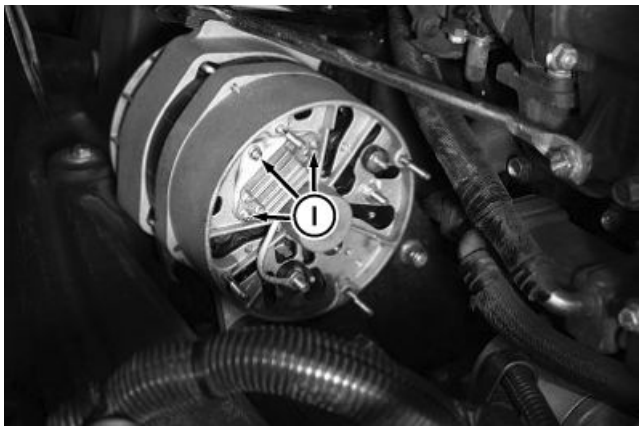


TCT009284 —UN—07NOV13

SW00544,0000044 -19-11NOV13-3/4

8. Remove screws (I) securing voltage regulator to alternator frame. Remove regulator.

I— TORX® Screw (3 used)



TCT009302 —UN—11NOV13

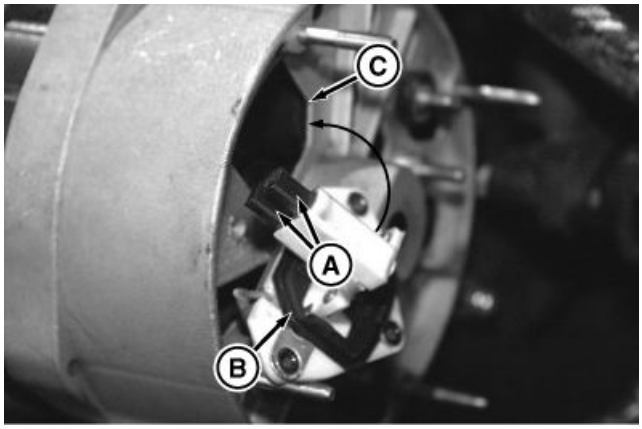
TORX is a trademark of Camcar/Textron

SW00544,0000044 -19-11NOV13-4/4

Install 48 Volt Voltage Regulator

1. Rotate voltage regulator and bush holder into position to properly locate brushes (A).
2. Position voltage regulator so that step in gasket (B) is located in alternator frame opening (C).

A—Alternator Brush
B—Gasket
C—Alternator Frame Opening

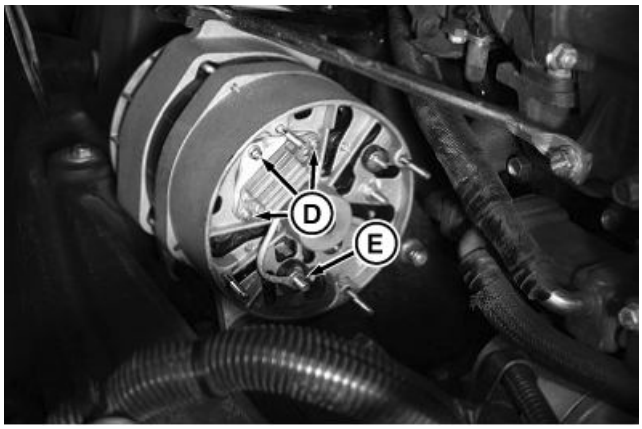


TCT009303 —UN—11NOV13

SW00544,0000045 -19-13NOV13-1/6

3. Secure voltage regulator with screws (D).
4. Install voltage regulator wire lead to alternator B+ terminal (E).

D—TORX® Screw (3 used)
E—B+ Terminal



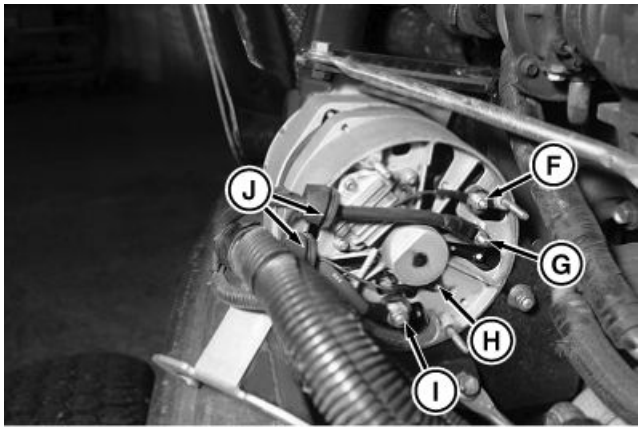
TCT009304 —UN—11NOV13

TORX is a trademark of Camcar/Textron

SW00544,0000045 -19-13NOV13-2/6

5. Install wire harness terminals (F), (G), (H), and (I) and secure with washers and nuts.
6. Position grommets so that grooves (J) are aligned with housing edge.

F— Wire Terminal
G— Wire Terminal
H— Wire Terminal
I— Wire Terminal
J— Wire Seal Groove



TCT009289 —UN—07NOV13

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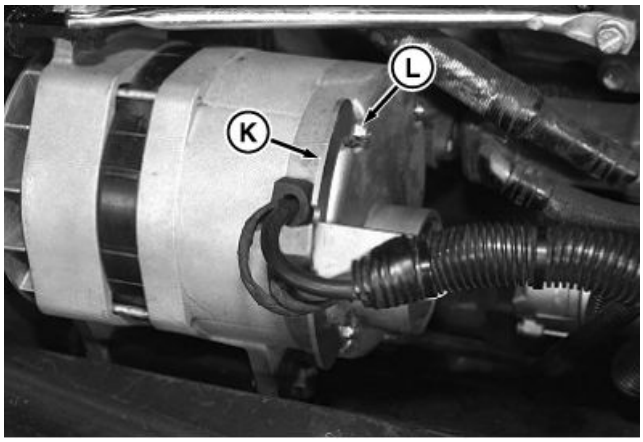
SW00544,0000045 -19-13NOV13-3/6

7. Install end cover. Take care that cover fits into grooves in wire harness grommets.
8. Install support (K) to studs. Secure cover and support with nuts (L).

K— Wire Harness Support **L— Lock Nut (4 used)**

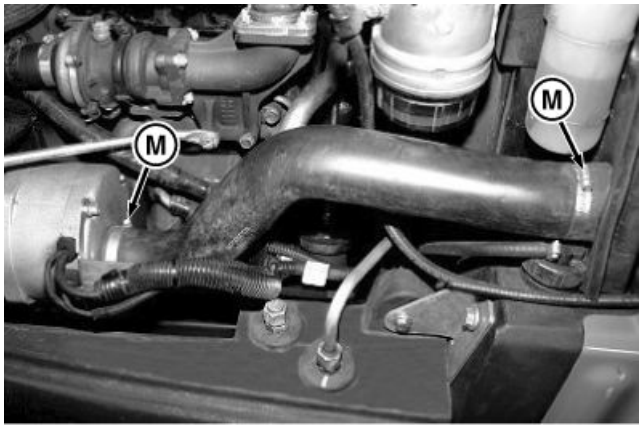


TCT009290 —UN—07NOV13

SW00544,0000045 -19-13NOV13-4/6

9. Install duct and tighten clamps (M).

M— Hose Clamp

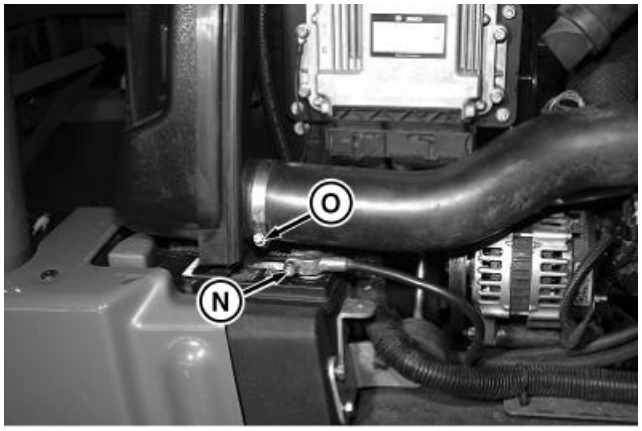


TCT009291 —UN—07NOV13

SW00544,0000045 -19-13NOV13-5/6

10. Install cable to battery negative terminal and tighten nut (N).
11. Install engine air duct to bulkhead inlet and tighten clamp (O).

N— Battery Connector Nut **O— Hose Clamp**



TCT009292 —UN—07NOV13

SW00544,0000045 -19-13NOV13-6/6

Summary of References

- Main Wiring Harness Connectors, Non-T4
- Main Wiring Harness Connectors, T4
- Command Arm Wiring Harness Connectors
- Reel 48V Wiring Harness Connectors
- Reel Motor Controller Harness and Connectors
- Load Center, Non-T4
- Load Center, T4
- Main Wiring Harness, Non-T4
- Main Wiring Harness, T4
- Command Arm Wiring Harness
- Reel 48V Power Wiring Harness
- Main Wiring Harness, Non-T4 Color Codes
- Main Wiring Harness, T4 Color Codes
- Command Arm Wiring Harness Color Codes
- Reel 48V Power Wiring Harness Color Codes

OUMX258,00006ED -19-01APR14-1/1

Main Wiring Harness Connectors, Non-T4

CAN-C1 — Front Left Controller
CAN-C2 — Rear Left Controller
CAN-C3 — Center Controller
CAN-C5 — Front Right Controller
CAN-C6 — Rear Right Controller
MC-1 — Work Light
MC-2 — Work Light
MC-3 — Work Light
MC-4 — Starter Solenoid
MC-7 — 120 ohm Resistor
MC-8 — 120 ohm Resistor
MC-9 — Right Lift Arm Position Sensor
MC-10 — Seat Switch
MC-11 — Left Lift Arm Position Sensor
MC-12 — Control Arm Wiring Harness (C-11)
MC-13 — Control Arm Wiring Harness (C-10)
MC-14 — Seat Compressor
MC-16 — Variable Reluctance Crankshaft Speed Pickup
MC-20 — Down Pressure Kit
MC-21 — Front Raise/Lower Valve
MC-22 — Rear Raise/Lower Valve
MC-23 — Vehicle Control Unit (VCU)
MC-24 — Brake Solenoid
MC-25 — Brake Pressure Switch
MC-26 — Fuel Solenoid
MC-27 — Fuel Transfer
MC-28 — Hyd Filter Restriction Switch
MC-32 — Forward Hydro Solenoid
MC-33 — Reverse Hydro Solenoid
MC-34 — Pump Angle Sensor
MC-35 — Fuel Level
MC-55 — Kit Switched Power
MC-61 — Forward (inboard) pedal
MC-62 — Reverse (outboard) pedal
MC-63 — Hyd Oil Temp
MC-64 — Raise Select Valve
MFB-1 — Load Center
MT-1 — Engine Oil Pressure Switch
MT-2 — Air Heater
MT-3 — Power, 80A fuse
MT-4 — Alternator (12VDC)
MT-5 — Ground
MT-6 — Ground
MT-7 — Alternator Ground
MT-8 — Coolant Temp Switch
MT-9 — VCU Case Ground
MT-10 — 48V Alternator (12VDC)
MT-11 — Ground
MT-12 — 48V Alternator Ground
V1 — V1 Diode

OUMX258,00006F1 -19-14MAR14-1/1

Main Wiring Harness Connectors, T4

A5501 — Engine Control Unit (ECU)
A5502 — Engine Control Unit (ECU)
B5109 — Differential Pressure Sensor
B5201 — DOC Inlet Temp Sensor
B5202 — DOC Outlet Temp Sensor
CAN-C1 — Front Left Controller
CAN-C2 — Rear Left Controller
CAN-C3 — Center Controller
CAN-C5 — Front Right Controller
CAN-C6 — Rear Right Controller
MC-1 — Work Light
MC-2 — Work Light
MC-3 — Work Light
MC-4 — Starter Solenoid
MC-7 — 120 ohm Resistor
MC-8 — 120 ohm Resistor
MC-9 — Right Lift Arm Position Sensor
MC-10 — Seat Switch
MC-11 — Left Lift Arm Position Sensor
MC-12 — Control Arm Wiring Harness (C-11)
MC-13 — Control Arm Wiring Harness (C-10)
MC-14 — Seat Compressor
MC-20 — Down Pressure Kit
MC-21 — Front Raise/Lower Valve
MC-22 — Rear Raise/Lower Valve
MC-23 — Vehicle Control Unit (VCU)
MC-24 — Brake Solenoid
MC-25 — Brake Pressure Switch
MC-27 — Fuel Transfer
MC-28 — Hyd Filter Restriction Switch
MC-32 — Forward Hydro Solenoid
MC-33 — Reverse Hydro Solenoid
MC-34 — Pump Angle Sensor
MC-35 — Fuel Level
MC-55 — Kit Switched Power
MC-61 — Forward (inboard) pedal
MC-62 — Reverse (outboard) pedal
MC-63 — Hyd Oil Temp
MC-64 — Raise Select Valve
MFB-1 — Load Center
MT-1 — Engine Oil Pressure Switch
MT-2 — Glow Plugs
MT-3 — Power, 80A fuse
MT-4 — Alternator (12VDC)
MT-5 — Ground
MT-6 — Ground
MT-7 — Alternator Ground
MT-8 — Ground
MT-9 — VCU Case Ground
MT-10 — 48V Alternator Field (12VDC)
MT-12 — 48V Alternator Ground
MT-13 — ECU Case Ground
X5057 — Engine Harness
X5058 — Engine Harness
X5059 — Engine Harness
X5060 — Engine Harness

SH24924,00001C1 -19-01APR14-1/1

Command Arm Wiring Harness Connectors

C-2 — Key Switch
C-3 — Power Port
C-4 — Hall Effect Raise/Lower Lever
C-5 — Buzzer
C-10 — Main Wiring Harness (MC-13)
C-11 — Main Wiring Harness (MC-12)
C-14A — Work Lights
C-16 — Display
C-24 — PTO Switch
C-25 — Park Brake Switch
CT-5 — Command Arm Ground
CT-6 — Seat Pan Ground
MC-60 — Service ADVISOR connector
R-1 — Resistor

OUMX258,00006F2 -19-02APR14-1/1

Reel 48V Wiring Harness Connectors

MT-1 — 48V Alternator Ground
PC-1 — Front Left Controller
PC-2 — Rear Left Controller
PC-3 — Front Center Controller
PC-5 — Front Right Controller
PC-6 — Rear Right Controller
PT-1 — 48V Alternator (48VDC)

OUMX258,00006F3 -19-14MAR14-1/1

Reel Motor Controller Harness and Connectors

The reel controller has four connectors; J1, J6, P1, and P2.

The reel controller connects to the main wiring harness through the J6 connector, and the 48V wiring harness through the J1 connector.

The reel controller connects to the reel motor through the P1 and P2 connectors.

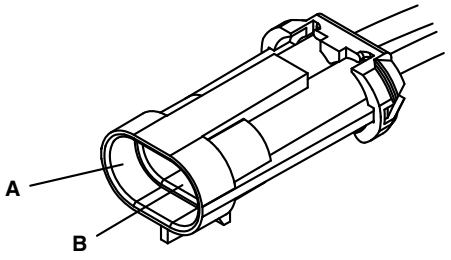
J6 Reel Motor Controller Connector to Main Wiring Harness Connector	
Front Left Controller 1	CAN-C1
Front Center Controller 3	CAN-C3
Front Right Controller 5	CAN-C5
Rear Left Controller 2	CAN-C2
Rear Right Controller 6	CAN-C6

J1		
A	RED	48V Switched Power
B	BLK	Ground

J6		
A	not used	
B	PUR	Location Bit (LSB)
C	WHT	Location Bit
D	not used	
E	RED	12V Power In
F	not used	
G	YEL	CAN-High
H	GRN	CAN-Low
J	not used	
K	BLU	Location Bit (MSB)

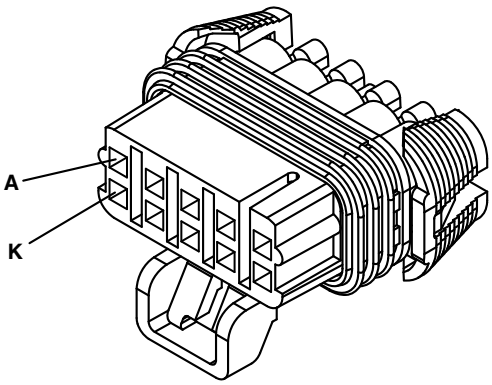
P1		
A	BLK	Sensor Return
B	RED	12V Sensor Power
C	BLU	Thermal Shutdown
D	BRN	Hall C-A
E	WHT	Hall B-C
F	GRN	Hall A-B

P2		
A	ORG	Phase A
B	BLK	Phase B
C	GRN	Phase C



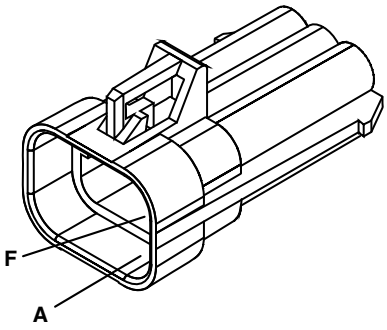
TCT010854 —UN—24MAR14

J1 Reel Controller Connector



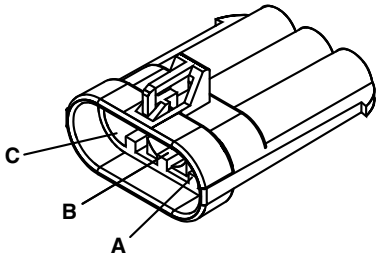
TCT010855 —UN—24MAR14

J6 Reel Controller Connector



TCT010856 —UN—24MAR14

P1 Reel Controller Connector



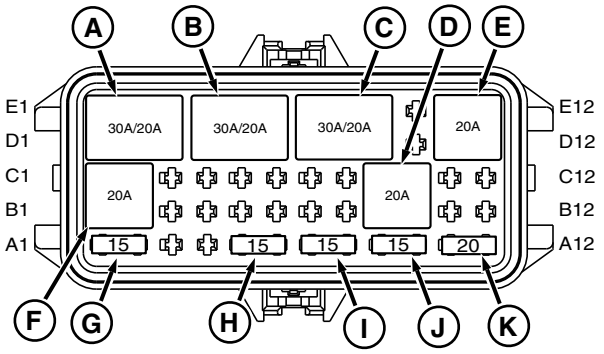
TCT010857 —UN—24MAR14

P2 Reel Controller Connector

OUMX258,0000445 -19-01APR14-1/1

Load Center, Non-T4

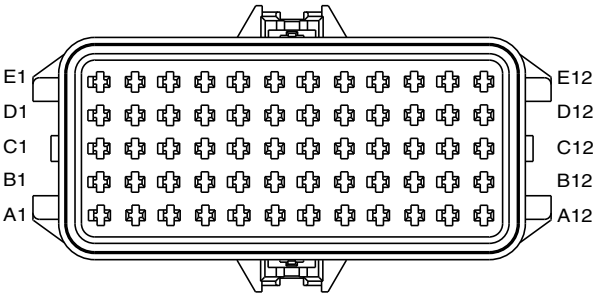
A—Fuel Pull-In Relay
B—Pre-Heat Relay
C—Starter Relay
D—48V Alternator Field Relay
E—Work Lights Relay
F—Power Port Relay
G—Vehicle Control Unit (VCU) Fuse, 15 A
H—Ignition Fuse, 15 A
I— Power Port Fuse, 15 A
J— Seat Fuse, 15 A
K—Work Lights Fuse, 20 A



TCT005942 —UN—29JAN13

OUMX258,00006F7 -19-02APR14-1/2

A1—208 Red
A2—211 Pnk
A5—209 Red
A6—210 Red
A7—207 Red
A8—604 Pnk
A9—212 Red
A10— 621 Pnk
A11— 206 Red
A12— 606 Pnk
B1—604 Pnk
B2—120 Blk
B9—537 Yel
B10— 426 Blu
C1—502 Yel
C2—306 Org
C9—523 Yel
C10— 690 Grn
D1—214 Red
D3—128 Blk
D4—202 Red
D6—321 Org
D7—213 Red
D9—130 Blk
D11— 606 Pnk
D12— 632 Pnk
E1—935 Wht
E3—900 Wht
E4—520 Yel
E6—920 Wht
E7—915 Wht
E9—700 Pur
E11— 451 Gry
E12— 400 Blu

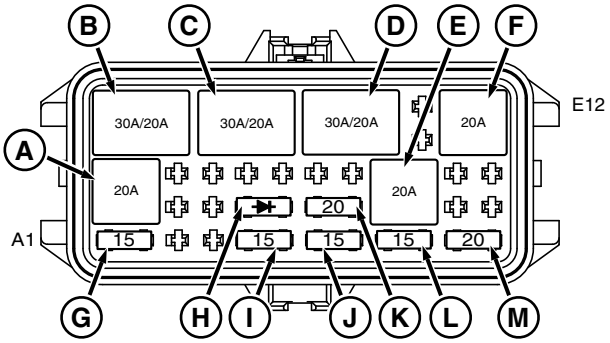


TCT004706 —UN—06NOV12

OUMX258,00006F7 -19-02APR14-2/2

Load Center, T4

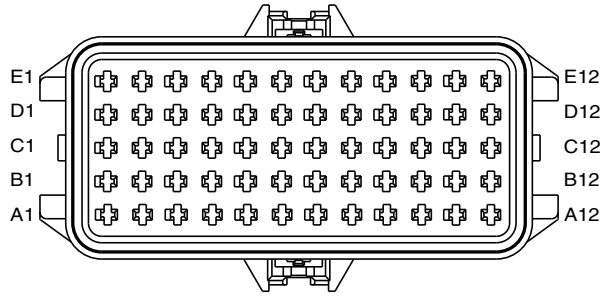
A—Power Port Relay
B—EGR Relay
C—Glow Plug Relay
D—Starter Relay
E—48V Alternator Field Relay
F—Work Lights Relay
G—Vehicle Control Unit (VCU) Fuse, 15 A
H—EGR Diode
I— Ignition Fuse, 15 A
J— Power Port Fuse, 15 A
K—Engine Control Unit (ECU) Fuse, 20A
L—Seat Compressor Fuse, 15 A
M—Work Lights Fuse, 20 A



TCT010250 —UN—25MAR14

SH24924,00001C0 -19-26MAR14-1/2

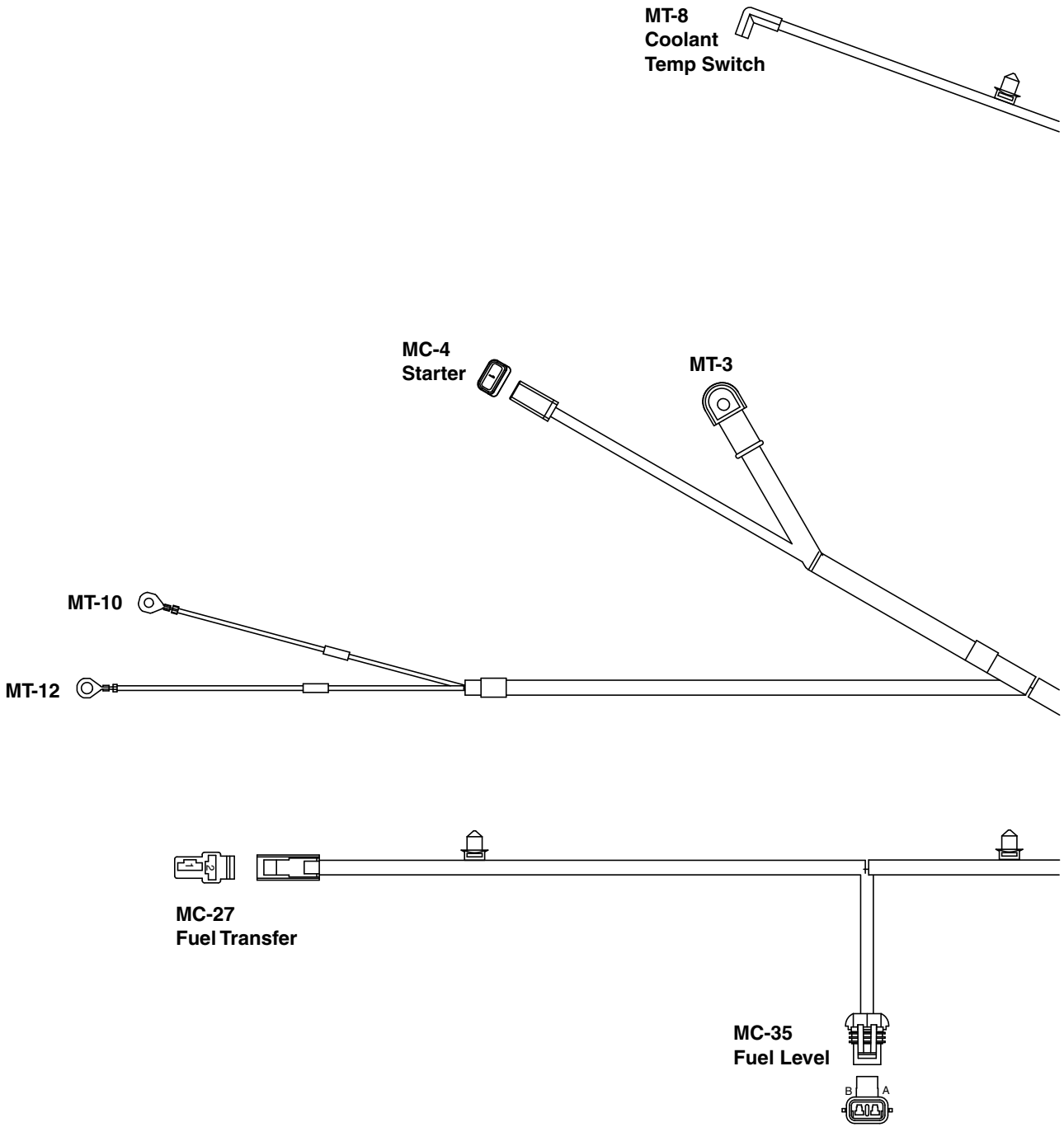
A1—208 Red
A2—211 Pnk
A5—209 Red
A6—210 Red
A7—207 Red
A8—604 Pnk
A9—212 Red
A10— 621 Pnk
A11— 206 Red
A12— 606 Pnk
B1—604 Pnk
B2—120 Blk
B5—636 Pnk
B6—404 Blu
B7—203 Red
B8—624 Pnk
B9—537 Yel
B10— 426 Blu
C1—502 Yel
C2—306 Org
C9—523 Yel
C10— 690 Grn
D1—615 Pnk
D3—128 Blk
D4—202 Red
D6—130 Blk
D7—213 Red
D9—465 Gry
D11— 606 Pnk
D12— 632 Pnk
E1—404 Blu
E3—309 Org
E4—626 Pnk
E6—920 Wht
E7—716 Pur
E9—700 Pur
E11— 451 Gry
E12— 400 Blu



TCT004706 —UN—06NOV12

SH24924,00001C0 -19-26MAR14-2/2

Main Wiring Harness, Non-T4



Main Wiring Harness (1 of 6)

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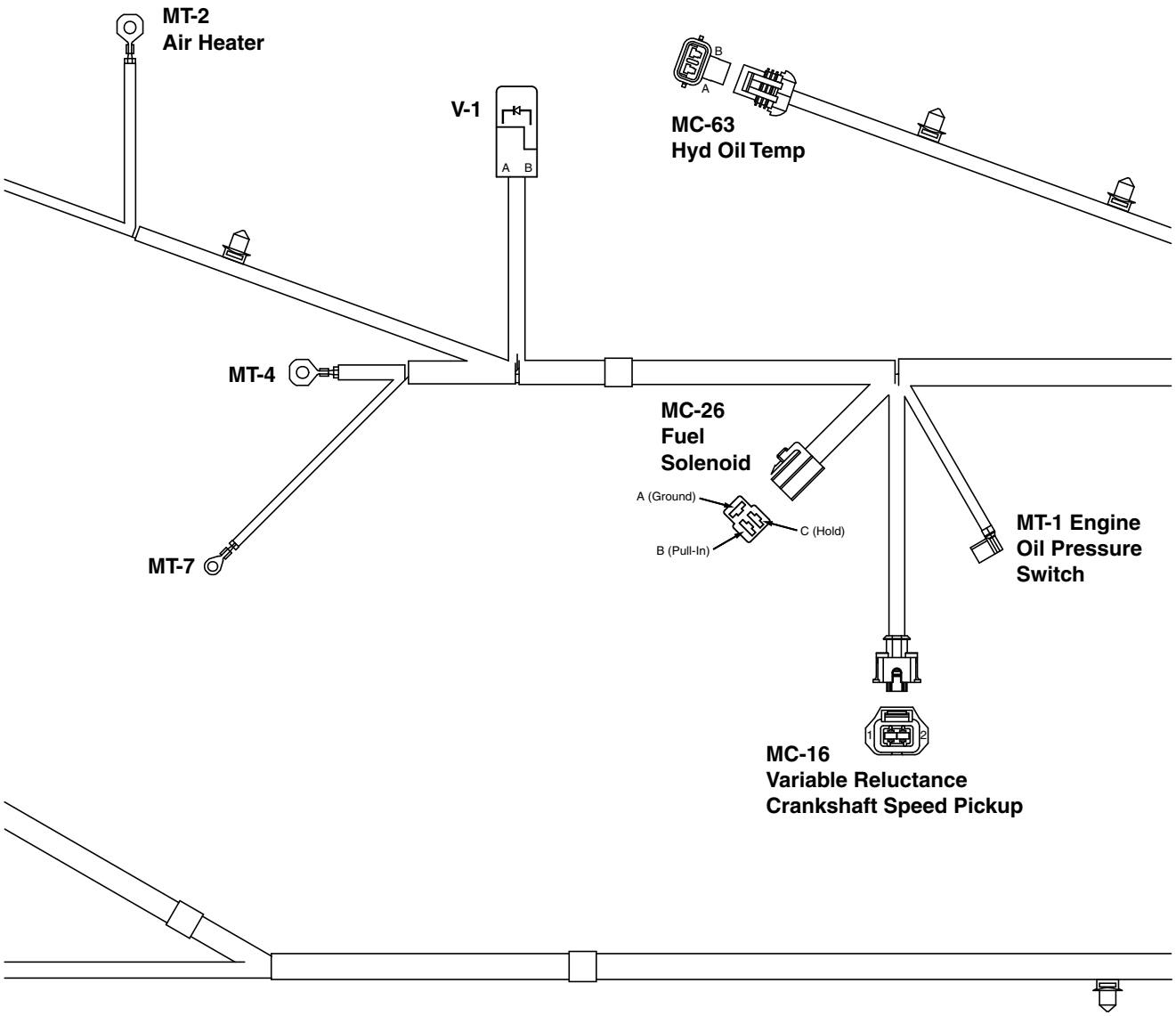
OUMX258,00006EE -19-18JUN14-1/6

Main Wiring Harness (2 of 6)



TCT005930 —UN—12MAR14

Main Wiring Harness (2 of 6)

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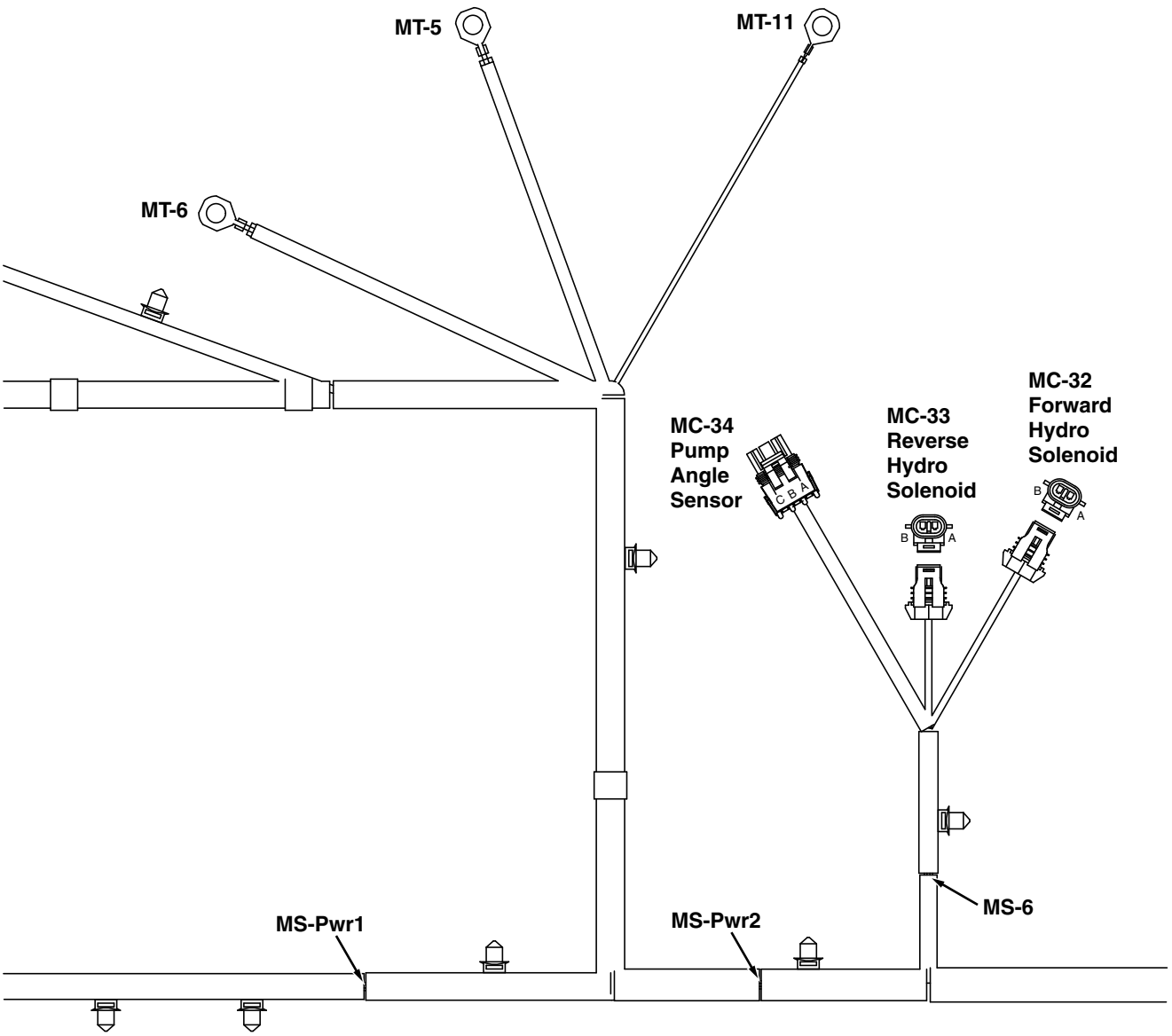
OUMX258,00006EE -19-18JUN14-2/6

Main Wiring Harness (3 of 6)



TCT0005931 —UN—25MAR14

Main Wiring Harness (3 of 6)

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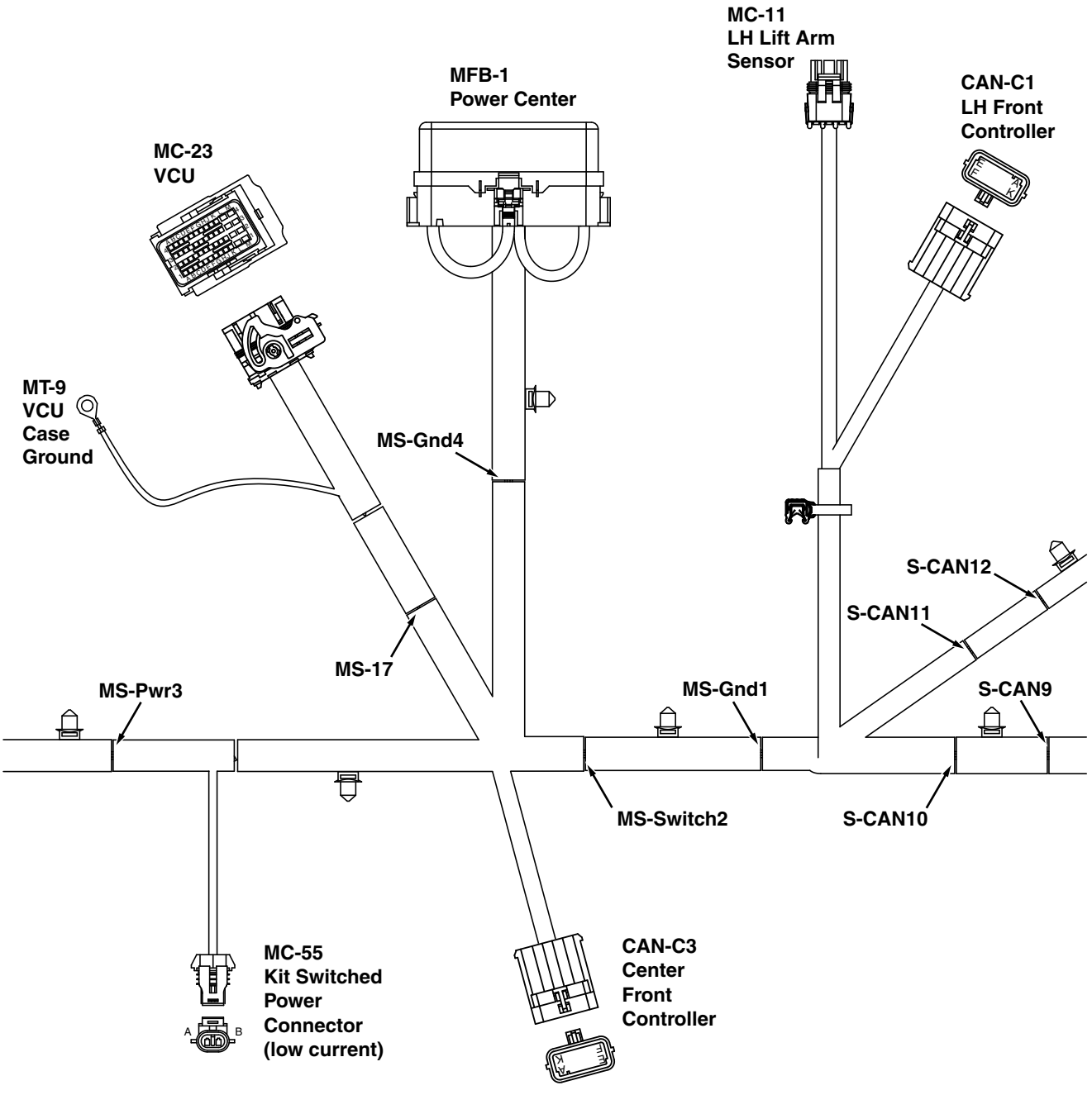
OUMX258,00006EE -19-18JUN14-3/6

Main Wiring Harness (4 of 6)



Main Wiring Harness (4 of 6)

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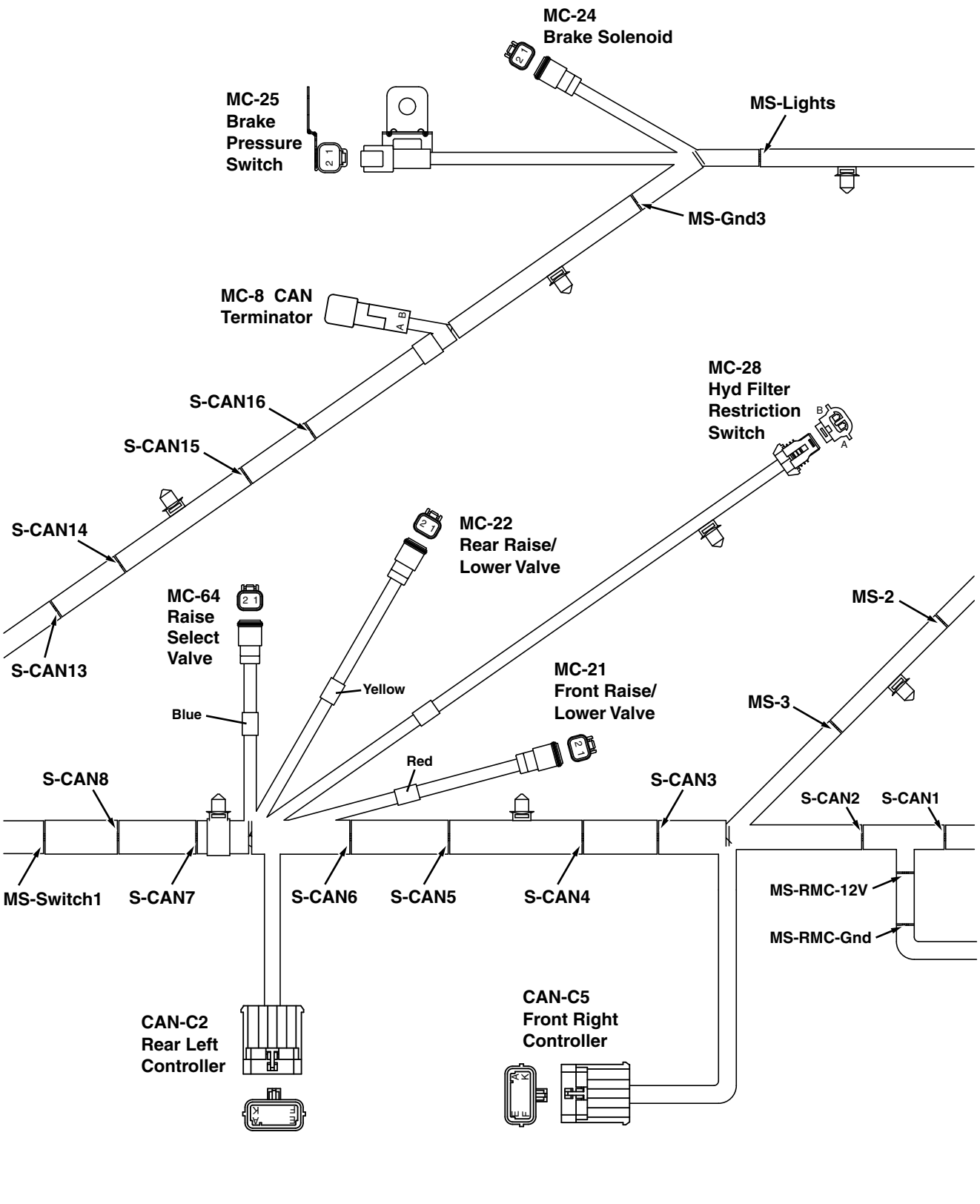
OUMX258,00006EE -19-18JUN14-4/6

Main Wiring Harness (5 of 6)



Main Wiring Harness (5 of 6)

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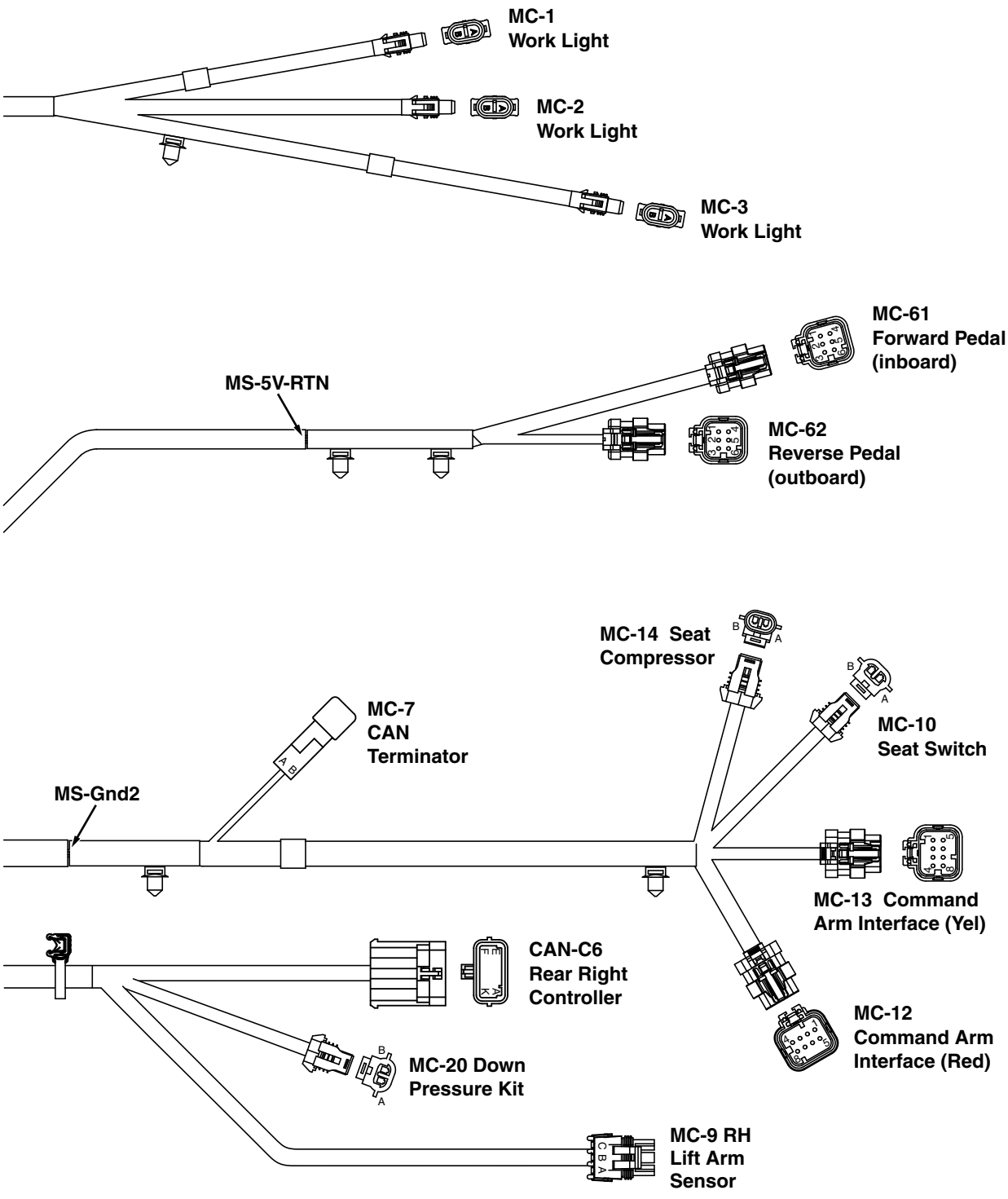
OUMX258,00006EE -19-18JUN14-5/6

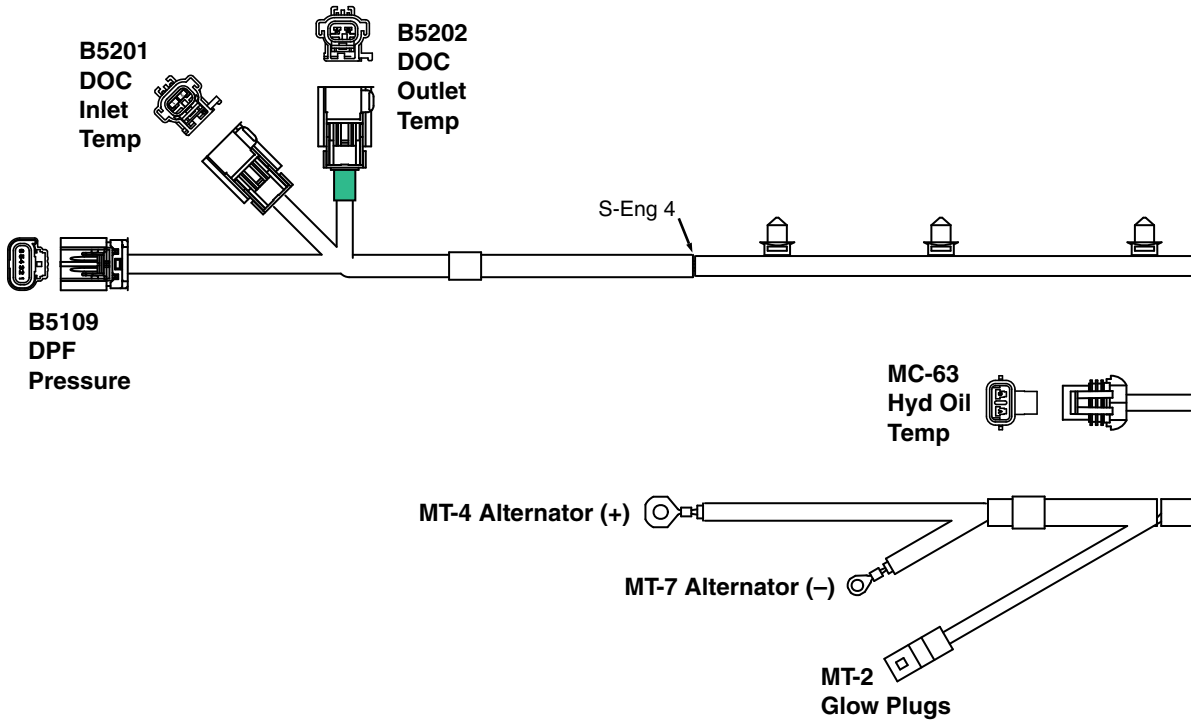
Main Wiring Harness (6 of 6)



Main Wiring Harness (6 of 6)

OUMX258,00006EE -19-18JUN14-6/6

Main Wiring Harness, T4



Main Wiring Harness, T4 (1 of 7)

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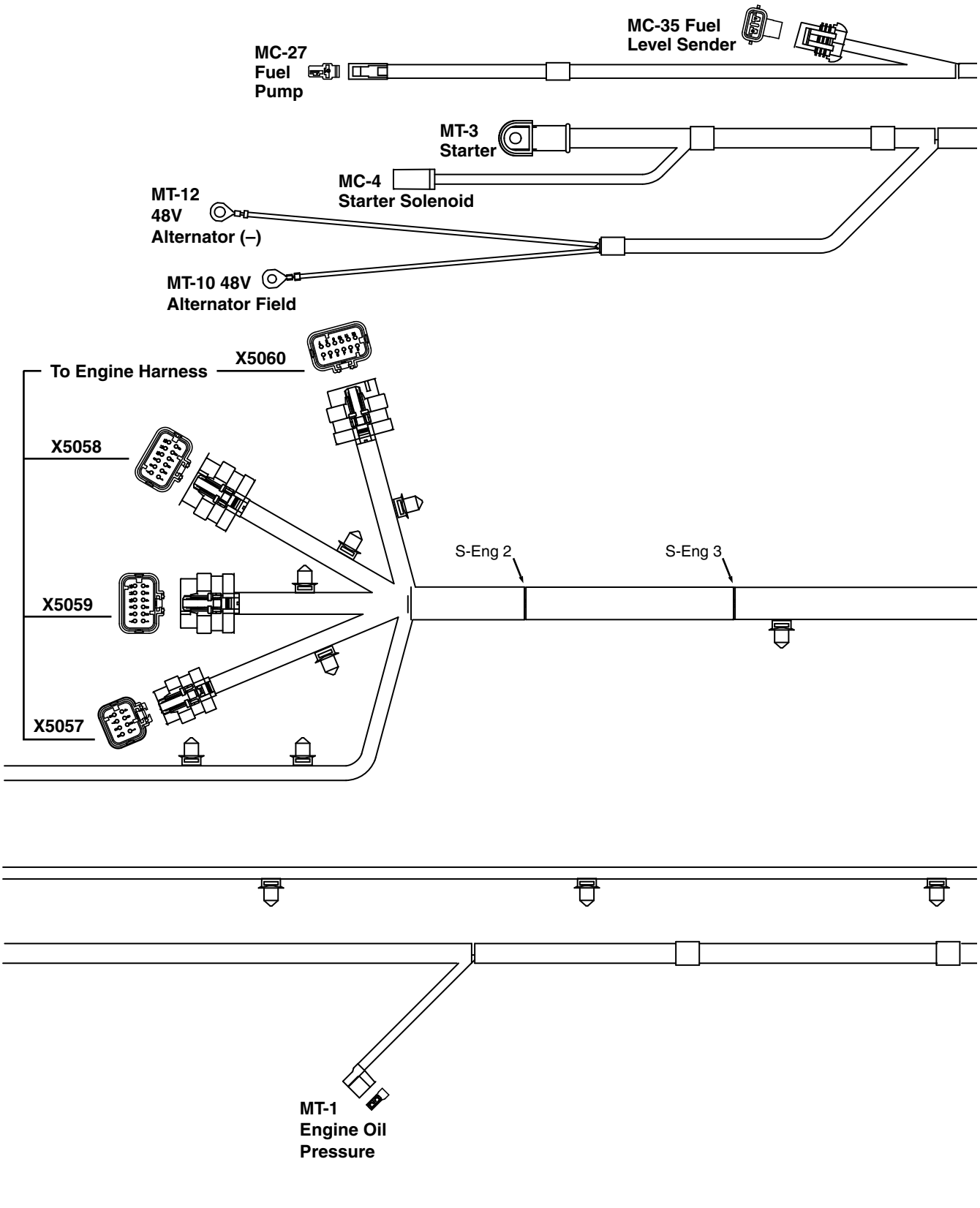
OUMX258,0000418 -19-25MAR14-1/7

Main Wiring Harness—T4 (2 of 7)



Main Wiring Harness, T4 (2 of 7)

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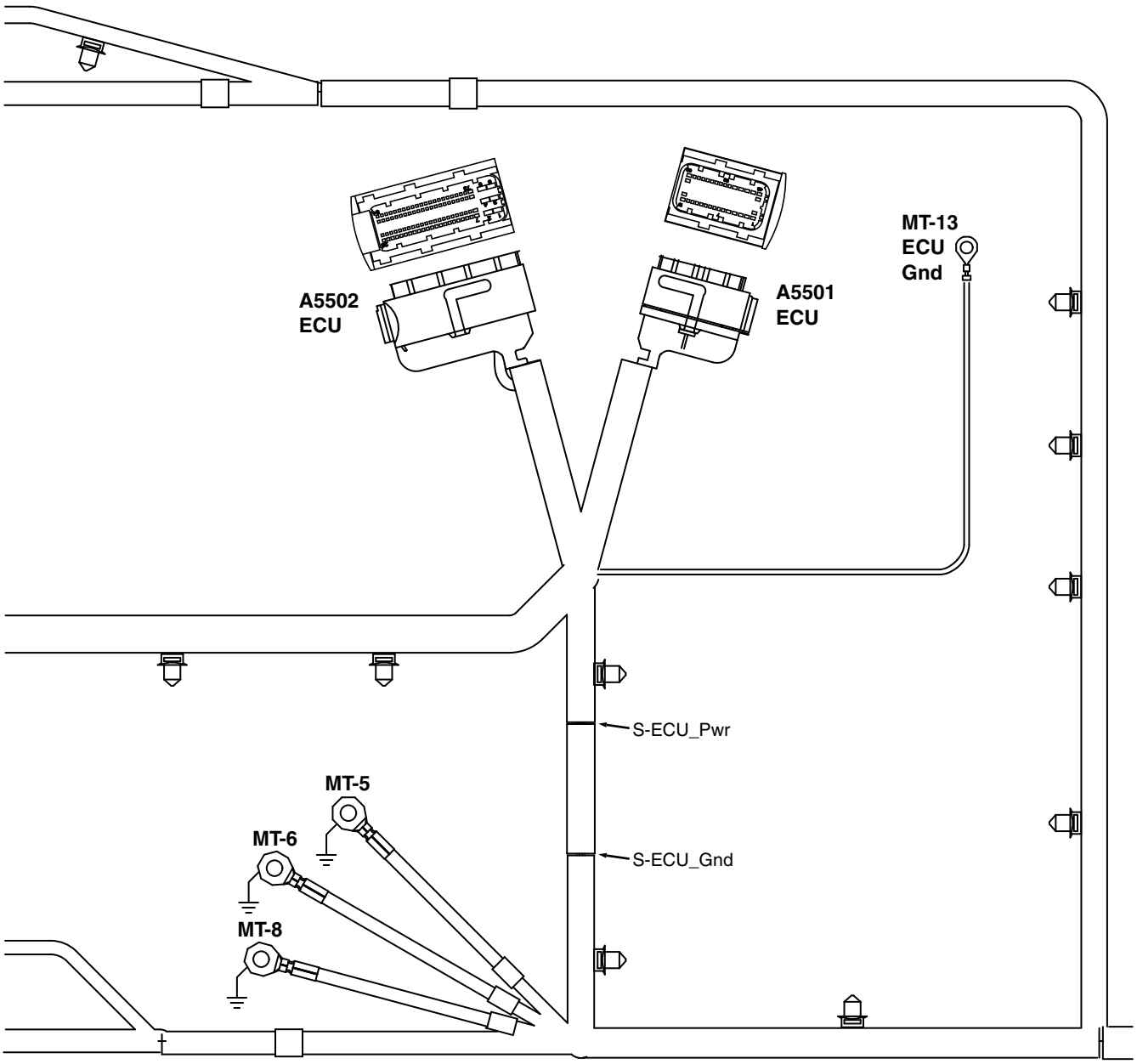
OUMX258,0000418 -19-25MAR14-2/7

Main Wiring Harness—T4 (3 of 7)



TCT0010239 —UN—14MAR14

Main Wiring Harness, T4 (3 of 7)

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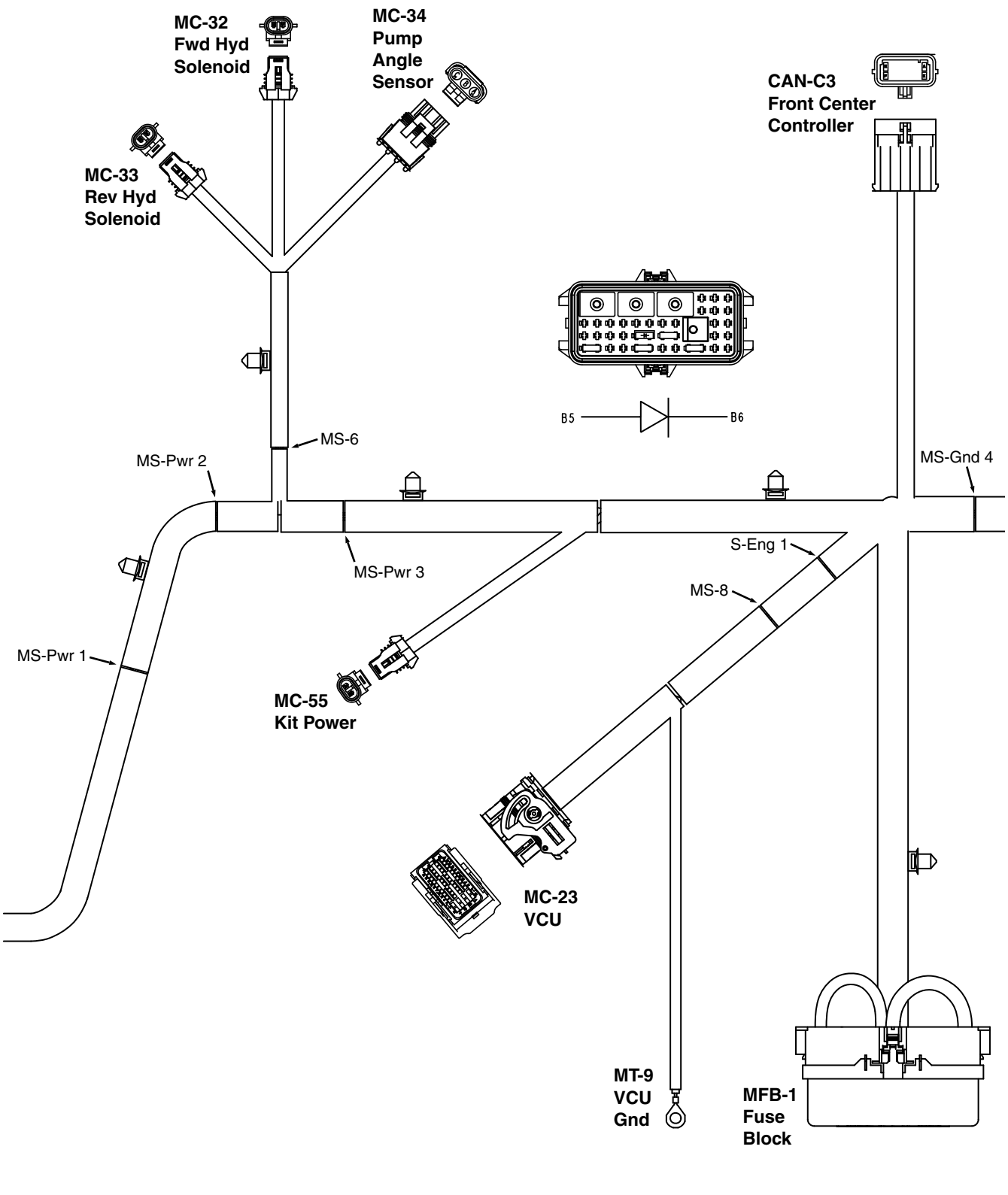
OUMX258,0000418 -19-25MAR14-3/7

Main Wiring Harness—T4 (4 of 7)



Main Wiring Harness, T4 (4 of 7)

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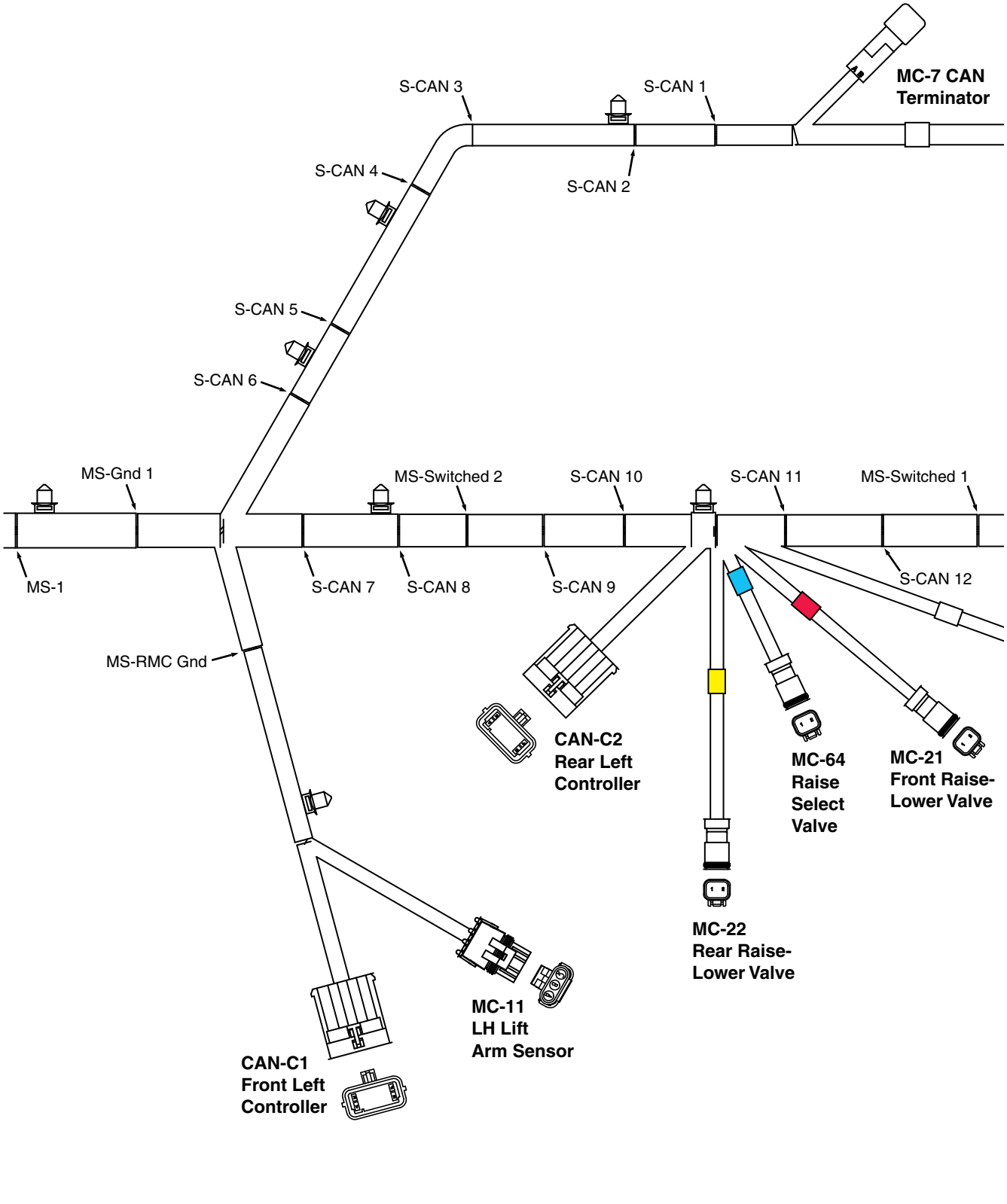
OUMX258,0000418 -19-25MAR14-4/7

Main Wiring Harness—T4 (5 of 7)



Main Wiring Harness, T4 (5 of 7)

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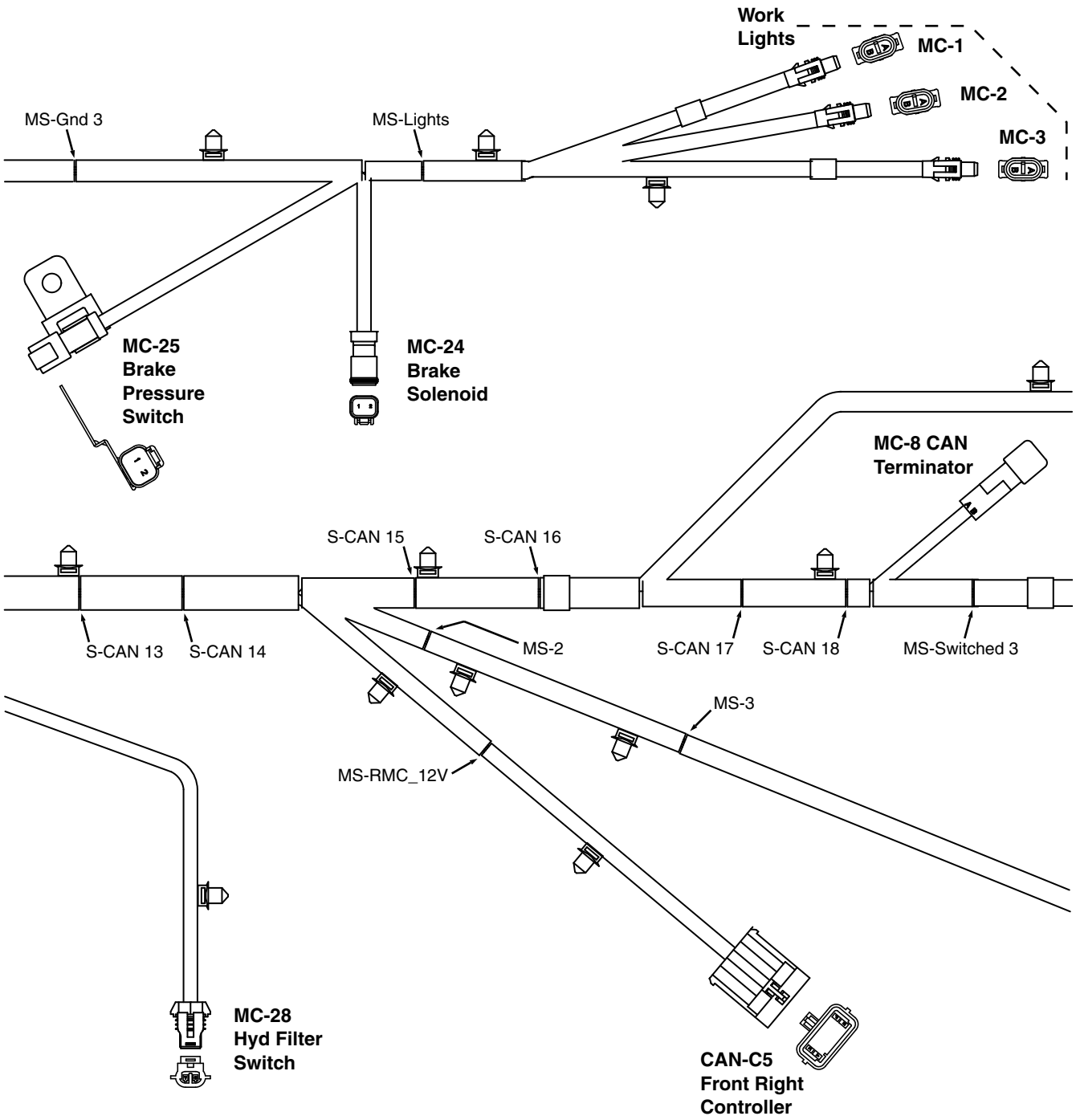
OUMX258,0000418 -19-25MAR14-5/7

Main Wiring Harness—T4 (6 of 7)



Main Wiring Harness, T4 (6 of 7)

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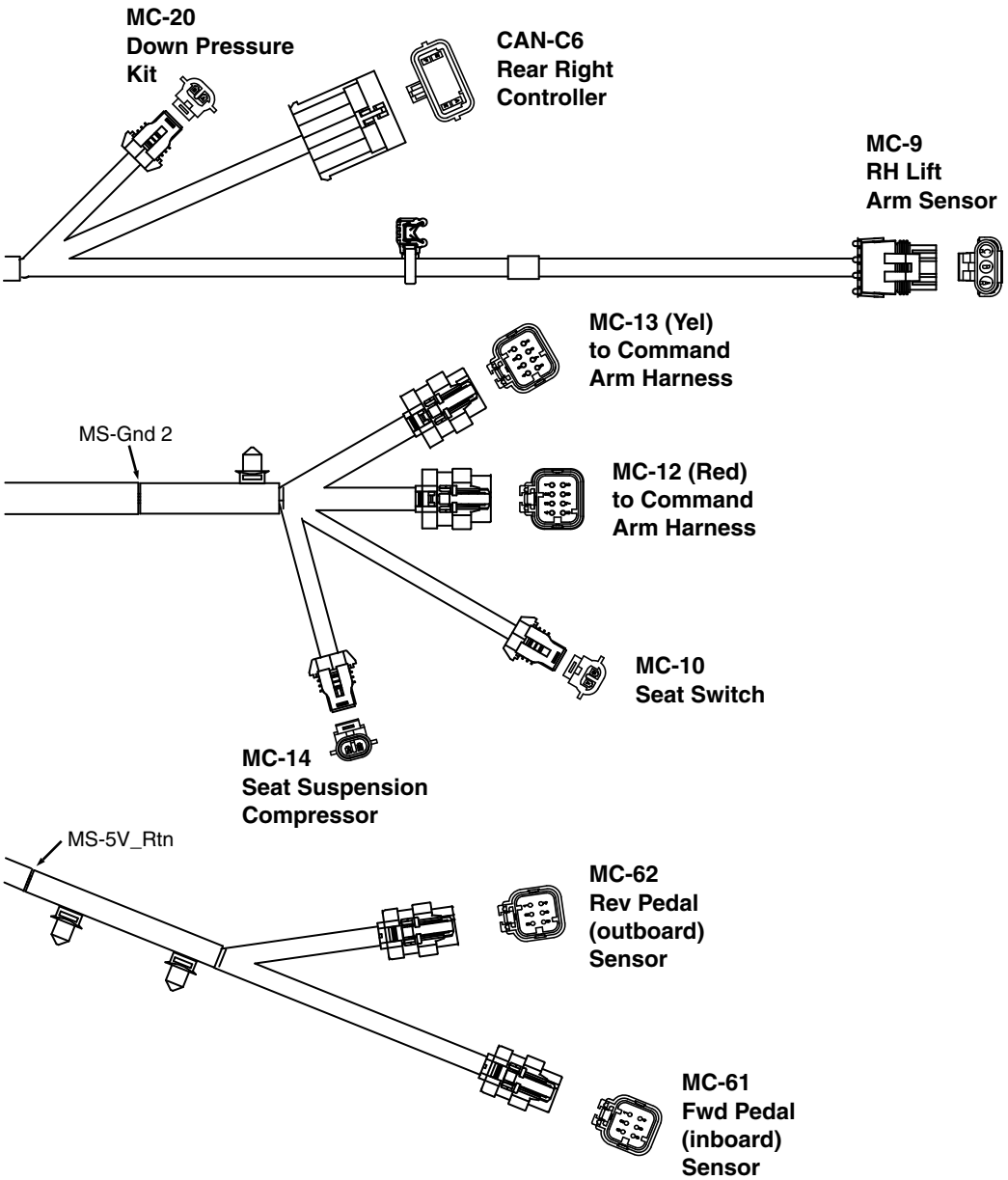
OUMX258,0000418 -19-25MAR14-6/7

Main Wiring Harness—T4 (7 of 7)

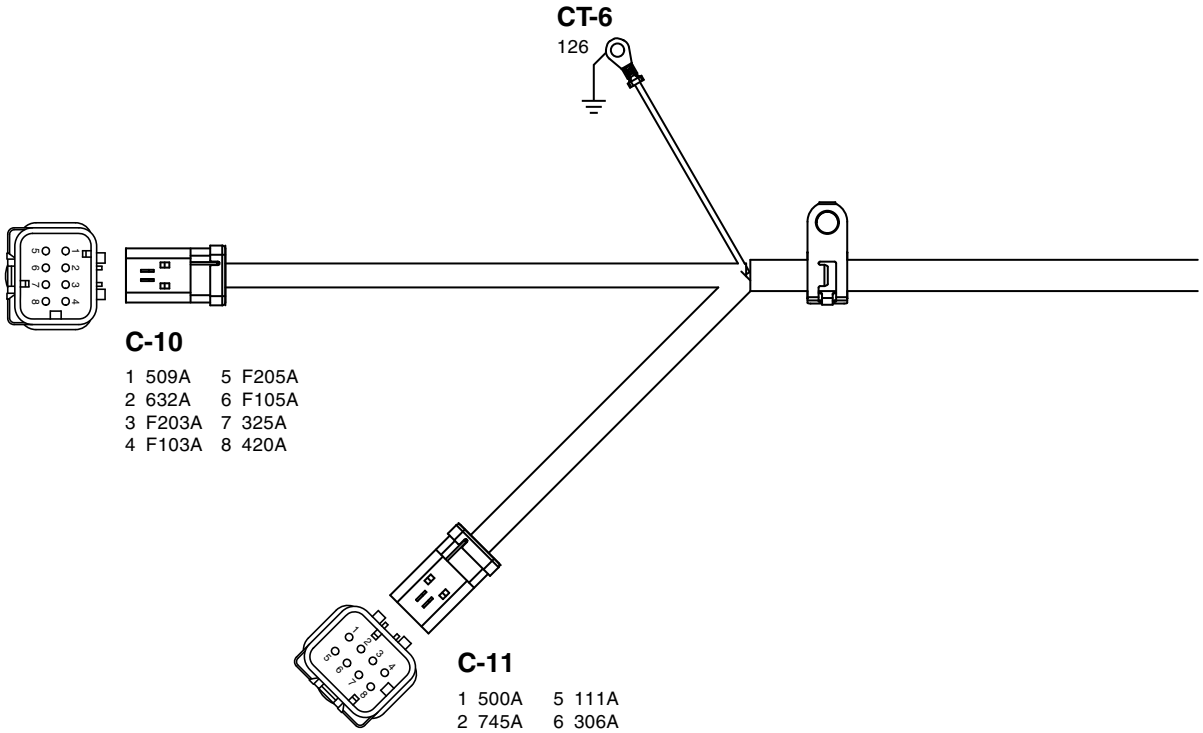


TCT0010243 —UN—14MAR14

Main Wiring Harness, T4 (7 of 7)

OUMX258,0000418 -19-25MAR14-7/7

Command Arm Wiring Harness



TCT005966 —UN—03MAR14

Command Arm Wiring Harness (1 of 2)

C-10— Main Wiring Harness, Yellow Connector

C-11— Main Wiring Harness, Red Connector

CT-6— Seat Pan Ground

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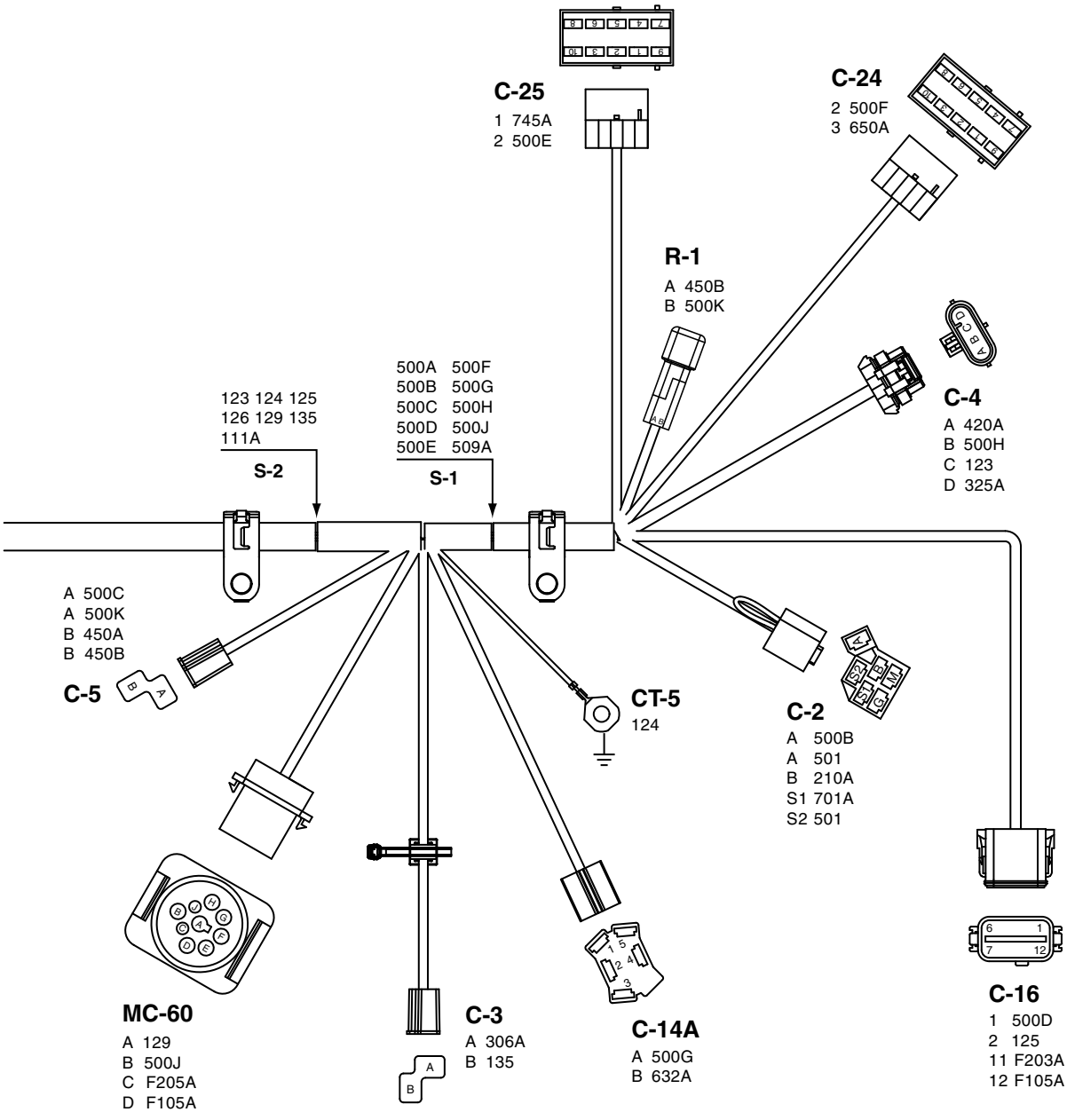
OUMX258,00006EF -19-08MAY14-1/2

Command Arm Wiring Harness (2 of 2)

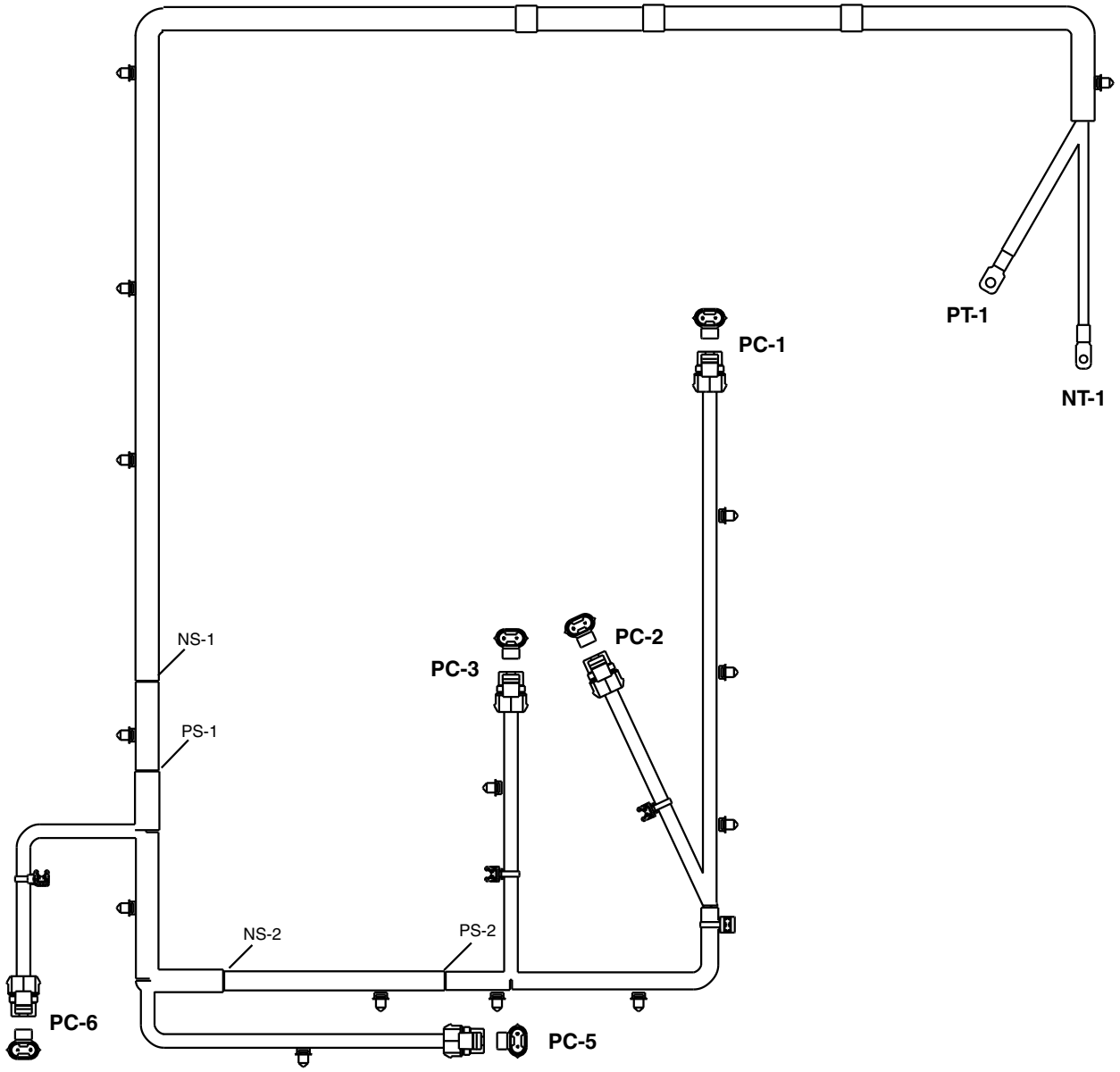


Command Arm Wiring Harness (2 of 2)

C-2— Key Switch Connector
C-3— Power Port Connector
C-4— Raise/Lower Lever Connector
C-5— Buzzer Connector
C14A— Work Light Switch Connector
C-16— Display Connector
C-24— PTO Switch Connector
C-25— Park Brake Switch Connector
CT-5— Command Arm Ground
MC-60—Service ADVISOR Connector
R-1— Resistor, 1000 Ω

OUMX258,00006EF -19-08MAY14-2/2

Reel 48V Power Wiring Harness



Reel 48V Power Wiring Hanress - 7500A

NT-1— 48V Alternator, Ground
PT-1— 48V Alternator, 48V Output
PC-1— Front Left Controller
PC-2— Rear Left Controller
PC-3— Front Center Controller
PC-5— Front Right Controller
PC-6— Right Rear Controller

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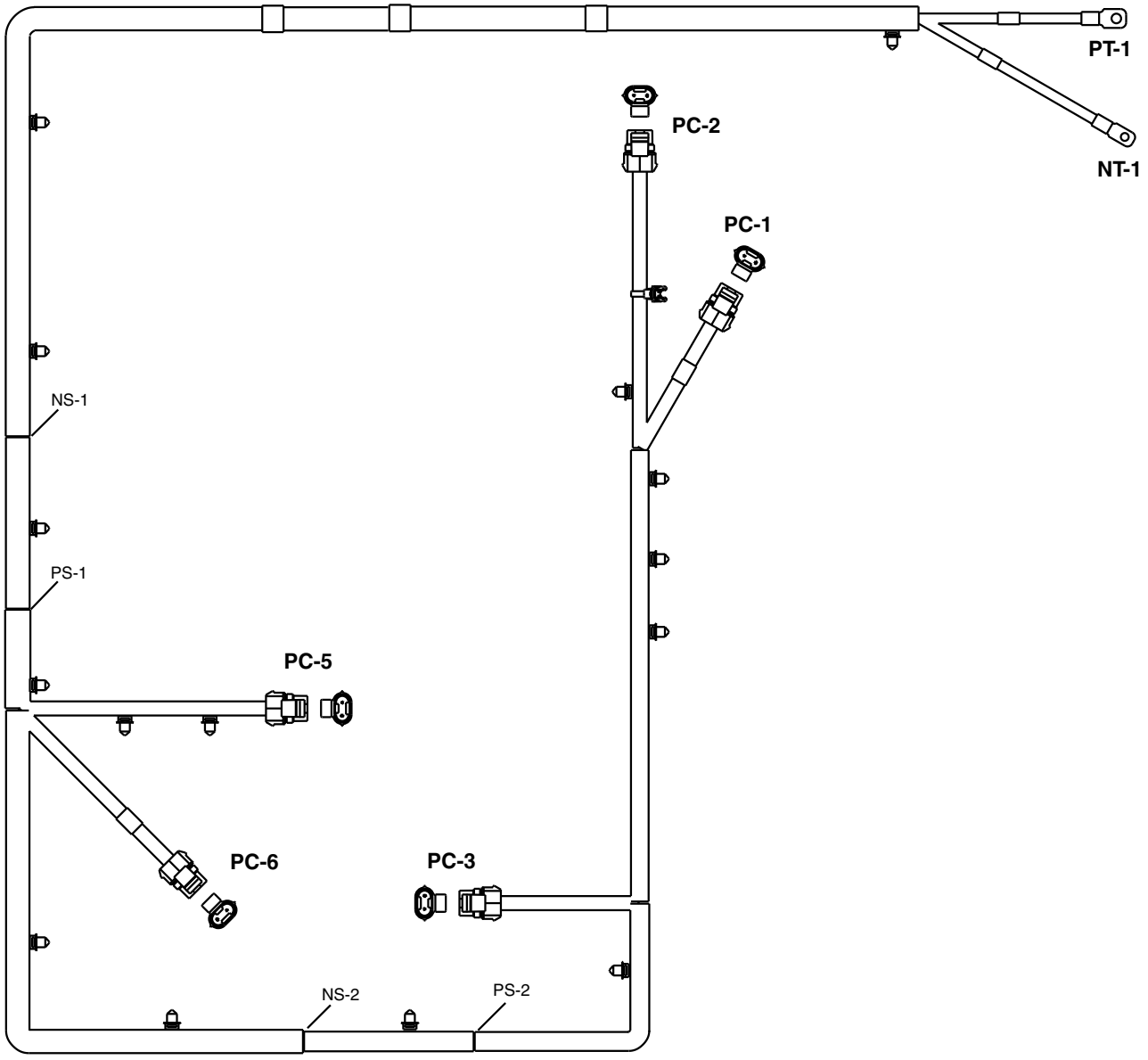
OUMX258,00006F0 -19-14MAR14-1/2



Reel 48V Power Wiring Hanress - 8000A

NT-1— 48V Alternator, Ground
PT-1— 48V Alternator, 48V Output
PC-1— Front Left Controller
PC-2— Rear Left Controller
PC-3— Front Center Controller
PC-5— Front Right Controller
PC-6— Right Rear Controller

OUMX258,00006F0 -19-14MAR14-2/2

Main Wiring Harness, Non-T4 Color Codes

Size/No./Color	Wire Connection Points
5.0 100 Blk	MS-Gnd1 Splice, MT-5
3.0 101 Blk	MT-6, MC-26 (A)
5.0 102 Blk	MT-6, MT-7
1.0 103 Blk	MS-17 Splice, MC-23 (L2)
0.8 104 Blk	MS-Gnd1 Splice, MC-27 (1)
2.0 105 Blk	MS-Gnd2 Splice, MS-Gnd1 Splice
0.8 107 Blk	MS-Gnd4 Splice, MS-Gnd1 Splice
0.8 109 Blk	MC-55 (B), MS-Gnd1 Splice
2.0 110 Blk	MS-Gnd3 Splice, MS-Gnd1 Splice
1.0 111 Blk	MS-Gnd2 Splice, MC-12 (5)
0.8 112 Blk	MC-22 (1), MS-Gnd2 Splice
0.8 113 Blk	MC-21 (1), MS-Gnd2 Splice
0.8 114 Blk	MS-Gnd2 Splice, MC-24 (2)
0.8 115 Blk	MS-Gnd1 Splice, MC-11 (C)
0.8 116 Blk	MS-Gnd3 Splice, MC-9 (C)
1.0 117 Blk	MC-3 (B), MS-Gnd3 Splice
1.0 118 Blk	MC-2 (B), MS-Gnd3 Splice
1.0 119 Blk	MC-1 (B), MS-Gnd3 Splice
0.8 120 Blk	MFB-1 (B2), MS-Gnd4 Splice
0.8 121 Blk	MS-RMC Gnd, MS-Gnd1 Splice
0.8 128 Blk	MFB-1 (D3), MS-Gnd4 Splice
0.8 130 Blk	MFB-1 (D9), MS-Gnd4 Splice
0.8 131 Blk	MC-14 (B), MS-Gnd2 Splice
0.8 132 Blk	MC-28 (A), MS-Gnd1 Splice
1.0 133 Blk	MS-17 Splice, MT-9
1.0 134 Blk	MS-17 Splice, MT-5
1.0 142 Blk	MT-11, MT-12
0.8 155 Blk	CAN-C3 (K), MS-RMC Gnd
0.8 156 Blk	CAN-C2 (B), MS-RMC Gnd
0.8 157 Blk	CAN-C2 (K), MS-RMC Gnd
0.8 158 Blk	CAN-C6 (B), MS-RMC Gnd
0.8 159 Blk	CAN-C5 (C), MS-RMC Gnd
0.8 160 Blk	CAN-C1 (K), MS-RMC Gnd
0.8 161 Blk	CAN-C1 (C), MS-RMC Gnd
8.0 200 Red	MT-3, MS-Power1 Splice
8.0 201 Red	MT-3, MT-4
3.0 202 Red	MFB-1 (D4), MS-Power3 Splice
3.0 204 Red	MS-Power1 Splice, MS-Power2 Splice
3.0 205 Red	MS-Power1 Splice, MS-Power3 Splice
3.0 206 Red	MFB-1 (A11), MS-Power2 Splice
3.0 207 Red	MFB-1 (A7), MS-Power1 Splice
3.0 208 Red	MFB-1 (A1), MS-Power1 Splice
3.0 209 Red	MFB-1 (A5), MS-Power3 Splice
1.0 210 Red	MFB-1 (A6), MC-12 (8)
1.0 211 Pnk	MFB-1 (A2), MC-23 (L1)
3.0 212 Red	MFB-1 (A9), MS-Power2 Splice
3.0 213 Red	MFB-1 (D7), MS-Power3 Splice
3.0 214 Red	MFB-1 (D1), MS-Power2 Splice
0.5 300 Org	MC-23 (H3), MT-8
0.5 305 Org	MC-23 (K1), MC-63 (A)
0.8 306 Org	MFB-1 (C2), MC-12 (6)
0.5 310 Org	MC-23 (A4), MC-35 (B)
0.5 315 Org	MC-23 (M3), MC-64 (2)
0.5 320 Org	MC-23 (L4), MC-32 (B)
0.5 321 Org	MFB-1 (D6), MC-23 (F2)
0.5 325 Org	MC-13 (7), MC-23 (D3)
1.0 350 Brn	MS-5V_RTN, MC-23 (M2)
0.5 351 Brn	MS-5V_RTN, MC-61 (4)
0.5 352 Brn	MS-5V_RTN, MC-61 (1)
0.5 353 Brn	MS-5V_RTN, MC-62 (4)
0.5 354 Brn	MS-5V_RTN, MC-62 (1)
0.8 355 Brn	MS-5V_RTN, MC-34 (A)
0.5 356 Brn	MS-5V_RTN, MC-35 (A)
2.0 400 Blu	MS-Lights Splice, MFB-1 (E12)
1.0 401 Blu	MS-Lights Splice, MC-1 (A)
1.0 402 Blu	MS-Lights Splice, MC-2 (A)
1.0 403 Blu	MS-Lights Splice, MC-3 (A)
0.5 420 Blu	MC-23 (C3), MC-13 (8)
0.5 426 Blu	MC-23 (E2), MFB-1 (B10)
0.5 430 Blu	MC-23 (C1), MC-10 (B)
0.5 435 Blu	MC-23 (F4), MC-21 (2)
0.5 445 Blu	MC-23 (C4), MC-20 (B)
0.5 450 Gry	MC-23 (G2), MC-12 (4)
0.5 451 Gry	MC-23 (H2), MFB-1 (E11)
0.5 452 Gry	MC-23 (H4), MC-33 (B)
1.0 500 Yel	MS-Switched1 Splice, MC-12 (1)
0.8 502 Yel	MS-Switched2 Splice, MFB-1 (C1)
0.8 503 Yel	MS-Switched1 Splice, MC-55 (A)
1.0 504 Yel	MS-Switched1 Splice, MS-Switched2 Splice
0.8 505 Yel	MS-Switched1 Splice, MC-10 (A)
0.8 506 Yel	MS-Switched1 Splice, MC-9 (A)
0.8 507 Yel	MS-Switched1 Splice, MC-11 (A)
0.8 508 Yel	MS-Switched2 Splice, MC-27 (2)
1.0 509 Yel	MC-23 (M1), MC-13 (1)
0.8 512 Yel	MS-Switched1 Splice, MC-64 (1)
0.8 514 Yel	MS-Switched2 Splice, MC-25 (A)

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OUMX258,00006F6 -19-03APR14-1/2

Size/No./Color	Wire Connection Points
0.8 517 Yel	MS-Switched1 Splice, MC-20 (A)
0.8 520 Yel	MS-Switched2 Splice, MFB-1 (E4)
0.8 523 Yel	MS-Switched2 Splice, MFB-1 (C9)
0.8 524 Yel	MS-Switched2 Splice, MC-63 (B)
0.8 531 Yel	CAN-C1 (E), MS-RMC_12V
0.8 532 Yel	CAN-C2 (E), MS-RMC_12V
0.8 533 Yel	CAN-C6 (E), MS-RMC_12V
0.8 534 Yel	CAN-C5 (E), MS-RMC_12V
0.8 535 Yel	CAN-C3 (E), MS-RMC_12V
0.8 536 Yel	MS-Switched1 Splice, MS-RMC_12V
0.8 537 Yel	MS-Switched2 Splice, MFB-1 (B9)
0.5 600 Pnk	MC-23 (E4), MC-24 (1)
0.8 604 Pnk	MFB-1 (A8), MFB-1 (B1)
0.5 605 Pnk	MC-23 (F1), MS-2 Splice
2.0 606 Pnk	MFB-1 (A12), MFB-1 (D11)
0.5 610 Pnk	MC-23 (G3), MS-6 Splice
0.5 611 Pnk	MC-32 (A), MS-6 Splice
0.5 612 Pnk	MC-33 (A), MS-6 Splice
0.5 615 Pnk	MC-23 (J3), MC-26 (C)
0.5 620 Pnk	MC-23 (K2), MS-3 Splice
0.8 621 Pnk	MFB-1 (A10), MC-14 (A)
0.5 630 Pnk	MS-61 (6), MS-2 Splice
0.8 632 Pnk	MFB-1 (D12), MC-13 (2)
0.5 635 Pnk	MS-62 (6), MS-2 Splice
0.5 640 Pnk	MS-61 (3), MS-3 Splice
0.5 641 Pnk	MS-34 (C), MS-3 Splice
0.5 645 Pnk	MS-62 (3), MS-3 Splice
0.5 650 Grn	MC-23 (A2), MC-12 (3)
0.5 651 Grn	MC-23 (B3), MC-9 (B)
0.5 652 Grn	MC-23 (D1), MC-62 (2)
0.5 654 Grn	MC-23 (L3), MC-11 (B)
0.5 657 Grn	MC-23 (F3), MC-61 (5)
0.5 659 Grn	MC-23 (D4), MC-22 (2)
0.8 661 Grn	MC-16 (1), MS-17 Splice
0.5 662 Grn	MC-23 (E3), MC-62 (5)
0.5 663 Grn	MC-23 (A3), MC-28 (B)
0.5 665 Grn	MC-23 (J2), MC-61 (2)
0.5 667 Grn	MC-23 (B4), MC-34 (B)
0.5 671 Grn	MC-23 (H1), MC-25 (B)
0.8 690 Grn	MFB-1 (C10), MT-10
3.0 700 Pur	MFB-1 (E9), MC-4
0.5 701 Pur	MC-23 (C2), MC-12 (7)
0.5 745 Pur	MC-23 (J1), MC-12 (2)

Size/No./Color	Wire Connection Points
0.8 800 Yel	MC-23 (M4), MC-16 (2)
0.5 830 Tan	MC-23 (G4), MT-1
3.0 900 Wht	MFB-1 (E3), MC-26 (B)
0.5 915 Wht	MFB-1 (E7), MC-23 (J4)
3.0 920 Wht	MFB-1 (E6), MT-2
0.5 935 Wht	MFB-1 (E1), MC-23 (B2)
1.0 101A Blk	MC-26 (A), V-1 (B)
1.0 900A Wht	MC-26 (B), V-1 (A)
0.5 F100 Grn	MC-7 (B), S-CAN2 Splice
0.5 F101 Grn	MC-23 (B1), S-CAN2 Splice
0.5 F102 Grn	S-CAN2 Splice, S-CAN4 Splice
0.5 F103 Grn	MC-13 (4), S-CAN16 Splice
0.5 F104 Grn	S-CAN4 Splice, S-CAN6 Splice
0.5 F105 Grn	MC-13 (6), S-CAN14 Splice
0.5 F106 Grn	S-CAN6 Splice, S-CAN8 Splice
0.5 F107 Grn	CAN-C2 (H), S-CAN6 Splice
0.5 F108 Grn	S-CAN8 Splice, S-CAN10 Splice
0.5 F109 Grn	CAN-C6 (H), S-CAN12 Splice
0.5 F110 Grn	S-CAN10 Splice, S-CAN12 Splice
0.5 F111 Grn	CAN-C5 (H), S-CAN10 Splice
0.5 F112 Grn	S-CAN12 Splice, S-CAN14 Splice
0.5 F113 Grn	CAN-C3 (H), S-CAN8 Splice
0.5 F114 Grn	S-CAN14 Splice, S-CAN16 Splice
0.5 F115 Grn	CAN-C1 (H), S-CAN4 Splice
0.5 F116 Grn	MC-8 (A), S-CAN16 Splice
0.5 F200 Yel	MC-7 (A), S-CAN1 Splice
0.5 F201 Yel	MC-23 (A1), S-CAN1 Splice
0.5 F202 Yel	S-CAN1 Splice, S-CAN3 Splice
0.5 F203 Yel	MC-13 (3), S-CAN15 Splice
0.5 F204 Yel	S-CAN3 Splice, S-CAN5 Splice
0.5 F205 Yel	MC-13 (5), S-CAN13 Splice
0.5 F206 Yel	S-CAN5 Splice, S-CAN7 Splice
0.5 F207 Yel	CAN-C2 (G), S-CAN5 Splice
0.5 F208 Yel	S-CAN7 Splice, S-CAN9 Splice
0.5 F209 Yel	CAN-C6 (G), S-CAN11 Splice
0.5 F210 Yel	S-CAN9 Splice, S-CAN11 Splice
0.5 F211 Yel	CAN-C5 (G), S-CAN9 Splice
0.5 F212 Yel	S-CAN11 Splice, S-CAN13 Splice
0.5 F213 Yel	CAN-C3 (G), S-CAN7 Splice
0.5 F214 Yel	S-CAN13 Splice, S-CAN15 Splice
0.5 F215 Yel	CAN-C1 (G), S-CAN3 Splice
0.5 F216 Yel	MC-8 (B), S-CAN15 Splice

OUMX258,00006F6 -19-03APR14-2/2

Main Wiring Harness, T4 Color Codes

Size/No./Color	Wire Connection Points
5.0 100 Blk	MT-5, MS-Gnd1 Splice
1.0 101 Blk	MT-5, MT-13
5.0 102 Blk	MT-6, MT-7
1.0 103 Blk	MS-8 Splice, MC-23 (L2)
0.8 104 Blk	MS-Gnd1 Splice, MC-27 (1)
0.8 105 Blk	MS-Gnd2 Splice, MS-Gnd1 Splice
0.8 107 Blk	MS-Gnd4 Splice, MS-Gnd1 Splice
0.8 109 Blk	MC-55 (B), MS-Gnd1 Splice
2.0 110 Blk	MS-Gnd3 Splice, MS-Gnd1 Splice
1.0 111 Blk	MS-Gnd2 Splice, MC-12 (5)
0.8 112 Blk	MC-22 (1), MS-Gnd2 Splice
0.8 113 Blk	MC-21 (1), MS-Gnd2 Splice
0.8 114 Blk	MS-Gnd3 Splice, MC-24 (2)
0.8 115 Blk	MS-Gnd3 Splice, MC-11 (C)
0.8 116 Blk	MS-Gnd3 Splice, MC-9 (C)
1.0 117 Blk	MC-3 (B), MS-Gnd3 Splice
1.0 118 Blk	MC-2 (B), MS-Gnd3 Splice
1.0 119 Blk	MC-1 (B), MS-Gnd3 Splice
0.8 120 Blk	MFB-1 (B2), MS-Gnd4 Splice
0.8 121 Blk	MS-RMC Gnd, MS-Gnd1 Splice
0.8 128 Blk	MFB-1 (D3), MS-Gnd4 Splice
0.8 130 Blk	MFB-1 (D6), MS-Gnd4 Splice
0.8 131 Blk	MC-14 (B), MS-Gnd2 Splice
0.8 132 Blk	MC-28 (A), MS-Gnd1 Splice
1.0 133 Blk	MS-8 Splice, MT-9
1.0 134 Blk	MS-8 Splice, MT-6
1.0 142 Blk	MT-8, MT-12
5.0 150 Blk	MT-8, S-ECU Gnd
1.0 151 Blk	X5058 (4), S-ECU Gnd
2.0 152 Blk	A5502 (6), S-ECU Gnd
2.0 153 Blk	A5502 (4), S-ECU Gnd
2.0 154 Blk	A5502 (2), S-ECU Gnd
0.8 155 Blk	CAN-C3 (K), MS-RMC Gnd
0.8 156 Blk	CAN-C2 (B), MS-RMC Gnd
0.8 157 Blk	CAN-C2 (K), MS-RMC Gnd
0.8 158 Blk	CAN-C6 (B), MS-RMC Gnd
0.8 159 Blk	CAN-C5 (C), MS-RMC Gnd
0.8 160 Blk	CAN-C1 (K), MS-RMC Gnd
0.8 161 Blk	CAN-C1 (C), MS-RMC Gnd
8.0 200 Red	MT-3, MS-Power1 Splice
8.0 201 Red	MT-3, MT-4
3.0 202 Red	MFB-1 (D4), MS-Power3 Splice
3.0 203 Red	MFB-1 (B7), MS-Power1 Splice
3.0 204 Red	MS-Power1 Splice, MS-Power2 Splice
3.0 205 Red	MS-Power1 Splice, MS-Power3 Splice
3.0 206 Red	MFB-1 (A11), MS-Power2 Splice
3.0 207 Red	MFB-1 (A7), MS-Power2 Splice
3.0 208 Red	MFB-1 (A1), MS-Power1 Splice
3.0 209 Red	MFB-1 (A5), MS-Power3 Splice
1.0 210 Red	MFB-1 (A6), MC-12 (8)
1.0 211 Pnk	MFB-1 (A2), MC-23 (L1)
3.0 212 Red	MFB-1 (A9), MS-Power2 Splice
3.0 213 Red	MFB-1 (D7), MS-Power3 Splice
0.5 305 Org	MC-23 (K1), MC-63 (A)
0.8 306 Org	MFB-1 (C2), MC-12 (6)
1.0 307 Org	A5501 (19), X5058 (8)
0.8 308 Yel	A5501 (51), X5059 (8)
1.0 309 Org	MFB-1 (E3), X5058 (1)
0.5 310 Org	MC-23 (A4), MC-35 (B)
1.0 311 Org	A5501 (18), X5060 (4)
0.5 312 Brn	A5502 (21), X5057 (6)
0.5 315 Org	MC-23 (M3), MC-64 (2)
0.5 320 Org	MC-23 (L4), MC-32 (B)
0.5 325 Org	MC-13 (7), MC-23 (D3)
1.0 350 Brn	MS-5V_RTN, MC-23 (M2)
0.5 351 Brn	MS-5V_RTN, MC-61 (4)
0.5 352 Brn	MS-5V_RTN, MC-61 (1)
0.5 353 Brn	MS-5V_RTN, MC-62 (4)
0.5 354 Brn	MS-5V_RTN, MC-62 (1)
0.8 355 Brn	MS-5V_RTN, MC-34 (A)
0.5 356 Brn	MS-5V_RTN, MC-35 (A)
0.5 360 Brn	S-Eng4 Splice, A5502 (77)
0.5 361 Brn	S-Eng4 Splice, B5109 (2)
0.5 362 Brn	S-Eng4 Splice, B5202 (2)
0.5 363 Brn	S-Eng4 Splice, B5201 (2)
2.0 400 Blu	MS-Lights Splice, MFB-1 (E12)
1.0 401 Blu	MS-Lights Splice, MC-1 (A)
1.0 402 Blu	MS-Lights Splice, MC-2 (A)
1.0 403 Blu	MS-Lights Splice, MC-3 (A)
0.8 404 Lt. Blu	MFB-1 (B6), MFB-1 (E1)
0.5 415 Blu	A5502 (63), B5109 (5)
0.5 420 Blu	MC-23 (C3), MC-13 (8)
0.5 421 Blu	A5502 (74), X5057 (4)
0.5 423 Blu	A5501 (29), X5057 (8)
0.5 424 Blu	A5501 (37), X5059 (5)
0.5 425 Blu	A5501 (11), X5059 (11)
0.5 426 Blu	MC-23 (E2), MFB-1 (B10)
1.0 427 Blu	A5501 (17), X5060 (6)
0.5 430 Blu	MC-23 (C1), MC-10 (B)
0.5 435 Blu	MC-23 (F4), MC-21 (2)
0.5 445 Blu	MC-23 (C4), MC-20 (B)
0.5 450 Gry	MC-23 (G2), MC-12 (4)
0.5 451 Gry	MC-23 (H2), MFB-1 (E11)
0.5 452 Gry	MC-23 (H4), MC-33 (B)
0.5 456 Gry	A5502 (86), A5502 (87)
1.0 460 Gry	A5501 (33), X5060 (7)
0.8 461 Grn	A5501 (39), X5059 (7)
0.5 465 Gry	A5502 (28), MFB-1 (D9)

Continued on next page

SH24924,00001C5 -19-03APR14-1/5

Size/No./Color	Wire Connection Points
1.0 500 Yel	MS-Switched3 Splice, MC-12 (1)
0.8 502 Yel	MS-Switched2 Splice, MFB-1 (C1)
0.8 503 Yel	MS-Switched1 Splice, MC-55 (A)
1.0 504 Yel	MS-Switched1 Splice, MS-Switched2 Splice
0.5 505 Yel	MS-Switched1 Splice, MC-10 (A)
0.8 506 Yel	MS-Switched1 Splice, MC-9 (A)
0.8 507 Yel	MS-Switched1 Splice, MC-11 (A)
0.8 508 Yel	MS-Switched2 Splice, MC-27 (2)
1.0 509 Yel	MC-23 (M1), MC-13 (1)
0.8 512 Yel	MS-Switched3 Splice, MC-64 (1)
1.0 513 Yel	MS-Switched1 Splice, MS-Switched3 Splice
0.8 514 Yel	MS-Switched2 Splice, MC-25 (A)
0.8 517 Yel	MS-Switched2 Splice, MC-20 (A)
0.8 523 Yel	MS-Switched2 Splice, MFB-1 (C9)
0.5 524 Yel	MS-Switched2 Splice, MC-63 (B)
0.5 525 Yel	A5502 (88), MS-Switched2 Splice
0.5 531 Yel	CAN-C1 (E), MS-RMC_12V
0.5 532 Yel	CAN-C2 (E), MS-RMC_12V
0.5 533 Yel	CAN-C6 (E), MS-RMC_12V
1.0 534 Yel	CAN-C5 (E), MS-RMC_12V
0.5 535 Yel	CAN-C3 (E), MS-RMC_12V
0.5 536 Yel	MS-Switched1 Splice, MS-RMC_12V
0.8 537 Yel	MS-Switched2 Splice, MFB-1 (B9)
0.5 600 Pnk	MC-23 (E4), MC-24 (1)
0.5 601 Pnk	A5502 (45), X5057 (1)
0.5 603 Pnk	A5502 (23), X5058 (5)
0.8 604 Pnk	MFB-1 (A8), MFB-1 (B1)
0.5 605 Pnk	MC-23 (F1), MS-2 Splice
2.0 606 Pnk	MFB-1 (A12), MFB-1 (D11)
0.5 607 Pnk	A5501 (7), X5059 (1)
0.5 608 Pnk	A5501 (8), X5059 (4)
0.5 610 Pnk	MC-23 (G3), MS-6 Splice
0.5 611 Pnk	MC-32 (A), MS-6 Splice
0.5 612 Pnk	MC-33 (A), MS-6 Splice
1.0 615 Pnk	MFB-1 (D1), S-ECU Pwr
0.5 620 Pnk	MC-23 (K2), MS-3 Splice
0.8 621 Pnk	MFB-1 (A10), MC-14 (A)
2.0 624 Pnk	MFB-1 (B8), S-ECU Pwr
0.5 626 Pnk	A5502 (70), MFB-1 (E4)
0.5 630 Pnk	MS-61 (6), MS-2 Splice
0.5 631 Pnk	A5502 (24), B5109 (3)
0.8 632 Pnk	MFB-1 (D12), MC-13 (2)
0.5 635 Pnk	MS-62 (6), MS-2 Splice
0.5 636 Pnk	A5502 (68), MFB-1 (B5)
0.5 640 Pnk	MS-61 (3), MS-3 Splice
0.5 641 Pnk	MS-34 (C), MS-3 Splice
2.0 643 Pnk	A5502 (5), S-ECU Pwr
2.0 644 Pnk	A5502 (3), S-ECU Pwr
0.5 645 Pnk	MS-62 (3), MS-3 Splice

Size/No./Color	Wire Connection Points
2.0 646 Pnk	A5502 (1), S-ECU Pwr
0.5 650 Grn	MC-23 (A2), MC-12 (3)
0.5 651 Grn	MC-23 (B3), MC-9 (B)
0.5 652 Grn	MC-23 (D1), MC-62 (2)
0.5 653 Grn	A5502 (33), X5058 (11)
0.5 654 Grn	MC-23 (L3), MC-11 (B)
0.5 657 Grn	MC-23 (F3), MC-61 (5)
0.5 659 Grn	MC-23 (D4), MC-22 (2)
0.5 661 Grn	A5501 (12), B5109 (4)
0.5 662 Grn	MC-23 (E3), MC-62 (5)
0.5 663 Grn	MC-23 (A3), MC-28 (B)
0.5 665 Grn	MC-23 (J2), MC-61 (2)
0.5 667 Grn	MC-23 (B4), MC-34 (B)
0.5 671 Grn	MC-23 (H1), MC-25 (B)
0.5 681 Grn	A5501 (28), X5057 (7)
0.5 683 Grn	A5502 (20), X5058 (6)
0.5 684 Grn	A5501 (26), X5059 (2)
0.5 685 Grn	A5502 (20), X5059 (10)
1.0 686 Grn	A5501 (48), X5060 (3)
1.0 687 Grn	X5060 (9), S-Eng2 Splice
1.0 688 Grn	X5060 (10), S-Eng2 Splice
1.0 689 Grn	A5501 (4), S-Eng2 Splice
0.8 690 Grn	MFB-1 (C10), MT-10
3.0 700 Pur	MFB-1 (E9), MC-4
0.5 701 Pur	MS-1 Splice, MC-12 (7)
0.5 702 Pur	A5502 (85), X5057 (2)
0.5 703 Pur	A5501 (59), X5058 (10)
0.5 704 Pur	MC-23 (C2), MS-1 Splice
0.5 705 Pur	A5502 (35), MS-1 Splice
0.5 710 Pur	A5502 (80), B5202 (1)
0.5 715 Pur	MC-23 (J4), S-Eng1 Splice
0.5 716 Pur	MFB-1 (E7), S-Eng1 Splice
0.5 717 Pur	A5502 (14), S-Eng1 Splice
0.5 745 Pur	MC-23 (J1), MC-12 (2)
0.5 800 Tan	A5502 (52), X5058 (7)
0.5 801 Tan	A5501 (51), X5059 (12)
1.0 802 Tan	A5501 (16), X5060 (8)
0.5 803 Tan	A5502 (79), X5057 (5)
0.5 830 Tan	A5502 (15), MT-1
0.5 910 Wht	A5502 (81), B5201 (1)
0.5 911 Wht	A5502 (32), MC-23 (J3)
3.0 920 Wht	MFB-1 (E6), MT-2
0.5 936 Wht	A5502 (39), X5057 (3)
1.0 937 Wht	A5501 (20), X5058 (9)
0.5 938 Wht	A5501 (25), X5059 (3)
0.5 939 Wht	A5501 (52), X5059 (6)
1.0 940 Wht	A5501 (47), X5060 (5)
1.0 941 Wht	X5060 (11), S-Eng3 Splice
1.0 942 Wht	X5060 (12), S-Eng3 Splice
1.0 943 Wht	A5501 (5), S-Eng3 Splice
Cable Shield	A5501 (38), X5059 (9)

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SH24924,00001C5 -19-03APR14-2/5

Size/No./Color	Wire Connection Points
0.5 E100 Grn	A5502 (75), X5058 (3)
0.5 E200 Yel	A5502 (54), X5058 (2)
0.5 F100 Grn	MC-7 (B), S-CAN2 Splice
0.5 F101 Grn	MC-23 (B1), S-CAN2 Splice
0.5 F102 Grn	S-CAN2 Splice, S-CAN4 Splice
0.5 F103 Grn	MC-13 (4), S-CAN16 Splice
0.5 F104 Grn	S-CAN4 Splice, S-CAN6 Splice
0.5 F105 Grn	MC-13 (6), S-CAN18 Splice
0.5 F106 Grn	S-CAN6 Splice, S-CAN8 Splice
0.5 F107 Grn	CAN-C2 (H), S-CAN10 Splice
0.5 F108 Grn	S-CAN8 Splice, S-CAN10 Splice
0.5 F109 Grn	CAN-C6 (H), S-CAN14 Splice
0.5 F110 Grn	S-CAN10 Splice, S-CAN12 Splice
0.5 F111 Grn	CAN-C5 (H), S-CAN12 Splice
0.5 F112 Grn	S-CAN12 Splice, S-CAN14 Splice
0.5 F113 Grn	CAN-C3 (H), S-CAN6 Splice
0.5 F114 Grn	S-CAN14 Splice, S-CAN16 Splice
0.5 F115 Grn	CAN-C1 (H), S-CAN8 Splice
0.5 F116 Grn	S-CAN18 Splice, S-CAN16 Splice
0.5 F117 Grn	A5502 (53), S-CAN4 Splice
0.5 F118 Grn	MC-8 (A), S-CAN18 Splice
0.5 F200 Yel	MC-7 (A), S-CAN1 Splice
0.5 F201 Yel	MC-23 (A1), S-CAN1 Splice
0.5 F202 Yel	S-CAN1 Splice, S-CAN3 Splice
0.5 F203 Yel	MC-13 (3), S-CAN15 Splice
0.5 F204 Yel	S-CAN3 Splice, S-CAN5 Splice
0.5 F205 Yel	MC-13 (5), S-CAN17 Splice
0.5 F206 Yel	S-CAN5 Splice, S-CAN7 Splice
0.5 F207 Yel	CAN-C2 (G), S-CAN9 Splice
0.5 F208 Yel	S-CAN7 Splice, S-CAN9 Splice
0.5 F209 Yel	CAN-C6 (G), S-CAN13 Splice
0.5 F210 Yel	S-CAN9 Splice, S-CAN11 Splice
0.5 F211 Yel	CAN-C5 (G), S-CAN11 Splice
0.5 F212 Yel	S-CAN11 Splice, S-CAN13 Splice
0.5 F213 Yel	CAN-C3 (G), S-CAN5 Splice
0.5 F214 Yel	S-CAN13 Splice, S-CAN15 Splice
0.5 F215 Yel	CAN-C1 (G), S-CAN7 Splice
0.5 F216 Yel	S-CAN17 Splice, S-CAN15 Splice
0.5 F217 Yel	A5502 (75), S-CAN3 Splice
0.5 F218 Yel	MC-8 (B), S-CAN17 Splice

Continued on next page

SH24924,00001C5 -19-03APR14-3/5

Command Arm Wiring Harness Color Codes

Size/No./Color	Wire Connection Points
0.8 111A Blk	Spl-2, C-11 (5)
0.8 123 Blk	Spl-2, C-4 (C)
0.8 124 Blk	CT-5 (1), Spl-2
0.8 125 Blk	C-16 (2), Spl-2
0.8 126 Blk	CT-6 (1), Spl-2
0.8 129 Blk	Spl-2, MC-60 (A)
0.8 135 Blk	Spl-2, C-3 (B)
0.8 210A Red	C-2 (B), C-11 (8)
0.8 306A Org	C-3 (A), C-11 (6)
0.8 325A Org	C-4 (A), C-10 (7)
0.8 420A Lt Blu	C-4 (A), C-10 (8)
0.8 450A Gry	C-5 (B), C-11 (4)
0.8 450B Gry	C-5 (B), R-1 (A)
0.8 500A Yel	Spl-1, C-11 (1)
0.8 500B Yel	C-2 (A), Spl-1
0.8 500C Yel	C-5 (A), Spl-1
0.8 500D Yel	C-16 (1), Spl-1
0.8 500E Yel	C-25 (2), Spl-1
0.8 500F Yel	C-24 (2), Spl-1
0.8 500G Yel	C-14A (1), Spl-1
0.8 500H Yel	C-4 (B), Spl-1
0.8 500J Yel	Spl-1, MC-60 (B)
0.8 500K Yel	C-5 (A), R-1 (B)
0.8 501 Yel	C-2 (A), C-2 (S2)
0.8 509A Yel	Spl-1, C-10 (1)
0.8 632A Pnk	C-14A (2), C-10 (2)
0.8 650A Grn	C-24 (3), C-11 (3)
0.8 701A Pur	C-2 (S1), C-11 (7)
0.8 745A Org	C-25 (1), C-11 (2)
0.5 F103A Grn	C-16 (12), C-10 (4)
0.5 F105A Grn	MC-60 (D), C-10 (6)
0.8 F203A Yel	C-16 (11), C-10 (3)
0.5 F205A Yel	MC-60 (C), C-10 (5)

F103A Grn and F203A Yel are twisted pair with one twist every 25 mm (1 in.).

OUMX258,00006F5 -19-03MAR14-1/1

Reel 48V Power Wiring Harness Color Codes

Wire harness information for 7500A and 8000A.

Size/No./Color	Wire Connection Points
21.0 140 Blk	NT-1, NS-1 Splice
5.0 141 Blk	PC-6 (B), NS-1 Splice
5.0 143 Blk	PC-2 (B), NS-2 Splice
13.0 144 Blk	NS-2 Splice, NS-1 Splice
5.0 145 Blk	NS-1 Splice, PC-5 (B)
5.0 146 Blk	PC-3 (B), NS-2 Splice
5.0 147 Blk	PC-1 (B), NS-2 Splice
21.0 220 Red	PT-1, PS-1 Splice
5.0 221 Red	PC-6 (A), PS-1 Splice
5.0 222 Red	PC-2 (A), PS-2 Splice
13.0 223 Red	PS-2 Splice, PS-1 Splice
5.0 224 Red	PC-1 (A), PS-2 Splice
5.0 225 Red	PC-3 (A), PS-2 Splice
5.0 226 Red	PS-1 Splice, PC-5 (A)

OUMX258,00006F4 -19-14MAR14-1/1

Section 40
Power Train Repair

Contents

Page

Group 10—Power Train
Summary of References 40-10-1
Specifications 40-10-2
Remove Driveline Components 40-10-4
Install Driveline Components 40-10-5
Remove Hydrostatic Pump 40-10-7
Install Hydrostatic Pump 40-10-10
Disassemble Hydrostatic Pump 40-10-12
Inspect Hydrostatic Pump 40-10-17
Assemble Hydrostatic Pump 40-10-22
Remove Front Wheel Motor Assembly 40-10-32
Install Front Wheel Motor Assembly 40-10-33
Disassemble and Inspect Front Wheel Motor Assembly 40-10-34
Assemble Front Wheel Motor Assembly 40-10-38
Remove Rear Wheel Motor—8000A 40-10-48
Install Rear Wheel Motor—8000A 40-10-49
Wheel Motor Final Checks 40-10-49
Start Up Procedure 40-10-50

Summary of References

- Remove Driveline Components
- Install Driveline Components
- Remove Hydrostatic Pump
- Install Hydrostatic Pump
- Disassemble Hydrostatic Pump
- Inspect Hydrostatic Pump
- Assemble Hydrostatic Pump
- Remove Front Wheel Motor Assembly
- Install Front Wheel Motor Assembly
- Disassemble and Inspect Front Wheel Motor Assembly
- Assemble Front Wheel Motor Assembly
- Remove Rear Wheel Motor—8000A
- Install Rear Wheel Motor—8000A
- Wheel Motor Final Checks
- Start Up Procedure

BS62576,000100A -19-12JUN14-1/1

Specifications

Item	Measurement	Specification
Flywheel Plate to Flywheel Bolts	Torque	28 N·m (20 lb.-ft.)
Flex Coupler to Flywheel Bolts	Torque	54 N·m (40 lb.-ft.)
Drive Shaft Flange to Flex Coupler Bolts	Torque	54 N·m (40 lb.-ft.)
Drive Shaft to Transmission Shaft Pinch Bolts	Torque	54 N·m (40 lb.-ft.)
Hydrostatic Pump		
Charge Pump Adapter Bushing Installation	Depth	2.41 mm (0.095 in.)
End Cover Shaft Bearing Installation	Height	2.29 mm (0.09 in.)
Valve Plate Stop Pin Installation	Height	4.39 mm (0.173 in.)
Shaft Bearing Installed	Depth	1.78 mm (0.07 in.)
Servo		
Piston to Cover Plate Installed	Distance	1.27 cm (0.5 in.)
Servo Piston Stud Jam Nut	Torque	17—18 N·m (150—160 lb.-in.)
Servo Piston Cover Plate Screw	Torque	4.5—5.4 N·m 40—48 in.-lb.)
Rotary Assembly		
Piston to Housing End Installed	Distance	1.27 cm (0.5 in.)
Swash Plate Cradle Bushing Screw	Torque	1.6—1.8 N·m (14—16 lb.-in.)
Swash Plate Cradle to Housing Screws	Torque	27—33 N·m (20—24 lb.-ft.)
Bearing Cage Height Above Pump End Cover Surface	Height	2.29 mm (0.09 in.)
Spring Pin Height Above Pump End Cover Surface	Height	4.39 mm (0.173 in.)
End Plate and Charge Pump		
End Cover Relief Valve	Torque	136—149 N·m (100—110 lb.-ft.)
End Cover Bypass Plug	Torque	36—40 N·m (26—30 lb.-ft.)
Charge Pump Adapter Relief Valve Plug	Torque	36.6—40.7 N·m (27—30 lb.-ft.)
Shaft Bushing Insertion Depth Below Adapter Surface	Depth	2.41 mm (0.095 in.)

Continued on next page

Item	Measurement	Specification
Charge Pump Adapter to Pump Housing Bolts	Torque	37—42 N·m (27—31 lb.-ft.)
Servo Control Housing to Pump Housing Screws	Torque	4.5—5.4 N·m (40—48 lb.-in.)
Front Wheel Motor		
Friction Disc	Minimum Thickness	3.6 mm (0.142 in.)
Separator Plate	Minimum Thickness	2.36 mm (0.093 in.)
Brake Housing Bolts	Torque	122 N·m 90 (lb.-ft.)
Special Bolts	Torque	68—75 N·m (50—55 lb.-ft.)
Brake Line Tube Nut	Torque	24 N·m (18 lb.-ft.)
Brake Line Fitting Adjustment Nut	Torque	24 N·m (18 lb.-ft.)
Foward/Reverse Line Tube Nut	Torque	68 N·m (50 lb.-ft.)
Foward/Reverse Line Fitting Adjustment Nut	Torque	68 N·m (50 lb.-ft.)
Front Wheel Hub Nut		
Wheel Hub Nut, 8000A	Torque	340 N·m (250 lb.-ft.)
Wheel Hub Nut, 7500A	Torque	475 N·m (350 lb.-ft.)
Rear Wheel Motor		
Rear Wheel Motor Housing Bolt	Torque	140 N·m (105 lb.-ft.)
Rear Wheel Motor 45° Fitting	Torque	108 N·m (80 lb.-ft.)
Rear Wheel Motor Nut (hydraulic line)	Torque	108 N·m (80 lb.-ft.)
Rear Wheel Motor Rotor Nut	Torque	190—217 N·m (140—160 lb.-ft.)
Rear Wheel Motor Rolling Drag	Torque	68 N·m (50 lb.-ft.)

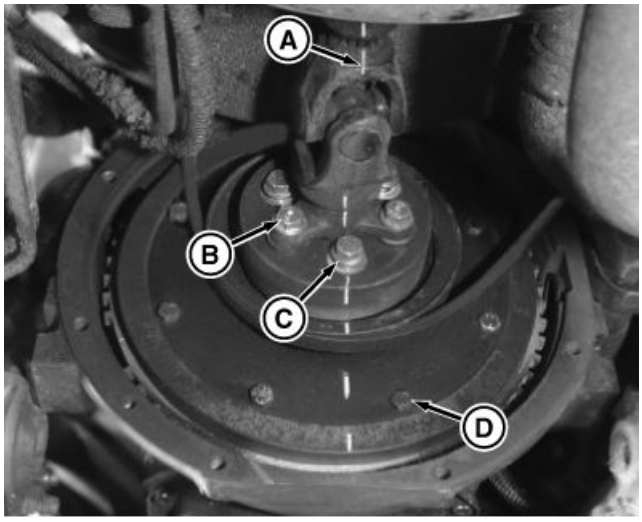
OUMX258,000053F -19-14AUG14-2/2

Remove Driveline Components

1. Park machine safely. Remove key from key switch and secure. See “Park Machine Safely”.
2. Open engine cover.
3. Disconnect battery negative (-) cable and loosen alternator drive belt. (See Remove 12 Volt Alternator Drive Belt.)
4. Remove drive belt from alternator and cooling fan sheaves.
5. Place marks (A) on driveline components for correct alignment at installation.

IMPORTANT: Avoid Damage! Do not hold the flywheel by the outer tone ring teeth to remove or install fasteners. Damage to the tone ring may affect engine controller performance.

6. Loosen drive shaft flange bolts (B), coupling bolts (C), and flywheel plate bolts (D).



TCT009238 —UN—01NOV13

A—Alignment Marks
B—Hex Bolt M10x45 (3 used)
C—Hex Bolt M10x60 (3 used)
D—Hex Bolt M8x16 (8 used)

BS62576,0001030 -19-15NOV13-1/2

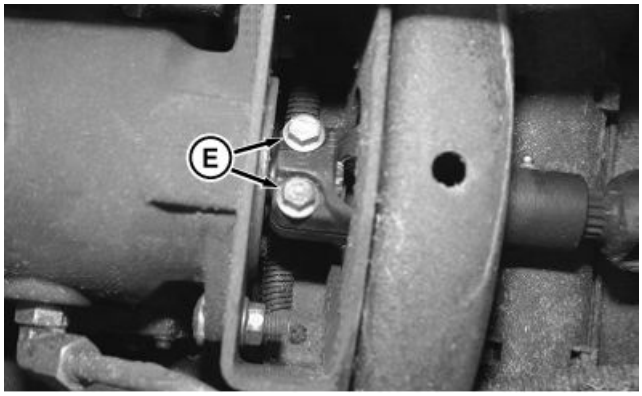
7. Loosen pinch bolts (E) securing drive shaft to transmission shaft.

NOTE: Support driveline assembly during removal to prevent separation of drive shaft ends.

8. Remove bolts (D) securing flywheel plate to flywheel.
9. Retract flywheel plate and pass alternator belt between plate and flywheel.
10. Fold drive shaft at universal joints, and remove drive shaft from transmission shaft.

NOTE: Remove bolts from the drive shaft flange after removing the drive shaft from the flex coupler.

11. Remove bolts (B) securing drive shaft flange and remove drive shaft.
12. Remove bolts (C) and remove coupler and sheave from plate.



TCT009239 —UN—01NOV13

E—Hex Bolt M10x30 (2 used)

13. Clean and inspect all components for wear or damage. Replace parts as needed.

BS62576,0001030 -19-15NOV13-2/2

Install Driveline Components

1. Ensure that all component mating surfaces are clean and free of damage.
2. Install bolts (A) to drive shaft flange.

A—Hex Bolt M10x45 (3 used)

TCT009241 —UN—01NOV13

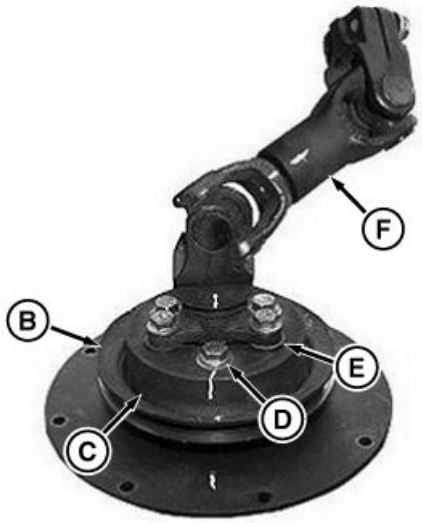
SW00544,000004A -19-15NOV13-1/5

3. Align marks and install sheave (B) to flywheel plate.
4. Align marks and install flex coupler (C). Align holes and loosely secure with bolts (D).
5. Align marks and install drive shaft flange to raised coupler spacers (E). Loosely secure with bolts (A).
6. Align marks and splines to install drive shaft outer end (F) to inner end.
7. Compress drive shaft splined ends and rotate joints for installation.

NOTE: Support installed driveline components during installation to prevent drive shaft separation.

8. Align splines and install drive shaft to transmission shaft.

B—Belt Sheave
C—Flex Coupler
D—Hex Bolt M10x60 (3 used)
E—Raised Spacer
F—Drive Shaft End



TCT009242 —UN—01NOV13

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SW00544,000004A -19-15NOV13-2/5

9. Pass alternator drive belt (G) between flywheel plate and flywheel.

IMPORTANT: Avoid Damage! Do not hold the flywheel by the outer tone ring teeth when removing or installing fasteners. Damage to the tone ring may affect engine controller performance.

10. Align flywheel plate and secure with bolts (H). Tighten bolts in a cross pattern to specification.

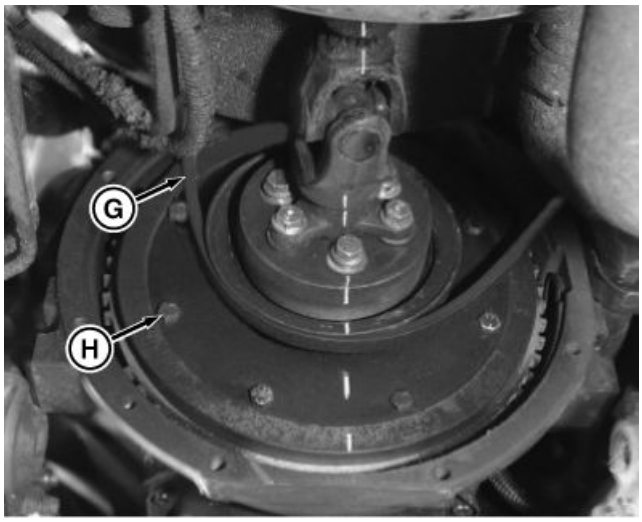
Specification	
Flywheel Plate to Flywheel Bolts—Torque	28 N·m (20 lb.-ft.)

11. Tighten flex coupler bolts (D) to specification.

Specification	
Flex Coupler to Flywheel Bolts—Torque	54 N·m (40 lb.-ft.)

12. Tighten drive shaft bolts (A) to specification.

Specification	
Drive Shaft Flange to Flex Coupler Bolts—Torque	54 N·m (40 lb.-ft.)



TCT009243 —UN—01NOV13

G—Drive Belt

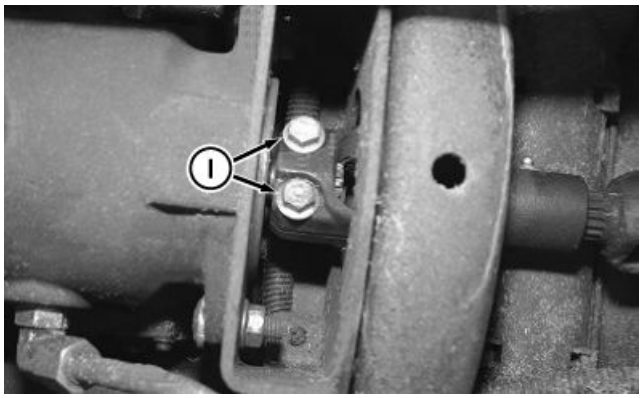
H—Hex Bolt M8x16 (8 used)

SW00544,000004A -19-15NOV13-3/5

13. Tighten drive shaft pinch bolts (I) evenly to specification.

Specification	
Drive Shaft to Transmission Shaft Pinch Bolts—Torque	54 N·m (40 lb.-ft.)

14. Install drive belt to cooling fan, driveline, and alternator sheaves. Adjust belt tension. (See Test and Adjust 12 Volt Alternator and Cooling Fan Drive Belt Tension.)



TCT009280 —UN—01NOV13

I— Hex Bolt M10x30 (2 used)

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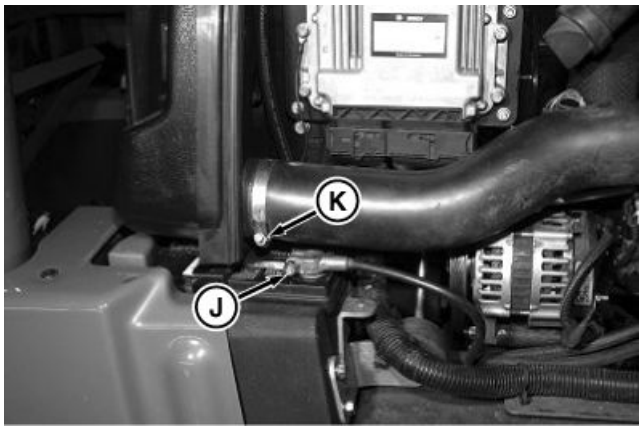
SW00544,000004A -19-15NOV13-4/5

15. Install negative battery connector and secure nut (J).
16. Install air duct and secure clamp (K).
17. Close engine cover.

J— Battery Connector Nut **K—Hose Clamp**



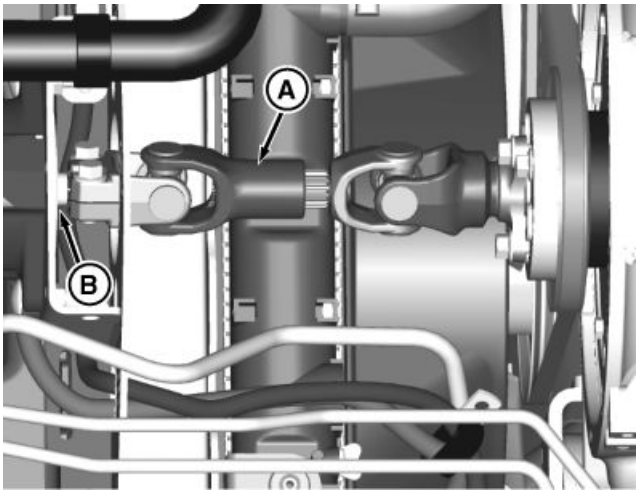
TCT009281 —UN—01NOV13

SW00544,000004A -19-15NOV13-5/5

Remove Hydrostatic Pump

1. Park machine safely.
2. Drain hydraulic oil from system.
3. Raise seat and remove screen from oil cooler/radiator.
4. Pressure wash hydrostatic and hydraulic pumps. Keep high pressure water away from electrical components.
5. Remove drive shaft (A) from pump input shaft (B).. (See Remove Driveline Components.)

A—Drive Shaft **B—Pump Input Shaft**

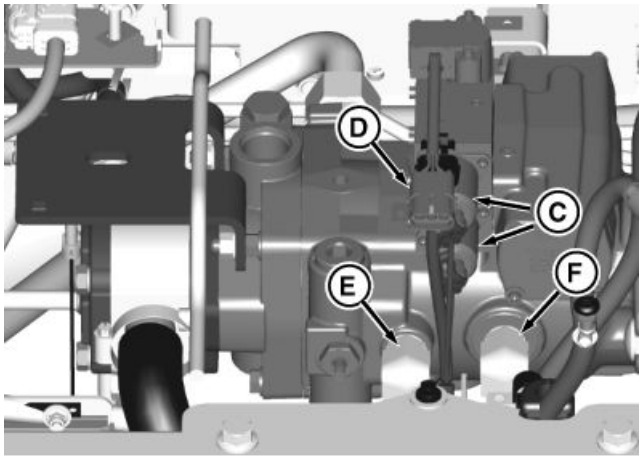


TCT009312 —UN—13NOV13

BS62576,0001035 -19-13NOV13-1/7

6. From left side of machine: disconnect wiring from solenoids (C) and servo position sensor (D).
7. Disconnect lines (E) and (F).

C—Forward/Reverse Solenoids **E—Hydraulic Line**
D—Servo Position Sensor **F—Hydraulic Line**



TCT006396 —UN—12MAR13

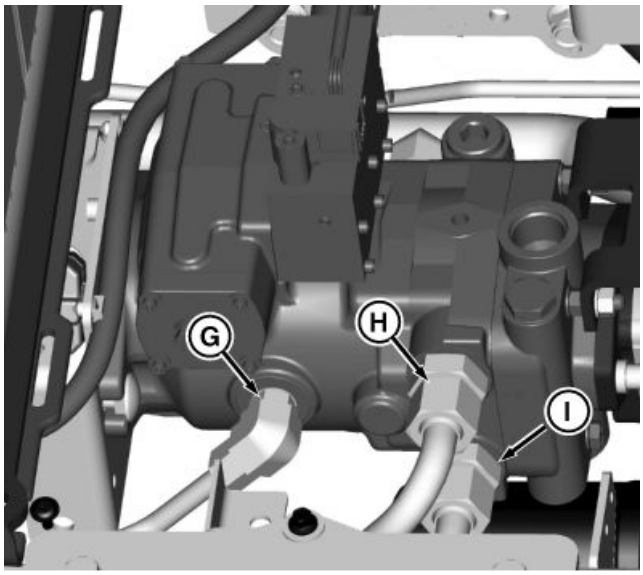
Left Side of Hydro Unit

Continued on next page

BS62576,0001035 -19-13NOV13-2/7

8. Disconnect lines (G), (H) and (I) from right side.

G—Small Line
H—Top Large Line
I— Bottom Large Line



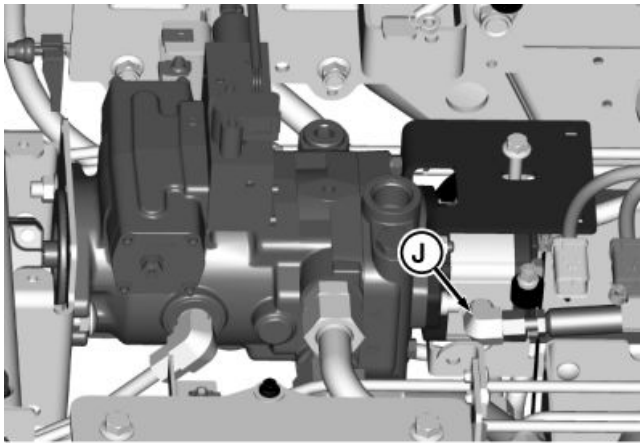
TCT006397 —UN—12MAR13

Right Side of Hydro Unit

BS62576,0001035 -19-13NOV13-3/7

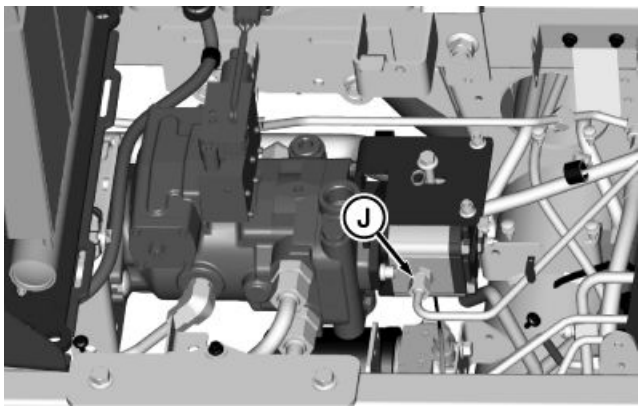
9. Disconnect hose (J) from pump unit at front of hydro.

J— Rear Hose



TCT006398 —UN—12MAR13

7500A E-Cut



TCT006399 —UN—12MAR13

8000A E-Cut

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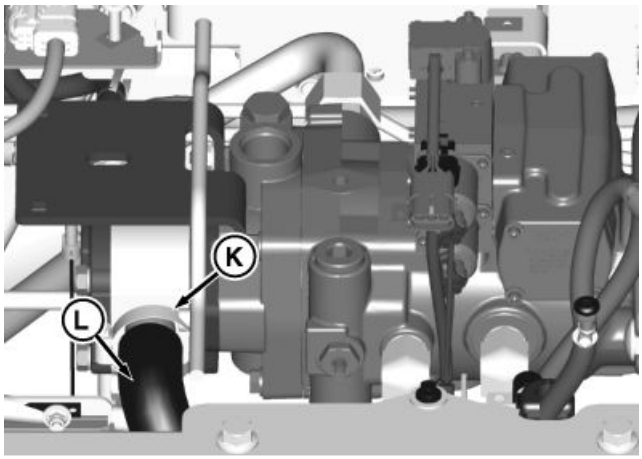
BS62576,0001035 -19-13NOV13-4/7

10. Loosen clamp (K) and remove hose (L) from left side of pump.

K—Clamp **L—Suction Hose**



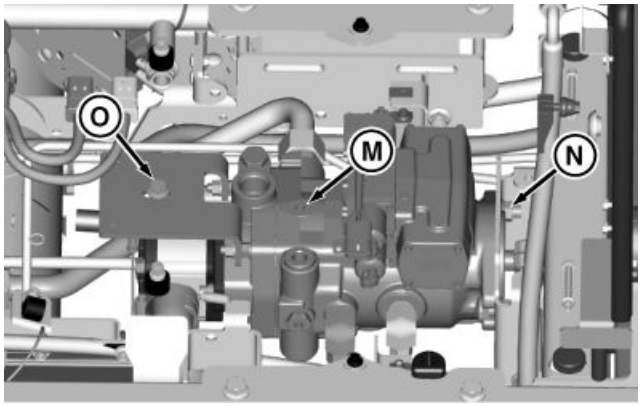
TCT006425 —UN—12MAR13

Suction Hose

BS62576,0001035 -19-13NOV13-5/7

11. Install a lifting bolt and chain into hole (M). Take slack out of chain with hoist and remove nuts (N) and bolt (O) from pump mounts.

M—Threaded Hole **O—Bolt and Nut**
N—Nuts

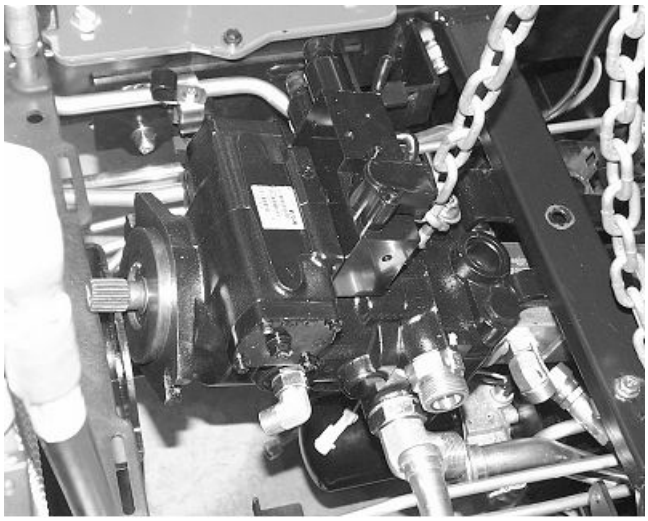


TCT006426 —UN—12MAR13

Pump Mounting Hardware

BS62576,0001035 -19-13NOV13-6/7

12. Have an assistant help lift and guide the assembly out of the machine.



TCT006458 —UN—04FEB13

Lifting Out Hydro

BS62576,0001035 -19-13NOV13-7/7

Install Hydrostatic Pump

1. Carefully lower hydrostatic pump and front pump assembly into position.

TCT006459 —UN—04FEB13

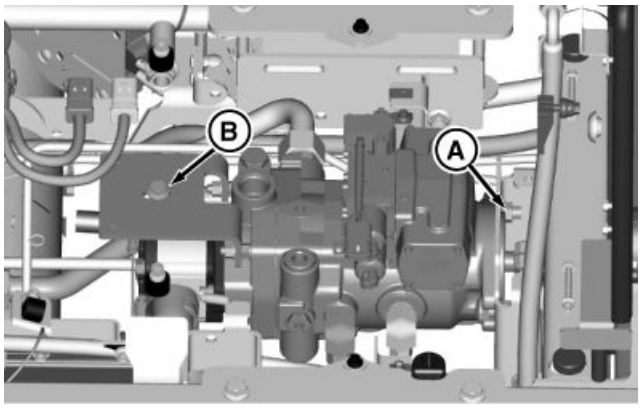
Install Hydrostatic Pump

BS62576,0001036 -19-21MAY14-1/4

2. Install and tighten bolts and nuts (A) and bolt and nut (B).

A—Pump Mount Bolts

B—Bracket to Crossmember Bolt



TCT006427 —UN—12MAR13

Hydrostatic Pump Mounting Bolts

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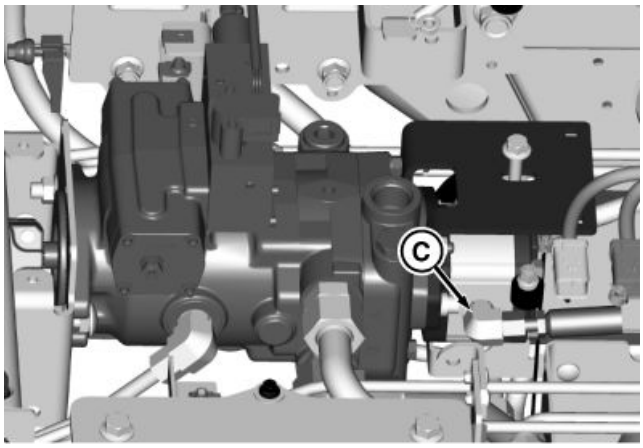
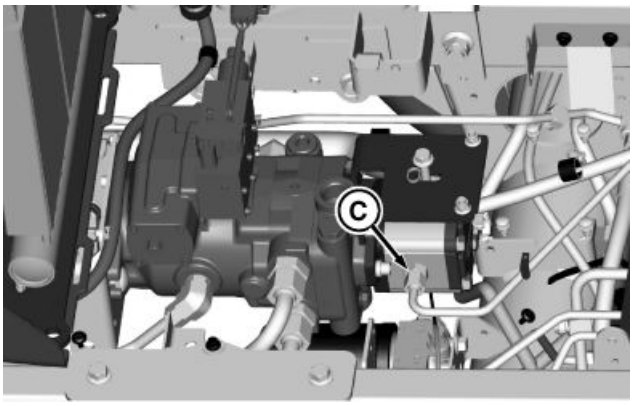
BS62576,0001036 -19-21MAY14-2/4

3. Connect hose (C) to front pump.



TCT006428 —UN—12MAR13

7500A E-Cut



TCT006429 —UN—12MAR13

8000A E-Cut

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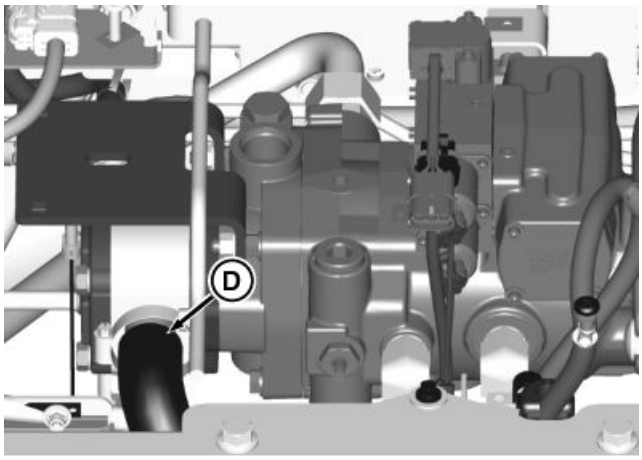
BS62576,0001036 -19-21MAY14-3/4

4. Connect suction hose (D) and tighten clamp.
5. Install drive shaft. (See Install Driveline Components.)
6. Connect wiring to forward and reverse solenoids and servo position sensor.
7. Install screen on radiator-oil cooler.
8. Bleed hydrostatic pump.
   a. Fill pump housing at least half full with filtered recommended oil.
   b. Make sure that all hydraulic connections and plugs are tightened
   c. Fill hydraulic reservoir to full mark on dipstick with recommended oil.

NOTE: For electronically controlled engines, connect to Service ADVISOR™ for turning over engine without starting.

   d. Turn engine over for 5 seconds without starting.
   e. Start engine and run at low idle with hydrostatic pump in neutral position. The charge pump should immediately pick up oil and fill the system. If there is no indication of fill in 30 seconds, stop engine and determine the cause.

Service ADVISOR is a trademark of Deere & Company



TCT006430 —UN—12MAR13

D—Suction Hose

   f. Bleed machine hydraulic system. (See Bleed Hydraulic System.)
   g. Change filter frequently after placing machine back in operation. Change hydraulic filter after 3 to 5 hours of operation, and again after approximately 50 hours.

BS62576,0001036 -19-21MAY14-4/4

Disassemble Hydrostatic Pump

Drain oil, and thoroughly clean outer surfaces of hydrostatic and tandem hydraulic pumps before beginning disassembly. Plug open pump ports

Match mark tandem hydraulic pump before removal from the hydrostatic pump for proper port orientation at reassembly.

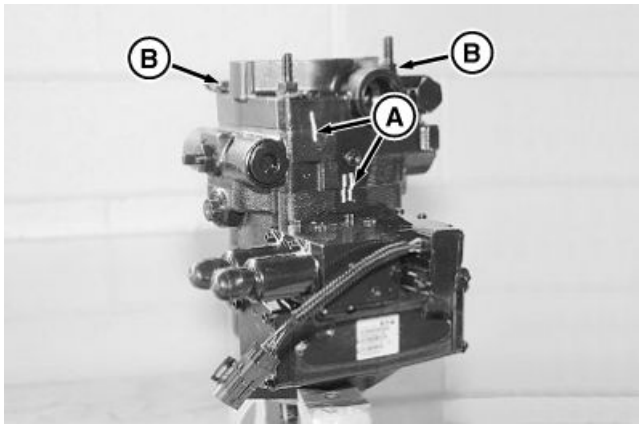
Match mark hydrostatic pump assemblies and components before removal for proper port orientation and component position at reassembly.

Wash all metal parts in clean solvent. Use filtered moisture free compressed air to dry cleaned parts. Do not wipe parts dry with paper or cloth towels. Lint will cause damage in a hydraulic system.

1. Place marks on tandem pump and adapter for proper assembly. Remove tandem hydraulic pump from charge pump adapter and set aside.

NOTE: Clamp vise jaws on the pump housing flange. Do not tighten vise jaws on pump housing machined surfaces.

2. Place hydrostatic pump assembly in a protected jaw vise with input shaft down.



TCT009340 —UN—17DEC13

A—Alignment Marks **B—Hex Bolt (4 used)**

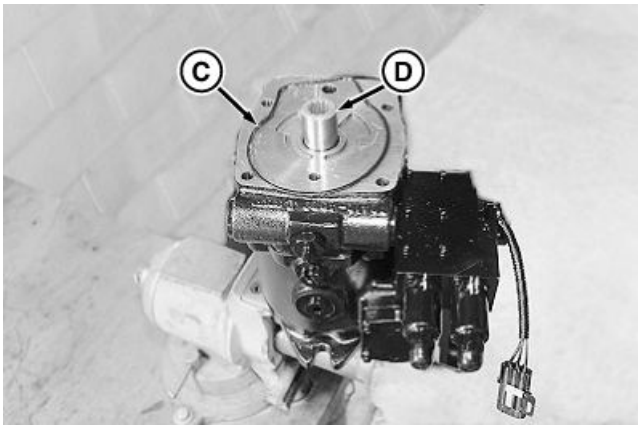
3. Place marks (A) on pump sections and relief valves for proper reassembly.
4. Remove bolts (B) securing adapter to end cover. Remove adapter.

Continued on next page

BS62576,0001037 -19-21MAY14-1/13

5. Remove formed O ring (C) and coupler (D).

C—Formed O ring
D—Splined Coupler

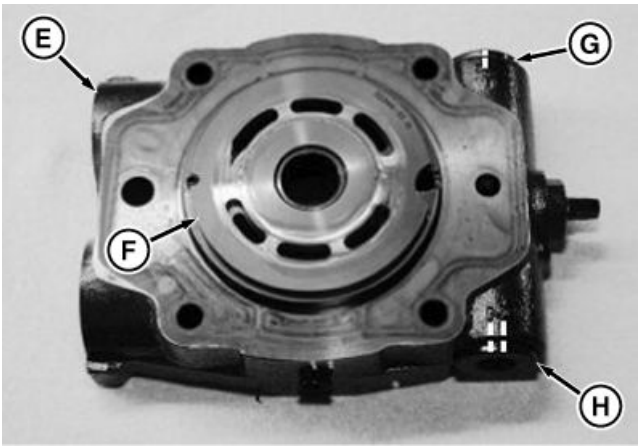


TCT009341 —UN—17DEC13

BS62576,0001037 -19-21MAY14-2/13

6. Remove end cover (E) from pump housing. Take care to retain valve plate (F) if removed with end cover.
7. Mark relief valves (G) and (H) for proper installation at reassembly. Remove valves and set aside, keeping components separate.

E—Pump End Cover
F—Valve Plate
G—Relief Valve
H—Relief Valve



TCT009342 —UN—17DEC13

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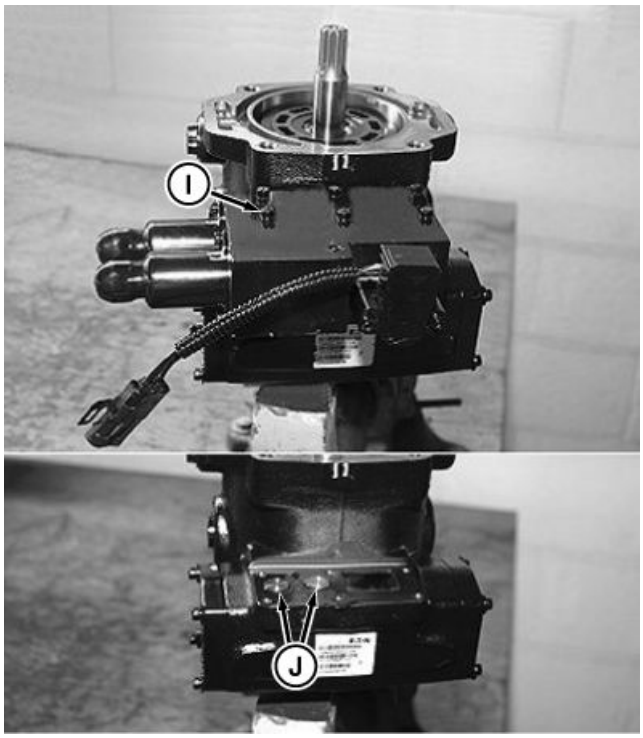
BS62576,0001037 -19-21MAY14-3/13

8. Support servo control assembly and remove screws (I). Remove control assembly, taking care to preserve position of orifice plates (J). Note orifice numbers for proper reassembly. Remove orifice plates and gasket.

I— Socket Head Screw (4 used) **J— Orifice Plate (2 used)**

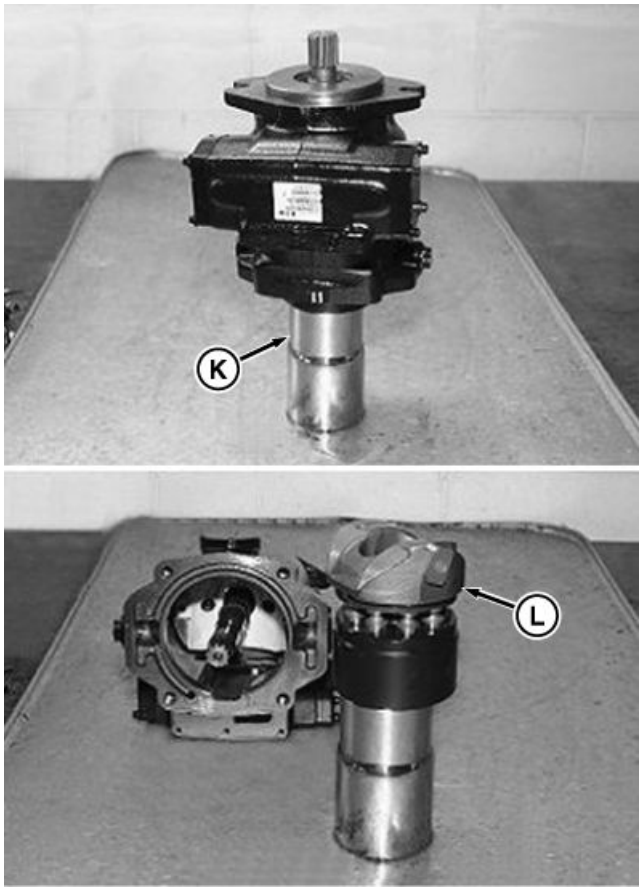


TCT009343 —UN—17DEC13

BS62576,0001037 -19-21MAY14-4/13

9. Remove pump housing from vise. Hold internal rotating assembly in place, and invert housing over support stand. Lift housing from rotating assembly and swashplate.
10. Remove swashplate (K) from rotating assembly (L) and set assemblies aside.

K—Support **L— Swashplate**



TCT009345 —UN—17DEC13

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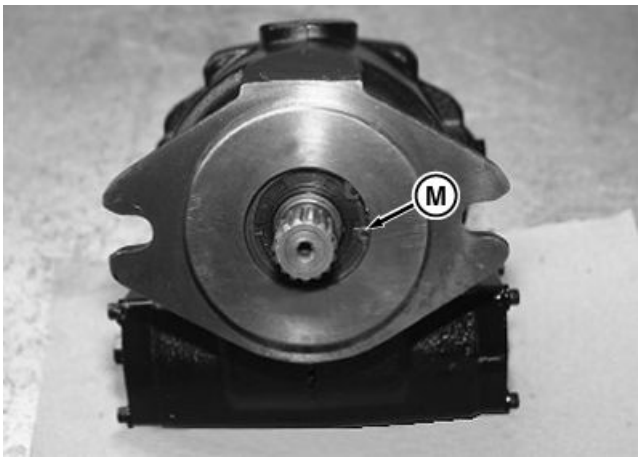
BS62576,0001037 -19-21MAY14-5/13

11. Remove snap ring (M) from pump housing.

M—Snap Ring



TCT009344 —UN—17DEC13

BS62576,0001037 -19-21MAY14-6/13

12. Tap shaft (N) to remove shaft with seal and bearing components from housing.

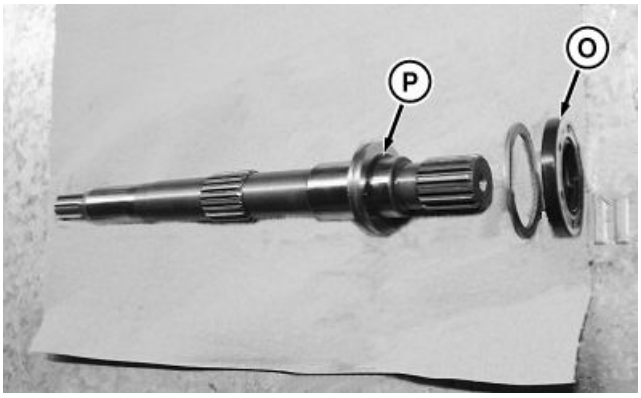
N—Shaft Assembly

TCT009346 —UN—17DEC13

BS62576,0001037 -19-21MAY14-7/13

13. Disassemble shaft components.
    a. Remove seal (O) and washer from shaft.
    b. Remove snap ring (P) from shaft.
    c. Remove bearing race, bearing, second race, and second snap ring from shaft.

O—Shaft Seal **P—Snap Ring**



TCT009347 —UN—17DEC13

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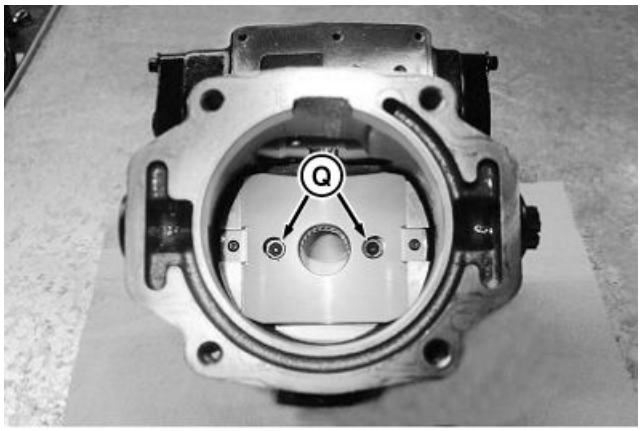
BS62576,0001037 -19-21MAY14-8/13

14. Remove screws (Q) securing cradle assembly. Remove assembly from housing.

Q—Socket Head Screw (2 used)

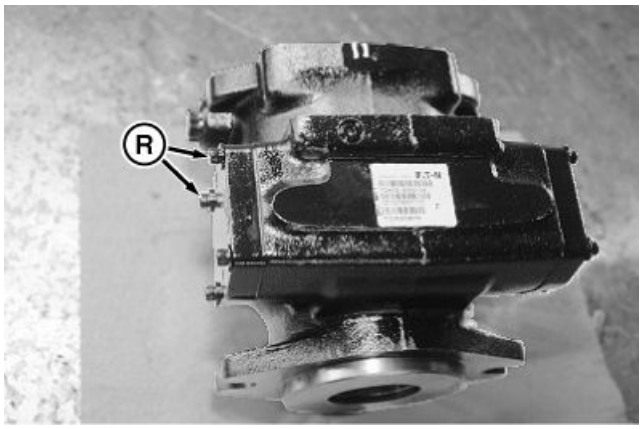


TCT009348 —UN—17DEC13

BS62576,0001037 -19-21MAY14-9/13

15. Remove screws (R) securing servo piston cover. Remove cover and gasket.

R—Socket Head Screw (4 used)

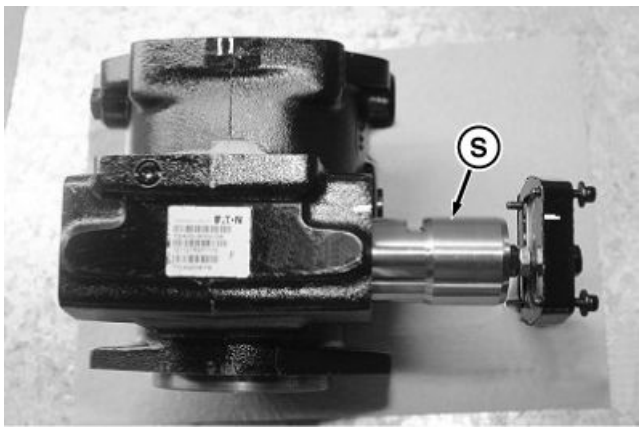


TCT009349 —UN—17DEC13

BS62576,0001037 -19-21MAY14-10/13

16. Remove screws securing opposite servo piston cover. Support cover and attached piston (S). Press piston out from open end of housing.

S—Servo Piston



TCT009350 —UN—17DEC13

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BS62576,0001037 -19-21MAY14-11/13

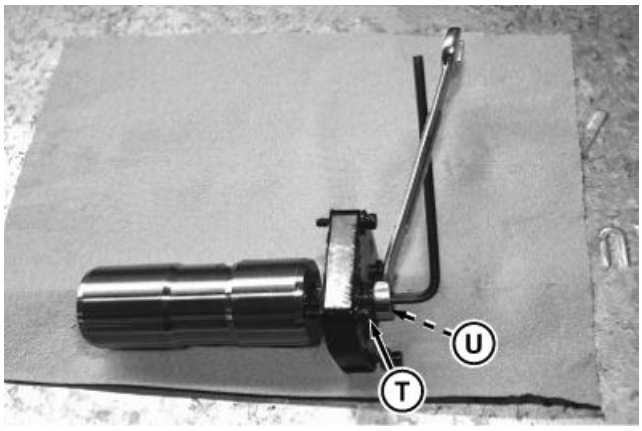
17. Remove servo piston seal washer (T).

NOTE: Preserve the neutral position of the servo piston. Do not change the position of the cover plate on the piston stud.

a. Hold servo piston center stud, and remove jam nut (U).

b. Remove washer and seal washer from stud.

T—Seal Washer **U—Jam Nut**



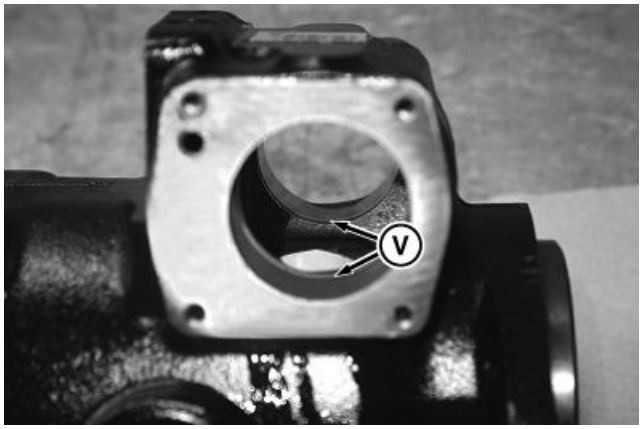
TCT009351 —UN—17DEC13

BS62576,0001037 -19-21MAY14-12/13

NOTE: Each piston bore seal assembly is comprised of an O ring and a flat piston contact seal.

18. Remove inner and outer piston bore seals (V) at two locations.

V—Servo Piston Seal (2 used)



TCT009644 —UN—17DEC13

BS62576,0001037 -19-21MAY14-13/13

Inspect Hydrostatic Pump

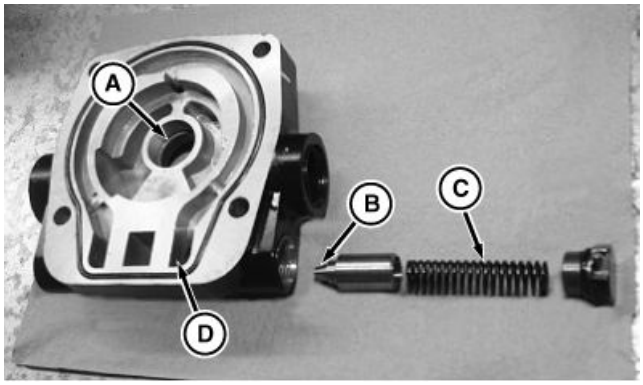
1. Inspect charge pump adapter shaft bushing and relief valve components.

a. Check to see that surface of bushing (A) is free of scoring.

b. Check to see that relief valve poppet (B) and spring (C) are in good condition.

c. Inspect relief valve seat (D) inside charge pump adapter. Make sure that seat is smooth and free of burrs or debris.

A—Bushing **C—Spring**
B—Poppet **D—Valve Seat**



TCT009671 —UN—23DEC13

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BS62576,0001038 -19-21MAY14-1/15

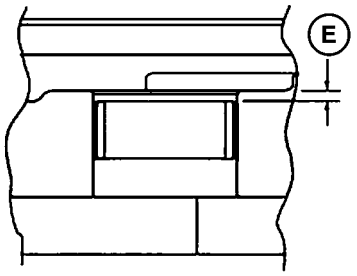
NOTE: The bushing is press fit to the adapter bore.

d. Check to see that bushing depth (E) below adapter outer surface as specified.

Specification

Charge Pump
Adapter Bushing
Installation—Depth ..... 2.41 mm (0.095 in.)

E—Depth



TCT009672 —UN—23DEC13

BS62576,0001038 -19-21MAY14-2/15

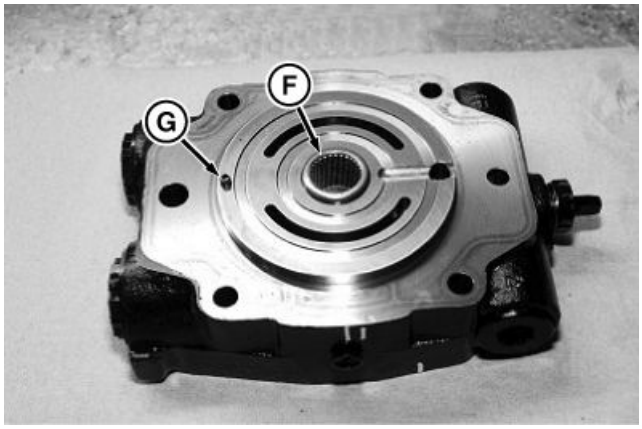
2. Inspect end cover shaft bearing and valve plate retainer pin.

a. Make sure that bearing rollers in end cover bearing (F) roll freely in cage.

NOTE: The bearing is press fit to the end cover bore. Install a replacement bearing with the number facing out.

b. Replace bearing if rollers are excessively loose or do not roll freely in cage.

c. Check to see that valve plate stop pin (G) is secure in end cover and that pin seam faces away from bearing.



TCT009673 —UN—23DEC13

BS62576,0001038 -19-21MAY14-3/15

d. Check to see that bearing height (H) above end cover surface is as specified.

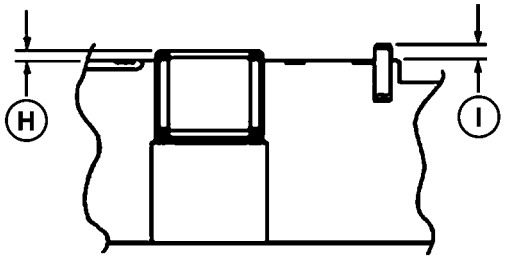
Specification

End Cover Shaft Bearing
Installation—Height ..... 2.29 mm (0.09 in.)

e. Check to see that valve plate stop pin height (I) above surface is as specified.

Specification

Valve Plate Stop Pin
Installation—Height ..... 4.39 mm (0.173 in.)



TCT009674 —UN—23DEC13

H—Bearing Height **I— Pin Height**

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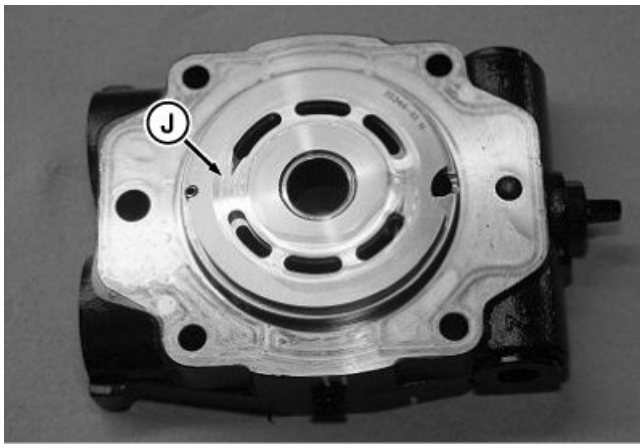
BS62576,0001038 -19-21MAY14-4/15

3. Check valve plate and rotating assembly for wear or damage. Replace the rotating assembly if damage or excessive wear to any components is found.

   a. Check to see that valve plate surface (J) is smooth and free of scoring.

J— Valve Plate Wear Surface



TCT009675 —UN—23DEC13

BS62576,0001038 -19-21MAY14-5/15

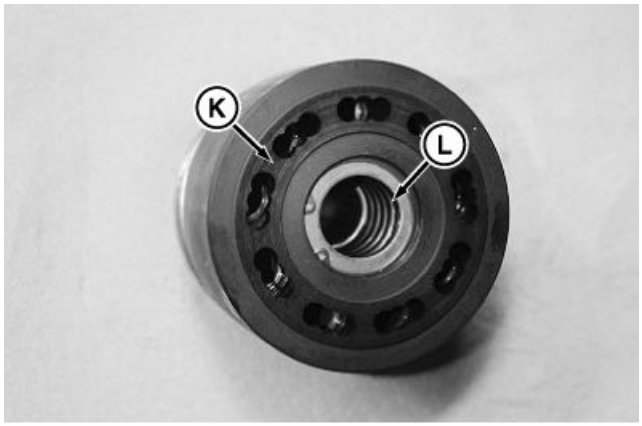
IMPORTANT: Avoid Damage! Do not tap any part of rotating assembly to free sticking components. Components fit with close tolerances, and may be easily damaged through impact.

   b. Check to see that valve plate contact surface (K) of cylinder barrel is not scored, and does not have embedded valve plate material.

   c. Check to see that spring (L) is in good condition.

K—Barrel Wear Surface

L— Rotating Kit Spring



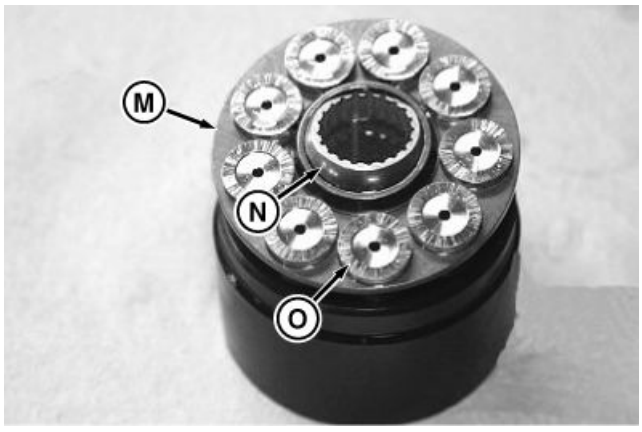
TCT009892 —UN—23DEC13

BS62576,0001038 -19-21MAY14-6/15

   d. Rock piston shoe retainer (M) around shoe retainer pivot (N) to see that assembly moves freely. Inspect retainer and pivot contact surfaces for scoring or wear.

   e. Inspect piston shoe swash plate wear surfaces (O) for scoring or wear.

M—Piston Shoe Retainer
N—Retainer Pivot
O—Piston Shoe Wear Surface



TCT009893 —UN—23DEC13

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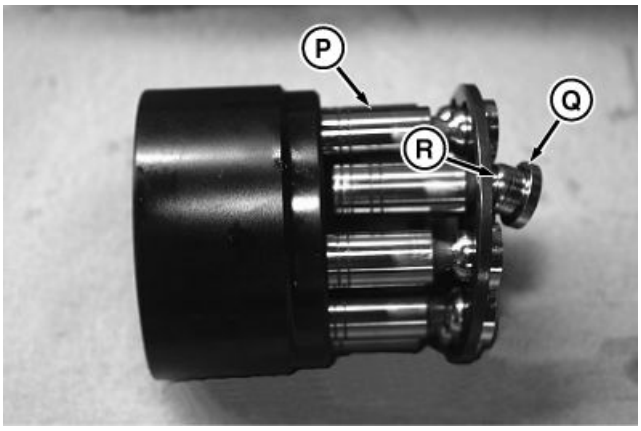
BS62576,0001038 -19-21MAY14-7/15

f. Inspect pistons (P) and piston bores for scoring or contamination if uneven movement is felt.

g. Inspect piston shoes (Q) for fit to piston ball ends (R) and shoe retainer. Shoes should fit snugly, but pivot with smooth movement.

P—Piston
Q—Piston Shoe
R—Piston Ball End



TCT009894 —UN—23DEC13

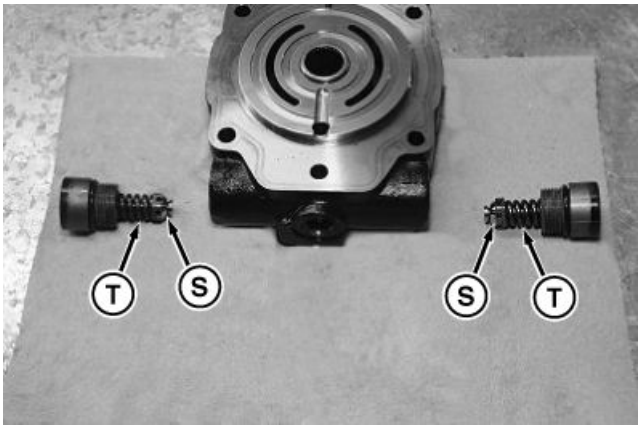
BS62576,0001038 -19-21MAY14-8/15

NOTE: Keep end cover relief valve assemblies separate.

h. Check to see that relief valve poppet (S) and spring (T) are in good condition.

i. Inspect relief valve seats inside end cover. Make sure that seats are smooth and free of burrs or debris.

S—Relief Valve Poppet (2 used; not interchangeable)
T—Relief Valve Spring (2 used; not interchangeable)



TCT009895 —UN—23DEC13

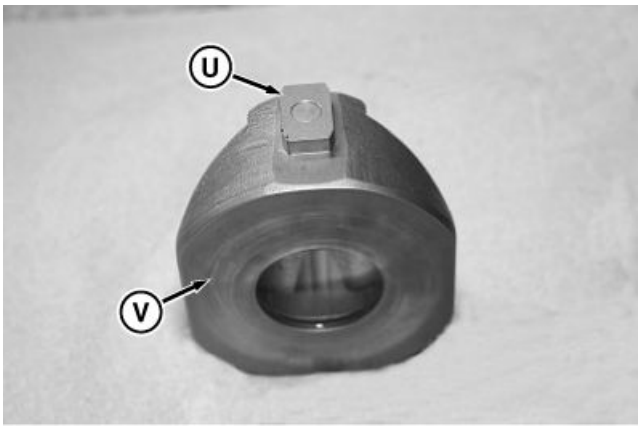
BS62576,0001038 -19-21MAY14-9/15

4. Inspect swashplate and cradle bushing contact surfaces.

   a. Remove servo piston follower (U) from swashplate pivot. Inspect follower bore and pivot surfaces for scoring or wear.

   b. Inspect piston shoe contact surface (V) of swashplate for scoring.

U—Servo Piston Follower
V—Piston Shoe Contact Surface



TCT009896 —UN—23DEC13

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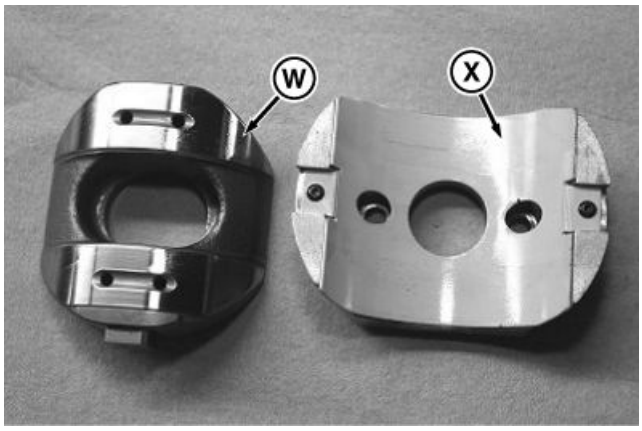
BS62576,0001038 -19-21MAY14-10/15

c. Inspect bushing contact surface (W) of swashplate for wear or transfer of bushing material.

d. Inspect cradle bushing (X) for contamination embedment in bushing surface contacting swashplate.

W—Swashplate Bushing Contact Surface

X—Cradle Bushing



TCT009897 —UN—23DEC13

BS62576,0001038 -19-21MAY14-11/15

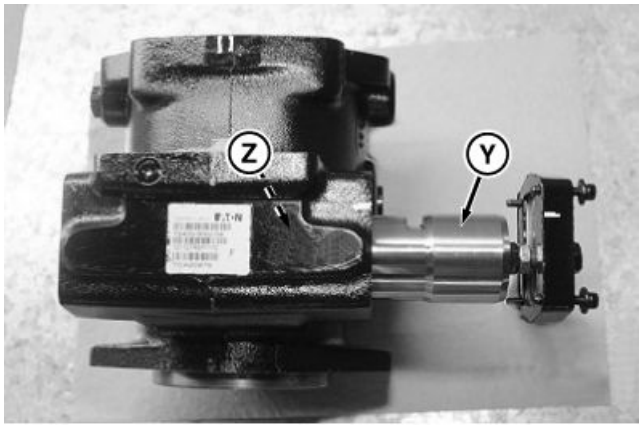
5. Inspect servo piston components.

   a. Inspect piston surfaces (Y) for damage.

   b. Inspect piston bore surfaces (Z) in pump housing.

Y—Servo Piston

Z—Servo Piston Bore



TCT009898 —UN—23DEC13

BS62576,0001038 -19-21MAY14-12/15

6. Inspect shaft and thrust bearing components.

   a. Inspect shaft bearing surfaces (aa) for damage or wear.

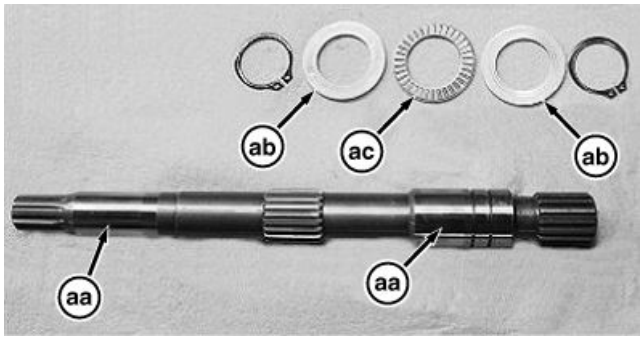
   b. Inspect bearing surfaces of thrust races (ab).

   c. Inspect thrust bearing (ac). Make sure that bearing rollers move freely within cage.

aa— Pump Shaft Bearing Surface

ab— Shaft Bearing Thrust Race (2 used)

ac— Shaft Thrust Bearing



TCT009899 —UN—23DEC13

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BS62576,0001038 -19-21MAY14-13/15

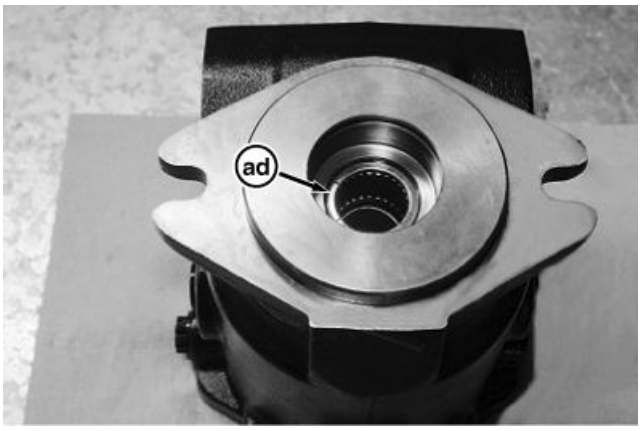
7. Inspect pump housing shaft bearing.

   a. Make sure that rollers in shaft bearing (ad) roll freely in cage.

NOTE: The bearing is press fit to the housing bore. Install a replacement bearing with the number facing out.

   b. Replace bearing if rollers are excessively loose or do not roll freely.

ad— Pump Housing Shaft Bearing



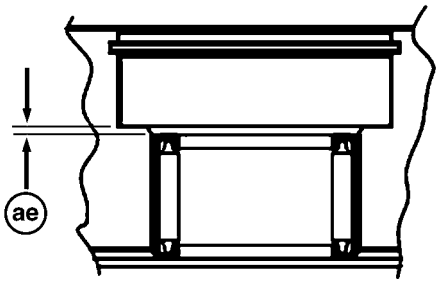
TCT009900 —UN—23DEC13

BS62576,0001038 -19-21MAY14-14/15

   c. Check to see that bearing depth (ae) below housing seal pocket surface is as specified.

Specification	
Shaft Bearing Installation—Depth	1.78 mm (0.07 in.)

ae— Bearing Installation Depth



TCT009901 —UN—23DEC13

BS62576,0001038 -19-21MAY14-15/15

Assemble Hydrostatic Pump

Make sure that all pump components are clean before assembly. Wash all metal parts in clean solvent. Use filtered, moisture free compressed air to dry parts. Do not wipe parts dry with paper or cloth towels. Lint in a hydraulic system will cause damage.

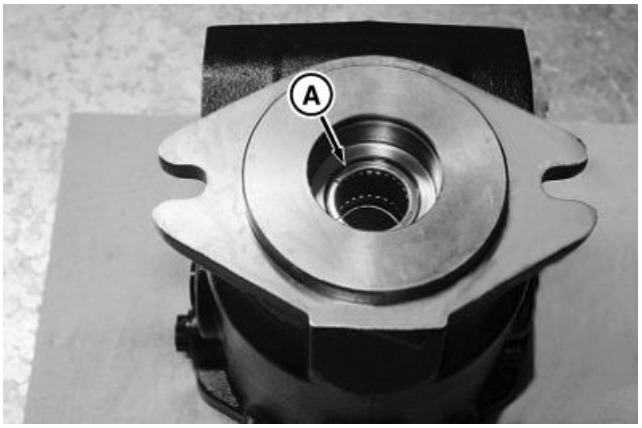
Always use new seals, gaskets, and O rings when assembling hydrostatic pump.

Lubricate all bearing surfaces and O rings with clean hydraulic fluid at assembly. Lubricate new rubber seals with petroleum jelly before installation.

Tighten all fasteners over gasketed joints to specification, then repeat tightening sequence to make up for gasket compression.

1. Install new bearing (A) to housing if needed.

   a. Press bearing into housing bore with number facing outward.



TCT009645 —UN—20DEC13

A—Shaft Bearing

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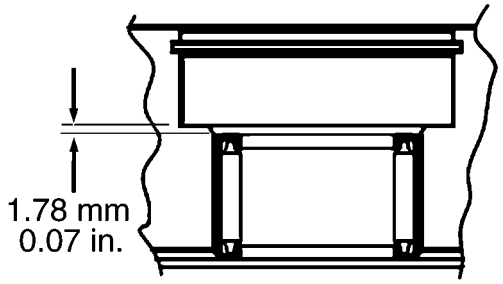
BS62576,0001039 -19-21MAY14-1/26

b. Install bearing so that bearing cage is recessed in housing bore as specified.

Specification	
Shaft Bearing Installed—Depth	1.78 mm (0.07 in.)

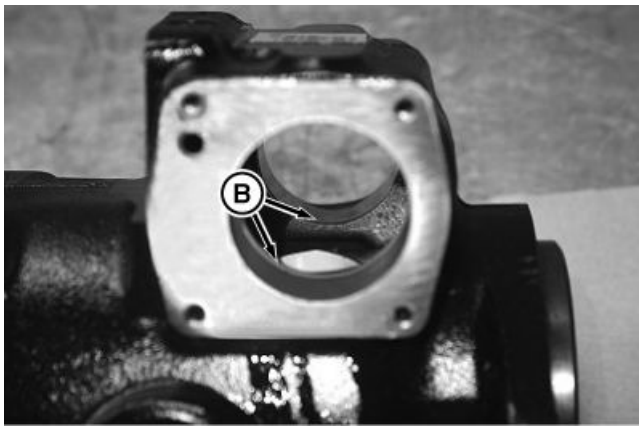


TCT009646 —UN—20DEC13

BS62576,0001039 -19-21MAY14-2/26

2. Lubricate and install new inner and outer seals (B) in piston bore.

B—Piston Seal (2 assemblies used)



TCT009647 —UN—20DEC13

BS62576,0001039 -19-21MAY14-3/26

3. Install new servo piston seal washer.

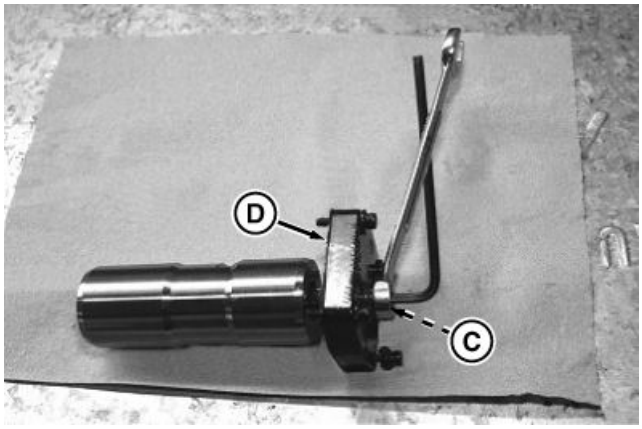
NOTE: Preserve the neutral position of the servo piston. Do not change the position of the cover plate on the piston stud.

a. Hold servo piston center stud, and remove jam nut (C), washer, and seal washer.

b. Install new seal washer, washer, and nut. Hold piston stud and tighten nut until snug.

c. Install new gasket (D) to cover plate.

C—Jam Nut **D—Gasket**



TCT009648 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-4/26

d. Check distance (E) between piston and installed cover plate gasket. Adjust jam nut and cover plate position on piston stud if distance is not to specification.

Specification

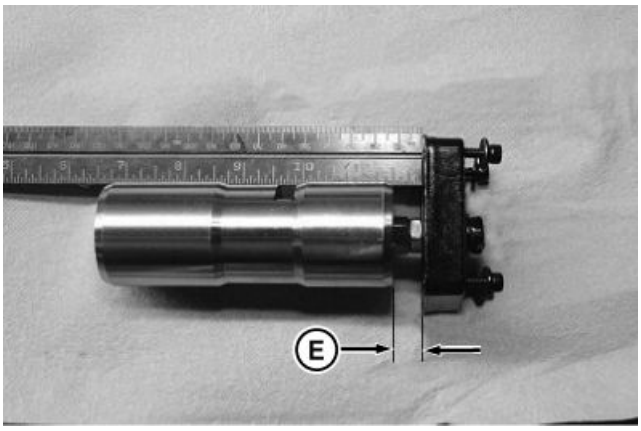
Piston to Cover Plate Installed—Distance..... 1.27 cm (0.5 in.)

e. Tighten piston stud jam nut to specification.

Specification

Servo Piston Stud Jam Nut—Torque..... 17—18 N·m (150—160 lb.-in.)

E—Piston to Cover Plate Distance



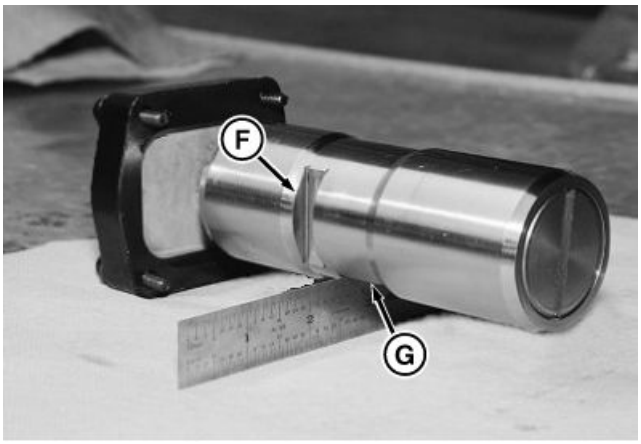
TCT009649 —UN—20DEC13

BS62576,0001039 -19-21MAY14-5/26

4. If necessary, rotate piston so that control arm notch (F) is aligned with long end of cover plate, and servo piston notch (G) is parallel to long sides of cover plate.

F—Servo PistonControl Arm Notch

G—Servo Piston Follower Notch



TCT009650 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-6/26

NOTE: Adjustment for servo piston neutral position may be required at start up.

5. Install servo piston assembly to housing bore.
   a. Lubricate and install piston.
   b. Install screws (H) with washers to secure cover. Tighten screws to specification.

Specification

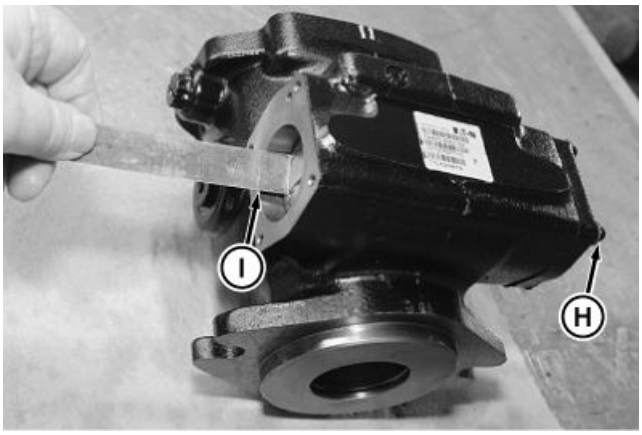
Servo Piston Cover Plate Screw—Torque ..... 4.5—5.4 N·m (40—48 in.-lb.)

   c. Check to see if distance (I) between piston and end of housing is as specified.

Specification

Piston to Housing End Installed—Distance ..... 1.27 cm (0.5 in.)

   d. Loosen piston stud jam nut and turn stud to equalize piston end distances if needed.
   e. Install end cover. Tighten screws to specification.



TCT009651 —UN—20DEC13

H—Socket Head Screw #10-24x25.4 mm (1.0 in.)

I— Piston to Housing End Distance

Specification

Servo Piston Cover Plate Screw—Torque ..... 4.5—5.4 N·m (40—48 in.-lb.)

BS62576,0001039 -19-21MAY14-7/26

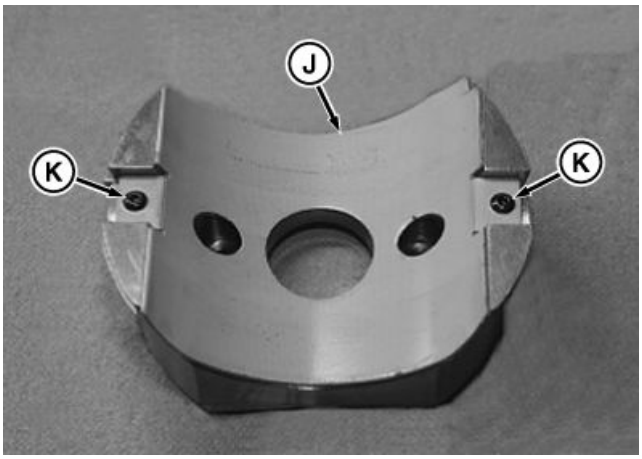
6. Install new bushing to swash plate cradle (if removed).
   a. Align attachment tabs and install new bushing (J) to cradle.
   b. Install screws (K) securing bushing to cradle, and tighten to specification.

Specification

Swash Plate Cradle Bushing Screw—Torque ..... 1.6—1.8 N·m (14—16 lb.-in.)

J— Swash Plate Bushing

K—Button Head Cap Screw (2 used)



TCT009652 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-8/26

7. Install cradle assembly to housing.

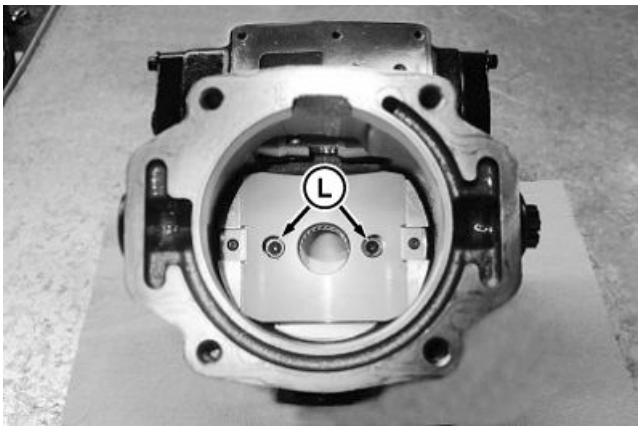
   a. Align dowel pins in cradle to holes in housing. Install cradle to housing, making sure that cradle is completely installed.

   b. Install screws (L) securing cradle to housing, tightening bolts to specification.

Specification

Swash Plate
Cradle to Housing
Screws—Torque ..... 27—33 N·m (20—24 lb.-ft.)

L—Socket Head Cap Screw (2 used)



TCT009654 —UN—20DEC13

BS62576,0001039 -19-21MAY14-9/26

8. Insert pump shaft through rotating assembly to align splines in shoe retainer pivot (M) and cylinder barrel (N).

M—Shoe Retainer Pivot
N—Cylinder Barrel

TCT009653 —UN—20DEC13

BS62576,0001039 -19-21MAY14-10/26

9. Assemble and install drive shaft.

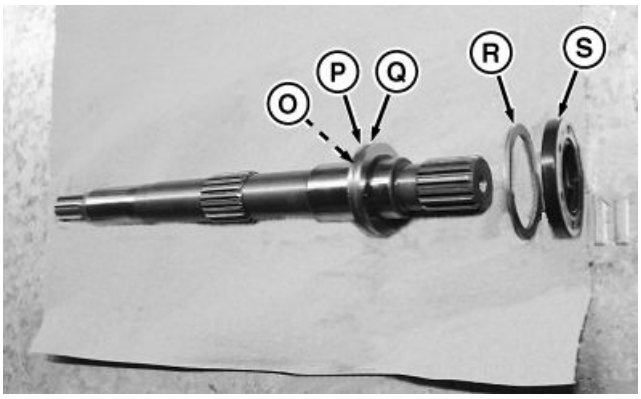
   a. Install snap ring (O) to inner shaft groove.

   b. Lubricate and install thrust race (P) and thrust bearing (Q). Secure bearing with second thrust race and snap ring.

NOTE: Install seal with seal lips facing thrust bearing.

   c. Lubricate and install washer (R) and seal (S) to shaft.

O—Snap Ring
P—Thrust Race
Q—Thrust Bearing
R—Washer
S—Seal



TCT009655 —UN—20DEC13

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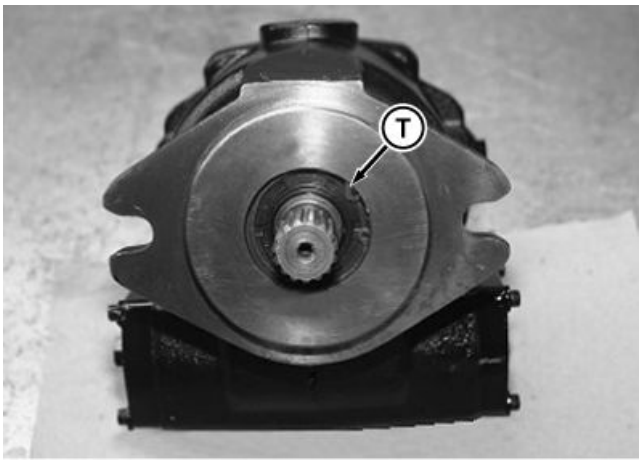
BS62576,0001039 -19-21MAY14-11/26

d. Lubricate housing bearing and shaft seal. Insert drive shaft to housing and seat seal with seal driver.

e. Install snap ring (T) to housing groove securing shaft assembly.

T—Snap Ring



TCT009656 —UN—20DEC13

BS62576,0001039 -19-21MAY14-12/26

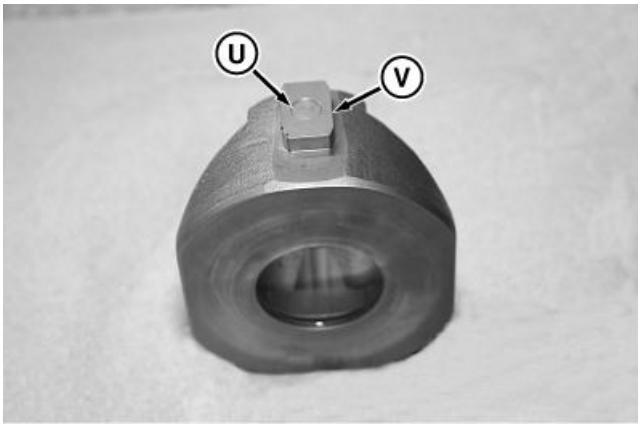
10. Install swashplate to housing.

a. Lubricate surface of swashplate cradle bushing.

b. Lubricate swashplate pivot (U) and install piston follower (V).

U—Swashplate Pivot

V—Piston Follower



TCT009657 —UN—20DEC13

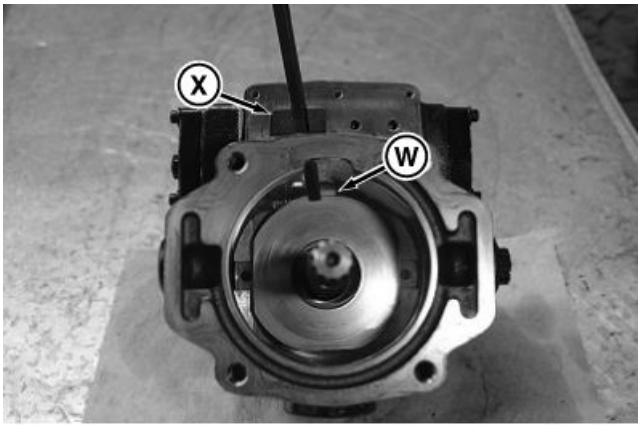
BS62576,0001039 -19-21MAY14-13/26

c. Carefully install swashplate to cradle, inserting follower into servo piston notch (W).

d. Hold swashplate in position with screwdriver inserted through servo controller passage (X) in housing.

W—Servo Piston Follower Notch

X—Servo Controller Passage



TCT009658 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-14/26

11. Install rotating kit assembly over shaft until seated against swashplate.

NOTE: Clamp vise jaws on the pump housing flange. Do not tighten vise jaws on pump housing machined surfaces.

12. Place hydrostatic pump assembly in a protected jaw vise with input shaft down.

TCT009670 —UN—20DEC13

BS62576,0001039 -19-21MAY14-15/26

13. Install new bearing and spring pin to end cover if needed.

NOTE: Press bearing into end cover bore with number facing outward.

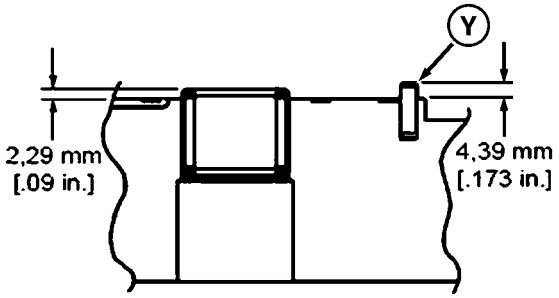
a. Press bearing into end cover until bearing cage extends above end cover surface as specified.

Specification

Bearing Cage Height Above Pump End Cover Surface—Height ..... 2.29 mm (0.09 in.)

NOTE: Install spring pin into end cover with seam (Y) facing away from installed bearing.

b. Press spring pin into end cover until pin end extends above end cover surface as specified.



TCT009660 —UN—20DEC13

Y—Spring Pin Seam

Specification

Spring Pin Height Above Pump End Cover Surface—Height ..... 4.39 mm (0.173 in.)

BS62576,0001039 -19-21MAY14-16/26

14. Install Relief Valves to End Cover

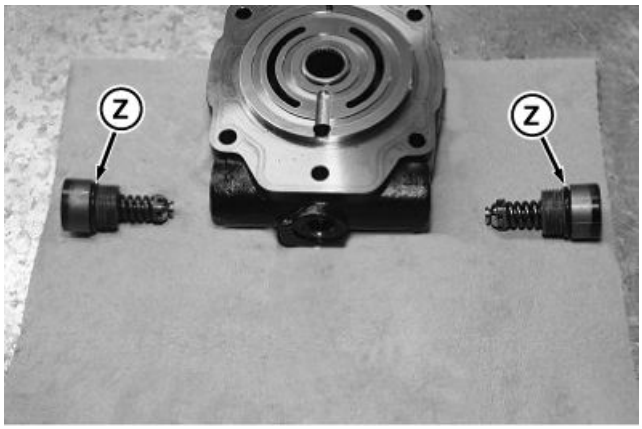
a. Lubricate and install new O rings (Z) to relief valve plugs.

b. Install relief valve assemblies to original positions in end cover. Tighten relief valve plugs to specification.

Specification

End Cover Relief Valve—Torque ..... 136—149 N·m (100—110 lb.-ft.)

Z—O-ring



TCT009659 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-17/26

15. Install Bypass Valve to End Cover

    a. Lubricate and install new O-ring (aa) to bypass valve shaft.

    b. Lubricate and install new O-ring (ab) to bypass valve plug.

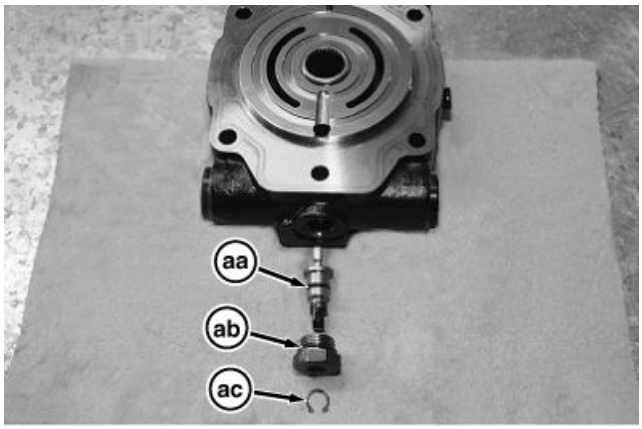
    c. Install bypass valve plug to valve shaft and secure with snap ring (ac).

    d. Install bypass valve assembly to end cover with valve paddle perpendicular to relief valve axis.

NOTE: The final installed position of the bypass valve internal paddle must be perpendicular to the relief valve axis.

    e. Hold bypass valve shaft flats to retain valve position and turn in plug, tightening to specification.

Specification	
End Cover Bypass Plug—Torque	36—40 N·m (26—30 lb.-ft.)



TCT009661 —UN—20DEC13

aa— O-ring
ab— O-ring
ac— Snap Ring

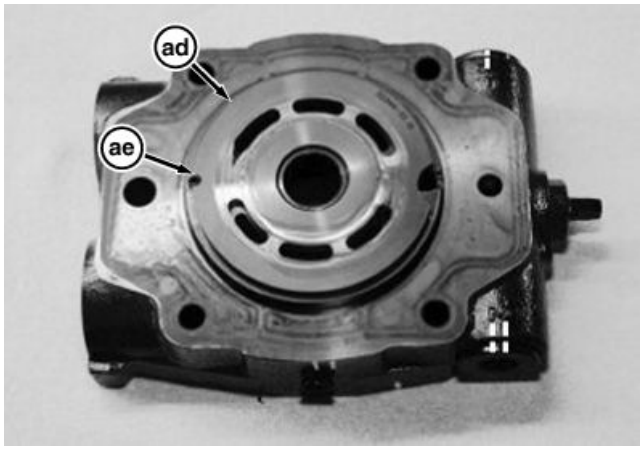
BS62576,0001039 -19-21MAY14-18/26

16. Install valve plate to end cover.

    a. Apply a small amount of petroleum jelly to steel side of valve plate (ad).

    b. Install valve plate to end cover, with steel side toward end cover. Align valve plate notch (ae) to roll pin in end cover.

ad— Valve Plate
ae— Alignment Notch



TCT009662 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-19/26

17. Install end cover to pump housing.

NOTE: Make sure that gasket openings and housing passages are aligned.

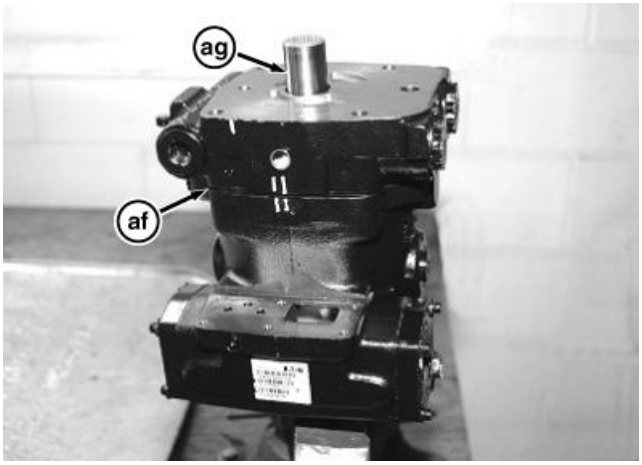
a. Install new gasket (af) to housing.

b. Align installation marks and install end cover assembly to housing assembly. Make sure that gasket and valve plate remain in position.

c. Install coupler (ag) to pump shaft.

af— Gasket

ag— Shaft Coupler



TCT009663 —UN—20DEC13

BS62576,0001039 -19-21MAY14-20/26

18. Assemble charge pump adapter.

a. Lubricate and install new O ring (ah) to charge pump adapter relief valve plug. Install relief valve poppet, spring, shim(s) (if used), and plug to adapter. Tighten plug to specification.

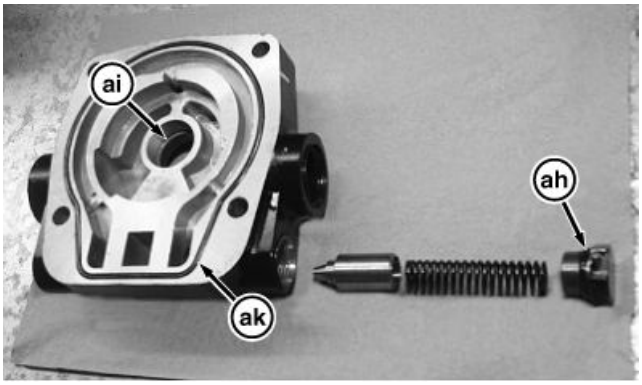
Specification	
Charge Pump Adapter Relief Valve Plug—Torque	36.6—40.7 N·m (27—30 lb.-ft.)

ah— O=ring

ai— Shaft Bushing

aj— Bushing Insertion Depth

ak— Formed O-ring



TCT009664 —UN—20DEC13

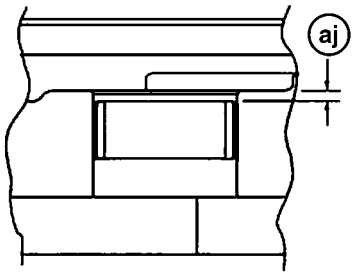
BS62576,0001039 -19-21MAY14-21/26

b. Install new bushing (ai) to charge pump adapter bore if needed. Press bushing into bore until depth below adapter surface (aj) is as specified.

Specification	
Shaft Bushing Insertion Depth Below Adapter Surface—Depth	2.41 mm (0.095 in.)

c. Lubricate and install formed O ring (ak) to adapter. If necessary, apply a small amount of petroleum jelly to O-ring for retention in groove.

aj— Bushing Insertion Depth



TCT009665 —UN—20DEC13

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BS62576,0001039 -19-21MAY14-22/26

19. Install adapter to end cover.

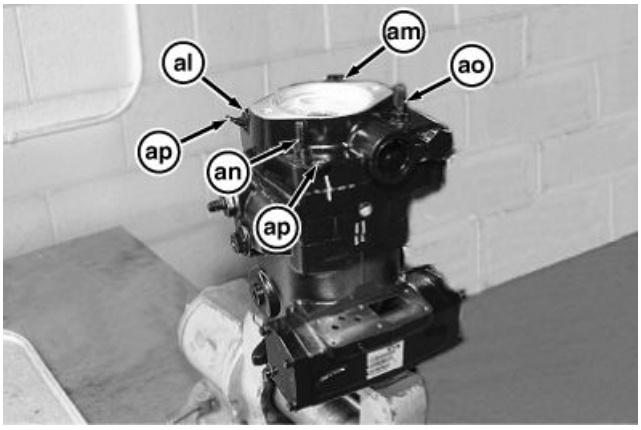
    a. Invert adapter assembly and match alignment marks on end cover. Install adapter to end cover, making sure that formed O-ring remains in place.

    b. Install bolts (al, am, an, and ao) with washers securing adapter and end cover to pump housing. Install tabs (ap) with bolts (al) and (an). Tighten bolts in a cross pattern to specification.

Specification

Charge Pump Adapter to Pump Housing Bolts—Torque ..... 37—42 N·m (27—31 lb.-ft.)

al— Hex Bolt 3.8-16x88.9 mm (3.5 in.)
am—Hex Bolt 3.8-16x88.9 mm (4 in.)
an— Hex Stud Bolt 3.8-16x88.9 mm (3.5 in.)
ao— Hex Stud Bolt 3.8-16x88.9 mm (4 in.)
ap— Tab



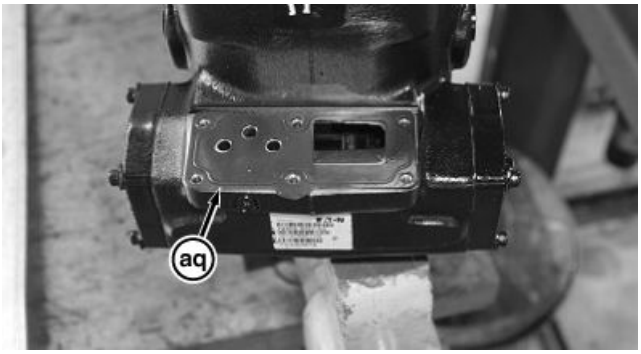
TCT009666 —UN—20DEC13

BS62576,0001039 -19-21MAY14-23/26

20. Install servo control to pump housing.

    a. Install servo housing gasket (aq), Align gasket and housing.

aq— Gasket



TCT009667 —UN—20DEC13

BS62576,0001039 -19-21MAY14-24/26

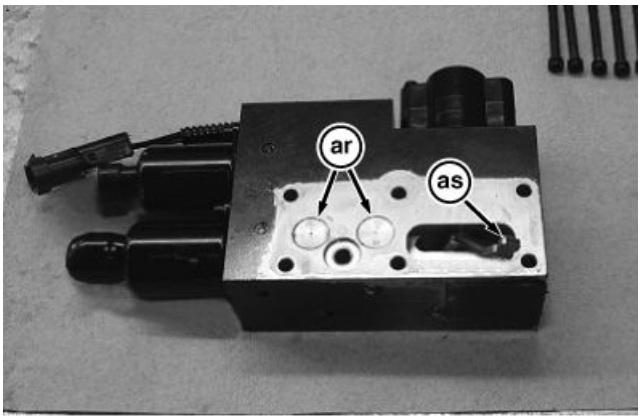
    b. Apply a small amount of petroleum jelly to orifices (ar).

    c. Install orifices to original locations in servo control housing recesses.

    d. Move control housing into alignment with pump housing, positioning servo control lever (as) into servo piston notch. Make sure that orifices remain in position.

ar— Flow Orifice

as— Servo Lever



TCT009668 —UN—20DEC13

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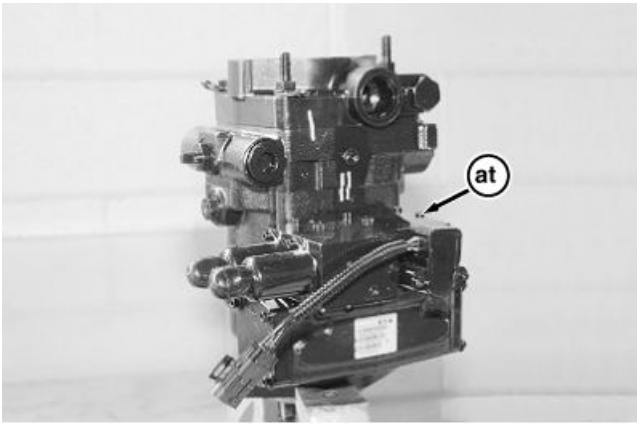
BS62576,0001039 -19-21MAY14-25/26

e. Insert attaching screws (at) through control housing into pump housing. Tighten screws starting from center to specification.

Specification	
Servo Control Housing to Pump Housing Screws—Torque	4.5—5.4 N·m (40—48 lb.-in.)

at— Socket Cap Screw (6 used)



TCT009669 —UN—20DEC13

BS62576,0001039 -19-21MAY14-26/26

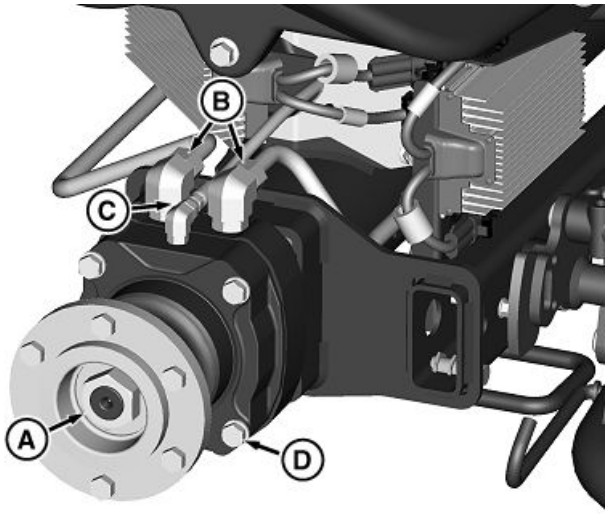
Remove Front Wheel Motor Assembly

1. Park machine safely.
2. Raise and lock front mowers.

NOTE: Front hub nuts are torqued to 474 N·m (350 lb.-ft.) It may be easier to loosen them before jacking the wheels off the ground.

3. Loosen hub nut (A) until nut is even with end of shaft.
4. Jack up machine and place safety stands under frame.
5. Remove wheel.
6. Place a drain pan under wheel motor and disconnect forward and reverse oil lines (B) and brake release pressure line (C).
7. Remove four bolts (D) and remove wheel motor.

A—Hub Nut
B—Forward and Reverse Hydraulic Lines
C—Brake Release Pressure Line
D—Wheel Motor Bolts



TCT009820 —UN—18DEC13

BS62576,0001031 -19-12JUN14-1/1

Install Front Wheel Motor Assembly

1. Install wheel motor assembly with four bolts (A).

NOTE: If brake line fitting was removed, or the fitting nut loosened, tighten nut to specification.

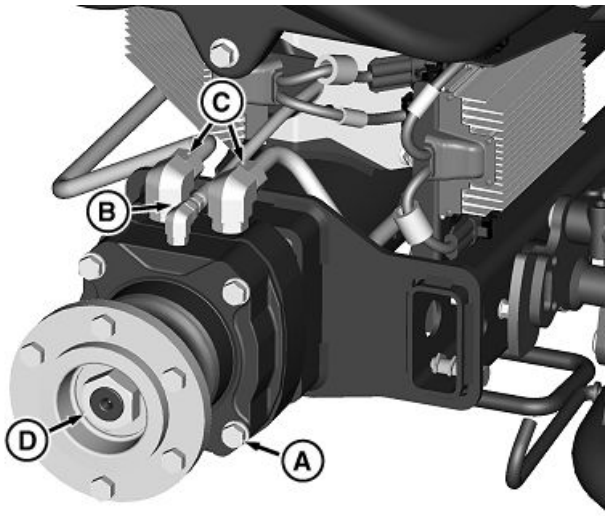
2. Connect brake line (B). Tighten tube nut to specification.If adjustment nut was removed, tighten to specification.

NOTE: If forward or reverse line fitting was removed, or the fitting nut loosened, tighten nut to specification.

3. Connect forward and reverse lines (C). Tighten tube nuts to specification.

IMPORTANT: Remove all residual oil from tapered shaft before installing and tightening the hub nut.

4. Install key and wheel hub on shaft.
5. Install hub nut and tighten to specification.



TCT009821 —UN—18DEC13

A—Bolts
B—Brake Line
C—Forward and Reverse Lines
D—Wheel Hub Nut

Front Wheel Motor—Specification

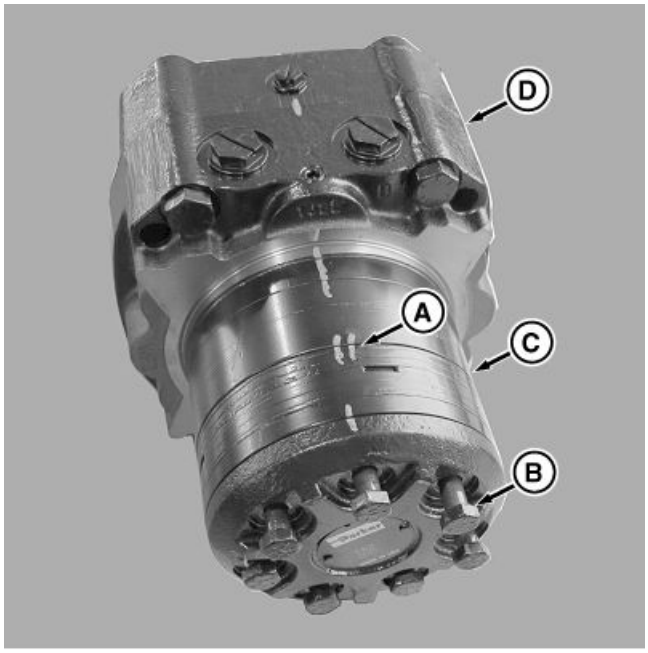
Brake Line Fitting Adjustment Nut—Torque	24 N·m (18 lb.-ft.)
Brake Line Tube Nut—Torque	24 N·m (18 lb.-ft.)
Foward/Reverse Line Fitting Adjustment Nut—Torque	68 N·m (50 lb.-ft.)
Foward/Reverse Line Tube Nut—Torque	68 N·m (50 lb.-ft.)
Wheel Hub Nut, 8000A—Torque	340 N·m (250 lb.-ft.)
Wheel Hub Nut, 7500A—Torque	475 N·m (350 lb.-ft.)

BS62576,0001032 -19-15AUG14-1/1

Disassemble and Inspect Front Wheel Motor Assembly

1. Place marks (A) on motor/brake assemblies to aid in reassembly.
2. Remove the key from shaft keyway.
3. Remove bolts (B) and separate motor assembly (C) from brake assembly (D).
4. Tap on end of shaft with a soft hammer and remove shaft from brake assembly.

A—Marks
B—Bolts
C—Motor Assembly
D—Brake Assembly



TCT005879 —UN—22JAN13

BS62576,0001033 -19-05MAR13-1/8

5. Alternately loosen brake housing bolts one half turn at a time until there is no spring pressure remaining on the bolts.
6. Separate the brake housing halves.

E—Brake Housing Bolts

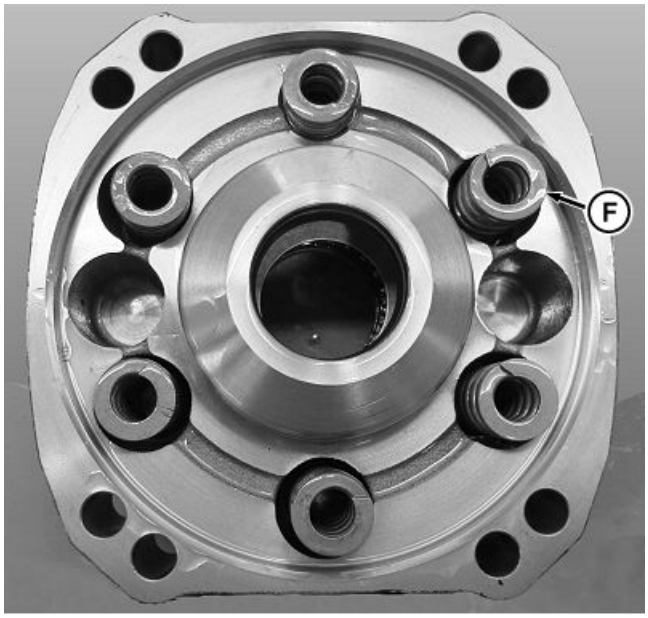
TCT005880 —UN—22JAN13

Continued on next page

BS62576,0001033 -19-05MAR13-2/8

7. Note position of brake springs for reassembly purposes. Remove and inspect the brake springs. Replace worn or broken springs.

F—Brake Springs



TCT005881 —UN—22JAN13

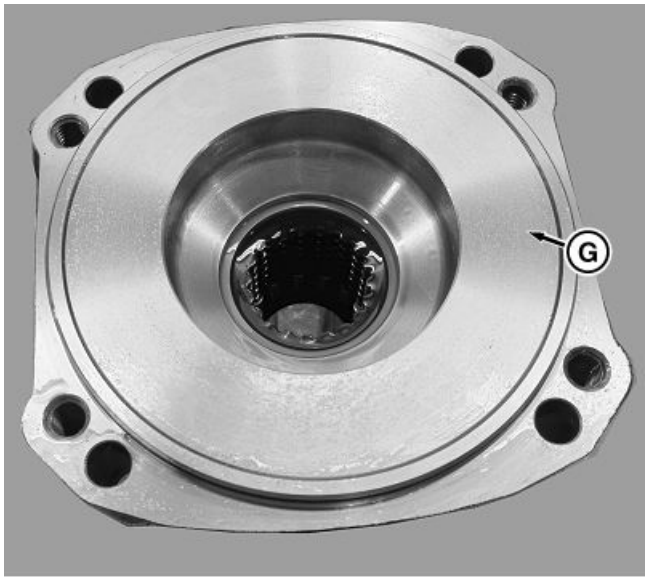
Brake Springs

BS62576,0001033 -19-05MAR13-3/8

CAUTION: Use extreme caution when removing the piston. To remove the piston from the brake assembly, cover the piston with a rigid restraint and apply low pressure air (10 - 20 psi) to the brake release port. The piston will slide up until released. Too much pressure could cause the piston to blow out of its bore causing personal harm.

8. Cover the piston with a rigid restraint and apply low air pressure 68-138 kPa (10-20 psi.) to the center (smaller) hole in the brake housing to release piston from housing.

G—Piston



TCT005882 —UN—22JAN13

Piston and Housing

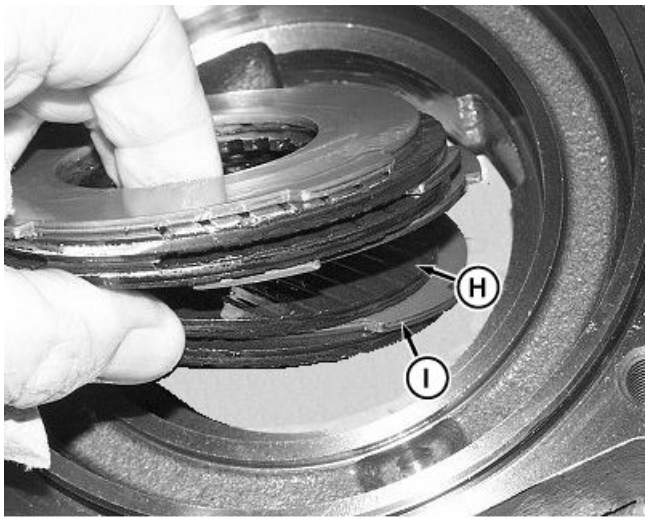
Continued on next page

BS62576,0001033 -19-05MAR13-4/8

NOTE: Note arrangement of friction discs and separator plates. There should be five of each in alternating order with a friction disc first in the bottom of the case then a separator plate etc. A separator plate will be on top of the stack when finished.

9. Remove friction discs (H) and separator plates (I). Replace any friction discs or separator plates that are damaged, warped, or excessively worn. Measure thickness of friction discs and separator plates and replace if below specification.

Specification	
Friction Disc—Minimum Thickness	3.6 mm (0.142 in.)
Separator Plate—Minimum Thickness	2.36 mm (0.093 in.)



TCT005884 —UN—22JAN13

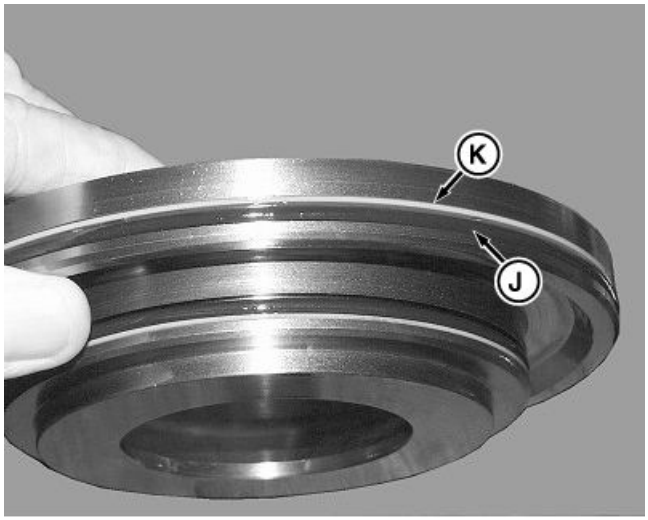
Brake Friction Discs and Separator Plates

H—Brake Friction Disc **I— Separator Plate**

BS62576,0001033 -19-05MAR13-5/8

10. Remove and discard O-rings (J) and back up rings (K) from piston. Note position of O-rings and back up rings. Install new O-rings and back up rings on piston in the same order as removed.

J— O-rings **K—Backup rings**



TCT005883 —UN—22JAN13

Piston O-Rings

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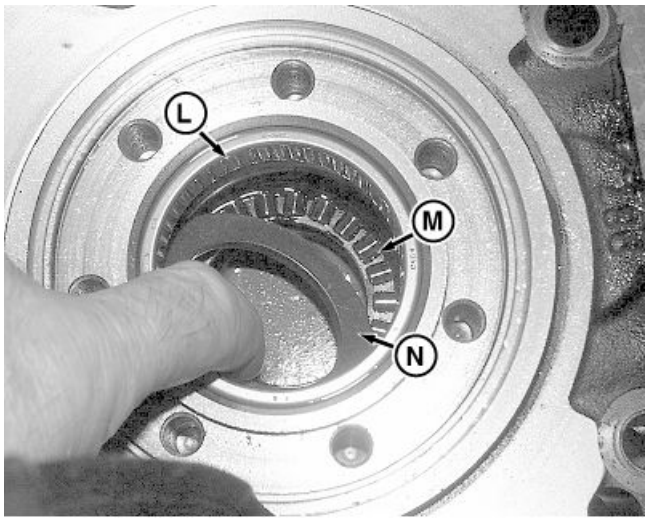
BS62576,0001033 -19-05MAR13-6/8

11. Inspect radial needle bearing (L), thrust bearing (M), and thrust washers (N) in rear housing. The needle bearing must be removed to replace thrust bearing and thrust washers. Use a bearing puller to remove the bearing. If original bearing is removed a new bearing must be used during reassembly.

L—Needle Bearing
M—Thrust Bearing
N—Thrust Washers



TCT005885 —UN—22JAN13

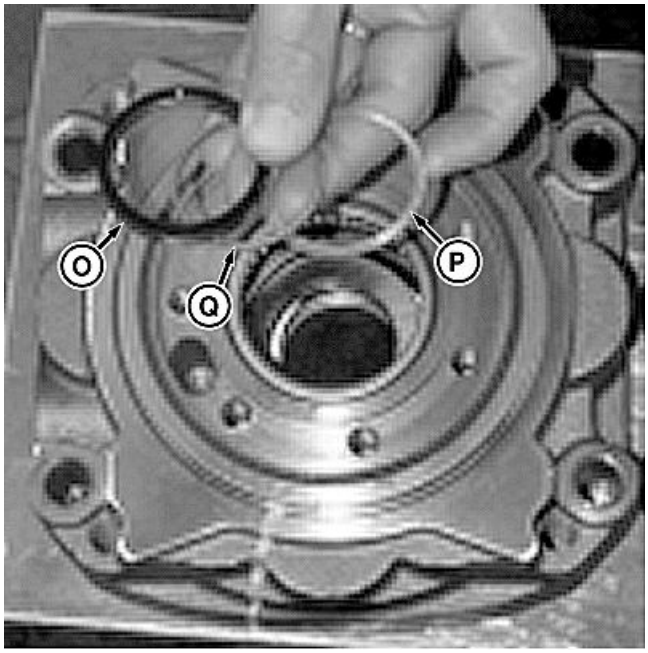
Thrust Bearing and Washers

BS62576,0001033 -19-05MAR13-7/8

12. Remove shaft seal (O), back up washer (P), and back up ring (Q) in that order. Inspect for any abnormal wear. Always replace seal with a new one.

CAUTION: Be careful not to scratch the seal bore when removing seals.

O—Shaft Seal
P—Back up Washer
Q—Back up Ring



TCT005886 —UN—07MAY14

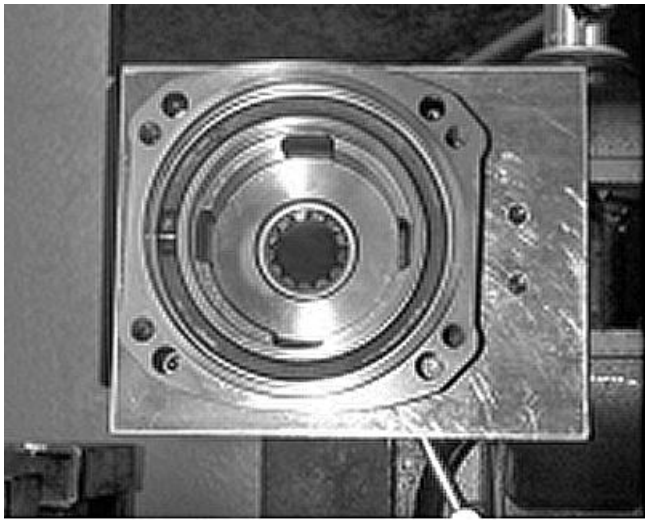
Shaft Seal

BS62576,0001033 -19-05MAR13-8/8

Assemble Front Wheel Motor Assembly

NOTE: Replace all seals and seal rings with new ones whenever reassembling the unit. Lubricate all seals and seal rings with SAE 10W40 oil or clean grease before assembly. Parts must be clean and dry before assembly. Visually inspect components for damage and abnormal wear. Replace damaged or worn parts.

1. Place front brake housing on a suitable work platform with the needle bearing down. Support the case in such a way that it allows room for the shaft to protrude out the bottom. Make sure that the unit is secured. If needle bearing is not being replaced skip to step 3.
2. If bearing is being replaced, press new bearing into the case with the bearing part number against the arbor.



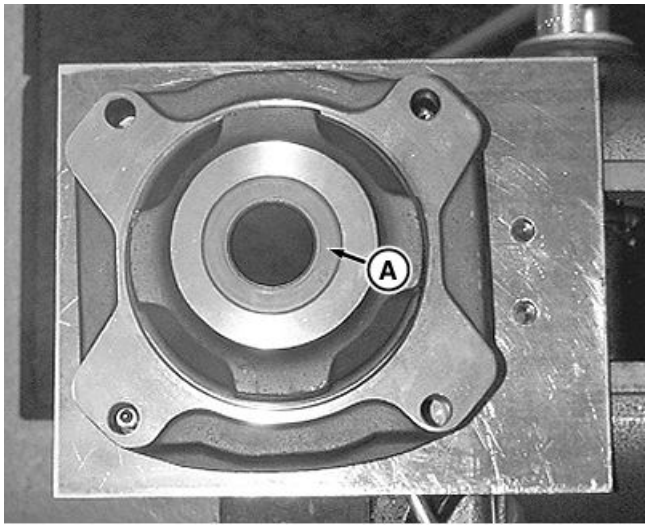
TCT005887 —UN—07MAY14

Front Brake Housing

BS62576,0001034 -19-12JUN14-1/23

3. Press the dirt and water seal (A) in flush to 0.5 mm (0.020 in.) below surface with the flat side facing out.

A— Seal



TCT005888 —UN—22JAN13

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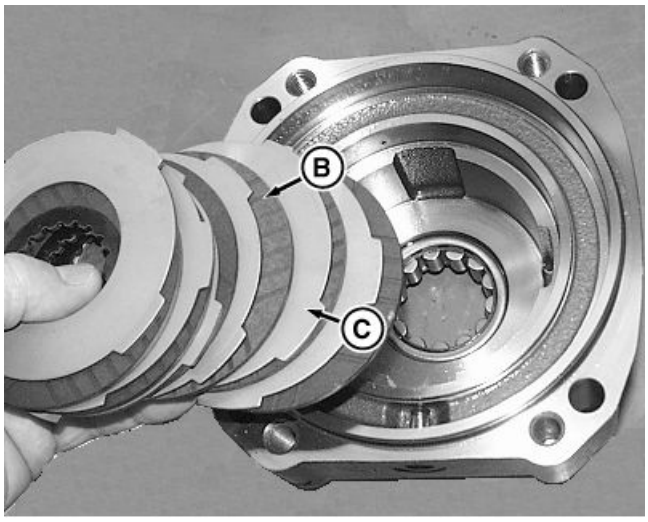
BS62576,0001034 -19-12JUN14-2/23

4. Install the brake friction discs (B) and separator plates (C) in the same order they were removed. There should be a separator plate on the top and a friction disc on the bottom of the stack. Be careful not to contaminate the friction disc or separator plate surfaces with dirt, grease, or fluid other than what the brake was designed to use.

B— Brake Friction Disc **C— Separator Plates**



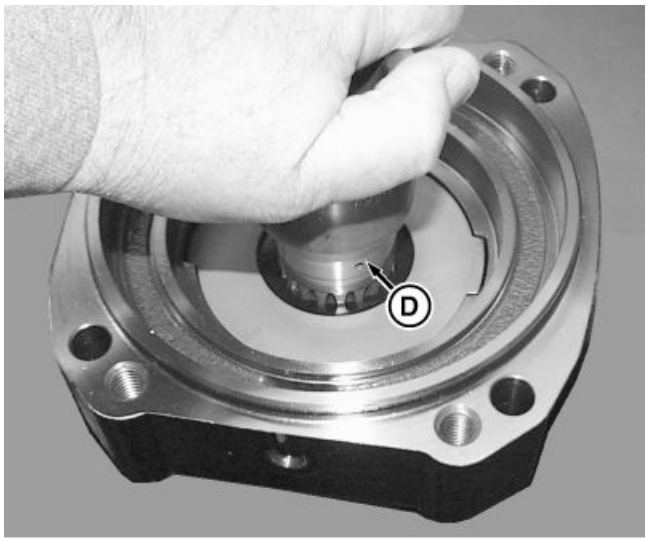
TCT005889 —UN—22JAN13

Brake Discs and Separator Plates

BS62576,0001034 -19-12JUN14-3/23

5. Use the shaft (D) to align the splines of the friction discs.

D— Shaft



TCT005890 —UN—22JAN13

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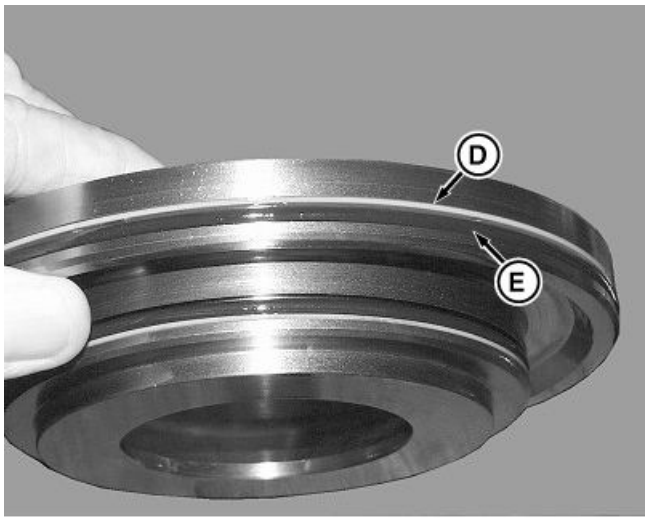
BS62576,0001034 -19-12JUN14-4/23

6. Replace the piston O-rings (E) and piston backup rings (D), be sure the O-rings are nearest each other with back up rings to the outside of the O-rings. Lightly lubricate piston bores and O-rings with SAE 30 oil.
7. Gently slide piston into case until larger O-ring is against the case. Using a light duty press, push the piston completely into the bore (be careful not to damage seals or back-up rings). This will squeeze the O-rings and back-up rings and set the piston against the friction pack. Use shaft as an alignment tool and align the brake discs.
8. Place rear housing on a suitable work surface with seal side down.

D— Piston Back Up Rings **E— Piston O-Rings**



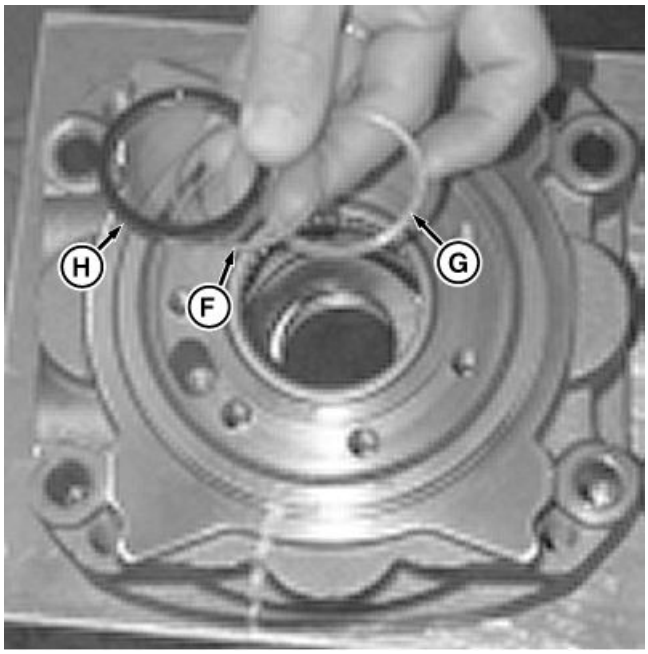
TCT006449 —UN—22JAN13

BS62576,0001034 -19-12JUN14-5/23

NOTE: If large needle bearing was not removed, the thrust bearing and thrust washers must be held aside while back up ring, back up washer, and seal are installed.

9. Install back-up ring (F), back-up washer (G), and shaft seal (H) (seal lip facing inwards).

F— Back-Up Ring **H— Shaft Seal**
G— Back-Up Washer



TCT006450 —UN—22JAN13

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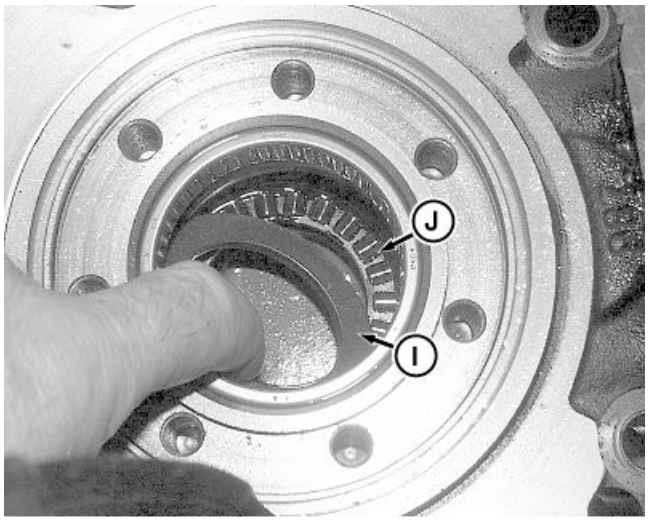
BS62576,0001034 -19-12JUN14-6/23

10. Place a thrust washer (I) in the bottom of the case, then the thrust bearing (J) and the other thrust washer on top.

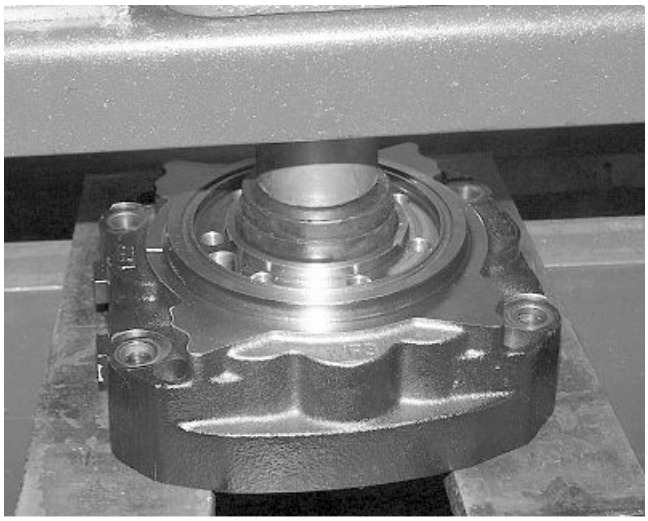
I— Thrust Washers **J— Thrust Bearing**



TCT006451 —UN—22JAN13

BS62576,0001034 -19-12JUN14-7/23

11. If input bearing was removed, press a new bearing into the case with the bearing part number facing out against the arbor. Press bearing in until edge of bearing is 2.66 - 3.1 mm (0.105-0.125 in.) below surface.



TCT005891 —UN—22JAN13

Pressing in Bearing

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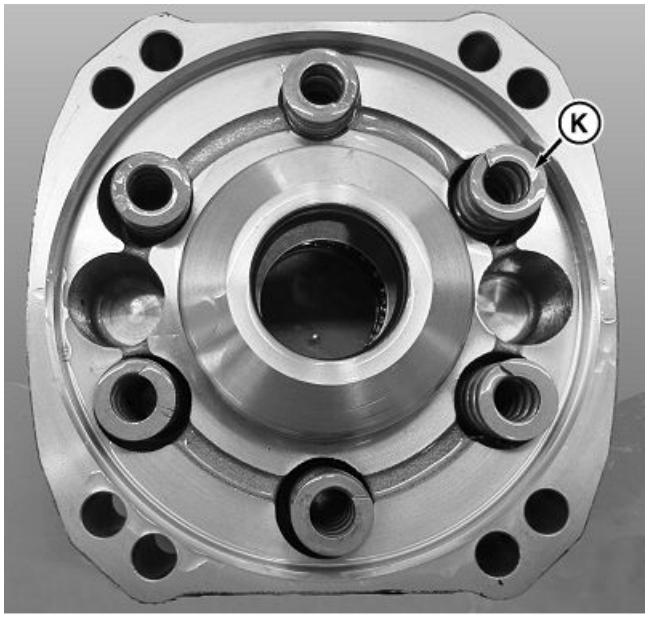
BS62576,0001034 -19-12JUN14-8/23

12. Invert rear housing so that the spring pockets are facing up. Place springs (K) into the pockets. Arrange springs as shown. Add approximately 175 mL (5.9 oz.) of SAE 30 motor oil around spring pockets.

K—Spring



TCT005892 —UN—22JAN13

Brake Spring Installation

BS62576,0001034 -19-12JUN14-9/23

13. Install O-ring (L) on piston housing. Ensure O-ring is in place and lays flat against flange.
14. Place front housing on top of rear housing and align the brake release port to the front housing ports. Install brake housing bolts. Tighten brake housing bolts in a uniform sequence to specification.

Specification

Brake Housing Bolts—Torque	122 N·m 90 (lb.-ft.)

L— O-Ring

TCT005893 —UN—22JAN13

Piston Housing O-Ring

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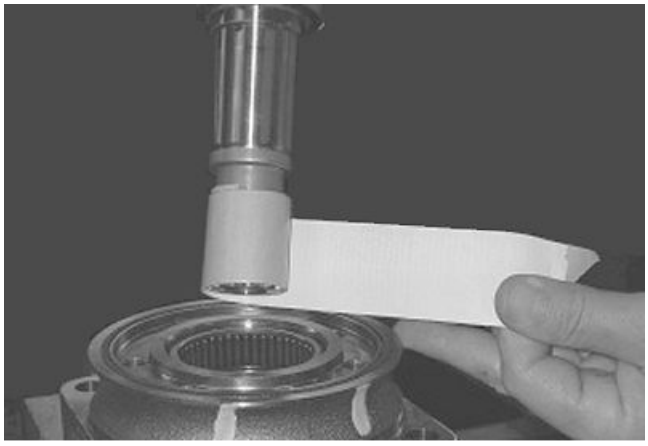
BS62576,0001034 -19-12JUN14-10/23

15. Apply masking tape around keyway on shaft to prevent damage to seal.



TCT006436 —UN—22JAN13

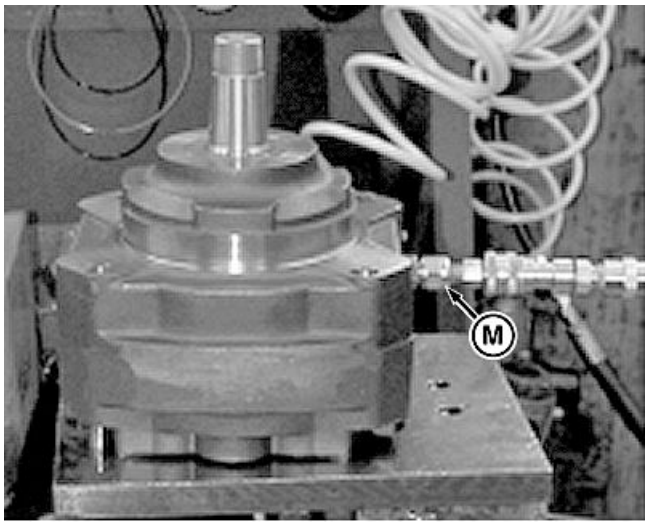
Tape Shaft Keyway

BS62576,0001034 -19-12JUN14-11/23

CAUTION: Avoid Injury! Do not attempt to use compressed air to release brake. Most shop air equipment is rated well below the pressure needed to release the brake. Use a hand operated hydraulic pump with a pressure gauge to obtain correct brake release pressure.

16. Pressurize brake release port with 350 psi to release brake. Install shaft from bottom side of brake housing assembly. Rotate shaft as needed to guide it through the splines of all of the friction discs and then push it into the shaft seal. Lightly tap with a rubber hammer to seat shaft.
17. Invert brake assembly so that the motor end is facing up. Keep the pressure on brake release port so rotor set can be aligned easily.

M— 7/16-20 Adapter Fitting



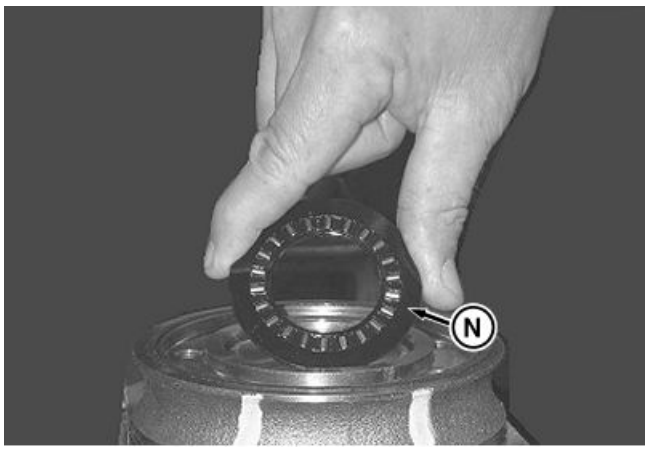
TCT005894 —UN—07MAY14

Attach Pressure Line

BS62576,0001034 -19-12JUN14-12/23

18. Install thrust bearing (N) onto the end of coupling shaft.

N—Thrust Bearing



TCT006437 —UN—22JAN13

Thrust Bearing

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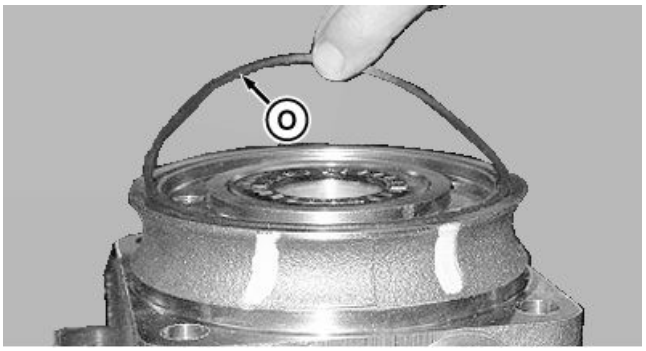
BS62576,0001034 -19-12JUN14-13/23

19. Apply a small amount of clean grease to a new seal ring (O) and insert it into the housing seal ring groove.

O— Seal Ring



TCT006438 —UN—22JAN13

Seal Ring

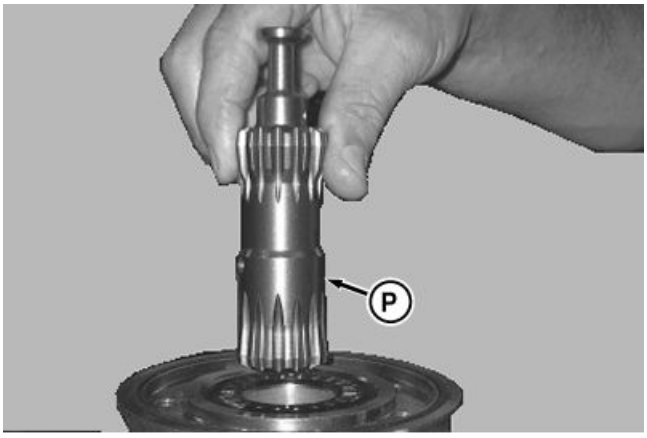
BS62576,0001034 -19-12JUN14-14/23

NOTE: Two alignment studs screwed finger tight into housing bolt holes, approximately 180 degrees apart, will facilitate the assembly and alignment of components as required in the following procedures. The studs can be made by cutting off the heads of 3/8-24 UNF 2A bolts as required that are over 12.7 mm (0.5 in.) longer than the bolts used in the Torqmotor™

20. Install drive link (P) with the long splined end down into the coupling shaft and engage the drive link splines into mesh with the coupling shaft splines.

21. Assemble wear plate over the drive link and alignment studs onto the housing.

P— Coupling Shaft

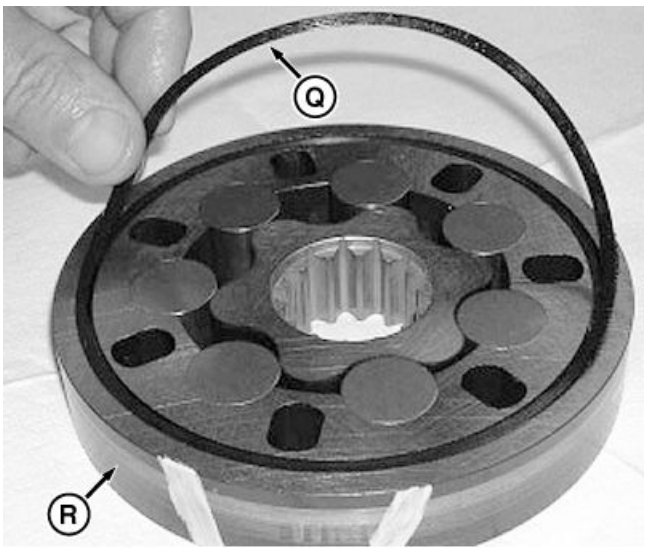


TCT006439 —UN—22JAN13

BS62576,0001034 -19-12JUN14-15/23

22. Apply a small amount of clean grease to a new seal ring (Q) and assemble it into the seal ring groove on the wear plate side of the rotor set stator (R).

Q—Seal Ring **R—Rotor Set Stator**



TCT006441 —UN—22JAN13

Rotor Set Stator

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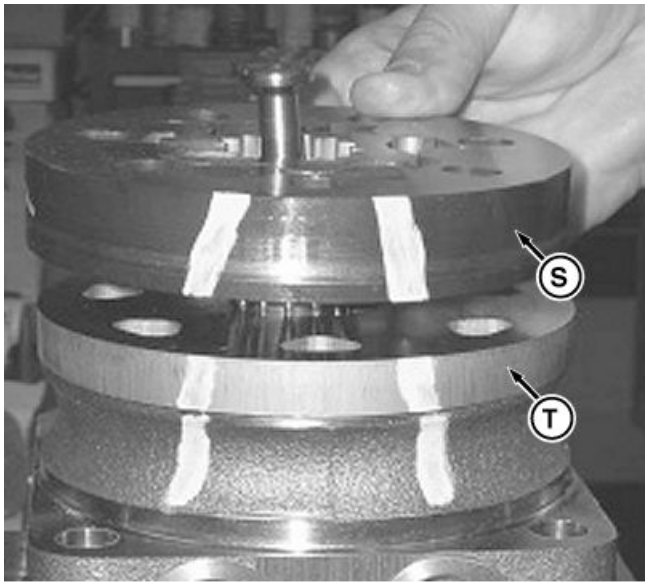
BS62576,0001034 -19-12JUN14-16/23

23. Install the assembled rotor set (S) onto wear plate (T) with rotor counter bore and seal ring side down and the splines meshing with the drive link splines.

S— Rotor Stator Assembly **T— Wear Plate**



TCT006442 —UN—22JAN13

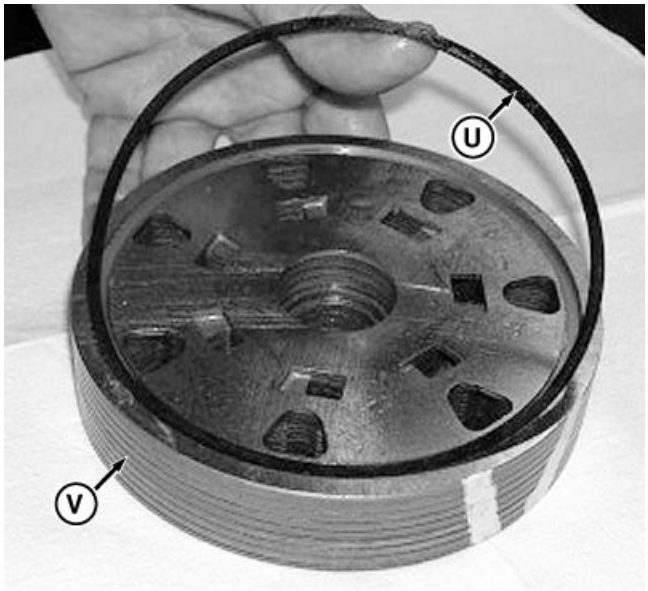
BS62576,0001034 -19-12JUN14-17/23

24. Apply clean grease to a new seal ring (U) and assemble it in the seal ring groove in the rotor set contact side of manifold (V).

NOTE: If the manifold was not marked during disassembly, determine which way to install the manifold as follows: The manifold surface that must contact the rotor set has it's series of irregular shaped cavities on the largest circumference or circle around the inside diameter. The polished impression left on the manifold by the rotor set is another indication of which surface must contact the rotor.

25. Assemble the manifold B over the alignment studs and drive link and onto the rotor set. Be sure the correct manifold surface is against the rotor set.

U— Seal Ring **V—Manifold**



TCT006443 —UN—22JAN13

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BS62576,0001034 -19-12JUN14-18/23

26. Apply grease to a new seal ring (W) and insert it in the seal ring groove exposed on the manifold.

W—Seal Ring

TCT006444 —UN—22JAN13

BS62576,0001034 -19-12JUN14-19/23

27. Assemble the commutator ring (X) over alignment studs onto the manifold.

X— Commutator Ring

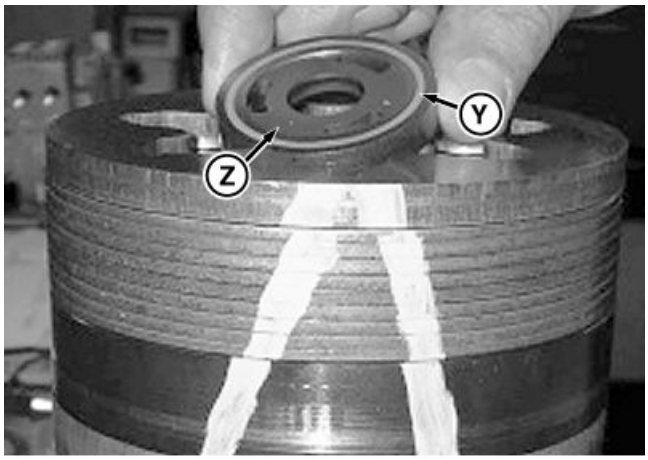
TCT006445 —UN—22JAN13

Continued on next page

BS62576,0001034 -19-12JUN14-20/23

28. Assemble a new seal ring (Y) flat side up, into commutator (Z) and assemble commutator over the end of drive link onto manifold with seal ring side up.

Y—Seal Ring **Z—Commutator**

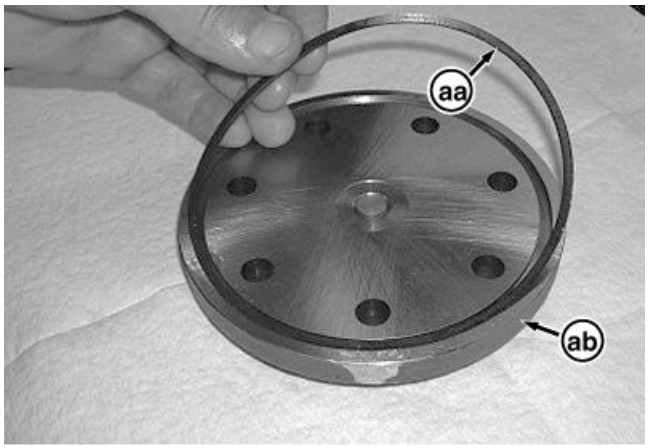


TCT006446 —UN—22JAN13

BS62576,0001034 -19-12JUN14-21/23

29. Assemble a new seal ring (aa) into end cover (ab) and assemble end cover over the alignment studs and onto the commutator set.

aa— Seal Ring **ab— End Cover**



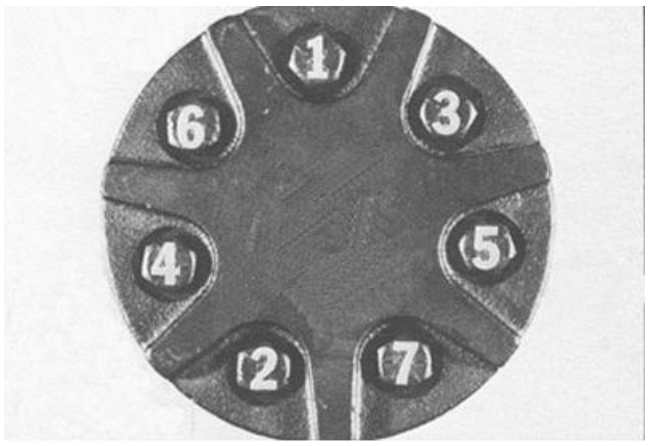
TCT006447 —UN—22JAN13

BS62576,0001034 -19-12JUN14-22/23

30. Install special bolts in the holes without the alignment studs and screw in finger tight. Remove and replace the two alignment studs with bolts after the other bolts are in place. Alternately and progressively tighten the bolts to specification in the order shown.

Specification

Special Bolts—Torque ..... 68—75 N·m (50—55 lb.-ft.)



Tightening Sequence

TCT006448 —UN—22JAN13

BS62576,0001034 -19-12JUN14-23/23

Remove Rear Wheel Motor—8000A

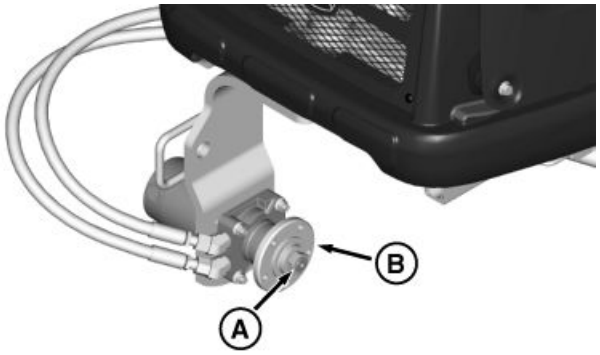
1. Park machine safely. See the “Safety Section”
2. Raise rear of vehicle and support safely with jackstands or wood blocks.
3. Remove rear wheel from side of machine requiring motor removal.

NOTE: Pipe wrench is used to prevent disk from rotating when removing nut without air tools.

4. Remove nut (A) from keyed motor shaft with 1-7/16 in. socket.

CAUTION: Avoid Injury! Disk will release from motor shaft with force. Stand out of the way of disk when tapping with hammer.

5. Remove rotor (B) from motor shaft using a three-jaw puller by applying tension and tapping with a hammer.



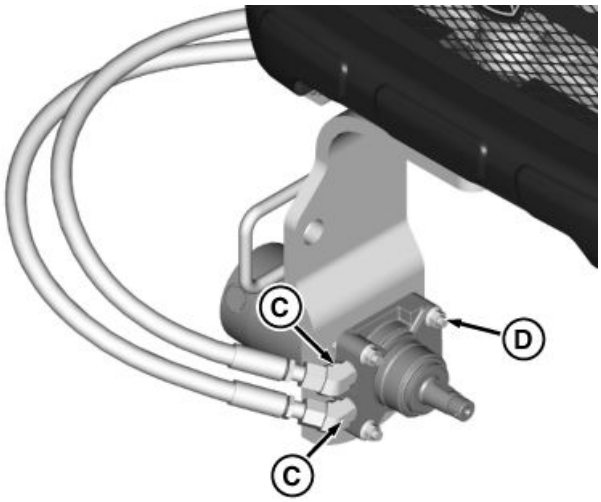
TCT006432 —UN—14MAR13

A—Nut **B—Rotor**

BS62576,000103A -19-14MAR13-1/2

6. Remove hydraulic lines (C) from motor. Use appropriate fluid containment procedures.
7. Remove four mounting nuts and bolts (D) from hydraulic mounting flange.
8. Remove wheel motor from rear axle housing.
9. Remove fittings if the motor is to be repaired or exchanged.

C—Hydraulic Lines **D—Mounting Nuts and Bolts**



TCT006433 —UN—14MAR13

BS62576,000103A -19-14MAR13-2/2

Install Rear Wheel Motor—8000A

1. Install fittings in wheel motor.
2. Place hydrostatic motor in rear axle housing.
3. Position motor so the fittings on the back plate of the motor face rear of the machine.

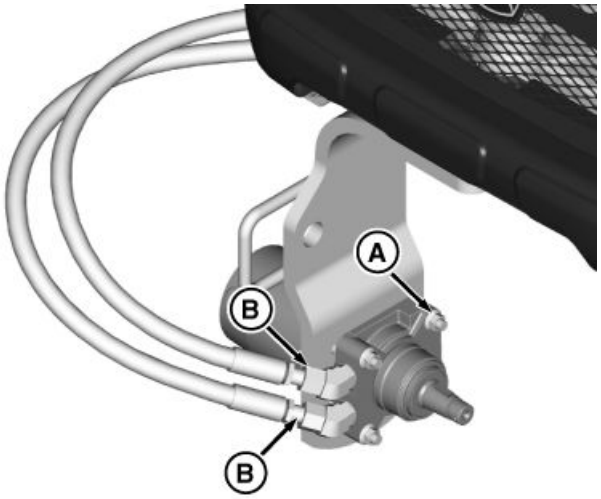
NOTE: Use a hold wrench on the hose when tightening to avoid hose twist. Hold the 45° wheel motor fitting in place while tightening.

4. Install four bolts (A) through motor mounting flange and into rear axle housing. Tighten hardware to specifications.

Specification	
Rear Wheel Motor Housing Bolt—Torque	140 N·m (105 lb.-ft.)

5. Install hydraulic lines (B) on motor. Tighten to specification.

Specification	
Rear Wheel Motor 45° Fitting—Torque	108 N·m (80 lb.-ft.)



TCT006434 —UN—14MAR13

A—Mounting Bolt **B—Hydraulic Lines**

Rear Wheel Motor B Nut (hydraulic line)—Torque	108 N·m (80 lb.-ft.)

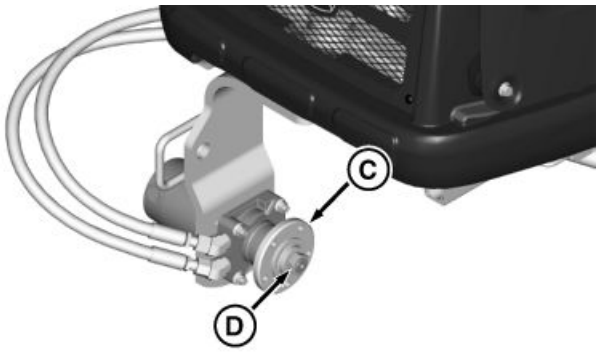
BS62576,000103B -19-14AUG14-1/2

6. Remove any oil residue from motor shaft and inner hub. Place rotor (C) on motor shaft and install nut (D). Use pipe wrench to keep disk from turning if not using air tools. Tighten to specifications.

Specification	
Rear Wheel Motor Rotor Nut—Torque	339 N·m (250 lb.-ft.)

7. Install wheel and tire assembly.
8. Start machine and operate motor to determine if motor rotates in the proper direction.

   If motor rotates in wrong direction, the hydraulic lines are reversed or timing procedure of the motor is incorrect.



TCT006435 —UN—14MAR13

C—Rotor **D—Nut**

BS62576,000103B -19-14AUG14-2/2

Wheel Motor Final Checks

1. Pressurize the wheel motor with 100 psi dry air or nitrogen and submerge in solvent to check for external leaks.
2. Check wheel motor for rolling drag. Torque required to rotate the coupling shaft should not be more than specifications.

Specification	
Rear Wheel Motor Rolling Drag—Torque	68 N·m (50 lb.-ft.)

3. Use test stand if available, to check for proper operation of the wheel motor.

NOTE: Bleed hydraulic system after installing wheel motor to the machine. (See Bleed Hydraulic System).

BS62576,000103E -19-20MAY14-1/1

Start Up Procedure

IMPORTANT: Avoid Damage! Follow this procedure to properly purge the hydrostatic drive system before returning the machine to service.

1. Ensure hydraulic reservoir is full.
2. Disconnect fuel shutoff solenoid connector and crank engine for 15 seconds.
3. Reconnect fuel shutoff solenoid connector.
4. With transmission in neutral, start engine and run at slow idle.
5. Operate steering and lift system through several cycles. Slowly operate the machine in forward and reverse to purge the air from the system.
6. Check and replenish the reservoir.
7. Check all connections for leaks and tighten if necessary.
8. Short hour filter changes are recommended for the first two changes after returning the machine back to service. Change the first filter after 3-5 hours of operation and the second after 50 hours.

BS62576,0000EE1 -19-14FEB13-1/1

Section 50
Hydraulics Repair

Contents

Page

Group 10—Hydraulics
Summary of References 50-10-1
Specifications 50-10-1
Repair Brakes 50-10-1
Remove and Install Lift Valve 50-10-2
Disassemble and Assemble Lift Valve 50-10-3
Remove and Install Brake Release Valve 50-10-4
Disassemble and Assemble Brake Valve 50-10-5
Remove Lift Cylinder 50-10-7
Install Lift Cylinder 50-10-8

Group 20—Hydraulic Pumps
Summary of References 50-20-1
Remove Hydraulic Pump 50-20-1
Install Hydraulic Pump 50-20-2
Disassemble Hydraulic Pump 50-20-4
Assemble Hydraulic Pump 50-20-7

Summary of References

- Repair Brakes
- Remove and Install Lift Valve
- Disassemble and Assemble Lift Valve
- Remove and Install Brake Release Valve
- Disassemble and Assemble Brake Valve
- Remove Lift Cylinder
- Install Lift Cylinder

BS62576,0000FFD -19-13MAR14-1/1

Specifications

Item	Measurement	Specification
Lift Valve Torque Specifications		
CF, CLFW, CR, CRFW Fittings	Torque	25 N·m (18 lb.-ft.)
90° Fitting	Torque	25 N·m (18 lb.-ft.)
Solenoid Valves	Torque	27.1 N·m (20 lb.-ft.)
T Fitting	Torque	36.6 N·m (27 lb.-ft.)
Brake Valve Components		
Brake Valve	Torque	27—34 N·m (20—25 lb.-ft.)
Brake Valve Coil	Torque	27 N·m (20 lb.-ft.)
EMERG and TANK Fittings	Torque	25 N·m (18 lb.-ft.)
Pressure Switch	Torque	27 N·m (20 lb.-ft.)

BS62576,00017E2 -19-15AUG14-1/1

Repair Brakes

The brakes are an integral part of the wheel motor assembly. Brakes are released with hydraulic pressure via the park brake switch and solenoid. In the event of no hydraulic pressure, the brake can be manually released, see the “Brake Theory of Operation” for the manual override procedure. For brake service or repair see Remove Front Wheel Motor Assembly and Disassemble and Inspect Front Wheel Motor Assembly.

BS62576,000113F -19-12MAR13-1/1

Remove and Install Lift Valve

Removal

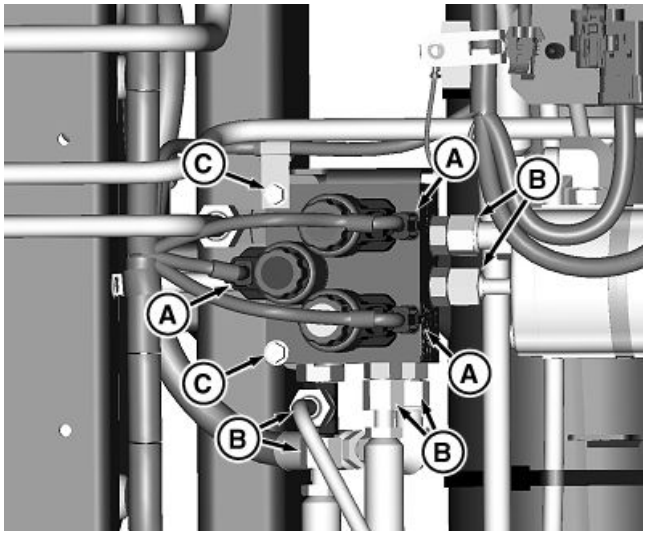
1. Park machine safely. See the “Safety Section”.
2. Fully lower lift arms to the ground.
3. Raise seat pad assembly to gain access to lift valve.
4. Pressure wash dirt and debris away from lift valve and hydraulic lines. Keep high pressure away from electrical components.

NOTE: Mark all harness connectors and hydraulic lines for installation purposes.

5. Disconnect harness connectors (A) from solenoids.
6. Remove hydraulic lines (B) from lift valve.
7. Plug hydraulic lines at tee fitting with an SAE-6 O-ring face seal plug.
8. Remove bolts (C) securing lift valve to bracket.
9. Remove lift valve from machine.

Installation

1. Place hydraulic valve into mounting position. Secure with bolts (C).
2. Connect hydraulic lines (B) and solenoid harness connectors (A) as noted during removal. Tighten to specification. (See Section 10, Group 10.)



TCT009042 —UN—15NOV13

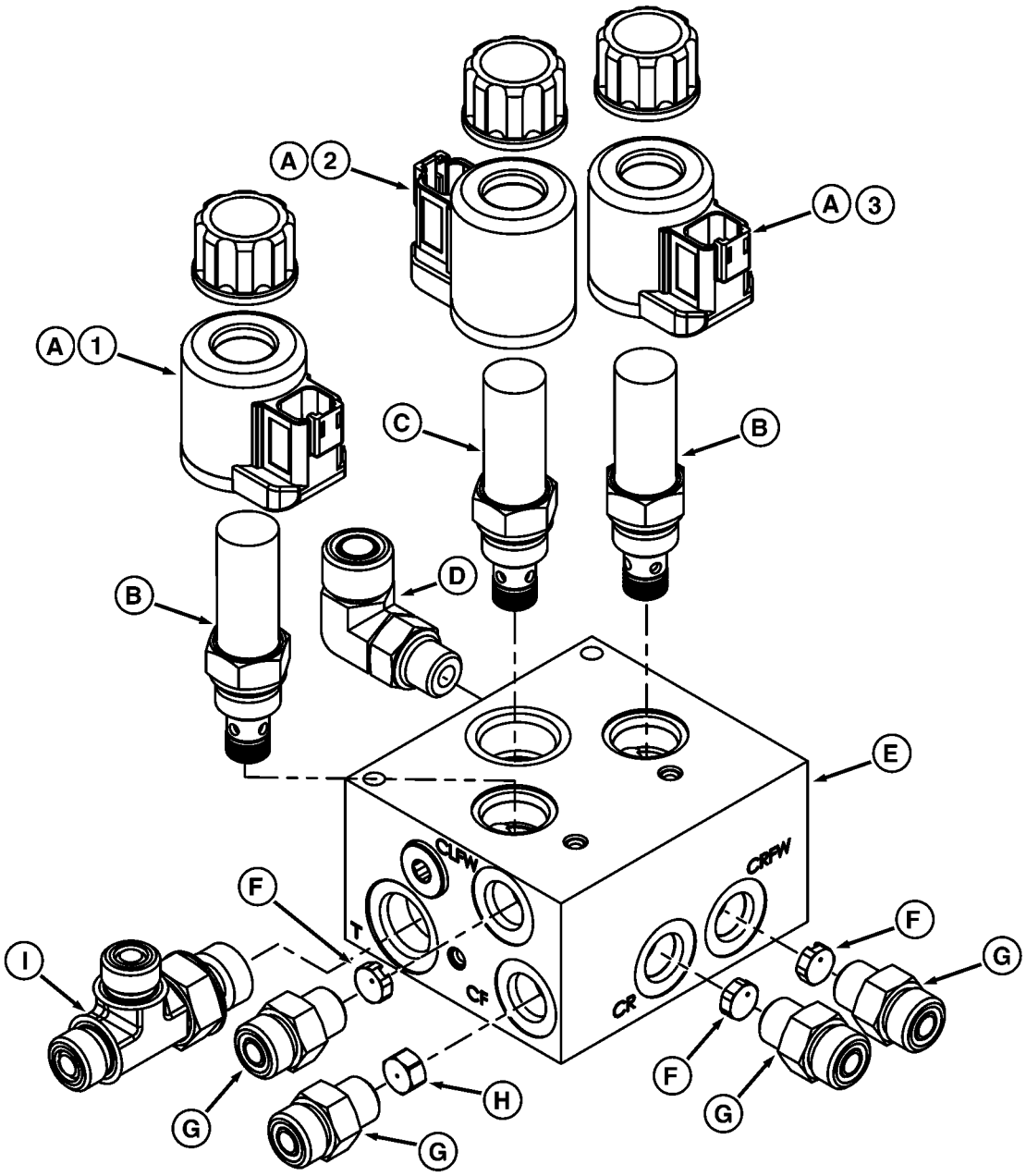
Picture Note: Components have been removed for photo clarity.

A—Connectors
B—Hydraulic Lines
C—Bolts

3. Fill hydraulic system and cycle lift system to remove air. (See Bleed Hydraulic System.)

BS62576,00015A5 -19-31MAR14-1/1

Disassemble and Assemble Lift Valve



TCT010846 —UN—12MAR14

A1—SV3 Valve Solenoid, Yellow
A2—SV1 Valve Solenoid, Blue
A3—SV2, Valve Solenoid, Red
B—Valve, 2 used
C—Valve
D—Fitting SAE 06x13/16-16 ORFS
E—Valve Block
F—Orifice 1 mm (0.04 in.), 3 used
G—Fitting SAE 06x11/16-16 ORFS, 4 used
H—Dual Orifice, 1.9/1.0 mm (0.075/0.04 in.)
I— Fitting SAE08x11/16-160RFSx11/16-16 ORFS

The valve body is a single machined block. The valves, O-rings, check valves, and seals can be removed, inspected for wear, and replaced.

1. Remove and inspect parts; replace as necessary.
   - Clean all parts with a suitable solvent. Clean bores with a brush hone and solvent.
   - Inspect bores in valve housing for scoring.
   - Inspect spools for scoring, fretting, and straightness.
2. Lubricate O-rings and backup seals before installing valves.

NOTE: Install dual orifice disk with fitting in CF port.

3. Tighten components to specification when assembling components into valve body.
4. Make sure valve solenoids have correct color tape and are installed in the correct positions.
   - SV1 Blue Tape

Continued on next page

BS62576,00016F3 -19-13MAR14-1/2

- SV2 Red Tape
- SV3 Yellow Tape

Item	Measurement	Specification
Lift Valve Torque Specifications		
CF, CLFW, CR, CRFW Fittings	Torque	25 N·m (18 lb.-ft.)
90° Fitting	Torque	25 N·m (18 lb.-ft.)
Solenoid Valves	Torque	27.1 N·m (20 lb.-ft.)
T Fitting	Torque	36.6 N·m (27 lb.-ft.)

BS62576,00016F3 -19-13MAR14-2/2

Remove and Install Brake Release Valve

Removal

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

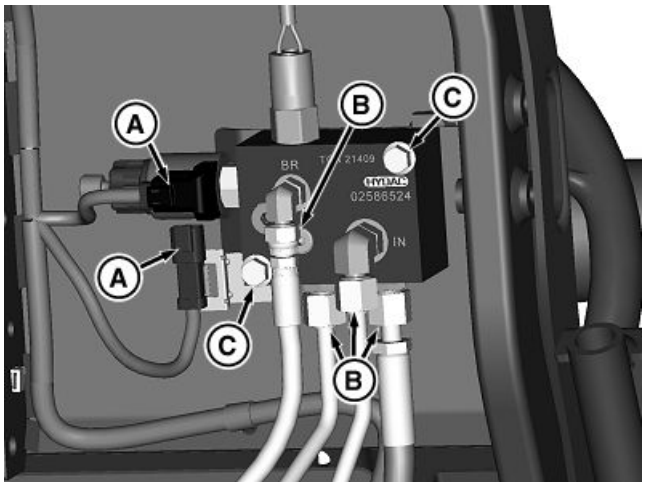
CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure 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 Deere & Company Medical Department in Moline, Illinois, U.S.A.

2. Relieve pressure from hydraulic system.

NOTE: Mark all harness connectors and hydraulic lines for installation purposes.

3. Disconnect wire harness connectors (A).
4. Remove hydraulic lines (B).
5. Remove bolts (C) securing brake release valve to frame.



TCT009043 —UN—15NOV13

Picture Note: Components have been removed for photo clarity.

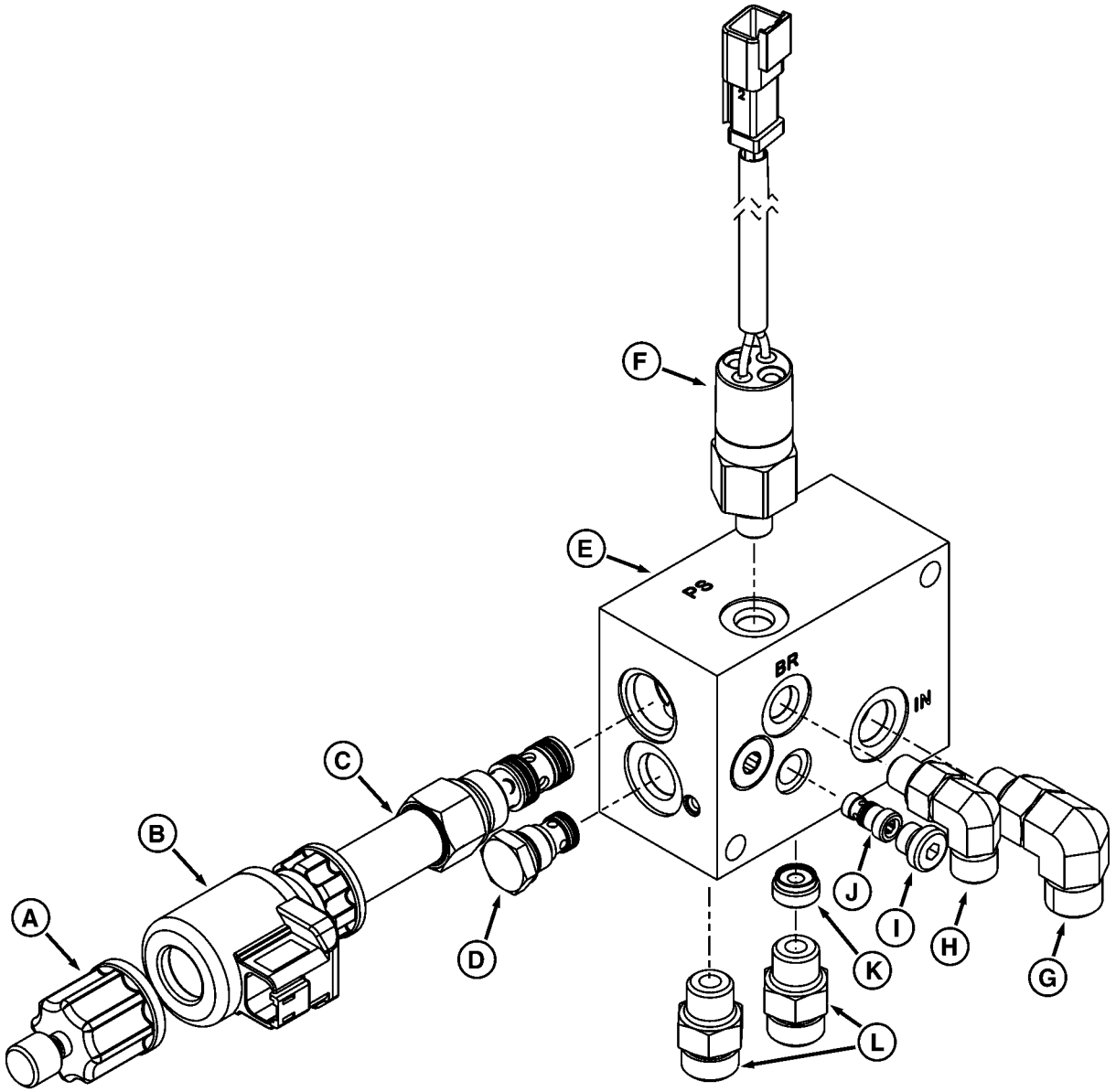
A—Connectors
B—Hydraulic Lines
C—Bolts

Installation

1. Place brake release valve into mounting position. Secure with bolts (C).
2. Connect hydraulic lines (B) and solenoid harness connectors (A) as noted during removal.
3. Fill hydraulic system and cycle lift system to remove air. Check oil level and fill as necessary. (See Bleed Hydraulic System.)

BS62576,00015A4 -19-27MAR14-1/1

Disassemble and Assemble Brake Valve



TCT010533 —UN—24FEB14

A—Manual Override Screw
B—Solenoid Coil
C—Brake Valve
D—Check Valve
E—Valve Body
F—Pressure Switch
G—Fitting, IN
H—Fitting, BR
I— Plug
J—Check Valve
K—Screened Orifice
L—Fitting (2 used)

The valve body (E) is a single machined block. The valves, seals can be removed, inspected for wear, and replaced.

1. Remove and inspect parts; replace as necessary.
   - Clean all parts with a suitable solvent. Clean bores with a brush hone and solvent.
   - Inspect bores in valve housing for scoring.
   - Inspect spools for scoring, fretting, and straightness.
2. Inspect filter screen (K) for holes. Clean debris or replace if necessary.
3. Lubricate O-rings and backup seals before installing valves.
4. Tighten components to specification when assembling components into valve body.

Item	Measurement	Specification
Brake Valve Components		
Brake Valve	Torque	27—34 N·m (20—25 lb.-ft.)

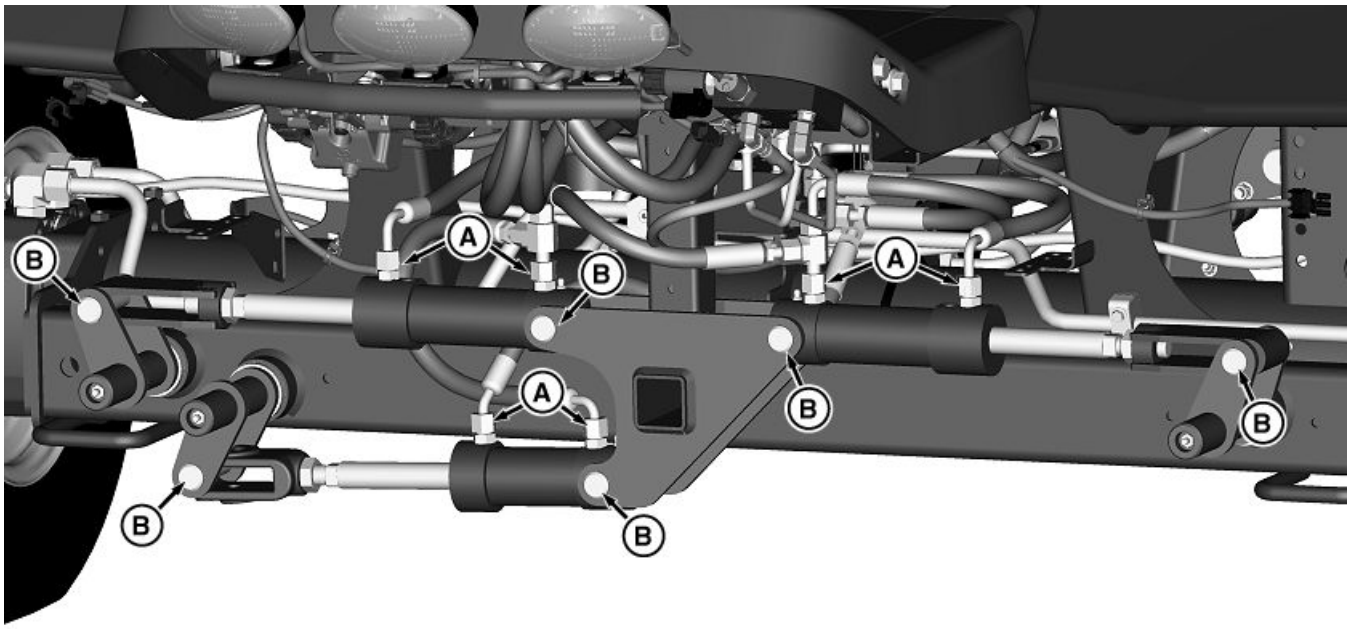
Continued on next page

BS62576,00016F4 -19-15AUG14-1/2

Item	Measurement	Specification
Brake Valve Coil	Torque	27 N·m (20 lb.-ft.)
EMERG and TANK Fittings	Torque	25 N·m (18 lb.-ft.)
Pressure Switch	Torque	27 N·m (20 lb.-ft.)

BS62576,00016F4 -19-15AUG14-2/2

Remove Lift Cylinder



TCT009053 —UN—19NOV13

Lift arms removed for photo clarity. Front cylinders shown.

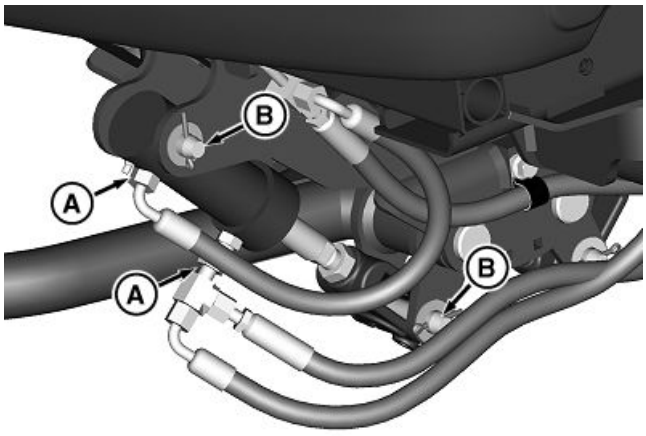
CAUTION: Avoid Injury! Lower cutting units to the ground prior to removing any hydraulic lines or fittings.

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

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 Deere & Company Medical Department in Moline, Illinois, U.S.A.

2. Fully lower cutting units to relieve hydraulic pressure.
3. Label and remove hydraulic hoses (A).
4. Remove washers and cotter pins at end of hydraulic cylinder mounting pins (B).



TCT009054 —UN—19NOV13

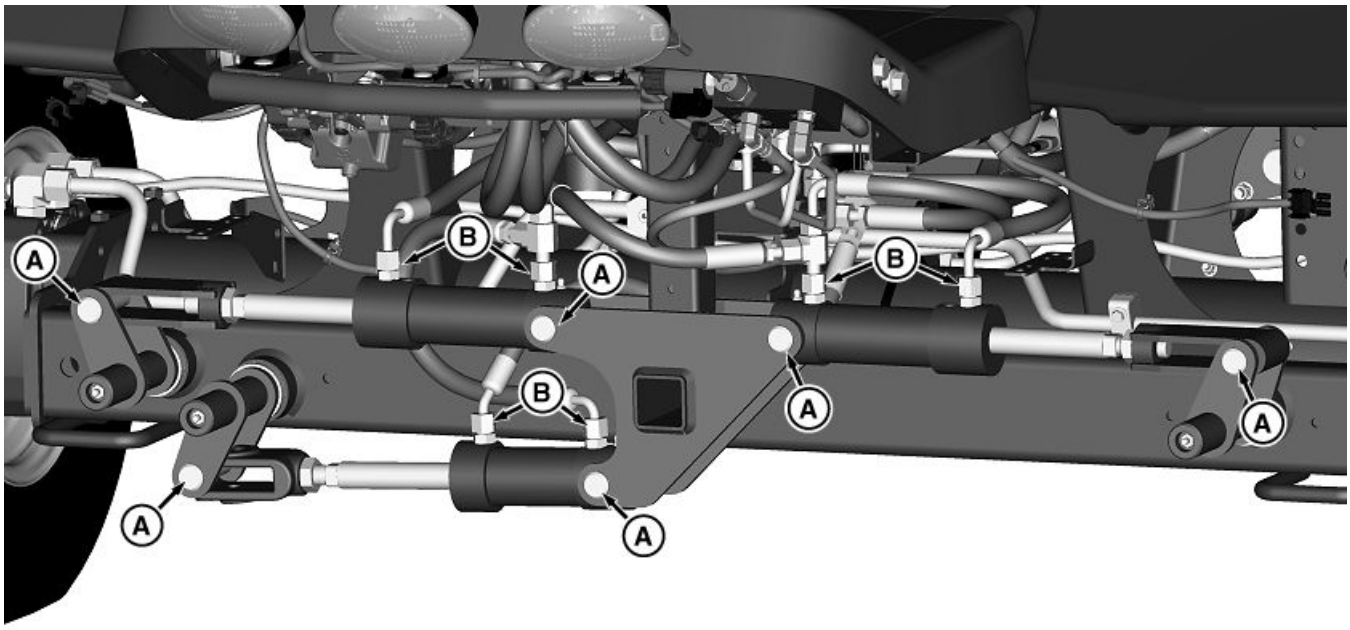
Components removed for photo clarity. Rear cylinders shown.

A—Hydraulic Hoses **B—Pin**

5. Remove mounting pins (B).
6. Remove hydraulic cylinder(s).

BS62576,00015A2 -19-27MAR14-1/1

Install Lift Cylinder

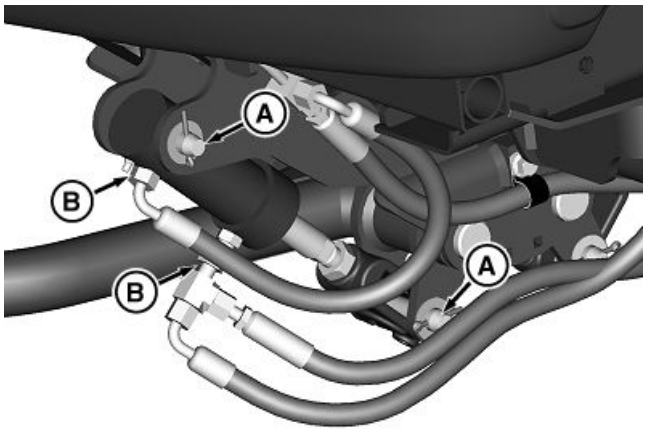


TCT009055 —UN—19NOV13

Lift arms removed for photo clarity. Front cylinders shown.

1. Install pins (A) securing lift cylinder to mounting brackets.
2. Secure pins (A) with washers and cotter pins.
3. Install new O-rings on fittings, and connect hydraulic hoses (B) as previously labeled. Tighten to specification. (See Section 10, Group 10.)
4. Start machine and cycle lift cylinders to purge air from system.
5. Check machine hydraulic fluid level.

A—Pin **B—Hydraulic Hoses**



TCT009056 —UN—19NOV13

Components removed for photo clarity. Rear cylinders shown.

BS62576,00015A3 -19-20MAY14-1/1

Summary of References

- Remove Hydraulic Pump
- Install Hydraulic Pump
- Disassemble Hydraulic Pump
- Assemble Hydraulic Pump

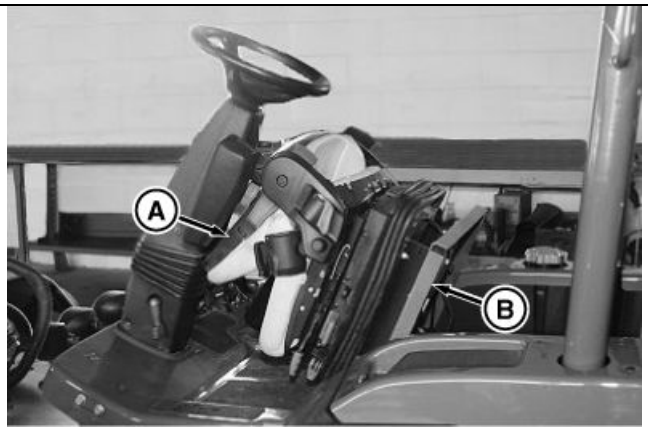
BS62576,0000FFE -19-05MAR13-1/1

Remove Hydraulic Pump

The hydraulic system pump is mounted in tandem with the hydrostatic pump. The hydraulic pump can be removed separately or with the hydrostatic pump. Remove the hydraulic pump separately if only the pump is to be serviced or replaced. Remove the hydrostatic pump and tandem pump together if comprehensive inspection or service is to be done. Service of hydraulic pumps is limited to seal replacement.

1. Park machine safely.

CAUTION: Avoid injury! 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. Use caution when filling and draining hydraulic oil. During periods of machine operation the hydraulic oil reservoir can get hot. Allow engine and oil reservoir to cool before servicing.



TCT009336 —UN—16DEC13

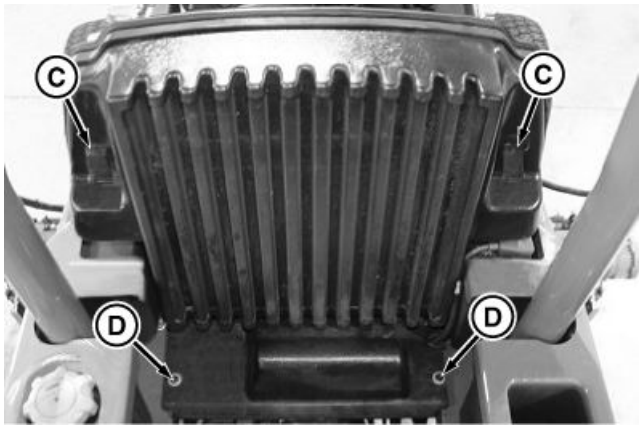
A—Seat Back **B—Seat Platform**

2. Allow machine to cool.
3. Release hydraulic pressure.
4. Fold seat backrest (A) and seat platform (B) forward.

BS62576,000104B -19-16DEC13-1/4

5. Release fasteners (C) and remove radiator cover.
6. Remove screws (D) and washers securing closeout cover. Remove cover.

C—Cam Lock Fastener (2 used) **D—Hex Screw (2 used)**



TCT009337 —UN—16DEC13

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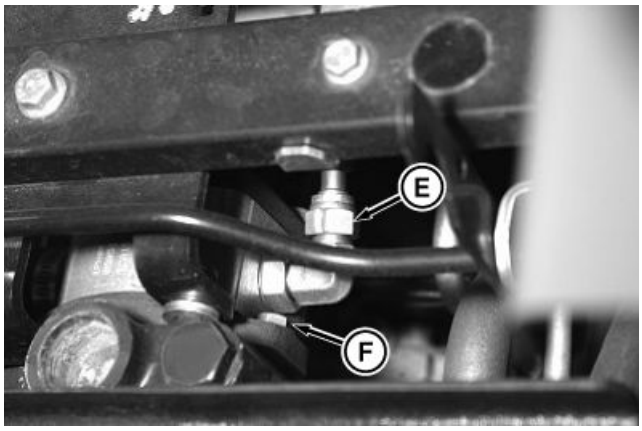
BS62576,000104B -19-16DEC13-2/4

7. Remove hydrostatic and tandem pump as a unit for comprehensive inspection or repair (See Remove Hydrostatic Pump.) or remove hydraulic pump only.
   a. Thoroughly clean area around hydrostatic and hydraulic pump.
   b. Clean hydraulic pump, especially areas around hydrostatic pump flange and pump hose connections.
   c. Remove steering valve supply hose fitting (E) from pump elbow.
   d. Loosen bolt (F) securing pump to hydrostatic pump adapter.

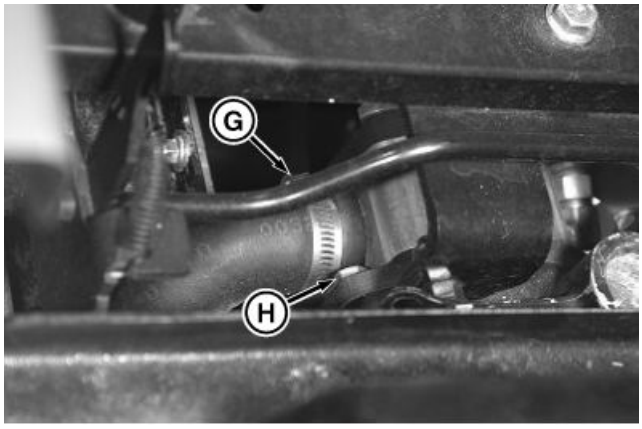


TCT009338 —UN—16DEC13

E—Hose Fitting Nut **F—Hex Bolt**

BS62576,000104B -19-16DEC13-3/4

   e. Loosen clamp (G) securing pump supply hose. Remove hose from pump fitting.
   f. Loosen second bolt (H) securing pump to hydrostatic pump adapter. Remove both bolts and remove pump.



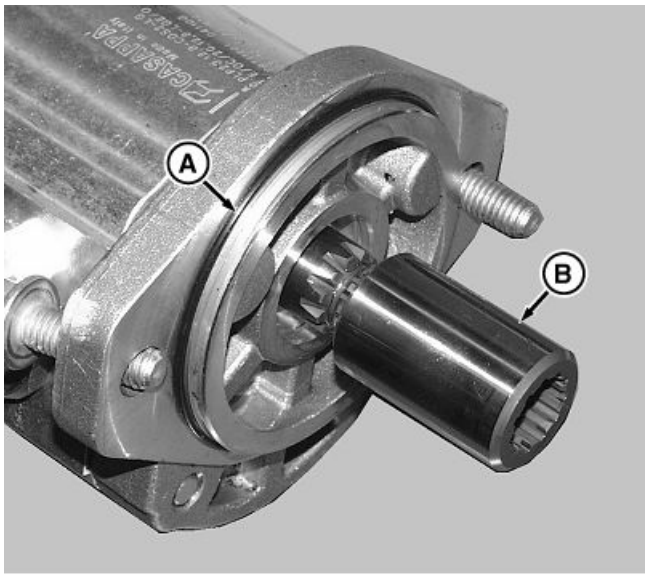
TCT009339 —UN—16DEC13

G—Hose Clamp **H—Hex Bolt**

BS62576,000104B -19-16DEC13-4/4

Install Hydraulic Pump

1. Lubricate and install O-ring (A) to pump.
2. Install coupler (B) to pump input shaft.



TCT006698 —UN—14FEB13

A—O-ring **B—Shaft Coupler**

Continued on next page

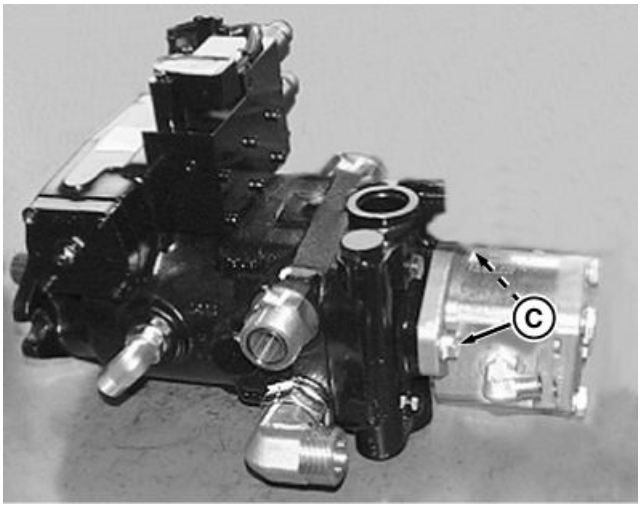
BS62576,000104C -19-21MAY14-1/4

NOTE: It may be necessary to rotate the pump assembly to align coupler and hydrostatic pump shaft splines.

3. Install tandem pump assembly to hydrostatic pump. Insert bolts (C) and tighten to specification.

Specification	
Tandem Pump to Hydrostatic Pump Bolts—Torque	63 N·m (46 lb.-ft.)

C—Hex Bolt (2 used)

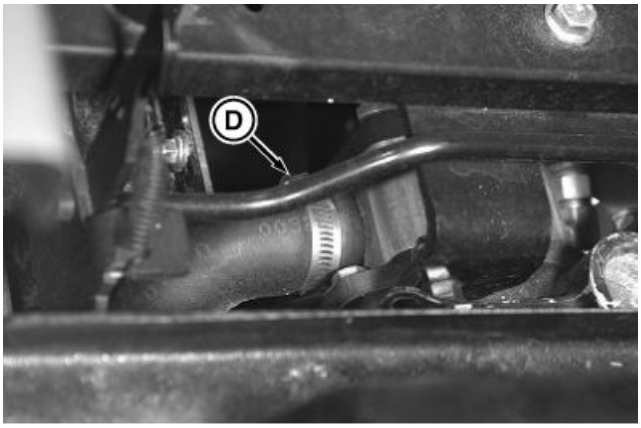


TCT009332 —UN—13DEC13

BS62576,000104C -19-21MAY14-2/4

4. Install suction hose to left side fitting and tighten clamp (D).

D—Hose Clamp

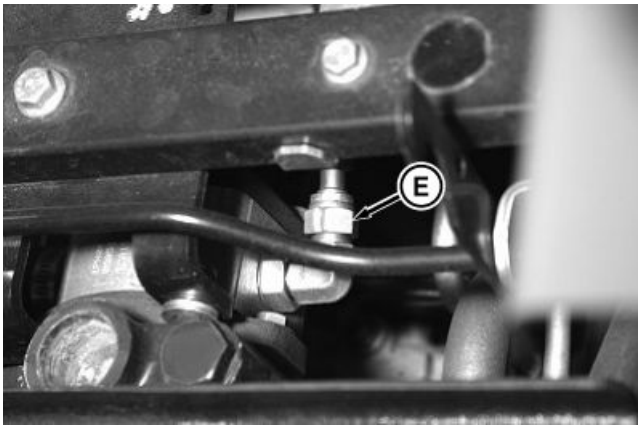


TCT009333 —UN—13DEC13

BS62576,000104C -19-21MAY14-3/4

5. Lubricate and install O-ring to steering valve hose fitting. Install hose to fitting and fitting nut (E). Tighten to specification. (See Section 10, Group 10.)
6. Fill hydraulic reservoir with specified oil.
7. Bleed air from hydraulic system. (See Bleed Hydraulic System.)
8. Check all connections for leaks. Repair if needed.

E—Hydraulic Fitting Nut



TCT009334 —UN—13DEC13

BS62576,000104C -19-21MAY14-4/4

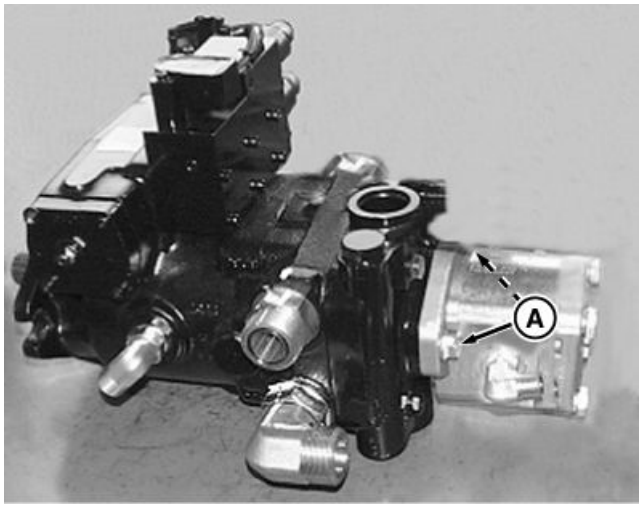
Disassemble Hydraulic Pump

Service of hydraulic pumps is limited to seal replacement. The pump may be disassembled and inspected for damage, but if any worn or broken parts are found the pump must be replaced.

Mark pump components for reassembly in correct order.

1. Remove hydraulic pump. (See Remove Hydraulic Pump.)
2. Remove bolts (A) securing pump to hydrostatic pump. Remove pump.

A—Mounting Bolts

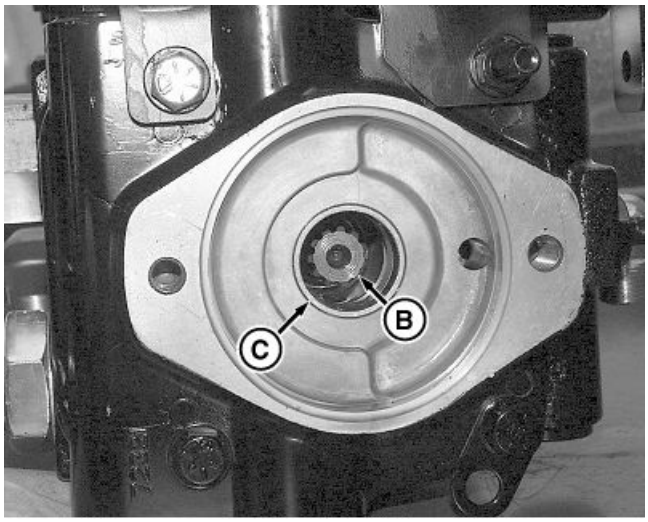


TCT009328 —UN—13DEC13

BS62576,000104D -19-13DEC13-1/6

3. Check shaft splines (B) and bushing (C) in hydrostatic pump for wear or damage.

B—Shaft Splines **C—Bushing**



TCT006465 —UN—04FEB13

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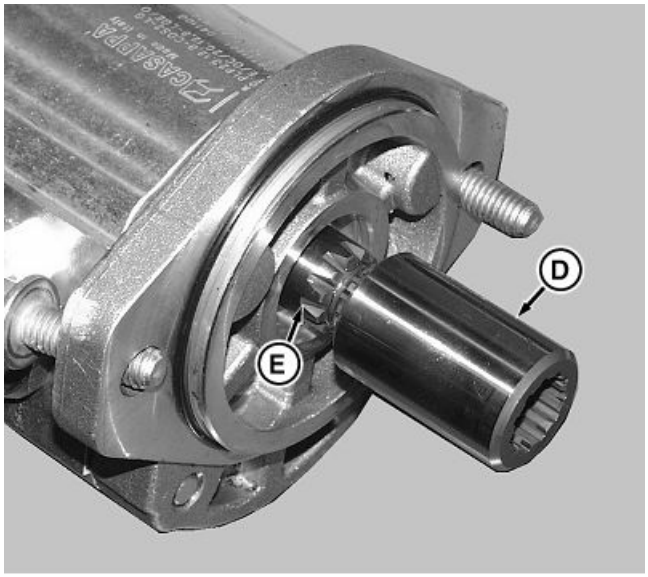
BS62576,000104D -19-13DEC13-2/6

4. Check splines in coupling (D) and pump shaft (E) for wear or damage.

D—Coupling **E—Pump Shaft**

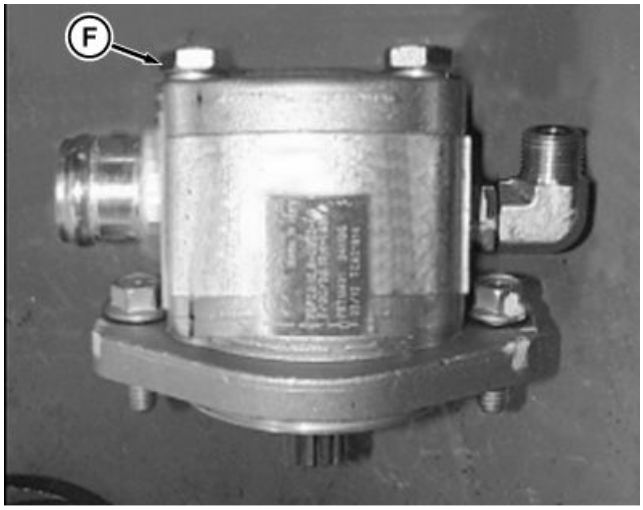


TCT006466 —UN—04FEB13

BS62576,000104D -19-13DEC13-3/6

5. Remove bolts (F) securing pump end plate and body.

F—Hex Bolt (4 used)



TCT009329 —UN—13DEC13

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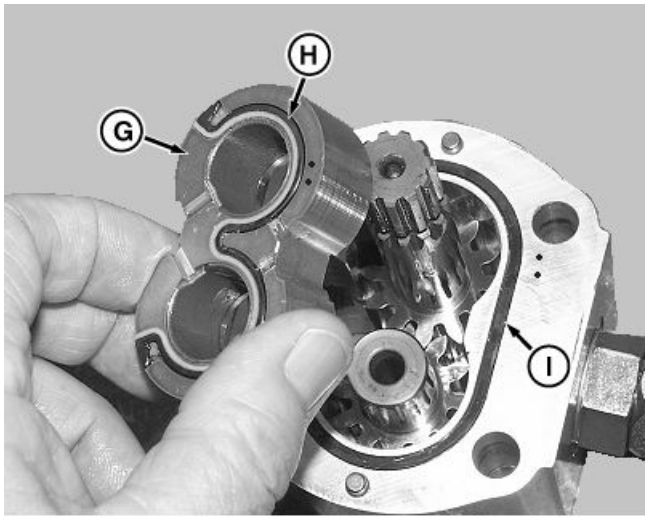
BS62576,000104D -19-13DEC13-4/6

6. Remove bushing (G). Remove and discard seals (H) and (I).

G—Bushing Assembly
H—Bushing Seals
I— End Seal

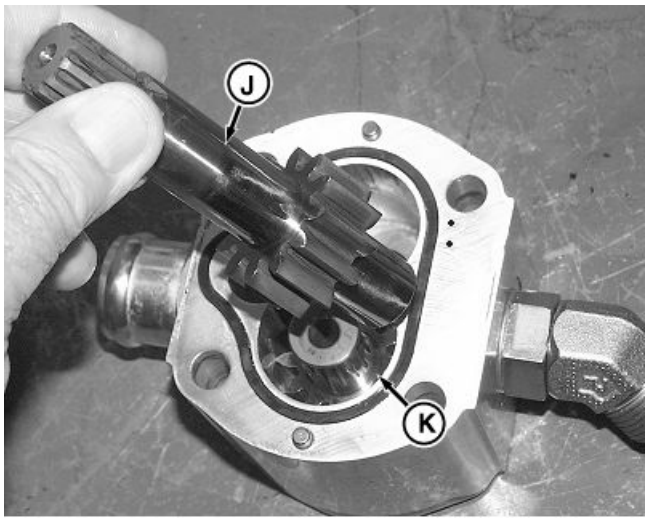


TCT009330 —UN—13DEC13

BS62576,000104D -19-13DEC13-5/6

7. Remove shaft (J) and gear (K).
8. Clean and inspect all parts. If any parts are excessively worn or broken, replace pump assembly.

J— Shaft
K—Gear



TCT009331 —UN—13DEC13

BS62576,000104D -19-13DEC13-6/6

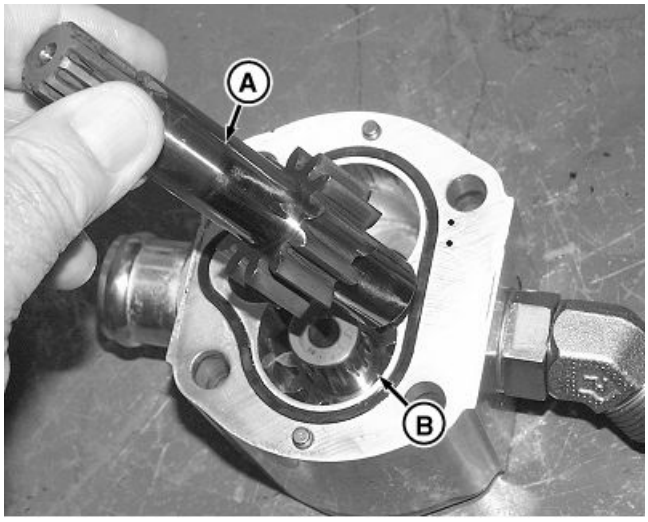
Assemble Hydraulic Pump

The hydraulic system pump is mounted in tandem with the machine hydrostatic pump.

Service of the hydraulic pump is limited to seal replacement. The pump may be disassembled and inspected for damage, but if any worn or broken parts are found the pump must be replaced.

1. Install Shaft (A) and gear (B) in original positions.

A—Shaft and Gear **B—Gear**

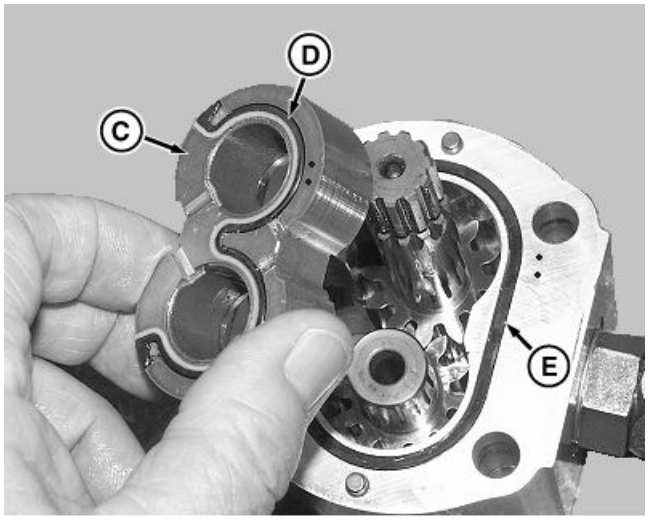


TCT006689 —UN—14FEB13

BS62576,000104E -19-27MAR14-1/5

2. Install bushing (C) to original position as marked. If not already done, replace seals (D) and (E).

C—Bushing Assembly **E—Pump Housing Seal**
D—Bushing Seals

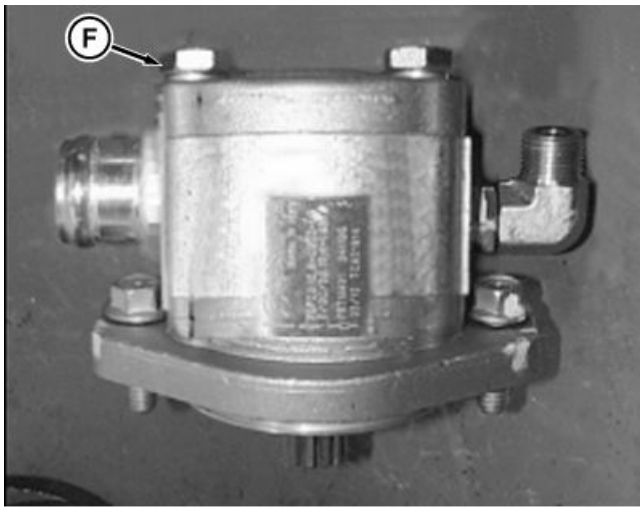


TCT006690 —UN—14FEB13

BS62576,000104E -19-27MAR14-2/5

3. Install bolts (F) through end plate and pump body, and tighten in a cross pattern. Tighten to specification. (See Section 10, Group 10.)

F—Hex Bolt (4 used)



TCT009329 —UN—13DEC13

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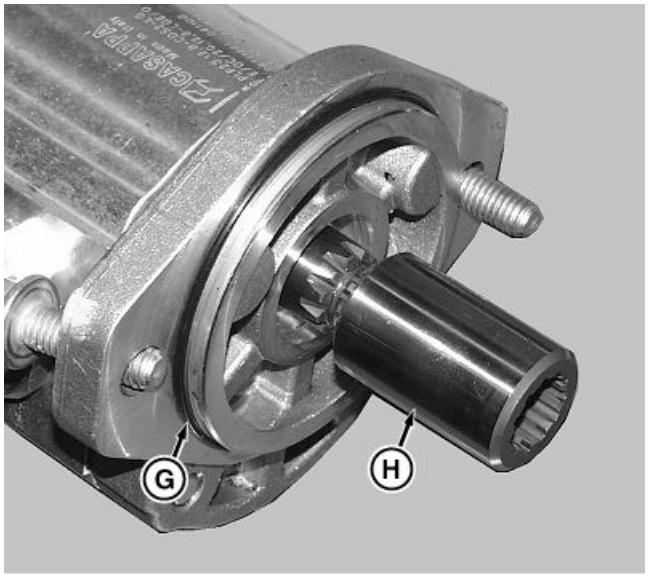
BS62576,000104E -19-27MAR14-3/5

4. Lubricate and install a new O-ring (G). Install coupling (H). Tighten to specification. (See Section 10, Group 10.)

G—O-ring **H—Coupling**

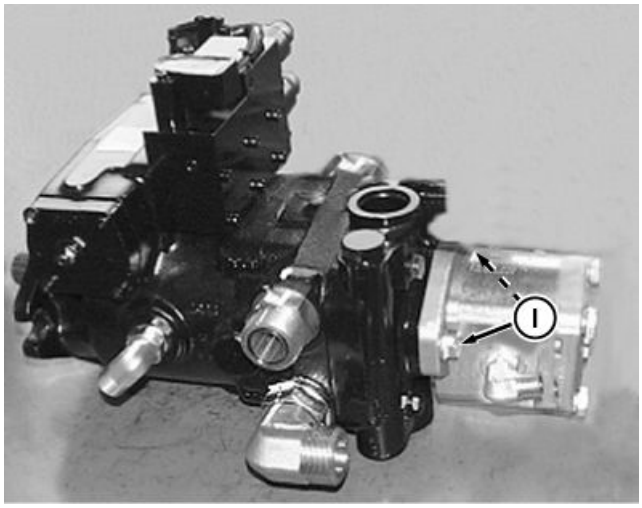


TCT006693 —UN—14FEB13

BS62576,000104E -19-27MAR14-4/5

5. Install pump assembly to hydrostatic pump and with bolts (I). Tighten to specification. (See Section 10, Group 10.)

I— Hex Bolt (2 used)



TCT009335 —UN—16DEC13

BS62576,000104E -19-27MAR14-5/5

Section 60
Steering Repair

Contents

Page

Group 10—Steering
Summary of References 60-10-1
Specifications 60-10-1
Remove and Install Steering Wheel 60-10-1
Remove Steering Column Cover 60-10-2
Install Steering Column Cover 60-10-3
Remove Steering Valve 60-10-3
Install Steering Valve 60-10-4
Remove Steering Cylinder—7500A 60-10-5
Install Steering Cylinder—7500A 60-10-6
Remove Steering Spindle—7500A 60-10-7
Install Steering Spindle—7500A 60-10-7
Remove and Install Tie Rod End—7500A 60-10-8
Remove and Install Steering Cylinder—8000A 60-10-9
Remove and Install Steering Clevis—8000A 60-10-11

Summary of References

- Remove and Install Steering Wheel
- Remove Steering Column Cover
- Install Steering Column Cover
- Remove Steering Valve
- Install Steering Valve
- Remove Steering Cylinder—7500A
- Install Steering Cylinder—7500A
- Remove Steering Spindle—7500A
- Install Steering Spindle—7500A
- Remove and Install Tie Rod End—7500A
- Remove and Install Steering Cylinder—8000A
- Remove and Install Steering Clevis—8000A

BS62576,0001000 -19-21NOV13-1/1

Specifications

Item	Measurement	Specification
Steering Wheel Retaining Nut	Torque	38 N·m (28 lb.-ft.)
Steering Valve (Ports R and L) Hose Connector	Torque	24 N·m (18 lb.-ft.)
Steering Valve (Ports P, T and E) Hose Connector	Torque	34 N·m (25 lb.-ft.)
Steering Support to Steering Valve Bolts	Torque	40 N·m (30 lb.-ft.)
Tie Rod End Stud Nut	Torque	146—170 N·m (108—126 lb.-ft.)
Steering Cylinder Mounting Screw	Torque	40.7 N·m (30 lb.-ft.)
Steering Clevis Nut	Torque	200 N·m (150 lb.-ft.)
Steering Cylinder Hose Nut	Torque	24 N·m (18 lb.-ft.)
Steering Cylinder Hose Fitting Adjustable Nut	Torque	24 N·m (18 lb.-ft.)

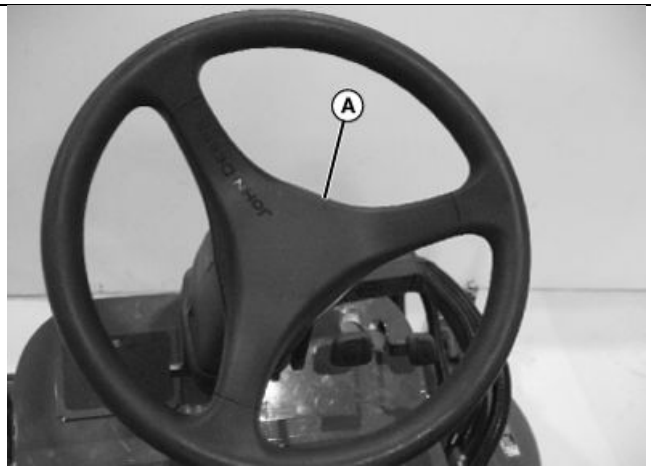
OUMX258,0000543 -19-18JUN14-1/1

Remove and Install Steering Wheel

Remove Steering Wheel

1. Remove steering wheel cover (A).

A—Steering Wheel Cover



TCAL25798 —UN—15JUN12

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SW00544,000004E -19-12JUN14-1/3

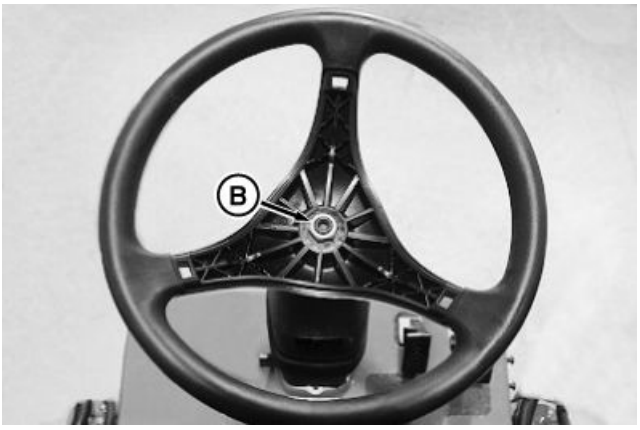
2. Remove nut (B) securing steering wheel.

IMPORTANT: Avoid Damage! DO NOT use a hammer on the end of steering shaft. Damage can occur to steering valve or shaft.

NOTE: If steering wheel cannot be pulled off shaft easily, use a knife-edge puller to remove.

3. Remove steering wheel.

B—Steering Wheel Nut



TCT009317 —UN—15NOV13

SW00544,000004E -19-12JUN14-2/3

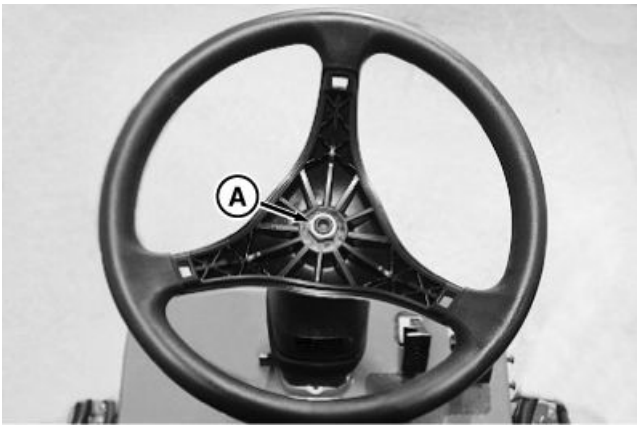
Install Steering Wheel

1. Align splines and install steering wheel to shaft.
2. Install nut (A) and tighten to specification.

Specification	
Steering Wheel Retaining Nut—Torque	38 N·m (28 lb.-ft.)

3. Install steering wheel cover.

A—Steering Wheel Nut



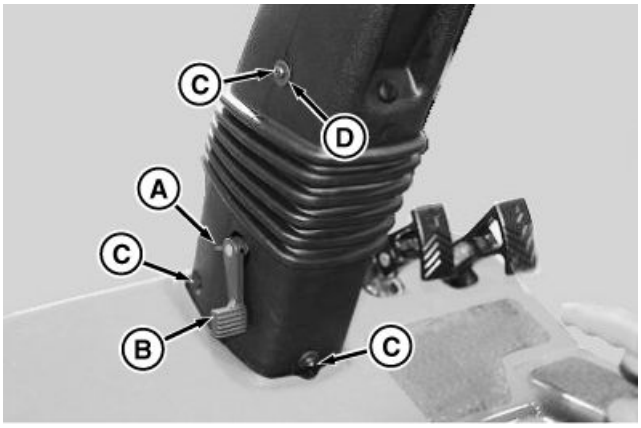
TCT009318 —UN—15NOV13

SW00544,000004E -19-12JUN14-3/3

Remove Steering Column Cover

1. Park machine safely. See “Park Machine Safely.”
2. Remove steering wheel. (See Remove and Install Steering Wheel.)
3. Displace spring pin (A) securing lever (B). Remove lever.
4. Remove screws (C) securing cover to column.
5. Remove washers (D) with upper screws.
6. Remove cover.

A—Spring Pin
B—Tilt Release Lever
C—Screw (5 used)
D—Washer (2 used)

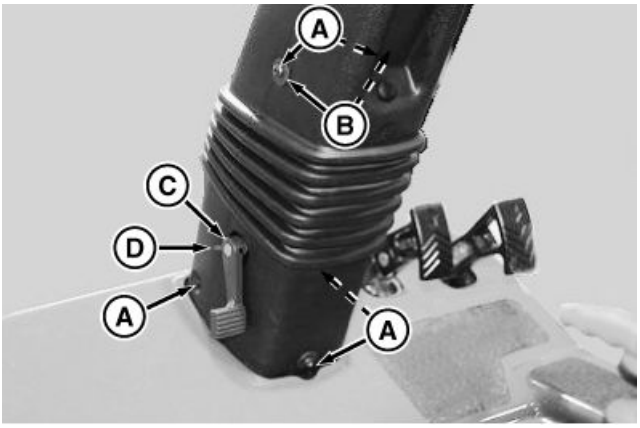


TCT009319 —UN—26MAR14

SW00544,000004F -19-15NOV13-1/1

Install Steering Column Cover

1. Install cover to steering column.
2. Align holes and install screws (A) to secure cover. Use washers (B) with upper screws.
3. Align holes and install screws (B) with washers to upper cover.
4. Install tilt lever (C) to shaft. Align holes and secure lever to shaft with spring pin (D)
5. Install steering wheel. (See Remove and Install Steering Wheel.)



TCT009320 —UN—15NOV13

A—Screw (5 used)
B—Washer (2 used)
C—Column Tilt Lever
D—Spring Pin

SW00544,0000050 -19-15NOV13-1/1

Remove Steering Valve

1. Park machine safely. See “Park Machine Safely.”

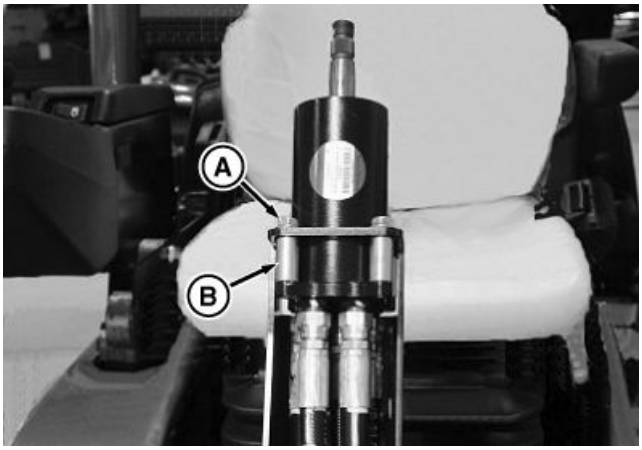
CAUTION: Avoid injury! Escaping fluid under high pressure can penetrate the skin and cause serious injury. Avoid the hazard by relieving pressure before connecting hydraulic

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 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-

2. Turn steering wheel back and forth several times with the engine off to relieve pressure from the hydraulic system.
3. Remove steering column cover.



TCT009313 —UN—15NOV13

A—Hex Bolt (4 used)
B—Spacer (4 used)

4. Remove bolts (A) and spacers (B) securing steering valve to support. Remove steering valve with hoses from front of support.
5. Place a suitable container under steering valve connections.

Continued on next page

SW00544,000004B -19-21MAR14-1/2

NOTE: Label all hydraulic hoses to matching valve ports before removal for correct reassembly.

6. Loosen hose connectors (C) and remove hoses from steering valve.

C—Hydraulic Hose Connector

TCT009314 —UN—15NOV13

SW00544,000004B -19-21MAR14-2/2

Install Steering Valve

1. Install hose fittings (A) to correct valve ports. Keep hoses straight, without twisting. Tighten hose fittings to specification.

Specification

Steering Valve (Ports R and L) Hose Connector—Torque.....24 N·m (18 lb.-ft.)

Steering Valve (Ports P, T and E) Hose Connector—Torque.....34 N·m (25 lb.-ft.)

Steering Valve Hydraulic Port Connections	
Port Marking	Port Connection
R	Right Steer
L	Left Steer
P	Pump
T	Tank
E	Power Beyond

A—Hydraulic Hose Fitting

TCT009315 —UN—15NOV13

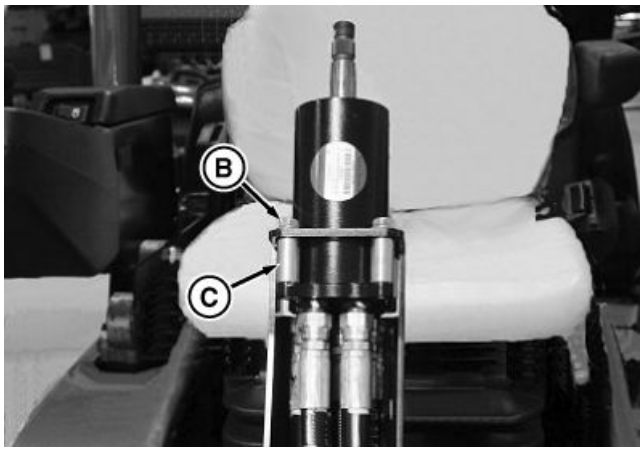
Continued on next page

SW00544,000004C -19-21MAR14-1/2

2. Rotate valve and hose assembly upward and install valve through steering support.
3. Insert bolts (B) through steering support and spacers (C) to valve. Tighten bolts evenly to specification.

Specification	
Steering Support to Steering Valve Bolts—Torque	40 N·m (30 lb.-ft.)

4. Install steering column cover and steering wheel. (See Install Steering Column Cover and Remove and Install Steering Wheel.)
5. Fill hydraulic reservoir with specified oil.
6. Bleed air from hydraulic system. (See Bleed Hydraulic System.)
7. Check all connections for leaks. Repair if needed.



TCT009316 —UN—15NOV13

B—Hex Bolt M8x45 (4 used) **C—Spacer (4 used)**

SW00544,000004C -19-21MAR14-2/2

Remove Steering Cylinder—7500A

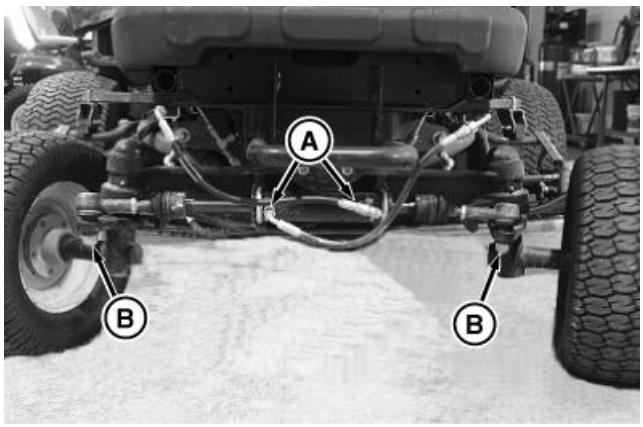
1. Park machine safely. See “Parking Safely”.

CAUTION: Avoid injury! Escaping fluid under high pressure can penetrate the skin and cause serious injury. Avoid the hazard by relieving pressure before connecting 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 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-

2. Turn steering wheel back and forth several times with the engine off to relieve hydraulic system pressure.
3. Place suitable container below steering cylinder.



TCT009213 —UN—24OCT13

A—Hose Connector **B—Rod End Nut**

4. Separate hydraulic hose fittings (A) at cylinder. Secure hose ends in a raised position to prevent loss of fluid.
5. Remove nuts (B) securing steering cylinder tie rod ends to steering arms at left and right sides. Remove tie rod ends from steering arms.

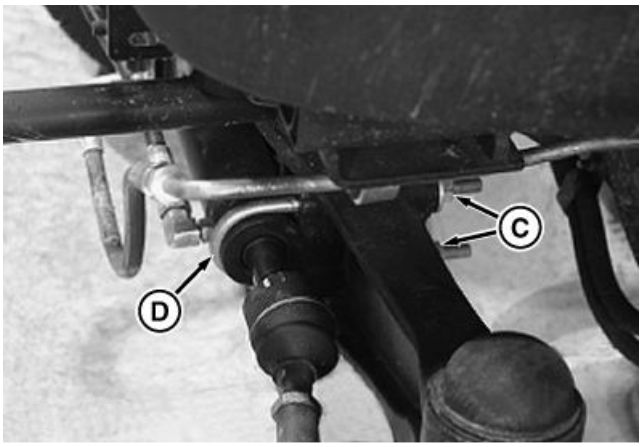
Continued on next page

BS62576,000102E -19-21NOV13-1/2

NOTE: Mark left and right ends of steering cylinder for correct installation.

6. Remove nuts (C) securing left and right steering cylinder U bolts.
7. Support steering cylinder. Remove U bolts (D) and steering cylinder.

C—Hex Nut (4 used) **D—U bolt (2 used)**



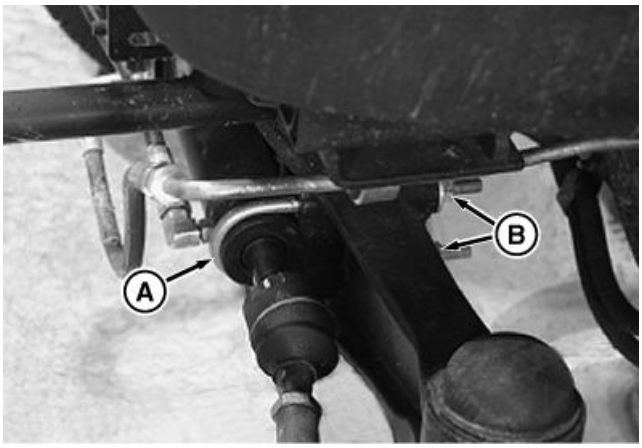
TCT009214 —UN—24OCT13

BS62576,000102E -19-21NOV13-2/2

Install Steering Cylinder—7500A

1. Position steering cylinder against axle, and install left and right U bolts (A).
2. Secure U bolts with washers and nuts (B). Tighten nuts to specification.

A—U bolt (2 used) **B—Hex Nut (4 used)**



TCT009215 —UN—24OCT13

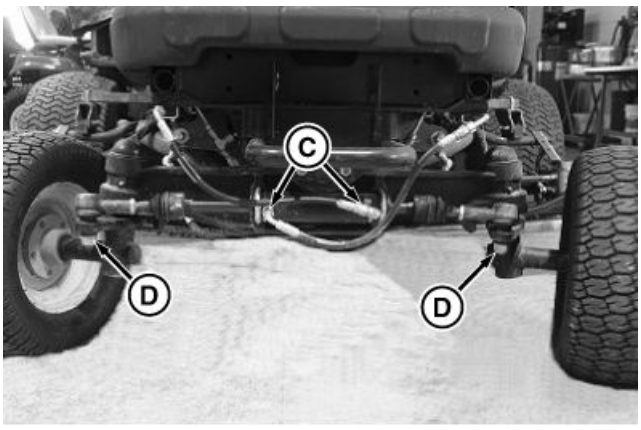
SW00544,0000052 -19-18JUN14-1/2

3. Install new O rings to hydraulic hose fittings (C), and install hoses to cylinder fittings.
4. Install tie rod ends to steering arms, and secure with nuts (D). Tighten nuts to specification.

Specification	
Tie Rod End Stud Nut—Torque	146—170 N·m (108—126 lb.-ft.)

5. Bleed hydraulic system. (See Bleed Hydraulic System.)
6. Check steering hose connections for leaks.

C—Hydraulic Hose Fitting **D—Hex Nut (2 used)**



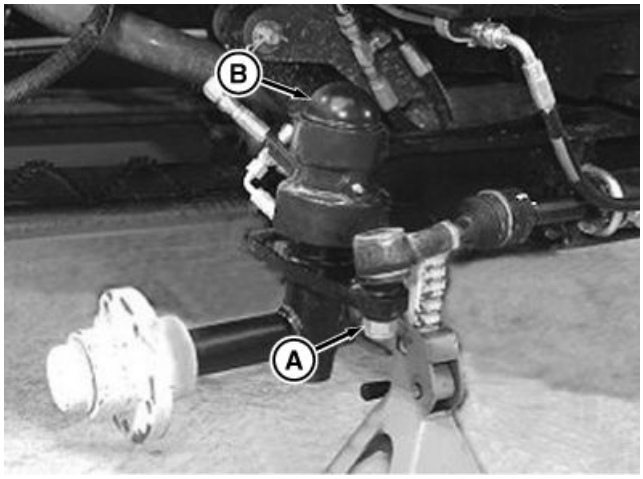
TCT009216 —UN—24OCT13

SW00544,0000052 -19-18JUN14-2/2

Remove Steering Spindle—7500A

1. Park machine safely. See “Safety Section”.
2. Raise and securely support steering axle.
3. Remove tire and wheel assembly.
4. Remove nut (A) securing tie rod end to steering arm.
5. Remove rod end from steering arm.
6. Clean dirt and debris from around spindle cap (B).
7. Remove spindle cap.

A—Hex Nut **B—Cap, Steering Spindle**

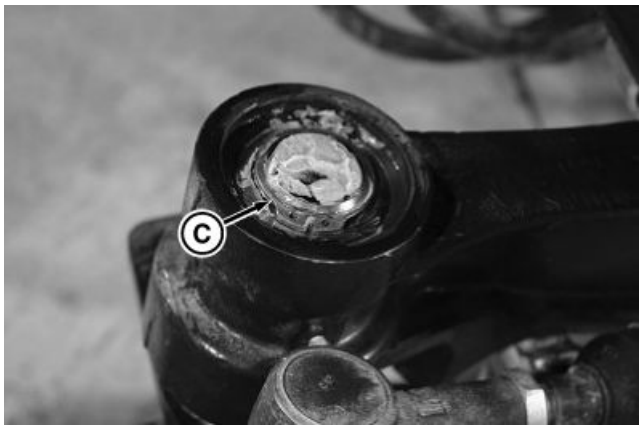


TCT009218 —UN—25OCT13

SW00544,0000039 -19-21NOV13-1/2

8. Remove snap ring (C) securing spindle. Remove spindle assembly.
9. Inspect upper and lower spindle bushings and seal. Replace components if worn or damaged.

C—Snap Ring



TCT009219 —UN—25OCT13

SW00544,0000039 -19-21NOV13-2/2

Install Steering Spindle—7500A

1. Lubricate spindle bushings and seal lip.
2. Install spindle through seal and bushings.
3. Install snap ring (A) securing spindle.

A—Snap Ring

TCT009220 —UN—25OCT13

Continued on next page

SW00544,0000054 -19-18JUN14-1/2

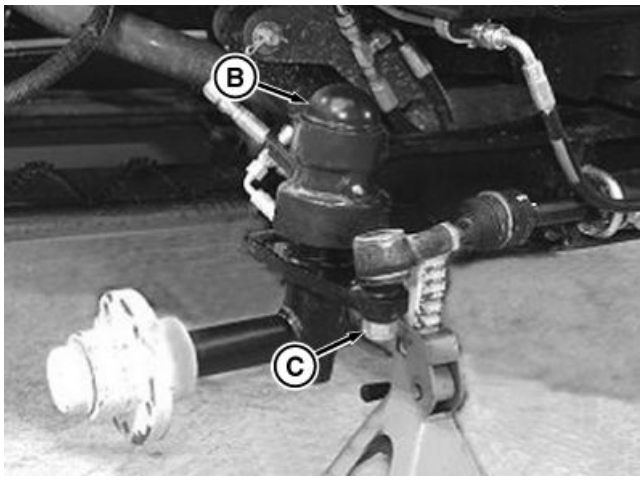
4. Install spindle cap (B).
5. Insert rod end stud into steering arm and secure with nut (C). Tighten nut to specification.

Specification

Tie Rod End Stud Nut—Torque ..... 146—170 N·m (108—126 lb.-ft.)

6. Install wheel and tire assembly.
7. Lower machine to surface.

B—Cap, Steering Spindle **C—Hex Nut**



TCT009221 —UN—25OCT13

SW00544,0000054 -19-18JUN14-2/2

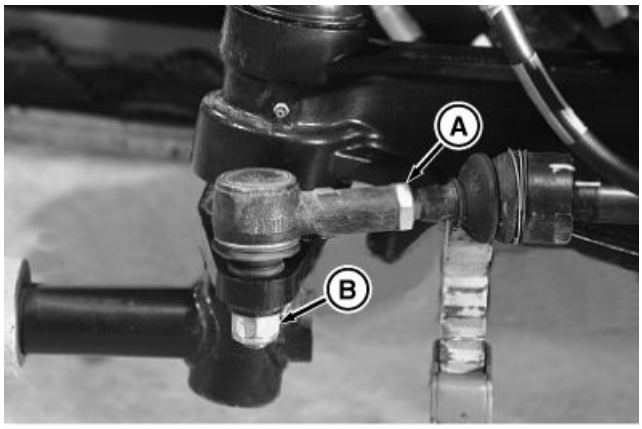
Remove and Install Tie Rod End—7500A

Remove Tie Rod End

1. Park machine safely. See “Safety Section”.
2. Raise and securely support steering axle.
3. Remove wheel and tire assembly.
4. Loosen jam nut (A).
5. Remove nut (B) securing tie rod end to steering arm.
6. Remove rod end stud from steering arm.

NOTE: Count and record the number of turns required to remove the rod end from the tie rod to maintain toe in at reassembly.

7. Remove rod end from tie rod.



TCT009217 —UN—25OCT13

A—Nut, Jam **B—Nut, Rod End Stud**

SW00544,000003C -19-18JUN14-1/2

Install Tie Rod End

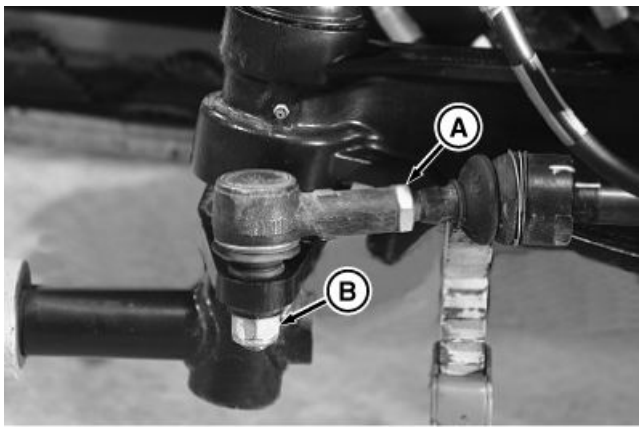
1. Install rod end to tie rod with the same number of turns as for removal.
2. Secure rod end with jam nut (A).
3. Install rod end stud to steering arm and secure with nut (B). Tighten nut to specification.

Specification

Tie Rod End Stud Nut—Torque ..... 146—170 N·m (108—126 lb.-ft.)

4. Install wheel and tire assembly.

A—Nut, Jam **B—Nut, Rod End Stud**



TCT009217 —UN—25OCT13

SW00544,000003C -19-18JUN14-2/2

Remove and Install Steering Cylinder—8000A

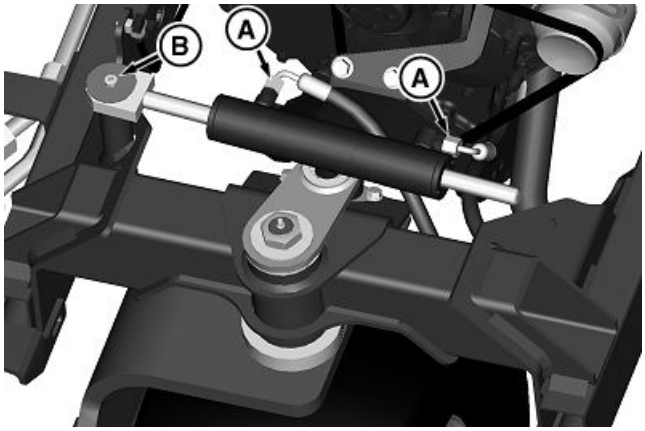
CAUTION: Avoid Injury! Escaping fluid under high pressure can penetrate the skin and cause serious injury. Avoid the hazard by relieving pressure before connecting hydraulic or other lines. Tighten all connections before applying pressure.

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 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.

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

NOTE: Label all hydraulic hoses before removing to ensure correct installation.



TCT010681 —UN—26MAR14

Grill Removed for Picture Clarity

A—Hydraulic Hoses **B—Screw**

2. Remove hydraulic hoses (A) from steering cylinder.
3. Remove washer and screw (B) securing cylinder to mounting bracket.

Continued on next page

BS62576,0001708 -19-14AUG14-1/2

4. Remove screw (C) securing steering cylinder to clevis arm. Remove cylinder.
5. Remove washer (D) and sleeve (E). Remove snap rings (F) securing bearing (G). Inspect components for wear or damage.

Installation

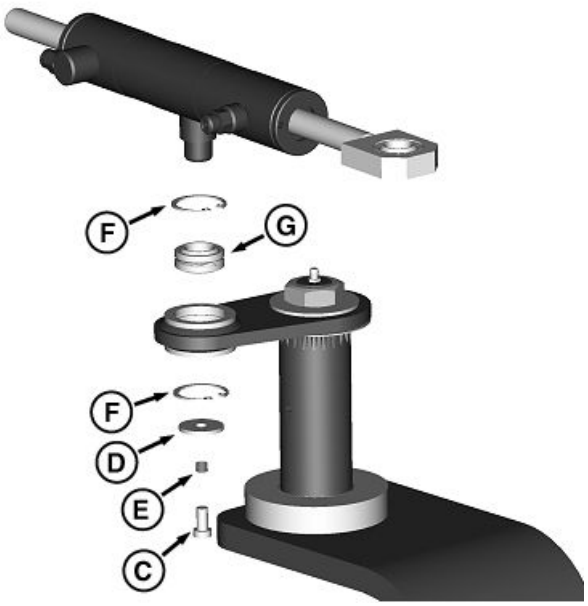
1. Installation is done in the reverse order of removal.
2. Grease splines with John Deere Special Purpose HD Moly grease before adding the clevis arm.
3. Tighten cylinder mounting hardware to specification.

Specification	
Steering Cylinder Mounting Screw—Torque	40.7 N·m (30 lb.-ft.)

4. Connect steering hoses to proper ports. Tighten to specification.

Specification	
Steering Cylinder Hose Nut—Torque	24 N·m (18 lb.-ft.)
Steering Cylinder Hose Fitting Adjustable Nut—Torque	24 N·m (18 lb.-ft.)

5. Fill hydraulic reservoir to full mark on dipstick with J20D oil.



TCT010682 —UN—26MAR14

C—Screw
D—Washer
E—Sleeve
F—Snap Ring
G—Bearing

6. Bleed air from hydraulic system.
7. Check all connections for leaks. Repair as needed.

BS62576,0001708 -19-14AUG14-2/2

Remove and Install Steering Clevis—8000A

1. Park machine safely. See the “Safety Section”.
2. Lift and support rear of machine with jackstands.
3. Remove rear wheel. (See Remove and Install Rear Wheels).
4. Remove steering cylinder. (See Remove and Install Steering Cylinder—8000A).
5. Remove rear wheel motor and move to the side without disconnecting hoses.
6. Remove nut (B) securing steering arm (D) to clevis shaft (H).

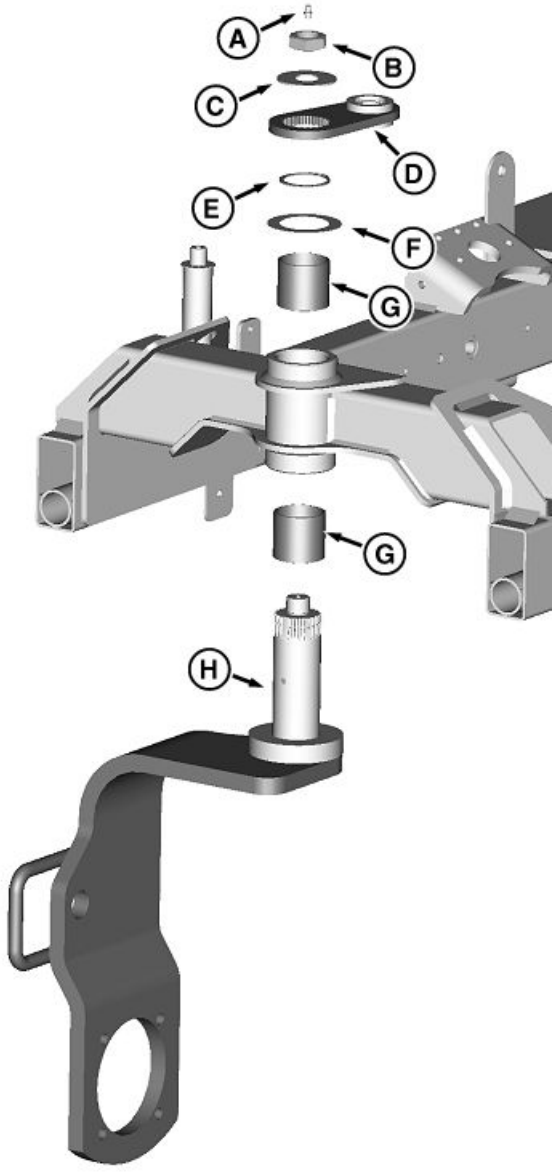
NOTE: Remove bushings only if replacement is necessary.

7. Remove snap ring (E). Inspect bushings (G) for wear or damage, replace as necessary.
8. Remove steering clevis from frame.
9. Clean and inspect all parts for wear or damage. Replace parts as necessary.

Installation

Installation is done in the reverse order of removal.

- Tighten nut (B) to specification.



TCT006873 —UN—04MAR13

A—Grease Fitting
B—Nut
C—Washer
D—Steering Arm
E—Snap Ring
F—Washer
G—Bushing
H—Steering Clevis

Item	Measurement	Specification
Steering Clevis Nut	Torque	200 N·m (150 lb.-ft.)

BS62576,000102F -19-18JUN14-1/1

Section 70
Attachments Repair

Contents

Page

Group 10—Reel Motor
Summary of References 70-10-1
Essential or Recommended Tools 70-10-1
Other Material 70-10-1
Remove and Install Electric Reel Motor 70-10-1
Reel Motor Orientation 70-10-3
Remove and Install Reel Drive Belt 70-10-4

Group 20—QA5 Cutting Unit
Summary of References 70-20-1
Other Material 70-20-1
Remove and Install Cutting Unit 70-20-1
Remove and Install Reel 70-20-3
Inspect Reel and Bed Knife 70-20-7
Remove and Install Bed Knife 70-20-8
Remove and Install Front Roller 70-20-10
Repair Front Roller 70-20-10
Remove and Install Rear Roller 70-20-11

Group 30—QA5 Cutting Unit Attachments
Summary of References 70-30-1
Essential or Recommended Tools 70-30-1
Specifications 70-30-1
Remove Greens Tender Conditioner 70-30-1
Install Greens Tender Conditioner 70-30-4
Disassemble Greens Tender Conditioner Drive 70-30-7
Assemble Greens Tender Conditioner Drive 70-30-9
Disassemble Greens Tender Conditioner Shaft 70-30-13
Assemble Greens Tender Conditioner Shaft 70-30-14
Disassemble Shaft Support Bracket 70-30-14
Assemble Shaft Support Bracket 70-30-15
Remove Power Brush 70-30-16
Install Power Brush 70-30-19

Summary of References

- Remove and Install Electric Reel Motor
- Reel Motor Orientation
- Remove and Install Reel Drive Belt

OUMX258,00006FD -19-08NOV12-1/1

Essential or Recommended Tools

NOTE: Order tools from the SERVICEGARD™ Catalog.

ESSENTIAL TOOLS listed are required to perform the job correctly and are obtainable only from the SERVICEGARD™ Catalog.

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RECOMMENDED TOOLS, as noted, are suggested to perform the job correctly. Some tools may be available from local suppliers or may be fabricated.

OUMX258,00006F8 -19-08NOV12-1/2

Puller ..... JDG10945 — Use to remove pulley from reel motor.

OUMX258,00006F8 -19-08NOV12-2/2

Other Material

Number	Name	Use
Not Applicable (U.S.)	MPG-2 (Multi-Purpose Grease)	Lubricating Shaft Splines

OUMX258,00006F9 -19-08NOV12-1/1

Remove and Install Electric Reel Motor

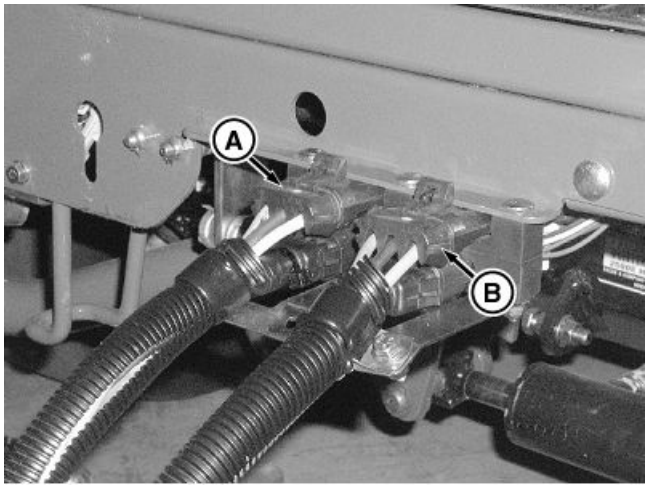
Remove

NOTE: When removing a cutting unit from the machine for service or maintenance, it is recommended to remove the reel motor and belt drive housing from the cutting unit and leave the reel motor-to-controller wiring harnesses connected. Only disconnect the motor-to-controller connectors if diagnosing a suspected faulty reel motor fault or if replacing a faulty reel motor. The routine practice of disconnecting motor-to-controller connectors can introduce contamination and cause connector pin wear.

1. Park machine safely on a hard level surface.
2. Cut tie straps that are used to secure locking tabs of reel motor-to-controller wiring harness connectors (A and B).
3. Loosen and remove hardware from reel motor wiring harness clamps.

NOTE: Mark connectors before removing to ensure correct installation.

4. Disconnect electric motor wire connectors (A and B).



TCT003409 —UN—11JUN12

Front reel motor connectors shown

A—Connector **B—Connector**

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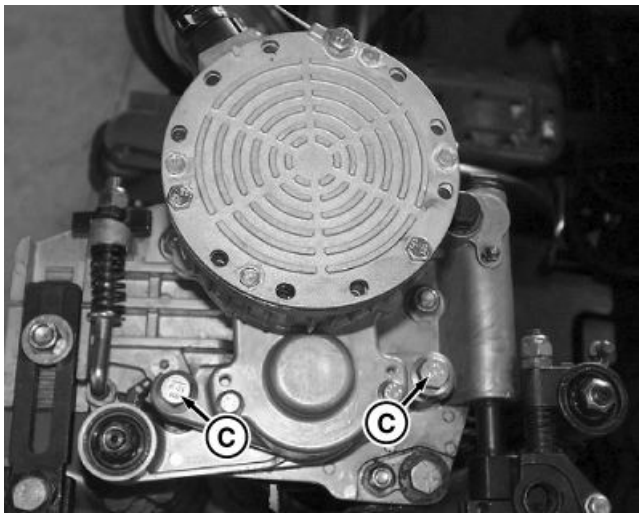
OUMX258,00006FA -19-20MAY14-1/3

5. Loosen reel motor mounting cap screws (C).

C—Screw



TCT003410 —UN—08JUN12

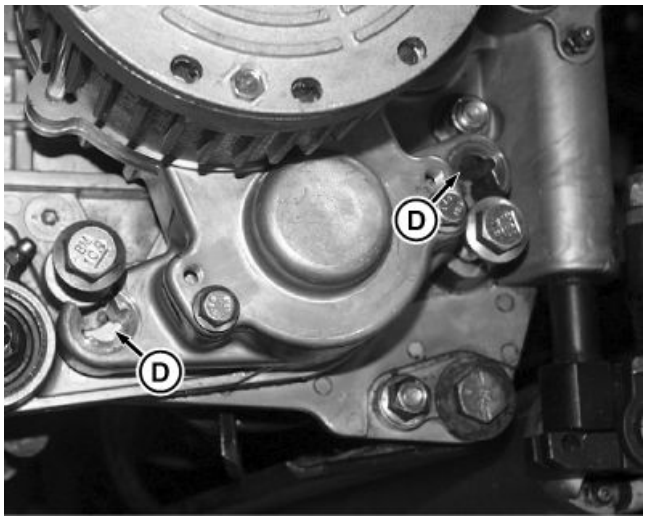
OUMX258,00006FA -19-20MAY14-2/3

6. Turn the reel motor assembly until slots (D) clear the cap screw heads.
7. Remove reel motor with belt drive housing.

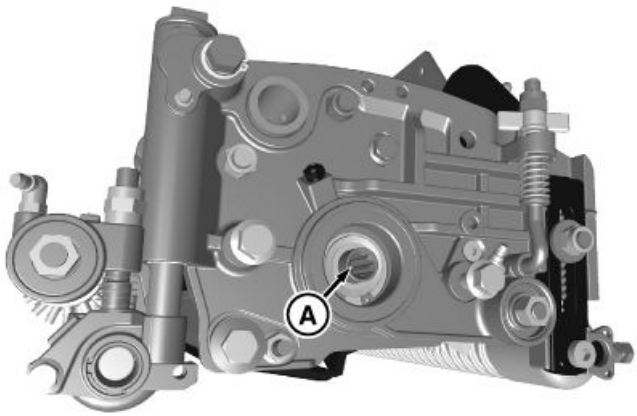
Installation

1. Installation is done in the reverse order of removal.
2. Apply MPG-2 Multi-Purpose Grease to reel shaft splines (A) before installing motor.

A—Splines **D—Slots**



TCT003411 —UN—08JUN12



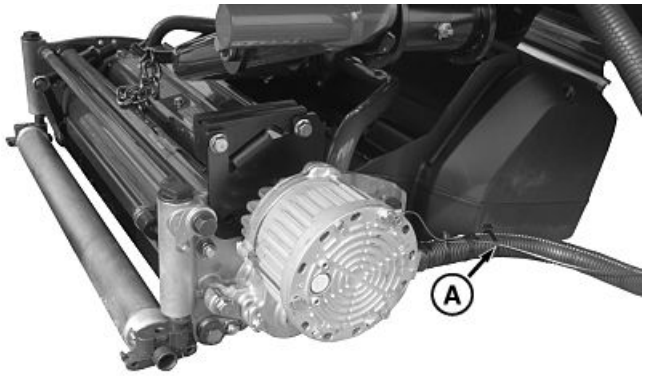
TCT003412 —UN—08JUN12

OUMX258,00006FA -19-20MAY14-3/3

Reel Motor Orientation

NOTE: Electric reel motors must all be oriented so the wiring harness (A) is horizontal and points to the front of the machine.

A—Harness



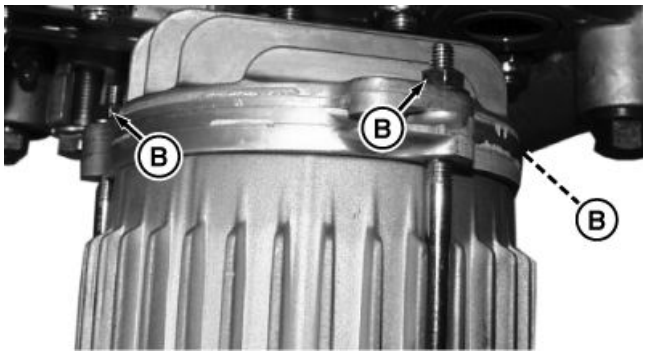
TCT003413 —UN—08JUN12

Center (Rear) Reel Shown

OUMX258,00006FB -19-08NOV12-1/3

1. Remove flange nuts (B) on cap screws.

B—Nut

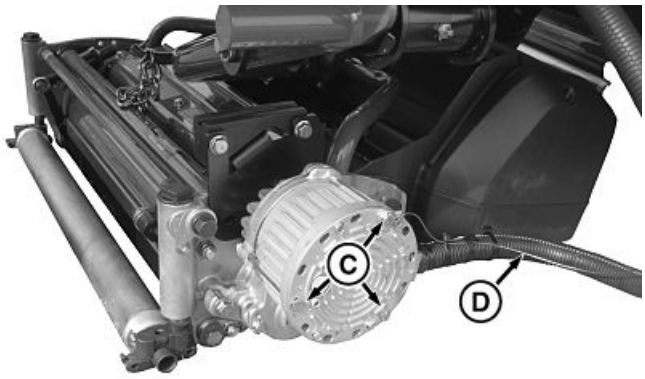


TCT003414 —UN—08JUN12

OUMX258,00006FB -19-08NOV12-2/3

2. Remove cap screws (C) and rotate motor until harness (D) is horizontal and pointing towards the front of machine.
3. Install cap screws and flange nuts.

C—Screw **D—Harness**



TCT003415 —UN—08JUN12

OUMX258,00006FB -19-08NOV12-3/3

Remove and Install Reel Drive Belt

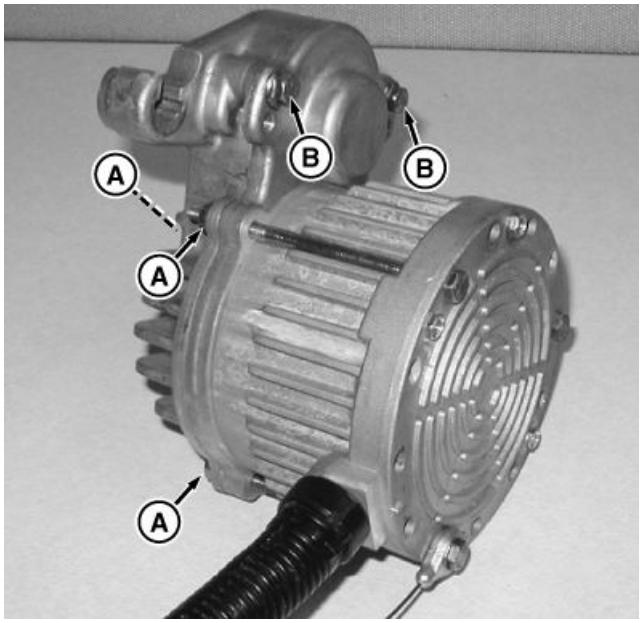
Remove

1. Remove reel motor assembly. (See Remove and Install Electric Reel Motor.)
2. Thoroughly clean and dry outside of reel motor assembly.

IMPORTANT: Avoid Damage! Do not use excessive force to remove drive cover. Be careful not to drop inner wave washer when separating assembly.

3. Remove three nuts (A) and two cap screws (B).

A—Nuts
B—Cap Screws

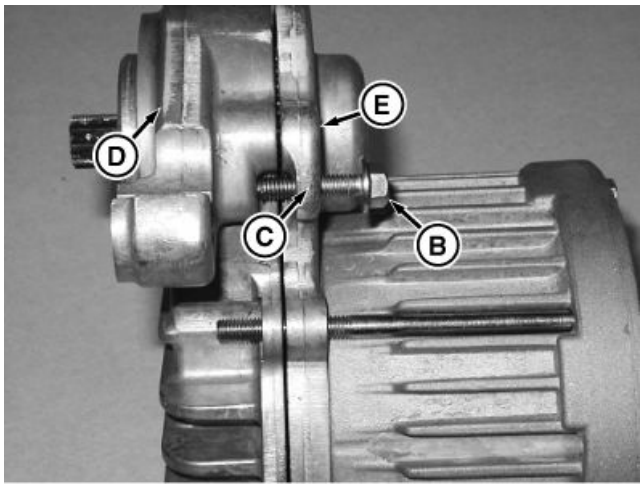


TCT003740 —UN—28JUN12

OUMX258,00006FC -19-08NOV12-1/10

4. Install two cap screws (B), removed in previous step, into jack holes (C).
5. Slowly and alternately tighten cap screws to separate drive cover (D) from reel motor (E).

B—Cap Screws
C—Jack holes
D—Drive Cover
E—Reel Motor



TCT003741 —UN—08JUN12

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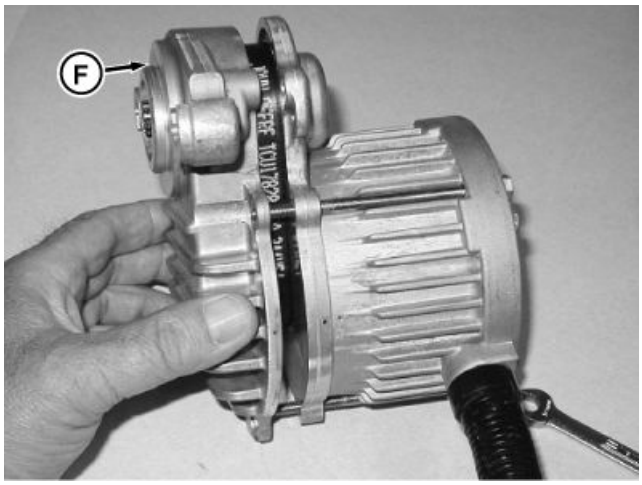
OUMX258,00006FC -19-08NOV12-2/10

6. Remove cover (F).

F—Cover

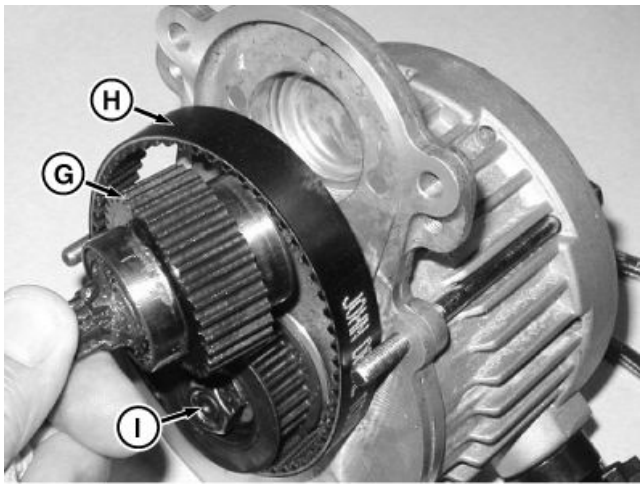


TCT003742 —UN—08JUN12

OUMX258,00006FC -19-08NOV12-3/10

7. Clean and inspect drive belt. Replace belt, if necessary.
   - Remove shaft assembly (G), belt (H), and nut (I).
8. Remove cap screws and lift housing from motor.

G—Shaft Assembly
H—Belt
I— Nut



TCT003743 —UN—08JUN12

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OUMX258,00006FC -19-08NOV12-4/10

NOTE: Avoid damage to reel motor. Only use puller to remove sprocket from reel motor shaft. Do not attempt to pry sprocket from motor shaft or apply impact to tip of motor shaft to force motor shaft from sprocket.

9. Use a puller to remove sprocket from motor as shown using JDG10945 tool.
10. Inspect drive pulleys and bearings. Replace parts as needed.

TCT003744 —UN—28JUN12

OUMX258,00006FC -19-08NOV12-5/10

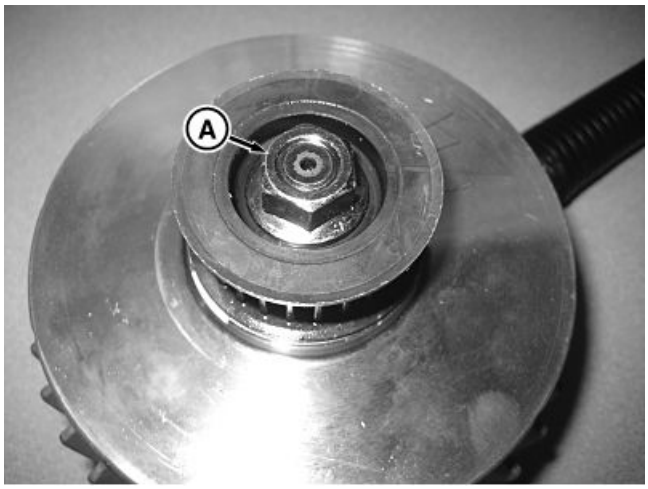
Install

1. Clean taper surface of motor shaft with clean rag. Install shaft key and install sprocket. Tighten flange nut (A) to specification.

Specification	
Reel Motor Pulley Flange Nut—Torque	43—54 N·m (32—40 ft.-lb)

2. Apply film of grease to mating surface of motor and belt housing. Install housing to motor using cap screws. (See Reel Motor Orientation.)

A—Flange Nut



TCT003745 —UN—08JUN12

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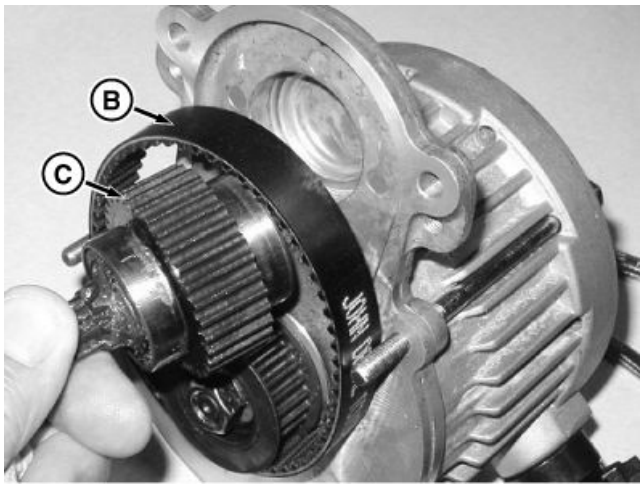
OUMX258,00006FC -19-08NOV12-6/10

3. Install drive belt (B) to shaft assembly (C) while inserting shaft into bearing bore.

B—Drive Belt **C—Shaft assembly**

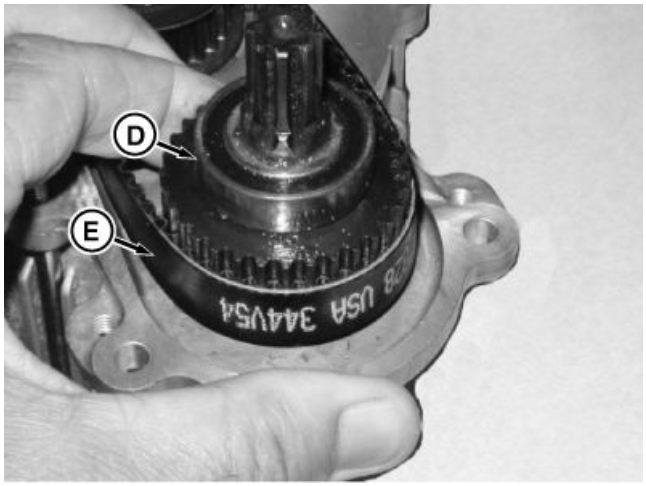


TCT003746 —UN—08JUN12

OUMX258,00006FC -19-08NOV12-7/10

4. Rotate shaft (D) and belt (E) while seating bearing to keep belt aligned in center of sprockets.

D—Shaft **E—Belt**

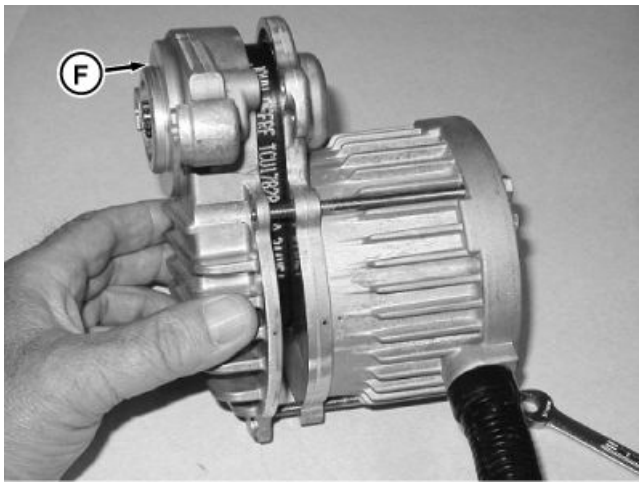


TCT003747 —UN—08JUN12

OUMX258,00006FC -19-08NOV12-8/10

5. Carefully install drive cover (F) to avoid damage to shaft seal.

F—Drive cover



TCT003748 —UN—08JUN12

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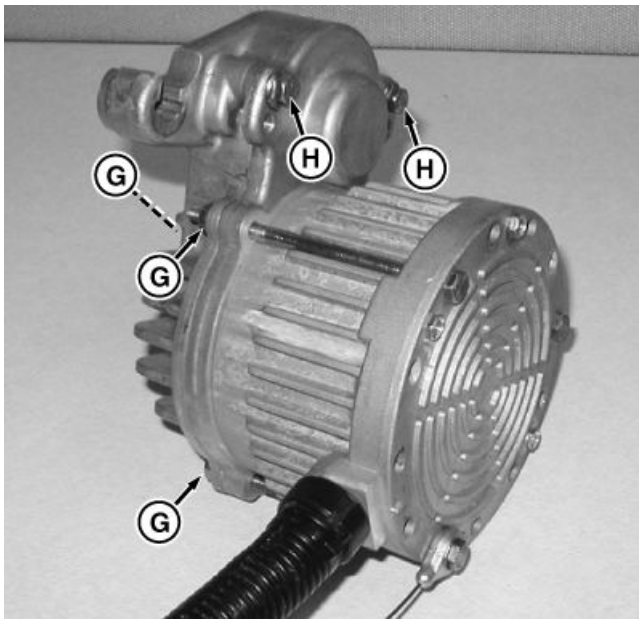
OUMX258,00006FC -19-08NOV12-9/10

6. Install three nuts (G) and two cap screws (H). Tighten in an alternating pattern.

G—Nuts **H—Cap Screws**



TCT003749 —UN—08JUN12

OUMX258,00006FC -19-08NOV12-10/10

Summary of References

- Remove and Install Cutting Unit
- Remove and Install Reel
- Inspect Reel and Bed Knife
- Remove and Install Bed Knife
- Remove and Install Front Roller
- Repair Front Roller
- Remove and Install Rear Roller

OUMX258,00006FE -19-08NOV12-1/1

Other Material

Number	Name	Use
TY25083 (U.S.)	Golf and Turf Cutting Unit Grease	Bearing Lubrication

OUMX258,00006FF -19-08NOV12-1/1

Remove and Install Cutting Unit

CAUTION: Avoid injury! Blades are sharp and rotate quickly:

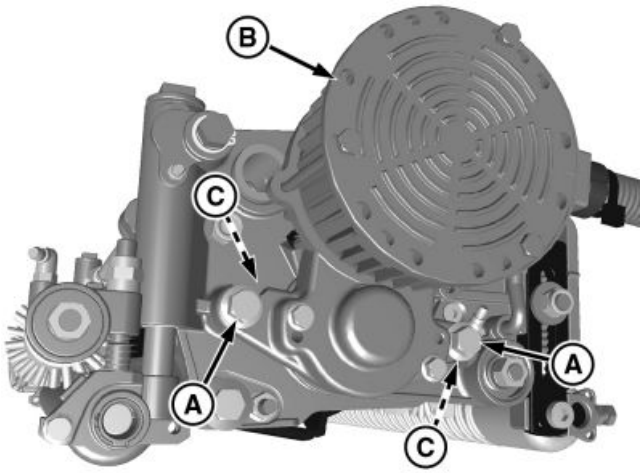
- **Keeps hands and feet away from cutting reels while machine is running.**
- **Always wear gloves while working on cutting reels.**
- **Watch for rotation of cutting reels. Rotating one cutting reel can cause another blade or cutting reel to rotate.**

Removing Cutting Units

1. Park the vehicle safely. (See Park Safely in the SAFETY section.)

NOTE: Hybrid units will need to have motor wire harness and tether pulled from J-Clamp on the yoke pivot. Then motors need to be placed on platform or on secured location to avoid damage.

2. Loosen two bolts (A), rotate motor (B) until motor housing mounting slots (C) clear bolts and remove motor from cutting unit.



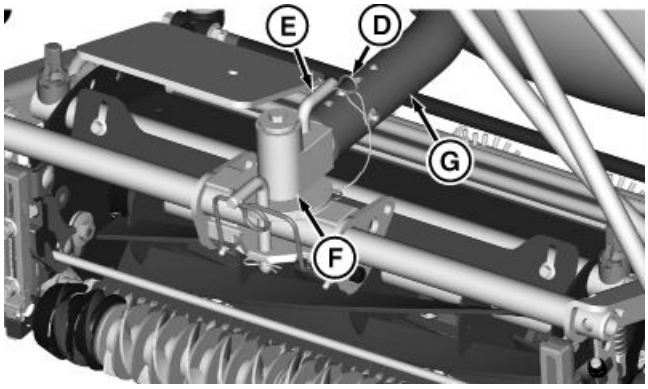
TCT006152 —UN—13NOV12

A—Bolts
B—Motor
C—Slots

BS62576,0001590 -19-27MAY14-1/5

3. Remove lower spring locking pin (D) and pin (E), and roll unit away, disconnecting yoke (F) from lift arm (G).

D—Locking Pin
E—Pin
F—Yoke
G—Lift Arm



TCT006593 —UN—23DEC13

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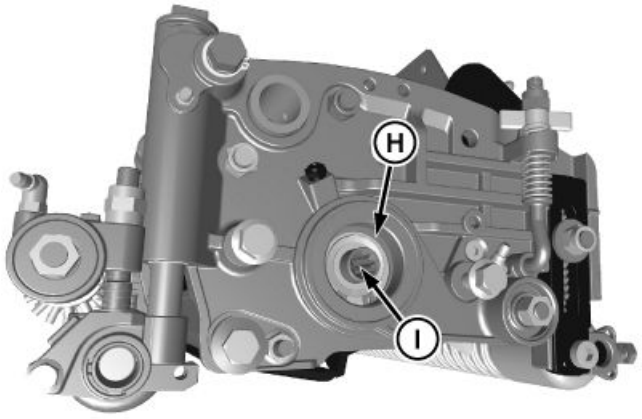
BS62576,0001590 -19-27MAY14-2/5

4. Inspect inside of reel bearing housing (H) for grease. Add John Deere Special Purpose HD Cornhead Grease to housing if additional lubrication is needed.
5. Check female reel spline (I) and mating male motor spline for wear. Repair if necessary.
6. Fill female reel spline bore with John Deere Special Purpose HD Cornhead Grease.
7. Repeat procedure for other cutting units if necessary.

H—Housing

I— Reel Spline



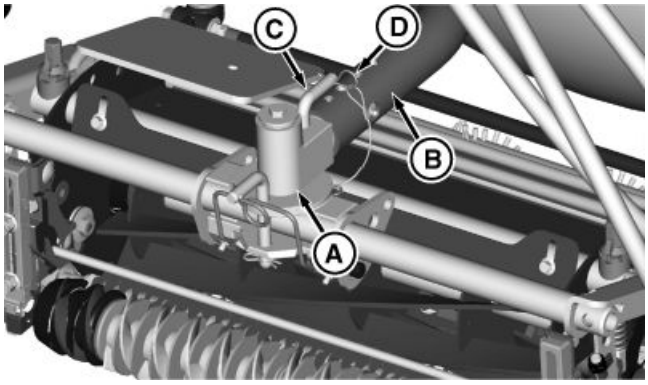
TCT006154 —UN—24FEB13

BS62576,0001590 -19-27MAY14-3/5

Installing Cutting Units

1. Install yoke (A) to lift arm (B).
2. Align yoke pin and lift arm mounting holes.
3. Fasten cutting reel in position with pin (C) and lower spring locking pin (D).

A—Yoke
B—Arm
C—Pin
D—Pin



TCT006594 —UN—23DEC13

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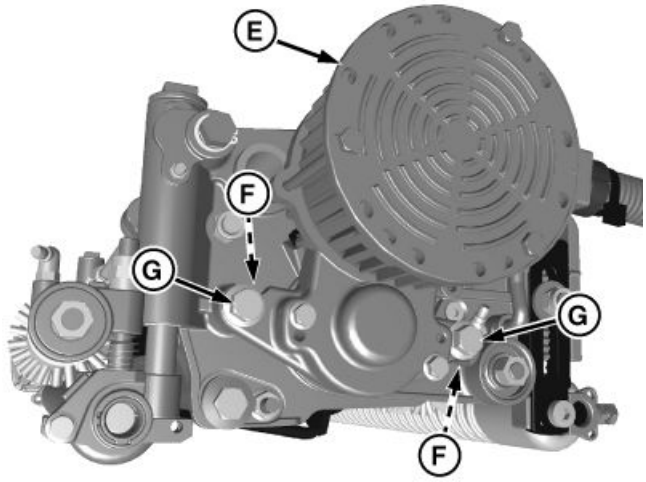
BS62576,0001590 -19-27MAY14-4/5

4. Install motor (E) onto the reel bearing housing.
   - Align female reel spline with splined motor (E) drive shaft and install motor on cutting unit.
   - Rotate motor until slots (F) align with bolts (G).
   - Tighten bolts (G).
5. Repeat procedure for other cutting units if necessary.

E—Motor
F—Slots
G—Bolts



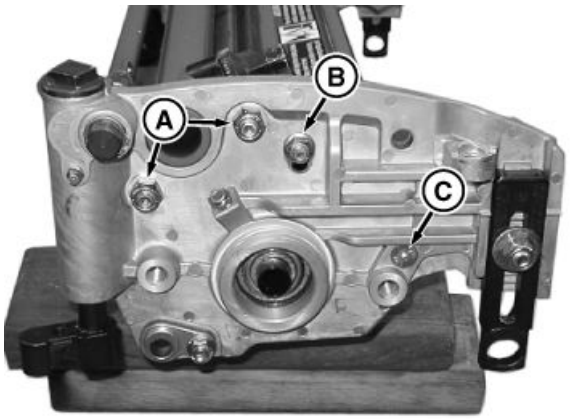
TCT006156 —UN—24FEB13

BS62576,0001590 -19-27MAY14-5/5

Remove and Install Reel

1. Remove cutting units from mower.
2. Remove greens tender conditioner (if equipped).
3. Remove front and rear rollers. (See Remove and Install Front Roller and Remove and Install Rear Roller.)
4. Remove bed knife. (See Remove and Install Bed Knife.)
5. Place cutting unit on a stable work surface.
6. Remove nuts (A) from the cross pipe, nut and bolt (B) from the shield, and tapered socket head screw (C) from small cross pipe.

A—Nuts
B—Bolt
C—Screw



TCT003428 —UN—08JUN12

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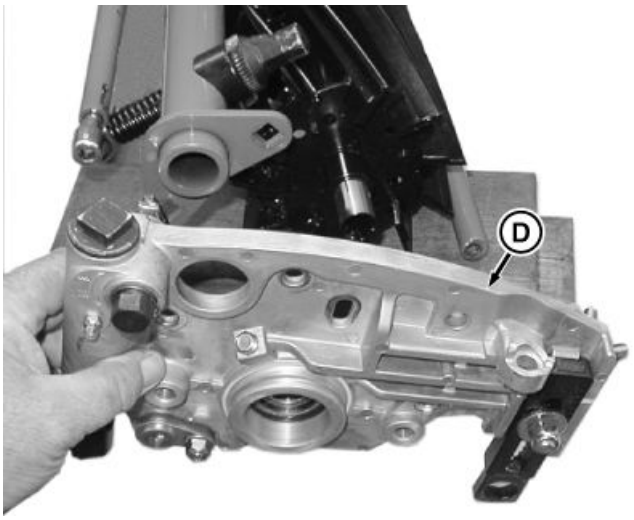
OUMX258,0000700 -19-08NOV12-1/8

7. Remove side assembly (D).

D—Assembly

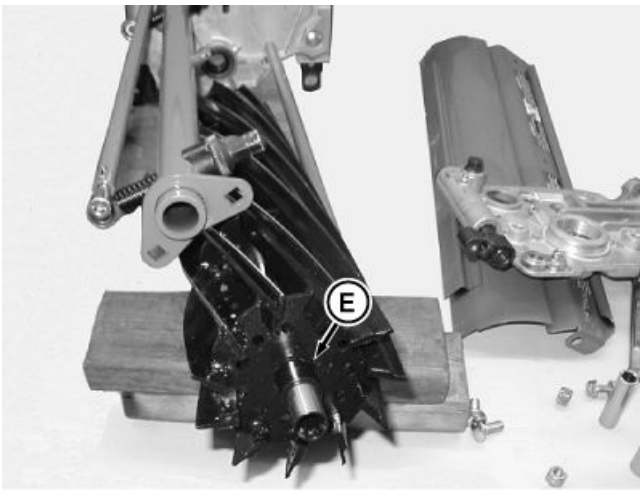


TCT003429 —UN—08JUN12

OUMX258,0000700 -19-08NOV12-2/8

8. Pull reel (E) out from other side assembly.

E—Reel

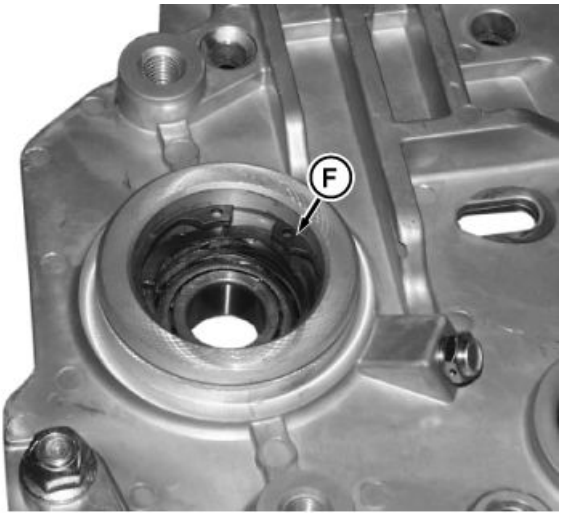


TCT003430 —UN—08JUN12

OUMX258,0000700 -19-08NOV12-3/8

9. Remove snap ring (F).

F—Ring



TCT003431 —UN—08JUN12

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OUMX258,0000700 -19-08NOV12-4/8

10. Remove wave washer (G).

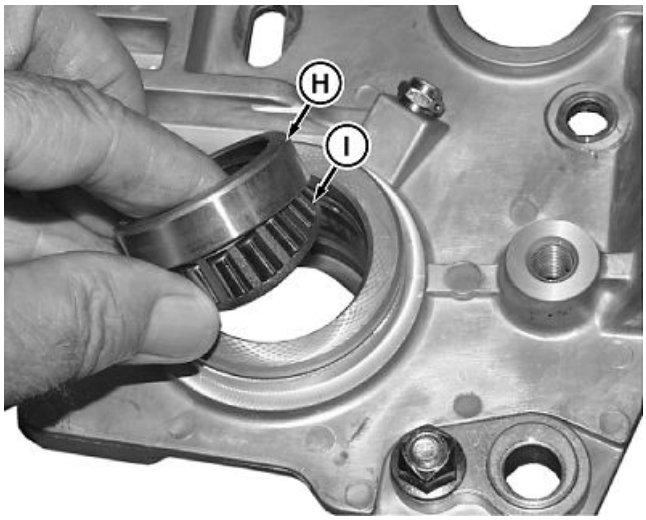
G—Washer

TCT003432 —UN—08JUN12

OUMX258,0000700 -19-08NOV12-5/8

11. Remove bearing race (H) and bearing (I)

H—Race **I— Bearing**



TCT003433 —UN—09MAY14

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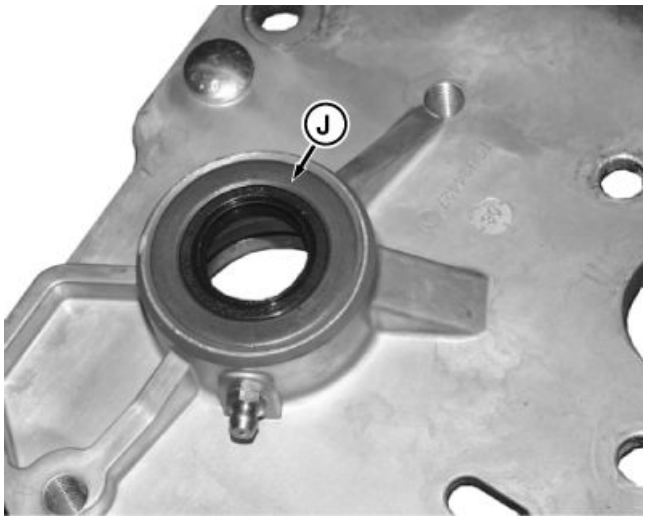
OUMX258,0000700 -19-08NOV12-6/8

12. Always replace seal (J) when servicing bearings.
13. Clean and inspect all parts. Replace parts as needed.

J— Seal



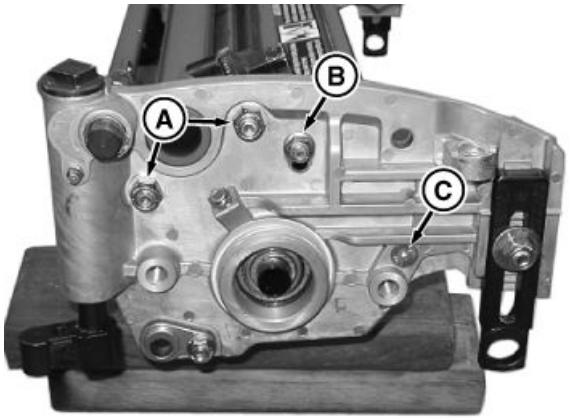
TCT003434 —UN—08JUN12

OUMX258,0000700 -19-08NOV12-7/8

Installation

1. Assembly is done in the reverse order of disassembly.
2. Correct assembly is essential to ensure proper frame alignment.
3. Install nuts (A) to the cross pipe, nut and bolt (B) to the shield, and tapered socket head screw (C) to small cross pipe.
4. Install front and rear rollers. (See Remove and Install Front Roller and Remove and Install Rear Roller.)
5. Install bed knife. (See Remove and Install Bed Knife.)
6. Align cutting unit frame. (See Align Cutting Unit Frame - QA5 Reel.)

A—Nut
B—Bolt
C—Screw



TCT003435 —UN—08JUN12

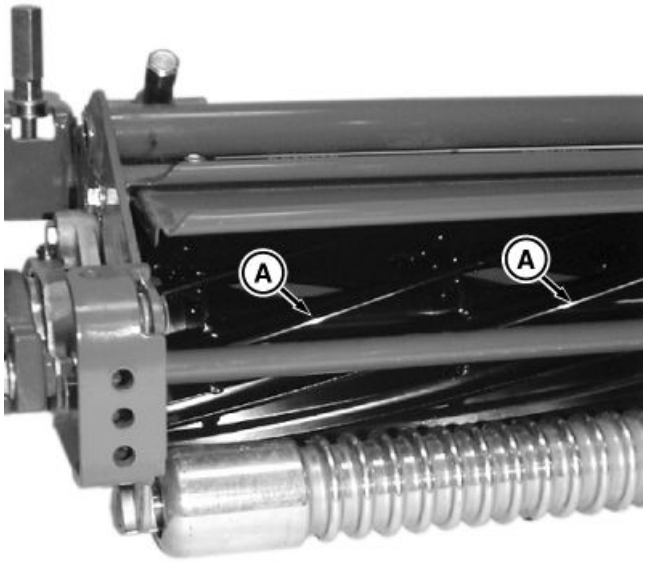
OUMX258,0000700 -19-08NOV12-8/8

Inspect Reel and Bed Knife

CAUTION: Avoid Injury! Avoid injury from rotating blades. Keep hands and feet away from blades while machine is running. Always wear protective gloves when working on or near the reel or bed knife. Severe personal injury can result from contact with the sharp cutting edges.

Never allow more than one person at a time to work on any one cutting unit. Never allow work to be accomplished on more than one cutting unit at the same time. Serious personal injury could result.

1. Visually inspect cutting unit for damage. Chipped paint, dents or gouges may indicate the need for a closer look at the frame for distortion, broken welds or other damage that could prevent proper adjustment. Repair or replace parts as necessary.
2. Inspect for vertical or lateral movement in the reel or bearings supporting the reel. Repair or replace as necessary.
3. While rotating the reel in the reverse direction by hand, inspect each blade cutting edge (A) for nicks, gouges or distortion. Ensure the cutting edge land does not exceed more than 3/4 of the blade thickness. Restore the relief angle and cutting edge before continuing with this procedure. (See Grinding Reel and Bed Knife.)

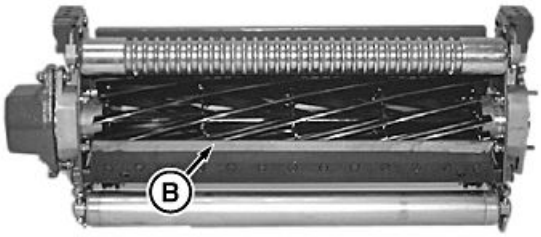


TCT003407 —UN—08JUN12

A—Edge

OUMX258,0000701 -19-08NOV12-1/2

4. Inspect the bed knife cutting edge (B) for nicks, gouges or distortion.
5. Inspect the bed knife for uneven wear (indicated by uneven land width across the length of the bed knife). Ensure the cutting edge land does not exceed 3/4 of the cutting edge. Replace the bed knife if the cutting edge extends below **1.45 mm (0.057 in.)** from the mounting surface.



TCT003408 —UN—09MAY14

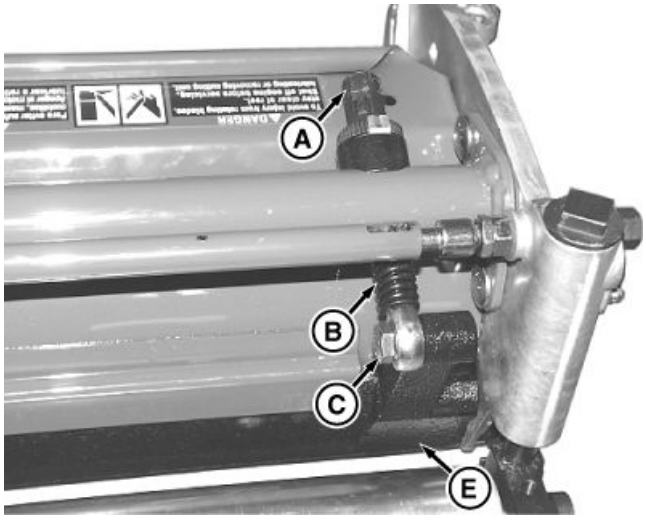
B—Edge

OUMX258,0000701 -19-08NOV12-2/2

Remove and Install Bed Knife

Removal

1. Remove the cutting unit from greens mower.
2. Position cutting unit with the bottom side down on a flat surface or workbench.
3. Relieve tension from bed knife tension springs on both sides of cutting unit.
4. Turn hex head bolt (A) counterclockwise until spring (B) is completely compressed. Repeat on opposite side.
5. Remove bolt (C) on each side connecting adjuster link to bed knife shoe.
6. Position cutting unit with bed knife up off of the bench.
7. Remove rear roller assembly. (See Remove and Install Rear Roller.)



TCT003420 —UN—08JUN12

A—Bolt
B—Spring
C—Bolt
E—Assembly

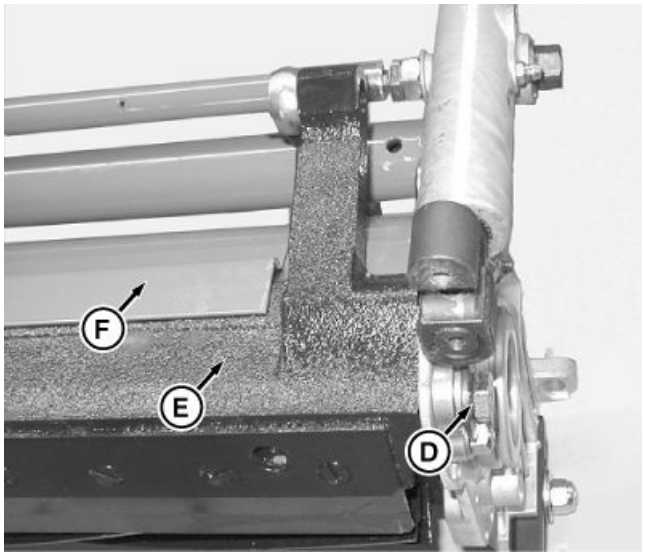
OUMX258,0000702 -19-27MAY14-1/5

8. Remove shoulder bolt and two spring washers (D) from each end of bed knife shoe.
9. Slide bed knife/shoe assembly (E) down out of shield (F) and out of the cutting unit.
10. If original bed knife is to be used again or if installing a used bed knife, grind the bed knife. (See Grinding Reel and Bed Knife.)

Installation

1. Remove and discard screws attaching bed knife to assembly support.
2. Install bed knife using new screws. Alternate tightening by starting with center screws and working out to the ends. Tighten screws to specification.

Specification	
Bed Knife Mounting Screw—Torque	7 N·m (62 lb.-in.)



TCT003421 —UN—08JUN12

D—Washer
E—Assembly
F—Shield

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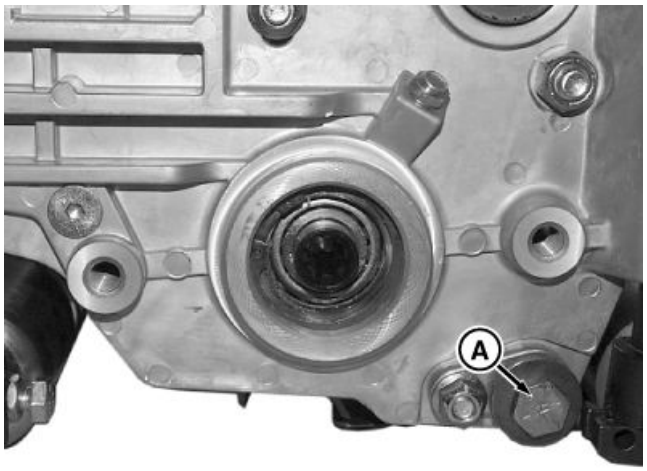
OUMX258,0000702 -19-27MAY14-2/5

3. Slide bed knife and support assembly into position and secure with bolt (A) on each side.

A—Bolt



TCT003422 —UN—08JUN12

OUMX258,0000702 -19-27MAY14-3/5

4. Install shoulder bolt with two spring washers on each side of unit. Make sure outer edges of spring washers touch and inner holes have space between them. Tighten hardware to specification.

Specification

Bed Knife Shoulder Bolt—Torque.....55 N·m (40 lb.-ft.)

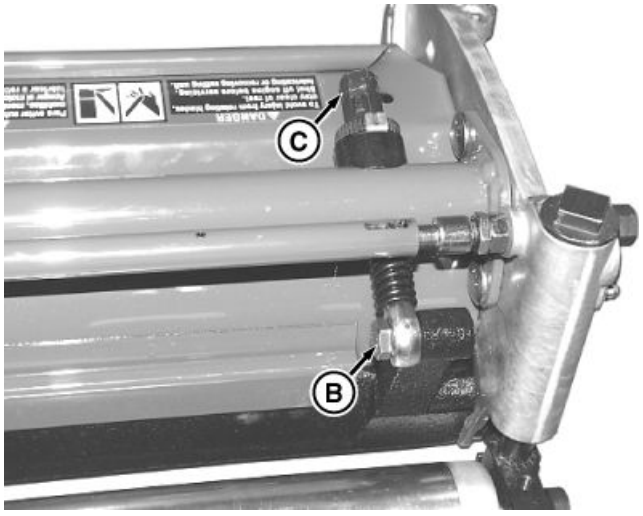
5. Position cutting unit with bottom side down on flat surface or workbench.
6. Install each adjustment assembly inside housing mounting bracket.

TCT003423 —UN—08MAY14

OUMX258,0000702 -19-27MAY14-4/5

7. Install bolts (B) through adjuster links into bed knife shoe.
8. Restore bed knife spring tension by turning hex head bolt (C) clockwise.
9. Install rear roller. (See Remove and Install Rear Roller.)
10. Adjust bed knife-to-reel. (See Adjust Bed Knife-to-Reel.)
11. Set height-of-cut.
12. Backlap reel. (See Backlapping Procedure.)
13. Check height-of-cut and adjust as necessary.

B—Bolt **C—Bolt**



TCT003424 —UN—08JUN12

OUMX258,0000702 -19-27MAY14-5/5

Remove and Install Front Roller

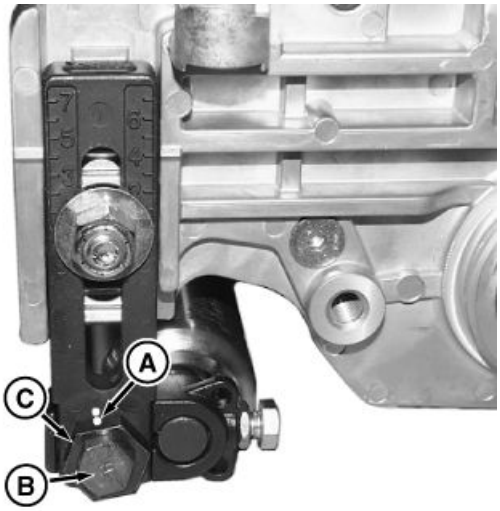
1. Remove cutting units from mower.
2. Place cutting unit on a stable working surface with the front roller suspended.
3. Place marks (A) on each eccentric and roller bracket for reassembly purposes.
4. Remove eccentric hex head screw (B) and eccentric adjuster (C) on each end of roller.
5. Remove roller and end bracket assembly.

Installation

1. Installation is done in the reverse order of removal.

NOTE: Roller brackets are offset. For standard use, the bracket should be installed on the roller with the offset to the rear of the cutting unit.

If Greens Tender Conditioner (GTC) is installed, the bracket should be installed on the roller with the offset to the front of the cutting unit.



TCT003425 —UN—08JUN12

A—Mark
B—Screw
C—Adjuster

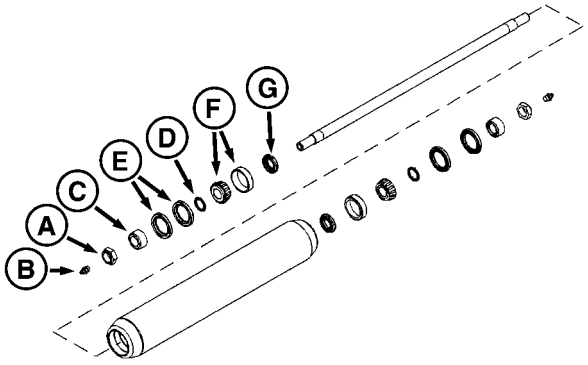
2. Install roller with eccentrics and cap screws.
3. Align marks made during disassembly on eccentrics and brackets.
4. Tighten cap screws.
5. Check roller height of cut and parallelism adjustments.

OUMX258,0000703 -19-08NOV12-1/1

Repair Front Roller

Disassembly

1. Remove front roller assembly from reel housing. (See Remove and Install Front Roller.)
2. Remove locknut (A) from both ends of shaft.
3. Remove grease fitting (B) from both ends of shaft.
4. Push shaft through roller to remove.
5. If spacer (C) and O-ring (D) do not come out with shaft, pull out to remove.
6. Remove outer seals (E).
7. Remove bearing and race (F).
8. Remove inner seal (G).
9. Repeat for opposite end of roller if needed.
10. Inspect all components and replace as necessary.



TCT003426 —UN—08JUN12

A—Nut
B—Fitting
C—Spacer
D—O-ring
E—Seal
F—Race
G—Seal

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OUMX258,0000704 -19-08NOV12-1/2

Assembly

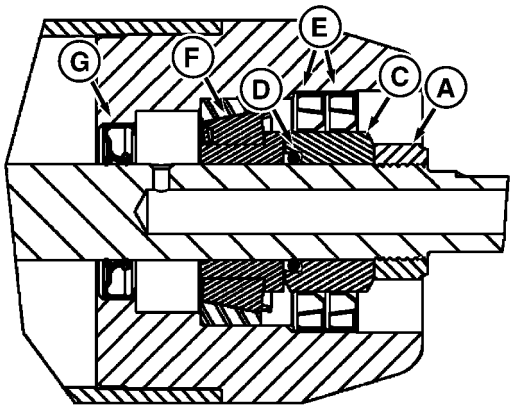
1. Install inner seal (G) with lip facing out.
2. Pack bearing (F) with TY25083 Golf and Turf Cutting Unit Grease. Install bearing.

IMPORTANT: Avoid Damage! Install outer seals with lips facing in.

3. Apply TY25083 Golf and Turf Cutting Unit Grease between lips of outer seals. Press outer seals (E) into place.
4. Install shaft in roller and approximately center it lengthwise.

IMPORTANT: Avoid Damage! Use care not to catch seal lips when installing spacer.

5. Install new O-ring (D) in spacer (C). Apply a light coat of grease to bore of spacer and install with O-ring next to bearing.
6. Repeat for opposite end of roller.
7. Install both locknuts (A) and tighten until end play is gone, yet roller rotates freely.



TCT003427 —UN—28JUN12

A—Nut
C—Spacer
D—O-ring
E—Seal
F—Bearing
G—Seal

8. Install front roller assembly onto reel housing. (See Remove and Install Front Roller.)

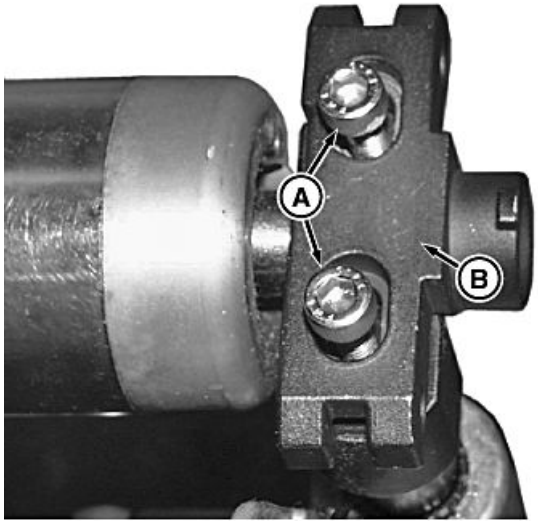
OUMX258,0000704 -19-08NOV12-2/2

Remove and Install Rear Roller

1. Remove cutting units from mower.
2. Remove roller brush (if equipped).
3. Place cutting unit upside down on a stable working surface (rollers facing up).
4. Remove cap screws (A) and caps (B) on both sides of cutting unit.
5. Remove roller.

Installation

1. Install roller bearing spindle shaft into cutting unit.
2. Center rear roller between brackets.
3. Install caps and cap screws on both sides of cutting unit.
4. Tighten cap screws.



TCT003436 —UN—09MAY14

A—Screw
B—Cap

OUMX258,0000705 -19-08NOV12-1/1

Summary of References

- Remove Greens Tender Conditioner
- Install Greens Tender Conditioner
- Disassemble Greens Tender Conditioner Drive
- Assemble Greens Tender Conditioner Drive
- Disassemble Greens Tender Conditioner Shaft
- Assemble Greens Tender Conditioner Shaft
- Disassemble Shaft Support Bracket
- Assemble Shaft Support Bracket
- Remove Power Brush
- Install Power Brush

OUMX258,0000707 -19-08NOV12-1/1

Essential or Recommended Tools

NOTE: Order tools from the SERVICEGARD™ Catalog.

ESSENTIAL TOOLS listed are required to perform the job correctly and are obtainable only from the SERVICEGARD™ Catalog.

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RECOMMENDED TOOLS, as noted, are suggested to perform the job correctly. Some tools may be available from local suppliers or may be fabricated.

OUMX258,0000708 -19-12JUN14-1/2

Belt Tension Tool .....JDST28 — Measure Belt Deflection to Set Belt Tension

OUMX258,0000708 -19-12JUN14-2/2

Specifications

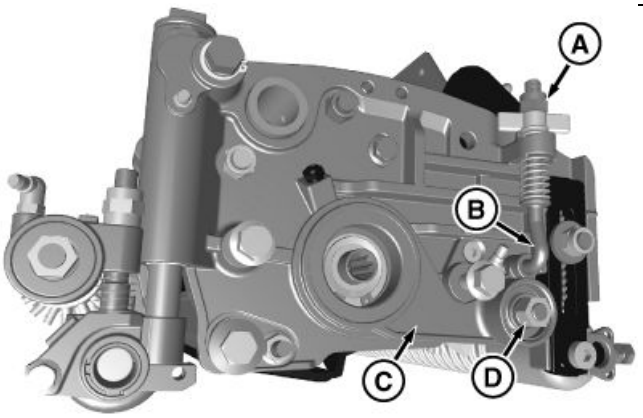
Item	Measurement	Specification
Greens Tender Conditioner Collet Nut	Torque	62 N·m (46 lb.-ft.)

OUMX258,0000709 -19-08NOV12-1/1

Remove Greens Tender Conditioner

1. Remove front roller assembly from reel housing. (See Remove and Install Front Roller.)
2. Remove locknut (A) from conditioner height adjustment rod and disconnect bottom of rod (B) from shaft support bracket (C).
3. Remove lock nut (D) from non-driven side of tender conditioner shaft.
4. Pull shaft support bracket (C) outward and remove from reel housing.

A—Locknut
B—Rod
C—Bracket
D—Nut



TCT003437 —UN—08JUN12

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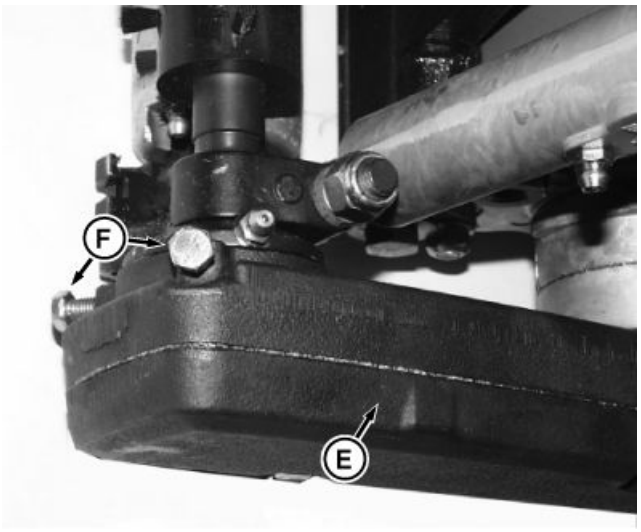
OUMX258,000070A -19-21MAY14-1/6

5. Remove two cap screws and belt cover (E).
6. Remove cap screws (F).

E—Cover **F—Screw**

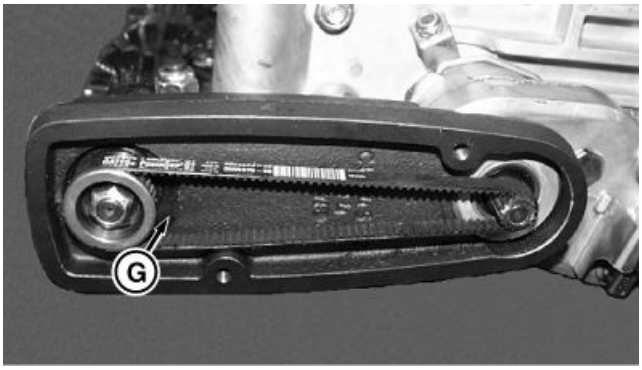


TCT003438 —UN—08JUN12

OUMX258,000070A -19-21MAY14-2/6

7. Turn eccentric (G) from brush side of cover to remove tension from belt.

G—Eccentric

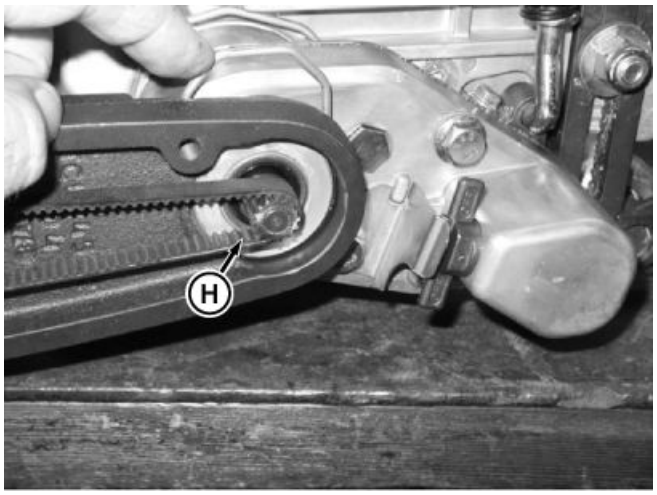


TCT003439 —UN—08JUN12

OUMX258,000070A -19-21MAY14-3/6

8. Remove belt (H).

H—Belt



TCT003440 —UN—08JUN12

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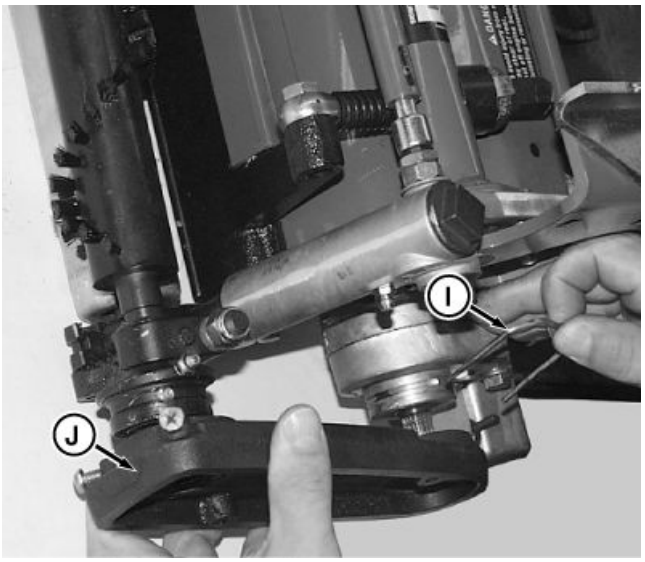
OUMX258,000070A -19-21MAY14-4/6

9. Remove retainer clip (I) and belt housing (J).

I— Clip
J— Housing

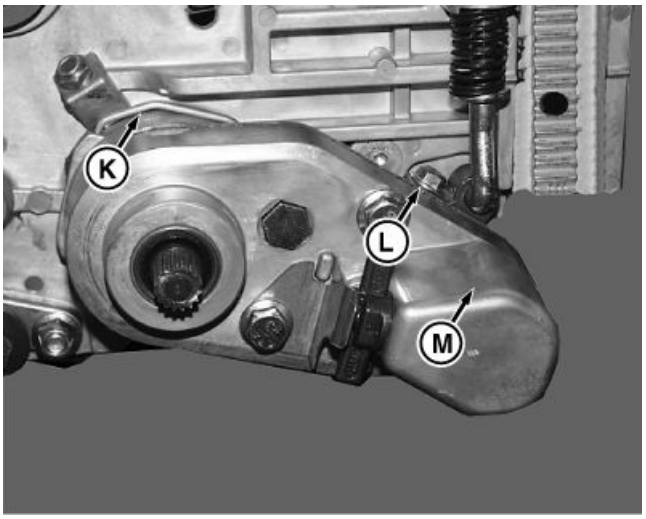


TCT003441 —UN—08JUN12

OUMX258,000070A -19-21MAY14-5/6

10. Remove retainer clip (K). Remove cap screw (L) and pull drive and conditioner assembly (M) out of reel.

K—Clip
L— Screw
M—Assembly



TCT003442 —UN—08JUN12

OUMX258,000070A -19-21MAY14-6/6

Install Greens Tender Conditioner

CAUTION: Avoid Injury! Blades are sharp and can cut. Use caution and wear gloves when handling blades or working near blades.

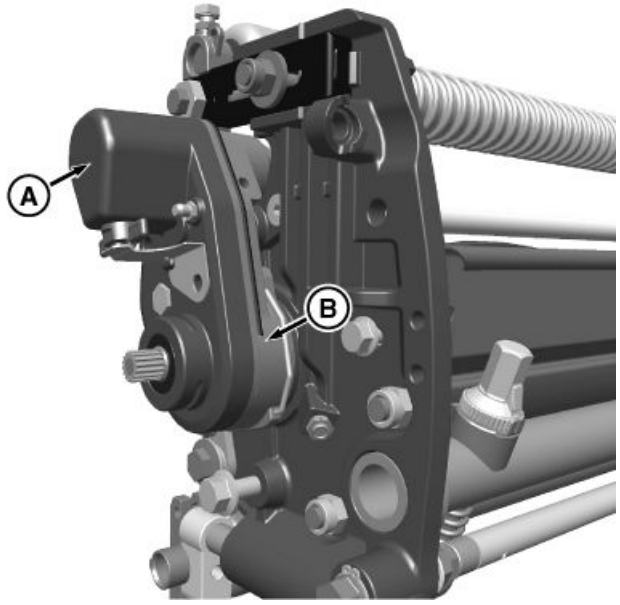
1. Position cutting unit on flat surface or workbench as shown below.

NOTE: Lubricate male shaft assembly of gearcase with John Deere Special Purpose HD Cornhead Grease before installing onto cutting unit bearing housing.

2. Install gearcase assembly (A), onto cutting unit, as shown. Carefully engage splined male gearcase input shaft with splined female shaft on end of reel.

NOTE: Gearcase assembly should be flush with the bearing holder, or U-shaped clip will not seat and secure the assembly properly.

3. Rotate assembly as shown, and install U-shaped clip (B) to secure in a locked position.



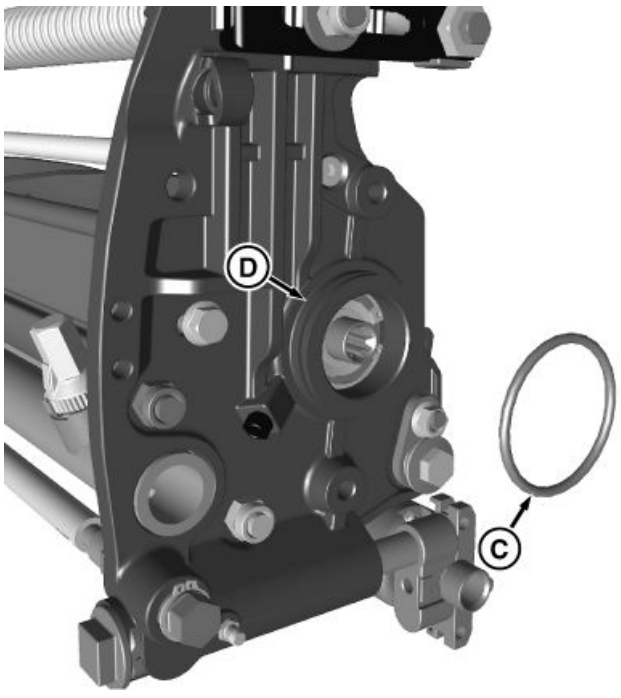
TCT003443 —UN—08JUN12

A—Assembly **B—Clip**

OUMX258,000070B -19-27MAY14-1/6

4. On opposite end, install O-ring (C) onto groove (D) on cutting unit end plate.

C—O-ring **D—Groove**



TCT003444 —UN—08JUN12

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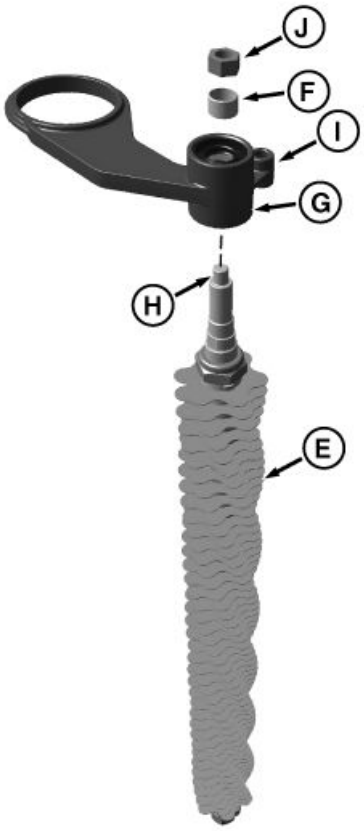
OUMX258,000070B -19-27MAY14-2/6

NOTE: Be sure to stand roll shaft (E) vertically and install conditioner idler bracket (G) onto roll shaft first before attaching to drive. (This is done because there are washers in the assembly that seat properly when following this procedure.)

5. Wearing gloves, stand roll shaft (E) vertically as shown.
6. Install 15.1 mm I.D. spacer (F) into idler bracket (G), and install idler bracket (G) onto threaded end (H) of roll shaft. Before securing assembly, make certain hole (I) on idler bracket would remain on the top side when installed on both left and right side installations.
7. Secure conditioner idler bracket (G) with M10 locknut (J).

E—Shaft
F—Spacer
G—Bracket
H—Threaded End
I— Hole
J—Nut



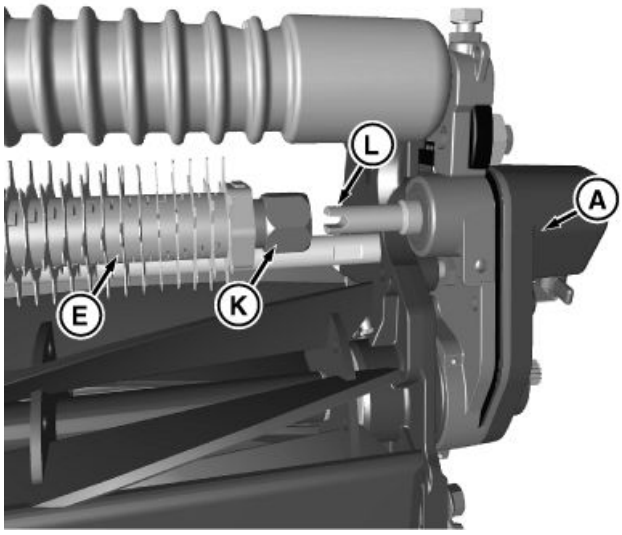
TCT003445 —UN—08JUN12

OUMX258,000070B -19-27MAY14-3/6

NOTE: You may need to loosen collet nut (K) before attempting to fit end of roll shaft into gearcase assembly (A) output shaft. Roll shaft should easily slide in place when assembling.

8. Install idler bracket onto cutting unit end plate, while simultaneously installing opposite end of roll shaft (E), with collet nut (K), onto the output shaft of gearcase assembly (A). Make sure roll shaft engages notched end (L) of gearcase assembly output shaft before attempting to secure components.

A—Assembly
E—Shaft
K—Nut
L—Notched End



TCT003446 —UN—08JUN12

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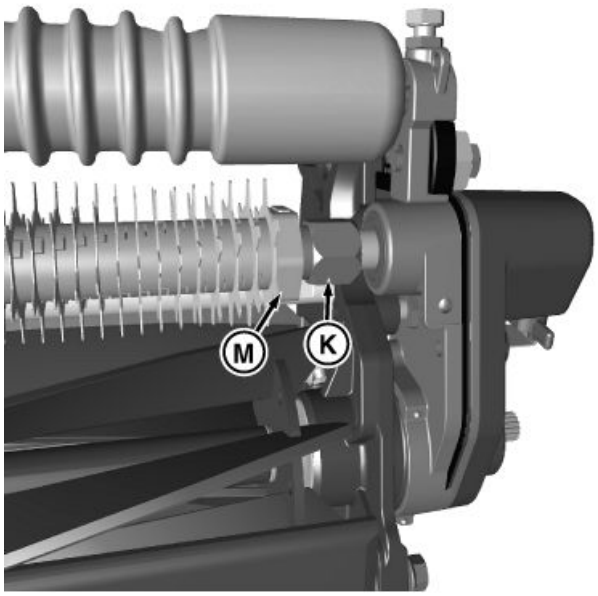
OUMX258,000070B -19-27MAY14-4/6

9. Holding a wrench on the large hex blade retainer (M). tighten collet nut (K) to lock conditioner drive to roll shaft. Maintain pressure of roll shaft into conditioner drive for proper alignment when tightening collet nut. Tighten collet to specification.

Specification	
Greens Tender Conditioner Collet Nut—Torque	62 N·m (46 lb.-ft.)



TCT003447 —UN—08JUN12

K—Nut **M—Retainer**

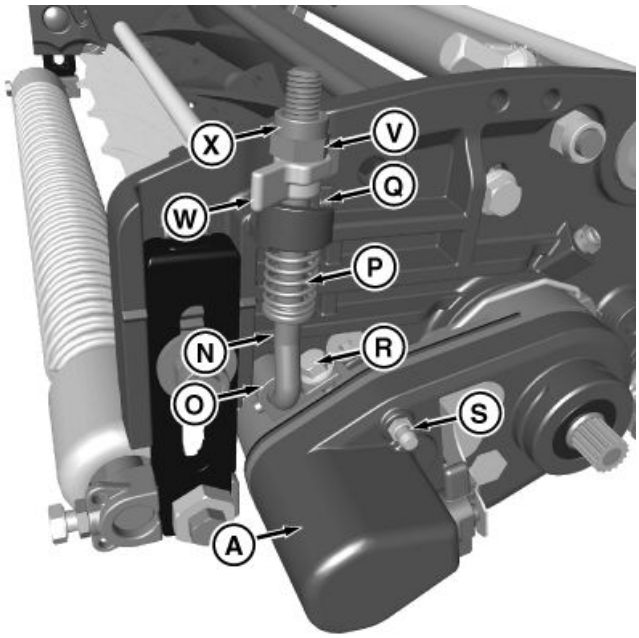
OUMX258,000070B -19-27MAY14-5/6

NOTE: When installing turf conditioner on opposite side, bushing (O) will be installed on opposite side of gearcase assembly (A).

10. On drive side:
    a. Install bent end of tensioner rod (N) through bushing (O).
    b. Install spring (P) onto opposite end of tensioner rod, and then insert tensioner rod through hole in tab (Q) on side of cutting unit frame.
    c. Install bushing (O) onto gearcase assembly (A) with M6 bolt (R) and M6 locknut.
    d. Lubricate grease fitting (S) with John Deere Special Purpose HD Cornhead Grease.
11. On driven side:
    a. Install spring (P) onto long end tensioner rod (N).
    b. Install long end of tensioner rod (N) through hole in tab (T) on side of cutting unit frame, and then bent end through hole on conditioner idler bracket (G).
    c. Position grease fitting (S) for access to allow lubrication. Lubricate grease fitting with John Deere Special Purpose HD Cornhead Grease.

NOTE: Be certain that thicker side (V) of knob (W) is on the top when installing.

12. On both sides of cutting unit, install knob (W) and M10 nylon insert locknut (X). Do not tighten hardware at this time.



TCT003448 —UN—08JUN12

Drive Side Shown

A—Assembly
N—Rod
O—Bushing
P—Spring
Q—Tab
R—Bolt
S—Grease Fitting
V—Thicker Side
W—Knob
X—Nut

13. Adjust greens tender conditioner. (See Adjusting Greens Tender Conditioner (GTC).)

OUMX258,000070B -19-27MAY14-6/6

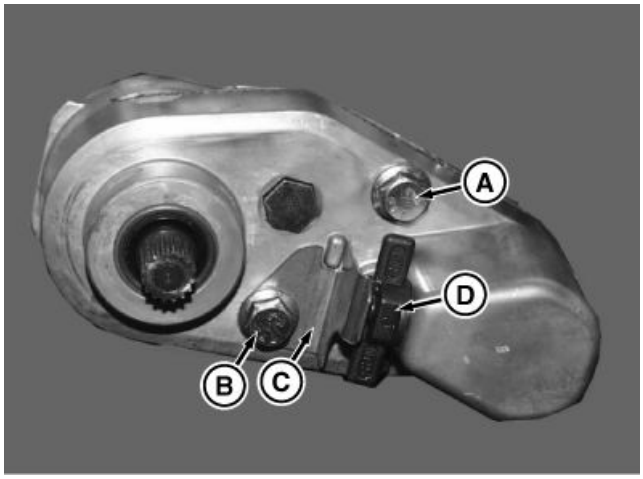
Disassemble Greens Tender Conditioner Drive

1. Remove GTC drive and shaft assembly from reel housing. (See Remove Greens Tender Conditioner.)
2. Remove cap screws (A) and (B) and bracket (C) from drive housing.

NOTE: Grease has been removed from gearcase for photos.

3. Pull knob (D) from housing.

A—Screw
B—Screw
C—Bracket
D—Knob

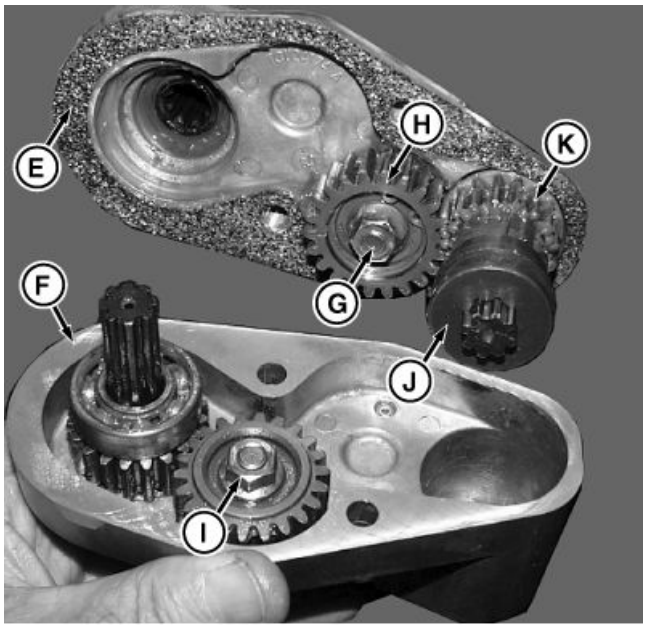


TCT003449 —UN—08JUN12

OUMX258,000070C -19-08NOV12-1/6

4. Pull inner housing (E) from outer housing (F).
5. Remove lock nut (G), gear (H) and cap screw from housing.
6. Remove lock nut, gear and cap screw (I) from outer housing (F).
7. Remove shift collar (J) from shaft.
8. Remove gear (K).

E—Housing
F—Housing
G—Nut
H—Gear
I— Screw
J— Collar
K—Gear



TCT003450 —UN—08JUN12

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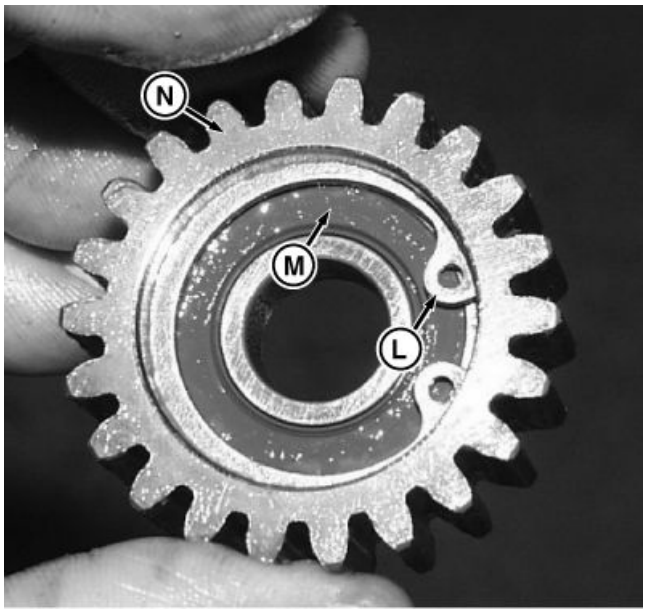
OUMX258,000070C -19-08NOV12-2/6

9. Remove snap ring (L) and bearing (M) from gears (N) removed in step 5 and 6.

L—Snap Ring
M—Bearing
N—Gear



TCT003451 —UN—08JUN12

OUMX258,000070C -19-08NOV12-3/6

10. Remove shaft assembly (O).

O—Assembly

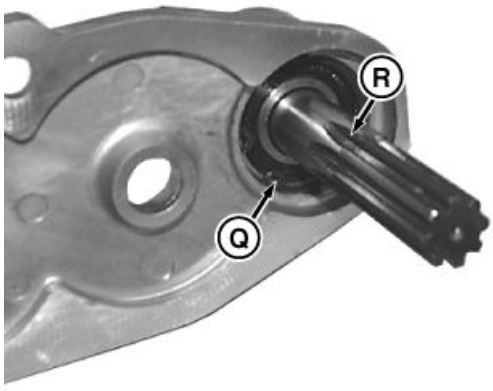
TCT003452 —UN—08JUN12

Continued on next page

OUMX258,000070C -19-08NOV12-4/6

11. Remove snap ring (Q) and pull shaft assembly (R) from housing.

Q—Snap Ring **R—Assembly**

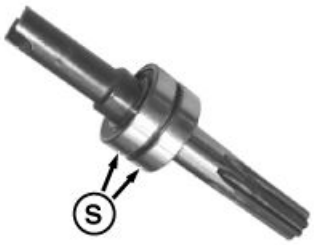


TCT003453 —UN—08JUN12

OUMX258,000070C -19-08NOV12-5/6

12. Remove bearings (S) from shaft.
13. Clean and inspect all components and replace as necessary. Clean all old gasket material from mating surfaces.

S—Bearing



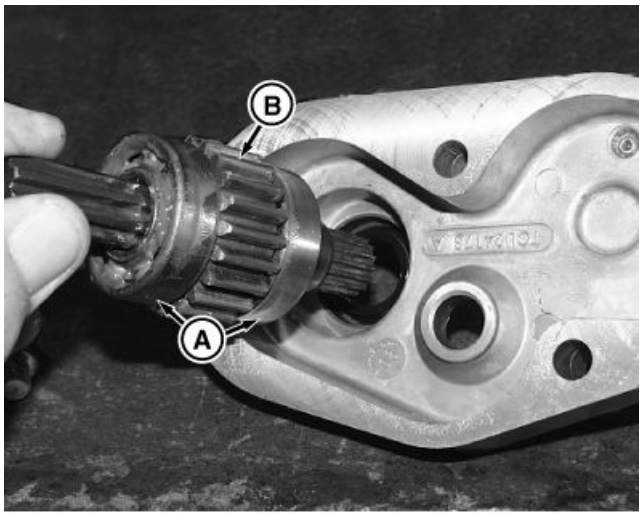
TCT003454 —UN—28JUN12

OUMX258,000070C -19-08NOV12-6/6

Assemble Greens Tender Conditioner Drive

1. Replace all shaft seals with new ones.
2. Install bearings (A) on shaft (B) and install shaft into housing.

A—Bearings **B—Shaft**



TCT003455 —UN—08JUN12

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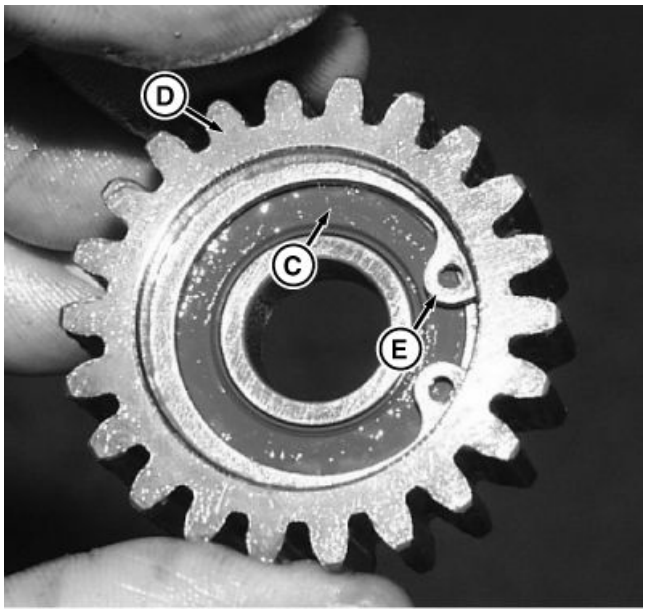
OUMX258,000070D -19-08NOV12-1/10

3. Install bearings (C) into gears (D) and secure with snap rings (E).

C—Bearing
D—Gear
E—Snap Ring

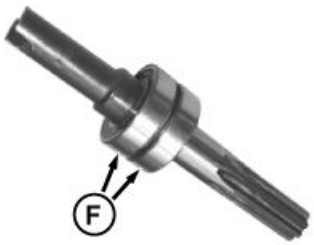


TCT003456 —UN—08JUN12

OUMX258,000070D -19-08NOV12-2/10

4. Install bearings (F) on shaft.

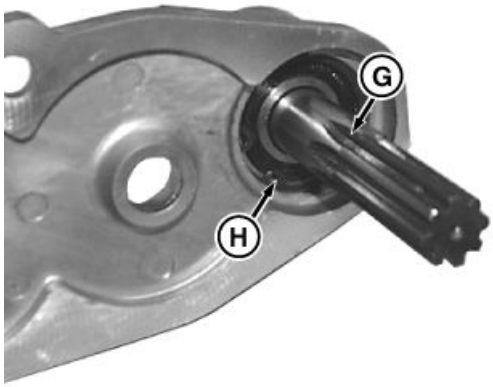
F—Bearings



TCT003457 —UN—28JUN12

OUMX258,000070D -19-08NOV12-3/10

5. Install shaft assembly (G) in housing and secure with snap ring (H).



TCT003458 —UN—08JUN12

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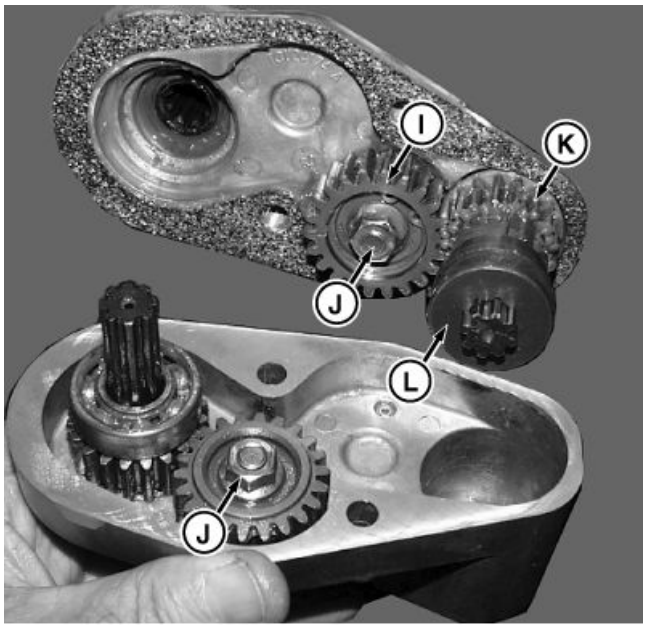
OUMX258,000070D -19-08NOV12-4/10

6. Install idler gears (I) in housings. Note that gear on inner housing has offset toward inside and gear in cover has offset toward outside. Secure gears with cap screw and nut (J).
7. Install gear (K) and shift collar (L).

I— Idle Gear
J— Nut
K—Gear
L—Collar

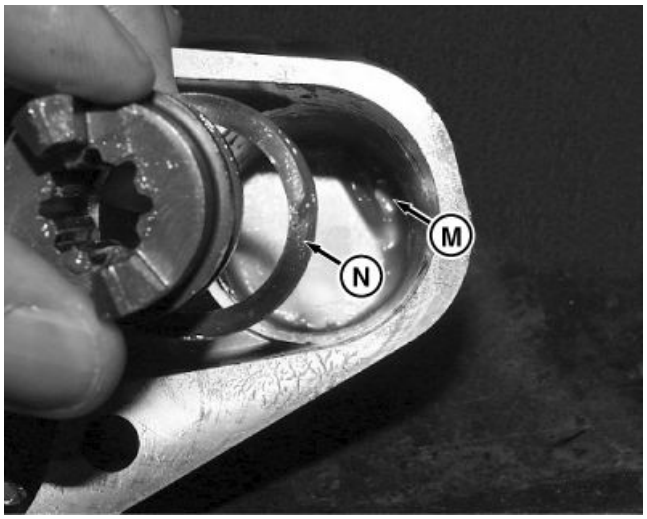


TCT003459 —UN—08JUN12

OUMX258,000070D -19-08NOV12-5/10

8. Place some grease (M) in housing to hold spring washer (N) in place and install spring washer.

M—Grease
N—Washer



TCT003460 —UN—08JUN12

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OUMX258,000070D -19-08NOV12-6/10

9. Install seal (O) with lip and spring facing out.
10. Apply a light coat of grease to housing and install O-ring (P) in housing.

O—Seal **P—O-ring**

TCT003461 —UN—08JUN12

OUMX258,000070D -19-08NOV12-7/10

11. Install new gasket (Q).
12. Pack the cavities with grease.

Q—Gasket

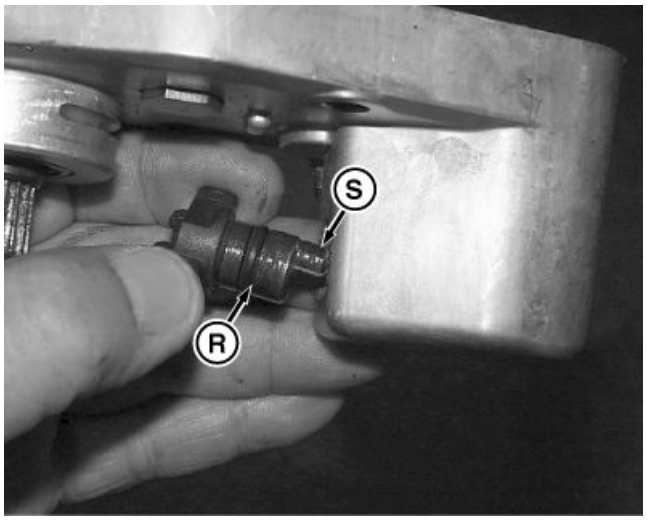
TCT003462 —UN—08JUN12

Continued on next page

OUMX258,000070D -19-08NOV12-8/10

13. Install the cover and secure with top cap screw.
14. Inspect O-ring (R) on selector. Replace if necessary. Install selector ensuring that the pin (S) on the base of the knob engages the slot in the shift collar.

R—O-Ring **S—Pin**

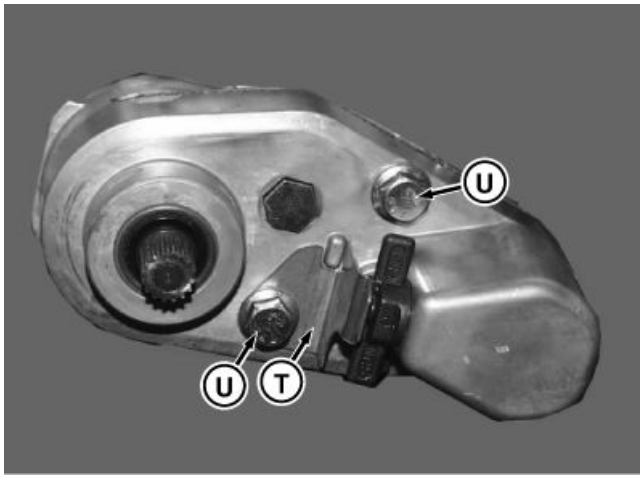


TCT003463 —UN—08JUN12

OUMX258,000070D -19-08NOV12-9/10

15. Install bracket (T) and cap screws (U).
16. Grease drive housing.
17. Install GTC drive on reel housing. (See Install Greens Tender Conditioner.)

T— Bracket **U—Screw**



TCT003464 —UN—08JUN12

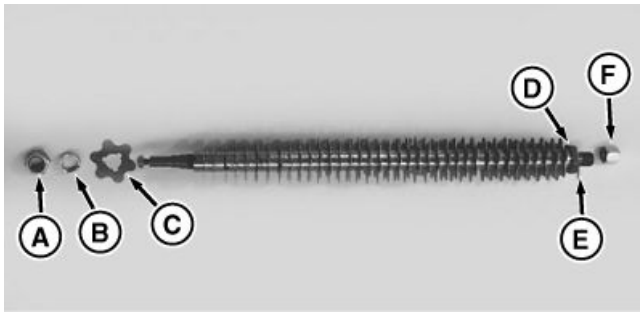
OUMX258,000070D -19-08NOV12-10/10

Disassemble Greens Tender Conditioner Shaft

1. Remove GTC assembly from reel housing. (See Remove Greens Tender Conditioner.)
2. Remove nut (A) on end of shaft. The spacers (B) and blade segments (C) can be removed as required.

NOTE: As nut (A) is loosened, the retainer on the opposite shaft end (D) can move, and its retaining pin can be removed.

3. Remove the compression nut (F) and inner ferrule.
4. Inspect all components and replace as necessary.



TCT003465 —UN—08JUN12

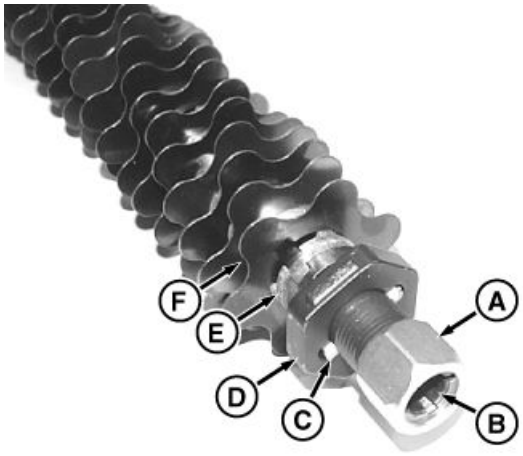
A—Nut **D—Shaft End**
B—Spacer **E—Spacer**
C—Segments **F—Nut**

OUMX258,000070E -19-08NOV12-1/1

Assemble Greens Tender Conditioner Shaft

1. Loosely install compression nut (A) with inner ferrule (B) on shaft.
2. Insert pin (C) in shaft. Install or index the blade stack retainer (D) over the exposed ends of the pin.
3. Alternately install spacers (E) and blade segments (F) on shaft.

A—Nut
B—Ferrule
C—Pin
D—Retainer
E—Spacer
F—Segments

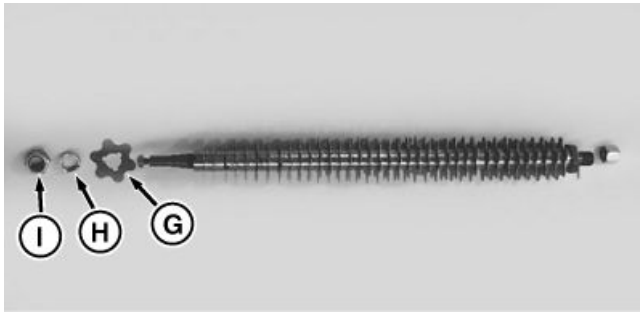


TCT003466 —UN—08JUN12

OUMX258,000070F -19-08NOV12-1/2

4. When all blade segments (G) and spacers (H) are added, install nut (I) and tighten securely.
5. Install GTC shaft on drive assembly/reel housing. (See Install Greens Tender Conditioner.)

G—Segment
H—Spacer
I— Nut



TCT003467 —UN—08JUN12

OUMX258,000070F -19-08NOV12-2/2

Disassemble Shaft Support Bracket

1. Remove GTC shaft support bracket from reel housing. (See Remove Greens Tender Conditioner.)
2. Remove seal (A), bearing (B), spacer (C) and bearing (D) from bracket.

A—Seal
B—Bearing
C—Spacer
D—Bearing

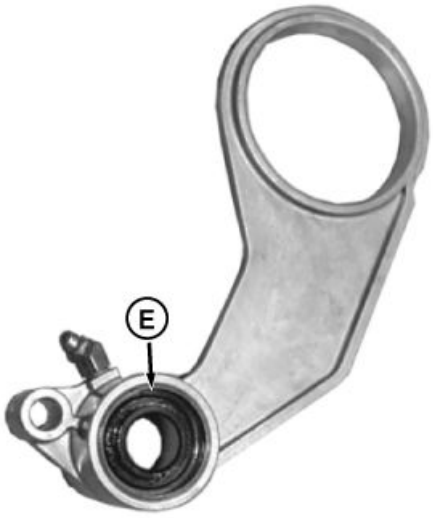
TCT003468 —UN—08JUN12

Continued on next page

OUMX258,0000710 -19-08NOV12-1/2

3. Remove seal (E).
4. Inspect all components and replace as necessary.

E—Seals



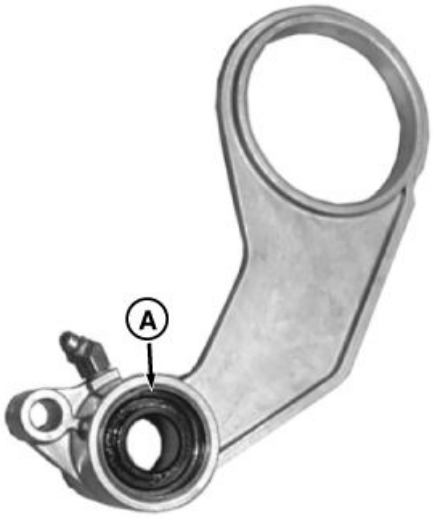
TCT003469 —UN—08JUN12

OUMX258,0000710 -19-08NOV12-2/2

Assemble Shaft Support Bracket

1. Install seal (A) with lip and spring facing out flush into housing.

A—Seal



TCT003470 —UN—08JUN12

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OUMX258,0000711 -19-08NOV12-1/3

2. Install bearing (B), spacer (C), bearing (D) in bracket.
3. Install seal (E) with lip and spring facing out flush into housing.

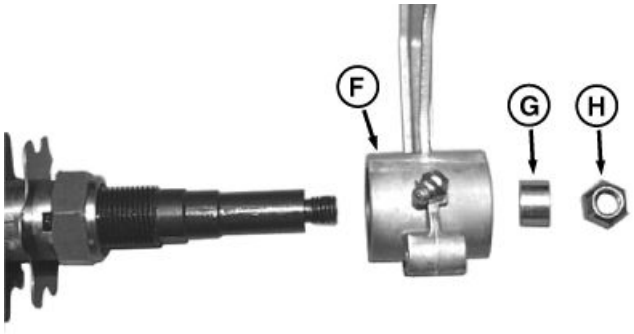
B—Bearing
C—Spacer
D—Bearing
E—Seal

TCT003471 —UN—08JUN12

OUMX258,0000711 -19-08NOV12-2/3

4. Install GTC shaft support bracket reel housing. (See Install Greens Tender Conditioner.)

F—Bracket
G—Bushing
H—Nut



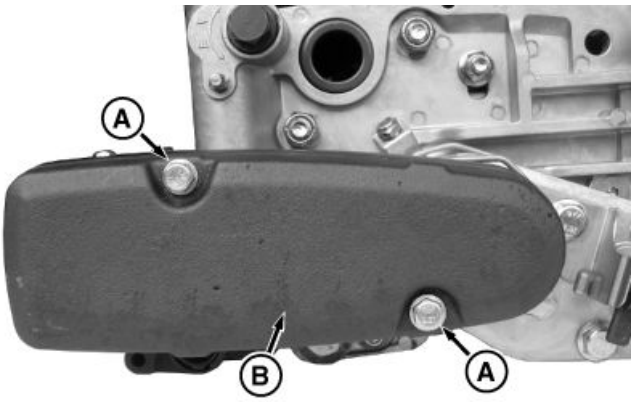
TCT003472 —UN—08JUN12

OUMX258,0000711 -19-08NOV12-3/3

Remove Power Brush

1. Remove both hex head bolts (A).
2. Remove drive housing cover (B).

A—Bolt
B—Cover



TCT011763 —UN—11SEP14

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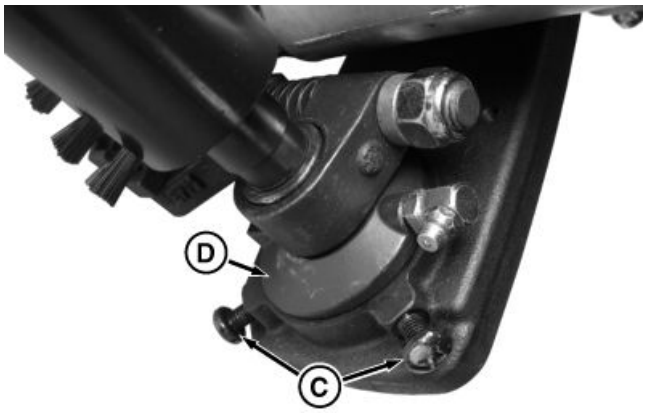
BS62576,000034B -19-10SEP14-1/7

3. Loosen two screws (C) and rotate top of eccentric housing (D) toward front of reel to loosen drive belt.

C—Screw **D—Housing**

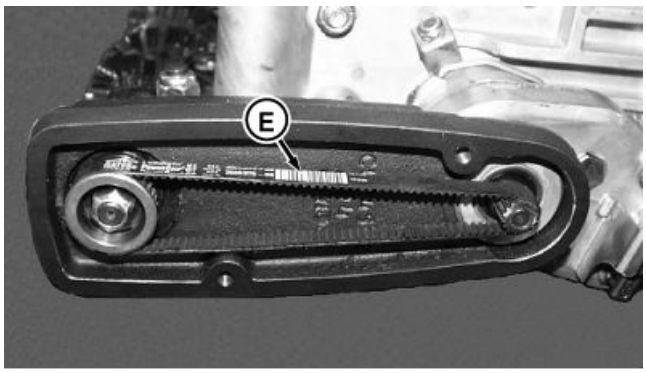


TCT011764 —UN—11SEP14

BS62576,000034B -19-10SEP14-2/7

4. Remove belt (E) from pulley and drive shaft.

E—Belt

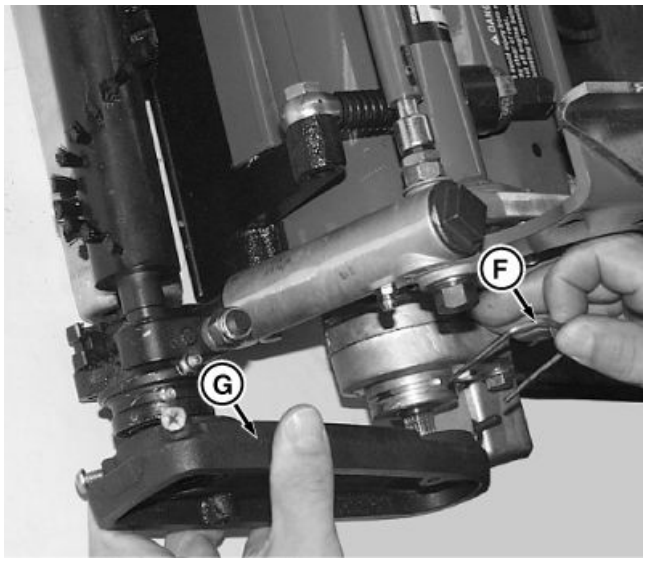


TCT003475 —UN—08JUN12

BS62576,000034B -19-10SEP14-3/7

5. Remove lock pin (F) from housing.
6. Remove inner drive housing (G) from reel assembly.

F—Pin **G—Housing**



TCT003476 —UN—08JUN12

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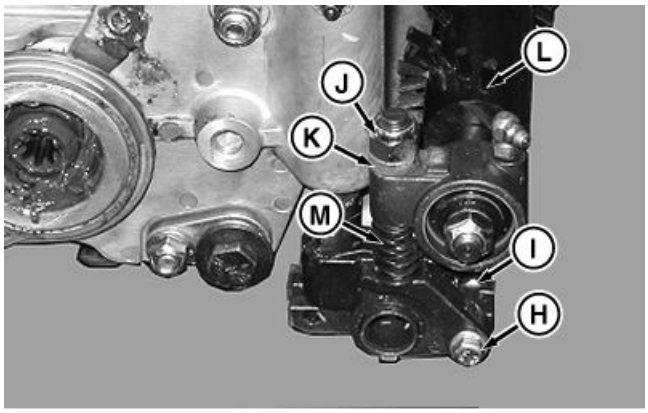
BS62576,000034B -19-10SEP14-4/7

7. Remove cap screw (H) and lock nut (I) from non-driven side of brush assembly.
8. Remove lock nut (J) and spacer (K) from both brush support brackets.
9. Lift brush assembly (L) and remove from reel.
10. Remove wave spring (M) from stud on both brush support brackets.

H—Screw
I— Nut
J— Nut
K—Spacer
L—Assembly
M—Spring

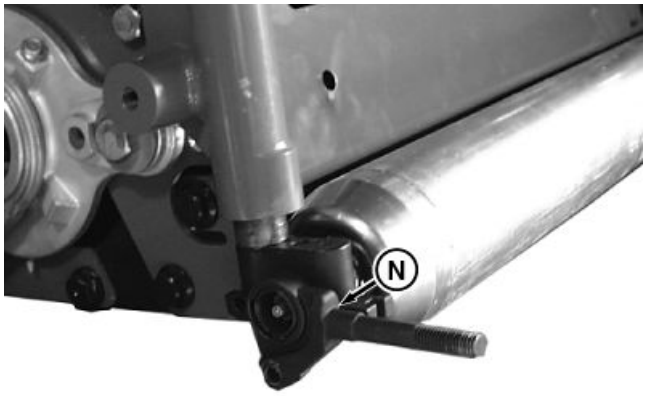


TCT003477 —UN—08JUN12

BS62576,000034B -19-10SEP14-5/7

11. Rotate and remove brush support bracket (N) from non-driven side of reel.

N—Bracket

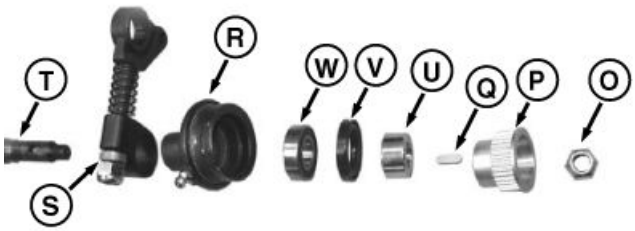


TCT003478 —UN—08JUN12

BS62576,000034B -19-10SEP14-6/7

12. Remove nut (O), gear (P), key (Q), housing (R), and shaft support bracket (S) from shaft (T).
13. Remove spacer (U), seal (V), and bearing (W) from housing (R).

O—Nut
P—Gear
Q—Key
R—Housing
S—Bracket
T— Shaft
U—Spacer
V—Seal
W—Bearing



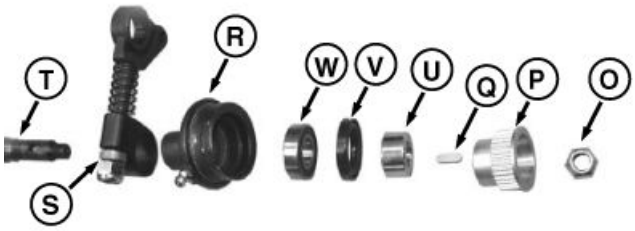
TCT003479 —UN—08JUN12

BS62576,000034B -19-10SEP14-7/7

Install Power Brush

1. Install bearing (W) in housing (R).
2. Install seal (V) in housing (R) with lip facing out.
3. Install brush support bracket (S), spacer (U), key (Q), and gear (P) onto shaft (T), and secure with lock nut (O).

O—Nut
P—Gear
Q—Key
R—Housing
S—Bracket
T—Shaft
U—Spacer
V—Seal
W—Bearing

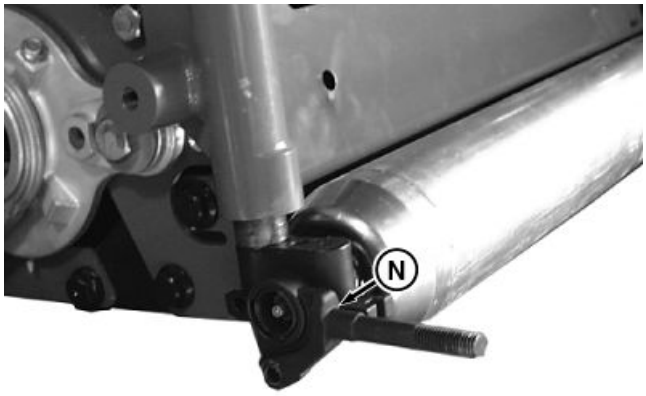


TCT003480 —UN—08JUN12

BS62576,00004E5 -19-10SEP14-1/8

4. Install brush support bracket (N) on non-driven side and rotate to a vertical position.

N—Bracket

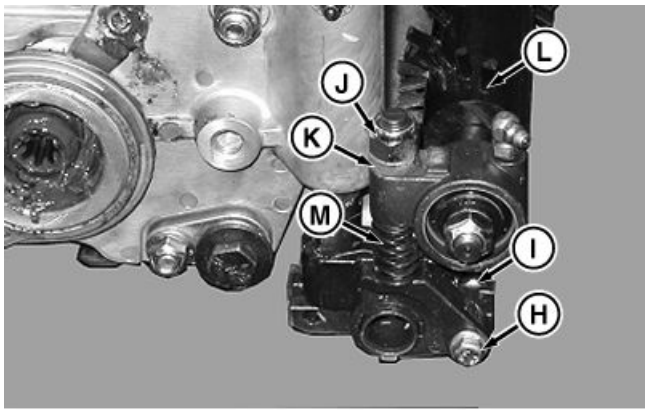


TCT003481 —UN—08JUN12

BS62576,00004E5 -19-10SEP14-2/8

5. Install wave spring (M) on stud on both brush support brackets.
6. Install brush assembly (L) on both brush support brackets.
7. Install spacer (K) and lock nut (J) on both brush support brackets. Adjust nut on each side to obtain brush to roller clearance of 0—1 mm (0—0.039 in.).
8. Install cap screw (H) and lock nut (I) on support bracket on non-driven side only.

H—Screw
I— Nut
J— Nut
K—Spacer
L—Assembly
M—Spring



TCT003482 —UN—08JUN12

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BS62576,00004E5 -19-10SEP14-3/8

9. Inspect O-rings (A) in inner drive housing. Replace if necessary. Lubricate O-rings before installing housing.

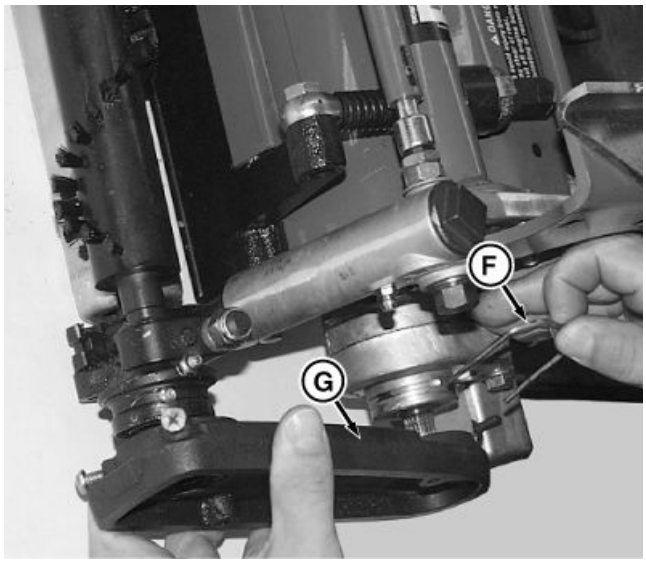
A—O-ring

TCT003483 —UN—08JUN12

BS62576,00004E5 -19-10SEP14-4/8

10. Install inner drive housing (G) on reel assembly.
11. Install lock pin (F) in housing.

F—Pin **G—Housing**



TCT003736 —UN—08JUN12

BS62576,00004E5 -19-10SEP14-5/8

12. Install belt (E) on pulley and drive shaft.

E—Belt

TCT003737 —UN—08JUN12

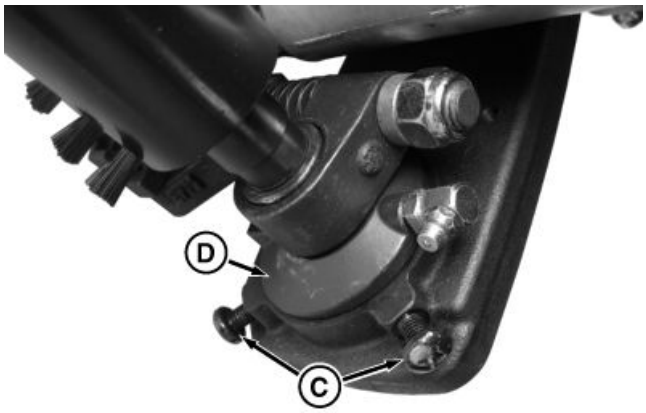
Continued on next page

BS62576,00004E5 -19-10SEP14-6/8

IMPORTANT: Avoid Damage! Do not over tighten screws to secure position of eccentric housing. Damage to internal bearing may occur.

13. Rotate top of eccentric housing (D) toward rear of cutting unit to set belt tension using JDST28 tool. Tighten screws (C) securely.
14. Install new gasket on housing.

C—Screw **D—Housing**

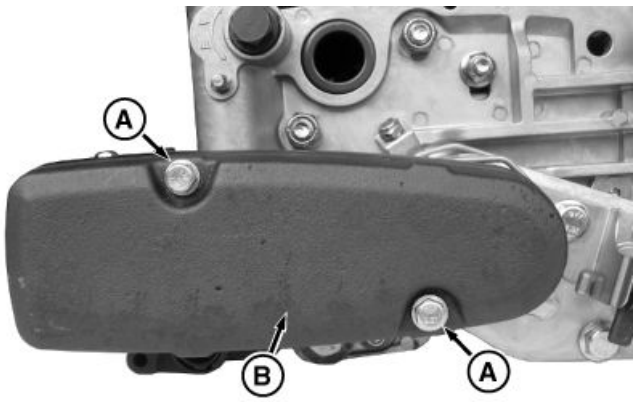


TCT011764 —UN—11SEP14

BS62576,00004E5 -19-10SEP14-7/8

15. Install drive housing cover (B) with hex head bolts (A) and tighten securely.

A—Bolt **B—Cover**



TCT011763 —UN—11SEP14

BS62576,00004E5 -19-10SEP14-8/8

Section 80
Miscellaneous Repair

Contents

Page

Group 10—Miscellaneous
Summary of References 80-10-1
Remove and Install Front Wheels 80-10-1
Remove and Install Rear Wheels 80-10-2
Remove Lift Arm 80-10-3
Remove Lift Arm Bushing 80-10-3
Install Lift Arm Bushing 80-10-3
Install Lift Arm 80-10-4

Group 20—Operator's Station
Summary of References 80-20-1
Remove and Install Seat 80-20-1

Group 30—Fuel System
Summary of References 80-30-1
Remove Fuel Tank 80-30-1
Install Fuel Tank 80-30-3

Summary of References

- Remove and Install Front Wheels
- Remove and Install Rear Wheels
- Remove Lift Arm
- Remove Lift Arm Bushing
- Install Lift Arm Bushing
- Install Lift Arm

BS62576,0001006 -19-14MAY14-1/1

Remove and Install Front Wheels

CAUTION: Avoid injury! Remove wheels safely.

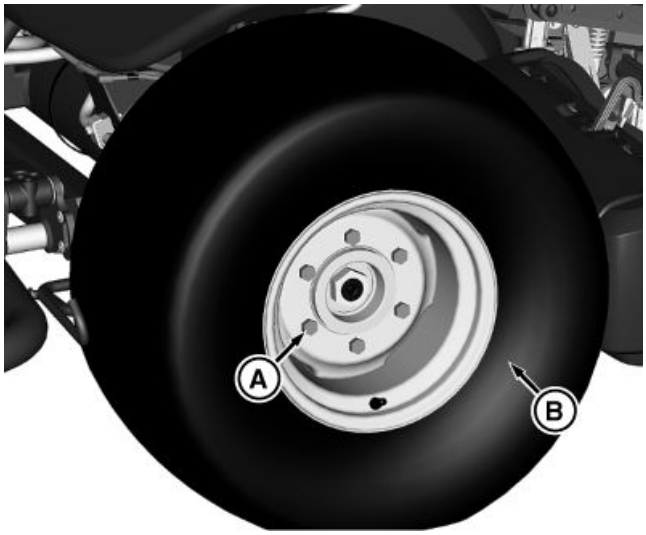
- **Use a safe lifting device and support machine securely on jack stands.**
- **Block front and rear of wheel not raised to prevent machine movement.**
- **Wheel can be heavy or difficult to handle when removing.**

Raising Front of Machine

1. Park machine safely. (See Parking Safely in the Safety section.)
2. Block rear tire.
3. Using a floor jack on frame behind front wheel, lift machine until front tire is off the ground.
4. Install jack stands under left and right of frame by front tires.

Removing Front Wheels

1. Remove front wheel bolts (A).



TCT011067 —UN—14MAY14

A—Bolts **B—Wheel**

2. Remove front wheel (B) from front axle.

BS62576,00017E5 -19-21MAY14-1/2

Installing Front Wheels

1. Install wheels onto axle hubs with valve stems (C) facing outward.
2. Tighten front wheel bolts to specification using a torque wrench.

Specification

Wheel Bolts—Torque.....136 N·m (100 lb.-ft.)

3. Lower machine to ground and remove floor jack.
4. Remove wheel blocks from rear tire.
5. Check wheel bolt torque:
   - After traveling 30 m (100 ft.) while changing direction.
   - After 3 to 10 hours of use.
   - Often during the next 100 hours of operation.

TCT011068 —UN—14MAY14

C—Valve Stem

BS62576,00017E5 -19-21MAY14-2/2

Remove and Install Rear Wheels

CAUTION: Avoid injury! Remove wheels safely.

- **Use a safe lifting device and support machine securely on jack stands.**
- **Block front and rear of wheel not raised to prevent machine movement.**
- **Wheel can be heavy or difficult to handle when removing.**

Raising Rear of Machine

1. Park machine safely. (See Parking Safely in the Safety section.)
2. Block front tires.
3. Using a floor jack on frame behind rear wheel, lift machine until rear tire is off the ground.
4. Install jack stands under frame by rear tire.

Removing Rear Wheel

1. Remove rear wheel bolts (A).
2. Remove rear wheel (B) from axle.

Installing Rear Wheel

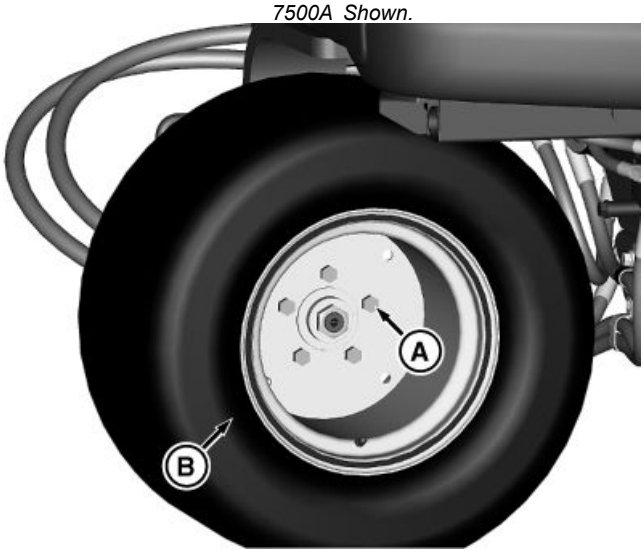
1. Install wheel onto hub with valve stem facing outward. Install the bolts into the wheel and hub.
2. Tighten rear wheel bolts to specification using a torque wrench.

Specification	
Wheel Bolts—Torque	136 N·m (100 lb.-ft.)

3. Lower machine to ground and remove floor jack.
4. Remove wheel blocks from front tires.
5. Check wheel bolt torque:
   - After traveling 30 m (100 ft.) while changing direction.
   - After 3 to 10 hours of use.
   - Often during the next 100 hours of operation.

7500A Shown.

TCT011069 —UN—14MAY14



8000A Shown.

TCT011070 —UN—14MAY14

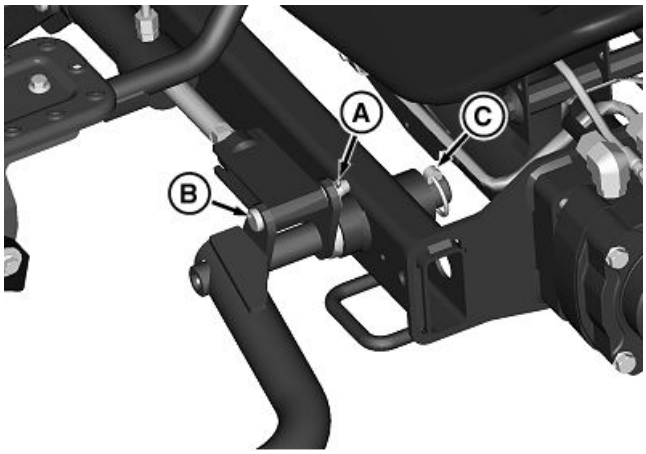
A—Bolts (A) **B—Rear Wheel (B)**

BS62576,00017E6 -19-14MAY14-1/1

Remove Lift Arm

1. Park machine safely. See the “Safety Section”.
2. Remove attachment from lift arm. (See Remove and Install Cutting Unit.)
3. Remove cotter pin (A) and pin (B) from lift cylinder.
4. Remove linchpin (C) securing lift arm.
5. Remove lift arm from frame.
6. Inspect busings for wear or damage. Replace as necessary. (See Remove Lift Arm Bushing and Install Lift Arm Bushing.)

A—Cotter Pin
B—Pin
C—Linch Pin



Front left shown.

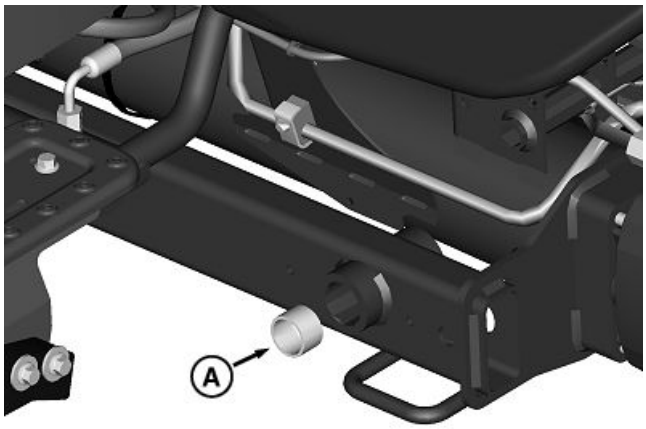
TCT009424 —UN—20NOV13

BS62576,00016F5 -19-13MAR14-1/1

Remove Lift Arm Bushing

1. Park machine safely. See the “Safety Section”.
2. Remove lift arm. (See Remove Lift Arm.)
3. Use a draft punch to remove bushings (A) from lift arm.

A—Bushings



Front left shown.

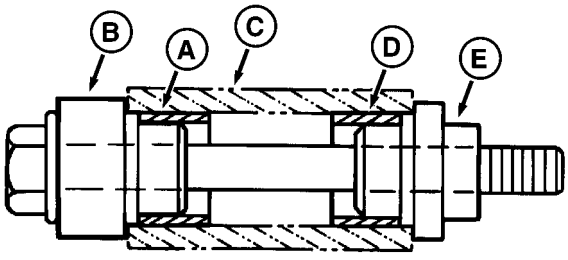
TCT009427 —UN—20NOV13

BS62576,00016F6 -19-13MAR14-1/1

Install Lift Arm Bushing

1. Place rear bushing (A) on threaded end of JDG892 Installation Tool (B) and place on back of pivot tube (C). Place front bushing (D) on front half of tool (E) and thread bolt from front to rear of tool.
2. Tighten bolt on tool to pull bushings into pivot tube. Tool will set correct depth for proper O-ring clearance.

A—Rear Bushing
B—Tool
C—Pivot Tube
D—Front Bushing
E—Tool



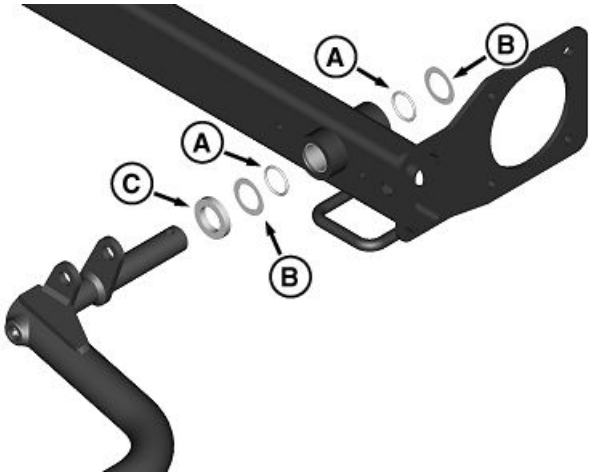
TCT006731 —UN—14FEB13

BS62576,00016F7 -19-13MAR14-1/1

Install Lift Arm

1. Replace bushings as necessary. (See Remove Lift Arm Bushing and Install Lift Arm Bushing.)
2. Use new seals (A).
3. Install lift arm through washers (B) and spacer (C) as shown.

A—Seal
B—Washer
C—Spacer

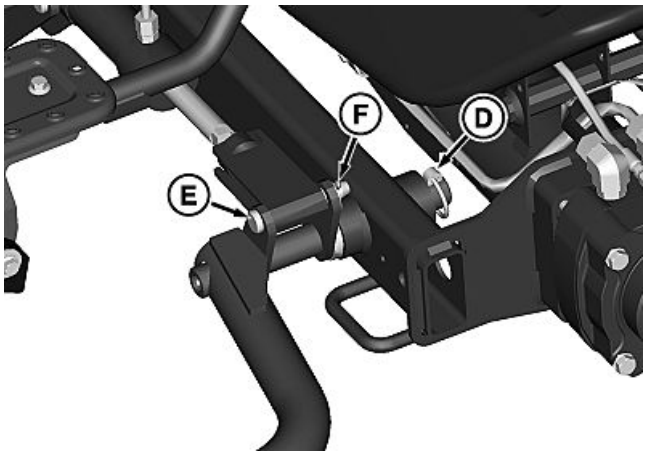


TCT010665 —UN—13MAR14

BS62576,00016F8 -19-20MAY14-1/2

4. Secure lift arm with linchpin (D).
5. Connect lift cylinder with pin (E) and cotter pin (C).
6. Install attachments. (See Remove and Install Cutting Unit.)

D—Linchpin
E—Pin
F—Cotter Pin



Front left shown.

TCT009426 —UN—02MAY14

BS62576,00016F8 -19-20MAY14-2/2

Summary of References

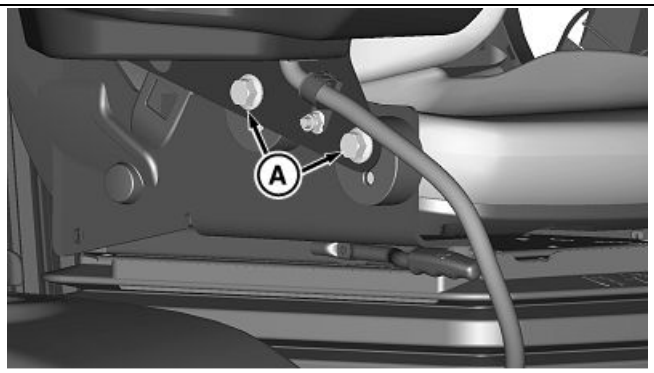
- Remove and Install Seat

BS62576,0001005 -19-28FEB13-1/1

Remove and Install Seat

1. Park machine safely. See the "Safety Section".
2. Remove screws (A) securing command arm to seat frame.
3. Disconnect seat switch.
4. Disconnect air ride connector (if equipped).

A—Screw



TCT006752 —UN—28FEB13

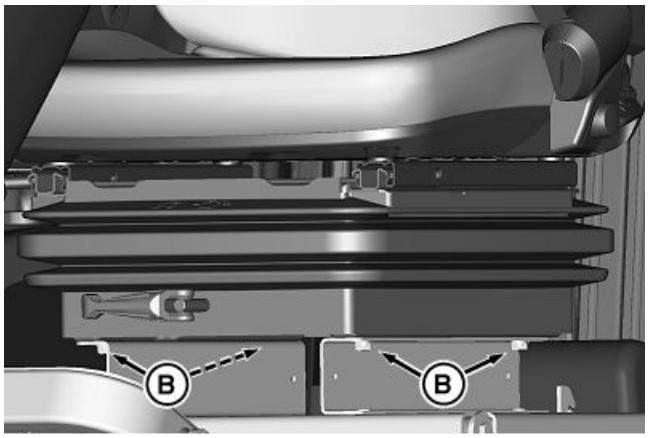
BS62576,0001012 -19-25MAR14-1/2

5. For the 7500A, remove screws (B) securing seat to mounting bracket.
6. For 8000A, tilt seat pan forward, remove screws (B) securing seat suspension to panel.
7. Remove seat.

Installation

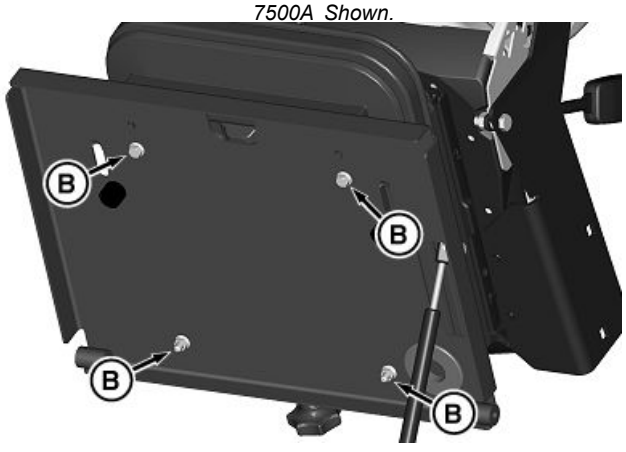
Installation is done in the reverse order of removal.

B—Screw



TCT006753 —UN—28FEB13

7500A Shown.



TCT010679 —UN—25MAR14

8000A Shown.

BS62576,0001012 -19-25MAR14-2/2

Summary of References

- Remove Fuel Tank
- Install Fuel Tank

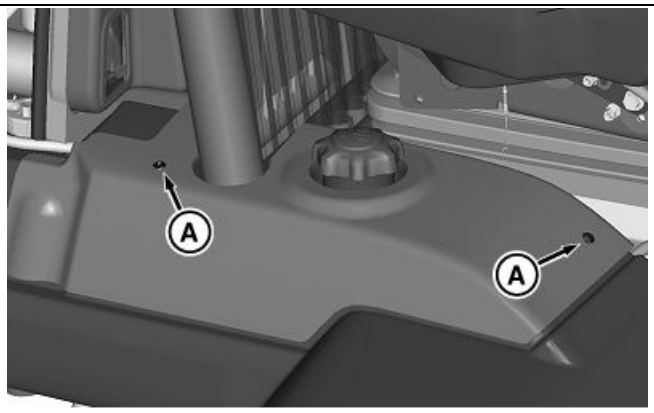
BS62576,000100E -19-28FEB13-1/1

Remove Fuel Tank

CAUTION: Avoid injury! Fuel vapors are explosive and flammable:

- **Do not smoke while handling fuel.**
- **Keep fuel away from flames or sparks.**
- **Shut off engine before servicing.**
- **Cool engine before servicing.**
- **Work in a well-ventilated area.**
- **Clean up spilled fuel immediately.**

1. Park machine safely. See the “Safety Section”.
2. Raise engine cover.
3. Remove screws (A) securing tank cover to tank. Remove cover.



TCT0066754 —UN—28FEB13

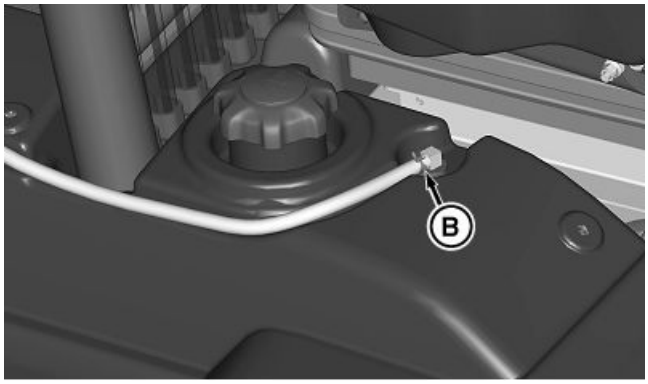
7500A Shown. 8000A Similar.

A—Screw

BS62576,000100C -19-29OCT13-1/5

4. Loosen clamp (B) and remove fuel hose from tank fitting. Plug fuel hose and fitting.

B—Clamp



TCT0066755 —UN—28FEB13

7500A Shown. 8000A Similar.

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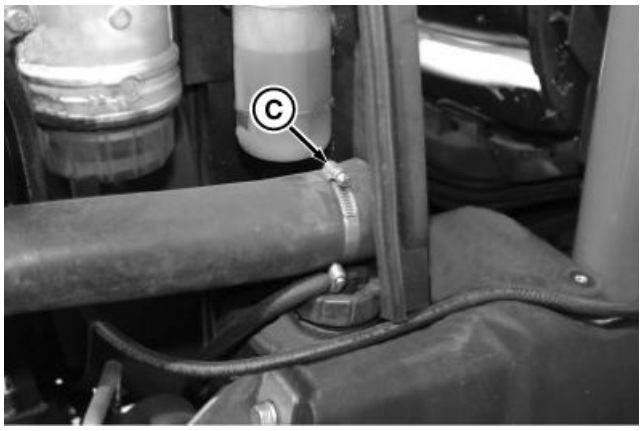
BS62576,000100C -19-29OCT13-2/5

5. Loosen clamp (C) and remove air duct end from bulkhead inlet. Secure duct away from work area.

C—Hose Clamp

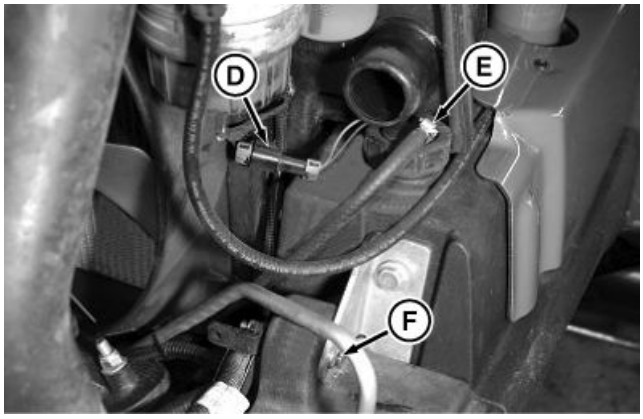


TCT009222 —UN—28OCT13

BS62576,000100C -19-29OCT13-3/5

6. Separate connector (D).
7. Loosen clamp (E) securing fuel return hose. Remove hose from fitting. Plug hose and fitting.
8. Remove nut and bolt (F) securing fuel tank.

D—Wire Harness Connector
E—Hose Clamp
F—Hex Bolt M10x80

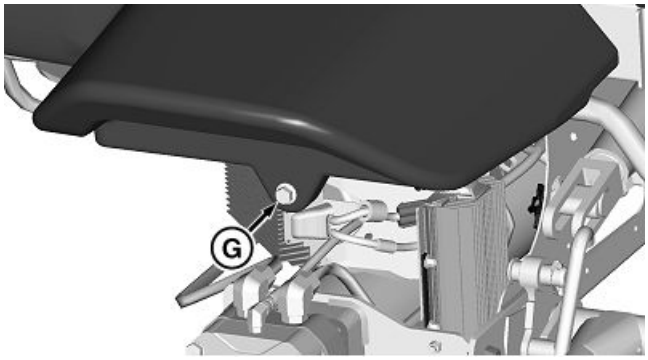


TCT009223 —UN—28OCT13

BS62576,000100C -19-29OCT13-4/5

9. Remove bolt (G) securing tank.
10. Remove fuel tank.

G—Hex Bolt M12x80



7500A Shown, 8000A Similar

TCT009224 —UN—28OCT13

BS62576,000100C -19-29OCT13-5/5

Install Fuel Tank

CAUTION: Avoid injury! Fuel vapors are explosive and flammable:

- **Do not smoke while handling fuel.**
- **Keep fuel away from flames or sparks.**
- **Shut off engine before servicing.**
- **Cool engine before servicing.**
- **Work in a well-ventilated area.**
- **Clean up spilled fuel immediately.**

1. Install fuel tank into mounting position.
2. Install bolt (A) through fuel tank rear bracket, hydraulic tank mount, frame bracket, and wire harness retainer. Secure bolt with lock nut and tighten to specification.

Specification	
Fuel Tank Rear Support Bracket Lock Nut—Torque	55 N·m (40 lb.-ft.)

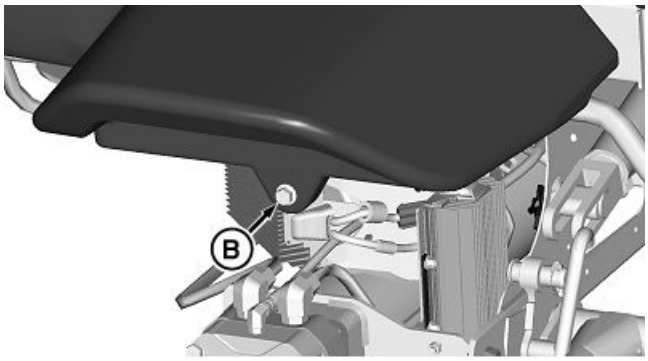
TCT007379 —UN—13MAY13

A—Hex Bolt M10x80

BS62576,000100D -19-21NOV13-1/6

3. Secure front side of fuel tank with bolt (B).

B—Hex Bolt M12x80



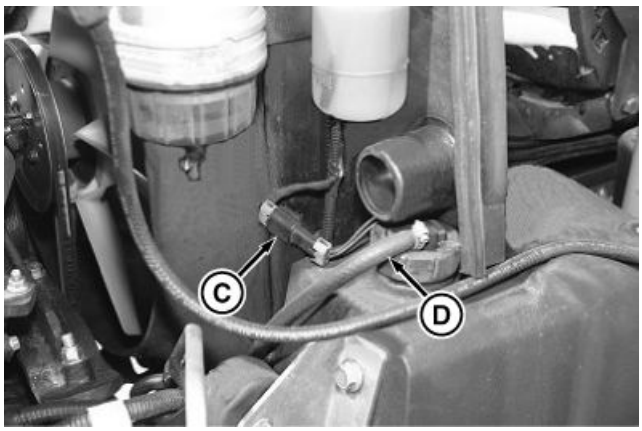
TCT006868 —UN—28FEB13

7500A Shown. 8000A Similar.

BS62576,000100D -19-21NOV13-2/6

4. Connect wire harness connector (C).
5. Install hose (D) to fitting and tighten hose clamp.

C—Wire Harness Connector **D—Hose Clamp**



TCT009225 —UN—28OCT13

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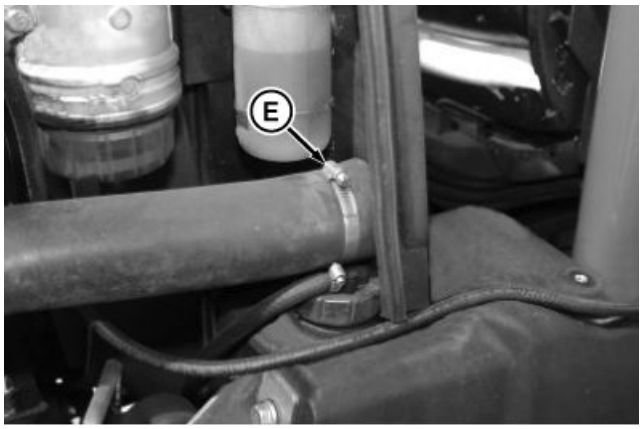
BS62576,000100D -19-21NOV13-3/6

6. Install air duct to bulkhead inlet and tighten clamp (E).

E—Hose Clamp

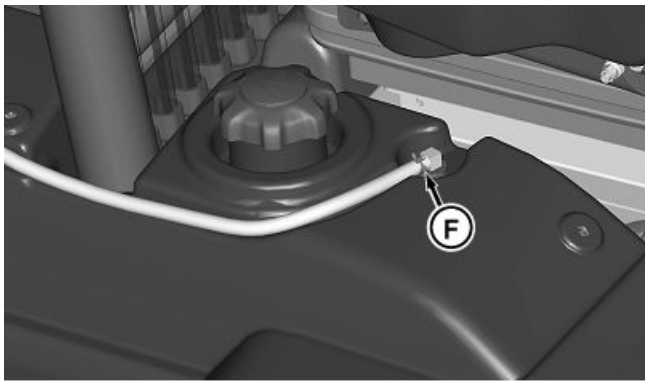


TCT009226 —UN—28OCT13

BS62576,000100D -19-21NOV13-4/6

7. Install fuel hose (F) to fitting. Ensure that hose is installed in tank channel.

F—Fuel Supply Hose

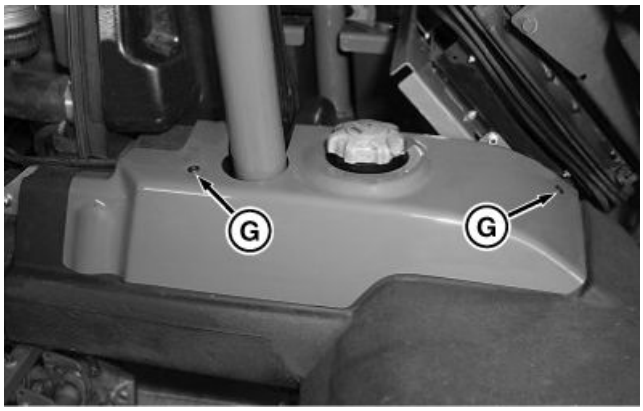


TCT009227 —UN—28OCT13

BS62576,000100D -19-21NOV13-5/6

8. Install fuel tank cover and secure with screws (G).
9. Install wheel and tire assembly.
10. Prime fuel system.
    a. Turn key switch to RUN position for 2 minutes to remove air from and pressurize fuel system.
    b. Start engine.
    c. Check for fuel in tank, leaks at fuel hose connections, or fuel pump operation if engine does not start.

G—Flange Head Screw M6x16 (2 used)



TCT009228 —UN—28OCT13

BS62576,000100D -19-21NOV13-6/6

Section 220
Engine Operation, Tests, and Adjustments
Contents

Page

Group 10—Theory of Operation
Fuel and Air System Operation 220-10-1
Cooling System Operation..... 220-10-3
Lubrication System Operation 220-10-4

Group 20—Engine Diagnosis
Engine Will Not Start 220-20-1
Procedure.....220-20-1
Engine Starts But Does Not Continue Running.....220-20-3
No Exhaust Smoke.....220-20-3
Excess Exhaust Smoke.....220-20-3
Low Engine Output.....220-20-4
Exhaust Color NORMAL.....220-20-4
Exhaust Color WHITE 220-20-5
Exhaust Color BLACK 220-20-7
Exhaust Color WHITE Under Load 220-20-8
Procedure.....220-20-8
Exhaust Color BLACK Under Load 220-20-9
Procedure.....220-20-9
Exhaust Temperature Too High 220-20-11
Procedure.....220-20-11
Engine Runs Rough 220-20-12
Misfiring 220-20-12
Uneven Combustion Sound.....220-20-13
Engine Surges DURING IDLING.....220-20-13
Engine Surges UNDER LOAD 220-20-14
Excessive Engine Vibration.....220-20-14
Excessive Fuel Consumption 220-20-15
Procedure.....220-20-15
Excessive Oil Consumption.....220-20-16
Procedure.....220-20-16
Fuel Oil in Crankcase 220-20-17
Procedure.....220-20-17
Coolant in Crankcase 220-20-18
Procedure.....220-20-18
Low Oil Pressure 220-20-18
Procedure.....220-20-18
Engine Is Overheating.....220-20-19
Procedure.....220-20-19
Low Engine Coolant Temperature.....220-20-20
Procedure.....220-20-20
Low Compression.....220-20-20
Procedure.....220-20-20

Group 30—Non-T4 Fuel and Air Operation, Tests, and Adjustments
Summary of References..... 220-30-1
Injection Pump Static Timing 220-30-1
Test Fuel Injection Nozzles..... 220-30-6
Adjust Throttle Cable 220-30-7

Page

Test Fuel System Leakage 220-30-8
Fuel Transfer Pump Pressure Test 220-30-9
Fuel Transfer Pump Flow Test..... 220-30-9
Bleed Fuel System 220-30-10

Group 40—Turbocharger Operation, Tests, and Adjustments
Summary of References..... 220-40-1
Extending Turbocharger Life 220-40-2
Turbocharger Seven-Step Inspection 220-40-4
Check Turbocharger Rotor Shaft Axial Play..... 220-40-7
Check Turbocharger Rotor Shaft Radial Play 220-40-8
Turbocharger Waste Gate Test..... 220-40-9

Group 50—Engine Tests, and Adjustments
Summary of References..... 220-50-1
Specifications 220-50-2
Test Cylinder Compression..... 220-50-3
Adjust Slow Idle 220-50-4
Adjust Valve Clearance 220-50-5
Adjust Valve Clearance—Obstructed Timing Marks 220-50-7
Check Valve Lift..... 220-50-8
Check Connecting Rod Side Play..... 220-50-9
Check Connecting Rod Bearing Clearance 220-50-9
Check Crankshaft End Play..... 220-50-10
Check Crankshaft Main Bearing Clearance 220-50-11
Check Camshaft End Play..... 220-50-12
Check Timing Gear Backlash 220-50-12
Test and Adjust 12 Volt Alternator and Cooling Fan Drive Belt Tension 220-50-13
Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension 220-50-14
Test Cylinder Leakdown 220-50-14
Test Radiator Cap Pressure 220-50-15
Test Thermostat Opening 220-50-16
Test Cooling System Pressure 220-50-17
Test Coolant Temperature Switch..... 220-50-17
Test Engine Coolant Temperature Sensor 220-50-18
Test Engine Oil Pressure..... 220-50-19

Fuel and Air System Operation

Function

The fuel system supplies fuel to injection nozzles.

The air intake system filters and supplies air needed for combustion.

Theory of Operation

NOTE: The water separator and pump are located adjacent to the right front wheel.

Fuel System

An electric fuel transfer pump (A) draws fuel through the water separator (B) from the tank outlet. The low-pressure fuel from the fuel pump flows through the filter (C) to the fuel injection pump inlet (D). The injection pump then directs high-pressure fuel through the injection lines (E) to the injectors, where it is injected into the cylinders for combustion. Excess fuel from the injectors and the injection pump is returned by line (F) to the filter where, if needed, it can be sent back to the injection pump. If not needed, the fuel is sent back to the tank by line (G).

If the unit runs out of fuel, there are two air bleed lines that allow air to escape from the top of the filter and the injection pump. These two lines allow the system to be self-bleeding.

The engine speed is controlled by the throttle lever and cable. The cable is connected to the injection pump governor control lever. The fuel shutoff solenoid controls the injection pump shutoff shaft. When the solenoid is retracted (key in the START or ON position), the engine can be started. When the key is turned off, return springs on the shutoff shaft extend the solenoid, moving the shutoff linkage to the shutoff position.

The injection pump meters fuel as determined by the governor and delivers it at high pressure to the injection nozzles.

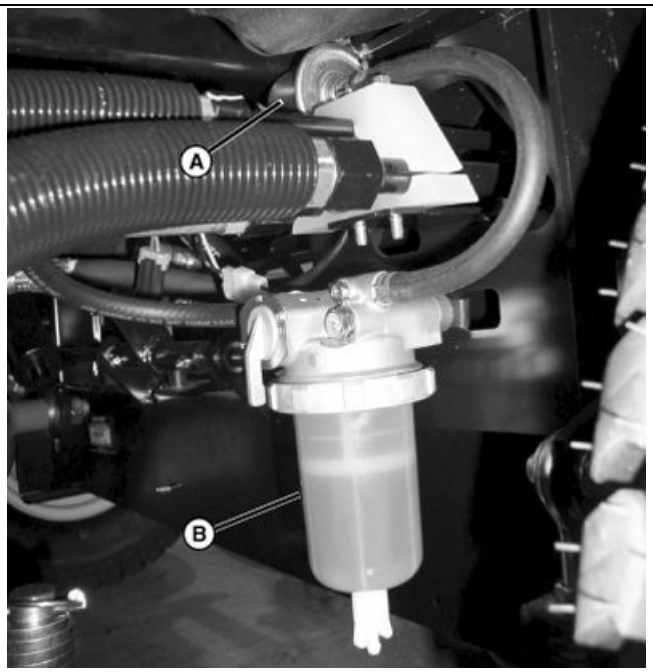
The injection nozzle prevents flow until high pressure is reached, opening the valve and spraying atomized fuel into the combustion chamber. Injection lines contain trapped fuel whenever injection is not taking place.

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.

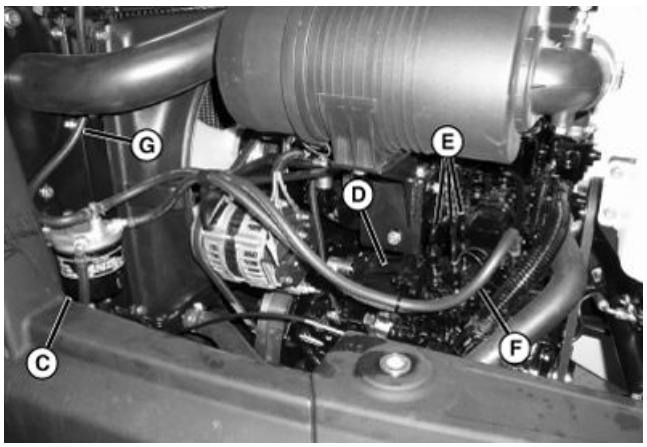
A fuel float gauge is mounted in the fuel tank to inform the operator of the fuel level.

Air Intake System

Air enters the air filter through the perforated side holes. The primary and secondary elements filter the air before entering the intake manifold.



TCAL25247 —UN—15JUN12



TCAL25248 —UN—15JUN12

A—Electric Fuel Transfer Pump
B—Water Separator
C—Filter
D—Fuel Injection Pump Inlet
E—Injection Lines
F—Return Line
G—Return Line

An air filter restriction indicator has a button that exposes a red indicator when the air filter needs servicing. The air filter restriction indicator is exposed when the vacuum reaches a specified level. A small amount of vacuum is always present due to some restriction of air movement through the filter elements. The unloading valve is like a one-way valve. It ejects heavy dirt particles from the air stream during engine operation, but does not let air into the air filter housing. The operator can squeeze the valve to let the large particles out.

Continued on next page

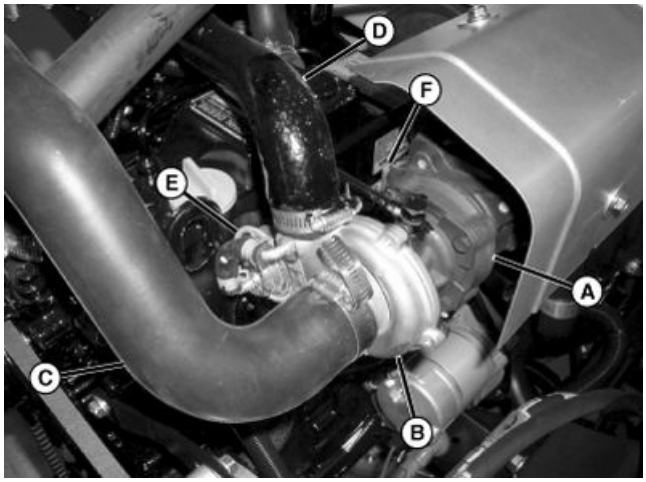
Turbocharger

The turbocharger provides additional air, to burn more fuel and produce more power without increasing the size of the engine. The turbine in the turbocharger may spin as fast as 150,000 rpm.

The turbine is on a shaft inside the turbine housing (A). The shaft is connected to the compressor wheel, which is inside the compressor housing (B). The shaft is supported by two floating bearings, which are located between the turbine and compressor housings.

Exhaust gases from the engine pass through the turbine housing, causing the turbine to rotate before the exhaust gas is discharged. The compressor wheel also begins to rotate in the compressor housing. Air from the air cleaner is supplied to the inlet side of the compressor housing by hose (C). The air is compressed inside the housing and delivered to the intake manifold by hose (D).

The turbocharger is equipped with a waste gate (F). If the turbocharger goes above a specified pressure, a diaphragm (E), sensing inlet pressure from the compressor, opens a waste gate valve (F) to allow excess exhaust gases to bypass the turbine. The waste gate valve limits boost pressure at high engine rpm to prevent damage to the engine.

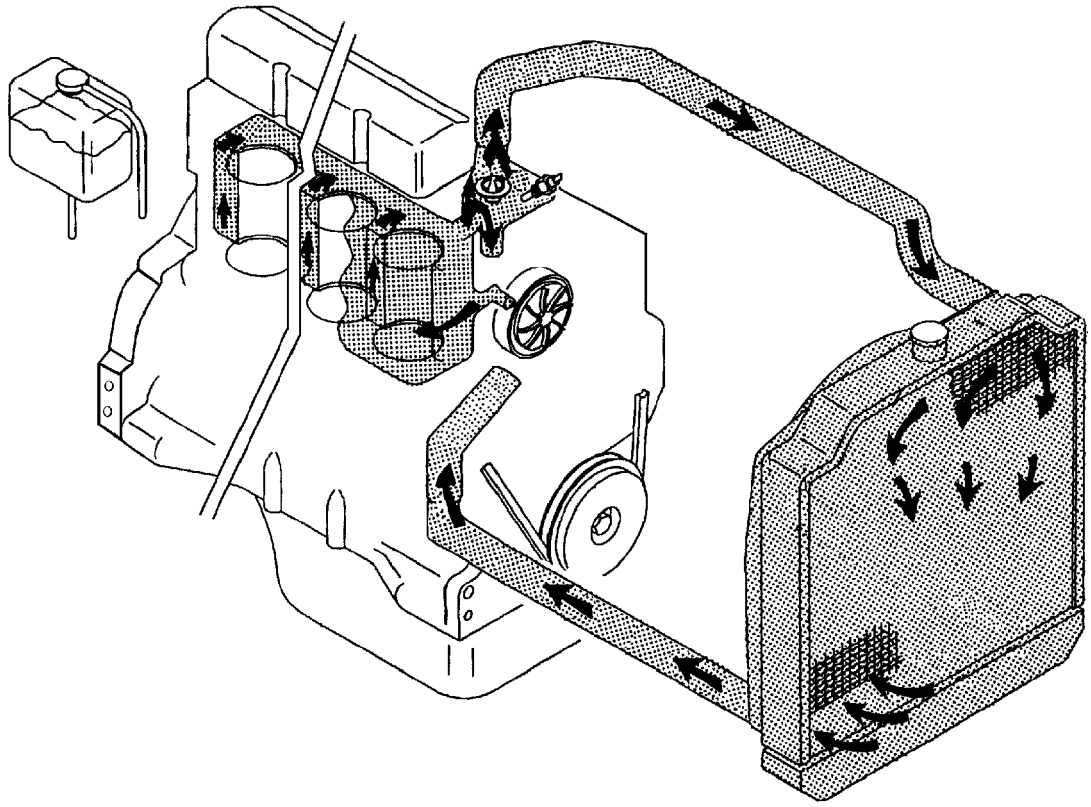


TCAL25249 —UN—15JUN12

A—Turbine Housing
B—Compressor Housing
C—Hose to Inlet Side of Compressor
D—Hose to Intake Manifold
E—Diaphragm
F—Waste Gate

OUMX258,00006D6 -19-05NOV12-2/2

Cooling System Operation



TCAL25250 —UN—15JUN12

Function

The coolant pump circulates coolant through the cooling system, drawing hot coolant from the engine block and circulating it through the radiator for cooling.

Theory of Operation

The pressurized cooling system includes the radiator, coolant pump, fan and thermostat.

During the warm-up period, the thermostat remains closed and the impeller-type coolant pump draws coolant from the bypass tube. Coolant from the pump flows to the cylinder block water jacket and up through the cylinder head, providing a fast warm-up.

Once the engine has reached operating temperature, the thermostat opens and coolant is pumped from the bottom of the radiator via the lower radiator hose into the cylinder block. Here it circulates through the block and around the cylinders.

From the block, coolant is then directed through the cylinder head and into the thermostat housing. With the thermostat open, warm engine coolant passes through the housing into the top of the radiator, where it is circulated to dissipate heat.

When coolant system pressure exceeds 88.3 kPa (12.8 psi), a valve in the radiator cap opens to allow coolant to discharge into the coolant recovery tank.

When temperature is reduced, a vacuum is produced in the radiator and coolant is drawn back out of the coolant recovery tank through a valve in the radiator cap.

A coolant temperature switch informs the operator of the engine coolant temperature and warns of a high-temperature condition by displaying and icon and sounding an alarm buzzer.

OUMX258,00006D7 -19-23MAY14-1/1

Lubrication System Operation

Function

A full-pressure system lubricates engine parts with filtered oil.

Theory of Operation

The pressure lubrication system consists of a positive displacement gear-driven pump, oil strainer, full-flow oil filter, oil pressure regulating valve, and an electrical pressure warning switch.

The 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 galley.

From the main oil galley, oil is forwarded under pressure to the crankshaft main bearing journals and idler gear shaft. 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 shaft. 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 galley through external oil lines.

An oil pressure switch activates an indicator on the display as well as a warning buzzer to alert the operator to shut down the engine if oil pressure drops below specification.

Turbocharger Lubrication

Engine oil under pressure from the engine lubrication system is pumped through passages into the center housing of the turbocharger and directed to the bearings.

The turbocharger contains two floating bearings that have clearance between the bearing OD and the housing wall, as well as clearance between the bearing ID and the shaft OD.

These clearances are lubricated by the pressurized oil supply, which allows the bearings to be protected by a cushion of oil.

The pressure-free oil drains by gravity from the center housing to the engine crankcase.

OUMX258,00006D8 -19-20MAY14-1/1

Engine Will Not Start

Engine Will Not Start

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

Coolant in the radiator is extremely hot during operation.

OUMX258,00006D9 -19-06NOV12-1/18

Procedure

OUMX258,00006D9 -19-06NOV12-2/18

Step 1	Proper starting procedure being used is correct for conditions?	**YES:** Go to next step. **NO:** Use correct procedure for conditions. (See Operator's Manual.)

OUMX258,00006D9 -19-06NOV12-3/18

Step 2	Battery 12.7 VDC or higher?	**YES:** Go to next step. **NO:** Charge and check battery.

OUMX258,00006D9 -19-06NOV12-4/18

Step 3	No open circuits in wiring?	**YES:** Go to next step. **NO:** Repair or replace as needed.

OUMX258,00006D9 -19-06NOV12-5/18

Step 4	Starting motor functioning properly?	**YES:** Go to next step. **NO:** Repair or replace starting motor. (See Disassemble and Assemble Starting Motor.)

OUMX258,00006D9 -19-06NOV12-6/18

Step 5	Engine oil of correct viscosity and type?	**YES:** Go to next step. **NO:** Replace engine oil with oil of proper viscosity and type. Replace oil filter.

OUMX258,00006D9 -19-06NOV12-7/18

Step 6	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006D9 -19-06NOV12-8/18

Step 7	Fuel filter not clogged?	**YES:** Go to next step. **NO:** Replace fuel filter.

OUMX258,00006D9 -19-06NOV12-9/18

Step 8	No air leak in fuel system?	**YES:** Go to next step. **NO:** Repair fuel system.

Continued on next page

OUMX258,00006D9 -19-06NOV12-10/18

Step 9	Fuel lines not plugged, pinched, or cracked?	**YES:** Go to next step. **NO:** Repair or replace fuel lines as needed.

OUMX258,00006D9 -19-06NOV12-11/18

Step 10	Correct volume of fuel supplied to injection pump?	**YES:** Go to next step. **NO:** Replace fuel transfer pump.

OUMX258,00006D9 -19-06NOV12-12/18

Step 11	Intake and/or exhaust valve clearance correct?	**YES:** Go to next step. **NO:** Adjust valve clearance. (See Adjust Valve Clearance.)

OUMX258,00006D9 -19-06NOV12-13/18

Step 12	Injection pump timing correct?	**YES:** Go to next step. **NO:** Correctly time injection pump.

OUMX258,00006D9 -19-06NOV12-14/18

Step 13	Intake and/or exhaust valve not seized?	**YES:** Go to next step. **NO:** Replace valve and check valve guide. (See Disassemble and Assemble Cylinder Head and Valves.)

OUMX258,00006D9 -19-06NOV12-15/18

Step 14	Piston rings not broken or seized?	**YES:** Go to next step. **NO:** Replace rings. Check piston and cylinder. (See Inspect Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006D9 -19-06NOV12-16/18

Step 15	Piston rings, piston, or cylinder not worn?	**YES:** Go to next step. **NO:** Replace piston and/or rings; bore or hone cylinder. (See Inspect Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006D9 -19-06NOV12-17/18

Step 16	Crankshaft pin or bearing not seized?	**NO:** Regrind crankshaft and replace bearings. (See Inspect Crankshaft and Main Bearings.)

OUMX258,00006D9 -19-06NOV12-18/18

Engine Starts But Does Not Continue Running

Engine Starts but Does Not Continue Running

OUMX258,00006DA -19-14MAR14-1/15

No Exhaust Smoke

OUMX258,00006DA -19-14MAR14-2/15

Step 1	Engine oil of proper viscosity and type?	**YES:** Go to next step. **NO:** Replace engine oil filter and use oil of proper viscosity and type.

OUMX258,00006DA -19-14MAR14-3/15

Step 2	Fuel filter not clogged?	**YES:** Go to next step. **NO:** Replace fuel filter.

OUMX258,00006DA -19-14MAR14-4/15

Step 3	No air leak in fuel system?	**YES:** Go to next step. **NO:** Repair fuel system.

OUMX258,00006DA -19-14MAR14-5/15

Step 4	Fuel lines not plugged, pinched, or cracked?	**YES:** Go to next step. **NO:** Repair or replace fuel lines as needed.

OUMX258,00006DA -19-14MAR14-6/15

Step 5	Correct volume of fuel supplied to injection pump?	**YES:** Go to next step. **NO:** Replace fuel transfer pump.

OUMX258,00006DA -19-14MAR14-7/15

Step 6	Valve clearance correct?	**YES:** Go to next step. **NO:** Adjust valve clearance. (See Adjust Valve Clearance.)

OUMX258,00006DA -19-14MAR14-8/15

Step 7	Crankshaft pin or bearing not seized?	**NO:** Regrind crankshaft and replace bearings. (See Inspect Crankshaft and Main Bearings.)

OUMX258,00006DA -19-14MAR14-9/15

Excess Exhaust Smoke

OUMX258,00006DA -19-14MAR14-10/15

Step 1	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

Continued on next page

OUMX258,00006DA -19-14MAR14-11/15

Step 2	Fuel filter not clogged?	**YES:** Go to next step. **NO:** Replace fuel filter.

OUMX258,00006DA -19-14MAR14-12/15

Step 3	Intake and/or exhaust valve not seized?	**YES:** Go to next step. **NO:** Replace valve and check valve guide. (See Disassemble and Assemble Cylinder Head and Valves.)

OUMX258,00006DA -19-14MAR14-13/15

Step 4	Piston rings not broken or seized?	**YES:** Go to next step. **NO:** Replace rings. Check piston and cylinder. (See Inspect Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DA -19-14MAR14-14/15

Step 5	Piston rings, piston, or cylinder not worn?	**NO:** Replace piston and/or rings; bore or hone cylinder. (See Inspect Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DA -19-14MAR14-15/15

Low Engine Output

Low Engine Output

OUMX258,00006DB -19-06NOV12-1/35

Exhaust Color NORMAL

OUMX258,00006DB -19-06NOV12-2/35

Step 1	Correct type of fuel being used?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DB -19-06NOV12-3/35

Step 2	Proper type and viscosity of oil being used?	**YES:** Go to next step. **NO:** Replace engine oil and filter.

OUMX258,00006DB -19-06NOV12-4/35

Step 3	Fuel filter not clogged?	**YES:** Go to next step. **NO:** Replace fuel filter.

OUMX258,00006DB -19-06NOV12-5/35

Step 4	Fuel lines not clogged, cracked, or pinched?	**YES:** Go to next step. **NO:** Clean or replace fuel lines.

Continued on next page

OUMX258,00006DB -19-06NOV12-6/35

Step 5	No air leakage into fuel system?	**YES:** Go to next step. **NO:** Repair fuel supply system.

OUMX258,00006DB -19-06NOV12-7/35

Step 6	Proper volume of fuel to injection pump?	**YES:** Go to next step. **NO:** Check or replace fuel transfer pump.

OUMX258,00006DB -19-06NOV12-8/35

Step 7	Intake and exhaust valve clearance correct?	**YES:** Go to next step. **NO:** Adjust valve clearance. (See Adjust Valve Clearance.)

OUMX258,00006DB -19-06NOV12-9/35

Step 8	Intake or exhaust valves not leaking compression?	**YES:** Go to next step. **NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Head and Valves.)

OUMX258,00006DB -19-06NOV12-10/35

Step 9	Intake or exhaust valves not seized?	**YES:** Go to next step. **NO:** Replace valve and check valve guide. (See Inspect Cylinder Head and Valves.)

OUMX258,00006DB -19-06NOV12-11/35

Step 10	Cylinder head gasket not leaking compression?	**NO:** Replace head gasket. (See Remove and Install Cylinder Head and Valves.) Resurface head and block if necessary (See Inspect Cylinder Head and Valves.)

OUMX258,00006DB -19-06NOV12-12/35

Exhaust Color WHITE

OUMX258,00006DB -19-06NOV12-13/35

Step 1	Correct type of fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DB -19-06NOV12-14/35

Step 2	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

Continued on next page

OUMX258,00006DB -19-06NOV12-15/35

Step 3	Even volume of fuel being injected?	**YES:** Go to next step. **NO:** Repair or replace fuel injection pump or fuel injectors.

OUMX258,00006DB -19-06NOV12-16/35

Step 4	Proper spray pattern from injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Remove and Install Fuel Injection Nozzle.)

OUMX258,00006DB -19-06NOV12-17/35

Step 5	Intake or exhaust valve stems not worn?	**YES:** Go to next step. **NO:** Replace valve guides and valves. (See Disassemble and Assemble Cylinder Head and Valves.)

OUMX258,00006DB -19-06NOV12-18/35

Step 6	Injection pump timing correct?	**YES:** Go to next step. **NO:** Correctly time injection pump.

OUMX258,00006DB -19-06NOV12-19/35

Step 7	Piston rings installed correctly?	**YES:** Go to next step. **NO:** Install piston rings correctly. (See Disassemble and Assemble Piston and Connecting Rod.)

OUMX258,00006DB -19-06NOV12-20/35

Step 8	Piston ring ends staggered?	**YES:** Go to next step. **NO:** Stagger piston ring ends. (See Disassemble and Assemble Piston and Connecting Rod.)

OUMX258,00006DB -19-06NOV12-21/35

Step 9	Piston, rings, or cylinder not worn?	**YES:** Go to next step. **NO:** Replace pistons and rings; bore or hone cylinders. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

Continued on next page

OUMX258,00006DB -19-06NOV12-22/35

Step 10	Piston rings not broken or seized?	**NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DB -19-06NOV12-23/35

Exhaust Color BLACK

OUMX258,00006DB -19-06NOV12-24/35

Step 1	Is engine NOT being run under high altitude or high temperature conditions?	**YES:** Go to next step. **NO:** Reduce load.

OUMX258,00006DB -19-06NOV12-25/35

Step 2	Correct type of fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DB -19-06NOV12-26/35

Step 3	Air filter elements not clogged?	**YES:** Go to next step. **NO:** Clean or replace air filter elements.

OUMX258,00006DB -19-06NOV12-27/35

Step 4	Exhaust pipe not clogged?	**YES:** Go to next step. **NO:** Clean exhaust pipe.

OUMX258,00006DB -19-06NOV12-28/35

Step 5	Engine running cool enough?	**YES:** Go to next step. **NO:** Check thermostat. (See Test Thermostat Opening.) Replace if faulty. Adjust coolant pump belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

OUMX258,00006DB -19-06NOV12-29/35

Step 6	Cooling system filled to correct level?	**YES:** Go to next step. **NO:** Check for leaks and fill system to correct level.

OUMX258,00006DB -19-06NOV12-30/35

Step 7	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

Continued on next page

OUMX258,00006DB -19-06NOV12-31/35

Step 8	Correct pattern from fuel injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DB -19-06NOV12-32/35

Step 9	Injection pump timing correct?	**YES:** Go to next step. **NO:** Correctly time injection pump.

OUMX258,00006DB -19-06NOV12-33/35

Step 10	Intake or exhaust valves not leaking compression?	**YES:** Go to next step. **NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Head and Valves.)

OUMX258,00006DB -19-06NOV12-34/35

Step 11	Intake or exhaust valve not seized?	**NO:** Replace valve and check valve guide. (See Inspect Cylinder Head and Valves.)

OUMX258,00006DB -19-06NOV12-35/35

Exhaust Color WHITE Under Load

Exhaust Color WHITE Under Load

OUMX258,00006DC -19-06NOV12-1/11

Procedure

OUMX258,00006DC -19-06NOV12-2/11

Step 1	Correct type of fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DC -19-06NOV12-3/11

Step 2	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DC -19-06NOV12-4/11

Step 3	Engine not running too cool?	**YES:** Go to next step. **NO:** Check thermostat. (See Test Thermostat Opening.) Replace if faulty. Adjust coolant pump belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

Continued on next page

OUMX258,00006DC -19-06NOV12-5/11

Step 4	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump.

OUMX258,00006DC -19-06NOV12-6/11

Step 5	Correct pattern from fuel injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DC -19-06NOV12-7/11

Step 6	Injection pump timing correct?	**YES:** Go to next step. **NO:** Adjust injection pump timing.

OUMX258,00006DC -19-06NOV12-8/11

Step 7	Piston rings installed correctly?	**YES:** Go to next step. **NO:** Install piston rings correctly. (See Disassemble and Assemble Piston and Connecting Rod.)

OUMX258,00006DC -19-06NOV12-9/11

Step 8	Pistons, rings, or cylinders not worn?	**YES:** Go to next step. **NO:** Replace pistons and rings; bore or hone cylinders. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DC -19-06NOV12-10/11

Step 9	Piston rings not broken or seized?	**NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DC -19-06NOV12-11/11

Exhaust Color BLACK Under Load

Exhaust Color BLACK Under Load

OUMX258,00006DD -19-06NOV12-1/12

Procedure

OUMX258,00006DD -19-06NOV12-2/12

Step 1	Is engine NOT being run under high altitude or high temperature conditions?	**YES:** Go to next step. **NO:** Reduce load.

Continued on next page

OUMX258,00006DD -19-06NOV12-3/12

Step 2	Correct type of fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DD -19-06NOV12-4/12

Step 3	Air filter elements not clogged?	**YES:** Go to next step. **NO:** Clean or replace air filter elements.

OUMX258,00006DD -19-06NOV12-5/12

Step 4	Exhaust pipe not clogged?	**YES:** Go to next step. **NO:** Clean exhaust pipe.

OUMX258,00006DD -19-06NOV12-6/12

Step 5	Even volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DD -19-06NOV12-7/12

Step 6	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DD -19-06NOV12-8/12

Step 7	Proper spray pattern from injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DD -19-06NOV12-9/12

Step 8	Injection pump timing correct?	**YES:** Go to next step. **NO:** Adjust injection pump timing. (See Adjust Fuel Injection Timing in Injection Pump Static Timing.)

OUMX258,00006DD -19-06NOV12-10/12

Step 9	Intake or exhaust valves not leaking compression?	**YES:** Go to next step. **NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Head and Valves.)

OUMX258,00006DD -19-06NOV12-11/12

Step 10	Intake or exhaust valves not seized?	**NO:** Replace valve and check valve guide. (See Inspect Cylinder Head and Valves.)

OUMX258,00006DD -19-06NOV12-12/12

Exhaust Temperature Too High

Exhaust Temperature Too High

OUMX258,00006DE -19-14MAR14-1/9

Procedure

OUMX258,00006DE -19-14MAR14-2/9

Step 1	Cooling system filled to correct level?	**YES:** Go to next step. **NO:** Check for leaks and fill system to correct level.

OUMX258,00006DE -19-14MAR14-3/9

Step 2	Engine running cool enough?	**YES:** Go to next step. **NO:** Check thermostat. (See Test Thermostat Opening.) Replace if faulty. Adjust coolant pump belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

OUMX258,00006DE -19-14MAR14-4/9

Step 3	Exhaust pipe not clogged?	**YES:** Go to next step. **NO:** Clean exhaust pipe.

OUMX258,00006DE -19-14MAR14-5/9

Step 4	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DE -19-14MAR14-6/9

Step 5	Intake or exhaust valve clearance correct?	**YES:** Go to next step. **NO:** Adjust valve clearance. (See Adjust Valve Clearance.)

OUMX258,00006DE -19-14MAR14-7/9

Step 6	Intake or exhaust valves not leaking compression?	**YES:** Go to next step. **NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Head and Valves.)

OUMX258,00006DE -19-14MAR14-8/9

Step 7	Piston rings not broken or seized?	**NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DE -19-14MAR14-9/9

Engine Runs Rough

Engine Runs Rough

OUMX258,00006DF -19-06NOV12-1/33

Misfiring

OUMX258,00006DF -19-06NOV12-2/33

Step 1	Intake or exhaust valve clearance correct?	**YES:** Go to next step. **NO:** Adjust valve clearance. (See Adjust Valve Clearance.)

OUMX258,00006DF -19-06NOV12-3/33

Step 2	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DF -19-06NOV12-4/33

Step 3	Injection pump timing correct?	**YES:** Go to next step. **NO:** Adjust injection pump timing. (See Adjust Fuel Injection Timing in Injection Pump Static Timing.)

OUMX258,00006DF -19-06NOV12-5/33

Step 4	Backlash of timing gear not excessive?	**YES:** Go to next step. **NO:** Repair gears as needed. (See Check Timing Gear Backlash.)

OUMX258,00006DF -19-06NOV12-6/33

Step 5	Combustion chambers clean of foreign matter?	**YES:** Go to next step. **NO:** Clean combustion chambers. (See Remove and Install Cylinder Head and Valves.)

OUMX258,00006DF -19-06NOV12-7/33

Step 6	Intake or exhaust valves not leaking compression?	**YES:** Go to next step. **NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Head and Valves.)

OUMX258,00006DF -19-06NOV12-8/33

Step 7	Intake or exhaust valves not seized?	**YES:** Go to next step. **NO:** Replace valve and check valve guide. (See Inspect Cylinder Head and Valves.)

Continued on next page

OUMX258,00006DF -19-06NOV12-9/33

Step 8	Piston rings not broken or seized?	**NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DF -19-06NOV12-10/33

Uneven Combustion Sound

OUMX258,00006DF -19-06NOV12-11/33

Step 1	Correct type of fuel being used?	**YES:** Go to next step. **NO:** Drain and replace fuel.

OUMX258,00006DF -19-06NOV12-12/33

Step 2	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel. Check fuel filter.

OUMX258,00006DF -19-06NOV12-13/33

Step 3	Even volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DF -19-06NOV12-14/33

Step 4	Proper spray pattern from injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DF -19-06NOV12-15/33

Step 5	Air filter elements not clogged?	**YES:** Go to next step. **NO:** Clean or replace air filter elements.

OUMX258,00006DF -19-06NOV12-16/33

Step 6	Exhaust pipe not clogged?	**NO:** Clean exhaust pipe.

OUMX258,00006DF -19-06NOV12-17/33

Engine Surges DURING IDLING

OUMX258,00006DF -19-06NOV12-18/33

Step 1	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel. Check fuel filter.

Continued on next page

OUMX258,00006DF -19-06NOV12-19/33

Step 2	Even volume of fuel injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DF -19-06NOV12-20/33

Step 3	Proper spray pattern from injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DF -19-06NOV12-21/33

Step 4	Piston rings not broken or seized?	**NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DF -19-06NOV12-22/33

Engine Surges UNDER LOAD

OUMX258,00006DF -19-06NOV12-23/33

Step 1	No water in fuel?	**YES:** Go to next step. **NO:** Drain and replace fuel. Check fuel filters.

OUMX258,00006DF -19-06NOV12-24/33

Step 2	Even volume of fuel injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DF -19-06NOV12-25/33

Step 3	Proper spray pattern from injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DF -19-06NOV12-26/33

Step 4	Piston rings not broken or seized?	**NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DF -19-06NOV12-27/33

Excessive Engine Vibration

Continued on next page

OUMX258,00006DF -19-06NOV12-28/33

Step 1	Even volume of fuel injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006DF -19-06NOV12-29/33

Step 2	Proper spray pattern from injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006DF -19-06NOV12-30/33

Step 3	Piston rings not broken or seized?	**YES:** Go to next step. **NO:** Replace rings. Replace pistons if damaged. Bore cylinder if damaged. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006DF -19-06NOV12-31/33

Step 4	Crankshaft pin or bearing not worn or seized?	**YES:** Go to next step. **NO:** Regrind crankshaft and replace bearings. (See Inspect Crankshaft and Main Bearings.)

OUMX258,00006DF -19-06NOV12-32/33

Step 5	Connecting rod bolts tightened properly?	**NO:** Replace damaged components. Tighten to correct specification. (See Remove and Install Cylinder Head and Valves.)

OUMX258,00006DF -19-06NOV12-33/33

Excessive Fuel Consumption

Excessive Fuel Consumption

OUMX258,00006E0 -19-06NOV12-1/6

Procedure

OUMX258,00006E0 -19-06NOV12-2/6

Step 1	Engine not running too cool?	**YES:** Go to next step. **NO:** Check thermostat. (See Test Thermostat Opening.) Replace if faulty. Adjust coolant pump belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

Continued on next page

OUMX258,00006E0 -19-06NOV12-3/6

Step 2	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006E0 -19-06NOV12-4/6

Step 3	Correct pattern from fuel injectors?	**YES:** Go to next step. **NO:** Clean or replace fuel injection nozzles. (See Test Fuel Injection Nozzles.)

OUMX258,00006E0 -19-06NOV12-5/6

Step 4	Intake or exhaust valves not leaking compression?	**NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Bore.)

OUMX258,00006E0 -19-06NOV12-6/6

Excessive Oil Consumption

Excessive Oil Consumption

OUMX258,00006E1 -19-06NOV12-1/9

Procedure

OUMX258,00006E1 -19-06NOV12-2/9

Step 1	Engine oil of correct viscosity and type?	**YES:** Go to next step. **NO:** Replace engine oil with oil of proper viscosity and type. Replace oil filter.

OUMX258,00006E1 -19-06NOV12-3/9

Step 2	No external or internal oil leak?	**YES:** Go to next step. **NO:** Repair as needed.

OUMX258,00006E1 -19-06NOV12-4/9

Step 3	Intake or exhaust valve stems not worn?	**YES:** Go to next step. **NO:** Replace valve guides and valves. (See Remove and Install Cylinder Head and Valves.)

OUMX258,00006E1 -19-06NOV12-5/9

Step 4	Pistons, rings, or cylinders not worn?	**YES:** Go to next step. **NO:** Replace pistons and rings; bore or hone cylinders. (See Remove and Install Piston and Connecting Rod.)

Continued on next page

OUMX258,00006E1 -19-06NOV12-6/9

Step 5	Piston rings installed correctly and properly staggered?	**YES:** Go to next step. **NO:** Install piston rings correctly. (See Disassemble and Assemble Piston and Connecting Rod.)

OUMX258,00006E1 -19-06NOV12-7/9

Step 6	Piston rings not broken or seized?	**YES:** Go to next step. **NO:** Replace rings. Check piston and cylinder. (See Inspect Piston and Connecting Rod.)

OUMX258,00006E1 -19-06NOV12-8/9

Step 7	No foreign matter in combustion chamber?	**NO:** Clean head and top of piston. Check for damage.

OUMX258,00006E1 -19-06NOV12-9/9

Fuel Oil in Crankcase

Fuel Oil in Crankcase

OUMX258,00006E2 -19-06NOV12-1/6

Procedure

OUMX258,00006E2 -19-06NOV12-2/6

Step 1	Correct volume of fuel being injected?	**YES:** Go to next step. **NO:** Replace faulty fuel injection pump or fuel injectors.

OUMX258,00006E2 -19-06NOV12-3/6

Step 2	Intake or exhaust valve not seized or broken?	**YES:** Go to next step. **NO:** Replace valve and check valve guide. (See Disassemble and Assemble Cylinder Head and Valves.)

OUMX258,00006E2 -19-06NOV12-4/6

Step 3	Piston rings, pistons, or cylinders not worn?	**YES:** Go to next step. **NO:** Replace pistons and rings; bore or hone cylinders. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006E2 -19-06NOV12-5/6

Step 4	Piston rings not broken or seized?	**NO:** Replace rings. Check piston and cylinder. (See Inspect Piston and Connecting Rod.)

OUMX258,00006E2 -19-06NOV12-6/6

Coolant in Crankcase

Coolant in Crankcase

OUMX258,00006E3 -19-06NOV12-1/4

Procedure

OUMX258,00006E3 -19-06NOV12-2/4

Step 1	Cylinder head gasket not leaking?	**YES:** Go to next step. **NO:** Replace head gasket. Resurface head and block if necessary. (See Remove and Install Cylinder Head and Valves and Inspect Cylinder Bore.)

OUMX258,00006E3 -19-06NOV12-3/4

Step 2	Cylinder block not cracked?	**NO:** Replace cylinder block.

OUMX258,00006E3 -19-06NOV12-4/4

Low Oil Pressure

Low Oil Pressure

OUMX258,00006E4 -19-06NOV12-1/9

Procedure

OUMX258,00006E4 -19-06NOV12-2/9

Step 1	Oil at correct level?	**YES:** Go to next step. **NO:** Add oil.

OUMX258,00006E4 -19-06NOV12-3/9

Step 2	Engine oil of correct viscosity and type?	**YES:** Go to next step. **NO:** Replace engine oil with oil of proper viscosity and type. Replace oil filter.

OUMX258,00006E4 -19-06NOV12-4/9

Step 3	No external or internal oil leak?	**YES:** Go to next step. **NO:** Repair as needed.

OUMX258,00006E4 -19-06NOV12-5/9

Step 4	Oil pressure relief valve not worn or damaged?	**YES:** Go to next step. **NO:** Replace oil pump. (See Remove and Install Oil Pump.)

Continued on next page

OUMX258,00006E4 -19-06NOV12-6/9

Step 5	Crankshaft pin or bearing not worn?	**YES:** Go to next step. **NO:** Regrind crankshaft and replace bearings. (See Inspect Crankshaft and Main Bearings.)

OUMX258,00006E4 -19-06NOV12-7/9

Step 6	Connecting rod bolts tightened properly?	**YES:** Go to next step. **NO:** Replace damaged components. Tighten to correct specification.

OUMX258,00006E4 -19-06NOV12-8/9

Step 7	Engine not worn excessively?	**NO:** Replace oil pump. (See Remove and Install Oil Pump.)

OUMX258,00006E4 -19-06NOV12-9/9

Engine Is Overheating

Engine Is Overheating

OUMX258,00006E5 -19-06NOV12-1/9

Procedure

OUMX258,00006E5 -19-06NOV12-2/9

Step 1	Is engine NOT being run under high altitude or high temperature conditions?	**YES:** Go to next step. **NO:** Reduce load on engine.

OUMX258,00006E5 -19-06NOV12-3/9

Step 2	Cooling system filled to correct level?	**YES:** Go to next step. **NO:** Check for leaks and fill system to correct level.

OUMX258,00006E5 -19-06NOV12-4/9

Step 3	Radiator clear of debris?	**YES:** Go to next step. **NO:** Clean radiator fins.

OUMX258,00006E5 -19-06NOV12-5/9

Step 4	Radiator core free from blockage?	**YES:** Go to next step. **NO:** Clean or replace radiator.

Continued on next page

OUMX258,00006E5 -19-06NOV12-6/9

Step 5	Thermostat operating correctly?	**YES:** Go to next step. **NO:** Check thermostat. (See Test Thermostat Opening.) Replace if faulty. Adjust coolant pump belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

OUMX258,00006E5 -19-06NOV12-7/9

Step 6	Cylinder head gasket not leaking?	**YES:** Go to next step. **NO:** Replace head gasket. Resurface head and block if necessary. (See Remove and Install Cylinder Head and Valves and Inspect Cylinder Head and Valves.)

OUMX258,00006E5 -19-06NOV12-8/9

Step 7	Cylinder block not cracked?	**NO:** Replace cylinder block.

OUMX258,00006E5 -19-06NOV12-9/9

Low Engine Coolant Temperature

Low Engine Coolant Temperature

OUMX258,00006E6 -19-06NOV12-1/3

Procedure

OUMX258,00006E6 -19-06NOV12-2/3

Step 1	Thermostat operating correctly?	**NO:** Check thermostat. (See Test Thermostat Opening.) Replace if faulty. Adjust coolant pump belt tension. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

OUMX258,00006E6 -19-06NOV12-3/3

Low Compression

Low Compression

OUMX258,00006E7 -19-06NOV12-1/8

Procedure

OUMX258,00006E7 -19-06NOV12-2/8

Step 1	Engine oil of correct viscosity and type?	**YES:** Go to next step. **NO:** Replace engine oil with oil of correct viscosity and type. Replace oil filter.

Continued on next page

OUMX258,00006E7 -19-06NOV12-3/8

Step 2	Intake or exhaust valves not leaking compression?	**YES:** Go to next step. **NO:** Grind valves and seats. (See Grind Valve Seats and Inspect Cylinder Head and Valves.)

OUMX258,00006E7 -19-06NOV12-4/8

Step 3	Intake or exhaust valve stems not worn?	**YES:** Go to next step. **NO:** Replace valve guides and valves. (See Disassemble and Assemble Cylinder Head and Valves.)

OUMX258,00006E7 -19-06NOV12-5/8

Step 4	Intake or exhaust valve not seized?	**YES:** Go to next step. **NO:** Replace valve guides and valves. (See Disassemble and Assemble Cylinder Head and Valves.)

OUMX258,00006E7 -19-06NOV12-6/8

Step 5	Pistons, rings, or cylinders not worn or seized?	**YES:** Go to next step. **NO:** Replace pistons and rings; bore or hone cylinders. (See Remove and Install Piston and Connecting Rod and Inspect Cylinder Bore.)

OUMX258,00006E7 -19-06NOV12-7/8

Step 6	Piston rings installed correctly and properly staggered?	**NO:** Install piston rings correctly. (See Disassemble and Assemble Piston and Connecting Rod.)

OUMX258,00006E7 -19-06NOV12-8/8

Summary of References

- Injection Pump Static Timing
- Test Fuel Injection Nozzles
- Adjust Throttle Cable
- Test Fuel System Leakage
- Fuel Transfer Pump Pressure Test
- Fuel Transfer Pump Flow Test
- Bleed Fuel System

OUMX258,00006D0 -19-10MAR14-1/1

Injection Pump Static Timing

Special or Required Tools

- JDG10436 Yanmar TNV Diesel Engine Timing Tool Kit

Check Injection Pump Timing

NOTE: Locate and record the fuel injection pump timing index number stamped into the boss on the engine side of the fuel injection pump housing. Treat this number as though there is a decimal point between the two digits, that is, 68 = 6.8.

Using the chart below, find the correct Fuel Injection Reference (FIR) for the model that you are working on.

John Deere Model	Yanmar Engine Model	FIR (Fuel Injection Reference Number)
7500A E-Cut Hybrid	3TNV84T-BMJFM	5

Insert the numbers you have recorded into the following equation:

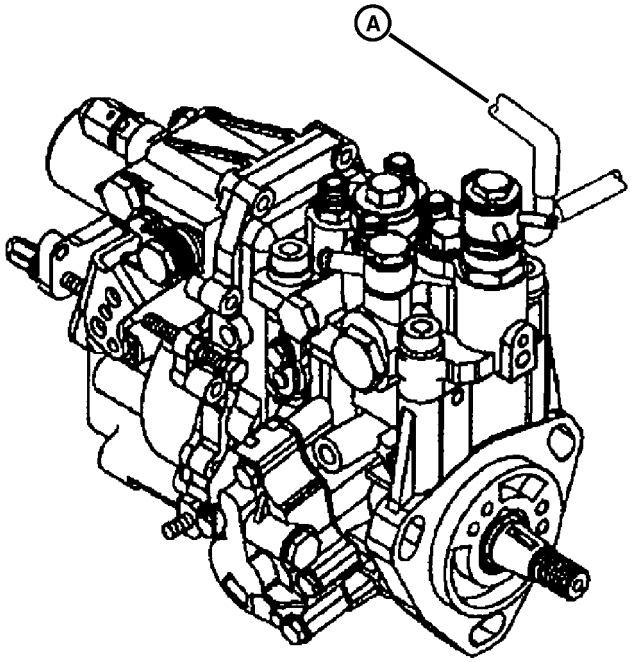
(Fuel Injection Pump Timing Index Number x 2)+ FIR Number = FIT° (Fuel Injection Timing in Degrees).

Record the calculated fuel injection timing in degrees.

NOTE: Some fuel may drain from the fuel injection pump during the process. Make provisions to contain any such spillage.

1. Turn off the fuel valve in the fuel supply hose and the fuel return hose.
2. Clamp shut the fuel injection pump return hose (A) leading to the fuel filter.
3. Remove the forward fuel injection pump plunger plug on top of the fuel injection pump.

A—Return Hose



TCAL25253 —UN—15JUN12

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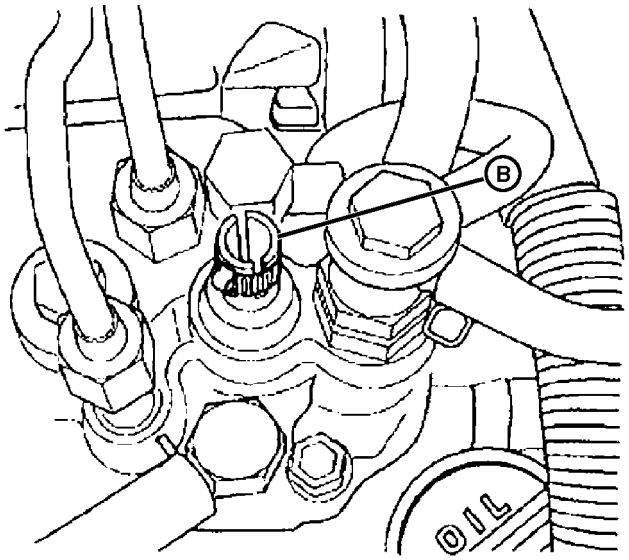
OUMX258,00006B9 -19-12JUN14-1/7

4. Install a dial adapter and clamp (B) from the Yanmar TNV Diesel Engine Timing Tool Kit (JDG10436) into the pump plunger opening.

B—Clamp

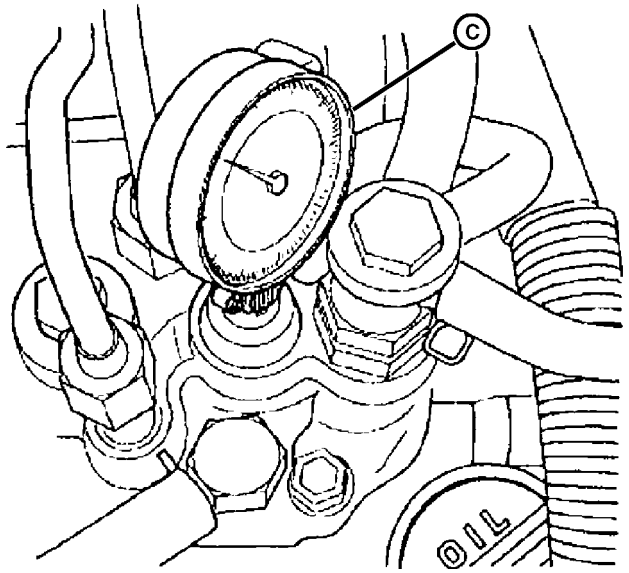


TCAL25254 —UN—15JUN12

OUMX258,00006B9 -19-12JUN14-2/7

5. Install the dial indicator (C) with extension from the Yanmar TNV Diesel Engine Timing Tool Kit into the adapter. Secure the adapter clamp at approximately the midpoint of its travel.

C—Dial Indicator



TCAL25255 —UN—15JUN12

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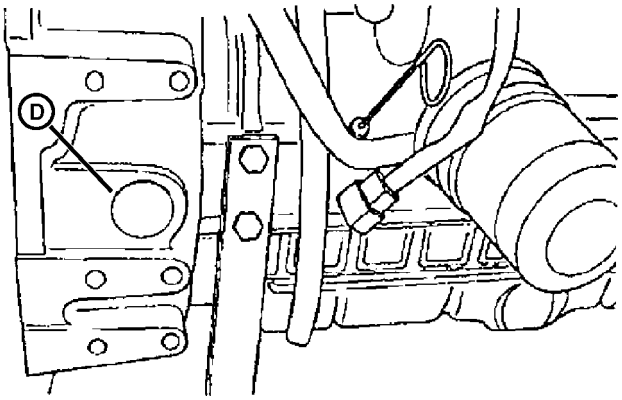
OUMX258,00006B9 -19-12JUN14-3/7

NOTE: The following references to the direction of rotation are facing the coolant pump end of the engine and are adjusted by turning the crankshaft pulley.

6. Using a wrench on the crankshaft pulley bolt, rotate the crankshaft in a clockwise direction while looking through the flywheel inspection port (D). Rotate the crankshaft until the injection timing marks on the flywheel are visible.

D—Flywheel Inspection Port



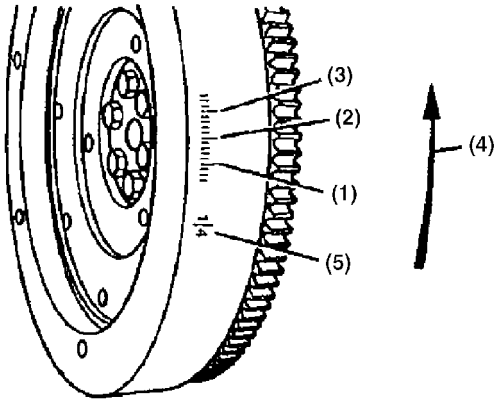
TCAL25256 —UN—15JUN12

OUMX258,00006B9 -19-12JUN14-4/7

NOTE: A typical flywheel will have multiple timing grids, depending on the number of cylinders. Any grid can be used to check the fuel injection timing.

7. Highlight the timing reference mark (E) on the flywheel housing or engine backplate. Highlight the Target timing mark (F) on the flywheel.
8. Rotate the crankshaft counterclockwise until the dial indicator shows that the injection pump plunger is at the bottom of its stroke. Rock the crankshaft back and forth slightly to confirm a point where the dial indicator shows no movement. Zero the dial indicator.
9. Slowly rotate the crankshaft clockwise until the dial indicator shows a pump plunger lift of **2.5 mm (0.100 in.)**.

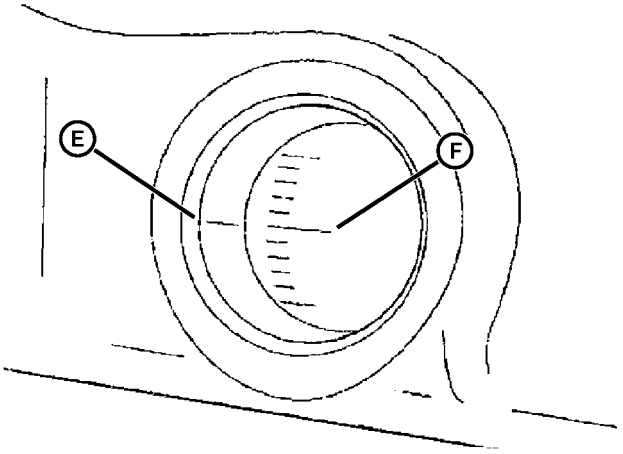
E—Timing Reference Mark **F—Target Timing Mark**



1 – 10° BTDC (Before Top Dead Center)
2 – 15° BTDC
3 – 20° BTDC
4 – Direction of Rotation
5 – TDC (Top Dead Center)

Flywheel Timing Marks

TCAL25257 —UN—15JUN12



TCAL25258 —UN—15JUN12

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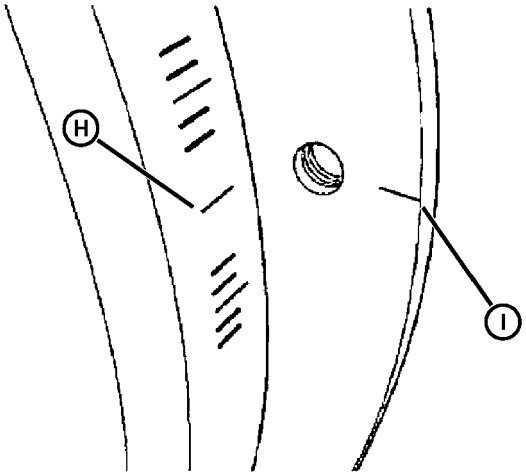
OUMX258,00006B9 -19-12JUN14-5/7

10. Check the position of the flywheel target timing mark (H) in relation to the timing reference mark on the flywheel housing or engine backplate (I). If the two marks are aligned, the fuel injection timing is correct. If the marks do not align, the fuel injection timing must be adjusted.
11. If the injection timing is correct, remove the indicator and adapter. Replace the pump plunger plug and its copper gasket and tighten to specifications. Replace the flywheel inspection port cover. Open the fuel supply valve and remove the clamp from the fuel supply hose and the fuel return hose.

Specification	
Fuel Injection Pump Plunger—Torque	34 N·m (25 lb.-ft.)

12. Prime the fuel system. Operate the engine and check for leaks.



TCAL25260 —UN—15JUN12

H—Flywheel Target Timing Mark **I— Engine Backplate**

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OUMX258,00006B9 -19-12JUN14-6/7

Adjust Fuel Injection Timing

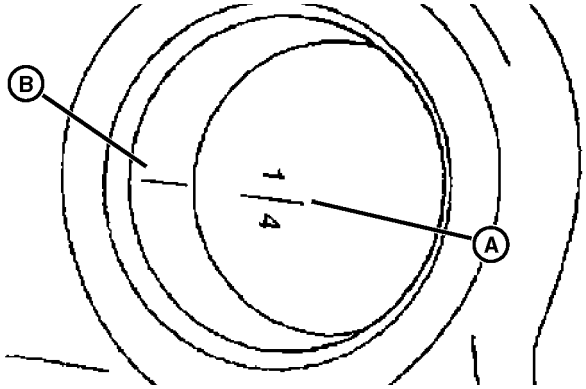
NOTE: If the timing marks did not align above, the following steps need to be performed to properly time the injection pump to the engine.

1. Leave the dial indicator installed in the fuel injection pump. Do not disturb the reading on the dial indicator.
2. Rotate the flywheel until the target timing mark (A) and the timing reference mark on the flywheel housing or backplate (B) are aligned.
3. Note the reading on the dial indicator. If the reading is less than 2.5 mm, the fuel injection timing is “retarded.” If the dial indicator reading is greater than 2.5 mm (0.100 in.), the fuel injection timing is “advanced.”
4. Loosen the nuts fastening the fuel injection pump to the gear case or front plate. Loosen the rear bracket(s) on the fuel injection pump.

NOTE: Some engine models may require the intake manifold and fuel injection pump insulator be removed to access the inner fuel injection pump retaining nuts.

Loosening the high pressure injection line nuts on the fuel injection pump may make rotating the pump easier.

5. Rotate the fuel injection pump until the dial indicator reads **2.5 mm (0.100 in.)**. To “advance” the injection timing, rotate the top of the fuel injection pump away from the engine. To “retard” the injection timing, rotate the top of the fuel injection pump toward the engine.
6. When the dial indicator reads **2.5 mm (0.100 in.)** of pump plunger lift, and the target timing mark on the flywheel aligns with the reference mark on the flywheel housing or engine backplate, the injection timing is correct.
7. Tighten the fuel injection pump mounting nuts and rear bracket(s).
8. Remove the dial indicator and adapter. Replace the plug in the pump plunger opening and tighten it to specification. If removed, install the intake manifold and pump insulator. Tighten the high-pressure injection line nuts to specification. Open the fuel return line and prime the fuel system. Operate the engine and check it for leaks.



A—Target Timing Mark

B—Flywheel Housing or Backplate

Specification

Pump Plunger—Torque	34 N·m (25 lb.-ft.)
High-Pressure Injection Line Nut—Torque	32 N·m (24 lb.-ft.)

OUMX258,00006B9 -19-12JUN14-7/7

Test Fuel Injection Nozzles

CAUTION: Avoid Injury! 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.,

Special or Required Tools

- D01110AA Adapter Set
- D01109AA Diesel Fuel Injection Nozzle Tester
- 23622 Straight Adapter

Connections

Connect the fuel injection nozzle (F) to D01109AA Diesel Fuel Injection Nozzle Tester (A) using parts 36352 (B), 23617 (C), and 23621 (D) from D01110AA Adapter Set, and 23622 Straight Adapter (E).

IMPORTANT: Avoid Damage! Use clean filtered diesel fuel when testing injection nozzles to get best test results.

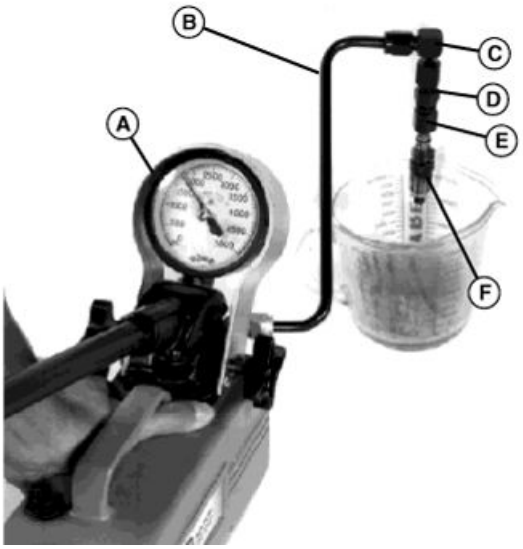
Procedure 1

Test the fuel injection nozzle opening pressure following the nozzle tester manufacturer's instructions. The opening pressure should be at specifications.

	Specification
Fuel Injection Nozzle Opening—Pressure	21 600—22 600 kPa (3133—3278 psi)

Results

- If the pressure reading does not meet specifications, disassemble the injection nozzle and inspect for contamination or a stuck valve. If necessary, add or remove shims to change opening pressure.



TCAL25276 —UN—15JUN12

A—Diesel Fuel Injection Nozzle Tester
B—36352 Line
C—23617 Elbow
D—23621 Fitting
E—23622 Straight Adaptor
F—Fuel Injector Nozzle

Procedure 2

Test fuel injection nozzle leakage following the nozzle tester manufacturer's instructions.

1. Dry the nozzle completely using a lint-free cloth.
2. Pressurize injection nozzle to 19 400 kPa (2814 psi).
3. Watch for leakage from nozzle spray orifice for a minimum of 5 seconds.

Results

- Fuel should not leak from the nozzle when the nozzle is pressurized.
- If the injection nozzle leaks fuel, disassemble and inspect the nozzle assembly for contamination. Inspect the valve seating surface. Replace the nozzle assembly if necessary.

Procedure 3

Test the fuel injection nozzle chatter and spray pattern following the nozzle tester manufacturer's instructions.

1. Pressurize injection nozzle to 21 600—22 600 kPa (3133-3278 psi).
2. Listen for chatter sound and watch spray pattern.

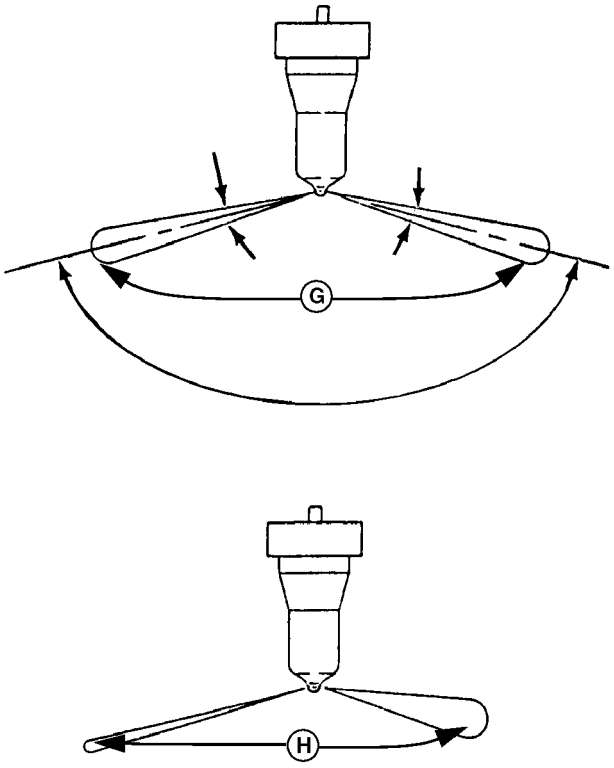
Continued on next page

OUO1086,10003B0 -19-12JUN14-1/2

3. With slow hand lever movement, there should be a “chatter” sound and a fine stream spray pattern.
4. With fast hand lever movement, the nozzle should exhibit an even, fine atomized spray pattern (G), unlike spray pattern (H).
5. Place a sheet of white paper 30 cm (12 in.) below the nozzle. The injection spray should form a perfect circle on the paper.

Results

- If nozzle chatter or the spray pattern does not meet specifications, disassemble the injection nozzle and inspect the nozzle assembly for contamination. Inspect the valve seating surface. Replace the nozzle assembly if necessary.
- If there is excessive difference in the spray angle or injection angle, incomplete atomizing or sluggish starting/stopping of injection (H), disassemble the injection nozzle and inspect the nozzle assembly for contamination. Replace the nozzle assembly if necessary.



TCAL25277 —UN—15JUN12

G—Good Spray Pattern

H—Unacceptable Spray Pattern

OUO1086,10003B0 -19-12JUN14-2/2

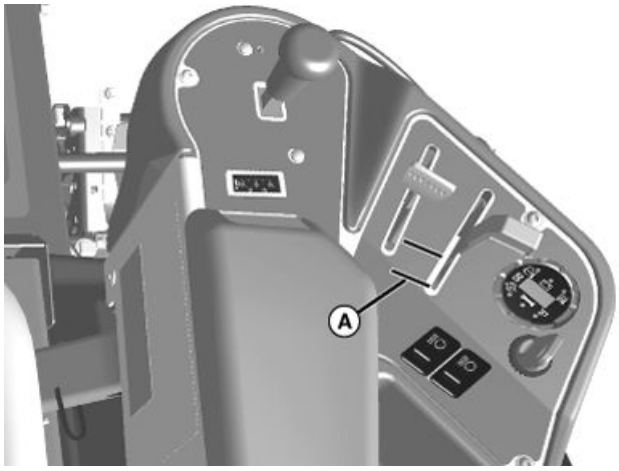
Adjust Throttle Cable

Reason

To make sure that throttle lever and cable move governor lever fully from slow idle to fast idle position.

Procedure

1. Move throttle lever on instrument panel to within approximately 7 mm (0.275 in.) from slow idle end of slot (A).



TCAL25284 —UN—15JUN12

A—Throttle Lever Slot

Continued on next page

OUMX258,00006CA -19-28MAY14-1/2

2. Loosen throttle cable clamp (B). Outer cable measurement (C) should be within specification. Tighten clamp.

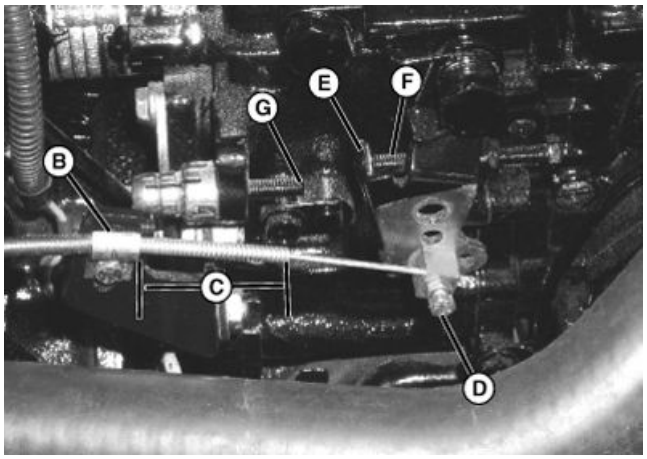
Specification

Throttle Cable—End of Outer Cable-to-Clamp—Distance..... Approximately 41 mm (1.625 in.)

3. Loosen screw and jam nut (D). Throttle arm (E) should be against slow idle stop screw (F).
4. Tighten screw and jam nut.

Results

Throttle lever should move governor linkage throughout full range of travel, touching slow idle stop screw (F) and fast idle stop screw (G).



TCAL25285 —UN—15JUN12

B—Throttle Cable Clamp
C—Outer Cable
D—Screw and Jam Nut
E—Throttle Arm
F—Slow Idle Stop Screw
G—Fast Idle Stop Screw

OUMX258,00006CA -19-28MAY14-2/2

Test Fuel System Leakage

Reason

Tests fuel system plumbing for external leakage. This test also determines if air is entering the fuel system at connections, allowing fuel to siphon back to tank.

Procedure

1. Disconnect fuel lines from fuel filter.
2. Place fuel line from fuel pump to fuel filter into a suitable container to catch drained fuel.

CAUTION: Avoid Injury! DO NOT apply more than 103 kPa (15 psi) air pressure to the fuel system. Damage to the injection pump or personal injury may result.

3. Apply 34—69 kPa (5—10 psi) air pressure to fuel supply hose until all fuel is drained from the system. DO NOT exceed maximum pressure of 103 kPa (15 psi).
4. Apply liquid soap and water solution to all joints and connections in the fuel system and inspect for leaks.

Results

- Find leaks and repair or replace parts as necessary.

OUO1086,10003B9 -19-15JUN12-1/1

Fuel Transfer Pump Pressure Test

Reason

To determine fuel transfer pump operating pressure.

Procedure

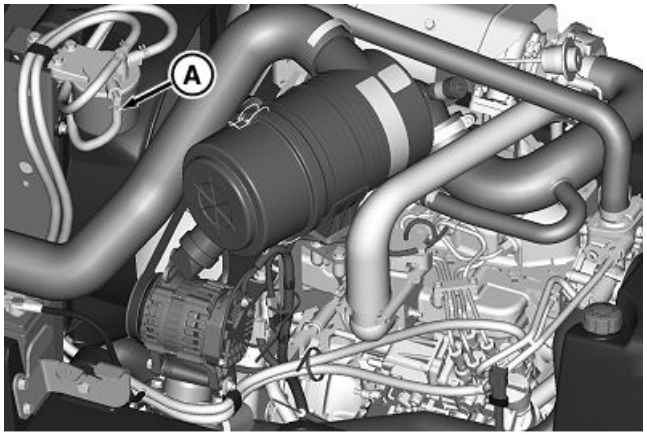
1. Disconnect transfer pump hose (A) from outlet side of pump at fuel filter.
2. Install the hose and gauge to outlet-side hose of pump.
3. Turn key switch to ON position for 15 seconds.
4. Record fuel pressure reading on gauge.

Results

- If the pressure is below specification, replace the fuel transfer pump.

Specification

Fuel Transfer Pump—Pressure	37.3 kPa (5.4 psi)



TCT010066 —UN—12MAY14

A—Transfer Pump Hose

OUMX258,00006CC -19-12MAY14-1/1

Fuel Transfer Pump Flow Test

Reason

To determine fuel transfer pump flow.

Procedure

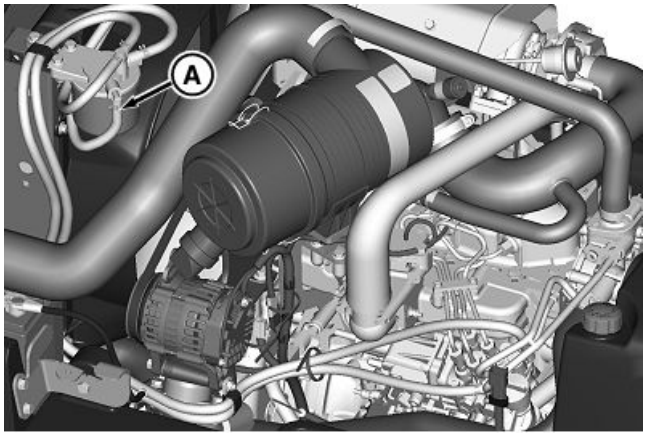
1. Disconnect transfer pump hose (A) from outlet side of pump at fuel filter.
2. Place hose in a graduated container.
3. Turn key switch to ON position for 15 seconds.
4. Compare fuel amount to specification.

Specification

Fuel Transfer Pump—Flow Rate	400 mL (13.5 oz)

Results

- If the quantity is below specification, replace the fuel transfer pump.



TCT010066 —UN—12MAY14

A—Transfer Pump Hose

OUMX258,00006CD -19-12MAY14-1/1

Bleed Fuel System

CAUTION: Avoid Injury! Be careful of moving fan blades, alternator pulley and belts when engine is running. Engine may also be hot.

IMPORTANT: Avoid Damage! Modification or alteration of the injection pump, pump timing, or the injection nozzles in any way not approved by the manufacturer will terminate the warranty obligation.

All engines are equipped with an automatic air venting system that makes the fuel system self-bleeding.

1. Ensure that all fuel line connections are securely tightened.
2. Add fuel to the fuel tank.
3. Turn key to RUN position for 2 minutes prior to starting engine. The fuel pump will pressurize the fuel and remove any air in the system.
4. Start engine. If engine will not start, repeat previous step.

OUO1086,10003BC -19-27MAY14-1/1

Summary of References

- Extending Turbocharger Life
- Turbocharger Seven-Step Inspection
- Check Turbocharger Rotor Shaft Axial Play
- Check Turbocharger Rotor Shaft Radial Play
- Turbocharger Waste Gate Test

OUMX258,00006D1 -19-05NOV12-1/1

Extending Turbocharger Life

Turbochargers are designed to last the life of the engine, but because they operate at such high speeds (100,000 rpm or more), a moment's carelessness can cause them to fail in seconds.

The major causes of turbocharger failure are:

- Lack of lube oil (quick starts and hot shutdowns)
- Oil contamination
- Ingestion of foreign objects
- Restricted oil drainage
- Low oil level
- Operation on excessive side slopes
- Abnormally high exhaust temperatures

Lack of Lube Oil

Oil not only lubricates the turbocharger's spinning shaft and bearings, it also carries away heat. When oil flow stops or is reduced, heat is immediately transferred from the hot turbine wheel to the bearings, which are also heating up because of the increased friction due to the lack of oil. This combination causes the turbocharger shaft temperature to increase rapidly.

If oil flow does not increase and the process continues, bearings will fail. Once the bearings fail (which can happen in just seconds), seals, shaft, turbine, and compressor wheels can also be damaged.

The principal causes of turbocharger bearing lubrication problems are low pressure; a bent, plugged, or undersized oil lube supply line; plugged or restricted oil galleys in the turbocharger; or improper machine start-up and shutdown procedures.

Oil levels and pressure should always be closely monitored, and all worn hoses and lines should be replaced. The turbocharger oil supply line should be checked frequently to make sure it is not kinked or bent, and it should always be replaced with a line of equal size, length, and strength.

IMPORTANT: Avoid Damage! Allow engine to idle for 2 minutes before shutting down after running under load to avoid damage to turbocharger.

The easiest way to damage a turbocharger is through improper start-up and shutdown procedures. Always idle the engine for at least 2 minutes (no load) after start-up and before shutdown. Warming the engine up before applying a load allows oil pressure to build up and lines to fill with oil.

Idling the engine before shutdown allows the engine and turbocharger to cool. "Hot" shutdowns can cause the turbocharger to fail because after high-speed operation the turbocharger will continue to rotate long after the engine has been shut off and oil pressure has dropped to zero. This will cause heat buildup and possible bearing damage. It can also cause carbon and varnish deposits to form.

Oil Contamination

A second cause of turbocharger failures is contaminated oil. It can be caused by a worn or damaged oil filter or by not changing the lube oil at recommended intervals. Expecting the oil filter to remove dirt, sand, metal chips, etc., from the oil before they reach the engine or turbocharger can be a costly mistake because contaminated oil may completely bypass the engine oil filter if the oil filter or oil cooler is clogged, if the filter element is improperly installed, or if the oil is thick during cold weather.

Four good ways of avoiding oil contamination are:

- Always inspect the engine thoroughly during major overhaul. Look especially for any sludge or debris left in lube oil galleys.
- Change lube oil at recommended intervals. Analysis of oil samples at filter change periods can help identify potentially harmful contaminants in the oil.
- Clean the area around the oil fill cap before adding oil.
- Use a clean container when adding oil.

Ingestion of Foreign Objects

The third cause of turbocharger damage is the ingestion of foreign objects. Foreign objects or particles can be ingested and cause damage to the turbocharger on both compressor and turbine sides. This is easy to avoid.

On the compressor side, foreign objects usually take the form of dust, sand, or shreds of air cleaner element that enter through improperly installed air cleaner elements. Leaky air inlet piping (loose clamps or torn rubber joints) or torn pleats in dry-type air cleaner elements also create problems.

The result is erosion of compressor blades that can cause the delicately balanced wheel to wobble.

IMPORTANT: Avoid Damage! Whenever an internal engine failure (valve, valve seat, piston) occurs, a thorough inspection of the turbocharger MUST BE performed before returning engine to service.

Restricted Oil Drainage

A fourth cause of turbocharger damage is restricted lube oil drainage. The lubricating oil carries away heat generated by friction of the bearings and from the hot exhaust gases. If drainage back to the sump is impeded, the bearings will overheat with damage that will ultimately lead to failure.

There are two primary reasons for restricted drainage:

- A blocked drain tube, due to either damage or a buildup of sludged oil.
- High crankcase pressure, due to restricted crankcase breather or excessive engine blow-by.

Periodically check both the turbocharger oil drain tube and engine breather tube for damage or restriction. Correction of these conditions leads to longer turbocharger life.

Continued on next page

Low Oil Level

Check engine oil level periodically according to the Operator's Manual. Proper oil level will prevent turbocharger failure.

Operation on Excessive Side Slopes

Operating equipment on excessive side slopes will prevent oil from being transferred up to the turbocharger, causing overheating wear of moving parts.

Abnormally High Exhaust Temperatures

A seventh cause of turbocharger damage is abnormally high exhaust temperatures. This can cause coking of oil, which can lead to bearing failure. Extreme over-temperature operation can cause wheel burst.

There are two basic causes of over-temperature:

- Restricted air flow
- Overpowering the engine

In either case, the engine has more fuel than available air for proper combustion. This over-fueled condition leads to elevated exhaust temperatures.

Causes of restricted air flow can include:

- Damaged inlet piping
- Clogged air filters
- Excessive exhaust restriction
- Operation at extreme altitudes

Overpowering generally is due to improper fuel delivery or injection timing. If over-temperature operation has been identified, an inspection of the air inlet and exhaust systems should be performed. Also, check the fuel delivery and timing.

OUO1086,10003BE -19-15JUN12-2/2

Turbocharger Seven-Step Inspection

The following inspection procedure is recommended for systematic failure analysis of a suspected failed turbocharger. This procedure will help to identify when a turbocharger has failed, and why it has failed, so the primary cause of failure can be corrected.

Proper diagnosis of a non-failed turbocharger is important for two reasons.

1. Identification of a non-failed turbocharger will lead to further investigation and repair of the cause of a performance complaint.
2. Proper diagnosis eliminates the unnecessary expense incurred when a non-failed turbocharger is replaced.

NOTE: To enhance the turbocharger inspection, use an inspection sheet (Form No. DS-2280 available from Distribution Service Center) to list the inspection steps in the proper order and show potential failure modes for each step. Check off each step of the inspection and record any details or problems obtained during inspection. Retain this with the work order for future reference.

The seven recommended inspection steps, which are explained in detail on the following pages, are:

- Compressor Housing Inlet and Compressor Wheel
- Compressor Housing Outlet
- Turbine Housing Inlet
- Turbine Housing Outlet and Turbine Wheel
- External Center Housing and Joints
- Internal Center Housing
- Turbo Bench Test

Compressor Housing Inlet and Compressor Wheel

NOTE: Foreign object damage may be extensive or minor. In either case, the source of the foreign object must be found and corrected to eliminate future damage.

Use a good light source for this check.

TCAL25289 —UN—15JUN12

A—Compressor Inlet

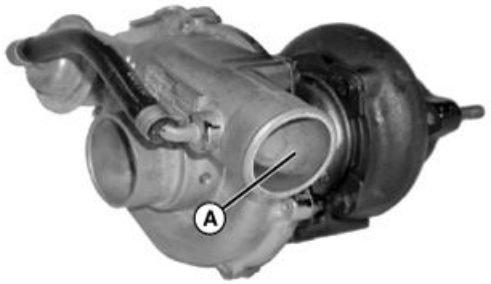
1. Check compressor inlet (A) and blade for foreign object damage.
2. Check compressor inlet for wheel rub on the housing. Look very closely for any score marks on the housing itself and check the tips of the compressor wheel blades for damage.
3. Mark findings on your checklist and continue the inspection.

OUO1086,10003BF -19-15JUN12-1/9

Compressor Housing Outlet

1. Check compressor housing outlet (A). The outlet should be clean and free of dirt or oil.
2. Mark the checklist if dirt or oil is found and continue the inspection.

A—Compressor Housing Outlet



TCAL25290 —UN—15JUN12

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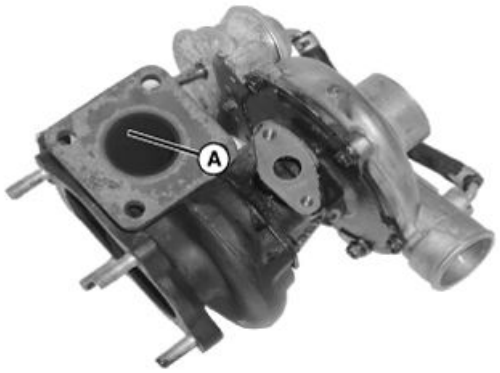
OUO1086,10003BF -19-15JUN12-2/9

Turbine Housing Inlet

Check the turbine housing inlet port (A) for oil in housing, excessive carbon deposit, or erosion of walls.

NOTE: If the inlet is wet with oil or has excessive carbon deposits, an engine problem is likely. Wall erosion (cracking or missing pieces) indicates excessive exhaust temperature.

A—Turbine Housing Inlet Port



TCAL25291 —UN—15JUN12

OUO1086,10003BF -19-15JUN12-3/9

Turbine Housing Outlet and Turbine Wheel

1. Use a flashlight to look up inside the turbine housing outlet (A) and check blades (B) for foreign object damage.
2. Inspect the wheel blades and housing for evidence of wheel rub. Wheel rub can bend the tips of the blades with the housing showing wear or damage.

A—Turbine Housing Outlet **B—Blades**

TCAL25292 —UN—15JUN12

OUO1086,10003BF -19-15JUN12-4/9

External Center Housing and Joints

Visually check the outside of the center housing (A), all connections to the compressor housing, and turbine housing for oil.

NOTE: If oil is present, make sure it is not coming from a leak at the oil supply or return line.

A—Center Housing

TCAL25293 —UN—15JUN12

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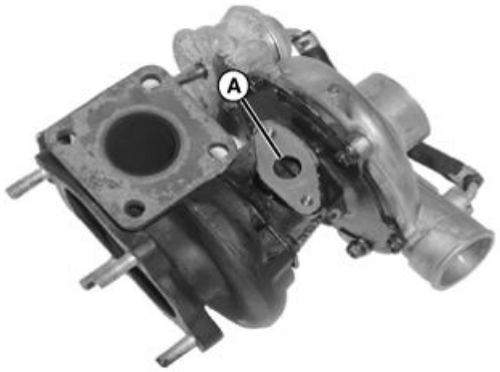
OUO1086,10003BF -19-15JUN12-5/9

Internal Center Housing

Using a flashlight, look through the oil return hole (A) to check the condition of the shaft and/or bearings. There should not be excess carbon deposits on the shaft or in the housing.

A—Oil Return Hole



TCAL25294 —UN—15JUN12

OUO1086,10003BF -19-15JUN12-6/9

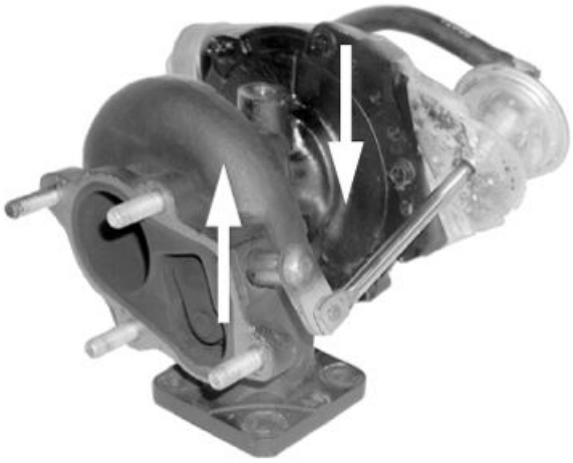
Turbo Bench Test

1. Mount the turbocharger in a vise.
2. Rotate the shaft, using both hands, to check rotation and clearance. The shaft should turn freely; however, there may be a slight amount of drag.

TCAL25295 —UN—15JUN12

OUO1086,10003BF -19-15JUN12-7/9

3. Pull up on the compressor end of the shaft and press down on the turbine end while rotating shaft. Neither the compressor wheel nor the turbine wheel should contact the housing at any point.



TCAL25296 —UN—15JUN12

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OUO1086,10003BF -19-15JUN12-8/9

NOTE: There will be some "play" because the bearings inside the center housing are free floating.

4. Check shaft end play by moving the shaft back and forth while rotating. There will be some end play, but not to the extent that the wheels contact the housing.

IMPORTANT: Avoid Damage! Before you finalize your conclusion that the turbocharger has not failed, it is strongly recommended to check rotor shaft axial and radial play. (See procedures later in this group.) These procedures are not required if a failure mode has already been identified.

NOTE: These diagnostic procedures will allow you to determine the condition of the turbocharger. If the turbocharger has failed, analysis of your inspection notes should direct you to the specific areas of the engine to correct the problems causing the turbocharger failure. It is not unusual to find that a turbocharger has not failed. If your turbocharger passes all the inspections, the problem lies somewhere else.

TCAL25297 —UN—15JUN12

OUO1086,10003BF -19-15JUN12-9/9

Check Turbocharger Rotor Shaft Axial Play

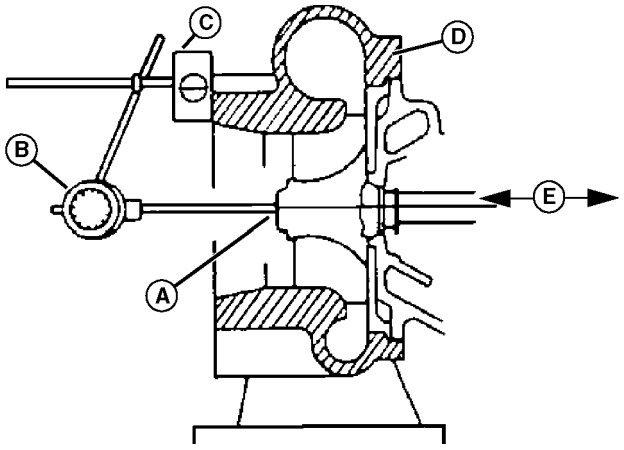
This test will give an indication of the condition of the axial bearing within the center housing and rotating assembly.

1. Mount magnetic base (C) so that indicator tip rests on end of shaft (A). Preload indicator tip and zero dial on indicator (B).
2. Move shaft axially back and forth by hand.
3. Observe and record total dial indicator movement.

   If axial play is not within specification, replace turbocharger.

Specification

Turbocharger Rotor—Axial Play—Standard	0.022—0.053 mm (0.009—0.0021 in.)
Turbocharger Rotor—Axial Play—Wear Limit	0.07 mm (0.0028 in.)



TCAL25298 —UN—15JUN12

A—Shaft End
B—Dial Indicator
C—Magnetic Base
D—Turbine Housing
E—Axial Direction

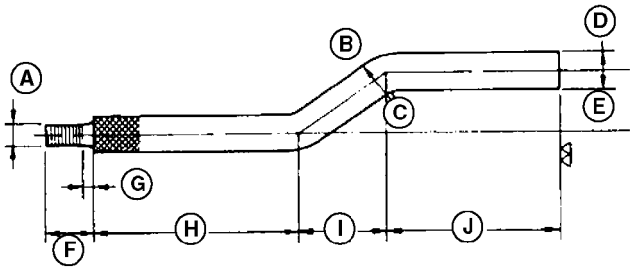
OUO1086,10003C0 -19-15JUN12-1/1

Check Turbocharger Rotor Shaft Radial Play

This test will give an indication of the condition of the radial bearing within the center housing and rotation assembly.

NOTE: Prelube center housing bearing prior to performing radial play test. (See Prelube Turbocharger.)

1. Purchase an extended indicator tip from a local supplier with the following approximate dimensions:
   - Length: 76 mm (3.0 in.)
   - Diameter: 5.0 mm (0.197 in.)
2. Heat and bend to size as shown.



TCAL25299 —UN—15JUN12

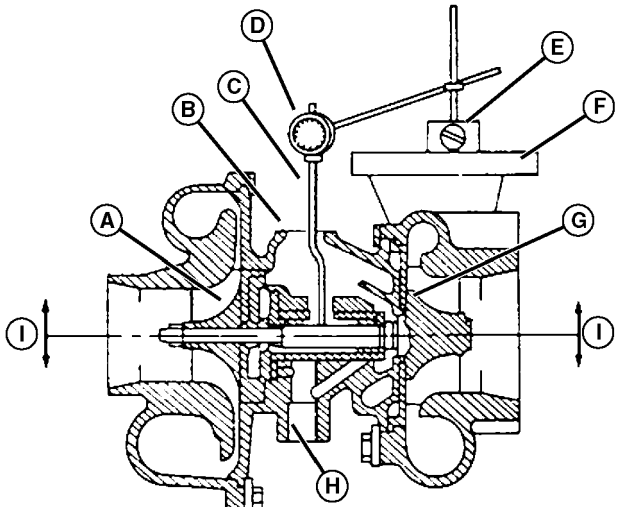
A—M2.6, P0.45
B—Radius: 10 mm (0.3937 in.)
C—Radius: 5 mm (0.1968 in.)
D—Diameter: 5 mm (0.1968 in.)
E—Distance: 7 mm (0.2755 in.)
F—Length: 8 mm (0.3149 in.)
G—Length: 1 mm (0.0393 in.)
H—Length: 40 mm (1.5748 in.)
I— Length: 10 mm (0.3937 in.)
J—Length: 15 mm (0.5905 in.)

OUO1086,10003C1 -19-15JUN12-1/2

3. Position dial indicator (D) with extension adapter (C) onto turbocharger mounting flange (F), so that tip rests on shaft by extending through oil return cavity (B).
4. Grasp rotation shaft at both ends and move the shaft toward the indicator and then away from the indicator (arrows) by applying moderate force.
5. Observe and record total indicator movement.
6. If total indicator reading is not within specification, replace turbocharger.

Specification

Turbocharger Rotor Shaft—Radial Play—Standard	0.061—0.093 mm (0.0024—0.0037 in.)
Turbocharger Rotor Shaft—Radial Play—Wear Limit	0.12 mm (0.0047 in.)



TCAL25300 —UN—15JUN12

A—Compressor Wheel
B—Oil Return Cavity
C—Extension Adapter
D—Dial Indicator
E—Magnetic Base
F—Turbocharger Mounting Flange
G—Turbine Wheel
H—Oil Inlet
I— Radial Direction

OUO1086,10003C1 -19-15JUN12-2/2

Turbocharger Waste Gate Test

Equipment

- Pressure regulating valve - Allowing gradual adjustment in a range from 0—200 kPa (0—29 psi).

Procedure

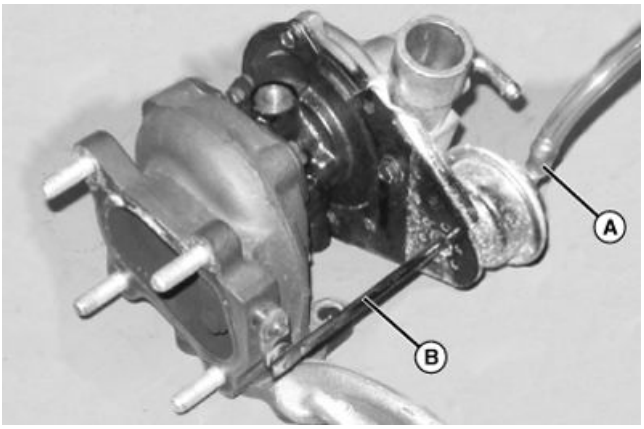
1. Park machine safely. (See “Park Machine Safely” in the Safety section.)
2. Allow engine to cool.
3. Raise hood.
4. Check hose to waste gate actuator for kinks or cracks. Replace if damaged.
5. Disconnect hose from waste gate actuator (A).
6. Connect a regulated air source to actuator fitting.

IMPORTANT: Avoid Damage! Do not apply more than 400 kPa (58 psi) to the actuator.

7. Vary pressure to waste gate actuator from 0—193 kPa (0—20 psi). Check results below.
8. Apply 117 kPa (17 psi) to actuator, shut off and seal air supply. Wait 1 minute and measure pressure in actuator.

Results

- Actuator rod (B) should move in and out freely as pressure is varied.



TCAL25301 —UN—15JUN12

A—Waste Gate Actuator **B—Actuator Rod**

- If rod does not move freely, disconnect turbocharger waste gate linkage. Check for movement and repair or replace components as necessary.
- Replace actuator if pressure drop exceeds specification.

Specification	
Turbocharger Waste Gate—Pressure Change	With 117 kPa (17 psi) is applied, the pressure should not drop below 103 kPa (15 psi) after 1 minute.

OUMX258,00006B5 -19-05NOV12-1/1

Summary of References

- Test Cylinder Compression
- Adjust Slow Idle
- Adjust Valve Clearance
- Adjust Valve Clearance—Obstructed Timing Marks
- Check Valve Lift
- Check Connecting Rod Side Play
- Check Connecting Rod Bearing Clearance
- Check Crankshaft End Play
- Check Crankshaft Main Bearing Clearance
- Check Camshaft End Play
- Check Timing Gear Backlash
- Test Thermostat Opening
- Test and Adjust 12 Volt Alternator and Cooling Fan Drive Belt Tension
- Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension
- Test Cylinder Leakdown
- Test Radiator Cap Pressure
- Test Cooling System Pressure
- Test Coolant Temperature Switch
- Test Engine Coolant Temperature Sensor
- Test Engine Oil Pressure

OUMX258,00006D2 -19-09JUN14-1/1

Specifications

Item	Measurement	Specification
Cylinder Compression @ 250 rpm	Pressure	2833—3040 kPa (411—441 psi)
Cylinder Compression @ 250 rpm	Pressure (minimum)	2344—2551 kPa (340—370 psi)
Difference Between Cylinders @ 250 rpm	Pressure (maximum)	296 kPa (43 psi)
Slow Idle	Speed	1450 ± 50 rpm
Valve	Clearance	0.15—0.25 mm (0.006—0.010 in.)
Rocker Arm Cover Nut	Torque	18 N·m (160 lb.-in.)
Connecting Rod Side	Play	0.2—0.4 mm (0.008—0.016 in.)
Connecting Rod Cap Screw	Torque	47 N·m (35 lb.-ft.)
Connecting Rod-to-Crankshaft Journal	Clearance	0.038—0.074 mm (0.001—0.003 in.)
Crankshaft	End Play	0.13—0.23 mm (0.005—0.009 in.)
Crankshaft	End Play—Wear Limit	0.28 mm (0.011 in.)
Main Bearing Cap Screw	Torque	98 N·m (72 lb.-ft.)
Main Bearing-to-Crankshaft Journal Oil	Clearance	0.038—0.068 mm (0.001—0.003 in.)
Main Bearing-to-Crankshaft Journal Oil	Clearance—Wear Limit	0.150 mm (72 lb.-ft.)
Camshaft End Play		
Camshaft	End Play	0.05—0.20 mm (0.002—0.010 in.)
Camshaft	End Play (Wear Limit)	0.30 mm (0.012 in.)
Timing Gear	Backlash	0.07—0.15 mm (0.0028—0.0059 in.)
Timing Gear	Backlash—Limit	0.17 mm (0.0067 in.)
Alternator and Cooling Fan Belt	Deflection @ 98 N (22 lb-force)	9 mm (3/8 in.)
Belt Deflection@ 50 N (11 lb-force)	Deflection	30 mm (1.2 in.)
Radiator Cap Opening	Pressure	103 ± 14 kPa (15 ± 2 psi)
Thermostat Opening - Beginning	Temperature	69—72° C (156—162° F)

Continued on next page

OUMX258,0000544 -19-12JUN14-1/2

Item	Measurement	Specification
Thermostat Opening - Fully Open	Temperature	85° C (184° F)
Cooling System Pressure Test	Pressure (maximum)	103 kPa (15 psi)
Coolant Temperature Switch	Contact Closing Temperature	107°—113° C (225°—235° F)
Variable Resistance Range (Hot)	Resistance	19.5 ohms @135°C (275°F)
Variable Resistance Range (Cold)	Resistance	275 ohms @40°C (104°F)
Engine Fast Idle	Speed	2800 ± 50 rpm
Engine Oil	Pressure	345 ± 48 kPa (50.0 ± 7.0 psi)

OUMX258,0000544 -19-12JUN14-2/2

Test Cylinder Compression

Reason

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

Special or Required Tools

- JT01682 Compression Gauge Assembly
- JDG560 Adapter

Procedure

1. Remove injection nozzles.
2. Remove heat protector from end of injector, and install on JDG560 Adapter (A).
3. Install JT01682 Compression Gauge Assembly (B) and adapter.
4. Disconnect fuel control solenoid connector.

IMPORTANT: Avoid Damage! DO NOT overheat starting motor during test.

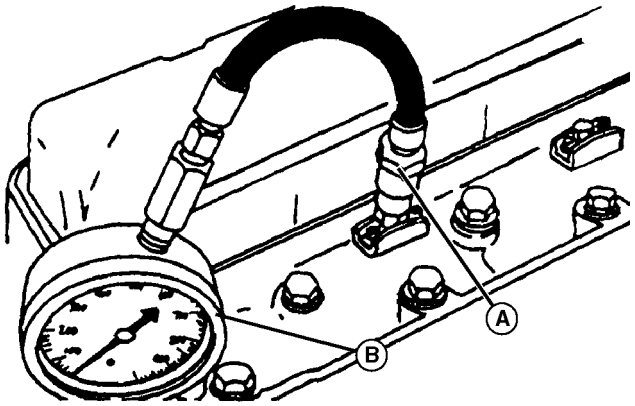
5. Crank the engine for 5 seconds with the starting motor. Minimum cranking speed is 250 rpm.
6. Record the pressure reading for each cylinder.

Results

- If pressure reading is below specification, squirt clean engine oil into cylinders through injector ports and repeat test.

Specification

Cylinder Compression @ 250 rpm—Pressure..... 2833—3040 kPa (411—441 psi)



TCAL25251 —UN—15JUN12

A—Adapter

B—Compression Gauge Assembly

Cylinder Compression @ 250 rpm—Pressure (minimum)..... 2344—2551 kPa (340—370 psi)

Difference Between Cylinders @ 250 rpm—Pressure (maximum)..... 296 kPa (43 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.

OUMX258,00006B6 -19-12JUN14-1/1

Adjust Slow Idle

Reason

To achieve proper slow idle rpm setting. Provides adequate rpm to keep the engine running smoothly without stalling.

Special or Required Tools

- JT05801 Inductive Electronic Tachometer

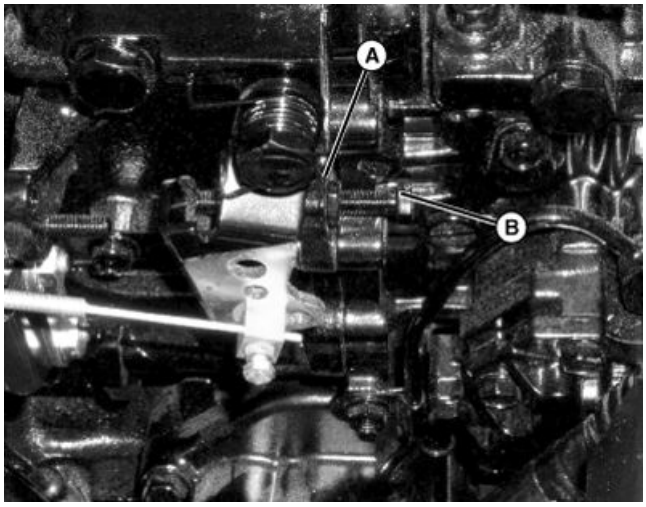
Procedure

NOTE: Make sure the air cleaner is clean and not restricted. Replace the air cleaner element as necessary.

1. Start the engine and run for 5 minutes to attain operating temperature.
2. Move the throttle lever to slow idle position.
3. Use JT05801 Inductive Electronic Tachometer to check engine speed at the crankshaft pulley.
4. Visually check that the injection pump throttle lever is against slow idle stop screw.

Results

- If the slow idle rpm is not according to specifications, loosen the nut (A) and turn the slow idle stop screw (B) clockwise to increase the engine speed, or counterclockwise to decrease the engine speed, until the slow idle speed is correct. After adjustment, tighten the nut.



TCAL25252 —UN—15JUN12

A—Nut **B—Slow Idle Stop Screw**

Specification

Slow Idle—Speed ..... 1450 ± 50 rpm

OUMX258,00006B7 -19-12JUN14-1/1

Adjust Valve Clearance

Reason

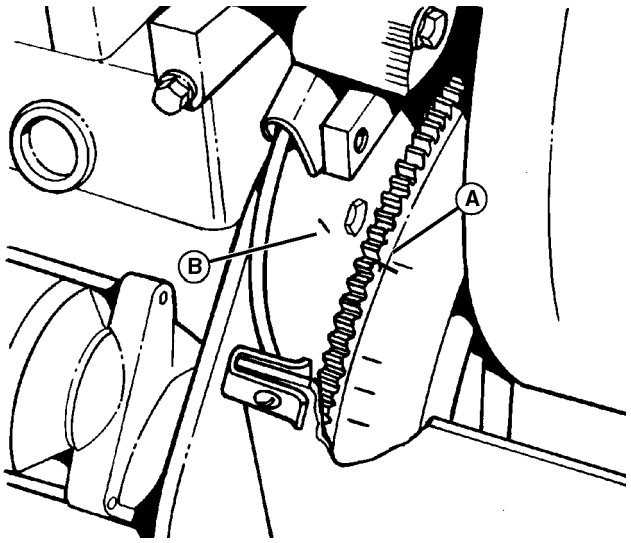
To set valve clearance for proper engine operation.

Procedure

CAUTION: Avoid Injury! Be sure ignition key is OFF before attempting to turn engine by hand.

NOTE: The engine must be cool (room temperature) before the valve clearance is checked.

1. Disconnect negative cable from battery.
2. Remove rocker arm cover. (See Remove and Install Rocker Arm Cover.)
3. Remove flywheel cover from starter side of engine.
4. Turn crankshaft pulley counterclockwise, as viewed from flywheel end, until No. 1 cylinder top dead center (TDC) mark (A) on flywheel aligns with index mark (B) on flywheel plate.
5. Try to move rocker arms and/or push rods for No. 1 cylinder:
   - If the rocker arms and push rods are loose, the piston is at TDC on the compression stroke. Go to step 8.
   - If the rocker arms and/or push rods are not loose, rotate the flywheel one revolution (360°), and recheck the rocker arms and push rods.



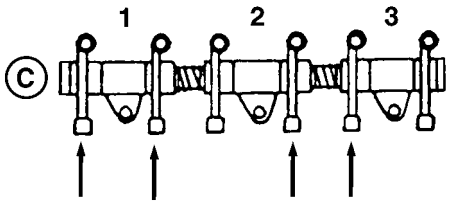
TCAL25262 —UN—15JUN12

A—No. 1 Cylinder Top Dead Center (TDC) Mark **B—Index Mark**

OUMX258,00006BA -19-25MAR14-1/5

6. Measure and adjust valve clearance (if necessary) on the valves (arrows) with No. 1 piston at TDC of the compression stroke. No. 1 piston is at the flywheel end (C). Valve clearance should be at specifications.

Specification	
Valve—Clearance	0.15—0.25 mm (0.006—0.010 in.)



TCT006750 —UN—21FEB13

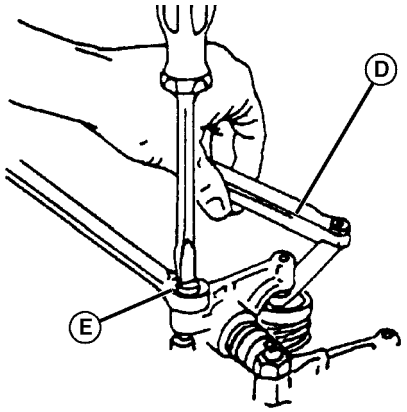
C—Flywheel End

Continued on next page

OUMX258,00006BA -19-25MAR14-2/5

7. If valve clearance is not at specifications, loosen the locknut and turn the adjusting screw (E) until the blade of the feeler gauge (D) can be inserted between the rocker arm and valve cap. Hold the adjusting screw while tightening the locknut.
8. Recheck the valve clearance after tightening the locknut.

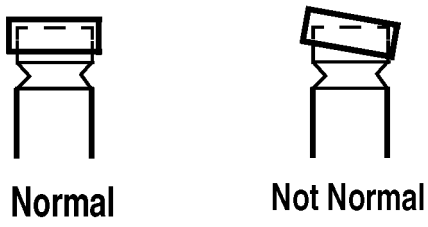
D—Feeler Gauge **E—Adjusting Screw**



TCAL25264 —UN—15JUN12

OUMX258,00006BA -19-25MAR14-3/5

9. Check that the valve cap on the valve stem remained seated on the valve and inside the valve spring retainer.
10. Turn crankshaft pulley one revolution (360°) and align No. 1 cylinder top dead center (TDC) mark on flywheel with index mark on flywheel plate. This puts the piston in No. 1 cylinder at TDC of the exhaust stroke.



TCAL25265 —UN—15JUN12

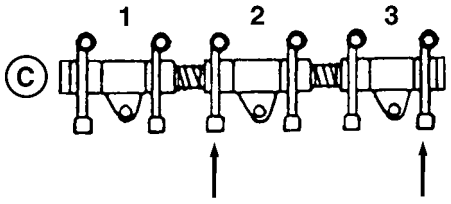
OUMX258,00006BA -19-25MAR14-4/5

11. Measure and adjust valve clearance (if necessary) on the valves (arrows) with No. 1 piston at TDC on the exhaust stroke.
12. Install flywheel cover.
13. Install rocker arm cover. Tighten rocker arm cover nuts to specifications.

Specification	
Rocker Arm Cover Nut—Torque	18 N·m (160 lb.-in.)

Results

If valve clearance cannot be adjusted to specification, check rocker arm assembly for wear or damage.



TCT006751 —UN—21FEB13

C—Flywheel End

OUMX258,00006BA -19-25MAR14-5/5

Adjust Valve Clearance—Obstructed Timing Marks

Reason

Alternate method to adjust valve clearance if timing marks are inaccessible.

Procedure

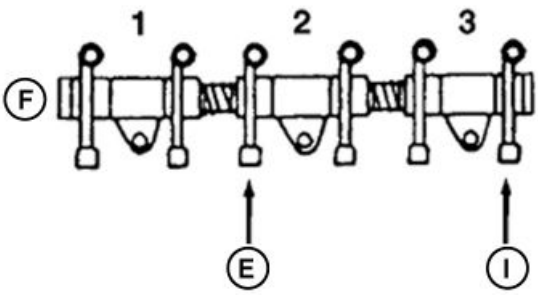
CAUTION: Avoid Injury! Be sure ignition key is OFF before attempting to turn engine by hand.

NOTE: The engine must be cool (room temperature) before the valve clearance is checked.

1. Disconnect negative cable from battery.
2. Remove rocker arm cover. (See Remove and Install Rocker Arm Cover.)

NOTE: Number 1 cylinder is cylinder closest to flywheel.

3. Rotate engine in direction of normal rotation (CCW at Flywheel) until No. 1 cylinder exhaust valve closes, and intake valve begins to open. This is TDC exhaust for No. 1 cylinder.
4. Place a mark on flywheel and flywheel housing for a reference point.
5. With engine at TDC of No. 1 piston's exhaust stroke, use a feeler gauge to check valve clearance on



TCT010037 —UN—16JAN14

Number One Cylinder at TDC Exhaust

F—Flywheel End **I— Intake**
E—Exhaust

Number 2 exhaust and Number 3 intake valves. Number 1 piston is at the flywheel end (F). Valve clearance should be at specifications.

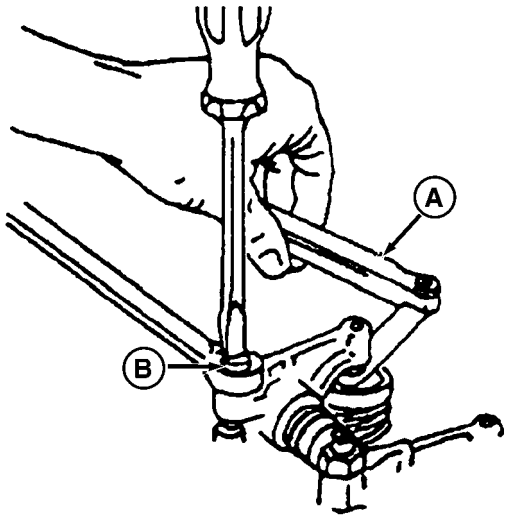
Specification

Valve—Clearance.....0.15—0.25 mm (0.006—0.010 in.)

OUO2003,000000C -19-17JAN14-1/4

6. If valve clearance is not at specifications, loosen the locknut and turn the adjusting screw (B) until there is a slight drag on the blade of the feeler gauge (A) when moved back and forth between the rocker arm and valve cap. Hold the adjusting screw while tightening the locknut.
7. Recheck the valve clearance after tightening the locknut.

A—Feeler Gauge **B—Adjusting Screw**

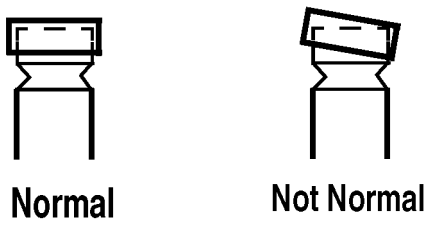


TCT010006 —UN—17JAN14

Continued on next page

OUO2003,000000C -19-17JAN14-2/4

8. Check that the valve cap on the valve stem remained seated on the valve and inside the valve spring retainer.
9. Turn crankshaft pulley one revolution (360°) and align mark on flywheel with mark on flywheel housing. This puts the piston in No. 1 cylinder at TDC of the compression stroke.



TCAL25265 —UN—15JUN12

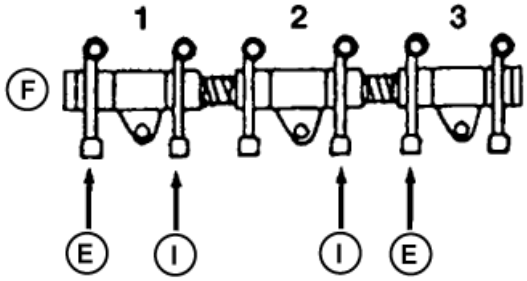
OUO2003,000000C -19-17JAN14-3/4

10. Check and adjust valve clearance to the same specifications for No. 1 and No. 3 exhaust and No. 1 and No. 2 intake valves.
11. Install rocker arm cover. Tighten rocker arm cover nuts to specifications.

Specification	
Rocker Arm Cover Nut—Torque	18 N·m (160 lb.-in.)

Results

If valve clearance cannot be adjusted to specification, check rocker arm assembly for wear or damage.



Number One Cylinder At TDC Compression

F—Flywheel End **I— Intake**
E—Exhaust

TCT010038 —UN—16JAN14

OUO2003,000000C -19-17JAN14-4/4

Check Valve Lift

Reason

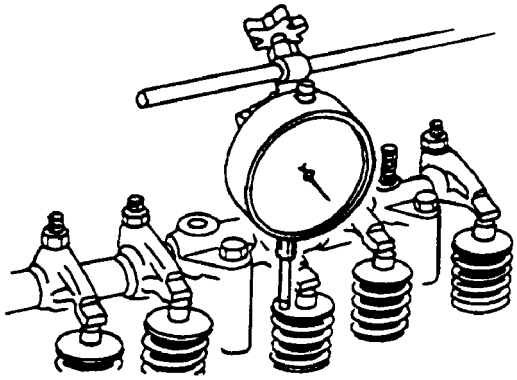
Check wear on cam lobes, followers, and/or push rods.

Special or Required Tools

- Dial Indicator

Procedure

1. Remove the rocker arm cover. (See Remove and Install Rocker Arm Cover.)
2. Adjust the valve clearance. (See Adjust Valve Clearance.)
3. Fasten the dial indicator to the engine and position the indicator tip on the valve retainer. The valve must be fully closed and the rocker arm must move freely.
4. Zero the dial indicator.
5. Manually turn the crankshaft pulley and observe the dial indicator as the valve is moved to the full open position and record measurement. Repeat for each valve .



TCAL25267 —UN—15JUN12

Results

- The valve lift should be the same for all valves. If one or more valves have less travel than the others, remove and inspect the camshaft, followers, and push rods. (See Remove and Install Camshaft.) If the camshaft, followers, and push rods are within specification, remove and inspect the cylinder head. (See Remove and Install Cylinder Head and Valves.)

OUMX258,00006BB -19-12JUN14-1/1

Check Connecting Rod Side Play

Reason

To determine proper side clearance between the crankshaft and the connecting rod.

Procedure

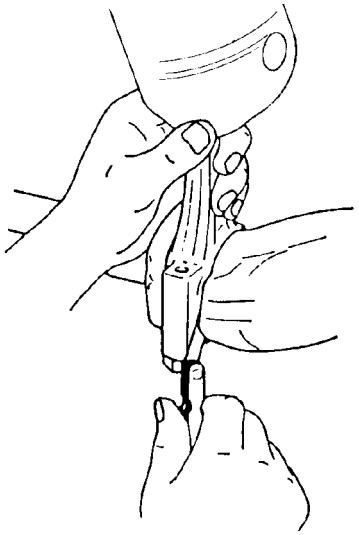
Insert a feeler gauge, according to specifications, between the connecting rod cap and the crankshaft.

Specification

Connecting Rod Side—Play.....0.2—0.4 mm (0.008—0.016 in.)

Results

- If the side play exceeds specification, replace the bearing inserts or the connecting rod.



TCAL25268 —UN—15JUN12

OUO1086,10003AA -19-15JUN12-1/1

Check Connecting Rod Bearing Clearance

Reason

To measure oil clearance between connecting rod bearing and crankshaft journal.

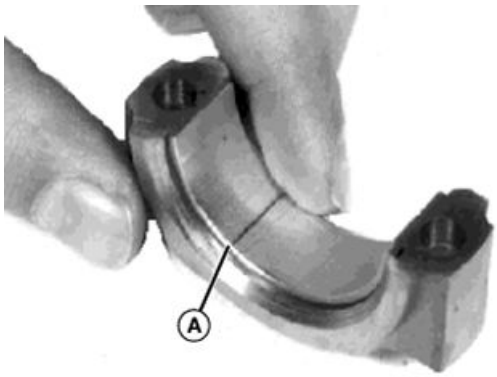
Special or Required Tools

- Plastigage®

Procedure

IMPORTANT: Avoid Damage! The 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 the connecting rod cap.
2. Wipe oil from the bearing insert and the crankshaft journal.
3. Put a piece of Plastigage® (A), or an equivalent, along the width of the bearing insert approximately 6 mm (0.25 in.) off center.
4. Turn the crankshaft approximately 30° from bottom dead center.
5. Install the connecting rod end cap and original rod end cap screws. Tighten the rod end cap screws to specification.



TCAL25269 —UN—15JUN12

A—Plastigage® Strip

Specification

Connecting Rod Cap Screw—Torque.....47 N·m (35 lb.-ft.)

NOTE: The flattened Plastigage® will be found on either the bearing insert or crankshaft journal.

6. Remove the rod end cap screws and the connecting rod cap.

Plastigage is a trademark of Perfect Circle Corporation

Continued on next page

OUMX258,00006BD -19-12JUN14-1/2

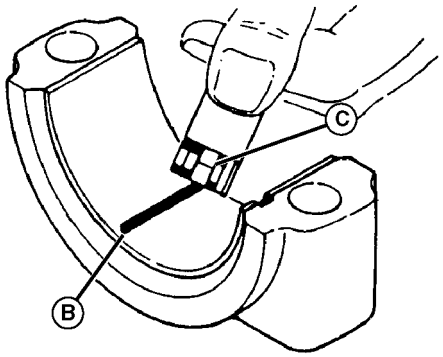
7. Use the graduation marks on the envelope (C) to compare the width of the flattened Plastigage® (B) at its widest point. The number within the graduation marks indicates the bearing clearance in inches or millimeters, depending on which side of the envelope is used.
8. Measure the connecting rod bearing oil clearance.
9. Remove the Plastigage®.

Results

- If the clearance exceeds the wear limit specification, replace the bearing inserts.

Specification

Connecting Rod-to-Crankshaft Journal—Clearance	0.038—0.074 mm (0.001—0.003 in.)



TCAL25270 —UN—15JUN12

B—Flattened Plastigage® Strip C—Envelope

OUMX258,00006BD -19-12JUN14-2/2

Check Crankshaft End Play

Reason

To determine proper side clearance between the crankshaft and the engine block.

Special or Required Tools

- Dial Indicator

Procedure

NOTE: Crankshaft end play can be measured at front end or rear end of crankshaft. Procedure is performed from the rear end. The flywheel is removed to show detail.

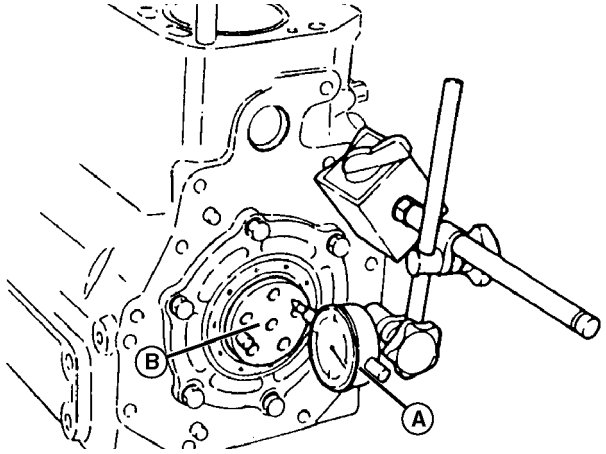
1. Fasten the dial indicator (A) to engine and position indicator tip on end of crankshaft (B).

IMPORTANT: Avoid Damage! Do not use excessive force when moving crankshaft to avoid damaging bearings.

2. Push the crankshaft toward rear as far as possible.
3. Zero the dial indicator.
4. Using a bar, gently pry the crankshaft as far forward as possible.

Results

- If the end play exceeds specifications, replace the thrust bearings.



TCAL25271 —UN—15JUN12

A—Dial Indicator B—Crankshaft

Specification

Crankshaft—End Play	0.13—0.23 mm (0.005—0.009 in.)
Crankshaft—End Play—Wear Limit	0.28 mm (0.011 in.)

OUO1086,10003AC -19-12JUN14-1/1

Check Crankshaft Main Bearing Clearance

Reason

To measure oil clearance between main bearing and crankshaft journal.

Special or Required Tools

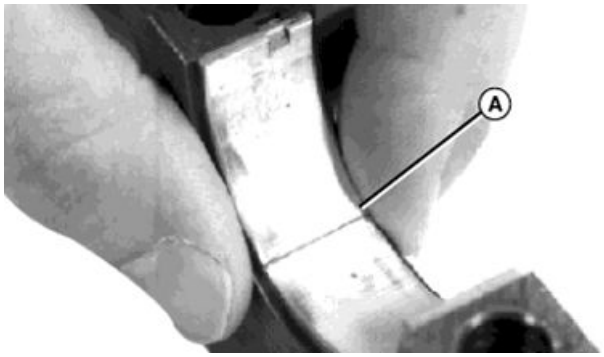
- Plastigage®

Procedure

IMPORTANT: Avoid Damage! Main bearing caps must be installed on the same main bearing and in the same direction to prevent crankshaft and main bearing damage.

1. Remove the main bearing cap.
2. Wipe oil from the bearing insert and the crankshaft journal.
3. Put a piece of Plastigage® (A), or an equivalent, along the width of the bearing insert approximately **6 mm (0.25 in.)** off center.
4. Install the main bearing cap and cap screws. Tighten the cap screws to specification.

Plastigage is a trademark of Perfect Circle Corporation



TCAL25272 —UN—15JUN12

A—Plastigage® Strip

Specification	
Main Bearing Cap Screw—Torque	98 N·m (72 lb.-ft.)

NOTE: The flattened Plastigage® will be found on either the bearing insert or crankshaft journal.

5. Remove the cap screws and main bearing caps.

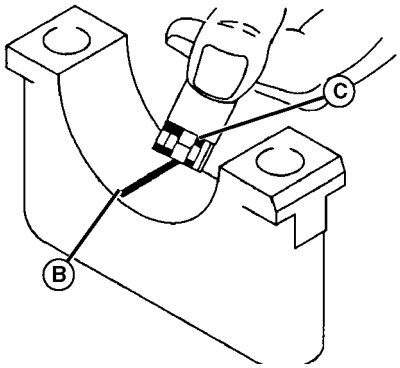
OUMX258,00006BF -19-12JUN14-1/2

6. Use the graduation marks (C) on the envelope to compare the width of the flattened Plastigage® (B) at its widest point. The number within the graduation marks indicates the bearing clearance in inches or millimeters, depending on which side of the envelope is used.
7. Remove Plastigage®.

Results

- If the clearance exceeds the wear limit specification, replace the bearing inserts.

Specification	
Main Bearing-to-Crankshaft Journal Oil—Clearance	0.038—0.068 mm (0.001—0.003 in.)
Main Bearing-to-Crankshaft Journal Oil—Clearance—Wear Limit	0.150 mm (72 lb.-ft.)



TCAL25273 —UN—15JUN12

B—Flattened Plastigage® Strip C—Envelope

OUMX258,00006BF -19-12JUN14-2/2

Check Camshaft End Play

Reason

To determine proper side clearance between camshaft gear end journal and thrust plate.

Special or Required Tools

- Dial Indicator

Procedure

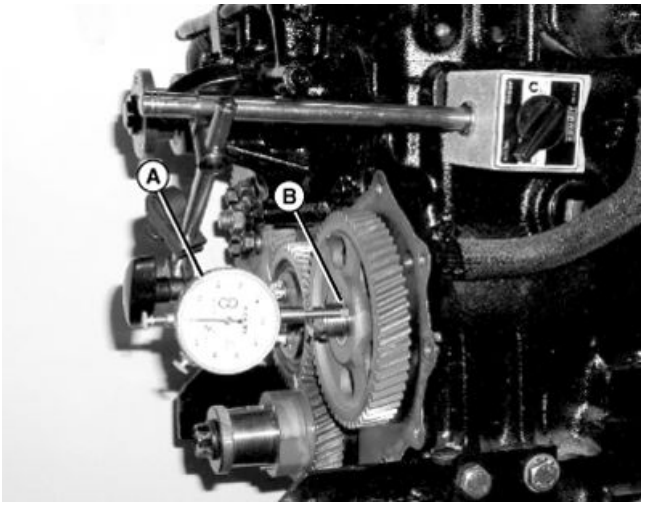
1. Remove the timing gear cover. (See Remove and Install Timing Gear Cover.)
2. Fasten the dial indicator (A) to the engine and position indicator tip on end of camshaft (B).
3. Push the camshaft toward the rear as far as possible.
4. Zero the dial indicator.
5. Pull the camshaft forward as far as possible.

Results

- If the end play exceeds specifications, remove the camshaft and replace the thrust plate. (See Remove and Install Camshaft.)

Camshaft End Play—Specification

Camshaft—End Play.....0.05—0.20 mm (0.002—0.010 in.)



TCAL25274 —UN—15JUN12

A—Dial Indicator **B—Camshaft**

Camshaft—End Play (Wear Limit).....0.30 mm (0.012 in.)

OUMX258,00006C0 -19-28MAY14-1/1

Check Timing Gear Backlash

Reason

To check for wear between meshing gears, resulting in excessive noise and poor engine performance.

Special or Required Tools

- Dial Indicator

Procedure

Measure the backlash between meshing gears.

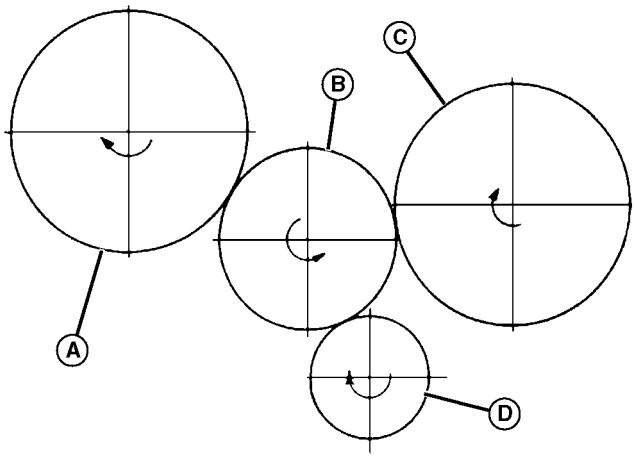
Results

If the backlash exceeds specifications, replace meshing gears as a set:

- Fuel Injection Pump Gear (A)
- Idler Gear (B)
- Camshaft Gear (C)
- Crankshaft Gear (D)

Specification

Timing Gear—Backlash.....0.07—0.15 mm (0.0028—0.0059 in.)



TCAL25275 —UN—15JUN12

A—Fuel Injection Pump Gear **C—Camshaft Gear**
B—Idler Gear **D—Crankshaft Gear**

Timing Gear—Backlash—Limit.....0.17 mm (0.0067 in.)

OUO1086,10003AF -19-12JUN14-1/1

Test and Adjust 12 Volt Alternator and Cooling Fan Drive Belt Tension

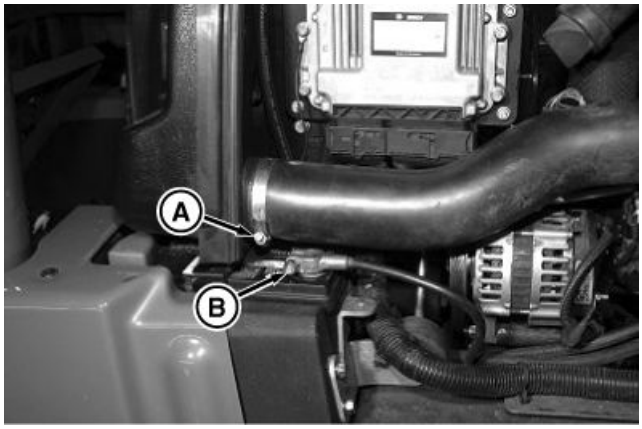
Maintaining proper drive belt tension will prevent belt slippage due to a loose belt, or rapid belt wear and shortened bearing life from a belt that is too tight.

The engine cooling fan and 12 volt alternator for the machine's electrical system are driven by a V belt from a sheave mounted to a flywheel adapter plate. Belt tension is maintained by adjustment of the alternator position in the mounting brackets.

1. Park machine safely. See "Park Machine Safely".

CAUTION: Avoid injury! Touching hot surfaces can burn skin. The engine, components, and fluids will be hot if the engine has been running. Allow the engine to cool before servicing or working near the engine and components.

2. Allow machine to cool.
3. Raise engine cover.
4. Loosen clamp (A) and remove duct from bulkhead fitting.



TCT009230 —UN—31OCT13

A—Hose Clamp **B—Battery Connector**

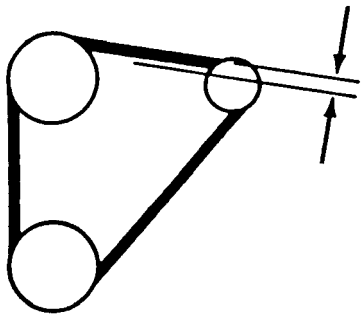
5. Loosen connector (B) and remove from battery negative (-) terminal.

OUMX258,00006C4 -19-12JUN14-1/4

6. Check belt tension midway between cooling fan and 12 volt alternator sheaves. Use belt tension gauge JDG529 or JDST28, or a straightedge with application of specified belt deflection.

Specification	
Alternator and Cooling Fan Belt—Deflection @ 98 N (22 lb-force)	9 mm (3/8 in.)

7. Adjust belt tension if not within specification.



TCAL25279 —UN—15JUN12

OUMX258,00006C4 -19-12JUN14-2/4

a. Loosen bolt (C) and nut (D) securing alternator.

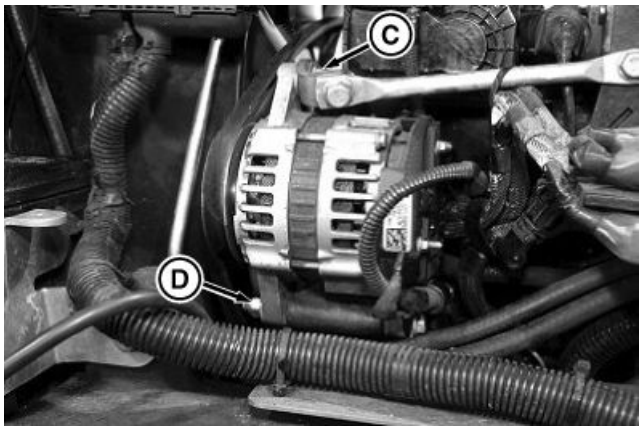
IMPORTANT: Avoid Damage! Apply force to FRONT of alternator housing (near the belt) only to adjust belt tension.

b. Adjust position of alternator as required to bring belt tension within specification.

c. Tighten bolt and nut securing alternator position.

d. Recheck belt tension.

C—Hex Bolt **D—Hex Nut**



TCT009231 —UN—31OCT13

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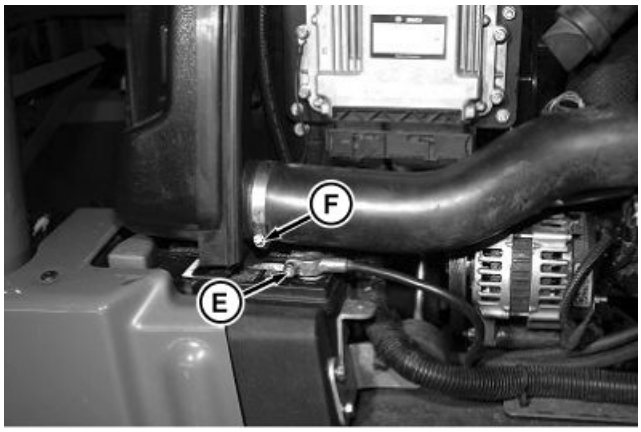
OUMX258,00006C4 -19-12JUN14-3/4

8. Install and secure negative battery connection (E).
9. Install duct and tighten clamp (F).

E—Battery Connector **F—Hose Clamp**



TCT009310 —UN—13NOV13

OUMX258,00006C4 -19-12JUN14-4/4

Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension

Maintaining proper drive belt tension will prevent belt slippage due to a loose belt, or rapid belt wear and shortened bearing life from a belt that is too tight.

The engine coolant pump and 48 volt alternator for electric reel mower drive are driven by a serpentine belt from a grooved sheave mounted to the crankshaft. Belt tension is maintained by a spring loaded tension arm and sheave, and is not adjustable. Effective belt tension is tested by determining the spring force at the belt tensioner.

Maintaining proper belt tension is limited to replacing the belt tensioner if spring force at the tensioner arm is not within specification.

Item	Measurement	Specification
Belt Deflection@ 50 N (11 lb-force)	Deflection	30 mm (1.2 in.)

SW00544,0000049 -19-12JUN14-1/1

Test Cylinder Leakdown

Reason

To determine if compression pressure is leaking from cylinder.

Special or Required Tools

- Adapter

Procedure

1. With the coolant at the proper level and the radiator cap tight, run the engine for 5 minutes to bring it to operating temperature.
2. Remove the recovery tank cap.
3. Check for bubbles coming from the overflow hose at the bottom of the tank.
4. If bubbles are present, isolate the source of the compression leak.
   a. Remove the injection nozzles.
   b. Install JDG560 Adapter in the injection port of the cylinder to be tested.
   c. Move the piston to the bottom of the stroke with intake and exhaust valves closed.
   d. Connect the hose from a compressed air source to the adapter.
   e. Apply shop air pressure into the cylinder.
   f. Check for bubbles in the recovery tank or air escaping from the muffler, air cleaner, or oil fill opening.
   g. Repeat for each cylinder.

Results

- If bubbles are present in the recovery tank, check for cracks in the cylinder head and block. Check for a damaged head gasket.
- If air escapes from the muffler, check for a worn exhaust valve.
- If air escapes from the air cleaner, check for a worn intake valve.
- If air escapes from the engine oil fill, check for worn piston rings.

OUMX258,00006C5 -19-12JUN14-1/1

Test Radiator Cap Pressure

Reason

To check that the radiator cap opens at the correct pressure.

Special or Required Tools

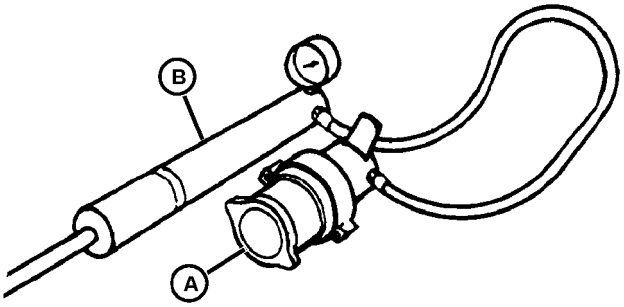
- D05104ST Cooling System Pressure Pump
- JDG692 Radiator Pressure Test Kit (Adapters)

Procedure

1. Park machine safely. See the “Safety Section”.
2. Turn key switch to STOP position, and allow engine to cool.
3. Remove radiator cap.
4. Install radiator cap (A) on D05104ST Cooling System Pressure Pump (B).
5. Apply pressure. Pressure valve in cap should open at specification.

Specification

Radiator Cap
Opening—Pressure ..... 103 ± 14 kPa (15 ± 2 psi)



LVAL20113 —UN—06JAN12

A—Radiator Cap

B—Cooling System Pressure Pump

Results

If cap leaks, retighten and test again. Replace cap if pressure is not within specification.

OUMX258,000052B -19-09JUN14-1/1

Test Thermostat Opening

Reason

To determine the opening temperature of the thermostat.

Special or Required Tools

- Thermometer
- Glass Container
- Heating Unit

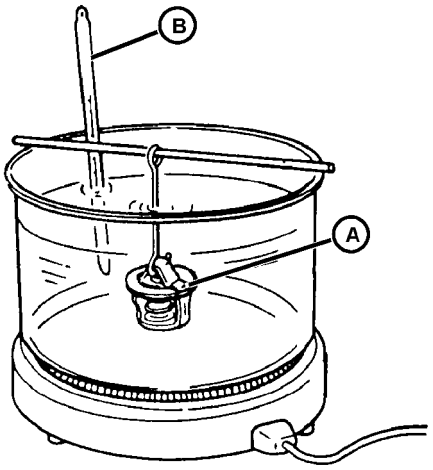
Procedure

1. Park machine safely. See the “Safety Section”.
2. Remove thermostat.

CAUTION: Avoid Injury! DO NOT allow thermostat or thermometer to rest against the side or bottom of glass container when heating water. Either may rupture if overheated.

3. Suspend thermostat (A) and a thermometer (B) in a container of water.
4. Heat and stir the water. Observe opening action of thermostat and compare temperatures with specifications.

Specification	
Thermostat Opening - Beginning—Temperature	69—72° C (156—162° F)
Thermostat Opening - Fully Open—Temperature	85° C (184° F)



LVAL20114 —UN—06JAN12

A—Thermostat **B—Thermometer**

5. Remove thermostat and observe its closing action as it cools.

Results

- If thermostat does not open according to specifications, replace thermostat.
- If closing action is not smooth and slow, replace thermostat.

OUMX258,000052C -19-09JUN14-1/1

Test Cooling System Pressure

Reason

To inspect the cooling system for leaks.

Special or Required Tools

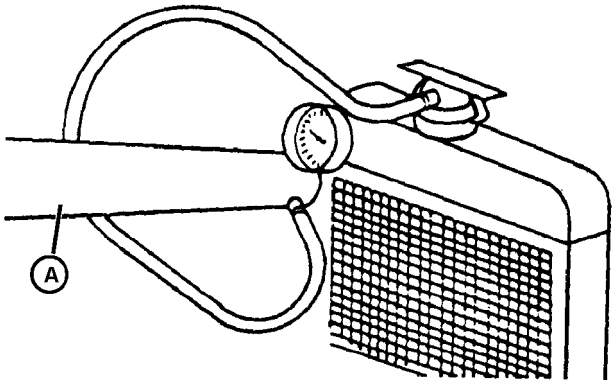
- D05104ST Cooling System Pressure Pum
- JDG692 Radiator Pressure Test Kit (Adapters)

Procedure

1. Park machine safely. See the “Safety Section”.
2. Turn key switch to STOP position and allow engine to cool.
3. Raise hood.
4. Remove cap and attach D05104ST Cooling System Pressure Pump (A) to radiator.
5. Apply specified maximum pressure to cooling system.

Specification	
Cooling System Pressure Test—Pressure (maximum)	103 kPa (15 psi)

6. Check for leaks throughout cooling system.



LVAL20112 —UN—06JAN12

A—Cooling System Pressure Pump

Results

- Pressure should hold to specification. If pressure decreases, check for leaks. Repair leaks or replace parts as necessary.
- If pressure test still indicates leakage after all external leaks have been stopped, a defective head gasket, cracked block, or cylinder head may be the cause. Perform Test Cylinder Leakdown.

OUMX258,000052D -19-13JUN14-1/1

Test Coolant Temperature Switch

Reason

To determine operating temperature of sender.

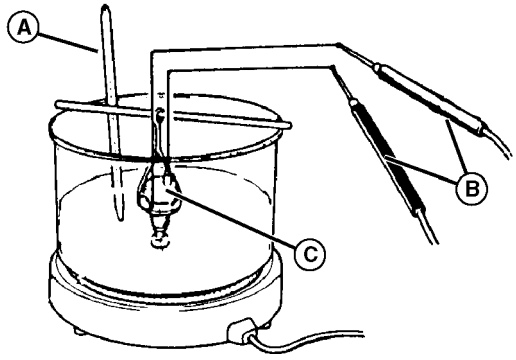
Special or Required Tools

- Thermometer
- Glass Container
- Heating Unit
- Ohmmeter

Procedure

IMPORTANT: Avoid Damage! DO NOT allow switch or thermometer to rest against the side or bottom of glass container when heating water. Either may rupture if overheated.

1. Connect lead wires from ohmmeter probes (B) to sender terminal and body.
2. Suspend sender (C) and a thermometer (A) in a container of water.
3. Heat and stir the water. Observe water temperature when continuity occurs. Water temperature should be at specifications.



TCAL25288 —UN—15JUN12

A—Thermometer
B—Ohmmeter Probes
C—Sender

Specification	
Coolant Temperature Switch—Contact Closing Temperature	107°—113° C (225°—235° F)

Results

- If continuity does not occur within temperature listed, replace sender.

OUMX258,00006CF -19-12JUN14-1/1

Test Engine Coolant Temperature Sensor

Reason:

To verify coolant temperature sensor is functioning properly.

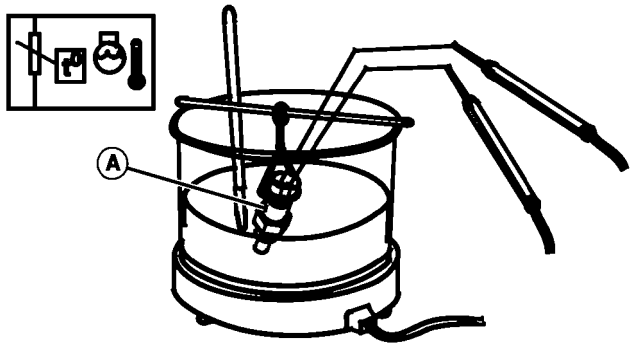
Equipment:

- Ohmmeter

Procedure:

NOTE: Perform test with engine at room temperature.

1. Park machine safely.
2. Raise hood.
3. Disconnect connector from engine coolant temperature sensor.
4. Measure resistance between terminals.
5. If resistance does not meet specification, replace coolant temperature switch.
6. Drain engine coolant and remove coolant temperature switch.



LVAL10240 —UN—23JUL10

A—Sensor

7. Place sensor (A) in antifreeze solution heated to approximately 96° C (205° F). Measure resistance while sensor is heated. Reading should be approximately 64 ohms.
8. If resistance does not meet specification, replace coolant temperature sensor.

Item	Measurement	Specification
Variable Resistance Range (Hot)	Resistance	19.5 ohms @135° C (275° F)
Variable Resistance Range (Cold)	Resistance	275 ohms @40° C (104° F)

BS62576,0001605 -19-12JUN14-1/1

Test Engine Oil Pressure

Reason

To determine if engine bearings or lubrication system components are worn.

Special or Required Tools

- JT03017 Hose Assembly
- JT07034 Pressure Gauge 689 kPa (100 psi)
- JT03349 Connector 1/8 in. Male BSP x 7/16 in. Male 37° Flare

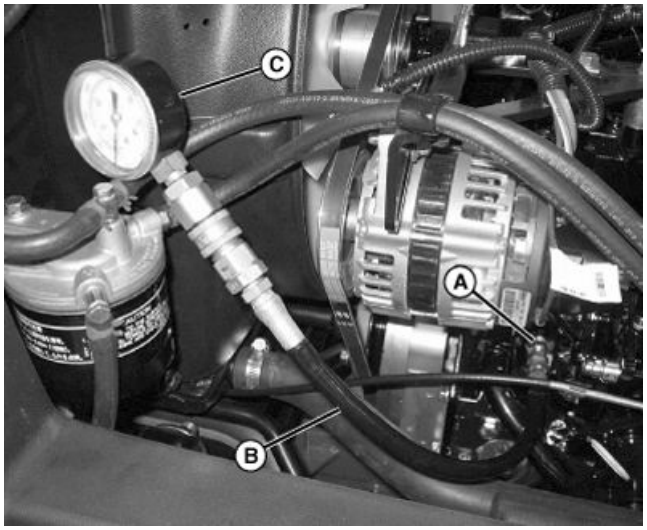
Procedure

1. Disconnect wire lead from oil pressure sender.
2. Remove oil pressure sender.
3. Install JT03349 Connector (A).
4. Connect JT03017 Hose Assembly (B) and JT07034 Pressure Gauge (C).

IMPORTANT: Avoid Damage! DO NOT run engine if there is insufficient oil pressure!

5. Start engine. If pressure reading is below 69 kPa (10 psi), STOP engine and discontinue this procedure.
6. Run engine approximately 5 minutes to heat oil, then check oil pressure at fast idle.

Specification	
Engine Fast Idle—Speed	2800 ± 50 rpm



TCAL25282 —UN—15JUN12

A—JT03349 Connector
B—JT03017 Hose Assembly
C—JT07034 Pressure Gauge

Results

- If the oil pressure is not within specifications, inspect the oil pump.

Specification	
Engine Oil—Pressure	345 ± 48 kPa (50.0 ± 7.0 psi)

- Inspect oil pressure regulating valve for wear or damage. Add or remove shims as necessary.

OUMX258,00006C8 -19-12JUN14-1/1

Section 230
Electrical Operation, Tests, and Adjustments
Contents

Page

Group 10—Component Location
Summary of References 230-10-1
Wiring Harness, Non-T4 230-10-1
Wiring Harness, T4 230-10-3
Wiring Harness, Command Arm 230-10-5
VCU Pinout, Non—T4 230-10-6
VCU Pinout, T4 230-10-7

Group 20—Theory of Operation
Summary of References 230-20-1
Theory Of Operation Information 230-20-1
Power Circuit, Non-T4 230-20-2
Power Circuit, T4 230-20-3
Cranking Circuit, Non-T4 230-20-4
Cranking Circuit, T4 230-20-4
Charging Circuit 230-20-5
Lift-Lower-Mow Circuit 230-20-5
Engine Oil Pressure Circuit, Non-T4 230-20-5
Engine Oil Pressure Circuit, T4 230-20-6
Engine & Hydraulic Temperature Circuit, Non-T4 230-20-6
Engine & Hydraulic Temperature Circuit, T4 230-20-6
Air Preheater Circuit, Non-T4 230-20-7
Glow Plug Circuit, T4 230-20-7
Traction Drive Circuit 230-20-8
Cruise Control Circuit 230-20-9

Group 30—Diagnosis
Cranking Circuit Diagnostics, Non—T4 230-30-1
Cranking Circuit Diagnostics, T4 230-30-1
Charging Circuit Diagnostics 230-30-1
Lift-Lower-Mow Circuit Diagnostics 230-30-1
Engine Oil Pressure Circuit Diagnostics 230-30-2
Engine & Hydraulic Temperature Circuit Diagnostics 230-30-2
Preheater Circuit Diagnostics 230-30-2
Forward Drive Circuit Diagnostics 230-30-2
Reverse Drive Circuit Diagnostics 230-30-3
Cruise Control Circuit Diagnostics 230-30-3

Group 40—Connectors
Summary of References 230-40-1
Work Light Connectors 230-40-1
Light Switch Connector 230-40-1
Key Switch Connector 230-40-2
Starter Solenoid Connector 230-40-2
Connector, 120 ohm Resistor 230-40-2

Page

Connector, 1000 ohm Resistor 230-40-2
RH Lift Arm Position Proximity Sensor Connector 230-40-3
LH Lift Arm Position Proximity Sensor Connector 230-40-3
Seat Switch Connector 230-40-3
Seat Suspension Compressor Connector 230-40-3
Main Harness to Command Arm Connector (Red) 230-40-4
Main Harness to Command Arm Connector (Yellow) 230-40-4
Command Arm to Main Harness Connector (Red) 230-40-4
Command Arm to Main Harness Connector (Yellow) 230-40-5
PTO Switch Connector 230-40-5
Park Brake Switch Connector 230-40-5
Forward (inboard) Pedal Connector 230-40-5
Reverse (outboard) Pedal Connector 230-40-6
Raise/Lower Switch Connector 230-40-6
Front Raise/Lower Valve Connector 230-40-6
Rear Raise/Lower Valve Connector 230-40-6
Raise Select Valve Connector 230-40-7
Brake Solenoid Connector 230-40-7
Brake Pressure Switch Connector 230-40-7
Hyd Filter Restriction Switch Connector 230-40-7
Hyd Oil Temp Connector 230-40-8
Forward Hydro Solenoid Connector 230-40-8
Reverse Hydro Solenoid Connector 230-40-8
Pump Angle Sensor Connector 230-40-8
Kit Switched Power Connector 230-40-9
Down Pressure Kit Connector 230-40-9
Crankshaft Speed Pickup Connector 230-40-9
Vehicle Control Unit (VCU) Connector 230-40-10
Engine Control Unit (ECU) Connector, 94 Pin 230-40-11
Engine Control Unit (ECU) Connector, 60 Pin 230-40-12
Main Harness to Engine Connector (Red 8-pin) 230-40-13

Continued on next page

Page

Main Harness to Engine Connector (Red) 230-40-13
Main Harness to Engine Connector (Gray) 230-40-14
Main Harness to Engine Connector (Yellow) 230-40-14
Fuel Solenoid Connector 230-40-15
Fuel Level Sensor Connector 230-40-15
Fuel Transfer Pump Connector 230-40-15
Diode Connector 230-40-16
Reel Motor Controller Connector 230-40-16
Display Connector 230-40-17
Power Port Connector 230-40-17
Alarm Connector 230-40-17
Diagnostic Connector 230-40-17

Group 50—Schematics
Summary of References 230-50-1
Command Arm with Y Axis Control Schematic 230-50-1
Main Electrical Schematic, Non-T4 230-50-2
Main Schematic Splices, Non-T4 230-50-8
Main Electrical Schematic, T4 230-50-9
Main Schematic Splices, T4 230-50-17
Reel Controllers and Motors Electrical Schematic 230-50-18
Main Schematic Reel Motor Controller Splices 230-50-20
Engine Connector X5057 Schematic 230-50-21
Engine Connector X5058 Schematic 230-50-22
Engine Connector X5059 Schematic 230-50-23
Engine Connector X5060 Schematic 230-50-24
Engine Controls and Sensors Schematic 230-50-25

Group 60—Tests and Adjustments
Summary of References 230-60-1
Common Circuit Tests 230-60-1
Ground Circuit Test 230-60-2
Battery Voltage and Specific Gravity Tests 230-60-3
Battery Charge 230-60-4
Battery Load Test 230-60-4
Regulated Voltage Output Test 230-60-5
Engine Oil Pressure Switch Test 230-60-6
Air Pre-Heater Test 230-60-6
Glow Plug Test 230-60-7
Key Switch Test 230-60-7
PTO Switch Test 230-60-8
Park Brake Switch Test 230-60-8
Relay Test 230-60-9
Fuel Pump Test 230-60-9
Fuel Shutoff Solenoid Test 230-60-10
Fuse Test 230-60-10
Diode Test 230-60-11

Page

CAN Resistor Test 230-60-11
R-1 Resistor Test 230-60-11
Warning Alarm Test 230-60-12
Brake Valve, Lift Valve Solenoid Test 230-60-12
Reel Motor Test 230-60-13
Reel Motor Phase Wire Test 230-60-13
Test Hydraulic Temperature Switch 230-60-14
Test Hydraulic Filter Restriction Switch 230-60-15
Proximity Switch Test 230-60-16
Test Raise/Lower Switch 230-60-17
Seat Switch Test 230-60-17
48V Alternator Current Output Test 230-60-18
48V Alternator Voltage Output Test 230-60-18
48 Volt Alternator Circuit Diagnosis 230-60-18

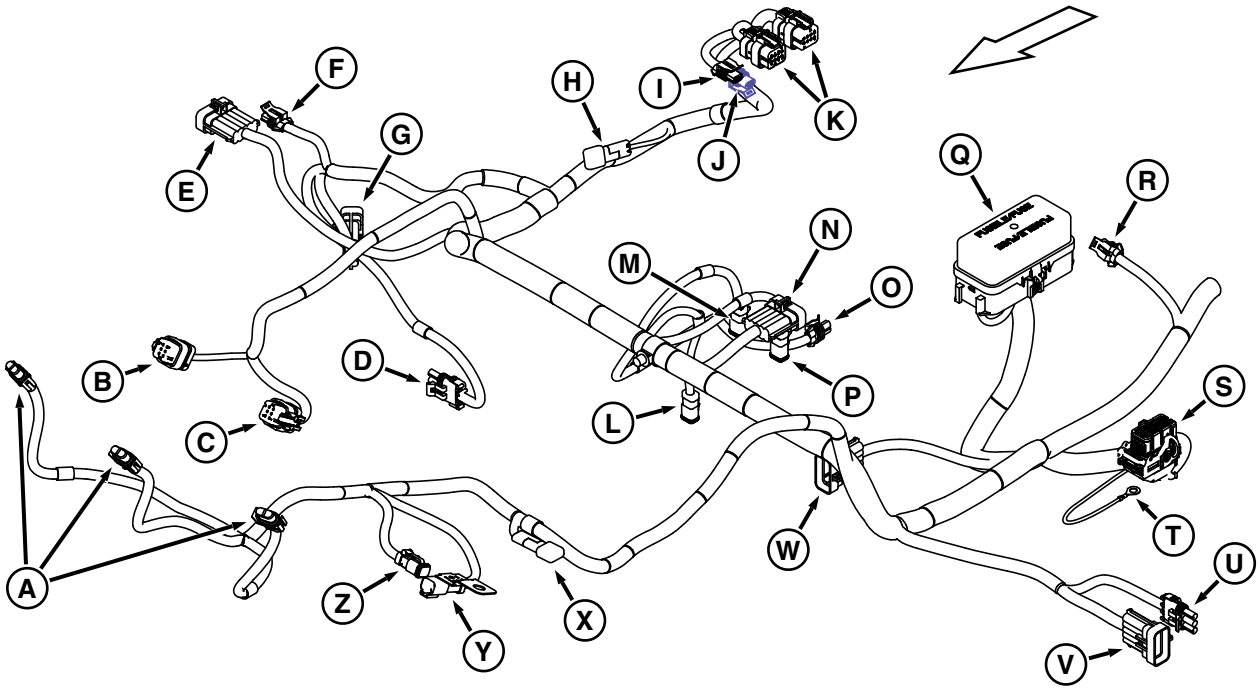
Summary of References

- Wiring Harness, Non-T4
- Wiring Harness, T4
- Wiring Harness, Command Arm
- VCU Pinout, Non—T4
- VCU Pinout, T4

BS62576,0001092 -19-02APR14-1/1

Wiring Harness, Non-T4

Main Wiring Harness



TCT010540 —UN—26MAR14

Main Wiring Harness, Non-T4 (1 of 2)

A — Work Light Connectors
B — Reverse Pedal Connector
C — Foward Pedal Connector
D — RH Lift Arm Sensor Connector
E — Right Front Controller Connector
F — Down Pressure Kit Connector
G — Right Rear Controller Connector
H — CAN Terminator Resistor
I — Seat Switch Connector
J — Seat Compressor Connector (7500A only)
K — (To Command Arm Harness)
L — Valve Solenoid Connector, Blue
M — Valve Solenoid Connector, Red
N — Left Rear Controller Connector
O — Hyd Filter Restriction Switch Connector
P — Valve Solenoid Connector, Yellow
Q — Load Center
R — Kit Switched Power Connector
S — VCU
T — VCU Case Ground
U — LH Lift Arm Sensor Connector
V — Left Front Controller Connector
W — Front Center Controller Connector
X — CAN Terminator Resistor
Y — Brake Pressure Switch Connector
Z — Brake Solenoid Connector

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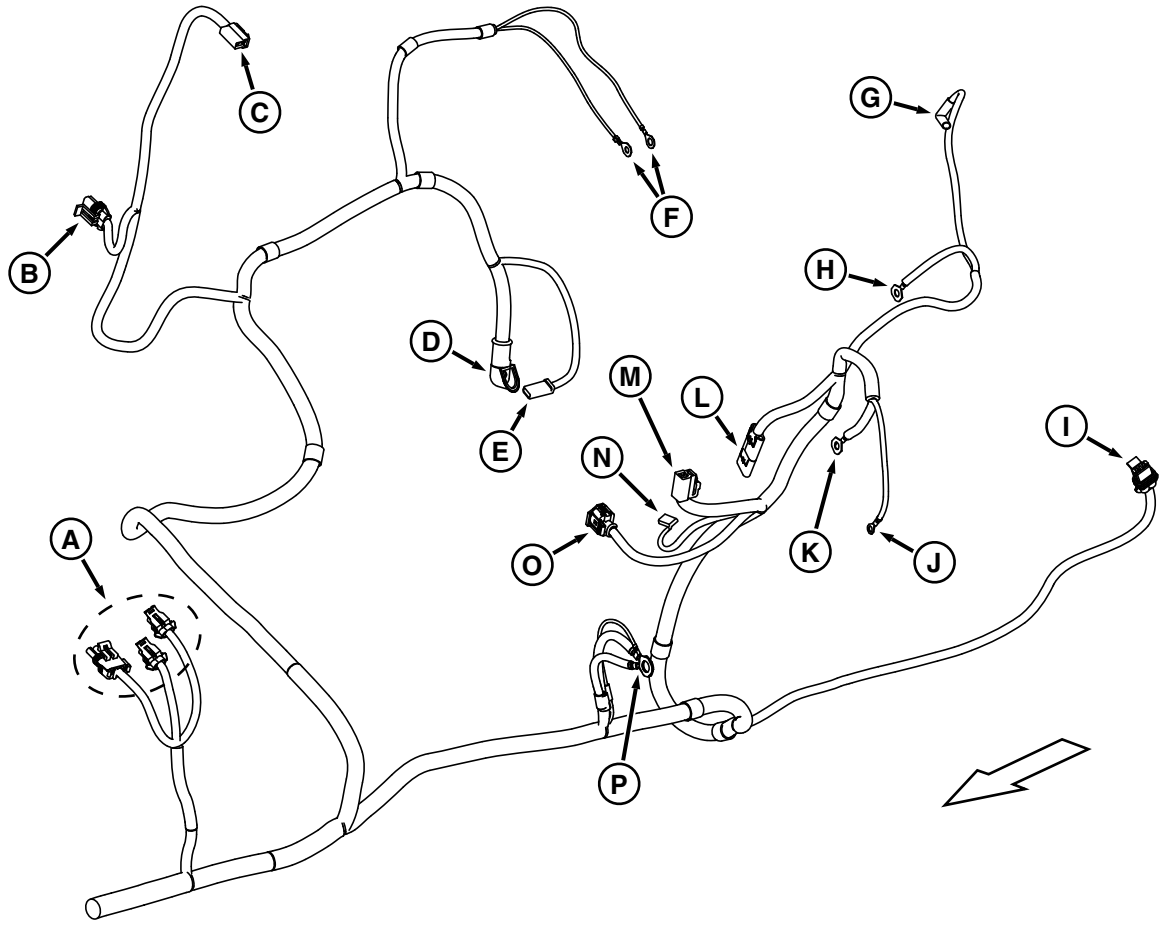
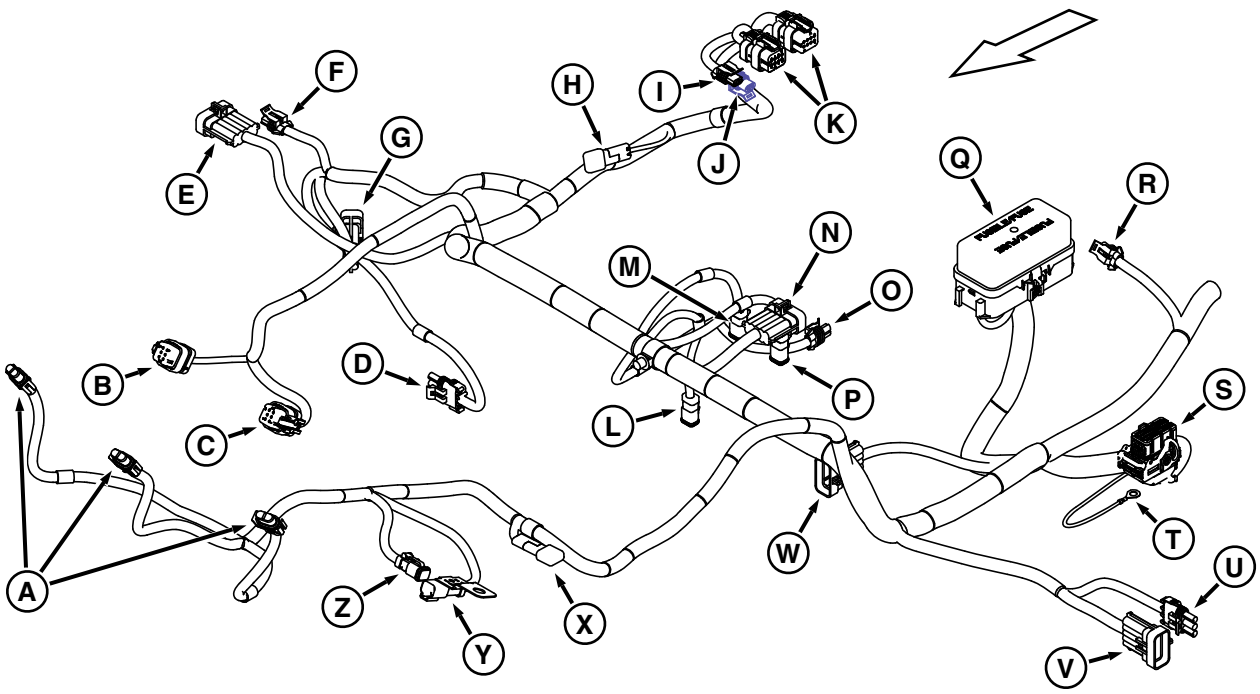


Main Wiring Harness, Non-T4 (2 of 2)

A — FWD/REV Solenoids and Swashplate Connectors
B — Fuel Level Sensor Connector
C — Fuel Transfer Pump Connector
D — Starter Motor (fuse)
E — Starter Solenoid Connector
F — (To 48V Alternator)
G — Engine Temp Switch Connector
H — Preheater Terminal
I — Hyd Oil Temp Switch Connector
J — 12V Alternator (–)
K — 12V Alternator (+)
L — Diode
M — Fuel Solenoid Connector
N — Engine Oil Pressure Switch Connector
O — Crank Speed Sensor Connector
P — Grounds (3)

SH24924,000020F -19-18JUN14-2/2

Wiring Harness, T4



Main Wiring Harness, T4 (1 of 2)

A — Work Light Connectors
B — Reverse Pedal Connector
C — Foward Pedal Connector
D — RH Lift Arm Sensor Connector
E — Right Front Controller Connector
F — Down Pressure Kit Connector
G — Right Rear Controller Connector
H — CAN Terminator Resistor
I — Seat Switch Connector
J — Seat Compressor Connector (7500A only)
K — (To Command Arm Harness)
L — Valve Solenoid Connector, Blue
M — Valve Solenoid Connector, Red
N — Left Rear Controller Connector
O — Hyd Filter Restriction Switch Connector
P — Valve Solenoid Connector, Yellow
Q — Load Center
R — Kit Switched Power Connector
S — VCU
T — VCU Case Ground
U — LH Lift Arm Sensor Connector
V — Left Front Controller Connector
W — Front Center Controller Connector
X — CAN Terminator Resistor
Y — Brake Pressure Switch Connector
Z — Brake Solenoid Connector

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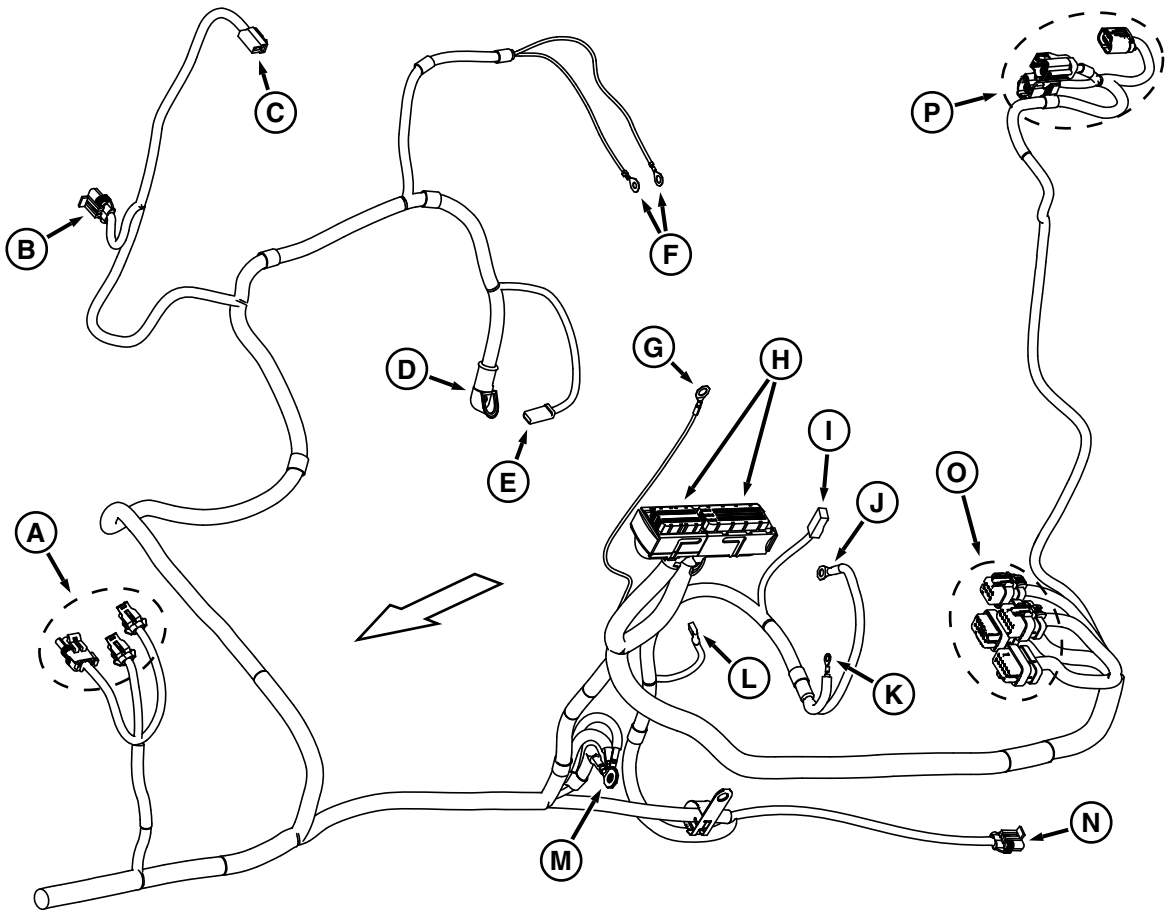
SH24924,00001C4 -19-18JUN14-1/2

Main Wiring Harness, T4 (2 of 2)



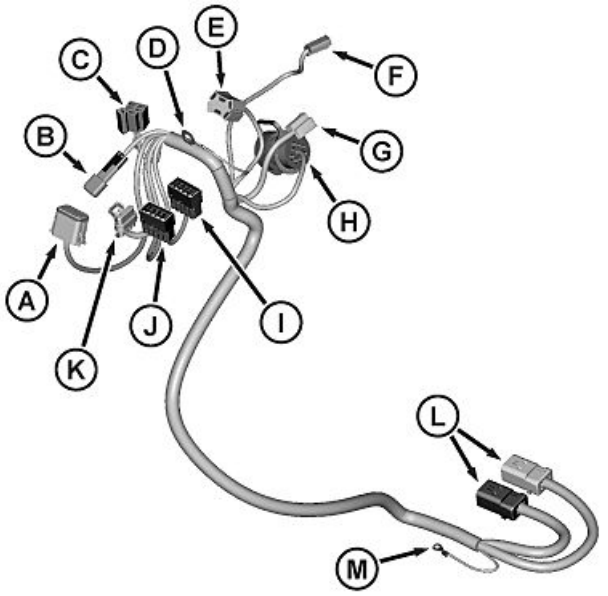
Main Wiring Harness, T4 (2 of 2)

A — FWD/REV Solenoids and Swashplate Connectors
B — Fuel Level Sensor Connector
C — Fuel Transfer Pump Connector
D — Starter Motor (fuse)
E — Starter Solenoid Connector
F — (To 48V Alternator)
G — ECU Case Ground
H — ECU
I — Glow Plugs Connector
J — 12V Alternator (+)
K — 12V Alternator (–)
L — Engine Oil Pressure Switch Connector
M — Grounds (3)
N — Hyd Oil Temp Switch Connector
O — (To Engine Harness)
P — (To DPF)

SH24924,00001C4 -19-18JUN14-2/2

Wiring Harness, Command Arm

A — Display Connector
B — Resistor
C — Ignition Switch Connector
D — Console Arm Ground
E — Work Light Switch Connector
F — Power Port Connector
G — Alarm Connector
H — Service Advisor Port
I — PTO Switch Connector
J — Park Brake Switch
K — Raise/Lower Switch Connector
L — (To Main Harness)
M — Seat Pan Ground



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SH24924,00001CB -19-02APR14-1/1

VCU Pinout, Non—T4

Pin No.	Circuit	Signal
A1	F201 Yel	CAN HI
A2	650 Grn	PTO In
A3	663 Grn	HYD Filter Restriction In
A4	310 Org	Fuel Level In
B1	F101 Grn	CAN LO
B2	935 Wht	Fuel Pull-in Solenoid (+)
B3	651 Grn	RH Proximity SW In
B4	667 Grn	Swash Plate Position In
C1	430 Blu	Seat SW In (Open/VBAT)
C2	701 Pur	Start In (Open/VBAT)
C3	420 Blu	Raise Reels In
C4	445 Blu	Rear Mow Solenoid (-)
D1	652 Grn	Reverse Pedal “A” In (PWM)
D2	—	—
D3	325 Org	Lower Reels In
D4	659 Grn	Rear Raise/Lower Solenoid (+)
E1	—	—
E2	426 Blu	48V Alternator Field Relay (-)
E3	662 Grn	Reverse Pedal “B” In (PWM)
E4	600 Pnk	Park Brake Solenoid (+)
F1	605 Pnk	+5V Sensor Supply, Pedal B
F2	321 Org	Pre-Heat Relay (-)
F3	657 Grn	Forward Pedal “B” Input (PWM)
F4	435 Blu	Front Raise/Lower Solenoid (+)
G1	—	—
G2	450 Gry	Warning Buzzer (-)
G3	610 Pnk	FWD/REV Hydro Solenoid (+)
G4	830 Tan	Oil Pressure In (Open/GND)
H1	671 Grn	Brake Pressure In
H2	451 Gry	Work Light Relay (-)
H3	300 Org	Engine Overtemp SW (Open/GND)
H4	452 Gry	Reverse Hydro Solenoid (-)
J1	745 Pur	Park Brake Switch (Open/VBAT)
J2	665 Grn	Forward Pedal “A” Input (PWM)
J3	615 Grn	Fuel Hold Solenoid (+)
J4	915 Wht	Starter Relay (+)
K1	305 Org	Hydraulic Oil Temp Switch Input
K2	620 Pnk	+5V Sensor Supply, Pedal A
K3	—	—
K4	—	—
L1	211 Pnk	VBAT Unswitched
L2	103 Blk	GND
L3	654 Grn	LH Proximity Switch Input
L4	320 Org	Forward Hydro Solenoid In
M1	509 Yel	+12V Switched
M2	350 Brn	Pedal Sensor Return
M3	315 Org	Raise/Lower “Select” Solenoid (-)
M4	800 Yel	Engine Speed

SH24924,0000210 -19-21MAY14-1/1

VCU Pinout, T4

Pin No.	Circuit	Signal
A1	F201 Yel	CAN HI
A2	650 Grn	PTO In
A3	663 Grn	HYD Filter Restriction In
A4	310 Org	Fuel Level In
B1	F101 Grn	CAN LO
B2	—	—
B3	651 Grn	RH Proximity SW In
B4	667 Grn	Swash Plate Position In
C1	430 Blu	Seat SW In (Open/VBAT)
C2	704 Pur	Start In (Open/VBAT)
C3	420 Blu	Raise Reels In
C4	445 Blu	Rear Mow Solenoid (-)
D1	652 Grn	Reverse Pedal “A” In (PWM)
D2	—	—
D3	325 Org	Lower Reels In
D4	659 Grn	Rear Raise/Lower Solenoid (+)
E1	—	—
E2	426 Blu	48V Alternator Field Relay (-)
E3	662 Grn	Reverse Pedal “B” In (PWM)
E4	600 Pnk	Park Brake Solenoid (+)
F1	605 Pnk	+5V Sensor Supply, Pedal B
F2	—	—
F3	657 Grn	Forward Pedal “B” Input (PWM)
F4	435 Blu	Front Raise/Lower Solenoid (+)
G1	—	—
G2	450 Gry	Warning Buzzer (-)
G3	610 Pnk	FWD/REV Hydro Solenoid (+)
G4	—	—
H1	671 Grn	Brake Pressure In
H2	451 Gry	Work Light Relay (-)
H3	—	—
H4	452 Gry	Reverse Hydro Solenoid (-)
J1	745 Pur	Park Brake Switch (Open/VBAT)
J2	665 Grn	Forward Pedal “A” Input (PWM)
J3	911 Wht	Engine Run Permission (+)
J4	715 Pur	Starter Relay (+)
K1	305 Org	Hydraulic Oil Temp Switch Input
K2	620 Pnk	+5V Sensor Supply, Pedal A
K3	—	—
K4	—	—
L1	211 Pnk	VBAT Unswitched
L2	103 Blk	GND
L3	654 Grn	LH Proximity Switch Input
L4	320 Org	Forward Hydro Solenoid In
M1	509 Yel	+12V Switched
M2	350 Brn	Pedal Sensor Return
M3	315 Org	Raise/Lower “Select” Solenoid (-)
M4	—	—

CB12260,0000104 -19-21MAY14-1/1

Summary of References

- Theory OF Operation Information
- Power Circuit, Non-T4
- Power Circuit, T4
- Cranking Circuit, Non-T4
- Cranking Circuit, T4
- Charging Circuit
- Lift-Lower-Mow Circuit
- Engine Oil Pressure Circuit, Non-T4
- Engine Oil Pressure Circuit, T4
- Engine & Hydraulic Temperature Circuit, Non-T4
- Engine & Hydraulic Temperature Circuit, T4
- Air Preheater Circuit, Non-T4
- Glow Plug Circuit, T4
- Cruise Control Circuit
- Traction Drive Circuit

BS62576,0001093 -19-13JUN14-1/1

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 when possible.

CB12260,00005FA -19-05JUN13-1/1

Power Circuit, Non-T4

Function:

The power circuit provides unswitched power to the primary components whenever the battery is connected and switched power to the operational components whenever the key switch is in either the RUN or START position.

Unswitched Power

Unswitched power must be available at the following connectors or components with the key switch off:

- BT-2 battery, 250 Red wire
- MT-4 alternator, 201 Red wire
- EF-1 fuse, 201 Red wire
- MT-3 fuse, 200 Red wire
- EF-1 fuse, Red wire
- MFB-1 Load center, 214 Red wire
- MFB-1 Load center, 208 Red wire
- MFB-1 Load center, 604 Pnk wire
- MFB-1 Load center, 211 Pnk wire
- MFB-1 Load center, 202 Red wire
- MFB-1 Load center, 210 Red wire
- MFB-1 Load center, 213 Red wire
- MFB-1 Load center, 207 Red wire
- MFB-1 Load center, 604 Pnk wire
- MFB-1 Load center, 212 Red wire
- MFB-1 Load center, 621 Pnk wire
- MC-12 Command arm connector, 210 Red wire
- C-2 Key switch, 210A Red wire

The positive battery cable connects the battery to the starting motor solenoid. The starting motor solenoid “B” terminal is used as the 12-Volt DC tie point for the rest of the electrical system.

The battery cables and the starting motor solenoid tie point connections must be in good condition for the vehicle electrical system to work properly. The ground cable and positive cable connections are equally important. Proper starting motor operation depends on these cables and connections to carry high current.

The entire electrical system is initially protected by the 80A main fuse, and all individual circuits have sub fuses for protection.

Switched Power

Switched power must be available at the following connectors or components with the key switch on:

- MC-5 Front mow valve connector, 515 Yel wire
- MC-9 RH lift arm position proximity sensor connector, 506 Yel wire
- MC-10 Seat switch connector, 505 Yel wire
- MC-11 LH lift arm position proximity sensor connector, 507 Yel Wire
- MC-12 Command arm connector, 500 Yel wire
- MC-13 Command arm connector, 509 Yel wire
- MC-20 Rear mow valve connector, 517 Yel wire
- MC-23 VCU connector, 509 Yel wire
- MC-25 Brake pressure connector, 514 Yel wire
- MC-27 Fuel sender connector, 506 Yel
- MC-55 Low current power connector, 503 Yel wire
- MC-63 Hydraulic oil temp sensor connector, 524 Yel wire
- MC-64 Raise select valve connector, 512 Yel wire
- MFB-1 Load center, 502 Yel wire
- MFB-1 Load center, 520 Yel wire
- MFB-1 Load center, 523 Yel wire
- C-2 Key switch, 500B Yel wire
- C-4 Hall effect Raise/Lower connector, 500H Yel wire
- C-5 Buzzer, 500C and 500K Yel wires
- C-14A Work lights connector, 500G Yel wire
- C-16 Display panel connector, 500D Yel wire
- C-24 PTO switch
- C-25 Park brake switch, 500E Yel wire
- MC-60 Service ADVISOR™ connector, 500J Yel wire
- R-1 Resistor, 500K Yel wire

+5V Sensor Voltage

- MC-23 VCU connector, 350 Brn wire
- MC-34 Pump angle sensor, 355 Brn wire
- MC-35 Fuel sender, 356 Brn wire
- MC-61 FWD pedal (inboard) rotary sensor, 351 and 352 Brn wires
- MC-62 REV pedal (outboard) rotary sensor, 353 and 354 Brn wires

With voltage present at the components listed above, the vehicle’s electrical circuits will be prepared for operation.

CB12260,00005E0 -19-02JUN14-1/1

Power Circuit, T4

Function:

The power circuit provides unswitched power to the primary components whenever the battery is connected and switched power to the operational components whenever the key switch is in either the RUN or START position.

Unswitched Power

Unswitched power must be available at the following connectors or components with the key switch off:

- BT-2 battery, 250 Red wire
- MT-4 alternator, 201 Red wire
- EF-1 fuse, 201 Red wire
- MT-3 (EF-1 fuse), 200 Red wire
- MFB-1 Load Center, 615 Pnk wire
- MFB-1 Load Center, 604 Pnk wire
- MFB-1 Load Center, 208 Red wire
- MFB-1 Load Center, 211 Pnk wire
- MFB-1 Load Center, 202 Red wire
- MFB-1 Load Center, 209 Red wire
- MFB-1 Load Center, 210 Red wire
- MFB-1 Load Center, 213 Red wire
- MFB-1 Load Center, 203 Red wire
- MFB-1 Load Center, 207 Red wire
- MFB-1 Load Center, 207 Red wire
- MFB-1 Load Center, 604 Pnk wire
- MFB-1 Load Center, 624 Pnk wire
- MFB-1 Load Center, 606 Pnk wire (D11 and A 12)
- MFB-1 Load Center, 206 Red wire
- MFB-1 Load Center, 212 Red wire
- MFB-1 Load Center, 621 Pnk wire
- MC-14 Seat Suspension Compressor, 621 Pnk wire
- MC-23 VCU, 211 Pnk wire
- MC-12 Red Command Harness Connector, 210 Red wire
- A5502 ECU, 646 Pnk wire
- A5502 ECU, 644 Pnk wire
- A5502 ECU, 643 Pnk wire
- C-2 Key Switch, 210A Red wire

The positive battery cable connects the battery to the starting motor solenoid. The starting motor solenoid “B” terminal is used as the 12-Volt DC tie point for the rest of the electrical system.

The battery cables and the starting motor solenoid tie point connections must be in good condition for the vehicle electrical system to work properly. The ground cable and positive cable connections are equally important. Proper starting motor operation depends on these cables and connections to carry high current.

The entire electrical system is initially protected by the 80A main fuse, and all individual circuits have sub fuses for protection.

Switched Power

Switched power must be available at the following connectors or components with the key switch on:

- MC-64 Raise Select Valve, 512 Yel wire
- MC-11 LH Lift Arm Position Sensor, 507 Yel wire
- MC-23 VCU, 509 Yel wire
- MC-63 Hydraulic Oil Temperature Switch
- MC-25 Brake Pressure Switch
- MC-9 RH Lift Arm Position Sensor
- MC-10 Seat Switch, 505 Yel wire
- MC-27 Fuel Pump, 508 Yel wire
- MC-20 Down Pressure Kit Connector 517 Yel wire
- MC-55 Kit Power Connector, 503 Yel wire
- MS-Switch2 and MS-Switch1 splices, 504 Yel wire
- MS-Switch1 and MS-Switch3 splices, 513 Yel wire
- MC-13 Yel Command Harness Connector, 509 Yel wire
- A5502 ECU, 525 Yel wire
- C-5 Buzzer, 500C and 500K Yel wires
- R-1 Resistor, 500K Yel wire
- C-11 Connector, 500A Yel wire
- C-2 Key Switch, 500B and 501 Yel wires
- C-14A Work Lights, 500G Yel wire
- C-4 Raise/Lower Lever Sensor, 500H Yel wire
- C-24 PTO Switch, 500F Yel wire
- C-25 Park Brake Switch, 500E Yel wire
- MC-60 Service ADVISOR Connector, 500J Yel wire

With voltage present at the components listed above, the vehicle’s electrical circuits will be prepared for operation.

CB12260,0000109 -19-02JUN14-1/1

Cranking Circuit, Non-T4

Function

To energize the starting motor solenoid and engage the starting motor.

Operating Conditions

To crank the engine, the following conditions must be met:

NOTE: There must be no pressure in the hydraulic system in order to engage the park brake.

- Park brake applied.
- PTO switch OFF.
- Directional pedals in neutral position
- Backlap OFF
- Key switch in START position.

Theory of Operation

With the key switch in the start position, power is output over the 701A Pur and 704 Pur wires (start request) to the VCU (pin C2).

When conditions are met, the VCU will output battery voltage over the 715 Pur wire (pin J4) to the start relay (MFB-1 Load Center, pin E7). This will cause the relay to close and output power to the MC-4 starter solenoid via the 700 Pur wire.

The starting motor solenoid is engaged by current flowing through the coil windings, pulling the plunger inward. The plunger closes the solenoid main contacts. Current flows through the hold-in windings, keeping the solenoid engaged.

With the solenoid main contacts closed, high current from the battery flows across the main contacts to the starting motor causing it to turn.

When a machine malfunction or operator error causes a controller to initiate an engine shutdown, cranking may not be possible until the shutdown condition is resolved.

Other conditions that may prevent cranking include:

- Electrical system not between 8~17 volts.
- Engine speeds greater than 675 rpm.
- Cranking times exceeding 30 seconds.

CB12260,00005E1 -19-18JUN14-1/1

Cranking Circuit, T4

Function

To energize the starting motor solenoid and engage the starting motor.

Operating Conditions

To crank the engine, the following conditions must be met:

NOTE: There must be no pressure in the hydraulic system in order to engage the park brake.

- Park brake applied.
- PTO switch OFF.
- Directional pedals in neutral position
- Backlap OFF
- Engine preheat OFF
- Load match OFF
- Key switch in START position.

Theory of Operation

With the key switch in the start position, power is output over the 701A Pur and 704 Pur wires (start request) to the VCU (pin C2).

With the key switch in the start position, power is output over the 701A Pur and 704 Pur wires (start request) to the VCU (pin C2). This signal is split and is fed to the ECU pin 35 Start-Key Switch input and the VCU pin C2 Start Input. The two controllers will confirm that their respective operating conditions are met via the CAN bus. The VCU will then send out 12 volts from pin J4, Starter Relay (+). This signal powers the high side of the start relay coil as well as being split off to the ECU pin 14, Starter Permission 1 SW. If start conditions are still ok, the ECU will pull pin 28, Start Relay (LSD) low and energize the start relay coil thereby closing its contacts. This will send 12 volts to the start relay.

The starting motor solenoid is engaged by current flowing through the coil windings, pulling the plunger inward. The plunger closes the solenoid main contacts. Current flows through the hold-in windings, keeping the solenoid engaged.

With the solenoid main contacts closed, high current from the battery flows across the main contacts to the starting motor causing it to turn.

When a machine malfunction or operator error causes a controller to initiate an engine shutdown, cranking may not be possible until the shutdown condition is resolved.

Other conditions that may prevent cranking include:

- Electrical system not between 8~17 volts.
- Engine speeds greater than 675 rpm.
- Cranking times exceeding 30 seconds.

CB12260,000010A -19-02JUN14-1/1

Charging Circuit

Function:

To maintain battery voltage between 12.4 volts DC and 15 volts DC.

Operating Conditions:

The key switch must be in the run position, with the engine running, for the charging system to operate.

Theory of Operation:

The main charging system components are the battery, alternator and the internal voltage regulator/rectifier. Charging output is controlled by the regulator/rectifier. The status of the charge rate is indicated by the discharge indicator on the display panel based on system voltage. Some charging information is transmitted via the CAN bus.

When the voltage regulator detects lower-than-normal system voltage, it energizes the rotating windings (field) in the alternator. The rotating magnetic field induces alternating current in the stator coils. The rectifier converts this alternating current into the direct current needed to charge the battery. Current is supplied to the battery via the 201 Red wire through the EF-1 80A fuse and the positive battery cable.

A fully-charged battery signals the regulator to turn off the field windings, stopping the charge current.

The alternator is grounded to the frame through the 102 Blk wire.

If the voltage on the sensing circuit falls below system usage or is insufficient to maintain a preset voltage, the display panel will sense the lowered voltage and turn on the discharge indicator.

CB12260,00005E2 -19-30MAY14-1/1

Lift-Lower-Mow Circuit

Function:

- Lift and lower the cutting reels
- Enable the cutting reel motors

Operating Conditions - Lift/Lower:

- Operator on seat
- Engine running (only required for lift function)

Theory of Operation - Lift/Lower:

Cutting units are raised and lowered by hydraulic cylinders. Signals from the lift/lower switch, and deck position sensor on the 7500A, are used by the VCU to control the hydraulic cylinder solenoid valves.

A “lift” command from a lift/lower switch requires the VCU to energize both the Lift/Lower Select (“Raise”) solenoid and the Lift/Lower solenoid. Depending on the type of machine, solenoids remain energized as long as the lift switch is active. A “lower” command only activates the Lift/Lower solenoid.

Should the lift/lower switch failure cause the lift and lower commands to occur simultaneously, the VCU stops the cutting units from raising, lowering, and mowing. A diagnostic code is shown on the display panel to indicate a failure. The VCU is programmed to prevent unexpected cutting unit movement resulting from intermittent switch faults.

Operating Conditions - Mow:

- Operator on seat
- Engine running
- Brake Off
- PTO On

Theory of Operation - Mow:

Operation of the cutting unit motors is linked to the lift-lower circuit. Logic in the VCU allows a cutting unit motor to turn only after the proximity switch (7500E) confirms that the cutting unit is in the fully lowered position.

Provided all conditions are met, switching on the PTO has the VCU activate the cutting unit motor control units. By doing so, 48 volt electric power is made available to the cutting unit motors.

Failure of a cutting unit proximity sensor switch (7500E) shuts off the cutting unit motor control unit.

CB12260,00005E3 -19-31MAR15-1/1

Engine Oil Pressure Circuit, Non-T4

Function

To warn the operator if the engine oil pressure drops below the minimum safe operating level.

Operating Conditions

- Key switch in the RUN position

Should the engine oil pressure drop below safe operating levels, the contacts of oil pressure switch close. The closed contacts complete a ground path that activates the oil pressure input of the VCU.

The VCU then activates the alarm buzzer while transmitting a message over the CAN bus to the display panel, alerting the operator. The buzzer and display alert stay on until the fault goes away or the machine is shut down.

CB12260,00005E4 -19-31MAR15-1/1

Engine Oil Pressure Circuit, T4

Function

To warn the operator if the engine oil pressure drops below the minimum safe operating level.

Operating Conditions

- Key switch in the RUN position

Should the engine oil pressure drop below safe operating levels, the contacts of oil pressure switch close. The closed contacts complete a ground path that activates the oil pressure input of the ECU. The oil pressure input of the ECU also senses the switch closure, causing the ECU to put the engine into a derate mode.

The ECU then broadcasts a message over the CAN bus. The VCU then activates the alarm buzzer while transmitting a message over the CAN bus to the display panel, alerting the operator. The buzzer and display alert stay on until the fault goes away or the machine is shut down.

CB12260,000010B -19-31MAR15-1/1

Engine & Hydraulic Temperature Circuit, Non-T4

Function

- To display an engine coolant over temperature condition
- To warn the operator of hydraulic system overheating
- To reduce the load on overheated components

Temperature Circuit Operation - Engine

The alarm buzzer will sound and an indicator on the display panel appear when an over temperature condition exists during machine operation. The engine coolant temperature switch closes to ground and the VCU detects the low input. A message is then broadcast over the CAN bus. The VCU turns off the reels to remove load. The VCU also activates the alarm buzzer. The PDU displays a message to alert the operator. Mowing is permitted when the temperature falls to a safe level and the machine has been shut down.

Temperature Circuit Operation - Hydraulics

The alarm buzzer sounds and an indicator on the display panel appears when an over temperature condition exists during machine operation. The hydraulic temperature switch closes and sends battery voltage to the VCU (pin K1). The VCU turns the reels off until the temperature falls to a safe level and the machine has been shut down.

CB12260,00005E5 -19-31MAR15-1/1

Engine & Hydraulic Temperature Circuit, T4

Function

- To display an engine coolant over temperature condition
- To warn the operator of hydraulic system overheating
- To reduce the load on overheated components

Temperature Circuit Operation - Engine

The alarm buzzer sounds and an indicator on the display panel appears when an over temperature condition exists during machine operation. The engine coolant temperature switch sends a signal to the ECU (pin 28). A message is then broadcast over the CAN bus. The VCU then turns off the reels to remove load. The VCU also activates the alarm buzzer. The PDU displays a message to alert the operator. The VCU turns the cutting units off until the temperature lowers and the machine has been shut down.

Temperature Circuit Operation - Hydraulics

The alarm buzzer sounds and an indicator on the display panel appears when an over temperature condition exists during machine operation. The hydraulic temperature switch closes and sends battery voltage to the VCU (pin K1). The VCU turns the cutting units off until the temperature lowers and the machine has been shut down.

CB12260,000010C -19-31MAR15-1/1

Air Preheater Circuit, Non-T4

Function

To preheat the air entering the engine combustion chamber during cold starts, and to activate an indicator on the instrument cluster indicating the air preheater is being powered.

Operating Conditions

- Key switch in the RUN position
- Park brake LOCKED

Theory of Operation

The ignition system is designed to inject diesel fuel into the piston cylinder where heat from compression ignites the air-fuel mixture. When starting a cold engine, compression may not provide enough heat to ignite the fuel. The intake air preheater is installed to provide additional heat to the air-fuel mixture.

When the key switch is turned from OFF to the RUN position, the VCU is powered up. The control module will then activate the air preheater circuit and air preheater indicator for approximately 3 to 15 seconds based on engine and ambient air temperatures.

One side of the preheat relay coil is connected to switched battery power via the 500 series Yel wires. The control module Preheat Relay output (connector MC-23, pin F2) and 321 Org wire provide the ground path to energize the relay coil.

The preheater indicator signal is sent to the display panel via the CAN bus.

With the preheat relay energized, the MT-2 air preheater receives battery power via the 920 Wht wire.

When the air preheater circuit is activated, approximately 24-30 amperes flows through the circuit. To reduce battery drain, the air preheater white wire at terminal (MT-2) should be disconnected when testing other circuits. Turning the key switch to the RUN position with the engine off will reset the air preheater circuit, continually cycling the air heater ON.

CB12260,00005E6 -19-02JUN14-1/1

Glow Plug Circuit, T4

Function

To preheat the air entering the engine combustion chamber during cold starts, and to activate an indicator on the instrument cluster indicating the glow plugs are being powered.

Operating Conditions

- Key switch in the RUN position
- Park brake LOCKED

Theory of Operation

The fuel system is designed to inject diesel fuel into the piston cylinder where heat from compression ignites the air-fuel mixture. When starting a cold engine, compression may not provide enough heat to ignite the fuel. The glow plugs are installed to provide additional heat to the air-fuel mixture and combustion chamber.

When the key switch is turned from OFF to the RUN position, the ECU is powered up. The control module will then activate the glow plug circuit and glow plug indicator on the PDU for approximately 3 to 15 seconds based on engine and ambient air temperatures.

One side of the preheat relay coil is connected to unswitched battery power via the 200 series Red wires. The control module's glow plug relay output (connector A5502, pin 70) 626 Pnk wire sends out 12V to energize the relay coil.

The preheater indicator signal is sent to the display panel via the CAN bus.

With the preheat relay energized, the MT-2 connector receives battery power via the 920 Wht wire.

When the glow plug circuit is activated, approximately 24-30 amperes flows through the circuit. To reduce battery drain, the air glow plug white wire at terminal (MT-2) should be disconnected when testing other circuits. Turning the key switch to the RUN position with the engine off will reset the glow plug circuit, continually cycling the glow plugs ON.

CB12260,000010D -19-02JUN14-1/1

Traction Drive Circuit

The forward and reverse pedals each have a dual channel rotary Hall Effect sensor that provides direction and speed inputs to the VCU. The independent channel A and channel B output of each sensor is a 200 Hz, 0-5 V square wave, with the duty cycle dependent on pedal position. The sensor is designed so that as the duty cycle of one output increases, the other duty cycle decreases. For a properly functioning sensor, the combined duty cycles will always sum to 100%. The VCU is continuously performing this check and causes a fault code to activate if this condition is not met. This prevents a “runaway” condition if one channel fails.

The VCU supplies a separate 4 KHz PWM signal to both the forward and reverse solenoids of the traction pump control block. As the VCU varies the duty cycle sent to each solenoid, the control block shuttles to drive the traction pump forward or reverse.

Forward Drive Circuit Operation

The forward drive circuit causes the VCU to propel the machine in a controlled forward direction.

Additionally the electronic drive control unit provides for setting the following functions during a forward drive:

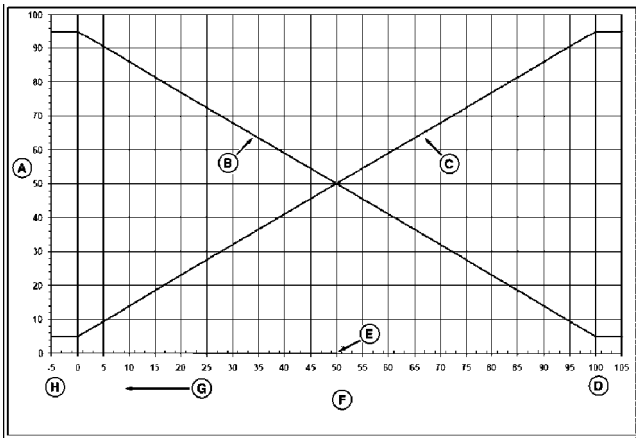
- Maximum travel speed
- Cruise control
- Load match

Each of these additional functions can to be controlled by the operator.

The VCU is a preprogrammed electrical device that allows the operator to control the machine forward drive function and speed via the electrical inputs from the forward foot pedal sensor. Under normal operating conditions, this creates an output to the pump in the transmission.

The forward pedal sensor is a hall effect style potentiometer that has the following signals:

- “A” Return
- “A” Signal 0.5 to 4.5 VDC
- “A” +5 VDC Reference
- “B” Return
- “B” Signal 0.5 to 4.5 VDC
- “B” +5 VDC Reference



Sensor Output

A—Frequency Duty Cycle (Hz)
B—Channel A Output
C—Channel B Output
D—Counter Clockwise
E—Index Point
F—Shaft Rotation in Percent
G—Spring Return
H—Clockwise

Reverse Drive Circuit Operation

The reverse drive circuit causes the VCU to propel the machine in a controlled reverse direction.

Additionally, the electronic drive control unit provides for setting the following functions during a reverse drive:

- Maximum travel speed

The VCU is a preprogrammed electrical device that allows the operator to control the machine reverse drive function and speed via the electrical inputs from the reverse foot pedal sensor. Under normal operating conditions, this creates an output to the pump in the transmission.

The reverse pedal sensor is a hall effect style potentiometer that has the following signals:

- “A” Return
- “A” Signal 0.5 to 4.5 VDC
- “A” +5 VDC Reference
- “B” Return
- “B” Signal 0.5 to 4.5 VDC
- “B” +5 VDC Reference

CB12260,0000102 -19-31MAR15-1/1

Cruise Control Circuit

Function:

To control the forward drive speed without having to hold the forward drive pedal.

Operating Conditions:

- Key switch in run position
- Engine running
- Operator on seat
- Park brake unlocked
- Forward pedal pressed to desired speed while setting the drive speed
- Cruise control set button on display pressed when desired forward speed is reached.

The cruise control remains engaged until one of the following happens:

- The brake switch is pressed
- The key switch is turned to the off position
- The forward or reverse pedal is depressed
- The PTO switch is toggled
- The cruise button on the display is pressed

Theory of Operation:

The cruise control circuit uses the VCU and display panel to allow the operator to set machine speed.

The cruise control circuit uses the forward pedal sensor, swash plate position sensor, and display panel to provide input to the VCU. The VCU processes thee inputs to provide output current to the traction pump.

The Cruise Control feature is enabled via the display Mower Set Up menu. Momentarily pressing the cruise set button on the display sets the cruise speed at the speed being traveled. The VCU monitors the machine speed and varies the current to the forward proportional solenoid to maintain a constant travel speed.

Disengage the cruise control and engage again at a different speed to adjust travel speed.

CB12260,00003DE -19-31MAR15-1/1

Cranking Circuit Diagnostics, Non—T4

Information for diagnosing cranking circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- Key Switch Test
  Relay Test

- Input/Output Status
- PDU I/O Status Displays
- Machine Start Status Pop-up DTCs
- Warning Icons

Additional References

- Main Electrical Schematic, Non-T4
- Main Schematic Splices, Non-T4
- Cranking Circuit, Non-T4

CB12260,000010E -19-13JUN14-1/1

Cranking Circuit Diagnostics, T4

Information for diagnosing cranking circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- Key Switch Test
  Relay Test

- Input/Output Status
- PDU I/O Status Displays
- Machine Start Status Pop-up DTCs
- Warning Icons

Additional References

- Main Schematic Splices, T4
- Main Electrical Schematic, T4
- Engine Controls and Sensors Schematic
- Cranking Circuit, T4

CB12260,00000DE -19-13JUN14-1/1

Charging Circuit Diagnostics

Information for diagnosing charging circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- PDU I/O Status Displays

Additional References

- Input/Output Status
- Charging Circuit
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Battery Voltage and Specific Gravity Tests
- Battery Load Test
- Regulated Voltage Output Test
- Warning Icons

CB12260,00000DF -19-01APR14-1/1

Lift-Lower-Mow Circuit Diagnostics

Information for diagnosing Lift-Lower-Lower problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- PDU I/O Status Displays
- Reel Motor Test
- Reel Motor Phase Wire Test
- PTO Switch Test

Additional References

- Input/Output Status
- Lift-Lower-Mow Circuit
- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Warning Icons

CB12260,00000E0 -19-20MAR14-1/1

Engine Oil Pressure Circuit Diagnostics

Information for diagnosing engine oil pressure circuit problems

NOTE: Information for diagnosing may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- Engine Oil Pressure Switch Test

Additional References

- Input/Output Status
- Engine Oil Pressure Circuit, Non-T4
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Engine Controls and Sensors Schematic
- Warning Icons

CB12260,00000E1 -19-20MAR14-1/1

Engine & Hydraulic Temperature Circuit Diagnostics

Information for diagnosing engine & hydraulic temperature circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- Test Coolant Temperature Switch
- Test Hydraulic Temperature Switch
- Input/Output Status
- PDU I/O Status Displays

Additional References

- Engine & Hydraulic Temperature Circuit, Non-T4
- Engine & Hydraulic Temperature Circuit, T4
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Warning Icons

CB12260,00000E2 -19-13JUN14-1/1

Preheater Circuit Diagnostics

Information for diagnosing preheater circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- Air Pre-Heater Test
- Glow Plug Test
- Input/Output Status
- PDU I/O Status Displays

Additional References

- Air Preheater Circuit, Non-T4
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Engine Controls and Sensors Schematic
- Warning Icons

CB12260,00000E3 -19-27MAY14-1/1

Forward Drive Circuit Diagnostics

Information for diagnosing forward drive circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- PDU I/O Status Displays
- Pedal Calibration
- Hydrostatic Transmission Calibration
- Hydrostatic Valve Calibration

Additional References

- Input/Output Status
- Traction Drive Circuit
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Warning Icons

CB12260,00000E4 -19-02JUN14-1/1

Reverse Drive Circuit Diagnostics

Information for diagnosing reverse drive circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- Pedal Calibration
- Hydrostatic Transmission Calibration
- Hydrostatic Valve Calibration
- PDU I/O Status Displays

Additional References

- Input/Output Status
- Traction Drive Circuit
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Warning Icons

CB12260,00000E5 -19-02JUN14-1/1

Cruise Control Circuit Diagnostics

Information for diagnosing cruise control circuit problems

NOTE: Service code diagnosis may resolve observable symptoms and must be performed first.

Recommended Diagnostic Procedures or Tests

- PDU I/O Status Displays

Additional References

- Input/Output Status
- Cruise Control Circuit
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Warning Icons

CB12260,00000E6 -19-20MAR14-1/1

Summary of References

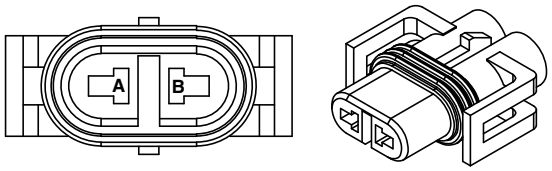
- Work Light Connectors
- Light Switch Connector
- Key Switch Connector
- Starter Solenoid Connector
- Connector, 120 ohm Resistor
- Connector, 1000 ohm Resistor
- RH Lift Arm Position Proximity Sensor Connector
- LH Lift Arm Position Proximity Sensor Connector
- Seat Switch Connector
- Seat Suspension Compressor Connector
- Main Harness to Command Arm Connector (Red)
- Main Harness to Command Arm Connector (Yellow)
- Command Arm to Main Harness Connector (Red)
- Command Arm to Main Harness Connector (Yellow)
- PTO Switch Connector
- Park Brake Switch Connector
- Forward (inboard) Pedal Connector
- Reverse (outboard) Pedal Connector
- Raise/Lower Switch Connector
- Front Raise/Lower Valve Connector
- Rear Raise/Lower Valve Connector
- Raise Select Valve Connector
- Brake Solenoid Connector
- Brake Pressure Switch Connector
- Hyd Filter Restriction Switch Connector
- Hyd Oil Temp Connector
- Forward Hydro Solenoid Connector
- Reverse Hydro Solenoid Connector
- Pump Angle Sensor Connector
- Kit Switched Power Connector
- Down Pressure Kit Connector
- Crankshaft Speed Pickup Connector
- Vehicle Control Unit (VCU) Connector
- Engine Control Unit (ECU) Connector, 94 Pin
- Engine Control Unit (ECU) Connector, 60 Pin
- Main Harness to Engine Connector (Red 8-pin)
- Main Harness to Engine Connector (Red)
- Main Harness to Engine Connector (Gray)
- Main Harness to Engine Connector (Yellow)
- Fuel Solenoid Connector
- Fuel Level Sensor Connector
- Fuel Transfer Pump Connector
- Diode Connector
- Reel Motor Controller Connector
- Display Connector
- Power Port Connector
- Alarm Connector
- Diagnostic Connector

SH24924,00001B2 -19-31MAR14-1/1

Work Light Connectors

Work Light Connectors	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	401 (MC-1), 402 (MC-2), 403 (MC-3)
B	119 (MC-1), 118 (MC-2), 117 (MC-3)

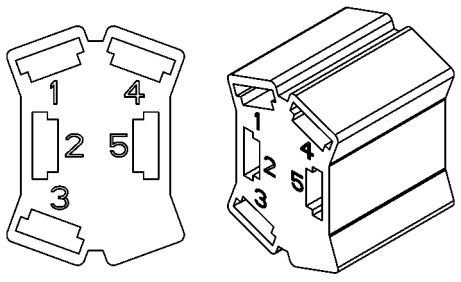
LVT001849 —UN—15MAY14



SH24924,0000195 -19-08MAR13-1/1

Light Switch Connector

Light Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	500G
2	632A

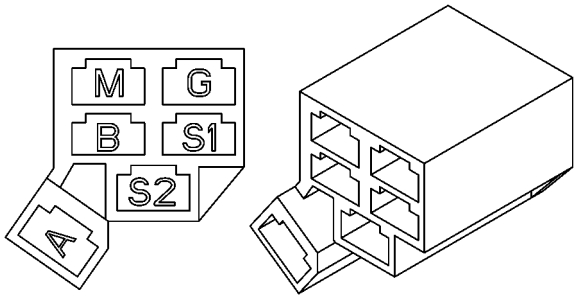


MXT001666 —UN—10OCT11

SH24924,0000208 -19-27MAR13-1/1

Key Switch Connector

Key Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	500B, 501
B	210A
G-M	—
S1	701A
S2	501



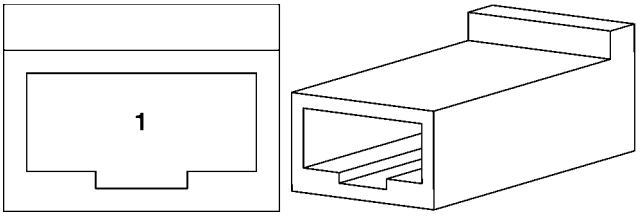
MXT001669 —UN—10OCT11

SH24924,0000209 -19-27MAR13-1/1

Starter Solenoid Connector

Starter Solenoid Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	700

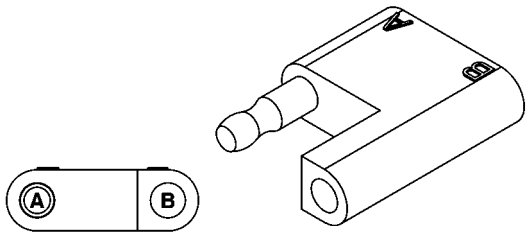
LVT001835 —UN—20JUN11



SH24924,0000196 -19-08MAR13-1/1

Connector, 120 ohm Resistor

Resistor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	F200 (MC-7), F116 (MC-8), F118 (MC-8 T4)
B	F100 (MC-7), F216 (MC-8), F218 (MC-8 T4)

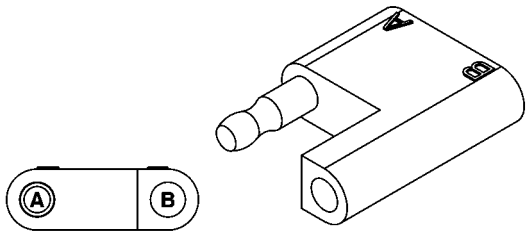


MXT001660 —UN—10OCT11

SH24924,0000197 -19-28MAR14-1/1

Connector, 1000 ohm Resistor

Resistor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	450B
B	500K

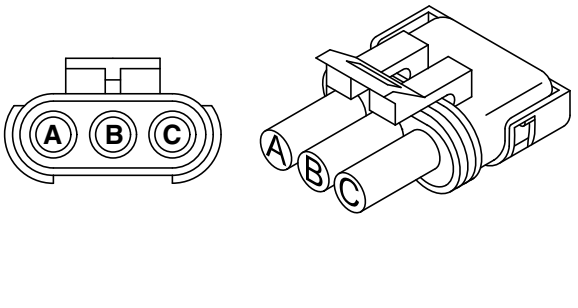


MXT001660 —UN—10OCT11

SH24924,00001C6 -19-31MAR14-1/1

RH Lift Arm Position Proximity Sensor Connector

RH Lift Arm Proximity Sensor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	506
B	651
C	116

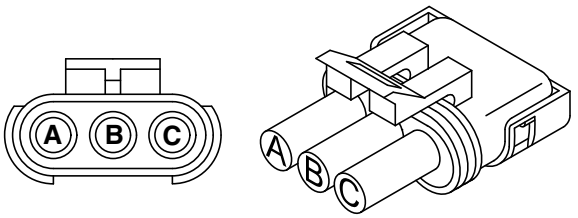


RXA0060730 —UN—05NOV02

SH24924,0000198 -19-08MAR13-1/1

LH Lift Arm Position Proximity Sensor Connector

LH Lift Arm Proximity Sensor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	507
B	654
C	115

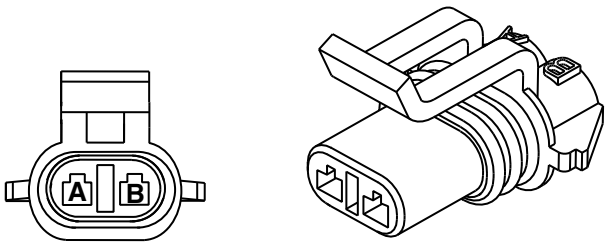


RXA0060730 —UN—05NOV02

SH24924,000019B -19-08MAR13-1/1

Seat Switch Connector

Seat Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	505
B	430

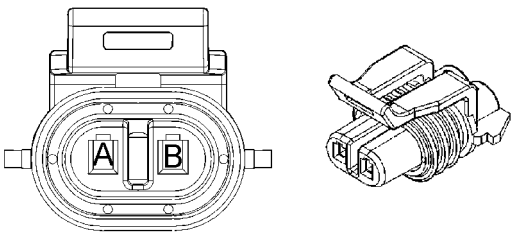


MXT005854 —UN—27NOV12

SH24924,000019A -19-08MAR13-1/1

Seat Suspension Compressor Connector

Seat Suspension Compressor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	621
B	131

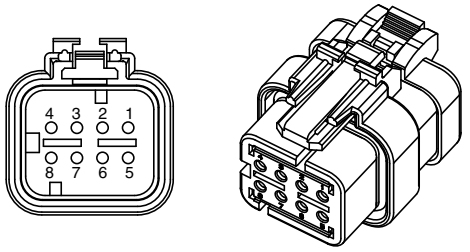


MXT001664 —UN—14FEB13

SH24924,000019C -19-08MAR13-1/1

Main Harness to Command Arm Connector (Red)

Main Harness to Command Arm Connector (Red)	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	500
2	745
3	650
4	450
5	111
6	306
7	701
8	210

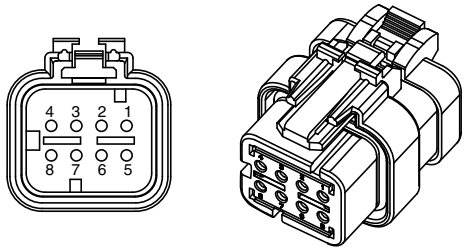


TCT006800 —UN—14MAR13

SH24924,000019D -19-18MAR13-1/1

Main Harness to Command Arm Connector (Yellow)

Main Harness to Command Arm Connector (Yellow)	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	509
2	632
3	F203
4	F103
5	F205
6	F105
7	325
8	420

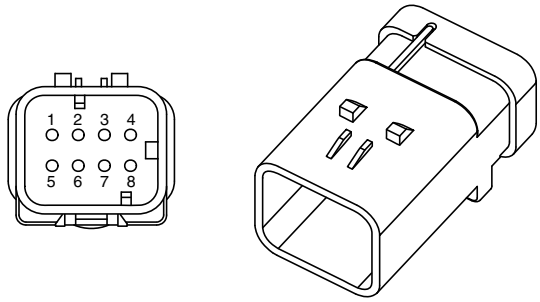


TCT006801 —UN—14MAR13

SH24924,000019E -19-27MAR13-1/1

Command Arm to Main Harness Connector (Red)

Command Arm to Main Harness Connector (Red)	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	500A
2	745A
3	650A
4	450A
5	111A
6	306A
7	701A
8	210A

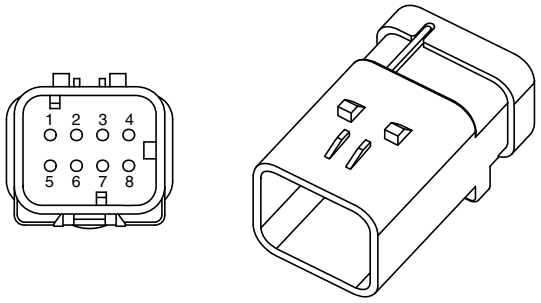


TCT006806 —UN—14MAR13

SH24924,0000206 -19-27MAR13-1/1

Command Arm to Main Harness Connector (Yellow)

Command Arm to Main Harness Connector (Yellow)	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	509A
2	632A
3	F203A
4	F103A
5	F205A
6	F105A
7	325A
8	420A

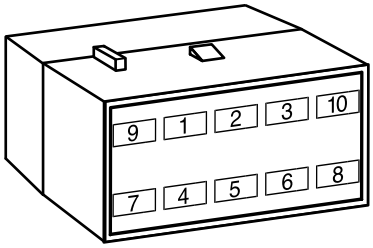


TCT006805 —UN—14MAR13

SH24924,0000207 -19-27MAR13-1/1

PTO Switch Connector

PTO Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	—
2	500F
3	650A
4-10	—

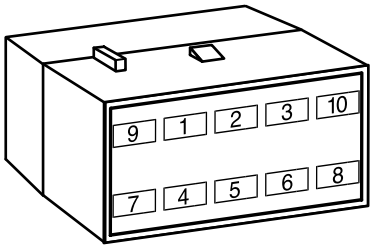


TCT006804 —UN—27DEC13

SH24924,00001C7 -19-13MAR13-1/1

Park Brake Switch Connector

Park Brake Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	745A
2	500E
3-10	—

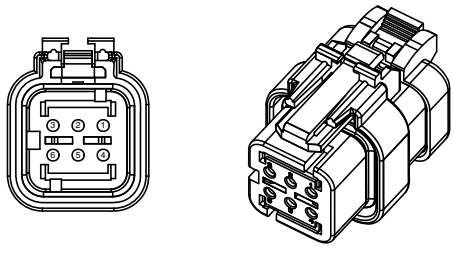


TCT006804 —UN—27DEC13

SH24924,00001C8 -19-13MAR13-1/1

Forward (inboard) Pedal Connector

Forward (inboard) Pedal Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	352
2	665
3	640
4	351
5	657
6	630

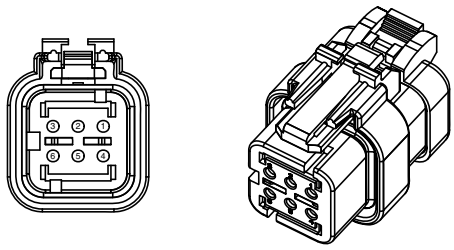


TCT006799 —UN—27FEB14

SH24924,000019F -19-08MAR13-1/1

Reverse (outboard) Pedal Connector

Reverse (outboard) Pedal Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	354
2	652
3	645
4	353
5	662
6	635

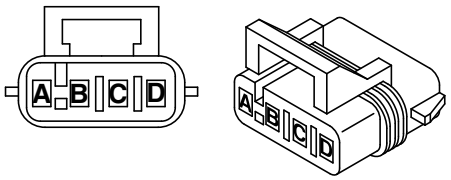


TCT006799 —UN—27FEB14

SH24924,00001A0 -19-08MAR13-1/1

Raise/Lower Switch Connector

Raise/Lower Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	420A
B	500H
C	123
D	325A

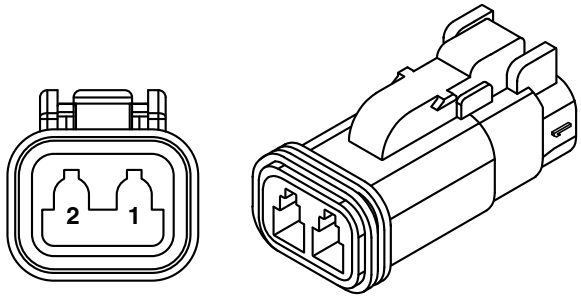


RXA0060738 —UN—05NOV02

SH24924,000020D -19-27MAR13-1/1

Front Raise/Lower Valve Connector

Front Raise/Lower Valve Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	113
2	435

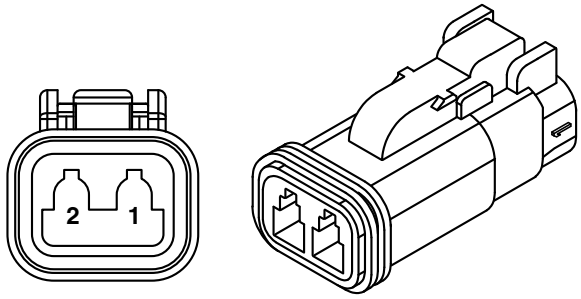


LVT001840 —UN—11JUN13

SH24924,00001A1 -19-08MAR13-1/1

Rear Raise/Lower Valve Connector

Raise Raise/Lower Valve Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	112
2	659

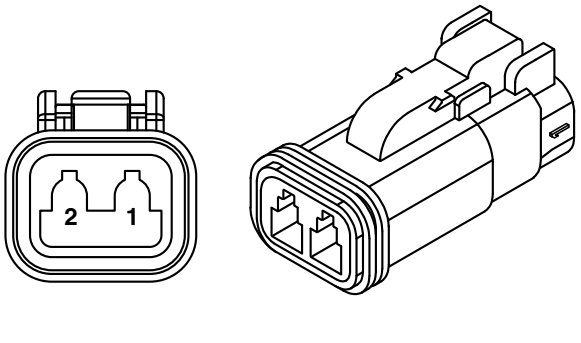


LVT001840 —UN—11JUN13

SH24924,00001A2 -19-08MAR13-1/1

Raise Select Valve Connector

Raise Select Valve Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	512
2	315

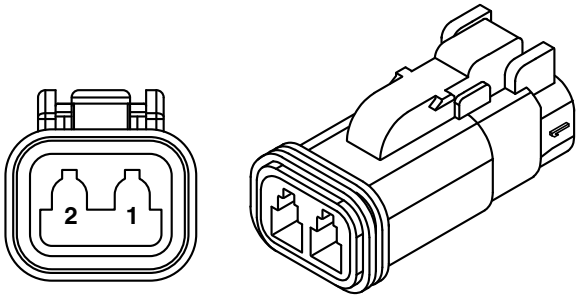


LVT001840 —UN—11JUN13

SH24924,00001A3 -19-08MAR13-1/1

Brake Solenoid Connector

Brake Solenoid Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	600
2	114

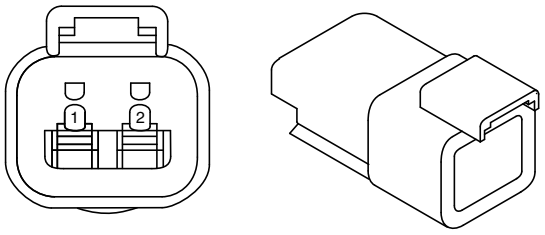


LVT001840 —UN—11JUN13

SH24924,00001A4 -19-08MAR13-1/1

Brake Pressure Switch Connector

Brake Pressure Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A (1)	514
B (2)	671

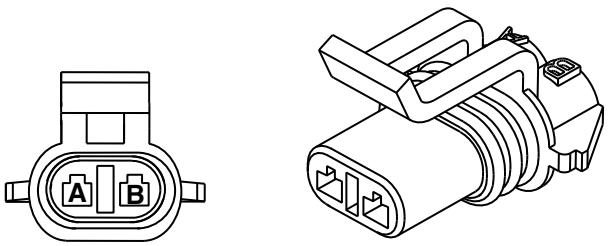


RXA0085697 —UN—06JAN06

SH24924,00001A5 -19-08MAR13-1/1

Hyd Filter Restriction Switch Connector

Hyd Filter Restriction Switch Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	132
B	663

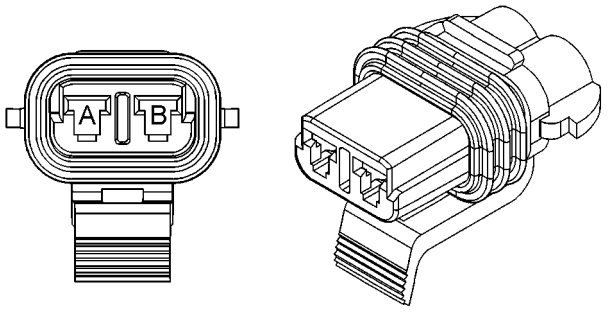


MXT005854 —UN—27NOV12

SH24924,00001A6 -19-08MAR13-1/1

Hyd Oil Temp Connector

Hyd Oil Temp Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	305
B	524

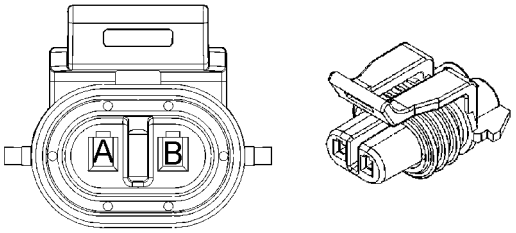


TCT010557 —UN—09MAY14

SH24924,00001AC -19-09MAY14-1/1

Forward Hydro Solenoid Connector

Forward Hydro Solenoid Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	611
B	320

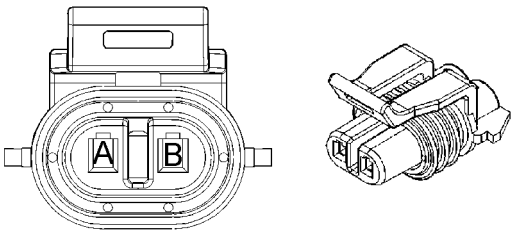


MXT001664 —UN—14FEB13

SH24924,00001A7 -19-08MAR13-1/1

Reverse Hydro Solenoid Connector

Reverse Hydro Solenoid Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	612
B	420

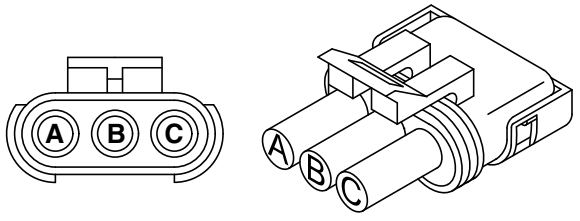


MXT001664 —UN—14FEB13

SH24924,00001A8 -19-08MAR13-1/1

Pump Angle Sensor Connector

Pump Angle Sensor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	355
B	667
C	641

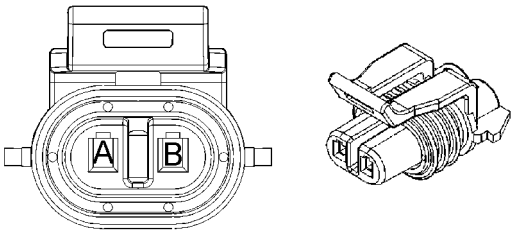


RXA0060730 —UN—05NOV02

SH24924,00001A9 -19-08MAR13-1/1

Kit Switched Power Connector

Kit Switched Power Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	503
B	109

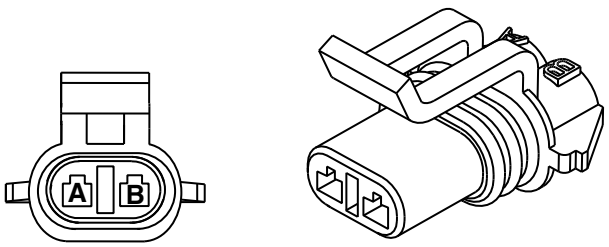


MXT001664 —UN—14FEB13

SH24924,00001AA -19-08MAR13-1/1

Down Pressure Kit Connector

Down Pressure Kit Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	517
B	445

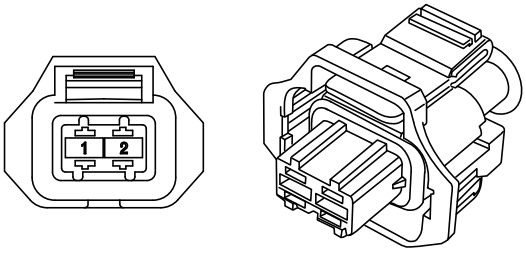


MXT005854 —UN—27NOV12

SH24924,00001B4 -19-08MAR13-1/1

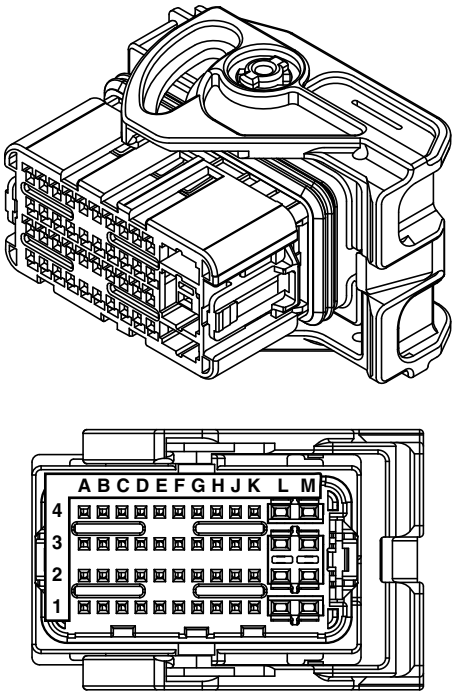
Crankshaft Speed Pickup Connector

Crankshaft Speed Pickup Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	661
2	800



TCT006802 —UN—27FEB13

SH24924,00001B1 -19-14MAR14-1/1



TCT006798 —UN—18DEC13

Vehicle Control Unit (VCU) Connector

VCU Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A1	F201
A2	650
A3	663
A4	310
B1	F101
B2	935 (T4: —)
B3	651
B4	935
C1	430
C2	701 (T4: 704)
C3	420
C4	430
D1	652
D2	—
D3	325
D4	659
E1	—
E2	426
E3	662
E4	600

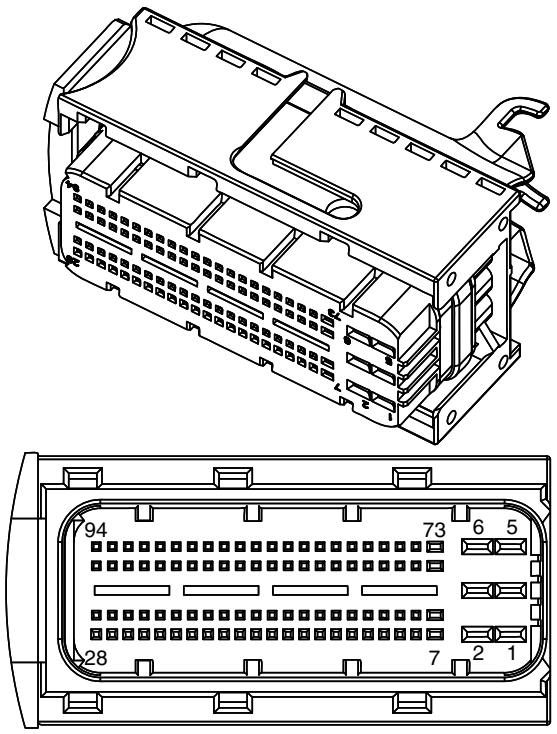
VCU Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
F1	605
F2	321 (T4: —)
F3	657
F4	435
G1	—
G2	450
G3	610
G4	830 (T4: —)
H1	671
H2	451
H3	300 (T4: —)
H4	452
J1	745
J2	665
J3	615 (T4: 911)
J4	915 (T4: 715)
K1	305
K2	620
K3	—
K4	—
L1	211
L2	103
L3	654
L4	320
M1	509
M2	350
M3	315
M4	800 (T4: —)

Continued on next page

SH24924,00001AB -19-25MAR14-1/2

Engine Control Unit (ECU) Connector, 94 Pin

ECU Connector, 94 Pin	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
1	646
2	154
3	644
4	153
5	643
6	152
7-13	—
14	717
15	830
16-19	—
20	683
21	312
22	—
23	603
24	631
25-27	—
28	465
29-31	—
32	911
33	653
34	—
35	705
36-38	—
39	936
40-44	—
45	601
46-51	—
52	800
53	F117
54	E200
55	—
56	685
57-62	—
63	415
64-67	—
68	636
69	—
70	626



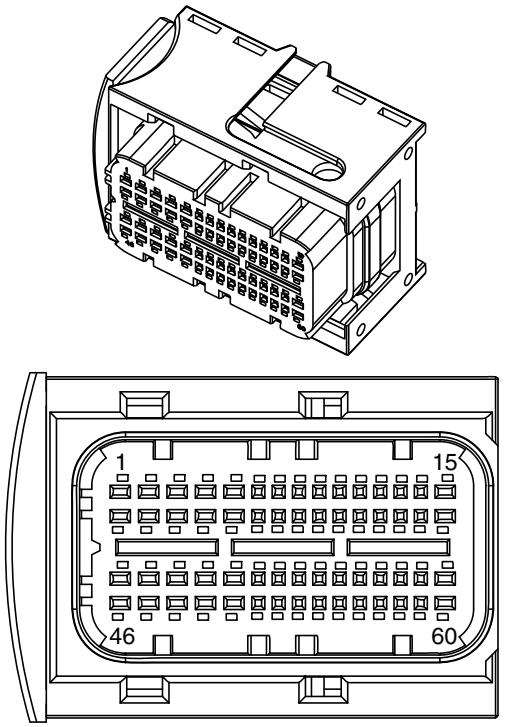
MXT009804 —UN—18DEC13

ECU Connector, 94 Pin	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
71-73	—
74	421
75	F217
76	E100
77	360
78	—
79	803
80	710
81	910
82-84	—
85	702
86	456
87	456
88	525
89-94	—

SH24924,00001C2 -19-25MAR14-1/1

Engine Control Unit (ECU) Connector, 60 Pin

ECU Connector, 60 Pin	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
1-3	—
4	689
5	943
6	—
7	607
8	608
9-10	—
11	425
12	661
13-15	—
16	802
17	427
18	311
19	307
20	937
21-24	—
25	938
26	684
27	—
28	681
29	423
30-32	—
33	460
34-36	—
37	424
38	Shield
39	461
40-46	—
47	940
48	686
49-50	—
51	801
52	939
53	—
54	308
55-58	—
59	703
60	—

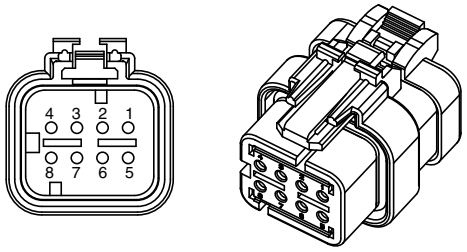


MXT009805 —UN—18DEC13

SH24924,00001C3 -19-25MAR14-1/1

Main Harness to Engine Connector (Red 8-pin)

Main Harness to Engine Connector (Red 8-pin)	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
1	601
2	702
3	936
4	421
5	803
6	312
7	681
8	423

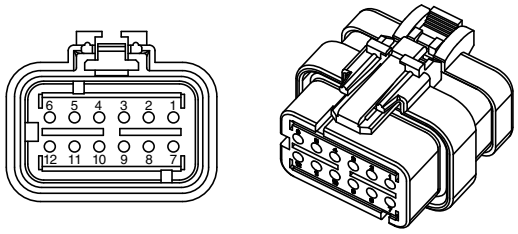


TCT006800 —UN—14MAR13

SH24924,00001C7 -19-31MAR14-1/1

Main Harness to Engine Connector (Red)

Main Harness to Engine Connector (Red)	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
1	309
2	E200
3	E100
4	151
5	603
6	683
7	800
8	307
9	937
10	703
11	653
12	—

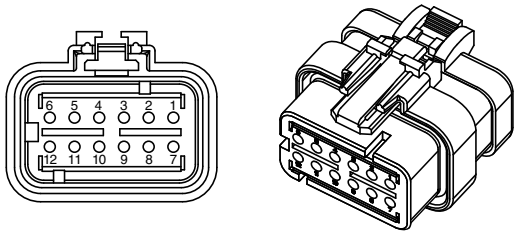


TCT006807 —UN—19MAR13

SH24924,00001C8 -19-31MAR14-1/1

Main Harness to Engine Connector (Gray)

Main Harness to Engine Connector (Gray)	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
1	607
2	684
3	938
4	608
5	424
6	939
7	461
8	308
9	Shield
10	685
11	425
12	801

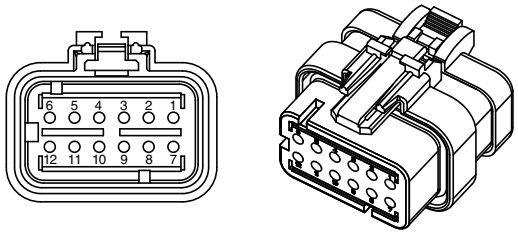


TCT006818 —UN—12APR13

SH24924,00001C9 -19-31MAR14-1/1

Main Harness to Engine Connector (Yellow)

Main Harness to Engine Connector (Yellow)	
Schematic:	—
Wiring Harnesses:	—
Terminal	**Circuit Number**
1	—
2	—
3	686
4	311
5	940
6	427
7	460
8	802
9	687
10	688
11	941
12	942

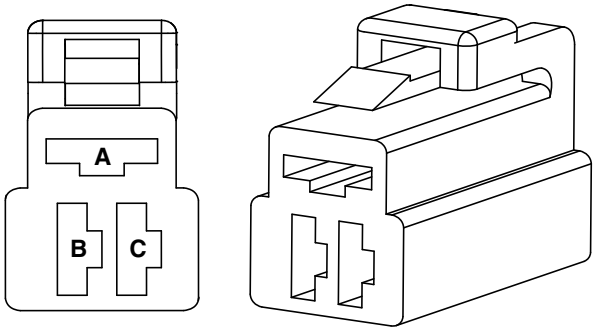


TCT006808 —UN—19MAR13

SH24924,00001CA -19-31MAR14-1/1

Fuel Solenoid Connector

Fuel Solenoid Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	101, 101A
B	900, 900A
C	615

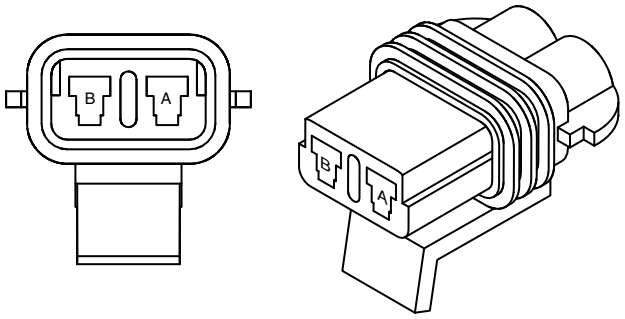


TCT010234 —UN—06MAR14

SH24924,00001AD -19-14MAR14-1/1

Fuel Level Sensor Connector

Fuel Level Sensor Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	356
B	310

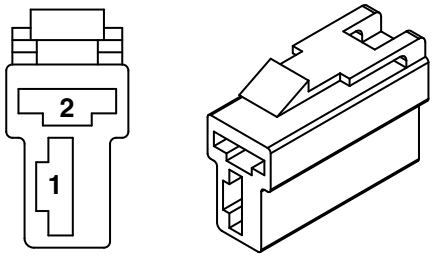


RXA0099948 —UN—18DEC08

SH24924,00001AE -19-08MAR13-1/1

Fuel Transfer Pump Connector

Fuel Transfer Pump Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	104
2	508

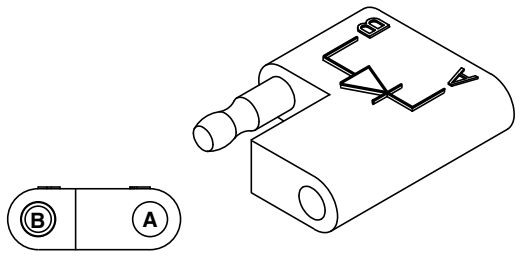


TCT006797 —UN—15FEB13

SH24924,00001AF -19-08MAR13-1/1

Diode Connector

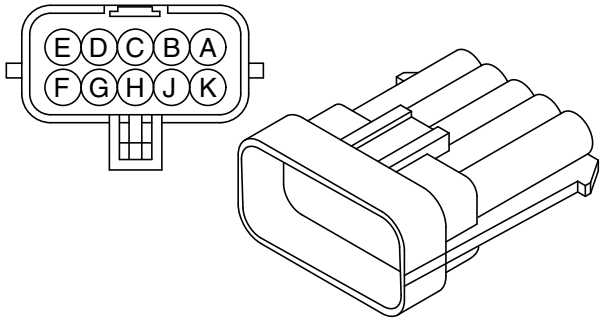
Diode Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	900A
B	101A



TCT005927 —UN—18MAR13

SH24924,00001B0 -19-08MAR13-1/1

Reel Motor Controller Connector



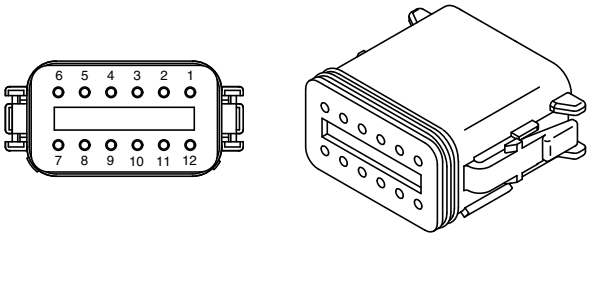
RXA0064243 —UN—06JAN03

Controller Connector					
Schematic:	Reel Controllers and Motors Electrical Schematic				
Wiring Harness:	Main Wiring Harness, Non-T4 Main Wiring Harness, T4 Refer to Reel Motor Controller Harness and Connectors for reel controller wires.				
Connector Number to Reel Motor Controller Number: CAN-C1 Front Left Controller 1 CAN-C3 Front Center Controller 3 CAN-C5 Front Right Controller 5 CAN-C2 Rear Left Controller 2 CAN-C6 Rear Right Controller 6					
	Reel Position and Main Harness to Reel Motor Connector				
Terminal (Reel Controller)	**Front Left CAN-C1**	**Front Center CAN-C3**	**Front Right CAN-C5**	**Rear Left CAN-C2**	**Rear Right CAN-C6**
A	—	—	—	—	—
B (Address Input 1)	—	—	—	156	158
C (Adress Input 2)	161	—	159	—	—
D	—	—	—	—	—
E (12V Input)	531	535	534	532	533
F	—	—	—	—	—
G (CAN-High)	F215	F213	F211	F207	F209
H (CAN Low)	F115	F113	F111	F107	F109
J	—	—	—	—	—
K (Address Input 3)	160	155	—	157	—

SH24924,00001B3 -19-27MAY14-1/1

Display Connector

Display Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
1	500D
2	125
3-10	—
11	F203A
12	F103A



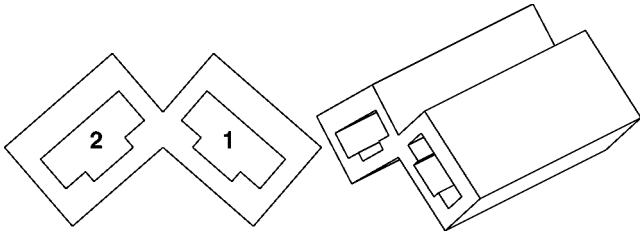
RXA0072294 —UN—25NOV03

SH24924,000020A -19-27MAR13-1/1

Power Port Connector

Power Port Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A [1]	306A
B [2]	135

LVT001881 —UN—01JUL11

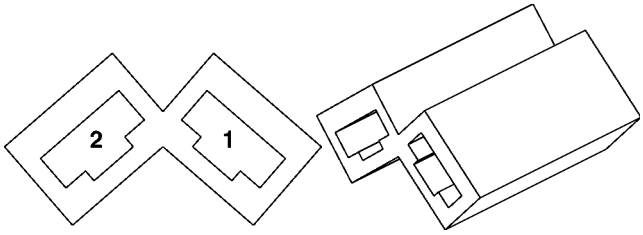


SH24924,000020B -19-27MAR13-1/1

Alarm Connector

Alarm Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A [1]	500C, 500K
B [2]	450A, 450B

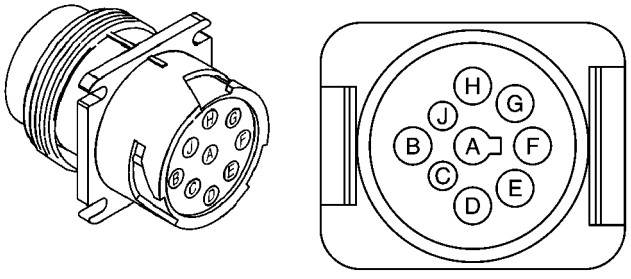
LVT001881 —UN—01JUL11



SH24924,000020C -19-25MAR14-1/1

Diagnostic Connector

Diagnostic Connector	
Schematic:	—
Wiring Harnesses:	7500A, 8000A
Terminal	**Circuit Number**
A	129
B	500J
C	F205A
D	F105A
E-F-G-H-J	—



TCT006803 —UN—12MAR13

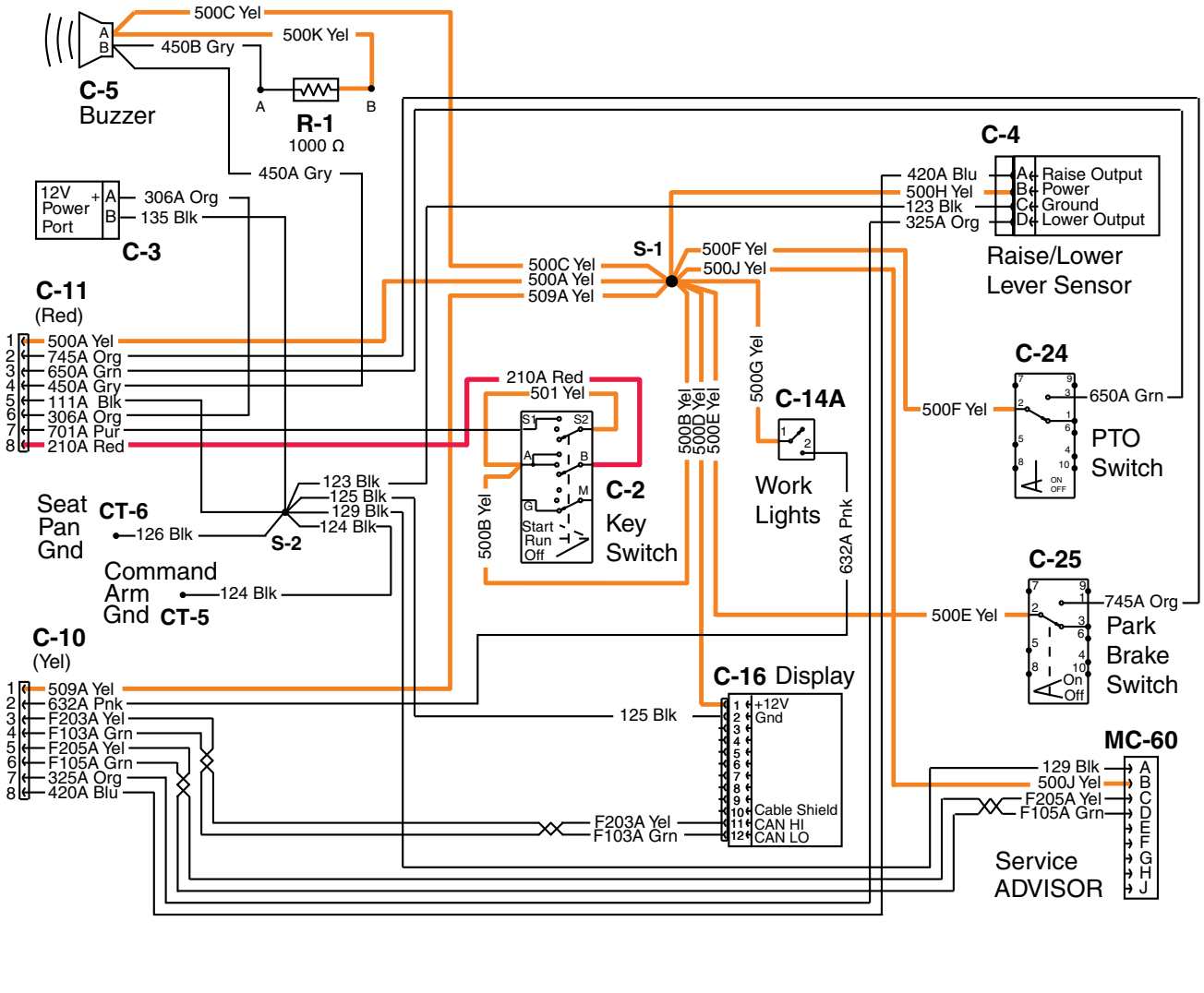
SH24924,00001C6 -19-12MAR13-1/1

Summary of References

- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, Non-T4
- Main Schematic Splices, Non-T4
- Main Electrical Schematic, T4
- Main Schematic Splices, T4
- Reel Controllers and Motors Electrical Schematic
- Main Schematic Reel Motor Controller Splices
- Engine Connector X5057 Schematic
- Engine Connector X5058 Schematic
- Engine Connector X5059 Schematic
- Engine Connector X5060 Schematic
- Engine Controls and Sensors Schematic

BS62576,0001097 -19-12JUN14-1/1

Command Arm with Y Axis Control Schematic

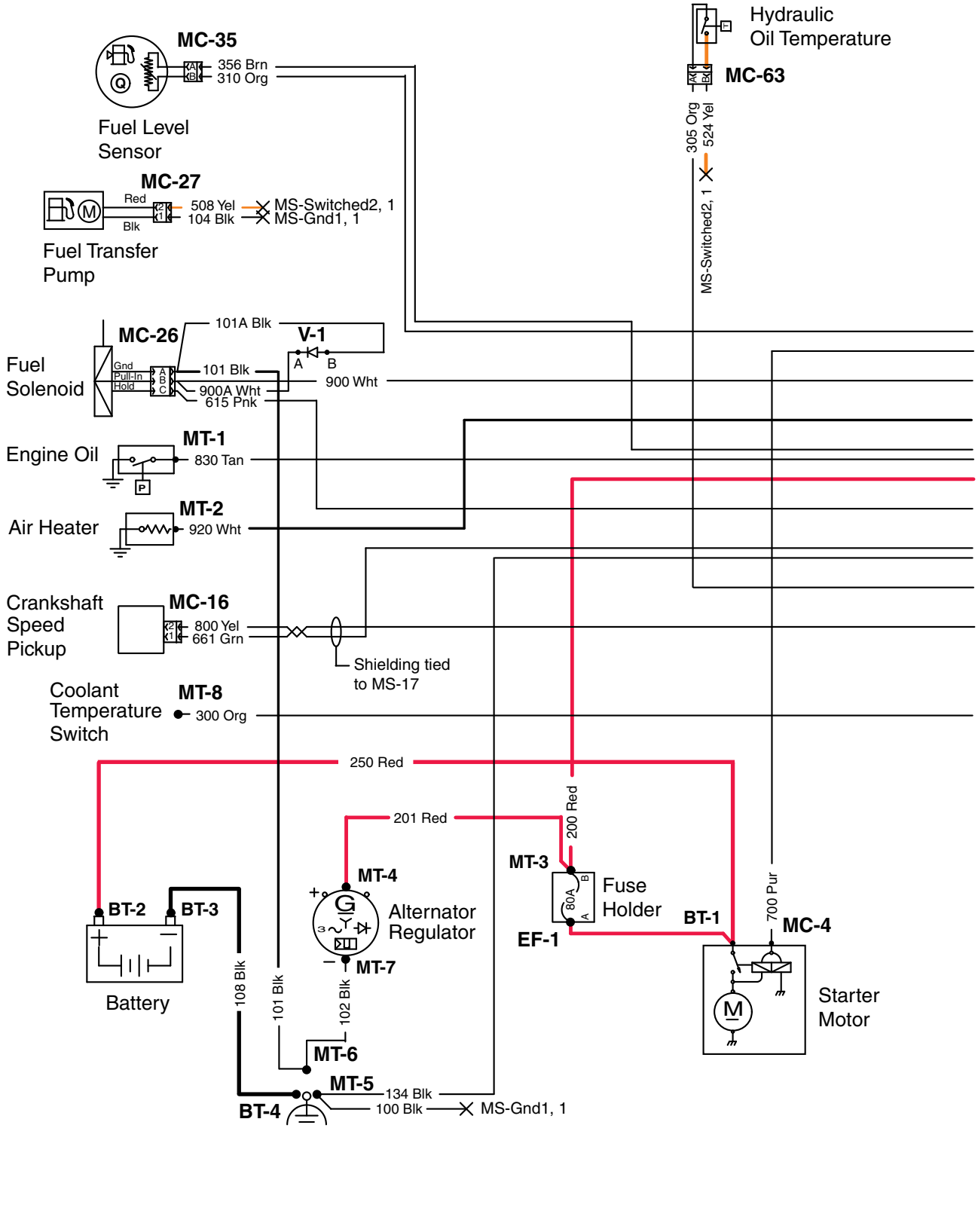


TCT005940 —UN—08MAY14

C-2— Key Switch
C-3— Power Port
C-4— Y-axis Raise/Lower
C-5— Buzzer
C-10— Main Wiring Harness, Yellow Connector
C-11— Main Wiring Harness, Red Connector
C-14A—Light Switch
C-16— Display
C-24— PTO Switch
C-25— Park Brake Switch
CT-5— Command Arm Ground
CT-6— Seat Pan Ground
MC-60—Service ADVISOR Connector
R-1— Resistor

OUMX258,0000A4A -19-06MAY14-1/1

Main Electrical Schematic, Non-T4



Main Schematic, Non-T4 (1 of 6)

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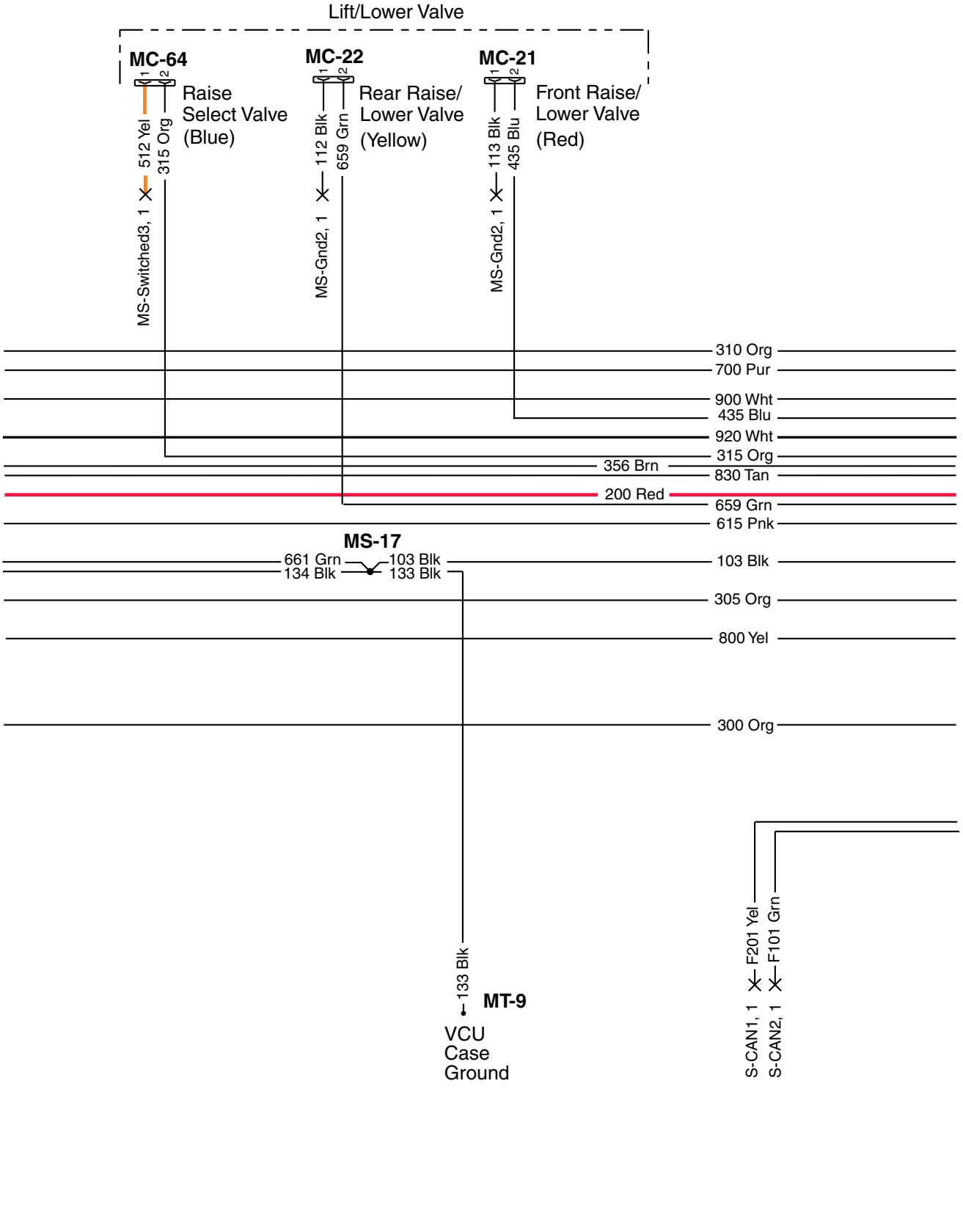
OUMX258,0000A3C -19-18JUN14-1/6

Main Schematic, Non-T4 (2 of 6)



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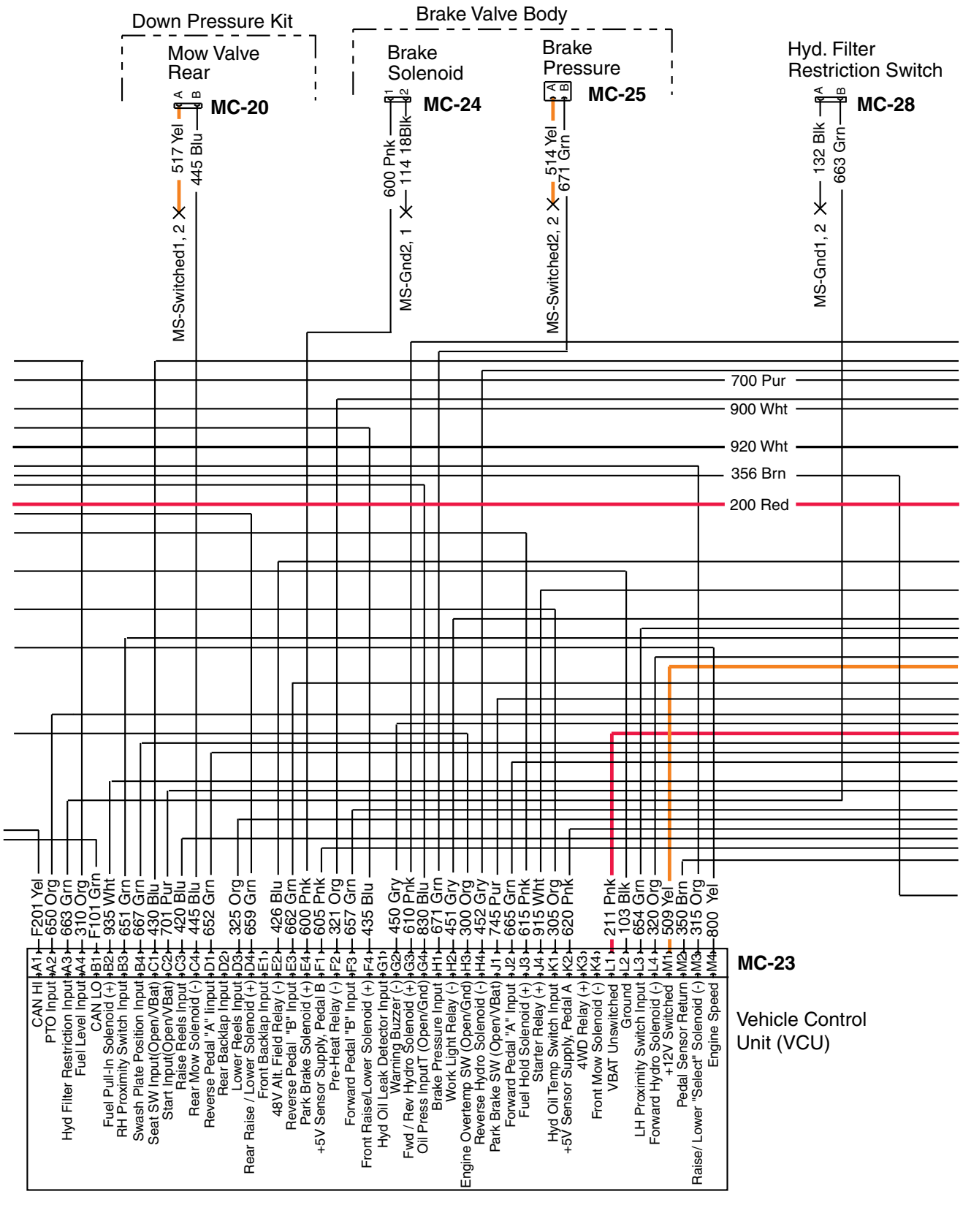
OUMX258,0000A3C -19-18JUN14-2/6

Main Schematic, Non-T4 (3 of 6)



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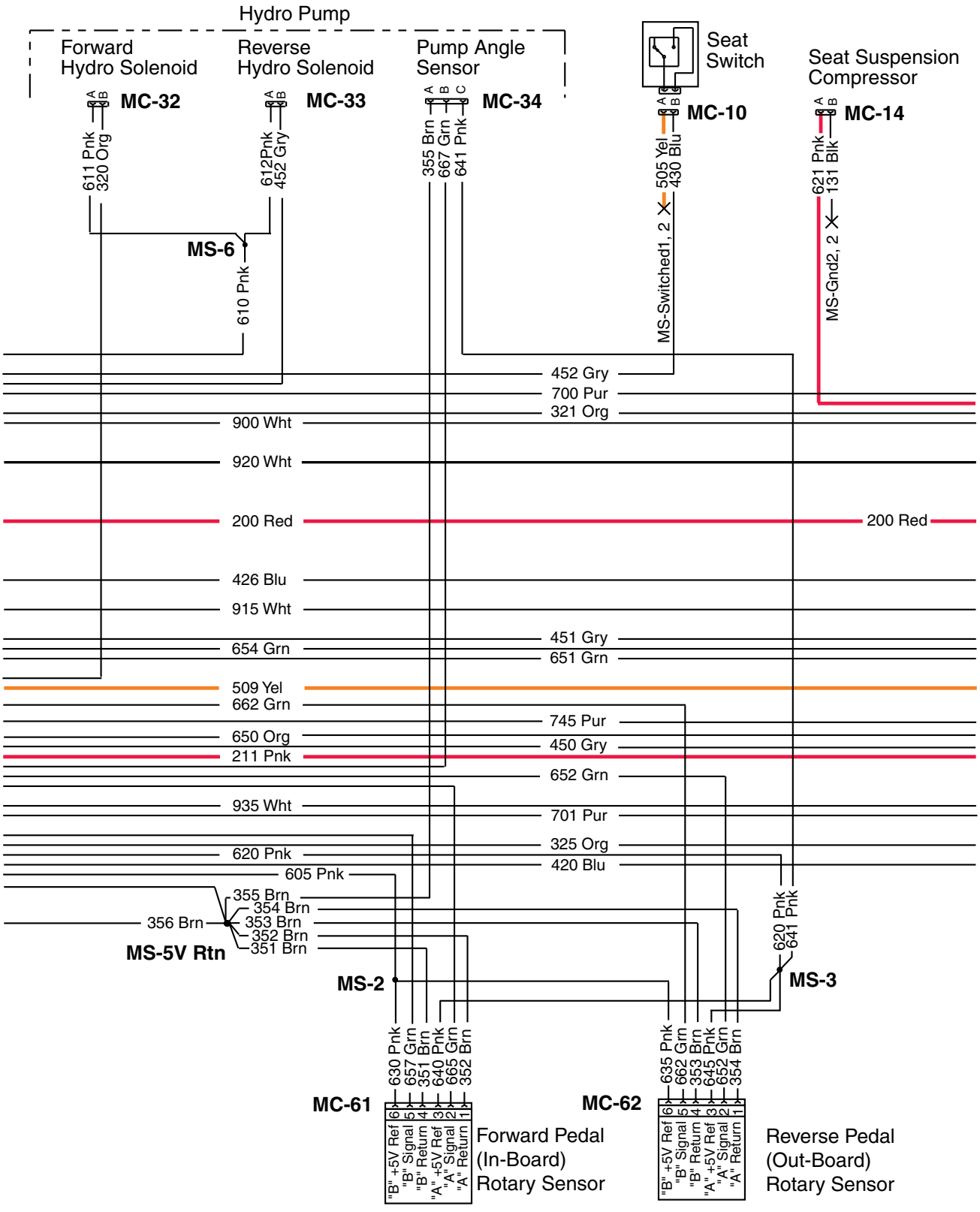
OUMX258,0000A3C -19-18JUN14-3/6

Main Schematic, Non-T4 (4 of 6)



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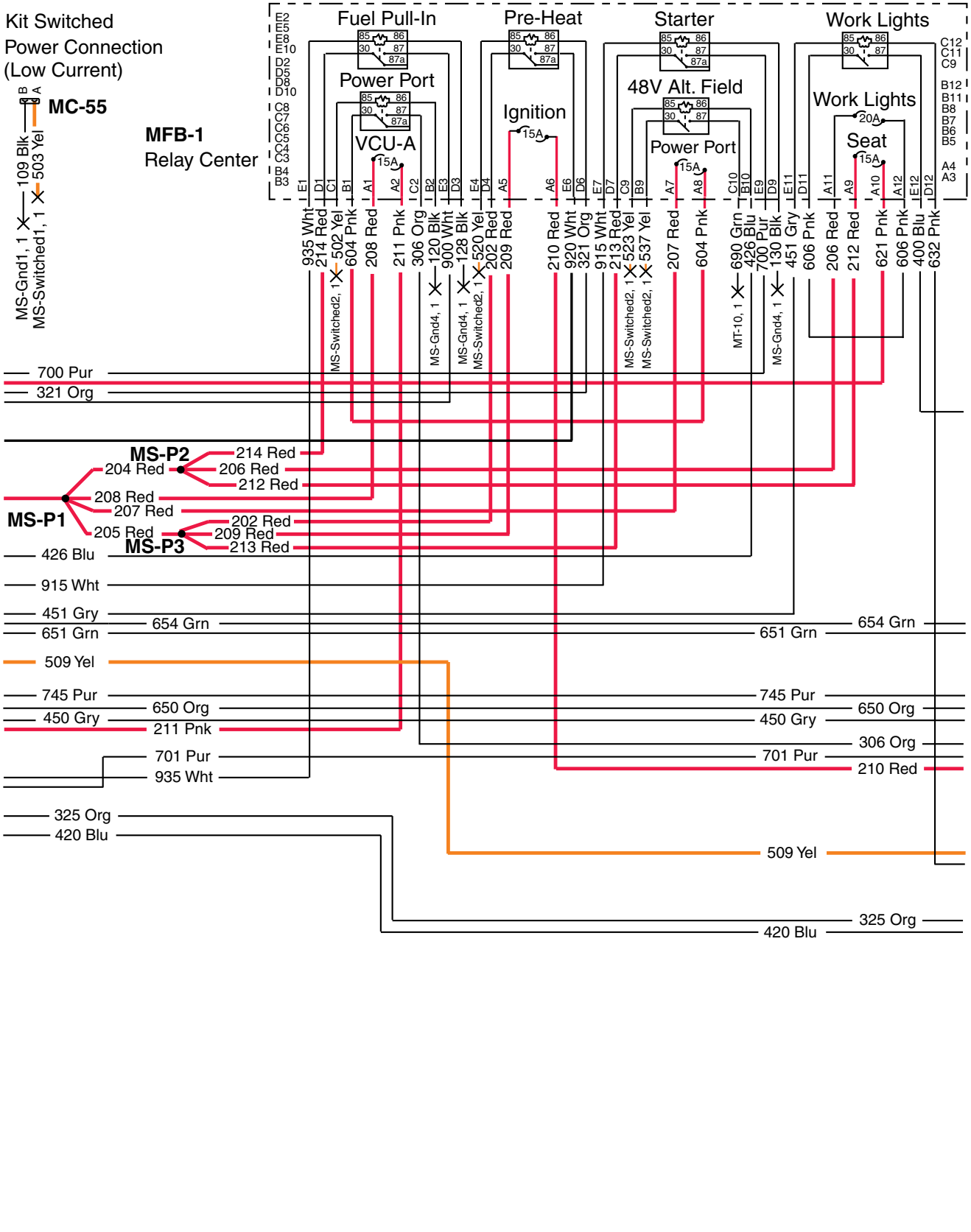
OUMX258,0000A3C -19-18JUN14-4/6

Main Schematic, Non-T4 (5 of 6)



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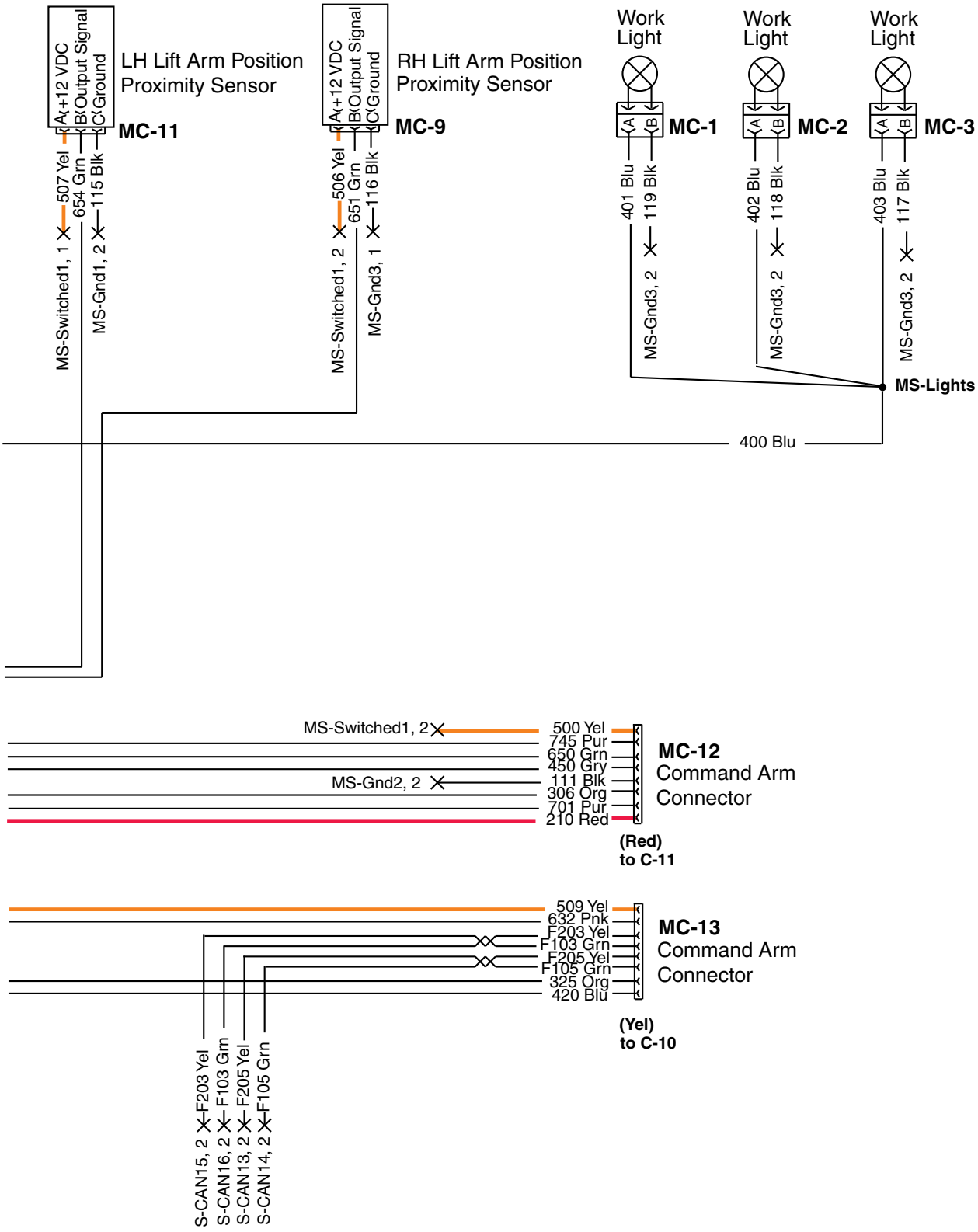
OUMX258,0000A3C -19-18JUN14-5/6

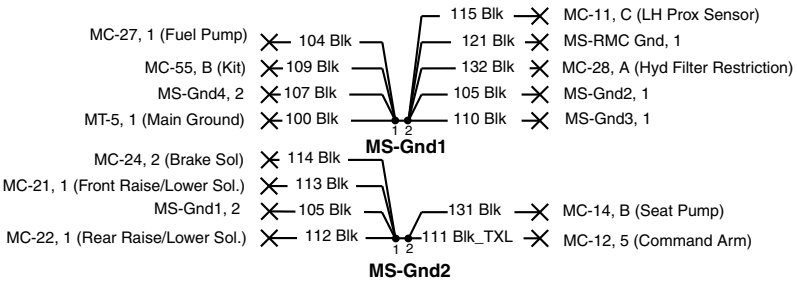
Main Schematic, Non-T4 (6 of 6)

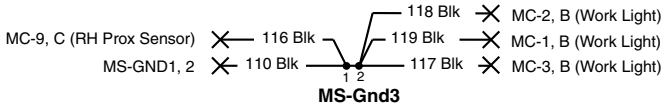


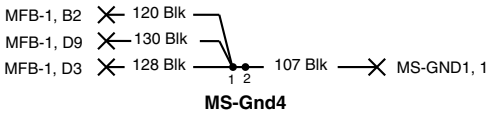
OUMX258,0000A3C -19-18JUN14-6/6

Main Schematic Splices, Non-T4

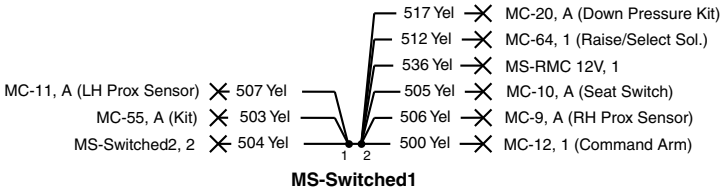
Ground Splices

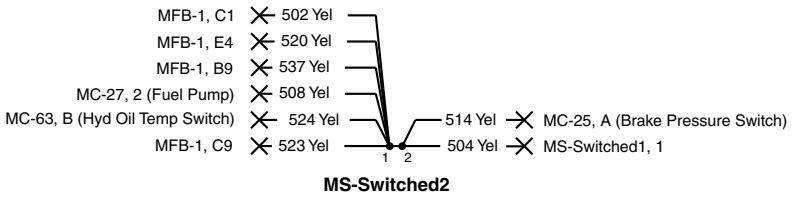






Switched Power Splices

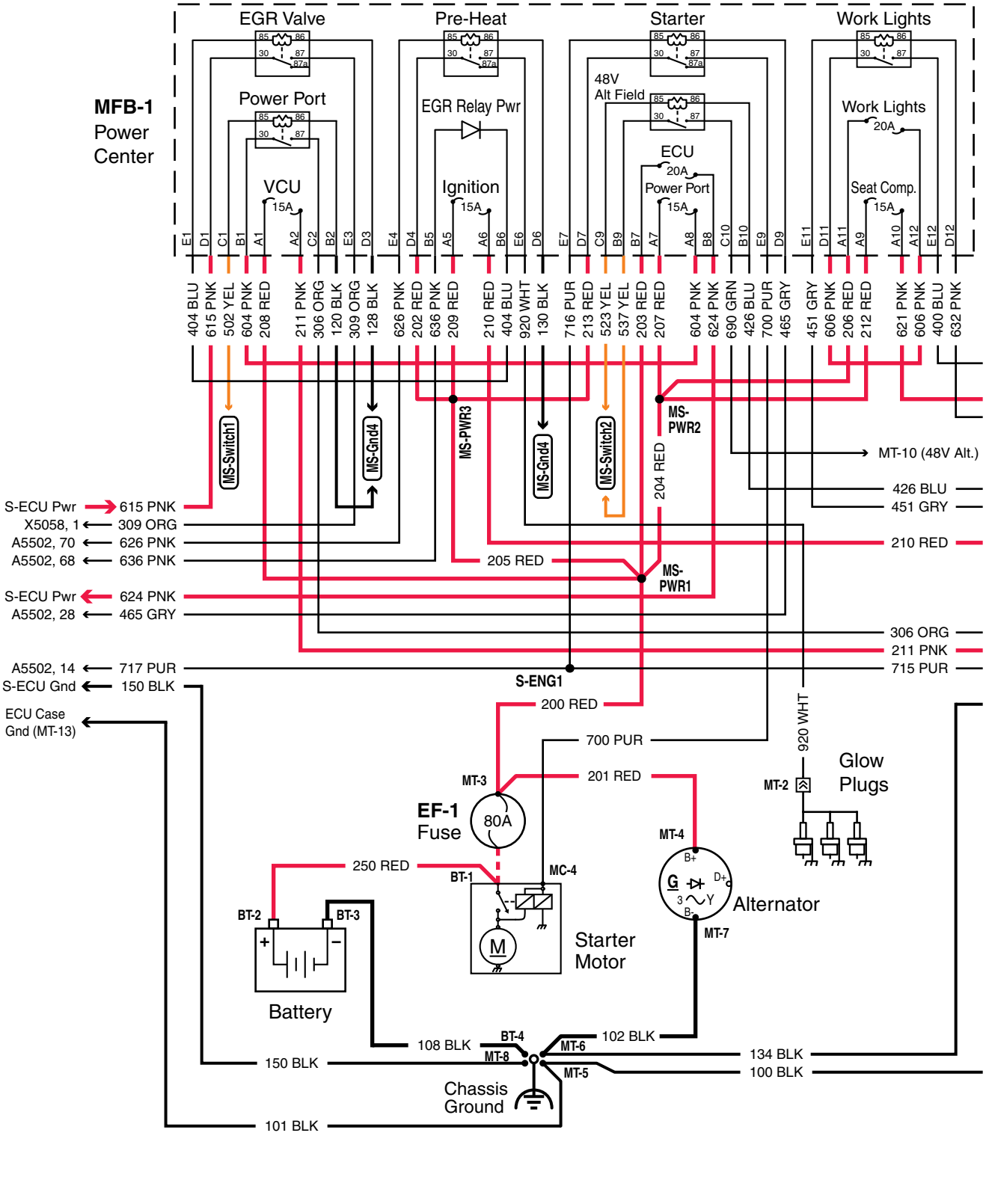




TCT005964 —UN—18JUN14

OUMX258,0000A3D -19-01APR14-1/1

Main Electrical Schematic, T4



Main Electrical Schematic—T4 (1 of 8)

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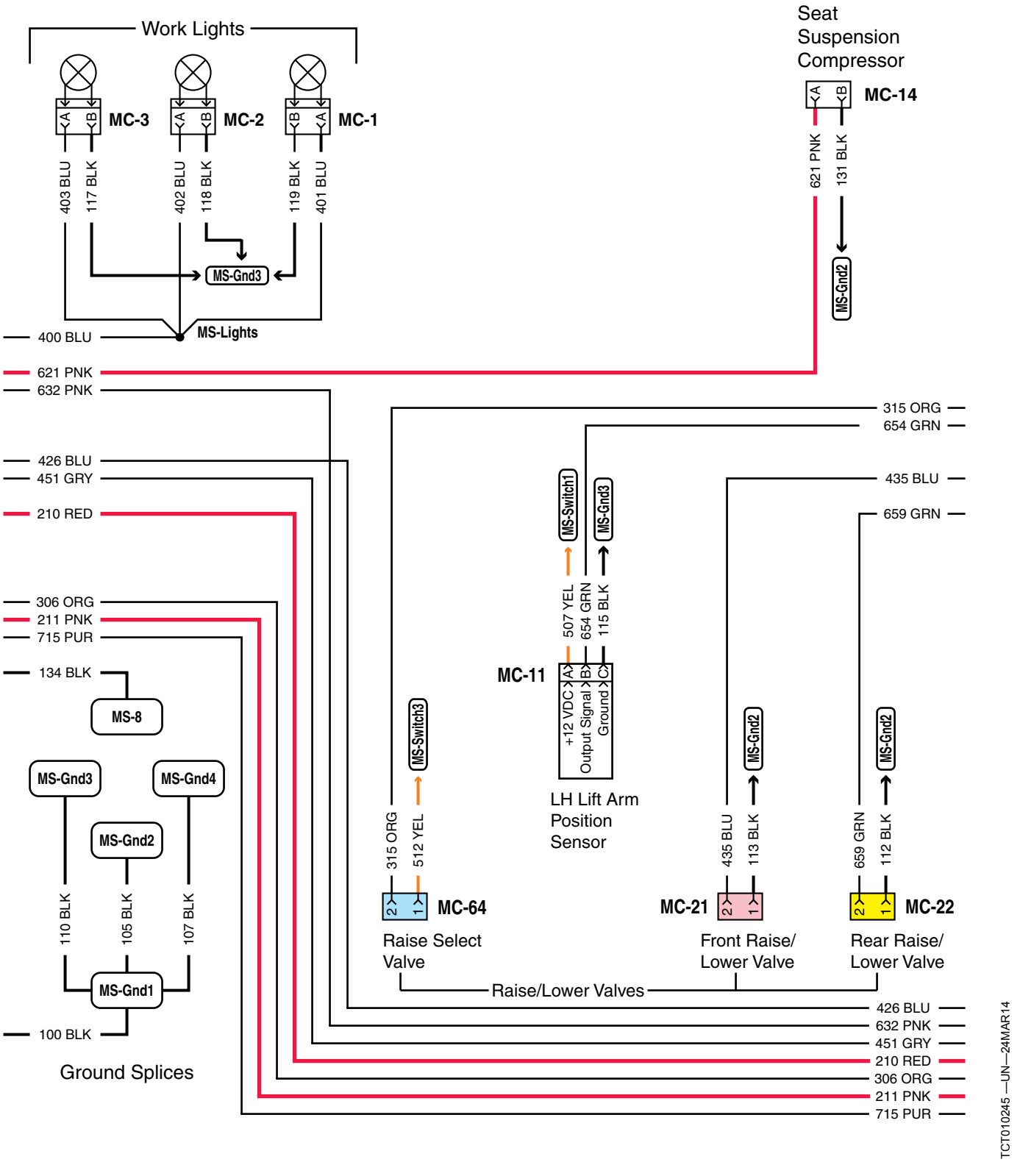
BS62576,00016EC -19-02APR14-1/8

Main Electrical Schematic—T4 (2 of 8)



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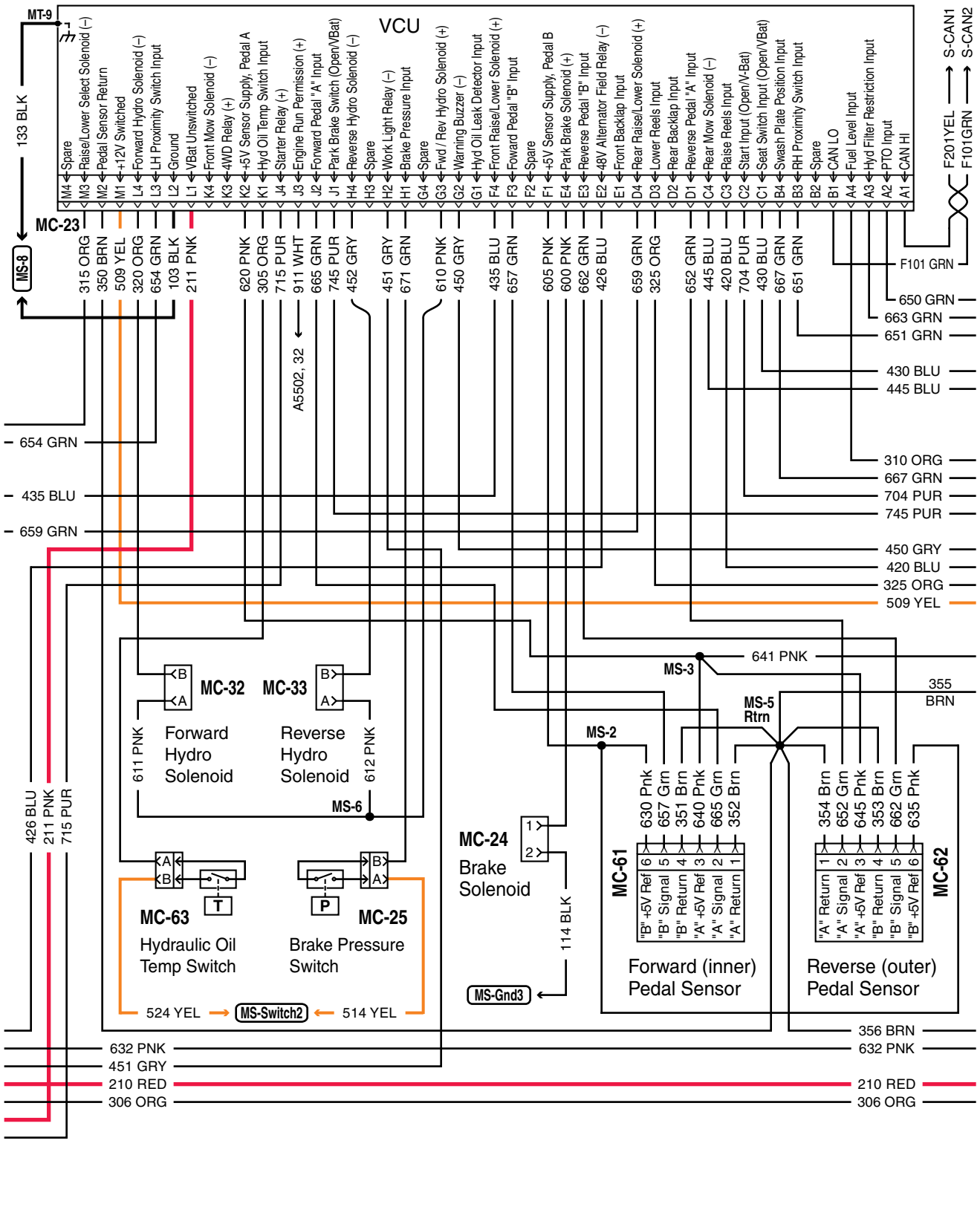
BS62576,00016EC -19-02APR14-2/8

Main Electrical Schematic—T4 (3 of 8)



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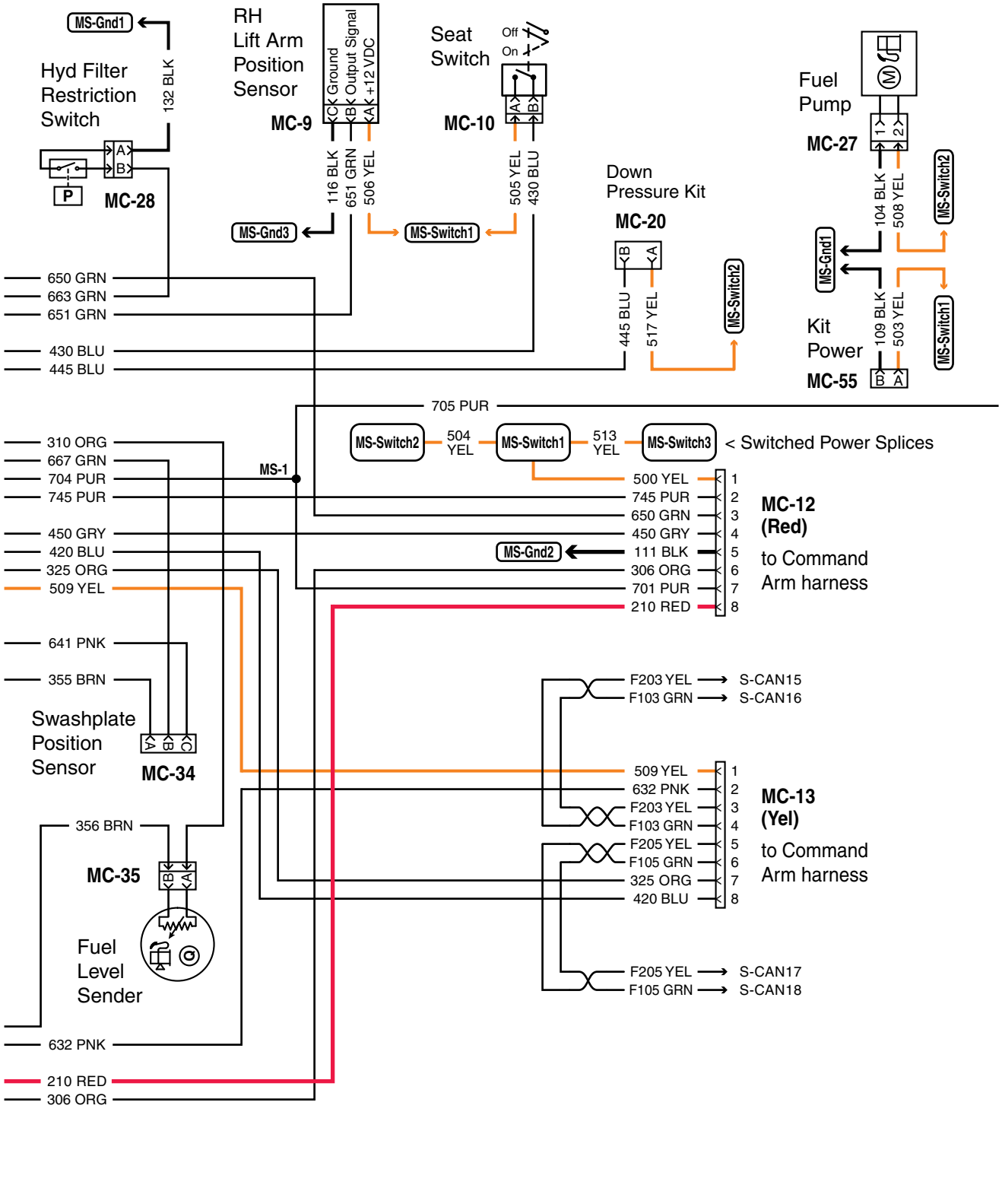
BS62576,00016EC -19-02APR14-3/8

Main Electrical Schematic—T4 (4 of 8)



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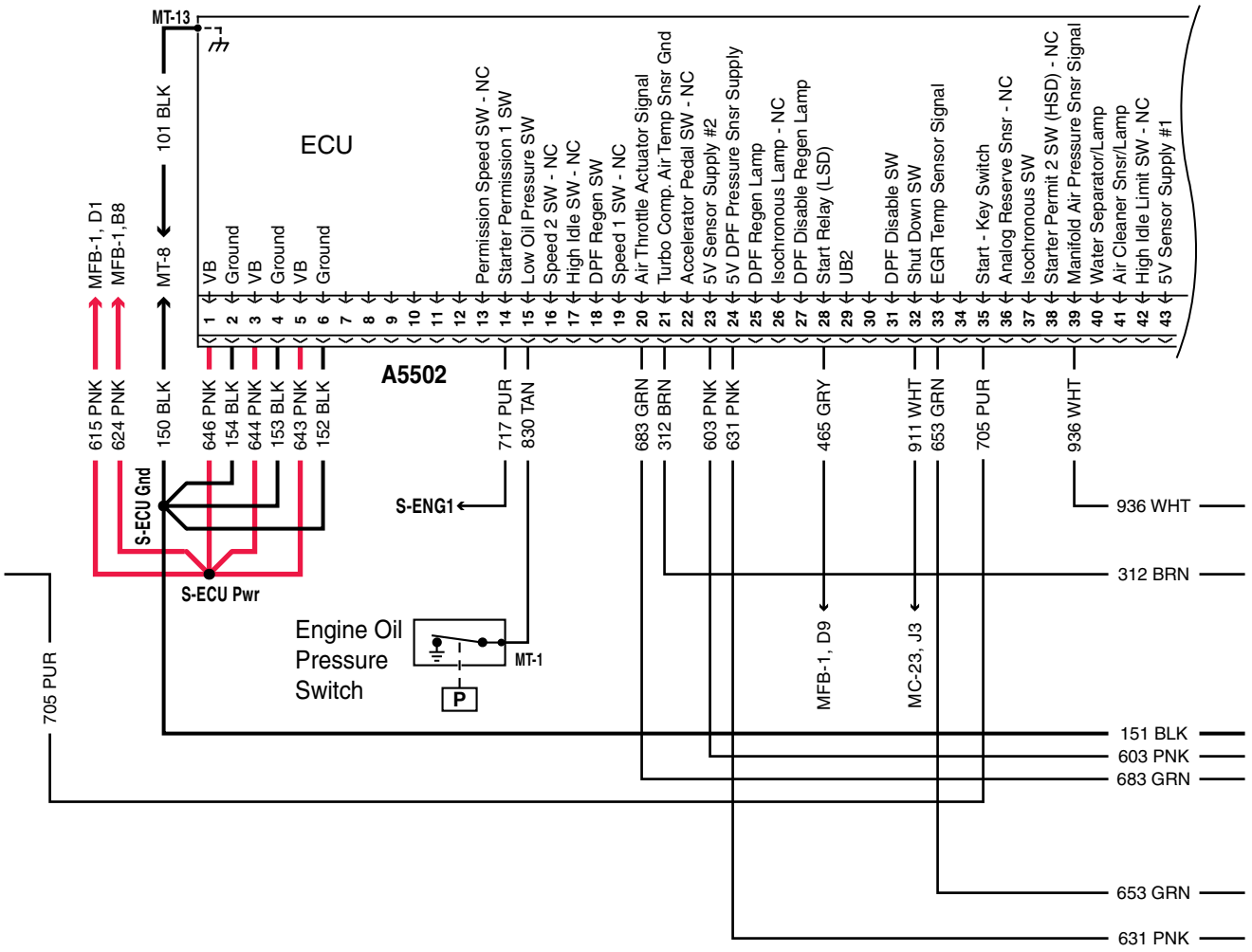
BS62576,00016EC -19-02APR14-4/8

Main Electrical Schematic—T4 (5 of 8)



TCT010248 —UN—29MAY14

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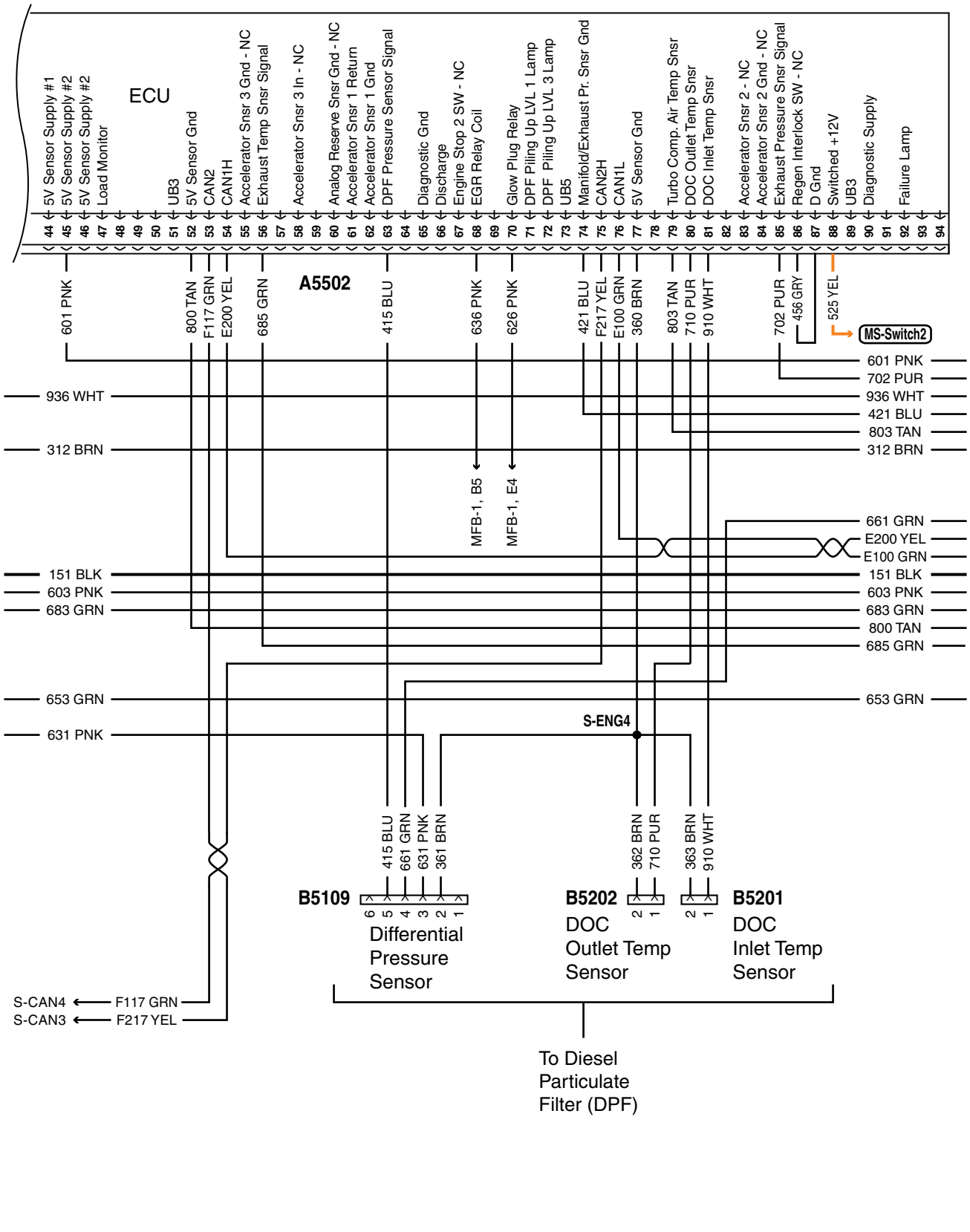
BS62576,00016EC -19-02APR14-5/8

Main Electrical Schematic—T4 (6 of 8)



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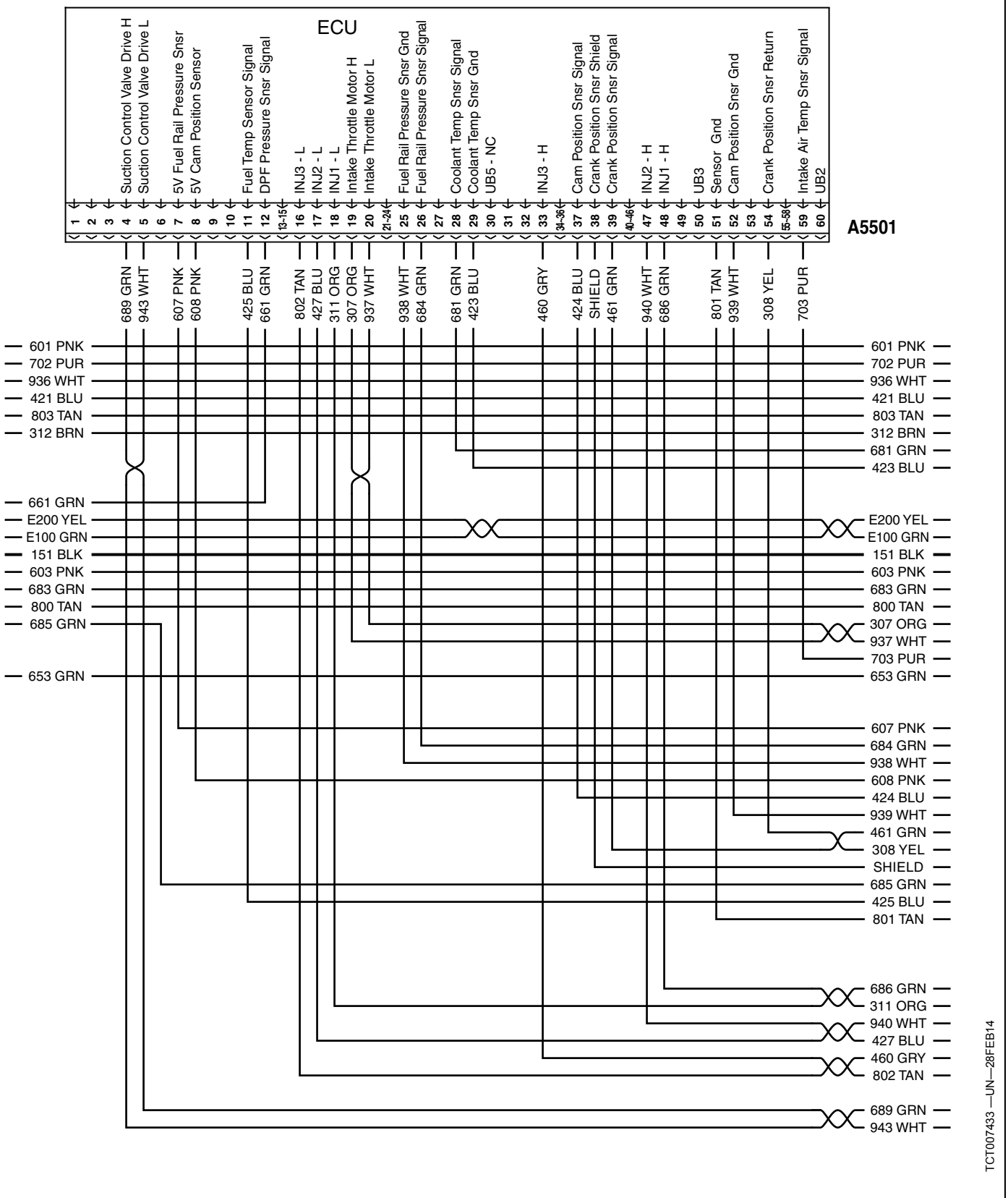
BS62576,00016EC -19-02APR14-6/8

Main Electrical Schematic—T4 (7 of 8)



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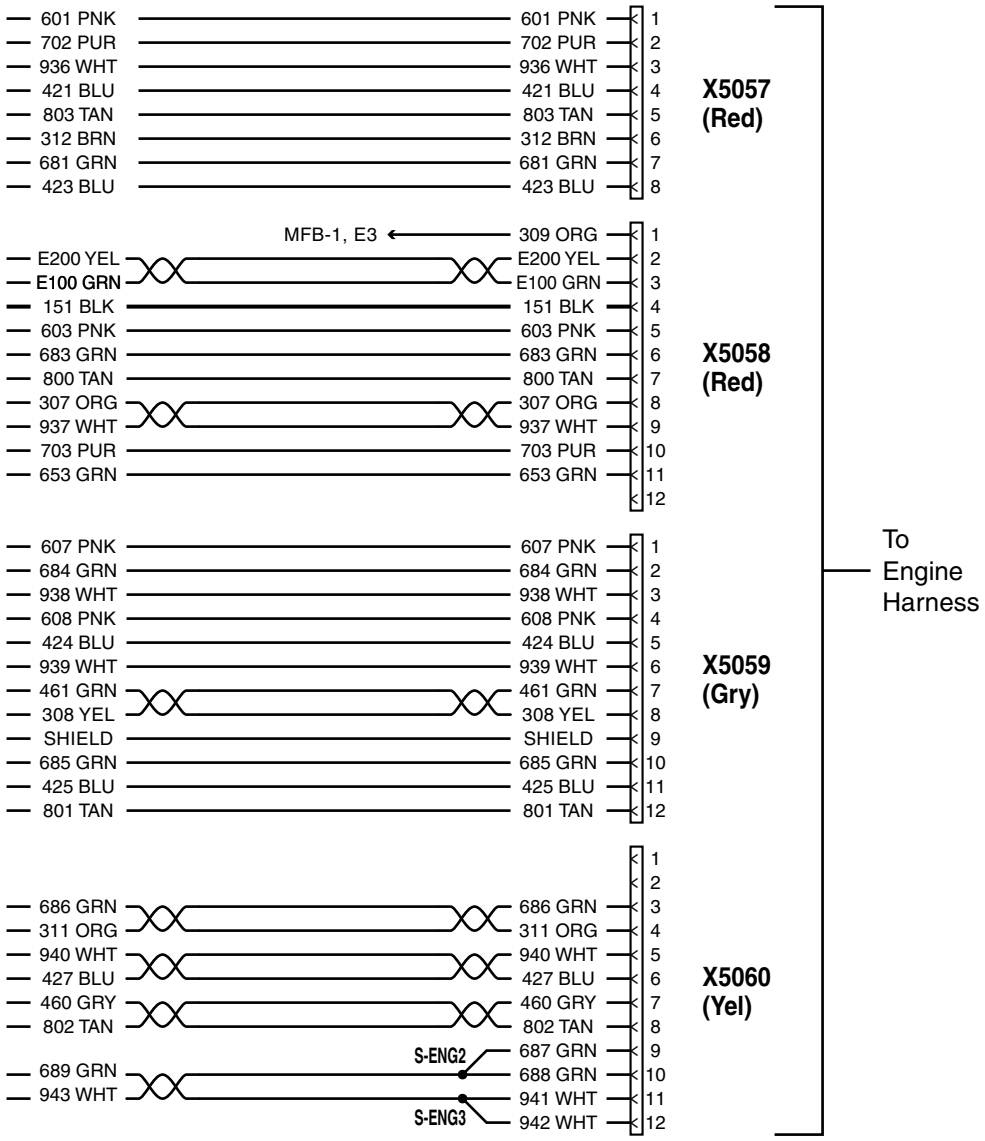
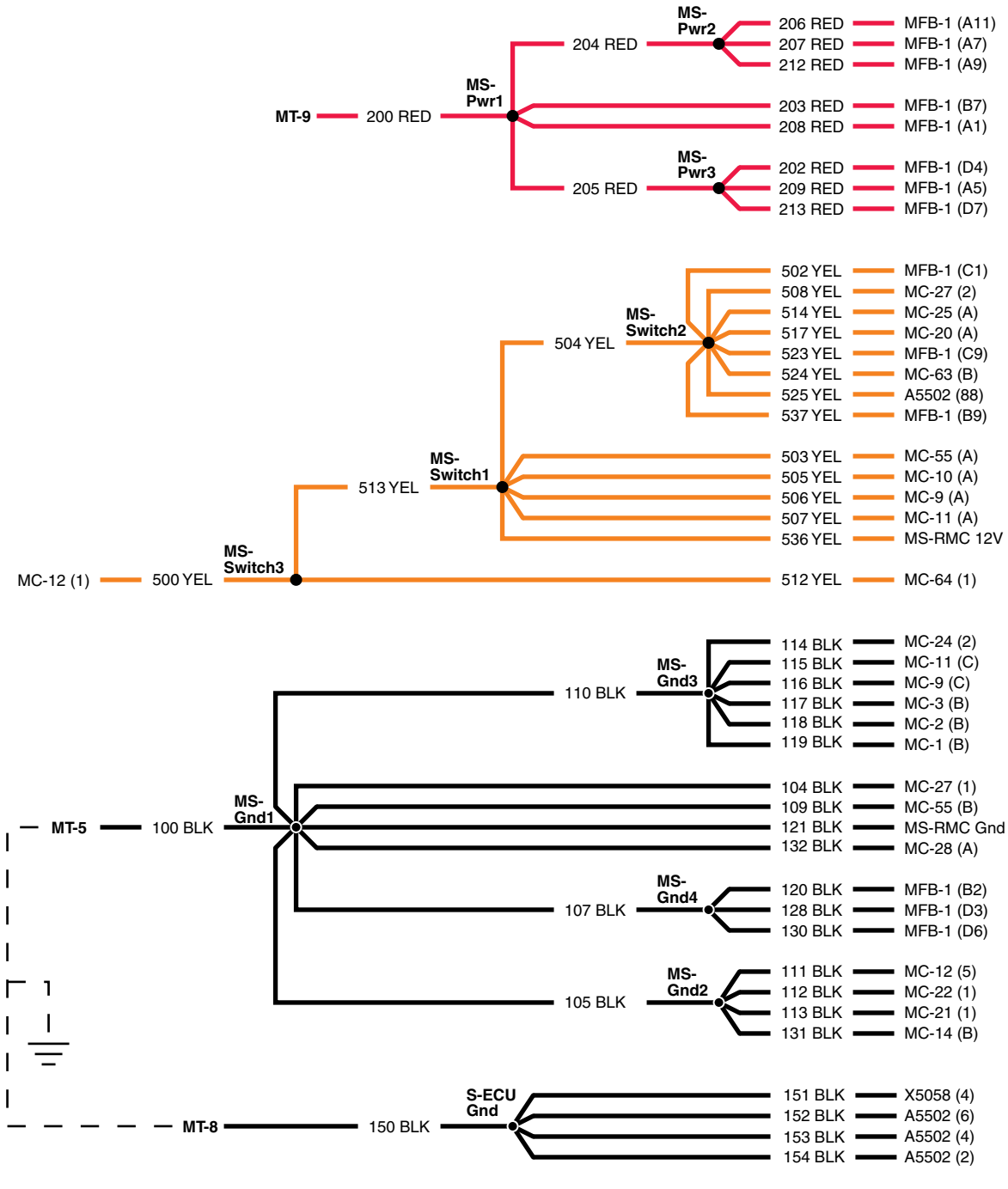
BS62576,00016EC -19-02APR14-7/8

Main Electrical Schematic—T4 (8 of 8)



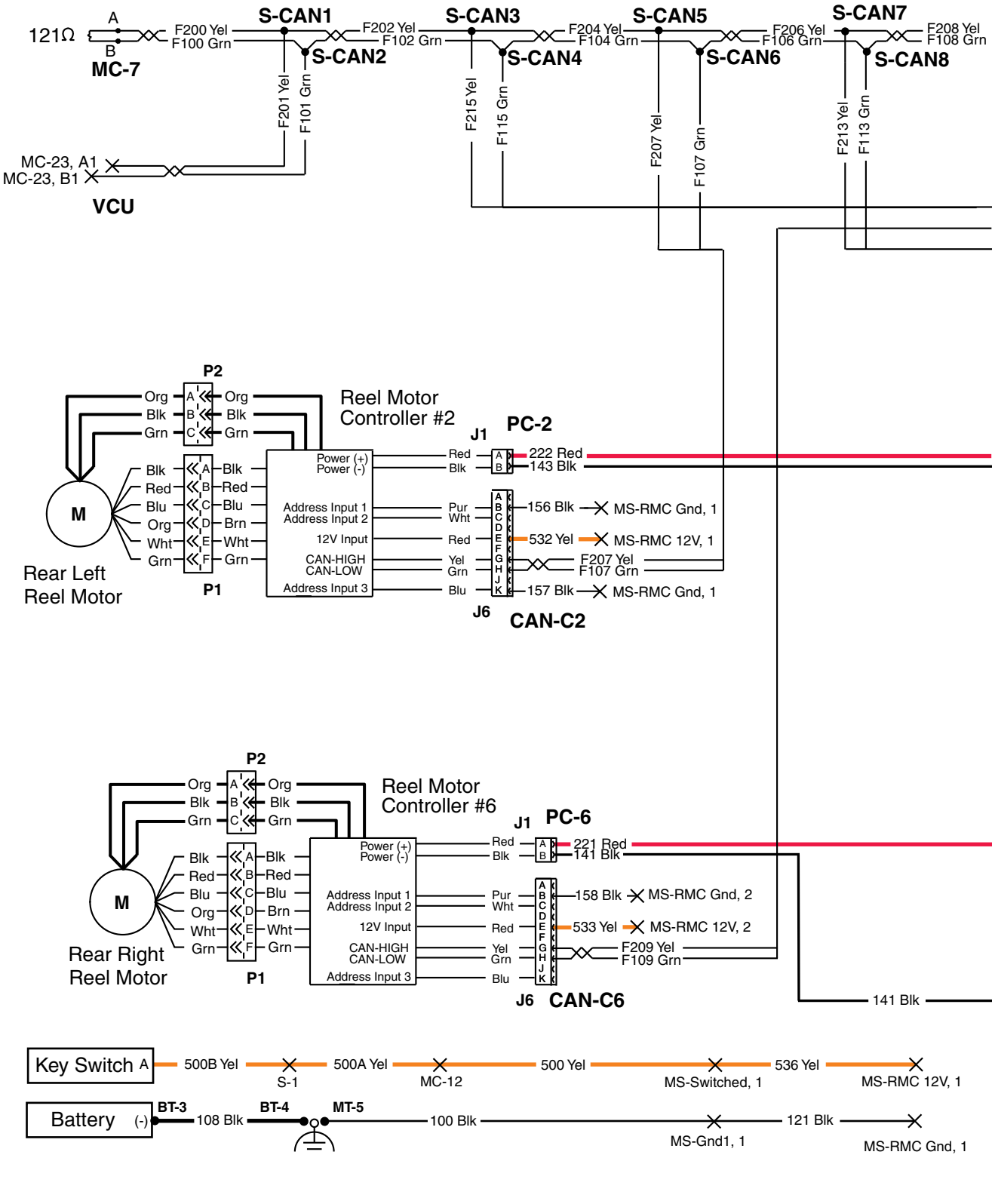
BS62576,00016EC -19-02APR14-8/8

Main Schematic Splices, T4



BS62576,00016ED -19-01APR14-1/1

Reel Controllers and Motors Electrical Schematic



Reel Controllers and 48V Schematic (1 of 2)

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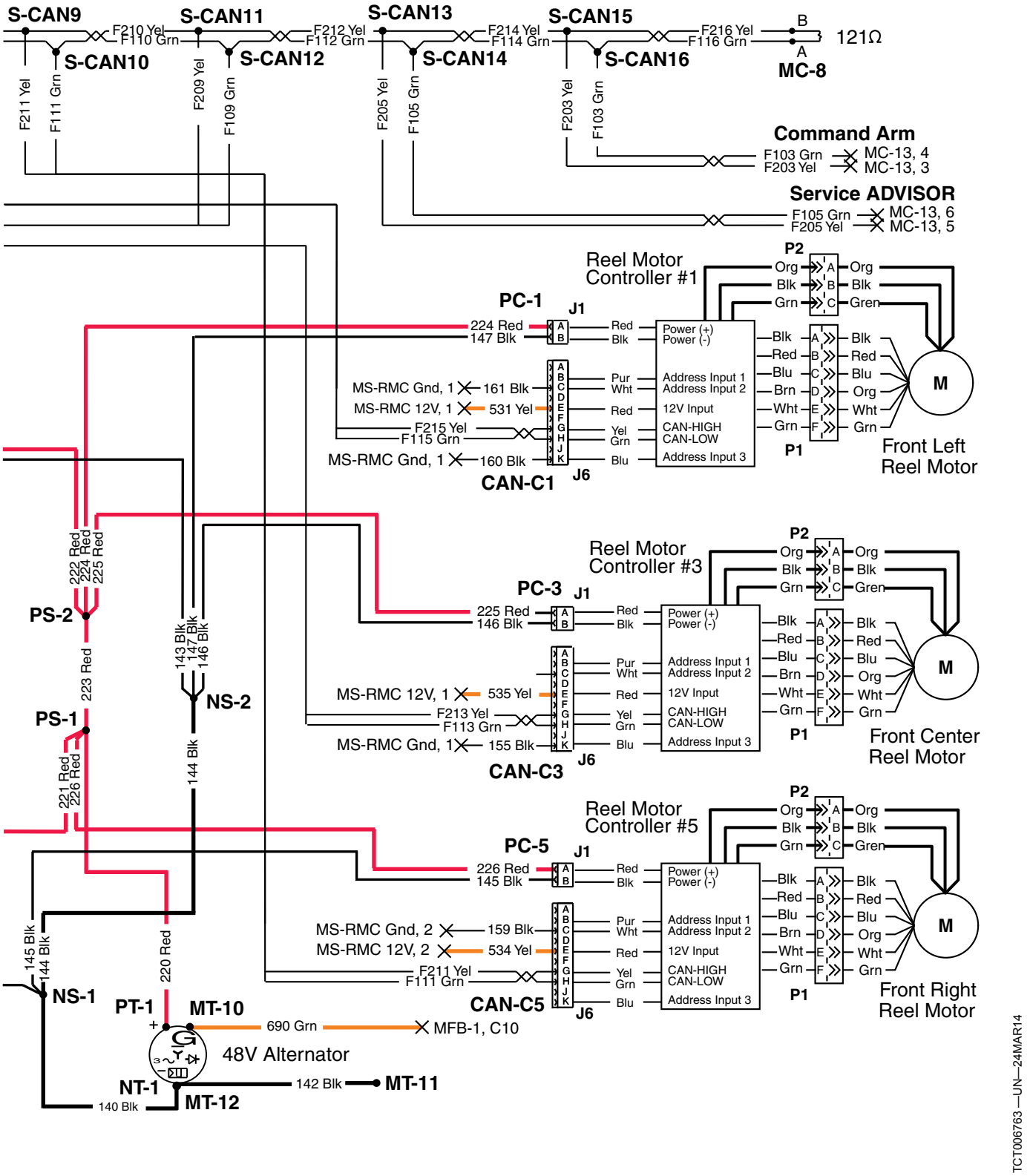
OUMX258,0000A3E -19-24MAR14-1/2

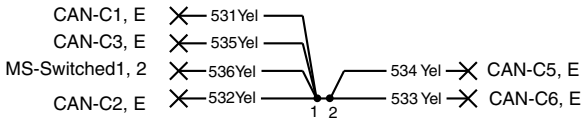
Reel Controllers and Motors Electrical Schematic (2 of 2)



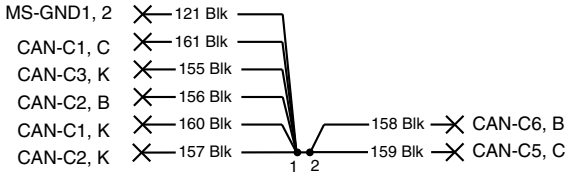
Reel Controllers and 48V Schematic (2 of 2)

OUMX258,0000A3E -19-24MAR14-2/2

Main Schematic Reel Motor Controller Splices



MS-RMC 12V

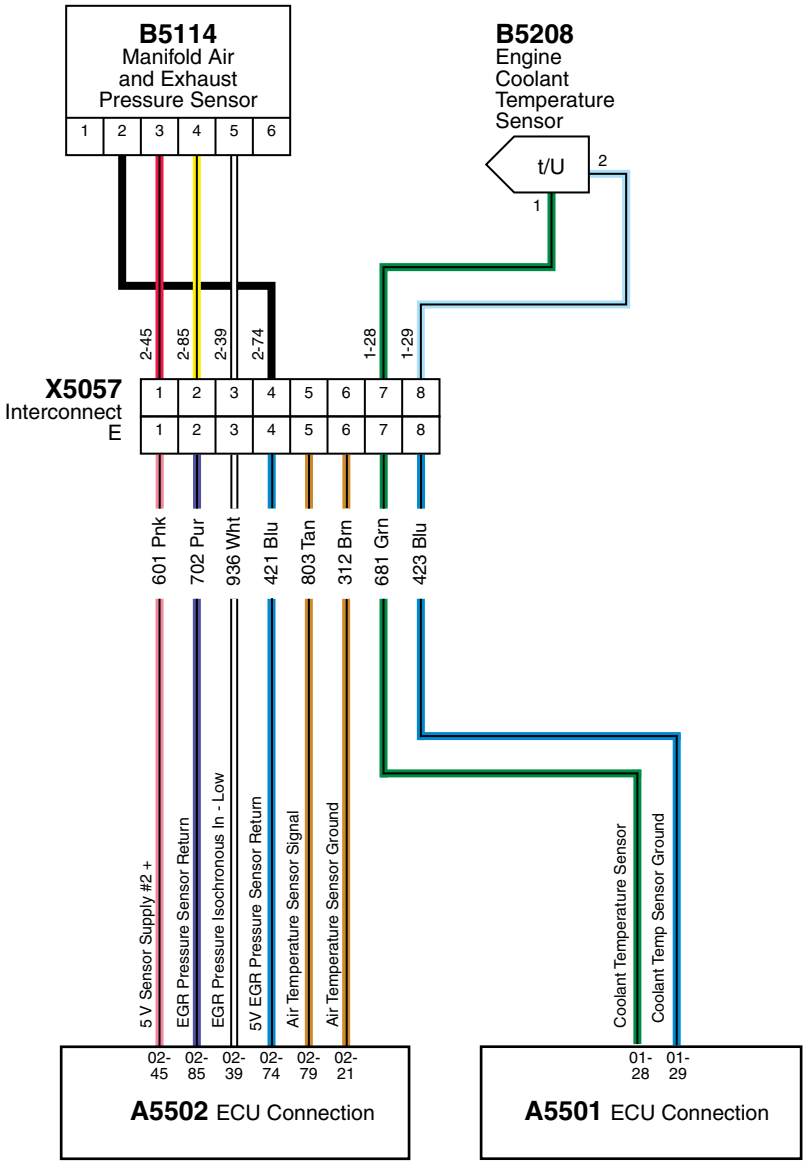


MS-RMC Gnd

TCT006764 —UN—04APR14

OUMX258,0000A3F -19-24MAR14-1/1

Engine Connector X5057 Schematic

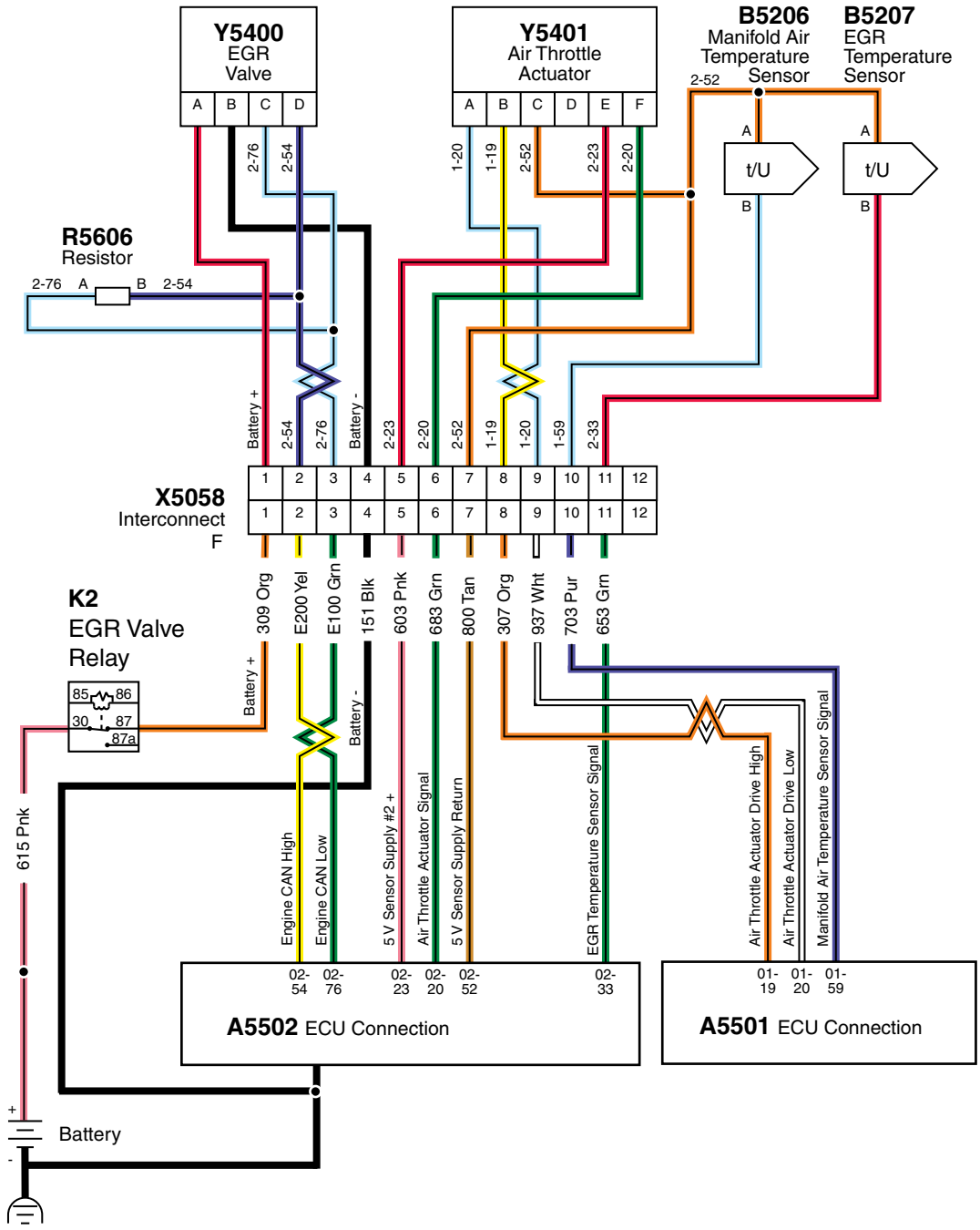


TCT010827 —UN—13MAY14

A5501—ECU Connector
A5502—ECU Connector
B5114—Manifold and Exhaust Pressure Sensor
B5208—Engine Coolant Temperature Sensor
X5057—Main Harness to Engine Harness Connector, Red

BS62576,00016EE -19-12MAR14-1/1

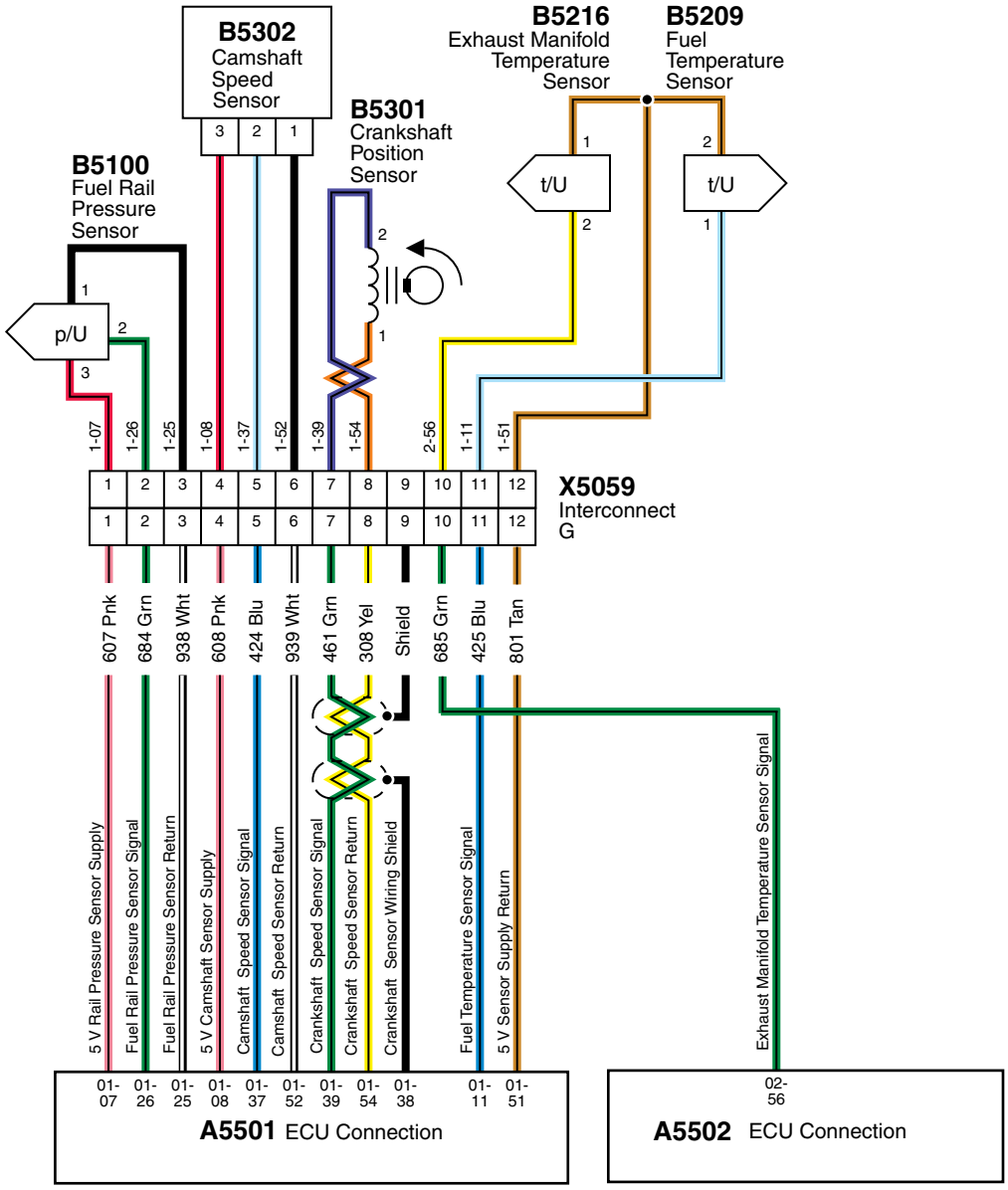
Engine Connector X5058 Schematic



A5501—ECU Connector
A5502—ECU Connector
B5206—Manifold Air Temperature Sensor
B5207—EGR Temperature Sensor
K2—EGR Valve Relay
X5058—Main Harness to Engine Harness Connector, Red
Y5400—EGR Valve
Y5401—Air Throttle Actuator

BS62576,00016EF -19-12MAR14-1/1

Engine Connector X5059 Schematic

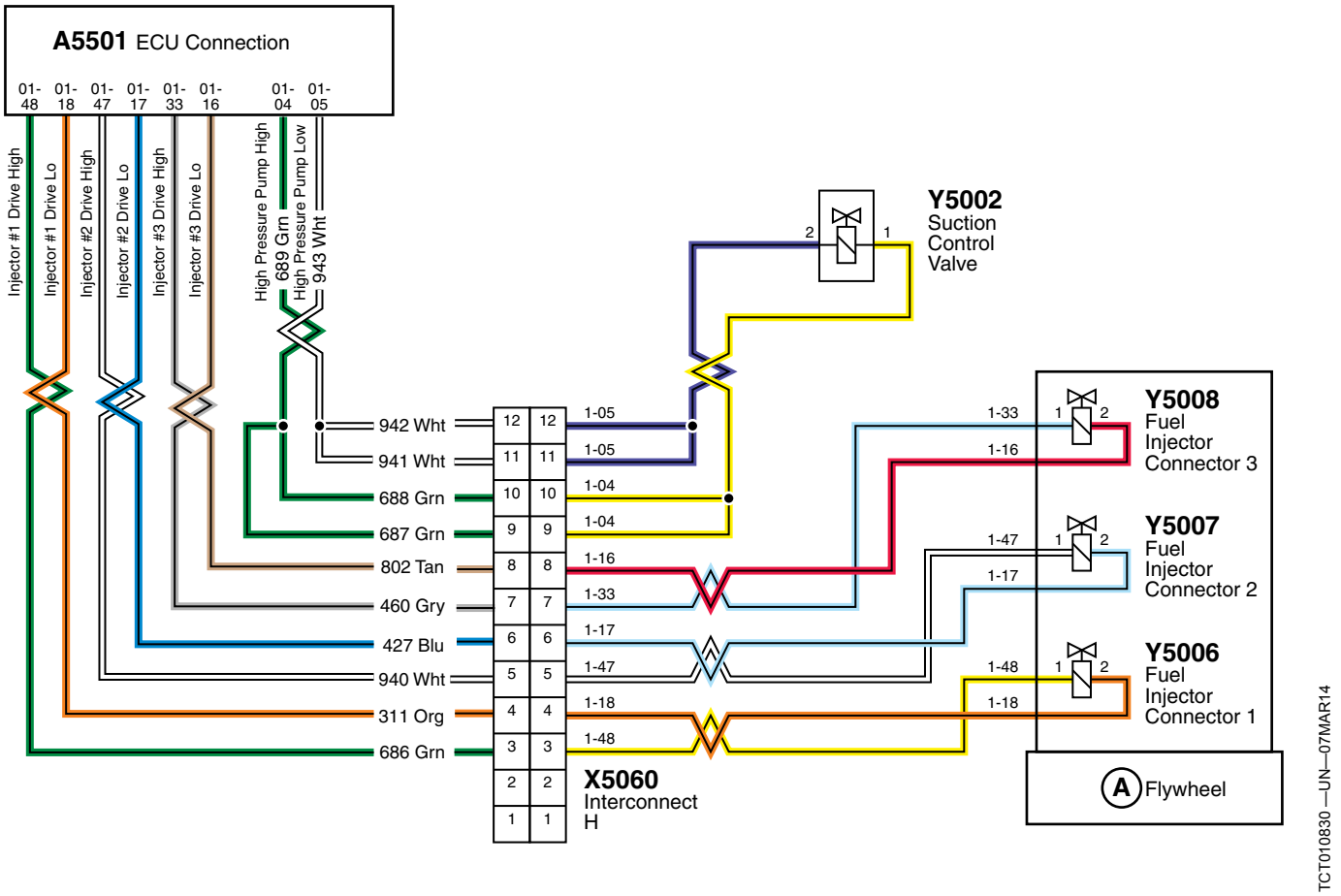


TCT010829 —UN—28FEB14

A5501—ECU Connector
A5502—ECU Connector
B5100—Fuel Rail Pressure Sensor
B5209—Fuel Temperature Sensor
B5216—Exhaust Manifold Temperature Sensor
B5301—Crankshaft Position Sensor
B5302—Camshaft Speed Sensor
X5059—Main Harness to Engine Harness Connector, Gray

BS62576,00016F0 -19-12MAR14-1/1

Engine Connector X5060 Schematic

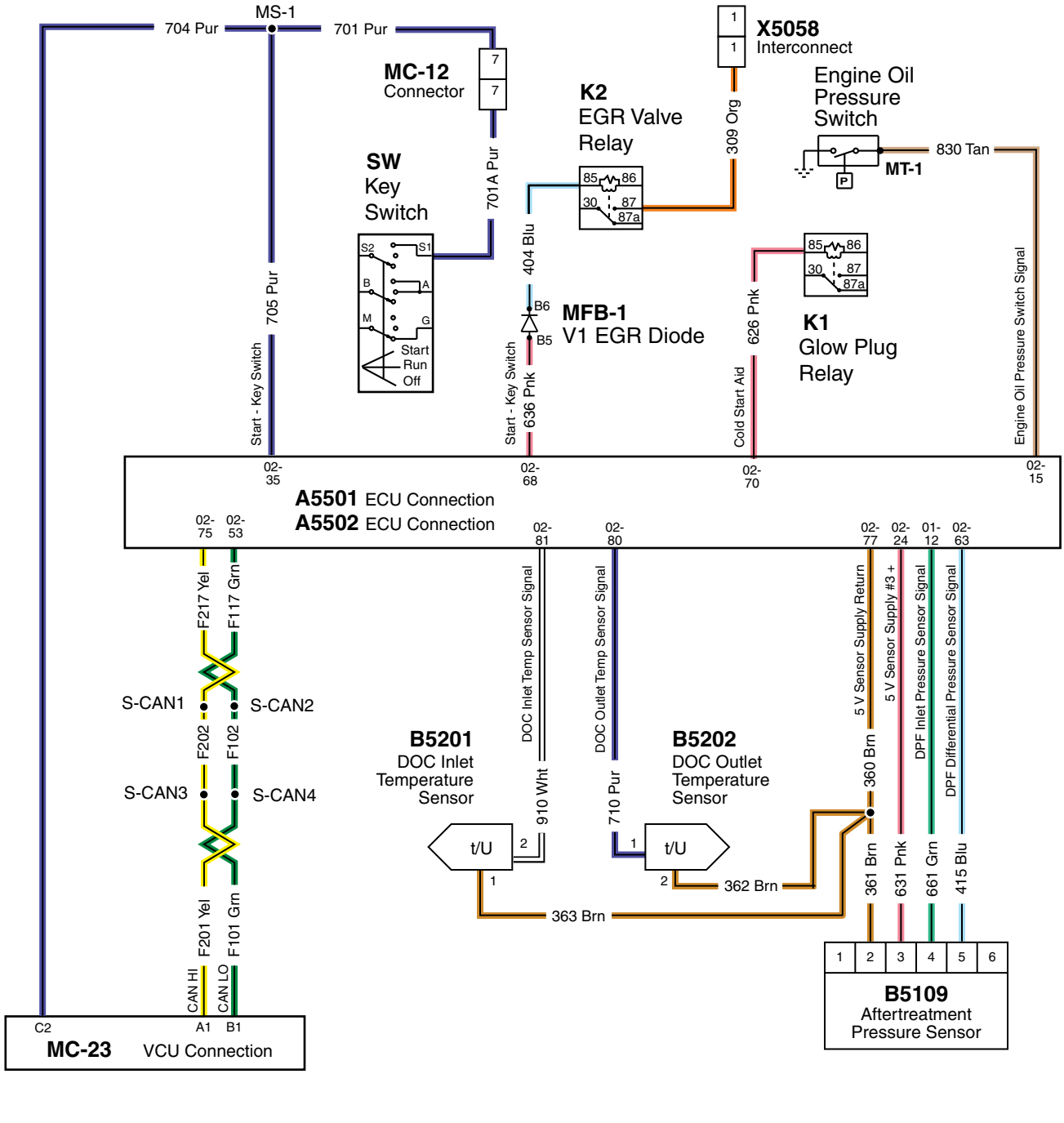


Engine Connector X5060 - 3 Cylinder Engines

A5501—ECU Connector
Y5002—Suction Control Valve
Y5006—Fuel Injector Connector 1
Y5007—Fuel Injector Connector 2
Y5008—Fuel Injector Connector 3
X5060—Main Harness to Engine Harness Connector, Yellow

BS62576,00016F1 -19-12MAR14-1/1

Engine Controls and Sensors Schematic



A5501—ECU Connector
A5502—ECU Connector
B5109—Aftertreatment Pressure Sensor
B5201—DOC Inlet Temperature Sensor
B5202—DOC Outlet Temperature Sensor
K1—Glow Plug Relay
K2—EGR Valve Relay
MC-23—VCU Connector
MT-1— Engine Oil Pressure Switch Connector
SW—Key Switch
MFB-1 V1—EGR Diode
X5058—Main Harness to Engine Harness Connector, Red

BS62576,00016F2 -19-12MAR14-1/1

Summary of References

- Common Circuit Tests
- Ground Circuit Test
- Battery Voltage and Specific Gravity Tests
- Battery Charge
- Battery Load Test
- Regulated Voltage Output Test
- Engine Oil Pressure Switch Test
- Air Pre-Heater Test
- Glow Plug Test
- Key Switch Test
- PTO Switch Test
- Park Brake Switch Test
- Relay Test
- Fuel Pump Test
- Fuel Shutoff Solenoid Test
- Fuse Test
- Diode Test
- CAN Resistor Test
- R-1 Resistor Test
- Warning Alarm Test
- Brake Valve, Lift Valve Solenoid Test
- Reel Motor Test
- Reel Motor Phase Wire Test
- Test Hydraulic Temperature Switch
- Test Hydraulic Filter Restriction Switch
- Proximity Switch Test
- Test Raise/Lower Switch
- Seat Switch Test
- Reel Motor Test
- 48V Alternator Current Output Test
- 48V Alternator Voltage Output Test

BS62576,0001094 -19-13JUN14-1/1

Common Circuit Tests

Shorted or Grounded Circuit:

A shorted circuit on the ground side of a component (i.e. improper wire-to-wire or wire to ground contact) may result in improper component operation.

A shorted circuit on the power side of a component or contact of two power circuits (i.e. improper wire-to-wire or wire to ground contact) may result in blown fusible link and fuses.

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 components stop operating.
4. Shorted or improper connections will be the last two wires disconnected.

High Resistance or Open Circuit:

High resistance or open circuits usually result in slow, dim, or no component operation (i.e. poor, corroded, or severed 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 ground connections of the circuit for corrosion.
2. If terminals are not loose or corroded, the problem is in the component or wiring.

OUMX068,0000292 -19-04DEC12-1/1

Ground Circuit Test

Reason

To check for open circuits, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.

NOTE: The voltmeter method checks ground connections under load.

Procedure - Ohmmeter Method

1. Park machine on level surface.
2. Turn all switches to the OFF position.
3. Lock park brake in neutral position.
4. Raise engine cover.
5. Connect ohmmeter negative (black) lead to negative terminal of battery. Connect meter positive (red) lead to negative terminal of battery and record reading.
6. Connect ohmmeter red lead to ground terminal of circuit or component to be tested that is closest to the battery negative terminal. Resistance reading must be the same or very close to the battery negative terminal reading. Work backward from the battery frame ground on the ground side of the problem circuit until the resistance reading increases above 0.1 ohm. 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 ohm. Check both sides of the connectors closely, as disconnecting and connecting may temporarily solve problem.

Procedure - Voltmeter Method

1. Park machine on level surface.
2. Turn all switches to the OFF position.
3. Lock park brake in neutral position.
4. Raise engine cover.
5. Connect voltmeter negative (black) lead to negative terminal of battery.
6. Connect voltmeter positive (red) lead to ground terminal of circuit (A) or component to be tested. Be sure that component circuit is activated (see appropriate circuit operation description) so that voltage will be present at the component. Record voltage. Voltage must be greater than 0, but less than 1.0 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 1.0 volt, the ground circuit is bad. Check for open wiring, loose terminal wire crimps, poor connections, or corrosion in the ground circuit.

CB12260,000042C -19-19AUG14-1/1

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.**

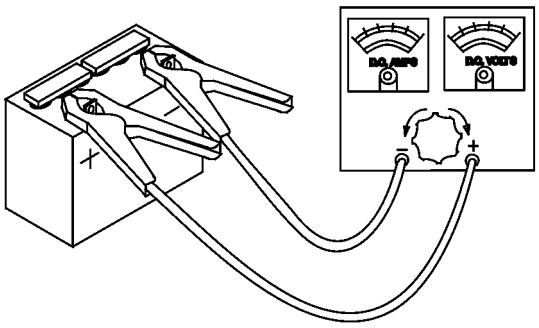
If you spill acid on yourself:

- **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 a hydrometer.

Results:

- Battery voltage less than 12.4 VDC, charge battery to specification.

Specification	
Battery (Minimum)—Voltage	12.4 VDC

- Battery voltage more than 12.4 VDC, 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 -19-11AUG14-1/1

Battery Charge

Reason:

To increase battery charge after battery has been discharged.

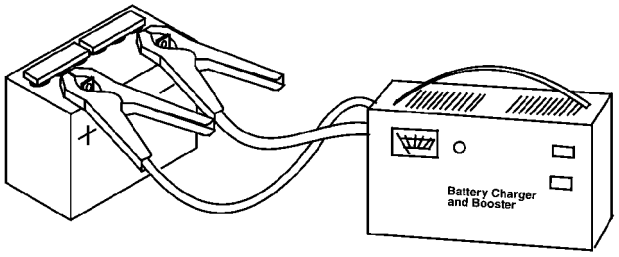
Procedure:

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.

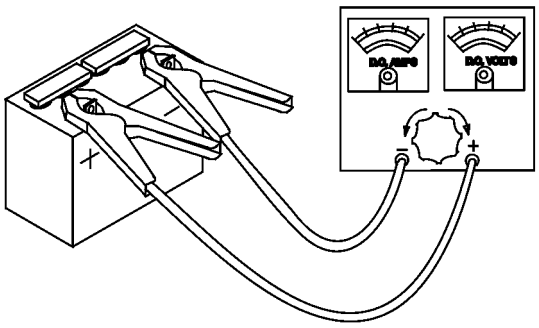
NOTE: Use the procedures given with the tester.

Procedure:

1. Turn load knob of JT05685 battery tester or equivalent clockwise until amperage reading is equal to:
   - 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 -19-11AUG14-1/1

Regulated Voltage Output Test

Reason

To check the regulated voltage (charging) output of the alternator.

Procedure

1. Park machine on level surface. (See “Safety Section”.)
2. Key switch OFF.
3. Park brake LOCKED.
4. Remove surface charge from battery by turning on the work lights for one minute. If the machine is not equipped with work lights, crank engine until it operates and then turn off engine.
5. Set JT05791A Digital Multimeter to measure voltage.
6. Connect meter black lead to battery negative (-) terminal (A).
7. Connect meter red lead to battery positive (+) terminal (B).
8. Start and run engine at FAST idle.
9. Read meter several times during 5 minutes of running time. Voltage should remain at specification.

Specification

Regulated—Voltage.....13.9–14.6 V

LVAL20873 —UN—31JAN12

A—Battery Negative (-) Terminal

B—Battery Positive (+) Terminal

Results

- If the DC voltage remains below the minimum specification: Check belt tension. Test fuse links and power cables between alternator and battery. Check any lamps, fuses, resistors, diodes and relays in the circuit that supply the field/regulator terminal. Inspect alternator for worn/damaged brushes, slip rings, shorted diodes, burnt wires etc. If all appears OK, replace voltage regulator.
- If the DC voltage goes above the maximum specification, replace the voltage regulator.

SH24924,00001C0 -19-11MAR13-1/1

Engine Oil Pressure Switch Test

Reason:

To determine if the oil pressure switch is functioning properly.

1. Park machine safely. (See “Park Machine Safely” in the Safety section.)
2. Raise hood.
3. Disconnect the wire from the oil pressure switch (located next to the engine oil filter).
4. Connect black lead of ohmmeter to engine block and red lead of ohmmeter to terminal of switch.
5. Set ohmmeter for 1X ohms scale.
6. Read meter.

Results:

NOTE: BE SURE to apply John Deere™ Pipe Thread Sealant with TEFLON® , or an equivalent to threads of switch anytime it is installed.

- There must be continuity to ground.
- If the switch does NOT have continuity to ground, replace the switch.

IMPORTANT: Avoid Damage! Do not allow wire connector to contact engine or frame because there will be voltage at that point during the test.

1. Start and run engine.
2. Read meter.

Results:

- The switch must 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.

Item	Measurement	Specification
Engine Oil (At rated speed)	Pressure	0.29—0.44 MPa (42—64 psi)
Engine Oil (At low idle speed)	Pressure	0.06 MPa (8.8 psi)

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TEFLON is a trademark of Du Pont Co.

SH24924,0000219 -19-19MAY14-1/1

Air Pre-Heater Test

Reason

To test the condition of the engine air pre-heater.

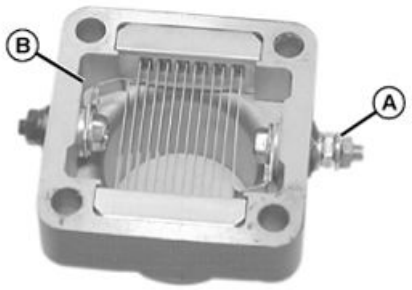
Procedure

1. Remove air pre-heater.
2. Measure the resistance between terminal (A) and terminal (B). The reading should be to specifications.

	Specification
Pre-Heater Element—Resistance	0.4–0.5 ohm

Results

If the resistance of the air pre-heater element is high or completely open, replace the element.



LVAL20848 —UN—31JAN12

A—Terminal **B—Terminal**

SH24924,00001BB -19-19AUG14-1/1

Glow Plug Test

Reason:

To test operation of glow plugs.

1. Park machine safely with park brake locked. (See the “Safety Section”.)
2. Turn all switches to the OFF position.
3. Raise hood.

NOTE: Cover glow plug hole to prevent debris from entering cylinder when glow plug is removed.

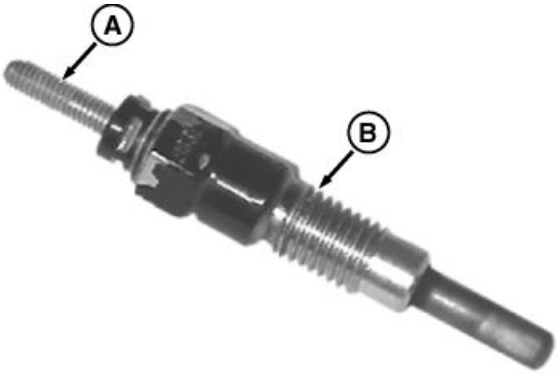
4. Remove glow plug lead. Remove glow plug.
5. Check continuity across terminal (A) and glow plug body (B) with ohmmeter.

Specification

Glow Plug—Resistance.....0.3—1.8 ohms

6. If glow plug does not have resistance within range, test glow plug with a 12 VDC source. If glow plug does not heat with a power source connected to it, replace glow plug.

CAUTION: Avoid Injury! Glow plug could become extremely hot.



MXT009726 —UN—17DEC13

A—Glow Plug Terminal **B—Glow Plug body**

a. Secure glow plug body. Connect glow plug body (B) to negative side of 12 VDC source.

b. Briefly apply 12 VDC to glow plug terminal (A).

CB12260,00000E9 -19-20MAR14-1/1

Key Switch Test

Reason

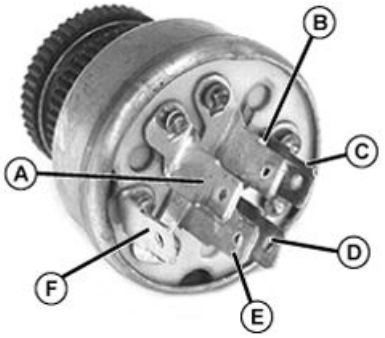
To verify key switch is operating properly.

Procedure

1. Park machine safely. (See “Safety Section”.)
2. Move control levers to NEUTRAL position.
3. Turn key switch to OFF position.
4. Engage park brake.
5. Remove instrument console cover to access switch.
6. Disconnect key switch connector.

NOTE: DO NOT refer to markings if stamped on terminals. Identify by art keys ONLY. Terminal combinations other than those listed should not have continuity.

7. Check key switch continuity in OFF, RUN, and START positions.



LVAL20849 —UN—31JAN12

A—Terminal **D—Terminal**
B—Terminal **E—Terminal**
C—Terminal **F—Terminal**

Key Switch Continuity

Switch Position	Terminal Continuity
OFF	C and D
RUN	E and F
START	E and F A and B

Results

If any continuity is not correct, replace the switch.

SH24924,00001BC -19-19AUG14-1/1

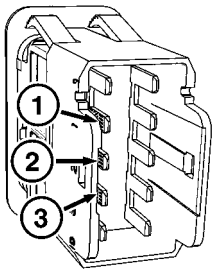
PTO Switch Test

Reason

To verify proper operation of PTO switch.

Procedure

1. Park machine safely.
2. Access wiring connectors located inside command arm.
3. Unplug connector from PTO switch.
4. Connect tester leads to switch terminals as directed.
5. Position switch rocker towards palm guard and check for the following:
   a. Continuity between terminals (2 and 3).
   b. No continuity between terminals (2 and 1).
6. Position switch rocker away from palm guard and check for the following:



TCT001638 —UN—28FEB14

1— Terminal
2— Terminal
3— Terminal

   a. Continuity between terminals (2 and 1).
   b. No continuity between terminals (2 and 3).

Results

If any continuity is not correct, replace switch.

SH24924,00001C4 -19-12JUN14-1/1

Park Brake Switch Test

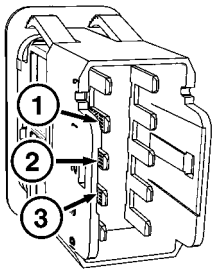
Reason

To verify proper operation of park brake switch.

Procedure

The park brake switch can be tested using a live reading in Service ADVISOR, or through an I/O reading from the PDU. (Refer to “Input/Output Status” in the Set Up, PDU section.)

1. Park machine safely.
2. Access wiring connectors located inside command arm.
3. Unplug connector from park brake switch.
4. Connect tester leads to switch terminals as directed.
5. Position switch rocker towards palm guard and check for the following:
   a. Continuity between terminals (2 and 3).
   b. No continuity between terminals (2 and 1).



TCT001638 —UN—28FEB14

1— Terminal
2— Terminal
3— Terminal

6. Position switch rocker away from palm guard and check for the following:
   a. Continuity between terminals (2 and 1).
   b. No continuity between terminals (2 and 3).

Results

If any continuity is not correct, replace switch.

SH24924,00001C5 -19-31MAR15-1/1

Relay Test

Reason:

To check relay in both the powered and unpowered states.

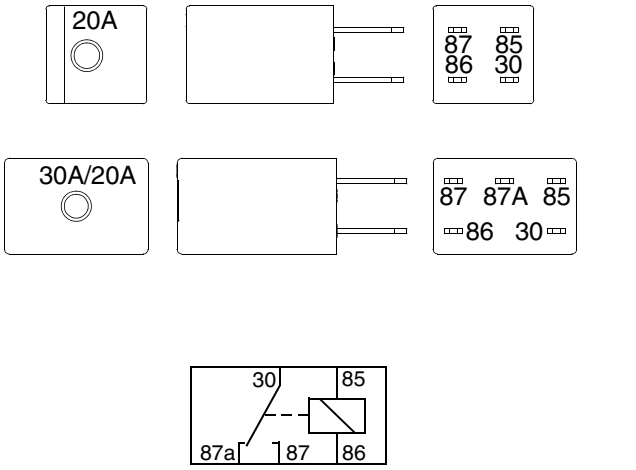
Equipment:

- Ohmmeter or continuity tester
- 12 Volt Power Source
- (2) Jumper wires

Procedure

NOTE: All relays function the same. The relay schematic below reflects the operation of the relays.

1. Unplug relay(s) from fuse block.
2. Check continuity using an ohmmeter or continuity tester.
   - Test for continuity across terminals (85)-(86) and across terminals (30)-(87a).
   - Test for no continuity across terminals (30)-(87).
3. Connect a 12 VDC power source to terminals (85)-(86).
   - Now test for continuity across terminals (30)-(87).
   - Test for no continuity across terminals (30)-(87a).



LVAL20853 —UN—31JAN12

Results

If continuity is not correct, replace relay.

SH24924,00001BD -19-12JUN14-1/1

Fuel Pump Test

Reason

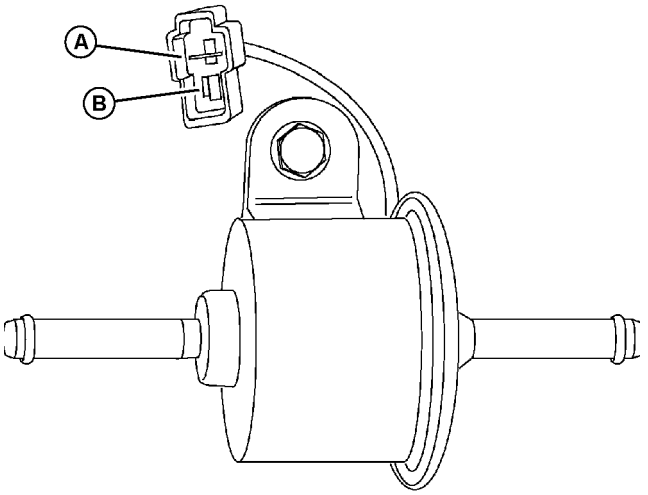
To determine if the fuel pump is operating properly.

Procedure

1. Disconnect fuel pump connector.
2. Connect jumper wire from battery positive (+) terminal to fuel pump red wire, terminal (A).
3. Connect another jumper wire from battery negative (-) terminal to fuel pump black wire, terminal (B). Fuel pump must operate.
4. Reverse jumper wire connections to (A) and (B). Fuel pump must not operate.

Results

- If fuel pump does not operate with correct polarity and power applied, replace fuel pump.
- If fuel pump operates with reverse polarity, internal circuitry is shorted. Replace fuel pump.



LVAL20867 —UN—31JAN12

A—Terminal **B—Terminal**

SH24924,00001BE -19-11MAR13-1/1

Fuel Shutoff Solenoid Test

Reason

To determine if the fuel shutoff solenoid is operating properly.

Equipment:

- Digital Multimeter

Procedure

1. Disconnect fuel shutoff solenoid.
2. Check hold-in coil resistance at terminals (A and C). Resistance must be to specification.

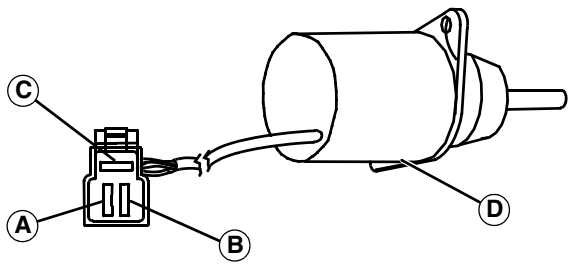
Specification	
Fuel Shutoff Solenoid (Hold-In Coil)—Resistance	23.6 ohms (±10%)

3. Check pull-in coil resistance at terminals (B and C). Resistance must be to specification.

Specification	
Fuel Shutoff Solenoid (Pull-In Coil)—Resistance	0.4 ohms (±10%)

4. Check resistance of both coils (combined), terminals (A and B). Resistance must be to specification.

Specification	
Fuel Shutoff Solenoid (Total Resistance)—Resistance	24 ohms (±10%)



LVAL23642 —UN—07MAY12

A—Solenoid Terminal A
B—Solenoid Terminal B
C—Solenoid Terminal C
D—Solenoid Housing

5. Check for grounds or shorts between solenoid terminals (A, B and C) and solenoid housing (D). There must be NO continuity between a terminal and the solenoid housing.

Results

- If resistance does not meet specification, replace fuel shutoff solenoid.
- If continuity exists between connector terminals and solenoid housing, replace fuel shutoff solenoid.

SH24924,00001C1 -19-11MAR13-1/1

Fuse Test

Reason:

To verify that the fuse has continuity.

Equipment:

- Ohmmeter or Continuity Tester

Procedure:

1. Park machine safely. (See the “Safety Section”.)
2. Remove fuse to be tested.
3. Check fuse visually for broken filament (A).
4. Connect ohmmeter or continuity tester to each end of fuse.
5. Check for continuity.

Results:

- If continuity is not indicated, replace fuse.

LVAL21827 —UN—17APR12

A—Broken Filament

SH24924,00001BF -19-12JUN14-1/1

Diode Test

Reason:

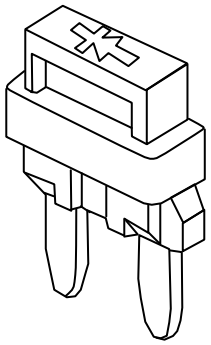
To determine if diode has failed.

Procedure:

1. Remove diode.
2. Set digital multi-meter to diode test.
3. Connect meter leads to each lead or end of diode. Check for continuity
4. Reverse test leads. Check for continuity

Results:

The diode must have a low resistance reading in one direction and a high resistance reading in the other direction. Replace the diode if low resistance reading occurs in both directions or high resistance reading occurs in both directions.



MXT004375 —UN—21MAY12

SH24924,0000224 -19-09APR13-1/1

CAN Resistor Test

Reason:

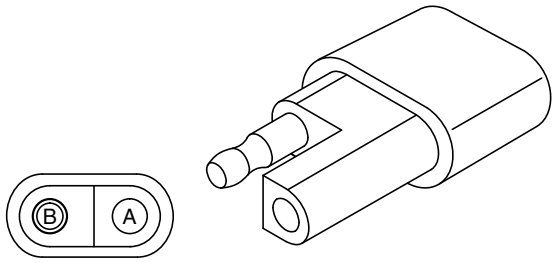
To determine if CAN terminator resistor is within tolerance.

Procedure:

1. Remove resistor.
2. Set digital multi-meter to ohms test.
3. Connect meter leads to each lead or end of resistor. Observe meter reading.

Results:

The resistor must measure 120Ω ±5%. Replace resistor if value exceeds tolerance limits.



TCT006817 —UN—09APR13

SH24924,0000225 -19-10APR13-1/1

R-1 Resistor Test

Reason:

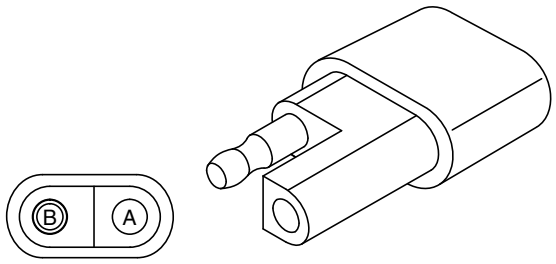
To determine if control arm R-1 resistor is within tolerance.

Procedure:

1. Remove resistor.
2. Set digital multi-meter to ohms test.
3. Connect meter leads to each lead or end of resistor. Observe meter reading.

Results:

The resistor must measure 1000Ω ±5%. Replace resistor if value exceeds tolerance limits.



TCT006817 —UN—09APR13

OUMX258,0000446 -19-24MAR14-1/1

Warning Alarm Test

Reason:

To verify proper operation of warning alarm.

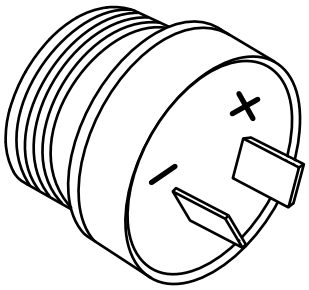
Equipment:

- 12 volt power source
- (2) Jumper Leads

Procedure:

1. Park machine safely.
2. Access wiring connectors and unplug warning alarm.
3. Attach a jumper lead to each terminal of warning alarm.
4. Connect the jumper leads to the 12 volt supply.

IMPORTANT: Observe polarity of connections!



MXT005799 —UN—01NOV12

Warning Alarm

Results:

There should be a loud beeping tone with 12 volts applied to the alarm. Replace warning alarm if tone is faulty or missing.

SH24924,00001C3 -19-16DEC13-1/1

Brake Valve, Lift Valve Solenoid Test

Reason:

To determine condition of the brake and lift valve solenoid.

Equipment:

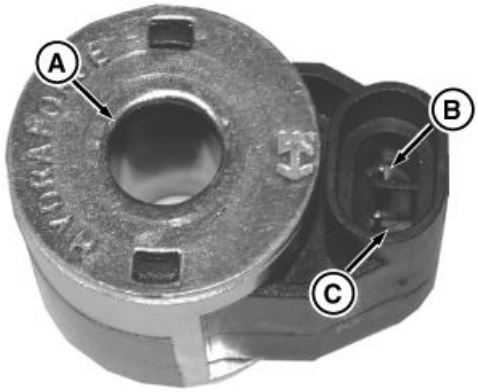
- Digital Multimeter

Procedure:

1. Measure resistance with JT05791A Digital Multimeter between solenoid connector terminals (B and C). Resistance must be within specification.
2. Check for grounds or shorts between solenoid terminals (B and C) and bare metal of the solenoid core (A). There must be NO continuity between terminal (B or C) and core (A).

Results:

- If resistance between terminals is not within specification, replace solenoid.
- If continuity exists between terminals and core, replace solenoid.



TCT006679 —UN—25FEB14

A—Core
B—Terminal
C—Terminal

Item	Measurement	Specification
Brake, Lift Valve Solenoid Resistance.	Resistance	Approximately 8 ±2 ohms

OUO2004,000025A -19-31MAR15-1/1

Reel Motor Test

Special or Required Tool

- JDG10429 Tester, Motor

Reason

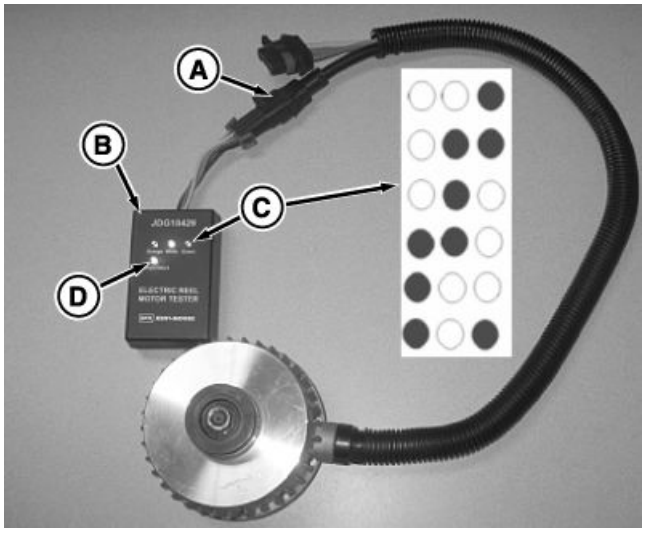
To determine if reel motor is operating properly.

Procedure

1. Machine parked on a level surface.
2. Key switch in STOP position.
3. Brake pedal in LOCKED position.
4. Connect reel motor 6-pin connector (A) to JDG10429 diagnostic tool (B).
5. When the gear on the motor is rotated, the diagnostic tool will light the LEDs in the order as indicated on pattern (C). Depending on the direction the gear is rotated, the pattern may be indicated in the reverse order. Amber LED (D) must be ON at all times.
6. While rotating the gear, move the wires near the connector terminals. Observe the light pattern. An erratic light pattern indicates a broken wire. Use the following chart to pinpoint which wire is broken:

Symptom	Probable Cause
No lights.	Broken black wire or contamination of the black wire terminal.
No red lights.	Broken red wire or contamination of the red wire terminal.
No amber light.	Broken blue wire or contamination of the blue wire terminal.
One red light not functioning.	Broken green, white, or orange wire or contamination of one of these terminals.

7. Repair broken wires and clean terminals as needed.



TCT004067 —UN—11JUN12

A—Connector
B—Diagnostic Tool
C—Pattern
D—Amber LED

8. While rotating the gear, move the wire harness at the area where the harness enters the body of the motor. Observe the light pattern. If any of the lights flickers or goes out while moving the wire harness, replace the motor.

Results

- Repair broken wires and clean terminals as needed.
- If a broken wire is determined to be near or inside the motor body, the motor must be replaced.

OUMX258,00002DC -19-12JUN14-1/1

Reel Motor Phase Wire Test

Reason

To test the motor internal phase to phase resistance in order to troubleshoot erratic motor performance.

IMPORTANT: Avoid Damage! Perform this procedure only if all other diagnostics (Service ADVISOR) have been performed. Repeated disconnection of connectors will cause damage to the connector.

1. Park machine safely with park brake locked.
2. With engine off and spark plug disconnected, disconnect reel motor phase connector from controller.
3. Using an ohmeter, measure for continuity between all pin combinations.

IMPORTANT: Avoid Damage! Do not cut or remove conduit from phase wires. If wiring is damaged within conduit, motor must be replaced.

4. If continuity is not present, check for damaged wiring or connectors (exposed from conduit).
5. While connected to multimeter, move wiring to different positions and note if continuity changes sporadically. If so, this is indicative of faulty wiring or connector.
6. If continuity is not present or does not change, replace reel motor if repair not possible.

Results

- If there is continuity between all phase combinations, motor external wiring is OK.

OUMX258,00002DD -19-22MAY14-1/1

Test Hydraulic Temperature Switch

Reason

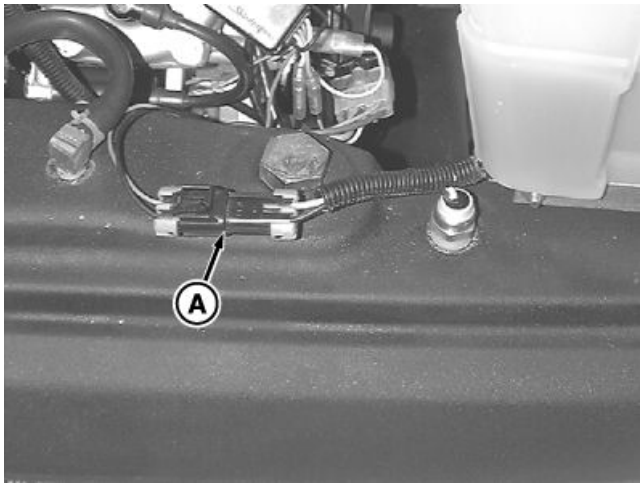
To verify the hydraulic oil temperature switch is functioning properly.

1. Park machine on level surface.
2. Lower cutting units to the ground.
3. Turn key switch to STOP position and allow the hydraulic oil to cool to room temperature.
4. Lock park brake.
5. Raise hood.
6. Disconnect wiring connector (A).
7. Measure resistance across switch terminals (B). There should be no continuity across the terminals at room temperature.

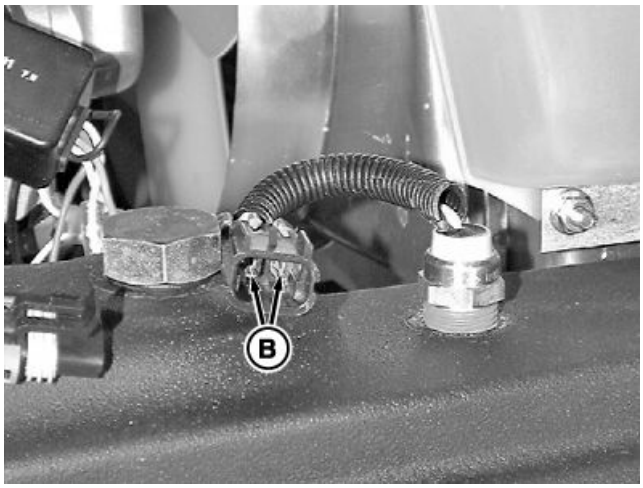
Results

Replace the switch if continuity is read at room temperature.

A—Connector **B—Terminals**



TCT004088 —UN—12JUN12



TCT004089 —UN—25FEB14

CB12260,00000E8 -19-20MAR14-1/1

Test Hydraulic Filter Restriction Switch

Reason:

To verify that the hydraulic filter restriction switch is functioning properly.

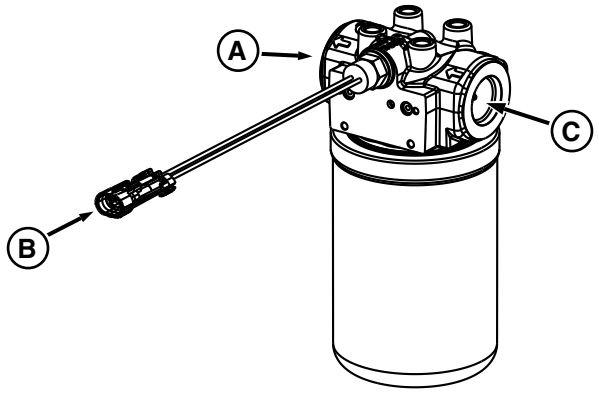
Equipment:

- Ohmmeter
- Regulated compressed air 0—690 kPa (0—100 psi)
- SAE-12 ORB plug (HXE24338) with O-ring (U12547)

Procedure:

1. Park machine safely.
2. Ensure that hydraulic pressure is released.
3. Remove oil filter assembly from machine.
4. Plug outlet port (A) with an SAE-12 ORB plug (HXE24338) with O-ring (U12547).
5. Connect ohmmeter leads to each terminal of pressure switch connector (B).
6. Using a suitable adaptor, connect a regulated air supply line to inlet port (C).
7. Gradually increase air pressure from 0 psi to approximately 50 psi.

Results:



TCT010858 —UN—25MAR14

A—Outlet Port
B—Connector
C—Inlet Port

Switch should have no continuity

Switch should close at approximately 250—290 kPa (36—42 psi) as pressure is increased.

Switch should reset open at approximately 205 kPa (30 psi) as pressure is reduced.

CB12260,00000D4 -19-31MAR14-1/1

Proximity Switch Test

Test Conditions:

- PTO switch OFF.
- Cutting decks in fully-raised position.
- Operator OFF seat and parking brake locked.
- Key switch in RUN position, engine OFF.
- Check connections for corrosion and looseness.

CAUTION: Avoid Injury! Engage service latches. Mower deck can drop if hydraulic pressure is lost.

1. Observe in Service ADVISOR or PDU I/O screen the sensor being tested. There is also an LED on the proximity sensor body that can be observed. Hold a flat steel object (A) (ex: screwdriver, wrench, etc.) parallel to the face of the proximity sensor (B) at a distance of 3–5mm. The sensor's output and LED should go ON.

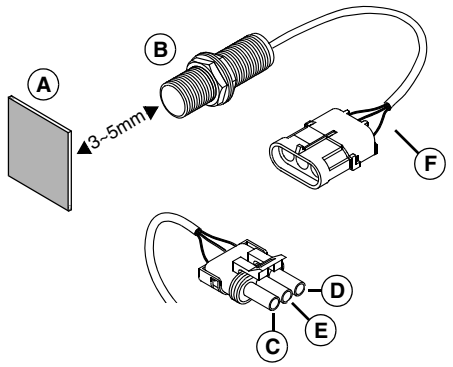
   Slowly pull the steel piece away from the sensor. At distances greater than 8mm, the sensor's output and LED should go OFF.

2. Unplug the sensor in question. Refer to VCU Input and Proximity Sensor graphics and VCU Pinout Connection Table. At the harness connector:

   - Test the Yel wire (C) for battery voltage.
   - Test the Blk wire (D) for continuity to ground.
   - Test the signal wire (E) for continuity to its corresponding pin at the VCU.

3. If problems still exist:

   - Inspect the sensor pigtail and connector (F).



LVAL20808 —UN—31JAN12

Proximity Sensor

A—Flat Steel Object
B—Proximity Sensor
C—Yel Wire
D—Blk Wire
E—Signal Wire
F—Sensor Pigtail and Connector

- Measure sensor-to-arm plate gap and compare to specification.

Specification

Sensor-to-Arm Plate—Gap ..... 3 mm (0.118 in.)

- Check for a bent or damaged sensor bracket.
- Substitute sensor from opposite side of machine and repeat tests. If operation is restored, replace defective sensor. Be sure to set gap when installing sensors.

JF70945,00000D3 -19-19JUN14-1/1

Test Raise/Lower Switch

Reason:

To determine condition of the raise/lower switch.

Equipment:

- Digital Multimeter

Procedure:

The switch can be tested using a live reading in Service ADVISOR, or through an I/O reading from the PDU. (Refer to “Input/Output Status” in the Set Up, PDU section.)

1. Key switch in RUN position, engine not running.
2. Set multimeter to DC Volts. Connect meter (-) lead to switch connector terminal (C) black wire, and meter (+) lead to terminal (B) yellow wire. Battery voltage should be present. Test switched power circuit if voltage is missing.
3. Leave meter (-) lead connected to terminal (C) for remainder of test procedure.
4. Connect meter (+) lead to terminal (A) blue wire. Move switch lever (E) to RAISE position. Meter should now indicate battery voltage at (A).
5. Connect meter (+) lead to terminal (D) orange wire. Move switch lever (E) to LOWER position. Meter should now indicate battery voltage at (D).

TCT010226 —UN—07FEB14

A—RAISE Output
B—Power (+)
C—Ground (-)
D—LOWER Output
E—Switch Lever

Results:

- If voltage is present at terminals (A) or (D) with switch in OFF (center) position, replace switch.
- If voltage is NOT present at terminals (A) or (D) with switch in specified position, replace switch.

SH24924,00001AF -19-10APR15-1/1

Seat Switch Test

Reason:

To determine if the seat switch is functioning properly.

Procedure:

The seat switch can be tested using a live reading in Service ADVISOR or through an I/O reading from the PDU. (See PDU I/O Status Displays.)

Results:

If the seat switch does not function properly, replace switch using service kit TCA18463.

CB12260,00000EC -19-31MAR15-1/1

48V Alternator Current Output Test

Reason:

To determine if the 48V alternator adequate current output to supply the reel controllers.

Special or Required Tools:

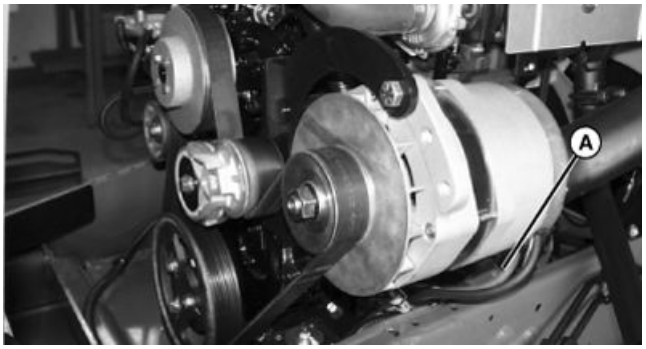
- DC Clamp-On Inductive Ammeter

Procedure:

1. Park machine on a level surface with park brake locked and key switch off.
2. Locate positive Red cable (A) at rear of 48V alternator.
3. Clamp DC inductive ammeter to positive cable.
4. Start unit and engage the reel motors.
5. Measure the current draw displayed on the ammeter.

NOTE: Current draw will vary based on reel bed knife clearance. If readings are incorrect, check/adjust bed knife clearance. See Attachments section.

6. Current draw should be within specifications.



TCAL25627 —UN—15JUN12

A—Red Cable

Specification	
48V Alternator—Nominal Current Draw—Amperage	120 A (sustained)
48V Alternator—Current Draw—Amperage	150 A (peak)

CB12260,0000107 -19-12JUN14-1/1

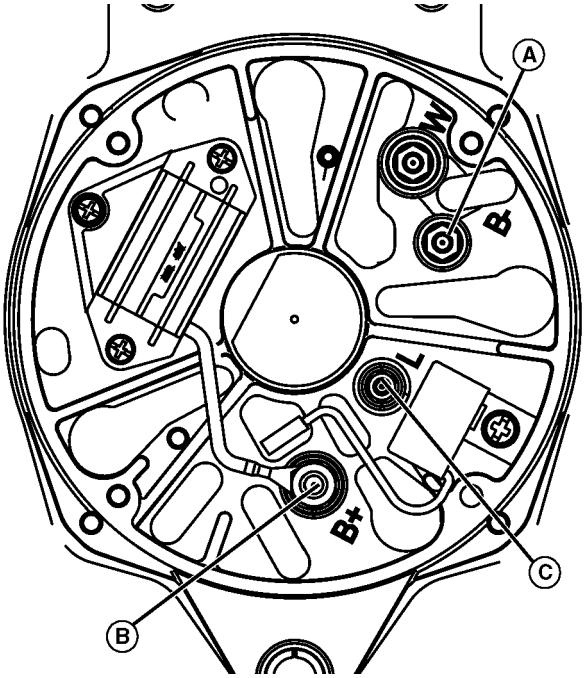
48V Alternator Voltage Output Test

CB12260,0000108 -19-02JUN14-1/6

48 Volt Alternator Circuit Diagnosis

Continued on next page

CB12260,0000108 -19-02JUN14-2/6

Step 1	**Test Conditions** • Machine parked on a level surface. • Cooling duct removed from rear of alternator. • Key switch in RUN position (engine operating at medium idle). • Mow-transport lever in the MOW position. • Meter negative (-) lead on battery negative (-) terminal or chassis ground. • Check connections for corrosion and looseness when testing.  TCAL25626 —UN—15JUN12 **A—B- Terminal** **B—B+ Terminal** **C—Regulator Power Terminal L** Measure ground circuit resistance at 48 volt alternator B- terminal (A) to frame ground. Is resistance at or less than 0.1 ohm?	**YES:** Go to next step. **NO:** Check Blk ground wires and alternator brackets.

CB12260,0000108 -19-02JUN14-3/6

Step 2	Check condition of ground terminals. Are the ground terminals clean?	**YES:** Go to next step. **NO:** Clean and tighten terminals.

CB12260,0000108 -19-02JUN14-4/6

Step 3	Measure voltage at 48-volt alternator regulator power terminal L, 690 Grn wire (C). Is battery voltage ±10% present?	**YES:** Go to next step. **NO:** Check Grn wire and connections and 48-volt alternator field terminal.

CB12260,0000108 -19-02JUN14-5/6

Step 4	Measure voltage at 48-volt alternator positive (+) output terminal B+, Red wire (B). Is voltage in the range of 48Vdc ±10%?	**YES:** Go to next step. **NO:** Replace 48-volt alternator.

CB12260,0000108 -19-02JUN14-6/6

Section 240
Controller Operation, Tests, and Adjustments
Contents

Page

Group 10—Set Up, PDU
Summary of References 240-10-1
Display Navigation 240-10-1
Mower Setup Menu 240-10-4
Service Menu 240-10-5
Diesel Particulate Filter (DPF) Menu 240-10-6
Mow Engine Speed Screen 240-10-6
Reel Speed Screen 240-10-6
Mow Speed Screen 240-10-7
Turn Speed Screen 240-10-7
Transport Speed Screen 240-10-7
LoadMatch Screen 240-10-8
Cruise Control Screen 240-10-8
Display Setup Screen 240-10-9
Pass Codes 240-10-10
Language Select 240-10-11
Text Select 240-10-12
Engine RPM 240-10-12
Backlap Screen 240-10-12
Backlap Speed 240-10-13
Stored Diagnostic Trouble Codes (DTCs) 240-10-13
Input/Output Status 240-10-13
Service Timers 240-10-15
Pedal Calibration 240-10-16
Hydrostatic Transmission Calibration 240-10-16
Hydrostatic Valve Calibration 240-10-17
Diesel Particulate Filter Regeneration 240-10-17
Pass Code - Change 240-10-19
Pass Code - Reset 240-10-20

Group 15—Theory of Operation
Summary of References 240-15-1
CAN Bus Message Structure 240-15-1
CAN Bus Operation 240-15-2
Data Bus Systems 240-15-2
CAN Trace 240-15-2
Alarm 240-15-2
Primary Display Unit—PDU 240-15-3
Hour Meter 240-15-3
Diagnostic Trouble Codes Overview 240-15-3
Reel Motor Controllers 240-15-4
Reel Motors 240-15-4
Reel Motor Controller Signals 240-15-5
Reel Motor Safety Interlock Operating Conditions 240-15-5

Page

Group 20—DPF Theory and Functions
Summary of References 240-20-1
Exhaust Filter System Overview 240-20-1
Understanding Diesel Particulate Filter (DPF) Regeneration 240-20-2
DPF Regeneration Control 240-20-3
DPF Self Regeneration — Mode Select 240-20-3
DPF Elevated Exhaust Temperature 240-20-3
DPF Parked Regeneration 240-20-4
DPF Ash Cleaning Required 240-20-4
DPF Filter Cleaning Required 240-20-5
DPF Parked Cleaning Required (Warning Level) 240-20-5
DPF Parked Cleaning Required (Stop Level) 240-20-5
DPF Recovery Regeneration 240-20-5

Group 30—Diagnose—DTCs, PDU
Summary of References 240-30-1
PDU 240-30-1
Warning Icons 240-30-1
Accessing DTCs through PDU 240-30-2
Machine Start Status Pop-up DTCs 240-30-2
Machine Fault Pop-up DTCs 240-30-4

Group 40—Diagnose—DTCs, VCU
VCU DTC Quick Reference Table 240-40-1
VCU 000070.14 — Park Brake Switch 240-40-5
Procedure 240-40-5
VCU 000096.01 — Fuel Level Sensor 240-40-6
Diagnosis 240-40-6
VCU 000096.03 — Fuel Level Sensor 240-40-7
Diagnosis 240-40-7
VCU 000096.16 — Fuel Level Sensor 240-40-8
Diagnosis 240-40-8
VCU 000100.01 — Engine Oil Pressure 240-40-10
Diagnostic Procedure 240-40-10
VCU 000110.00 — Engine Coolant 240-40-12
Diagnostic Procedure 240-40-12
VCU 000158.00 — Switched Power (ELX) Fault 240-40-14

Continued on next page

Page

Diagnostics 240-40-14
VCU 000158.01 — Switched Power (ELX) Fault 240-40-16
Diagnostics 240-40-16
VCU 000168.00 — Supply Voltage (VBAT) Fault 240-40-18
Diagnostics 240-40-18
VCU 000168.01 — Supply Voltage (VBAT) Critically Low 240-40-19
Diagnostics 240-40-19
VCU 000168.16 — Supply Voltage (VBAT) Fault 240-40-21
Diagnostics 240-40-21
VCU 000168.18 — Supply Voltage (VBAT) Fault 240-40-22
Diagnostics 240-40-22
VCU 000190.00 — Engine Speed 240-40-23
Diagnostics 240-40-24
VCU 000190.01 — Engine Speed 240-40-24
Diagnostics 240-40-24
VCU 000190.02 — Engine Speed Sensor 240-40-25
Diagnostics 240-40-25
VCU 000190.09 — Engine Speed 240-40-26
Diagnostics 240-40-26
VCU 000629.12 — Watch Dog Time Out 240-40-27
Procedure 240-40-27
VCU 000639.12 — CAN, Lost Message 240-40-28
VCU 000639.14 — CAN, Bus Off 240-40-28
VCU 000677.03 — Starter Relay 240-40-29
Diagnosis 240-40-29
VCU 000677.04 — Starter Relay 240-40-30
Diagnosis 240-40-30
VCU 000677.14 — Crank Time Exceeded 240-40-31
VCU 000677.31 — Starter Cool Down in Process 240-40-31
VCU 000920.04 — Buzzer Short to Low 240-40-32
Diagnostics 240-40-32
VCU 000920.03 — Buzzer Short to High 240-40-33
Diagnostics 240-40-33
VCU 000976.14 — PTO Switch 240-40-34
Diagnostics 240-40-34
VCU 001504.14 — PTO On While Off of Seat 240-40-35
Diagnostics 240-40-35
VCU 001638.00 — Hydraulic Oil 240-40-37
Electrical Diagnostics 240-40-37
VCU 001713.00 — Hydraulic Filter 240-40-38
Diagnostics 240-40-38

Page

VCU 001713.03 — Hydraulic Filter Restriction 240-40-39
Diagnostics 240-40-39
VCU 001713.31 — Hydraulic Filter Restriction 240-40-40
Diagnostics 240-40-41
VCU 003509.03 — Sensor Power Supply 1 Voltage 240-40-41
Diagnostics 240-40-42
VCU 003509.04 — Sensor Power Supply 1 Voltage 240-40-42
Diagnostics 240-40-42
VCU 003510.03 — Sensor Power Supply 2 Voltage 240-40-43
Diagnostics 240-40-43
VCU 003510.04 — Sensor Power Supply 2 Voltage 240-40-44
Diagnostics 240-40-44
VCU 516124.03 — Engine Run Request 240-40-45
Procedure 240-40-45
VCU 516124.04 — Engine Run Request 240-40-46
Procedure 240-40-46
VCU 516125.03 — Fuel Solenoid Pull-In Relay 240-40-47
Procedure 240-40-47
VCU 516125.04 — Fuel Solenoid Pull-In Relay 240-40-48
Procedure 240-40-48
VCU 516135.03 — Air Preheat, Non-T4 240-40-49
Procedure 240-40-49
VCU 516135.04 — Air Preheat, Non-T4 240-40-50
Procedure 240-40-50
VCU 516183.02 — Proximity Sensor #2 240-40-51
Diagnostics 240-40-51
VCU 516183.07 — Proximity Sensor #2 240-40-52
Diagnostics 240-40-52
VCU 516183.04 — Proximity Sensor #2 240-40-53
Diagnostics 240-40-53
VCU 516184.02 — Proximity Sensor #1 240-40-54
Diagnostics 240-40-54
VCU 516184.07 — Proximity Sensor #1 240-40-55
Diagnostics 240-40-55
VCU 516184.04 — Proximity Sensor #1 240-40-56
Diagnostics 240-40-56
VCU 516199.03 — Raise-Lower Select Solenoid 240-40-57
Procedure 240-40-57

Continued on next page

Page

VCU 516199.04 — Raise-Lower Select Solenoid 240-40-58
Procedure 240-40-58
VCU 516207.03 — 48 Volt Alternator Relay Driver 240-40-59
Procedure 240-40-59
VCU 516207.04 — 48 Volt Alternator Relay Driver 240-40-60
Procedure 240-40-60
VCU 516708.00 — Hydraulic Oil Leak 240-40-61
VCU 520608.14 — Backlap 240-40-61
VCU 520870.31 — Check Sum Fail 240-40-62
Procedure 240-40-62
VCU 520871.31 — Non Critical Data Check Sum Fail 240-40-63
Procedure 240-40-63
VCU 520872.31 — Critical Data Check Sum Fail 240-40-64
Procedure 240-40-64
VCU 520873.31 — Vehicle Hours Data Check Sum Fail 240-40-65
Procedure 240-40-65
VCU 520957.03 — Park Brake Solenoid 240-40-66
Procedure 240-40-66
VCU 520957.04 — Park Brake Solenoid 240-40-67
Procedure 240-40-67
VCU 521426.31 — Lower Reel Switch Signal Invalid 240-40-68
Procedure 240-40-68
VCU 521427.31 — Raise Reel Switch Invalid Signal 240-40-69
Procedure 240-40-69
VCU 522011.08 — CAN Display Heartbeat 240-40-70
Diagnostics 240-40-70
VCU 522405.03 — Park Brake Pressure Switch 240-40-71
Diagnostics 240-40-71
VCU 522405.04 — Park Brake Pressure Switch 240-40-72
Diagnostics 240-40-72
VCU 522405.31 — Park Brake Pressure Switch 240-40-73
Diagnostics 240-40-73
VCU 522771.31 — VCU Connected to Unknown Address 240-40-74
Diagnostics 240-40-74
VCU 523652.31 — VCU Connected to Unknown Controller 240-40-75
Diagnostics 240-40-75
VCU 523324.02 — Swash Plate Position Sensor 240-40-76
Diagnostics 240-40-76

Page

VCU 523324.03 — Swash Plate Position Sensor 240-40-77
Diagnostics 240-40-77
VCU 523324.04 — Swash Plate Position Sensor 240-40-78
Diagnostics 240-40-78
VCU 523324.10 — Swash Plate Position Sensor 240-40-80
Diagnostics 240-40-80
VCU 523324.13 — Swash Plate Position Sensor 240-40-81
Diagnostics 240-40-81
VCU 523324.16 — Swash Plate Position Sensor 240-40-82
Diagnostics 240-40-82
VCU 523324.18 — Swash Plate Position Sensor 240-40-84
Diagnostics 240-40-84
VCU 523590.03 — Forward Pedal Sensor 240-40-85
Procedure 240-40-85
VCU 523590.04 — Forward Pedal Sensor 240-40-86
Procedure 240-40-86
VCU 523590.08 — Forward Pedal Sensor 240-40-87
Procedure 240-40-87
VCU 523590.13 — Forward Pedal Sensor 240-40-88
Procedure 240-40-88
VCU 523590.14 — Forward Pedal Sensor 240-40-89
VCU 523590.16 — Forward Pedal Sensor 240-40-89
Procedure 240-40-89
VCU 523590.18 — Forward Pedal Sensor 240-40-90
Procedure 240-40-90
VCU 523590.31 — Forward Pedal Sensor 240-40-91
Procedure 240-40-91
VCU 523591.03 — Reverse Pedal Sensor 240-40-92
Procedure 240-40-92
VCU 523591.04 — Reverse Pedal Sensor 240-40-93
Procedure 240-40-93
VCU 523591.08 — Reverse Pedal Sensor 240-40-94
Procedure 240-40-94
VCU 523591.13 — Reverse Pedal Sensor 240-40-95
Procedure 240-40-95
VCU 523591.14 — Reverse Pedal Sensor 240-40-96
VCU 523591.16 — Reverse Pedal Sensor 240-40-96
Procedure 240-40-96

Continued on next page

Page

VCU 523591.18 — Reverse Pedal Sensor....240-40-97
Procedure....240-40-97
VCU 523591.31 — Reverse Pedal Sensor....240-40-98
Procedure....240-40-98
VCU 523735.03 — eHydro FWD/REV Solenoid....240-40-99
Diagnostics....240-40-99
VCU 523735.04 — eHydro FWD/REV Solenoid....240-40-100
Diagnostics....240-40-100
VCU 524069.03 — Reverse Hydro Solenoid....240-40-101
Diagnostics....240-40-101
VCU 524069.04 — Reverse Hydro Solenoid....240-40-102
Diagnostics....240-40-103

Group 50—Diagnose—DTCs, ECU 000001 — 000199
ECU, Quick Reference Table....240-50-1
ECU 000051.03 — Air Throttle Actuator Position Signal Out of Range High....240-50-5
Diagnostic Procedure....240-50-6
ECU 000051.04 — Air Throttle Actuator Position Signal Out of Range Low....240-50-7
Diagnostic Procedure....240-50-8
ECU 000100.01 — Engine Oil Pressure Signal Extremely Low....240-50-10
Diagnostic Procedure....240-50-10
ECU 000100.04 — Engine Oil Pressure Signal Out of Range Low....240-50-12
Diagnostic Procedure....240-50-12
ECU 000102.03 — Manifold Air Pressure Signal Out of Range High....240-50-14
Diagnostic Procedure....240-50-14
ECU 000102.04 — Manifold Air Pressure Signal Out of Range Low....240-50-16
Diagnostic Procedure....240-50-16
ECU 000102.13 — Manifold Air Pressure Signal Calibration Fault....240-50-18
Diagnostic Procedure....240-50-18
ECU 000105.03 — Manifold Air Temperature Signal Out of Range High....240-50-20
Diagnostic Procedure....240-50-20
ECU 000105.04 — Manifold Air Temperature Signal Out of Range Low....240-50-22
Diagnostic Procedure....240-50-22
ECU 000108.03 — Barometric Pressure Signal Out of Range High....240-50-24

Page

Diagnostic Procedure....240-50-24
ECU 000108.04 — Barometric Pressure Signal Out of Range Low....240-50-25
Diagnostic Procedure....240-50-25
ECU 000108.10 — Barometric Pressure Signal Abnormal....240-50-26
Diagnostic Procedure....240-50-26
ECU 000110.00 — Engine Coolant Temperature Signal Extremely High....240-50-27
Diagnostic Procedure....240-50-27
ECU 000110.03 — Engine Coolant Temperature Signal Out of Range High....240-50-29
Diagnostic Procedure....240-50-29
ECU 000110.04 — Engine Coolant Temperature Signal Out of Range Low....240-50-31
Diagnostic Procedure....240-50-31
ECU 000157.00 — Fuel Rail Pressure Signal Extremely High....240-50-33
Diagnostic Procedure....240-50-33
ECU 000157.03 — Fuel Rail Pressure Signal Out of Range High....240-50-35
Diagnostic Procedure....240-50-35
ECU 000157.04 — Fuel Rail Pressure Signal Out of Range Low....240-50-37
Diagnostic Procedure....240-50-37
ECU 000157.15 — Fuel Rail Pressure Signal Slightly High....240-50-39
Diagnostic Procedure....240-50-39
ECU 000157.16 — Fuel Rail Pressure Limiter Open....240-50-41
Diagnostic Procedure....240-50-41
ECU 000157.18 — Fuel Rail Pressure Signal Moderately Low....240-50-42
Diagnostic Procedure....240-50-42
ECU 000167.01 — Charging System Voltage Extremely Low....240-50-44
Diagnostic Procedure....240-50-44
ECU 000167.05 — Charging System Circuit Out of Range Low....240-50-45
Diagnostic Procedure....240-50-45
ECU 000173.03 — Exhaust Manifold Temperature Signal Out Of Range High....240-50-46
Diagnostic Procedure....240-50-46
ECU 000173.04 — Exhaust Manifold Temperature Signal Out Of Range Low....240-50-48
Diagnostic Procedure....240-50-48
ECU 000174.00 — Fuel Temperature Signal Extremely High....240-50-50
Diagnostic Procedure....240-50-50
ECU 000174.03 — Fuel Temperature Signal Out Of Range High....240-50-52
Diagnostic Procedure....240-50-52

Continued on next page

Page

ECU 000174.04 — Fuel Temperature Signal Out Of Range Low 240-50-54
Diagnostic Procedure 240-50-54
ECU 000190.00 — Engine Speed Extremely High....240-50-56
Diagnostic Procedure 240-50-56

Group 51—Diagnose—DTCs, ECU 000200 — 000699
ECU 000412.03 — EGR Temperature Signal Out of Range High 240-51-1
Diagnostic Procedure 240-51-1
ECU 000412.04 — EGR Temperature Signal Out Of Range Low 240-51-3
Diagnostic Procedure 240-51-3
ECU 000630.12 — ECU EEPROM Error 240-51-5
Diagnostic Procedure 240-51-5
ECU 000633.03 — Suction Control Valve Circuit Out of Range High....240-51-6
Diagnostic Procedure 240-51-6
ECU 000633.05 — Suction Control Valve Circuit Has High Resistance 240-51-9
Diagnostic Procedure 240-51-9
ECU 000633.06 — Suction Control Valve Circuit Has Low Resistance 240-51-12
Diagnostic Procedure 240-51-12
ECU 000652.03 — Injector #3 Circuit Out of Range High 240-51-15
Diagnostic Procedure 240-51-15
ECU 000652.05 — Injector #3 Circuit Has High Resistance....240-51-17
Diagnostic Procedure 240-51-17
ECU 000652.06 — Injector #3 Circuit Has Low Resistance 240-51-19
Diagnostic Procedure 240-51-19
ECU 000653.03 — Injector #2 Circuit Out of Range High 240-51-21
Diagnostic Procedure 240-51-21
ECU 000653.05 — Injector #2 Circuit Has High Resistance....240-51-23
Diagnostic Procedure 240-51-23
ECU 000653.06 — Injector #2 Circuit Has Low Resistance 240-51-25
Diagnostic Procedure 240-51-25
ECU 000654.03 — Injector #1 Circuit Out of Range High 240-51-27
Diagnostic Procedure 240-51-27
ECU 000654.05 — Injector #1 Circuit Has High Resistance....240-51-29
Diagnostic Procedure 240-51-29
ECU 000654.06 — Injector #1 Circuit Has Low Resistance 240-51-31
Diagnostic Procedure 240-51-31

Page

Group 52—Diagnose—DTCs, ECU 000700 — 001999
ECU 001209.03 — Exhaust Manifold Pressure Signal Out of Range High....240-52-1
Diagnostic Procedure 240-52-1
ECU 001209.04 — Exhaust Manifold Pressure Signal Out of Range Low....240-52-3
Diagnostic Procedure 240-52-3
ECU 001209.13 — Exhaust Manifold Pressure Signal Calibration Fault 240-52-6
Diagnostic Procedure 240-52-6

Group 53—Diagnose—DTCs, ECU 002000 — 002999
ECU 002791.00 — EGR Valve Drive Circuit Voltage Extremely High....240-53-1
Diagnostic Procedure 240-53-1
ECU 002791.01 — EGR Valve Drive Circuit Voltage Extremely Low 240-53-3
Diagnostic Procedure 240-53-3
ECU 002791.07 — EGR Valve Position Error 240-53-6
Diagnostic Procedure 240-53-6
ECU 002791.09 — EGR Valve Communication Error 240-53-7
Diagnostic Procedure 240-53-7
ECU 002791.12 — EGR Valve Actuator Internal Error 240-53-8
Diagnostic Procedure 240-53-8
ECU 002797.06 — Injector High Voltage Supply #1 Circuit Has Low Resistance 240-53-9
Diagnostic Procedure 240-53-9
ECU 002798.06 — Injector High Voltage Supply #2 Circuit Has Low Resistance 240-53-10
Diagnostic Procedure 240-53-10
ECU 002950.03 — Air Throttle Actuator Drive Circuit 1 Out of Range High 240-53-11
Diagnostic Procedure 240-53-11
ECU 002950.04 — Air Throttle Actuator Drive Circuit 1 Out of Range Low....240-53-13
Diagnostic Procedure 240-53-13
ECU 002950.05 — Air Throttle Actuator Drive Circuit Has High Resistance 240-53-15
Diagnostic Procedure 240-53-15
ECU 002950.06 — Air Throttle Actuator Drive Circuit Has Low Resistance 240-53-18
Diagnostic Procedure 240-53-18

Continued on next page

Page

ECU 002951.03 — Air Throttle Actuator Drive Circuit 2 Out of Range High 240-53-21
Diagnostic Procedure 240-53-21
ECU 002951.04 — Air Throttle Actuator Drive Circuit 2 Out of Range Low 240-53-24
Diagnostic Procedure 240-53-24

Group 54—Diagnose—DTCs, ECU 003000 — 003999
ECU 003242.00 — DOC Inlet Temperature Extremely High....240-54-1
Diagnostic Procedure 240-54-1
ECU 003242.03 — DOC Inlet Temperature Signal Out of Range High....240-54-3
Diagnostic Procedure 240-54-3
ECU 003242.04 — DOC Inlet Temperature Signal Out of Range Low....240-54-5
Diagnostic Procedure 240-54-5
ECU 003250.00 — DOC Outlet Temperature Extremely High....240-54-7
Diagnostic Procedure 240-54-7
ECU 003250.01 — DOC Outlet Temperature Extremely Low 240-54-9
Diagnostic Procedure 240-54-9
ECU 003250.03 — DOC Outlet Temperature Signal Out of Range High....240-54-11
Diagnostic Procedure 240-54-11
ECU 003250.04 — DOC Outlet Temperature Signal Out of Range Low....240-54-13
Diagnostic Procedure 240-54-13
ECU 003251.00 — DPF Differential Pressure Extremely High 240-54-15
Diagnostic Procedure 240-54-15
ECU 003251.03 — DPF Differential Pressure Signal Out of Range High....240-54-17
Diagnostic Procedure 240-54-17
ECU 003251.04 — DPF Differential Pressure Signal Out of Range Low....240-54-19
Diagnostic Procedure 240-54-19
ECU 003251.13 — DPF Differential Pressure Sensor Calibration Fault 240-54-21
Diagnostic Procedure 240-54-21
ECU 003609.03 — DPF Inlet Pressure Signal Out of Range High 240-54-23
Diagnostic Procedure 240-54-23
ECU 003609.04 — DPF Inlet Pressure Signal Out of Range Low 240-54-25
Diagnostic Procedure 240-54-25

Page

ECU 003695.14 — Exhaust Filter Cleaning Inhibited by Operator Interface (PDU) 240-54-27
ECU 003719.00 — Calculated Soot Level Extremely High 240-54-28
Diagnostic Procedure 240-54-28
ECU 003719.07 — DPF Recovery Prohibited 240-54-30
Diagnostic Procedure 240-54-30
ECU 003719.09 — DPF Recovery Failed 240-54-32
Diagnostic Procedure 240-54-32
ECU 003719.16 — Calculated Soot Level Moderately High 240-54-33
Diagnostic Procedure 240-54-33
ECU 003720.00 — Calculated Ash Level Extremely High 240-54-35
Diagnostic Procedure 240-54-35
ECU 003720.16 — Calculated Ash Level Moderately High 240-54-36
Diagnostic Procedure 240-54-36

Group 55—Diagnose—DTCs, ECU 004000 — 529999
ECU 004257.12 — Injector High Voltage Supply Internal Failure 240-55-1
Diagnostic Procedure 240-55-1
ECU 522243.05 — Engine Starter Solenoid Lockout Relay Driver Circuit Has High Resistance 240-55-2
Procedure 240-55-2
ECU 522243.06 — Engine Starter Solenoid Lockout Relay Driver Circuit Has Low Resistance 240-55-3
Procedure 240-55-3
ECU 522400.02 — Crankshaft Position Signal Invalid....240-55-5
Diagnostic Procedure 240-55-5
ECU 522400.05 — Crankshaft Position Signal Missing 240-55-7
Diagnostic Procedure 240-55-7
ECU 522401.02 — Camshaft Position Signal Invalid....240-55-9
Diagnostic Procedure 240-55-9
ECU 522401.05 — Camshaft Position Signal Missing 240-55-12
Diagnostic Procedure 240-55-12
ECU 522401.07 — Camshaft Position and Crankshaft Position Signals Out of Sync 240-55-15
Diagnostic Procedure 240-55-15
ECU 522571.03 — Suction Control Valve Low Side Drive Circuit Out of Range High 240-55-18
Diagnostic Procedure 240-55-18
ECU 522571.06 — Suction Control Valve Low Side Drive Circuit Has Low Resistance....240-55-21

Continued on next page

Page

Diagnostic Procedure 240-55-21
ECU 522572.06 — Suction Control Valve High Side Drive Circuit Has Low Resistance 240-55-24
Diagnostic Procedure 240-55-24
ECU 522572.11 — Suction Control Valve High Side Drive Circuit Current Fault 240-55-27
Diagnostic Procedure 240-55-27
ECU 522573.00 — Calculated Soot Level High 240-55-30
Diagnostic Procedure 240-55-30
ECU 522574.00 — DPF Differential Pressure Soot Level High 240-55-31
Diagnostic Procedure 240-55-31
ECU 522575.07 — Parked Regeneration Failed 240-55-32
Diagnostic Procedure 240-55-32
ECU 522576.12 — ECU EEPROM Read Error 240-55-33
Diagnostic Procedure 240-55-33
ECU 522577.11 — Parked Regeneration Not Performed 240-55-34
ECU 522578.12 — ECU EEPROM Write Error 240-55-35
Diagnostic Procedure 240-55-35
ECU 522579.12 — EGR Valve Actuator Low Resistance Error 240-55-36
Diagnostic Procedure 240-55-36
ECU 522580.12 — EGR Valve Position Internal Error 240-55-37
Diagnostic Procedure 240-55-37
ECU 522582.07 — EGR Valve Initialization Error 240-55-38
Diagnostic Procedure 240-55-38
ECU 522583.01 — EGR Valve Actuator High Temperature Sensor Fault 240-55-40
Diagnostic Procedure 240-55-40
ECU 522584.01 — EGR Valve Actuator Low Temperature Sensor Fault 240-55-41
Diagnostic Procedure 240-55-41
ECU 522585.12 — ECU Internal Fault 17 240-55-42
Diagnostic Procedure 240-55-42
ECU 522588.12 — ECU Internal Voltage High Error 240-55-43
Diagnostic Procedure 240-55-43
ECU 523489.12 — ECU Internal Voltage Low Error 240-55-44
Diagnostic Procedure 240-55-44
ECU522591.12 — Sensor Supply #2 Voltage Error 240-55-45
Diagnostic Procedure 240-55-47
ECU 522592.12 — Sensor Supply #3 Voltage Error 240-55-48
Diagnostic Procedure 240-55-49

Page

ECU 522596.09 — No CAN Message Received From Source Address 1 240-55-50
ECU 522597.09 — No CAN Message Received From Source Address 2 240-55-51
ECU 522599.09 — Vehicle Controller CAN Communication Error #1 240-55-51
ECU 522600.09 — Vehicle Controller CAN Communication Error #2 240-55-52
ECU 522601.09 — Vehicle Controller CAN Communication Error #3 240-55-52
ECU 522609.09 — Vehicle Controller CAN Communication Error #4 240-55-53
ECU 522610.09 — EGR Valve CAN Communication Error 240-55-54
Diagnostic Procedure 240-55-54
ECU 522617.12 — EGR Valve Position Mismatch 240-55-55
Diagnostic Procedure 240-55-55
ECU 522618.09 — Vehicle Controller CAN Communication Error #5 240-55-56
ECU 522619.09 — Vehicle Controller Communication Error 240-55-57
ECU 522744.04 — ECU Power Supply Output #1 Circuit Has Low Resistance 240-55-57
Diagnostic Procedure 240-55-57
ECU 522994.04 — ECU Power Supply Output #2 Circuit Has Low Resistance 240-55-58
ECU 523249.05 — Crankshaft Position and Camshaft Position Signals Invalid 240-55-59
Diagnostic Procedure 240-55-60
ECU 523460.07 — Fuel Rail Pressure Error For a Duration 240-55-61
Diagnostic Procedure 240-55-62
ECU 523462.13 — Injector #1 Calibration Error 240-55-63
Diagnostic Procedure 240-55-63
ECU 523463.13 — Injector #2 Calibration Error 240-55-64
Diagnostic Procedure 240-55-64
ECU 523464.13 — Injector #3 Calibration Error 240-55-65
Diagnostic Procedure 240-55-65
ECU 523468.09 — Rail Pressure Limiter Open 240-55-66
Diagnostic Procedure 240-55-66
ECU 523469.00 — Rail Pressure Limiter Occurrence Count Extremely High 240-55-68
Diagnostic Procedure 240-55-68
ECU 523470.00 — Rail Pressure Limiter Cumulative Time Extremely High 240-55-70
Diagnostic Procedure 240-55-70

Continued on next page

Page

ECU 523489.00 — Fuel Rail Pressure Extremely High For a Duration....240-55-72
Diagnostic Procedure....240-55-72
ECU 523491.00 — Fuel Temperature Extremely High For a Duration....240-55-74
Diagnostic Procedure....240-55-74

Group 60—Diagnose—DTCs, RMC
RMC DTC Quick Reference Table....240-60-1
Data Point Live Readings....240-60-3
RMC 000628.12 — Stuck in Boot Block....240-60-4
Stuck in Boot Block....240-60-5
RMC 002513.03 — Orange Phase (A) is Shorted to Supply....240-60-5
Orange Phase (A) is Shorted to Supply....240-60-5
RMC 002513.04 — Orange Phase (A) is Shorted to Ground....240-60-6
Orange Phase (A) is Shorted to Ground....240-60-6
RMC 002513.05 — Orange Phase (A) is Open....240-60-7
Orange Phase (A) is Open....240-60-7
RMC 002514.03 — Black Phase (B) is Shorted to Supply....240-60-8
Black Phase (B) is Shorted to Supply....240-60-8
RMC 002514.04 — Black Phase (B) is Shorted to Ground....240-60-9
Black Phase (B) is Shorted to Ground....240-60-9
RMC 002514.05 — Black Phase (B) is Open....240-60-10
Black Phase (B) is Open....240-60-10
RMC 002515.03 — Green Phase (C) is Shorted to Supply....240-60-11
Green Phase (C) is Shorted to Supply....240-60-11
RMC 002515.04 — Green Phase (C) is Shorted to Ground....240-60-12
Green Phase (C) is Shorted to Ground....240-60-12
RMC 002515.05 — Green Phase (C) is Open....240-60-13
Green Phase (C) is Open....240-60-13
RMC 003511.00 — Hall Voltage High....240-60-14
Hall Voltage High....240-60-14
RMC 003511.01 — Hall Voltage Low....240-60-15
Hall Voltage Low....240-60-15
RMC 003597.00 — Controller 14V High....240-60-16
Controller 14V High....240-60-16
RMC 003597.01 — Controller 14V Low....240-60-17
Controller 14V Low....240-60-17

Page

RMC 521153.15 — Controller Shutdown Over Temp....240-60-18
Controller Shutdown Over Temp....240-60-18
RMC 522327.00 — Motor Over Temp....240-60-19
Motor Over Temp....240-60-19
RMC 522917.00 — Controller Current Threshold 3 Shutdown....240-60-21
Controller Current Threshold 3 Shutdown....240-60-21
RMC 522917.06 — Controller Hardware Current Shutdown....240-60-22
Controller Hardware Current Shutdown....240-60-22
RMC 522917.15 — Controller Current Threshold 1 Shutdown....240-60-24
Controller Current Threshold 1 Shutdown....240-60-24
RMC 522917.16 — Controller Current Threshold 2 Shutdown....240-60-25
Controller Current Threshold 2 Shutdown....240-60-25
RMC 522918.00 — Motor Start Failed 3x Fault....240-60-27
Motor Start Failed 3x Fault....240-60-27
RMC 522918.02 — Motor Spin Direction Shutdown....240-60-28
Motor Spin Direction Shutdown....240-60-28
RMC 522918.15 — Motor Stalled While Running....240-60-30
Motor Stalled While Running....240-60-30
RMC 522919.03 — Hall Resync Shutdown....240-60-32
Hall Resync Shutdown....240-60-32
RMC 522919.12 — Invalid Hall State Detected at Start Up....240-60-33
Invalid Hall State Detected at Start Up....240-60-33
RMC 523666.00 — Bus Voltage High....240-60-34
Bus Voltage High....240-60-34
RMC 523666.01 — Bus Voltage Low....240-60-35
Bus Voltage Low....240-60-35
RMC 523666.02 — Low VBus on Start....240-60-36
Bus Voltage Low....240-60-37

Group 70—Tests and Adjustments
Summary of References....240-70-1
PDU I/O Status Displays....240-70-1
Engine Oil Service Timer....240-70-4
Hydraulic Oil Service Timer....240-70-5
Hydrostatic Transmission Calibration Procedure....240-70-6
Hydrostatic Valve Calibration Procedure....240-70-7
CAN Message Not Received....240-70-8

Continued on next page

Page

CAN Message Received Error 240-70-9
CAN Message Received Is Incorrect..... 240-70-10
Terminal Test 240-70-11
Verification Procedure 240-70-13
Procedure 240-70-13
Wiggle Test..... 240-70-14
Short to Voltage Procedure 240-70-15
Diagnostic Procedure 240-70-15
Electronic Injector — Calibration Information..... 240-70-16
Aftertreatment Verification Procedure 240-70-16
Accessing Diagnostic Trouble Codes 240-70-17
CAN Communication Fault Checks..... 240-70-18
CAN Bus Terminator Test 240-70-19
Control Unit Messaging Errors 240-70-19
CAN Network Voltage Checks..... 240-70-20
Erroneous Diagnostic Trouble Codes 240-70-22
Control Unit Information and Overview Test..... 240-70-22
Troubleshooting Electronic Controllers 240-70-23
Diagnostic Information..... 240-70-23
Readings Overview 240-70-24
Problem Not Found Procedure..... 240-70-25
Diagnostic Procedure 240-70-25
Approved Software for Control Units 240-70-25

Summary of References

- Display Navigation
- Mower Setup Menu
- Service Menu
- Diesel Particulate Filter (DPF) Menu
- Mow Engine Speed Screen
- Reel Speed Screen
- Mow Speed Screen
- Turn Speed Screen
- Transport Speed Screen
- LoadMatch Screen
- Cruise Control Screen
- Display Setup Screen
- Pass Codes
- Language Select
- Text Select
- Engine RPM
- Backlap Screen
- Backlap Speed
- Stored Diagnostic Trouble Codes (DTCs)
- Input/Output Status
- Service Timers
- Pedal Calibration
- Hydrostatic Transmission Calibration
- Hydrostatic Valve Calibration
- Diesel Particulate Filter Regeneration
- Pass Code - Change
- Pass Code - Reset

OUMX258,0000410 -19-01APR15-1/1

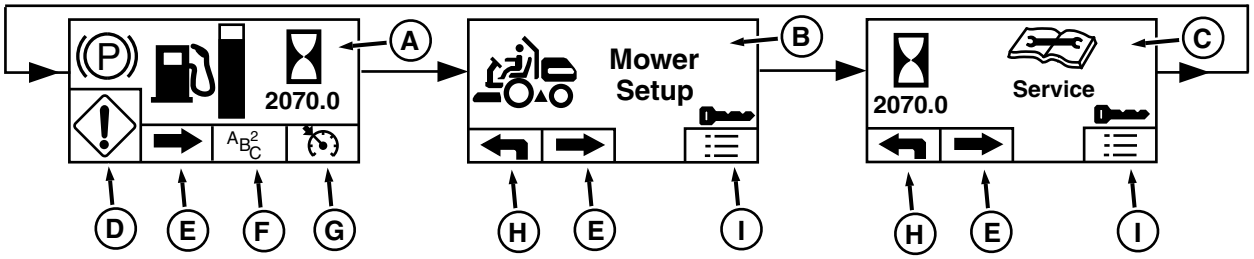
Display Navigation

There are two top-level default menus displayed on the primary display unit (PDU) screen. One is for non-Tier 4 engine machine models and has three screens at the top operator level that can be cycled through. The other is for Tier 4 (controlled engine) machines and has four screens that can be cycled through.

Icons are displayed above the four operator buttons to depict the current function available for each button.

Buttons may or may not have a function option on different screens. If a function is not available for a button there is not an icon displayed above that button.
The area above the first button is reserved on the main menu for the diagnostic icon. A key displayed above an icon indicates that a pass code is required for that selection.

Non-Tier 4 Main Menu



TCT012122 —UN—31MAR15

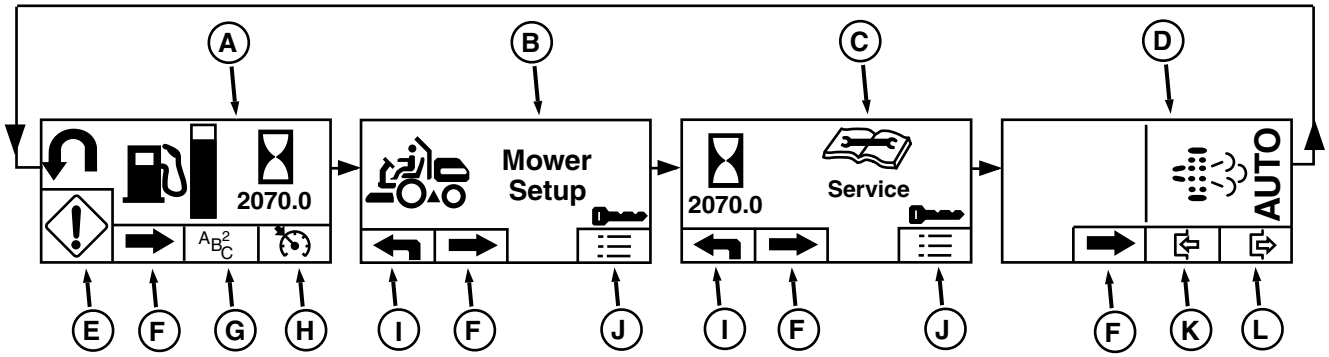
Non-Tier 4 Main Menu

A—Mow Mode, Engine Speed, and Target Speed Screen
B—Mower Setup Screen
C—Service Screen
D—Button 1: Active DTC Warning Icon
E—Button 2: Go to Next Screen
F—Button 3: Operator Language Select
G—Button 4: Enable/Disable Cruise Control
H—Go to Primary Home Screen
I— Menu Options List

Continued on next page

OUMX258,0000407 -19-10APR15-1/5

Tier 4 Main Menu



TCT012123 —UN—31MAR15

Tier 4 Main Menu

A—Turn Mode, Fuel Level, Machine Hours Screen
B—Mower Setup Screen
C—Service Screen
D—Diesel Particulate Filter (DPF) Screen
E—Button 1: Active DTC Warning Lamp
F—Button 2: Go to Next Screen
G—Button 3: Operator Language Select
H—Button 4: Enable/Disable Cruise Control
I— Go to Primary Home Screen
J—Menu Options List
K—Engage
L—Disengage

Mower Setup Menu

The mower setup screen sublevel menu list requires a password to access the sublevel menu screens. After the password has been entered an option can be displayed and changed using the button under the indicator icon.

The Display Setup screen has another sublevel menu that can be displayed. See Mower Setup Menu.

Service Menu

The service menu screen options list requires a password to access the options screens. After the password has been entered an option can be displayed and changed using the button under the indicator icon.

The Stored Diagnostic Trouble Codes, I/O Status, Service Timers, Pedal Calibrations. Hydrostatic Transmission Calibration, and the Hydrostatic Valve Calibrations screens have sublevel menu options list that can be displayed. See Service Menu.

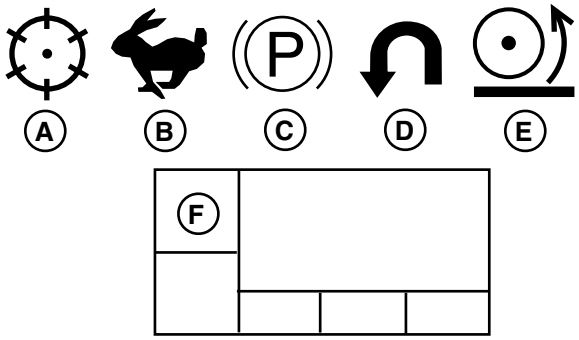
Diesel Particulate Filter (DPF) Status Screen

The DPF status screen displays the status of the diesel particulate filter regeneration. The automatic active regeneration may be enabled or disabled. Indicators display when a parked regeneration is in progress and may display warning indicators. See Diesel Particulate Filter Regeneration.

OUMX258,0000407 -19-10APR15-2/5

Mode Icons

The top left area of the screen is reserved for the Mode display. It displays an icon according to value of the CAN mower traction mode.



TCT009982 —UN—12FEB14

A—Mow: PTO On, Cutting Units Lowered
B—Transport: PTO Off, Park Brake Off
C—Park: Park Brake Engaged
D—End-of-Cut: PTO On, Units Raised
E—LoadMatch: Automatic Ground Speed Adjustment
F—Reserved Display Area

Continued on next page

OUMX258,0000407 -19-10APR15-3/5

Warning Indicator Icons

A - Low-level warning for informational purposes.

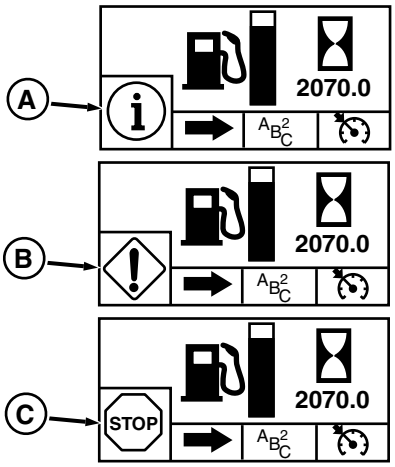
B - This indicates that there is a warning alert that needs to be addressed.

C - This indicates that there is a service alert that needs to be addressed.

The icons are displayed when DTC(s) are active on the CAN bus. The displayed icon is selected based on priority.

When button 1 is pressed with active faults, and there are more than one fault, the faults are viewed one at a time. The order of display is based on priority.

A—Protect Icon, Information
B—Warning Icon
C—Stop Icon



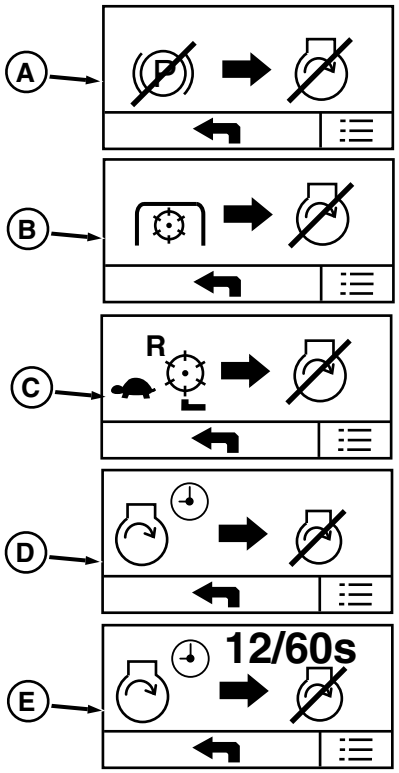
TCT009983 —UN—03FEB14

OUMX258,0000407 -19-10APR15-4/5

Start Interlock Violations

These indicators show a condition that prevents the machine from starting.

A—Park Brake Not Engage, No Crank
B—PTO On, No Crank
C—Backlap Engaged
D—Cranking Time Exceeded
E—Starting Motor 60 Second Cool Down



TCT012125 —UN—31MAR15

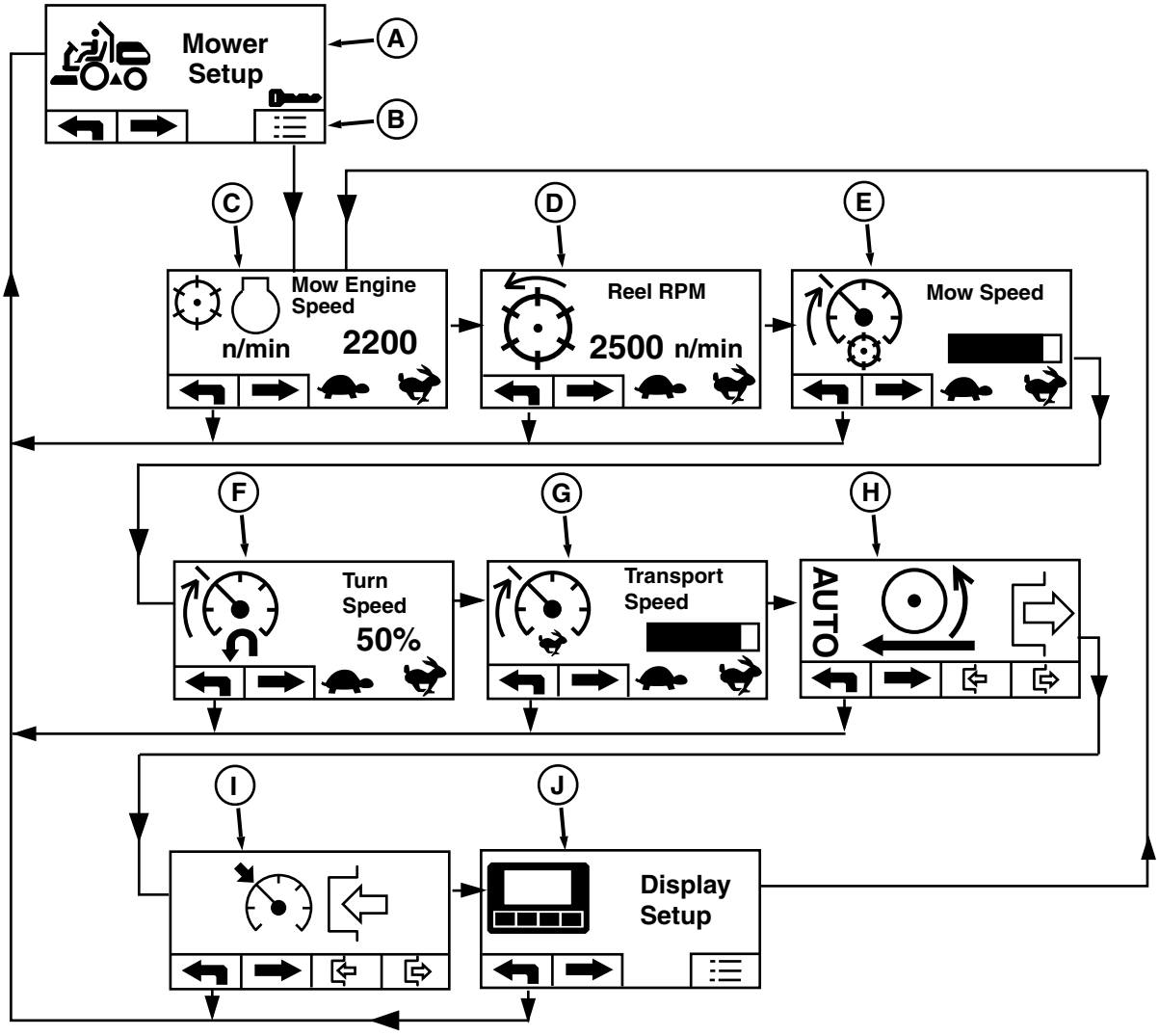
OUMX258,0000407 -19-10APR15-5/5

Mower Setup Menu

Within Mower Setup, the operator is able to set controls and parameters for how the machine operates.

The mower setup screen menu options list requires a password to access the options screens. After the password has been entered menu option screens are displayed using the forward (button 2) or go back (button 1) selections. Adjusting speeds and mower engagement is selected and changed using the buttons (buttons 3 and 4) under the icons. If an incorrect password is entered the screen will display an error message and return to the Mower Setup screen after 2 seconds.

The Display Setup screen has a sublevel menu options list. (See Display Setup Screen.).



Mower Setup Menu

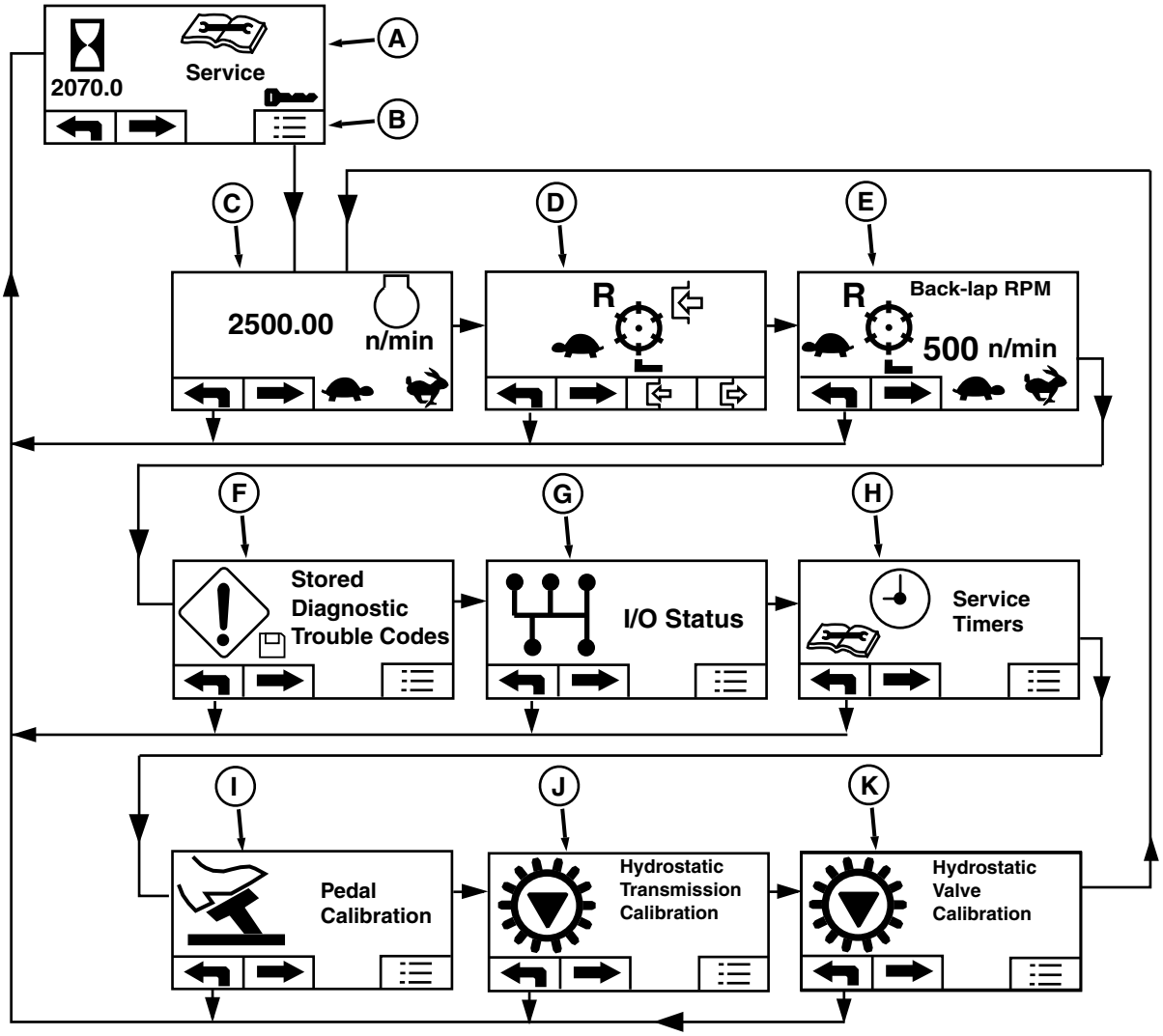
A—Mower Setup Screen
B—Menu Options List
C—Mow Engine Speed Screen
D—Reel RPM Screen
E—Mow Speed Screen
F—Turn Speed Screen
G—Transport Speed Screen
H—LoadMatch Enable/Disable Screen
I— Cruise Control Enable/Disable Screen
J— Display Setup Screen and Sub-Level Menu

OUMX258,00002FE -19-10APR15-1/1

Service Menu

The main menu Service screen displays the hour meter for the machne and is the only entry point to access the service screens when the sub-level menu (button 4) is pressed.

A four digit pass code is required to gain access to the sub-level screens. The default pass code is “1111”.



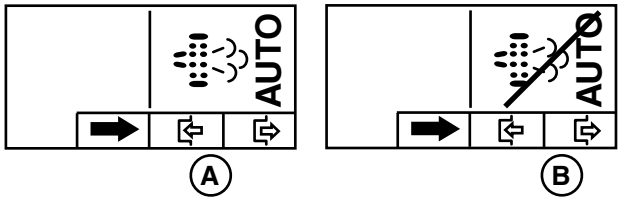
A—Service Screen
B—Menu Options List
C—Engine RPM Screen
D—Backlap Screen
E—Reel RPM Backlap Speed
F—Backlap Engage/Disengage Screen
G—Backlap RP Screen
H—Stored Diagnostic Codes Screen
I— Input/Output Status Screen
J— Service Timers Screen
K—Pedal Calibration Screen
L—Hydrostatic Transmission calibration
M—Hydrostatic Valve calibration

OUMX258,00002FF -19-02APR14-1/1

Diesel Particulate Filter (DPF) Menu

The Diesel Particulate Filter (DPF) screen is only available on the Tier 4 controlled engine machines. The top-level screens display CAN messages and DTCs. With automatic active regeneration active the machine performs an active regeneration any time the automatic active regeneration is not inhibited or disabled.

DTC messages appear in the display to indicate that a parked, or stationary, regeneration should be performed or is required. See Diesel Particulate Filter Regeneration.



TCT010468 —UN—07FEB14

No Regeneration Required

A—Automatic Active Regeneration Enabled

B—Automatic Active Regeneration Disabled

OUMX258,0000353 -19-01APR15-1/1

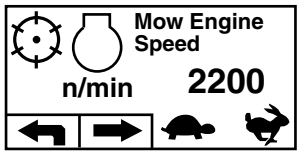
Mow Engine Speed Screen

Non-Tier 4 Machines: The Mow Engine Speed screen provides the superintendent the ability to set a target for the operator to achieve with the mechanical throttle when the PTO is engaged. The target rpm and current “live” rpm displays on the home screen, the operator adjusts the throttle to meet the target.

Tier 4 Machines: This screen sets the engine rpm for Mow and End-of-Cut Traction Modes.

- If RPM Value message is not available, display shows “---- n/min
- Rated engine rpm is the default speed.
- The text “MOW ENGINE SPEED” is not displayed when Text is disabled under the Display Setup Menu.

TCT009991 —UN—05FEB14



1. Press and hold the Tortoise button to decrease engine speed. Release when desired speed is reached.
2. Press and hold the Hare button to increase engine speed. Release when desired speed is reached.
3. Press next button to go to the next setting if desired.

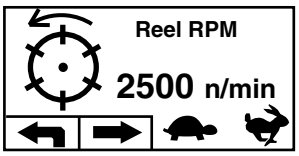
OUMX258,0000354 -19-10APR15-1/1

Reel Speed Screen

The Reel Speed screen provides the ability to adjust the rotational speed of the electric reel motors to set for mowing and backlap procedures.

1. Press and hold the Tortoise button to decrease reel speed. Release when desired speed is reached.
2. Press and hold the Hare button to increase reel speed. Release when desired speed is reached.

TCT010851 —UN—12MAR14



OUMX258,0000409 -19-12MAR14-1/1

Mow Speed Screen

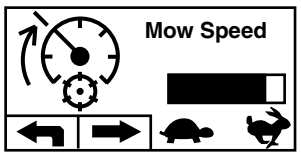
The PDU shows the mow speed setting when the PTO is on and the cutting units are down. The maximum mow speed for a mower is preset at the factory (bar graph filled black). The mow screen is used to set the mow speed electronically. No tools are needed to adjust.

A GPS unit or the time/distance method is needed to calibrate speed accurately.

- The text “MOW SPEED” is not be displayed when Text is disabled under the Display Setup Menu
- Minimum setting is 20% and displays as partially filled bar graph

1. Press and hold the Tortoise button to decrease mow speed. Release when desired speed is reached.

TCT009992 —UN—05FEB14



Tier 4 Mow Speed

2. Press and hold the Hare button to increase mow speed. Release when desired speed is reached.

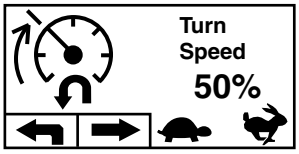
OUMX258,0000355 -19-01APR15-1/1

Turn Speed Screen

Turn speed is the ability to slow a mower to a percentage of the Mow Speed while cutting units are raised to the cross cut position. The Turn Speed can be set from 50—100%. The mower will slow to the percentage of the mow speed set when the cutting units are raised and PTO ON. The mower will resume the Mow Speed when cutting units are lowered back down to the cutting surface.

- Expressed as a percentage of the maximum Mow Speed. See “Mow Speed”.
- The text “TURN SPEED” will not be displayed if Text is disabled under the Display Setup Menu.
- Min 50%
- Max 100%

TCT009993 —UN—05FEB14



1. Press and hold the Tortoise button to decrease turn speed. Release when desired speed is reached.
2. Press and hold the Hare button to increase turn speed. Release when desired speed is reached.

OUMX258,0000356 -19-17JUN14-1/1

Transport Speed Screen

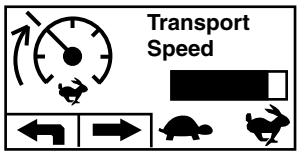
The maximum transport speed for a mower is preset at the factory. The TechControl provides a means to limit the speed which the machine can travel with the PTO not engaged.

The transport speed is set electronically. No tools are needed to adjust.

A gps unit or the time/distance method is used to calibrate speed accurately.

- The graphical text “TRANSPORT SPEED” is not displayed when Text is disabled under the Display Setup Menu.
- Minimum setting is 20%.
- Maximum setting is 100% and is displayed as all filled.

TCT009994 —UN—05FEB14



1. Press and hold the Tortoise button to decrease transport speed. Release when desired speed is reached.
2. Press and hold the Hare button to increase transport speed. Release when desired speed is reached.

OUMX258,0000357 -19-01APR15-1/1

LoadMatch Screen

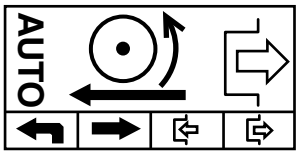
The LoadMatch™ screen sets engage or disengage of LoadMatch in the Mow mode. When LoadMatch is engaged, the machine slows under a heavy load to allow the cutting units to maintain cut quality.

- This screen enables or disables the LoadMatch feature available in Mow mode.
- The LoadMatch state is stored in non-volatile memory
- Default state is disabled

NOTE: LoadMatch™ is not currently available on hybrid machines.

LoadMatch is a trademark of Deere & Company

TCT009996 —UN—05FEB14



1. Press and release the “In” button to engage.
2. Press and release the “Out” button to disengage.

OUMX258,0000358 -19-10APR15-1/1

Cruise Control Screen

The cruise control screen enables the cruise control feature. When the cruise control is enabled on this screen, the operator can engage cruise control from the home screen. If cruise is disabled, icon (A) above button 4 is not visible on the home screen.

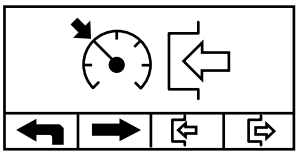
- This screen enables or disables the cruise control feature available in Mow mode.
- The cruise control state is stored in non-volatile memory
- Default state is disabled

1. Press and release the “In” button to engage.
2. Press and release the “Out” button to disengage.

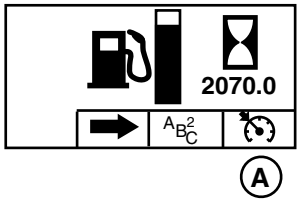
Main Screen Control

The button 4 icon (A) on the main screen is displayed when the cruise control is enabled. When button 4 is pressed for 0.35 seconds, and while the machine is moving forward at the proper speed, the TechControl ‘sets’ the cruise control. When button 4 is momentarily pressed the cruise control is disengaged. When the cruise control is engaged or disengaged the large area above buttons 3 and 4 displays an appropriate cruise icon.

TCT009997 —UN—05FEB14



Cruise Control Screen Under Mower Setup



TCT010531 —UN—18FEB14

Cruise Control - Main Screen

A—Button 4: Cruise Control

OUMX258,0000359 -19-10APR15-1/1

Display Setup Screen

Once at the display setup menu, the sublevel menus display pass code, language options, and firmware version:

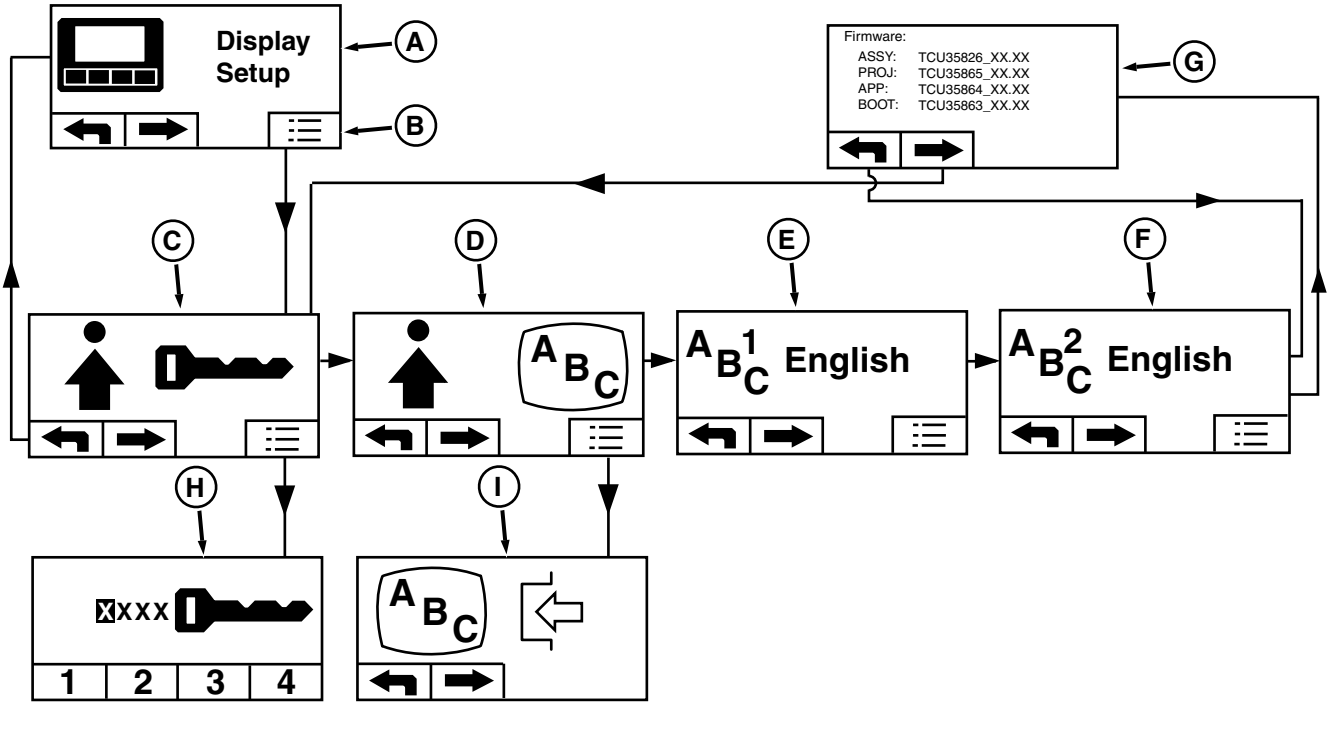
- Change Owner Pass Code
- Text On-Off Setup
- Language Selection - Operator Language 1
- Language Selection - Operator Language 2
- Version Info

Display Setup Sub-Level Screen

Selecting the sublevel options displays the change options screen (C). Selecting the change screen sublevel and then entering the current pass code displays the change pass code screen. See Pass Codes.

Selecting the next screen option selects the language options menu screen. See Text Select or Language Select.

When the button 1 icon displays as a left arrow, it takes the operator back to the Display Setup home screen (A).

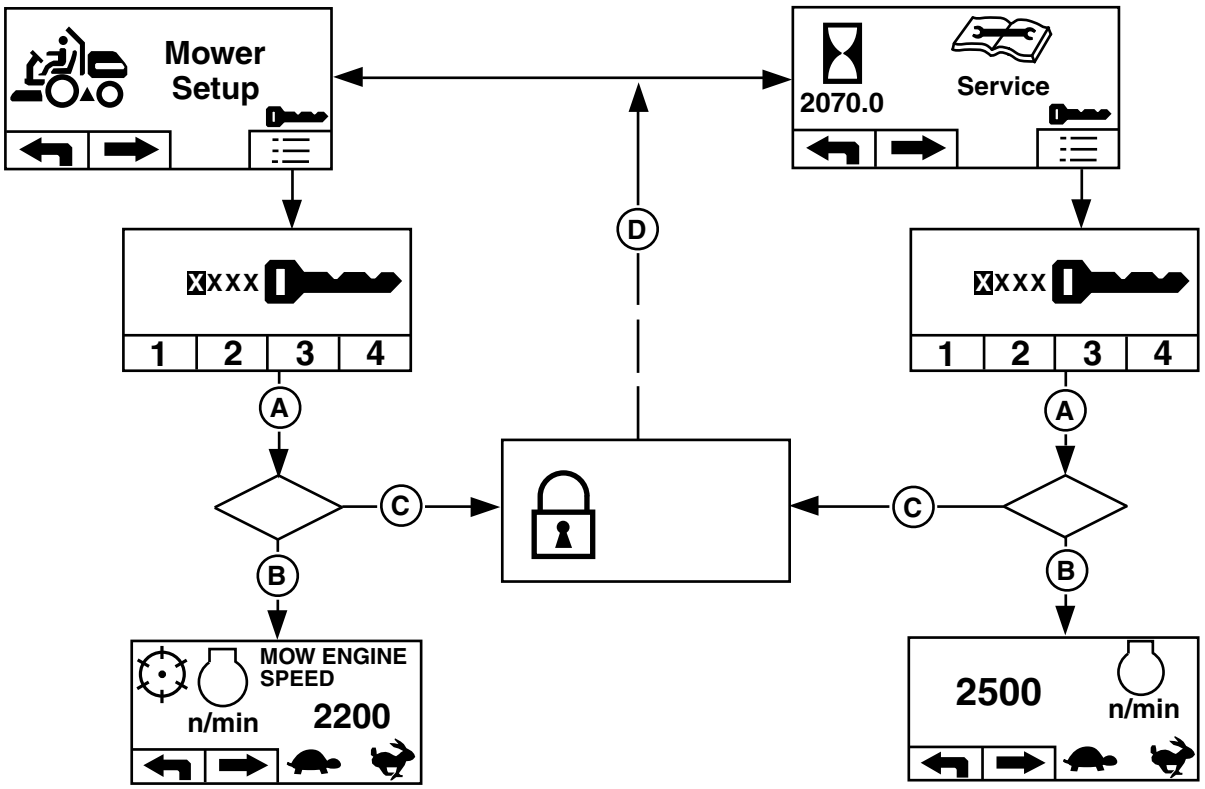


Display Setup Sublevel Screen

A—Display Setup Screen
B—Menu Options List
C—Change Operator Pass Code
D—Text Mode Menu Screen
E—Change Operator 1 Language
F—Change Operator 2 Language
G—Firmware Version
H—Change Pass Code
I— Text Mode Enable-Disable Screen

OUMX258,000035A -19-01APR15-1/1

Pass Codes



A—Pass Code Entered
B—Pass Code Correct - Yes
C—Pass Code Correct - No
D—2 Second Delay

There is one level of password protection to enhance machine security and restrict access to certain features.

Use the pass code is to perform the following:

- Mower setup
- Service setup
- Pass code change

The default owner pass code is “1111”.

The password can be changed. (See Pass Code - Change.)

In the event of a lost pass code, Service ADVISOR is required to reset. (See Pass Code - Reset.)

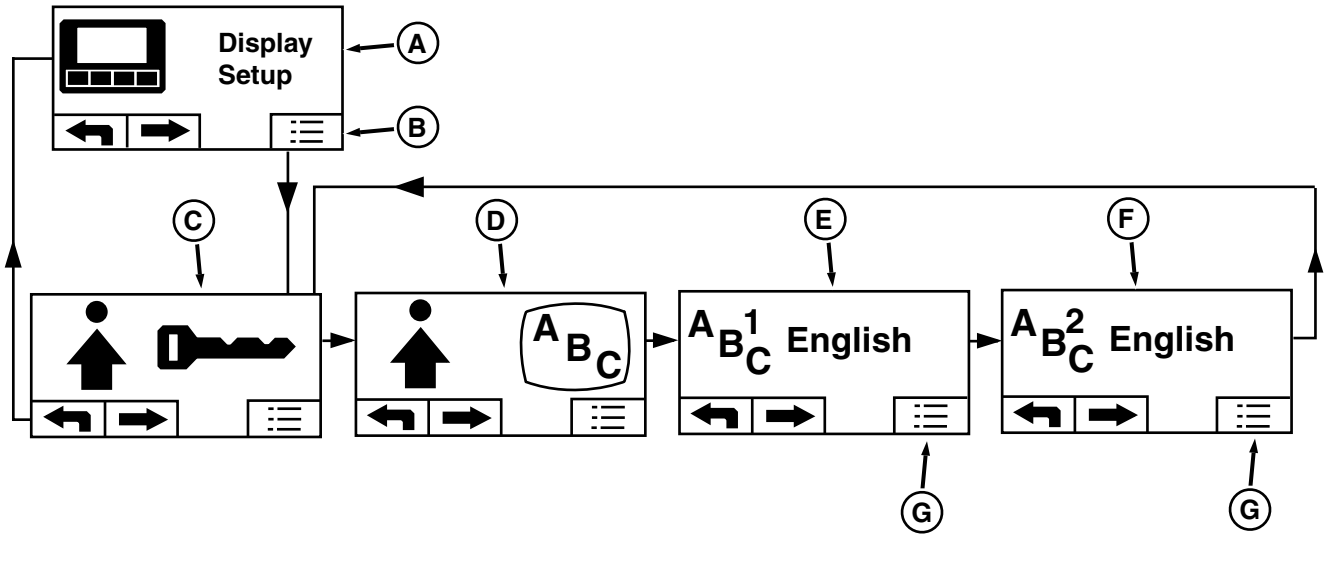
OUMX258,000035B -19-10APR15-1/1

Language Select

The display can show text in the following languages:

- English
- French
- German
- Italian
- Spanish
- Portuguese
- Russian
- Chinese

The language displayed may be changed. Different languages can be displayed for each of two operators. Language changes are made in a sublevel menu of the display setup screen.



A—Display Setup Screen
B—Button 4: Sublevel Menu
C—Passcode Screen
D—Text Mode Menu Screen
E—Operator 1 Language
F—Operator 2 Language
G—Button 4: Language Cycle

The language screens are cycled by pressing the forward button. Repeatedly press button 4 to cycle through the language list and select operator language.

All displayed text may be turned off. For setup information See Text Select.

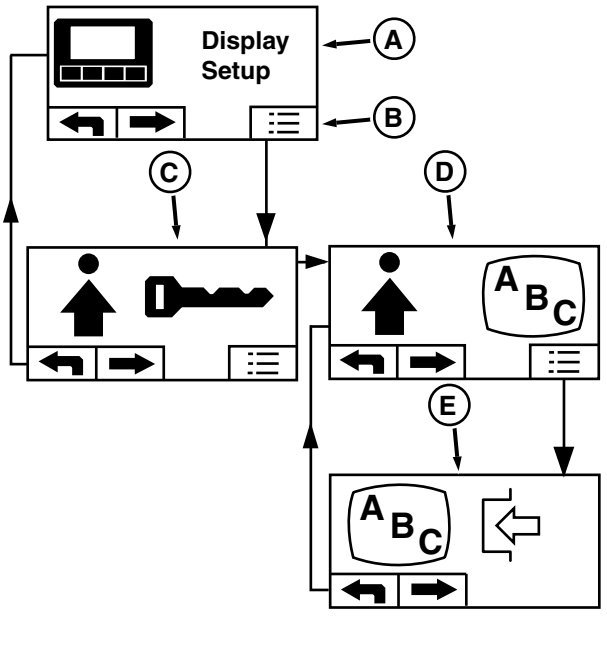
OUMX258,000035C -19-10APR15-1/1

Text Select

The text display can be changed to show the text or hide the text. Text display changes are made in a sublevel menu of the language and text options screen. A pass code is required at the text options screen sublevel menu selection. The text on-off sublevel menu pass code is: **1212**.

When the text on-off screen (E) is shown the text is toggled on and off by pressing button 2.

A—Display Setup Screen
B—Button 4: Sublevel Menu
C—Passcode Screen
D—Text Mode Enable/Disable Screen
E—Text On-Off Screen



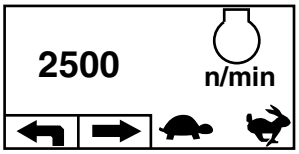
TCT012442 —UN—01APR15

Text Display On-Off

OUMX258,000035D -19-10APR15-1/1

Engine RPM

TCT010470 —UN—07FEB14



Tier 4 Machines: The engine rpm screen and sublevel menu is used to adjust engine rpm. The engine rpm is set in Service Mode only.

The park brake must be engaged to adjust engine speed

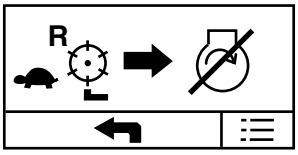
1. Press and hold the Tortoise button to decrease engine speed. Release when desired speed is reached.
2. Press and hold the Hare button to increase engine speed. Release when desired speed is reached.

Non-Tier 4 Machines: The engine speed is displayed but the engine speed is controlled manually with the throttle.

OUMX258,000035F -19-01APR15-1/1

Backlap Screen

TCT010501 —UN—11FEB14



The backlap screen is used to enable or disable backlap operation by reversing the reel motors. The controller start up default is disable.

1. Press the 3rd button to enable backlap operation and reverse the rotation of the reels.
2. Press the 4th button to disable backlap operation and return the rotation to the forward mow rotation.

OUMX258,0000449 -19-13JUN14-1/1

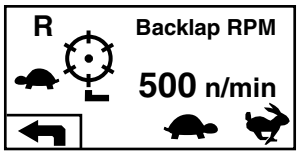
Backlap Speed

The backlap speed adjustment screen is used to vary the reel speed during backlap operations. The text Backlap RPM is displayed if the text display is enabled.

The reel speed can be adjusted in 20 rpm increments

1. Press the left button to return to the backlap screen.
2. Press and hold the Tortoise button to decrease reel speed. Release when desired speed is reached.

TCT010544 —UN—02APR14



3. Press and hold the Hare button to increase reel speed. Release when desired speed is reached.

OUMX258,000044A -19-02APR14-1/1

Stored Diagnostic Trouble Codes (DTCs)

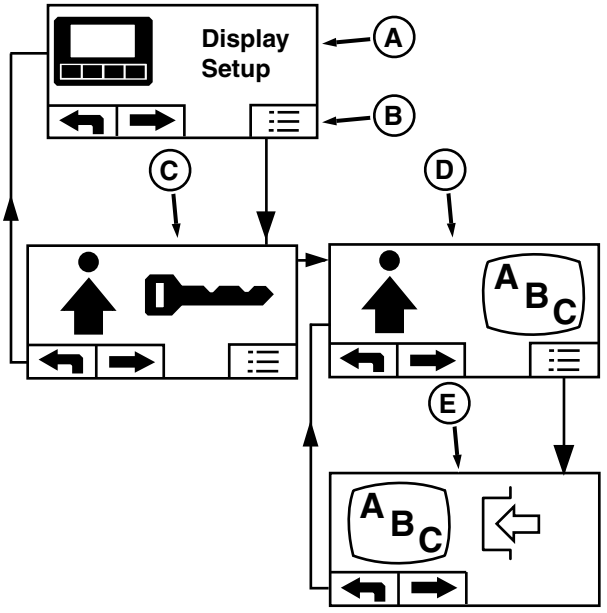
The stored diagnostic trouble code screen and sublevel menus are used to display stored DTCs.

The DTCs are organized and shown by control units. Typical control units on these machines are ECU, VCU, PDU, etc.

Stored DTCs can be cleared in the sublevel menu of the selected control unit. This screen shows the number of DTCs, the specific DTC digit code, and the number of times the DTC has occurred.

1. Press the sublevel menu button (B) to access the DTC information screen.
2. Select the control unit to view by pressing the next button (C) until it is displayed.
3. Press the sublevel menu button (D) to access the DTC information screen.
4. Press the Clear DTCs button (E) to clear DTCs from memory.

A—Stored Diagnostics Codes Screen
B—Menu Options List
C—Button 2: Next
D—Menu Options List
E—Button 3 and Button 4: Clear DTCs



TCT012442 —UN—01APR15

OUMX258,0000304 -19-01APR15-1/1

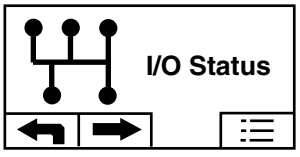
Input/Output Status

The Input and Output (I/O) screen is used as a diagnostic tool to check whether inputs or outputs are turning on or off. Battery voltage, switch inputs, switch outputs, cutting unit outputs, and sensor inputs are examples of I/O status that can be displayed.

Each screen that is displayed can show from one to four icons that indicate an input function or output function is active.

For more information on individual Input/Output screens, see PDU I/O Status Displays in Section 240, Group 70.

TCT010472 —UN—07FEB14



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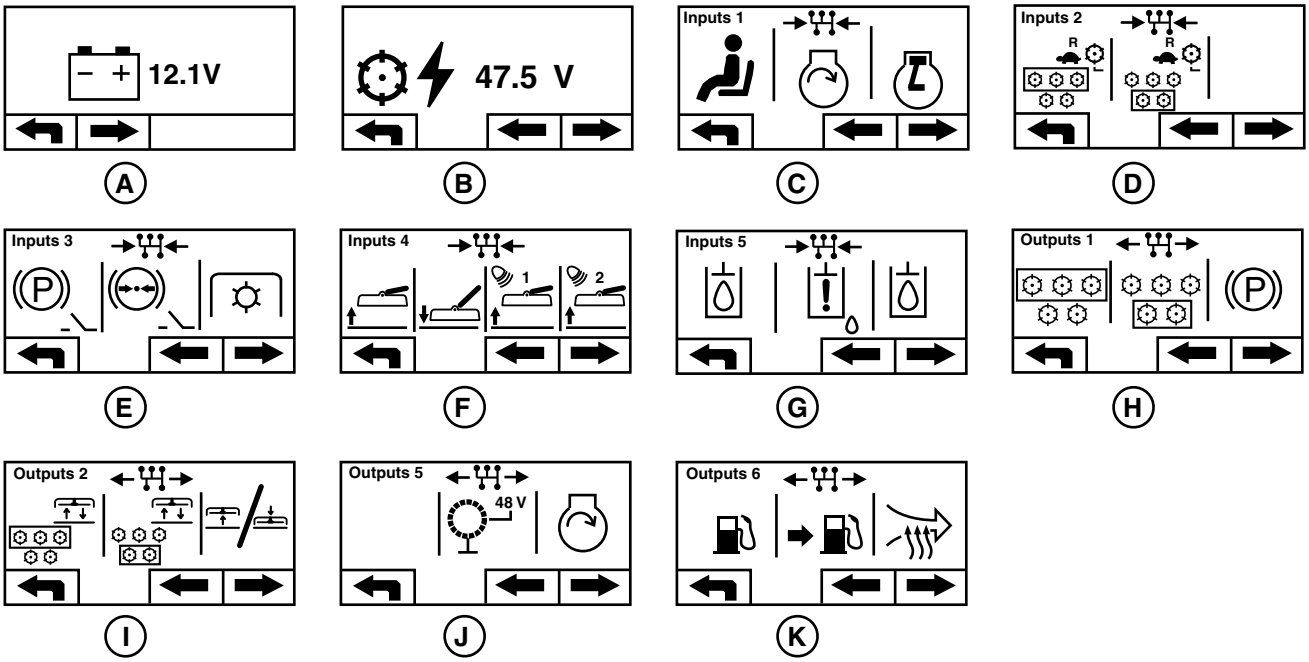
OUMX258,000040D -19-02APR15-1/2



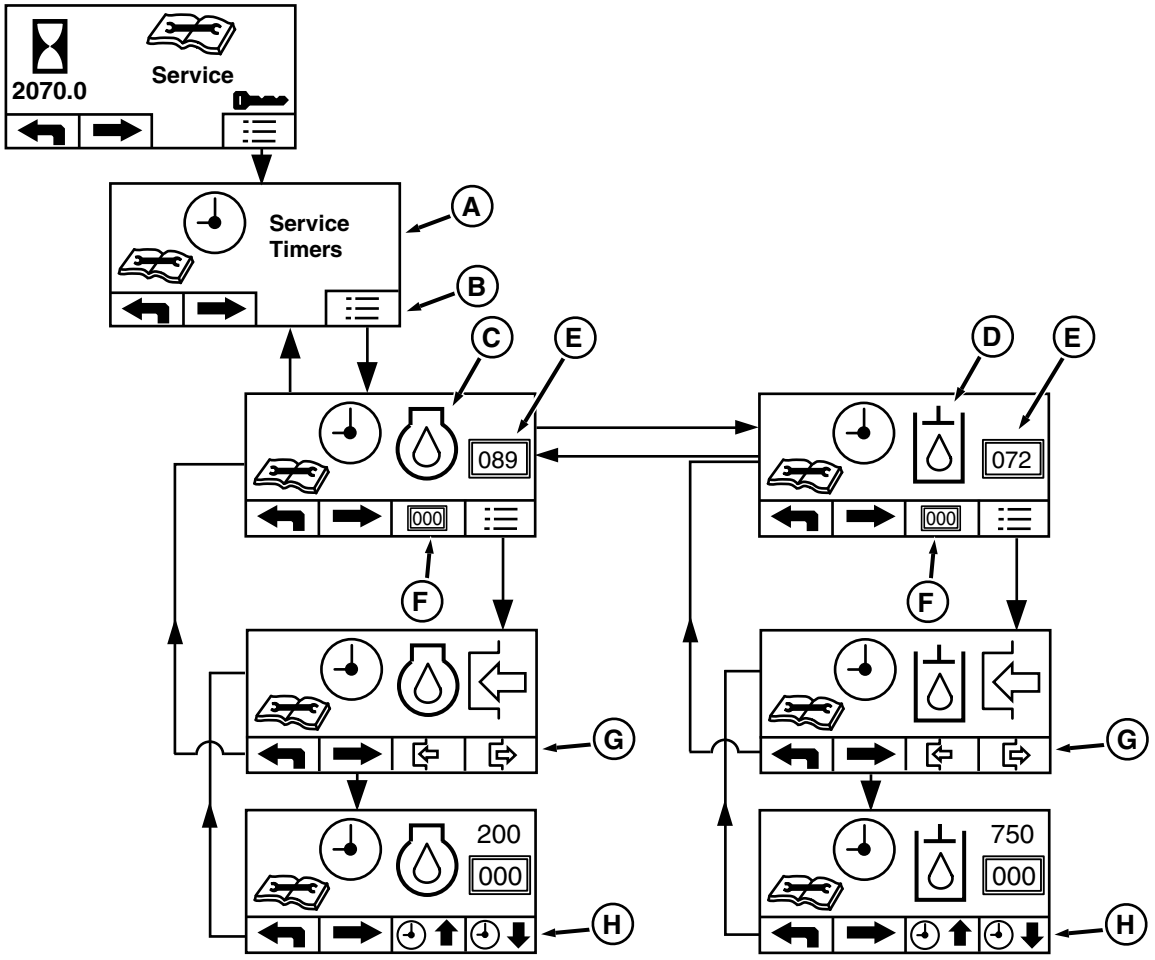
TCT010473 —UN—12MAR14

A—Battery Voltage
B—48 V Alternator Output
C—Seat Switch, Key Switch=Start, Key Switch=Run
D—Backlap Front Switch, Backlap Rear Switch
E—Park Brake Switch, Brake Pressure, PTO Switch
F—Raise Switch, Lower Switch, Proximity Sensors 1 and 2
G—Hydraulic Oil Filter Restriction Switch, Hydraulic Oil Leak Detected (not available), Hydraulic Oil Overtemperature Switch
H—Mow Solenoid Front Solenoid, Mow Solenoid Rear Solenoid, Park Brake Solenoid
I— Deck Raise/Lower Front Solenoid, Deck Raise/Lower Rear Solenoid, Raise/Lower Select Solenoid
J— 48 V Alternator, Starter Relay
K—Run Request (T4 Engines) or Fuel Hold (Non-T4), Fuel Pull-In Relay (Non-T4), Preheat Relay (Non-T4)

OUMX258,000040D -19-02APR15-2/2

Service Timers

The service timer function is available to track the machines service schedule for engine oil and hydraulic oil. A reminder displays in the TechControl when the machines hours reach the target hours set.



TCT007228 —UN—10MAR14

A— Service Timers Screen
B— Button 4: Sub-Level Menu
C— Engine Oil Timer Screen
D— Hydraulic Oil Timer Screen
E— Elapsed Hours Since Last Reset
F— Button 3: Hours Reset
G—Buttons 3 or 4: Timer On or Off
H—Buttons 3 or 4: Service Timer Interval

- Press the sub-level menu button (B) on the Service Timer menu to access the timer screens.
- Toggle between the engine oil timer screen and hydraulic oil timer screen
- Press the menu button (F) to reset elapsed hours to zero.
- Press the sub-level menu button on the selected oil timer to access the timer on/off function and service timer interval set functions.
- Select timer On or timer Off (engage or disengage) function (G).
- Set the timer interval for engine oil or hydraulic oil (H).
  - Button 2: Move curser to the right to select timer digit (1st, 2nd, 3rd)
  - Button 3: Increase digit (range: 1st digit 0-2, 2nd digit 0-9, 3rd digit 0-9) for engine oil
  - Button 3: Increase digit (range: 1st digit 0-7, 2nd digit 0-9, 3rd digit 0-9) for hydraulic oil
  - Button 4: Decrease digit

(See Engine Oil Service Timer or Hydraulic Oil Service Timer.)

Maximum Interval Hours

Engine oil timer: **200** hours

Hydraulic oil timer: **750** hours

OUMX258,0000362 -19-02APR14-1/1

Pedal Calibration

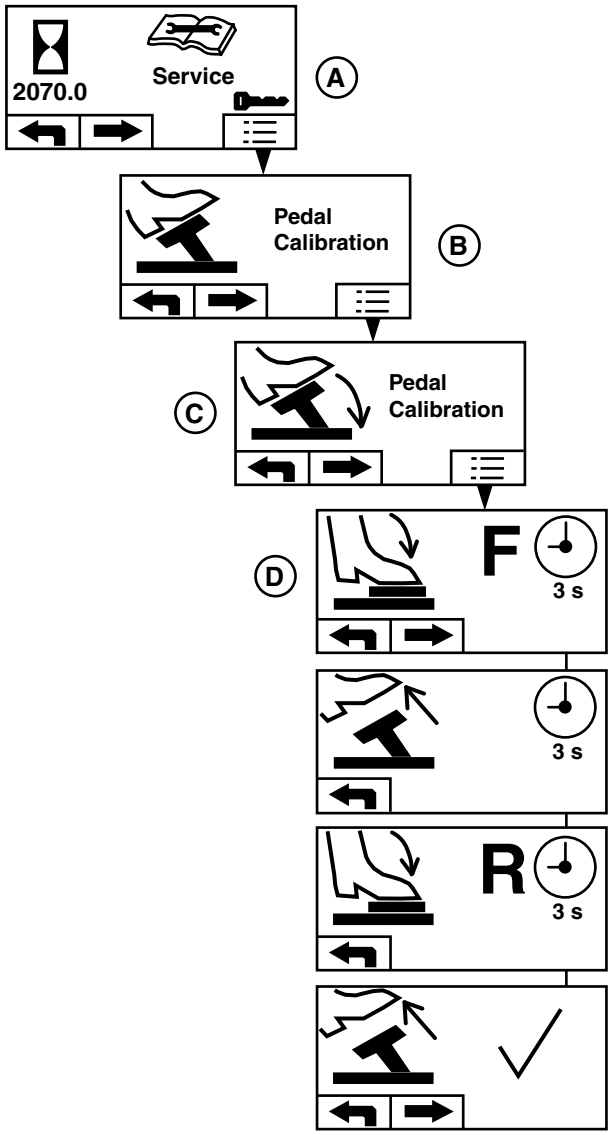
Pedal calibration is necessary when the pedals or one of the sensors have been replaced. Additionally, over a long time, the pedal position sensor may wear and lose the ability to detect neutral.

Pedal calibration is accessed through the main service screen menu sublevel menu and cycling through the sublevel menu options to the pedal calibration screen (B). Pedal calibration is started by pressing the sublevel menu (button 4) when the pedal calibration screen (B) is shown.

During calibration the pedal must remain in each position for 3 seconds. The PDU screen provides steps for calibration.

1. Enter pedal calibration mode
2. Display shows “Pedal Calibration” procedure start screen.
3. Press forward pedal down completely and hold for three seconds.
4. Release pedal for three seconds.
5. Display shows reverse calibration screen.
6. Depress reverse pedal down completely and hold for three seconds.
7. Release reverse pedal.
8. If successful, “Pedal Calibration Complete” displays.
9. If not successful, repeat procedure.

A—Service Screen
B—Pedal Calibration Screen
C—Button 4: Pedal Calibration Procedure
D—Button 4: Start Calibration



TCT012444 —UN—02APR15

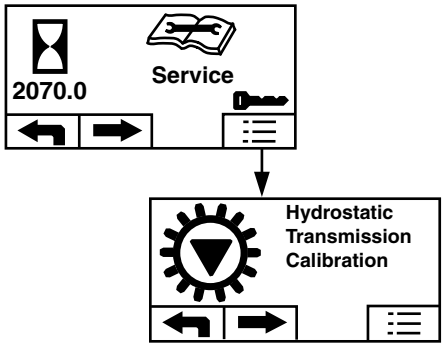
OUMX258,0000363 -19-02APR15-1/1

Hydrostatic Transmission Calibration

Whenever the pump control unit has been replaced or adjusted, the hydrostatic transmission calibration is needed.

Calibration is performed with the engine off.

If the software payload has been reinstalled or updated, the pump may need to be calibrated. See Hydrostatic Transmission Calibration Procedure.



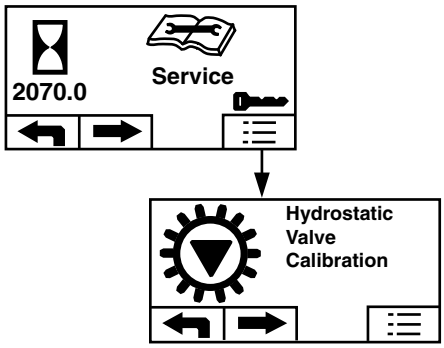
TCT009987 —UN—05FEB14

OUMX258,000040E -19-02APR14-1/1

Hydrostatic Valve Calibration

If the hydrostatic pump has been replaced the hydrostatic valve needs to be calibrated.

The calibration process takes approximately five minutes and the engine must be running with the park brake engaged. See Hydrostatic Valve Calibration Procedure.



TCT009988 —UN—05FEB14

OUMX258,0000365 -19-02APR15-1/1

Diesel Particulate Filter Regeneration

The TechControl PDU displays status and functions of engine regeneration used to monitor and clean the Diesel Particulate Filter (DPF).

No Regeneration required

The Diesel Particulate Filter (DPF) screen indicates the status of automatic active regeneration, either enabled (A) or disabled (B). If a parked regeneration is available the left button Parked Regeneration icon displays.

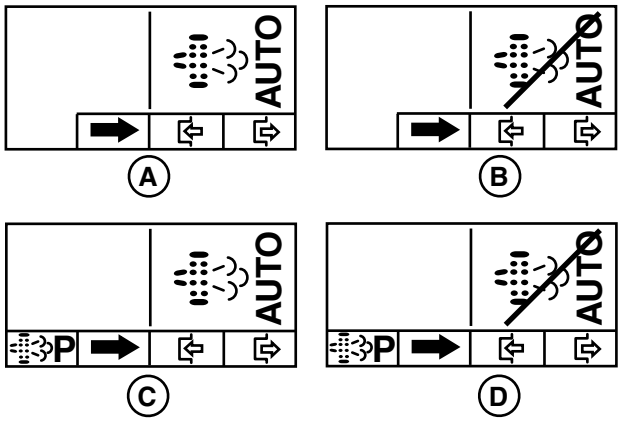
If the automatic active regeneration is disabled, and the machine requires a regeneration, a DTC fault code becomes active on the TechControl screen.

Parked Regeneration Available

A parked, or stationary regeneration requires that the machine is safely parked with the park brake engaged, PTO disengaged, and the transmission in neutral.

NOTE: Button 2,3,4 have the same function for all DPF Status screens in the DPF section

- When Button 1 icon shown in either screen (C) or (D) is solid, an interlock violation exists. The icon indicates that the engine is ready to perform a regeneration, but the machine is not properly set. Make sure that the engine is at low idle, the park brake switch is on, the PTO switch is off, the active regeneration inhibit is disabled, and the engine temperature has reached the proper level. When the operator presses and holds the button for 3 seconds, an interlock violation displays.



TCT010524 —UN—14FEB14

A—Automatic Active Regeneration Enabled
B—Automatic Active Regeneration Disabled
C—Parked Regeneration Available, Automatic Enabled
D—Parked Regeneration Available, Automatic Disabled

- When Button 1 icon shown in screen (D) is flashing, the operator can press and hold the button for 3 seconds to initiate a Parked Regeneration operation. A delay occurs before the engine RPMs increase and the parked regeneration begins.

Continued on next page

OUMX258,0000366 -19-10APR15-1/2

Exhaust Gas Temperature Elevated

When a regeneration is occurring and exhaust temperatures are above normal temperatures, screen (A) or (B) display.

Parked Cleaning Required

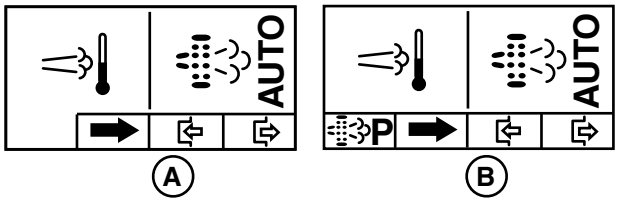
If a parked regeneration is needed a DTC Fault Code displays on main screen.

If the exhaust soot load reaches a high level the machine requires a parked regeneration.

If a parked regeneration is needed and 10 operating hours have passed since notification, or if the soot loading is over 12 g/l, the control unit enters a Limp Home Mode.

- Recovery regeneration needed
- No increasing warning during the 10 operating hours

The control unit reaction in Limp Home Mode:



TCT010525 —UN—17FEB14

A—Exhaust Gas Temperature High

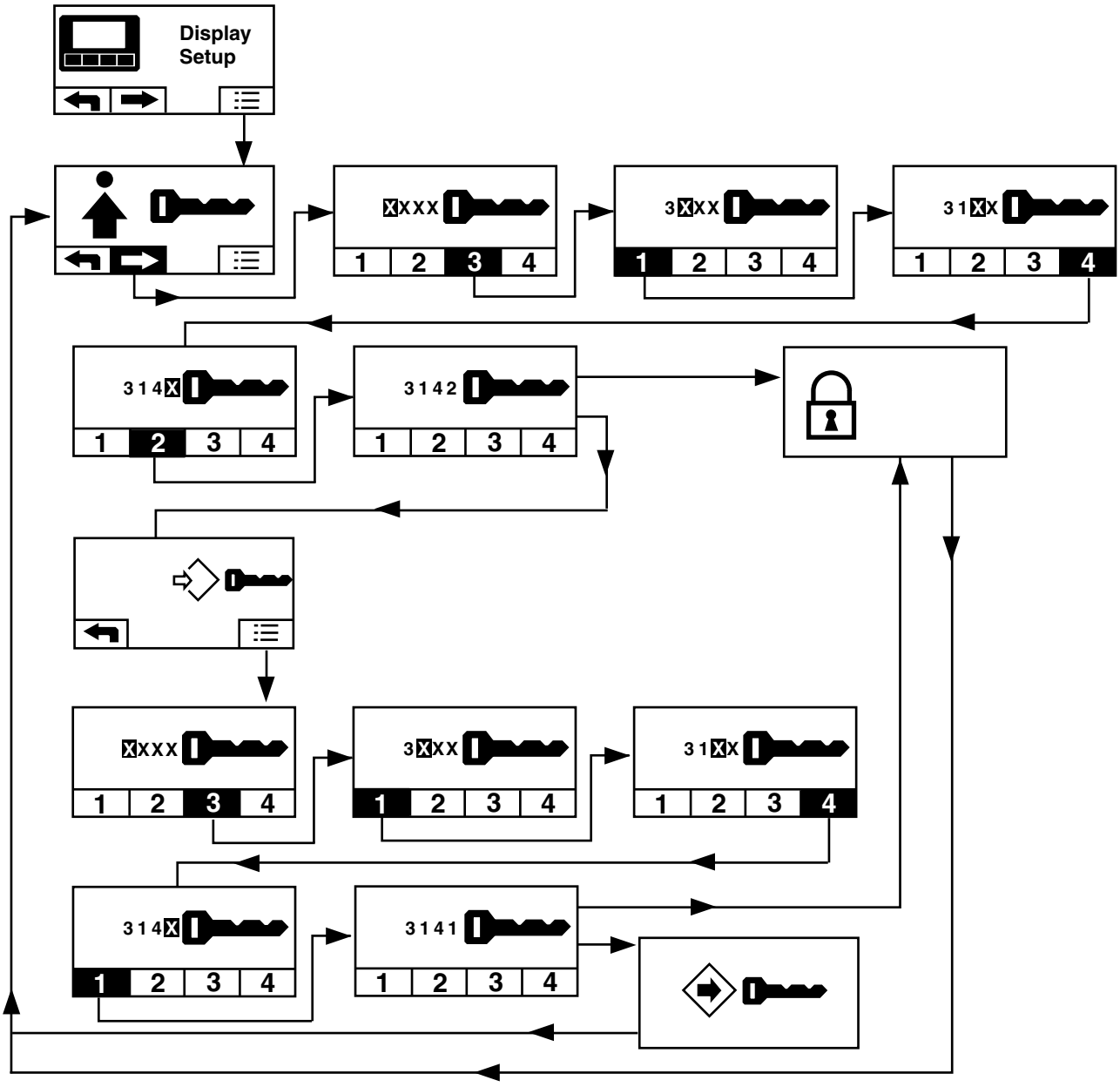
B—Parked Regen Exhaust Gas Temp High

- The control unit derates the engine to 50% of full load
- The engine speed is limited to a lower rpm

Refer to the “Diagnosis-DTCs, PDU” section for more information.

OUMX258,0000366 -19-10APR15-2/2

Pass Code - Change



1. Turn key switch to run position.
2. Go to the Mower Setup screen sublevel menu, enter the current pass code, and then cycle through the menu screens to the Display Setup screen.
3. Select button 4 of the Display Setup screen for the Pass Code sublevel menu.
4. Press button 2 to proceed with pass code entry.
5. Enter the current pass code by selecting buttons 1, 2, 3, or 4 for each digit in the pass code.
   - If the pass code is correct the PDU displays another screen for a new code to be entered.
   - If the pass code is incorrect the PDU will display an error message and go to the Pass Code screen after 2 seconds.
6. Press and release the 4 button to proceed with new pass code entry. The first digit shows the 'X' as a black/white inversion.
7. Enter the new pass code by selecting buttons 1, 2, 3, or 4 for each digit in the pass code. Each button press changes the 'X' placeholder to the selected digit, and the black/white inversion 'X' moves to the right. Numbers may be repeated. All combinations of 1, 2, 3, and 4 are possible.

Continued on next page

OUMX258,0000367 -19-02APR15-1/2

- If the pass code is accepted the PDU displays a Pass Code Entered screen.
- If the pass code is incorrect the PDU displays the lock symbol and go to the Pass Code screen after 2 seconds.

OUMX258,0000367 -19-02APR15-2/2

Pass Code - Reset

Pass Code Reset:

At start-up the display will turn on displaying the John Deere logo for 2 seconds. During these 2 seconds the Pass-code may be reset to factory default (1111) with a specific button sequence.

1. Turn key switch to run position.
2. Within 2 seconds, press and hold buttons two and four simultaneously.
3. The screen will go blank. Within 10 seconds, simultaneously press the 3 and 4 buttons and release.
4. Press and release the 3 button.
5. Press and release the 4 button.
6. Simultaneously press and release the 1 and 4 buttons.
7. If the wrong key combinations are pressed or the procedure times out, the screen revert to the main operational screen.
8. If the procedure was successful, the default factory pass code of “1111” will be set.

OUMX258,0000368 -19-01APR15-1/1

Summary of References

- CAN Bus Message Structure
- CAN Bus Operation
- Data Bus Systems
- CAN Trace
- Alarm
- Primary Display Unit—PDU
- Hour Meter
- Reel Motor Controllers
- Diagnostic Trouble Codes Overview
- Reel Motors
- Reel Motor Controller Signals
- Reel Motor Safety Interlock Operating Conditions

BS62576,0001144 -19-13JUN14-1/1

CAN Bus Message Structure

Basically, the electronic control units consist of two elements.

- The electronic control unit

- The interface controller

The electronic control unit is fully occupied with performing its tasks.

The interface controller manages the vast amount of data that is broadcast and recalled via the CAN BUS [CAN = CONTROLLER AREA NETWORK] communication lines. The data it passes on to the electronic control unit is only the data that the control unit actually requires.

The electronic control units share their monitoring, operational and display data with each other by continually "broadcasting" it on the CAN BUS line.

In CAN BUS systems, addresses are allocated according to the importance of the data.

- Start signal - Indicates the start of the data frame and synchronizes all the electronic control units.
- Assignment field - Consists of identifier and control bit. The identifier indicates the priority accorded to the data. During transmission of this field, the sender checks that it has the right to transmit, or if priority should be given to another electronic control unit. The control bit indicates whether the data is a question or an answer.
- Control field - Contains information on the size of the data in the data field.
- Data field - Contains the actual data.
- Cyclic redundancy check (CRC) field - To recognize any errors that may occur in transmission, this field contains a CRC code name; this code name must be known by every electronic control unit.
- Acknowledgement field - Contains the acceptance signals from data that have been received without error by the various electronic control units.
- End signal - Indicates the end of the frame.

The sender (electronic control unit) initiates a data transfer by sending a data frame. However, the receiver (electronic control unit) can also request data from the sender. To do this, the receiver issues a request. Question (request) and answer both have the same identifier. The only difference lies in the control bit.

An acceptance check is carried out within the electronic control units. This means that only data with an identifier stored in a list is actually accepted by the control units. The code numbers that are otherwise required for data transmission are thus eliminated.

The identifier determines the priority with which the data is transmitted. Each electronic control unit can transmit its data, provided the CAN communication lines are free. If several want to transmit at the same time, the data sent first are the ones with the highest priority. The other electronic control units then go automatically to the "receive" mode and do not send their data until the CAN BUS communication lines are free.

If a malfunction is registered, the electronic control unit interrupts the current transmission. The electronic control units are capable of telling the difference between malfunctions that only occur occasionally and malfunctions that persist. This is achieved by making a statistical assessment of the error situation.

All the electronic control units send and receive data while the key switch is on, so the CAN communication lines are continually carrying "broadcast" data. Some are ”broadcast” more frequently than others, depending on what data it is.

A terminating resistor is located each end of the CAN-BUS communication lines. The terminating resistors are required to reduce faults in the communication lines. The resistors are sometimes internal to the controllers, depending on the configuration of the network.

BS62576,000113C -19-15APR14-1/1

CAN Bus Operation

The Controller Area Network (CAN-BUS) is used to allow communication between control units on a machine. When the key switch is turned on, the electronic control units start to send and receive information over the CAN-BUS. Information may also continue to be transmitted by some controllers for a short time after the key switch is turned off. Some of the information is broadcast more frequently than others, depending on what the data is and which controller is sending it.

The CAN bus has a terminating resistor after the last physical controller on each end of the bus. The terminating resistors are required to reduce faults in the communication lines.

Each control unit can send and receive digital messages via the CAN-BUS.

In order to regulate the information being transmitted, each electronic control unit has an interface controller built in. While the electronic control unit is fully occupied performing its own tasks, the interface controller manages the large amount of information being broadcast on the CAN-BUS and only passes required information onto the bus.

Diagnostic Trouble Codes (DTCs) are based on the CAN ISO and J1939 SAE Standards. These are worldwide standards for automotive and off-highway machines and are controlled by an ISO industry committee.

BS62576,000113D -19-06MAY14-1/1

Data Bus Systems

The following electronic control units are equipped. These are:

- VCU - Vehicle Control Unit
- PDU - Primary Display Unit
- RMC - Reel Motor Control unit
- ECU - Engine Control Unit
- EGR - Exhaust Gas Recirculation (This component is capable of sending and receiving messages on the CAN bus, but is controlled by the ECU)

The electronic control units are connected to each other via data Bus systems (CAN BUS [CAN = CONTROLLER AREA NETWORK]).

The data Bus system forms a communication network for data-sharing between control units.

The lines that link up the elements of a data Bus system are known as communication lines.

OUMX258,000087C -19-02APR15-1/1

CAN Trace

CAN Trace allows one to record and view all or some messaging traffic on the CAN bus. This is useful for diagnosing difficult to troubleshoot problems. Service ADVISOR™ is required to use CAN Trace.

If this data needs to be used for diagnostic purposes, it should be sent to DTAC though Service ADVISOR for analysis.

DTAC has the ability to create custom filters to allow only certain data to be recorded if a particular system is suspect. This will speed the troubleshooting process. If this is the case, DTAC should be informed beforehand in order for the filter to be created and applied to the CAN Trace function in Service ADVISOR™.

CB12260,0000445 -19-10APR13-1/1

Alarm

Function:

An audible warning to alert the operator of a problem with the machine or an unsafe operating condition.

Operation:

The alarm sounds under certain operating conditions. The audible alarm is continuous until the issue stops or a button on the display is pressed.

If a DTC triggered a non-shutdown persistent alarm, the alarm is silenced by acknowledging the fault. Acknowledging the fault is accomplished by pressing the second button from the left on the display. Pressing the button sends SPN 521844 to the VCU. The SPN is a request for alarm termination. The DTC is stored in nonvolatile memory.

The PDU displays an icon identifying the severity of the alarm as well. Not all faults or operating conditions sound the audible alarm, but alarms always display a warning icon.

Alarm Icons

See the following:

- Warning Icons
- Display Navigation
- Machine Start Status Pop-up DTCs

CB12260,0000443 -19-02APR15-1/1

Primary Display Unit—PDU

Function:

The PDU is a graphic and text based user interface for machine control, settings, and diagnostics.

Theory of Operation:

The PDU is interactive with the operator or technician. It receives information from all on-board controllers as well as sending commands to all on-board controllers. This information is transmitted via the CAN bus.

CB12260,000044D -19-10APR13-1/1

Hour Meter

The PDU displays total engine operating hours on the main (default) screen. The VCU records the data and transmits it to the PDU over the CAN bus. Hours are only recorded when the engine is running. Hours are not recorded while the key switch is in the on position and the engine is off. Hour data is stored in nonvolatile memory of the VCU and cannot be changed.

CB12260,000044E -19-02APR15-1/1

Diagnostic Trouble Codes Overview

SPN.FMI Codes

Diagnostic Trouble Codes (DTC) are based on the CAN ISO and J1939 SAE Standards. These are worldwide standards for automotive and off-highway vehicles and are controlled by an ISO industry committee. There are two main parts that make up a DTC:

SPN (Suspect Parameter Number) is intended to identify where the problem exists. An example is 000094 which the standard defines as Fuel Delivery System. Any vehicles using the 000094 in the DTC will therefore be defining a problem with the fuel delivery system. The list of possible SPNs is too large to provide here, but basically, codes in the lower numbers (currently, below 005000) are assigned numbers that are set standards. SPNs above 005000, such as 524255 are considered proprietary, and are set up in blocks. An example would be 520000—540000 which might be assigned to John Deere to use for parameters that are not already defined. At some point, if these proprietary numbers are approved by SAE and the CAN committee, they may be assigned a lower number and become available industry-wide.

FMI (Failure Mode Indicator) is a standard set of numbers that defines how the SPN failed. FMIs are defined by the J1939 standard.

By combining the SPN and FMI, the code 000094.03 would mean that the Fuel Delivery System input voltage is high. With the universal standard, this would apply to any CAN based vehicle.

Failure Modes:

FMI	Condition
00	Data valid but above normal operating range—most severe level
01	Data valid but below normal operational range—most severe level
02	Data erratic, intermittent, or incorrect
03	Voltage above normal, or shorted to high source
04	Voltage below normal, or shorted to low source
05	Current below normal or open circuit
06	Current above normal or grounded circuit
07	Mechanical system not responding or out of adjustment
08	Abnormal frequency or pulse width or period
09	Abnormal update rate
10	Abnormal rate of change
11	Root cause not known
12	Bad intelligent device or component
13	Out of calibration
14	Special instructions
15	Data valid but above normal operating range—least severe level
16	Data valid but above normal operating range—moderately severe level
17	Data valid but below normal operating range—least severe level
18	Data valid but below normal operating range—moderately severe level
19	Received network data in error
20-30	Reserved for SAE assignment
31	Too long

AA95137,0002941 -19-12MAR15-1/1

Reel Motor Controllers

The reel motor controllers control all aspects of reel motor functionality when provided with an “enable” message from the VCU via the CAN bus. The controllers are capable of monitoring many operating conditions as well as sending DTC’s to Service ADVISOR and selected codes to the PDU.

The reel motor controllers use the CAN bus system to communicate with all other onboard controllers and supply them with readings, status, and diagnostic information.

For CAN communications, the controllers get their addressing via hard wiring on the wiring harness. Each controller has up to three addressing wires. If a controller is replaced or moved, it will assume the old controller’s address. The address is a three bit binary number, based on the presence (binary 0) or absence (binary 1) of address wires, which is converted to its decimal equivalent when viewed in Service ADVISOR. The addressing scheme is not sequential. Some addresses will be skipped when viewed in Service ADVISOR.

The reel motor controllers have the ability to store some DTCs/Fault codes for later retrieval for troubleshooting purposes.

When no DTCs/Fault codes are active, all five controllers will be functioning identically. If a controller has an active DTC/Fault code, it may shut down or function independently from the other controllers.

With the machine turned on, control units are constantly broadcasting messages (data) at the rate of at least 80 per second on the CAN bus for proper machine operation and Service ADVISOR connectivity.

CB12260,0000105 -19-22MAY14-1/1

Reel Motors

Overview:

The machine has 5 electric reel motors, each controlled by an individual reel motor controller (RMC). The motors have various sensors to provide feedback to the controllers for command, safety, and diagnostic functions.

Theory of Operation:

The motor is a brushless DC, three phase, bidirectional type. All aspects of the motor’s functionality are controlled by the RMC, and through the CAN bus, the Primary Display unit (PDU) and Vehicle Control Unit (VCU).

When conditions are correct for motor operation, three-phase pulse width modulated current at 48Vdc will be supplied to each motor in a staggered fashion (to prevent power supply overload). All motors will then spin at a nominal 2800 rpm (±10%). The motor’s normal ambient operating temperature is -20°C to +40°C (-4°F to 104°F).

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As the motor spins, three internal Hall effect sensors provide the controller with speed, stalling, and direction of spin information.

The motor also has a thermal protection circuit. This is a normally closed switch when operating conditions are met. If the motor experiences an internal overtemp condition (140±5°C [284±11°F]), the switch will open and the RMC will shut down the motor until it cools.

As the motor sends sensor information back to the RMC, the controller broadcasts this information on the CAN bus. This will consist of either motor operational parameters or as diagnostic trouble codes. This information can be read using Service ADVISOR™.

The PDU can pass operator initiated motor command information to the RMC, which will in turn, sends control information to the motor. These commands concern speed and motor spin direction.

CB12260,00004F4 -19-22MAY14-1/1

Reel Motor Controller Signals

NOTE: Connector numbers on the controller side may not match the connector number on the main harness side. Use location key in tables as a guide.

NOTE: The lower case 'x' represents a variable, depending upon the reel controller location on the machine.

Replace "x" with:	Controller Location
1	Front Left
2	Rear Left
3	Front Center
5	Front Right
6	Rear Right

CAN:

NOTE: Not all addressing wires may be used. (See Electronic Controllers "Theory of Operation".)

- CAN-Cx, pin A - Not used
- CAN-Cx Pur, pin B - Controller address LSB (Gnd)
- CAN-Cx Wht, pin C - Controller address (Gnd)
- CAN-Cx, pin D - Not used
- CAN-Cx Red, pin E - 12Vdc in
- CAN-Cx, pin F - Not used
- CAN-Cx Yel, pin G- CAN Hi
- CAN-Cx Grn, pin H - CAN Lo
- CAN-Cx, pin J - Not Used
- CAN-Cx Blu, pin K - Controller address MSB (Gnd)

Motor Sensors:

- P1-x Blk, pin A - Sensor Return Input
- P1-x Red, pin B - 12Vdc Sensor Power Output
- P1-x Blu, pin C - Thermal Shutdown Input
- P1-x Brn, pin D - Hall C-A Input
- P1-x Wht, pin E - Hall B-C Input
- P1-x Grn, pin F - Hall A-B Input

Reel Motor Power:

- P2-x Org, pin A - Phase A Output
- P2-x Blk, pin B - Phase B Output
- P2-x Grn, pin C - Phase C Output

Reel Motor Controller Power Motor Feed

- PC-x Red - 48Vdc
- PC-x Blk Gnd

OUMX258,00002D4 -19-22MAY14-1/1

Reel Motor Safety Interlock Operating Conditions

NOTE: This table shows the interlock states for reel operation.

Mowing Units Lowered	Park Brake Not Engaged	Mow Engaged	Operator on Seat	Backlap Engaged	Hydraulic Temp Warning OFF
X		X	X		X
or					
X	X	X		X	X

OUMX258,00002D5 -19-13MAR14-1/1

Summary of References

- Exhaust Filter System Overview
- Understanding Diesel Particulate Filter (DPF) Regeneration
- DPF Regeneration Control
- DPF Self Regeneration — Mode Select
- DPF Elevated Exhaust Temperature
- DPF Parked Regeneration
- DPF Ash Cleaning Required
- DPF Filter Cleaning Required
- DPF Parked Cleaning Required (Warning Level)
- DPF Parked Cleaning Required (Stop Level)
- DPF Recovery Regeneration

OUMX258,0000A13 -19-07MAY15-1/1

Exhaust Filter System Overview

The exhaust filter contains the diesel oxidation catalyst (DOC) and the diesel particulate filter (DPF). Exhaust gas flows through the filter radial inlet, DOC, DPF, and an axial or radial outlet, depending on the application.

With the engine under load, Nitric Oxide (NO) oxidizes in the DOC into Nitrogen Dioxide. NO is an agent that allows particulates to oxidize easier in the DPF. During active regeneration, fuel is dosed into the exhaust system using an in-cylinder dosing strategy. The extra fuel is oxidized in the DOC. The ECU monitors the DOC outlet temperature to determine the temperature increase across the DOC.

The DPF traps particulate matter, or soot. Exhaust gas passes through channels in the ceramic filter core. Every other channel is obstructed at the outlet. Exhaust gas moves through porous channel walls until it exits through an open outlet. While the exhaust gas circulates through the filter, particulates are trapped on the channel walls. The channel walls are coated with precious metals that aid in the oxidation of the particulate matter. The oxidation of the particulate matter in the DPF is called regeneration.

IMPORTANT: Avoid Damage! Under normal machine operation, the system is in auto regeneration and requires minimal operator interaction.

IMPORTANT: Avoid Damage! Soot builds up during times when engine exhaust gas temperature is lower (lower engine speed, lower engine load). Performing extended operations at either low engine speed, or low engine load, results in needing a parked regeneration.

To avoid unnecessary buildup of diesel particulates or soot in the exhaust filter system:

- Avoid unnecessary idling.
- Use proper engine oil.
- Use only ultra low sulfur fuel.

OUMX258,0000866 -19-24MAR15-1/1

Understanding Diesel Particulate Filter (DPF) Regeneration

Regeneration

Regeneration is the process of increased exhaust temperatures to oxidize the accumulated particulate matter, or soot, from the walls of the DPF. There are five types of regeneration that can occur. Passive Regeneration, Enhanced Passive Regeneration, Active Regeneration, Parked Regeneration, and DPF Recovery.

Passive Regeneration

Passive regeneration occurs naturally in the DPF when the operating conditions produce sufficient exhaust gas temperatures for the oxidation of soot to occur. The engine ECU takes no action during passive regeneration. There is no fuel dosing or closing of the air throttle to increase exhaust gas temperatures. No indicators are present on the operators interface during the passive regeneration.

Enhanced Passive Regeneration

When the soot level in the DPF reaches a predetermined level and the vehicle operating conditions are not resulting in sufficient exhaust gas temperatures to promote sufficient passive regeneration, the engine ECU activates the enhanced passive regeneration strategy. During enhanced passive regeneration, the engine ECU closes the air throttle and changes injection timing to increase the exhaust gas temperature to a level that promotes passive regeneration. The engine is allowed to be operated normally and no fuel is dosed during the enhanced passive regeneration. No indicators are present on the operators interface during the enhanced passive regeneration.

Active Regeneration

When the soot level in the DPF reaches a predetermined level or soot is accumulating at a rate greater than can be managed by the enhanced passive regeneration, an active regeneration will be initiated. During an active regeneration, the ECU initiates the in-cylinder fuel dosing strategy, modifies fuel injection timing, and closes the air throttle to increase exhaust gas temperatures to promote rapid oxidation and removal of the soot in the DPF. The exhaust gas temperatures during the active regeneration are higher than the temperatures in the enhanced passive regeneration. During this regeneration, the engine is allowed to be operated normally.

Parked Regeneration

When the soot level reaches a predetermined level, the ECU mandates a parked regeneration be performed. When a parked regeneration is needed, the ECU derates the engine to encourage the parked regeneration be performed. During a parked regeneration, the ECU increased the engine speed to 2200 rpm, initiates the in-cylinder fuel dosing strategy, modifies fuel injection timing, and closes the air throttle to increase exhaust gas temperatures to promote rapid oxidation and removal of the soot in the DPF. The vehicle must remain parked until the parked regeneration has ended.

Recovery Regeneration

If the soot in the DPF reaches a severe level, a recovery regeneration is required to reduce the soot level. Running the vehicle with the regenerations inhibited or not performing a parked regeneration when needed can cause the recovery regeneration to be needed. During a recovery regeneration, the vehicle must be parked, the ECU closes the air throttle, and changes injection timing to increase the exhaust gas temperature to a level that promotes passive regeneration. No fuel is dosed during the portion of the recovery. After sufficient time has passed and the soot level is at a low level, a parked regeneration is performed before the recovery regeneration is complete. The vehicle must remain parked until the recovery regeneration has ended.

OUMX258,0000865 -19-19MAR15-1/1

DPF Regeneration Control

Differential pressure sensors are installed in the exhaust system on each side of the diesel particulate filter (DPF). If the after treatment system builds up a soot level due to low load or other abnormal operating conditions, the ECU will control assisted DPF regeneration automatically to prevent particulate matter (PM) from over accumulating. The after treatment system may eventually build up an ash load that will require ash cleaning or after treatment replacement. See CTM120419 for more details.

Temperature sensors are installed in the exhaust system to monitor and control DPF regeneration.

Various modes of regeneration may be allowed or disallowed through the TechControl (Primary Display Unit). Refer to specific mode explanations for more information.

While each mode is active, an informational screen is displayed. Fault codes may display as icons to indicate specific conditions or requirements.

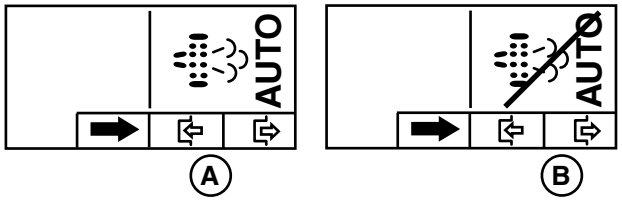
CB12260,00005B0 -19-03APR15-1/1

DPF Self Regeneration — Mode Select

Under normal operation and the automatic regeneration option is selected (default), the Diesel Particulate Filter (DPF) will self clean. See CTM120419 for more information on the process.

A - Indicates automatic regeneration is enabled and may occur anytime the machine is operating.

B - Indicates automatic DPF regeneration is disabled.



TCT010468 —UN—07FEB14

No Regeneration Required

A—Automatic Active Regeneration Enabled

B—Automatic Active Regeneration Disabled

CB12260,00005B2 -19-28APR14-1/1

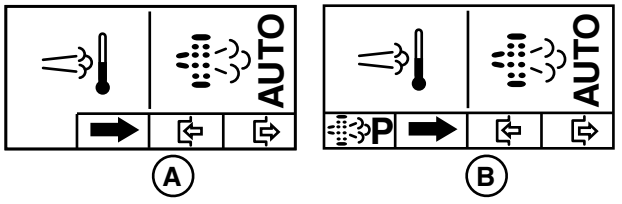
DPF Elevated Exhaust Temperature

Assisted regeneration occurs under certain conditions.

CAUTION: If these icons are displayed during regeneration operation, exhaust gas and exhaust components are extremely hot. Keep all flammable materials away as well as ensuring all personnel maintaining a safe distance.

A - Indicates assisted regeneration is enabled while machine is in normal operation and the exhaust gas temperature is above normal operating temperature.

B - Indicates assisted regeneration is enabled while machine is parked and the exhaust gas temperature is above normal operating temperature.



TCT010525 —UN—17FEB14

A—Exhaust Gas Temperature High

B—Parked Regen Exhaust Gas Temp High

CB12260,00005B3 -19-28APR14-1/1

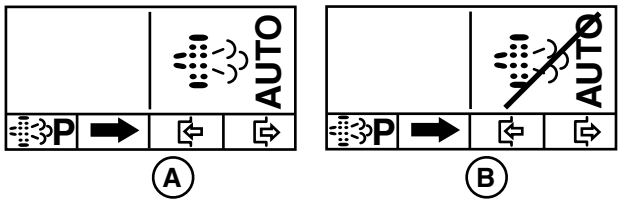
DPF Parked Regeneration

Parked (Stationary) regeneration can be performed when certain conditions are met.

A - Indicates that automatic parked regeneration is enabled, and parked regeneration is available.

B - Indicates that automatic parked regenerations is disabled, and parked regeneration is not available.

- When Button 1 icon shown in screen (A) is flashing about once per second a parked regeneration is available: The park brake is engaged and the engine is to temperature.
- When Button 1 icon shown in either screen (A) is solid a parked regeneration is available but the interlock requirements are not met.



TCT010526 —UN—17FEB14

A—Automatic Parked Regeneration Enabled

B—Automatic Parked Regeneration Disabled

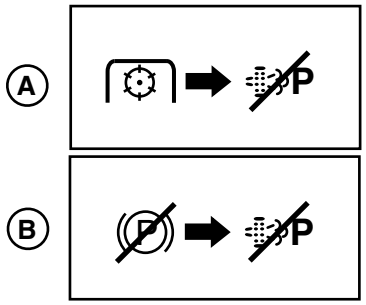
CB12260,00005B5 -19-08APR15-1/2

NOTE: Button 2,3,4 have the same function for all DPF Status screens in the DPF section

- When the operator presses and holds Button 1 for 2 seconds, an interlock regeneration notification popup displays. The machine must be parked with the PTO OFF, and the park brake engaged.

Parked Regeneration Procedure

1. Park the machine safely.
2. Engage the park brake.
3. Press and hold button 1 for 3 seconds to initiate a Parked Regeneration operation. A delay occurs before the engine rpm increases and the parked regeneration starts.



TCT010532 —UN—18JUN14

Parked Regeneration Interlock Violations

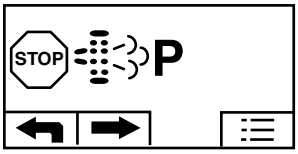
A—PTO ON

B—Park Brake OFF

CB12260,00005B5 -19-08APR15-2/2

DPF Ash Cleaning Required

TCT010527 —UN—17FEB14



NOTE: Auto cleaning will be disabled if this icon is present.

Indicates that ash cleaning is required. Press sub-level menu button 4 for more information.

This icon becomes active when a DTC ECU 003720.00, “Ash cleaning required” becomes active. It also becomes active for DTC 003719.00 Forced Regen.

The engine rpm derates to 50% for a “limp home” operation.

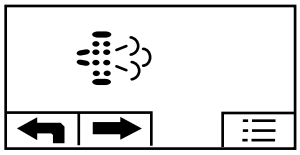
NOTE: This icon will flash every second regardless of the status of the parked cleaning request

button. Filter cleaning must be preformed before parked cleaning can be performed.

CB12260,00005B8 -19-28APR14-1/1

DPF Filter Cleaning Required

TCT010528 —UN—17FEB14



Indicates that filter cleaning is required. Press sub-level menu button 4 for more information.

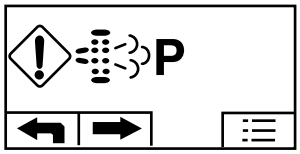
This icon becomes active when a DTC ECU 003695.14, “Filter cleaning required” becomes active.

No engine rpm derate occurs.

CB12260,00005B9 -19-28APR14-1/1

DPF Parked Cleaning Required (Warning Level)

TCT010529 —UN—17FEB14



Indicates that ash cleaning is required. Press sub-level menu button 4 for more information.

This icon becomes active when DTC 003719.16 Forced Regen or DTC ECU 003720.00 Ash Clean Required become active.

The engine rpm derates to 50% operation.

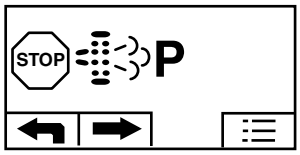
NOTE: Icon will flash every second regardless of the status or the parked cleaning request button.

DTC ECU 003719.16 Calculated Ash Level Moderately High will be present.

CB12260,00005BA -19-28APR14-1/1

DPF Parked Cleaning Required (Stop Level)

TCT010530 —UN—17FEB14



Indicates that parked regeneration cleaning is required. Press sub-level menu button 4 for more information.

This icon becomes active when DTC 003719.00 Forced Regen or DTC ECU003720.00 Ash Clean Required become active.

The engine rpm derates to 50% operation.

NOTE: Icon will flash every second regardless of the status of the parked cleaning request button.

DTC ECU 003719.00 Calculated Ash Level Extremely High will be present.

CB12260,00005BB -19-28APR14-1/1

DPF Recovery Regeneration

Recovery Regeneration is a forced regeneration of the Diesel Particulate Filter that can be performed on demand. It can be done without an error code requiring a regeneration or the parked regeneration being available.

This recovery regeneration is performed the same as a parked regeneration but it requires a pass code.

The pass code is hard-coded as: **4112**.

OUMX258,0000336 -19-28APR14-1/1

Summary of References

- PDU
- Warning Icons
- Accessing DTCs through PDU
- Machine Start Status Pop-up DTCs
- Machine Fault Pop-up DTCs

OUMX258,0000403 -19-07MAY15-1/1

PDU

The Primary Display Unit (PDU) is an interactive controller that functions as an operator control and information system. The display is connected with a two wire CAN based communication scheme coming from other machine controllers. Multiple icons/messages are displayed on a graphical LCD display which has a preferred address on the CAN bus.

In addition, the display acts as an operator interface for selecting machine functions and for setting machine parameters such as mow speed. Also, it is used to enable/disable Diesel Particulate Filter cleaning on Yanmar Tier IV diesel engines. Finally, the display is a diagnostic tool reporting digital I/O states and diagnostic trouble codes with icon and text (option) screens.

BS62576,00010D0 -19-17FEB14-1/1

Warning Icons

There are three levels of warning icons on the display unit:

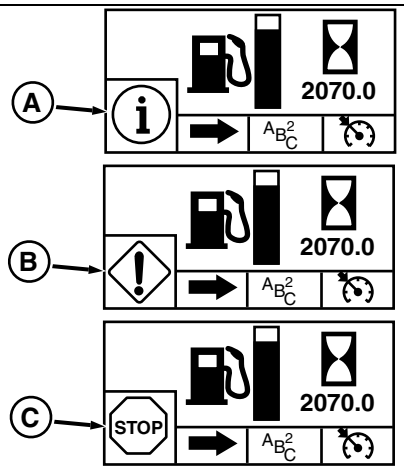
A - Low-level warning for informational purposes.

B - Warning alert that needs to be addressed.

C - Service alert that needs to be addressed.

When button 1 is pressed with active faults, and there is more than one fault, the faults are viewed one at a time. The order of display is based on priority.

A—Protect Icon, Information
B—Warning Icon
C—Stop Icon



TCT009983 —UN—03FEB14

CB12260,0000573 -19-03APR15-1/1

Accessing DTCs through PDU

All DTCs current or stored DTCs may be accessed through the PDU and the occurrence count.

Stored DTCs are requested from the individual control unit when the stored DTC screen is entered for that particular control unit.

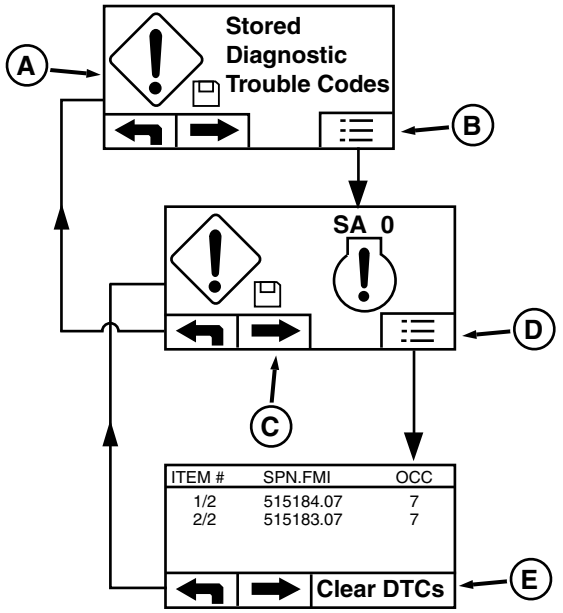
When viewing stored DTCs for individual control units, the list of stored DTCs that appears can be cleared with the “Clear DTCs” button. Either button 3 or button 4 can be pressed to “Clear DTCs”. When the Clear DTCs button is pressed, the display sends a request to the control unit to clear its stored DTCs. The control unit transmits a response back indicating success or failure. Immediately after the request to clear, the display also requests the stored DTCs again. If the clearing was a success, there should be no stored DTCs reported. If it failed, the list still shows the DTCs that remain stored in the control unit’s memory.

The fault history is also visible using Service ADVISOR. Through Service ADVISOR or the TechControl display, John Deere technicians see the occurrence count from the last time Service ADVISOR cleared the stored DTCs.

The control units that can store DTCs are:

- VCU
- ECU
- RMCs

1. Press the sublevel menu button (B) to access the DTC information screen.
2. Select the control unit to view by pressing the next button (C) until it is displayed.



TCT010471 —UN—13FEB14

A—Stored Diagnostics Codes Screen
B—Menu Options List
C—Button 2: Next
D—Menu Options List
E—Button 3 and Button 4: Clear DTCs

3. Press the sublevel menu button (D) to access the DTC information screen.
4. Press the Clear DTCs button (E) to clear DTCs from memory.

OUMX258,0000404 -19-03APR15-1/1

Machine Start Status Pop-up DTCs

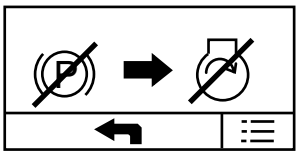
In a situation where the operator is attempting to crank the engine under an unsafe condition, a Vehicle Control Unit (VCU) generated DTC triggers and the PDU displays a graphical representation of the error. These screens display only while the key is in start position and the interlocks are not in the proper state. They automatically turn off when the VCU DTC is no longer received.

The pop-up screen order of priority is PTO, Park Brake, and Backlap engagement.

These DTCs are:

DTC VCU 000070.14, Park brake off, no crank

TCT010498 —UN—11FEB14

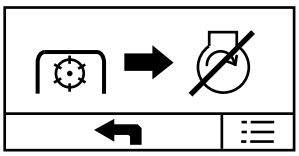


Continued on next page

CB12260,0000575 -19-03APR15-1/5

DTC VCU 000976.14, PTO on, no crank

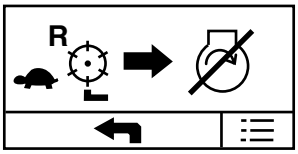
TCT010500 —UN—11FEB14



CB12260,0000575 -19-03APR15-2/5

DTC VCU 520608.14, Backlap engaged, no crank

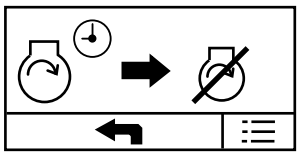
TCT010501 —UN—11FEB14



CB12260,0000575 -19-03APR15-3/5

DTC VCU 000677.14, Crank Time Exceeded

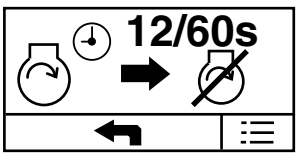
TCT010513 —UN—11FEB14



CB12260,0000575 -19-03APR15-4/5

DTC VCU 000677.31, Crank Time Exceeded, 60 Second Cool Down Started

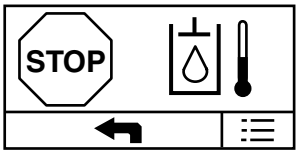
TCT010514 —UN—11FEB14



CB12260,0000575 -19-03APR15-5/5

Machine Fault Pop-up DTCs

TCT010506 —UN—11FEB14



Certain faults, while the machine is running, trigger a PDU pop-up screen and corresponding DTC.

These faults are:

- DTC 000100.01, Engine oil pressure low
- DTC 000110.00, Engine coolant over temp
- DTC 000168.00, Battery Fault - Stop
- DTC 000168.16, Battery Fault - Warning
- DTC 001638.00, Hydraulic oil over temp
- DTC 001713.00, Hydraulic oil filter restriction
- DTC 516708.00, Hydraulic Oil leak - Stop

If more than one fault occurs concurrently, the fault with the highest priority displays first then the fault with the next highest priority displays. However, if a fault clears before it can be displayed, that fault may display even though the condition no longer exists. Multiple pop-ups may have the same priority level and are displayed in a sequence of time of occurrence.

Faults that come from the ECU and do not have a custom DTC popup code display one of the General Engine Fault icons, either Engine Fault - Stop, or Engine Fault - Warning.

Certain pop-up screens trigger based on a CAN message value that does not come from a DTC message. These messages are similar to other messages received data from the other control units. These pop-up screens have priorities which coordinate with DTC pop-ups. If a DTC message occurs simultaneously with a Non-DTC Pop-up condition, the pop-ups display in priority order. Non-DTC pop-up screens appear on the home screen only.

The pop-ups are cleared by using the “return” arrow.

Pressing button 1 on the PDU displays all pop-up faults in priority of currently active faults, even if the pop-up was previously acknowledged.

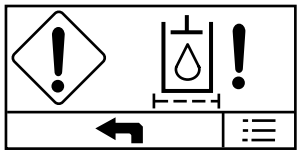
Hydraulic Over-Temp Fault - Stop

Fault DTC: VCU 001638.00

OUMX258,0000406 -19-03APR15-1/11

Hydraulic Oil Filter Restriction - Warning

TCT010507 —UN—11FEB14



Fault DTC: VCU 001713.00

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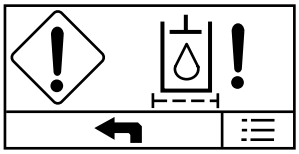
OUMX258,0000406 -19-03APR15-2/11

Hydraulic Oil Leak - Stop

Fault DTC: VCU 516708.00

TCT010512 —UN—11FEB14

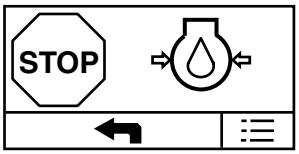


OUMX258,0000406 -19-03APR15-3/11

Engine Oil Pressure Low Fault - Stop

Fault DTC: VCU 00100.01 or ECU 000100.01

TCT010504 —UN—11FEB14

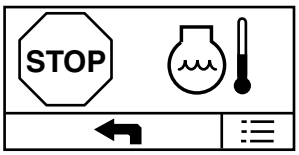


OUMX258,0000406 -19-03APR15-4/11

Engine Coolant Temperature Fault - Stop

Fault DTC: VCU 000110.00 or ECU 000110.00

TCT010505 —UN—11FEB14

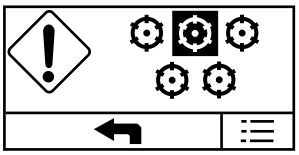


OUMX258,0000406 -19-03APR15-5/11

Reel Motor Fault - Warning

Fault RMC: Various

TCT010834 —UN—12MAR14

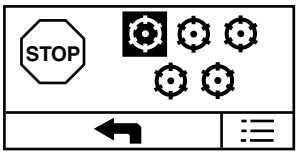


OUMX258,0000406 -19-03APR15-6/11

Reel Motor Fault - Stop

Fault RMC: Various

TCT010833 —UN—12MAR14



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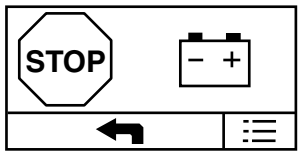
OUMX258,0000406 -19-03APR15-7/11

Battery Fault - Stop

Fault DTC: VCU 000168.00

TCT010508 —UN—12FEB14

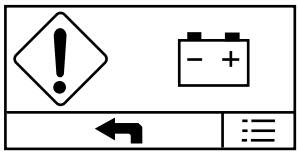


OUMX258,0000406 -19-03APR15-8/11

Battery Fault - Warning

Fault DTC: VCU 000168.16

TCT010509 —UN—11FEB14

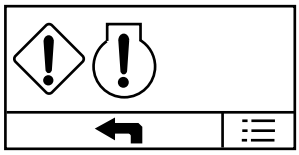


OUMX258,0000406 -19-03APR15-9/11

Engine Fault - Warning

Fault DTC: ECU “General”

TCT012447 —UN—03APR15

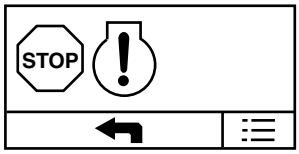


OUMX258,0000406 -19-03APR15-10/11

Engine Fault - Stop

Fault DTC: ECU “General”

TCT012446 —UN—03APR15



OUMX258,0000406 -19-03APR15-11/11

VCU DTC Quick Reference Table

SPN.FMI (DTC)	Drive control unit Response	Other Controlled Response	Fault	Clear Method
000070.14	Informational	Indicator/Alarm only	Park Brake Switch Off during Start Switch On (attempting to crank)	
000096.01	Informational Amber Lamp	Indicator/Alarm only	Low fuel warning	
000096.04	Service Alert Amber Lamp	Display DTC	Fuel Level Sensor short to ground.	
000096.16	Amber Lamp	Indicator/Alarm only	Fuel Level Sensor valid, but above normal	
000100.01 (Non-T4)	Limited Functionality Red Lamp	Does not allow mowing.	Engine Oil pressure low.	
000110.00 (Non-T4)	Limited Functionality Red Lamp	Does not allow mowing.	Engine Coolant over temp.	
000158.00	Ramp hydros to 0 and no motion is allowed. Red Lamp	Does not allow lowering Does not allow mowing Engine shuts down	Switched Power (ELX) Fault voltage above normal operating range (>18V persist and 1 sec)	
000168.00	Ramp hydros to 0 and no motion is allowed. Red Lamp	Does not allow lowering Does not allow mowing Engine shuts down	Supply Voltage (VBAT) Fault - Voltage above normal operating range. (>18V persist and 1 sec)	
000168.01	Shutdown of eHydro currents and engine Red Lamp	Does not allow mowing. Engine shuts down	Switched Power (VBAT) Fault voltage below normal operating range when not cranking (<8V persistence 1 sec)	
000168.16	Service Alert Amber Lamp	Indicator/Alarm only	Supply Voltage (VBAT) Fault 16>X<18V for 5000 msec when NOT in engine start mode.	
000168.18	Service Alert Amber Lamp	Indicator/Alarm only	Supply Voltage (VBAT) Fault 8>X<9 for 5000 msec when NOT in engine start mode.	Cycle key switch & Input greater than 10V for 100 msec.
000190.00	Assume engine rpm wide-open to limit traction speed. Service Alert Amber Lamp	Does not allow mowing.	Engine speed above normal max.	Cycle key switch.
000190.01	Assume engine rpm wide-open to limit traction speed. Service Alert Amber Lamp	Does not allow mowing.	Engine speed below normal min	Cycle key switch.
000190.02	Assume engine rpm wide-open to limit traction speed. Service Alert Red Lamp	Does not allow mowing.	Engine speed erratic, intermittent or incorrect.	Cycle key switch.
000190.09	Engine speed not arriving over CAN bus or updated at an abnormal rate Service Alert Red Lamp	Does not allow mowing and limited traction speed	Engine speed missing or updated at abnormal rate	Restart engine.
000629.13	Informational	Display DTC	Out of calibration	
000639.12	Informational	Display DTC	CAN, Lost Message	
000639.14	Service Alert Amber Lamp		CAN, Bus Off	
000677.03	Service Alert Amber Lamp	No motion allowed	Starter Relay coil short to high	
000677.04	Service Alert Amber Lamp	No motion allowed	Starter Relay coil short to ground	
000677.14	Informational	Indicator/Alarm only	Crank Time Exceeded (>15 seconds)	
000677.31	Informational	Indicator/Alarm only	Starter Cool down in Process (for 60 seconds)	
000920.03	Service Alert Amber Lamp	Indicator/Alarm only	Warning Buzzer low side driver short to 12 V	
000920.04	Service Alert Amber Lamp	Indicator/Alarm only	Warning Buzzer short to ground	

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CB12260,0000484 -19-08APR15-1/5

000976.14	Informational	Indicator/Alarm only	PTO Switch On during Start Switch On (attempting to crank)	PTO switch off
001504.14	Informational	Indicator/Alarm only	PTO Switch On while Seat Switch Off	PTO switch off
001638.00	Service Alert Amber Lamp	Engine shut down	Hydraulic Oil over temp.	
001713.00	Service Alert Amber Lamp	Does not allow mowing	Hydraulic Oil Filter restriction.	
001713.03	Service Alert Amber Lamp	Does not allow mowing	Hydraulic Oil Filter restriction switch short to 12 V	
001713.31	Service Alert Amber Lamp	Does not allow mowing	Hydraulic Oil Filter restriction switch invalid	
002853.31 (T4 only)	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down	No power to ECU (ECU fuse may be open)	Check fuse, connections, and wiring
003509.03	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down	Sensor Power Supply 1 Voltage is above 5.5 V	Cycle key switch.
003509.04	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down	Sensor Power Supply 1 Voltage is below 4.5 V	Cycle key switch.
003510.03	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down	Sensor Power Supply 2 Voltage is above 5.5 V	Cycle key switch.
003510.04	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down	Sensor Power Supply 2 Voltage is below 4.5 V	Cycle key switch.
516124.03	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down Display DTC	Non-T4 Fuel Hold Solenoid short to high T4 Engine Run Request short to high	
516124.04	Ramp hydros to 0 and no motion is allowed. Red Lamp	Engine shut down Display DTC	Non-T4 Fuel Hold Solenoid short to low T4 Engine Run Request short to low	
516125.03 (Non-T4)	Service Alert Amber Lamp	Display DTC	Fuel Solenoid Pull-In short to high	
516125.04 (Non-T4)	Service Alert Amber Lamp	Display DTC	Fuel Solenoid Pull-In short to low	
516135.03 (Non-T4)	Service Alert Amber Lamp	Display DTC	Air Preheat Relay short to high	
516135.04 (Non-T4)	Service Alert Amber Lamp	Display DTC	Air Preheat Relay short to low	
516182.03	Service Alert Amber Lamp	Indicator/Alarm only Display DTC	4WD Reverse Relay Coil short to high	
516182.04	Service Alert Amber Lamp	Indicator/Alarm only Display DTC	4WD Reverse Relay high side driver short to ground	
516183.02	Service Alert Amber Lamp	Function degraded Display DTC	Proximity Sensor #2, Incorrect Value	
516183.07	Service Alert Amber Lamp	Engine shut down Display DTC	Proximity Sensor Malfunction	
516184.02	Service Alert Amber Lamp	Display DTC	Proximity Sensor #1, Incorrect Value	
516184.04	Service Alert Amber Lamp	Display DTC	Proximity Sensor #1, Short to Low (exclusively)	
516184.07	Service Alert Amber Lamp	Engine shut down Display DTC	Proximity Sensor Malfunction	
516199.03	Service Alert Amber Lamp	Function degraded Display DTC	Raise/Lower Select solenoid low side driver, Short to High	
516199.04	Service Alert Amber Lamp	Function degraded Display DTC	Raise/Lower Select solenoid low side driver, Short to Low	
516200.03	Service Alert Amber Lamp	Function degraded Display DTC	Rear Mow Solenoid low side driver, Short to High	
516200.04	Service Alert Amber Lamp	Function degraded Display DTC	Rear Mow Solenoid low side driver, Short to Low	

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CB12260,0000484 -19-08APR15-2/5

516201.03	Service Alert Amber Lamp	Function degraded Display DTC	Mower raise/lower solenoid high side driver - Front, voltage above normal, or short to 12 V	
516201.04	Service Alert Amber Lamp	Function degraded Display DTC	Mower raise/lower solenoid high side driver - Front, short to ground	
516202.03	Service Alert Amber Lamp	Function degraded Display DTC	Mower raise/lower solenoid high side driver - Rear, voltage above normal, or short to 12 V	
516202.04	Service Alert Amber Lamp	Function degraded Display DTC	Mower raise/lower solenoid high side driver - Rear, short to ground	
516206.03	Service Alert Amber Lamp	Function degraded Display DTC	Front (or Single) Mow solenoid low side driver, Short to 12 V	
516206.04	Service Alert Amber Lamp	Function degraded Display DTC	Front (or Single) Mow solenoid low side driver, Short to Low	
516207.03	Service Alert Amber Lamp	Function degraded Display DTC	48V Alternator Field Winding relay low side driver, Short to High	
516207.04	Service Alert Amber Lamp	Function degraded Display DTC	48V Alternator Field Winding relay low side driver, Short to Low	
520608.14	Informational	Display DTC	Backlap Switch On during Start On (attempting to crank)	
520870.31	Service Alert Amber Lamp	Function degraded	Control Unit memory failure, check sum failure	Cycle key switch.
520871.31	Service Alert Amber Lamp	Function degraded	Non-critical data check sum failure	Cycle key switch.
520872.31	Service Alert Red Lamp	Function degraded	Critical data check sum failure	Cycle key switch.
520873.31	Service Alert Amber Lamp	Function degraded	Vehicle hours check sum failure	Cycle key switch.
520957.03	Service Alert Red Lamp	Engine shut down	Park Brake Solenoid wire shorted to power (high)	Cycle key switch.
520957.04	Service Alert Red Lamp	Engine shut down	Park Brake Solenoid wire shorted to ground	
521426.31	Service Alert Amber Lamp	Function degraded Cutting units may not lower.	Lower Cutting Units Switch signal invalid	
521427.31	Service Alert Amber Lamp	Function degraded Cutting units may not raise.	Raise Cutting Units Switch signal invalid	
522011.08	Service Alert Red Lamp	Function degraded	CAN Display Heartbeat, Abnormal Rate	
522405.03	Service Alert Red Lamp	Engine shut down Display DTC	Park Brake Pressure Switch: With engine running and Park Brake switch OFF (rocker switch in position that the operator would expect the brakes to released), VCU receives HIGH signal (which normally indicates insufficient hydraulic pressure in the brake system to release the brakes).	Cycle key switch.
522405.04	Service Alert Red Lamp	Engine shut down Display DTC	Park Brake Pressure Switch: With engine running and Park Brake switch ON (rocker switch in position that the operator would expect the brakes to be applied), VCU receives LOW signal (which normally indicates sufficient hydraulic pressure in the brake system to release the brakes).	Cycle key switch.
522405.31	Service Alert Red Lamp	Engine shut down Display DTC	Start Interlocked. Manual brake release Active (Override). The engine is off; PB switch engaged and park brake pressure switch is open.	Cycle key switch.
522770.31	Service Alert Red Lamp	Engine shut down Display DTC	VCU installed in MCU position on harness	
522771.31	Service Alert Red Lamp	Engine shut down Display DTC	Wrong VCU installed (LWFM instead of T&S)	

Continued on next page

CB12260,0000484 -19-08APR15-3/5

523324.02	Service Alert Red Lamp	Engine shut down Display DTC	Three consecutive mismatches of 'actual direction' (swash plate sensor) vs. 'commanded direction' (control system) Then test and see if 3 misses are equal within a tolerance band,	Cycle key switch.
523324.03	Service Alert Red Lamp	Engine shut down Display DTC	Swash plate position sensor output voltage shorted to high power source.	Cycle key switch.
523324.04	Service Alert Red Lamp	Engine shut down Display DTC	Swash plate position sensor output voltage is open or shorted to low power source, S2L.	Cycle key switch.
523324.10	Service Alert Red Lamp	Engine shut down Display DTC	Three consecutive mismatches of 'actual direction' (swash plate sensor) vs. 'commanded direction' (control system) Then test and see if 3 misses are outside of a tolerance band.	Cycle key switch.
523324.13	Service Alert Red Lamp	Engine shut down Display DTC	Swash plate position sensor is not in neutral when engine is not running.	When situation no longer exists. (250 msec. persistence.)
523324.16	Service Alert Red Lamp	Engine shut down Display DTC	Swash plate position sensor output voltage is above 90% of supply voltage, or shorted to high power source.	Cycle key switch.
523324.18	Service Alert Red Lamp	Engine shut down Display DTC	Swash plate position sensor output voltage is below 10% of supply voltage.	Cycle key switch.
523590.03	Service Alert Amber Lamp	Function degraded Display DTC	Forward Pedal Sensor, Short to 5 V	
523590.04	Service Alert Amber Lamp	Function degraded Display DTC	Forward Pedal Sensor, Short to Low	
523590.08	Service Alert Amber Lamp	Function degraded Display DTC	Forward Pedal Sensor, Abnormal Frequency	
523590.14	Service Alert Amber Lamp	Function degraded Display DTC	Forward Pedal, Reverse as Forward	Check wiring connections
523590.31	Service Alert Amber Lamp	Function degraded Display DTC	Forward Pedal Sensor, A-B Mismatch	
523591.03	Service Alert Amber Lamp	Function degraded Display DTC	Reverse Pedal Sensor, Short to 5 V	
523591.04	Service Alert Amber Lamp	Function degraded Display DTC	Reverse Pedal Sensor, Short to Low	
523591.08	Service Alert Amber Lamp	Function degraded Display DTC	Reverse Pedal Sensor, Abnormal Frequency	
523591.14	Service Alert Amber Lamp	Function degraded Display DTC	Reverse Pedal, Forward as Reverse	Check wiring connections
523591.31	Service Alert Amber Lamp	Function degraded Display DTC	Reverse Pedal Sensor, A-B Mismatch	
523652.31	Service Alert Red Lamp	Engine shut down	VCU harness position unknown	
523735.03	Service Alert Amber Lamp	Indicator/Alarm only	eHydro FWD/REV Solenoid Supply shorted 12 V	Cycle key switch.
523735.04	Service Alert Red Lamp	Engine shut down	eHydro FWD/REV Solenoid Supply shorted low	Cycle key switch.
523899.03	Service Alert Amber Lamp	Indicator/Alarm only Display DTC	Work Light Relay low side driver short to high.	
524069.03	Service Alert Red Lamp	Engine shut down Display DTC	Reverse Solenoid short to high.	Cycle key switch.
524069.04	Service Alert Red Lamp	Engine shut down Display DTC	Reverse Solenoid short to ground.	Cycle key switch.
524069.13	Service Alert Amber Lamp	Display DTC	Reverse Solenoid not calibrated	Calibrate
524071.03	Service Alert Red Lamp	Engine shut down Display DTC	Forward Solenoid short to high.	Cycle key switch.

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CB12260,0000484 -19-08APR15-4/5

524071.04	Service Alert Red Lamp	Engine shut down Display DTC	Reverse Solenoid short to ground.	Cycle key switch.
524071.13	Service Alert Amber Lamp	Display DTC	Forward Solenoid Not Calibrated	Calibrate
524204.31	Service Alert Red Lamp	Engine shut down	Aux input for control unit position select invalid value	
524211.31	Service Alert Red Lamp	Engine shut down	Aux input for control unit position select invalid value	
524265.31	Service Alert Red Lamp	Function degraded Display DTC	Internal error, data check sum error	Dismiss DTC using PDU

CB12260,0000484 -19-08APR15-5/5

VCU 000070.14 — Park Brake Switch

Code Caused By:

Park brake switch off during start switch on (attempting to crank)

Alarm Level:

Informational

To Clear Display:

Correct condition

Alarm Frequency:

Continuous

Control Unit Response:

No crank

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

Service ADVISOR is a trademark of Deere & Company

Check for park brake applied when starting.

Check park brake switch ON/OFF function through TechControl Service Menu,

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty switch*
- *Faulty wiring*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Command Arm with Y Axis Control Schematic

JF70945,00000EE -19-19MAY14-1/3

Procedure

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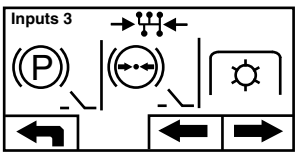
JF70945,00000EE -19-19MAY14-2/3

1 Park Brake Switch	Does park brake switch cycle from On to Off in the TechControl Service Menu, I/O status screens, Input 3?  TCT010480 —UN—07FEB14	**YES:** Switch and circuit are good. **NO:** Test park brake switch. See Park Brake Switch Test. **NO:** Check command arm circuit wire 745A Org from park brake switch to pin 2 of main harness connector for loose wire or connections. See Command Arm with Y Axis Control Schematic. **NO:** Check main harness wires and connectors for possible loose wire connection on 745 Pur wire. See Main Electrical Schematic, Non-T4 or Main Electrical Schematic, T4.

JF70945,00000EE -19-19MAY14-3/3

VCU 000096.01 — Fuel Level Sensor

Code Caused By:

Fuel Level Sensor out of range low

Alarm Level:

Service Alert

To Clear Display:

Key Cycle

Alarm Frequency:

Continuous

Control Unit Response:

None

Snapshot Recorded:

No

Required Tools:

Multimeter

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Preliminary Checks:

Check fuel level.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,00000EF -19-13JUN14-1/5

Diagnosis

Continued on next page

JF70945,00000EF -19-13JUN14-2/5

❶ **Fuel Level Sensor**	Is there 12 volts at fuel sender connector MC-35 pin A? (See Fuel Level Sensor Connector.)	**YES:** Go to next step. **NO:** Check wiring d connections to sender.

JF70945,00000EF -19-13JUN14-3/5

❷ **VCU**	Check wire continuity from connector MC-35 pin B to VCU pin A4. Is the resistance less than 5 ohms?	**YES:** Go to next step. **NO:** Check wiring, repair as needed. Perform Verification Procedure

JF70945,00000EF -19-13JUN14-4/5

❸ **Fuel Level Sender**	Measure resistance of fuel level sender. Is resistance within specification? **Fuel Level Sensor—Specification** Sensor (full tank)—Resistance.....28—33 ohms Sensor (1/2 full tank)—Resistance.....103—116 ohms Sensor (empty tank)—Resistance.....240—250 ohms	**YES:** Contact DTAC. **NO:** Replace fuel level sender and perform Verification Procedure.

JF70945,00000EF -19-13JUN14-5/5

VCU 000096.03 — Fuel Level Sensor

Code Caused By:

Fuel Level Sensor short to high

Alarm Level:

Service Alert

To Clear Display:

Key Cycle

Alarm Frequency:

Continuous

Control Unit Response:

None

Snapshot Recorded:

No

Required Tools:

Multimeter

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Preliminary Checks:

Check fuel level

Are all wires connected and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,00000F0 -19-19MAY14-1/5

Diagnosis

Continued on next page

JF70945,00000F0 -19-19MAY14-2/5

❶ **Fuel Level Sensor**	Is there 12 volts at fuel sender connector MC-35 pin B, 310 Org wire? (See Fuel Level Sensor Connector.)	**YES:** Go to next step. **NO:** Check wiring and connections to sender.

JF70945,00000F0 -19-19MAY14-3/5

❷ **VCU**	Check wire continuity from connector MC-35 pin B to VCU pin A4. Is the resistance less than 5 ohms?	**YES:** Go to next step. **NO:** Check wiring, repair as needed. Perform Verification Procedure.

JF70945,00000F0 -19-19MAY14-4/5

❸ **Fuel Level Sender**	Measure resistance of fuel level sender. Is resistance within specification? **Fuel Level Sensor—Specification** Sensor (full tank)—Resistance.....28—33 ohms Sensor (1/2 full tank)—Resistance.....103—116 ohms Sensor (empty tank)—Resistance.....240—250 ohms	**YES:** Contact DTAC. **NO:** Replace fuel level sender and perform Verification Procedure.

JF70945,00000F0 -19-19MAY14-5/5

VCU 000096.16 — Fuel Level Sensor

Code Caused By:

Fuel Level Sensor out of range high

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Key Cycle

Alarm Frequency:

Continuous

Control Unit Response:

None

Snapshot Recorded:

No

Required Tools:

Multimeter

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Check fuel level

Are all connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,00000F1 -19-12JUN14-1/5

Diagnosis

Continued on next page

JF70945,00000F1 -19-12JUN14-2/5

1 Fuel Level Sensor	Is there 12 volts at fuel sender connector MC-35 pin B, 310 Org wire? (See Fuel Level Sensor Connector.)	**YES:** Go to next step. **NO:** Check wiring and connections to sender.

JF70945,00000F1 -19-12JUN14-3/5

2 VCU	Check wire continuity from connector MC-35 pin B to VCU A4. Is the resistance less than 5 ohms?	**YES:** Go to next step. **NO:** Check wiring, repair as needed. Perform Verification Procedure

JF70945,00000F1 -19-12JUN14-4/5

3 Fuel Level Sender	Measure resistance of fuel level sender. Is resistance within specification? **Fuel Level Sensor—Specification** Sensor (full tank)—Resistance.....28—33 ohms Sensor (1/2 full tank)—Resistance.....103—116 ohms Sensor (empty tank)—Resistance.....240—250 ohms	**YES:** Contact DTAC. **NO:** Replace fuel level sender and perform Verification Procedure.

JF70945,00000F1 -19-12JUN14-5/5

VCU 000100.01 — Engine Oil Pressure

Code Caused By:

Engine oil pressure low

Alarm Level:

Stop-continuous audible

To Clear Display:

Cycle key switch-correct problem causing code

Alarm Frequency:

As long as condition is present

Control Unit Response:

Do not allow mowing

The PDU will have a pop-up screen.

Engine Oil Pressure Low Fault - Stop

Fault DTC: VCU 00100.01 or ECU 000100.01

Snapshot Recorded:

No

Required Tools:

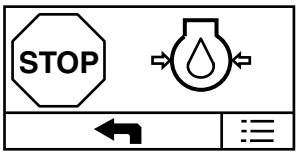
Multimeter

Preliminary Checks:

Check engine oil level.

Service ADVISOR is a trademark of Deere & Company

TCT010504 —UN—11FEB14



Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Low engine oil level*
- *Faulty switch*
- *Faulty wiring*

Additional Information

For complete wiring, see Main Electrical Schematic, Non-T4 or Main Electrical Schematic, T4.

JF70945,00000F2 -19-19MAY14-1/6

Diagnostic Procedure

JF70945,00000F2 -19-19MAY14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect to Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition OFF, Engine OFF. 3. Check engine oil level. Is level between the “Add” and “Full” marks?	**YES:** Go to next step. **NO:** Adjust oil level to the proper level. Perform Verification Procedure.

Continued on next page

JF70945,00000F2 -19-19MAY14-3/6

❷ Verify Engine Has Oil Pressure	1. Remove oil pressure switch from the engine and install a pressure gauge in engine block. See Test Engine Oil Pressure.	
	2. Run engine at rated engine speed and slow idle engine speed.	**YES:** Reinstall oil pressure switch. Go to next step.
	Was the gauge readings within specification?	**NO:** Investigate other potential mechanical problems: • Incorrect Oil • Plugged Oil Filter • Excessive Oil Temperature • Sticky Oil Pressure Regulating Valve • Plugged Oil Pump Screen • Cracked Pick-up Tube • Worn or Dirty Oil Pump • Faulty or Missing Piston Cooling Orifice • Excessive Main Bearing Clearance • Excessive Rod Bearing Clearance

JF70945,00000F2 -19-19MAY14-4/6

❸ Terminal Check Non-T4 Engine	1. Ignition OFF, Engine OFF.	
	2. Disconnect engine oil pressure switch connector MT-1.	
	3. Measure the resistance between MC-23 connector socket G4 and MT-1 connector.	
	4. Perform Terminal Test on switch and MT-1 connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

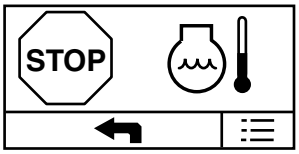
JF70945,00000F2 -19-19MAY14-5/6

❹ Test Switch	Test engine oil pressure switch. See Engine Oil Pressure Switch Test. Does the switch pass?	**YES:** Contact DTAC **NO:** Replace switch and perform Verification Procedure.

JF70945,00000F2 -19-19MAY14-6/6

VCU 000110.00 — Engine Coolant

TCT010505 —UN—11FEB14



Code Caused By:

Engine coolant temperature high

Alarm Level:

Stop-continuous audible

To Clear Display:

Allow engine to cool-cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

VCU shuts off cutting units.

The PDU has a pop-up screen.

Engine Coolant Temperature Fault - Stop

Fault DTC: VCU 000110.00 or ECU 000110.00

Snapshot Recorded:

No

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

NOTE: This code from the VCU is for non-Tier 4 engines. The Tier 4 engine coolant sensor connects to the machine's ECU.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the "Diagnostics" tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty sensor*
- *Stuck thermostat*
- *Plugged radiator*
- *Defective water pump*

Additional Information

- Main Electrical Schematic, T4 or Main Electrical Schematic, Non-T4.

JF70945,00000F3 -19-19MAY14-1/6

Diagnostic Procedure

JF70945,00000F3 -19-19MAY14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect to Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition OFF, engine OFF. **CAUTION: Allow engine to cool before checking coolant level.** 3. Check coolant level. Is level good?	**YES:** Go to next step. **NO:** Adjust coolant level to the proper level. Perform Verification Procedure.

Continued on next page

JF70945,00000F3 -19-19MAY14-3/6

2 Terminal Check Non-T4 Engine	1. Ignition OFF, engine OFF. 2. Disconnect engine coolant temperature switch connector MT-8. 3. Measure the resistance between MC-23 connector socket H3 and MT-8 connector. 4. Perform Terminal Test on switch and MT-8 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

JF70945,00000F3 -19-19MAY14-4/6

3 Check Thermostat	Remove thermostat and inspect. Is it stuck open or closed? If physical condition is good, perform Test Thermostat Opening. Does thermostat pass all tests?	**YES:** Reinstall and Go to next step. **NO:** Replace thermostat and perform Verification Procedure.

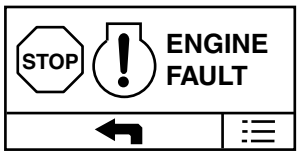
JF70945,00000F3 -19-19MAY14-5/6

4 Test Coolant Temp Switch Non-T4 Engines	Test coolant temperature switch. Refer to Test Coolant Temperature Switch. Does it pass?	**YES:** Contact DTAC. **NO:** Replace switch and perform Verification Procedure.

JF70945,00000F3 -19-19MAY14-6/6

VCU 000158.00 — Switched Power (ELX) Fault

TCT010510 —UN—11FEB14



Code Caused By:

Switched VCU power high (>18VDC)

Alarm Level:

Stop

To Clear Display:

Key cycle

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

The PDU will display a message

Engine Fault - Stop

Fault DTC: ECU “General”

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Are all of the connections tight.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Shorted battery*
- *Defective alternator*
- *Shorted wiring*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

JF70945,00000F4 -19-19MAY14-1/7

Diagnostics

JF70945,00000F4 -19-19MAY14-2/7

1 **Code Active**	Start the machine. Does the code become active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00000F4 -19-19MAY14-3/7

2 **Voltage Checks**	Check for 12 volts at pins M1 of the VCU connector. Spec is 12-14 volts. Is there 12 volts present?	**YES:** Go to next step. **NO:** Repair wires as needed and perform Verification Procedure.

Continued on next page

JF70945,00000F4 -19-19MAY14-4/7

3 Check Key Switch	Test key Switch. See Key Switch Test. Does the key switch pass?	**YES:** Go to next step. **NO:** Replace key switch and perform Verification Procedure.

JF70945,00000F4 -19-19MAY14-5/7

4 Test Alternator	Check charging system. See Regulated Voltage Output Test. Spec is 12-14 volts. Does alternator pass?	**YES:** Go to next step. **NO:** Replace alternator and perform Verification Procedure.

JF70945,00000F4 -19-19MAY14-6/7

5 Test Battery	Load test the battery. See Battery Load Test. Does it pass?	**YES:** If code it still active, suspect a defective VCU. **NO:** Replace battery and perform Verification Procedure.

JF70945,00000F4 -19-19MAY14-7/7

VCU 000158.01 — Switched Power (ELX) Fault

Code Caused By:

Switched power (ELX) to VCU below normal operating range (<8VDC)

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

The PDU displays a message

Engine Fault - Stop

Fault DTC: ECU “General”

Snapshot Recorded:

Yes

Required Tools:

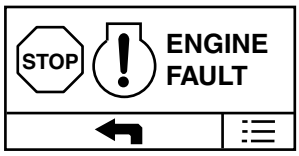
Multimeter and Service ADVISOR™

Preliminary Checks:

Are all of the connections tight.

Service ADVISOR is a trademark of Deere & Company

TCT010510 —UN—11FEB14



Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Shorted battery*
- *Defective alternator*
- *Shorted wiring*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

JF70945,00000F5 -19-19MAY14-1/7

Diagnostics

JF70945,00000F5 -19-19MAY14-2/7

❶ **Code Active**	Start the machine. Does the code become active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00000F5 -19-19MAY14-3/7

❷ **Test Alternator**	Check charging system. See Regulated Voltage Output Test. Spec is 12-14 volts. Does alternator pass?	**YES:** Go to next step. **NO:** Replace alternator and perform Verification Procedure.

Continued on next page

JF70945,00000F5 -19-19MAY14-4/7

3 Voltage Checks	Check for 12 volts at pins M1 of the VCU connector. Spec is 12-14 volts. Is there 12 volts present?	**YES:** Go to next step. **NO:** Repair wires as needed and perform Verification Procedure.

JF70945,00000F5 -19-19MAY14-5/7

4 Check Key Switch	Test key Switch. See Key Switch Test. Does the key switch pass?	**YES:** Go to next step. **NO:** Replace key switch and perform Verification Procedure.

JF70945,00000F5 -19-19MAY14-6/7

5 Test Battery	Load test the battery. See Battery Load Test. Does it pass?	**YES:** If code it still active suspect a defective VCU. **NO:** Replace battery and perform Verification Procedure.

JF70945,00000F5 -19-19MAY14-7/7

VCU 000168.00 — Supply Voltage (VBAT) Fault

Code Caused By:

Battery voltage (VBAT), critical high voltage (above normal operating range (>18VDC))

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

The PDU will have a pop-up screen.

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Check battery and connections.

Diagnosis:

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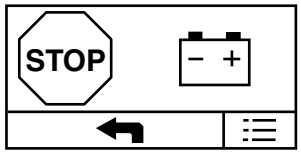
TCT010508 —UN—12FEB14



Battery Fault - Stop

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty alternator.*
- *Loose connections.*
- *Corroded connections.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,00000F6 -19-19MAY14-1/6

Diagnostics

JF70945,00000F6 -19-19MAY14-2/6

❶ **Check Codes**	Using Service ADVISOR, is code active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00000F6 -19-19MAY14-3/6

❷ **Check Battery**	Check battery for corrosion and load test battery. Battery Load Test. Does battery pass?	**YES:** Go to next step. **NO:** Replace battery and perform Verification Procedure.

Continued on next page

JF70945,00000F6 -19-19MAY14-4/6

3 Check Voltage	Check alternator output voltage. Perform Regulated Voltage Output Test. Spec is 12 to 14 Volts. Is voltage within spec?	**YES:** Perform Wiggle Test. **NO:** Go to next step.

JF70945,00000F6 -19-19MAY14-5/6

4 Check Wiring	Check wiring from alternator to VCU pin L1 for short to ground or connection problems. Is wiring in good condition?	**YES:** Suspect faulty controller. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00000F6 -19-19MAY14-6/6

VCU 000168.01 — Supply Voltage (VBAT) Critically Low

Code Caused By:

Supply Voltage (VBAT) Fault - Voltage above normal operating range. (>18V for more than 1 sec)

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Ramp hydros to 0 and no motion is allowed.

The PDU will have a pop-up screen.

Snapshot Recorded:

Yes

Required Tools:

Multimeter

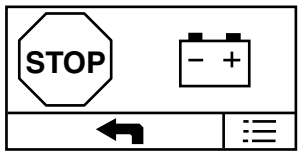
Preliminary Checks:

Check battery and connections.

Diagnosis:

Service ADVISOR is a trademark of Deere & Company

TCT010508 —UN—12FEB14



Battery Fault - Stop

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty alternator.*
- *Loose connections.*
- *Corroded connections.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,00000F7 -19-19MAY14-1/6

Diagnostics

Continued on next page

JF70945,00000F7 -19-19MAY14-2/6

1 Check Codes	Using Service ADVISOR. Is code active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00000F7 -19-19MAY14-3/6

2 Check Battery	Check battery for corrosion and load test battery. Battery Load Test Does battery pass?	**YES:** Go to next step. **NO:** Replace battery and perform Verification Procedure.

JF70945,00000F7 -19-19MAY14-4/6

3 Check Voltage	Check alternator output voltage. Perform Regulated Voltage Output Test. Spec is 12 to 14 Volts. Is voltage with spec?	**YES:** Perform Wiggle Test. **NO:** Go to next step.

JF70945,00000F7 -19-19MAY14-5/6

4 Check Wiring	Check wiring from alternator to VCU pin L1 for short to ground or connection problems. Is wiring in good condition?	**YES:** Suspect faulty controller. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00000F7 -19-19MAY14-6/6

VCU 000168.16 — Supply Voltage (VBAT) Fault

Code Caused By:

Battery voltage (VBAT) High (16> and <18VDC for .5 sec when not in start mode)

Alarm Level:

Service alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

The PDU will have a pop-up screen.

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

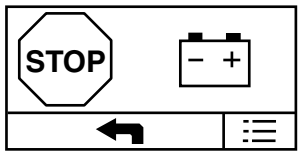
Preliminary Checks:

Check battery and connections.

Diagnosis:

Service ADVISOR is a trademark of Deere & Company

TCT010508 —UN—12FEB14



Battery Fault - Stop

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty alternator.*
- *Loose connections.*
- *Corroded connections.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,00000F8 -19-20MAY14-1/6

Diagnostics

JF70945,00000F8 -19-20MAY14-2/6

1 Check Codes	Using Service ADVISOR. Is code active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00000F8 -19-20MAY14-3/6

2 Check Battery	Check battery for corrosion and load test battery. Battery Load Test Does battery pass?	**YES:** Go to next step. **NO:** Replace battery and perform Verification Procedure.

Continued on next page

JF70945,00000F8 -19-20MAY14-4/6

3 Check Voltage	Check alternator output voltage. Perform Regulated Voltage Output Test. Spec is 12 to 14 Volts. Is voltage with spec? Regulated Voltage Output Test	**YES:** Perform Wiggle Test. **NO:** Go to next step.

JF70945,00000F8 -19-20MAY14-5/6

4 Check Wiring	Check wiring from alternator to VCU pin L1 for short to ground or connection problems. Is wiring in good condition?	**YES:** Suspect faulty controller. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00000F8 -19-20MAY14-6/6

VCU 000168.18 — Supply Voltage (VBAT) Fault

Code Caused By:

Supply Voltage (VBAT) Fault 8>X<9 for 5000 msec when NOT in engine start mode.

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continious

Control Unit Response:

Limited functionality

The PDU will have a pop-up screen.

Snapshot Recorded:

Yes

Required Tools:

Multimeter

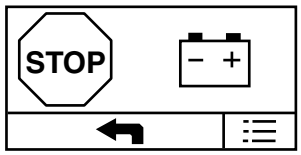
Preliminary Checks:

Check battery and connections.

Diagnosis:

Service ADVISOR is a trademark of Deere & Company

TCT010508 —UN—12FEB14



Battery Fault - Stop

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty wiring.*
- *Faulty alternator.*
- *Loose connections.*
- *Corroded connections.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,00000F9 -19-20MAY14-1/6

Diagnostics

Continued on next page

JF70945,00000F9 -19-20MAY14-2/6

1 Check Codes	Using Service ADVISOR. Is code active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00000F9 -19-20MAY14-3/6

2 Check Battery	Check battery for corrosion and load test battery. Battery Load Test Does battery pass?	**YES:** Go to next step. **NO:** Replace battery and perform Verification Procedure.

JF70945,00000F9 -19-20MAY14-4/6

3 Check Voltage	Check alternator output voltage. Perform Regulated Voltage Output Test. Spec is 12 to 14 Volts. Is voltage with specification?	**YES:** Perform Wiggle Test. **NO:** Go to next step.

JF70945,00000F9 -19-20MAY14-5/6

4 Check Wiring	Check wiring from alternator to VCU pin L1 for short to ground or connection problems. Is wiring in good condition?	**YES:** Suspect faulty controller. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00000F9 -19-20MAY14-6/6

VCU 000190.00 — Engine Speed

Code Caused By:

Engine speed sensor too high (above maximum allowed)

Alarm Level:

Service alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Check engine speed using PDU or Service ADVISOR.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Alternative fuel source in the intake.*
- *Throttle not adjusted properly.*

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Continued on next page

JF70945,00000FA -19-19MAY14-1/4

Diagnostics

JF70945,00000FA -19-19MAY14-2/4

1	**Is The Engine Speed Too High**	Start engine and run at high idle. Is engine speed within specification?	**YES:** Go To Problem Not Found Procedure. **NO:** Go to next step.

JF70945,00000FA -19-19MAY14-3/4

2	**Remove Intake**	Remove intake manifold and check for an alternative fuel source. Is oil or other fuels in the intake?	**YES:** Diagnose were fuel source is coming from. **NO:** Check for a mechanical problem with the engine or injection pump.

JF70945,00000FA -19-19MAY14-4/4

VCU 000190.01 — Engine Speed

Code Caused By:

Engine speed sensor too low (below min. allowed)

Alarm Level:

Service alert

To Clear Display:

Key cycle

Alarm Frequency:

Continuous display

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Check engine speed on PDU service screen.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Plugged air filter.*
- *Throttle not adjusted properly.*

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JF70945,00000FB -19-17JUN14-1/4

Diagnostics

JF70945,00000FB -19-17JUN14-2/4

1	**Check Engine Speed**	Check engine speed with cutting units on and lowered. Is engine speed at correct rpm?	**YES:** Go To Problem Not Found Procedure. **NO:** Go to next step.

Continued on next page

JF70945,00000FB -19-17JUN14-3/4

2 Smoke	With the engine running, turn on cutting units and lower. Put a load on the engine. Is there any smoke coming out of the exhaust? If so, what color and what under what conditions?	**YES:** See Engine Diagnosis Section 220, Group 20. **YES:** Check Service ADVISOR Diagnostics Tab, Observed Symptoms, Engine. **NO:** If there is no exhaust smoke and engine RPM is below specification, see section 220-20 Engine output low, exhaust color normal.

JF70945,00000FB -19-17JUN14-4/4

VCU 000190.02 — Engine Speed Sensor

Code Caused By:

Engine speed erratic, intermittent or incorrect

Alarm Level:

Service alert

To Clear Display:

Key cycle

Alarm Frequency:

Continuous display

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Service ADVISOR™

Preliminary Checks:

Check wire connection to crankshaft speed sensor.

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Check 800 Yel wire between MC-16 crankshaft speed connector and VCU connector pin M4.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Loose or dirty connections to crankshaft speed sensor.*
- *Loose throttle cable wire.*

Additional Information

- Main Electrical Schematic, Non-T4, Main Electrical Schematic, T4 and Engine Controls and Sensors Schematic.

JF70945,00000FC -19-20MAY14-1/4

Diagnostics

JF70945,00000FC -19-20MAY14-2/4

1 Check Wiring	Disconnect VCU connector and connector MC-16. Ohm out pin 2 of MC-16 to ground. Spec is less than 5 ohms. Ohm out wire from MC-16 pin 1 to VCU pin M4. Specification is less than 5 ohms. When doing test, perform Wiggle Test. Are wires within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,00000FC -19-20MAY14-3/4

❷ **Check Sensor**	Ohm out sensor from pin 1 to pin 2. Spec is 1050 ohms +- 10%. Is it within spec?	**YES:** Recheck wiring and if no problems are found, suspect faulty VCU. **NO:** Replace sensor and perform Verification Procedure.

JF70945,00000FC -19-20MAY14-4/4

VCU 000190.09 — Engine Speed

Code Caused By:

Engine speed not arriving on CAN bus or updated at and abnormal rate (ECU engines only.)

Alarm Level:

Red lamp.

To Clear Display:

Cycle key switch

Alarm Frequency:

Alert

Control Unit Response:

Engine may shut down.

Snapshot Recorded:

No

Required Tools:

Multimeter

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Preliminary Checks:

Is the engine speed sensor connected?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Are all of the controller communicating on the CAN Bus?*
- *Are all of the connections clean and tight?*

Additional Information

- Main Electrical Schematic, T4

JF70945,00000FD -19-20MAY14-1/5

Diagnostics

JF70945,00000FD -19-20MAY14-2/5

❶ **Controllers**	Using Service ADVISOR, check CAN Bus operation. Are all of the controllers communicating on the CAN Bus?	**YES:** Go to next step. **NO:** Check CAN Bus operation. Perform CAN Message Received Error, CAN Message Received Is Incorrect, CAN Communication Fault Checks, and CAN Bus Terminator Test.

Continued on next page

JF70945,00000FD -19-20MAY14-3/5

2 Check Wiring	Check wiring from crankshaft speed sensor to ECU. Check for short to ground, power, broken wire or high resistance in wiring. Does the wiring check out ok? • Engine Connector X5059 Schematic	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00000FD -19-20MAY14-4/5

3 Check Sensor	Check crankshaft speed sensor. Specification is 1050 ohms +- 10%. Is it within specification?	**YES:** Recheck wiring. If it all checks ok contact DTAC. **NO:** Replace sensor and perform Verification Procedure.

JF70945,00000FD -19-20MAY14-5/5

VCU 000629.12 — Watch Dog Time Out

Code Caused By:

Watch Dog Time Out

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

None

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Preliminary Checks:

Is the VCU communicating on the CAN bus? Observe CAN traffic using CAN Trace.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- CAN Network Voltage Checks
- CAN Bus Terminator Test
- CAN Communication Fault Checks

JF70945,00000FE -19-20MAY14-1/3

Procedure

JF70945,00000FE -19-20MAY14-2/3

1 Payload	Install latest payload. (See Approved Software for Control Units). Is problem corrected?	**YES:** End of test. **NO:** Suspect faulty VCU or another controller.

JF70945,00000FE -19-20MAY14-3/3

VCU 000639.12 — CAN, Lost Message

Code Caused By:

Communication error between controllers

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

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Are all of the controllers powered up?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty CAN bus wiring.*
- *Faulty CAN terminator.*

Additional Information

- CAN Communication Fault Checks
- CAN Bus Terminator Test
- CAN Network Voltage Checks
- CAN Message Not Received

JF70945,00000FF -19-20MAY14-1/1

VCU 000639.14 — CAN, Bus Off

Code Caused By:

No communication over CAN bus

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

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Are all of the controllers powered up?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty CAN terminator.*

Additional Information

- CAN Message Not Received
- CAN Communication Fault Checks
- CAN Bus Terminator Test
- CAN Network Voltage Checks

JF70945,0000100 -19-20MAY14-1/1

VCU 000677.03 — Starter Relay

Code Caused By:

Starter relay short to high. DTC for non-T4 engine machines only.

Alarm Level:

Informational

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Function degraded, the engine may not start.

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

Turn key switch to Off position before cranking engine.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, T4

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JF70945,0000101 -19-18JUN14-1/4

Diagnosis

JF70945,0000101 -19-18JUN14-2/4

❶ **Start Relay**	Is there 12 volts at power center start relay connector pin 85 with the key in the start position only?	**YES:** Go to the next step if code persists. **NO:** Make sure all start conditions are met. Go to next step.

JF70945,0000101 -19-18JUN14-3/4

❷ **Start Relay**	With key in run position, is battery voltage present at start relay, Pur wire?	**YES:** Check Pur wire for a short to high source. **YES:** Test relay. See Relay Test. **YES:** Perform wiggle test and check connections. See Wiggle Test. **NO:** Suspect faulty VCU.

JF70945,0000101 -19-18JUN14-4/4

VCU 000677.04 — Starter Relay

Code Caused By:

Starter relay short to ground.

Alarm Level:

Informational-intermittent audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Function degraded, the engine may not start.

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Turn key switch to Off position before cranking engine.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, T4

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JF70945,0000102 -19-27MAR14-1/5

Diagnosis

JF70945,0000102 -19-27MAR14-2/5

❶ **Start Relay**	Is there 12 volts at power center starter relay connector pin 85 with the key in the start position only?	**YES:** Go to the next step. **NO:** Make sure all start conditions are met. Go to next step.

JF70945,0000102 -19-27MAR14-3/5

❷ **Start Relay**	Is low side drive signal at power center start relay connector pin 86 with the key in the start position only?	**YES:** Test relay. See Relay Test. **NO:** Go to next step.

JF70945,0000102 -19-27MAR14-4/5

❸ **ECU**	Check wire continuity from power center start relay connector pin 86 to ECU connector pins 28, then from starter relay pin 85 to VCU pin J4. Is the resistance less than 5 ohms?	**YES:** Perform wiggle test and check connections. See Wiggle Test. **NO:** Check wiring, repair as needed. Perform Verification Procedure.

JF70945,0000102 -19-27MAR14-5/5

VCU 000677.14 — Crank Time Exceeded

Code Caused By:

Crank Time Exceeded (>20 seconds)

Alarm Level:

Informational

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Will not allow cranking until key switch is cycled after a wait period of 60 seconds

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

None

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Over cranking starter. Let starter cool down.*
- *Check for issues with engine not allowing it to start.*

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JF70945,0000103 -19-20MAY14-1/1

VCU 000677.31 — Starter Cool Down in Process

Code Caused By:

Starter Cool Down in Process (for 60 seconds)

Alarm Level:

Informational

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Will not allow crank for 1 minute

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

None

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Starter was cranked for more than 20 seconds.*
- *Check for issues with engine not allowing it to start.*

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JF70945,0000104 -19-20MAY14-1/1

VCU 000920.04 — Buzzer Short to Low

Code Caused By:

Buzzer active driver shorted to low.

Alarm Level:

Informational - amber lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

—

Control Unit Response:

Indicator only

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Are all of the connections clean and tight?

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring. Check 450 series Gray wires between control arm buzzer and VCU and connections.*
- *Faulty buzzer. Test buzzer. (See Warning Alarm Test).*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

JF70945,0000105 -19-20MAY14-1/5

Diagnostics

JF70945,0000105 -19-20MAY14-2/5

1	**Check for Short to Ground**	Unplug connector C-5. Check wire from pin B to VCU pin G-2. Does it have continuity to ground?	**YES:** Repair wiring and perform Verification Procedure. **NO:** Go to next step.

JF70945,0000105 -19-20MAY14-3/5

2	**Check Voltage**	Is there 12 volts at pin A of the C-5 connector with the key on?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000105 -19-20MAY14-4/5

3	**Check Buzzer**	Test buzzer. Is it shorted to ground?	**YES:** Replace buzzer and perform Verification Procedure. **NO:** Suspect faulty VCU.

JF70945,0000105 -19-20MAY14-5/5

VCU 000920.03 — Buzzer Short to High

Code Caused By:

Battery voltage detected on buzzer driver when in “buzzer off” state.

Alarm Level:

Informational - amber lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

None

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Are all of the connections clean and tight?

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Shorted wiring. Check wires and connections on 450 series Gray wires between control arm buzzer and VCU.*
- *Faulty buzzer. Test buzzer (See Warning Alarm Test).*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

JF70945,0000106 -19-20MAY14-1/5

Diagnostics

JF70945,0000106 -19-20MAY14-2/5

1	**Check for Short to Ground**	Disconnect connector C-5. Check wire from pin B to VCU pin G-2. Does it have continuity to ground?	**YES:** Repair wiring and perform Verification Procedure. **NO:** Go to next step.

JF70945,0000106 -19-20MAY14-3/5

2	**Check Voltage**	Is there 12 volts at pin A of the C-5 connector with the key on?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

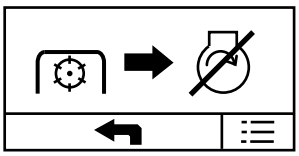
JF70945,0000106 -19-20MAY14-4/5

3	**Check Buzzer**	Check buzzer. Is it shorted to ground?	**YES:** Replace buzzer and perform Verification Procedure. **NO:** Suspect faulty VCU.

JF70945,0000106 -19-20MAY14-5/5

VCU 000976.14 — PTO Switch

TCT010500 —UN—11FEB14



Code Caused By:

PTO Switch On during Start Switch On (attempting to crank)

Alarm Level:

Informational

To Clear Display:

Correct condition

Alarm Frequency:

Continuous

Control Unit Response:

No crank

The PDU will have a pop-up screen.

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Check PTO switch position.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *PTO switch left in On position during machine shut down.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

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JF70945,0000107 -19-17JUN14-1/5

Diagnostics

JF70945,0000107 -19-17JUN14-2/5

1 Check Switch	Unplug the switch and test the switch. Place meter leads on pin 2 and pin 3 of the switch. With the switch off there should be no continuity, with the switch on there should be continuity between pins 2 and 3. Does the switch pass test?	**YES:** Go to next step. **NO:** Replace the switch and perform Verification Procedure.

JF70945,0000107 -19-17JUN14-3/5

2 Check Wiring	Check the wire from pin 3 of C-24 to pin A-2 of the VCU. Check for the wire being shorted to ground , power source, or another wire. Does it pass test? See PTO Switch Test.	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

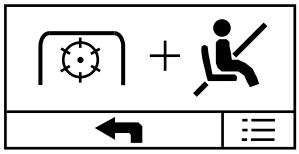
JF70945,0000107 -19-17JUN14-4/5

3 Voltage test	With the key on and the PTO switch off, back probe pin A-2 of the VCU. Is there 12 volts present at pin A-2?	**YES:** Repair wiring and perform Verification Procedure. **NO:** If the code is still active, suspect faulty VCU.

JF70945,0000107 -19-17JUN14-5/5

VCU 001504.14 — PTO On While Off of Seat

TCT010515 —UN—11FEB14



Code Caused By:

PTO ON while out of seat.

Alarm Level:

Informational

To Clear Display:

Correct operating conditions

Alarm Frequency:

Continuous

Control Unit Response:

Engine stop or no run

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Are there any loose connections.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *The PTO is engaged while operator is off the seat.*
- *The forward or reverse pedal is not in neutral while operator is not on the seat.*

Additional Information

- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,0000108 -19-20MAY14-1/7

Diagnostics

JF70945,0000108 -19-20MAY14-2/7

1 Check PTO Switch	Unplug the switch and test the switch. Place meter leads on pin 2 and pin 3 of the switch. With the switch off there should be no continuity. With the switch on, there should be continuity between pins 2 and 3. Does the switch pass the test?	**YES:** Go to next step. **NO:** Replace the switch and perform Verification Procedure.

Continued on next page

JF70945,0000108 -19-20MAY14-3/7

2 Check Wiring	Ohm out the wire from pin 3 of C-24 to A-2 of the VCU. Check for the wire being shorted to ground , power source or another wire. Does it pass test?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000108 -19-20MAY14-4/7

3 Voltage Test	With the key on and the PTO switch off, back probe pin A-2 of the MCU. Is there 12 volts present at pin A-2?	**YES:** Repair wiring. **NO:** Test seat switch. See Seat Switch Test. **NO:** If the code is still active suspect faulty VCU.

JF70945,0000108 -19-20MAY14-5/7

4 Check Seat Switch	Disconnect seat switch and place multimeter leads on pin A and B. With operator off the seat there should be no continuity. With operator on the seat there should be continuity between pins A and B. Does the switch pass the test?	**YES:** Go to next step. **NO:** Replace seat switch and perform Verification Procedure.

JF70945,0000108 -19-20MAY14-6/7

5 Voltage Tests	With the seat switch plugged into the harness there should be 12 volts on pin A. With operator on the seat and key on check for 12 volts at pin C1 of the VCU connector. Do any of the tests fail?	**YES:** Repair wiring and perform Verification Procedure. **NO:** Suspect faulty VCU.

JF70945,0000108 -19-20MAY14-7/7

VCU 001638.00 — Hydraulic Oil

Code Caused By:

Hydraulic oil temperature high

Alarm Level:

Service alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous audible-continuous display

Control Unit Response:

Limited functionality

Snapshot Recorded:

No

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

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Is the hydraulic cooler plugged?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Hydraulic cooler is plugged with dirt.*
- *Faulty sensor.*
- *Hydraulic system is over worked.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,0000109 -19-20MAY14-1/5

Electrical Diagnostics

JF70945,0000109 -19-20MAY14-2/5

1 Check Wiring	Check wire from MC-63 pin A to VCU pin K1. Specification is less than 5 ohms. Is it within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000109 -19-20MAY14-3/5

2 Voltage Check	Check for voltage at MC-63 pin B. There should be approximately 12 volts with key on. With connector MC-63 disconnected check for voltage at VCU pin K1. There should be 0 volts present. Are the measurements within specification?	**YES:** Go to next step. **NO:** Repair wiring, perform Verification Procedure.

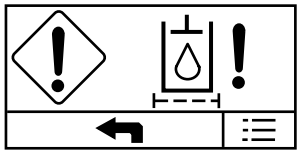
JF70945,0000109 -19-20MAY14-4/5

3 Test Switch	Test hydraulic temp switch. See Test Hydraulic Temperature Switch. Did the switch pass?	**YES:** Recheck wiring. If it checks good, suspect faulty VCU. **NO:** Replace switch and perform Verification Procedure.

JF70945,0000109 -19-20MAY14-5/5

VCU 001713.00 — Hydraulic Filter

TCT010507 —UN—11FEB14



Code Caused By:

Hydraulic filter restricted

Alarm Level:

Service alert

To Clear Display:

Repair problem

Alarm Frequency:

Continuous display-continuous audible

Control Unit Response:

Shuts off reels

Snapshot Recorded:

No

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Plugged hydraulic filter.*
- *Faulty switch (See Test Hydraulic Filter Restriction Switch).*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000010A -19-20MAY14-1/6

Diagnostics

JF70945,000010A -19-20MAY14-2/6

❶ **Change Hydraulic Filter**	Change the hydraulic filter (See Operator’s Manual). Top off the fluid level. Operate the mower. Does the hydraulic filter indicator stay off?	**YES:** End of test. **NO:** Go to next step.

JF70945,000010A -19-20MAY14-3/6

❷ **Check Switch**	With the engine not running, check hydraulic filter restriction switch from pins A to B. Check from pins A and B to ground. The switch should have no continuity. Does it pass?	**YES:** Go to next step. **NO:** Replace switch and perform Verification Procedure.

Continued on next page

JF70945,000010A -19-20MAY14-4/6

3 Check Wiring	Check the wire from the VCU pin A3 to MC-28 pin B. Spec is less than 5 ohms. Does it pass?	**YES:** Go To Next step. **NO:** Repair wiring and perform Verification Procedure.

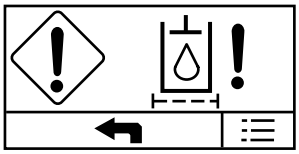
JF70945,000010A -19-20MAY14-5/6

4 Operational Test	Connect a pressure gauge on both sides of the hydraulic filter. With the engine running, operate the hydraulics while monitoring the pressures on both sides of the hydraulic filter. There should be less than a 12 psi difference from the inlet of the filter to the outlet of the filter. Does it pass?	**YES:** If the hydraulic filter indicator is still on and all of the test passed, contact DTAC. **NO:** Find the restriction and repair. Perform Verification Procedure.

JF70945,000010A -19-20MAY14-6/6

VCU 001713.03 — Hydraulic Filter Restriction

TCT010507 —UN—11FEB14



Code Caused By:

Hydraulic filter restriction switch short to high.

Alarm Level:

Service alert

To Clear Display:

Repair problem

Alarm Frequency:

Audible

Control Unit Response:

Filter restriction detection will not occur.

The PDU will show image.

Snapshot Recorded:

No

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Check filter restriction switch and wiring connections.

Diagnosis:

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- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty switch (See Test Hydraulic Filter Restriction Switch).*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,000010B -19-12JUN14-1/5

Diagnostics

Continued on next page

JF70945,000010B -19-12JUN14-2/5

1 Check Switch	With the engine not running, test hydraulic filter restriction switch from pins A to B. Check from pins A and B to ground. The switch should have no continuity. Does it pass?	**YES:** Go to next step. **NO:** Replace switch and perform Verification Procedure.

JF70945,000010B -19-12JUN14-3/5

2 Check Wiring	Test the wire from the VCU pin A3 to MC-28 pin B. Specification is less than 5 ohms. Does it pass?	**YES:** Go To Next step. **NO:** Repair wiring and perform Verification Procedure.

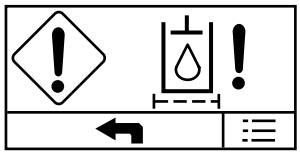
JF70945,000010B -19-12JUN14-4/5

3 Operational Test	Connect a pressure gauge on both sides of the hydraulic filter. With the engine running, operate the hydraulics while monitoring the pressures on both sides of the hydraulic filter. The normal pressure drop across the filter is 12 psi. There should be less than a 40 psi difference from the inlet of the filter to the outlet of the filter. Does it pass?	**YES:** If the hydraulic filter indicator is still on and all of the test passed, contact DTAC. **NO:** Find the restriction and repair. Perform Verification Procedure.

JF70945,000010B -19-12JUN14-5/5

VCU 001713.31 — Hydraulic Filter Restriction

TCT010507 —UN—11FEB14



Code Caused By:

Hydraulic filter restriction switch signal invalid.

Alarm Level:

Service alert

To Clear Display:

Repair problem

Alarm Frequency:

Audible

Control Unit Response:

Filter restriction detection will not occur.

The PDU will show image.

Snapshot Recorded:

No

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Check filter restriction switch and wiring connections.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty switch (See Test Hydraulic Filter Restriction Switch).*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

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Continued on next page

JF70945,000010C -19-20MAY14-1/5

Diagnostics

JF70945,000010C -19-20MAY14-2/5

1 Check Switch	With the engine not running, measure resistance of the hydraulic filter restriction switch from pins A to B. Check from pins A and B to ground. The switch should have no continuity. Does it pass?	**YES:** Go to next step. **NO:** Replace switch and perform Verification Procedure.

JF70945,000010C -19-20MAY14-3/5

2 Check Wiring	Test the wire from the VCU pin A3 to MC-28 pin B. Specification is less than 5 ohms. Does it pass	**YES:** Go To Next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000010C -19-20MAY14-4/5

3 Operational Test	Connect a pressure gauge on both sides of the hydraulic filter. With the engine running, operate the hydraulics while monitoring the pressures on both sides of the hydraulic filter. The normal pressure drop across the filter is 12 psi. There should be less than a 40 psi difference from the inlet of the filter to the outlet of the filter. Does it pass?	**YES:** If the hydraulic filter light is still on and all of the tests passed, contact DTAC. **NO:** Find the restriction and repair. Perform Verification Procedure.

JF70945,000010C -19-20MAY14-5/5

VCU 003509.03 — Sensor Power Supply 1 Voltage

Code Caused By:

Sensor power supply 1 voltage above 5.5 VDC

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

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Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty sensor.*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Engine Controls and Sensors Schematic

Continued on next page

JF70945,000010D -19-20MAY14-1/4

Diagnostics

JF70945,000010D -19-20MAY14-2/4

1 Voltage Checks	Disconnect connectors MC-61, MC-62 and MC-34. Check voltages on MC-61 pin 3, MC-62 pin 3 and MC-34 pin C with the key on. Specification is 4.5 to 5.5 volts. Are the voltages within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000010D -19-20MAY14-3/4

2 Sensor Check	With the key on, connect sensors from previous step 1 at a time. Check voltage every time you plug in a sensor. Did the voltage stay at 5 volts?	**YES:** If the code is still active and all of the voltages were within specification, suspect faulty VCU. **NO:** Replace or test sensor that raised the voltage and perform Verification Procedure.

JF70945,000010D -19-20MAY14-4/4

VCU 003509.04 — Sensor Power Supply 1 Voltage

Code Caused By:

Senor power supply 1 voltage below 4.5 VDC

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

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Are all of the connectors clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty sensor.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Engine Controls and Sensors Schematic

JF70945,000010E -19-20MAY14-1/4

Diagnostics

Continued on next page

JF70945,000010E -19-20MAY14-2/4

1 Voltage Checks	Disconnect connectors MC-61, MC-62 and MC-34. Check Voltages on MC-61 pin 3, MC-62 pin 3 and MC-34 pin C with the key on. Specification is 4.5 to 5.5 volts. Are the voltages within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000010E -19-20MAY14-3/4

2 Sensor Check	With the key on, connect sensors from previous step 1 at a time. Check voltage every time you connect a sensor. Did the voltage stay at 5 volts?	**YES:** If the code is still active and all of the voltages were within spec, suspect faulty VCU. **NO:** Replace sensor that raised the voltage and perform Verification Procedure.

JF70945,000010E -19-20MAY14-4/4

VCU 003510.03 — Sensor Power Supply 2 Voltage

Code Caused By:

Sensor power supply 2 voltage above 5.5 VDC

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

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Preliminary Checks:

Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty sensor.*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Engine Controls and Sensors Schematic

JF70945,000010F -19-20MAY14-1/4

Diagnostics

JF70945,000010F -19-20MAY14-2/4

1 Voltage Checks	Disconnect connectors MC-61 and MC-62. Check Voltages on MC-61 pin 6 and MC-62 pin 6 with the key on. Specification is 4.5 to 5.5 volts. Are the voltages within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,000010F -19-20MAY14-3/4

❷ **Sensor Check**	With the key on, connect sensors from pervious step 1 at a time. Check voltage every time you connectn a sensor. Did the voltage stay at 5 volts?	**YES:** If the code is still active and all of the voltages were within specification, suspect faulty VCU. **NO:** Replace sensor that raised the voltage and perform Verification Procedure.

JF70945,000010F -19-20MAY14-4/4

VCU 003510.04 — Sensor Power Supply 2 Voltage

Code Caused By:

Sensor power supply 2 below 4.5 VDC

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

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Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring.*
- *Faulty sensor.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Engine Controls and Sensors Schematic

JF70945,0000110 -19-20MAY14-1/4

Diagnostics

JF70945,0000110 -19-20MAY14-2/4

❶ **Voltage Checks**	Disconnect connectors MC-61 and MC-62. Check voltages on MC-61 pin 6 and MC-62 pin 6 with the key on. Specification is 4.5 to 5.5 volts. Are the voltages within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,0000110 -19-20MAY14-3/4

2 Sensor Check	With the key on, connect sensors from pervious step 1 at a time. Check voltage every time you connect a sensor. Did the voltage stay at 5 volts?	**YES:** If the code is still active and all of the voltages were within specification, suspect faulty VCU. **NO:** Replace sensor that raised the voltage and perform Verification Procedure.

JF70945,0000110 -19-20MAY14-4/4

VCU 516124.03 — Engine Run Request

Code Caused By:

Engine run request shorted to high

Alarm Level:

Machine stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

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Ensure that key switch is not in start position.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty key switch*
- *Faulty wiring*
- *Faulty starter relay (See Relay Test)*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

JF70945,0000111 -19-20MAY14-1/3

Procedure

JF70945,0000111 -19-20MAY14-2/3

1 Key Switch	Test key switch. See Key Switch Test. Does key switch test ok?	**YES:** Go to next step. **NO:** Replace key switch. Perform verification procedure. (See Verification Procedure.)

JF70945,0000111 -19-20MAY14-3/3

VCU 516124.04 — Engine Run Request

Code Caused By:

Engine run request shorted to ground

Alarm Level:

Machine stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Ensure that key switch is not in start position.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty key switch*
- *Faulty wiring*
- *Faulty starter relay (See Relay Test).*

Additional Information

- Main Electrical Schematic, Non-T4
- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, T4

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JF70945,0000112 -19-20MAY14-1/3

Procedure

JF70945,0000112 -19-20MAY14-2/3

1 **Key Switch**	Test key switch. See Key Switch Test . Does key switch test ok?	**YES:** Go to next step. **NO:** Replace key switch.

JF70945,0000112 -19-20MAY14-3/3

VCU 516125.03 — Fuel Solenoid Pull-In Relay

Code Caused By:

Fuel pull-in shorted to high

Alarm Level:

Function degraded - amber warning lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Machine may not start

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Make sure that key switch is in run position.

Check relay insertion

Check fuel solenoid connections

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty key switch*
- *Faulty wiring*
- *Faulty fuel pull-in relay (See Relay Test)*

Additional Information

- Main Electrical Schematic, T4
- Command Arm with Y Axis Control Schematic

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JF70945,0000113 -19-31MAR14-1/4

Procedure

JF70945,0000113 -19-31MAR14-2/4

❶ **Key Switch**	Test key switch. See Key Switch Test. Does key switch pass test?	**YES:** Go to next step. **NO:** Replace key switch.

JF70945,0000113 -19-31MAR14-3/4

❷ **Check Relay**	Check operation of the relay. Does the relay click when the key switch is in the run position? When the relay is activated is there 12 volts coming out of pin 87 to fuel solenoid? See Relay Test.	**YES:** Check wiring from relay to fuel solenoid. **NO:** Check for 12 volts on pin 85 and with low on pin 86, if they are good replace relay. Perform verification procedure. (See Verification Procedure.)

JF70945,0000113 -19-31MAR14-4/4

VCU 516125.04 — Fuel Solenoid Pull-In Relay

Code Caused By:

Fuel pull-in shorted to ground

Alarm Level:

Function degraded - amber warning lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Machine may not start

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Make sure that key switch is in run position.

Check MC-11 diode for short. Remove diode and check pull-in function.

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Check relay insertion

Check fuel solenoid connections

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty key switch*
- *Faulty wiring*
- *Faulty fuel pull-in relay (See Relay Test)*

Additional Information

- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,0000114 -19-12JUN14-1/4

Procedure

JF70945,0000114 -19-12JUN14-2/4

1 Key Switch	With key off, remove pull-in relay. Check for continuity between terminal in cavity E1 of power center (terminal 85 of relay) and ground. Is there any continuity?	**YES:** Check wiring circuit 935 WHT. **NO:** Go to next step.

JF70945,0000114 -19-12JUN14-3/4

2 Check Relay	Check operation of the relay. Does the relay click when the key switch is in the run position? When the relay is activated is there 12 volts coming out of pin 87 to fuel solenoid?	**YES:** Check wiring from relay to fuel solenoid. **NO:** Check for 12 volts on pin 85 and with low on pin 86, if they are good replace relay. Perform verification procedure. (See Verification Procedure.)

JF70945,0000114 -19-12JUN14-4/4

VCU 516135.03 — Air Preheat, Non-T4

Code Caused By:

Air preheat relay shorted.

Alarm Level:

Function degraded

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Air preheat may not turn on

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Make sure that key switch is in run position.

Check relay insertion

Check pre-heat relay connections

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty key switch*
- *Faulty wiring*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Command Arm with Y Axis Control Schematic

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JF70945,0000115 -19-20MAY14-1/5

Procedure

JF70945,0000115 -19-20MAY14-2/5

❶ **Preheat Relay**	Remove air preheat relay. With key switch ON, check for voltage at terminal in cavity D6 of power center (terminal 85 of relay) and ground. Is there any voltage?	**YES:** Check wire circuit 321 ORG. **NO:** Go to next step.

JF70945,0000115 -19-20MAY14-3/5

❷ **Key Switch**	Test key switch. See Key Switch Test. Does key switch test ok?	**YES:** Go to next step. **NO:** Replace key switch.

JF70945,0000115 -19-20MAY14-4/5

❸ **Check Relay**	Check operation of the relay. Does the relay click when the key switch is in the run position? When the relay is activated, is there 12 volts coming out of pin 87 to MT-2 preheat connector? See Relay Test.	**YES:** Check wiring from relay to MT-2 pre heater connector. **NO:** Check for 12 volts on pin 85 and with low on pin 86, if they are good replace relay. Perform verification procedure. (See Verification Procedure.)

JF70945,0000115 -19-20MAY14-5/5

VCU 516135.04 — Air Preheat, Non-T4

Code Caused By:

Air preheat relay shorted to ground

Alarm Level:

Function degraded - amber warning lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Air preheat may not turn off

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Make sure that key switch is in run position.

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Check relay insertion

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty key switch*
- *Faulty wiring*
- *Faulty fuel pull-in relay (See Relay Test).*

Additional Information

- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,0000116 -19-12JUN14-1/4

Procedure

JF70945,0000116 -19-12JUN14-2/4

1 Check Relay	Check operation of the relay. Does the relay click when the key switch is in the run position? When the relay is activated is there 12 volts coming out of pin 87 to MT-2 preheat connector for approximately 15 seconds?	**YES:** Check wiring from relay to MT-2 preheat connector. **NO:** Check for 12 volts on pin 85 and with low on pin 86, if they are good replace relay. Perform verification procedure. (See Verification Procedure.)

JF70945,0000116 -19-12JUN14-3/4

2 continued	With the key switch OFF, remove air preheat relay. Check for continuity between terminal in cavity D6 of power center (terminal 86 of relay) and ground. Is continuity present?	**YES:** Check wire circuit 935 WHT. **NO:** Go to next step.

JF70945,0000116 -19-12JUN14-4/4

VCU 516183.02 — Proximity Sensor #2

Code Caused By:

Right proximity sensor voltage data incorrect.

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Right lift arm may not function properly

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Service ADVISOR is a trademark of Deere & Company

Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty sensor.*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,0000119 -19-20MAY14-1/5

Diagnostics

JF70945,0000119 -19-20MAY14-2/5

1 Voltage Checks	Disconnect right proximity sensor. With the key on, measure voltage from pins A to C. Specification is 12 volts. Is voltage within specification?	**YES:** Go to next step. **NO:** Repair harness as needed and perform Verification Procedure.

JF70945,0000119 -19-20MAY14-3/5

2 Check Wiring	Check wire from VCU pin B3 to MC-9 pin B. Specification is less than 5 ohms. Does wire test ok?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000119 -19-20MAY14-4/5

3 Proximity Sensor Switch Tests	Test right side proximity switch . See Proximity Switch Test. Does the switch pass?	**YES:** Contact DTAC. **NO:** Replace sensor and perform Verification Procedure.

JF70945,0000119 -19-20MAY14-5/5

VCU 516183.07 — Proximity Sensor #2

Code Caused By:

Proximity Sensor #2, Short to High, or Stuck On, or incorrect data.

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Reels will be shut off.

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty sensor.*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000011A -19-20MAY14-1/5

Diagnostics

JF70945,000011A -19-20MAY14-2/5

1 Voltage Checks	Disconnect right proximity sensor. With the key on, measure voltage from pins A to C. Specification is 12 volts. Is voltage within specification?	**YES:** Go to next step. **NO:** Repair harness as needed and perform Verification Procedure.

JF70945,000011A -19-20MAY14-3/5

2 Check Wiring	Check wire from VCU pin B3 to MC-9 pin B. Specification is less than 5 ohms. Does circuit pass?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000011A -19-20MAY14-4/5

3 Proximity Sensor Switch Tests	Test right side proximity switch (SeeProximity Switch Test). Does the switch pass?	**YES:** Contact DTAC. **NO:** Replace sensor and perform Verification Procedure.

JF70945,000011A -19-20MAY14-5/5

VCU 516183.04 — Proximity Sensor #2

Code Caused By:

Proximity Sensor #2, Short to Low, or Open Circuit, or Stuck Off

Alarm Level:

Service Alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty sensor.*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,000011B -19-20MAY14-1/5

Diagnostics

JF70945,000011B -19-20MAY14-2/5

1 Voltage Checks	Disconnect right proximity sensor. With the key on, measure voltage from pins A to C. Specification is 12 volts. Is voltage within specification?	**YES:** Go to next step. **NO:** Repair harness as needed and perform Verification Procedure.

JF70945,000011B -19-20MAY14-3/5

2 Check Wiring	Check wire from VCU pin B3 to MC-9 pin B. Specification is less than 5 ohms.	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000011B -19-20MAY14-4/5

3 Proximity Sensor Switch Tests	Test right side proximity switch (See Proximity Switch Test). Does the switch pass?	**YES:** Contact DTAC. **NO:** Replace sensor and perform Verification Procedure.

JF70945,000011B -19-20MAY14-5/5

VCU 516184.02 — Proximity Sensor #1

Code Caused By:

Proximity Sensor #1, Incorrect Value

Alarm Level:

Service Alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Left arm may not function properly.

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty sensor.*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

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JF70945,000011C -19-20MAY14-1/5

Diagnostics

JF70945,000011C -19-20MAY14-2/5

1 Voltage Checks	Disconnect right proximity sensor. With the key on, measure voltage from pins A to C. Specification is 12 volts. Is voltage within specification?	**YES:** Go to next step. **NO:** Repair harness as needed and perform Verification Procedure.

JF70945,000011C -19-20MAY14-3/5

2 Check Wiring	Check wire from VCU pin L3 to MC-11 pin B. Specification is less than 5 ohms. Does circuit pass test?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000011C -19-20MAY14-4/5

3 Proximity Sensor Switch Tests	Test right side proximity switch (See Proximity Switch Test). Does the Switch pass?	**YES:** Contact DTAC. **NO:** Replace sensor and perform Verification Procedure.

JF70945,000011C -19-20MAY14-5/5

VCU 516184.07 — Proximity Sensor #1

Code Caused By:

Proximity Sensor #1, Short to High, or Stuck On

Alarm Level:

Service Alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Reels will shut off.

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty sensor.*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

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JF70945,000011D -19-20MAY14-1/5

Diagnostics

JF70945,000011D -19-20MAY14-2/5

❶ **Voltage Checks**	Disconnect right proximity sensor. With the key on, measure voltage from pins A to C. Specification is 12 volts. Is voltage within specification?	**YES:** Go to next step. **NO:** Repair harness as needed and perform Verification Procedure.

JF70945,000011D -19-20MAY14-3/5

❷ **Check Wiring**	Check wire from VCU pin L3 to MC-11 pin B. Specification is less than 5 ohms. Does circuit pass test?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000011D -19-20MAY14-4/5

❸ **Proximity Sensor Switch Tests**	Test right side proximity switch (See Proximity Switch Test). Does the switch pass?	**YES:** Contact DTAC **NO:** Replace sensor and perform Verification Procedure.

JF70945,000011D -19-20MAY14-5/5

VCU 516184.04 — Proximity Sensor #1

Code Caused By:

Proximity sensor #1, short to low (exclusively)

Alarm Level:

Service Alert

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Left arm may not function properly.

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

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Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty sensor.*
- *Faulty wiring.*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000011E -19-20MAY14-1/5

Diagnostics

JF70945,000011E -19-20MAY14-2/5

1 Voltage Checks	Disconnect right proximity sensor. With the key on, measure voltage from pins A to C. Spec is 12 volts. Is voltage within spec?	**YES:** Go to next step. **NO:** Repair harness as needed and perform Verification Procedure.

JF70945,000011E -19-20MAY14-3/5

2 Check Wiring	Check wire from VCU pin L3 to MC-11 pin B. Specification is less than 5 ohms. Does circuit pass test?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000011E -19-20MAY14-4/5

3 Proximity Sensor Switch Tests	Test right side proximity switch (See Proximity Switch Test). Does the switch pass?	**YES:** Contact DTAC. **NO:** Replace sensor and perform Verification Procedure.

JF70945,000011E -19-20MAY14-5/5

VCU 516199.03 — Raise-Lower Select Solenoid

Code Caused By:

Voltage below normal or shorted tohigh

Alarm Level:

Alert

To Clear Display:

Correct condition and cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Required Tools:

Service ADVISOR and multimeter

Preliminary Checks:

Visually inspect wiring and connections.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

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JF70945,000011F -19-20MAY14-1/5

Procedure

NOTE: This circuit uses a low side driver (LSD) to driver to activate the mow solenoid. Its voltage potential will be slightly above chassis ground in most cases.

JF70945,000011F -19-20MAY14-2/5

❶ **Driver**	Disconnect MC-64. Raise select solenoid connector and measure voltage (key on, engine off) at Org wire, pin 2. Is voltage approximately 4 volts?	**YES:** Check wiring for shorts to high source. **NO:** Go to next step.

JF70945,000011F -19-20MAY14-3/5

❷ **Solenoid**	Test raise select solenoid. (See Brake Valve, Lift Valve Solenoid Test). Does solenoid test ok?	**YES:** Go to next step. **NO:** Replace solenoid. Perform Verification Procedure.

JF70945,000011F -19-20MAY14-4/5

❸ **Wiring**	With key off, measure continuity between solenoid connector and ground. Is continuity present?	**YES:** Repair wiring. **NO:** Open DTAC case.

JF70945,000011F -19-20MAY14-5/5

VCU 516199.04 — Raise-Lower Select Solenoid

Code Caused By:

Voltage below normal or shorted to low source

Alarm Level:

Alert

To Clear Display:

Correct condition and cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Required Tools:

Service ADVISOR and multimeter

Preliminary Checks:

Visually inspect wiring and connections.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

Service ADVISOR is a trademark of Deere & Company

JF70945,0000120 -19-20MAY14-1/5

Procedure

NOTE: This circuit uses a low side driver (LSD) to driver to activate the mow solenoid. Its voltage potential will be slightly above chassis ground in most cases.

JF70945,0000120 -19-20MAY14-2/5

❶ **Driver**	Disconnect MC-64. Raise select solenoid connector and measure voltage (key on, engine off) at Org wire, pin 2. Is voltage less than 4 volts?	**YES:** Go to next step. **NO:** If above, check for shorted wiring.

JF70945,0000120 -19-20MAY14-3/5

❷ **Solenoid**	Test raise select solenoid. (See Brake Valve, Lift Valve Solenoid Test). Does solenoid test ok?	**YES:** Go to next step. **NO:** Replace solenoid. Perform Verification Procedure.

JF70945,0000120 -19-20MAY14-4/5

❸ **Wiring**	With key off, measure continuity between solenoid connector and ground. Is continuity present?	**YES:** Repair wiring. **NO:** Open DTAC case.

JF70945,0000120 -19-20MAY14-5/5

VCU 516207.03 — 48 Volt Alternator Relay Driver

Code Caused By:

48V Alternator Field Winding relay low side driver, Short to High

Alarm Level:

Alert

Amber Lamp

To Clear Display:

Correct condition and cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR and multimeter

Preliminary Checks:

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Visually inspect wiring and connections.

Check and reseat 48 V alternator field relay. (See Load Center, Non-T4, or Load Center, T4.)

Check alternator output on PDU input/output status screen. (See Input/Output Status.)

Check alternator drive belt. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific control unit to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

OUMX258,000088C -19-08APR15-1/4

Procedure

OUMX258,000088C -19-08APR15-2/4

❶ **Relay Coil Wire**	Check low side driver Blue wire and connections from VCU to MFB-1 relay center, pin B10. Are the wire and connections OK?	**YES:** Go to next step. **NO:** Repair wire.

OUMX258,000088C -19-08APR15-3/4

❷ **Relay**	Test relay. (See Relay Test.) Is the relay OK?	**NO:** Replace relay.

OUMX258,000088C -19-08APR15-4/4

VCU 516207.04 — 48 Volt Alternator Relay Driver

Code Caused By:

48V Alternator Field Winding relay low side driver, Short to Low

Alarm Level:

Alert

Amber Lamp

To Clear Display:

Correct condition and cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR and multimeter

Preliminary Checks:

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Visually inspect wiring and connections.

Check and reseat 48 V alternator field relay. (See Load Center, Non-T4, or Load Center, T4.)

Check alternator output on PDU input/output status screen. (See Input/Output Status.)

Check alternator drive belt. (See Test and Adjust 48 Volt Alternator and Coolant Pump Drive Belt Tension.)

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific control unit to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

OUMX258,000088B -19-08APR15-1/4

Procedure

OUMX258,000088B -19-08APR15-2/4

❶ **Relay Coil Wire**	Check low side driver Blue wire and connections from VCU to MFB-1 relay center, pin B10. Are the wire and connections OK?	**YES:** Go to next step. **NO:** Repair wire.

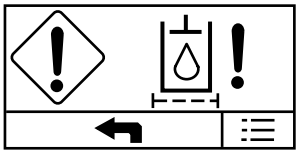
OUMX258,000088B -19-08APR15-3/4

❷ **Relay**	Test relay. (See Relay Test.) Is the relay OK?	**NO:** Replace relay.

OUMX258,000088B -19-08APR15-4/4

VCU 516708.00 — Hydraulic Oil Leak

TCT010512 —UN—11FEB14



Hydraulic Oil Leak Detected

Code Caused By:

Not used on this application. Considered a “Ghost Code” as it still is possible to go active.

Alarm Level:

Function degraded - amber warning lamp

To Clear Display:

Key cycle

Alarm Frequency:

As long as condition is present.

Control Unit Response:

Does not allow mowing

The PDU will have a pop-up screen.

Preliminary Checks:

See Erroneous Diagnostic Trouble Codes

JF70945,0000125 -19-19MAR14-1/1

VCU 520608.14 — Backlap

Code Caused By:

Backlap(s) On during Start On (attempting to crank)

Alarm Level:

Informational

To Clear Display:

Correct condition and cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

None

Snapshot Recorded:

No

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Required Tools:

None

Preliminary Checks:

This is an informational code only.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

JF70945,0000158 -19-03APR14-1/1

VCU 520870.31 — Check Sum Fail

Code Caused By:

Internal VCU error

Alarm Level:

Informational

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

None

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Are all of the connection clean and tight?

Service ADVISOR is a trademark of Deere & Company

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Power or ground problems.*
- *Faulty or corrupted controller.*

Preliminary Checks:

- Ensure that power and ground circuits are ok.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,0000159 -19-20MAY14-1/3

Procedure

JF70945,0000159 -19-20MAY14-2/3

1 **VCU**	Is DTC persistent?	**YES:** Reload payload. (See Approved Software for Control Units). **YES:** Contact DTAC. **NO:** Possible erroneous error. (See Erroneous Diagnostic Trouble Codes).

JF70945,0000159 -19-20MAY14-3/3

VCU 520871.31 — Non Critical Data Check Sum Fail

Code Caused By:

Issue with vehicle controller memory

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR™

Diagnosis:

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- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Power or ground problems.*
- *Faulty or corrupted controller.*

Preliminary Checks:

- Ensure that power and ground circuits are ok.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000015A -19-20MAY14-1/3

Procedure

JF70945,000015A -19-20MAY14-2/3

1 **VCU**	Is DTC persistent?	**YES:** Reload payload. (See Approved Software for Control Units). **YES:** Contact DTAC. **NO:** Possible erroneous error. (See Erroneous Diagnostic Trouble Codes).

JF70945,000015A -19-20MAY14-3/3

VCU 520872.31 — Critical Data Check Sum Fail

Code Caused By:

Internal VCU error

Alarm Level:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Function degraded

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR™

Preliminary Checks:

Are all of the connections clean and tight?

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Power or ground problems.*
- *Faulty or corrupted controller.*

Preliminary Checks:

- Ensure that power and ground circuits are ok.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000015B -19-20MAY14-1/3

Procedure

JF70945,000015B -19-20MAY14-2/3

❶ **VCU**	Is DTC persistent?	**YES:** Reload payload. (See Approved Software for Control Units). **YES:** Contact DTAC. **NO:** Possible erroneous error. (See Erroneous Diagnostic Trouble Codes).

JF70945,000015B -19-20MAY14-3/3

VCU 520873.31 — Vehicle Hours Data Check Sum Fail

Code Caused By:

Internal VCU error

Alarm Level:

Amber lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Indicator only

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR™

Preliminary Checks:

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Are all of the connections clean and tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Power or ground problems.*
- *Faulty or corrupted controller.*

Preliminary Checks:

- Ensure that power and ground circuits are ok.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000015C -19-20MAY14-1/3

Procedure

JF70945,000015C -19-20MAY14-2/3

1 **VCU**	Is DTC persistent?	**YES:** Reload payload. (See Approved Software for Control Units). **YES:** Contact DTAC. **NO:** Possible erroneous error. (See Erroneous Diagnostic Trouble Codes).

JF70945,000015C -19-20MAY14-3/3

VCU 520957.03 — Park Brake Solenoid

Code Caused By:

Park brake solenoid wire shorted to power (high)

Alarm Level:

Stop-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Visually inspect circuit wiring.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- PDU I/O Status Displays

JF70945,000015D -19-17JUN14-1/4

Procedure

JF70945,000015D -19-17JUN14-2/4

❶ **Park Brake Solenoid**	Using Service ADVISOR or PDU, observe park brake circuit status while toggling park brake switch with engine running. Does circuit change states?	**YES:** Circuit is ok. If code persists, go to next step. **YES:** End of test. Perform Verification Procedure. **NO:** Check wiring and connections and perform Wiggle Test **NO:** Test park brake solenoid. (See Brake Valve, Lift Valve Solenoid Test). **NO:** Reload VCU payload. (See Approved Software for Control Units). **NO:** Contact DTAC.

JF70945,000015D -19-17JUN14-3/4

❷ **Persistent Code**	Is the code present when everything checks ok?	**YES:** Reload VCU payload. (See Approved Software for Control Units. **YES:** Contact DTAC. **NO:** End of test. Perform Verification Procedure).

JF70945,000015D -19-17JUN14-4/4

VCU 520957.04 — Park Brake Solenoid

Code Caused By:

Park brake solenoid circuit shorted to ground or low source

Alarm Level:

Stop-continuous audible

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Engine shuts down

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Visually inspect circuit wiring.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4
- Input/Output Status

JF70945,000015E -19-17JUN14-1/4

Procedure

JF70945,000015E -19-17JUN14-2/4

1 Park Brake Solenoid	Using Service ADVISOR or PDU, observe park brake circuit status while toggling park brake switch with engine running. Does circuit change states?	**YES:** Circuit is ok. If code persists, go to next step. **YES:** End of test. Perform Verification Procedure. **NO:** Check wiring and connections and perform Wiggle Test **NO:** Test park brake solenoid. (See Brake Valve, Lift Valve Solenoid Test). **NO:** Reload VCU payload. (See Approved Software for Control Units). **NO:** Contact DTAC.

JF70945,000015E -19-17JUN14-3/4

2 Persistent Code	Is the code present when everything checks ok?	**YES:** Reload VCU payload. (See Approved Software for Control Units). **YES:** Contact DTAC. **NO:** End of test. Perform Verification Procedure.

JF70945,000015E -19-17JUN14-4/4

VCU 521426.31 — Lower Reel Switch Signal Invalid

Code Caused By:

Lower signal is present for an extended period of time

Alarm Level:

Service alert

To Clear Display:

Correct problem and cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Decks my not lower.

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Ensure that there is no physical damage to control lever.

Service ADVISOR is a trademark of Deere & Company

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Defective switch*
- *Lever stuck or held in lower position for an extended period of time*
- *Raise signal shorted to high*

Additional Information

- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Input/Output Status

JF70945,000015F -19-17JUN14-1/3

Procedure

JF70945,000015F -19-17JUN14-2/3

❶ **Raise Status**	Either using Service ADVISOR or PDU, check status of raise function. Is active lowering indicated with lever in neutral position?	**YES:** Test switch. (See Test Raise/Lower Switch). Does switch test ok? **YES:** Check wiring and connections for short to high. **YES:** Reload VCU payload. (See Approved Software for Control Units). **NO:** Replace switch.

JF70945,000015F -19-17JUN14-3/3

VCU 521427.31 — Raise Reel Switch Invalid Signal

Code Caused By:

Raise signal is present for an extended period of time

Alarm Level:

Amber lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Reel may not raise.

Snapshot Recorded:

No

Required Tools:

Multimeter

Preliminary Checks:

Ensure that there is no physical damage to control lever.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Defective switch*
- *Lever stuck or held in raise position for an extended period of time*
- *Raise signal shorted to high*

Additional Information

- Command Arm with Y Axis Control Schematic
- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Input/Output Status

JF70945,0000160 -19-17JUN14-1/3

Procedure

JF70945,0000160 -19-17JUN14-2/3

1	**Raise Status**	Either using Service ADVISOR or PDU, check status of raise function. Is active raising indicated with lever in neutral position?	**YES:** Test switch. (See Test Raise/Lower Switch). **YES:** Check wiring and connections for short to high. **NO:** Reload VCU payload. (See Approved Software for Control Units).

JF70945,0000160 -19-17JUN14-3/3

VCU 522011.08 — CAN Display Heartbeat

Code Caused By:

CAN display heartbeat, abnormal rate

Alarm Level:

E-stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Function Degraded

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Are all of the connections clean and tight.

Service ADVISOR is a trademark of Deere & Company

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Rubbed wires*
- *Faulty controller*
- *Noise on CAN Bus*

Additional information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- CAN Message Received Error
- CAN Message Received Is Incorrect

JF70945,0000161 -19-20MAY14-1/4

Diagnostics

JF70945,0000161 -19-20MAY14-2/4

1 SERVICE ADVISOR	Connect Service ADVISOR to the machine. Check to see which controllers are communicating on the CAN bus. Are all of the controllers communicating on the CAN bus?	**YES:** See Erroneous Diagnostic Trouble Codes, Wiggle Test and Verification Procedure. **NO:** Go to next step.

JF70945,0000161 -19-20MAY14-3/4

2 Voltage Checks	Check the voltages at the diagnostic connector and at all of the controls not communicating on the CAN bus. Are the voltages within specification?	**YES:** Reload the payload. See Approved Software for Control Units and then perform CAN Network Voltage Checks. **NO:** Repair wiring then perform Approved Software for Control Units.. **NO:** Perform Terminal Test. **NO:** Open DTAC case.

JF70945,0000161 -19-20MAY14-4/4

VCU 522405.03 — Park Brake Pressure Switch

Code Caused By:

Park brake pressure switch: Engine must be running and brake pressure switch is above normal or shorted to high when the brake switch is off (Pressure appears low)

Alarm Level:

Stop

Red Lamp

To Clear Display:

Cycle key switch.

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Check brake valve manual override screw. Screw should be turned fully out (counterclockwise) from the valve body.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific control unit to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Tow valve in override position with engine running or cranking.*
- *Defective park brake switch*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Brake Operation

JF70945,0000162 -19-09APR15-1/4

Diagnostics

JF70945,0000162 -19-09APR15-2/4

❶ **Brake Valve**	Is the override valve in the proper position?	**YES:** Go to next step **NO:** Place override valve in the proper position.

JF70945,0000162 -19-09APR15-3/4

❷ **Park Brake Switch**	Disconnect brake switch and jumper across terminals of main wiring harness connector. Attempt to start engine. Does engine start?	**YES:** Replace park brake switch and perform Wiggle Test and Verification Procedure **NO:** Check wiring and connections. **NO:** Open DTAC case.

JF70945,0000162 -19-09APR15-4/4

VCU 522405.04 — Park Brake Pressure Switch

Code Caused By:

Park brake pressure switch: Engine running and park brake switch voltage is below normal or open circuit when park brake switch is on. (Pressure appears high).

Alarm Level:

Stop

Red Lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

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Preliminary Checks:

Override valve in proper position.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific control unit to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Tow valve in override position with engine running or cranking.*
- *Defective park brake switch*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Brake Operation

JF70945,0000163 -19-09APR15-1/4

Diagnostics

JF70945,0000163 -19-09APR15-2/4

❶ **Brake Valve**	Is the override valve in the proper position?	**YES:** Go to next step **NO:** Place over-ride valve in the proper position.

JF70945,0000163 -19-09APR15-3/4

❷ **Park Brake Switch**	Disconnect brake switch and jumper across terminals of main wiring harness connector. Attempt to start engine. Does engine start?	**YES:** Replace park brake switch and perform Wiggle Test and Verification Procedure **NO:** Check wiring and connections. Open DTAC case if all wires and connections are OK.

JF70945,0000163 -19-09APR15-4/4

VCU 522405.31 — Park Brake Pressure Switch

Code Caused By:

Start interlocked: manual brake release active (override)

Alarm Level:

Stop

Red Lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display-continuous audible

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Service ADVISOR is a trademark of Deere & Company

Check brake valve manual override screw. Screw should be turned fully out (counterclockwise) from the valve body.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific control unit to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Tow valve in override position with engine running or cranking.*
- *Defective park brake switch*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- Brake Operation

JF70945,0000164 -19-09APR15-1/5

Diagnostics

JF70945,0000164 -19-09APR15-2/5

1 Over-Ride Valve	Check brake valve manual override screw. Screw should be turned fully out (counterclockwise) from the valve body. Is the override valve in the proper position?	**YES:** Go to next step. **NO:** Place override valve in the proper position.

JF70945,0000164 -19-09APR15-3/5

2 Brake Pressure Switch	Check for continuity on the brake valve pressure switch. Switch should have continuity when the engine is not running. Is the continuity correct?	**YES:** Go to next step. **NO:** Replace switch.

JF70945,0000164 -19-09APR15-4/5

3 Park Brake Switch	Disconnect brake switch and jumper across terminals of main wiring harness connector. Attempt to start engine. Does engine start?	**YES:** Perform Wiggle Test and Verification Procedure **NO:** Check wiring and connections. Open DTAC case if all wires and connections are OK.

JF70945,0000164 -19-09APR15-5/5

VCU 522771.31 — VCU Connected to Unknown Address

VCU Connected to Unknown Address

Code Caused By:

Communication error between controllers, VCU is trying to communicate with a unknown controller.

Alarm Level:

Red stop lamp

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Engine will shut down

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR and Multimeter

Preliminary Checks:

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Check for rubbed wires

Check that all the connectors are tight

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Rubbed wires*
- *Faulty controller*
- *Noise on CAN bus*

Additional information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- CAN Message Received Error
- CAN Message Received Is Incorrect

JF70945,0000166 -19-13JUN14-1/4

Diagnostics

JF70945,0000166 -19-13JUN14-2/4

1 **SERVICE ADVISOR**	Connect Service ADVISOR to the machine. Check to see which controllers are communicating on the CAN bus. Are all of the controllers communicating on the CAN bus?	**YES:** See Erroneous Diagnostic Trouble Codes, Wiggle Test and Verification Procedure. **NO:** Go to next step

JF70945,0000166 -19-13JUN14-3/4

2 **Voltage Checks**	Check the voltages at the diagnostic connector and at all of the controls not communicating on the CAN bus. Are the voltages within specification?	**YES:** Reload the payload. See Approved Software for Control Units and then perform CAN Network Voltage Checks. **NO:** Repair wiring then perform Approved Software for Control Units. **NO:** Perform Terminal Test. **NO:** Open DTAC case.

JF70945,0000166 -19-13JUN14-4/4

VCU 523652.31 — VCU Connected to Unknown Controller

VCU Connected to unknown Controller

Code Caused By:

Communication error between controllers

Alarm Level:

Red stop lamp

To Clear Display:

Cycle key switch. Correct problem.

Alarm Frequency:

Continuous

Control Unit Response:

Engine will shut down

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Check for rubbed or broken wires

Ensure that all connections are secure.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Rubbed wires*
- *Faulty controller*
- *Noise on CAN Bus*

Additional information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4
- CAN Message Received Error
- CAN Message Received Is Incorrect

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JF70945,000018A -19-20MAY14-1/4

Diagnostics

JF70945,000018A -19-20MAY14-2/4

1 **SERVICE ADVISOR**	Connect Service ADVISOR to the machine. Check to see which controllers are communicating on the CAN bus. Are all of the controllers communicating on the CAN bus?	**YES:** See Erroneous Diagnostic Trouble Codes, Wiggle Test and Verification Procedure. **NO:** Go to next step

JF70945,000018A -19-20MAY14-3/4

2 **Voltage Checks**	Check the voltages at the diagnostic connector and at all of the controls not communicating on the CAN bus. Are the voltages within specification?	**YES:** Reload the payload. See Approved Software for Control Units and then perform CAN Network Voltage Checks. **NO:** Repair wiring then perform Approved Software for Control Units.. **NO:** Perform Terminal Test. **NO:** Open DTAC case.

JF70945,000018A -19-20MAY14-4/4

VCU 523324.02 — Swash Plate Position Sensor

Code Caused By:

The consecutive mismatches of ‘actual direction’ (swash plate sensor) vs. ‘command direction’ (control system)

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

Check for loose connections and corrosion.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Rubbed wires*
- *Bad connection*
- *Faulty sensor*

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JF70945,000018B -19-20MAY14-1/6

Diagnostics

JF70945,000018B -19-20MAY14-2/6

1 Is Code Active	Using Service ADVISOR monitor swash plate sensor. Is the code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

JF70945,000018B -19-20MAY14-3/6

2 Voltage Checks	Check for 5 volts at sensor. Measure from pin A to C. Is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000018B -19-20MAY14-4/6

3 Check Wiring	Check the signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,000018B -19-20MAY14-5/6

4 Calibration	Perform calibrations. Did all of the calibrations pass? • Hydrostatic Valve Calibration • Hydrostatic Transmission Calibration	**YES:** Perform Verification Procedure. If the code returns contact DTAC. **NO:** Contact DTAC.

JF70945,000018B -19-20MAY14-6/6

VCU 523324.03 — Swash Plate Position Sensor

Code Caused By:

Swash plate position sensor shorted to high.

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display-continuous audible

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Check for loose connections and corrosion.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbed wires*
- *Bad connection*
- *Faulty sensor*

JF70945,000018C -19-20MAY14-1/7

Diagnostics

JF70945,000018C -19-20MAY14-2/7

1 Is Code Active	Using Service ADVISOR, monitor swash plate sensor. Is the code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

JF70945,000018C -19-20MAY14-3/7

2 Voltage Checks	Check for 5 volts at sensor. Measure from pin A to C. Is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,000018C -19-20MAY14-4/7

3 MC-34 Connector	With MC-34 disconnected, and key switch ON, measure voltage from pin B (main harness) to ground. Is any voltage present?	**YES:** Inspect wiring. **NO:** Go to next step.

JF70945,000018C -19-20MAY14-5/7

4 Check Wiring	Check the signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000018C -19-20MAY14-6/7

5 Calibration	Perform calibrations. Did all of the calibrations pass?	
	• Hydrostatic Valve Calibration	**YES:** Perform Verification Procedure. If the code returns, contact DTAC.
	• Hydrostatic Transmission Calibration	**NO:** Contact DTAC.

JF70945,000018C -19-20MAY14-7/7

VCU 523324.04 — Swash Plate Position Sensor

Code Caused By:

Swash plate position sensor shorted to low.

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Preliminary Checks:

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Check for loose connections and corrosion

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbed wires*
- *Bad connection*
- *Faulty sensor*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,000018D -19-20MAY14-1/7

Diagnostics

Continued on next page

JF70945,000018D -19-20MAY14-2/7

1 Is Code Active	Using Service ADVISOR, monitor swash plate sensor. Is code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

JF70945,000018D -19-20MAY14-3/7

2 Voltage Checks	Check for 5 volts at sensor. Measure from pin A to C. Is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000018D -19-20MAY14-4/7

3 MC-34 Connector	With MC-34 disconnected, and key switch OFF, measure continuity from pin B (main harness) to ground. Is any continuity present?	**YES:** Inspect wiring. **NO:** Go to next step.

JF70945,000018D -19-20MAY14-5/7

4 Check Wiring	Check signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000018D -19-20MAY14-6/7

5 Calibration	Perform calibrations. Did all of the calibrations pass?	
	• Hydrostatic Transmission Calibration	**YES:** Perform Verification Procedure if code returns contact DTAC.
	• Hydrostatic Valve Calibration	**NO:** Contact DTAC.

JF70945,000018D -19-20MAY14-7/7

VCU 523324.10 — Swash Plate Position Sensor

Code Caused By:

The consecutive mismatches of ‘actual direction’ (swash plate sensor) vs. ‘command direction’ (control system)

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Are all of the connections tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbing wires*
- *Bad connection*
- *faulty sensor*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000018E -19-20MAY14-1/6

Diagnostics

JF70945,000018E -19-20MAY14-2/6

❶ **Is Code Active**	Using Service ADVISOR, monitor swash plate sensor, Is code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

JF70945,000018E -19-20MAY14-3/6

❷ **Voltage Checks**	Check for 5 volts at sensor. Measure from pin A to C. Is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000018E -19-20MAY14-4/6

❸ **Check Wiring**	Ohm out signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,000018E -19-20MAY14-5/6

4 Calibration	Perform calibrations. Did all of the calibrations pass? • Hydrostatic Transmission Calibration • Hydrostatic Valve Calibration	**YES:** Perform Verification Procedure if code returns contact DTAC. **NO:** Contact DTAC.

JF70945,000018E -19-20MAY14-6/6

VCU 523324.13 — Swash Plate Position Sensor

Code Caused By:

The consecutive mismatches of ‘actual direction’ (swash plate sensor) vs. ‘command direction’ (control system)

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Are all of the connections tight?

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbing wires*
- *Bad connection*
- *faulty sensor*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,000018F -19-20MAY14-1/6

Diagnostics

JF70945,000018F -19-20MAY14-2/6

1 Is Code Active	Using Service ADVISOR, monitor swash plate sensor. Is code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

JF70945,000018F -19-20MAY14-3/6

2 Voltage Checks	Check for 5 volts at sensor. Measure from pin A to C. Is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,000018F -19-20MAY14-4/6

3 Check Wiring	Ohm out signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,000018F -19-20MAY14-5/6

4 Calibration	Perform calibrations. Did all of the calibrations pass? • Hydrostatic Transmission Calibration • Hydrostatic Valve Calibration	**YES:** Perform Verification Procedure if code returns contact DTAC. **NO:** Contact DTAC.

JF70945,000018F -19-20MAY14-6/6

VCU 523324.16 — Swash Plate Position Sensor

Code Caused By:

Swash plate position sensor voltage is 90% above supply voltage - Out of range high

Alarm Level:

Stop

To Clear Display:

Key cycle

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Are all of the connections clean and tight.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Rubbing wires*
- *Bad connection*
- *faulty sensor*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,0000190 -19-12JUN14-1/7

Diagnostics

JF70945,0000190 -19-12JUN14-2/7

1 Is Code Active	Using Service ADVISOR, monitor swash plate sensor. Is code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

Continued on next page

JF70945,0000190 -19-12JUN14-3/7

2 Voltage Checks	Check for 5 volts at sensor. Measure from pin A to C, is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000190 -19-12JUN14-4/7

3 MC-34 Connector	With MC-34 disconnected, and key switch ON, measure voltage from pin B (main harness) to ground. Is any voltage present?	**YES:** Inspect wiring. **NO:** Go to next step.

JF70945,0000190 -19-12JUN14-5/7

4 Check Wiring	Ohm out signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000190 -19-12JUN14-6/7

5 Calibration	Perform calibrations. Did all of the calibrations pass?	
	• Hydrostatic Transmission Calibration	**YES:** Perform Verification Procedure if code returns contact DTAC.
	• Hydrostatic Valve Calibration	**NO:** Contact DTAC.

JF70945,0000190 -19-12JUN14-7/7

VCU 523324.18 — Swash Plate Position Sensor

Code Caused By:

Swash plate sensor voltage is 10% below supply voltage - Out of range low

Alarm Level:

Stop

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous display

Control Unit Response:

E-stop

Snapshot Recorded:

Yes

Required Tools:

Multimeter and Service ADVISOR™

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Preliminary Checks:

Check for loose connections or corrosion.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbing wires*
- *Bad connection*
- *faulty sensor*

Additional Information

- Main Electrical Schematic, T4
- Main Electrical Schematic, Non-T4

JF70945,0000191 -19-20MAY14-1/7

Diagnostics

JF70945,0000191 -19-20MAY14-2/7

❶ **Is Code Active**	Using Service ADVISOR, monitor swash plate sensor. Is code active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

JF70945,0000191 -19-20MAY14-3/7

❷ **Voltage Checks**	Check for 5 volts at sensor. Measure from pin A to C. Is there 5 volts?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000191 -19-20MAY14-4/7

❸ **MC-34 Connector**	With MC-34 disconnected, and key switch OFF, measure continuity from pin B (main harness) to ground. Is any continuity present?	**YES:** Inspect wiring. **NO:** Go to next step.

Continued on next page

JF70945,0000191 -19-20MAY14-5/7

4 Check Wiring	Ohm out signal wire. Measure from pin B at connector MC-34 to pin B4 at the VCU. Is there less than 5 ohms?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,0000191 -19-20MAY14-6/7

5 Calibration	Perform calibrations. Did all of the calibrations pass? • Hydrostatic Transmission Calibration • Hydrostatic Valve Calibration	**YES:** Perform Verification Procedure if code returns contact DTAC. **NO:** Contact DTAC.

JF70945,0000191 -19-20MAY14-7/7

VCU 523590.03 — Forward Pedal Sensor

Code Caused By:

Forward Pedal Sensor, Short to High

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited Functionality

Required Tools:

None

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty or shorted wiring.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

CB12260,00000F2 -19-20MAY14-1/5

Procedure

CB12260,00000F2 -19-20MAY14-2/5

1 Source Voltage	Disconnect MC-61 forward pedal sensor connector. Measure voltage at pins 3 and 6 with respect to sensor ground. Is voltage approximately 5 VDC?	**YES:** Go to next step. **NO:** If above, check source wiring for shorts to high source.

Continued on next page

CB12260,00000F2 -19-20MAY14-3/5

❷ **On-board Diagnostics**	Connect Service ADVISOR to machine. Observe and note pedal readings at rest. Do channels A and B have complementary signal percentages as the pedal is moved from rest to fully down?	**YES:** Go to next step. **NO:** Determine which channel is incorrect and check signal return wiring for problems.

CB12260,00000F2 -19-20MAY14-4/5

❸ **Sensor**	Swap sensor connectors and repeat pedal readings again. Does error move to opposite sensor?	**YES:** Replace faulty sensor. **NO:** Contact DTAC.

CB12260,00000F2 -19-20MAY14-5/5

VCU 523590.04 — Forward Pedal Sensor

Code Caused By:

Forward Pedal Sensor, Short to Low

Alarm Level:

Service Alert-continuous audible

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

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- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty or shorted wiring.*

Addtitonal Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

CB12260,00000F3 -19-20MAY14-1/5

Procedure

CB12260,00000F3 -19-20MAY14-2/5

❶ **Source Voltage**	Disconnect MC-61 forward pedal sensor connector. Measure voltage at pins 3 and 6 with respect to sensor ground. Is voltage approximately 5 VDC?	**YES:** Go to next step. **NO:** If above, check source wiring for shorts to low source.

Continued on next page

CB12260,00000F3 -19-20MAY14-3/5

2 On-board Diagnostics	Connect Service ADVISOR to machine. Observe and note pedal readings at rest. Do channels A and B have complementary signal percentages as the pedal is moved from rest to fully down?	**YES:** Go to next step. **NO:** Determine which channel is incorrect and check signal return wiring for problems.

CB12260,00000F3 -19-20MAY14-4/5

3 Sensor	Swap sensor connectors and repeat pedal readings again. Does error move to opposite sensor?	**YES:** Replace faulty sensor. **NO:** Contact DTAC.

CB12260,00000F3 -19-20MAY14-5/5

VCU 523590.08 — Forward Pedal Sensor

Code Caused By:

Forward Pedal Sensor, Abnormal Frequency

Alarm Level:

Service Alert

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty wiring*
- *Faulty sensor*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

Erroneous Diagnostic Trouble Codes

CB12260,00000F4 -19-20MAY14-1/4

Procedure

CB12260,00000F4 -19-20MAY14-2/4

1 Frequency Check	Connect machine to Service ADVISOR. Observe forward pedal frequency at rest. Then observe forward pedal frequency while slowly depressing pedal to full forward position. Is frequency range between 100 and 200 Hz?	**YES:** Go to next step. **NO:** Check for possible erroneous trouble codes.

Continued on next page

CB12260,00000F4 -19-20MAY14-3/4

❷ **Sensor**	Swap pedal sensor connectors and recheck pedal frequency. Does problem move to opposite pedal?	**YES:** Replace faulty sensor. **NO:** Contact DTAC.

CB12260,00000F4 -19-20MAY14-4/4

VCU 523590.13 — Forward Pedal Sensor

Code Caused By:

Forward Pedal, Not Calibrated

Alarm Level:

Stop

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

Snapshot Recorded:

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Pedals out of calibration.*
- *Physical damage or interference with pedal assembly.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

CB12260,00000F5 -19-20MAY14-1/4

Procedure

CB12260,00000F5 -19-20MAY14-2/4

❶ **Mechanical Assembly**	Check for physical damage or interference with pedal assembly. Does it check ok?	**YES:** Go to next step. **NO:** Repair or replace components as necessary.

CB12260,00000F5 -19-20MAY14-3/4

❷ **Calibration**	Calibrate pedals and swash plate. See Hydrostatic Transmission Calibration and Hydrostatic Valve Calibration. Does machine pass calibration?	**YES:** End of tests. **NO:** Contact DTAC.

CB12260,00000F5 -19-20MAY14-4/4

VCU 523590.14 — Forward Pedal Sensor

Code Caused By:

Forward Pedal, Reverse as Forward

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Preliminary Checks:

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Check for crossed wiring.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Pedal connectors are connected to the wrong pedal. Swap connections.*

CB12260,00000F6 -19-20MAY14-1/1

VCU 523590.16 — Forward Pedal Sensor

Code Caused By:

Forward Pedal Sensor, Value Too High

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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NOTE: Common conditions to cause code.

- *Damaged pedal sensor*
- *Faulty wiring.*
- *Calibration error*
- *One of the redundant sensors is in range but inaccurate.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

Erroneous Diagnostic Trouble Codes

CB12260,00000F7 -19-20MAY14-1/3

Procedure

Continued on next page

CB12260,00000F7 -19-20MAY14-2/3

1 **Sensor Channels**	Connect machine to Service ADVISOR. Observe and note forward pedal output with pedal at rest. Then, observe and note output percentages while slowly depressing pedal to fully depressed position. Do channels A and B's percentages add up to approximately %100 over full travel of pedal?	**YES:** Possible erroneous trouble code. Check operating conditions. **NO:** Replace faulty sensor.

CB12260,00000F7 -19-20MAY14-3/3

VCU 523590.18 — Forward Pedal Sensor

Code Caused By:

Forward Pedal Sensor, Value Too Low

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the "Diagnostics" tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Damaged pedal sensor*
- *Faulty wiring.*
- *Calibration error*
- *One of the redundant sensor channels is in range but inaccurate.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

Erroneous Diagnostic Trouble Codes

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CB12260,00000F8 -19-20MAY14-1/3

Procedure

CB12260,00000F8 -19-20MAY14-2/3

1 **Sensor Channels**	Connect machine to Service ADVISOR. Observe and note forward pedal output with pedal at rest. Then, observe and note output percentages while slowly depressing pedal to fully depressed position. Do channels A and B's percentages add up to approximately %100 over full travel of pedal?	**YES:** Possible erroneous trouble code. Check operating conditions. **NO:** Replace faulty sensor.

CB12260,00000F8 -19-20MAY14-3/3

VCU 523590.31 — Forward Pedal Sensor

Code Caused By:

Forward Pedal Sensor, A-B Mismatch

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Damaged pedal sensor*
- *Faulty wiring.*
- *Calibration error*
- *One of the redundant sensors is in range but inaccurate.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Forward (inboard) Pedal Connector

Erroneous Diagnostic Trouble Codes

Service ADVISOR is a trademark of Deere & Company

CB12260,00000F9 -19-20MAY14-1/3

Procedure

CB12260,00000F9 -19-20MAY14-2/3

❶ **Sensor Channels**	Connect machine to Service ADVISOR. Observe and note forward pedal output with pedal at rest. Then, observe and note output percentages while slowly depressing pedal to fully depressed position. Do channels A and B’s percentages add up to approximately %100 over full travel of pedal?	**YES:** Possible erroneous trouble code. Check operating conditions. **NO:** Replace faulty sensor.

CB12260,00000F9 -19-20MAY14-3/3

VCU 523591.03 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal Sensor, Short to High

Alarm Level:

Service Alert

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Limited Functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty or shorted wiring.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Reverse (outboard) Pedal Connector

CB12260,00000FA -19-20MAY14-1/5

Procedure

CB12260,00000FA -19-20MAY14-2/5

1 Source Voltage	Disconnect MC-62 reverse pedal sensor connector. Measure voltage at pins 3 and 6 with respect to sensor ground. Is voltage approximately 5 VDC?	**YES:** Go to next step. **NO:** If above, check source wiring for shorts to high source.

CB12260,00000FA -19-20MAY14-3/5

2 On-board Diagnostics	Connect Service ADVISOR to machine. Observe and note pedal readings at rest. Do channels A and B have complementary signal percentages as the pedal is moved from rest to fully down?	**YES:** Go to next step. **NO:** Determine which channel is incorrect and check signal return wiring for problems.

CB12260,00000FA -19-20MAY14-4/5

3 Sensor	Swap sensor connectors and repeat pedal readings again. Does error move to opposite sensor?	**YES:** Replace faulty sensor. **NO:** Contact DTAC.

CB12260,00000FA -19-20MAY14-5/5

VCU 523591.04 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal Sensor, Short to Low

Alarm Level:

Service Alert

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty or shorted wiring.*

Addtitonal Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Reverse (outboard) Pedal Connector

CB12260,00000FB -19-20MAY14-1/5

Procedure

CB12260,00000FB -19-20MAY14-2/5

1 **Source Voltage**	Disconnect MC-62 reverse pedal sensor connector. Measure voltage at pins 3 and 6 with respect to sensor ground. Is voltage approximately 5 VDC?	**YES:** Go to next step. **NO:** If above, check source wiring for shorts to low source.

CB12260,00000FB -19-20MAY14-3/5

2 **On-board Diagnostics**	Connect Service ADVISOR to machine. Observe and note pedal readings at rest. Do channels A and B have complementary signal percentages as the pedal is moved from rest to fully down?	**YES:** Go to next step. **NO:** Determine which channel is incorrect and check signal return wiring for problems.

CB12260,00000FB -19-20MAY14-4/5

3 **Sensor**	Swap sensor connectors and repeat pedal readings again. Does error move to opposite sensor?	**YES:** Replace faulty sensor. **NO:** Contact DTAC.

CB12260,00000FB -19-20MAY14-5/5

VCU 523591.08 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal Sensor, Abnormal Frequency

Alarm Level:

Service Alert

To Clear Display:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

Service ADVISOR is a trademark of Deere & Company

Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Faulty wiring*
- *Faulty sensor*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Erroneous Diagnostic Trouble Codes

CB12260,00000FC -19-20MAY14-1/4

Procedure

CB12260,00000FC -19-20MAY14-2/4

1	**Frequency Check**	Connect machine to Service ADVISOR. Observe reverse pedal frequency at rest. Then observe reverse pedal frequency while slowly depressing pedal to full forward position. Is frequency range between 100 and 200 Hz?	**YES:** Go to next step. **NO:** Check for possible erroneous trouble codes.

CB12260,00000FC -19-20MAY14-3/4

2	**Sensor**	Swap pedal sensor connectors and recheck pedal frequency. Does problem move to opposite pedal?	**YES:** Replace faulty sensor. **NO:** Contact DTAC.

CB12260,00000FC -19-20MAY14-4/4

VCU 523591.13 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal, Not Calibrated

Alarm Level:

Stop

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

Snapshot Recorded:

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

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- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Pedals out of calibration.*
- *Physical damage or interference with pedal assembly.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

CB12260,00000FD -19-20MAY14-1/4

Procedure

CB12260,00000FD -19-20MAY14-2/4

❶ **Mechanical Assembly**	Check for physical damage or interference with pedal assembly. Does it check ok?	**YES:** Go to next step. **NO:** Repair or replace components as necessary.

CB12260,00000FD -19-20MAY14-3/4

❷ **Calibration**	Calibrate pedals and swash plate. See Hydrostatic Transmission Calibration and Hydrostatic Valve Calibration. Does machine pass calibration?	**YES:** End of tests. **NO:** Contact DTAC.

CB12260,00000FD -19-20MAY14-4/4

VCU 523591.14 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal, Forward as Reverse

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Diagnosis:

Service ADVISOR is a trademark of Deere & Company

Check for proper connections.

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Pedal connectors are swapped. Swap pedal connectors.*

CB12260,00000FE -19-20MAY14-1/1

VCU 523591.16 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal Sensor, Value Too High

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Service ADVISOR is a trademark of Deere & Company

NOTE: Common conditions to cause code.

- *Damaged pedal sensor*
- *Faulty wiring.*
- *Calibration error*
- *One of the redundant sensor channels is in range but inaccurate.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Erroneous Diagnostic Trouble Codes

CB12260,00000FF -19-18JUN14-1/3

Procedure

CB12260,00000FF -19-18JUN14-2/3

❶ **Sensor Channels**	Connect machine to Service ADVISOR. Observe and note reverse pedal output with pedal at rest. Then, observe and note output percentages while slowly depressing pedal to fully depressed position. Do channels A and B’s percentages add up to approximately %100 over full travel of pedal?	**YES:** Possible erroneous trouble code. Check operating conditions. **NO:** Replace faulty sensor.	

CB12260,00000FF -19-18JUN14-3/3

VCU 523591.18 — Reverse Pedal Sensor

Code Caused By:

Reverse pedal sensor, data valid but below normal operating range - moderately severe level.

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited Functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Damaged pedal sensor*
- *Faulty wiring.*
- *Calibration error*
- *One of the redundant sensor channels is in range but inaccurate.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Erroneous Diagnostic Trouble Codes

Service ADVISOR is a trademark of Deere & Company

CB12260,0000100 -19-20MAY14-1/3

Procedure

CB12260,0000100 -19-20MAY14-2/3

1	**Sensor Channels**	Connect machine to Service ADVISOR. Observe and note reverse pedal output with pedal at rest. Then, observe and note output percentages while slowly depressing pedal to fully depressed position. Do channels A and B’s percentages add up to approximately %100 over full travel of pedal?	**YES:** Possible erroneous trouble code. Check operating conditions. **NO:** Replace faulty sensor.

CB12260,0000100 -19-20MAY14-3/3

VCU 523591.31 — Reverse Pedal Sensor

Code Caused By:

Reverse Pedal Sensor, A-B Mismatch

Alarm Level:

Service Alert

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Required Tools:

Multimeter

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Damaged pedal sensor*
- *Faulty wiring.*
- *Calibration error*
- *One of the redundant sensors is in range but inaccurate.*

Additional Information:

Main Electrical Schematic, Non-T4

Main Electrical Schematic, T4

Traction Drive Circuit

Erroneous Diagnostic Trouble Codes

Service ADVISOR is a trademark of Deere & Company

CB12260,0000101 -19-20MAY14-1/3

Procedure

CB12260,0000101 -19-20MAY14-2/3

1 Sensor Channels	Connect machine to Service ADVISOR. Observe and note reverse pedal output with pedal at rest. Then, observe and note output percentages while slowly depressing pedal to fully depressed position. Do channels A and B’s percentages add up to approximately %100 over full travel of pedal?	**YES:** Possible erroneous trouble code. Check operating conditions. **NO:** Replace faulty sensor.

CB12260,0000101 -19-20MAY14-3/3

VCU 523735.03 — eHydro FWD/REV Solenoid

Code Caused By:

Forward/reverse solenoids shorted to high or voltage above normal.

Alarm Level:

Stop

To Clear Display:

Cycle key switch.

Alarm Frequency:

Continuous

Control Unit Response:

Machine stop

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR and multimeter

Service ADVISOR is a trademark of Deere & Company

Preliminary Checks:

Check wiring and connections.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbed wires*
- *Bad connection*
- *Faulty solenoid*

Additional Information

- *Main Electrical Schematic, Non-T4*
- *Main Electrical Schematic, T4*

JF70945,00001CB -19-20MAY14-1/6

Diagnostics

JF70945,00001CB -19-20MAY14-2/6

1 Is Code Active	Connect Service ADVISOR. Is the code active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

JF70945,00001CB -19-20MAY14-3/6

2 Voltage Checks	Check for 12 Volts at connectors MC-32 pin A and MC-33 pin A to ground. Is there 12 volts present with key on?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00001CB -19-20MAY14-4/6

3 Check Wiring	Measure resistance between VCU pin G3 to MC-32 pin A and to MC-33 pin A. Measure resistance between MC-32 pin B to VCU pin H4. Ohm out wire from MC- 33 pin B to VCU pin L4. Specifdication for all of the wires is less than 5 Ohms. Are the wires within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,00001CB -19-20MAY14-5/6

4 Check Solenoid	Measure resistance of forward and reverse solenoids. Specification is 2.5 Ohms. Are the solenoids within specification?.	**YES:** Open DTAC case. **NO:** Replace failed solenoid and perform Hydrostatic Transmission Calibration and Hydrostatic Valve Calibration.

JF70945,00001CB -19-20MAY14-6/6

VCU 523735.04 — eHydro FWD/REV Solenoid

Code Caused By:

Forward/Reverse solenoids short to ground or low source.

Alarm Level:

Alarm

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Engine Shuts Down

Snapshot Recorded:

Yes.

Required Tools:

Service ADVISOR and multimeter

Preliminary Checks:

Service ADVISOR is a trademark of Deere & Company

Check connectors and connections.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbed wires*
- *Bad connection*
- *Faulty solenoid*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,00001CC -19-20MAY14-1/6

Diagnostics

JF70945,00001CC -19-20MAY14-2/6

1 Is Code Active	Connect Service ADVISOR. Is the code active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

JF70945,00001CC -19-20MAY14-3/6

2 Voltage Checks	Check for 12 Volts at connectors MC-32 pin A and MC-33 pin A to ground. Is there 12 volts present with key on?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

Continued on next page

JF70945,00001CC -19-20MAY14-4/6

3 Check Wiring	Measure resistance between VCU pin G3 to MC-32 pin a and to MC-33 pin A. Measure resistance between MC-32 pin B to VCU pin H4. Ohm out wire from MC- 33 pin B to VCU pin L4. Specification for all of the wires is less than 5 Ohms. Are the wires within specification?	**YES:** Go to next step. **NO:** Repair wiring and perform Verification Procedure.

JF70945,00001CC -19-20MAY14-5/6

4 Check Solenoid	Measure resistance of forward and Reverse solenoids. Spec is 2.5 Ohms. Are the solenoids within spec?	**YES:** Open DTAC case. **NO:** Replace failed solenoid and perform Hydrostatic Transmission Calibration and Hydrostatic Valve Calibration.

JF70945,00001CC -19-20MAY14-6/6

VCU 524069.03 — Reverse Hydro Solenoid

Code Caused By:

Reverse solenoid above normal or short to high.

Alarm Level:

Alarm

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Engine Shuts Down

Snapshot Recorded:

Yes.

Required Tools:

Service ADVISOR and multimeter

Preliminary Checks:

Service ADVISOR is a trademark of Deere & Company

Check connections and connectors.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbed wires*
- *Bad connection*
- *Faulty solenoid*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

JF70945,00001D8 -19-20MAY14-1/7

Diagnostics

JF70945,00001D8 -19-20MAY14-2/7

1 Is Code Active	Connect Service ADVISOR. Is the code active?	**YES:** Go to next step.. **NO:** Perform Verification Procedure.

Continued on next page

JF70945,00001D8 -19-20MAY14-3/7

❷ **Voltage Checks**	Is the 12 volts at pin A of connector MC-33?	**YES:** Go to next step. **NO:** Repair wiring, perform Verification Procedure.

JF70945,00001D8 -19-20MAY14-4/7

❸ **Check Wiring**	Ohm out wiring from VCU pin H4 to MC-33 pin B and VCU pin G3 to MC-33 pin A. Spec is less than 5 ohms. Is the wiring within spec?	**YES:** Go to next step. **NO:** Repair wiring

JF70945,00001D8 -19-20MAY14-5/7

❹ **Check Solenoid**	Test solenoid from pin A to pin B. Specification Is 2.5 ohms. Is solenoid within specification?	**YES:** Contact DTAC. **NO:** Replace solenoid and go to next step.

JF70945,00001D8 -19-20MAY14-6/7

❺ **Calibration**	Calibrate new solenoids • Hydrostatic Transmission Calibration • Hydrostatic Valve Calibration Did the transmission pass calibrations?	 **YES:** Perform Verification Procedure. **NO:** Contact DTAC.

JF70945,00001D8 -19-20MAY14-7/7

VCU 524069.04 — Reverse Hydro Solenoid

Code Caused By:

Forward/Reverse solenoid short to ground

Alarm Level:

Alarm

To Clear Display:

Cycle key switch

Alarm Frequency:

Continuous

Control Unit Response:

Engine Shuts Down

Snapshot Recorded:

Yes

Required Tools:

Service ADVISOR and a multimeter

Preliminary Checks:

Service ADVISOR is a trademark of Deere & Company

Check connectors and connections

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code:

- *Rubbed wires*
- *Bad connection*
- *Faulty solenoid*

Additional Information

- Main Electrical Schematic, Non-T4
- Main Electrical Schematic, T4

Continued on next page

JF70945,00001D9 -19-20MAY14-1/7

Diagnostics

JF70945,00001D9 -19-20MAY14-2/7

1 Is Code Active	Connect machine to Service ADVISOR. Is the code active?	**YES:** Go to next step. **NO:** Perform Problem Not Found Procedure.

JF70945,00001D9 -19-20MAY14-3/7

2 Voltage Checks	With the key on, is the 12 volts at pin A of connector MC-33?	**YES:** Go to next step. **NO:** Repair wiring, perform Verification Procedure.

JF70945,00001D9 -19-20MAY14-4/7

3 Check Wiring	Check resistance between VCU pin H4 to MC-33 pin B. Also check resistance between VCU pin G3 to MC-33 pin A. Specification is less than 5 ohms. Is the wiring within specification?	**YES:** Go to next step. **NO:** Repair wiring, perform Verification Procedure.

JF70945,00001D9 -19-20MAY14-5/7

4 Check Solenoid	Check resistance at solenoid from pin A to pin B. Specification is 2.5 ohms. Is solenoid within specification?	**YES:** Contact DTAC. **NO:** Replace solenoid and go to next step.

JF70945,00001D9 -19-20MAY14-6/7

5 Calibration	Calibrate new solenoids • Hydrostatic Transmission Calibration • Hydrostatic Valve Calibration Did the transmission pass calibrations?	 **YES:** Perform Verification Procedure **NO:** Contact DTAC.

JF70945,00001D9 -19-20MAY14-7/7

ECU, Quick Reference Table

SPN.FMI (DTC)	Engine Controller Response	Other Controlled Response	Fault	Diagnosis
000051.03	The ECU will derate the engine. The ECU commands the Air Throttle Actuator fully closed. The ECU commands the EGR Valve fully closed. The ECU will command an engine stop after 2 hours of continuous operation with the fault active.		Air Throttle Actuator Position Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
000051.04	The ECU will derate the engine. The ECU commands the Air Throttle Actuator fully closed. The ECU commands the EGR Valve fully closed. The ECU will command an engine stop after 2 hours of continuous operation with the fault active.		Air Throttle Actuator Position Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000094.03			Low-Pressure Fuel Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
000094.04			Low-Pressure Fuel Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000094.16			Low-Pressure Fuel Signal Moderately High	See diagnostic procedure for this DTC in CTM120419
000094.17			Low-Pressure Fuel Signal Slightly Low	See diagnostic procedure for this DTC in CTM120419
000094.18			Low-Pressure Fuel Signal Moderately Low.	See diagnostic procedure for this DTC in CTM120419
000097.00			Water-In-Fuel Level Extremely High.	See diagnostic procedure for this DTC in CTM120419
000097.03			Water-In-Fuel Signal Out Of Range High	See diagnostic procedure for this DTC in CTM120419
000097.04			Water-In-Fuel Signal Out Of Range Low	See diagnostic procedure for this DTC in CTM120419
000097.16			Water-In-Fuel Level Moderately High	See diagnostic procedure for this DTC in CTM120419
000100.01			Engine Oil Pressure Signal Extremely Low.	See diagnostic procedure for this DTC in CTM120419
000100.04			Engine Oil Pressure Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000101.00			Engine Crankcase Pressure Extremely High	See diagnostic procedure for this DTC in CTM120419
000101.03			Engine Crankcase Pressure Signal Out of Range High.	See diagnostic procedure for this DTC in CTM120419
000101.04			Engine Crankcase Pressure Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000101.16			Engine Crankcase Pressure Moderately High.	See diagnostic procedure for this DTC in CTM120419
000102.03			Manifold Air Pressure Signal Out of Range	See diagnostic procedure for this DTC in CTM120419
000102.04			Manifold Air Pressure Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000105.03			Manifold Air Temperature Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419

Continued on next page

000105.04			Manifold Air Temperature Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000107.00			Air Filter Pressure Differential Extremely High.	See diagnostic procedure for this DTC in CTM120419
000107.15			Air Filter Pressure Differential Slightly High	See diagnostic procedure for this DTC in CTM120419
000107.16			Air Filter Pressure Differential Moderately High.	See diagnostic procedure for this DTC in CTM120419
000110.00			Engine Coolant Temperature Signal Extremely High.	See diagnostic procedure for this DTC in CTM120419
000110.03			Engine Coolant Temperature Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
000110.04			Engine Coolant Temperature Signal Out of Range Low.	See diagnostic procedure for this DTC in CTM120419
000157.03			Fuel Rail Pressure Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
000157.04			Fuel Rail Pressure Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
000157.18			Fuel Rail Pressure Signal Moderately Low.	See diagnostic procedure for this DTC in CTM120419
000174.00			Fuel Temperature Signal Extremely High	See diagnostic procedure for this DTC in CTM120419
000174.03			Fuel Temperature Signal Out Of Range High.	See diagnostic procedure for this DTC in CTM120419
000174.04			Fuel Temperature Signal Out Of Range Low	See diagnostic procedure for this DTC in CTM120419
000190.00			Engine Speed Extremely High.	See diagnostic procedure for this DTC in CTM120419
000412.03			EGR Temperature Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
000412.04			EGR Temperature Signal Out Of Range Low	See diagnostic procedure for this DTC in CTM120419
000633.03			Suction Control Valve Circuit Out of Range High	See diagnostic procedure for this DTC in CTM120419
000633.05			Suction Control Valve Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
000651.05			Injector #1 Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
000652.05			Injector #2 Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
000653.05			Injector #3 Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
000654.05			Injector #4 Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
001209.03			Exhaust Manifold Pressure Signal Out of Range High.	See diagnostic procedure for this DTC in CTM120419
001209.04			Exhaust Manifold Pressure Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
002630.00			Charge Air Cooler Outlet Temperature Signal Extremely High.	See diagnostic procedure for this DTC in CTM120419

Continued on next page

BS62576,000165D -19-17JUN14-2/4

002630.03			Charge Air Cooler Outlet Temperature Signal Out Of Range High.	See diagnostic procedure for this DTC in CTM120419
002630.04			Charge Air Cooler Outlet Temperature Signal Out Of Range Low.	See diagnostic procedure for this DTC in CTM120419
002630.15			Charge Air Cooler Outlet Temperature Signal Slightly High.	See diagnostic procedure for this DTC in CTM120419
002630.16			Charge Air Cooler Outlet Temperature Signal Moderately High..	See diagnostic procedure for this DTC in CTM120419
002797.03			Injector High Voltage Supply #1 Out of Range High	See diagnostic procedure for this DTC in CTM120419
002797.05			Supply #1 Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
002797.06			Injector High Voltage Supply #1 Circuit Has Low Resistance	See diagnostic procedure for this DTC in CTM120419
002798.03			Injector High Voltage Supply #2 Out of Range High	See diagnostic procedure for this DTC in CTM120419
002798.05			Injector High Voltage Supply #2 Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
002798.06			Injector High Voltage Supply #2 Circuit Has Low Resistance	See diagnostic procedure for this DTC in CTM120419
003242.00			DOC Inlet Temperature Signal Extremely High.	See diagnostic procedure for this DTC in CTM120419
003242.03			DOC Inlet Temperature Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
003242.04			DOC Inlet Temperature Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
003250.00			DOC Outlet Temperature Extremely High.	See diagnostic procedure for this DTC in CTM120419
003250.01			DOC Outlet Temperature Extremely Low.	See diagnostic procedure for this DTC in CTM120419
003250.03			DOC Outlet Temperature Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
003250.04			DOC Outlet Temperature Signal Out of Range Low	See diagnostic procedure for this DTC in CTM120419
003251.00			DPF Differential Pressure Extremely High	See diagnostic procedure for this DTC in CTM120419
003251.03			DPF Differential Pressure Signal Out of Range High	See diagnostic procedure for this DTC in CTM120419
003251.04			DPF Differential Pressure Signal Out of Range Low.	See diagnostic procedure for this DTC in CTM120419
003251.16			DPF Differential Pressure Moderately High.	See diagnostic procedure for this DTC in CTM120419
003719.00			Calculated Soot Level Extremely High.	See diagnostic procedure for this DTC in CTM120419
003719.16			Calculated Soot Level Moderately High	See diagnostic procedure for this DTC in CTM120419
003720.00			Calculated Ash Level Extremely High.	See diagnostic procedure for this DTC in CTM120419

Continued on next page

003720.16			Calculated Ash Level Moderately High	See diagnostic procedure for this DTC in CTM120419
522323.00			Air Filter Pressure Differential Extremely High.	See diagnostic procedure for this DTC in CTM120419
522329.00			Water-In-Fuel Level Extremely High.	See diagnostic procedure for this DTC in CTM120419
522400.02			Crankshaft Position Signal Invalid.	See diagnostic procedure for this DTC in CTM120419
522400.05			Crankshaft Position Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
522401.02			Camshaft Position Signal Invalid.	See diagnostic procedure for this DTC in CTM120419
522401.05			Camshaft Position Circuit Has High Resistance	See diagnostic procedure for this DTC in CTM120419
522575.07			Parked Regeneration Failed	See diagnostic procedure for this DTC in CTM120419
522577.11			Regeneration Failed .	See diagnostic procedure for this DTC in CTM120419
522803.02			High-Pressure Injection Pump Calibration Invalid	See diagnostic procedure for this DTC in CTM120419
523074.03			Sensor Supply #1 Voltage Out of Range High .	See diagnostic procedure for this DTC in CTM120419
523074.04			Sensor Supply #1 Voltage Out of Range Low	See diagnostic procedure for this DTC in CTM120419
523075.03			Sensor Supply #2 Voltage Out of Range High	See diagnostic procedure for this DTC in CTM120419
523075.04			Sensor Supply #2 Voltage Out of Range Low .	See diagnostic procedure for this DTC in CTM120419

BS62576,000165D -19-17JUN14-4/4

ECU 000051.03 — Air Throttle Actuator Position Signal Out of Range High

The air throttle actuator position signal is higher than the sensor high-voltage specification.

Troubleshooting Sequence:
522591.12
000051.03

When DTC is Displayed:
When the ignition is on, engine is running, and the fault is active.

Related Information:

The air throttle actuator position signal voltage to the ECU corresponds to a position greater than what is physically possible for the air throttle actuator position signal sensor.

Alarm Level:

Warning

Control Unit Response:

The ECU derates the engine.

The ECU commands the Air Throttle Actuator fully open.

The ECU commands the EGR Valve fully closed.

The ECU aborts an active regeneration.

Additional references:

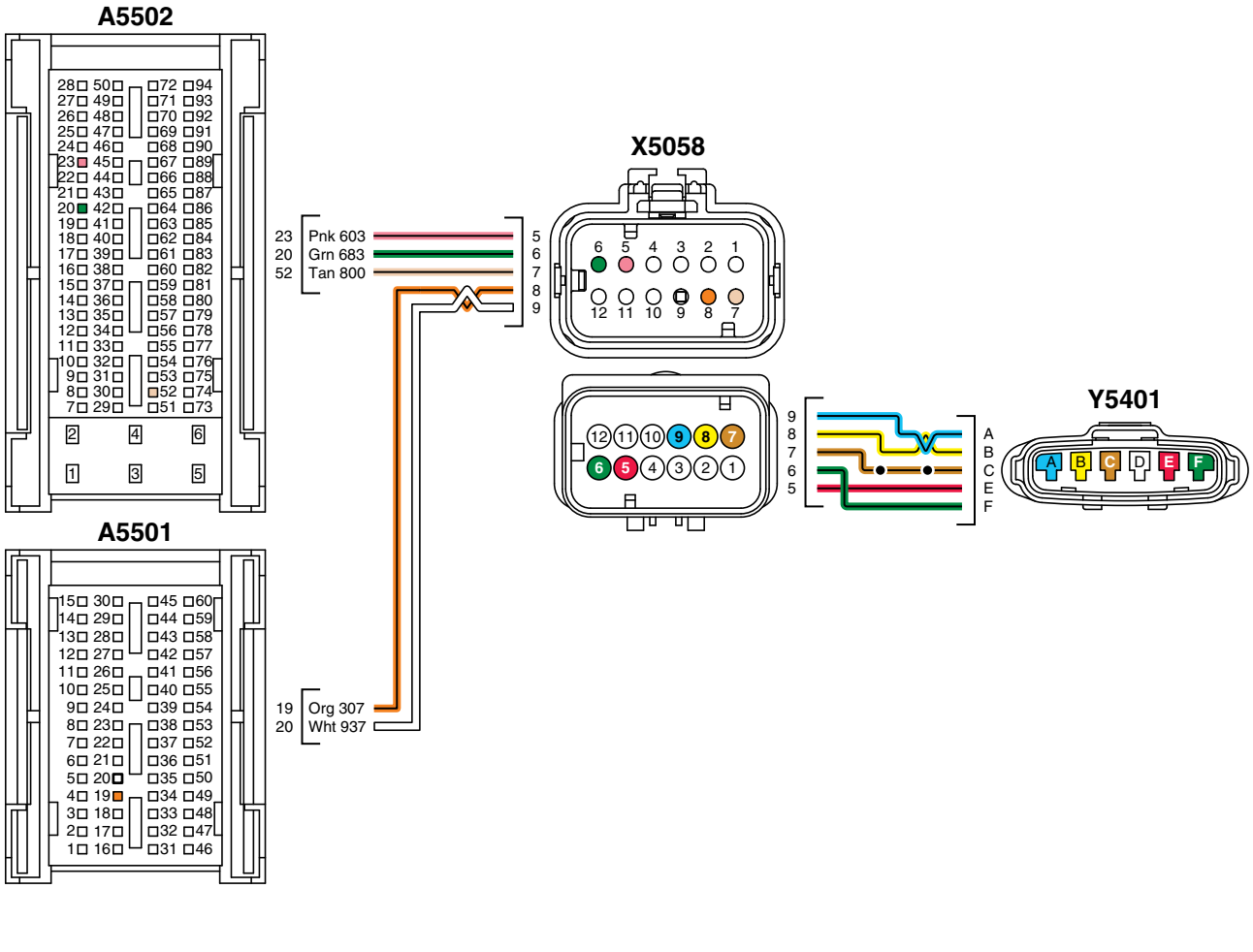
For sensor location, more air throttle actuator information, and more information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



TCT010341 —UN—11FEB14

A5502—23—Supply
A5502—20—Signal
A5502—52—Return
A5501—19—Drive (+)
A5501—20—Drive (-)

Continued on next page

OUMX258,0000371 -19-02JUN14-1/6

Diagnostic Procedure

OUMX258,0000371 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 522591.12 active or stored?

YES: See DTC 522591.12.

NO: Go to next step.

OUMX258,0000371 -19-02JUN14-3/6

2 Code Check

Is DTC 000051.03 active?

YES: Go to next step.

NO: Go to “Circuit Check”.

OUMX258,0000371 -19-02JUN14-4/6

3 Continuity Check

1. Measure resistance between A5502 connector female socket 20 and Y5401 connector female socket F.
2. Measure resistance between A5502 connector female socket 52 and Y5401 connector female socket C.

Are both resistance measurements less than 5 ohms?

YES: See CTM120419.

NO: Repair open wire or mispin in harness.

OUMX258,0000371 -19-02JUN14-5/6

4 Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor Air Throttle Actuator Position Input Voltage.

Data Point	Normal Range
Air Throttle Actuator Position Input Voltage	2.0—4.75 V

Does sensor input voltage ever read greater than 4.9 V?

YES: Repair harness problem.

NO: See CTM120419.

OUMX258,0000371 -19-02JUN14-6/6

ECU 000051.04 — Air Throttle Actuator Position Signal Out of Range Low

The air throttle actuator position signal is lower than the sensor low voltage specification.

Troubleshooting Sequence:
522591.12
000051.03
000051.04

When DTC is Displayed:
When the ignition is on, engine is running, and the fault is active.

Related Information:
The air throttle actuator position sensor signal voltage to the ECU corresponds to a position lower than what is physically possible for the air throttle actuator position sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully closed.
The ECU commands the EGR Valve fully closed.

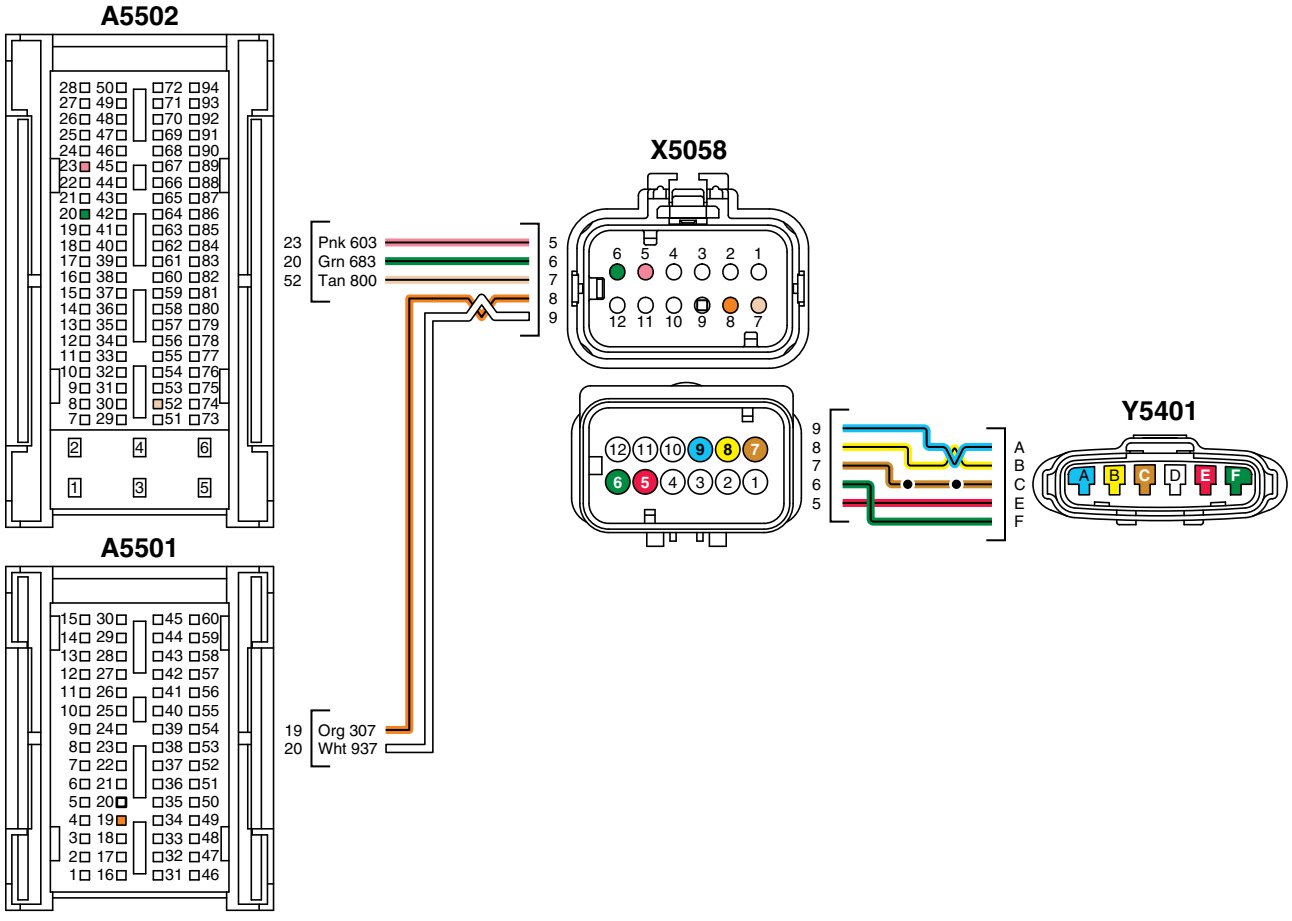
Additional references:
For sensor location, more air throttle actuator information, and more information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5502—23—Supply
A5502—20—Signal
A5502—52—Return
A5501—19—Drive (+)
A5501—20—Drive (-)

Continued on next page

OUMX258,0000372 -19-02JUN14-1/9

Diagnostic Procedure

IMPORTANT: Terminal damage occurs if anything other than the specified flex probes are used.

OUMX258,0000372 -19-02JUN14-2/9

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522591.12 stored?	**YES:** See DTC 522591.12. **NO:** Go to next step.

OUMX258,0000372 -19-02JUN14-3/9

2 Code Check	Is DTC 000051.03 stored?	**YES:** See DTC 000051.03. **NO:** Go to next step.

OUMX258,0000372 -19-02JUN14-4/9

3 Code Check	Is DTC 000051.04 active?	**YES:** Go to next step. **NO:** Go to “Circuit Check”.

OUMX258,0000372 -19-02JUN14-5/9

4 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect air throttle actuator connector Y5401. 3. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Check codes. **NO:** Go to next step.

OUMX258,0000372 -19-02JUN14-6/9

5 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect ECU connector A5502. 3. Perform Terminal Test on A5502 connector female sockets 20, 23, and 52. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Check codes. **NO:** Go to next step.

OUMX258,0000372 -19-02JUN14-7/9

6 Continuity Check	1. Disconnect connector Y5401. 2. Measure resistance between A5502 connector female socket 20 and Y5401 connector female socket F. Is resistance measurement less than 5 ohms?	**YES:** Repair short to signal wire in harness. **NO:** Repair open wire or mis-pin in harness. .

Continued on next page

OUMX258,0000372 -19-02JUN14-8/9

7 Circuit Check

1. In Service ADVISOR, monitor Air Throttle Actuator Position Input Voltage.

Data Point	Normal Range
Air Throttle Actuator Position Input Voltage	2.0 — 4.75 V

2. Perform Wiggle Test.

Does voltage ever go below 0.2 V?

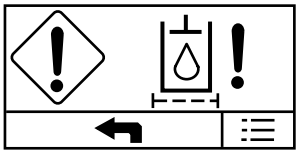
YES: Repair harness problem.

NO: See CTM120419.

OUMX258,0000372 -19-02JUN14-9/9

ECU 000100.01 — Engine Oil Pressure Signal Extremely Low

TCT010512 —UN—11FEB14



The engine oil pressure signal is much lower than expected.

Troubleshooting Sequence:
000100.01

When DTC is Displayed:

When the engine is running and the error is active.

Related Information:

The engine oil pressure is lower than the oil pressure switch threshold.

Alarm Level:
Stop

Control Unit Response:
The ECU will derate the engine.

The PDU will have a pop-up screen.

Additional references:

For sensor location, and more information on how to use Diagnostic Test Box, see CTM120419.

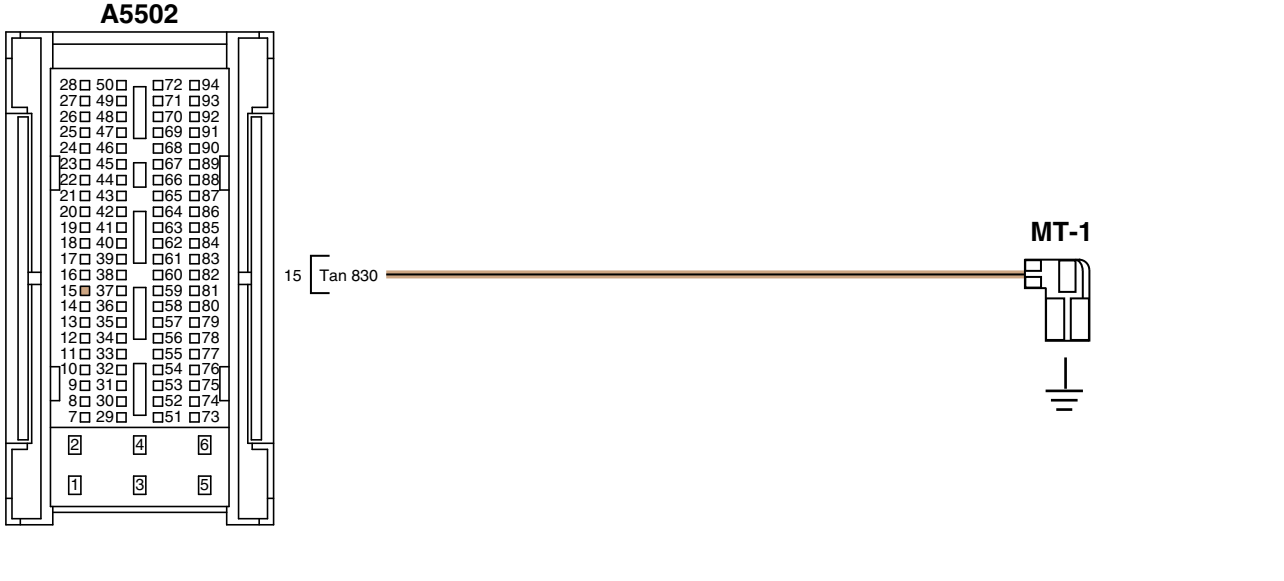
For complete wiring information:

- see Main Electrical Schematic, T4

located in Section 230, Group 50.

OUMX258,0000373 -19-11MAR14-1/5

Diagnostic Procedure



TCT010841 —UN—06MAR14

MT-1—15—Signal

Continued on next page

OUMX258,0000373 -19-11MAR14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect to Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition OFF, Engine OFF. 3. Check engine oil level. Is level between the “Add” and “Full” marks?	**YES:** Go to next step. **NO:** Adjust oil level to the proper level. Perform Verification Procedure.

OUMX258,0000373 -19-11MAR14-3/5

2 Verify Engine Has Oil Pressure	1. Remove oil pressure switch from the engine and install a pressure gauge in engine block. 2. Run engine at rated engine speed and slow idle engine speed. Was the gauge readings within specification?	**YES:** Reinstall oil pressure switch. Go to next step. **NO:** Investigate other potential mechanical problems: • Incorrect Oil • Plugged Oil Filter • Excessive Oil Temperature • Sticky Oil Pressure Regulating Valve • Plugged Oil Pump Screen • Cracked Pick-up Tube • Worn or Dirty Oil Pump • Faulty or Missing Piston Cooling Orifice • Excessive Main Bearing Clearance • Excessive Rod Bearing Clearance

OUMX258,0000373 -19-11MAR14-4/5

3 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect engine oil pressure switch connector MT-1. 3. Measure the resistance between A5502 connector socket 15 and MT-1 connector. 4. Perform Terminal Test on switch and MT-1 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,0000373 -19-11MAR14-5/5

ECU 000100.04 — Engine Oil Pressure Signal Out of Range Low

The engine oil pressure signal is lower than expected.

OUMX258,0000374 -19-24MAR14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
000100.01
000100.04

When DTC is Displayed:

When the ignition is ON, the engine is OFF, and the fault is active.

Related Information:

This fault detects an open circuit in the oil pressure switch circuit approximately 1 second after the ignition is switched from OFF to ON and the starter is not immediately engaged.

Alarm Level:

Stop

Control Unit Response:

The ECU will derate the engine.

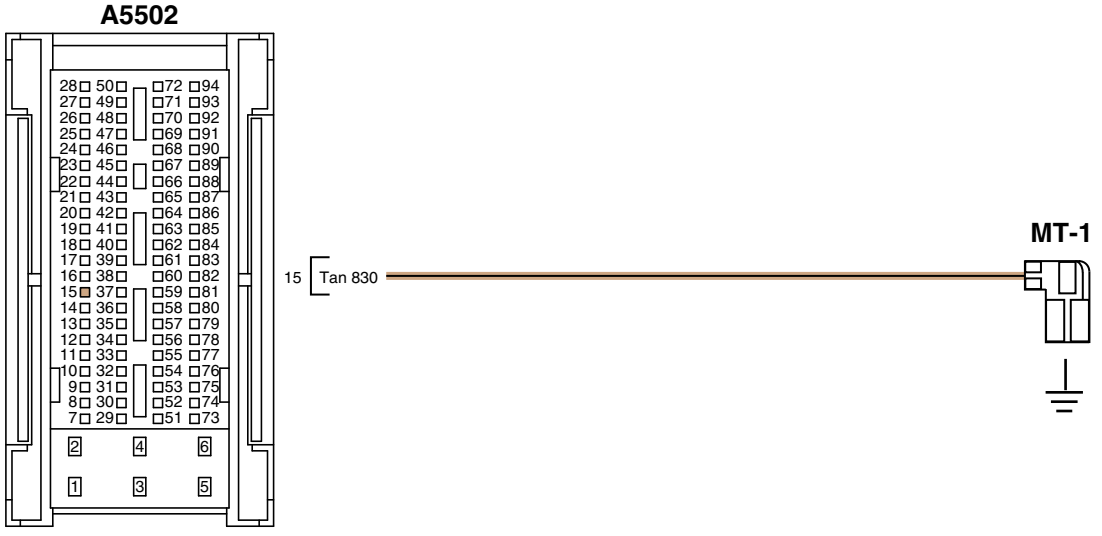
Additional references:

For sensor location, and more information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

located in Section 230, Group 50.



TCT010841 —UN—06MAR14

MT-1—15—Signal

Continued on next page

OUMX258,0000374 -19-24MAR14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 000100.04 active?	**YES:** Go to next step. **NO:** See DTC 000100.01.

OUMX258,0000374 -19-24MAR14-3/5

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect engine oil pressure switch connector MT-1. 3. Perform Terminal Test on sensor and MT-1 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000374 -19-24MAR14-4/5

3 Switch Check	1. Disconnect connector MT-1. *NOTE: Ignore any oil pressure codes that set once the connector has been removed.* 2. Ignition ON, engine running. 3. Measure the resistance between switch male pin and single point ground. Is resistance greater than 100K Ohms?	**YES:** See CTM120419. **NO:** Replace engine oil pressure switch. Perform Verification Procedure.

OUMX258,0000374 -19-24MAR14-5/5

ECU 000102.03 — Manifold Air Pressure Signal Out of Range High

The manifold air pressure signal exceeds the sensor high voltage specification.

OUMX258,0000375 -19-02JUN14-1/7

Diagnostic Procedure

Troubleshooting Sequence:
522591.12
000102.03

When DTC is Displayed:
When the ignition is on, engine is running, and the fault is active.

Related Information:
The manifold air pressure signal voltage to the ECU corresponds to a pressure higher than what is physically possible for the manifold air pressure sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU will command an engine stop after 15 minutes of continuous operation with the fault active.

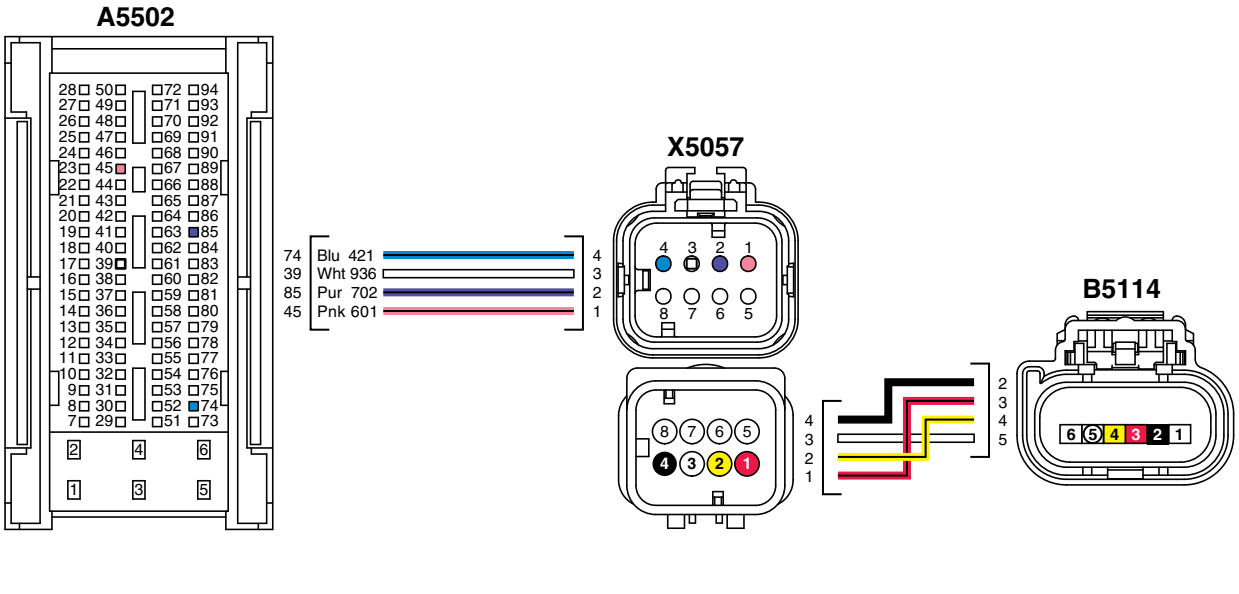
Additional references:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic

located in Section 230, Group 50.



A5502 — 45—Supply
A5502 — 74—Return

A5502 — 39—Manifold Air Pressure Signal

A5502 — 85—Exhaust Pressure Signal

Continued on next page

OUMX258,0000375 -19-02JUN14-2/7

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 522591.12 active or stored?

YES: See DTC 522591.12
NO: Go to next step.

OUMX258,0000375 -19-02JUN14-3/7

2 Code Check

Is DTC 000102.03 active?

YES: Go to next step.

NO: See CTM120419.

OUMX258,0000375 -19-02JUN14-4/7

3 Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor Manifold Air Pressure Input Voltage.

Data Point	Normal Range
Manifold Air Pressure Input Voltage	2.0 — 3.2 V

3. Perform Wiggle Test.

Does sensor input voltage ever read greater than 4.9 V?

YES: Repair harness problem. Perform Verification Procedure.
NO: Go to next step.

OUMX258,0000375 -19-02JUN14-5/7

4 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect Manifold Air and Exhaust Pressure sensor connector B5114.
3. Perform Terminal Test on sensor and B5114 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.
NO: Go to next step.

OUMX258,0000375 -19-02JUN14-6/7

5 Continuity Check

1. Measure the resistance between A5502 connector female socket 74 and B5114 connector female socket 2.
2. Measure the resistance between A5502 connector female socket 39 and B5114 connector female socket 5.

Are both resistance measurements less than 5 ohms?

YES: See CTM120419.
NO: Repair mis-pin. Perform Verification Procedure.

OUMX258,0000375 -19-02JUN14-7/7

ECU 000102.04 — Manifold Air Pressure Signal Out of Range Low

The manifold air pressure signal is lower than the sensor low voltage specification.

OUMX258,0000376 -19-02JUN14-1/8

Diagnostic Procedure

Troubleshooting Sequence:
522591.12
000102.03
000102.04

When DTC is Displayed:
When the ignition is on, engine is running, and the fault is active.

Related Information:
The manifold air pressure signal voltage to the ECU corresponds to a pressure lower than what is physically possible for the manifold air pressure sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commansd an engine stop after 15 minutes of continuous operation with the fault active.

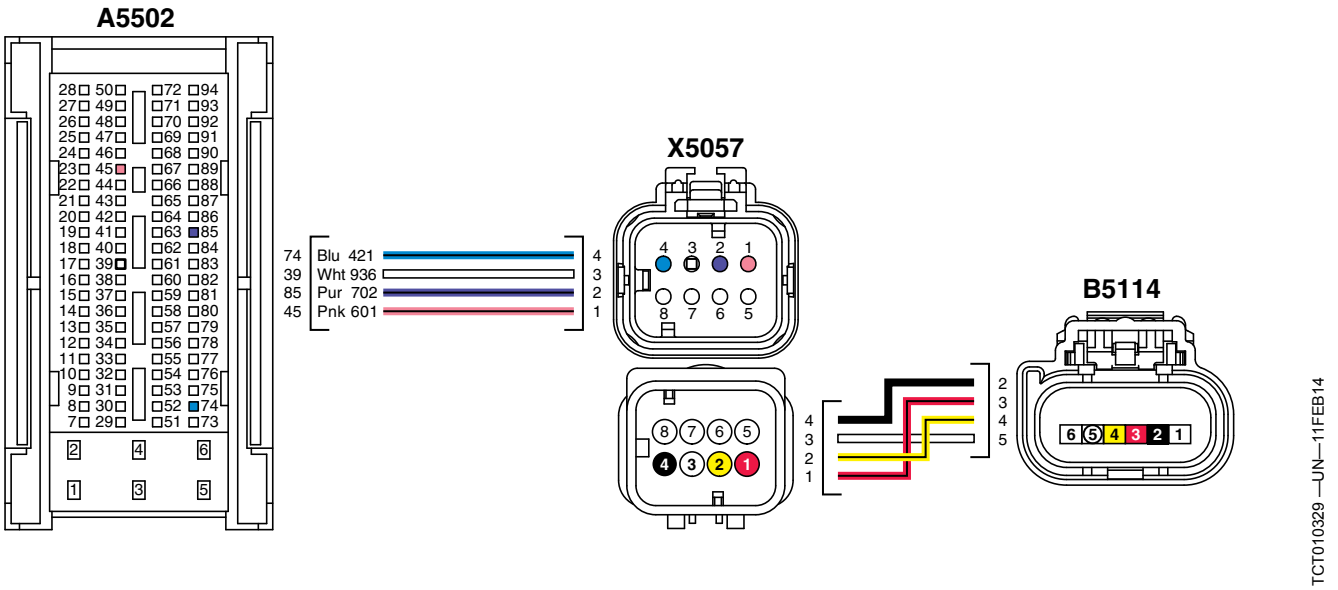
Additional references:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic

located in Section 230, Group 50.



A5502 — 45—Supply
A5502 — 74—Return

A5502 — 39—Manifold Air Pressure Signal

A5502 — 85—Exhaust Pressure Signal

Continued on next page

OUMX258,0000376 -19-02JUN14-2/8

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 522591.12 stored?

YES: See DTC 522591.12

NO: Go to next step.

OUMX258,0000376 -19-02JUN14-3/8

2 Code Check

Is DTC 000102.03 stored?

YES: See DTC 000102.03.

NO: Go to next step.

OUMX258,0000376 -19-02JUN14-4/8

3 Code Check

1. Ignition ON, engine running.

2. Refresh codes.

Is DTC 000102.04 active?

YES: Go to next step.

NO: See CTM120419.

OUMX258,0000376 -19-02JUN14-5/8

4 Circuit Check

1. In Service ADVISOR, monitor Manifold Air Pressure Input Voltage.

Data Point	Normal Range
Manifold Air Pressure Input Voltage	2.0 — 3.2 V

2. Perform Wiggle Test.

Does voltage ever go below 0.2 V?

YES: Repair harness problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,0000376 -19-02JUN14-6/8

5 Terminal Check

1. Ignition OFF, Engine OFF.

2. Disconnect Manifold Air and Exhaust Pressure sensor connector B5114.
3. Perform Terminal Test on sensor and B5114 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,0000376 -19-02JUN14-7/8

6 Continuity Check

Measure resistance between A5502 connector female socket 39 and B5114 connector female socket 5.

Is resistance less than 5 ohms?

YES: Repair short to signal wire in harness. Perform Verification Procedure. See CTM120419.

NO: Repair open or mis-pin in harness. Perform Verification Procedure. See CTM120419.

OUMX258,0000376 -19-02JUN14-8/8

ECU 000102.13 — Manifold Air Pressure Signal Calibration Fault

The manifold air pressure signal is lower than the sensor low voltage specification.

OUMX258,0000377 -19-17JUN14-1/9

Diagnostic Procedure

Troubleshooting Sequence:
522591.12
000102.03
000102.04
000102.07

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
At ignition on, engine off, the ECU performs a comparison of multiple pressure sensors on the engine.
The manifold air pressure sensor signal voltage to the ECU is higher or lower than the other sensors being compared at ignition on, engine off.

Alarm Level:
Stop

Control Unit Response:
The ECU will derate the engine.
The ECU will command an engine stop after 15 minutes of continuous operation with the fault active.

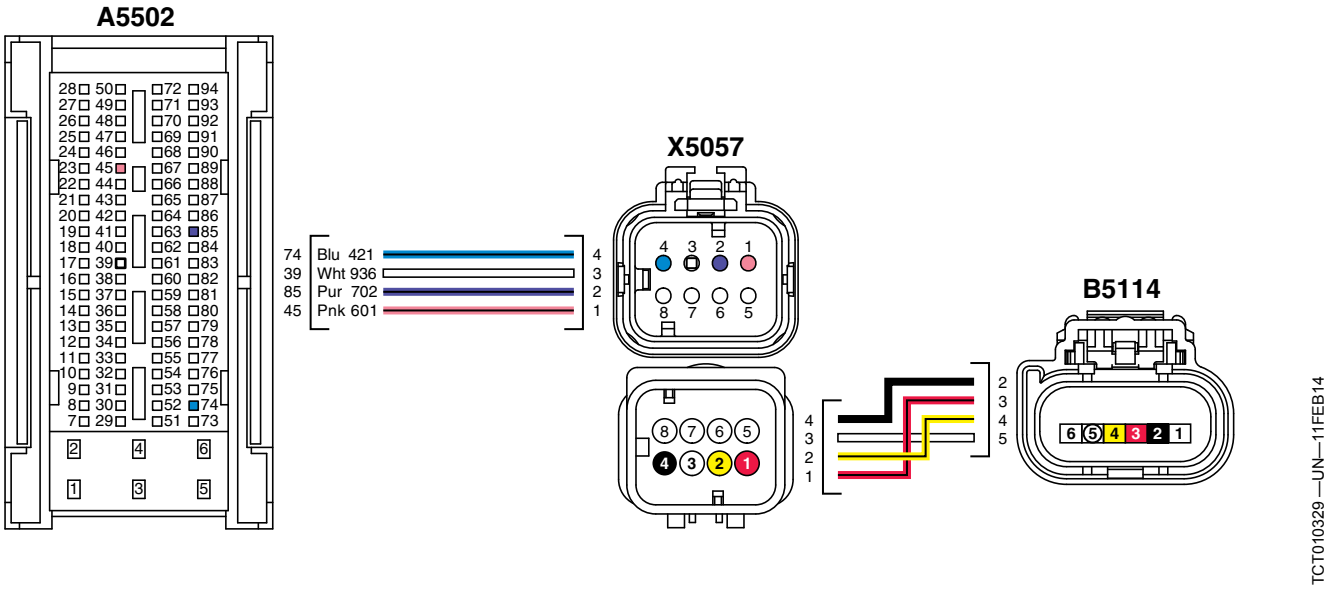
Additional references:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic

located in Section 230, Group 50.



A5502 — 45—Supply
A5502 — 74—Return

A5502 — 39—Manifold Air Pressure Signal

A5502 — 85—Exhaust Pressure Signal

Continued on next page

OUMX258,0000377 -19-17JUN14-2/9

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522591.12 stored?	**YES:** See DTC 522591.12. **NO:** Go to next step.

OUMX258,0000377 -19-17JUN14-3/9

2 Code Check	Is DTC 000102.03 stored?	**YES:** See DTC000102.03 procedure. **NO:** Go to next step.

OUMX258,0000377 -19-17JUN14-4/9

3 Code Check	Is DTC 000102.04 stored?	**YES:** See DTC 000102.04. **NO:** Go to next step.

OUMX258,0000377 -19-17JUN14-5/9

4 Code Check	Is DTC 000102.07 active?	**YES:** Go to next step. **NO:** See CTM120419.

OUMX258,0000377 -19-17JUN14-6/9

5 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect Manifold Air and Exhaust Pressure sensor connector B5114. 3. Perform Terminal Test on sensor and B5114 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000377 -19-17JUN14-7/9

6 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect ECU connector A5502. 3. Perform Terminal Test on A5502 connector female sockets 39, 45, 74, and 85. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000377 -19-17JUN14-8/9

7 Continuity Check	Measure the resistance between A5502 connector female socket 39 and B5114 connector female socket 5. Is resistance measurement less than 5 ohms?	**YES:** Repair short in harness. Perform Verification Procedure. **NO:** Repair open, high resistance, or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000377 -19-17JUN14-9/9

ECU 000105.03 — Manifold Air Temperature Signal Out of Range High

The manifold air temperature signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
000105.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The manifold air temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the manifold air temperature sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR Valve fully closed.
The ECU commands an engine stop after 15 minutes of continuous operation with the fault active.

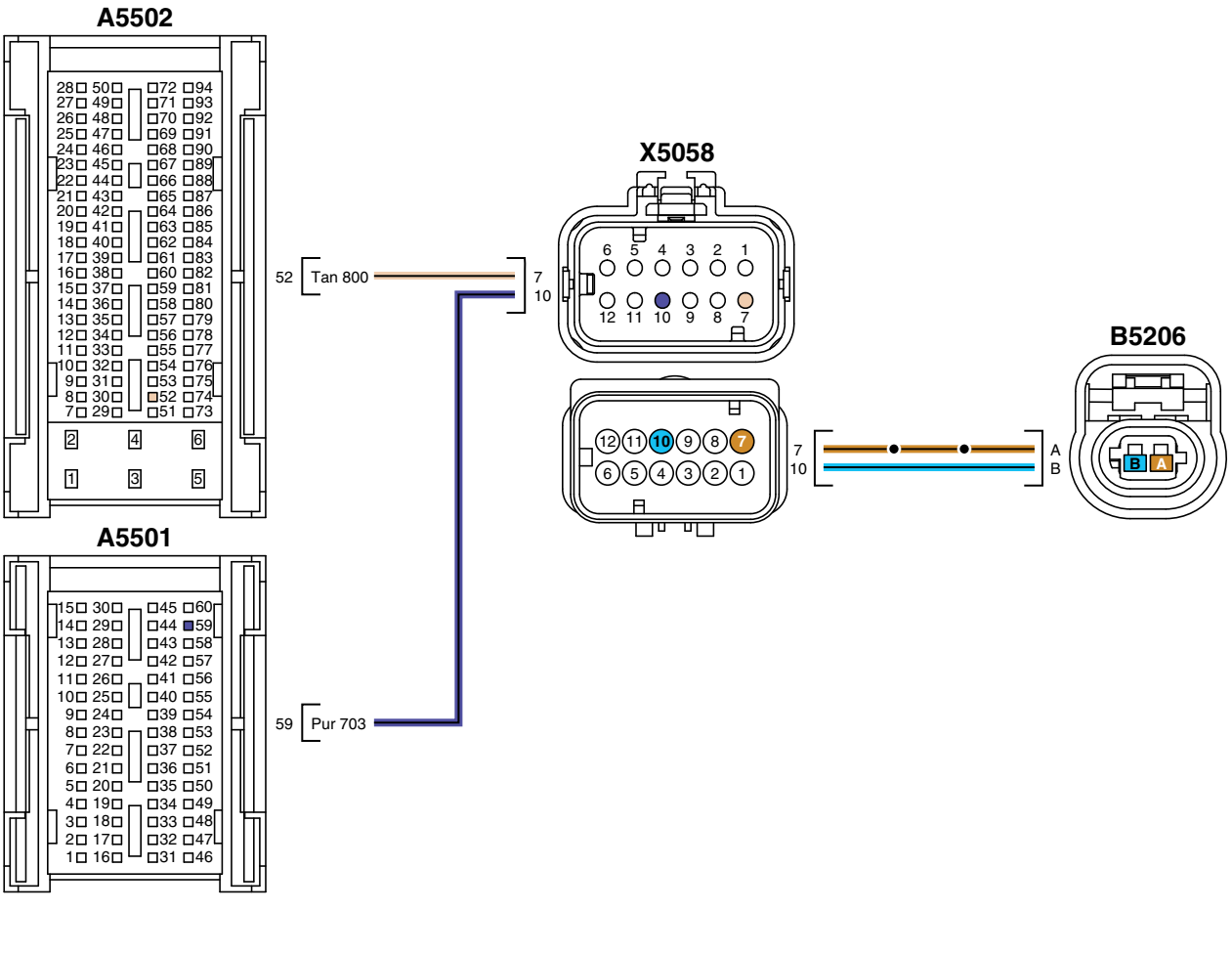
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 59—Signal **A5502 — 52—Return**

OUMX258,0000378 -19-02JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,0000378 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 000105.03 active?

YES: Go to next step.

NO: Skip next step, go to following step.

OUMX258,0000378 -19-02JUN14-3/6

2 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect manifold air temperature sensor connector B5206.
3. Perform Terminal Test on sensor and B5206 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,0000378 -19-02JUN14-4/6

3 Sensor Check

In Service ADVISOR, monitor Manifold Air Temperature Input Voltage.

Is voltage between 2.4 and 2.8 V?

Data Point	Normal Range
Manifold Air Temperature Input Voltage	2.0 — 3.2 V

YES: Replace sensor. Perform Verification Procedure.

NO: Go to next step.

OUMX258,0000378 -19-02JUN14-5/6

4 Circuit Check

Perform Wiggle Test while monitoring manifold sensor input voltage.

Does sensor input voltage ever read greater than 4.9 V?

YES: Repair harness problem. Perform Verification Procedure.

NO: See CTM124019.

OUMX258,0000378 -19-02JUN14-6/6

ECU 000105.04 — Manifold Air Temperature Signal Out of Range Low

The manifold air temperature signal is lower than the sensor low voltage specification.

Troubleshooting Sequence:
000105.03
000105.04

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The manifold air temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the manifold air temperature sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR Valve fully closed.
The ECU commands an engine stop after 15 minutes of continuous operation with the fault active.

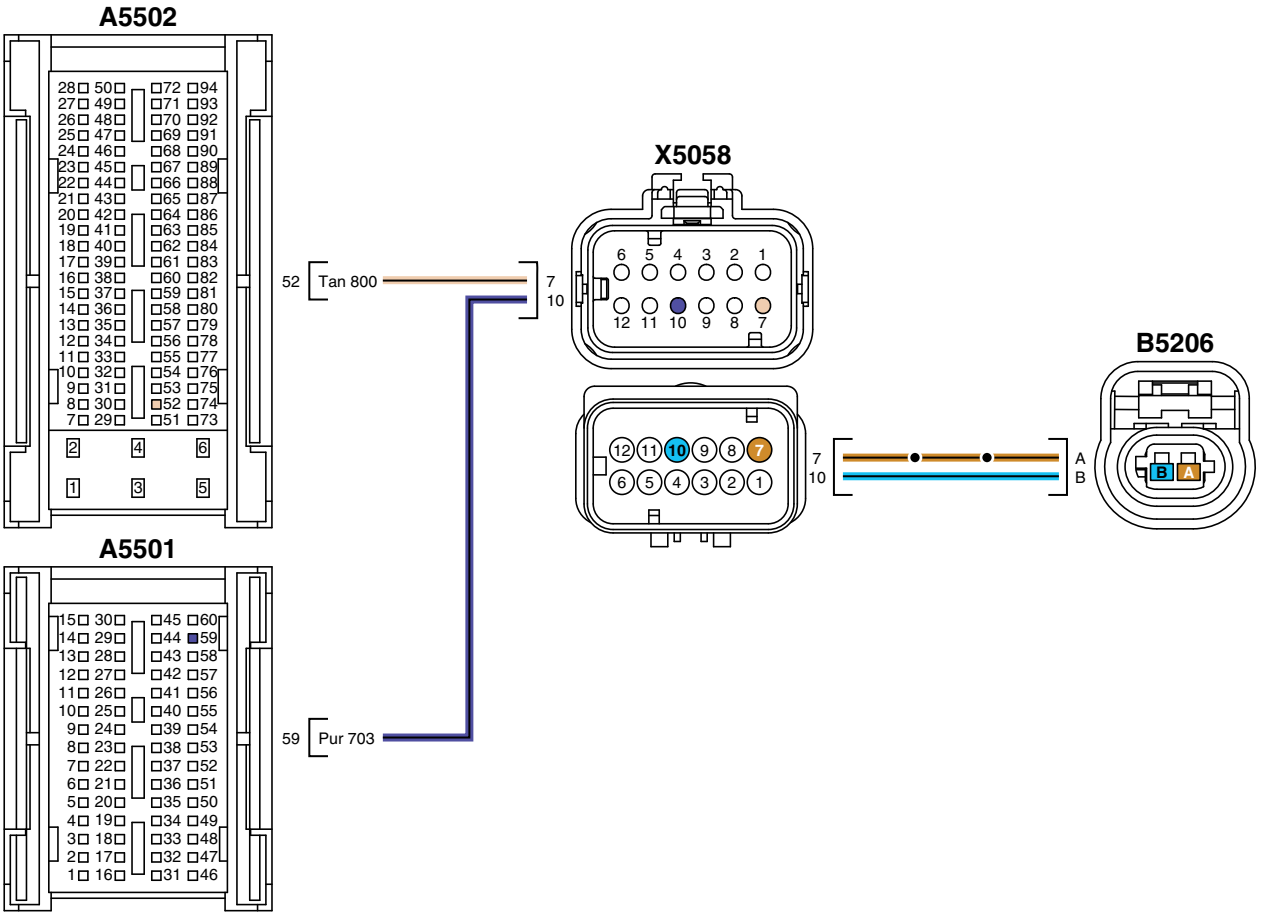
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 59—Signal **A5502 — 52—Return**

OUMX258,0000379 -19-02JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,0000379 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Refresh codes.

Is DTC 000105.03 a stored code?

YES: See DTC 000105.03 procedure.

NO: Go to next step.

OUMX258,0000379 -19-02JUN14-3/6

2 Code Check

Is DTC 000105.04 active?

YES: Go to next step.

NO: Go to “Circuit Check” step.

OUMX258,0000379 -19-02JUN14-4/6

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect manifold air temperature sensor connector B5206.
3. Perform Terminal Test on sensor and B5206 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,0000379 -19-02JUN14-5/6

4 Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor Manifold Air Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
Manifold Air Temperature Input Voltage	2.0 — 3.2 V

Is voltage between 2.4 and 2.8 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,0000379 -19-02JUN14-6/6

ECU 000108.03 — Barometric Pressure Signal Out of Range High

The barometric pressure sensor signal exceeds the sensor high voltage specification.

OUMX258,000037A -19-11MAR14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
000108.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The barometric pressure sensor signal voltage to the ECU corresponds to a pressure higher than what is physically possible for the barometric pressure sensor. The barometric air pressure sensor is an internal ECU sensor and cannot be repaired.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For more information see CTM120419.

OUMX258,000037A -19-11MAR14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh DTCs. Is DTC 000108.03 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure

OUMX258,000037A -19-11MAR14-3/5

2 Air Vent Check	1. Ignition OFF, Engine OFF. 2. Inspect the air vent located on the side of the ECU. Is vent free from debris?	**YES:** See CTM120419. **NO:** Clear debris from air vent. Go to next step.

OUMX258,000037A -19-11MAR14-4/5

3 Check Codes	Ignition ON, Engine OFF. Is DTC 000108.03 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,000037A -19-11MAR14-5/5

ECU 000108.04 — Barometric Pressure Signal Out of Range Low

The barometric pressure sensor signal exceeds the sensor low voltage specification.

OUMX258,000037B -19-11MAR14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
000108.04

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The barometric pressure sensor signal voltage to the ECU corresponds to a pressure lower than what is physically possible for the barometric pressure sensor. The barometric air pressure sensor is an internal ECU sensor and cannot be repaired.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For more information see CTM120419.

OUMX258,000037B -19-11MAR14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh DTCs. Is DTC 000108.04 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,000037B -19-11MAR14-3/5

2 Air Vent Check	1. Ignition OFF, Engine OFF. 2. Inspect the air vent located on the side of the ECU. Is vent free from debris?	**YES:** See CTM120419. **NO:** Clear debris from air vent. Go to next step.

OUMX258,000037B -19-11MAR14-4/5

3 Check Codes	Ignition ON, Engine OFF. Is DTC 000108.04 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,000037B -19-11MAR14-5/5

ECU 000108.10 — Barometric Pressure Signal Abnormal

The barometric pressure sensor signal is abnormal.

OUMX258,000037C -19-11MAR14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
000108.04

When DTC is Displayed:
When the ignition is on and the fault is active.

Related Information:
The barometric pressure sensor signal voltage to the ECU corresponds to a pressure that is significantly different than the exhaust manifold pressure and manifold air pressure. The barometric air pressure sensor is an internal ECU sensor and cannot be repaired. The ECU performs a cross check of the three pressure sensors at Ignition ON, Engine OFF.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For more information on the Control Unit Information and Overview Test, see CTM120419.

OUMX258,000037C -19-11MAR14-2/5

❶ **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Refresh DTCs. Is DTC 000108.10 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,000037C -19-11MAR14-3/5

❷ **Air Vent Check**	1. Ignition OFF, Engine OFF. 2. Inspect the air vent located on the rear of the ECU. Is vent free from debris?	**YES:** See CTM120419. **NO:** Clear debris from air vent. Go to next step.

OUMX258,000037C -19-11MAR14-4/5

❸ **Check Codes**	1. Ignition ON, Engine OFF. 2. Clear DTCs 3. Refresh codes. Is DTC 000108.10 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,000037C -19-11MAR14-5/5

ECU 000110.00 — Engine Coolant Temperature Signal Extremely High

The engine coolant temperature signal is much higher than expected

Preliminary Checks:

- Leaks around hoses and clamps
- Indication of spraying coolant
- Leaks around water pump housing
- Blockage of air flow through radiator
- Overall cooling fan operation
- Fan damage
- Damaged shrouds and shutters
- Low coolant level

Troubleshooting Sequence:
000110.03
000110.00

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The engine coolant temperature sensor signal is much higher than expected at the operating conditions that set the DTC.

Alarm Level:
Stop

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.

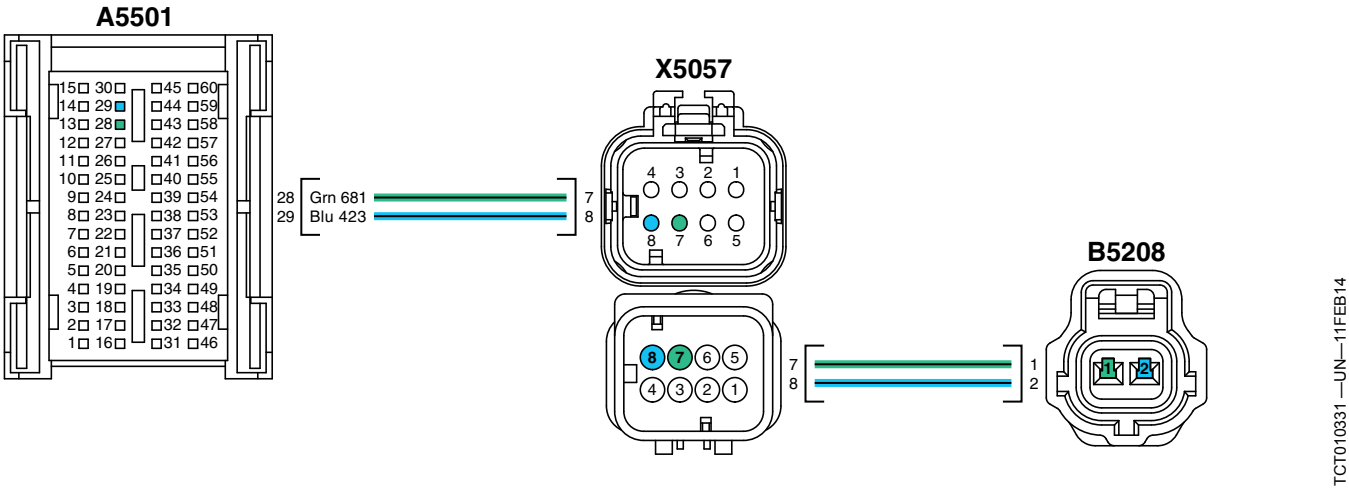
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic

located in Section 230, Group 50.



A5501 — 28—Signal **A5501 — 29—Return**

OUMX258,000037D -19-12JUN14-1/6

Diagnostic Procedure

OUMX258,000037D -19-12JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition OFF, Engine OFF. Are any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

Continued on next page

OUMX258,000037D -19-12JUN14-3/6

❷ Verify Sensor Operation

1. Ignition ON, engine running.
2. Operate engine at fast idle for 15 minutes.
3. Ignition OFF, Engine OFF.
4. Let engine cool for 10 minutes.
5. Ignition ON, Engine OFF.
6. Monitor Engine Coolant Temperature in Service ADVISOR.
7. Measure temperature of thermostat housing with JT07253 infrared temperature gun.
8. Compare the readings.

Data Point	Normal Range
Engine Coolant Temperature	71 — 88 °C 160 — 190 °F

Were the readings within 5 °C (9 °F) of each other?

YES: Perform Verification Procedure.

NO: Go to next step.

OUMX258,000037D -19-12JUN14-4/6

❸ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect engine coolant temperature sensor connector B5208.
3. Perform Terminal Test on sensor and B5208 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000037D -19-12JUN14-5/6

❹ Sensor Check

In Service ADVISOR, monitor Engine Coolant Temperature Input Voltage.

Data Point	Normal Range
Engine Coolant Temperature Input Voltage	3.0 — 3.4 V

Is voltage between 3.0 and 3.4 V?

YES: Replace thermostat.

NO: See CTM120419.

OUMX258,000037D -19-12JUN14-6/6

ECU 000110.03 — Engine Coolant Temperature Signal Out of Range High

The engine coolant temperature signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
000110.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The engine coolant temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the engine coolant temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.

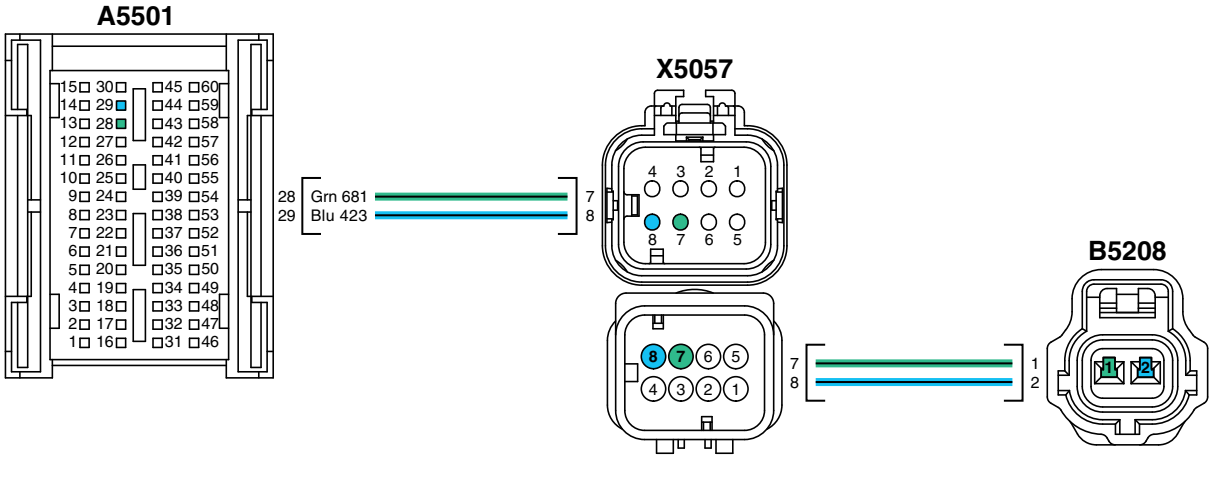
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic

located in Section 230, Group 50.



A5501 — 28—Signal **A5501 — 29—Return**

OUMX258,000037E -19-02JUN14-1/5

Diagnostic Procedure

OUMX258,000037E -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 000110.03 active?	**YES:** Go to next step. **NO:** Go to "Circuit Check" step.

Continued on next page

OUMX258,000037E -19-02JUN14-3/5

❷ Sensor Check

In Service ADVISOR, monitor Engine Coolant Temperature Input Voltage.

Data Point	Normal Range
Engine Coolant Temperature Input Voltage	3.0 — 3.4 V

Is voltage between 3.0 and 3.4 V?

YES: Replace sensor. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000037E -19-02JUN14-4/5

❸ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect engine coolant temperature sensor connector B5208.
3. Perform Terminal Test on sensor and B5208 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000037E -19-02JUN14-5/5

ECU 000110.04 — Engine Coolant Temperature Signal Out of Range Low

The engine coolant temperature signal is lower than the sensor low voltage specification.

Troubleshooting Sequence:
000110.03
000110.04

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The engine coolant temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the engine coolant temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

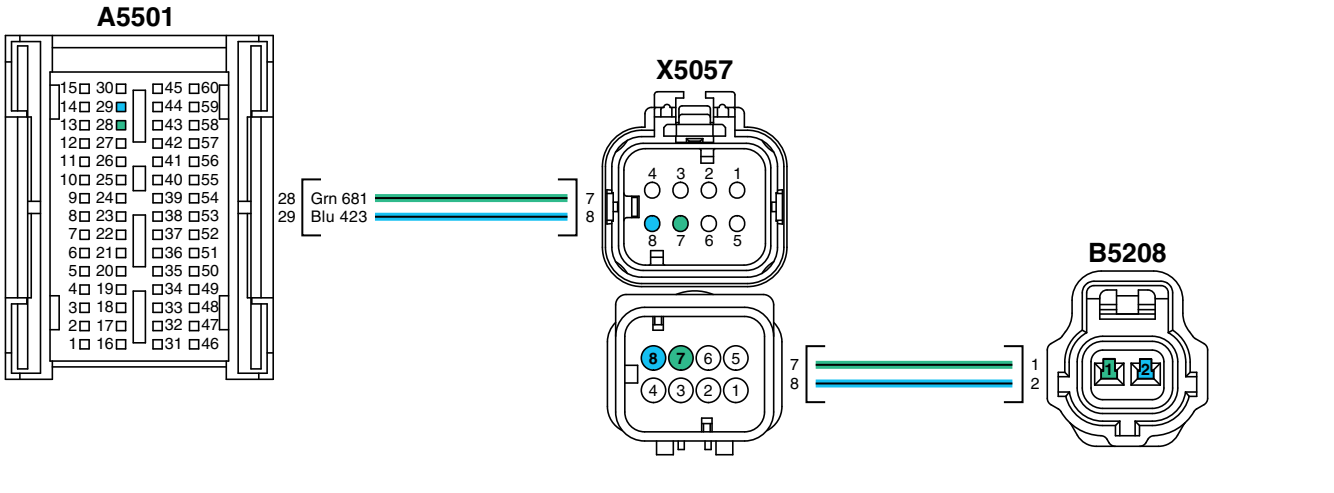
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic

located in Section 230, Group 50.



A5501 — 28—Signal **A5501 — 29—Return**

OUMX258,000037F -19-02JUN14-1/6

Diagnostic Procedure

OUMX258,000037F -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 000110.03 a stored code?	**YES:** See DTC 000110.03. **NO:** Go to next step.

OUMX258,000037F -19-02JUN14-3/6

2 Code Check	Is DTC 000110.04 active?	**YES:** Go to next step. **NO:** Go to "Circuit Check" step.

Continued on next page

OUMX258,000037F -19-02JUN14-4/6

❸ Sensor Check

In Service ADVISOR, monitor Engine Coolant Temperature Input Voltage.

Data Point	Normal Range
Engine Coolant Temperature Input Voltage	3.0 — 3.4 V

Is voltage between 3.0 and 3.4 V?

YES: Replace sensor. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000037F -19-02JUN14-5/6

❹ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect engine coolant temperature sensor connector B5208.
3. Perform Terminal Test on sensor and B5208 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000037F -19-02JUN14-6/6

ECU 000157.00 — Fuel Rail Pressure Signal Extremely High

The fuel rail pressure signal is extremely high.

OUMX258,0000380 -19-11MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522592.12
000633.03
000633.05
000633.06
000157.00

When DTC is Displayed:
When the ignition is on, engine running, and the error is active.

Related Information:
The fuel rail pressure sensor signal voltage to the ECU corresponds to a pressure higher than an ECU defined threshold.

Alarm Level:
STOP

Control Unit Response:
The ECU commands the engine to stop.
The ECU commands the EGR Valve fully closed.

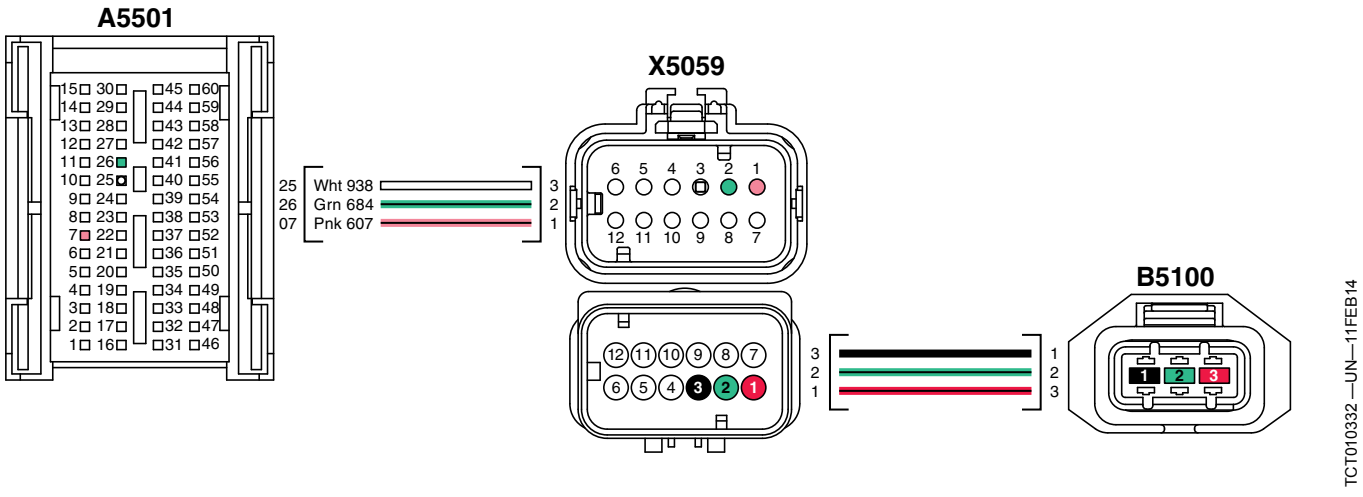
Additional References:
For sensor location, more pressure sensor information, more high-pressure fuel system information, information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 07 —Supply **A5501 — 25 —Return** **A5501 — 26 —Signal**

Continued on next page

OUMX258,0000380 -19-11MAR14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Wait 90 seconds. Refresh DTCs. Is DTC 000157.00 active?	**YES:** See CTM120419, “High-Pressure Fuel System Check”. **NO:** See Problem Not Found Procedure.

OUMX258,0000380 -19-11MAR14-3/3

ECU 000157.03 — Fuel Rail Pressure Signal Out of Range High

The fuel rail pressure signal is higher than the sensor high voltage specification.

OUMX258,0000381 -19-02JUN14-1/6

Diagnostic Procedure

Troubleshooting Sequence:
522592.12
000157.03

When DTC is Displayed:
When the ignition is on, and the error is active.

Related Information:
The fuel rail pressure sensor signal voltage to the ECU corresponds to a pressure higher than what is physically possible for the fuel rail pressure.

Alarm Level:
STOP

Control Unit Response:
The ECU commands the engine to stop.

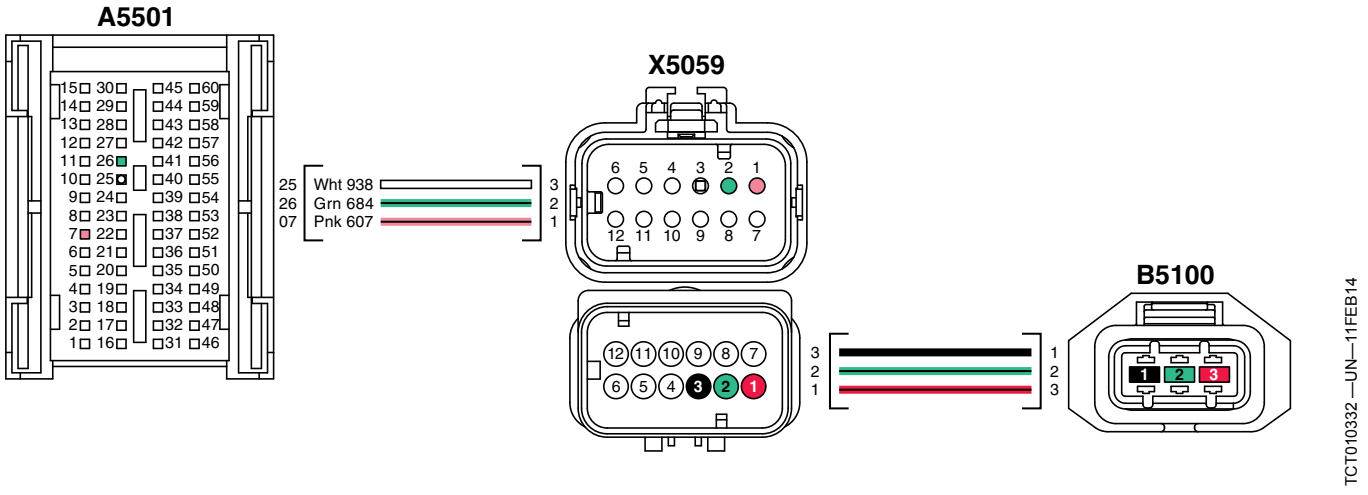
Additional References:
For sensor location, more pressure sensor information, more high-pressure fuel system information, information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 07 —Supply **A5501 — 25 —Return** **A5501 — 26 —Signal**

Continued on next page

OUMX258,0000381 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 522592.12 active or stored?	**YES:** See DTC 522592.12. **NO:** Go to next step.

OUMX258,0000381 -19-02JUN14-3/6

2 Code Check	Is DTC 000157.03 active?	**YES:** Go to next step. **NO:** Go to “Sensor Check” step.

OUMX258,0000381 -19-02JUN14-4/6

3 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect fuel rail pressure sensor connector B5100. 3. Perform Terminal Test on sensor and B5100 connector. Were any problems found?	**YES:** Repair problem. Check codes. **NO:** Go to next step.

OUMX258,0000381 -19-02JUN14-5/6

4 Sensor Check	In Service ADVISOR, monitor Fuel Rail Pressure Input Voltage. **Data Point** / **Normal Range**: Fuel Rail Pressure Input Voltage / 1.6 — 2.0 V Is voltage between 1.6 and 2.0 V?	**YES:** Replace sensor. Check codes. **NO:** See CTM120419.

OUMX258,0000381 -19-02JUN14-6/6

ECU 000157.04 — Fuel Rail Pressure Signal Out of Range Low

The fuel rail pressure signal is lower than the sensor low voltage specification.

OUMX258,0000382 -19-02JUN14-1/6

Diagnostic Procedure

Troubleshooting Sequence:
522592.12
000157.03
000157.04

When DTC is Displayed:
When the ignition is on, and the error is active.

Related Information:
The fuel rail pressure sensor signal voltage to the ECU corresponds to a pressure lower than what is physically possible for the fuel rail pressure.

Alarm Level:
STOP

Control Unit Response:
The ECU commands the engine to stop.

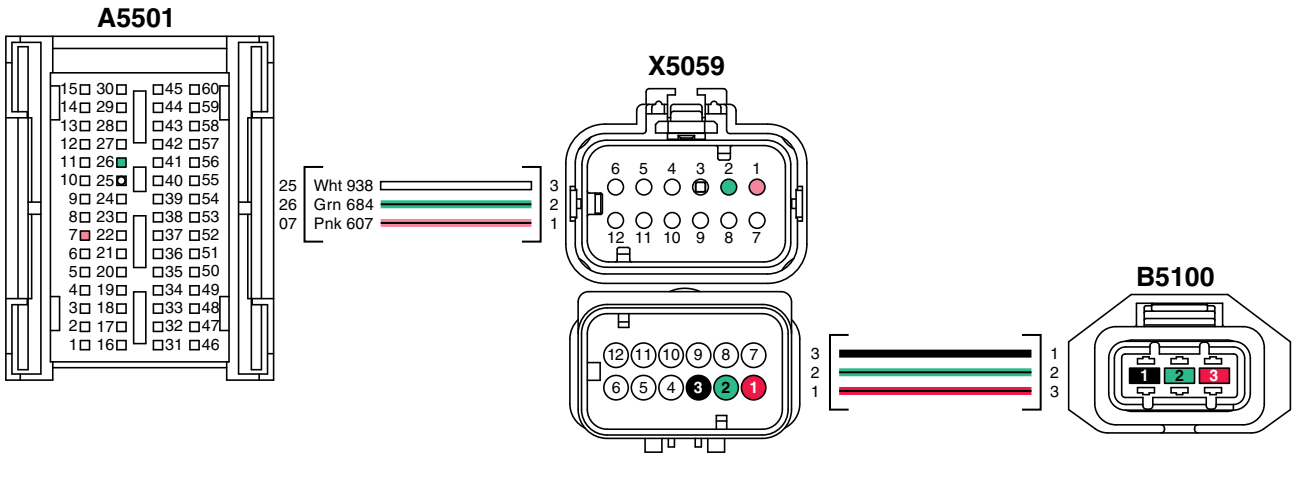
Additional References:
For sensor location, more pressure sensor information, more high-pressure fuel system information, information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 07 —Supply **A5501 — 25 —Return** **A5501 — 26 —Signal**

Continued on next page

OUMX258,0000382 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 000157.03 stored?	**YES:** See DTC 000157.03. **NO:** Go to next step.

OUMX258,0000382 -19-02JUN14-3/6

2 Code Check	Is DTC 000157.04 active?	**YES:** Go to next step. **NO:** Go to “Circuit Check” step.

OUMX258,0000382 -19-02JUN14-4/6

3 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect fuel rail pressure sensor connector B5100. 3. Perform Terminal Test on sensor and B5100 connector. Were any problems found?	**YES:** Repair problem. Check codes. **NO:** Go to next step.

OUMX258,0000382 -19-02JUN14-5/6

4 Sensor Check	In Service ADVISOR, monitor Fuel Rail Pressure Input Voltage. **Data Point** / **Normal Range**: Fuel Rail Pressure Input Voltage / 1.6 — 2.0 V Is voltage between 1.6 and 2.0 V?	**YES:** Replace sensor. Check codes. **NO:** See CTM120419.

OUMX258,0000382 -19-02JUN14-6/6

ECU 000157.15 — Fuel Rail Pressure Signal Slightly High

The fuel rail pressure signal is slightly higher than desired.

OUMX258,0000383 -19-25MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522592.12
000633.03
000633.05
000633.06
000157.15

When DTC is Displayed:
When the ignition is on, engine running, and the error is active.

Related Information:
The fuel rail pressure sensor signal voltage to the ECU corresponds to a pressure slightly higher than an ECU defined threshold.

Alarm Level:
STOP

Control Unit Response:
The ECU commands the engine to stop.
The ECU commands the EGR Valve fully closed.

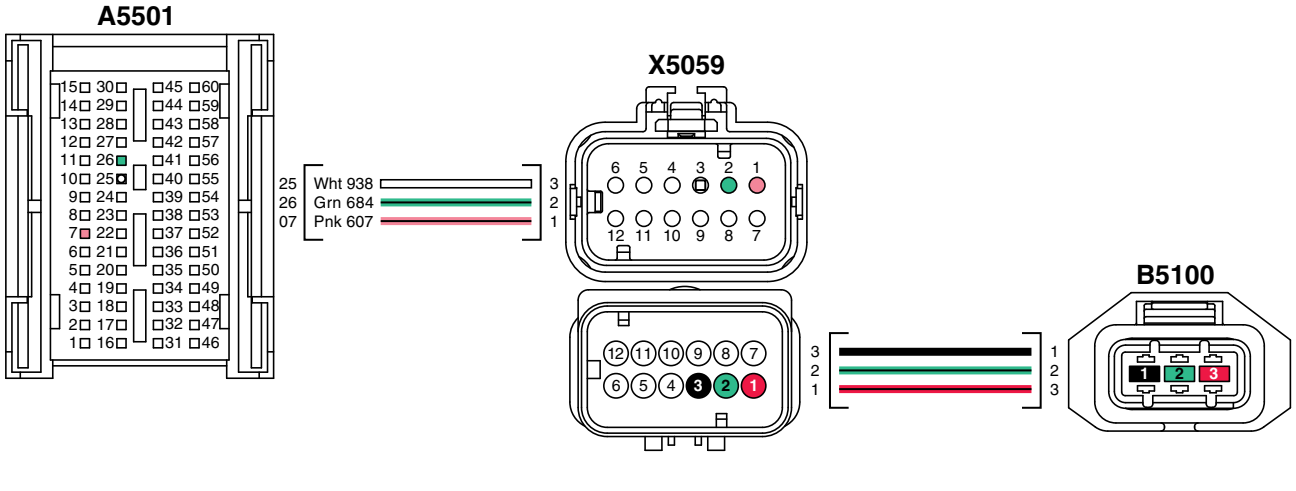
Additional References:
For sensor location, more pressure sensor information, more high-pressure fuel system information, information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 07 —Supply **A5501 — 25 —Return** **A5501 — 26 —Signal**

Continued on next page

OUMX258,0000383 -19-25MAR14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Wait 90 seconds. Refresh DTCs Is DTC 000157.15 active?	**YES:** See DTC 000157.00 for troubleshooting procedure. **NO:** See Problem Not Found Procedure

OUMX258,0000383 -19-25MAR14-3/3

ECU 000157.16 — Fuel Rail Pressure Limiter Open

The fuel rail pressure signal is moderately lower than desired.

Troubleshooting Sequence:
522592.12
000633.03
000633.05
000633.06
000157.00
000157.03
000157.04
000157.15
000157.18
523469.00
000157.16

When DTC is Displayed:
When the ignition is on, engine running, and the error is active.

Related Information:
The fuel rail pressure sensor signal voltage to the ECU corresponds to a pressure lower than an ECU defined threshold.

Alarm Level:
STOP

Control Unit Response:
The ECU commands the engine to stop.

Additional References:
For sensor location, more pressure sensor information, more high-pressure fuel system information, information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

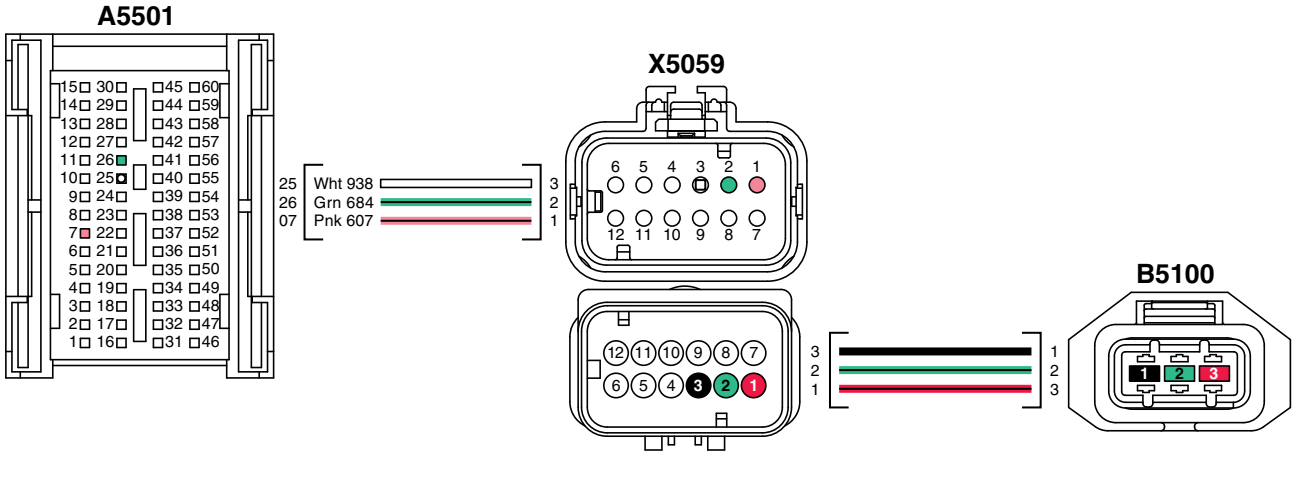
- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.

OUMX258,0000384 -19-25MAR14-1/3

Diagnostic Procedure



A5501 — 07 —Supply **A5501 — 25 —Return** **A5501 — 26 —Signal**

OUMX258,0000384 -19-25MAR14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh DTCs Is DTC 523469.00 active or stored?	**YES:** Refer to CTM120419. Replace Fuel Rail Pressure Limiter. **NO:** See CTM124019, “High-Pressure Fuel System Check”.

OUMX258,0000384 -19-25MAR14-3/3

ECU 000157.18 — Fuel Rail Pressure Signal Moderately Low

The fuel rail pressure signal is moderately lower than desired.

OUMX258,0000385 -19-25MAR14-1/4

Diagnostic Procedure

Troubleshooting Sequence:
522592.12
000633.03
000633.05
000633.06
000157.18

When DTC is Displayed:
When the ignition is on, engine running, and the error is active.

Related Information:
The fuel rail pressure sensor signal voltage to the ECU corresponds to a pressure lower than an ECU defined threshold.

Alarm Level:
STOP

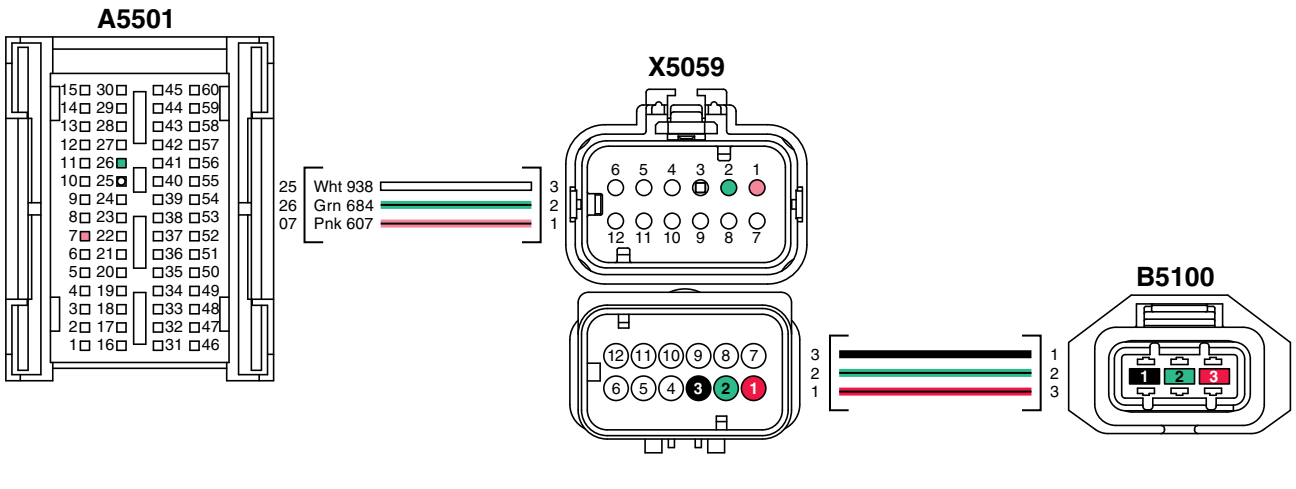
Control Unit Response:
The ECU commands the engine to stop.
The ECU commands the EGR Valve fully closed.

Additional References:
For sensor location, more pressure sensor information, more high-pressure fuel system information, information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

located in Section 230, Group 50.



A5501 — 07 —Supply **A5501 — 25 —Return** **A5501 — 26 —Signal**

Continued on next page

OUMX258,0000385 -19-25MAR14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Wait 90 seconds. Refresh DTCs Is DTC 000157.18 active?	**YES:** Go to next step. **NO:** See CTM120419, “Problem Not Found Procedure”.

OUMX258,0000385 -19-25MAR14-3/4

2 Low-Pressure Fuel Supply System Check	Check for fuel pump DTC codes in ECU. Are codes present?	**YES:** Go to CTM120419, DTC diagnostics section. **NO:** Check fuel pump pressure.

OUMX258,0000385 -19-25MAR14-4/4

ECU 000167.01 — Charging System Voltage Extremely Low

The charging system voltage is extremely low.

Related Troubleshooting Codes

000158.01

Code Caused By:

Battery voltage (VBAT), critical low voltage (below normal operating range).

Alarm Level:

Stop

SAE Lamp:

Red

When DTC is Displayed:
When the ignition is on, engine running, and the error is active.

Additional References:
For electrical voltage tests - see Electrical Tests and Adjustments Section 230, Group 40.
For alternator tests - see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

located in Section 230, Group 50.

OUMX258,0000386 -19-25MAR14-1/4

Diagnostic Procedure

OUMX258,0000386 -19-25MAR14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 000167.01 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure

OUMX258,0000386 -19-25MAR14-3/4

2 Alternator	Test alternator output and system voltage. See Regulated Voltage Output Test. Is voltage okay?	**YES:** Perform Verification Procedure **NO:** Repair or replace alternator. See alternator repair in Section 30, Group 30.

OUMX258,0000386 -19-25MAR14-4/4

ECU 000167.05 — Charging System Circuit Out of Range Low

The charging system has high resistance.

Code Caused By:

Battery voltage (VBAT), critical low voltage (below normal operating range).

Alarm Level:

Stop

SAE Lamp:

Red

When DTC is Displayed:
When the ignition is on, engine running, and the error is active.

Additional References:
For electrical voltage tests - see Electrical Tests and Adjustments Section 230, Group 40.
For alternator tests - see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

located in Section 230, Group 50.

OUMX258,0000387 -19-25MAR14-1/4

Diagnostic Procedure

OUMX258,0000387 -19-25MAR14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 000167.05 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure

OUMX258,0000387 -19-25MAR14-3/4

2 Alternator	Test alternator output and system voltage. See Regulated Voltage Output Test. Is voltage okay?	**YES:** Perform Verification Procedure **NO:** Repair or replace alternator. See alternator repair in Section 30, Group 30.

OUMX258,0000387 -19-25MAR14-4/4

ECU 000173.03 — Exhaust Manifold Temperature Signal Out Of Range High

The exhaust manifold temperature signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
000173.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The exhaust manifold temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the exhaust manifold temperature sensor.

Alarm Level:

Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

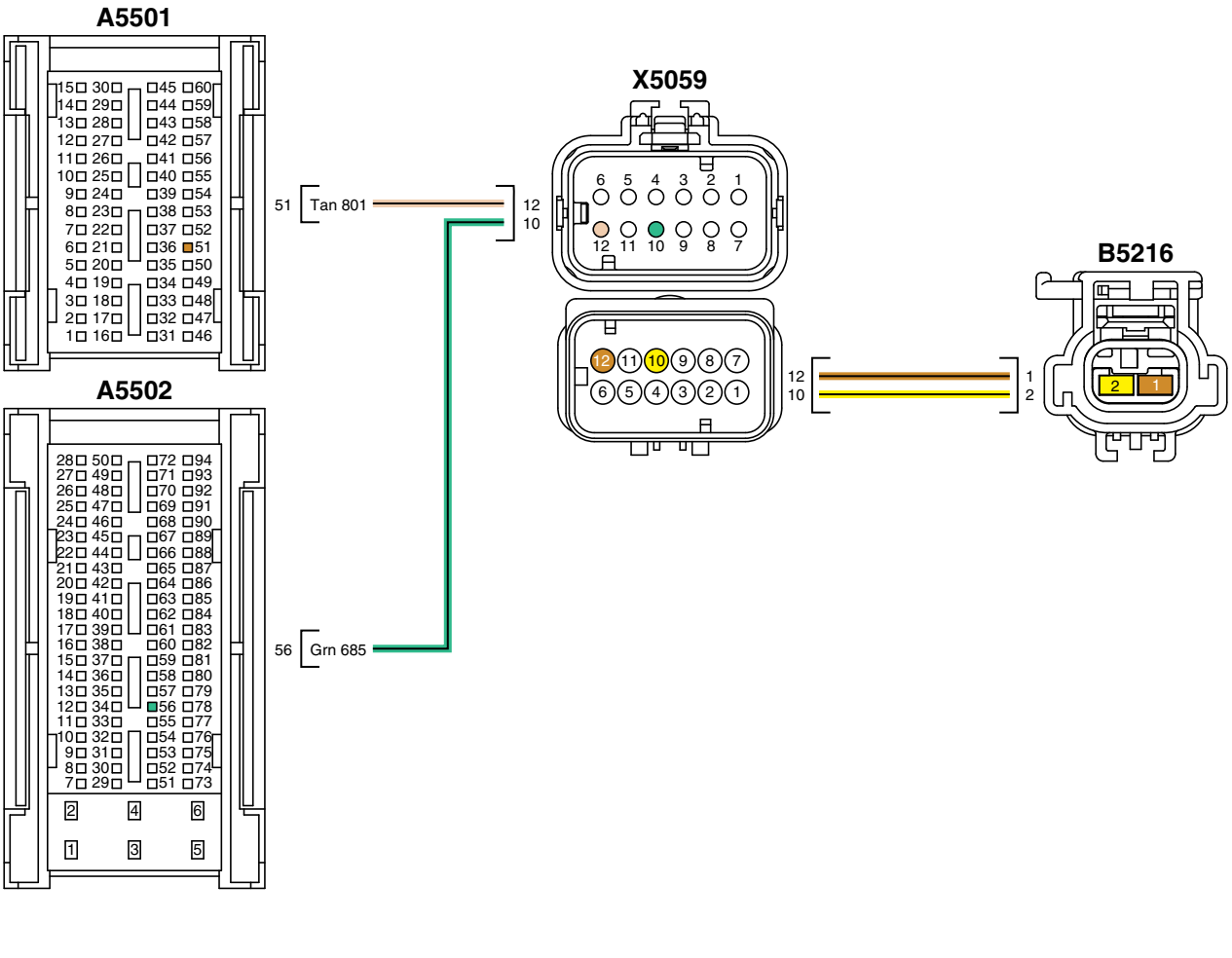
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



TCT010333 —UN—13FEB14

A5502 — 56 —Signal **A5501 — 51 —Return**

OUMX258,0000388 -19-02JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,0000388 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 000173.03 active?	**YES:** Go to next step. **NO:** Go to "Circuit Check" step.

OUMX258,0000388 -19-02JUN14-3/6

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect exhaust manifold temperature sensor connector B5216. 3. Perform Terminal Test on sensor and B5216 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000388 -19-02JUN14-4/6

3 Sensor Check	1. In Service ADVISOR, monitor Exhaust Manifold Temperature Input Voltage. 2. Perform Wiggle Test. Does sensor input voltage ever read greater than 4.9 V?	**YES:** Repair harness problem. Perform Verification Procedure. **NO:** Go to next step.

Data Point	Normal Range
Exhaust Manifold Temperature Input Voltage	1.8 — 2.4 V

OUMX258,0000388 -19-02JUN14-5/6

4 Sensor Check	Is voltage between 1.8 and 2.2 V?	**YES:** Replace sensor. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,0000388 -19-02JUN14-6/6

ECU 000173.04 — Exhaust Manifold Temperature Signal Out Of Range Low

The exhaust manifold temperature signal is lower than the sensor low voltage specification.

Troubleshooting Sequence:
000173.03
000173.04

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The exhaust manifold temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the exhaust manifold temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

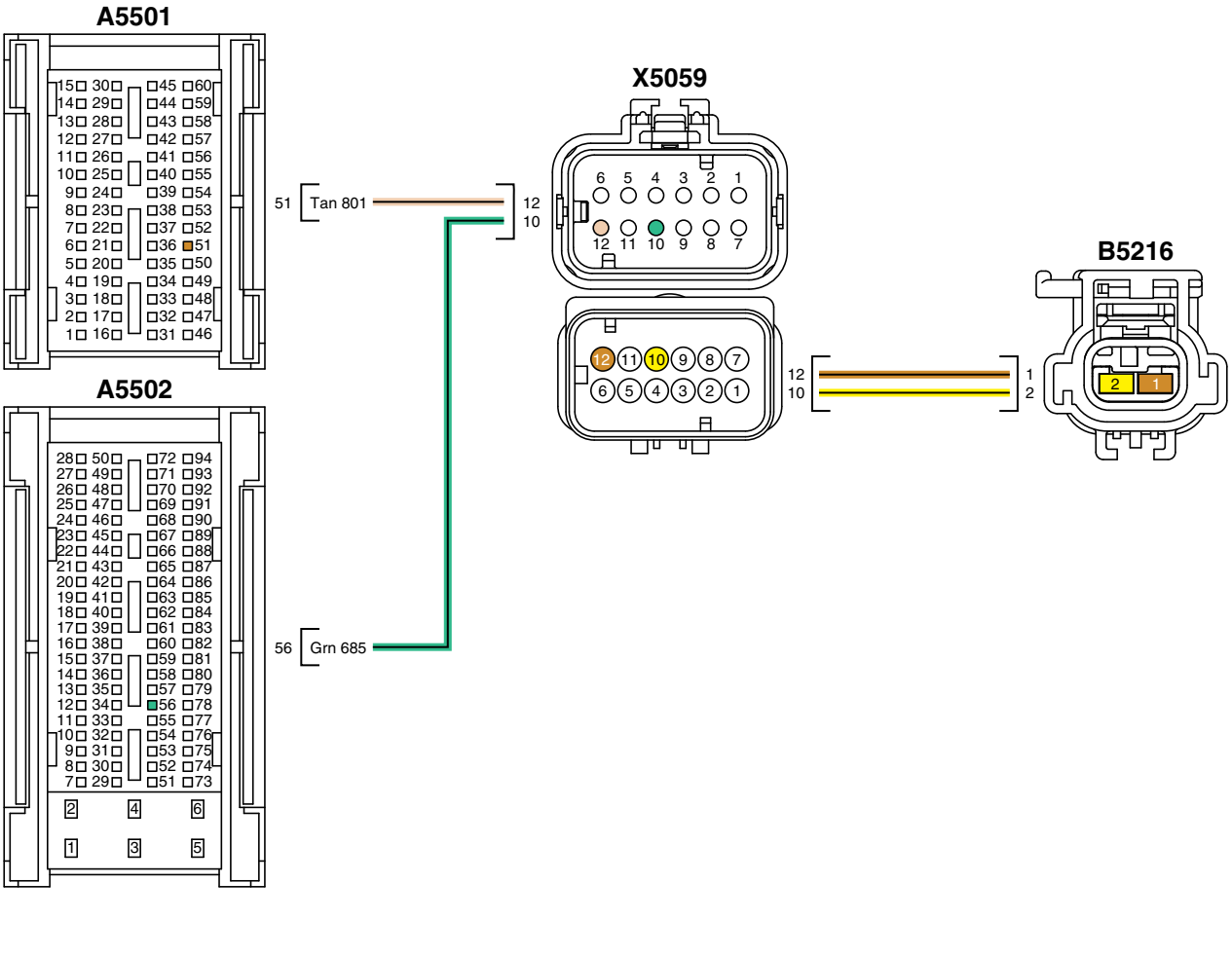
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5502 — 56 —Signal **A5501 — 51 —Return**

OUMX258,0000389 -19-02JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,0000389 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 000173.03 a stored code?

YES: See DTC 000173.03 procedure.

NO: Go to next step.

OUMX258,0000389 -19-02JUN14-3/6

2 Code Check

1. Ignition ON, Engine OFF

2. Refresh codes.

Is DTC 000173.04 active?

YES: Go to next step.

NO: Go to “Circuit Check” step.

OUMX258,0000389 -19-02JUN14-4/6

3 Sensor Check

1. Ignition ON, Engine OFF.

2. In Service ADVISOR, monitor Exhaust Manifold Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
Exhaust Manifold Temperature Input Voltage	1.8 — 2.4 V

Does voltage ever go below 0.2 V?

YES: Repair short to ground on signal wire. Perform Verification Procedure.

NO: Go to next step.

OUMX258,0000389 -19-02JUN14-5/6

4 Circuit Check

Is voltage between 1.8 and 2.2 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,0000389 -19-02JUN14-6/6

ECU 000174.00 — Fuel Temperature Signal Extremely High

The ECU has detected that the fuel temperature signal is much higher than specification.

OUMX258,000038A -19-12JUN14-1/5

Diagnostic Procedure

Trouble Shooting Sequence:
000110.00
000174.00

When DTC is Displayed:
When the engine has been running for a minimum length of time and the fuel temperature is greater than a predetermined threshold for a minimum length of time.

Related Information:

The ECU has detected that the fuel temperature signal is much higher than specification.

Alarm Level:
Warning

Control Unit Response:
The ECU attempts to operate engine as normal.

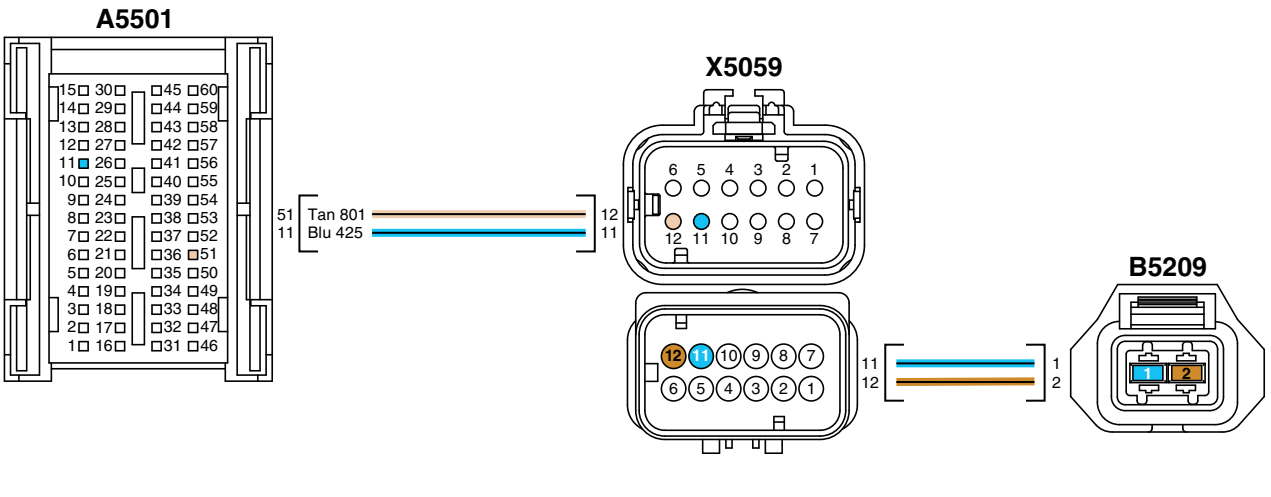
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 11 —Signal **A5501 — 51 —Return**

Continued on next page

OUMX258,000038A -19-12JUN14-2/5

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.
2. Allow engine to sit for 5 minutes.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

3. Ignition ON, Engine OFF.
4. Visually inspect fuel cooler (if equipped) for plugging, debris, or damage.
5. Visually inspect for low fuel level in the fuel tank.

Were any problems found?

YES: Repair Problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000038A -19-12JUN14-3/5

2 Sensor Check

1. Ignition ON, engine running.
2. In Service ADVISOR, monitor Fuel Temperature until temperature stabilizes.
3. Measure temperature of the fuel near the fuel temperature sensor with JT07253 infrared temperature gun.
4. Compare the readings.

Data Point	Normal Range
Fuel Temperature	-18— 49 °C 0 — 120 °F

Are the readings within 5 °C (9 °F) of each other?

YES: See CTM120419.

NO: Go to next step.

OUMX258,000038A -19-12JUN14-4/5

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect fuel temperature sensor connector B5209.
3. Perform Terminal Test on sensor and B5209 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000038A -19-12JUN14-5/5

ECU 000174.03 — Fuel Temperature Signal Out Of Range High

The fuel temperature signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
000174.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The fuel temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the fuel temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.

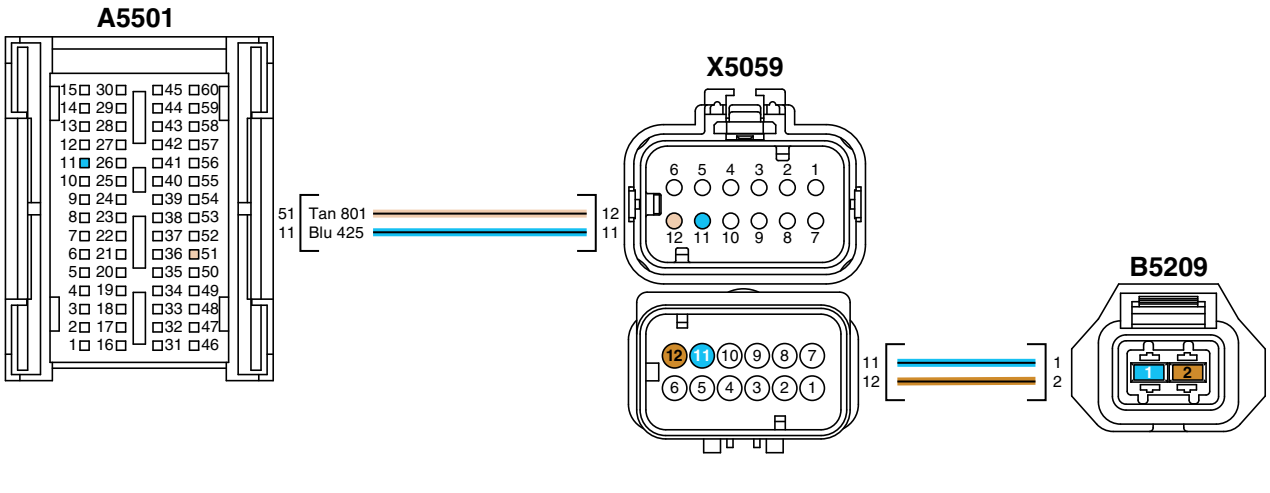
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 11 —Signal **A5501 — 51 —Return**

OUMX258,000038B -19-02JUN14-1/6

Diagnostic Procedure

OUMX258,000038B -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 000174.03 active?	**YES:** Go to next step. **NO:** Go to "Sensor Check" step.

Continued on next page

OUMX258,000038B -19-02JUN14-3/6

❷ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect fuel temperature sensor connector B5209.
3. Perform Terminal Test on sensor and B5209 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000038B -19-02JUN14-4/6

❸ Sensor Check

1. In Service ADVISOR, monitor Fuel Temperature Input Voltage.
2. Perform Wiggle Test.

Data Point	Normal Range
Fuel Temperature Input Voltage	2.0 — 2.4 V

Does sensor input voltage ever read greater than 4.9 V?

YES: Repair harness problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000038B -19-02JUN14-5/6

❹ Circuit Check

Is voltage between 2.0 and 2.4 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000038B -19-02JUN14-6/6

ECU 000174.04 — Fuel Temperature Signal Out Of Range Low

The fuel temperature signal is lower than the sensor low voltage specification.

OUMX258,000038C -19-11MAR14-1/7

Diagnostic Procedure

Troubleshooting Sequence:
000174.03
000174.04

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The fuel temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the fuel temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.

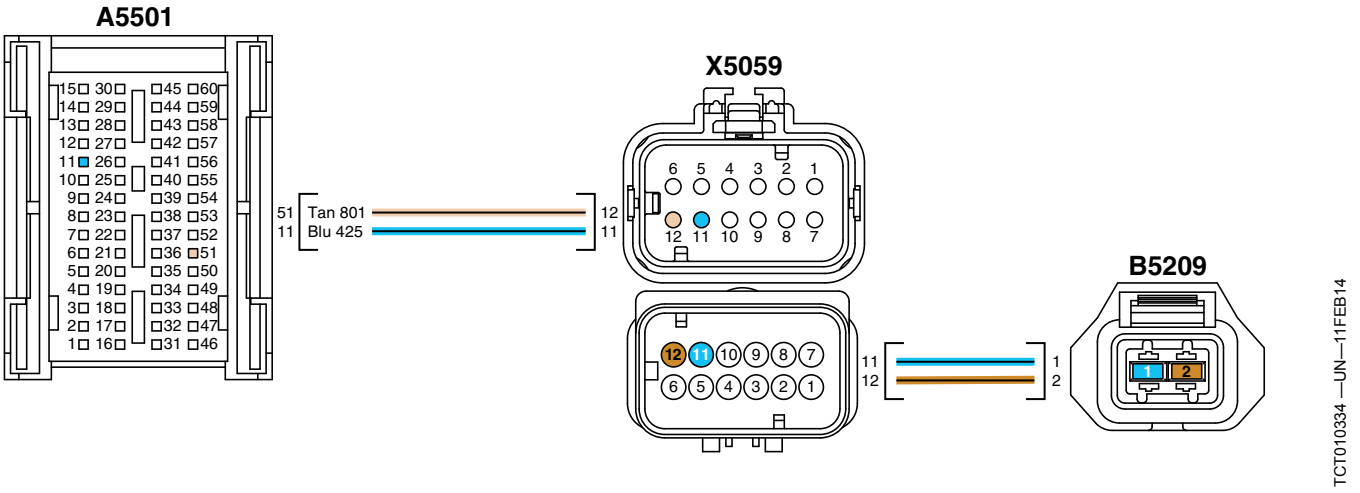
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 11 —Signal **A5501 — 51 —Return**

Continued on next page

OUMX258,000038C -19-11MAR14-2/7

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 000174.03 a stored code?

YES: See DTC 000174.03 procedure.

NO: Go to next step.

OUMX258,000038C -19-11MAR14-3/7

2 Code Check

1. Ignition ON, Engine OFF
2. Refresh codes.

Is DTC 000174.04 active?

YES: Go to next step.

NO: Go to “Check Circuit” step.

OUMX258,000038C -19-11MAR14-4/7

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect fuel temperature sensor connector B5209.
3. Perform Terminal Test on sensor and B5209 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure

NO: Go to next step.

OUMX258,000038C -19-11MAR14-5/7

4 Sensor Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor Fuel Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Live Reading	Normal Range
Fuel Temperature Input Voltage		2.0 — 2.4 V

Does voltage ever go below 0.2 V?

YES: Repair short to ground on signal wire. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000038C -19-11MAR14-6/7

5 Circuit Check

Is voltage between 2.0 and 2.4 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000038C -19-11MAR14-7/7

ECU 000190.00 — Engine Speed Extremely High

The ECU detects that the engine speed exceeds the maximum RPM.

OUMX258,000038D -19-19JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522400.02
522400.05
522401.02
522401.05
522401.07
000190.00

When DTC is Displayed:
When the ignition is on and the engine is running.

Related Information:
The ECU detects that the engine speed exceeds the maximum RPM.

Alarm Level:
Stop

Control Unit Response:
The ECU stops fuel flow to the high-pressure common-rail (HPCR), by turning off the suction control valve on the high-pressure fuel pump.

Additional references:
For more high-pressure fuel system information, speed sensors, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.

OUMX258,000038D -19-19JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Obtain information about operating conditions from the operator that observed this code being set. 5. Inspect for possible conditions that may possibly cause this code: • Unintended fuel in intake. • Machine driving the engine to an excessive speed. Example: Going down a hill and using the engine as a brake. Have any of these conditions occurred?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See Problem Not Found Procedure.

OUMX258,000038D -19-19JUN14-3/3

ECU 000412.03 — EGR Temperature Signal Out of Range High

The EGR temperature signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
000412.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The EGR temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the EGR temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional references:

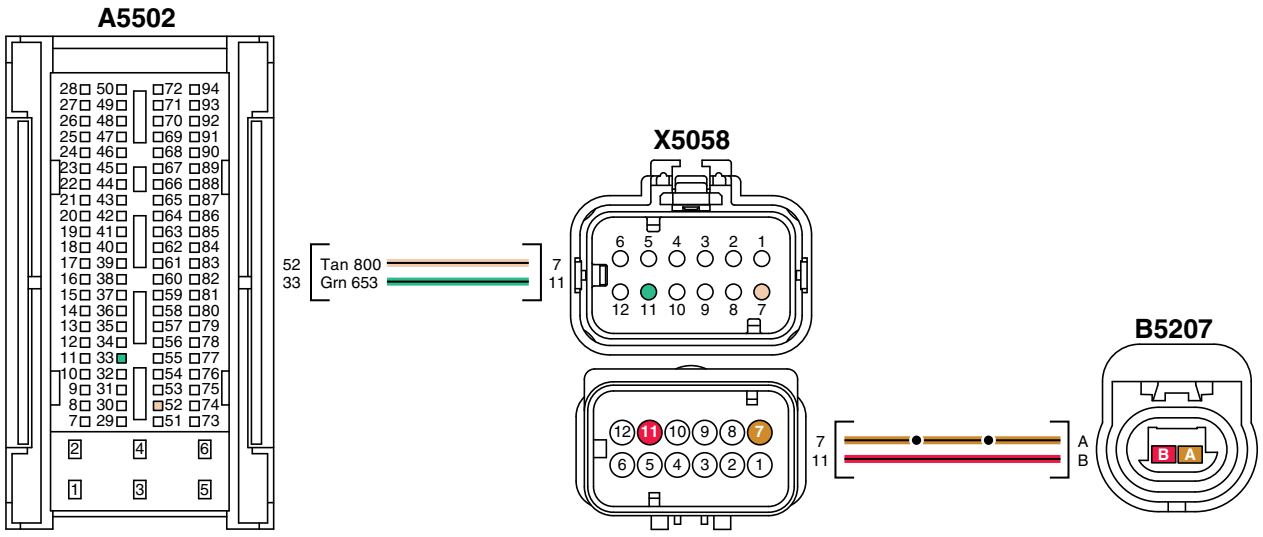
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 33—Signal **A5502 — 52—Return**

OUMX258,00001E1 -19-02JUN14-1/5

Diagnostic Procedure

OUMX258,00001E1 -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Is DTC 000412.03 active?	**YES:** Go to next step. **NO:** Go to "Circuit Check" step.

Continued on next page

OUMX258,00001E1 -19-02JUN14-3/5

❷ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect EGR temperature sensor connector B5207.
3. Perform Terminal Test on sensor and B5207 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,00001E1 -19-02JUN14-4/5

❸ Sensor Check

In Service ADVISOR, monitor EGR Temperature Input Voltage.

Data Point	Normal Range
EGR Temperature Input Voltage	2.0 — 3.2 V

Is voltage between 2.4 and 2.8 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,00001E1 -19-02JUN14-5/5

ECU 000412.04 — EGR Temperature Signal Out Of Range Low

The EGR temperature signal is lower than the sensor low voltage specification.

OUMX258,00001E2 -19-02JUN14-1/7

Diagnostic Procedure

Troubleshooting Sequence:
000412.03
000412.04

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The EGR temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the EGR temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

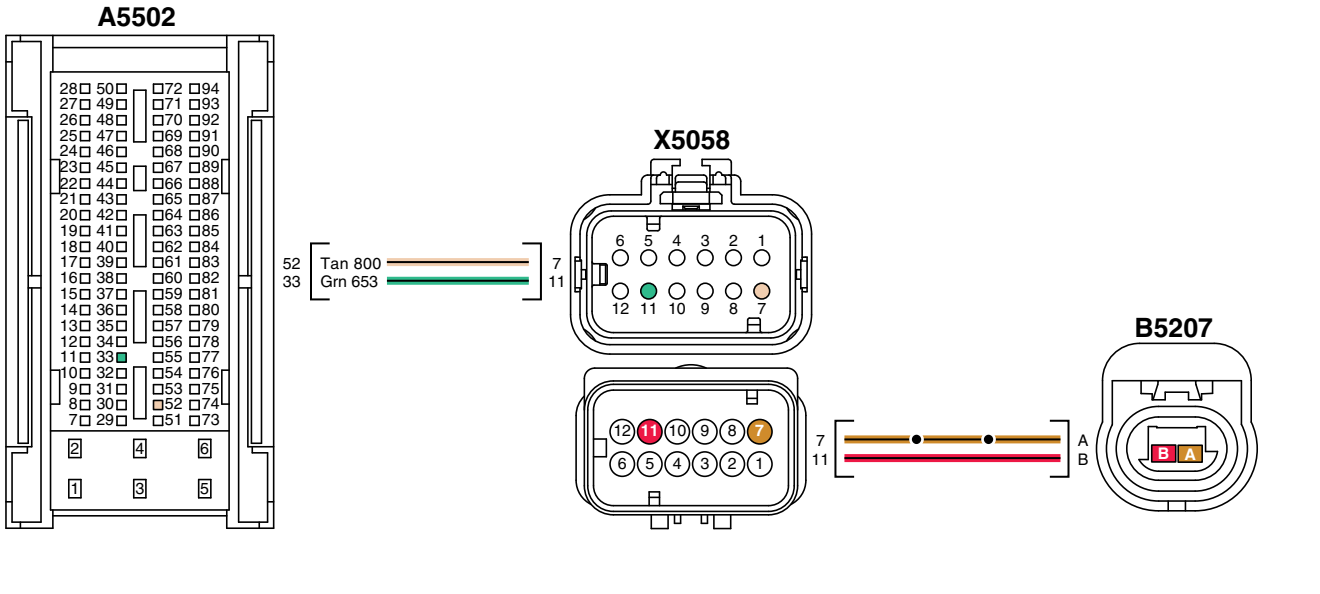
Additional references:
For sensor location, more temperature sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 33—Signal **A5502 — 52—Return**

Continued on next page

OUMX258,00001E2 -19-02JUN14-2/7

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 000412.03 a stored code?	**YES:** See DTC 000412.03 procedure. **NO:** Go to next step.

OUMX258,00001E2 -19-02JUN14-3/7

2 Code Check	1. Ignition ON, Engine OFF 2. Refresh codes. Is DTC 000412.04 active?	**YES:** Go to next step. **NO:** Go to “Circuit Check” step.

OUMX258,00001E2 -19-02JUN14-4/7

3 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect EGR temperature sensor connector B5207. 3. Perform Terminal Test on sensor and B5207 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E2 -19-02JUN14-5/7

4 Circuit Check	1. Ignition ON, Engine OFF. 2. In Service ADVISOR, monitor EGR Temperature Input Voltage. 3. Perform Wiggle Test. Does voltage ever go below 0.2 V?	**YES:** Repair short to ground on signal wire. Perform Verification Procedure. **NO:** Go to next step.

Data Point	Normal Range
EGR Temperature Input Voltage	2.0 — 4.75 V

OUMX258,00001E2 -19-02JUN14-6/7

5 Circuit Check	In Service ADVISOR, monitor EGR Temperature Input Voltage. Is voltage between 2.4 and 2.8 V?	**YES:** Replace sensor. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00001E2 -19-02JUN14-7/7

ECU 000630.12 — ECU EEPROM Error

The ECU detects an internal error.

OUMX258,00001E3 -19-02JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
000630.12

When DTC is Displayed:
The ECU detects an internal error.

Related Information:
This DTC will be present if the ECU has not been programmed or may be present if there is an internal error.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.

OUMX258,00001E3 -19-02JUN14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Refresh codes. Is DTC 000630.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00001E3 -19-02JUN14-3/3

ECU 000633.03 — Suction Control Valve Circuit Out of Range High

The ECU has detected the suction control valve drive voltage is greater than the specified value.

OUMX258,00001E4 -19-02JUN14-1/11

Diagnostic Procedure

Troubleshooting Sequence:
000633.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected the voltage to the suction control valve is greater than expected.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

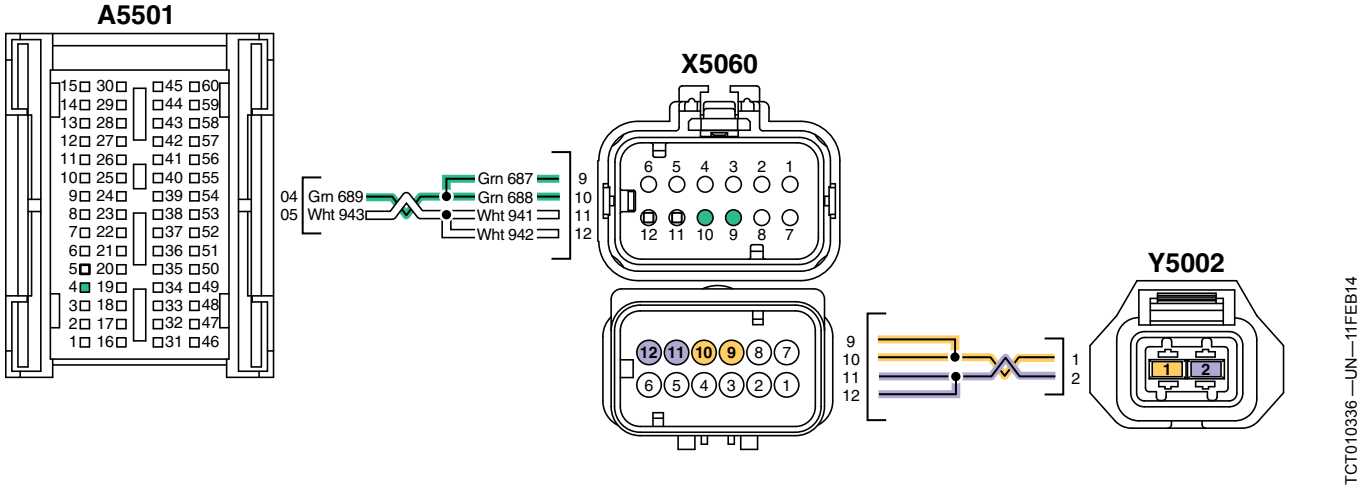
Additional references:
For component location, more suction control information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

Continued on next page

OUMX258,00001E4 -19-02JUN14-2/11

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 000633.03 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,00001E4 -19-02JUN14-3/11

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E4 -19-02JUN14-4/11

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E4 -19-02JUN14-5/11

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,00001E4 -19-02JUN14-6/11

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 Ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,00001E4 -19-02JUN14-7/11

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E4 -19-02JUN14-8/11

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E4 -19-02JUN14-9/11

8 Terminal Check	1. Disconnect ECU connector A5502. 2. Measure the resistance between A5501 connector female socket 4 and all sockets in A5502 connector. 3. Measure the resistance between A5501 connector female socket 5 and all sockets in A5502 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E4 -19-02JUN14-10/11

9 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 000633.03 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure

OUMX258,00001E4 -19-02JUN14-11/11

ECU 000633.05 — Suction Control Valve Circuit Has High Resistance

The ECU has detected high resistance on the suction control valve drive circuit.

OUMX258,00001E5 -19-02JUN14-1/10

Diagnostic Procedure

Troubleshooting Sequence:
000633.05

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected that the current to the suction control valve is lower than expected, indicating high resistance in the drive circuit.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

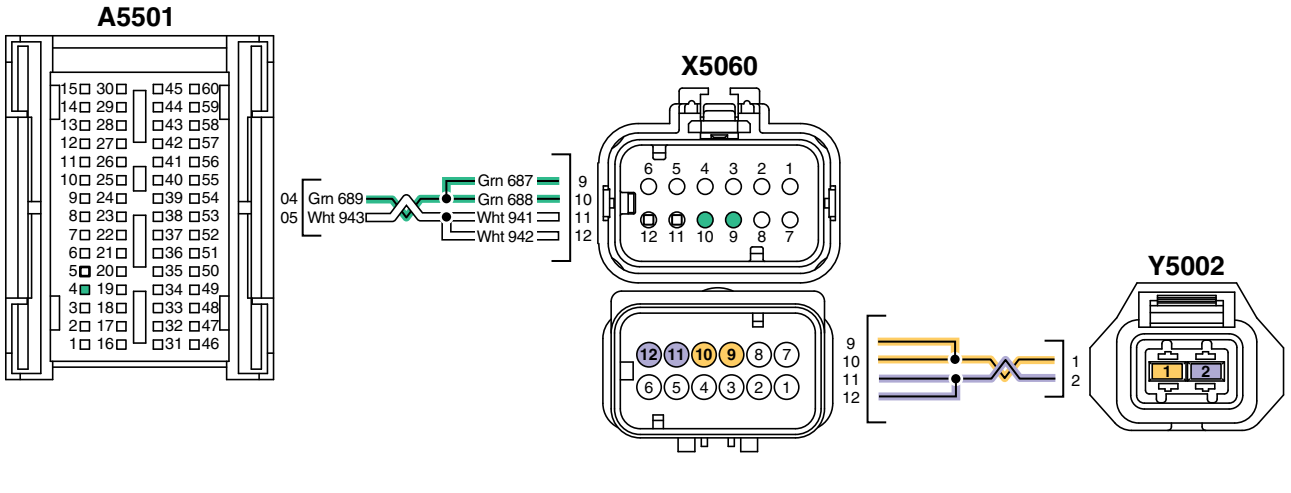
Additional references:
For component location, more suction control information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

Continued on next page

OUMX258,00001E5 -19-02JUN14-2/10

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, Engine OFF. 4. Refresh codes. Is DTC 000633.05 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,00001E5 -19-02JUN14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E5 -19-02JUN14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E5 -19-02JUN14-5/10

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,00001E5 -19-02JUN14-6/10

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 Ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,00001E5 -19-02JUN14-7/10

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E5 -19-02JUN14-8/10

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E5 -19-02JUN14-9/10

8 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 000633.05 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure

OUMX258,00001E5 -19-02JUN14-10/10

ECU 000633.06 — Suction Control Valve Circuit Has Low Resistance

The ECU has detected low resistance on the suction control valve drive circuit.

OUMX258,00001E6 -19-25MAR14-1/11

Diagnostic Procedure

Troubleshooting Sequence:
000633.06

When DTC is Displayed:
When the ignition is ON, and the fault is active.

Related Information:
The ECU has detected that the current to the suction control valve is higher than expected, indicating low resistance in the drive circuit.

Alarm Level:
Stop

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.

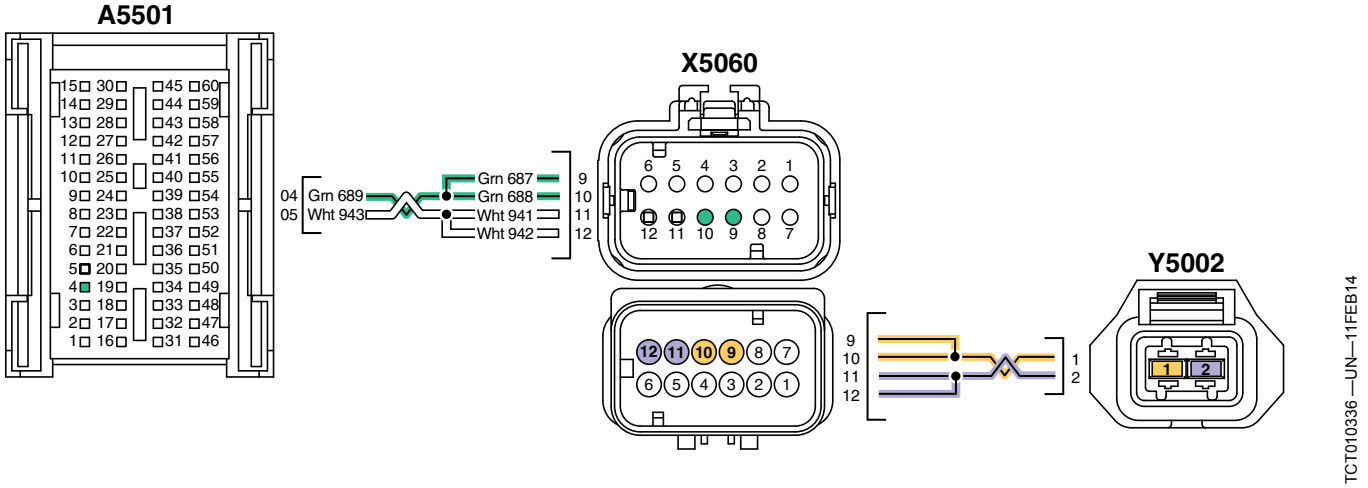
Additional references:
For component location, more suction control information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

Continued on next page

OUMX258,00001E6 -19-25MAR14-2/11

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 000633.03 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,00001E6 -19-25MAR14-3/11

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E6 -19-25MAR14-4/11

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001E6 -19-25MAR14-5/11

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,00001E6 -19-25MAR14-6/11

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 Ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,00001E6 -19-25MAR14-7/11

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E6 -19-25MAR14-8/11

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E6 -19-25MAR14-9/11

8 Terminal Check	1. Disconnect ECU connector A5502. 2. Measure the resistance between A5501 connector female socket 4 and all sockets in A5502 connector. 3. Measure the resistance between A5501 connector female socket 5 and all sockets in A5502 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,00001E6 -19-25MAR14-10/11

9 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 000633.03 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure

OUMX258,00001E6 -19-25MAR14-11/11

ECU 000652.03 — Injector #3 Circuit Out of Range High

The ECU detected high voltage on the injector #3 circuit.

Troubleshooting Sequence:
002798.06
000652.03

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected high voltage on the injector #3 circuit. The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

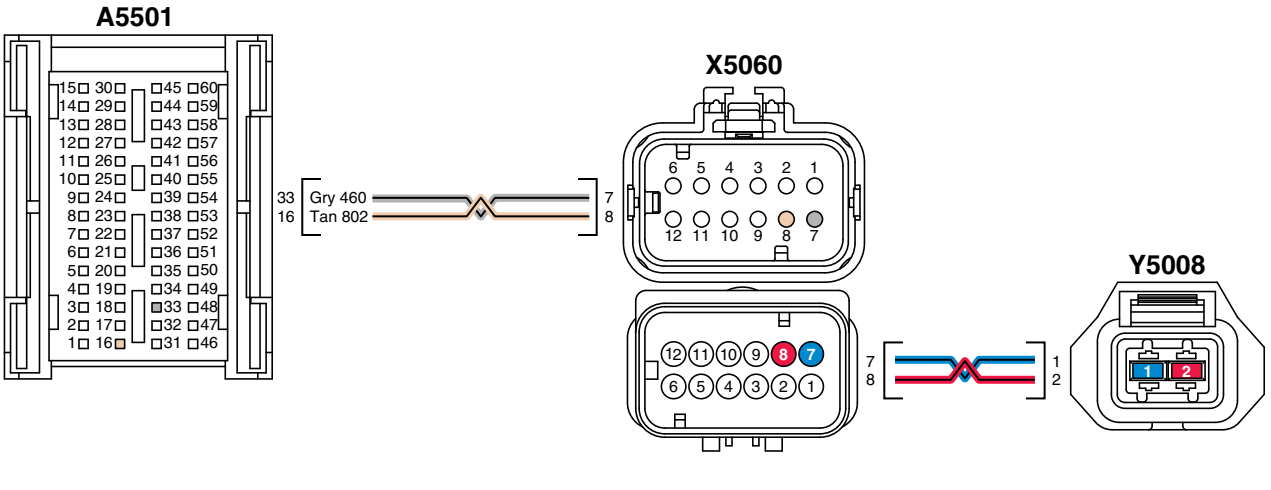
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001EA -19-25MAR14-1/5

Diagnostic Procedure



Injector #3 Circuit, Three Cylinder Engine

A5501 — 33—Injector #3 Drive High

A5501 — 16—Injector #3 Drive Low

OUMX258,00001EA -19-25MAR14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000652.03 active?	**YES:** Go to next step. **NO:** Go to "Terminal Check" step 3.

Continued on next page

OUMX258,00001EA -19-25MAR14-3/5

❷ Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect injector #3 connector Y5008.	
	3. Perform Terminal Test on engine and injector harness sides of connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,00001EA -19-25MAR14-4/5

❸ Terminal Check	1. Disconnect ECU connector A5501.	**YES:** Repair problem. Perform Verification Procedure.
	2. Perform Terminal Test on A5501 connector female sockets 16 and 33. And corresponding ECU male pins.	**NO:** See Problem Not Found Procedure.
	Were any problems found?	**NO:** See CTM120419.

OUMX258,00001EA -19-25MAR14-5/5

ECU 000652.05 — Injector #3 Circuit Has High Resistance

The ECU detected high resistance in the injector #3 circuit.

Troubleshooting Sequence:
002798.06
000652.05

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected high resistance on the injector #3 circuit.
The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines.
The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

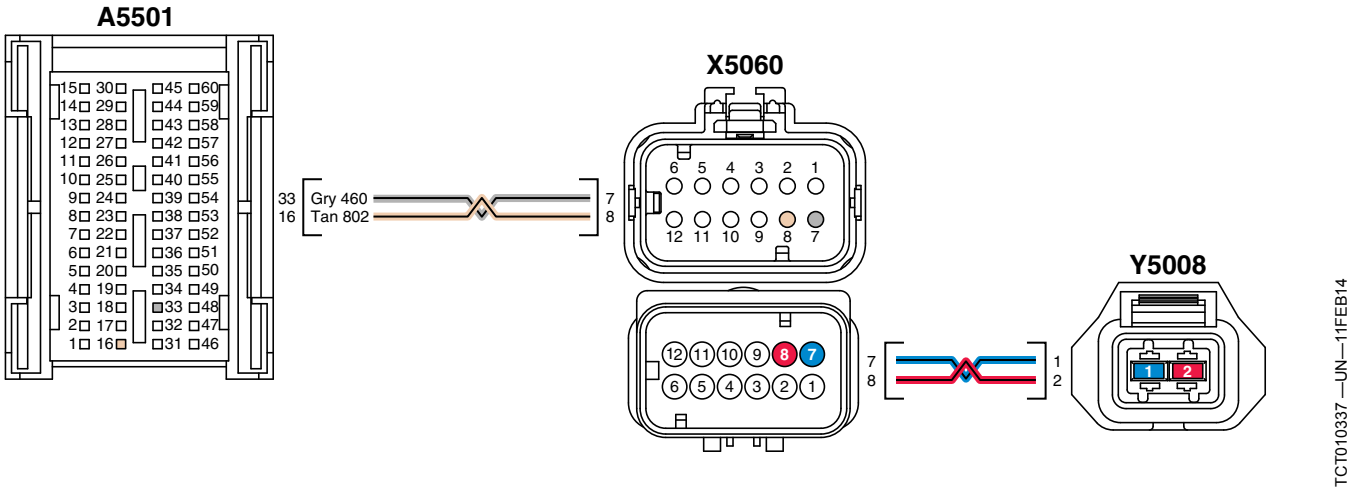
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001EB -19-02JUN14-1/4

Diagnostic Procedure



Injector #3 Circuit, Three Cylinder Engine

A5501 — 33—Injector #3 Drive High

A5501 — 16—Injector #3 Drive Low

OUMX258,00001EB -19-02JUN14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000652.05 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

Continued on next page

OUMX258,00001EB -19-02JUN14-3/4

❷ **Terminal Check**	1. Ignition OFF, Engine OFF. 2. Disconnect injector #3 connector Y5008. 3. Perform Terminal Test on engine and injector harness sides of connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00001EB -19-02JUN14-4/4

ECU 000652.06 — Injector #3 Circuit Has Low Resistance

The ECU detected low resistance in the injector #1 circuit.

Troubleshooting Sequence:
002798.06
000652.06

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected low resistance on the injector #3 circuit. The ECU supplies injectors #1, #2, and #3 from one common high-voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

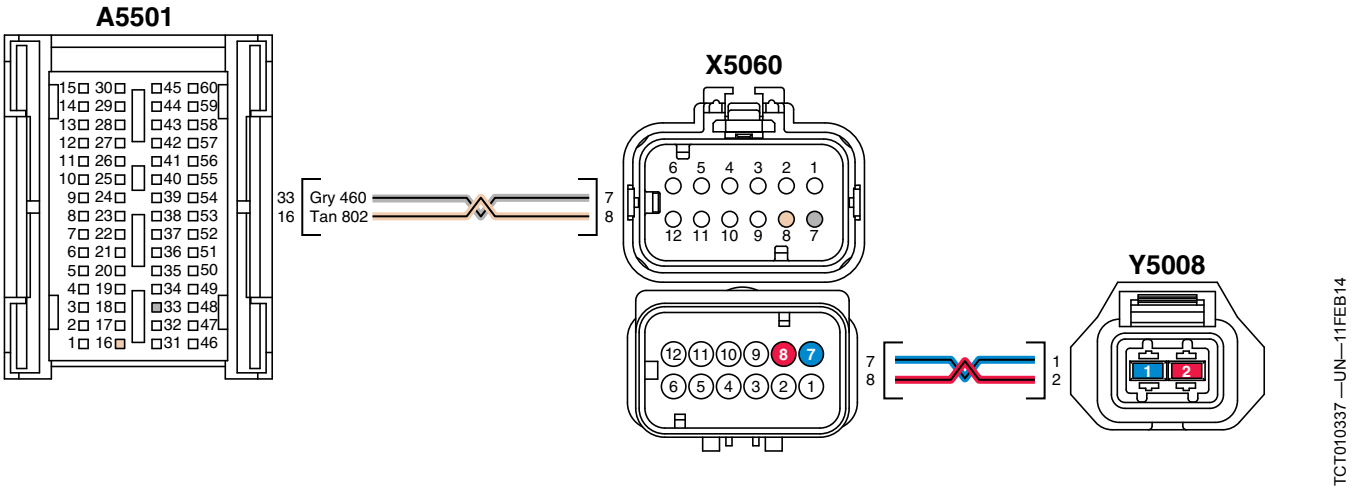
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001EC -19-02JUN14-1/5

Diagnostic Procedure



Injector #3 Circuit, Three Cylinder Engine

A5501 — 33—Injector #3 Drive High

A5501 — 16—Injector #3 Drive Low

OUMX258,00001EC -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000652.06 active?	**YES:** Go to next step. **NO:** Go to “Short Circuit Check” step.

Continued on next page

OUMX258,00001EC -19-02JUN14-3/5

❷ Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect injector #3 connector Y5008.	
	3. Perform Terminal Test on engine and injector harness sides of connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,00001EC -19-02JUN14-4/5

❸ Short Circuit Check	1. Ignition ON, engine running.	
	2. Refresh codes.	**YES:** See CTM120419.
	NOTE: Disregard DTC 652.05 if it becomes active.	
	Is DTC 000652.06 active?	**NO:** Replace #3 fuel injector. Perform Verification Procedure.

OUMX258,00001EC -19-02JUN14-5/5

ECU 000653.03 — Injector #2 Circuit Out of Range High

The ECU detected high voltage on the injector #2 circuit.

Troubleshooting Sequence:
002798.06
000653.03

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected high voltage on the injector #2 circuit. The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

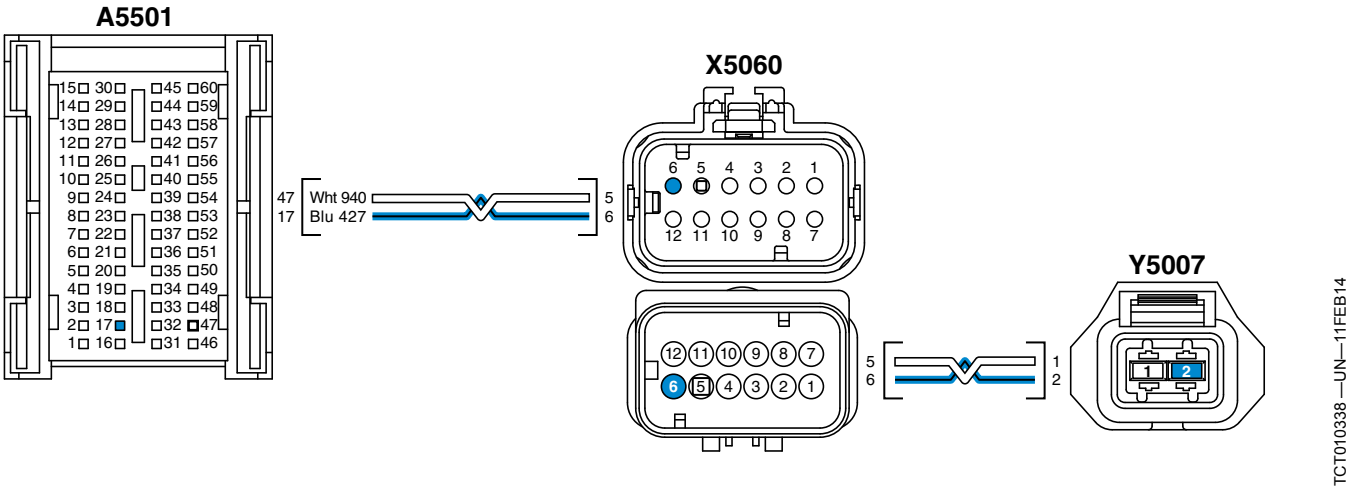
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001ED -19-02JUN14-1/5

Diagnostic Procedure



Injector #2 Circuit, Three Cylinder Engine

A5501 — 47—Injector #2 Drive High

A5501 — 17—Injector #2 Drive Low

OUMX258,00001ED -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000653.03 active?	**YES:** Go to next step. **NO:** Go to "Terminal Check" step 3.

Continued on next page

OUMX258,00001ED -19-02JUN14-3/5

2 Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect injector #2 connector Y5007.	
	3. Perform Terminal Test on engine and injector harness sides of connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,00001ED -19-02JUN14-4/5

3 Terminal Check	1. Disconnect ECU connector A5501.	**YES:** Repair problem. Perform Verification Procedure.
	2. Perform Terminal Test on A5501 connector female sockets 17 and 47. And corresponding ECU male pins.	**NO:** See Problem Not Found Procedure.
	Were any problems found?	**NO:** See CTM120419.

OUMX258,00001ED -19-02JUN14-5/5

ECU 000653.05 — Injector #2 Circuit Has High Resistance

The ECU detected high resistance in the injector #2 circuit.

Troubleshooting Sequence:
002798.06
000653.05

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected high resistance on the injector #2 circuit.
The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines.
The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

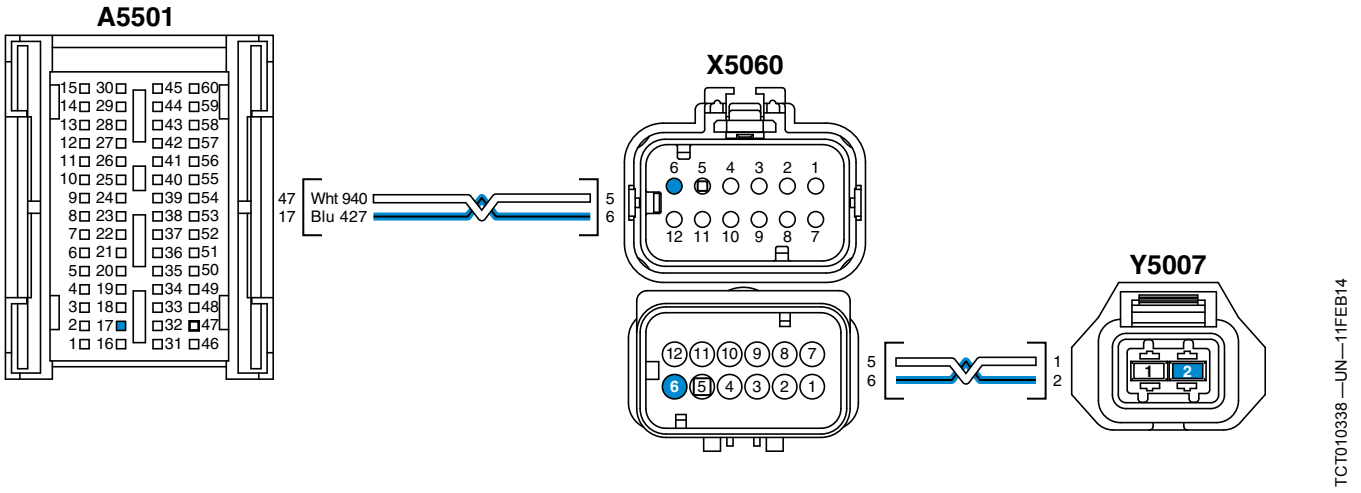
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001EE -19-02JUN14-1/4

Diagnostic Procedure



Injector #2 Circuit, Three Cylinder Enigne

A5501 — 47—Injector #2 Drive High

A5501 — 17—Injector #2 Drive Low

OUMX258,00001EE -19-02JUN14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000653.05 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

Continued on next page

OUMX258,00001EE -19-02JUN14-3/4

❷ **Terminal Check**	1. Ignition OFF, Engine OFF. 2. Disconnect injector #2 connector Y5007. 3. Perform Terminal Test on engine and injector harness sides of connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00001EE -19-02JUN14-4/4

ECU 000653.06 — Injector #2 Circuit Has Low Resistance

The ECU detected low resistance in the injector #2 circuit.

Troubleshooting Sequence:
002798.06
000653.06

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected low resistance on the injector #2 circuit. he ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

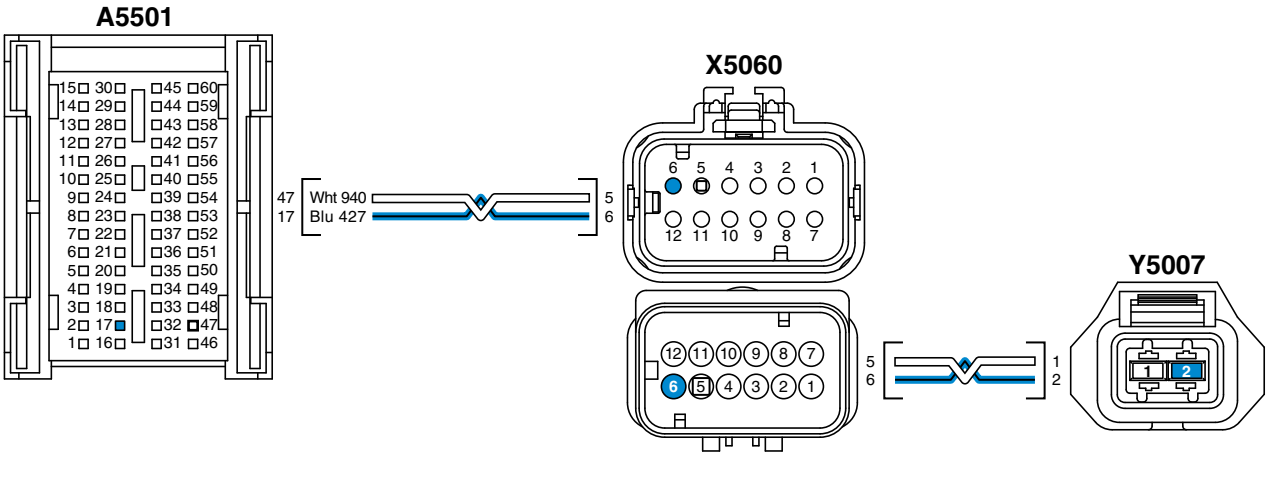
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001EF -19-02JUN14-1/5

Diagnostic Procedure



Injector #2 Circuit, Three Cylinder Engine

A5501 — 47—Injector #2 Drive High

A5501 — 17—Injector #2 Drive Low

OUMX258,00001EF -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000653.06 active?	**YES:** Go to next step. **NO:** Go to “Short Circuit Check” step.

Continued on next page

OUMX258,00001EF -19-02JUN14-3/5

❷ Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect injector #2 connector Y5007. 3. Perform Terminal Test on engine and injector harness sides of connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001EF -19-02JUN14-4/5

❸ Short Circuit Check	1. Ignition ON, engine running. 2. Refresh codes. *NOTE: Disregard DTC 653.05 if it becomes active.* Is DTC 000653.06 active?	**YES:** See CTM120419. **NO:** Replace #2 fuel injector. Perform Verification Procedure.

OUMX258,00001EF -19-02JUN14-5/5

ECU 000654.03 — Injector #1 Circuit Out of Range High

The ECU detected high voltage on the injector #1 circuit.

Troubleshooting Sequence:
002797.06
000654.03

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected high voltage on the injector #1 circuit. The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

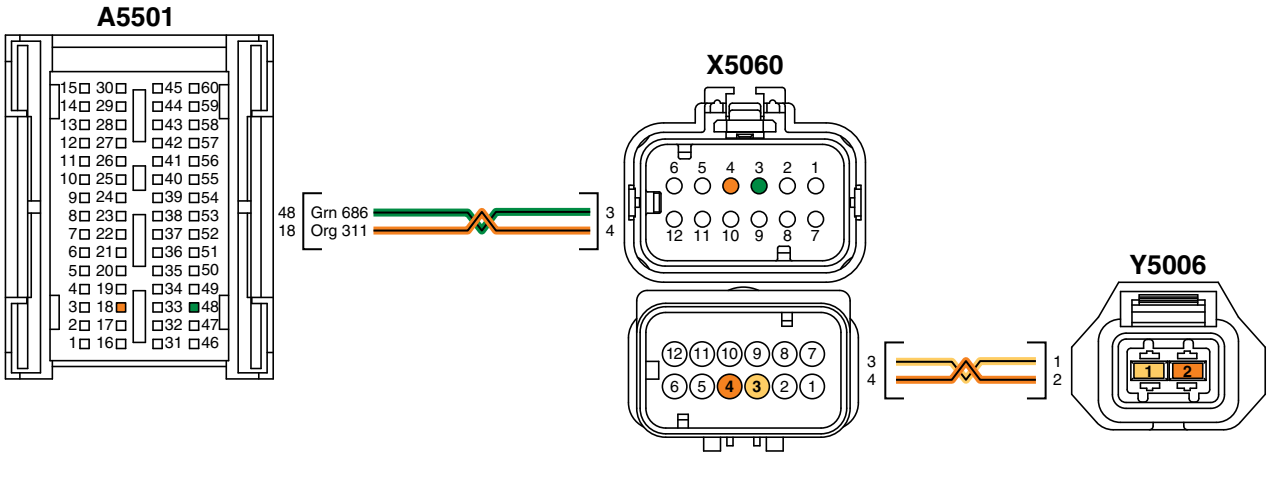
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001F0 -19-02JUN14-1/5

Diagnostic Procedure



Injector #1 Circuit Three Cylinder Engine

A5501 — 48—Injector #1 Drive High

A5501 — 18—Injector #1 Drive Low

OUMX258,00001F0 -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000654.03 active?	**YES:** Go to next step. **NO:** Go to "Terminal Check" step 3.

Continued on next page

OUMX258,00001F0 -19-02JUN14-3/5

❷ Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect injector #1 connector Y5006.	
	3. Perform Terminal Test on engine and injector harness sides of connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,00001F0 -19-02JUN14-4/5

❸ Terminal Check	1. Disconnect ECU connector A5501.	**YES:** Repair problem. Perform Verification Procedure.
	2. Perform Terminal Test on A5501 connector female sockets 18 and 48. And corresponding ECU male pins.	**NO:** See Problem Not Found Procedure.
	Were any problems found?	**NO:** See CTM120419.

OUMX258,00001F0 -19-02JUN14-5/5

ECU 000654.05 — Injector #1 Circuit Has High Resistance

The ECU detected high resistance in the injector #1 circuit.

Troubleshooting Sequence:
002797.06
000654.05

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected high resistance in the injector #1 circuit. The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

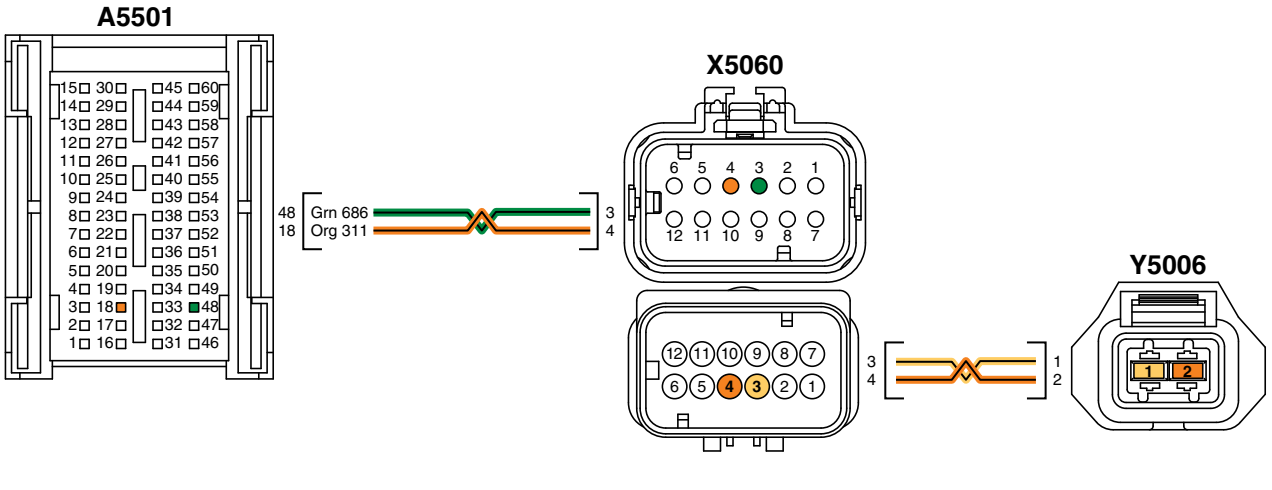
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001F1 -19-02JUN14-1/4

Diagnostic Procedure



Injector #1 Circuit Three Cylinder Engine

A5501 — 47—Injector #1 Drive High

A5501 — 17—Injector #1 Drive Low

OUMX258,00001F1 -19-02JUN14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000654.05 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure

Continued on next page

OUMX258,00001F1 -19-02JUN14-3/4

❷ **Terminal Check**	1. Ignition OFF, Engine OFF. 2. Disconnect injector #1 connector Y5006. 3. Perform Terminal Test on engine and injector harness sides of connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00001F1 -19-02JUN14-4/4

ECU 000654.06 — Injector #1 Circuit Has Low Resistance

The ECU detected low resistance in the injector #1 circuit.

Troubleshooting Sequence:
002797.06
000654.06

When DTC is Displayed:
When the engine is cranking or running.

Related Information:
The ECU detected low resistance in the injector #1 circuit. The ECU supplies injectors #1, #2, and #3 from one common high voltage driver on three cylinder engines. The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands the faulty injector to stop injecting fuel.

Additional References:
For more Electronic Injector (EI) information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

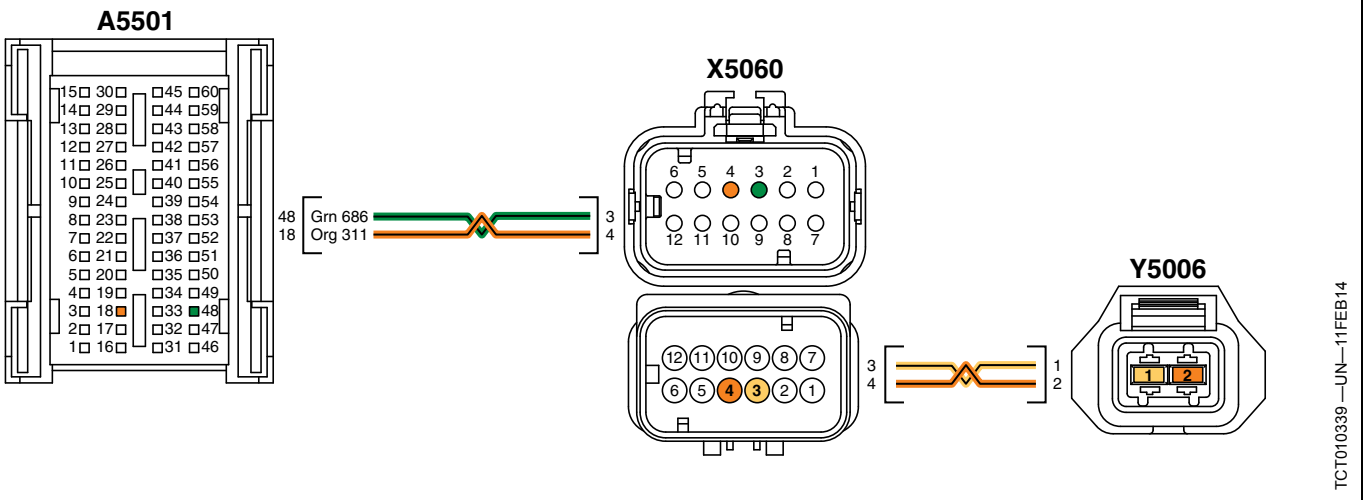
- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001F2 -19-02JUN14-1/5

Diagnostic Procedure



Injector #1 Circuit Three Cylinder Engine

A5501 — 47—Injector #1 Drive High

A5501 — 17—Injector #1 Drive Low

OUMX258,00001F2 -19-02JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, engine running. Is DTC 000654.06 active?	**YES:** Go to next step. **NO:** Go to “Short Circuit Check” step.

Continued on next page

OUMX258,00001F2 -19-02JUN14-3/5

❷ **Terminal Check**	1. Ignition OFF, Engine OFF.	
	2. Disconnect injector #1 connector Y5006.	
	3. Perform Terminal Test on engine and injector harness sides of connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,00001F2 -19-02JUN14-4/5

❸ **Short Circuit Check**	1. Ignition ON, engine running.	
	2. Refresh codes.	**YES:** See CTM120419.
	NOTE: Disregard DTC 000654.05 if it becomes active.	
	Is DTC 000654.06 active?	**NO:** Replace #1 fuel injector. Perform Verification Procedure.

OUMX258,00001F2 -19-02JUN14-5/5

ECU 001209.03 — Exhaust Manifold Pressure Signal Out of Range High

The exhaust manifold pressure signal exceeds the sensor high voltage specification.

OUMX258,00001F3 -19-02JUN14-1/6

Diagnostic Procedure

Troubleshooting Sequence:
001209.03

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The exhaust pressure signal voltage to the ECU corresponds to a pressure higher than what is physically possible for the exhaust pressure sensor.

Alarm Level:
Stop

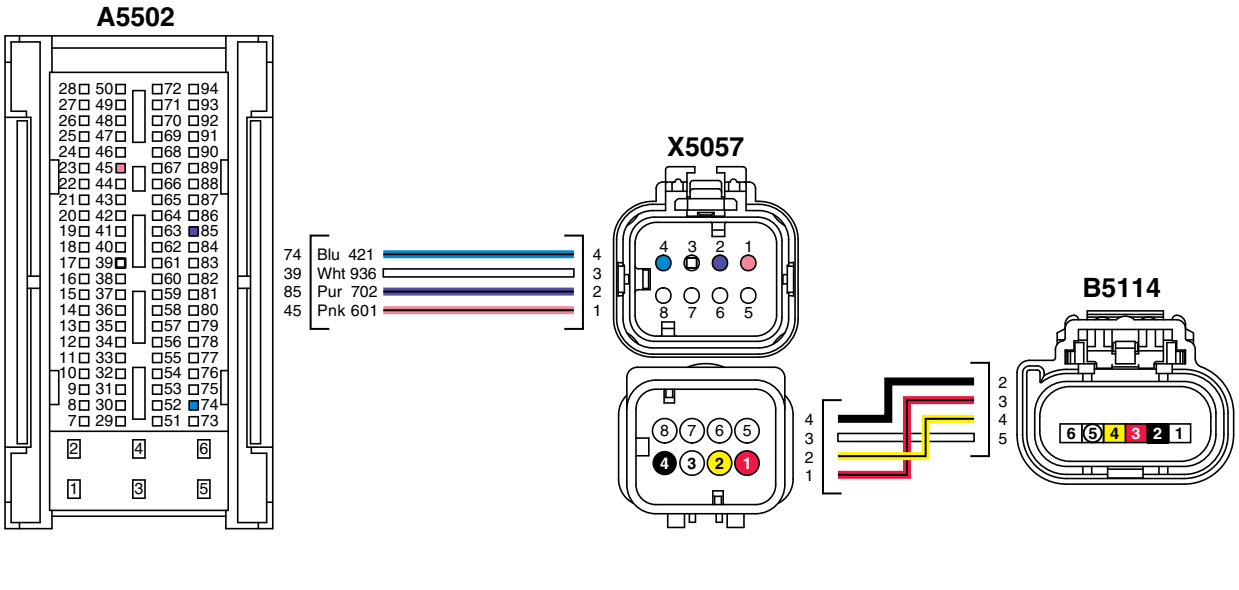
Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU prohibits a service regeneration.

Additional references:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic



A5502 – 39—Manifold Air Pressure Sensor Signal

A5502 – 45—Supply
A5502 – 74—Return

A5502 – 85—Exhaust Pressure Sensor Signal

Continued on next page

OUMX258,00001F3 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 001209.03 active?	**YES:** Go to next step. **NO:** Go to "Circuit Check" step.

OUMX258,00001F3 -19-02JUN14-3/6

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect manifold air and exhaust pressure sensor connector B5114. 3. Check terminals on sensor and B5114 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001F3 -19-02JUN14-4/6

3 Continuity Check	1. Measure the resistance between A5502 connector female socket 74 and B5114 connector female socket 2. 2. Measure the resistance between A5502 connector female socket 85 and B5114 connector female socket 4. Are both resistance measurements less than 5 ohms?	**YES:** See CTM201419. **NO:** Repair mis-pin. Perform Verification Procedure.

OUMX258,00001F3 -19-02JUN14-5/6

4 Terminal Check	1. Disconnect ECU connector A5502. 2. Perform Terminal Test on A5502 connector female sockets 39, 45, 74, and 85. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure **NO:** See CTM201419.

OUMX258,00001F3 -19-02JUN14-6/6

ECU 001209.04 — Exhaust Manifold Pressure Signal Out of Range Low

The exhaust manifold pressure signal is lower than the sensor low voltage specification.

OUMX258,00001F4 -19-02JUN14-1/8

Diagnostic Procedure

Troubleshooting Sequence:
001209.03
001209.04

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The exhaust pressure sensor signal voltage to the ECU corresponds to a pressure lower than what is physically possible for the exhaust pressure sensor.

Alarm Level:
Stop

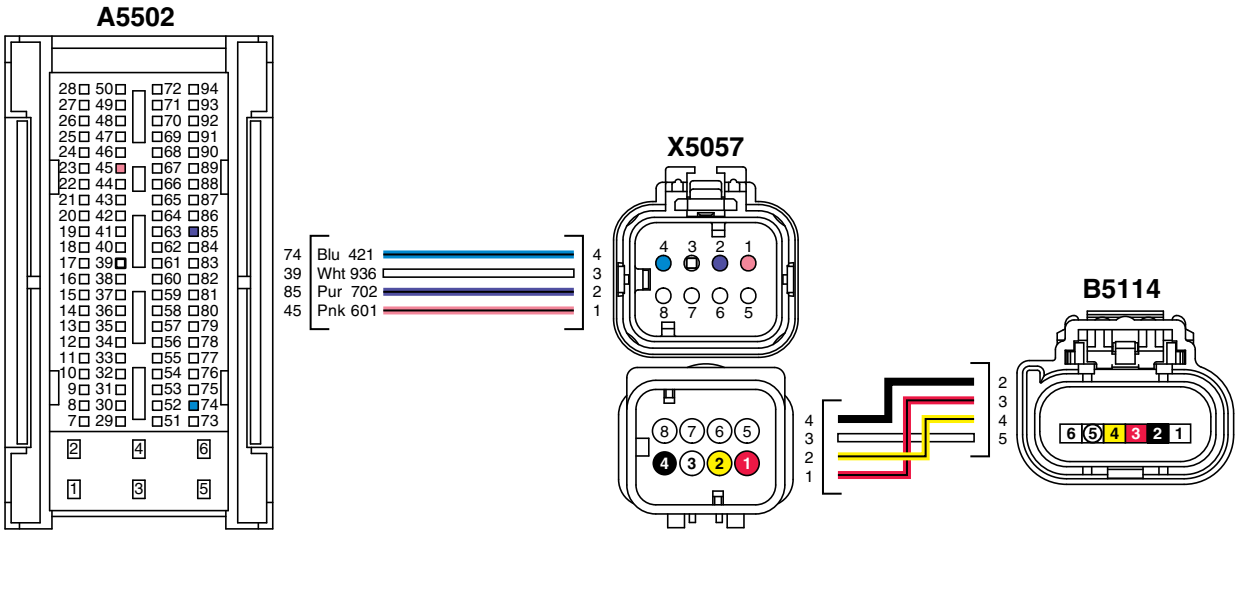
Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU will prohibit a service regeneration.

Additional references:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic



A5502 – 39—Manifold Air Pressure Sensor Signal

A5502 – 45—Supply
A5502 – 74—Return

A5502 – 85—Exhaust Pressure Sensor Signal

Continued on next page

OUMX258,00001F4 -19-02JUN14-2/8

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 001209.03 stored?	**YES:** See DTC 001209.03 diagnostics. **NO:** Go to next step.

OUMX258,00001F4 -19-02JUN14-3/8

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect manifold air and exhaust pressure sensor connector B5114. 3. Perform Terminal Test on sensor and B5114 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001F4 -19-02JUN14-4/8

3 Continuity Check	Measure the resistance between A5502 connector female socket 85 and B5114 connector female socket 4. Is resistance less than 5 ohms?	**YES:** Repair short to signal wire in harness. Perform Verification Procedure. **NO:** Repair open, high resistance, or mis-pin in harness. Perform Verification Procedure.

OUMX258,00001F4 -19-02JUN14-5/8

4 Circuit Check	1. Ignition ON, Engine OFF. 2. Monitor Exhaust Manifold Pressure Sensor Input Voltage in Service ADVISOR. 3. Perform Wiggle Test. Does voltage ever go below 0.2 V?	**YES:** Repair harness problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001F4 -19-02JUN14-6/8

5 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect exhaust manifold pressure sensor connector B5114. 3. Perform Terminal Test on sensor and B5114 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

Continued on next page

OUMX258,00001F4 -19-02JUN14-7/8

6 Terminal Check	1. Disconnect ECU connector A5502.	
	2. Perform Terminal Test on A5502 connector female sockets 39, 45, 74, and 85. And corresponding ECU male pins.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** See CTM201419.

OUMX258,00001F4 -19-02JUN14-8/8

ECU 001209.13 — Exhaust Manifold Pressure Signal Calibration Fault

The ECU detects an exhaust manifold pressure mismatch.

OUMX258,00001F5 -19-02JUN14-1/7

Diagnostic Procedure

Troubleshooting Sequence:
001209.03
001209.04
001209.13

When DTC is Displayed:
When the ignition is ON, the engine is OFF, and the fault is active.
When the ignition is ON, engine is running, and the actual exhaust manifold pressure is not within an estimated range the ECU expects, based from engine operating conditions.

Related Information:
The ECU compares the exhaust manifold pressure to the manifold air pressure sensor and the barometric pressure sensor at ignition on, engine off.

Alarm Level:
Stop

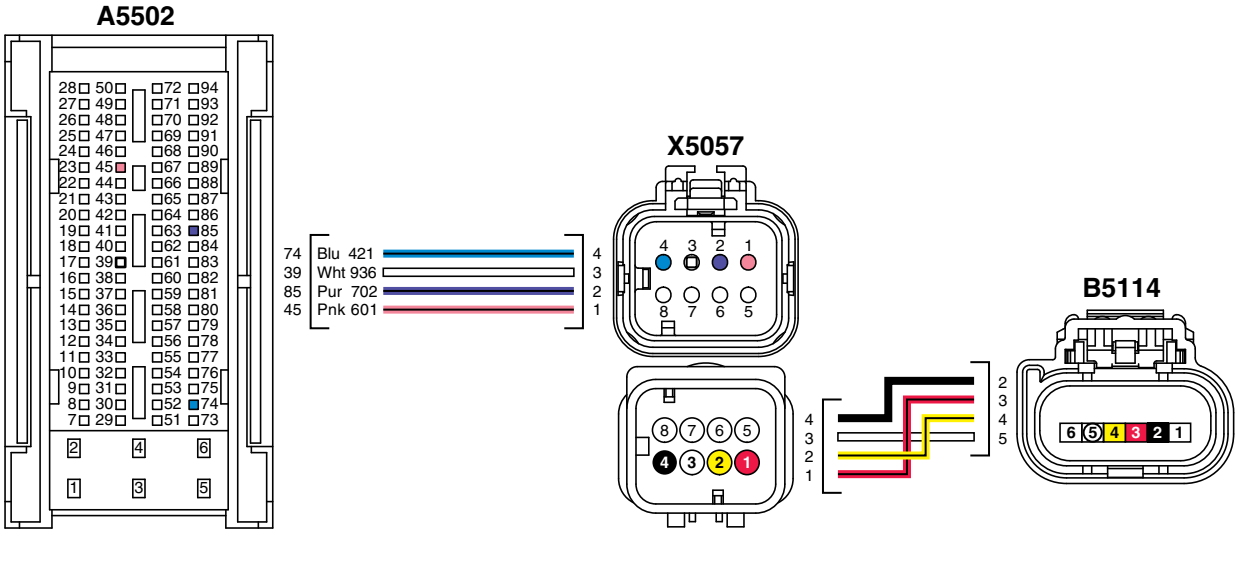
Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU will prohibit a service regeneration.

Additional references:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5057 Schematic



A5502 – 39—Manifold Air Pressure Sensor Signal

A5502 – 45—Supply
A5502 – 74—Return

A5502 – 85—Exhaust Pressure Sensor Signal

Continued on next page

OUMX258,00001F5 -19-02JUN14-2/7

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 001209.03 stored?	**YES:** See 001209.03 diagnostics. **NO:** Go to next step.

OUMX258,00001F5 -19-02JUN14-3/7

2 Code Check	Is DTC 001209.04 stored?	**YES:** See 001209.04 diagnostics. **NO:** Go to next step.

OUMX258,00001F5 -19-02JUN14-4/7

3 Code Check	1. Ignition ON, engine running. 2. Wait a minimum of 20 seconds. 3. Refresh codes. Is DTC 001209.13 active?	**YES:** Go to “Terminal Check” step. **NO:** Go to next step.

OUMX258,00001F5 -19-02JUN14-5/7

4 Code Check	1. Review Snapshot Information stored from step 1 or speak with operator to determine conditions where DTC became active. 2. Operate engine under condition where the DTC became active. 3. Refresh codes. Is DTC 001209.13 active?	**YES:** Go to next step. **NO:** See diagnostics section in CTM201419.

OUMX258,00001F5 -19-02JUN14-6/7

5 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect manifold air and exhaust pressure sensor connector B5114. 3. Perform Terminal Test on sensor and B5114 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00001F5 -19-02JUN14-7/7

ECU 002791.00 — EGR Valve Drive Circuit Voltage Extremely High

The EGR Valve has detected its supply voltage is out of range high.

Trouble Shooting Sequence:
002791.00

When DTC is Displayed:
When the ignition is on, or engine is running, and the EGR valve reports the fault is active.

Related Information:

This code is set when the EGR valve detects that its supply voltage from the ECU is out of range high .

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For EGR actuator location, information on how to use Diagnostic Test Box, and for more information on the control unit information and overview test, see CTM120419.

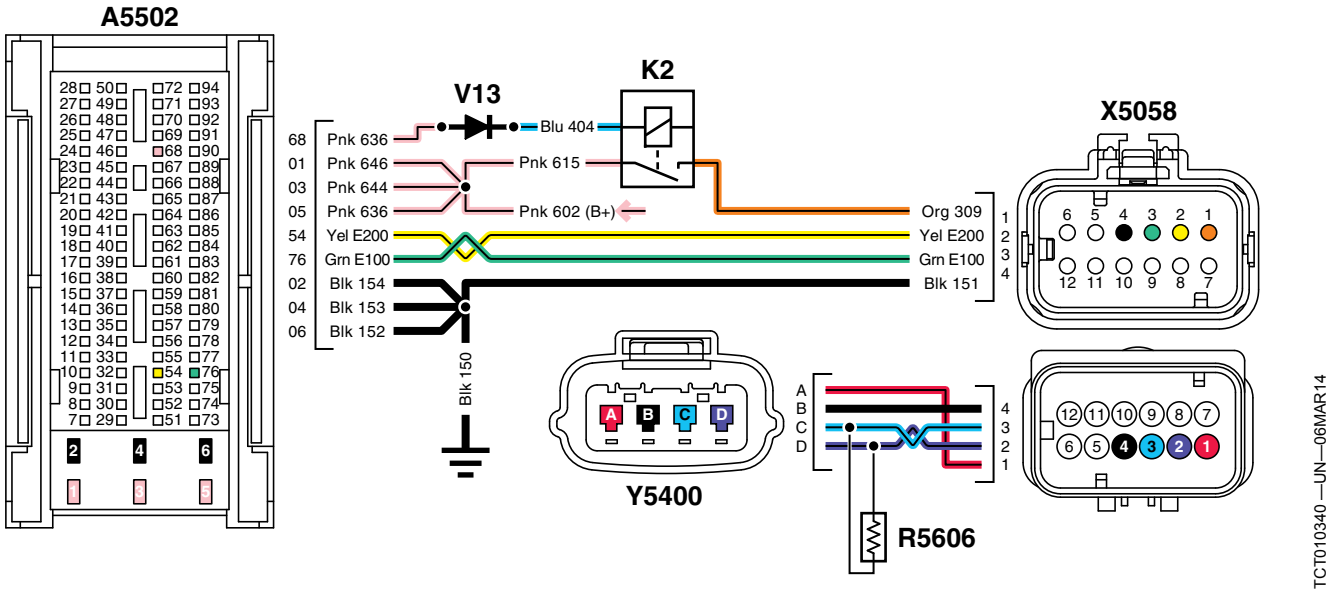
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5502 – 01—Supply
A5502 – 02—Return
A5502 – 03—Supply
A5502 – 04—Return
A5502 – 05—Supply
A5502 – 06—Return
A5502 – 54—CAN High
A5502 – 76—CAN Low
A5502 – 68—Relay Coil Control
K2—EGR Valve Power Relay
R5606—Resistor
V13— Diode

OUMX258,00001F6 -19-02JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,00001F6 -19-02JUN14-2/6

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, Engine running. 5. Refresh codes. Is DTC 002791.00 active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

OUMX258,00001F6 -19-02JUN14-3/6

2 Charging System Check	1. Check battery terminals and battery state of charge. 2. Ignition ON, engine running. 3. Check charging system for proper operation. Were any problems found?	**YES:** Repair problem. Go to "Check Codes" step. **NO:** Go to next step.

OUMX258,00001F6 -19-02JUN14-4/6

3 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect EGR valve connector Y5400. 3. Perform Terminal Test on EGR valve and Y5400 connector. Were any problems found?	**YES:** Repair problem. Go to "Check Codes" step. **NO:** Go to next step.

OUMX258,00001F6 -19-02JUN14-5/6

4 Circuit Check	1. Connect multimeter : • to Y5400 connector female socket A (+). • to Y5400 connector female socket B (-). 2. Ignition ON, Engine OFF. 3. In Service ADVISOR, monitor Unswitched Battery Voltage. 4. Monitor voltage on multimeter. Is reading on multimeter within +/- 0.5 V of unswitched battery voltage?	**YES:** Replace EGR valve. Perform Verification Procedure. **NO:** See CTM120419.

Data Point	Normal Range
Battery Voltage	10.8 — 14.4 V

OUMX258,00001F6 -19-02JUN14-6/6

ECU 002791.01 — EGR Valve Drive Circuit Voltage Extremely Low

The EGR Valve has detected its supply voltage is out of range low.

Trouble Shooting Sequence:
002791.01

When DTC is Displayed:
When the ignition is on, or engine is running, and the EGR valve reports the fault is active.

Related Information:

This code is set when the EGR valve detects that its supply voltage from the ECU is out of range low.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For EGR actuator location, information on how to use Diagnostic Test Box, and for more information on the control unit information and overview test, see CTM120419.

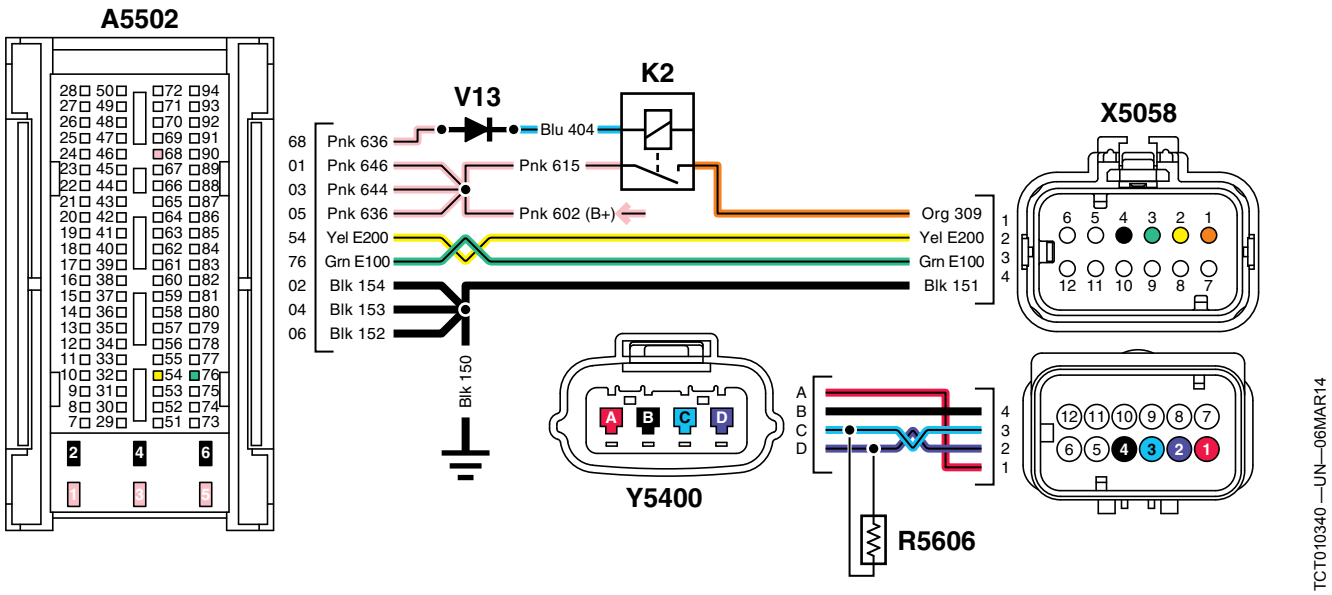
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5502 – 01—Supply
A5502 – 02—Return
A5502 – 03—Supply
A5502 – 04—Return
A5502 – 05—Supply
A5502 – 06—Return
A5502 – 54—CAN High
A5502 – 76—CAN Low
A5502 – 68—Relay Coil Control
K2—EGR Valve Power Relay
R5606—Resistor
V13— Diode

OUMX258,00001F7 -19-02JUN14-1/8

Diagnostic Procedure

Continued on next page

OUMX258,00001F7 -19-02JUN14-2/8

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information. 4. Ignition ON, Engine running. 5. Refresh codes. Is DTC 002791.01 active?	**YES:** Go to next step. **NO:** See Problem Not Found Procedure.

OUMX258,00001F7 -19-02JUN14-3/8

2 Charging System Check	1. Check battery terminals and battery state of charge. 2. Ignition ON, engine running. 3. Check charging system for proper operation. Were any problems found?	**YES:** Repair problem. Go to "Check Codes" step. **NO:** Go to next step.

OUMX258,00001F7 -19-02JUN14-4/8

3 Continuity Check	1. Remove K2 relay from socket. 2. Measure resistance between A5502 connector female socket 1 and K2 female socket pin 30. 3. Measure resistance between K2 female socket pin 87 and Y5400 connector female socket A. 4. Measure resistance between A5502 connector female socket 2 and Y5400 connector female socket B. Are both resistances less than 5 ohms?	**YES:** Test K2 relay. Replace relay as necessary. Perform Verification Procedure. Go to next step. **NO:** Repair high resistance or open in harness. Perform Verification Procedure. Go to next step.

OUMX258,00001F7 -19-02JUN14-5/8

4 Diode Check	1. Set multimeter to diode test. 2. Check continuity between A5502 connector female socket 68 and K2 female socket pin 85. 3. Reverse leads and measure continuity. Does continuity check okay for diode test in both directions?	**YES:** Go to next step. **NO:** Replace diode as necessary. Perform Verification Procedure. Go to next step.

Continued on next page

OUMX258,00001F7 -19-02JUN14-6/8

5 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect EGR valve connector Y5400.
3. Perform Terminal Test on EGR valve and Y5400 connector.

Were any problems found?

YES: Repair problem. Go to "Check Codes" step.

NO: Go to next step.

OUMX258,00001F7 -19-02JUN14-7/8

6 Circuit Check

1. Connect multimeter :
   - to Y5400 connector female socket A (+).
   - to Y5400 connector female socket B (-).
2. Ignition ON, Engine OFF.
3. In Service ADVISOR, monitor Unswitched Battery Voltage.
4. Monitor voltage on multimeter.

Data Point	Normal Range
Battery Voltage	10.8 — 14.4 V

Is reading on multimeter within +/- 0.5 V of unswitched battery voltage?

YES: Replace EGR valve. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,00001F7 -19-02JUN14-8/8

ECU 002791.07 — EGR Valve Position Error

The EGR valve actuator has detected an internal feedback error.

OUMX258,00001F8 -19-02JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
002791.07

When DTC is Displayed:
When the ignition is on and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects an internal feedback error. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected an internal feedback error and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For EGR actuator location, information on how to use Diagnostic Test Box, and for more information on the control unit information and overview test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,00001F8 -19-02JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, Engine OFF. 5. Refresh codes. Is DTC 002791.07 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See CTM102491, “Problem Not Found Procedure”.

OUMX258,00001F8 -19-02JUN14-3/3

ECU 002791.09 — EGR Valve Communication Error

The EGR valve actuator has detected an internal data error.

OUMX258,00001F9 -19-03JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
002791.09

When DTC is Displayed:
When the ignition is on and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects an internal data error. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected an internal data error and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For EGR actuator location, information on how to use Diagnostic Test Box, and for more information on the control unit information and overview test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,00001F9 -19-03JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, Engine OFF. 5. Refresh codes. Is DTC 002791.09 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See CTM102491, “Problem Not Found Procedure”.

OUMX258,00001F9 -19-03JUN14-3/3

ECU 002791.12 — EGR Valve Actuator Internal Error

The EGR valve actuator has detected an internal error.

OUMX258,00001FA -19-03JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
002791.12

When DTC is Displayed:
When the ignition is on, or engine is running, and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects an internal error. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected an internal error and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For EGR actuator location, information on how to use Diagnostic Test Box, and for more information on the control unit information and overview test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,00001FA -19-03JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 002791.12 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See CTM102491, “Problem Not Found Procedure”.

OUMX258,00001FA -19-03JUN14-3/3

ECU 002797.06 — Injector High Voltage Supply #1 Circuit Has Low Resistance

The ECU has detected a problem with injector high voltage supply #1.

OUMX258,00001FB -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
002797.06

When DTC is Displayed:
When the ignition is on, engine running, or cranking, and the fault is active.

Related Information:
The ECU has detected an internal problem with the injector high voltage supply #1 circuit.

The ECU supplies injectors from one common high voltage driver on three cylinder engines.

The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU tries to maintain proper operating conditions.
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands injection to stop for injectors.
The engine may not run when this fault is present.
The ECU will command an engine stop after two hours of continuous operation with the fault active.

Additional references:
For more electronic injector information, and for more information on the control unit information and overview test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001FB -19-03JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, cranking or engine running. 5. Refresh codes. Is DTC 002797.06 active?	**YES:** See CTM120419. **NO:** See Verification Procedure.

OUMX258,00001FB -19-03JUN14-3/3

ECU 002798.06 — Injector High Voltage Supply #2 Circuit Has Low Resistance

The ECU has detected a problem with injector high voltage supply #2.

OUMX258,00001FC -19-17JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
002798.06

When DTC is Displayed:
When the ignition is on, engine running, and the fault is active.

Related Information:
The ECU has detected an internal problem with the injector high voltage supply #2 circuit.

The ECU supplies injectors from one common high voltage driver on three cylinder engines.

The ECU switches the low side (ground) to control each individual injector.

Alarm Level:
Warning

Control Unit Response:
The ECU tries to maintain proper operating conditions.
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU commands injection to stop for injectors #2 and #3.
The ECU will command an engine stop after two hours of continuous operation with the fault active.

Additional references:
For more electronic injector information, and for more information on the control unit information and overview test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.

OUMX258,00001FC -19-17JUN14-2/3

1 **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 002798.06 active?	**YES:** Go CTM120419. **NO:** See Problem Not Found Procedure.

OUMX258,00001FC -19-17JUN14-3/3

ECU 002950.03 — Air Throttle Actuator Drive Circuit 1 Out of Range High

The ECU has detected high voltage on the air throttle actuator drive circuit 1.

Troubleshooting Sequence:
002950.03

When DTC is Displayed:
When the ignition is on, engine is running, and the fault is active.

Related Information:
The ECU has detected the air throttle actuator drive circuit 1 is out of range high.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the air throttle actuator fully open.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

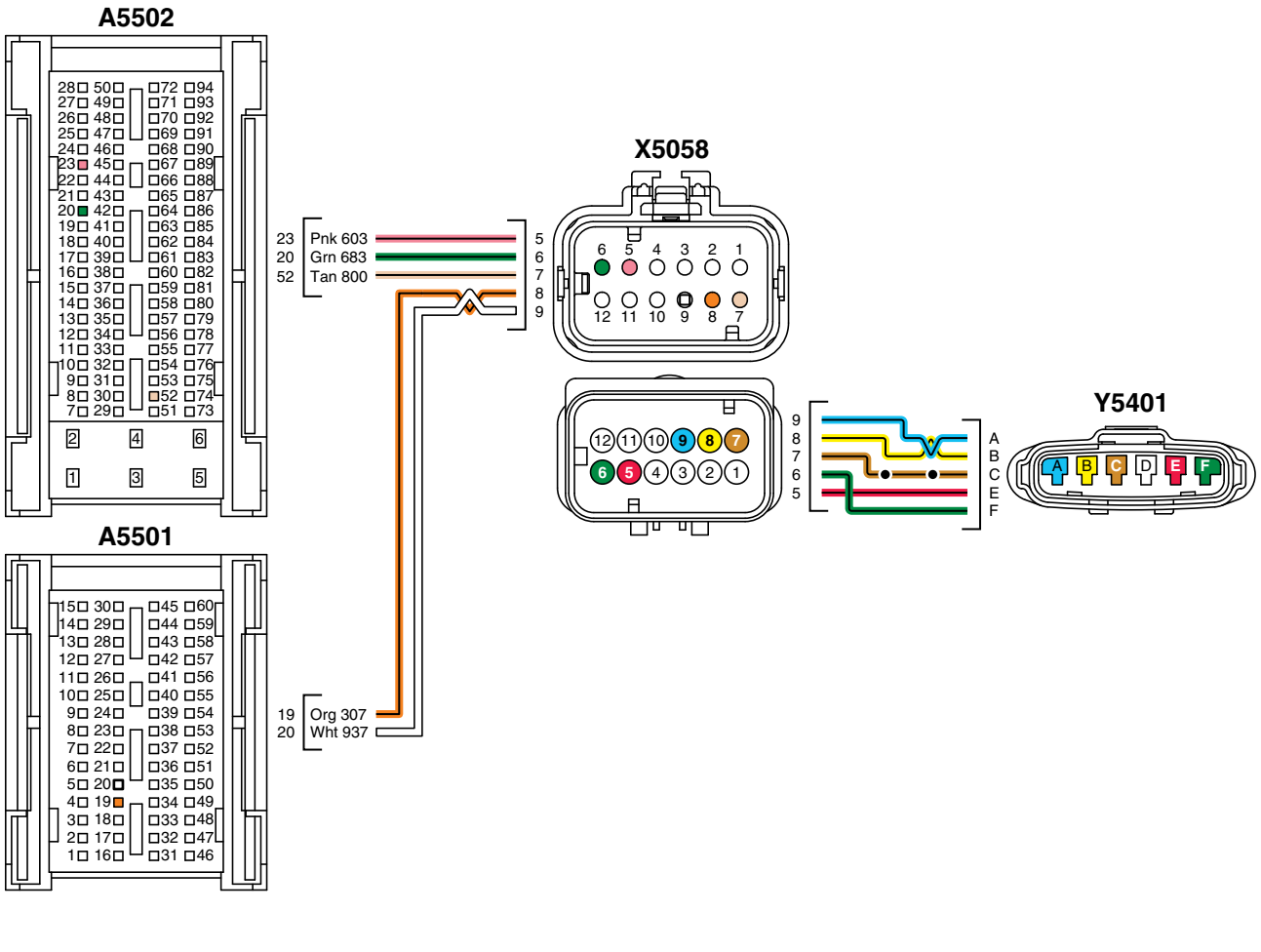
Additional references:
For component location, more air throttle actuator information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 19—Drive (+)
A5501 — 20—Drive (-)
A5502 — 20—Signal
A5502 — 23—Supply
A5502 — 52—Return

OUMX258,00001FD -19-03JUN14-1/7

Diagnostic Procedure

Continued on next page

OUMX258,00001FD -19-03JUN14-2/7

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 002950.03 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,00001FD -19-03JUN14-3/7

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect air throttle actuator connector Y5401. 3. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001FD -19-03JUN14-4/7

3 Terminal Check	1. Disconnect ECU connectors A5501 and A5502. 2. Perform Terminal Test on A5501 connector female sockets 19, 20, and A5502 connector female sockets 20, 23, 52, and corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001FD -19-03JUN14-5/7

4 Wire to Wire Check	On A5501 connector, measure resistance between female sockets 19 and 20 while performing Wiggle Test. Is resistance always greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,00001FD -19-03JUN14-6/7

5 Replace Air Throttle Actuator	1. Replace air throttle actuator. 2. Ignition ON, Engine OFF. *NOTE: Ignore any air throttle actuator codes except for DTC 002950.03.* 3. Refresh codes. Is DTC 002950.03 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00001FD -19-03JUN14-7/7

ECU 002950.04 — Air Throttle Actuator Drive Circuit 1 Out of Range Low

The ECU has detected low voltage on the air throttle actuator drive circuit 1.

Troubleshooting Sequence:
002950.04

When DTC is Displayed:
When the ignition is ON, engine is running, and the fault is active.

Related Information:
The ECU has detected the air throttle actuator drive circuit 1 is out of range low.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR valve fully closed.
The ECU aborts an active regeneration.

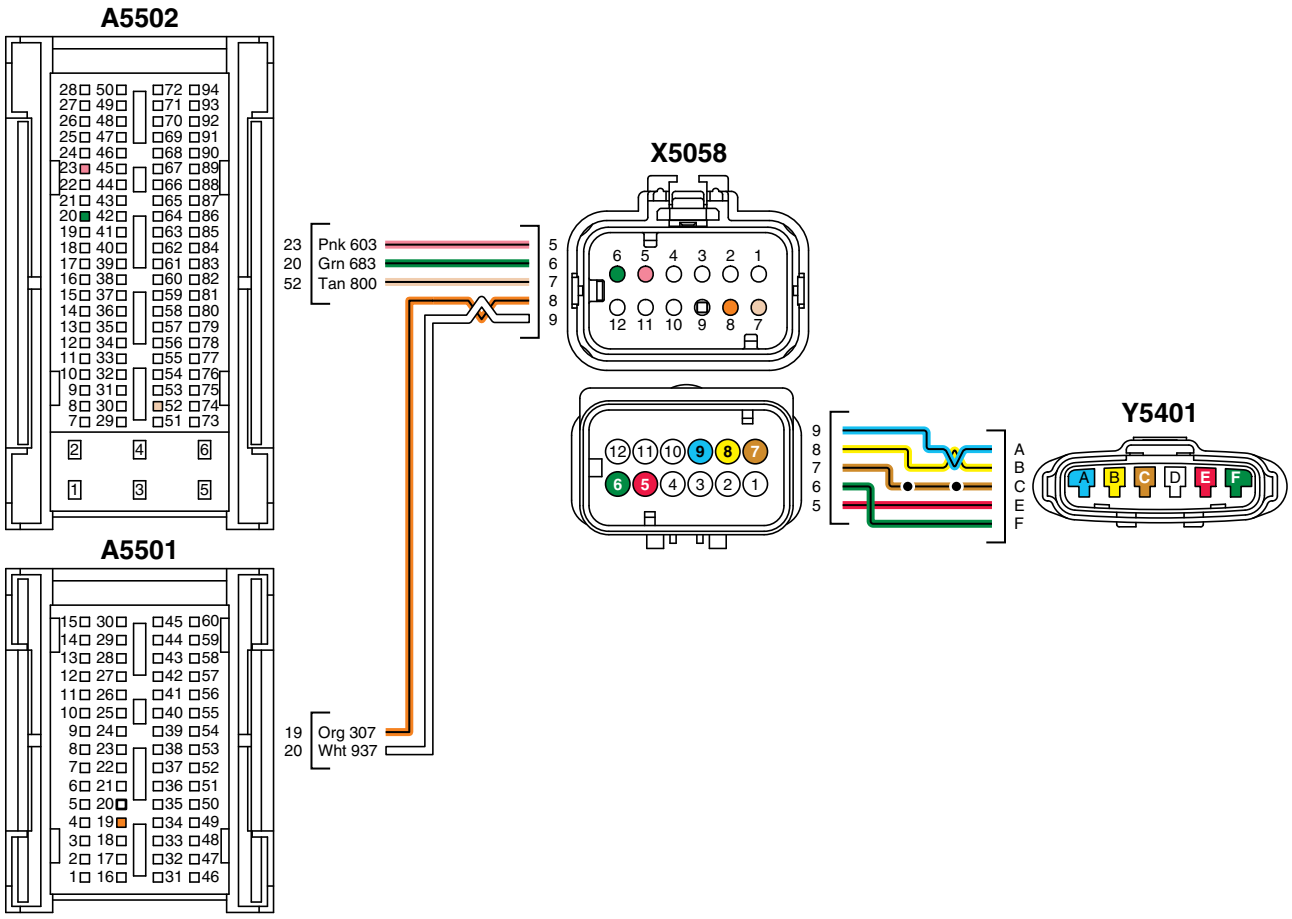
Additional references:
For component location, more air throttle actuator information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 19—Drive (+)
A5501 — 20—Drive (-)
A5502 — 20—Signal
A5502 — 23—Supply
A5502 — 52—Return

OUMX258,00001FE -19-03JUN14-1/7

Diagnostic Procedure

Continued on next page

OUMX258,00001FE -19-03JUN14-2/7

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 002950.04 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,00001FE -19-03JUN14-3/7

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect air throttle actuator connector Y5401. 3. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001FE -19-03JUN14-4/7

3 Terminal Check	1. Disconnect ECU connectors A5501 and A5502. 2. Perform Terminal Test on A5501 connector female sockets 19, 20, and A5502 connector female sockets 20, 23, and 52, and corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001FE -19-03JUN14-5/7

4 Wire to Wire Check	On A5501 connector, measure resistance between female sockets 19 and 20 while performing Wiggle Test. Is resistance always greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,00001FE -19-03JUN14-6/7

5 Replace Air Throttle Actuator	1. Replace air throttle actuator. 2. Ignition ON, Engine OFF. *NOTE: Ignore any air throttle actuator codes except for DTC 002950.04.* 3. Refresh codes. Is DTC 002950.04 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00001FE -19-03JUN14-7/7

ECU 002950.05 — Air Throttle Actuator Drive Circuit Has High Resistance

The ECU has detected high resistance on the air throttle actuator drive circuit.

Troubleshooting Sequence:
002950.05

When DTC is Displayed:
When the ignition is on and the fault is active.

Related Information:
The ECU has detected that there is a fault on the air throttle actuator drive circuit.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

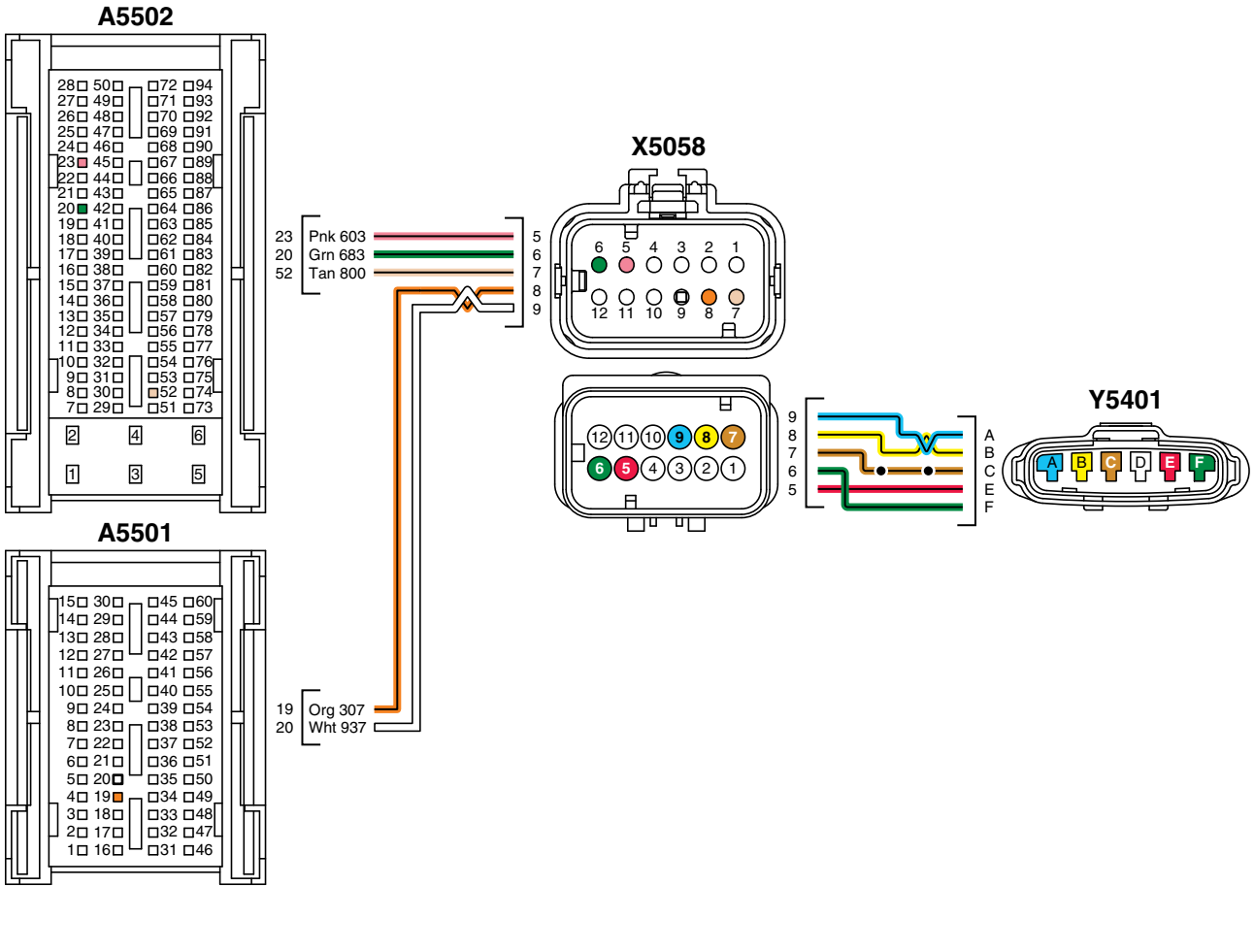
Additional references:
For component location, more air throttle actuator information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 19—Drive (+)
A5501 — 20—Drive (-)
A5502 — 20—Signal
A5502 — 23—Supply
A5502 — 52—Return

OUMX258,00001FF -19-07JUL14-1/10

Diagnostic Procedure

Continued on next page

OUMX258,00001FF -19-07JUL14-2/10

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. Is DTC 002950.05.05 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,00001FF -19-07JUL14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect Air Throttle Actuator connector Y5401. 3. Perform Terminal Test on Air Throttle Actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001FF -19-07JUL14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 19, 20, and A5502 connector female sockets 20, 23, and 52, and corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00001FF -19-07JUL14-5/10

4 Short to Voltage Check	1. Ignition ON, Engine OFF 2. Measure the voltage between Y5401 connector female socket A (+) and single point ground. 3. Measure the voltage between Y5401 connector female socket B (+) and single point ground. Is either measurement greater than 0.5 V?	**YES:** See Short to Voltage Procedure. **NO:** Go to next step.

OUMX258,00001FF -19-07JUL14-6/10

5 Continuity Check	1. Ignition OFF, Engine OFF 2. Measure resistance between A5501 connector female socket 20 and Y5401 connector female socket A. 3. Measure resistance between A5501 connector female socket 19 and Y5401 connector female socket B. Are both resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair open, high resistance, or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,00001FF -19-07JUL14-7/10

6 Short to Ground Check	1. Reconnect ECU connector A5501.	
	2. Measure resistance between Y5401 connector female socket A and single point ground.	
	3. Measure resistance between Y5401 connector female socket B and single point ground.	**YES:** Repair drive wire short to ground in harness. Perform Verification Procedure.
	Is either measurement less than 100 ohms?	**NO:** Go to next step.

OUMX258,00001FF -19-07JUL14-8/10

7 Wire to Wire Check	1. Measure resistance between A5501 connector female socket 19 and all other sockets in A5501.	
	2. Measure resistance between A5501 connector female socket 20 and all other sockets in A5501.	**YES:** Repair drive wire short in harness. Perform Verification Procedure.
	Is any measurement less than 100k Ohms?	**NO:** Go to next step.

OUMX258,00001FF -19-07JUL14-9/10

8 Replace Air Throttle Actuator	1. Ignition OFF, Engine OFF.	
	2. Replace air throttle actuator.	
	3. Reconnect all components.	
	4. Ignition ON, Engine Running.	
	5. Wait 90 seconds. Refresh DTCs.	**YES:** See CTM120419.
	Is DTC 002950.05 active?	**NO:** Perform Verification Procedure.

OUMX258,00001FF -19-07JUL14-10/10

ECU 002950.06 — Air Throttle Actuator Drive Circuit Has Low Resistance

The ECU has detected low resistance on the air throttle actuator drive circuit.

Troubleshooting Sequence:
002950.06

When DTC is Displayed:
When the ignition is on and the fault is active.

Related Information:
The ECU has detected that there is a fault on the air throttle actuator drive circuit.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

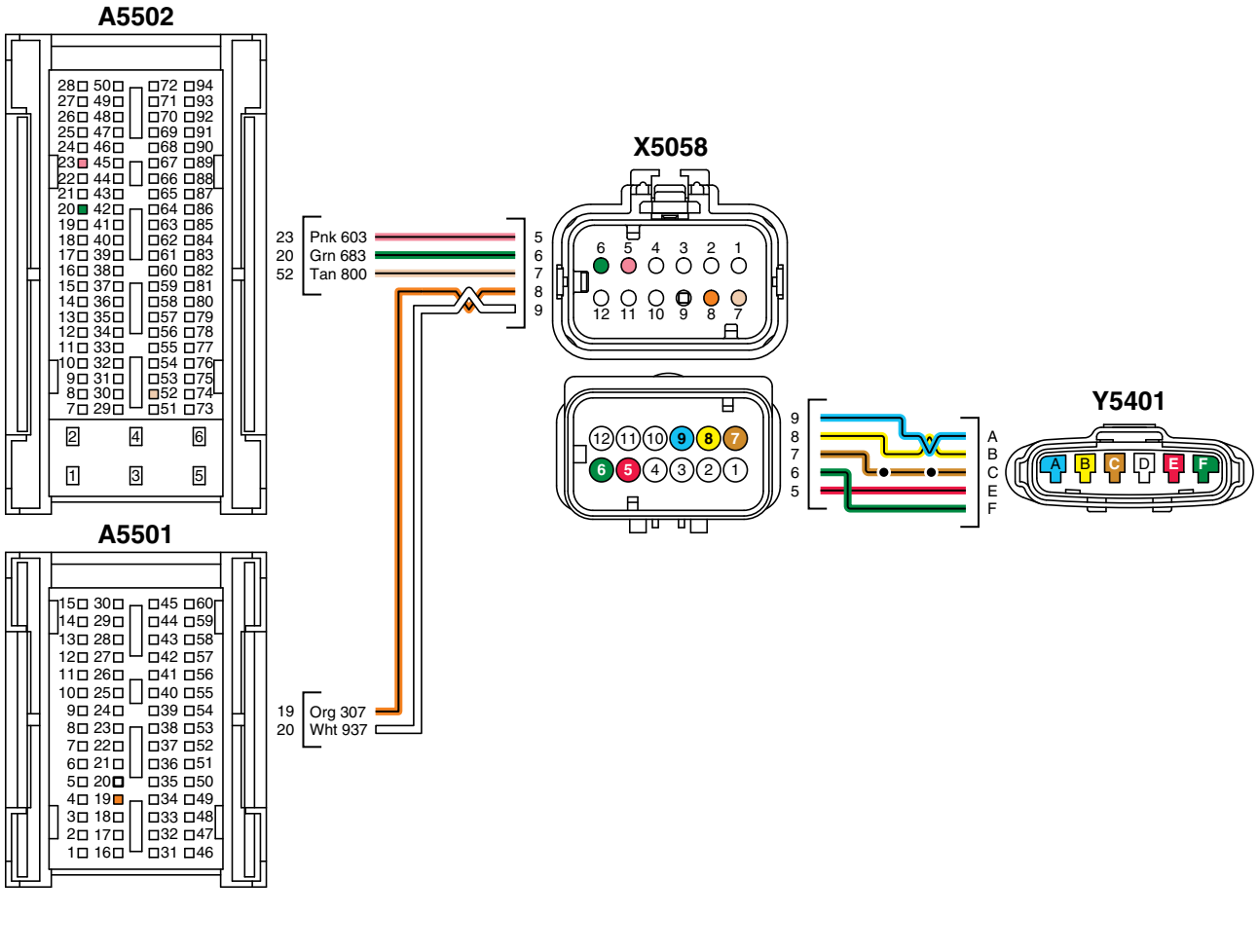
Additional references:
For component location, more air throttle actuator information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 19—Drive (+)
A5501 — 20—Drive (-)
A5502 — 20—Signal
A5502 — 23—Supply
A5502 — 52—Return

OUMX258,0000200 -19-03JUN14-1/10

Diagnostic Procedure

Continued on next page

OUMX258,0000200 -19-03JUN14-2/10

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. Is DTC 002950.06 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,0000200 -19-03JUN14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect air throttle actuator connector Y5401. 3. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000200 -19-03JUN14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 19, 20, and A5502 connector female sockets 20, 23, and 52, and corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000200 -19-03JUN14-5/10

4 Short to Voltage Check	1. Ignition ON, Engine OFF 2. Measure the voltage between Y5401 connector female socket A (+) and single point ground. 3. Measure the voltage between Y5401 connector female socket B (+) and single point ground. Is either measurement greater than 0.5 V?	**YES:** See Short to Voltage Procedure. **NO:** Go to next step.

OUMX258,0000200 -19-03JUN14-6/10

5 Continuity Check	1. Ignition OFF, Engine OFF 2. Measure resistance between A5501 connector female socket 20 and Y5401 connector female socket A. 3. Measure resistance between A5501 connector female socket 19 and Y5401 connector female socket B. Are both resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair open, high resistance, or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000200 -19-03JUN14-7/10

6 Short to Ground Check	1. Reconnect ECU connector A5501.	
	2. Measure resistance between Y5401 connector female socket A and single point ground.	
	3. Measure resistance between Y5401 connector female socket B and single point ground.	**YES:** Repair drive wire short to ground in harness. Perform Verification Procedure.
	Is either measurement less than 100 ohms?	**NO:** Go to next step.

OUMX258,0000200 -19-03JUN14-8/10

7 Wire to Wire Check	1. Measure resistance between A5501 connector female socket 19 and all other sockets in A5501.	
	2. Measure resistance between A5501 connector female socket 20 and all other sockets in A5501.	**YES:** Repair drive wire short in harness. Perform Verification Procedure.
	Is any measurement less than 100k ohms?	**NO:** Go to next step.

OUMX258,0000200 -19-03JUN14-9/10

8 Replace Air Throttle Actuator	1. Ignition OFF, Engine OFF.	
	2. Replace air throttle actuator.	
	3. Reconnect all components.	
	4. Ignition ON, engine running.	
	5. Wait 90 seconds. Refresh DTCs.	**YES:** See CTM120419.
	Is DTC 002950.05 active?	**NO:** Perform Verification Procedure.

OUMX258,0000200 -19-03JUN14-10/10

ECU 002951.03 — Air Throttle Actuator Drive Circuit 2 Out of Range High

The ECU has detected high voltage on the air throttle actuator drive circuit 2.

Troubleshooting Sequence:
002951.03

When DTC is Displayed:
When the ignition is on and the fault is active.

Related Information:
The ECU has detected the air throttle actuator drive circuit 2 is out of range high.

Alarm Level:
Warning

Control Unit Response:

The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR valve fully closed.
The ECU aborts an active regeneration.
The ECU commands an engine stop after two hours of continuous operation with the fault active.

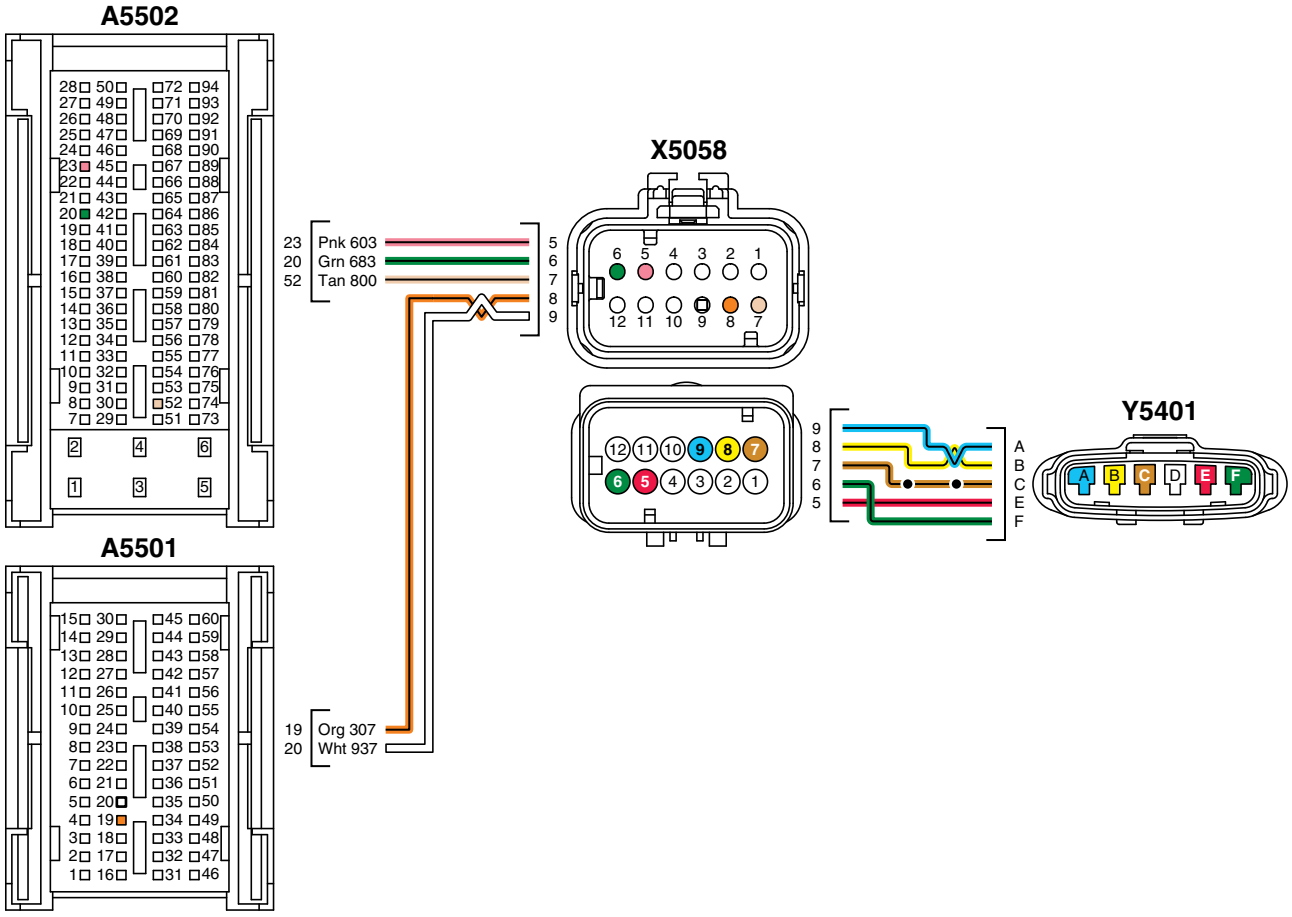
Additional references:
For component location, more air throttle actuator information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 19—Drive (+)
A5501 — 20—Drive (-)
A5502 — 20—Signal
A5502 — 23—Supply
A5502 — 52—Return

OUMX258,0000201 -19-03JUN14-1/10

Diagnostic Procedure

Continued on next page

OUMX258,0000201 -19-03JUN14-2/10

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. Is DTC 002951.03 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,0000201 -19-03JUN14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect air throttle actuator connector Y5401. 3. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000201 -19-03JUN14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 19, 20, and A5502 connector female sockets 20, 23, and 52, and corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000201 -19-03JUN14-5/10

4 Short to Voltage Check	1. Ignition ON, Engine OFF 2. Measure the voltage between Y5401 connector female socket A (+) and single point ground. 3. Measure the voltage between Y5401 connector female socket B (+) and single point ground. Is either measurement greater than 0.5 V?	**YES:** See Short to Voltage Procedure. **NO:** Go to next step.

OUMX258,0000201 -19-03JUN14-6/10

5 Continuity Check	1. Ignition OFF, Engine OFF 2. Measure resistance between A5501 connector female socket 20 and Y5401 connector female socket A. 3. Measure resistance between A5501 connector female socket 19 and Y5401 connector female socket B. Are both resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair open, high resistance, or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000201 -19-03JUN14-7/10

6 Short to Ground Check	1. Reconnect ECU connector A5501.	
	2. Measure resistance between Y5401 connector female socket A and single point ground.	
	3. Measure resistance between Y5401 connector female socket B and single point ground.	**YES:** Repair drive wire short to ground in harness. Perform Verification Procedure.
	Is either measurement less than 100 Ohms?	**NO:** Go to next step.

OUMX258,0000201 -19-03JUN14-8/10

7 Wire to Wire Check	1. Measure resistance between A5501 connector female socket 19 and all other sockets in A5501.	
	2. Measure resistance between A5501 connector female socket 20 and all other sockets in A5501.	**YES:** Repair drive wire short in harness. Perform Verification Procedure.
	Is any measurement less than 100k ohms?	**NO:** Go to next step.

OUMX258,0000201 -19-03JUN14-9/10

8 Replace Air Throttle Actuator	1. Ignition OFF, Engine OFF.	
	2. Replace air throttle actuator.	
	3. Reconnect all components.	
	4. Ignition ON, Engine Running.	
	5. Wait 90 seconds. Refresh DTCs.	**YES:** See CTM120419.
	Is DTC 002950.05 active?	**NO:** Perform Verification Procedure.

OUMX258,0000201 -19-03JUN14-10/10

ECU 002951.04 — Air Throttle Actuator Drive Circuit 2 Out of Range Low

The ECU has detected low voltage on the air throttle actuator drive circuit.

Troubleshooting Sequence:
002951.04

When DTC is Displayed:
When the ignition is on and the fault is active.

Related Information:
The ECU has detected the air throttle actuator drive circuit 2 is out of range low.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the Air Throttle Actuator fully open.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

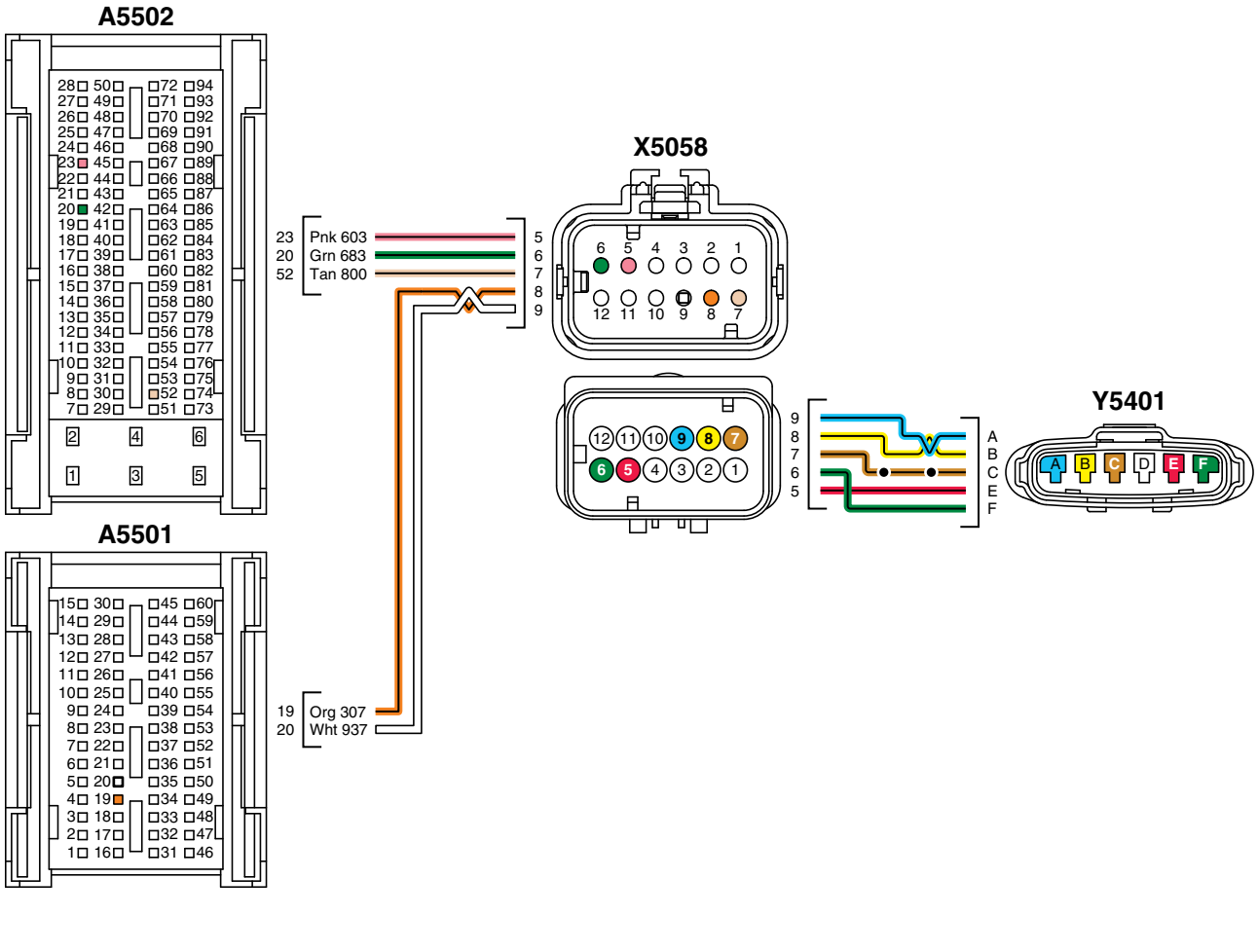
Additional references:
For component location, more air throttle actuator information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5501 — 19—Drive (+)
A5501 — 20—Drive (-)
A5502 — 20—Signal
A5502 — 23—Supply
A5502 — 52—Return

OUMX258,0000202 -19-03JUN14-1/10

Diagnostic Procedure

Continued on next page

OUMX258,0000202 -19-03JUN14-2/10

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. Is DTC 002951.04 active?	**YES:** Go to next step. **NO:** Perform Verification Procedure.

OUMX258,0000202 -19-03JUN14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect air throttle actuator connector Y5401. 3. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000202 -19-03JUN14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 19, 20, and A5502 connector female sockets 20, 23, and 52, and corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000202 -19-03JUN14-5/10

4 Short to Voltage Check	1. Ignition ON, Engine OFF 2. Measure the voltage between Y5401 connector female socket A (+) and single point ground. 3. Measure the voltage between Y5401 connector female socket B (+) and single point ground. Is either measurement greater than 0.5 V?	**YES:** See Short to Voltage Procedure. **NO:** Go to next step.

OUMX258,0000202 -19-03JUN14-6/10

5 Continuity Check	1. Ignition OFF, Engine OFF 2. Measure resistance between A5501 connector female socket 20 and Y5401 connector female socket A. 3. Measure resistance between A5501 connector female socket 19 and Y5401 connector female socket B. Are both resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair open, high resistance, or mis-pin in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000202 -19-03JUN14-7/10

6 Short to Ground Check	1. Reconnect ECU connector A5501.	
	2. Measure resistance between Y5401 connector female socket A and single point ground.	
	3. Measure resistance between Y5401 connector female socket B and single point ground.	**YES:** Repair drive wire short to ground in harness. Perform Verification Procedure.
	Is either measurement less than 100 ohms?	**NO:** Go to next step.

OUMX258,0000202 -19-03JUN14-8/10

7 Wire to Wire Check	1. Measure resistance between A5501 connector female socket 19 and all other sockets in A5501.	
	2. Measure resistance between A5501 connector female socket 20 and all other sockets in A5501.	**YES:** Repair drive wire short in harness. Perform Verification Procedure.
	Is any measurement less than 100k ohms?	**NO:** Go to next step.

OUMX258,0000202 -19-03JUN14-9/10

8 Replace Air Throttle Actuator	1. Ignition OFF, Engine OFF.	
	2. Replace air throttle actuator.	
	3. Reconnect all components.	
	4. Ignition ON, engine running.	
	5. Wait 90 seconds. Refresh DTCs.	**YES:** See CTM120419.
	Is DTC 002950.05 active?	**NO:** Perform Verification Procedure.

OUMX258,0000202 -19-03JUN14-10/10

ECU 003242.00 — DOC Inlet Temperature Extremely High

The ECU has detected that the DOC inlet temperature is less than the specification.

Troubleshooting Sequence:
Any DTC
003242.00

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Related Information:
The DOC inlet temperature sensor signal voltage to the ECU corresponds to a temperature greater than what is physically possible for the DOC inlet temperature sensor.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.

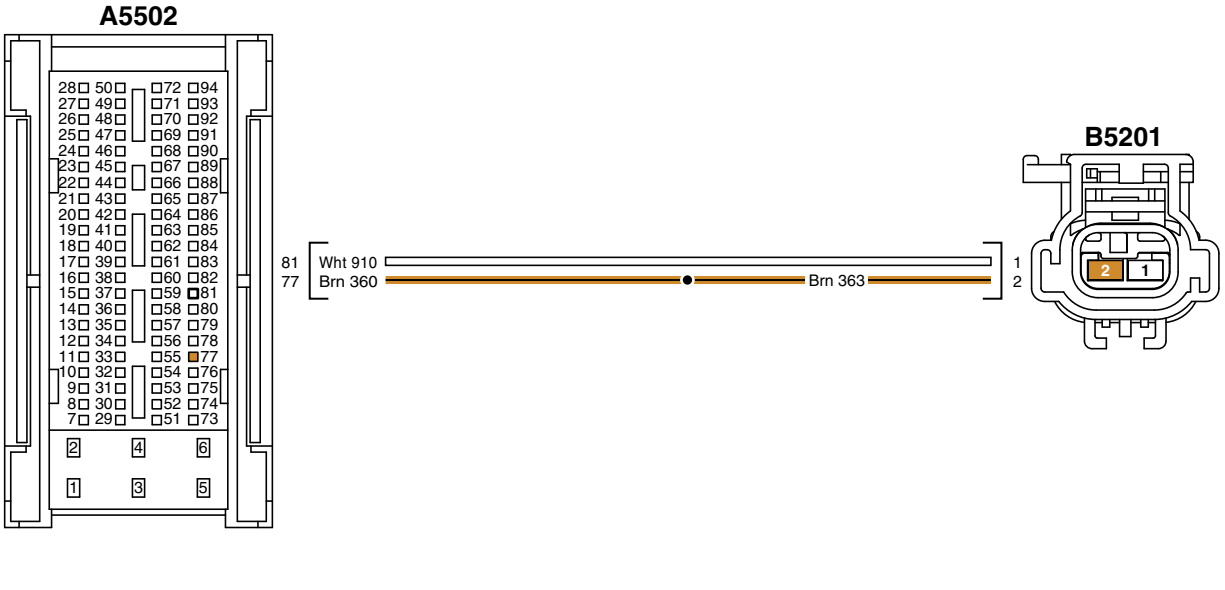
Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Inlet Temperature Sensor Wiring Diagram

A5502—77—Return **A5502—81—Signal**

OUMX258,0000203 -19-03JUN14-1/5

Diagnostic Procedure

OUMX258,0000203 -19-03JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Ignition OFF, Engine OFF. 4. Disconnect DOC inlet temperature sensor connector B5201. 5. Perform Terminal Test on sensor and B5201 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

Continued on next page

OUMX258,0000203 -19-03JUN14-3/5

❷ Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Inlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Inlet Temperature Input Voltage	2.8 — 3.2 V

Is voltage between 2.8 and 3.2 V?

YES: Go to next step.

NO: See CTM120419.

OUMX258,0000203 -19-03JUN14-4/5

❸ Condition Check

1. Ignition OFF, Engine OFF.
2. Reconnect all connectors and components.
3. Inspect for possible causes of high exhaust temperatures such as:
   - Fuel injection system problems
   - Turbocharger compressor inlet restrictions (if applicable)
   - DOC inlet piping damage
   - Excessive blow-by
   - Turbocharger system problems (if applicable)
   - EGR system problems

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Replace sensor. Perform Verification Procedure.

OUMX258,0000203 -19-03JUN14-5/5

ECU 003242.03 — DOC Inlet Temperature Signal Out of Range High

The DOC inlet temperature sensor signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
003242.03

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Related Information:
The DOC inlet temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the DOC inlet temperature sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

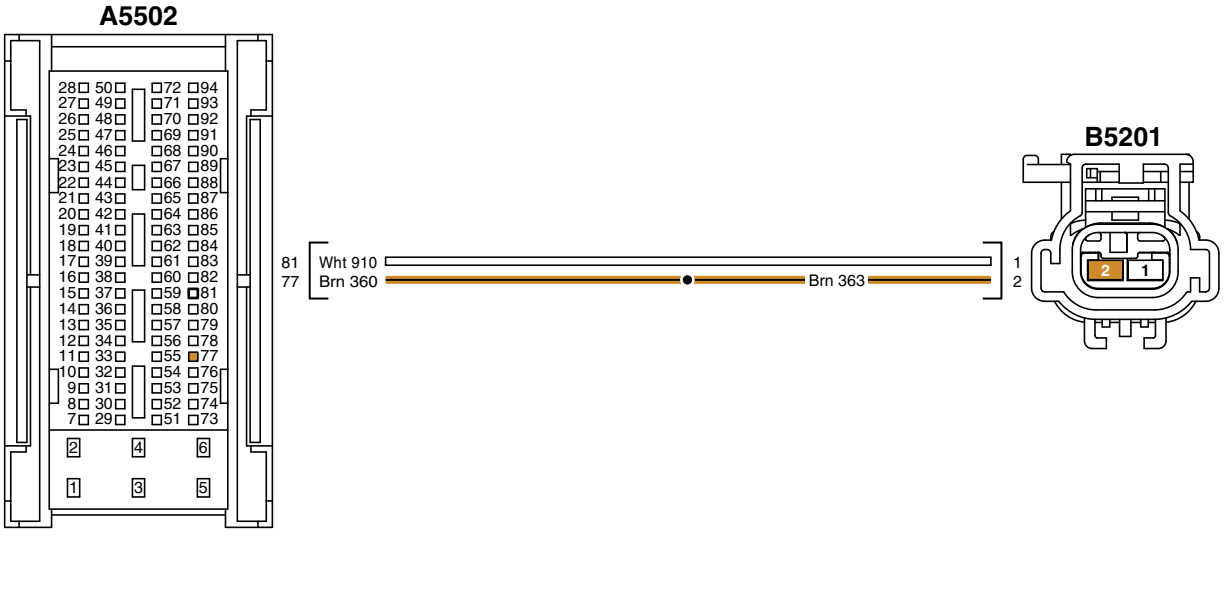
Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Inlet Temperature Sensor Wiring Diagram

A5502— 77—Return **A5502— 81—Signal**

OUMX258,0000204 -19-07JUL14-1/5

Diagnostic Procedure

Continued on next page

OUMX258,0000204 -19-07JUL14-2/5

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Ignition ON, engine running.
5. Refresh Codes.

Is DTC 003242.03 active?

YES: Go to next step.

NO: Perform Aftertreatment Verification Procedure.

OUMX258,0000204 -19-07JUL14-3/5

2 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect DOC inlet temperature sensor connector B5201.
3. Perform Terminal Test on sensor and B5201 connector.

Were any problems found?

YES: Repair problem. Perform Aftertreatment Verification Procedure.

NO: Go to next step.

OUMX258,0000204 -19-07JUL14-4/5

3 Sensor Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Inlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Inlet Temperature Input Voltage	2.8 — 3.2 V

Is voltage between 2.8 and 3.2 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,0000204 -19-07JUL14-5/5

ECU 003242.04 — DOC Inlet Temperature Signal Out of Range Low

The DOC inlet temperature sensor signal exceeds the sensor low voltage specification.

Troubleshooting Sequence:
003242.03
003242.04

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Related Information:
The DOC inlet temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the DOC inlet temperature sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

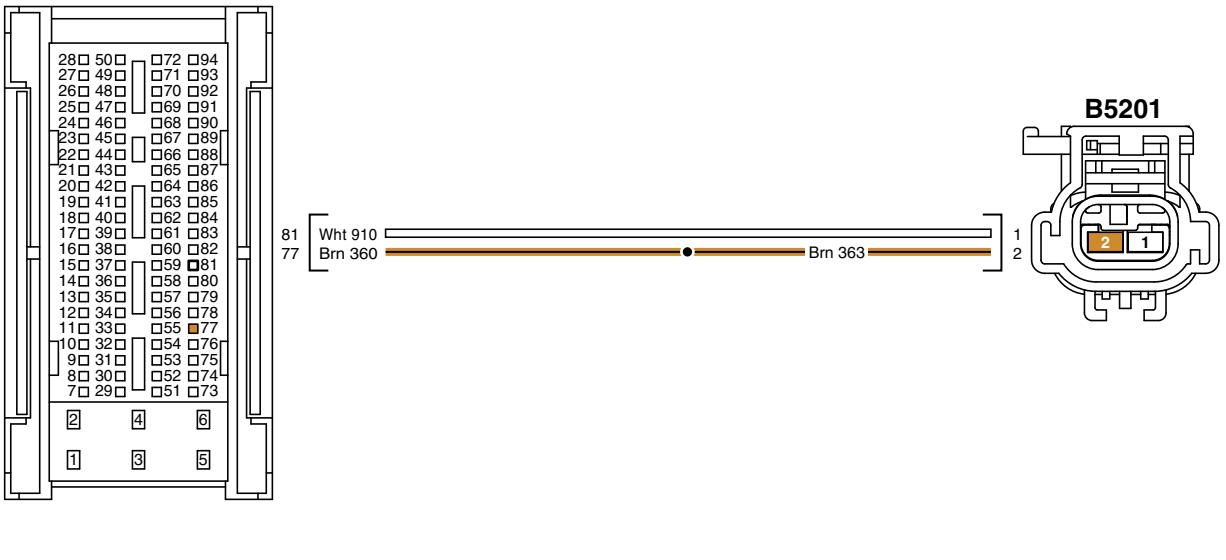
Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Inlet Temperature Sensor Wiring Diagram

A5502—77—Return **A5502—81—Signal**

OUMX258,0000205 -19-03JUN14-1/5

Diagnostic Procedure

OUMX258,0000205 -19-03JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 003242.03 a stored code?	**YES:** See DTC 003242.03. **NO:** Go to next step.

Continued on next page

OUMX258,0000205 -19-03JUN14-3/5

❷ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect DOC inlet temperature sensor connector B5201.
3. Perform Terminal Test on sensor and B5201 connector.

Were any problems found?

YES: Repair problem. Perform Aftertreatment Verification Procedure.

NO: Go to next step.

OUMX258,0000205 -19-03JUN14-4/5

❸ Sensor Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Inlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Inlet Temperature Input Voltage	2.8 — 3.2 V

Is voltage between 2.8 and 3.2 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,0000205 -19-03JUN14-5/5

ECU 003250.00 — DOC Outlet Temperature Extremely High

The ECU has detected that the DOC outlet temperature is greater than the specification.

Troubleshooting Sequence:
003250.00

When DTC is Displayed:
When the ignition is on, the engine is running, active regeneration is occurring, and the fault is active.

Related Information:
The DOC outlet temperature sensor signal voltage to the ECU corresponds to a temperature greater than what is expected by the ECU.
The DOC inlet temperature sensor B5201, DOC outlet temperature sensor B5202, and aftertreatment pressure sensor B5109 utilize a common 5 V sensor return circuit from ECU A5502 connector, pin 77. A failure on this common circuit may result in fault codes for more than one of the components listed.
This DTC can indicate:

A faulty DOC outlet temperature sensor

A DOC outlet temperature sensor circuit issue
Unintended hydrocarbons in the DOC

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

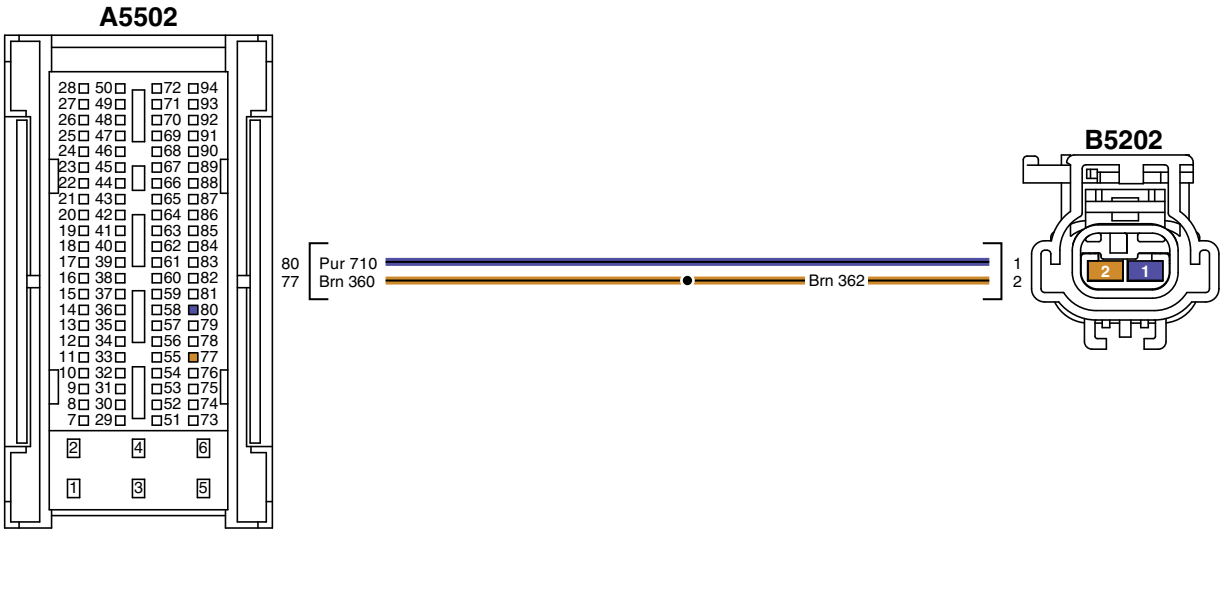
For more information on the Exhaust Condition Check, see CTM120419 Section 04, Group 155.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Outlet Temperature Sensor Wiring Diagram

A5502—77—Return **A5502—80—Signal**

OUMX258,0000206 -19-03JUN14-1/5

Diagnostic Procedure

Continued on next page

OUMX258,0000206 -19-03JUN14-2/5

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.
2. Ignition OFF, Engine OFF.

CAUTION: Wait until exhaust filter is cool enough to touch to avoid burning injury.

3. Disconnect DOC Outlet temperature sensor connector B5202.
4. Perform Terminal Test on sensor and B5202 connector.

Were any problems found?

YES: Repair problem.

NO: Go to next step.

OUMX258,0000206 -19-03JUN14-3/5

2 Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Outlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Outlet Temperature Input Voltage	2.8 — 3.2 V

Does voltage remain between 2.8 and 3.2 V?

YES: Go to next step.

NO: Repair harness problem. Perform “Exhaust Condition Check”. See CTM120419 Section 04, Group 155.

OUMX258,0000206 -19-03JUN14-4/5

3 Replace Sensor

1. Replace DOC Outlet temperature sensor.
2. If possible, run engine under operating conditions that set code.
3. Refresh codes.

Did DTC 003250.00 reappear?

YES: See CTM120419.

NO: Perform “Exhaust Condition Check”. See CTM120419 Section 04, Group 155.

OUMX258,0000206 -19-03JUN14-5/5

ECU 003250.01 — DOC Outlet Temperature Extremely Low

The ECU has detected that the DOC outlet temperature is less than the specification.

Troubleshooting Sequence:
003250.01

When DTC is Displayed:
When the ignition is on, the engine is running, active regeneration is occurring, and the fault is active.

Related Information:
The DOC outlet temperature sensor signal voltage to the ECU corresponds to a temperature less than what is expected by the ECU. The DOC inlet temperature sensor B5201, DOC outlet temperature sensor B5202, and aftertreatment pressure sensor B5109 utilize a common 5 V sensor return circuit from ECU A5502 connector, pin 77. A failure on this common circuit may result in fault codes for more than one of the components listed. This DTC can indicate:

A faulty DOC outlet temperature sensor
A DOC outlet temperature sensor circuit issue
Unintended hydrocarbons in the DOC

NOTE: The fault can be caused by running fuel with too high of sulfur content. Refer to your operators manual to ensure that the correct fuel is being used.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

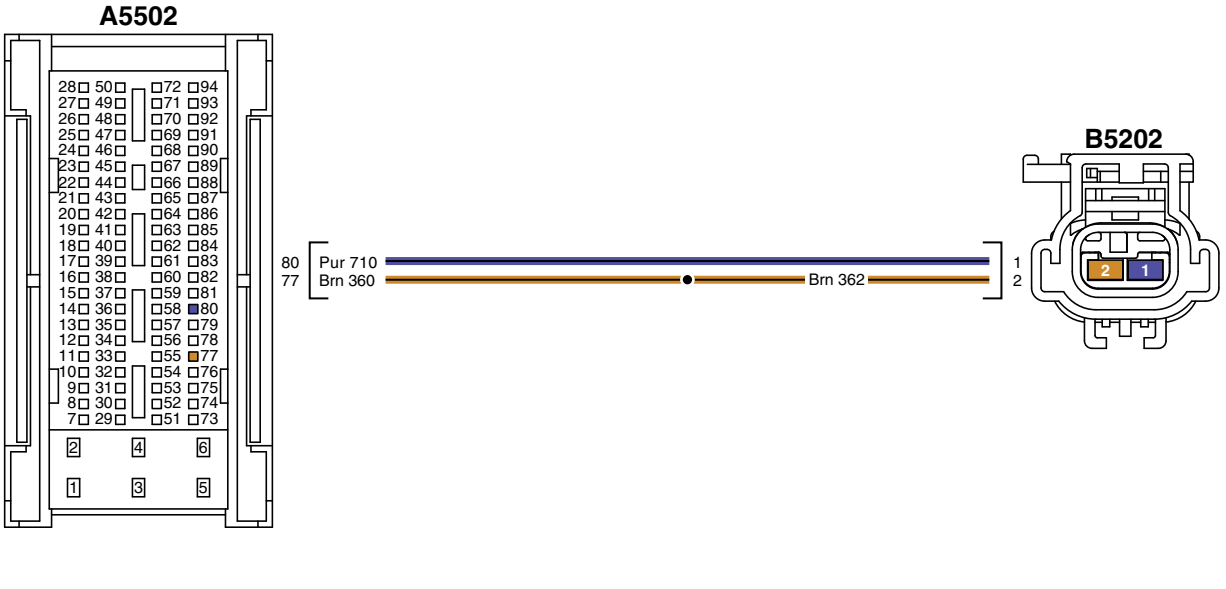
For more information on the Service Regeneration, see CTM120419 Section 04, Group 160.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Outlet Temperature Sensor Wiring Diagram

A5502—77—Return **A5502—80—Signal**

OUMX258,0000207 -19-03JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,0000207 -19-03JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Review snapshot data for code 003250.01.

Was ambient temperature below -20 °C (-4 °F) when DTC 003250.01 was active?

YES: Go to next step.

NO: Perform Terminal Test.

OUMX258,0000207 -19-03JUN14-3/6

2 Service Regeneration Check

1. Ignition ON, engine running.
2. In Service ADVISOR, monitor Engine Coolant Temperature.
3. Run engine until Engine Coolant Temperature rises above 75 °C (167 °F).
4. In Service ADVISOR, perform Service Regeneration, see CTM120419 Section 04, Group 160 for instructions.

Does DTC 003250.01 become active?

YES: Go to next step.

NO: Perform “Exhaust Condition Check”. See CTM120419 Section 04, Group 155.

OUMX258,0000207 -19-03JUN14-4/6

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect B5202 DOC Outlet Temperature Sensor connector.
3. Perform Terminal Test on sensor and B5202 connector.

Were any problems found?

YES: Repair Problem. Perform “Exhaust Condition Check”. See CTM120419 Section 04, Group 155.

NO: Go to next step.

OUMX258,0000207 -19-03JUN14-5/6

4 Sensor Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Outlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Outlet Temperature Input Voltage	2.8 — 3.2 V

Does voltage remain between 2.8 and 3.2 V?

YES: Replace sensor. Perform “Exhaust Condition Check”. See CTM120419 Section 04, Group 155.

NO: See CTM120419.

OUMX258,0000207 -19-03JUN14-6/6

ECU 003250.03 — DOC Outlet Temperature Signal Out of Range High

The DOC outlet temperature sensor signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
003250.03

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Related Information:
The DOC outlet temperature sensor signal voltage to the ECU corresponds to a temperature higher than what is physically possible for the DOC outlet temperature sensor. The DOC inlet temperature sensor B5201, DOC outlet temperature sensor B5202, and aftertreatment pressure sensor B5109 utilize a common 5 V sensor return circuit from ECU A5502 connector, pin 77. A failure on this common circuit may result in fault codes for more than one of the components listed.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.
The ECU commands an engine stop after 15 minutes of continuous operation with the fault active.

Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

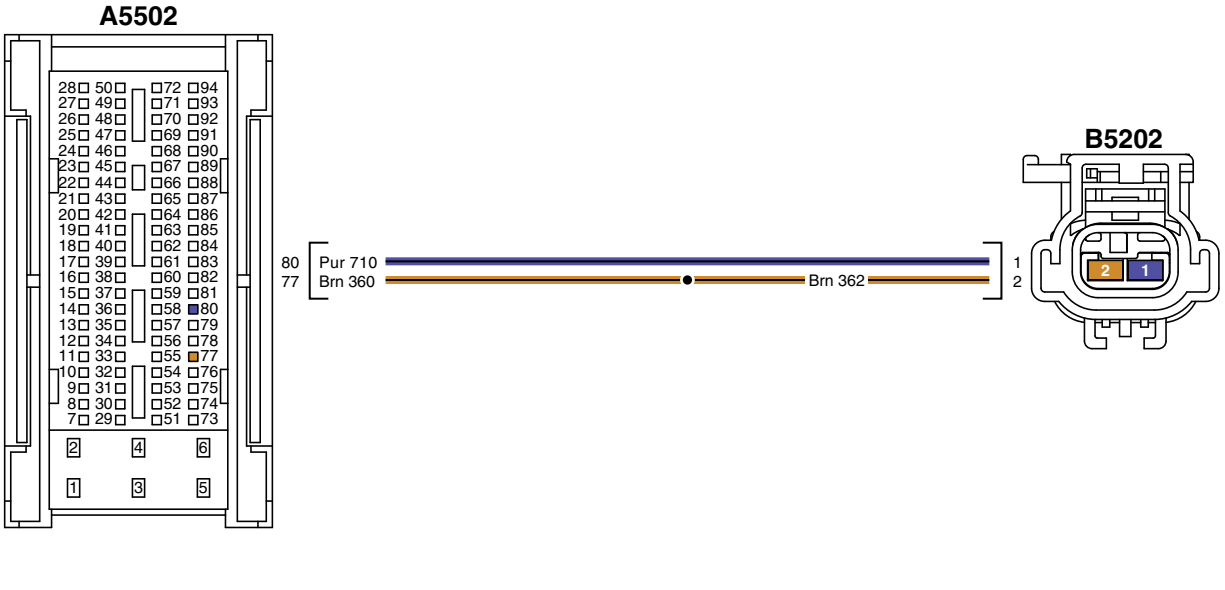
For more information on the Exhaust Condition Check, see CTM120419 Section 04, Group 155.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Outlet Temperature Sensor Wiring Diagram

A5502—77—Return **A5502—80—Signal**

OUMX258,0000208 -19-03JUN14-1/5

Diagnostic Procedure

Continued on next page

OUMX258,0000208 -19-03JUN14-2/5

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Ignition ON, engine running.
4. Refresh codes.

Is DTC 003250.03 active?

YES: Go to next step.

NO: Perform Aftertreatment Verification Procedure. See CTM120419.

OUMX258,0000208 -19-03JUN14-3/5

2 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect DOC outlet temperature sensor connector B5202.
3. Perform Terminal Test on sensor and B5202 connector.

Were any problems found?

YES: Repair problem. Perform Aftertreatment Verification Procedure. See CTM120419.

NO: Go to next step.

OUMX258,0000208 -19-03JUN14-4/5

3 Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Outlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Outlet Temperature Input Voltage	2.8 — 3.2 V

Does voltage remain between 2.8 and 3.2 V?

YES: Replace sensor. Perform Aftertreatment Verification Procedure. See CTM120419.

NO: See CTM120419.

OUMX258,0000208 -19-03JUN14-5/5

ECU 003250.04 — DOC Outlet Temperature Signal Out of Range Low

The DOC outlet temperature sensor signal exceeds the sensor low voltage specification.

Troubleshooting Sequence:
003250.03
003250.04

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Related Information:
The DOC outlet temperature sensor signal voltage to the ECU corresponds to a temperature lower than what is physically possible for the DOC outlet temperature sensor. The DOC inlet temperature sensor B5201, DOC outlet temperature sensor B5202, and aftertreatment pressure sensor B5109 utilize a common 5 V sensor return circuit from ECU A5502 connector, pin 77. A failure on this common circuit may result in fault codes for more than one of the components listed.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU will abort an active regeneration.

Additional References:
For sensor location, more temperature sensor information, information on how to use Diagnostic Test Box, more information on the Aftertreatment Verification Procedure, and more information on the Service Regeneration test, see CTM120419.

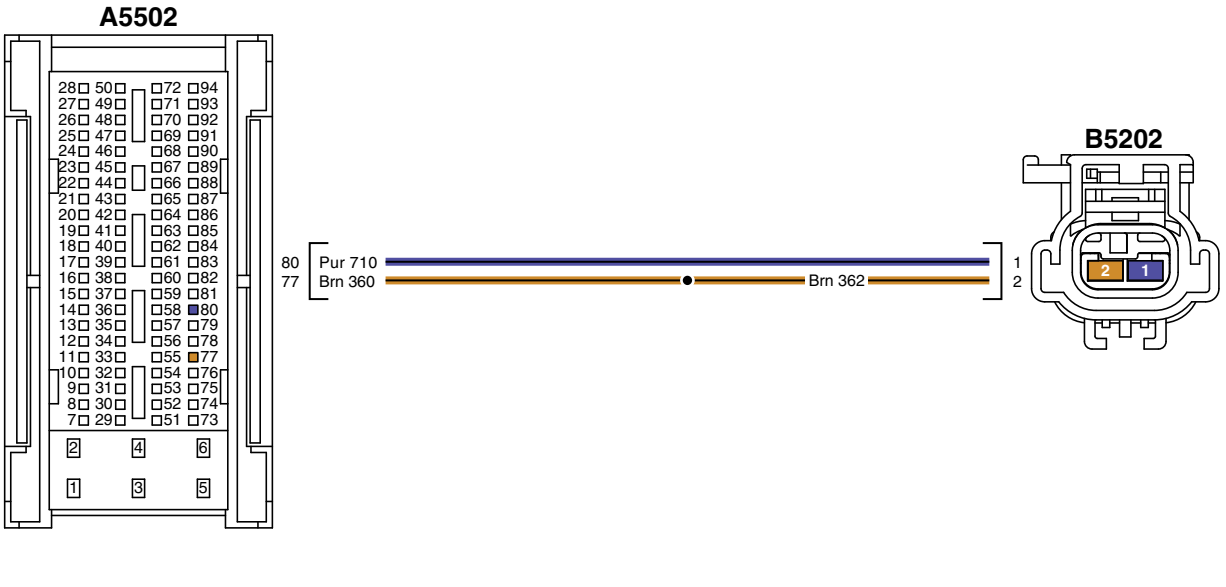
For more information on the Exhaust Condition Check, see CTM120419 Section 04, Group 155.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



DOC Outlet Temperature Sensor Wiring Diagram

A5502—77—Return **A5502—80—Signal**

OUMX258,0000209 -19-03JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,0000209 -19-03JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Ignition ON, engine running.
5. Refresh codes.

Is DTC 003250.03 a stored code?

YES: See CTM120419.

NO: Go to next step.

OUMX258,0000209 -19-03JUN14-3/6

2 Code Check

Is DTC 003250.04 active?

YES: Go to next step.

NO: Perform Aftertreatment Verification Procedure. See CTM120419.

OUMX258,0000209 -19-03JUN14-4/6

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect DOC outlet temperature sensor connector B5202.
3. Perform Terminal Test on sensor and B5202 connector.

Were any problems found?

YES: Repair problem. Perform Aftertreatment Verification Procedure. See CTM120419.

NO: Go to next step.

OUMX258,0000209 -19-03JUN14-5/6

4 Circuit Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR, monitor DOC Outlet Temperature Input Voltage.
3. Perform Wiggle Test.

Data Point	Normal Range
DOC Outlet Temperature Input Voltage	2.8 — 3.2 V

Does voltage remain between 2.8 and 3.2 V?

YES: Replace sensor. Perform Aftertreatment Verification Procedure.

NO: See CTM120419.

OUMX258,0000209 -19-03JUN14-6/6

ECU 003251.00 — DPF Differential Pressure Extremely High

The DPF Differential Pressure Sensor is not responding or the ECU has detected an exhaust flow and DPF differential pressure correlation problem.

Troubleshooting Sequence:
003251.03
003251.04
003251.00

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The DPF Differential Pressure Sensor is reporting a pressure greater than specifications allow.

NOTE: This DTC can be caused by extreme cold conditions where moisture has frozen in a line. DTC clears once line thaws.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

Additional References:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

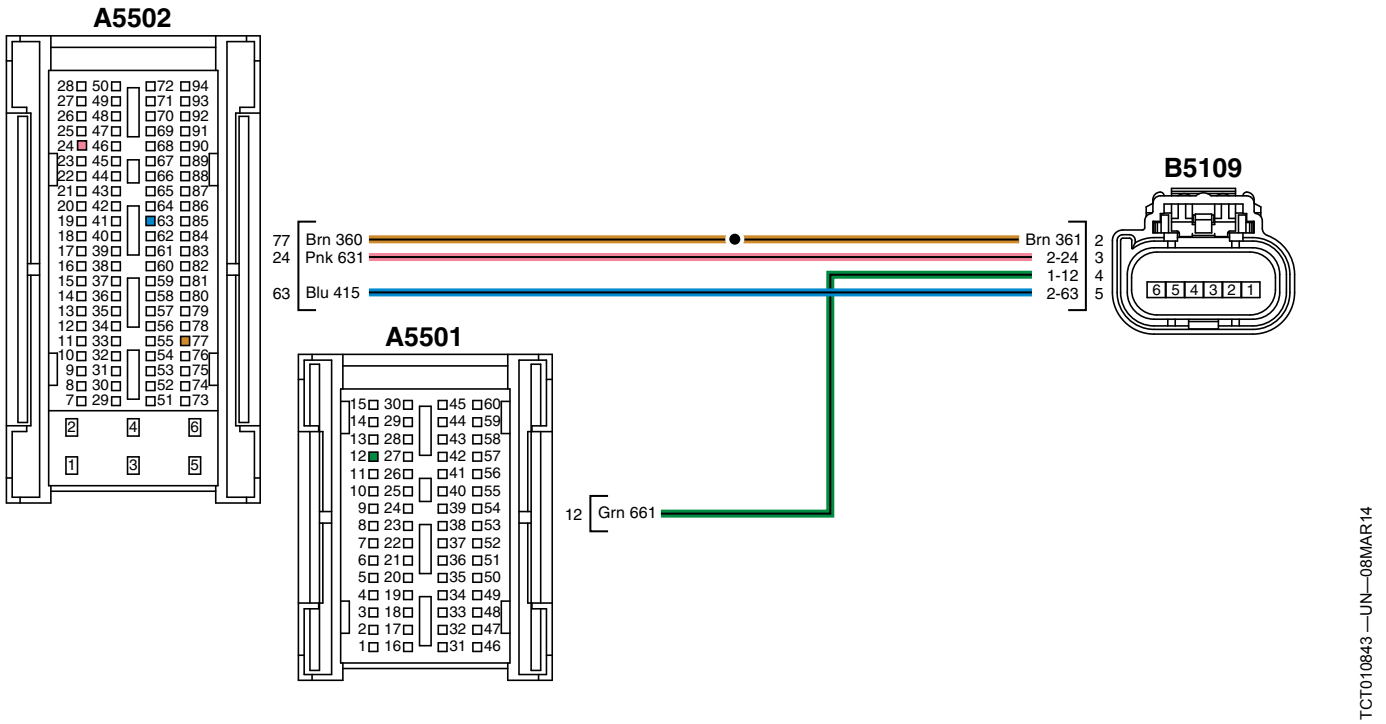
For more information on the control unit information and overview test, see CTM120419 Section 04, Group 160.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501 — 12—DPF Inlet Pressure Sensor Signal

A5502 — 24—Supply

A5502 — 63—DPF Differential Pressure Signal

A5502 — 77—Return

OUMX258,000020A -19-03JUN14-1/8

Diagnostic Procedure

Continued on next page

OUMX258,000020A -19-03JUN14-2/8

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Refresh codes.

Is DTC 003251.03 stored?

YES: See DTC 003251.03 procedure.

NO: Go to next step.

OUMX258,000020A -19-03JUN14-3/8

2 Code Check

Is DTC 003251.04 stored?

YES: See DTC 003251.04 procedure.

NO: Go to next step.

OUMX258,000020A -19-03JUN14-4/8

3 Line Check

1. Ignition OFF, Engine OFF
2. Remove lines from DPF to the aftertreatment pressure sensor.
3. Inspect lines for obstructions.

Are obstructions found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020A -19-03JUN14-5/8

4 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect aftertreatment pressure sensor connector B5109.
3. Perform Terminal Test on sensor and B5109 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020A -19-03JUN14-6/8

5 Continuity Check

Measure resistance between A5501 connector female socket 63 and B5109 connector female socket 5.

Is resistance measurement less than 5 ohms?

YES: Repair short on signal wire in harness. Perform Verification Procedure.

NO: Repair high resistance or mis-pin on signal wire in harness. Perform Verification Procedure.

OUMX258,000020A -19-03JUN14-7/8

6 Circuit Check

1. In Service ADVISOR, monitor DPF Differential Pressure Input Voltage.
2. Perform Wiggle Test.

Data Point	Normal Range
DPF Differential Pressure Input Voltage	2.7 — 3.1 V

Is voltage between 2.7 and 3.1 V?

YES: Replace aftertreatment pressure sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000020A -19-03JUN14-8/8

ECU 003251.03 — DPF Differential Pressure Signal Out of Range High

The DPF Differential pressure signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
003251.03

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The DPF Differential pressure signal voltage to the ECU corresponds to a pressure higher than what is physically possible for the DPF Differential pressure sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

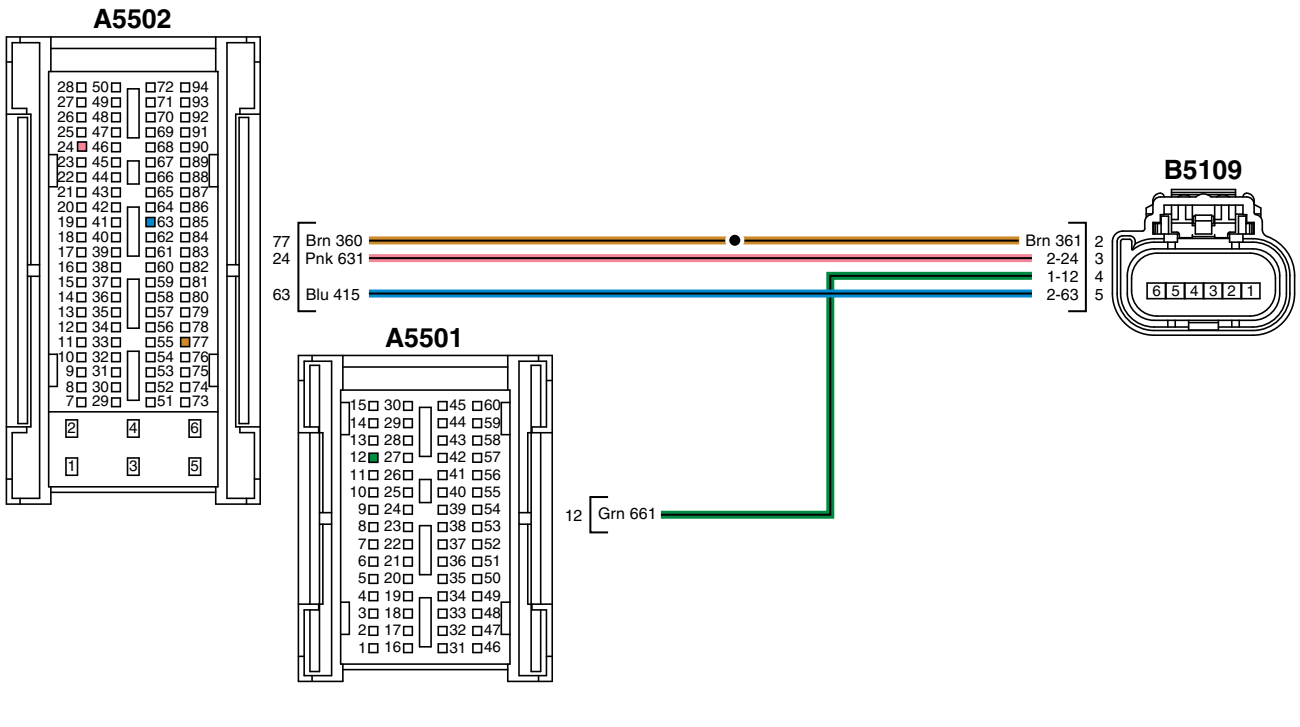
Additional References:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501 — 12—DPF Inlet Pressure Sensor Signal

A5502 — 24—Supply
A5502 — 63—DPF Differential Pressure Signal

A5502 — 77—Return

OUMX258,000020B -19-03JUN14-1/7

Diagnostic Procedure

Continued on next page

OUMX258,000020B -19-03JUN14-2/7

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. Ignition ON, Engine OFF.
4. Refresh codes.

Is DTC 003251.03 active or stored?

YES: Go to next step.

NO: Go to “Circuit Check” step.

OUMX258,000020B -19-03JUN14-3/7

2 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect aftertreatment pressure sensor connector B5109.
3. Perform Terminal Test on sensor and B5109 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020B -19-03JUN14-4/7

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect ECU connectors A5501 and A5502.
3. Perform Terminal Test on A5501 connector female socket 12 and A5502 connector female sockets 24, 63, and 77, and corresponding ECU male pins.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020B -19-03JUN14-5/7

4 Continuity Check

1. Measure the resistance between A5502 connector female socket 77 and B5109 connector female socket 2.
2. Measure the resistance between A5502 connector female socket 63 and B5109 connector female socket 5.

Are both resistance measurements less than 5 ohms?

YES: See Problem Not Found Procedure.

NO: Repair mis-pin. Perform Aftertreatment Verification Procedure.

OUMX258,000020B -19-03JUN14-6/7

5 Circuit Check

1. Ignition ON, Engine OFF.
2. Monitor DPF Differential Pressure Input Voltage in Service ADVISOR.
3. Perform Wiggle Test.

Data Point	Normal Range
DPF Differential Pressure Input Voltage	2.7 — 3.1 V

Does sensor input voltage ever read greater than 4.8 V?

YES: Repair harness problem. Perform Verification Procedure

NO: See CTM120419

OUMX258,000020B -19-03JUN14-7/7

ECU 003251.04 — DPF Differential Pressure Signal Out of Range Low

The DPF differential pressure signal is lower than the sensor low voltage specification.

Troubleshooting Sequence:
003251.03
003251.04

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The DPF differential pressure sensor signal voltage to the ECU corresponds to a pressure lower than what is physically possible for the DPF differential pressure sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

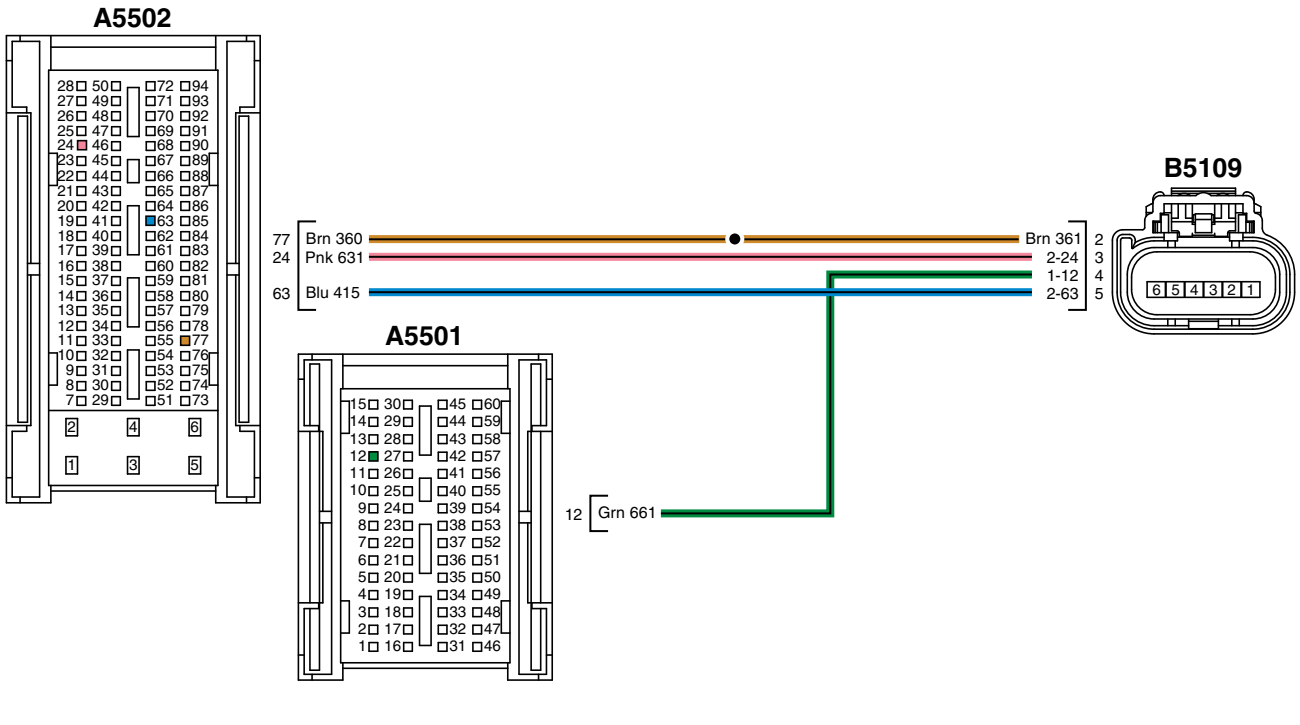
Additional References:
For sensor location, more pressure sensor information, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501 — 12—DPF Inlet Pressure Sensor Signal
A5502 — 24—Supply
A5502 — 63—DPF Differential Pressure Signal
A5502 — 77—Return

OUMX258,000020C -19-03JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,000020C -19-03JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Refresh codes.

Is DTC 003251.03 stored?

YES: See DTC 003251.03 procedure.

NO: Go to next step.

OUMX258,000020C -19-03JUN14-3/6

2 Code Check

Is DTC 003251.04 active?

YES: Go to next step.

NO: Go to “Circuit Check” step.

OUMX258,000020C -19-03JUN14-4/6

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect aftertreatment pressure sensor connector B5109.
3. Perform Terminal Test on sensor and B5109 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020C -19-03JUN14-5/6

4 Circuit Check

1. In Service ADVISOR, monitor DPF Differential Pressure Input Voltage.
2. Perform Wiggle Test.

Data Point	Normal Range
DPF Differential Pressure Input Voltage	2.7 — 3.1 V

Is voltage between 2.7 and 3.1 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000020C -19-03JUN14-6/6

ECU 003251.13 — DPF Differential Pressure Sensor Calibration Fault

The ECU detects a difference in the DPF differential pressure signal compared to other pressure sensors prior to startup.

Troubleshooting Sequence:
003251.03
003251.04
003251.13

When DTC is Displayed:
When the ignition is ON, engine OFF, and the fault is active.

Related Information:
At ignition ON, engine OFF prior to starting the engine, the ECU compares pressure sensor values to detect abnormal sensor values.
This fault is set when the DPF differential pressure sensor value is not within a predetermined range compared to the other pressure sensors.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

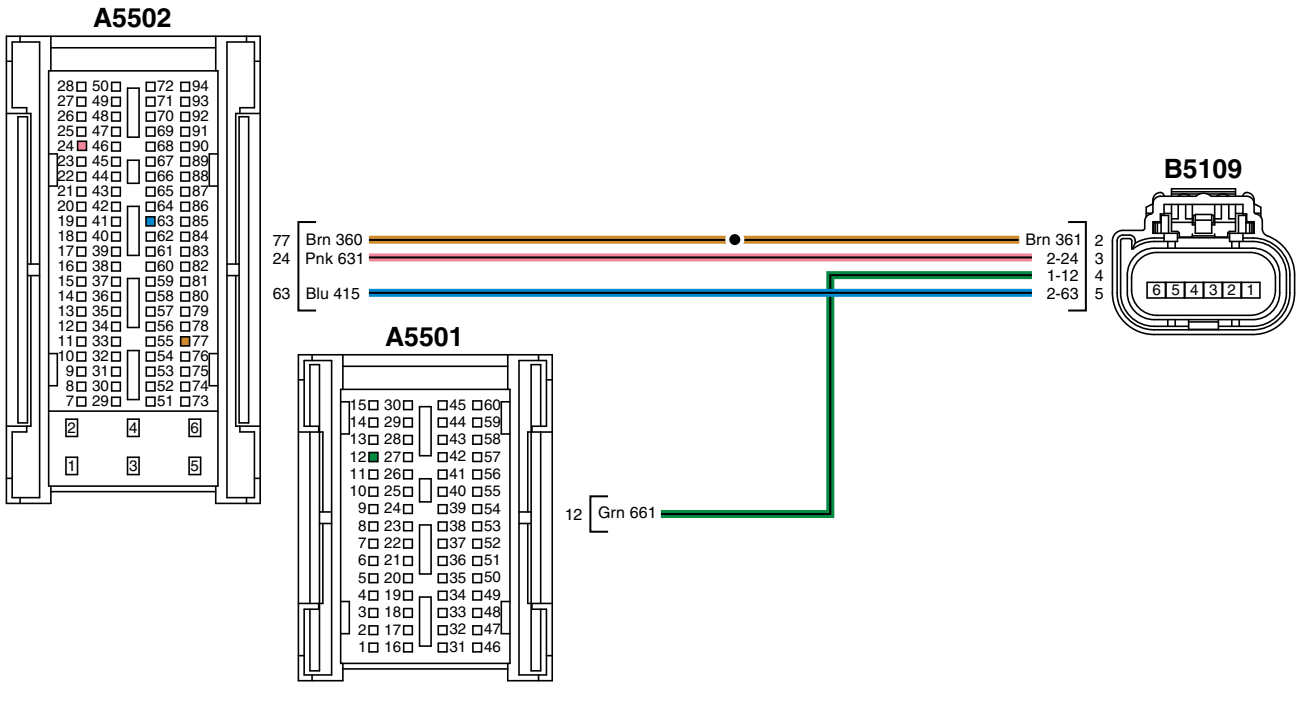
Additional References:
For sensor location, more pressure sensor information, information on how to measure pressures, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501 — 12—DPF Inlet Pressure Sensor Signal
A5502 — 24—Supply
A5502 — 63—DPF Differential Pressure Signal
A5502 — 77—Return

OUMX258,000020D -19-03JUN14-1/6

Diagnostic Procedure

Continued on next page

OUMX258,000020D -19-03JUN14-2/6

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Refresh codes.

Is DTC 003251.03 active or stored?

YES: See DTC 003251.03 procedure.

NO: Go to next step.

OUMX258,000020D -19-03JUN14-3/6

2 Code Check

Is DTC 003251.04 active or stored?

YES: See DTC 003251.04 procdure.

NO: Go to next step.

OUMX258,000020D -19-03JUN14-4/6

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect aftertreatment pressure sensor connector B5109.
3. Perform Terminal Test on sensor and B5109 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020D -19-03JUN14-5/6

4 Circuit Check

1. In Service ADVISOR, monitor DPF Differential Pressure Input Voltage.
2. Perform Wiggle Test.

Data Point	Normal Range
DPF Differential Pressure Input Voltage	2.7 — 3.1 V

Is voltage between 2.7 and 3.1 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000020D -19-03JUN14-6/6

ECU 003609.03 — DPF Inlet Pressure Signal Out of Range High

The DPF inlet pressure signal exceeds the sensor high voltage specification.

Troubleshooting Sequence:
003609.03

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The DPF inlet pressure signal voltage to the ECU corresponds to a pressure higher than what is physically possible for the DPF inlet pressure sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

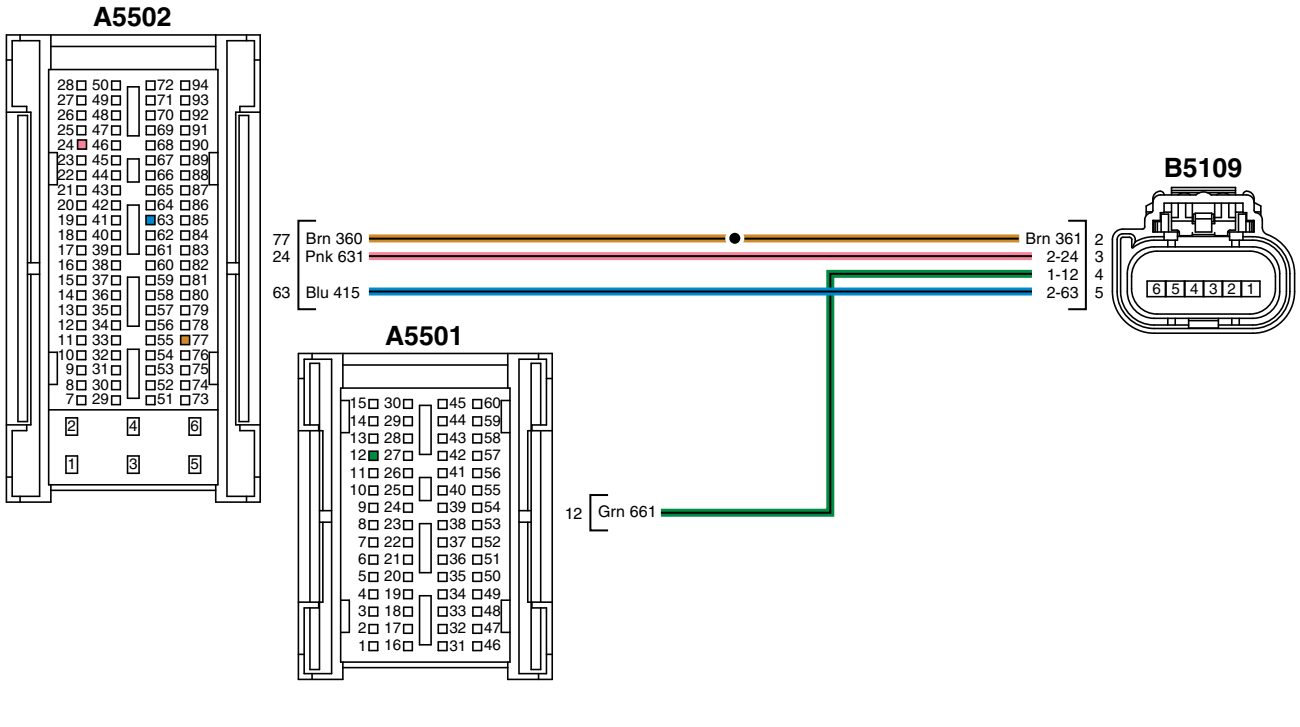
Additional References:
For sensor location, more pressure sensor information, information on how to measure pressures, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501 — 12—DPF Inlet Pressure Sensor Signal

A5502 — 24—Supply
A5502 — 63—DPF Differential Pressure Signal

A5502 — 77—Return

OUMX258,000020E -19-03JUN14-1/7

Diagnostic Procedure

Continued on next page

OUMX258,000020E -19-03JUN14-2/7

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared Snapshot information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information, save the information.
4. Ignition ON, engine running.
5. Refresh codes.

Is DTC 003609.03 active or stored?

YES: Go to next step.

NO: Go to "Circuit Check" procedure.

OUMX258,000020E -19-03JUN14-3/7

2 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect aftertreatment pressure sensor connector B5109.
3. Perform Terminal Test on sensor and B5109 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020E -19-03JUN14-4/7

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect ECU connectors A5501 and A5502.
3. Perform Terminal Test on ECU connectors A5501 and A5502.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020E -19-03JUN14-5/7

4 Continuity Check

1. Measure the resistance between A5502 connector female socket 77 and B5109 connector female socket 2.
2. Measure the resistance between A5501 connector female socket 12 and B5109 connector female socket 4.

Are both resistance measurements less than 5 ohms?

YES: Go to next step.

NO: Repair mis-pin. Perform Verification Procedure.

OUMX258,000020E -19-03JUN14-6/7

5 Circuit Check

1. In Service ADVISOR, monitor DPF Inlet Pressure Input Voltage.
2. Perform Wiggle Test.

Data Point	Normal Range
DPF Inlet Pressure Input Voltage	1.9 — 2.3 V

Is voltage between 1.9 and 2.3 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000020E -19-03JUN14-7/7

ECU 003609.04 — DPF Inlet Pressure Signal Out of Range Low

The DPF inlet pressure signal is lower than the sensor low voltage specification.

Troubleshooting Sequence:
003609.03
003609.04

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The DPF inlet pressure sensor signal voltage to the ECU corresponds to a pressure lower than what is physically possible for the DPF inlet pressure sensor.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts an active regeneration.

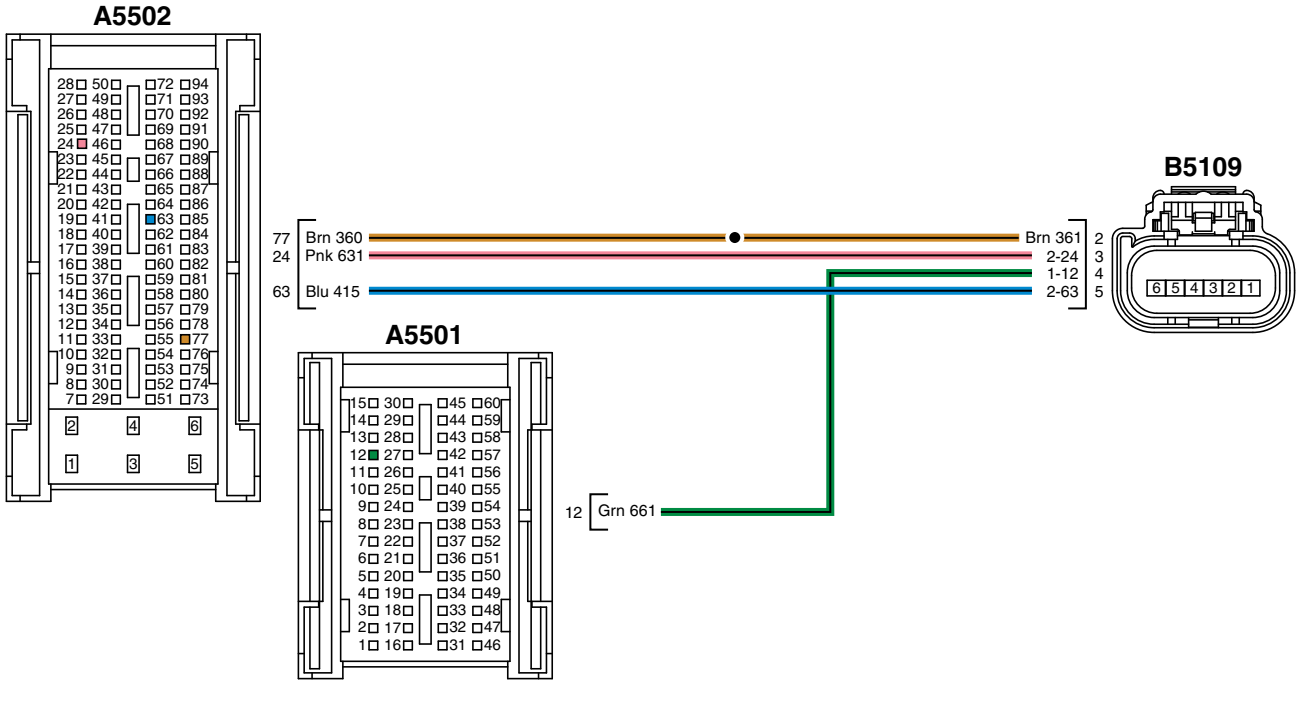
Additional References:
For sensor location, more pressure sensor information, information on how to measure pressures, and information on how to use Diagnostic Test Box, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501 — 12—DPF Inlet Pressure Sensor Signal

A5502 — 24—Supply

A5502 — 63—DPF Differential Pressure Signal

A5502 — 77—Return

OUMX258,000020F -19-03JUN14-1/7

Diagnostic Procedure

Continued on next page

OUMX258,000020F -19-03JUN14-2/7

1 Read DTCs and Store Snapshot Information

1. Connect Service ADVISOR.

NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.

2. Ignition ON, Engine OFF.
3. If any DTCs have snapshot capture or snapshot recording information.
4. Refresh codes.

Is DTC 003609.03 stored?

YES: See DTC 003609.03 procedure.

NO: Go to next step.

OUMX258,000020F -19-03JUN14-3/7

2 Code Check

Is DTC 003609.04 active?

YES: Go to next step.

NO: See CTM120419.

OUMX258,000020F -19-03JUN14-4/7

3 Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect aftertreatment pressure sensor connector B5109.
3. Perform Terminal Test on sensor and B5109 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000020F -19-03JUN14-5/7

4 Open or High Resistance Circuit Check

1. Press and hold both S2 and S3 buttons on Diagnostic Test Box.
2. Monitor voltage on multimeter.

Does voltage now remain between 4.8 and 5.2 V?

YES: Repair open or high resistance in return wire. Perform Verification Procedure.

NO: Repair open or high resistance in supply wire. Perform Verification Procedure.

OUMX258,000020F -19-03JUN14-6/7

5 Circuit Check

1. In Service ADVISOR, monitor DPF Inlet Pressure Input Voltage.
2. Perform Wiggle Test.

Data Point	Normal Range
DPF Inlet Pressure Input Voltage	1.9 — 2.3 V

Is voltage between 1.9 and 2.3 V?

YES: Replace sensor. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000020F -19-03JUN14-7/7

ECU 003695.14 — Exhaust Filter Cleaning Inhibited by Operator Interface (PDU)

Code Caused By:

Operator manually turned off DPF functions.

Alarm Level:

Service alert

To Clear Display:

Check TechControl display for regeneration settings.

Alarm Frequency:

Audible

Control Unit Response:

None

Snapshot Recorded:

Yes

Required Tools:

None

Preliminary Checks:

Refer to Primary Display Unit (PDU) Section 235, Group 10 to change regeneration status.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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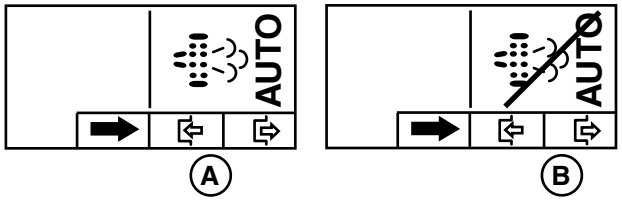
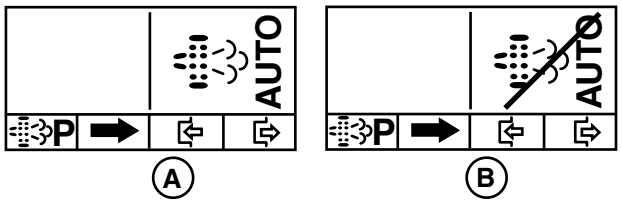


TCT010468 —UN—07FEB14

No Regeneration Required



TCT010526 —UN—17FEB14

A—Automatic Parked Regeneration Enabled

B—Automatic Parked Regeneration Disabled

Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

CB12260,000008B -19-03JUN14-1/1

ECU 003719.00 — Calculated Soot Level Extremely High

The DPF soot level indicates that the soot level in the DPF is extremely high.

OUMX258,0000210 -19-17JUN14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
Any active or stored DTC.
003719.00

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
There are two different soot models used to calculate soot level within the DPF. There is a calculated base model, and a DPF pressure differential based model. One or more of these models is indicating that the soot level within the DPF is extremely high.
This fault will set in conjunction with either the 522573.00 or 522574.00 DTC. These faults are for information only. This fault can be caused by other factors such as, regenerations being inhibited via the operator interface, improper sulfur content in the fuel, poor engine condition causing high blow-by, or electronic fuel injector fueling problems.

Using Service ADVISOR or the vehicle operator interface, a DPF Service Recovery procedure is required when the soot level within the DPF is extremely high.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.

Additional references:
For more information on the Control Unit Information and Overview Test, and more information on DPF Service Recovery test, see CTM120419.

OUMX258,0000210 -19-17JUN14-2/5

❶ **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. On the vehicle operator interface, view the Exhaust Filter Clean status. Does status read “Auto Clean Disabled”?	**YES:** Go to next step. **NO:** Go to “Monitor DTCs” step.

OUMX258,0000210 -19-17JUN14-3/5

❷ **DPF Recovery**	1. On the vehicle operator interface, change the Exhaust Filter Clean status to read “Auto Clean Enabled”. 2. Ignition ON, Engine Running. 3. In Service ADVISOR, perform DPF Service Recovery. Does DPF Service Recovery complete successfully?	**YES:** Talk to operator about machine usage and Exhaust Filter Cleaning process. **NO:** Go to next step.

Continued on next page

OUMX258,0000210 -19-17JUN14-4/5

❸ **Monitor DTCs**	Refresh DTCs. Are any DTCs other than 003719.00, 003719.16, 522573.00, or 522574.00 active or stored?	**YES:** Troubleshoot those DTCs. **NO:** Contact DTAC for support.

OUMX258,0000210 -19-17JUN14-5/5

ECU 003719.07 — DPF Recovery Prohibited

The DPF soot level indicates that the soot level in the DPF is extremely high.

OUMX258,0000211 -19-17JUN14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
Any active or stored DTC.
003719.07

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
There are two different soot models used to calculate soot level within the DPF. There is a calculated base model, and a DPF pressure differential based model. One or more of these models is indicating that the soot level within the DPF is extremely high.
This fault will set in conjunction with either the 522573.00 or 522574.00 DTC. These faults are for information only. This fault can be caused by other factors, such as, regenerations being inhibited via the operator interface, improper sulfur content in the fuel, poor engine condition causing high blow-by, or electronic fuel injector fueling problems.

Using Service ADVISOR or the vehicle operator interface, a DPF Service Recovery procedure is required when the soot level within the DPF is extremely high. For more information on DPF Service Recovery.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.

Additional references:
For more information on the Control Unit Information and Overview Test, see CTM120419.
For more information on DPF Service Recovery test, see CTM120419.

OUMX258,0000211 -19-17JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR, in Section 04, Group 160.	
	2. Ignition ON, Engine OFF.	
	3. In Service ADVISOR, perform Control Unit Information and Overview Test, see CTM120419.	
	4. On the vehicle operator interface, view the Exhaust Filter Clean status.	**YES:** Go to next step.
	Does status read “Auto Clean Disabled”?	**NO:** Go to step 3.

OUMX258,0000211 -19-17JUN14-3/5

2 DPF Recovery	1. On the vehicle operator interface, change the Exhaust Filter Clean status to read “Auto Clean Enabled”. See DPF Self Regeneration — Mode Select or DPF Parked Regeneration.	
	2. Ignition ON, Engine Running.	
	3. In Service ADVISOR, perform DPF Service Recovery, see CTM120419, Section 04, Group 160.	**YES:** Talk to operator about machine usage and Exhaust Filter Cleaning process.
	Does DPF Service Recovery complete successfully?	**NO:** Go to next step.

Continued on next page

OUMX258,0000211 -19-17JUN14-4/5

❸ **Monitor DTCs**	1. Ignition OFF, engine OFF for 60 seconds. 2. Ignition ON, engine OFF. 3. Refresh DTCs. Are any DTCs other than 003719.00, 003719.16, 522573.00, or 522574.00 active or stored?	**YES:** Troubleshoot those DTCs. **NO:** Contact DTAC for support.

OUMX258,0000211 -19-17JUN14-5/5

ECU 003719.09 — DPF Recovery Failed

The ECU has detected the DPF regeneration has failed.

OUMX258,0000212 -19-17JUN14-1/5

Diagnostic Procedure

Troubleshooting Sequence:
Any active or stored DTC.
003250.01
003719.09

When DTC is Displayed:
When the ignition is ON and the fault is active.

Related Information:
The fault can be caused by other factors such as, regenerations being inhibited, improper sulfur content in the fuel, or electronic fuel injector fuel problems.
Using Service ADVISOR or the vehicle operator interface, a DPF Service Recovery procedure is required when the soot level within the DPF is extremely high. For more information on DPF Service Recovery, see CTM120419.

Alarm Level:
Stop

Control Unit Response:
The ECU commands the engine to stop.

Additional references:
For more information on the Control Unit Information and Overview Test, more information on DPF Service Recovery test, see CTM120419.

OUMX258,0000212 -19-17JUN14-2/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. On the vehicle operator interface, view the Exhaust Filter Clean status. Does status read “Auto Clean Disabled”?	**YES:** Go to next step. **NO:** Go to “Monitor DTCs” step.

OUMX258,0000212 -19-17JUN14-3/5

2 DPF Recovery	1. On the vehicle operator interface, change the Exhaust Filter Clean status to read “Auto Clean Enabled”. 2. Ignition ON, Engine Running. 3. In Service ADVISOR, perform DPF Service Recovery, see DPF Recovery Regeneration in Section 04, Group 160. Does DPF Service Recovery complete successfully?	**YES:** Talk to operator about machine usage and Exhaust Filter Cleaning process. **NO:** Go to next step.

OUMX258,0000212 -19-17JUN14-4/5

3 Monitor DTCs	Refresh DTCs. Are any DTCs active or stored?	**YES:** Troubleshoot those DTCs. **NO:** Contact DTAC for support.

OUMX258,0000212 -19-17JUN14-5/5

ECU 003719.16 — Calculated Soot Level Moderately High

The DPF soot level indicates that the soot level in the DPF is moderately high.

Troubleshooting Sequence:
Any active or stored DTC.
003719.16

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
There are two different soot models used to calculate soot level within the DPF. There is a calculated base model, and a DPF pressure differential based model. One or more of these models is indicating that the soot level within the DPF is moderately high.
This fault will set in conjunction with either the 522573.00 or 522574.00 DTC. These faults are for information only. This fault can be caused by other factors, such as, regenerations being inhibited via the operator interface, improper sulfur content in the fuel, poor engine condition causing high blow-by, or electronic fuel injector fueling problems.

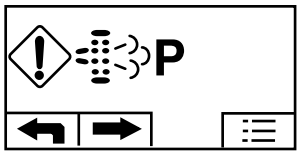
Using Service ADVISOR or the vehicle operator interface, a Service Regeneration procedure is required when the soot level within the DPF is moderately high.

Alarm Level:
Warning

Control Unit Response:

The ECU derates the engine.

TCT010529 —UN—17FEB14



Parked Cleaning Required - Warning

The TechControl will display a Parked Cleaning Required - Warning

Additional references:

See DPF Recovery Regeneration.

For more information on the Control Unit Information and Overview Test, and more information on Service Regeneration test, see CTM120419.

OUMX258,0000213 -19-17JUN14-1/6

Diagnostic Procedure

OUMX258,0000213 -19-17JUN14-2/6

1	**Regeneration**	Perform Service Regeneration. See DPF Recovery Regeneration. Does the code clear after regeneration is complete?	**YES:** Clear DTCs and check for related codes. **NO:** Go to next step.

OUMX258,0000213 -19-17JUN14-3/6

2	**Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. On the vehicle operator interface, view the Exhaust Filter Clean status. Does status read “Auto Clean Disabled”?	**YES:** Go to next step. **NO:** Go to “Monitor DTCs” step.

Continued on next page

OUMX258,0000213 -19-17JUN14-4/6

3 Service Regeneration	1. On the vehicle operator interface, change the Exhaust Filter Clean status to read “Auto Clean Enabled”. 2. Ignition ON, Engine Running. 3. In Service ADVISOR, perform Service Regeneration. See CTM120419 Section 04, Group 160. Does Service Regeneration complete successfully?	**YES:** Talk to operator about machine usage and Exhaust Filter Cleaning process. **NO:** Go to next step.

OUMX258,0000213 -19-17JUN14-5/6

4 Monitor DTCs	Refresh DTCs. Are any DTCs other than 003719.00, 003719.16, 522573.00, or 522574.00 active or stored?	**YES:** Troubleshoot those DTCs. **NO:** Contact DTAC for support.

OUMX258,0000213 -19-17JUN14-6/6

ECU 003720.00 — Calculated Ash Level Extremely High

The calculated ash level is extremely high.

Troubleshooting Sequence:
003251.04
003251.03
003251.00
003720.00

When DTC is Displayed:

When the ignition is ON, the engine is running, and the fault is active.

Related Information:

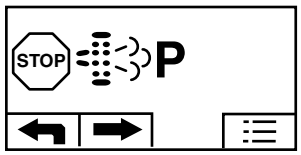
The calculated ash level is extremely high. This is the second notification to the operator that the DPF ash load is getting too high.

Alarm Level:

Function Limited or Stop

Control Unit Response:

TCT010527 —UN—17FEB14



Ash Cleaning required

The ECU derates the engine to 50%.

The TechControl will flash an Ash Cleaning Required icon each second.

Additional References:

See DPF Ash Cleaning Required.

For more DPF ash information, see “Exhaust Filter Operation” in CTM12041, in Section 03, Group 137.

OUMX258,0000214 -19-03JUN14-1/3

Diagnostic Procedure

OUMX258,0000214 -19-03JUN14-2/3

1 Read DTCs	1. Connect to Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Refresh codes. Are any of the DTCs in the Troubleshooting Sequence active or stored?	**YES:** Work stored codes in order of Troubleshooting Sequence. **NO:** Replace DPF. Perform Verification Procedure

OUMX258,0000214 -19-03JUN14-3/3

ECU 003720.16 — Calculated Ash Level Moderately High

The calculated ash level is moderately higher than expected.

OUMX258,0000215 -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
003251.04
003251.03
003251.00
003720.00
003720.16

When DTC is Displayed:
When the ignition is ON, the engine is running, and the fault is active.

Related Information:
The calculated ash level is moderately high. This is the first notification to the operator that the DPF ash load is getting too high.

Alarm Level:
Warning

Control Unit Response:

The ECU derates the engine.

The TechControl will display an Engine Fault - Warning

Additional References:
For more DPF ash information, see “Exhaust Filter Operation” in CTM120419, Section 03, Group 137.

OUMX258,0000215 -19-03JUN14-2/3

1 Read DTCs	1. Connect to Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Refresh codes. Are any of the DTCs in the Troubleshooting Sequence active or stored?	**YES:** Work stored codes in order of Troubleshooting Sequence. **NO:** Replace DPF. Perform Verification Procedure.

OUMX258,0000215 -19-03JUN14-3/3

ECU 004257.12 — Injector High Voltage Supply Internal Failure

The ECU detects an internal fault in the injector high voltage supply.

OUMX258,00001A6 -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
004257.12

When DTC is Displayed:
The ECU detects an internal fault in the injector high voltage supply when the ignition is on, engine running, and the fault is active.

Related Information:
This DTC may be present if the ECU has not been programmed and will be present if there is an internal fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

OUMX258,00001A6 -19-03JUN14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 004257.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00001A6 -19-03JUN14-3/3

ECU 522243.05 — Engine Starter Solenoid Lockout Relay Driver Circuit Has High Resistance

Engine will not start if code is active.

Code Caused By:

Engine run request shorted to high

Alarm Level:

Machine stop

To Clear Display:

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Ensure that key switch is not in start position.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty key switch*
- *Faulty wiring*
- *Faulty starter relay*

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OUMX258,000025A -19-03JUN14-1/6

Procedure

OUMX258,000025A -19-03JUN14-2/6

❶ **Signal Check**	Using Service ADVISOR, determine if “Engine run request” signal is active. Is signal active?	**YES:** Go to next step. **NO:** End of tests.

OUMX258,000025A -19-03JUN14-3/6

❷ **Key Switch**	Test key switch. See Key Switch Test. Does key switch test ok?	**YES:** Go to next step. **NO:** Replace key switch.

OUMX258,000025A -19-03JUN14-4/6

❸ **Wiring**	Check 700 series Purple wires for shorts to battery voltage. Is wiring ok?	**YES:** Reinstall controller payload. Check Approved Software for Control Units. **NO:** Repair wiring as required.

Continued on next page

OUMX258,000025A -19-03JUN14-5/6

4 Check relay	Check operation of the relay. Does the relay click when the key switch is in the start position? When the relay is activated is there 12 volts coming out of pin 87?	**YES:** Check wiring from relay to starter. **NO:** Check for signals coming in on pins 85 and 86, if they are good replace relay. Perform verification procedure. See Verification Procedure.

OUMX258,000025A -19-03JUN14-6/6

ECU 522243.06 — Engine Starter Solenoid Lockout Relay Driver Circuit Has Low Resistance

Code Caused By:

Engine run request shorted to low.

Alarm Level:

Machine stop

To Clear Display:

Key Cycle

Alarm Frequency:

Continuous

Control Unit Response:

Shutdown

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Ensure that key switch is not in start position.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty key switch*
- *Faulty wiring*
- *Faulty starter relay*

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OUMX258,000025B -19-03JUN14-1/6

Procedure

OUMX258,000025B -19-03JUN14-2/6

1 Signal Check	Using Service ADVISOR, determine if “Engine run request” signal is active. Is signal active?	**YES:** Go to next step. **NO:** End of tests.

OUMX258,000025B -19-03JUN14-3/6

2 Key Switch	Test key switch. See Key Switch Test. Does key switch test ok?	**YES:** Go to next step. **NO:** Replace key switch.

Continued on next page

OUMX258,000025B -19-03JUN14-4/6

3 Wiring	Check 700 series Purple wires for shorts to battery voltage. Is wiring ok?	**YES:** Reinstall controller payload. Approved Software for Control Units **NO:** Repair wiring as required.

OUMX258,000025B -19-03JUN14-5/6

4 Check relay	Check operation of the relay. Does the relay click when the key switch is in the start position? When the relay is activated is there 12 volts coming out of pin 87?	**YES:** Check wiring from relay to starter. **NO:** Check for signals coming in on pins 85 and 86, if they are good replace relay. Perform Verification Procedure.

OUMX258,000025B -19-03JUN14-6/6

ECU 522400.02 — Crankshaft Position Signal Invalid

The ECU detects excessive noise (extra pulses) on the crankshaft position signal.

Troubleshooting Sequence:
522400.02

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU has detected abnormal pulses or excessive noise (extra pulses) on the crankshaft position signal.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU tries to maintain proper operating conditions and uses the camshaft position sensor for engine speed.

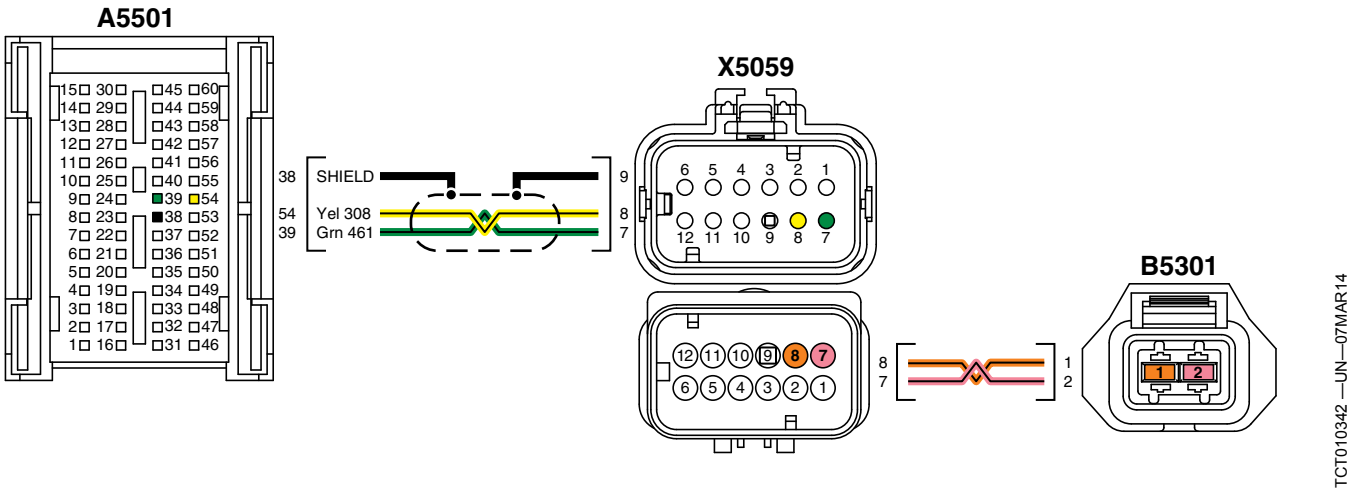
Additional References:
For more crankshaft position sensor information, see CTM120419, Section 03, Group 140.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501—54—Return **A5501—39—Signal** **A5501—38—Shield**

OUMX258,000025E -19-03JUN14-1/6

Diagnostic Procedure

OUMX258,000025E -19-03JUN14-2/6

1 **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 522400.02 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,000025E -19-03JUN14-3/6

❷ Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect crankshaft position sensor B5301. 3. Perform Terminal Test on crankshaft position sensor and B5301 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,000025E -19-03JUN14-4/6

❸ Sensor Check	On crankshaft position sensor, measure resistance between female sockets 1 and 2. Is resistance between 945 and 1155 Ohms?	**YES:** Go to next step. **NO:** Replace sensor. Perform Verification Procedure.

OUMX258,000025E -19-03JUN14-5/6

❹ Physical Damage Inspection	1. Remove crankshaft position sensor. 2. Visually inspect crankshaft position sensor for damage. Any damage found?	**YES:** Replace sensor. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,000025E -19-03JUN14-6/6

ECU 522400.05 — Crankshaft Position Signal Missing

The ECU has not detected the crankshaft position signal.

Troubleshooting Sequence:
522400.05

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU has not detected the crankshaft position signal.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU tries to maintain proper operating conditions and uses the camshaft position sensor for engine speed.

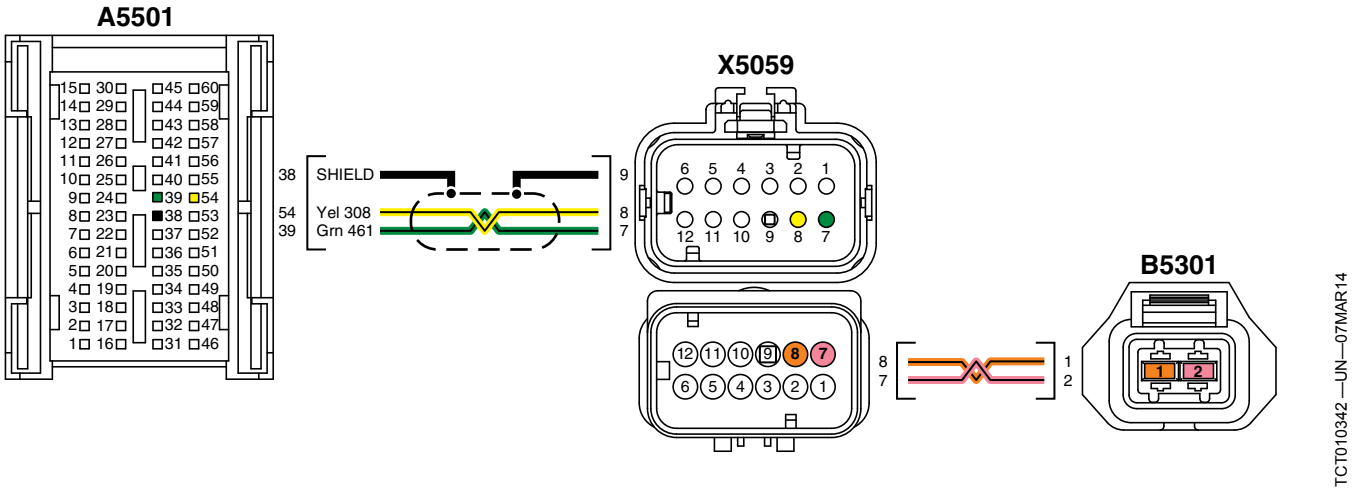
Additional References:
For more crankshaft position sensor information, see CTM120419, Section 03, Group 140.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501—54—Return **A5501—39—Signal** **A5501—38—Shield**

OUMX258,000025F -19-03JUN14-1/6

Diagnostic Procedure

OUMX258,000025F -19-03JUN14-2/6

1 **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 522400.05 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,000025F -19-03JUN14-3/6

2 Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect crankshaft position sensor B5301.	
	3. Perform Terminal Test on crankshaft position sensor and B5301 connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,000025F -19-03JUN14-4/6

3 Sensor Check	On crankshaft position sensor, measure resistance between female sockets 1 and 2.	**YES:** Go to next step.
	Is resistance between 945 and 1155 Ohms?	**NO:** Replace sensor. Perform Verification Procedure.

OUMX258,000025F -19-03JUN14-5/6

4 Physical Damage Inspection	1. Remove crankshaft position sensor.	
	2. Visually inspect crankshaft position sensor for damage.	**YES:** Replace sensor. Perform Verification Procedure.
	Any damage found?	**NO:** See CTM120419.

OUMX258,000025F -19-03JUN14-6/6

ECU 522401.02 — Camshaft Position Signal Invalid

The ECU detects excessive noise (extra pulses) on the camshaft position signal.

Troubleshooting Sequence:
522401.02

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU has detected abnormal pulses or excessive noise (extra pulses) on the camshaft position signal.

Alarm Level:
Warning

Control Unit Response:
The ECU tries to maintain proper operating conditions and uses the crankshaft position sensor for engine speed.

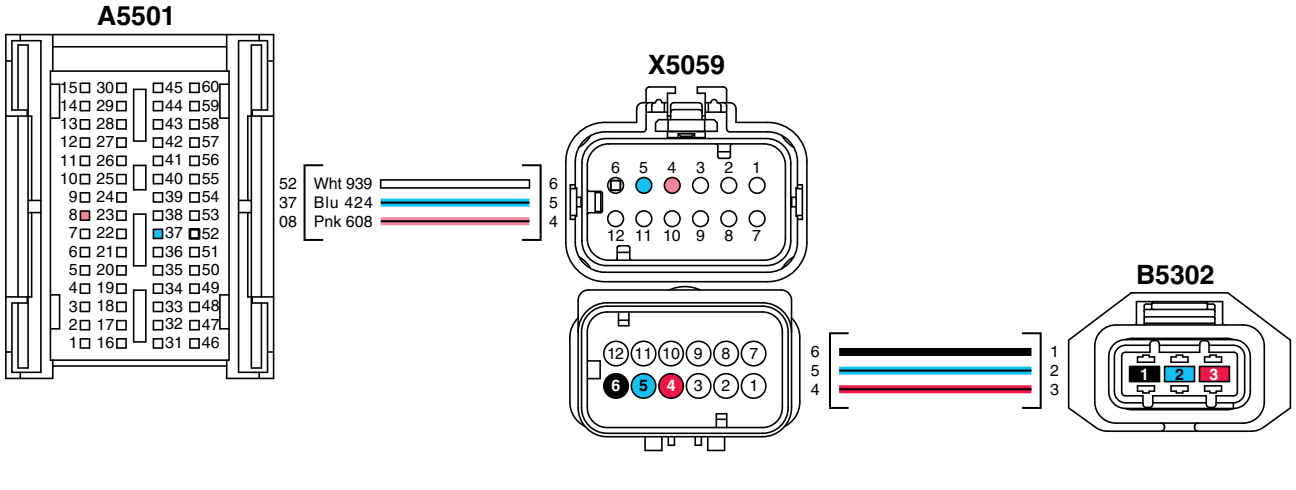
Additional References:
For more camshaft position sensor information, see CTM120419, Section 03, Group 140.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 08—Supply **A5501 — 52—Return** **A5501 — 37—Signal**

OUMX258,0000260 -19-03JUN14-1/11

Diagnostic Procedure

OUMX258,0000260 -19-03JUN14-2/11

1 **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 522401.02 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,0000260 -19-03JUN14-3/11

❷ Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect camshaft position sensor B5302.	
	3. Perform Terminal Test on camshaft position sensor and B5302 connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** Go to next step.

OUMX258,0000260 -19-03JUN14-4/11

❸ Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect ECU connector A5501.	
	3. Perform Terminal Test on A5501 connector female sockets 8, 37, and 52. And corresponding ECU male pins.	**YES:** Repair problem. Perform Verification Procedure.
	Any damage found?	**NO:** Go to next step.

OUMX258,0000260 -19-03JUN14-5/11

❹ Wire to Wire Check	On B5302 connector, measure resistance between female sockets 1 and 2.	**YES:** Go to next step.
	Is resistance greater than 100k ohms?	**NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000260 -19-03JUN14-6/11

❺ Continuity Check	1. Measure the resistance between A5501 connector female socket 37 and B5302 connector female socket 2.	
	2. Measure the resistance between A5501 connector female socket 52 and B5302 connector female socket 1.	**YES:** Go to next step.
	Are all resistance measurements less than 5 ohms?	**NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000260 -19-03JUN14-7/11

❻ Short to Ground Check	1. On A5501 connector, measure resistance between female socket 37 and single point ground.	
	2. On A5501 connector, measure resistance between female socket 52 and single point ground.	**YES:** Go to next step.
	Are both resistances greater than 100k ohms?	**NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000260 -19-03JUN14-8/11

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 37 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 52 and all other sockets in A5501 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000260 -19-03JUN14-9/11

8 Physical Damage Inspection	1. Remove camshaft position sensor. 2. Visually inspect camshaft position sensor for damage. Any damage found?	**YES:** Replace sensor. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000260 -19-03JUN14-10/11

9 Physical Damage Inspection	1. Remove high-pressure fuel pump gear cover. 2. Visually inspect camshaft timing wheel for damage. Any damage found?	**YES:** Replace camshaft timing wheel. Perform Verification Procedure. **NO:** Contact DTAC for support.

OUMX258,0000260 -19-03JUN14-11/11

ECU 522401.05 — Camshaft Position Signal Missing

The ECU has not detected the camshaft position signal.

Troubleshooting Sequence:
522401.05

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU has not detected the camshaft position signal.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU tries to maintain proper operating conditions and uses the crankshaft position sensor for engine speed.

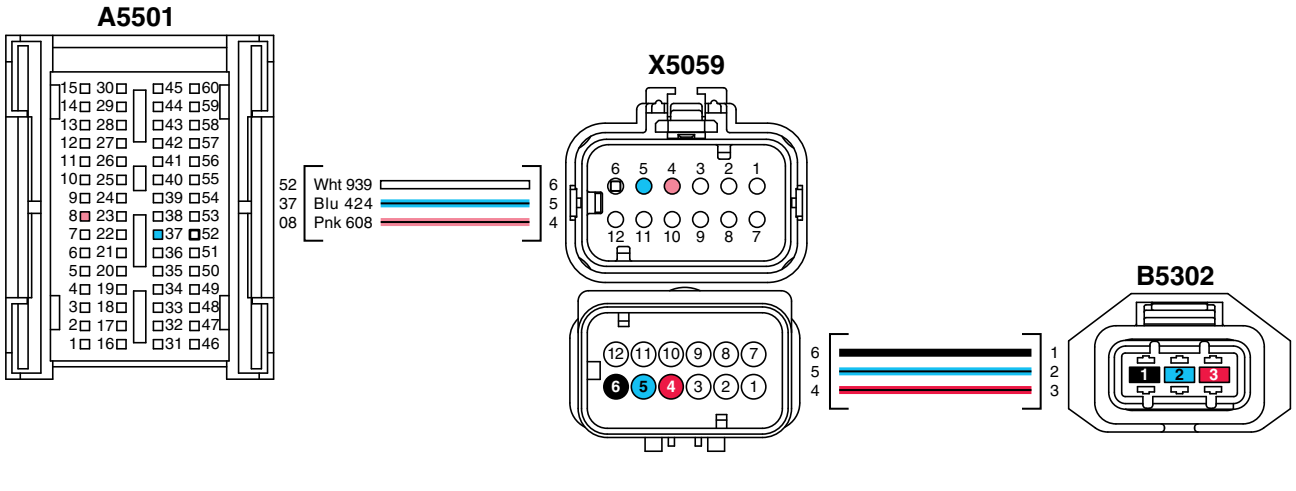
Additional References:
For more camshaft position sensor information, see CTM120419, Section 03, Group 140.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 08—Supply **A5501 — 52—Return** **A5501 — 37—Signal**

OUMX258,0000261 -19-03JUN14-1/11

Diagnostic Procedure

OUMX258,0000261 -19-03JUN14-2/11

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 522401.05 active?	**YES:** Go to next step. **NO:** See CTM120419.

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OUMX258,0000261 -19-03JUN14-3/11

2 Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect camshaft position sensor B5302.	
	3. Perform Terminal Test on camshaft position sensor and B5302 connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** See CTM120419.

OUMX258,0000261 -19-03JUN14-4/11

3 Terminal Check	1. Ignition OFF, Engine OFF.	
	2. Disconnect ECU connector A5501.	
	3. Perform Terminal Test on A5501 connector female sockets 8, 37, and 52. And corresponding ECU male pins.	**YES:** Repair problem. Perform Verification Procedure.
	Any damage found?	**NO:** Go to next step.

OUMX258,0000261 -19-03JUN14-5/11

4 Wire to Wire Check	On B5302 connector, measure resistance between female sockets 1 and 2.	**YES:** Go to next step.
	Is resistance greater than 100k ohms?	**NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000261 -19-03JUN14-6/11

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 37 and B5301 connector female socket 2.	
	2. Measure the resistance between A5501 connector female socket 52 and B5301 connector female socket 1.	**YES:** Go to next step.
	Are all resistance measurements less than 5 ohms?	**NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000261 -19-03JUN14-7/11

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 37 and single point ground.	
	2. On A5501 connector, measure resistance between female socket 52 and single point ground.	**YES:** Go to next step.
	Are both resistances greater than 100k ohms?	**NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000261 -19-03JUN14-8/11

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 37 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 52 and all other sockets in A5501 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000261 -19-03JUN14-9/11

8 Physical Damage Inspection	1. Remove camshaft position sensor. 2. Visually inspect camshaft position sensor for damage. Any damage found?	**YES:** Replace sensor. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000261 -19-03JUN14-10/11

9 Physical Damage Inspection	1. Remove high-pressure fuel pump timing cover. 2. Visually inspect camshaft timing wheel for damage. Any damage found?	**YES:** Replace camshaft timing wheel. Perform Verification Procedure. **NO:** Contact DTAC for support.

OUMX258,0000261 -19-03JUN14-11/11

ECU 522401.07 — Camshaft Position and Crankshaft Position Signals Out of Sync

The ECU has not detected the camshaft position signal.

Troubleshooting Sequence:
522401.02
522401.05
522401.07

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU the camshaft position sensor signal is not correctly timed relative to the crankshaft position sensor signal.

Alarm Level:

Warning

Control Unit Response:
The ECU tries to maintain proper operating conditions and uses the crankshaft position sensor for engine speed.

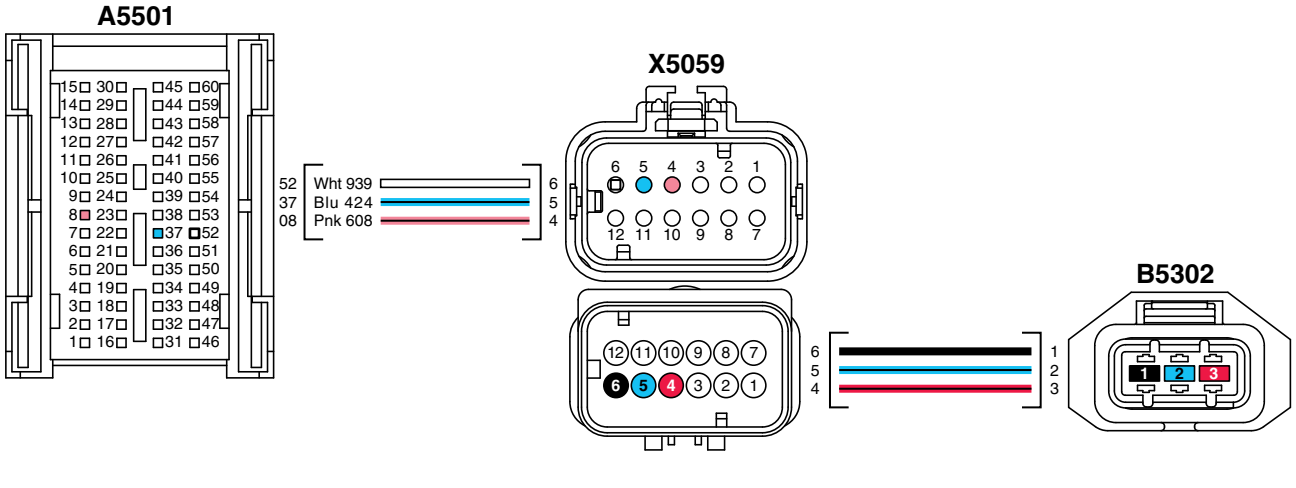
Additional References:
For more camshaft position sensor and crankshaft position sensor information, see CTM120419, Section 03, Group 140.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501 — 08—Supply **A5501 — 52—Return** **A5501 — 37—Signal**

OUMX258,0000262 -19-07MAR14-1/11

Diagnostic Procedure

OUMX258,0000262 -19-07MAR14-2/11

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 522401.07 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,0000262 -19-07MAR14-3/11

2 Service Check	Have repairs for camshaft or crankshaft timing gears been perform recently?	**YES:** Inspect for proper camshaft to crankshaft timing. See CTM120419 for proper timing information. **NO:** Go to next step.

OUMX258,0000262 -19-07MAR14-4/11

3 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect camshaft position sensor B5302. 3. Perform Terminal Test on camshaft position sensor and B5302 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000262 -19-07MAR14-5/11

4 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect ECU connector A5501. 3. Perform Terminal Test on A5501 connector female sockets 8, 37, and 52. And corresponding ECU male pins. Any damage found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000262 -19-07MAR14-6/11

5 Wire to Wire Check	On B5302 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000262 -19-07MAR14-7/11

6 Continuity Check	1. Measure the resistance between A5501 connector female socket 37 and B5302 connector female socket 2. 2. Measure the resistance between A5501 connector female socket 52 and B5302 connector female socket 1. Are all resistance measurements less than 5 Ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000262 -19-07MAR14-8/11

7 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 37 and single point ground. 2. On A5501 connector, measure resistance between female socket 52 and single point ground. Are both resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000262 -19-07MAR14-9/11

8 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 37 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 52 and all other sockets in A5501 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000262 -19-07MAR14-10/11

9 Physical Damage Inspection	1. Remove camshaft position sensor. 2. Visually inspect camshaft position sensor for damage. Any damage found?	**YES:** Replace sensor. Perform Verification Procedure. **NO:** Contact DTAC for support.

OUMX258,0000262 -19-07MAR14-11/11

ECU 522571.03 — Suction Control Valve Low Side Drive Circuit Out of Range High

The ECU has detected the suction control valve low side drive circuit voltage is greater than the specified value.

Troubleshooting Sequence:
522571.03

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected the voltage on the suction control valve low side drive circuit is greater than expected.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
DPF regeneration is aborted and inhibited while the fault is active.

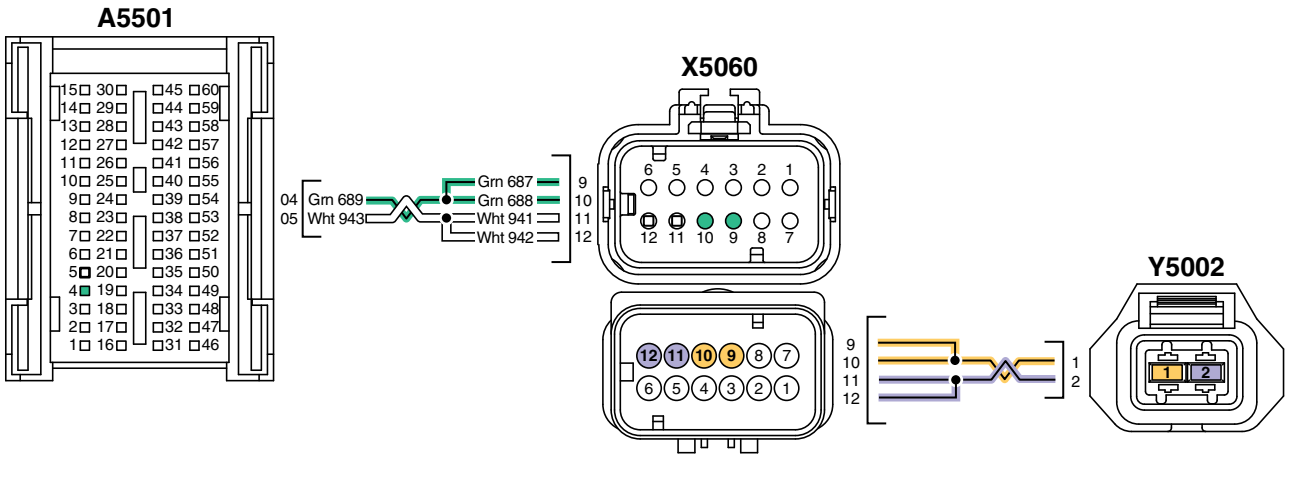
Additional References:
For suction control valve information, see CTM120419, Section 03, Group 130.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

OUMX258,0000263 -19-03JUN14-1/11

Diagnostic Procedure

OUMX258,0000263 -19-03JUN14-2/11

1 **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522571.03 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,0000263 -19-03JUN14-3/11

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000263 -19-03JUN14-4/11

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000263 -19-03JUN14-5/11

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000263 -19-03JUN14-6/11

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000263 -19-03JUN14-7/11

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000263 -19-03JUN14-8/11

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000263 -19-03JUN14-9/11

8 Resistance Check	1. Disconnect ECU connector A5502. 2. Measure the resistance between A5501 connector female socket 4 and all sockets in A5502 connector. 3. Measure the resistance between A5501 connector female socket 5 and all sockets in A5502 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000263 -19-03JUN14-10/11

9 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 522571.03 active?	**YES:** Contact DTAC for support. **NO:** Perform Verification Procedure

OUMX258,0000263 -19-03JUN14-11/11

ECU 522571.06 — Suction Control Valve Low Side Drive Circuit Has Low Resistance

The ECU has detected low resistance on the suction control valve drive circuit.

Troubleshooting Sequence:
522571.06

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected that the current to the suction control valve is higher than expected, indicating low resistance in the drive circuit.

Alarm Level:
Stop

Control Unit Response:
The ECU will derate the engine.
The ECU commands the EGR Valve fully closed.
DPF regeneration will be aborted and inhibited while the fault is active.

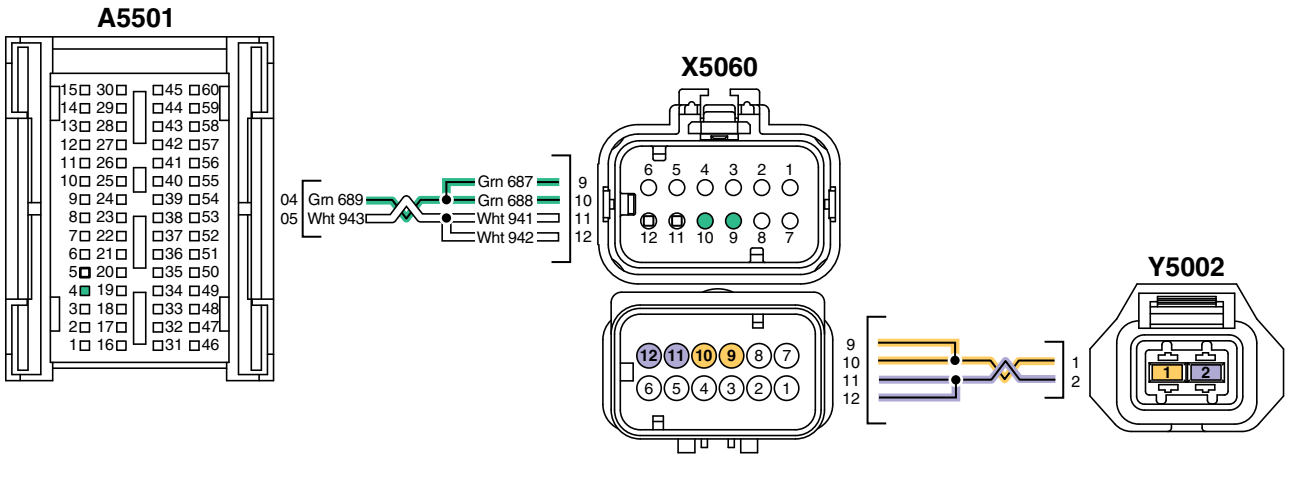
Additional References:
For suction control valve information, see CTM120419, Section 03, Group 130.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

OUMX258,0000264 -19-07MAR14-1/10

Diagnostic Procedure

OUMX258,0000264 -19-07MAR14-2/10

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522571.06 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,0000264 -19-07MAR14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000264 -19-07MAR14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000264 -19-07MAR14-5/10

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000264 -19-07MAR14-6/10

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 Ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000264 -19-07MAR14-7/10

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000264 -19-07MAR14-8/10

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k Ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000264 -19-07MAR14-9/10

8 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 522571.06 active?	**YES:** Contact DTAC for support. **NO:** Perform Verification Procedure

OUMX258,0000264 -19-07MAR14-10/10

ECU 522572.06 — Suction Control Valve High Side Drive Circuit Has Low Resistance

The ECU has detected low resistance on the suction control valve drive circuit.

Troubleshooting Sequence:
522572.06

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected that the current to the suction control valve is higher than expected, indicating low resistance in the drive circuit.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
DPF regeneration is aborted and inhibited while the fault is active.

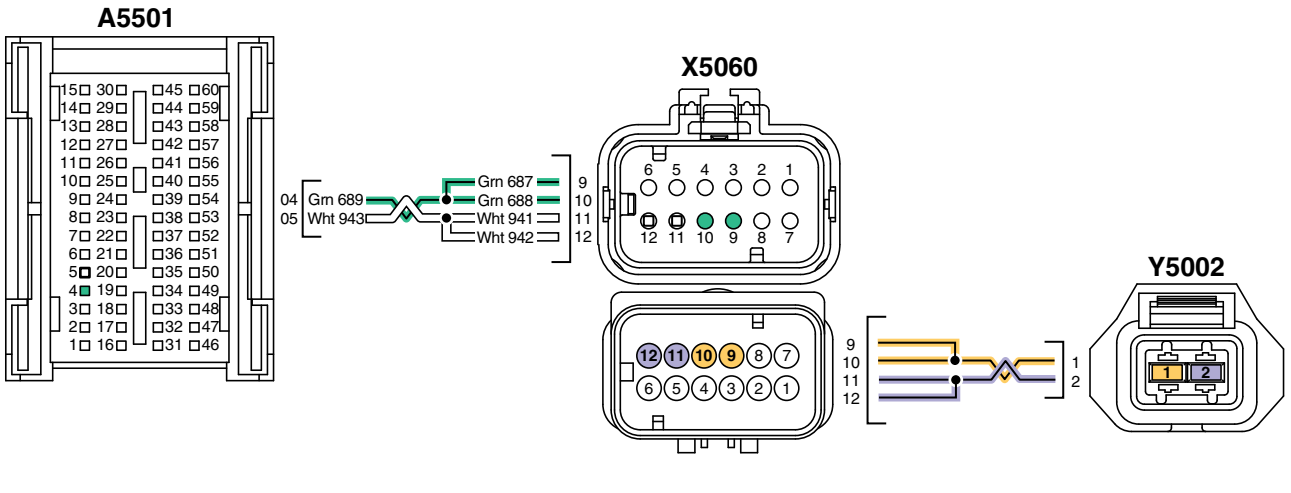
Additional References:
For suction control valve information, see CTM120419, Section 03, Group 130.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

OUMX258,0000265 -19-03JUN14-1/10

Diagnostic Procedure

OUMX258,0000265 -19-03JUN14-2/10

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522572.06 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,0000265 -19-03JUN14-3/10

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000265 -19-03JUN14-4/10

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000265 -19-03JUN14-5/10

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000265 -19-03JUN14-6/10

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000265 -19-03JUN14-7/10

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000265 -19-03JUN14-8/10

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000265 -19-03JUN14-9/10

8 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 522572.06 active?	**YES:** Contact DTAC for support. **NO:** Perform Verification Procedure.

OUMX258,0000265 -19-03JUN14-10/10

ECU 522572.11 — Suction Control Valve High Side Drive Circuit Current Fault

The ECU has detected a current fault on the suction control valve drive circuit.

Troubleshooting Sequence:
522572.11

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected that the current to the suction control valve is higher than expected, and overheating has occurred in the drive circuit.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
The ECU aborts and inhibits DPF regenerations.

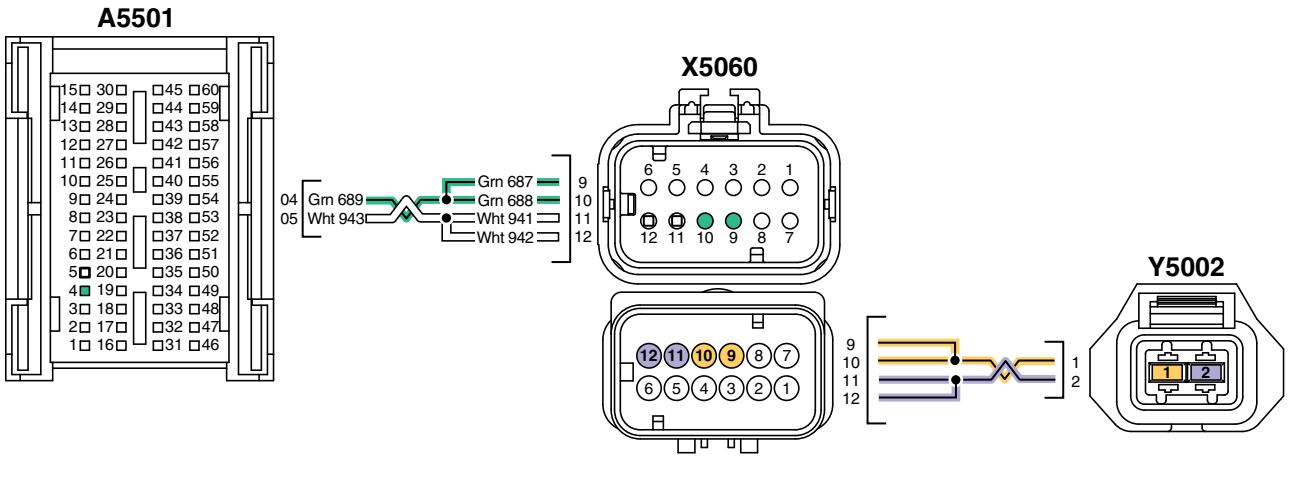
Additional References:
For suction control valve information, see CTM120419, Section 03, Group 130.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501 — 5—Drive - **A5501 — 4—Drive +**

OUMX258,0000266 -19-03JUN14-1/11

Diagnostic Procedure

OUMX258,0000266 -19-03JUN14-2/11

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522572.11 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,0000266 -19-03JUN14-3/11

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect suction control valve connector Y5002. 3. Perform Terminal Test on suction control valve and Y5002 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000266 -19-03JUN14-4/11

3 Terminal Check	1. Disconnect ECU connector A5501. 2. Perform Terminal Test on A5501 connector female sockets 4 and 5. And corresponding ECU male pins. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,0000266 -19-03JUN14-5/11

4 Wire to Wire Check	On Y5002 connector, measure resistance between female sockets 1 and 2. Is resistance greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in wiring harness. Perform Verification Procedure.

OUMX258,0000266 -19-03JUN14-6/11

5 Continuity Check	1. Measure the resistance between A5501 connector female socket 4 and Y5002 connector female socket 1. 2. Measure the resistance between A5501 connector female socket 5 and Y5002 connector female socket 2. Are all resistance measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair high resistance or mis-pin in harness. Perform Verification Procedure.

OUMX258,0000266 -19-03JUN14-7/11

6 Short to Ground Check	1. On A5501 connector, measure resistance between female socket 4 and single point ground. 2. On A5501 connector, measure resistance between female socket 5 and single point ground. Are both resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

Continued on next page

OUMX258,0000266 -19-03JUN14-8/11

7 Check Wiring Harness	1. On A5501 connector, measure resistance between female socket 4 and all other sockets in A5501 connector. 2. On A5501 connector, measure resistance between female socket 5 and all other sockets in A5501 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000266 -19-03JUN14-9/11

8 Resistance Check	1. Disconnect ECU connector A5502. 2. Measure the resistance between A5501 connector female socket 4 and all sockets in A5502 connector. 3. Measure the resistance between A5501 connector female socket 5 and all sockets in A5502 connector. Are all resistances greater than 100k ohms?	**YES:** Go to next step. **NO:** Repair short in harness. Perform Verification Procedure.

OUMX258,0000266 -19-03JUN14-10/11

9 Replace Suction Control Valve	1. Ignition OFF, Engine OFF 2. Replace suction control valve. 3. Reconnect all connectors and components. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 522572.11 active?	**YES:** Contact DTAC for support. **NO:** Perform Verification Procedure.

OUMX258,0000266 -19-03JUN14-11/11

ECU 522573.00 — Calculated Soot Level High

The ECU has calculated that the soot level in the diesel particulate filter is high.

OUMX258,0000267 -19-12MAR14-1/4

Diagnostic Procedure

Troubleshooting Sequence:
003719.00
003719.16

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Alarm Level:
None

Control Unit Response:
This DTC is an information only fault code. It will be accompanied by either a 003719.00 or 003719.16 DTC.
This fault indicates that the soot level is high based upon calculations performed in the ECU.
This DTC does not indicate that a problem has occurred.
It does indicate the method the ECU used to determine the soot level is high in the DPF.
The 522573.00 DTC is resolved by performing the diagnostic steps for the accompanying DTC 003719.00 or 003719.16

NOTE: Any fault with the DOC outlet temperature sensor or circuit can contribute to errors in the ECU calculation for soot level. If any DTC with the SPN of 003250 are present, it is critical to diagnose those first.

OUMX258,0000267 -19-12MAR14-2/4

1 Read DTCs	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 003719.00 active or stored?	**YES:** See DTC 003719.00 procedure. **NO:** Go to next step.

OUMX258,0000267 -19-12MAR14-3/4

2 Read DTCs	Is DTC 003719.16 active or stored?	**YES:** See DTC 003719.16 procedure. **NO:** Contact DTAC.

OUMX258,0000267 -19-12MAR14-4/4

ECU 522574.00 — DPF Differential Pressure Soot Level High

The ECU has determined that the DPF Differential Pressure sensor is indicating that the soot level in the diesel particulate filter is high.

OUMX258,0000268 -19-12MAR14-1/4

Diagnostic Procedure

Troubleshooting Sequence:
003719.00
003719.16

When DTC is Displayed:
When the ignition is on, the engine is running, and the fault is active.

Alarm Level:
None

Control Unit Response:
This DTC is an information only fault code. It will be accompanied by either a 003719.00 or 003719.16 DTC.
This fault indicates that the soot level is high based upon the DPF differential pressure sensor reading.
This DTC does not indicate that a problem has occurred.
It does indicate the method the ECU used to determine the soot level is high in the DPF.
The 522574.00 DTC is resolved by performing the diagnostic steps for the accompanying DTC 003719.00 or 003719.16

NOTE: Any fault with the DPF differential pressure sensor or circuit can contribute to errors in the ECU determination of soot level. If any DTC with the SPN of 003251 are present, it is critical to diagnose those first.

OUMX258,0000268 -19-12MAR14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 003719.00 active or stored?	**YES:** See DTC 003719.00 procedure. **NO:** Go to next step.

OUMX258,0000268 -19-12MAR14-3/4

2 Read DTCs	Is DTC 003719.16 active or stored?	**YES:** See DTC 003719.16 procedure. **NO:** Contact DTAC.

OUMX258,0000268 -19-12MAR14-4/4

ECU 522575.07 — Parked Regeneration Failed

The ECU detects that the parked regeneration has not completed within the required time.

OUMX258,0000269 -19-12MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
Any active or stored DTCs
003250.01
522575.07

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU detects that the parked regeneration has not completed within the required time.
DTC 003719.16 becomes active when this fault becomes active.

Other Possible Causes of this DTC:
Aftertreatment temperature sensors error.
DOC deterioration.
DOC sulfur poisoning or contamination.

Alarm Level:
Warning

Control Unit Response:
The ECU tries to maintain proper operating conditions.

Additional References:
For more aftertreatment system operation information, see CTM120419, Section 03, Group 137.

OUMX258,0000269 -19-12MAR14-2/3

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh Codes. Are any other active or stored DTCs present?	**YES:** Perform diagnostics on the active or stored DTCs. **NO:** Investigate other possible causes of the parked regeneration failure.

OUMX258,0000269 -19-12MAR14-3/3

ECU 522576.12 — ECU EEPROM Read Error

The ECU detects an internal fault.

OUMX258,000026A -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522576.12

When DTC is Displayed:
The ECU detects an internal fault.

Related Information:
This DTC is present if the ECU has not been programmed or is be present if there is an internal fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

OUMX258,000026A -19-03JUN14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Refresh codes. Is DTC 522576.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,000026A -19-03JUN14-3/3

ECU 522577.11 — Parked Regeneration Not Performed

The ECU detects the parked regeneration has not been performed within the required time since requested.

Troubleshooting Sequence:
Any active or stored DTCs
522577.11

When DTC is Displayed:
When the engine is running and the fault is active.

Related Information:
The ECU detects the parked regeneration has not been performed within the required time since requested.
DTC ECU 003719.16 becomes active when this fault becomes active.

Alarm Level:
Warning

Control Unit Response:
The ECU tries to maintain proper operating conditions.

The TechControl will display a Parked Cleaning Required - Warning

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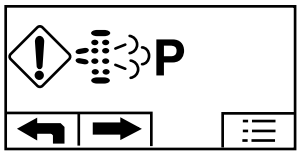


Parked Cleaning Required - Warning

Additional References:
For more aftertreatment system operation information, see CTM120419, Section 03, Group 137.

Possible Causes of this DTC:
Vehicle operator not performing the parked regeneration within the required time.
The parked regeneration is interrupted before completing.
Faulty parked regeneration needed indicator.
For details on operation and troubleshooting of vehicle regeneration controls, refer to CTM120419 Section 235, Group 55.

OUMX258,000026B -19-12MAR14-1/1

ECU 522578.12 — ECU EEPROM Write Error

The ECU detects an internal fault.

OUMX258,000026C -19-07MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522578.12

When DTC is Displayed:
The ECU detects an internal fault.

Related Information:
This DTC will be present if the ECU has not been programmed or may be present if there is an internal fault.

Alarm Level:
Warning

Control Unit Response:
The ECU will derate the engine.

OUMX258,000026C -19-07MAR14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Refresh codes. Is DTC 522578.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,000026C -19-07MAR14-3/3

ECU 522579.12 — EGR Valve Actuator Low Resistance Error

The EGR valve actuator has detected low resistance on the motor coils.

OUMX258,000026D -19-03JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
522579.12

When DTC is Displayed:
When the ignition is on, or engine is running, and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects an internal error. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected an internal error and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For EGR actuator location, and more information on the Control Unit Information and Overview Test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,000026D -19-03JUN14-2/3

1 Read DTCs	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Is DTC 522579.12 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See Problem Not Found Procedure.

OUMX258,000026D -19-03JUN14-3/3

ECU 522580.12 — EGR Valve Position Internal Error

The EGR valve actuator has detected an internal position error.

OUMX258,000029A -19-03JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
522580.12

When DTC is Displayed:
When the ignition is on, or engine is running, and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects an internal error. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected an internal error and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
See CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,000029A -19-03JUN14-2/3

❶ **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, engine running. 5. Refresh codes. Is DTC 522580.12 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See Problem Not Found Procedure.

OUMX258,000029A -19-03JUN14-3/3

ECU 522582.07 — EGR Valve Initialization Error

The ECU is indicating the EGR did not initialize within a specified amount of time.

Troubleshooting Sequence:
522582.07

When DTC is Displayed:
When the ignition is on, engine is running, and the fault is active.

Related Information:
This fault indicates that the initialization of the EGR valve has exceeded a specified time.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

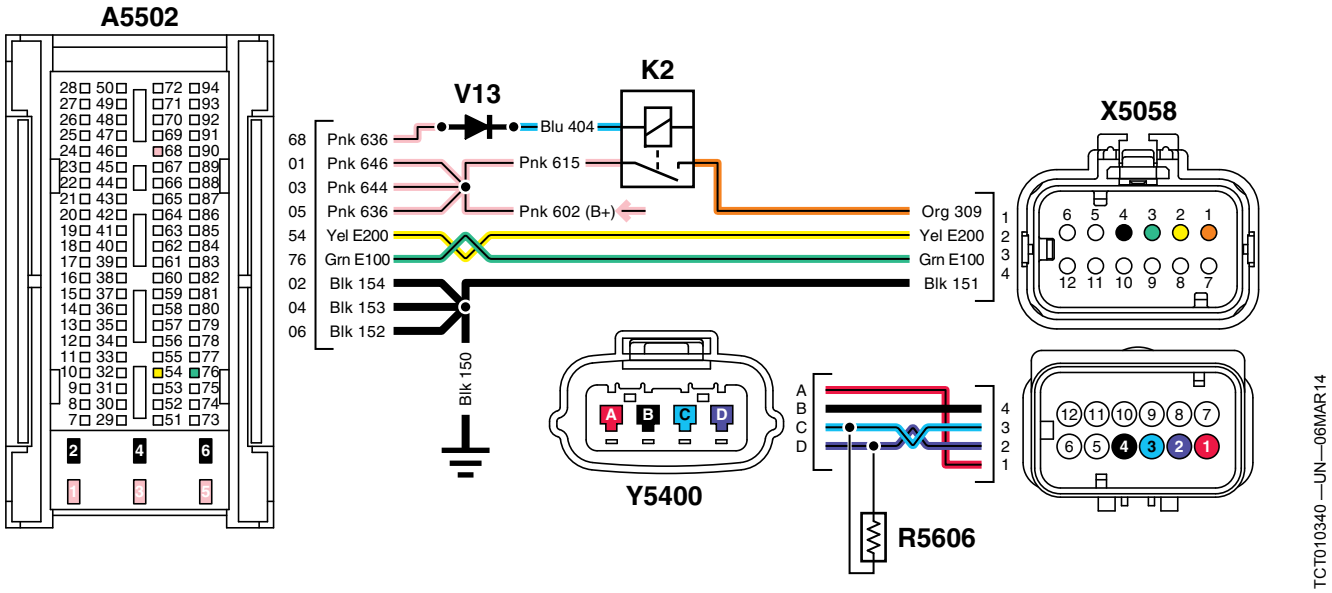
Additional References:
For more EGR valve information, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5502 – 1—Supply
A5502 – 2—Return

A5502 – 76—CAN Low

A5502 – 54—CAN High

OUMX258,000029D -19-03JUN14-1/6

Diagnostic Procedure

OUMX258,000029D -19-03JUN14-2/6

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522582.07 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,000029D -19-03JUN14-3/6

❷ Terminal Check

1. Ignition OFF, Engine OFF.
2. Disconnect EGR valve connector Y5400.
3. Perform Terminal Test on valve and Y5400 connector.

Were any problems found?

YES: Repair problem. Perform Verification Procedure.

NO: Go to next step.

OUMX258,000029D -19-03JUN14-4/6

❸ Supply Voltage Check

1. Ignition ON, Engine OFF.
2. In Service ADVISOR monitor Unswitched Battery Voltage.
3. Monitor battery voltage on multimeter.

Data Point	Normal Range
Unswitched Battery Voltage	12.0 — 14.0 V

Is reading within 0.5 V of unswitched battery voltage?

YES: Go to “CAN Circuit Check” step.

NO: See CTM120419.

OUMX258,000029D -19-03JUN14-5/6

❹ CAN Circuit Check

1. Ignition OFF, Engine OFF
2. Disconnect Diagnostic Test Box.
3. Ignition ON, Engine OFF.
4. On Y5400 connector, measure voltage between female socket C(+) and B(-).
5. On Y5400 connector, measure voltage between female socket D(+) and B(-).

Is voltage for both measurements between 1.5 and 3.5 V?

YES: Replace EGR valve. Perform Verification Procedure.

NO: See CTM120419.

OUMX258,000029D -19-03JUN14-6/6

ECU 522583.01 — EGR Valve Actuator High Temperature Sensor Fault

The EGR valve actuator has detected a high temperature sensor fault.

OUMX258,00002A9 -19-03JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
522583.01

When DTC is Displayed:
When the ignition is on and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects a high temperature sensor fault. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected a high temperature sensor fault and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For more EGR valve information, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,00002A9 -19-03JUN14-2/3

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522583.01 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See Problem Not Found Procedure.

OUMX258,00002A9 -19-03JUN14-3/3

ECU 522584.01 — EGR Valve Actuator Low Temperature Sensor Fault

The EGR valve actuator has detected a low temperature sensor fault.

OUMX258,00002AA -19-03JUN14-1/3

Diagnostic Procedure

Trouble Shooting Sequence:
522584.01

When DTC is Displayed:
When the ignition is on and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects a low temperature sensor fault. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected a low temperature sensor fault and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional References:
For more EGR valve information, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.

OUMX258,00002AA -19-03JUN14-2/3

1 **Read DTCs**	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522584.01 active?	**YES:** Replace EGR valve actuator. Perform Verification Procedure. **NO:** See Problem Not Found Procedure.

OUMX258,00002AA -19-03JUN14-3/3

ECU 522585.12 — ECU Internal Fault 17

The ECU detects an internal fault.

OUMX258,00002AB -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522585.12

When DTC is Displayed:
The ECU detects an internal fault.

Related Information:
This DTC is present if the ECU has not been programmed or is present if there is an internal fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.

OUMX258,00002AB -19-03JUN14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Refresh codes. Is DTC 522585.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00002AB -19-03JUN14-3/3

ECU 522588.12 — ECU Internal Voltage High Error

The ECU detects an internal fault.

OUMX258,00002AC -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522588.12

When DTC is Displayed:
The ECU detects an internal fault.

Related Information:
This DTC is present if the ECU has not been programmed or may be present if there is an internal fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.

OUMX258,00002AC -19-03JUN14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Refresh codes. Is DTC 522588.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00002AC -19-03JUN14-3/3

ECU 523489.12 — ECU Internal Voltage Low Error

The ECU detects an internal fault.

OUMX258,00002AD -19-03JUN14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
522589.12

When DTC is Displayed:
The ECU detects an internal fault.

Related Information:
This DTC is present if the ECU has not been programmed or may be present if there is an internal fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.

OUMX258,00002AD -19-03JUN14-2/3

1 Read DTCs	1. Ignition ON, engine OFF 2. Connect Service ADVISOR. 3. Refresh codes. Is DTC 522589.12 active?	**YES:** See CTM120419. **NO:** Perform Verification Procedure.

OUMX258,00002AD -19-03JUN14-3/3

ECU522591.12 — Sensor Supply #2 Voltage Error

The ECU detects a supply voltage above specification on the ECU 5 V supply #2 circuit.

Troubleshooting Sequence:
522591.12

When DTC is Displayed:
When the ignition is on, and the error is active.

Related Information:
The ECU detects a supply voltage greater than 5.3 V on the Sensor Supply #2 circuit.

Alarm Level:
Warning

Components Using Sensor Supply #2 Voltage:
Camshaft Position Sensor, Air Throttle Actuator, Manifold Air and Exhaust Pressure Sensor.

Control Unit Response:

The ECU tries to maintain proper operating conditions.

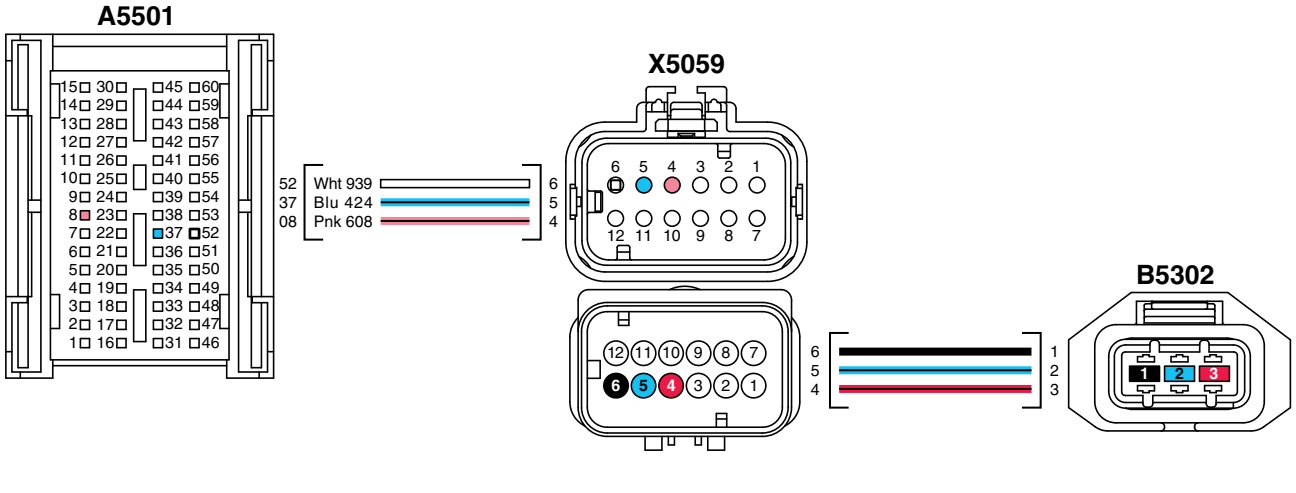
Additional References:
For more sensor supply #2 information, see CTM120419, Section 03, Group 140.

For more fuel rail pressure sensor information, see CTM120419, Section 03, Group 140.
For more aftertreatment pressure sensor information, see CTM120419, Section 03, Group 140.
For more air throttle actuator information, see CTM120419, Section 03, Group 140.

For complete wiring information:

- see Main Electrical Schematic, T4
- see Engine Connector X5057 Schematic
- see Engine Connector X5058 Schematic
- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501—08—Supply **A5501—52—Return** **A5501—37—Signal**

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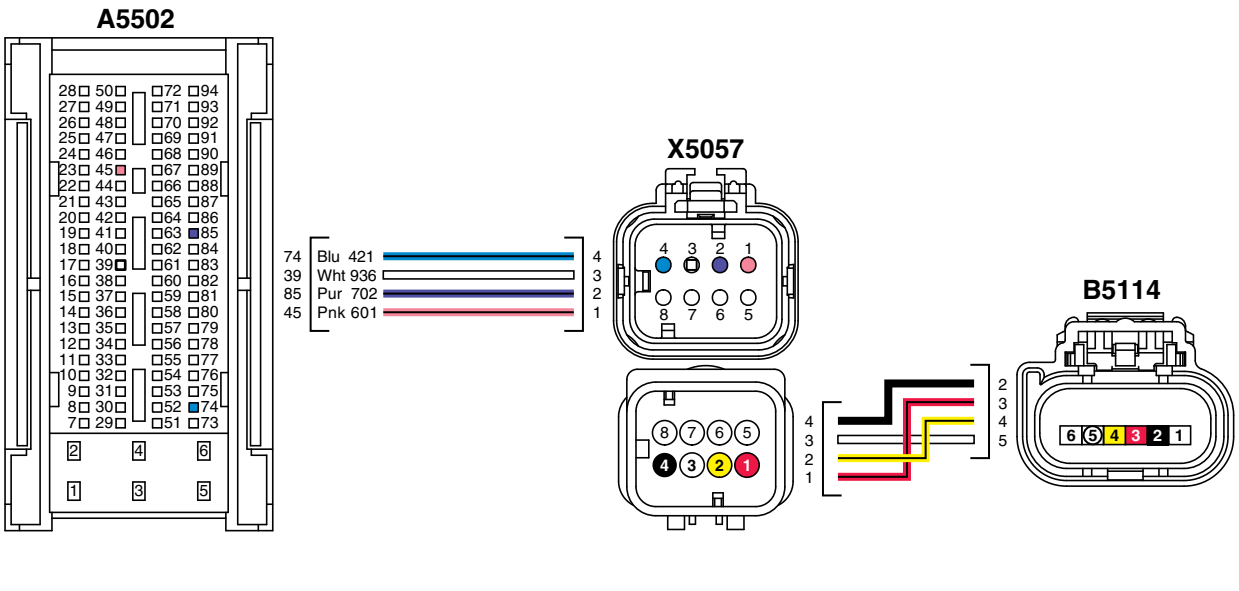
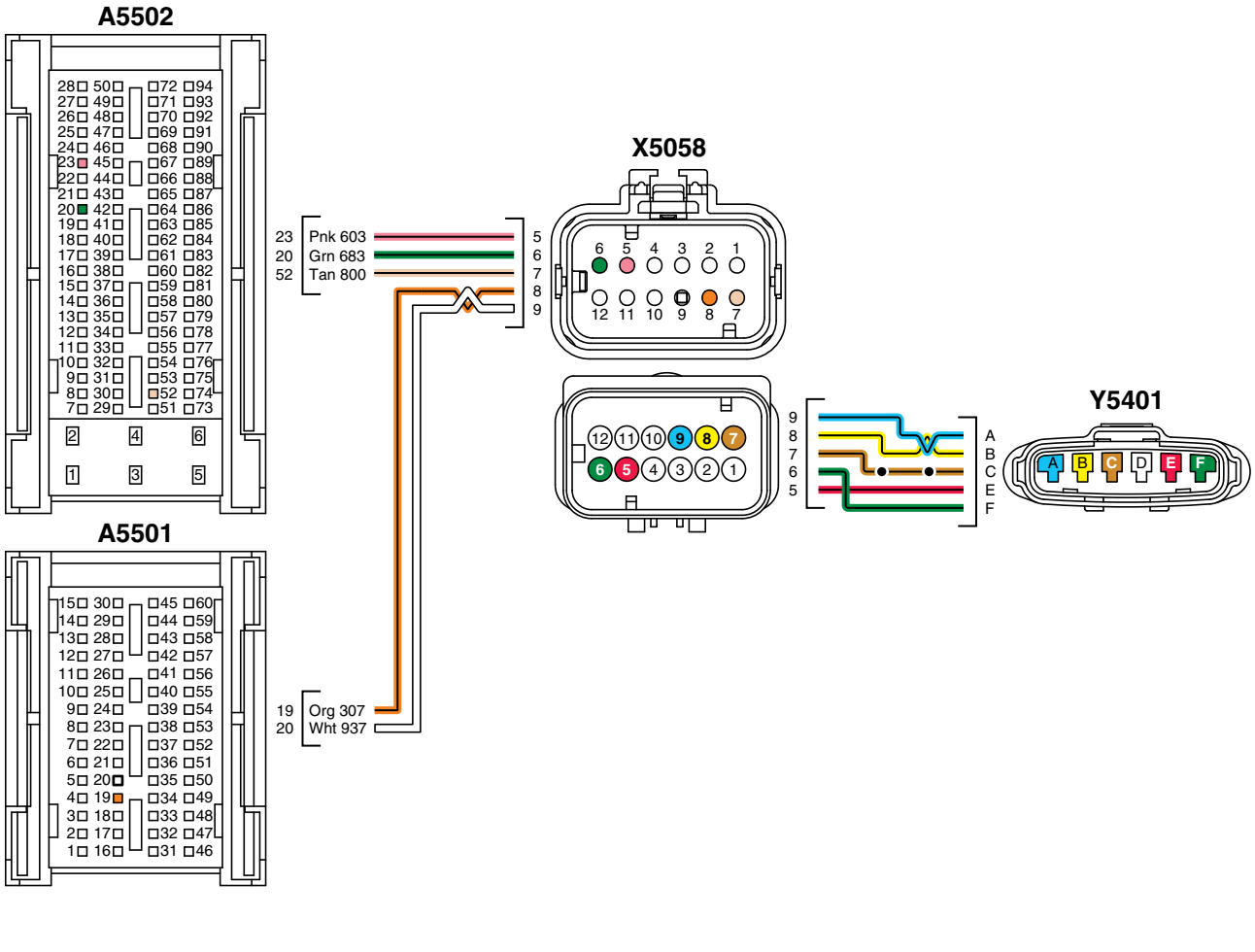
OUMX258,00002B6 -19-07MAR14-1/7



A5502—39—Manifold Aire Pressure Sensor Signal

A5502—45—Supply
A5502—74—Return

A5502—85—Exhaust Pressure Sensor Signal



A5502—23—Supply
A5502—20—Signal

A5502—52—Return
A5501—19—Drive (+)

A5501—20—Drive (-)

Continued on next page

OUMX258,00002B6 -19-07MAR14-2/7

Diagnostic Procedure

OUMX258,00002B6 -19-07MAR14-3/7

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522591.12 active?	**YES:** Go to next step. **NO:** See CTM120419.

OUMX258,00002B6 -19-07MAR14-4/7

2 Terminal Check	1. Ignition OFF, Engine OFF. 2. Disconnect B5302 Camshaft Position Sensor. 3. Perform Terminal Test on camshaft position sensor and B5302 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00002B6 -19-07MAR14-5/7

3 Terminal Check	1. Disconnect B5114 Manifold Air and Exhaust Pressure Sensor. 2. Perform Terminal Test on aftertreatment pressure sensor and B5114 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00002B6 -19-07MAR14-6/7

4 Terminal Check	1. Disconnect Y5401 Air Throttle Actuator. 2. Perform Terminal Test on air throttle actuator and Y5401 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00002B6 -19-07MAR14-7/7

ECU 522592.12 — Sensor Supply #3 Voltage Error

The ECU detects a supply voltage above specification on the ECU 5 V supply #3 circuit.

Troubleshooting Sequence:
003242.03
003242.04
003250.03
003250.04
000157.03
000157.04
003251.03
003251.04
003609.03
003609.04
522592.12

When DTC is Displayed:
When the ignition is on, and the error is active.

Related Information:
The ECU detects a supply voltage greater than 5.3 V on the Sensor Supply #3 circuit.

Alarm Level:
Warning

Components Using Sensor Supply #3 Voltage:
Fuel Rail Pressure Sensor, Aftertreatment Pressure Sensor.

Control Unit Response:
The ECU tries to maintain proper operating conditions.

Additional References:
For more sensor supply #2 information, see CTM120419, Section 03, Group 140.

For more fuel rail pressure sensor information, see CTM120419, Section 03, Group 140.
For more aftertreatment pressure sensor information, see CTM120419, Section 03, Group 140.

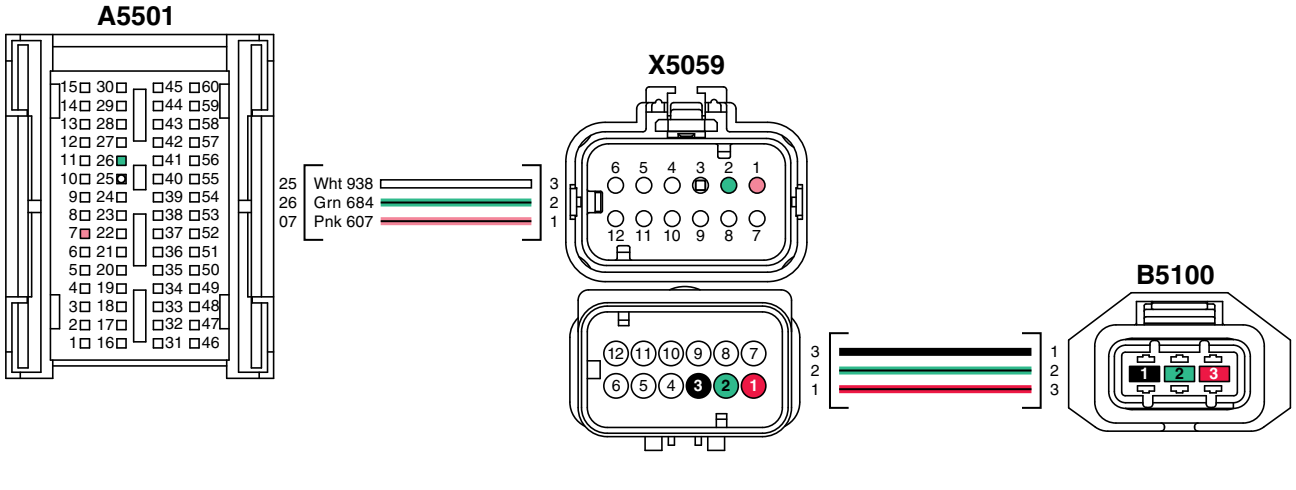
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.



A5501—07—Supply **A5501—25— Signal** **A5501—26—Return**

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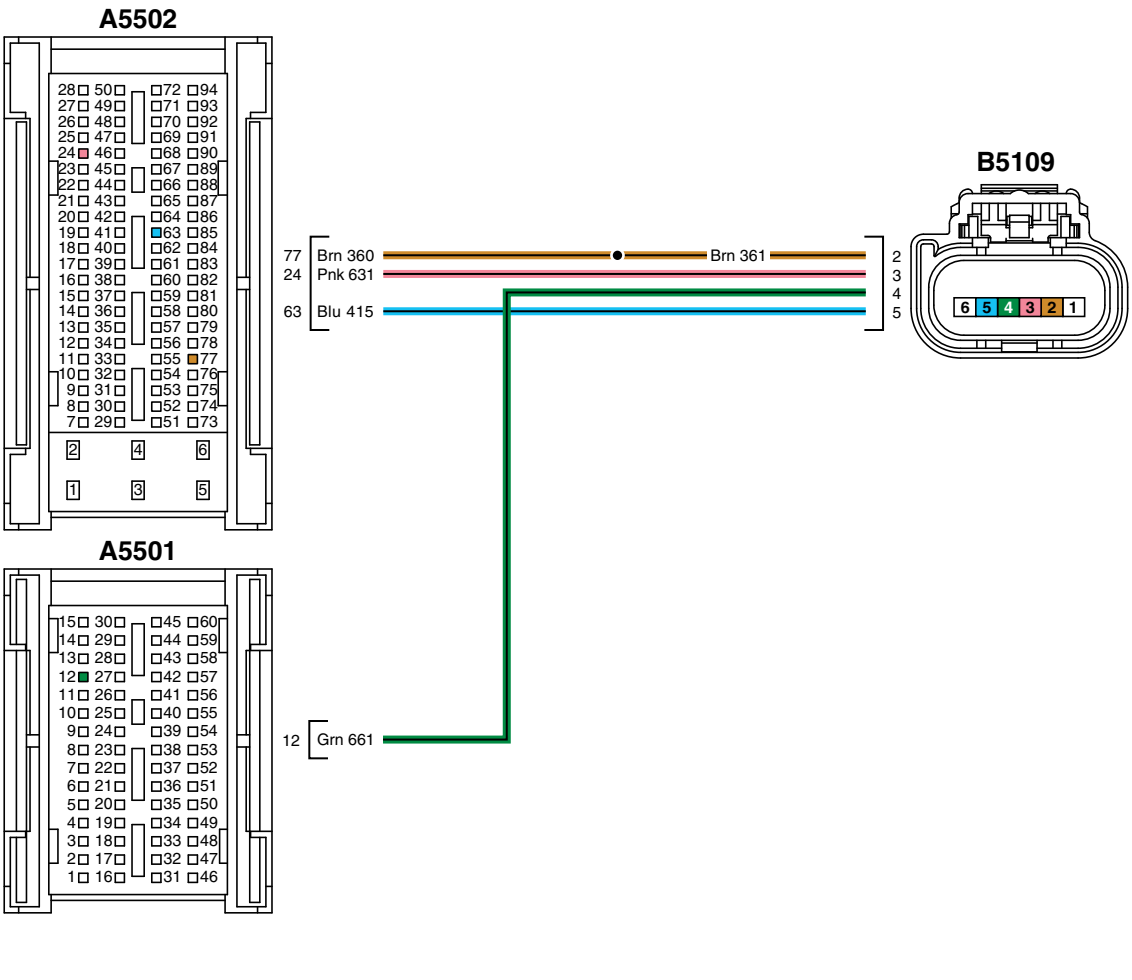

Aftertreatment Pressure Sensor

A5501—12—DPF Inlet Pressure Sensor Signal

A5502—24—Supply

A5502—63—DPR Differential Pressure Signal

A5502—77—Return

OUMX258,00002B4 -19-07JUL14-2/5

Diagnostic Procedure

OUMX258,00002B4 -19-07JUL14-3/5

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition OFF, Engine OFF. 4. Disconnect B5100 Fuel Rail Pressure Sensor. 5. Perform Terminal Test on fuel rail pressure sensor and B5100 connector. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

Continued on next page

OUMX258,00002B4 -19-07JUL14-4/5

❷ **Terminal Check**	1. Disconnect B5109 Aftertreatment Pressure Sensor.	
	2. Perform Terminal Test on aftertreatment pressure sensor and B5109 connector.	**YES:** Repair problem. Perform Verification Procedure.
	Were any problems found?	**NO:** See CTM120419.

OUMX258,00002B4 -19-07JUL14-5/5

ECU 522596.09 — No CAN Message Received From Source Address 1

Code Caused By:

Communication error between controllers

Alarm Level:

Service Alert-continuous audible

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

None

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty CAN bus wiring. See CAN Message Not Received*
- *Faulty CAN terminator(s). See CAN Communication Fault Checks, CAN Bus Terminator Test, and CAN Network Voltage Checks.*

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OUMX258,00002B2 -19-03JUN14-1/1

ECU 522597.09 — No CAN Message Received From Source Address 2

Code Caused By:

Communication error between controllers

Alarm Level:

Service Alert-continuous audible

Alarm Frequency:

Continuous

Control Unit Response:

Limited functionality

Snapshot Recorded:

No

Required Tools:

None

Preliminary Checks:

None

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty CAN bus wiring. See CAN Message Not Received*
- *Faulty CAN terminator(s). See CAN Communication Fault Checks, CAN Bus Terminator Test, and CAN Network Voltage Checks.*

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OUMX258,00002B3 -19-03JUN14-1/1

ECU 522599.09 — Vehicle Controller CAN Communication Error #1

Code Caused By:

CAN bus communication abnormal update rate.

Alarm Level:

Service alert

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Key switch is in on position and ECU did not receive any messages from other on board controllers.

Common tests:

- CAN Bus physical wiring, connections and splices.
- CAN Bus terminator(s). See CAN Bus Terminator Test.
- Electromagnetic interference. See Erroneous Diagnostic Trouble Codes.
- Communication faults. See CAN Communication Fault Checks.

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OUMX258,00002B5 -19-03JUN14-1/1

ECU 522600.09 — Vehicle Controller CAN Communication Error #2

Code Caused By:

CAN bus communication abnormal update rate.

Alarm Level:

Service alert

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Key switch is in on position and ECU did not receive any messages from other on board controllers.

Common tests:

- CAN Bus physical wiring, connections and splices.
- CAN Bus terminator(s). See CAN Bus Terminator Test.
- Electromagnetic interference. See Erroneous Diagnostic Trouble Codes.
- Communication faults. See CAN Communication Fault Checks.

CB12260,000008C -19-03JUN14-1/1

ECU 522601.09 — Vehicle Controller CAN Communication Error #3

Code Caused By:

CAN bus communication abnormal update rate.

Alarm Level:

Service alert

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Key switch is in on position and ECU did not receive any messages from other on board controllers.

Common tests:

- CAN Bus physical wiring, connections and splices.
- CAN Bus terminator(s). See CAN Bus Terminator Test.
- Electromagnetic interference. See Erroneous Diagnostic Trouble Codes.
- Communication faults. See CAN Communication Fault Checks.

CB12260,000008D -19-03JUN14-1/1

ECU 522609.09 — Vehicle Controller CAN Communication Error #4

Code Caused By:

CAN bus communication abnormal update rate.

Alarm Level:

Service alert

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Key switch is in on position and ECU did not receive any messages from other on board controllers.

Common tests:

- CAN Bus physical wiring, connections and splices.
- CAN Bus terminator(s). See CAN Bus Terminator Test.
- Electromagnetic interference. See Erroneous Diagnostic Trouble Codes.
- Communication faults. See CAN Communication Fault Checks.

CB12260,000008E -19-03JUN14-1/1

ECU 522610.09 — EGR Valve CAN Communication Error

The ECU is indicating that it did not receive a CAN message from the EGR valve.

Troubleshooting Sequence:
522610.09
003719.00

When DTC is Displayed:
When the ignition is ON, engine is OFF

Related Information:
This fault indicates that the ECU did not receive a CAN message from the EGR valve.

Alarm Level:

Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

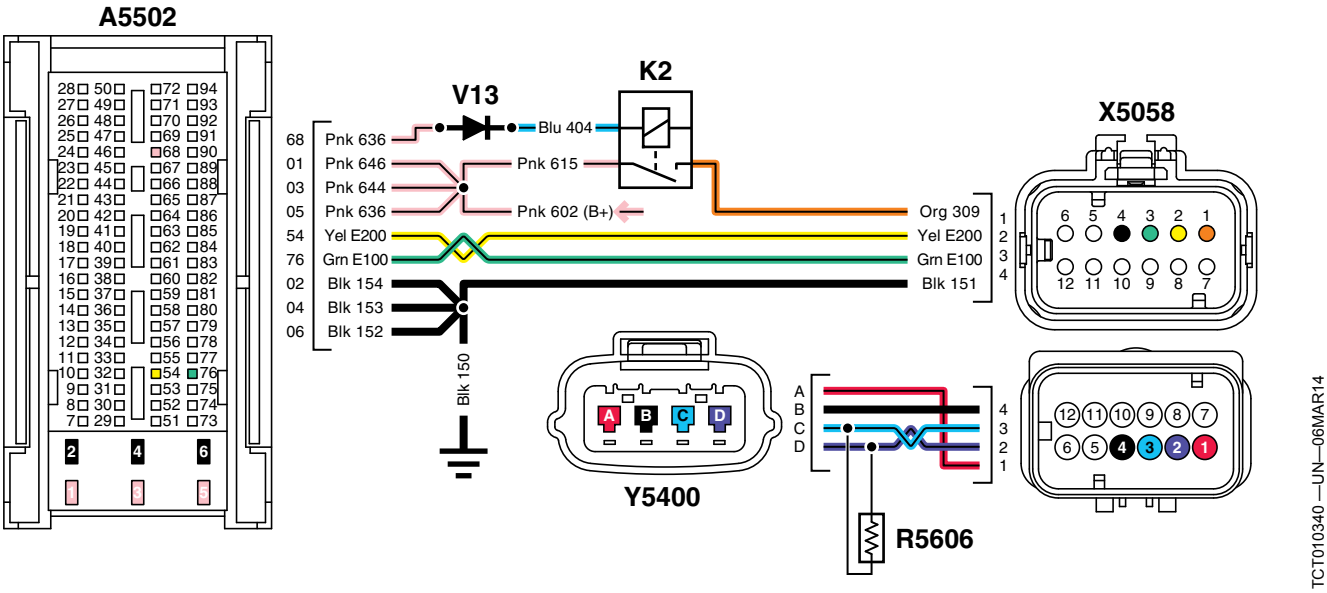
Additional references:
For component location, and more EGR valve information, see CTM120419

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5502 – 01—Supply
A5502 – 02—Return
A5502 – 03—Supply
A5502 – 04—Return
A5502 – 05—Supply
A5502 – 06—Return
A5502 – 54—CAN High
A5502 – 76—CAN Low

OUMX258,00002B8 -19-03JUN14-1/3

Diagnostic Procedure

OUMX258,00002B8 -19-03JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Refresh codes. Is DTC 522610.09 active?	**YES:** Perform Verification Procedure. **NO:** See CTM120419.

OUMX258,00002B8 -19-03JUN14-3/3

ECU 522617.12 — EGR Valve Position Mismatch

The EGR valve actuator has detected a position mismatch between the commanded position from the ECU and the actual valve position.

Trouble Shooting Sequence:
522617.12

When DTC is Displayed:
When the ignition is on and the EGR actuator reports the fault is active.

Related Information:

This code is set when the EGR actuator detects a position mismatch between the commanded position from the ECU and the actual valve position. The EGR actuator sends a message via the CAN communication system to the ECU stating that it has detected the position mismatch error and the ECU sets the fault.

Alarm Level:
Warning

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

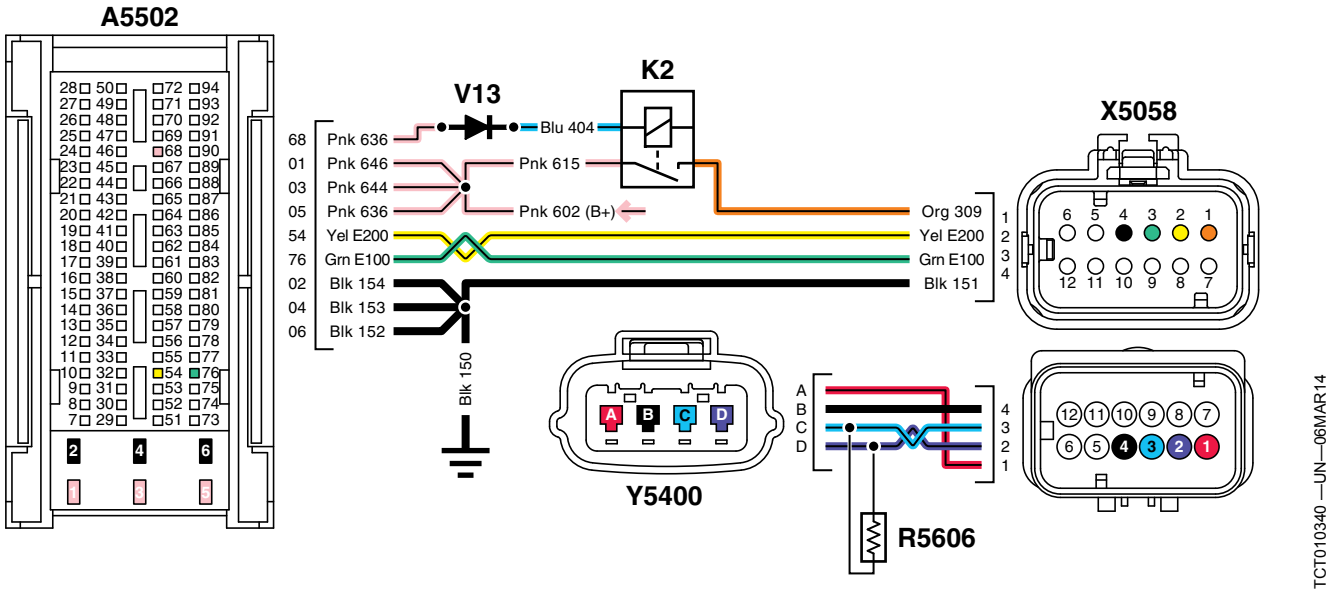
Additional references:
For component location, and more EGR valve information, see CTM120419

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5058 Schematic

located in Section 230, Group 50.



A5502 – 01—Supply
A5502 – 02—Return
A5502 – 03—Supply
A5502 – 04—Return
A5502 – 05—Supply
A5502 – 06—Return
A5502 – 54—CAN High
A5502 – 76—CAN Low

OUMX258,00002B9 -19-03JUN14-1/3

Diagnostic Procedure

Continued on next page

OUMX258,00002B9 -19-03JUN14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. Ignition ON, Engine OFF. 5. Refresh codes. Is DTC 5222617.12 active?	**YES:** See CTM120419. **NO:** See Problem Not Found Procedure.

OUMX258,00002B9 -19-03JUN14-3/3

ECU 522618.09 — Vehicle Controller CAN Communication Error #5

Code Caused By:

CAN bus communication abnormal update rate.

Alarm Level:

Service alert

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

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Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Key switch is in on position and ECU did not receive any messages from other on board controllers.

Common tests:

- CAN Bus physical wiring, connections and splices.
- CAN Bus terminator(s). See CAN Bus Terminator Test.
- Electromagnetic interference. See Erroneous Diagnostic Trouble Codes.
- Communication faults. See CAN Communication Fault Checks.

CB12260,0000090 -19-03JUN14-1/1

ECU 522619.09 — Vehicle Controller Communication Error

Code Caused By:

CAN bus communication abnormal update rate.

Alarm Level:

Service alert

Snapshot Recorded:

Yes

Required Tools:

Multimeter

Preliminary Checks:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.

Service ADVISOR is a trademark of Deere & Company

Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

Key switch is in on position and ECU did not receive any messages from other on board controllers.

Common tests:

- CAN Bus physical wiring, connections and splices.
- CAN Bus terminator(s). See CAN Bus Terminator Test.
- Electromagnetic interference. See Erroneous Diagnostic Trouble Codes.
- Communication faults. See CAN Communication Fault Checks.

CB12260,0000091 -19-03JUN14-1/1

ECU 522744.04 — ECU Power Supply Output #1 Circuit Has Low Resistance

The ECU power supply output #1 has low resistance.

Troubleshooting Sequence:
522744.04

When DTC is Displayed:
When the ignition is on, and the error is active.

Related Information:
The ECU detects a high current draw on the power output to the actuators.

Alarm Level:
Warning

Components Using Power Supply Output #1 Circuit.
EGR Valve .

Control Unit Response:
The ECU tries to maintain proper operating conditions.

Additional References:
For more Power Supply Output #1, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Controls and Sensors Schematic

located in Section 230, Group 50.

OUMX258,00002BA -19-17JUN14-1/5

Diagnostic Procedure

OUMX258,00002BA -19-17JUN14-2/5

❶ **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes. Is DTC 522744.04 active?	**YES:** Go to next step. **NO:** See CTM120419.

Continued on next page

OUMX258,00002BA -19-17JUN14-3/5

❷ **Check for Short To Ground**	Disconnect ECU connector and remove EGR valve power relay. Does pin 85 at the relay have continuity to ground?	**YES:** Repair wiring **NO:** Go To Next Step

OUMX258,00002BA -19-17JUN14-4/5

❸ **Check Relay**	Check the relay for internal shorting. See Relay Test.	**YES:** Replace relay **NO:** Recheck wiring. If all the wiring checks out ok, suspect faulty ECU.

OUMX258,00002BA -19-17JUN14-5/5

ECU 522994.04 — ECU Power Supply Output #2 Circuit Has Low Resistance

The ECU power supply output #2 has low resistance.

Troubleshooting Sequence:
522744.04

When DTC is Displayed:
When the ignition is on, and the error is active.

Related Information:
The ECU detects a high current draw on the power out put to the actuators.

Alarm Level:
Warning

Components Using Power Supply Output #1 Circuit.
EGR Valve .

Control Unit Response:
The ECU tries to maintain proper operating conditions.

Additional References:
For more Power Supply Output #1 see CTM120419.

Contact DTAC if this code comes active.

OUMX258,00002BB -19-12MAR14-1/1

ECU 523249.05 — Crankshaft Position and Camshaft Position Signals Invalid

The ECU has not detected the crankshaft position signal and camshaft position signal.

Troubleshooting Sequence:
522400.05
522401.05
523249.05

When DTC is Displayed:
When the engine cranks and will not start.

Related Information:
The ECU has not detected the crankshaft position signal and camshaft position signal.

Alarm Level:
Stop

Control Unit Response:
The ECU will not permit engine to run.

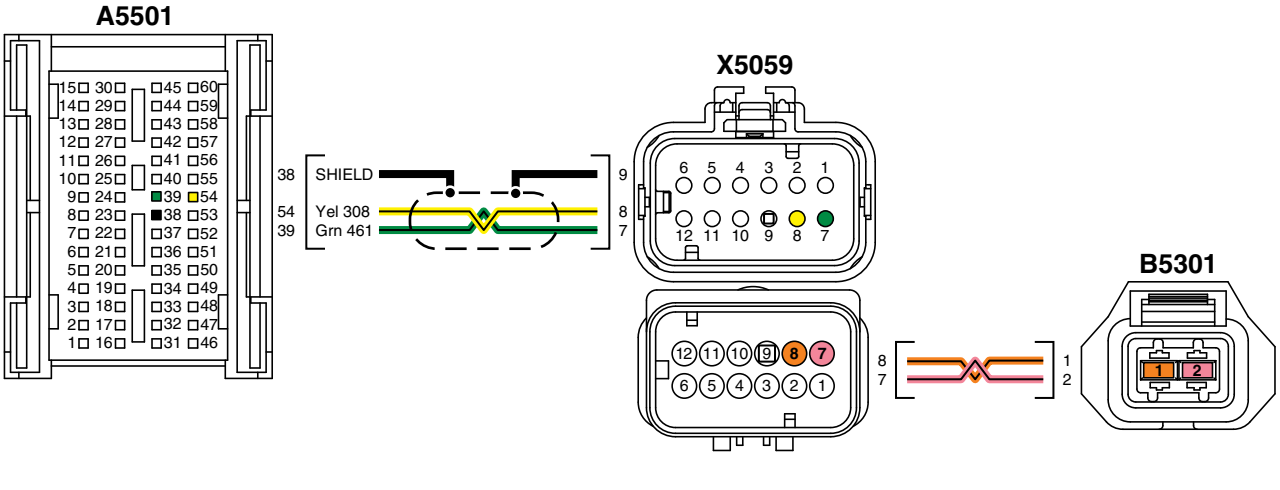
Additional References:
For more crankshaft position sensor information, and more camshaft position sensor information, see CTM120419.

For complete wiring information:

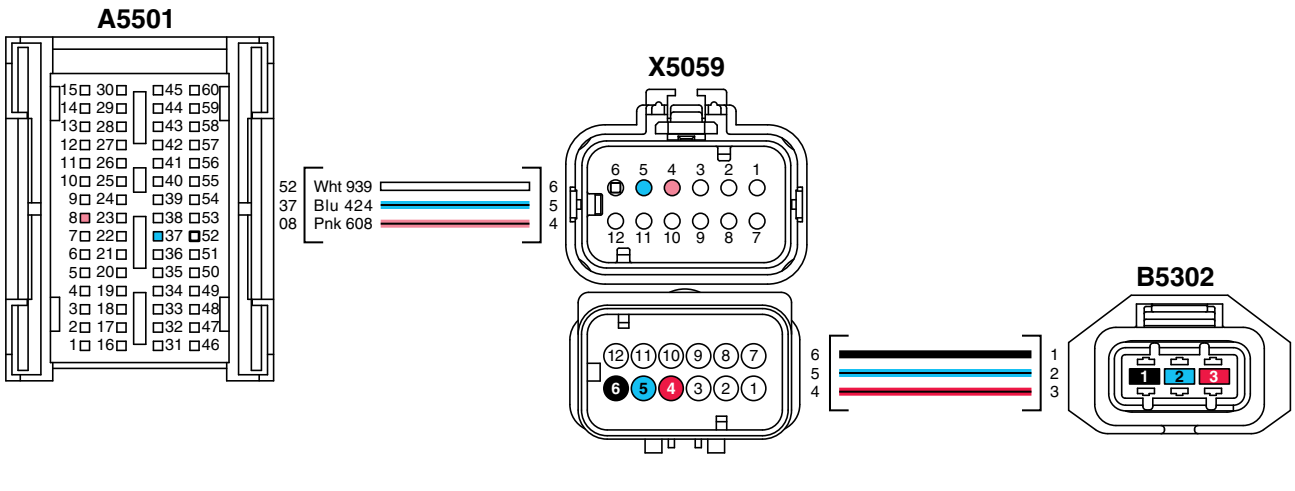
- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501—54—Return **A5501—39—Signal** **A5501—38—Shield**



A5501—08—Supply **A5501—52—Return** **A5501—37—Signal**

Continued on next page

OUMX258,00002BC -19-07MAR14-1/4

Diagnostic Procedure

OUMX258,00002BC -19-07MAR14-2/4

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot Information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. If any DTCs have snapshot capture or snapshot recording information, save the information. 4. See DTC 522400.05 procedure. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** Go to next step.

OUMX258,00002BC -19-07MAR14-3/4

2 Sensor Test	Perform DTC 522401.05 procedure. Were any problems found?	**YES:** Repair problem. Perform Verification Procedure. **NO:** See Problem Not Found Procedure.

OUMX258,00002BC -19-07MAR14-4/4

ECU 523460.07 — Fuel Rail Pressure Error For a Duration

The ECU has detected a fuel rail pressure error for a duration greater than a threshold value defined in the ECU.

Troubleshooting Sequence:
Any SPN 157 DTC
Any SPN 174 DTC
Any SPN 633 DTC
522571.03
522571.06
522572.06
522572.11
523489.00

When DTC is Displayed:
When the ignition is on, engine running, and the fault is active.

Related Information:
The ECU has detected a fuel rail pressure error for a duration greater than a threshold value defined in the ECU. This fault can be caused by a rail pressure sensor system fault, a suction control valve system fault, or a fuel temperature sensor fault.

The root cause of the rail pressure error must be determined and repaired prior to replacing the rail pressure limiter.
The rail pressure limiter has a finite number of opening cycles and must be replaced once the threshold is exceeded.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.

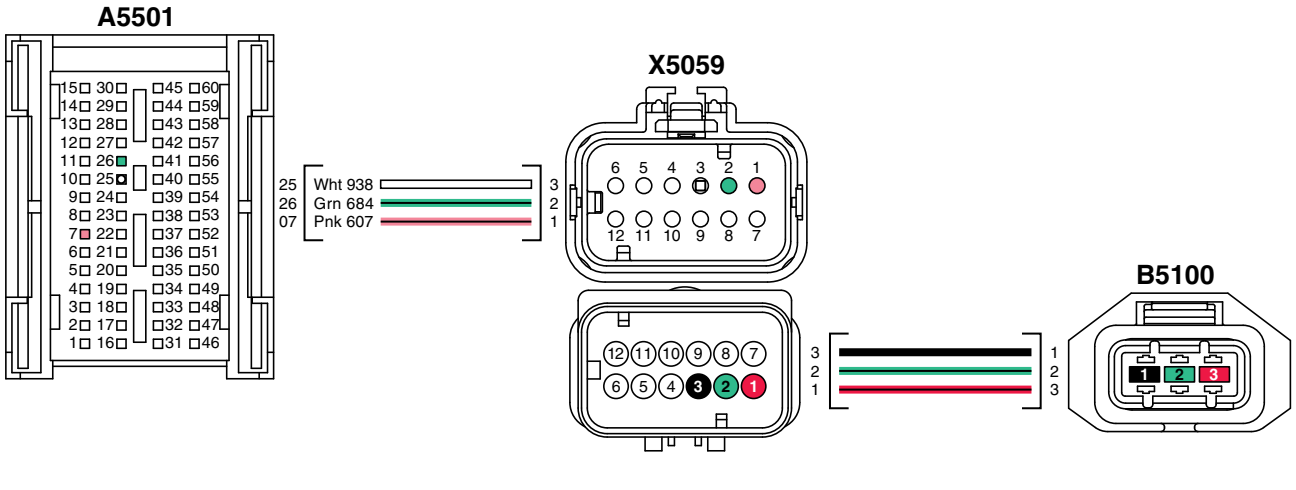
Additional references:
For component location, more suction control valve information, high-pressure fuel system information, and information on the Fuel Rail Pressure Relief Valve Counter Reset test, see CTM120419.

For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

located in Section 230, Group 50.



A5501—07—Supply **A5501—25— Signal** **A5501—26—Return**

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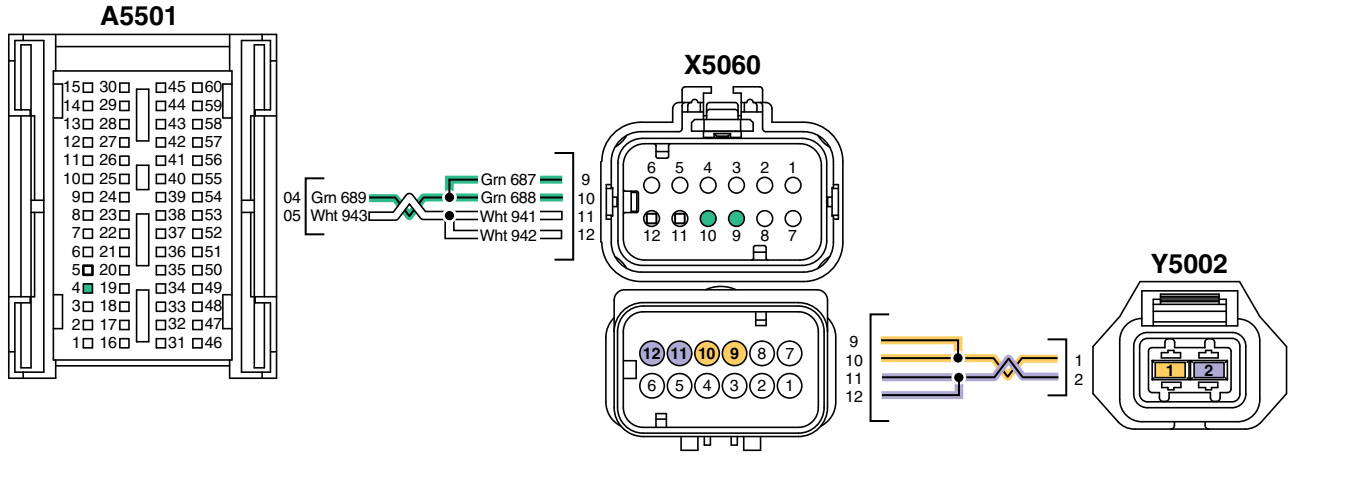


A5501—5—Drive - **A5501—4—Drive +**

OUMX258,00002BD -19-03JUN14-2/5

Diagnostic Procedure

OUMX258,00002BD -19-03JUN14-3/5

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes. Are any of the DTCs in the Troubleshooting Sequence active or stored?	**YES:** Perform diagnostics for those DTCs. Once root problem is resolved, replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test. See CTM120419 for replacement procedure. **NO:** Go to next step.

OUMX258,00002BD -19-03JUN14-4/5

2 Fuel System Check	Perform High-Pressure Fuel System Check procedure. See CTM120419 for check procedure. Did the high-pressure fuel system check pass?	**YES:** See Problem Not Found Procedure. **NO:** Repair problem. Replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test.

OUMX258,00002BD -19-03JUN14-5/5

ECU 523462.13 — Injector #1 Calibration Error

The ECU detects an injector calibration data error.

OUMX258,00002BE -19-07MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
523462.13

When DTC is Displayed:
When the ignition is on and the error is active.

Related Information:
The ECU detects an injector calibration data error. Engine performance may be dramatically affected. The engine may also be out of emissions compliance.

Alarm Level:
Stop

Control Unit Response:
The ECU commands an engine stop.

Additional References:
For more fuel injector information, see CTM120419, Section 03, Group 130.

For more fuel system information, see CTM120419, Section 03, Group 130.

For more electronic injector calibration information, see CTM120419, Section 04, Group 160.

OUMX258,00002BE -19-07MAR14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. In Service ADVISOR, perform Electronic Injector — Calibration Information. 4. Refresh codes. Is DTC 523462.13 active?	**YES:** Contact DTAC. **NO:** Perform Verification Procedure.

OUMX258,00002BE -19-07MAR14-3/3

ECU 523463.13 — Injector #2 Calibration Error

The ECU detects an injector calibration data error.

OUMX258,00002BF -19-13MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
523463.13

When DTC is Displayed:
When the ignition is on and the error is active.

Related Information:
The ECU detects an injector calibration data error. Engine performance may be dramatically affected. The engine may also be out of emissions compliance.

Alarm Level:
Stop

Control Unit Response:
The ECU commands an engine stop.

Additional References:
For more fuel injector information, see CTM120419, Section 03, Group 130.

For more fuel system information, see CTM120419, Section 03, Group 130.

For more electronic injector calibration information, see CTM120419, Section 04, Group 160.

OUMX258,00002BF -19-13MAR14-2/3

❶ **Read DTCs and Store Snapshot Information**	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. In Service ADVISOR, perform Electronic Injector — Calibration Information. 4. Refresh codes. Is DTC 523463.13 active?	**YES:** Contact DTAC. **NO:** Perform Verification Procedure.

OUMX258,00002BF -19-13MAR14-3/3

ECU 523464.13 — Injector #3 Calibration Error

The ECU detects an injector calibration data error.

OUMX258,00002C0 -19-07MAR14-1/3

Diagnostic Procedure

Troubleshooting Sequence:
523464.13

When DTC is Displayed:
When the ignition is on and the error is active.

Related Information:
The ECU detects an injector calibration data error. Engine performance may be dramatically affected. The engine may also be out of emissions compliance.

Alarm Level:
Stop

Control Unit Response:
The ECU commands an engine stop.

Additional References:
For more fuel injector information, see CTM120419, Section 03, Group 130.

For more fuel system information, see CTM120419, Section 03, Group 130.

For more electronic injector calibration information, see CTM120419, Section 04, Group 160.

OUMX258,00002C0 -19-07MAR14-2/3

1 Read DTCs and Store Snapshot Information	1. Connect Service ADVISOR. 2. Ignition ON, Engine OFF. 3. In Service ADVISOR, perform Electronic Injector — Calibration Information. 4. Refresh codes. Is DTC 523464.13 active?	**YES:** Contact DTAC. **NO:** Perform Verification Procedure.

OUMX258,00002C0 -19-07MAR14-3/3

ECU 523468.09 — Rail Pressure Limiter Open

The ECU has detected the rail pressure limiter has opened and is not able to control fuel rail pressure.

Troubleshooting Sequence:
Any SPN 157 DTC
Any SPN 633 DTC
522571.03
522571.06
522572.06
522572.11
523470.00

When DTC is Displayed:
When the ignition is on, engine running, and the fault is active.

Related Information:
The ECU has detected the rail pressure limiter has opened and is not able to control fuel rail pressure.
This fault can be caused by a problem with the rail pressure sensor or the suction control valve.
The root cause of the rail pressure limiter opening must be determined and repaired prior to replacing the rail pressure limiter.

The rail pressure limiter has a finite number of opening cycles and must be replaced once the threshold is exceeded.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional references:
For component location, more suction control valve information, high-pressure fuel system information, and information on the Fuel Rail Pressure Relief Valve Counter Reset test, see CTM120419.

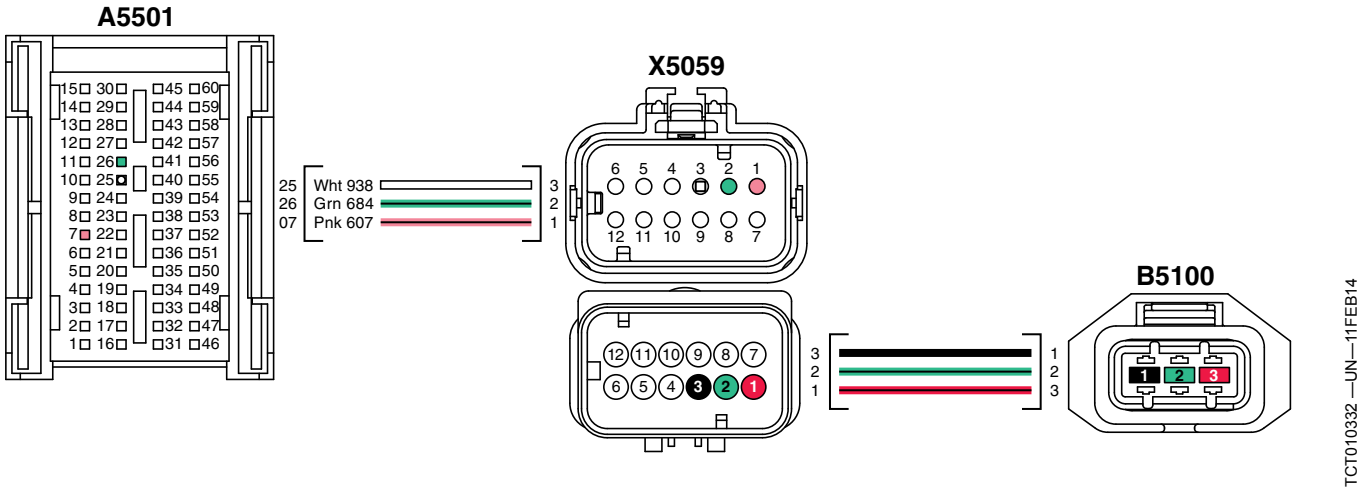
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501—07—Supply **A5501—25— Signal** **A5501—26—Return**

OUMX258,00002C1 -19-03JUN14-1/4

Diagnostic Procedure

Continued on next page

OUMX258,00002C1 -19-03JUN14-2/4

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes.	
	Are any of the DTCs in the Troubleshooting Sequence active or stored?	**YES:** Perform diagnostics for those DTCs. Once root problem is resolved, replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test. See CTM120419 for test procedure. **NO:** Go to next step.

OUMX258,00002C1 -19-03JUN14-3/4

2 Fuel System Check	Perform High-Pressure Fuel System Check procedure. See CTM120419 for check procedure.	
	Did the high-pressure fuel system check pass?	**YES:** See Problem Not Found Procedure. **NO:** Repair problem. Replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test.

OUMX258,00002C1 -19-03JUN14-4/4

ECU 523469.00 — Rail Pressure Limiter Occurrence Count Extremely High

The ECU has detected the rail pressure limiter has opened a greater number of occurrences than a threshold value defined in the ECU.

Troubleshooting Sequence:
Any SPN 157 DTC
Any SPN 633 DTC
522571.03
522571.06
522572.06
522572.11
523469.00

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected the rail pressure limiter has opened a greater number of occurrences than a threshold value defined in the ECU.
The root cause of the rail pressure limiter must be determined and repaired prior to replacing the rail pressure limiter.

The rail pressure limiter has a finite number of opening cycles and must be replaced once the threshold is exceeded.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional references:
For component location, more suction control valve information, high-pressure fuel system information, and information on the Fuel Rail Pressure Relief Valve Counter Reset test, see CTM120419.

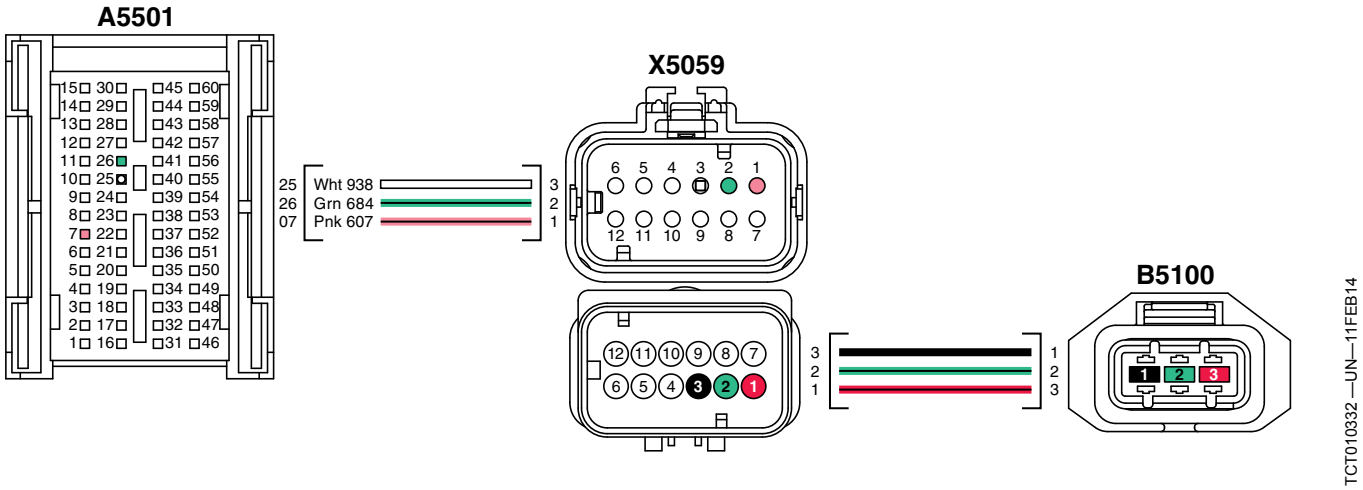
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501—07—Supply **A5501—25— Signal** **A5501—26—Return**

OUMX258,00002C2 -19-03JUN14-1/4

Diagnostic Procedure

Continued on next page

OUMX258,00002C2 -19-03JUN14-2/4

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes.	
		YES: Perform diagnostics for those DTCs. Once root problem is resolved, replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test.
	Are any of the DTCs in the Trouble Shooting Sequence active or stored?	**NO:** Go to next step.

OUMX258,00002C2 -19-03JUN14-3/4

2 Fuel System Check	Perform High-Pressure Fuel System Check procedure. See CTM120419 for check procedure.	**YES:** See Problem Not Found Procedure.
	Did the high-pressure fuel system check pass?	**NO:** Repair problem. Replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test.

OUMX258,00002C2 -19-03JUN14-4/4

ECU 523470.00 — Rail Pressure Limiter Cumulative Time Extremely High

The ECU has detected the amount of cumulative time the rail pressure limiter has opened is greater than a threshold value defined in the ECU.

Troubleshooting Sequence:
Any SPN 157 DTC
Any SPN 633 DTC
522571.03
522571.06
522572.06
522572.11
523470.00

When DTC is Displayed:
When the ignition is on, and the fault is active.

Related Information:
The ECU has detected the amount of cumulative time the rail pressure limiter has opened is greater than a threshold value defined in the ECU.
The root cause of the rail pressure limiter must be determined and repaired prior to replacing the rail pressure limiter.

The rail pressure limiter has a finite number of opening cycles and must be replaced once the threshold is exceeded.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional references:
For component location, more suction control valve information, high-pressure fuel system information, and information on the Fuel Rail Pressure Relief Valve Counter Reset test, see CTM120419.

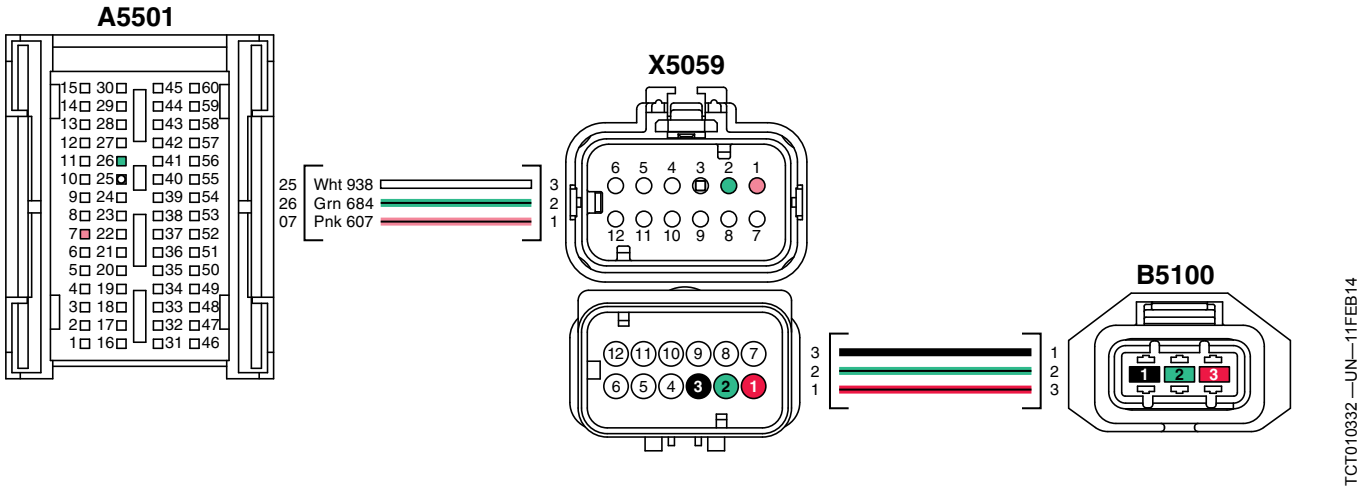
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501—07—Supply **A5501—25— Signal** **A5501—26—Return**

OUMX258,00002C3 -19-03JUN14-1/4

Diagnostic Procedure

Continued on next page

OUMX258,00002C3 -19-03JUN14-2/4

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes.	
	Are any of the DTCs in the Trouble Shooting Sequence active or stored?	**YES:** Perform diagnostics for those DTCs. Once root problem is resolved, replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test. See CTM120419 for replacement and test procedures. **NO:** Go to next step.

OUMX258,00002C3 -19-03JUN14-3/4

2 Fuel System Check	Perform High-Pressure Fuel System Check procedure. See CTM120419 for check procedure.	**YES:** See Problem Not Found Procedure.
	Did the high-pressure fuel system check pass?	**NO:** Repair problem. Replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test. See CTM120419 for test procedure.

OUMX258,00002C3 -19-03JUN14-4/4

ECU 523489.00 — Fuel Rail Pressure Extremely High For a Duration

The ECU has detected fuel rail pressure greater than a threshold value defined in the ECU for a duration greater than a threshold value defined in the ECU.

Troubleshooting Sequence:
Any SPN 157 DTC
Any SPN 633 DTC
522571.03
522571.06
522572.06
522572.11
523489.00

When DTC is Displayed:
When the ignition is on, engine running, and the fault is active.

Related Information:
The ECU has detected fuel rail pressure greater than a threshold value defined in the ECU for a duration greater than a threshold value defined in the ECU.
This fault can be caused by a rail pressure sensor system fault, a suction control valve system fault, or a rail pressure limiter failure.
The root cause of the extremely high rail pressure must be determined and repaired prior to replacing the rail pressure limiter.
The rail pressure limiter has a finite number of opening cycles and must be replaced once the threshold is exceeded.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.

Additional references:
For component location, more suction control valve information, high-pressure fuel system information, and information on the Fuel Rail Pressure Relief Valve Counter Reset test, see CTM120419.

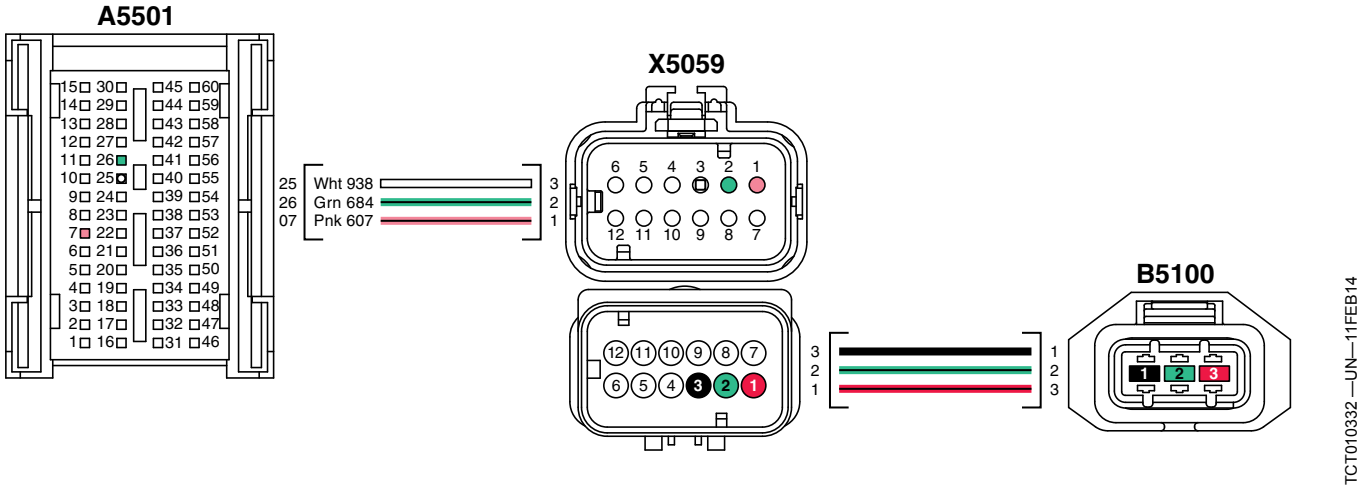
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501—07—Supply **A5501—25— Signal** **A5501—26—Return**

OUMX258,00002C4 -19-03JUN14-1/4

Diagnostic Procedure

Continued on next page

OUMX258,00002C4 -19-03JUN14-2/4

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Ignition ON, engine running. 4. Refresh codes.	
	Are any of the DTCs in the Trouble Shooting Sequence active or stored?	**YES:** Perform diagnostics for those DTCs. Once root problem is resolved, replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test. See CTM120419 for replacement and test procedures. **NO:** Go to next step.

OUMX258,00002C4 -19-03JUN14-3/4

2 Fuel System Check	Perform High-Pressure Fuel System Check procedure. See CTM120419 for check procedure.	**YES:** See Problem Not Found Procedure.
	Did the high-pressure fuel system check pass?	**NO:** Repair problem. Replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test. See CTM120419 for test procedure.

OUMX258,00002C4 -19-03JUN14-4/4

ECU 523491.00 — Fuel Temperature Extremely High For a Duration

The ECU has detected fuel temperature is greater than a threshold value defined in the ECU for a duration greater than a threshold value defined in the ECU.

Troubleshooting Sequence:
Any SPN 157 DTC
Any SPN 633 DTC
522571.03
522571.06
522572.06
522572.11
523491.00

When DTC is Displayed:
When the ignition is on, engine running, and the fault is active.

Related Information:
The ECU has detected fuel temperature is greater than a threshold value defined in the ECU for a duration greater than a threshold value defined in the ECU.
This fault can be caused by a rail pressure sensor system fault, a suction control valve system fault, or a rail pressure limiter failure. A fault in any of these systems can result in excessive rail pressure causing extremely high fuel temperature.

The root cause of the extremely high fuel temperature must be determined and repaired prior to replacing the rail pressure limiter.
The rail pressure limiter has a finite number of opening cycles and must be replaced once the threshold is exceeded.

Alarm Level:
Stop

Control Unit Response:
The ECU derates the engine.
The ECU commands the EGR Valve fully closed.
DPF regeneration will be aborted and inhibited while the fault is active.

Additional references:
For component location, high-pressure fuel system information, and information on the Fuel Rail Pressure Relief Valve Counter Reset test, see CTM120419.

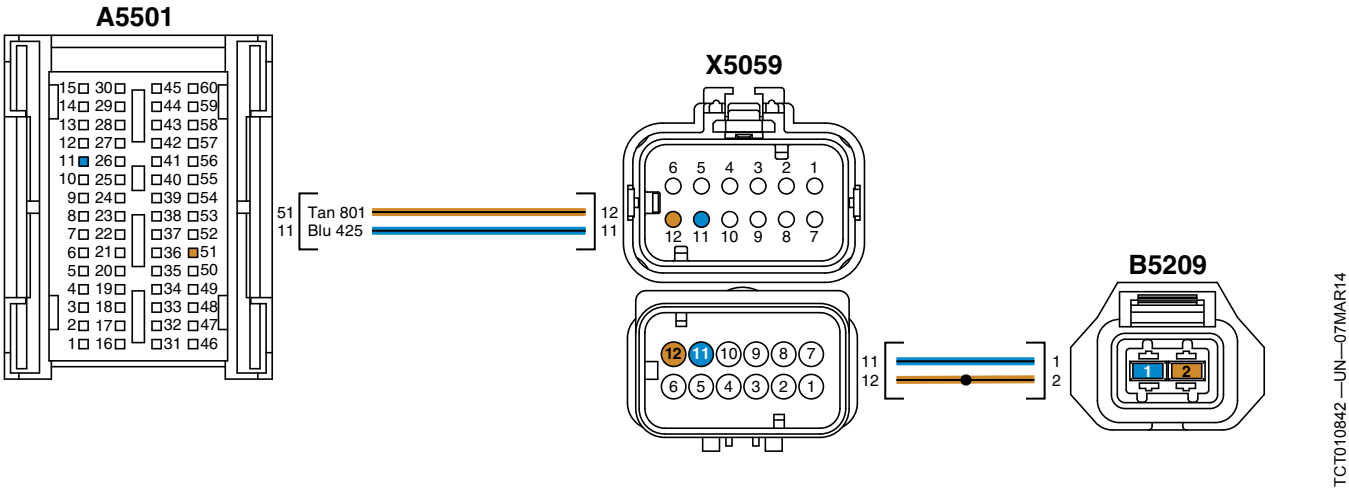
For complete wiring information:

- see Main Electrical Schematic, T4

- see Engine Connector X5059 Schematic

- see Engine Connector X5060 Schematic

located in Section 230, Group 50.



A5501—11—Signal **A5501—51—Return**

OUMX258,00002C5 -19-03JUN14-1/4

Diagnostic Procedure

Continued on next page

OUMX258,00002C5 -19-03JUN14-2/4

1 Read DTCs	1. Connect Service ADVISOR. *NOTE: When DTCs are cleared, Snapshot information for ALL DTCs is cleared.* 2. Ignition ON, Engine OFF. 3. Refresh codes.	
		YES: Perform diagnostics for those DTCs. Once root problem is resolved, replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test.
	Are any of the DTCs in the Troubleshooting Sequence active or stored?	**NO:** Go to next step.

OUMX258,00002C5 -19-03JUN14-3/4

2 Fuel System Check	Perform High-Pressure Fuel System Check procedure. See CTM120419 for check procedure.	**YES:** See Problem Not Found Procedure.
	Did the high-pressure fuel system check pass?	**NO:** Repair problem. Replace rail pressure limiter and perform Fuel Rail Pressure Relief Valve Counter Reset test.

OUMX258,00002C5 -19-03JUN14-4/4

RMC DTC Quick Reference Table

Diagnostic Trouble Code (DTC)	Cycle Enable	Shutdown Required	Fault Description	Possible Cause/Solution
RMC_00628.12 See RMC_000628.12 - Stuck in Boot Block.	false	false	STUCK IN BOOT BLOCK	Install latest payload into controller
RMC_002513.03 See RMC_002513.03 - Orange Phase (A) is Shorted to Supply.	false	true	PHASE A SHORT TO SUPPLY (PHASE HIGH)	Inspect high current wires to motor.
RMC_002513.04 See RMC_002513.04 - Orange Phase (A) is Shorted to Ground.	false	true	PHASE A SHORT TO GND (PHASE LOW)	Most likely short in high-amperage phase wire. Inspect for damage.
RMC_002513.05 See RMC_002513.05 - Orange Phase (A) is Open.	false	true	PHASE A OPEN	Open high-amperage wire. Check harness and connector.
RMC_002514.03 See RMC_002514.03 - Black Phase (B) is Shorted to Supply.	false	true	PHASE B SHORT TO SUPPLY (PHASE HIGH)	Inspect high current wires to motor.
RMC_002514.04 See RMC_002514.04 - Black Phase (B) is Shorted to Ground.	false	true	PHASE B SHORT TO GND (PHASE LOW)	Most likely short in high-amperage phase wire. Inspect for damage.
RMC_002514.05 See RMC_002514.05 - Black Phase (B) is Open.	false	true	PHASE B OPEN	Open high-amperage wire. Check harness and connector.
RMC_002515.03 See RMC_002515.03 - Green Phase (C) is Shorted to Supply.	false	true	PHASE C SHORT TO SUPPLY (PHASE HIGH)	Inspect high current wires to motor.
RMC_002515.04 See RMC_002515.04 - Green Phase (C) is Shorted to Ground.	false	true	PHASE C SHORT TO GND (PHASE LOW)	Most likely short in high-amperage phase wire. Inspect for damage.
RMC_002515.05 See RMC_002515.05 - Green Phase (C) is Open.	false	true	PHASE C OPEN	Open high-amperage wire. Check harness and connector.
RMC_003511.00 See RMC_003511.00 - Hall Voltage High.	true	true	HIGH FAULT HALL PWR	Motor control sensor wire voltage is High. Signal wires shorted to external power line. Inspect connector and wires. Possible internal controller regulator failure. Disconnect motor and inspect sense wire output from control.
RMC_003511.01 See RMC_003511.01 - Hall Voltage Low.	true	true	LOW FAULT HALL PWR	Motor control sensor wire voltage is Low. Signal wires shorted to Ground. Inspect connector and wires. Possible internal controller regulator failure. Disconnect motor and inspect sense wire output from control.
RMC_003597.00 See RMC_003597.00 - Controller 14V High.	true	true	HIGH FAULT 14V	Connections/Controller
RMC_003597.01 See RMC_003597.01 - Controller 14V Low.	true	true	LOW FAULT 14V	Connections/Controller
RMC_521153.15 See RMC_521153.15 - Controller Shutdown Over Temp.	true	true	CONTROLLER OVER TEMP	Internal controller temperature resulted in controller shutting down motor. Likely heavy load on motor/controller combined with high ambient temperature. If controller is cool to touch and fault does not clear then suspect controller.
RMC_522327.00 See RMC_522327.00 - Motor Over Temp.	true	true	MOTOR OVER TEMP	Internal motor temperature resulted in controller shutting down motor. Likely heavy load on motor/controller. If it happens with a invalid start position code, then connector is off. Let motor cool and if signal does not clear then check motor wires for damage. Do continuity check of internal motor temperature switch.
RMC_522919.03 See RMC_522913.03 Hall Resync Shutdown	true	false	HALL RESYNC ERROR	Motor position sensor error while running. If accompanied multiple stalls or motor hot likely due to heavy load. Check for contamination in connectors, bent pin, broken wiring, failed internal motor sensor.
RMC_522917.00 See RMC_522917.00 - Controller Current Threshold 3 Shutdown.	true	true	OVER CURRENT3	Motor current over the limit. Likely cause is excessive load. Check for jammed reels; Check reel to bed knife clearance; Monitor current into controller. Check for jammed reels or failed bearings;

Continued on next page

CB12260,00004F1 -19-03JUN14-1/2

Diagnostic Trouble Code (DTC)	Cycle Enable	Shutdown Required	Fault Description	Possible Cause/Solution
RMC_522917.06 See RMC_522917.06 - Controller Hardware Current Shutdown.	true	true	HARDWARE OVER CURRENT	Motor current over the limit. Likely cause is excessive load. Check for jammed reels; Check reel to bed knife clearance; Monitor current into controller. Check for jammed reels or failed bearings;
RMC_522917.15 See RMC_522917.15 - Controller Current Threshold 1 Shutdown.	true	false	OVER CURRENT1	Motor current over the limit. Likely cause is excessive load. Check for jammed reels; Check reel to bed knife clearance; Monitor current into controller. Check for jammed reels or failed bearings;
RMC_522917.16 See RMC_522917.16 - Controller Current Threshold 2 Shutdown.	true	false	OVER CURRENT2	Motor current over the limit. Likely cause is excessive load. Check for jammed reels; Check reel to bed knife clearance; Monitor current into controller. Check for jammed reels or failed bearings;
RMC_522918.00 See RMC_522918.00 - Motor Start Failed 3x Fault.	false	false	START FAILED	Motor failed to start. Likely mechanical obstruction in reel. Likely cause is excessive load. Check for jammed reels; Check reel to bed knife clearance; Monitor current into controller. Check for jammed reels or failed bearings;
RMC_522918.02 See RMC_522918.02 - Motor Spin Direction Shutdown.	true	false	DIR ERROR3	Reel direction reversed for 1/4 turn of motor. Hit obstacle or attachment issue. Check reel, bed knife, attachment for damage.
RMC_522918.15 See RMC_522918.15 - Motor Stalled While Running.	true	false	MOTOR STALLED	Motor stalled while running. Reel obstructed while turning. Likely cause is excessive load. Check for jammed reels; Check reel to bed knife clearance; Monitor current into controller. Check for jammed reels or failed bearings;
RMC_522919.03 See RMC_522919.03 - Hall Resync Shutdown.	true	false	HALL RESYNC ERROR	Motor position sensor error while running; If accompanied multiple stalls or motor hot likely due to heavy load. Check for contamination in connectors; bent pin; broken wiring, failed internal motor sensor.
RMC_522919.12 See RMC_522919.12 - Invalid Hall State Detected at Start-Up.	false	true	START POSITION INVALID	Motor position sensor error at start. When motor not running there is an invalid hall pattern. If occurs with a motor temperature fault, most likely is that connector is disconnected. Check for connector off; contamination in connectors; bent pin; broken wiring, failed internal motor sensor.
RMC_523666.00 See RMC_523666.00 Bus Voltage High.	true	false	HIGH FAULT VBUS	Alternator output exceeding 48V. Check alternator internal regulator and connections.
RMC_523666.01 See RMC_523666.01 Bus Voltage Low.	true	false	LOW FAULT VBUS	48V DC Low - alternator voltage below 20 volts when running. Overloaded reels or insufficient engine rpm. Possible alternator malfunction.
RMC_523666.02 See RMC_523666.02 Low VBUS on Start.	true	false	LOW VBUS ON START	48V DC Low - alternator voltage below 20 volts when running. Overloaded reels or insufficient engine rpm. Possible alternator malfunction.

CB12260,00004F1 -19-03JUN14-2/2

Data Point Live Readings

RMC Motor Current

Amperage supplied by controller to reel motor to achieve and maintain commanded motor speed. (amps)

NOTE: Equivalent to motor operating load.

Motor Current, RMC 1, Front Left		6—7 amps each reel: reel with GTC, or FTC 7—8 amps
Motor Current, RMC 2, Rear Left		
Motor Current, RMC 3, Front Center		
Motor Current, RMC 5, Front Right		
Motor Current, RMC 6, Rear Right		

RMC Motor Driver Heat Sink Temperature

Internal controller operating temperature (Fahrenheit).

Heat Sink Temperature, RMC 1, Front Left		(Deg F)
Heat Sink Temperature, RMC 2, Rear Left		(Deg F)
Heat Sink Temperature, RMC 3, Front Center		(Deg F)
Heat Sink Temperature, RMC 5, Front Right		(Deg F)
Heat Sink Temperature, RMC 6, Rear Right		(Deg F)

RMC Power Supply Voltage #1, Switched

Measured voltage supplied by 48V Alternator to controller. (volts)

Supply Voltage, RMC 1, Front Left		45—50 Volts
Supply Voltage, RMC 2, Rear Left		45—50 Volts
Supply Voltage, RMC 3, Front Center		45—50 Volts
Supply Voltage, RMC 5, Front Right		45—50 Volts
Supply Voltage, RMC 6, Rear Right		45—50 Volts

RMC Drive Motor Speed

Reel motor operating speed (rpm). Controller determines motor speed using electrical signals received from magnetic switches inside motor. (rpm)

NOTE: Motor operating speed should closely match commanded speed. Reel motors located on left side of cutting unit will have negative (-) value, whereas reel motors located on right side will have positive (+) value.

Drive Motor Speed, RMC 1, Front Left		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 2, Rear Left		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 3, Front Center		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 5, Front Right		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 6, Rear Right		variable (200—2815 rpm) slow to fast

RMC Drive Motor Speed Command

Reel motor speed commanded by controller. Determined by position of operator input to display panel. Controller calculates a target motor speed.. (rpm)

NOTE: Commanded motor speed is unaffected by positions of Mow/Backlap command through display panel.

Drive Motor Speed Command, RMC 1, Front Left		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 2, Rear Left		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 3, Front Center		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 5, Front Right		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 6, Rear Right		variable (200—2815 rpm)

RMC Motor Operating Modes

Direction of reel motor rotation.

Continued on next page

RMC Motor Operating Modes, RMC 1, Front Left		Direction of rotation
RMC Motor Operating Modes, RMC 2, Rear Left		Direction of rotation
RMC Motor Operating Modes, RMC 3, Front Center		Direction of rotation
RMC Motor Operating Modes, RMC 5, Front Right		Direction of rotation
RMC Motor Operating Modes, RMC 6, Rear Right		Direction of rotation

RMC PTO State

Mow function status.

RMC PTO State, RMC 1, Front Left		Enable / Disable
RMC PTO State, RMC 2, Rear Left		
RMC PTO State, RMC 3, Front Center		
RMC PTO State, RMC 5, Front Right		
RMC PTO State, RMC 6, Rear Right		

RMC Drive Motor Torque Limit Command - Driving Torque

Calculated reel motor torque based on commanded motor speed.

Drive Motor Torque Limit, RMC 1, Front Left		(lb.-ft. / N·m)
Drive Motor Torque Limit, RMC 2, Rear Left		(lb.-ft. / N·m)
Drive Motor Torque Limit, RMC 3, Front Center		(lb.-ft. / N·m)
Drive Motor Torque Limit, RMC 5, Front Right		(lb.-ft. / N·m)
Drive Motor Torque Limit, RMC 6, Rear Right		(lb.-ft. / N·m)

RMC Cable ID

Position of Reel Motor Controller on machine. Determined by pin configuration of CAN connector on machine wiring harness.

RMC Cable ID, RMC 1, Front Left		Position on machine
RMC Cable ID, RMC 2, Rear Left		Position on machine
RMC Cable ID, RMC 3, Front Center		Position on machine
RMC Cable ID, RMC 5, Front Right		Position on machine
RMC Cable ID, RMC 6, Rear Right		Position on machine

OUMX258,00002D7 -19-03JUN14-2/2

RMC 000628.12 — Stuck in Boot Block

RMC_xxxxxx.xx Incorrect Application Software

Code Caused By: Software error

Alarm Level: Stop

To Clear Display: N/A

Alarm Frequency:

Control Unit Response: Function degraded

Snapshot Recorded: N/A

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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Continued on next page

BS62576,000114D -19-14MAR14-1/3

Stuck in Boot Block

BS62576,000114D -19-14MAR14-2/3

1 **Test Procedure**	Connect Service ADVISOR and install available payload for controller. Does this clear error code?	**YES:** End of procedure. **NO:** Open DTAC case.

BS62576,000114D -19-14MAR14-3/3

RMC 002513.03 — Orange Phase (A) is Shorted to Supply

Code Caused By: High voltage to phase A in orange wire or motor (phase high)

Alarm Level:

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: None

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

Inspect high current wires to motor.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire shorted to 48V supply or another phase wire.*
- *Faulty controller.*

BS62576,000114E -19-14MAR14-1/3

Orange Phase (A) is Shorted to Supply

BS62576,000114E -19-14MAR14-2/3

1 **Test Procedure**	Visually verify that the phase leads to the motor are not frayed or shorted together. Inspect connector for damage. Are phase wires and connector to motor okay?	**YES:** Replace reel controller. **NO:** Repair wire or connector.

BS62576,000114E -19-14MAR14-3/3

RMC 002513.04 — Orange Phase (A) is Shorted to Ground

Code Caused By: Low current to phase A in orange wire or motor (phase low)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase or current errors on reel controller in question

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Inspect high current wires to motor.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire shorted to ground.*
- *Faulty motor or controller.*

BS62576,000114F -19-14MAR14-1/4

Orange Phase (A) is Shorted to Ground

BS62576,000114F -19-14MAR14-2/4

1 Test Procedure	Visually verify that the phase leads to the motor are not frayed or shorted together. Inspect connector for damage. Are phase wires or connector to motor damaged?	**YES:** Repair wire or connector. **NO:** Go to next step.

BS62576,000114F -19-14MAR14-3/4

2 Continued	Disconnect motor from controller and observe Service ADVISOR diagnostics. Is the currently active fault for the controller now showing OPEN phase?	**YES:** Replace reel motor. **NO:** Replace controller.

BS62576,000114F -19-14MAR14-4/4

RMC 002513.05 — Orange Phase (A) is Open

Code Caused By: No current to phase A in orange wire or motor (phase low)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

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Inspect high current wires to motor.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty motor or controller.*

BS62576,0001150 -19-14MAR14-1/7

Orange Phase (A) is Open

BS62576,0001150 -19-14MAR14-2/7

1 Test Procedure	Are heavy current wires and connectors damaged?	**YES:** Repair wire or connector. **NO:** Go to next step.

BS62576,0001150 -19-14MAR14-3/7

2 Continued	Swap motor with another motor on machine. Is problem resolved or does problem move?	**YES:** Replace reel motor. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Go to next step.

BS62576,0001150 -19-14MAR14-4/7

3 Continued	Does problem remain in same location?	**YES:** Replace reel controller. **NO:** Go to next step.

BS62576,0001150 -19-14MAR14-5/7

4 Continued	Connect to Service ADVISOR and check all RMC Current readings. Are all RMCs showing similar readings?	**YES:** Clear code and retest. **NO:** Go to next step.

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

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BS62576,0001150 -19-14MAR14-6/7

5 Continued	Does problem return?	**YES:** Open DTAC case. **NO:** Intermittent problem. Duplicate conditions to cause code and repeat procedure.

BS62576,0001150 -19-14MAR14-7/7

RMC 002514.03 — Black Phase (B) is Shorted to Supply

Code Caused By: High voltage to phase B in black wire or motor (phase high)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

Inspect high current wires to motor.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire shorted to 48V supply or another phase wire.*
- *Faulty controller.*

BS62576,0001152 -19-14MAR14-1/3

Black Phase (B) is Shorted to Supply

BS62576,0001152 -19-14MAR14-2/3

1 Test Procedure	Visually verify that the phase leads to the motor are not frayed or shorted together. Inspect connector for damage. Are phase wires and connector to motor okay?	**YES:** Replace reel controller. **NO:** Repair wire or connector.

BS62576,0001152 -19-14MAR14-3/3

RMC 002514.04 — Black Phase (B) is Shorted to Ground

Code Caused By: Low current to phase B in black wire or motor (phase low)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

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Inspect high current wires to motor.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire shorted to ground.*
- *Faulty motor or controller.*

BS62576,0001154 -19-14MAR14-1/4

Black Phase (B) is Shorted to Ground

BS62576,0001154 -19-14MAR14-2/4

1 Test Procedure	Visually verify that the phase leads to the motor are not frayed or shorted together. Inspect connector for damage. Are phase wires or connector to motor damaged?	**YES:** Repair wire or connector. **NO:** Go to next step.

BS62576,0001154 -19-14MAR14-3/4

2 Continued	Disconnect motor from controller and observe Service ADVISOR diagnostics. Is the currently active fault for the controller now showing OPEN phase?	**YES:** Replace reel motor. **NO:** Replace controller.

BS62576,0001154 -19-14MAR14-4/4

RMC 002514.05 — Black Phase (B) is Open

Code Caused By: No current to phase A in black wire or motor (phase low)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

Inspect high current wires to motor.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire open.*
- *Faulty motor or controller.*

BS62576,0001155 -19-03JUN14-1/7

Black Phase (B) is Open

BS62576,0001155 -19-03JUN14-2/7

❶ **Test Procedure**	Are heavy current wires and connectors damaged?	**YES:** Repair wire or connector. **NO:** Go to next step.

BS62576,0001155 -19-03JUN14-3/7

❷ **Continued**	Swap motor with another motor on machine. Is problem resolved or does problem move?	**YES:** Replace reel motor. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Go to next step.

BS62576,0001155 -19-03JUN14-4/7

❸ **Continued**	Does problem remain in same location?	**YES:** Replace reel motor. **NO:** Go to next step.

BS62576,0001155 -19-03JUN14-5/7

❹ **Continued**	Connect to Service ADVISOR and check al RMC Current readings. Are all RMCs showing similar readings?	**YES:** Clear code and check for return of problem. **NO:** Go to next step.

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

Continued on next page

BS62576,0001155 -19-03JUN14-6/7

5 Continued	Does problem return?	**YES:** Open DTAC case. **NO:** Intermittent problem. Duplicate conditions to cause code and repeat procedure.

BS62576,0001155 -19-03JUN14-7/7

RMC 002515.03 — Green Phase (C) is Shorted to Supply

Code Caused By: High voltage to phase C in green wire or motor (phase high)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

Inspect high current wires to motor.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire shorted to 48V supply or another phase wire.*
- *Faulty controller.*

BS62576,0001156 -19-14MAR14-1/3

Green Phase (C) is Shorted to Supply

BS62576,0001156 -19-14MAR14-2/3

1 Test Procedure	Visually verify that the phase leads to the motor are not frayed or shorted together. Inspect connector for damage. Are phase wires and connector to motor okay?	**YES:** Replace reel controller. **NO:** Repair wire or connector.

BS62576,0001156 -19-14MAR14-3/3

RMC 002515.04 — Green Phase (C) is Shorted to Ground

Code Caused By: Low current to phase C in green wire or motor (phase low)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

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Inspect high current wires to motor.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire shorted to ground.*
- *Faulty motor or controller.*

BS62576,0001157 -19-14MAR14-1/4

Green Phase (C) is Shorted to Ground

BS62576,0001157 -19-14MAR14-2/4

1 Test Procedure	Visually verify that the phase leads to the motor are not frayed or shorted together. Inspect connector for damage. Are phase wires or connector to motor damaged?	**YES:** Repair wire or connector. **NO:** Go to next step.

BS62576,0001157 -19-14MAR14-3/4

2 Continued	Disconnect motor from controller and observe Service ADVISOR diagnostics. Is the currently active fault for the controller now showing OPEN phase?	**YES:** Replace reel motor. **NO:** Replace controller.

BS62576,0001157 -19-14MAR14-4/4

RMC 002515.05 — Green Phase (C) is Open

Code Caused By: No current to phase A in black wire or motor (phase low)

Alarm Level: Stop

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: Reel stops

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other 48V phase errors on reel controller in question.

Inspect high current wires to motor.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Phase wire open.*
- *Faulty motor or controller.*

BS62576,0001158 -19-14MAR14-1/7

Green Phase (C) is Open

BS62576,0001158 -19-14MAR14-2/7

❶ **Test Procedure**	Are heavy current wires and connectors damaged?	**YES:** Repair wire or connector. **NO:** Go to next step.

BS62576,0001158 -19-14MAR14-3/7

❷ **Continued**	Swap motor with another motor on machine. Is problem resolved or does problem move?	**YES:** Replace reel motor. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Go to next step.

BS62576,0001158 -19-14MAR14-4/7

❸ **Continued**	Does problem remain in same location?	**YES:** Replace reel motor. **NO:** Go to next step.

BS62576,0001158 -19-14MAR14-5/7

❹ **Continued**	Connect to Service ADVISOR and check al RMC Current readings. Are all RMCs showing similar readings? Motor Current, RMC 1, Front Left Motor Current, RMC 2, Rear Left Motor Current, RMC 3, Front Center Motor Current, RMC 5, Front Right Motor Current, RMC 6, Rear Right	**YES:** Clear code and check for return of problem. **NO:** Go to next step.

Continued on next page

BS62576,0001158 -19-14MAR14-6/7

5 Continued	Does problem return?	**YES:** Open DTAC case. **NO:** Intermittent problem. Duplicate conditions to cause code and repeat procedure.

BS62576,0001158 -19-14MAR14-7/7

RMC 003511.00 — Hall Voltage High

Code Caused By: Indicates voltage from controller to Hall sensors is high

Alarm Level: Service Alert

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: No

Required Tools: Service ADVISOR, Multimeter

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_003597.00 14V Voltage High - Indicated failed controller voltage regulator.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Faulty controller*

BS62576,0001159 -19-14MAR14-1/4

Hall Voltage High

BS62576,0001159 -19-14MAR14-2/4

1 Test Procedure	Is Hall voltage over 15 V?	**YES:** Replace controller. **NO:** Go to next step.

BS62576,0001159 -19-14MAR14-3/4

2 Continued	Swap controller with another controller on machine. Is problem resolved or does problem move?	**YES:** Replace controller. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Open DTAC case.

BS62576,0001159 -19-14MAR14-4/4

RMC 003511.01 — Hall Voltage Low

Code Caused By: Indicates voltage from controller to Hall sensors is low

Alarm Level: Service Alert

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: No

Required Tools: Service ADVISOR, Multimeter

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_003597.01 14V Voltage Low - Indicated failed controller voltage regulator.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Hall supply wire shorted to ground.*
- *Faulty controller*

BS62576,000115A -19-03JUN14-1/5

Hall Voltage Low

BS62576,000115A -19-03JUN14-2/5

❶ **Test Procedure**	Unplug the motor for test. Is at least 11.3 VDC present at Hall power output.	**YES:** Plug motor back in. If voltage is low with motor plugged back in, but not when unplugged then swap motor to see if problem moves with the motor or stays with the controller. Go to next step. **NO:** If no 003597.01 code present, go to next step. Otherwise, troubleshoot low 14 VDC code.

BS62576,000115A -19-03JUN14-3/5

❷ **Continued**	Is 14 Vdc present at controller, Red wire?	**YES:** Check Red wire for short to ground. **YES:** Check Wht wire for short to ground. **NO:** Replace controller.

BS62576,000115A -19-03JUN14-4/5

❸ **Continued**	Swap controller with another controller on machine. Is problem resolved or does problem move?	**YES:** Replace controller. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Open DTAC case.

BS62576,000115A -19-03JUN14-5/5

RMC 003597.00 — Controller 14V High

Code Caused By: Indicates an internal 14V voltage regulator failure in reel motor controller

Alarm Level: Service Alert

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other controllers with RMC_003597.00 - Controller 14V High. If so, look for:

RMC_523666.00 If code appears, troubleshoot first.

RMC_003511.00 - Hall Voltage High

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *If code happened once, cleared, and did not reoccur, suspect possible transient voltage spike*
- *Faulty 48V alternator*
- *Faulty controller ground connection*
- *Faulty controller power supply*

BS62576,000115C -19-14MAR14-1/3

Controller 14V High

BS62576,000115C -19-14MAR14-2/3

1 Test Procedure	If none of the above symptoms or causes can be found, swap controller with another controller on machine. Is problem resolved or does problem move?	**YES:** Replace controller. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Open DTAC case.

BS62576,000115C -19-14MAR14-3/3

RMC 003597.01 — Controller 14V Low

Code Caused By: Indicates an internal 14V voltage regulator failure in reel motor controller

Alarm Level: Service Alert

To Clear Display: Cycle key switch

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: No

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

Any other controllers with RMC_003597.01 - Controller 14V Low. If so, look for:

RMC_523666.01. If code appears, troubleshoot first.

RMC_003511.01 - Hall Voltage Low

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *If code happened once, cleared, and did not reoccur, suspect possible transient voltage spike*
- *Faulty 48V alternator*
- *Faulty controller ground connection*
- *Faulty controller power supply*

BS62576,000115E -19-14MAR14-1/3

Controller 14V Low

BS62576,000115E -19-14MAR14-2/3

1 Test Procedure	If none of the above symptoms or causes can be found, swap controller with another controller on machine. Is problem resolved or does problem move?	**YES:** Replace controller. DTAC case should be submitted showing this fault with the serial # of the controller. **NO:** Open DTAC case.

BS62576,000115E -19-14MAR14-3/3

RMC 521153.15 — Controller Shutdown Over Temp

Code Caused By: Indicates controller/motor drawing too much current and controller is shut down

Alarm Level: Stop

To Clear Display: Cycle power

Alarm Frequency: Only when active

Control Unit Response: Controller/Motor shutdown

Snapshot Recorded: Yes

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_522917.00 Controller Current Threshold 3 Shutdown.

RMC_522917.06 Controller Hardware Current Shutdown.

RMC_522918.15 Motor Stall While Running.

RMC_522919.12 This code likely indicates that the reel motor connector is disconnected.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive debris in reel*
- *Controller cooling fins blocked*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *High ambient temperature*

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BS62576,0001160 -19-03JUN14-1/5

Controller Shutdown Over Temp

BS62576,0001160 -19-03JUN14-2/5

1 Test Procedure	Does controller feel warm to the touch?	**YES:** Allow controller to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

BS62576,0001160 -19-03JUN14-3/5

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Suspect motor or reel problems.

NO: Go to next step.

Continued on next page

BS62576,0001160 -19-03JUN14-4/5

❸ **Continued**	Swap controller with another controller on machine. Does problem move with controller?	**YES:** Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001160 -19-03JUN14-5/5

RMC 522327.00 — Motor Over Temp

Code Caused By: Indicates high internal motor temperature resulted in controller shutting down motor

Alarm Level: Stop

To Clear Display: Cycle power

Alarm Frequency: Only when active

Control Unit Response: Motor shutdown

Snapshot Recorded: Yes

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_522917.00 Controller Current Threshold 3 Shutdown.

RMC_522917.06 Controller Hardware Current Shutdown.

RMC_522918.15 Motor Stall While Running.

RMC_522919.12 This code likely indicates that the reel motor connector is disconnected.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive debris in reel*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *High ambient temperature*

BS62576,0001161 -19-14MAR14-1/6

Motor Over Temp

BS62576,0001161 -19-14MAR14-2/6

❶ **Test Procedure**	Does controller feel warm to the touch?	**YES:** Allow controller to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

Continued on next page

BS62576,0001161 -19-14MAR14-3/6

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Go to next step.

NO: Go to step 4.

BS62576,0001161 -19-14MAR14-4/6

3 Continued

Temperature sensor check - Unplug motor from controller. Check continuity between P1 pin C and P1 pin A on motor harness end. Is there continuity?

YES: Go to next step.

NO: If motor is cool and no continuity, test or replace motor.

BS62576,0001161 -19-14MAR14-5/6

4 Continued

Swap controller with another controller on machine. Does problem move with controller?

YES: Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001161 -19-14MAR14-6/6

RMC 522917.00 — Controller Current Threshold 3 Shutdown

Code Caused By: Indicates high controller current draw (most severe level)

Alarm Level: Stop

To Clear Display: Cycle power

Alarm Frequency: Only when active

Control Unit Response: Controller/Motor shutdown

Snapshot Recorded: Yes

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

NOTE: The presence of any stored 522917.xx codes for the controller in question likely indicate ongoing problems with controller/reel combination.

RMC_522917.15 Controller Current Threshold 2 Shutdown (least severe level).

RMC_522917.16 Controller Current Threshold 1 Shutdown (moderately severe level).

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RMC_522917.06 Controller Hardware Current Shutdown.

RMC_522918.15 Motor Stall While Running.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive debris in reel*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *High ambient temperature*

BS62576,0001162 -19-14MAR14-1/5

Controller Current Threshold 3 Shutdown

BS62576,0001162 -19-14MAR14-2/5

1 Test Procedure	Does controller feel warm to the touch?	**YES:** Allow controller to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

Continued on next page

BS62576,0001162 -19-14MAR14-3/5

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Suspect motor or reel problems.

NO: Go to next step.

BS62576,0001162 -19-14MAR14-4/5

3 Continued

Swap controller with another controller on machine. Does problem move with controller?

YES: Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001162 -19-14MAR14-5/5

RMC 522917.06 — Controller Hardware Current Shutdown

Code Caused By: Indicates high controller current draw (most severe level)

Alarm Level: Stop

To Clear Display: Cycle power

Alarm Frequency: Only when active

Control Unit Response: Controller/Motor shutdown

Snapshot Recorded: Yes

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

NOTE: The presence of any stored 522917.xx codes for the controller in question likely indicate ongoing problems with controller/reel combination.

RMC_522917.00 Controller Current Threshold 3 Shutdown.

RMC_522917.15 Controller Current Threshold 2 Shutdown (least severe level).

RMC_522917.16 Controller Current Threshold 1 Shutdown (moderately severe level).

RMC_522918.15 Motor Stall While Running.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive debris in reel*
- *Controller cooling fins blocked*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *High ambient temperature*
- *Controller 3-phase output shorted to ground*

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BS62576,0001165 -19-21MAR14-1/5

Controller Hardware Current Shutdown

Continued on next page

BS62576,0001165 -19-21MAR14-2/5

1 Test Procedure	Does controller feel warm to the touch?	**YES:** Allow controller to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

BS62576,0001165 -19-21MAR14-3/5

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Suspect motor or reel problems.

NO: Go to next step.

BS62576,0001165 -19-21MAR14-4/5

3 Continued	Swap controller with another controller on machine. Does problem move with controller?	**YES:** Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001165 -19-21MAR14-5/5

RMC 522917.15 — Controller Current Threshold 1 Shutdown

Code Caused By: Indicates high controller current draw (least severe level)

Alarm Level: Stop

To Clear Display: Cycle power

Alarm Frequency: Only when active

Control Unit Response: Controller/Motor shutdown

Snapshot Recorded: Yes

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

NOTE: The presence of any stored 522917.xx codes for the controller in question likely indicate ongoing problems with controller/reel combination.

RMC_522918.15 Motor Stall While Running.

RMC_522917.15 Controller Current Threshold 2 Shutdown (least severe level).

RMC_522917.06 Controller Hardware Current Shutdown (moderately severe level).

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RMC_522917.00 Controller Current Threshold 3 Shutdown.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive debris in reel*
- *Controller cooling fins blocked*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *High ambient temperature*

BS62576,0001163 -19-14MAR14-1/5

Controller Current Threshold 1 Shutdown

BS62576,0001163 -19-14MAR14-2/5

❶ **Test Procedure**	Does controller feel warm to the touch?	**YES:** Allow controller to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

Continued on next page

BS62576,0001163 -19-14MAR14-3/5

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Suspect motor or reel problems.

NO: Go to next step.

BS62576,0001163 -19-14MAR14-4/5

3 Continued

Swap controller with another controller on machine. Does problem move with controller?

YES: Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001163 -19-14MAR14-5/5

RMC 522917.16 — Controller Current Threshold 2 Shutdown

Code Caused By: Indicates high controller current draw (moderately severe level)

Alarm Level: Stop

To Clear Display: Cycle power

Alarm Frequency: Only when active

Control Unit Response: Controller/Motor shutdown

Snapshot Recorded: Yes

Required Tools: Service ADVISOR

Preliminary Checks: Check for presence of these codes to assist diagnosis:

NOTE: The presence of any stored 522917.xx codes for the controller in question likely indicate ongoing problems with controller/reel combination.

RMC_522918.15 Motor Stall While Running.

RMC_522917.15 Controller Current Threshold 1 Shutdown (least severe level).

RMC_522917.06 Controller Hardware Current Shutdown (moderately severe level).

RMC_522917.00 Controller Current Threshold 3 Shutdown.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive debris in reel*
- *Controller cooling fins blocked*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *High ambient temperature*

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BS62576,0001164 -19-14MAR14-1/5

Controller Current Threshold 2 Shutdown

Continued on next page

BS62576,0001164 -19-14MAR14-2/5

1 Test Procedure	Does controller feel warm to the touch?	**YES:** Allow controller to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

BS62576,0001164 -19-14MAR14-3/5

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Suspect motor or reel problems.

NO: Go to next step.

BS62576,0001164 -19-14MAR14-4/5

3 Continued	Swap controller with another controller on machine. Does problem move with controller?	**YES:** Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001164 -19-14MAR14-5/5

RMC 522918.00 — Motor Start Failed 3x Fault

Code Caused By: Motor failed to start after 3 tries. No Hall effect state changes reported to controller

Alarm Level: Stop

To Clear Display: Cycle PTO switch

Alarm Frequency: Only when active

Control Unit Response: Controller/Motor shutdown

Snapshot Recorded: Yes

Required Tools:JDG10429 Electric Reel Motor tester or multimeter

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_522918.15 Motor Stalled While Running.

RMC_522919.02 Unexpected Hall Received.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Obstruction in reel*
- *Excessive debris in reel*
- *Excessive debris in reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*

NOTE: If available, use the JDG10429 Electric Reel Motor Tester. See Reel Motor Test.

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BS62576,0001166 -19-14MAR14-1/6

Motor Start Failed 3x Fault

BS62576,0001166 -19-14MAR14-2/6

1 Test Procedure	Does motor feel warm to the touch?	**YES:** Allow motor to cool and check for common conditions to cause problem. Are any common problems found? **YES:** Correct problem. **NO:** Go to next step.

BS62576,0001166 -19-14MAR14-3/6

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

YES: Go to next step.

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

NO: Go to step 4.

Continued on next page

BS62576,0001166 -19-14MAR14-4/6

3 Continued	Test motor sensors. Do sensors pass test?	**YES:** Go to next step. **NO:** Replace reel motor.

BS62576,0001166 -19-14MAR14-5/6

4 Continued	Swap controller with another controller on machine. Does problem move with controller?	**YES:** Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001166 -19-14MAR14-6/6

RMC 522918.02 — Motor Spin Direction Shutdown

Code Caused By: Reel direction reversed for 1/4 turn of motor

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: All reels shutdown

Snapshot Recorded: Yes

Required Tools: JDG10429 Electric Reel Motor tester or multimeter

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_522918.15 Motor Stalled While Running.

RMC_522919.02 Unexpected Hall Received.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Reel obstructed while running or attachment issue - Check reel, bedknife, and attachment for damage*

NOTE: If available, use the JDG10429 Electric Reel Motor Tester. See Reel Motor Test.

BS62576,0001167 -19-14MAR14-1/6

Motor Spin Direction Shutdown

BS62576,0001167 -19-14MAR14-2/6

1 Test Procedure	Check for common conditions to cause problem. Are any common problems found?	**YES:** Correct problem. **NO:** Go to next step.

Continued on next page

BS62576,0001167 -19-14MAR14-3/6

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Go to next step.

NO: Go to step 4.

BS62576,0001167 -19-14MAR14-4/6

3 Continued

Test motor sensors. Do sensors pass test?

YES: Go to next step.

NO: Replace reel motor.

NO: Check for broken or damaged wires.

BS62576,0001167 -19-14MAR14-5/6

4 Continued

Swap controller with another controller on machine. Does problem move with controller?

YES: Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001167 -19-14MAR14-6/6

RMC 522918.15 — Motor Stalled While Running

Code Caused By: Reel stopped while running

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: All reels shutdown

Snapshot Recorded: Yes

Required Tools: JDG10429 Electric Reel Motor tester or multimeter

Preliminary Checks: Access drive motor speed

Reel motor operating speed (rpm). Controller determines motor speed using electrical signals received from magnetic switches inside motor. (rpm)

NOTE: Motor operating speed should closely match commanded speed. Reel motors located on left side of cutting unit will have negative (-) value, whereas reel motors located on right side will have positive (+) value.

Drive Motor Speed, RMC 1, Front Left		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 2, Rear Left		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 3, Front Center		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 5, Front Right		variable (200—2815 rpm) slow to fast
Drive Motor Speed, RMC 6, Rear Right		variable (200—2815 rpm) slow to fast

Reel motor speed commanded by controller. Determined by position of Speed Control potentiometer. Controller calculates a target motor speed using measured voltage from potentiometer. (rpm)

NOTE: Commanded motor speed is unaffected by positions of Mow/Backlap command through display panel.

Drive Motor Speed Command, RMC 1, Front Left		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 2, Rear Left		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 3, Front Center		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 5, Front Right		variable (200—2815 rpm)
Drive Motor Speed Command, RMC 6, Rear Right		variable (200—2815 rpm)

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Reel obstructed while running or attachment issue - Check reel, bedknife, and attachment for damage*
- *Excessive load*
- *Obstruction in reel*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *Excessive debris in reel*

NOTE: If available, use the JDG10429 Electric Reel Motor Tester. See Reel Motor Test.

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BS62576,0001168 -19-03JUN14-1/6

Motor Stalled While Running

Continued on next page

BS62576,0001168 -19-03JUN14-2/6

1 Test Procedure	Check for common conditions to cause problem. Are any common problems found?	**YES:** Correct problem. **NO:** Go to next step.

BS62576,0001168 -19-03JUN14-3/6

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

YES: Go to next step.

NO: Go to step 4.

BS62576,0001168 -19-03JUN14-4/6

3 Continued	Test motor sensors. Do sensors pass test?	**YES:** Go to next step. **NO:** Replace reel motor. **NO:** Check for broken or damaged wires.

BS62576,0001168 -19-03JUN14-5/6

4 Continued	Swap controller with another controller on machine. Does problem move with controller?	**YES:** Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,0001168 -19-03JUN14-6/6

RMC 522919.03 — Hall Resync Shutdown

Code Caused By: Motor position sensor error while running

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: Yes

Required Tools: JDG10429 Electric Reel Motor tester or multimeter

Preliminary Checks: None

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Heavy load on reel*
- *Excessive load*
- *Controller cooling fins blocked*
- *Jammed reel*
- *Incorrect bedknife clearance*
- *Failing bearings on reel*
- *Water in motor*

NOTE: If available, use the JDG10429 Electric Reel Motor Tester.

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BS62576,000116A -19-21MAR14-1/6

Hall Resync Shutdown

BS62576,000116A -19-21MAR14-2/6

1 Test Procedure	Check for common conditions to cause problem. Are any common problems found?	**YES:** Correct problem. **NO:** Go to next step.

BS62576,000116A -19-21MAR14-3/6

2 Continued

Investigate current draw using “Readings” in Service ADVISOR. Check motor driver heat sink temperature AND motor current. Remove and swap reels to look for a high load. Is problem resolved or does problem move?

Heat Sink Temperature, RMC 1, Front Left	
Heat Sink Temperature, RMC 2, Rear Left	
Heat Sink Temperature, RMC 3, Front Center	
Heat Sink Temperature, RMC 5, Front Right	
Heat Sink Temperature, RMC 6, Rear Right	

YES: Go to next step.

Motor Current, RMC 1, Front Left	
Motor Current, RMC 2, Rear Left	
Motor Current, RMC 3, Front Center	
Motor Current, RMC 5, Front Right	
Motor Current, RMC 6, Rear Right	

NO: Go to step 4.

Continued on next page

BS62576,000116A -19-21MAR14-4/6

3 Continued	Test motor sensors. Do sensors pass test?	**YES:** Go to next step. **NO:** Replace reel motor. **NO:** Check for broken or damaged wires.

BS62576,000116A -19-21MAR14-5/6

4 Continued	Swap controller with another controller on machine. Does problem move with controller?	**YES:** Replace controller. DTAC case should be submitted showing this fault stayed with controller when controller is moved.

BS62576,000116A -19-21MAR14-6/6

RMC 522919.12 — Invalid Hall State Detected at Start Up

Code Caused By: Motor position error at start

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: No

Required Tools: JDG10429 Electric Reel Motor tester or multimeter

Preliminary Checks: Check for presence of these codes to assist diagnosis:

RMC_522327.00 Motor Over Temp - Most likely motor connector is disconnected, contaminated terminals, bent pins, etc.

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Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Bad connections or wiring between controller and reel motor.*
- *Water in motor.*

NOTE: If available, use the JDG10429 Electric Reel Motor Tester. See Reel Motor Test.

BS62576,000116F -19-14MAR14-1/4

Invalid Hall State Detected at Start Up

BS62576,000116F -19-14MAR14-2/4

1 Test Procedure	Do sensors pass test?	**YES:** Go to next step. **NO:** Check for broken or damaged wires, contaminated connector terminals, bent pins, etc. **NO:** Replace reel motor.

Continued on next page

BS62576,000116F -19-14MAR14-3/4

❷ **Continued**	Swap controller with another controller on machine. Is problem resolved or does problem move?	**YES:** Replace controller. **NO:** If controller replaced and problem does not clear, suspect motor problems.

BS62576,000116F -19-14MAR14-4/4

RMC 523666.00 — Bus Voltage High

Code Caused By: 48V alternator over voltage

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: Yes

Required Tools: Multimeter

Preliminary Checks: Access Power Supply Voltage #1, switched. Check for presence of these codes to assist diagnosis:

Check for RMC_523666.00 codes from other controllers. If additional controllers report a problem, suspect 48V alternator. If only one controller reports problem, check controller connections and ground.

Measured voltage supplied by 48V Alternator to controller. (volts)

Supply Voltage, RMC 1, Front Left		45—50 Volts
Supply Voltage, RMC 2, Rear Left		45—50 Volts
Supply Voltage, RMC 3, Front Center		45—50 Volts
Supply Voltage, RMC 5, Front Right		45—50 Volts
Supply Voltage, RMC 6, Rear Rightt		45—50 Volts

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.

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- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Failed 48V regulator*

BS62576,0001170 -19-14MAR14-1/4

Bus Voltage High

BS62576,0001170 -19-14MAR14-2/4

❶ **Test Procedure**	Test output of 48V alternator. Is alternator ok?	**YES:** Go to next step. **NO:** Check for broken or damaged wires, shorts to ground from alternator to controller on negative wire.

Continued on next page

BS62576,0001170 -19-14MAR14-3/4

❷ **Continued**	Swap controller with another controller on machine. Is problem resolved or does problem move?	**YES:** Replace controller **NO:** If controller replaced and problem does not clear, return to alternator troubleshooting.

BS62576,0001170 -19-14MAR14-4/4

RMC 523666.01 — Bus Voltage Low

Code Caused By: 48V alternator low

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: Yes

Required Tools: multimeter

Preliminary Checks: Access Power Supply Voltage #1, switched. Check for presence of these codes to assist diagnosis:

NOTE: The RMC PTO State reading is the enable signal status for the 48 volt alternator. This signal must be in the "enable" state to generate alternator output.

Check for RMC_523666.01 codes from other controllers. If additional controllers report problem, suspect 48V alternator. If only one controller reports problem, check controller wiring and connections.

Measured voltage supplied by 48V Alternator to controller. (volts)

Supply Voltage, RMC 1, Front Left		45—50 Volts
Supply Voltage, RMC 2, Rear Left		45—50 Volts
Supply Voltage, RMC 3, Front Center		45—50 Volts
Supply Voltage, RMC 5, Front Right		45—50 Volts
Supply Voltage, RMC 6, Rear Rightt		45—50 Volts

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the "Diagnostics" tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Engine under-speed*
- *Failed 48V alternator/regulator*
- *Excessive load on reel(s)*

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BS62576,0001171 -19-03JUN14-1/5

Bus Voltage Low

BS62576,0001171 -19-03JUN14-2/5

❶ **Test Procedure**	Check to see that ADDRESSES for controllers are 1, 3, 5, 2 & 6. Start sequence with delays are based upon controller address. Errors in address can cause insufficient power to start reels. Are the addresses okay?	**YES:** Go to next step. **NO:** Inspect for bent pins on any controller that does not have proper address.

Continued on next page

BS62576,0001171 -19-03JUN14-3/5

❷ **Continued**	Test output of 48V alternator. Is it to specification?	**YES:** Go to next step. **NO:** Check for broken or damaged wires, shorts to ground from alternator to controller on positive wire.

BS62576,0001171 -19-03JUN14-4/5

❸ **Continued**	Swap controller with another controller on machine (if only one controller reporting problem). Is problem resolved or does problem move?	**YES:** Replace controller. **NO:** If controller replaced and problem does not clear, return to alternator troubleshooting.

BS62576,0001171 -19-03JUN14-5/5

RMC 523666.02 — Low VBus on Start

Code Caused By: 48V alternator below 20V at start

Alarm Level: Stop

To Clear Display: Lift and lower reel arms

Alarm Frequency: Only when active

Control Unit Response: None

Snapshot Recorded: Yes

Required Tools: Multimeter

Preliminary Checks: Access Power Supply Voltage #1, switched. Check for presence of these codes to assist diagnosis:

Measured voltage supplied by 48V Alternator to controller. (volts)

Supply Voltage, RMC 1, Front Left		45—50 Volts
Supply Voltage, RMC 2, Rear Left		45—50 Volts
Supply Voltage, RMC 3, Front Center		45—50 Volts
Supply Voltage, RMC 5, Front Right		45—50 Volts
Supply Voltage, RMC 6, Rear Rightt		45—50 Volts

NOTE: The RMC PTO State reading is the enable signal status for the 48 volt alternator. This signal must be in the "enable" state to generate alternator output.

RMC PTO State, RMC 1, Front Left		Enable / Disable
RMC PTO State, RMC 2, Rear Left		Enable / Disable
RMC PTO State, RMC 3, Front Center		Enable / Disable
RMC PTO State, RMC 5, Front Right		Enable / Disable
RMC PTO State, RMC 6, Rear Right		Enable / Disable

Check for RMC_523666.02 codes from other controllers. If additional controllers report problem, suspect alternator. If only one controller reports problem, suspect wiring or controller problems.

Diagnosis:

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the "Diagnostics" tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab.
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

NOTE: Common conditions to cause code.

- *Engine under-speed*
- *Failed 48V alternator/regulator*
- *Excessive load on reel(s) at start up..*

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Continued on next page

BS62576,0001172 -19-03JUN14-1/5

Bus Voltage Low

BS62576,0001172 -19-03JUN14-2/5

1 Test Procedure	Check to see that ADDRESSES for controllers are 1, 3, 5, 2 & 6. Start sequence with delays are based upon controller address. Errors in address can cause insufficient power to start reels. Are the addresses okay?	**YES:** Go to next step. **NO:** Inspect for bent pins on any controller that does not have proper address.

BS62576,0001172 -19-03JUN14-3/5

2 Continued	Test output of 48V alternator. Is it to specification?	**YES:** Go to next step. **NO:** Check for broken or damaged wires, shorts to ground from alternator to controller on positive wire.

BS62576,0001172 -19-03JUN14-4/5

3 Continued	Swap controller with another controller on machine (if only one controller reporting problem). Is problem resolved or does problem move?	**YES:** Replace controller. **NO:** If controller replaced and problem does not clear, return to alternator troubleshooting.

BS62576,0001172 -19-03JUN14-5/5

Summary of References

- PDU I/O Status Displays
- Engine Oil Service Timer
- Hydraulic Oil Service Timer
- Hydrostatic Transmission Calibration Procedure
- Hydrostatic Valve Calibration Procedure
- CAN Message Not Received
- CAN Message Received Error
- CAN Message Received Is Incorrect
- Terminal Test
- Verification Procedure
- Wiggle Test
- Short to Voltage Procedure
- Electronic Injector — Calibration Information
- Aftertreatment Verification Procedure
- Accessing Diagnostic Trouble Codes
- CAN Communication Fault Checks
- CAN Bus Terminator Test
- Control Unit Messaging Errors
- CAN Network Voltage Checks
- Erroneous Diagnostic Trouble Codes
- Control Unit Information and Overview Test
- Troubleshooting Electronic Controllers
- Diagnostic Information
- Readings Overview
- Problem Not Found Procedure
- Approved Software for Control Units

BS62576,0001145 -19-07MAY15-1/1

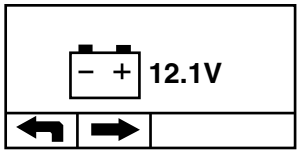
PDU I/O Status Displays

I/O Status Menu displays status information for inputs and outputs for enabled circuits. Each screen shows 2 or 3 switches and indicates their status.

- Status is either ‘ON’ (black image on white background) or ‘OFF’ (white image on black background).
- Location of CAN message data value is in ‘PGN/SPN’ column.
- Input/output is OFF, and inverted icon displays.
- Input/output is ON, and normal icon displays (all icons shown are in the ON or normal state)

Voltages

TCT010476 —UN—07FEB14



Battery Voltage Level

CB12260,00004E4 -19-03APR15-1/11

Battery Voltage

The battery status icon displays battery voltage.

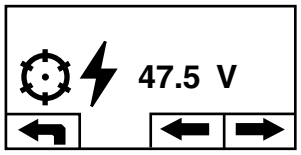
Associated DTCs:

000168.xx

48 V Alternator Output

The 48 V alternator icon displays the voltage output.

TCT010477 —UN—07FEB14



48 V Alternator Output

CB12260,00004E4 -19-03APR15-2/11

Inputs 1

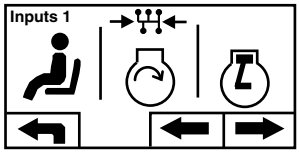
- Left: Seat Switch
- Center: Key Switch=Start
- Right: Key Switch=Run

Associated DTCs:

001504.xx Seat Switch

520438.xx Key Switch=Start

TCT010478 —UN—07FEB14



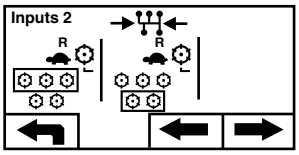
521488.xx Key Switch=Run

Continued on next page

CB12260,00004E4 -19-03APR15-3/11

Inputs 2

TCT010835 —UN—05MAR14



- Left: Back Lap Front Switch
- Center: Back Lap Rear Switch

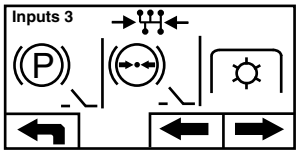
Associated DTCs:

516181.xx

CB12260,00004E4 -19-03APR15-4/11

Inputs 3

TCT010480 —UN—07FEB14



- Left: Park Brake Switch
- Center: Brake Pressure Switch
- Right: PTO Switch

Associated DTCs:

000070.xx Park Brake Switch

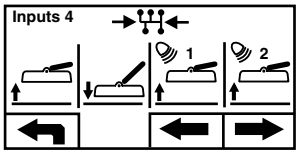
522405.xx Issue with brake system

003939.xx

CB12260,00004E4 -19-03APR15-5/11

Inputs 4

TCT010492 —UN—07FEB14



- Left: Raise Cutting Units Switch
- Center Left: Lower Cutting Units Switch
- Center Right: Proximity Sensor 1
- Right: Proximity Sensor 2

Associated DTCs:

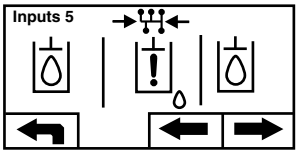
521427.xx Raise Switch incorrect voltage

521426.xx Lower Switch incorrect voltage

CB12260,00004E4 -19-03APR15-6/11

Inputs 5

TCT010482 —UN—07FEB14



- Left: Hydraulic Oil Filter Restriction Switch
- Center: Hydraulic Oil Leak Detect (not available)
- Right: Hydraulic Oil Overtemperature Switch

Associated DTCs:

001638.xx Hydraulic oil temperature

001713.xx Hydraulic Filter Restriction Switch

516708.xx Hydraulic leak detected

Continued on next page

CB12260,00004E4 -19-03APR15-7/11

Outputs 1

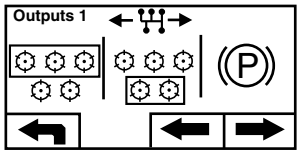
- Left: Mow Solenoid Front Solenoid
- Center: Mow Solenoid Rear Solenoid
- Right: Park Brake Solenoid

Associated DTCs:

516206.xx Mow Solenoid

522087.xx

TCT010493 —UN—07FEB14



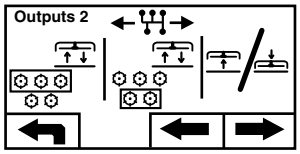
CB12260,00004E4 -19-03APR15-8/11

Outputs 2

- Left: Cutting Units Raise/Lower Front Solenoid
- Center: Cutting Units Raise/Lower Rear Solenoid
- Right: Raise/Lower Select Solenoid

Associated DTCs:

TCT010494 —UN—07FEB14



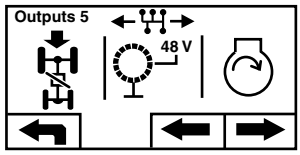
CB12260,00004E4 -19-03APR15-9/11

Outputs 5

- Center: 48 V Alternator
- Right: Starter Relay

Associated DTCs:

TCT010497 —UN—07FEB14



CB12260,00004E4 -19-03APR15-10/11

Outputs 6

- Left: Engine Fuel Hold Solenoid (non-T4 engines), or Engine Run Request (T4 engines)
- Center: Engine Fuel Pull-in Relay (non-T4)
- Right: Engine Intake Air Heater Relay (non-T4)

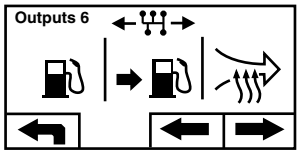
Associated DTCs:

516124.xx Fuel Hold circuit

516125.xx Pull-In relay

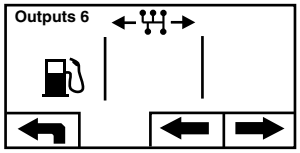
516135.xx Air Preheat Relay

TCT010489 —UN—07FEB14



Outputs 6 (Non-Tier 4 Engines)

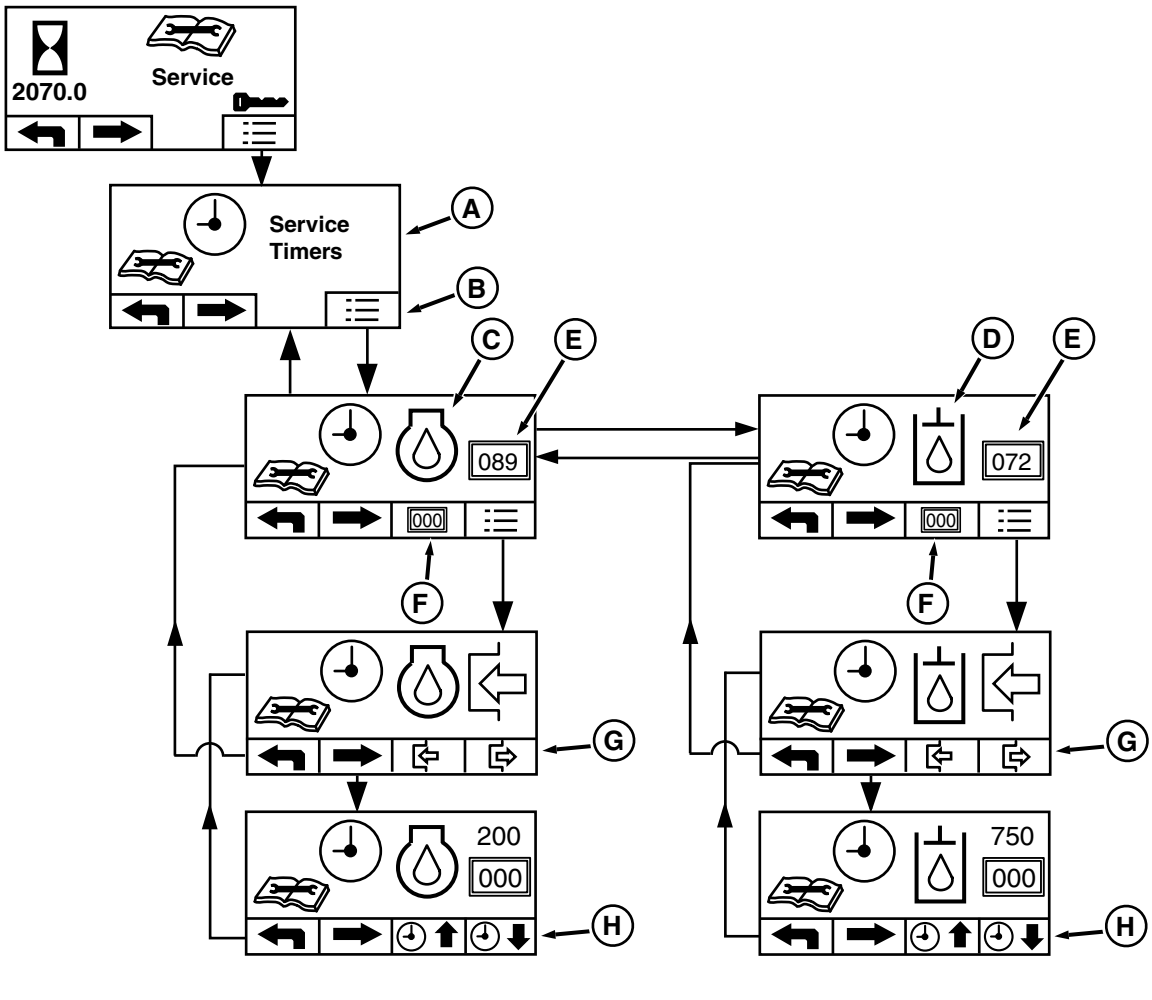
TCT010852 —UN—12MAR14



Outputs 6 (Tier 4 Engines)

CB12260,00004E4 -19-03APR15-11/11

Engine Oil Service Timer



TCT007228 —UN—10MAR14

A— Service Timers Screen
B— Button 4: Sub-Level Menu
C— Engine Oil Timer Screen
D— Hydraulic Oil Timer Screen
E— Elapsed Hours Since Last Reset
F— Button 3: Hours Reset
G—Buttons 3 or 4: Timer On or Off
H—Buttons 3 or 4: Service Timer Interval

The service timer function is available to track the machines service schedule for engine oil and hydraulic oil. A reminder displays in the TechControl when the machines operating hours reach the target operating hours set.

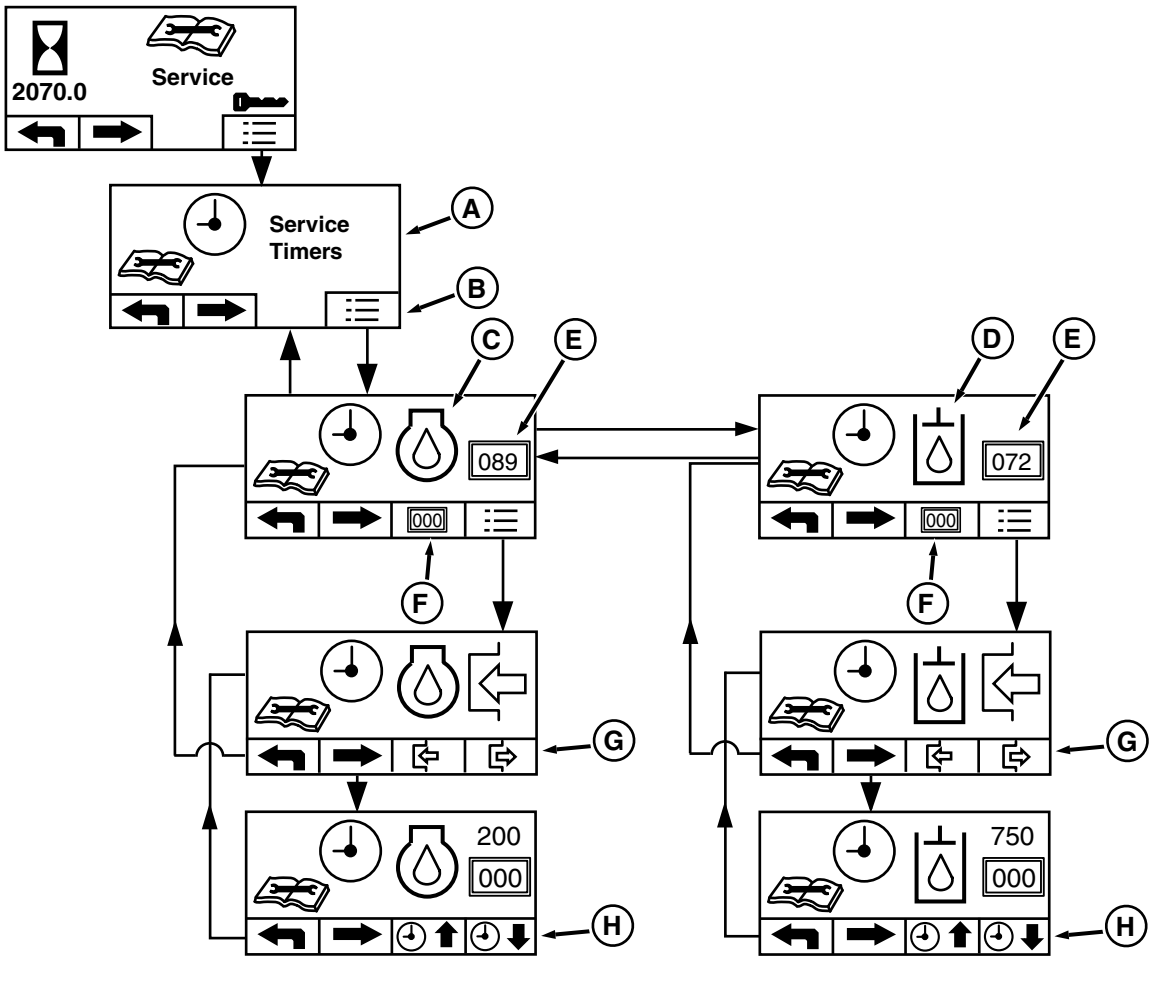
1. Enter Service mode. See Service Timers.
2. Press the sublevel menu button (B) on the Service Timer menu to access the timer screens.
3. Press the counter-button (F) to reset the service timer.
4. Press the sublevel menu button to go to the engine oil timer engage or disengage screen.
   - Select timer On or timer Off (engage or disengage) function (G).
5. Press the forward button to go to the engine oil service timer interval set functions.
   - Set the timer interval by pressing the “next” button to cycle through the individual digits that are displayed. Press the “up” or “down” button to set the digit.
   - Button 2: Move curser to the right to select timer digit (1st, 2nd, 3rd)
   - Button 3: Increase digit (range: First digit 0-2, second digit 0-9, third digit 0-9)
   - Button 4: Decrease digit

Maximum Interval Hours

Engine oil timer: **200** operating hours

CB12260,000057E -19-03APR15-1/1

Hydraulic Oil Service Timer



TCT007228 —UN—10MAR14

A— Service Timers Screen
B— Button 4: Sub-Level Menu
C— Engine Oil Timer Screen
D— Hydraulic Oil Timer Screen
E— Elapsed Hours Since Last Reset
F— Button 3: Hours Reset
G—Buttons 3 or 4: Timer On or Off
H—Buttons 3 or 4: Service Timer Interval

The service timer function is available to track the machines service schedule for engine oil and hydraulic oil. A reminder displays in the TechControl when the machines operating hours reach the target operating hours set.

1. Enter the Service menu. See Service Timers.
2. Press the sublevel menu button (B) on the Service Timer menu to access the timer screens.
3. Press the sublevel menu button to go to the hydraulic oil timer engage or disengage screen.
4. Press the “next” button to go from the engine oil screen (C) to the hydraulic oil screen (D).
5. Press the counter-button (F) to reset the service timer.
6. Press the forward button to go to the engine oil service timer interval set functions.
   - Set the timer interval by pressing the “next” button to cycle through the individual digits that are displayed. Press the “up” or “down” button to set the digit.
   - Button 2: Move curser to the right to select timer digit (1st, 2nd, 3rd)
   - Button 3: Increase digit (range: First digit 0-7, second digit 0-9, third digit 0-9)
   - Button 4: Decrease digit

Maximum Interval Hours

Hydraulic oil timer: **750** operating hours

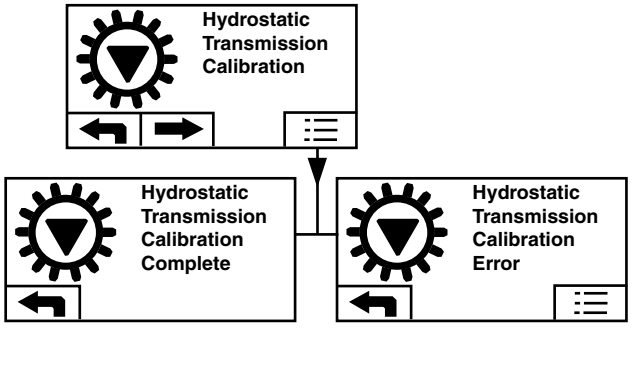
CB12260,000057F -19-03APR15-1/1

Hydrostatic Transmission Calibration Procedure

The hydrostatic calibration checks and calibrates the swash plate angles in the transmission. Calibration is done with the engine off.

When the right sublevel menu button is pressed, the PDU transmits commands to the VCU to begin the calibration procedure.

The display changes to either the Hydrostatic Transmission Calibration Complete screen or the Hydrostatic Transmission Calibration Error screen.

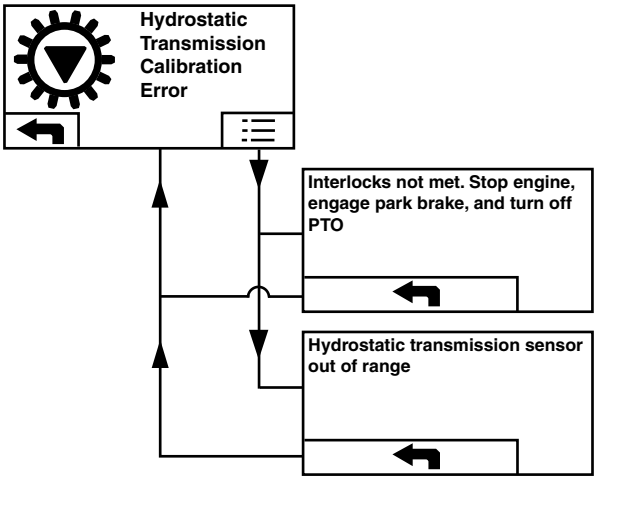


OUMX258,0000337 -19-02APR15-1/2

Procedure

1. Park machine safely on a flat level surface.
2. Stop engine.
3. Place key in RUN position.
4. Enter the Service Menu on the TechControl.
5. Press the right sublevel menu button, enter passcode.
6. Press the forward button 2 to cycle through the menu screens to the Hydrostatic Transmission Calibration screen.
7. Press the right sublevel menu button to start the calibration.
8. Press the left button to return to the Hydrostatic Calibration screen.
9. Press the right sublevel menu button to transition to a screen that shows details about the specific error.

The display continues to transmit the Abort command in the Calibration Control message. The VCU continues to transmit the Calibration Data message and the Error Code value.



Return to the Hydrostatic Transmission Calibration Error screen and then to the Hydrostatic Calibration Procedure screen. The display resumes transmitting the calibration command.

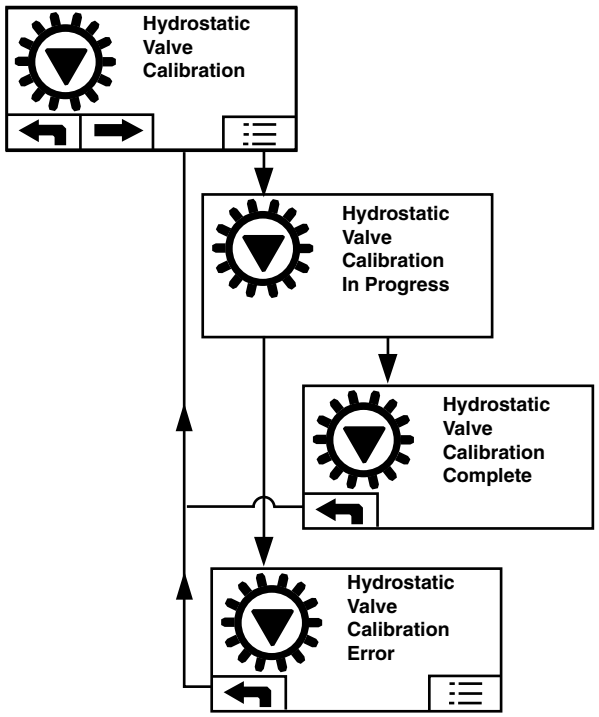
OUMX258,0000337 -19-02APR15-2/2

Hydrostatic Valve Calibration Procedure

The calibration process takes approximately two minutes and the engine must be running with the park brake engaged. The hydrostatic valve calibration checks and calibrates the forward valve and the reverse valve in the transmission.

When the right sublevel menu button is pressed the PDU transmits a message to the VCU to start the forward valve calibration procedure. When the forward valve calibration begins the VCU transmits a message to the PDU and the screen changes to the Hydrostatic Valve Calibration in Progress message. When the forward valve calibration is complete the VCU starts the reverse valve calibration. The Hydrostatic Valve Calibration in Progress message remains on the PDU screen.

When the valve calibration is complete the screen displays a Hydrostatic Valve Calibration Complete message.



TCT010522 —UN—14FEB14

Procedure

1. Park machine on a flat level surface.
2. Turn PTO OFF.
3. Engage park brake.
4. Key in RUN position with engine running.
5. Enter the Service Menu on the TechControl.
6. Press the right sublevel menu button, enter passcode.
7. Press the forward button 2 to cycle through the menu screens to the Hydrostatic Valve Calibration screen.
8. Press the right sublevel menu button to start the calibration.
9. Press the left button to return to the Hydrostatic Valve Calibration screen.

OUMX258,0000338 -19-02APR15-1/2

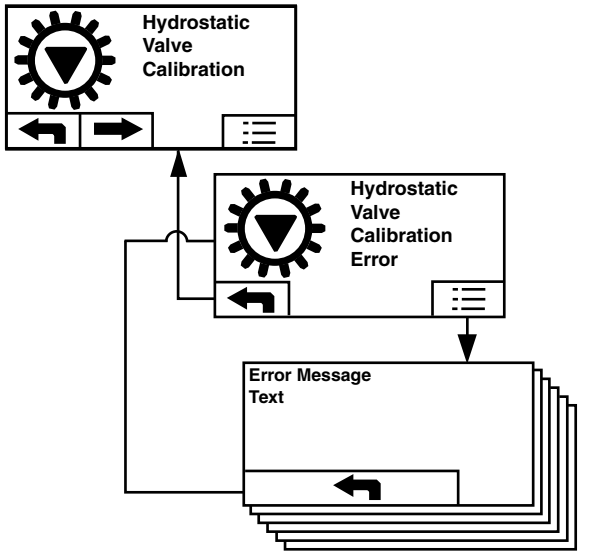
During any of the states of hydrostatic valve calibration, calibration errors may occur and will be reported by the VCU. If errors are reported by the VCU, the display changes to the Hydrostatic Valve Calibration Error screen.

Press the left button to return to the Hydrostatic Valve Calibration screen. Press the right sublevel menu button to show details about the specific error.

Error Codes:

- Hydrostatic transmission out of neutral
- Abnormal swashplate angle
- Forward valve out of range
- Reverse valve out of range
- No response
- Interlocks not met. Engage park brake, turn PTO OFF, sit in seat, and START engine.

Press any of the 3 left most buttons to return to the Hydrostatic Valve Calibration Error screen. The PDU resumes transmitting to the VCU.



TCT010523 —UN—14FEB14

OUMX258,0000338 -19-02APR15-2/2

CAN Message Not Received

The controller did not receive a CAN message from another control unit.

When DTC is Displayed:
When the controller does not receive a CAN message from another control unit.

To determine which control unit has stopped sending messages to the ECU, use the following procedure:

IMPORTANT: You MUST determine how many controllers are on the machine and what their source addresses are.

1. Ignition ON, Engine OFF.
2. Using Service ADVISOR, go to the Readings menu and select Get Controllers.
3. Service ADVISOR should now be displaying a list of control units communicating on your machine.
4. Determine which controller is no longer communicating.

IMPORTANT: If the control unit source address is not listed, it is not communicating on the CAN bus.

Were you able to identify the control unit that is not communicating?

Yes: Look for an open or short connection of the CAN wiring between the controller and the other controller. Repair problem. Perform Verification Procedure.

No, all control units are communicating: While performing the Wiggle Test, close displayed list, repeat step 3 and watch for a new controller to be displayed. If a new controller is displayed look for an intermittent connection of the CAN wiring between the controller and the other controller or corrosion at the connectors. Repair problem. Perform Verification Procedure.

CB12260,00004E5 -19-18JUN14-1/1

CAN Message Received Error

The controller received a CAN message error when communicating to another control unit.

When DTC is Displayed:
When the controller receives a CAN message error when communicating to another control unit.

Related Information:

To determine which controller has the communication error, use the following procedure.

1. **Identify Control Unit**
   a. Ignition ON, Engine OFF.
   b. In Service ADVISOR, go to Readings menu and select Get Controllers.
   c. Service ADVISOR should now be displaying a list of controllers communicating on your machine.
   d. Look for the last three digits of the diagnostic trouble code that sent you here in the source address column of the displayed list to identify the controller the suspect controller is having communications problems with.

   Were you able to identify the control unit that is generating the communication error?
   Yes: GO TO 2
   No, source address is not in the displayed list: While performing the Wiggle Test, close displayed list, repeat step c and watch for a new controller to be displayed. If a new controller is displayed look for an intermittent connection of the CAN wiring between the controller and the other controller(s) or corrosion at the connectors. Repair problem. Perform Verification Procedure.
2. **Inspect Connectors and Harness**
   a. Ignition OFF, Engine OFF.
   b. Disconnect controller connector(s) and connector of controller identified in step 1.
   c. Look for corrosion at the disconnected connectors and the mating connectors in the CAN wiring terminals.
   d. Look for chaffed or pinched places in the harness between the controller and the identified controller.

   Were any problems found?
   Yes: Repair problem. Perform Verification Procedure.
   No: GO TO 3
3. **Reprogram controller**
   a. Ignition ON, Engine OFF.
   b. Reprogram controller.
   c. Refresh codes.

   Is DTC that sent you here active?
   Yes: GO TO 4
   No: Problem resolved. Perform Verification Procedure.
4. **Troubleshoot Identified Controller**
   a. Ignition OFF, Engine OFF.
   b. Ignition ON, Engine OFF.
   c. Refresh codes.

   Is DTC that sent you here active?
   Yes: GO TO 5
   No: Problem resolved. Perform Verification Procedure.
5. **Replace controller**
   a. Ignition OFF, Engine OFF.
   b. Replace ECU programmed with identical software that was in the removed ECU.
   c. Ignition ON, Engine OFF.
   d. Refresh codes.

   Is DTC that sent you here active?
   Yes: Contact DTAC for support.
   No: Problem resolved. Perform Verification Procedure.

CB12260,00004E6 -19-17JUN14-1/1

CAN Message Received Is Incorrect

The controller received a CAN message that was incorrect when communicating to another control unit.

When DTC is Displayed:
When the controller receives a CAN message that is incorrect when communicating to another control unit.

To determine which controller has the communication error, use the following procedure.

1. **Identify Control Unit**
   a. Ignition ON, Engine OFF.
   b. Connect Service ADVISOR.
   c. In Service ADVISOR, go to Readings menu and select Get Controllers.
   d. Service ADVISOR should now be displaying a list of controllers communicating on your machine.
   Were you able to identify the control unit that is generating the communication error?
   Yes: Go to next step.
   No, source address is not in the displayed list: While performing the Wiggle Test, close displayed list, repeat step c and watch for a new controller to be displayed. If a new controller is displayed look for an intermittent connection of the CAN wiring between the controller and the other controller or corrosion at the connectors. Repair problem. Perform Verification Procedure.

2. **Inspect Connectors and Harness**
   a. Ignition OFF, Engine OFF.
   b. Disconnect suspect controller connector and connector of controller identified in step 1.
   c. Look for corrosion at the disconnected connectors and the mating connectors in the CAN wiring terminals.
   d. Look for chaffed or pinched places in the harness between the controller and the identified controller.
   Were any problems found?
   Yes: Repair problem. Perform Verification Procedure.
   No: Go to next step.

3. **Reprogram Controller**
   a. Ignition ON, Engine OFF.
   b. Reprogram controller.
   c. Refresh codes.
   Is DTC that sent you here active?
   Yes: Go to next step.
   No: Problem resolved. Perform Verification Procedure.

4. **Troubleshoot Identified Controller**
   a. Ignition OFF, Engine OFF.
   b. Troubleshoot identified controller.
   c. Ignition ON, Engine OFF.
   d. Refresh codes.
   Is DTC that sent you here active?
   Yes: Go to next step.
   No: Problem resolved. Perform Verification Procedure.

5. **Replace Controller**
   a. Ignition OFF, Engine OFF.
   b. Replace controller programmed with identical software that was in the removed controller.
   c. Ignition ON, Engine OFF.
   d. Refresh codes.
   Is DTC that sent you here active?
   Yes: Contact DTAC for support.
   No: Problem resolved. Perform Verification Procedure.

CB12260,00004E7 -19-17JUN14-1/1

Terminal Test

The purpose of this test is to check for electrical terminal and connector problems.

Terminal Basics

Terminals are typically made from a base metal that is plated with tin, gold, or an alloy. The plating material helps protect the base metal of the terminal from corroding. There are two main varieties of terminals; pins (male) and sockets (female). The male pins are inserted into the female sockets to provide the electrical connection between wires or electrical devices. The female socket terminals typically contain one or more contact springs which provide firm contact points with the male pin terminal.

Terminal Problems

The five main types of terminal problems are corrosion, loose fit, bent terminals, pushed out terminals, and crimp problems.

Corrosion or foreign material on terminals acts as a series resistance between the contact spring and the mating terminal. This series resistance can decrease the voltage measured by the controller at its inputs. Corrosion, liquids, or other foreign material in a connector may also provide a parallel resistance that permits current to flow between other terminals in the connector. This parallel path can increase or decrease the voltage measured by the controller at its inputs. Once terminals are corroded, they must be replaced. Scraping the layer of corrosion from the terminal also removes any remaining plating material resulting in a rapid reappearance of the corrosion.

A loose fit between the pin and the socket terminals may result in an intermittent open circuit. The loose fit is usually due to a damaged or worn contact spring inside the female socket terminal. Loose fitting terminals may be caused by misaligned terminals or by previous troubleshooting procedures where a probe was inserted into the female socket terminal to obtain a measurement.

Bent male pin terminals may cause an open circuit and possibly a short circuit with adjacent pins in the connector. Bent terminals are often caused by connector alignment or improper terminal crimping techniques.

Terminals that are partially pushed out of the connector may cause an open circuit or an intermittent connection if the tip of the partially pushed out terminal makes electrical contact with the tip of the mating terminal. Pushed out terminals are caused by misaligned terminals or by terminals that were not fully seated in the connector during assembly.

Terminals are crimped to wire ends to provide electrical and mechanical connection to the wire. The wire end may pull out of the terminal if not crimped correctly or if the wire has been pulled on with too much force. This results in an open circuit or an intermittent open circuit if the wire end makes contact with the terminal.

Terminal Test Visual Inspection

Inspect the terminals on both sides of the connection including the controller or sensor for the following problems:

- Corrosion on the terminals or in the connector.
- Water or other foreign material in the connector.
- Bent terminals.
- Pushed out terminals.

Replace or reinsert terminals. Replace connector if damaged.

Terminal Test Loose Fit Check

- Select the proper terminal adapter, Flex Probe, from JDG10466 that matches the terminal you are testing.
- Gently insert the male pin terminal fully into the female socket terminal without twisting or bending.
- Slowly pull the male pin terminal out of the female socket terminal. There should be a noticeable tension as terminal probe is withdrawn.

Replace terminals that have a loose fit.

Terminal Test Crimp Check

- Remove connector back shell to gain access to wire insertion end of connector, if applicable.
- Gently pull on each wire in the connector.

Replace terminal if wire end pulls out of the terminal.

Terminal Tips

- Use the specified extraction tools to remove terminals.
- Always use the specified terminal as a replacement. The plating on mating terminals must be compatible or corrosion could occur.
- Always use the specified seals for those connectors that require them.
- Always use the correct crimping tool to attach replacement terminals.
- After crimping a terminal to the wire end, pull gently on the terminal to make sure that it is securely crimped.

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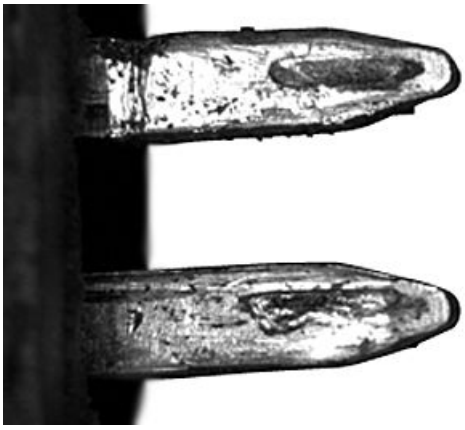
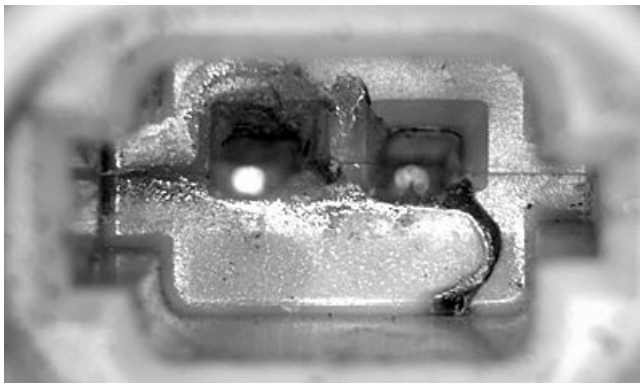


Fuse- Worn and Corroded Pins

RG16614 —UN—25NOV08

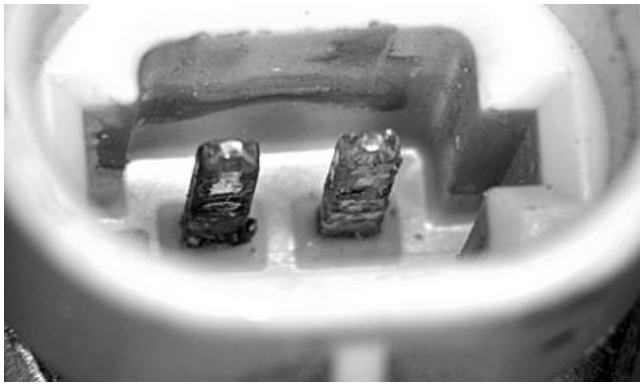


RG16615 —UN—25NOV08

2-pin female- Corroded Pins

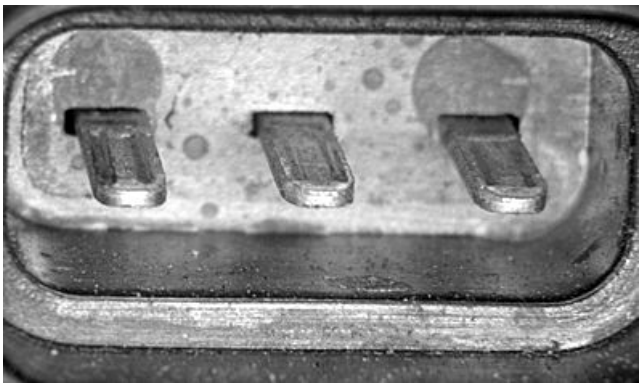
RG16616 —UN—25NOV08

3-pin male- Worn Pins



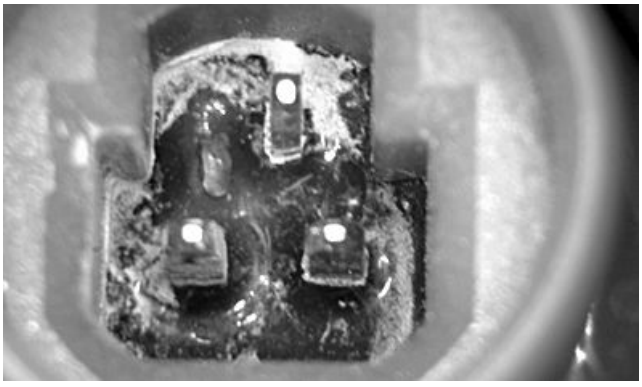
RG16617 —UN—25NOV08

2-pin male- Worn and Corroded Pins



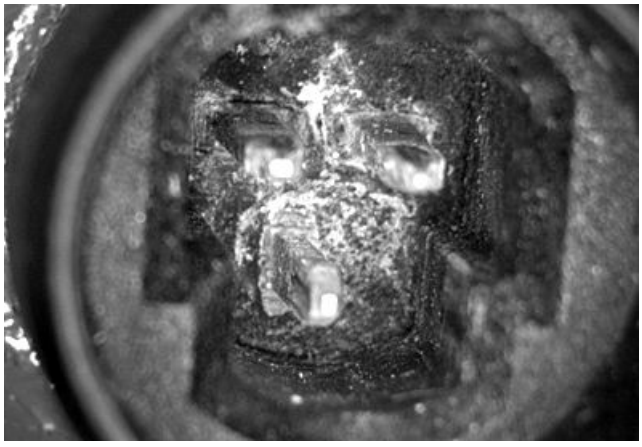
RG16618 —UN—25NOV08

3-pin male- Corroded Pins



RG16621 —UN—25NOV08

3-pin male- Corroded Pins



RG16623 —UN—25NOV08

3-pin male- Corroded Pins

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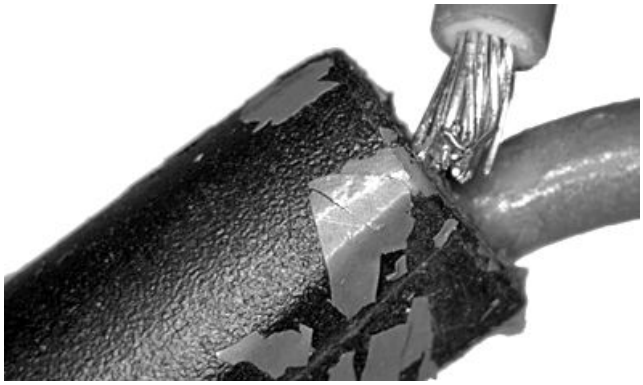
CB12260,0000467 -19-06MAY14-2/3

RG16624 —UN—25NOV08

3-pin male- Worn Pins



RG16619 —UN—25NOV08

Faulty Wire- Not Crimped Correctly

CB12260,0000467 -19-06MAY14-3/3

Verification Procedure

NOTE: Only perform this procedure if directed to by a DTC diagnostic procedure.

CB12260,00004E9 -19-16JUN14-1/5

Procedure

CB12260,00004E9 -19-16JUN14-2/5

1 DTC Check	Did you come to this procedure from a DTC procedure?	**YES:** Go to next step. **NO:** Go to step 3.

CB12260,00004E9 -19-16JUN14-3/5

2 Operating Conditions	Operate machine under conditions where DTC became active. Did DTC you were troubleshooting become active?	**YES:** Return to DTC procedure, step 1, due to possible change in conditions. **NO:** Procedure complete. Continue troubleshooting any other DTC's, if present.

Continued on next page

CB12260,00004E9 -19-16JUN14-4/5

❸ **Operating Conditions**	Operate machine under conditions where observable symptom was present. Did observable symptom you were troubleshooting become active?	**YES:** Return to observable procedure step 1 due to possible change in conditions. **NO:** Procedure complete. Continue any other necessary troubleshooting.

CB12260,00004E9 -19-16JUN14-5/5

Wiggle Test

NOTE: For appropriate connector and terminal identification, reference the Diagram in the DTC that you are diagnosing.

This is to help diagnose intermittent faults.

Intermittent DTCs are problems that periodically “go away”. A problem such as a loose terminal that intermittently does not make contact with its mating terminal is a likely cause of an intermittent fault. Other intermittent DTCs may only be set under certain operating conditions such as heavy load, extended idle, and others. When diagnosing intermittent DTCs, take special note of the condition of wiring and connectors since a high percentage of intermittent problems originate here. Check for loose, dirty, or partially disconnected connectors. Inspect the wiring routing looking for possible intermittent shorts to ground caused by contact with external parts (for example, rubbing against sharp sheet metal edges). Inspect the connector vicinity looking for wires that are partially pulled out of connector terminals, damaged connectors, poorly positioned terminals, and corroded or damaged terminals. Look for broken wires, damaged splices, and wire-to-wire shorts.

NOTE: The controller is the component LEAST likely to fail. Only replace the controller if the diagnostic procedure indicates that controller replacement is necessary.

Inspect harness and connectors for signs of damage such as heat damage, chaffing, corrosion, and other possible causes.

While monitoring or making measurements, watch for changes and perform the following:

- Beginning at the suspect component, gently wiggle the harness.
- Continue to gently wiggle the harness at different points along the harness until reaching the controller connectors.

CB12260,0000469 -19-06MAY14-1/1

Short to Voltage Procedure

NOTE: For appropriate connector and terminal identification, reference the Diagram in the DTC that you are diagnosing.

BS62576,00016E9 -19-21MAR14-1/6

Diagnostic Procedure

BS62576,00016E9 -19-21MAR14-2/6

1 Unswitched Voltage Check	*NOTE: For appropriate connector and terminal identification, reference the Diagram in the DTC that you are diagnosing.* 1. Ignition OFF, Engine OFF. 2. Disconnect Diagnostic Test Box, if connected. 3. On the harness, use multimeter to measure voltage between component connector signal (+) and return (-) terminals. Is voltage greater than 0.5 volts?	**YES:** Disconnect battery and go to next step. **NO:** Go to next step.

BS62576,00016E9 -19-21MAR14-3/6

2 Signal Circuit Continuity Check	1. Disconnect applicable controller connector containing the component signal wire terminal. 2. On the harness, measure resistance between the component signal wire terminal in controller connector and component connector signal wire terminal. 3. On the harness, measure resistance between the component return wire terminal in controller connector and component connector return wire terminal. Are both measurements less than 5 ohms?	**YES:** Go to next step. **NO:** Repair mis-pin. Perform Verification Procedure.

BS62576,00016E9 -19-21MAR14-4/6

3 Wire to Wire Short Check	1. Disconnect battery if not already disconnected. 2. On the harness, measure resistance between component signal terminal in controller connector to all other terminals in applicable controller connector. Are any measurements less than 100k ohms?	**YES:** Repair short to signal wire. Perform Verification Procedure. **NO:** Go to next step.

BS62576,00016E9 -19-21MAR14-5/6

4 Wire to Wire Short Check	1. Disconnect all other controller connectors. 2. On the harness, measure resistance between component signal terminal in controller connector to all other terminals in all other controller connectors. Are any measurements less than 100k ohms?	**YES:** Repair short to signal wire. Perform Verification Procedure. **NO:** Contact DTAC for support.

BS62576,00016E9 -19-21MAR14-6/6

Electronic Injector — Calibration Information

Purpose:

The purpose of this test is to place the proper injector part number, serial number, and calibration code information in the ECU for each injector. Information in the ECU is specific for each injector and the cylinder number where it is installed. If the information is not correct, it may cause the engine to be out of emissions compliance or cause poor engine performance.

IMPORTANT: Injector number 1 is located on the flywheel end of the engine.

1. Ignition ON, Engine OFF.
2. In Service ADVISOR,
   a. Select Tests and Calibrations in the left-hand shortcut bar.
   b. Select Connected Calibrations.
   c. Select Interactive Calibrations.
   d. Select ECU - Level B1.
   e. Select Injector Calibration.
   f. Select the desired operation from the test menu.

Operation:

Options:

- Change Information
- Exit
- Print

Change Information

If an injector is being replaced, then the information for that injector must be loaded into the ECU. This is done by selecting the “Change Information” button. The screen displays a table showing the existing information that is stored in the ECU. There is a “Change To” box for each cylinder. Enter the correct injector Part Number, Serial Number, and Calibration Code in the appropriate box. Once all the injector information has been updated, click the “Next” button, verify that the data entered is correct, and then click the “Yes” button.

Exit

Stops test and asks for Cancel confirmation. If “Yes” is Selected, test is exited. If “No” is selected then you are returned to the opening screen to start testing again.

NOTE: If you have changed some information and press Exit you will need to turn the key off for 120 seconds for the data to be properly stored in the ECU.

Print

Allows you to print what is displayed on the screen. For more information see CTM120419, Section 04, Group 160.

IMPORTANT: When you connect to the Deere network, the information you changed will be uploaded to Deere.

JF70945,000009B -19-18JUN14-1/1

Aftertreatment Verification Procedure

1. Ignition ON, engine running.
2. Ensure the auto exhaust filter cleaning is enabled and throttle is at slow idle.
3. In Service ADVISOR, monitor Engine Coolant Temperature and allow it to reach 70 °C (158 °F).

IMPORTANT: If exhaust filter cleaning begins, allow it to complete.

4. Monitor DTCs. If any DTCs become active, go to those troubleshooting procedures.

NOTE: Upon key cycle, DTCs related to the aftertreatment system may become stored.

JF70945,000009A -19-06MAY14-1/1

Accessing Diagnostic Trouble Codes

Every control unit monitors certain electrical circuits within the network of circuits for which it is responsible. The unit then stores the relevant diagnostic trouble code if there is a malfunction (error) or if the operator makes a mistake. However, not all the diagnostic trouble codes indicate a current problem, since most of the circuits are monitored only at the actual moment of activation or when they are actually activated (switched on). To make sure that the diagnostic trouble code you are troubleshooting is ”active”, proceed as follows:

1. General procedure for dealing with diagnostic trouble codes:
   - Access the diagnostic trouble codes
   - Note and clear the diagnostic trouble code(s)
   - Carry out an operational test (activate the circuit affected) or test drive the machine
   - Switch off ignition and turn it on again after five sec. (reinitiate the control units)
   - Access the diagnostic trouble codes again and process them
   - If it is not possible to (re-)produce a relevant diagnostic trouble code with a functional check and the problem is still present in the circuit, deal with the codes you noted earlier.
2. Procedure for dealing with diagnostic trouble codes using Service ADVISOR:
   - Access diagnostic trouble codes via the ”Diagnostics” tab
   - “Active” diagnostic trouble codes take priority
   - If no “Active” diagnostic trouble codes are present:
     - Delete diagnostic trouble code(s)
     - Carry out an operational test (activate the circuit affected) or test drive the machine
     - Switch off ignition and turn it on again after five sec. (reinitiate the control units)
     - If no active diagnostic trouble codes are present, deal with the ”SAVED” codes
     - If it is not possible to (re-)produce a relevant diagnostic trouble code with a functional check or test-drive, and the circuit problem persists, the cleared diagnostic trouble codes must be checked; if the codes are associated with the problem on the machine, they must be processed.

NOTE: Cleared diagnostic trouble codes should only be dealt with if it is not possible to (re-)produce the problem on the machine (no active or saved codes are present after a functional test/test drive has been carried out) and when the description of diagnostic trouble code(s) can be associated with the machine problem.

3. Processing cleared diagnostic trouble codes using Service ADVISOR:
   - Every time a diagnostic trouble code is accessed, it is saved in Service ADVISOR in the “Readings Logs” of the job that is being processed. Before it is cleared, the diagnostic trouble code status of the machine can be accessed via the “Session” menu or “Logs”.
4. Status of diagnostic trouble codes in Service ADVISOR:
   - Status: “ACTIVE” (priority 1):
     - Diagnostic trouble code cannot be cleared.
     - Current problem with the machine.
   - Status: “SAVED” (priority 2):
     - Diagnostic trouble code can be cleared
     - At present the problem is not recognized by the control unit (example: Faulty solenoid valve, switch, or circuit not activated at the moment).

CB12260,00005EC -19-12MAR15-1/1

CAN Communication Fault Checks

Reason:

To check the physical integrity of the CAN bus.

Equipment:

- Multimeter

Procedure:

NOTE: CAN related DTCs (SPN/FMI xxxxxx.09) usually indicate a physical problem with the CAN bus, a failed control unit, or a control unit that has lost its power or ground circuits.

There are several CAN bus error conditions that may exist. Find the one that best describes the situation:

- Condition 1: More than one control unit function reports one missing message xxxxxx.09 code.
- Condition 2: One or more control unit functions that should be displaying in Service ADVISOR™ Or on the PDU display does not appear. There may or may not be associated missing message codes.
- Condition 3: More than one control unit reports multiple missing message xxxxxx.09 codes.
- Condition 4: Only one unit displays multiple missing message xxxxxx.09 codes.

NOTE: Intermittent missing message DTCs can be caused by excessive CAN bus traffic as well as poor connections or failing wiring. It may be necessary to simulate field conditions by moving suspect wiring around or putting mild strain on connections.

Condition 1:

NOTE: It is rare for multiple control units to display only one missing message code without another component DTC to be present as well.

1. Disconnect CAN connectors from all affected control units and check continuity of CAN Hi and CAN Lo between control units.

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Condition 2:

NOTE: Control units only display missing messages DTCs from other control units required for their operation. Therefore, some control units may be missing but not generate a code from other control units. Some control units may not appear as missing if they are not present on the network upon start-up.

1. If entire control unit is missing, check power and ground circuits for that control unit.
2. If control unit is present but messages missing, disconnect CAN connector from control unit and check CAN Hi and CAN Lo continuity between suspect control unit and control unit reporting error.
3. If entire control unit is missing and using Service ADVISOR, check CAN bus continuity between affected control unit and diagnostic interface.
4. If a component-based error should be displayed and is not, troubleshoot affected component circuit.
5. If control unit is missing, using PDU, disconnect CAN connector from control unit and check CAN Hi and CAN Lo continuity between suspect control unit and PDU.

Condition 3:

1. Disconnect CAN connector from all affected control units and check continuity of CAN Hi and CAN Lo between control units.
2. Check power and ground circuits to all affected control units.
3. Possible erroneous code(s).

Condition 4:

1. Suspect bad CAN wiring to reporting control unit. Disconnect CAN connector from all affected control unit and check continuity of CAN Hi and CAN Lo between reporting control unit and closest CAN connector.

CB12260,00005EE -19-12MAR15-1/1

CAN Bus Terminator Test

Reason:

To determine the resistance value of the CAN Bus terminator.

Equipment:

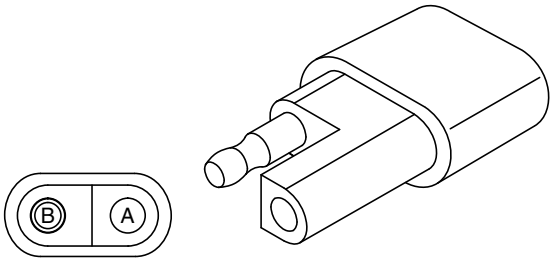
- Ohmmeter

Procedure:

1. Park machine safely in neutral with park brake locked.
2. Turn engine off.
3. Unplug the CAN bus terminator from the harness.
4. Connect the ohmmeter to terminals A and B of the CAN terminator.

Results:

- Resistance should measure 120 ±2 ohms.



TCT006817 —UN—09APR13

A— Terminal **B— Terminal**

NOTE: Meter accuracy and test lead resistance affect readings.

If, after accounting for equipment tolerances, the reading is not within specification, replace the terminator.

CB12260,00005EF -19-03APR15-1/1

Control Unit Messaging Errors

With the machine turned on, control units are constantly exchanging messages (data) for proper machine operation.

NOTE: Control units only display missing messages from other control units required for their operation.

Therefore, some control units may be "missing" but not generate a code from other control units. The PDU will display a missing message for any control unit that is present at start-up, but becomes missing after start-up. The PDU will NOT display missing messages for control units that are not present at start-up. Example: bad fuse to control unit.

CB12260,00005F0 -19-06MAY14-1/1

CAN Network Voltage Checks

NOTE: These procedures should be followed in sequence until the problem is resolved.

Reason:

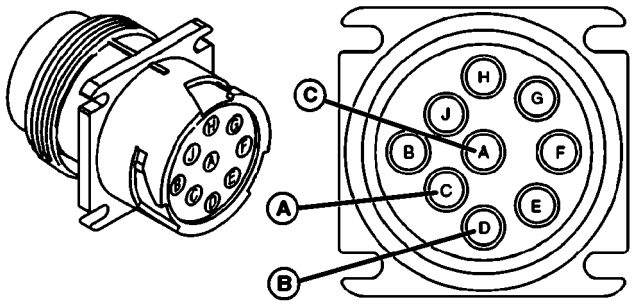
To check the CAN Hi(+) and CAN Lo(-) signals for proper voltage.

Equipment:

- Multimeter

Check for proper voltage:

1. Turn key to on position (engine off).
2. Use a multimeter to measure CAN Hi (A) and CAN Lo (B) voltages at the Service ADVISOR™ diagnostic connector.
3. Correct readings (desired):
   a. CAN Hi: 2.50—3.50 V
   b. CAN Lo: 1.50—2.49 V
4. Incorrect readings:
   a. One or both voltages above 5 V.
   b. One or both voltages below 1 V.
   c. CAN Hi and CAN Lo voltages are equal.
   d. Voltages out of specification but between 1—5 V.



LVAL10288 —UN—23JUL10

A—CAN Hi
B—CAN Lo
C—Ground

Ground Checks:

1. Turn key to off position.
2. Locate and remove passive terminator.
3. Check resistance to ground (C).
4. Resistance should be less than 1 ohm.

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Continued on next page

CB12260,00005F1 -19-10JUN14-1/2

Check for Short Circuits to CAN Hi and CAN Lo:

1. This check should only be performed if the previous checks of CAN Hi and CAN Lo indicated:
   a. Voltage at or near battery voltage.
   b. Voltage above 5 volts and ground checks OK.
   c. Voltage below 1 volt.
   d. Voltages of CAN Hi and CAN Lo were equal.
2. Verify all connectors and terminators are connected.
3. Turn key switch to RUN position (engine OFF).
4. Use a multimeter to measure CAN Hi (A) and CAN Lo (B) voltages at the Service ADVISOR diagnostic connector, from CAN ground (C) to CAN Hi and CAN Lo. Record values.
5. Remove CAN passive terminator.

NOTE: **Voltage higher than 5 V on either CAN Hi or CAN Lo indicates a short to high voltage. Voltage lower than 1 V indicates a short to ground. If CAN Hi and CAN Lo are equal, they could be shorted together.**

6. Check for a change in voltage on CAN Hi and CAN Lo from value recorded. If voltage changed, replace passive terminator.

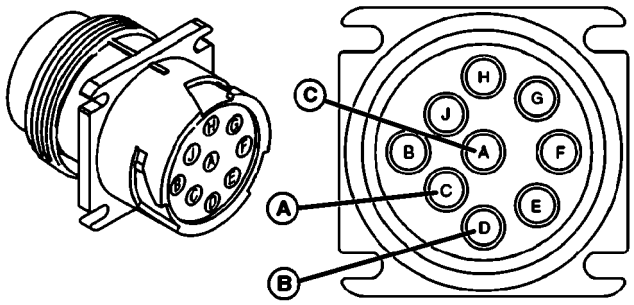
Compare CAN Hi and CAN Lo Voltages:

NOTE: **The CAN bias voltage is 2.5 V. To evaluate the CAN Hi and CAN Lo circuits, the voltage recorded for each must be calculated in reference to this bias.**

1. To calculate CAN voltage bias differential where X = CAN Hi voltage and where Y = CAN Lo voltage and:
   a. CAN Hi: Recorded voltage—2.5 V = X
   b. CAN Lo: 2.5 V—Recorded voltage = Y
2. Compare results from CAN Hi and CAN Lo calculations. Values must be within 35% of each other. Use the following table to evaluate:

CAN Hi Result (X)	CAN Lo Result (Y)
0.1 V	0.06—0.14 V
0.2 V	0.13—0.27 V
0.3 V	0.21—0.4 V
0.4 V	0.26—0.54 V
0.5 V	0.33—0.67 V
0.6 V	0.39—0.81 V
0.7 V	0.46—0.94 V
0.8 V	0.52—1.0 V
0.9 V	0.59—1.0 V
1.0 V	0.65—1.0 V

3. If results are within acceptable limits according to table:
   a. CAN differential voltage is OK.
4. If results are not within acceptable limits according to table:
   a. CAN Hi result approximately 2X CAN Lo result. Loss of CAN Lo between controller and passive terminator.
   b. CAN Lo result approximately 2X CAN Hi result. Loss of CAN Hi between controller and passive terminator.



LVAL10288 —UN—23JUL10

A—CAN Hi
B—CAN Lo
C—Ground

Voltages Within Range but Out of Specification:

Perform the following until voltages are within specification:

1. Check voltages at Service ADVISOR diagnostic connector after each of the next steps. (Turn key switch to the OFF position when removing fuses or disconnecting control units and to the RUN position (engine OFF) when measuring voltages.)
   a. One at a time, remove fuse or connector supplying power to each control unit and repeat voltage checks.
   b. One at a time, disconnect all connectors at each control unit and repeat voltage checks.
   c. Results:
   d. If removing fuse to any control unit causes voltage to come within specification, check CAN Hi and CAN Lo, power and ground circuits to control unit. Replace control unit if circuits check OK. If removing fuse did not cause voltage to return to normal but disconnecting control unit resulted in voltage within specification, replace control unit.
2. Replace or test passive terminator.
3. With keys switch off terminator removed, perform continuity checks on all CAN bus circuits.

CB12260,00005F1 -19-10JUN14-2/2

Erroneous Diagnostic Trouble Codes

On occasion, a DTC may appear or be recorded due to various anomalies such as electromagnetic interference, voltage or current spikes, lightning, or other similar but temporary conditions. These factors should be taken into account when performing diagnostic procedures.

A snapshot of the DTC in question can be analyzed in Service ADVISOR™ to aid in the determination as to whether the code is erroneous or not.

Often times, these codes will be “missing or erratic data” or “abnormal update rate” types. These can also be caused by excessive CAN bus traffic that prevent lower priority messages from being transmitted.

A component on the machine or attachment may cause a false DTC as well. Commonly, false DTCs occur when a component in a circuit is switched on or off. These may consist of:

- Glow plugs
- Blower motors
- A/C compressors
- Horn
- Strobe/beacon lights
- Electric PTO clutches
- Electric solenoids

Gather as much information as possible about the operating conditions at the time the suspect code became active. If a component is suspect, cycle the component on and off several times to see if the DTC reoccurs.

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CB12260,00005F4 -19-06MAY14-1/1

Control Unit Information and Overview Test

This test gathers specific information from the controller and puts it into a printable format. The test automatically starts and gathers all of the information listed below. When all the information has been gathered, it is displayed on the screen. The following options are then displayed: Refresh, Exit, and Print.

Refresh:
Selecting this option gathers the information again and displays the new data.

Exit:
Selecting this option exits the test.

Print:
Selecting this option allows the user to print the data now or save it to a file and print it later.

The information gathered is:

- Date tested
- Engine serial number
- Engine hour meter
- Controller serial number
- Service tool version
- Controller part number
- Controller map data part number

To perform the test:

1. Ignition ON, Engine OFF.
2. In Service ADVISOR,
   a. Select Tests and Calibrations in the left hand shortcut bar.
   b. Select Connected Interactive Tests.
   c. Select Control Unit Information and Overview Test.
3. Follow the instructions on the screens.

OUMX258,000033C -19-06MAY14-1/1

Troubleshooting Electronic Controllers

NOTE: This reference is a guideline for troubleshooting problems that still exist after standard diagnostics have been performed. These problems are typically due to specific operating conditions, intermittent failures or, in rare cases, control unit failures. Depending on the situation, some or all of the following may be important.

Problems Due to Specific Operating Conditions:

Review all recorded codes and consult with operator to determine operating and vehicle conditions when the problem occurs. Record details.

- Does code/problem occur at the same time as other problems?
- Does code/problem occur when vehicle is warm or cold?
- Does code/problem occur during field or transport operation?
- Does code/problem occur while performing a specific action such as shifting, turning, braking, operating certain hydraulics?
- When did code/problem first appear? Was there any maintenance performed recently? (If yes, inspect areas of maintenance for inadvertent damage or improper installations.)

Attempt to recreate code/problem based on conditions. If possible, repeat operational, system, electrical, hydraulic or mechanical checks under these conditions.

Problems Due to Intermittent Electrical Failures:

NOTE: **Electrical intermittent failures are usually caused by harness, terminal or connector problems.**

- Inspect all connectors and terminals of related circuits.
- Inspect mechanical linkages for interference with harnesses or connectors.
- Inspect harnesses for missing or improperly installed clamps or bands. Loose harnesses that are allowed to move too freely or harnesses that are banded too tightly may result in worn or damaged wires.
- Inspect mechanical linkages for proper operating condition.

Problems Due to Control Unit Failures:

NOTE: Before replacing control unit, review all tests. Control units are the least likely cause of failure!

- If all checks have been made with no problems identified, check power and ground circuits. Power inputs must be within 1 V of battery voltage and ground circuits must be less than 1.0 ohm to the vehicle single point ground.
- Inspect all connectors and terminals of associated control units.

CB12260,00005FC -19-05JUN13-1/1

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 POINT/PROCEDURES listed in the first column and follow the sequence carefully. The middle RESULTS column gives the reading or condition that should be obtained in **BOLD** print. If the results of the test or check are not normal, perform the test, check, or adjustment listed below the **BOLD** print. The system diagram that accompanies each test procedure is drawn to resemble machine components. The leader line points to the exact point the test is to be made.

CB12260,00005FF -19-06JUN13-1/1

Readings Overview

The readings, whether displayed in Service ADVISOR™ or on the display panel, are shown live - voltages, pressures, positions, etc. These are shown for reference, diagnostics, adjustment, or calibration purposes.

It is recommended that Service ADVISOR™ be used to take readings as multiple components can be checked simultaneously. The display panel can show certain readings, only a few at a time. See:

- Accessing DTCs through PDU
- PDU
- Display Navigation
- Service Menu

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CB12260,0000601 -19-03JUN14-1/1

Problem Not Found Procedure

BS62576,00016E8 -19-11MAR14-1/6

Diagnostic Procedure

BS62576,00016E8 -19-11MAR14-2/6

1 Read DTCs and Store Snapshot Information	1. Review Snapshot Information stored from previous diagnostics.	
	2. Ignition OFF, Engine OFF.	
	3. Reconnect all components and connectors.	
	4. Operate engine under condition where DTC became active.	**YES:** Perform diagnostics for active DTC.
	Did DTC reappear active?	**NO:** Go to next step.

BS62576,00016E8 -19-11MAR14-3/6

2 Obtain More Information	1. Speak with the operator that observed the problem and obtain more information about when problem occurred.	
	2. Operate engine under same conditions as when problem occurred.	**YES:** Perform diagnostics for active DTC.
	Did DTC reappear active?	**NO:** Go to next step.

BS62576,00016E8 -19-11MAR14-4/6

3 Search DTAC Solutions	Search DTAC solutions in Service ADVISOR for known issues which may cause DTC you are troubleshooting.	**YES:** Perform steps found in DTAC solution.
	Are DTAC solutions found?	**NO:** Go to next step.

BS62576,00016E8 -19-11MAR14-5/6

4 Controller Reprogram	Search Custom Performance for controller software updates.	**YES:** Reprogram controller with newest version of software. Perform Verification Procedure.
	Is a new version of software available?	**NO:** Contact DTAC for support.

BS62576,00016E8 -19-11MAR14-6/6

Approved Software for Control Units

IMPORTANT: Avoid Damage! When reprogramming electronic control units, always comply with the relevant instructions (e.g. installation instructions, DTAC or PIP).

Do NOT reprogram the control unit if the version numbers of the new and current software are identical, or if the control unit is already programmed with a newer software version.

NOTE: New software always includes the properties that were newly introduced with the previous software. However, not all software versions can be used on every machine.

NOTE: The software for reprogramming is either supplied with the Service ADVISOR data DVD, or else it must be downloaded from John Deere's Intranet (John Deere Custom Performance (Software Delivery System)).

For the current summary of software, see PATHWAYS or DTAC.

CB12260,00005EA -19-30MAY13-1/1

Section 250
Power Train Operation, Tests, and Adjustments
Contents

Page

Group 10—Component Location
Summary of References 250-10-1
Hydrostatic Power Train—7500A 250-10-1
Hydrostatic Power Train—8000A 250-10-2
Driveline Components 250-10-3
Hydrostatic Assembly Components 250-10-4
Hydrostatic End Cover and Charge Pump Adapter Components 250-10-5

Group 20—Theory of Operation
Summary of References 250-20-1
Hydrostatic Transmission 250-20-2

Group 30—Diagnosis
Power Train Troubleshooting Hints 250-30-1
Diagnose Mower Will Not Move in Forward or Reverse 250-30-1
Mower Will Not Move in Forward or Reverse 250-30-1
Diagnose Mower Will Not Reach Full Speed 250-30-2
Mower Will Not Reach Full Speed 250-30-2
Diagnose Sluggish Response to Acceleration or Deceleration 250-30-4
Sluggish Response to Acceleration or Deceleration 250-30-4
Diagnose Hydrostatic System Operating Hot 250-30-5
Hydrostatic System Operating Hot 250-30-5
Diagnose Noisy Pump 250-30-5
Noisy Pump 250-30-6

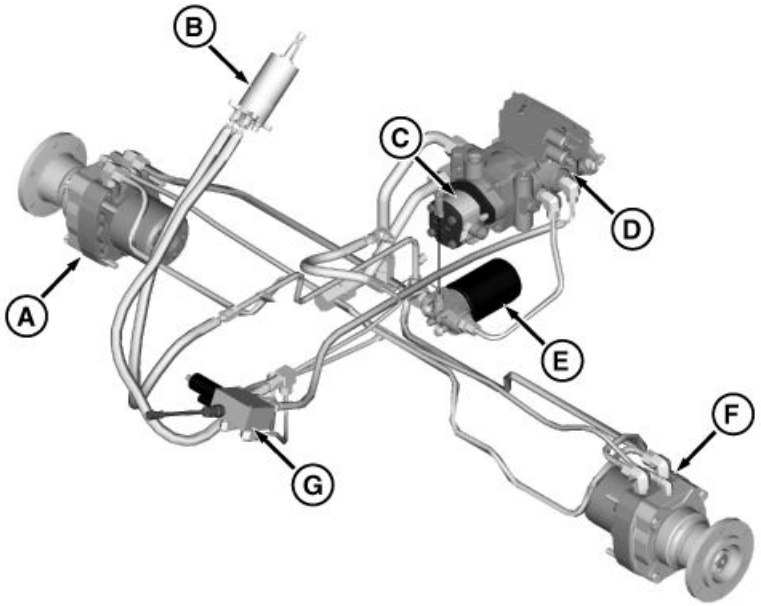
Group 40—Tests and Adjustments
Summary of References 250-40-1
Test Port Location 250-40-1
Test Hydrostatic System Relief Pressure 250-40-3
Test Charge Pressure 250-40-4

Summary of References

- Hydrostatic Power Train—7500A
- Hydrostatic Power Train—8000A
- Driveline Components
- Hydrostatic Assembly Components
- Hydrostatic End Cover and Charge Pump Adapter Components

BS62576,000100B -19-29NOV13-1/1

Hydrostatic Power Train—7500A

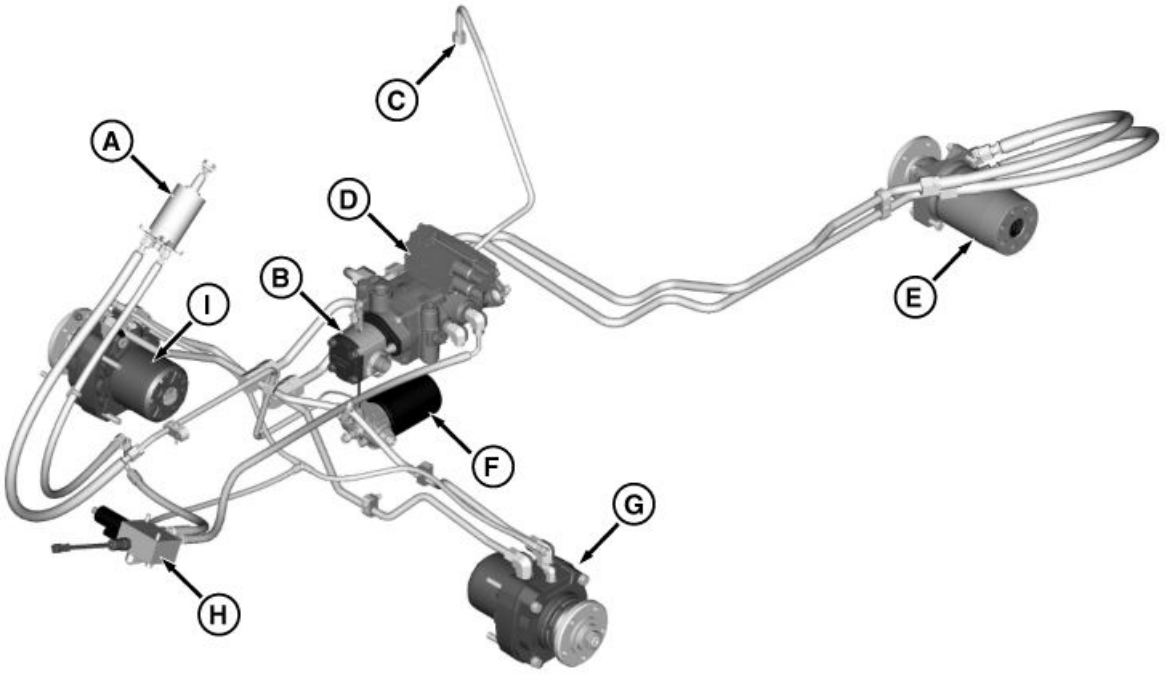


TCT006668 —UN—15MAR13

A—Right Hydraulic Wheel Motor
B—Steering Valve
C—Hydraulic Front Pump Assembly
D—Hydrostatic Pump
E—Hydraulic Oil Filter
F—Left Hydraulic Wheel Motor
G—Brake Release Valve

BS62576,0001007 -19-15MAR13-1/1

Hydrostatic Power Train—8000A



TCT006395 —UN—15MAR13

A—Steering Valve
B—Hydraulic Front Pump Assembly
C—Hydraulic Oil Return (to hydraulic tank)
D—Hydrostatic Pump
E—Rear Hydraulic Wheel Motor
F—Hydraulic Oil Filter
G—Left Hydraulic Wheel Motor
H—Brake Release Valve
I— Right Hydraulic Wheel Motor

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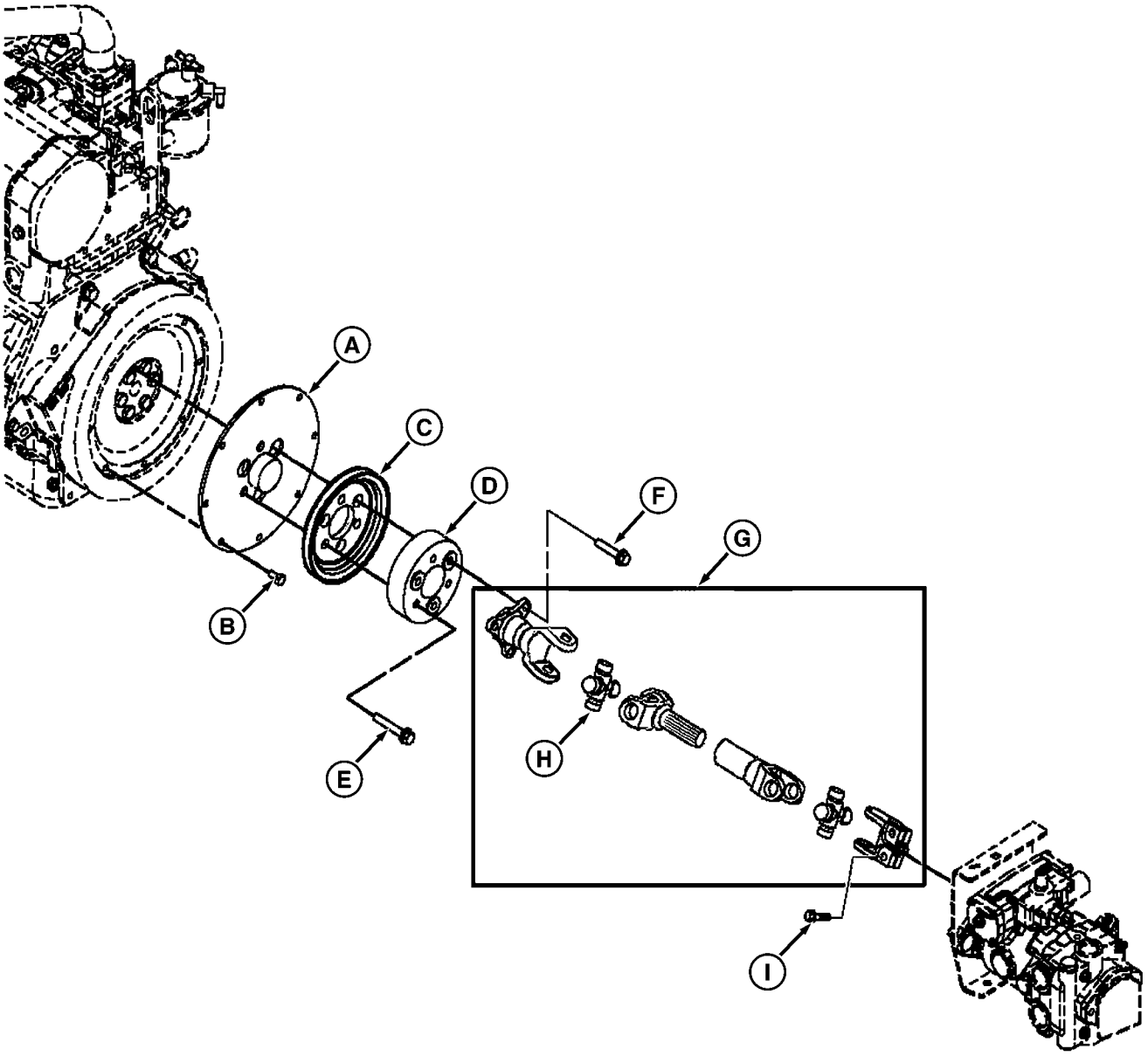
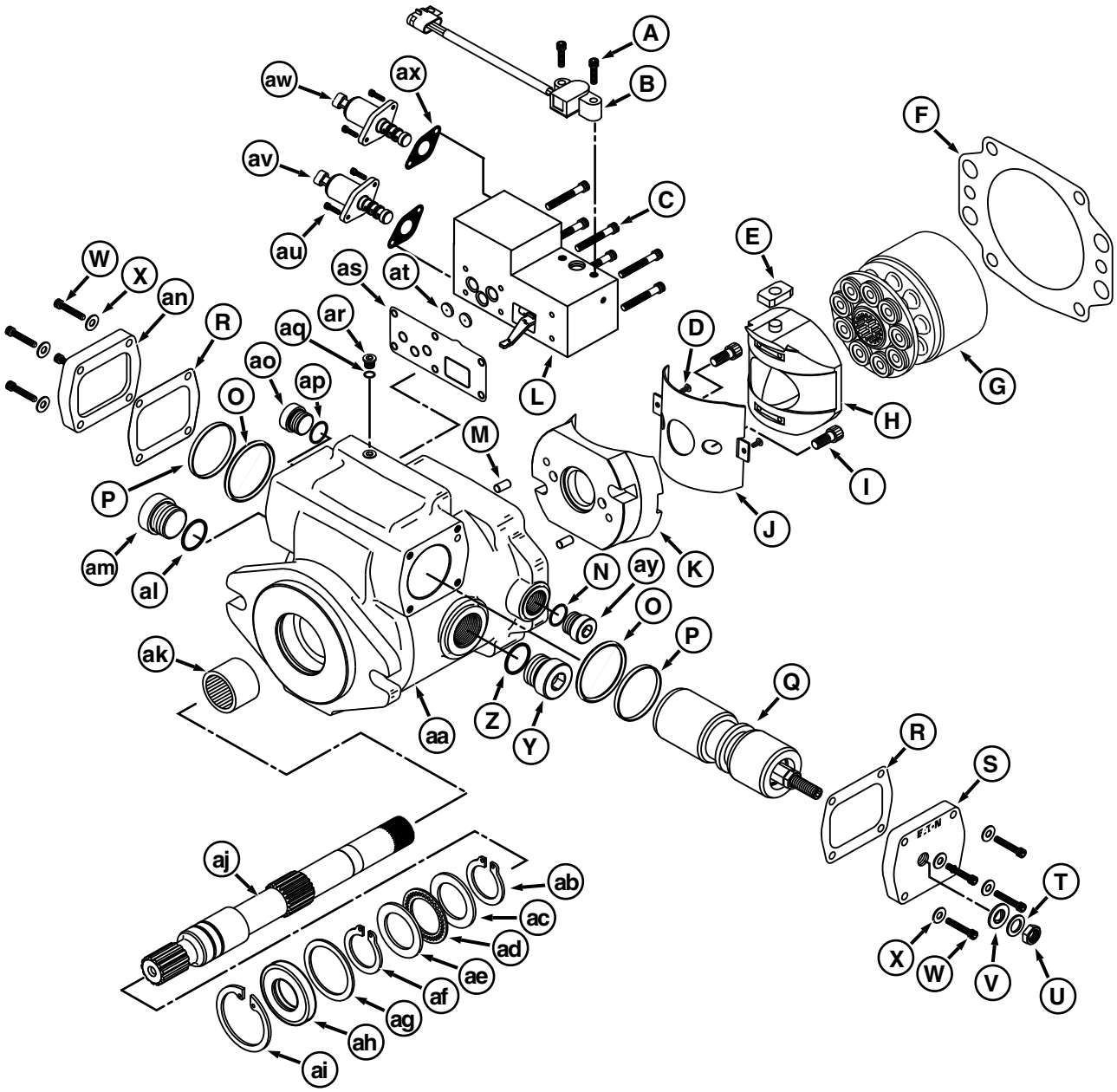
Driveline Components



A—Flywheel Plate
B—Hex Bolt M8x16 (8 used)
C—Sheave, Belt
D—Coupler, Flex
E—Hex Bolt M10x60 (3 used)
F—Hex Bolt M10x45 (3 used)
G—Assembly, Drive Shaft
H—Universal joint (2 used)
I— Hex Bolt M10x30 (2 used)

SW00544,000003D -19-04NOV13-1/1

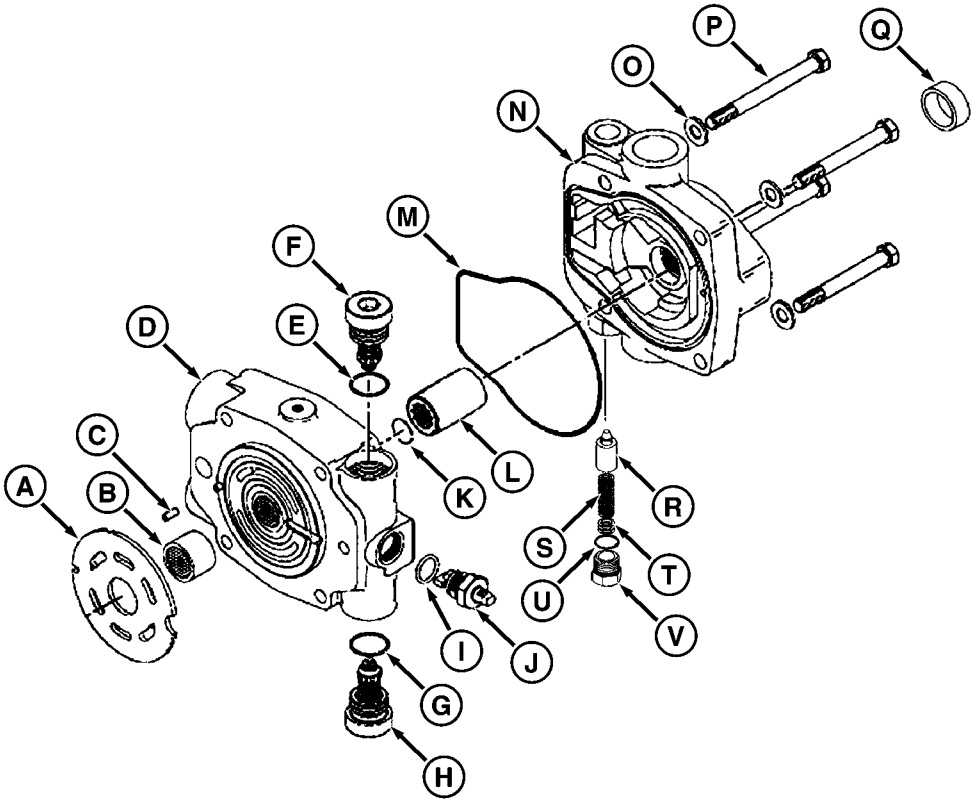
Hydrostatic Assembly Components



A—Screw (2 used)
B—Position Sensor
C—Screw (6 used)
D—Screw (2 used)
E—Servo Piston Follower
F—Gasket
G—Rotating Assembly
H—Swashplate
I— Screw
J—Bushing
K—Cradle Sub-Assembly
L—Servo Control Assembly
M—Dowl Pin
N—O-Ring
O—Seal
P—Seal
Q—Servo Piston Assembly
R—Gasket
S—Cover Plate
T—Washer
U—Nut
V—Seal Washer
W—Screw
X—Washer
Y—Plug
Z—O-Ring
aa—Housing
ab—Snap Ring
ac—Washer
ad—Thrust Bearing
ae—Washer
af—Snap Ring
ag—Washer
ah—Seal
ai—Snap Ring
aj—Drive Shaft
ak—Bearing
al—O-Ring
am—Plug
an—Cover Plate
ao—Plug
ap—O-Ring
aq—O-Ring
ar—Plug
as—Gasket
at—Orifice
au—Screw (4 used)
av—Solenoid
aw—Solenoid
ax—Gasket (2 used)
ay—Plug

BS62576,000125B -19-02MAY14-1/1

Hydrostatic End Cover and Charge Pump Adapter Components



TCT009325 —UN—27NOV13

A—Valve Plate
B—Bearing
C—Roll Pin
D—End Cover (includes B, C)
E—O-ring
F—Relief Valve for Port A (includes E)
G—O-ring
H—Relief Valve for Port B (includes G)
I— O-ring
J—Bypass Valve Actuator (includes I)
K—Retaining Ring
L—Coupler, 11 Tooth
M—Molded O-ring
N—Charge Pump Adapter
O—Washer (4 used)
P—Cap Screws[1]
Q—Bushing
R—Poppet
S—Spring
T—Shim
U—O-ring
V—Plug

[1]*Different size cap screws are used. Label cap screws for removal. Refer to parts catalog for sizes.*

BS62576,000125C -19-02MAY14-1/1

Summary of References

- Hydrostatic Transmission

BS62576,0001008 -19-19JUN14-1/1

Hydrostatic Transmission

Function

The hydrostatic system provides a means to transfer power from the engine to the final drive for the wheels. It also provides infinitely variable speed control.

Theory

The hydrostatic system is a closed loop fluid power system that consists of an Eaton piston pump and three (two-wheel drive) or four (four-wheel drive) motors. Speed and direction are controlled by two foot pedals.

Engine power is transferred to the hydrostatic pump by a drive shaft connected to the engine flywheel. The Eaton piston pump, or hydrostatic transmission, is mounted to a bulkhead under the operators platform.

Hydrostatic fluid is provided to the hydrostatic pump from a pressurized charge pump flow. Fluid from the steering/charge pump is directed through two dual-purpose system relief/check valves located in the pump backplate. An internal charge pump relief valve maintains a minimum charge pressure level. Excess charge fluid is returned to the gear pump inlet.

The hydrostatic pump provides hydraulic fluid in varying amounts to the motors through hydraulic lines and fittings. The hydraulic fluid in the power train circulates in a closed loop. The amount and pressure of the fluid is a result of the displacement of the pump pistons, which are controlled by a variably angled surface called a swash plate or cam plate. Fluid leaves the pump, flows through the wheel motor(s) and is returned to the pump, not the reservoir.

During operation, some fluid intentionally leaves this closed loop circuit, such as case drain, and is replenished by cool filtered fluid from the front gear set (steering/charge pump) of the triple pump assembly. (See Hydraulic section.) This fresh fluid enters through the check valve part of the relief/check valve assembly. If the pressure going to the wheel motors exceeds a certain preset amount, the relief valve for that circuit will move off its seat and allow some fluid to pass to the low-pressure side of the system.

Hydrostatic Pump

The pump is an Eaton Model 72400 servo-controlled piston pump. The servo controlling the swashplate position is electronically controlled by the VCU through two solenoids, one for forward and one for reverse.

Hydrostatic fluid is provided to the hydrostatic pump from a pressurized charge pump flow. An internal charge relief valve maintains a minimum charge pressure level of 1310 - 1516 kPa (190-220 psi). Charge oil pressure is also used to operate the servo control and four-wheel drive control.

During operation, some fluid is intentionally “leaked” from the hydrostatic circuit and is routed back to tank. This fluid is replaced by charge oil that enters the closed loop through one of the relief/check valves, thereby introducing cool filtered oil into the hydrostatic system.

Speed and direction are controlled by the direction of, and angle of the cam plate rotation. The servo controlling the swashplate position is electronically controlled by the VCU through two solenoids, one for forward and one for reverse. The greater the angle of the cam plate from the center position (neutral), the greater the volume of fluid the pistons will displace and the faster the vehicle travels.

Servo Control Function

Transmission output is initiated by movement of the forward or reverse pedal. The pedal position is monitored by sensors that send pedal position information to the VCU. The VCU then sends an electronic signal to the forward and reverse solenoids on the hydrostatic pump. When the solenoids are energized charge pressure oil is directed to one side or the other of the servo piston. The pressurized servo piston pushes against the cam plate causing the cam plate to rotate to a position out of neutral. Fluid on the opposite side of the servo piston is exhausted through the control valve spool to the pump housing.

The control valve is equipped with a swashplate position sensor, which is monitored by the VCU for cruise control and speed limiting functions.

As the pedal is depressed forward or reverse, the vehicle starts a forward or reverse movement. The movement of the pump cam plate in either the forward or reverse position controls the direction of the motor rotation. In the reverse position, the pump shaft still rotates in the same direction, but the discharge of oil from the pump is reversed, thus reversing the motor rotation. When the cam plate begins to move, the piston assemblies start to reciprocate farther, generating a flow; more oil is being pumped and the speed of the vehicle is increased. Flow rate is determined by length and frequency of strokes. When full cam angle is reached, which also is maximum volume of oil being discharged from the pump, the speed of the motor increases. When the cam plate begins to move, the relief valve on the discharge or pressure side seats because of the higher pressure differential. The other relief valve serves as a charge check, remaining open, on the intake or low-pressure side to continue supplying the closed loop system with cool filtered charge oil.

System Pressure Relief

The pressure relief valves are combination relief and check valves mounted within the hydrostatic pump assembly. One serves the forward pressure loop, and one serves the reverse pressure loop.

The function of the system relief valve is to relieve excess hydrostatic pressure if the vehicle encounters a heavy load or stalls out.

Continued on next page

When a preset pressure is reached, the large spring in the relief valve compresses and opens an orifice, allowing oil to bypass into the low-pressure side of the system. The opposite relief valve, serving as a check valve, opens and allows the oil to flow to the intake side of the pump.

Steering/Charge Pump

The steering/charge pump provides several functions to the hydrostatic circuits:

• Provides flow to keep circuits primed and make up internal leakages.

• Provides flow, under pressure, for maintaining back pressure on pump/motors pistons.

• Provides flow, under pressure, for hydraulic control purposes.

• Provides cooled and cleansed fluid for temperature control and flushing.

Wheel Motors 7500E

The wheel motors are Parker low speed, high torque positive displacement motors. The front being a Parker TH Series.

Both motors are fixed displacement type delivering a constant output torque for a given pressure throughout the speed range of the motor.

The motors for the front wheels are mounted on the flanges of the front axle assembly. The motors for the rear wheels, with rear wheel drive option only, are mounted on the ends of the control arms.

The drive wheels are mounted on hubs which are keyed onto the output shaft of each motor.

Wheel Motors 8000E

The wheel motors are Parker TG series motors.

The motors for the front wheels are mounted on the “T” frame. The motor for the rear wheel is mounted on the end of the third wheel steering clevis.

Each motor has a tapered keyed output shaft on which the wheel hubs are mounted. The two front wheel hubs incorporate a park brake disk.

The rear wheel motor contains a check valve. It allows hydraulic fluid to recirculate through the motor to prevent cavitation during turns, since the rear motor travels farther than the front two motors during turns. When traveling forward, the check valve closes and pressure is built to drive the motor. In reverse, the check valve opens and fluid is allowed to bypass the motor. During turns, the fluid travels through the motor and, when required, travels through the check valve from the downstream side to supplement the fluid flow. This allows the motor to speed up relative to the front motors without cavitation.

Hydrostatic Relief Valves

During operation while descending steep grades it is possible to build higher than normal pressure in the return lines. This happens when the machine’s momentum develops more pressure in the return lines of the hydraulic system than the hydrostatic pump develops in the directional/pressure flow line.

Effectively, the wheel motors try to drive the hydrostatic pump. Higher pressure in the return lines could cause the wheels to stop turning or start turning in the reverse direction. Either case could result in a loss of motion control. Hydrostatic relief valves are installed in the high and low/return pressure lines to counteract this effect.

The hydrostatic relief valve opens when the pressure in the return line reaches and exceeds a predetermined pressure value and then relieves the pressure in the return line through recirculation.

Dump Valve

IMPORTANT: Avoid Damage! Serious damage to the hydrostatic drive will result if the vehicle is towed.

The purpose of the dump valve is to allow the movement of a disabled vehicle, or if you want to just push it a short distance, without starting the engine. If an attempt is made to push the vehicle, the hydrostatic motor becomes a pump, trying to pump oil to the hydrostatic pump. This creates a hydraulic lock between the motor and pump. To overcome this condition, a dump valve has been installed between the high-pressure relief valves in the backplate of the piston pump.

The dump valve is a plug that contains a rotating stem with a flat spade end that fits between the two ends of the high pressure relief valves. When the dump valve is in the closed position, the relief valves are also in the closed position. When the dump valve stem is rotated 90°, the flat spade end spreads the relief valves to the open position. This allows the oil in the hydrostatic closed loop to bypass around the high-pressure relief valves inside the pump backplate. The bypassing of oil inside the pump backplate will allow the motor to rotate freely when the vehicle is moved a short distance. The dump valve is intended only for moving a vehicle a very short distance and not intended for towing a vehicle behind a truck or tractor.

Power Train Troubleshooting Hints

The most noticeable result of a worn pump or motor is reduced travel speed. This results from either the pump's inability to provide the necessary flow at the required pressure, or the pump/motor bypassing fluid to case drain.

Component wear is normally caused by either fluid contamination or pump cavitation. Pump cavitation can be a result of fluid contamination, clogged filter, or insufficient fluid in the system.

Before testing the hydrostatic pump, check the charge pump pressure. (See Hydraulics section.) Once you are satisfied that charge pressure is sufficient, test the hydrostatic pump efficiency (forward and reverse) with a flow meter. If the hydrostatic pump is delivering the required flow at full output pressure, the problem is probably with a wheel motor.

BS62576,000159C -19-17DEC13-1/1

Diagnose Mower Will Not Move in Forward or Reverse

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the "Diagnostics" tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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BS62576,000159D -19-17JUN14-1/10

Mower Will Not Move in Forward or Reverse

BS62576,000159D -19-17JUN14-2/10

❶ **Test Procedure**	Are the park brakes released?	**YES:** Go to next step. **NO:** Release park brakes.

BS62576,000159D -19-17JUN14-3/10

❷ **Continued**	Check electrical system function and check for error codes. Are error codes present?	**YES:** Refer to diagnostic Section 240. Refer to specific codes. **NO:** Go to next step.

BS62576,000159D -19-17JUN14-4/10

❸ **Continued**	Is hydraulic fluid at proper level in reservoir?	**YES:** Go to next step. **NO:** Fill reservoir to proper level.

BS62576,000159D -19-17JUN14-5/10

❹ **Continued**	Is correct grade hydraulic oil used (hydraulic oil viscosity not too high for operating conditions)?	**YES:** Go to next step. **NO:** Replace hydraulic oil with correct grade of proper viscosity.

Continued on next page

BS62576,000159D -19-17JUN14-6/10

5 Continued	Is dump valve closed?	**YES:** Go to next step. **NO:** Close dump valve.

BS62576,000159D -19-17JUN14-7/10

6 Continued	Do the pedals move freely down and back?	**YES:** Go to next step. **NO:** Check for binding parts or debris. Repair or replace parts as necessary.

BS62576,000159D -19-17JUN14-8/10

7 Continued	Is the suction strainer clear of restrictions?	**YES:** Go to next step. **NO:** Clean suction strainer.

BS62576,000159D -19-17JUN14-9/10

8 Continued	Is the driveshaft secure?	**NO:** Secure, repair or replace driveshaft.

BS62576,000159D -19-17JUN14-10/10

Diagnose Mower Will Not Reach Full Speed

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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BS62576,000159E -19-17JUN14-1/11

Mower Will Not Reach Full Speed

BS62576,000159E -19-17JUN14-2/11

1 Test Procedure	Has the speed been adjusted?	**YES:** Go to next step. **NO:** Adjust speed.

BS62576,000159E -19-17JUN14-3/11

2 Continued	Is hydraulic fluid at proper level in reservoir?	**YES:** Go to next step. **NO:** Fill reservoir to proper level.

Continued on next page

BS62576,000159E -19-17JUN14-4/11

3 Continued	Is correct grade hydraulic oil used (hydraulic oil viscosity not too high for operating conditions)?	**YES:** Go to next step. **NO:** Replace hydraulic oil with correct grade of proper viscosity.

BS62576,000159E -19-17JUN14-5/11

4 Continued	Is dump valve closed?	**YES:** Go to next step. **NO:** Close dump valve.

BS62576,000159E -19-17JUN14-6/11

5 Continued	Do the pedals move freely down and back?	**YES:** Go to next step. **NO:** Check for bent or broken components. Repair or replace parts as necessary.

BS62576,000159E -19-17JUN14-7/11

6 Continued	Is the suction strainer clear of restrictions?	**YES:** Go to next step. **NO:** Clean suction strainer.

BS62576,000159E -19-17JUN14-8/11

7 Continued	Is hydraulic fluid free from air bubbles?	**YES:** Go to next step. **NO:** Check suction line for air leaks. Repair as necessary.

BS62576,000159E -19-17JUN14-9/11

8 Continued	Check charge pressure. Is charge pressure within specifications?	**YES:** Go to next step. **NO:** If pressure does not meet specification, follow results of procedure.

BS62576,000159E -19-17JUN14-10/11

9 Continued	Perform hydrostatic transmission flow test. Is hydrostatic transmission flow within specifications?	**NO:** Check and/or replace relief valves. Repair or replace pump as necessary. Remove drive motors and bench check. Repair or replace as necessary.

BS62576,000159E -19-17JUN14-11/11

Diagnose Sluggish Response to Acceleration or Deceleration

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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BS62576,000159F -19-17JUN14-1/9

Sluggish Response to Acceleration or Deceleration

BS62576,000159F -19-17JUN14-2/9

1 Test Procedure	Is hydraulic fluid at proper level in reservoir?	**YES:** Go to next step. **NO:** Fill reservoir to proper level.

BS62576,000159F -19-17JUN14-3/9

2 Continued	Is correct grade hydraulic oil used (hydraulic oil viscosity not too high for operating conditions)?	**YES:** Go to next step. **NO:** Replace hydraulic oil with correct grade of proper viscosity.

BS62576,000159F -19-17JUN14-4/9

3 Continued	Is dump valve closed?	**YES:** Go to next step. **NO:** Close dump valve.

BS62576,000159F -19-17JUN14-5/9

4 Continued	Is the suction strainer clear of restrictions?	**YES:** Go to next step. **NO:** Clean suction strainer.

BS62576,000159F -19-17JUN14-6/9

5 Continued	Is hydraulic fluid free from air bubbles?	**YES:** Go to next step. **NO:** Check suction line for air leaks. Repair as necessary.

Continued on next page

BS62576,000159F -19-17JUN14-7/9

6 **Continued**	Check charge pressure. Is charge pressure within specifications?	**YES:** Go to next step. **NO:** If pressure does not meet specification, follow results of procedure.

BS62576,000159F -19-17JUN14-8/9

7 **Continued**	Perform hydrostatic transmission flow test. Is hydrostatic transmission flow within specifications?	**NO:** Replace relief valve.

BS62576,000159F -19-17JUN14-9/9

Diagnose Hydrostatic System Operating Hot

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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BS62576,00015A0 -19-17JUN14-1/5

Hydrostatic System Operating Hot

BS62576,00015A0 -19-17JUN14-2/5

1 **Test Procedure**	Is hydraulic fluid at proper level in reservoir?	**YES:** Go to next step. **NO:** Fill reservoir to proper level with hydraulic fluid.

BS62576,00015A0 -19-17JUN14-3/5

2 **Continued**	Are oil cooler fins free of dirt and debris?	**YES:** Go to next step. **NO:** Clean oil cooler fins of dirt and debris.

BS62576,00015A0 -19-17JUN14-4/5

3 **Continued**	Check relief valve operation. (See Test Hydrostatic System Relief Pressure.) Are the relief valves opening at the correct pressure?	**NO:** Replace relief valve(s).

BS62576,00015A0 -19-17JUN14-5/5

Diagnose Noisy Pump

- Recall, record (Snapshot test under Interactive Tests) and clear codes.
  Service ADVISOR™ : This procedure can be performed by making a connection to the machine and using the ”Diagnostics” tab to view and clear codes. Use Snapshot Test under Interactive Test tab for specific controller to record fault.
- Clear codes using Diagnostic tab
- Recall codes again and check for return of this code.
- Recreate operating conditions that caused code.
- End of tests if code does not return.

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BS62576,00015A1 -19-17JUN14-1/9

Noisy Pump

BS62576,00015A1 -19-17JUN14-2/9

1 Test Procedure	Is hydraulic fluid at proper level in reservoir?	**YES:** Got to next step. **NO:** Fill reservoir to proper level.

BS62576,00015A1 -19-17JUN14-3/9

2 Continued	Is dump valve closed?	**YES:** Got to next step. **NO:** Close dump valve.

BS62576,00015A1 -19-17JUN14-4/9

3 Continued	Is hydraulic fluid free from air bubbles?	**YES:** Got to next step. **NO:** Check suction line for air leaks. Repair as necessary.

BS62576,00015A1 -19-17JUN14-5/9

4 Continued	Is oil filter clean (free from restrictions)?	**YES:** Got to next step. **NO:** Replace filter. Find source of any excess contamination.

BS62576,00015A1 -19-17JUN14-6/9

5 Continued	Perform hydrostatic transmission forward and reverse relief valve tests. Are the hydrostatic transmission forward and reverse relief valves opening at the correct pressure?	**YES:** Got to next step. **NO:** Replace relief valve(s).

BS62576,00015A1 -19-17JUN14-7/9

6 Continued	Is charge pressure correct?	**YES:** Got to next step. **NO:** Test and adjust charge pressure.

BS62576,00015A1 -19-17JUN14-8/9

7 Continued	Disassemble and inspect pump for damage. Was any damage found?	**YES:** Repair or replace as necessary.

BS62576,00015A1 -19-17JUN14-9/9

Summary of References

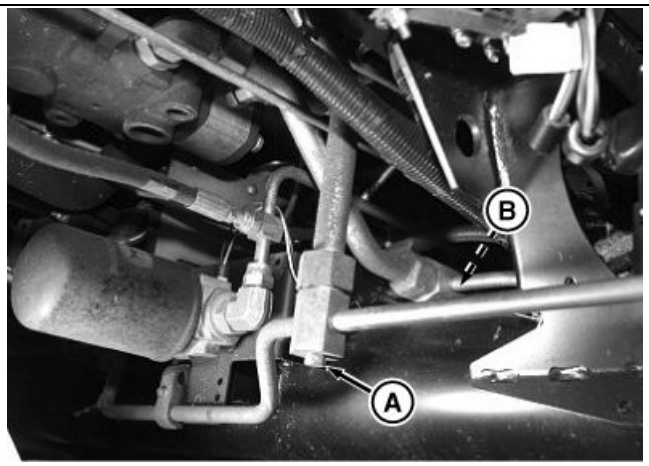
- Test Port Location
- Test Hydrostatic System Relief Pressure
- Test Charge Pressure

BS62576,0000CEE -19-27MAR14-1/1

Test Port Location

Recommended Gauges		
Port	System Function	Pressure range
A	System Pressure	700 bar (10,000 PSI)
B	System Pressure	700 bar (10,000 PSI)
C	Hydraulic Pump Supply to Steering Valve	150 bar (2000 PSI)
D	Drain Port (Case Pressure)	0—20 bar (0 to 300 PSI)
E	Charge Pressure	0—40 bar (0 to 600 PSI)
F	Hydraulic Pump Suction	2 bar to 1 bar (30 PSI to 30 in. Hg)

1. Park machine safely. (See “Park Machine Safely” in Safety Section.)
2. Thoroughly clean area around hydrostatic and hydraulic pumps and pump fittings.
3. Install appropriate fittings and gauges where needed for specific pressure tests as called for in test procedures.
   a. Check reverse travel charge pressure to wheel motors at tee block port (A) with recommended gauge.



TCT009905 —UN—26DEC13

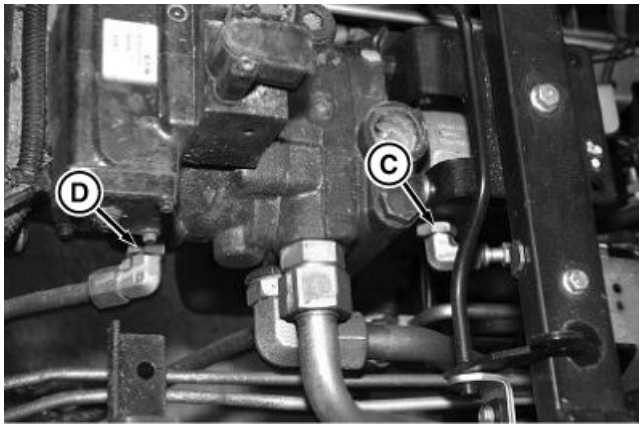
A—Pressure Port A, to Wheel Motors (Reverse)

B—Pressure Port B, to Wheel Motors (Forward)

   b. Check forward travel charge pressure to wheel motors at tee block port (B) with recommended gauge.

SW00544,0000055 -19-27MAR14-1/4

   c. Install appropriate tee fitting to hydraulic pump outlet (C) to check supply pressure to steering valve with recommended gauge.
   d. Install appropriate tee fitting to hydrostatic pump fitting (D) to check case pressure with recommended gauge.



TCT009902 —UN—26DEC13

C—Pressure Port, Pump to Steering Valve

D—Pressure Port, Case Pressure

Continued on next page

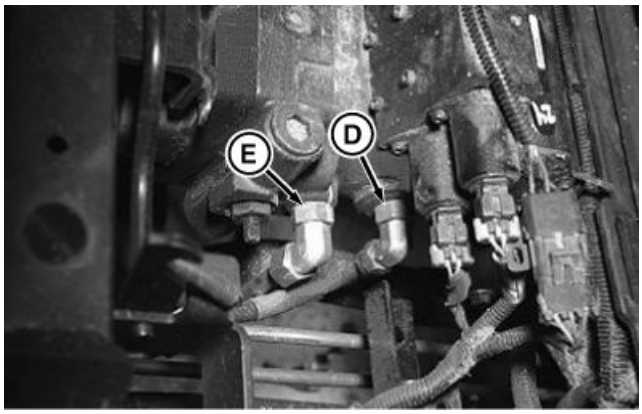
SW00544,0000055 -19-27MAR14-2/4

e. Install appropriate tee fitting to alternate hydrostatic pump fitting (D) to check case pressure with recommended gauge.

f. Install appropriate tee fitting to hydrostatic pump auxiliary port (E) to check charge pressure with recommended gauge.

D—Pressure Port, Case Pressure

E—Auxiliary Port, Charge Pressure

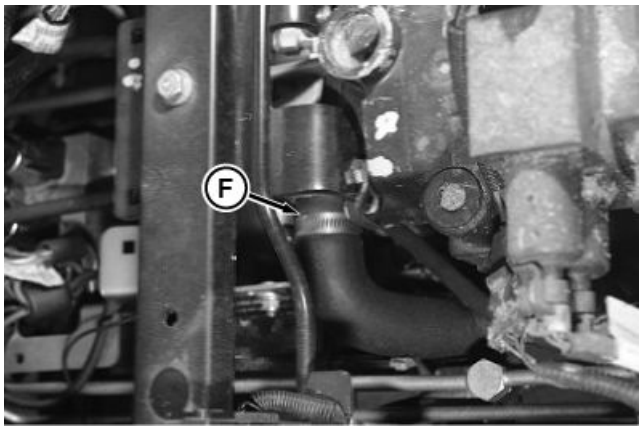


TCT009903 —UN—26DEC13

SW00544,0000055 -19-27MAR14-3/4

g. Install appropriate tee fitting to hydraulic pump suction port (F) to check suction with recommended gauge.

F—Suction Port



TCT009904 —UN—26DEC13

SW00544,0000055 -19-27MAR14-4/4

Test Hydrostatic System Relief Pressure

Reason

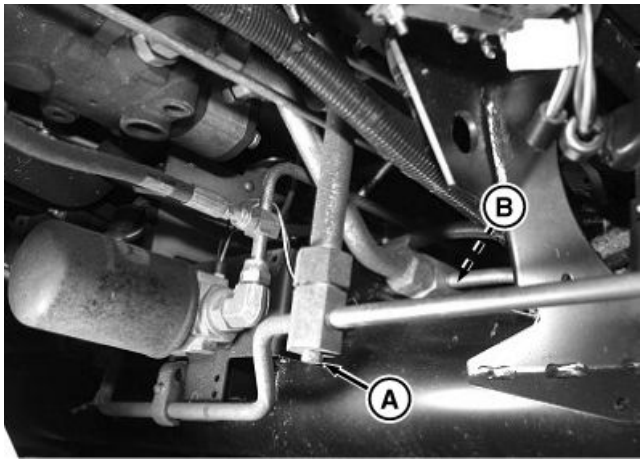
To ensure that the hydrostatic system forward and reverse relief valves are operating properly.

1. Install diagnostic fitting into test port (A) located on “T” fitting behind front axle to test reverse relief pressure.
2. Install diagnostic fitting into test port (B) located on “T” fitting behind front axle to test forward relief pressure.
3. Connect pressure gauge to diagnostic fitting.
4. Secure machine to an immovable object.
5. Start engine and set throttle to fast idle (2800 ± 50 rpm).
6. Charge pressure reading on gauge must be to specification.

Specification

Charge Pressure—Pressure ..... 1240 kPa (180 psi)

7. Slowly depress forward or reverse pedal, depending on direction being tested, while observing the pressure gauge reading.
8. Depress pedal until maximum pressure is reached. Relief pressure reading should be to specification.



TCT009905 —UN—26DEC13

A—Pressure Port A, to Wheel Motors (Reverse)
B—Pressure Port B, to Wheel Motors (Forward)

Specification

Relief Pressure—Pressure ..... 31 025 ±1380 kPa (4500 ±200 psi)

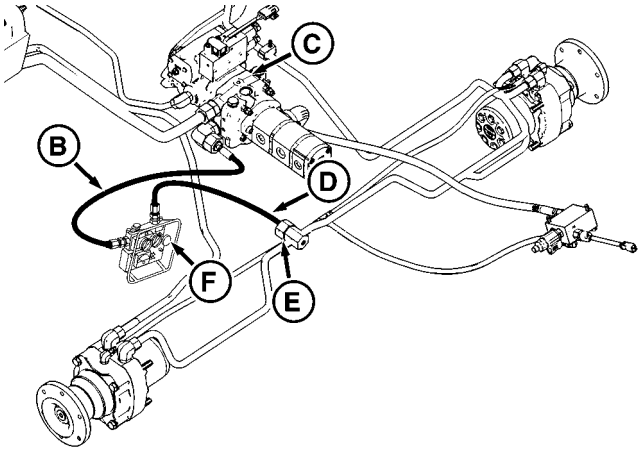
9. Raise machine so wheels are off the ground. Support machine with jackstands.

BS62576,0000CEF -19-27MAR14-1/2

10. Remove the line from the hydrostatic pump to “T” fitting.
11. Connect flow gauge inlet hose (B) to the hydrostatic pump (C), and outlet hose (D) to the axle bulkhead fitting (E).
12. Turn flow control knob (F) completely open (counterclockwise).
13. Start engine and set throttle to fast idle (2800 ± 50 rpm).
14. For forward test, depress the forward pedal and read right test port fitting pressure gauge.
15. For reverse test, depress the reverse pedal and read left test port fitting pressure gauge.
16. Slowly close flow control knob (clockwise) until maximum pressure is reached.
17. Pressure reading should be to specification.

Specification

Hydrostatic Pump—Pressure ..... 31 025 ±1380 kPa (4500 ±200 psi)



TCT007206 —UN—24APR13

B—Inlet Hose
C—Pump
D—Outlet Hose
E—Fitting
F—Control Knob

Results

If relief pressure is reached, remove and inspect wheel motors and associated hoses.

If relief pressure is not reached, remove and inspect relief valves and replace as necessary. If problem persists, repair or replace pump.

BS62576,0000CEF -19-27MAR14-2/2

Test Charge Pressure

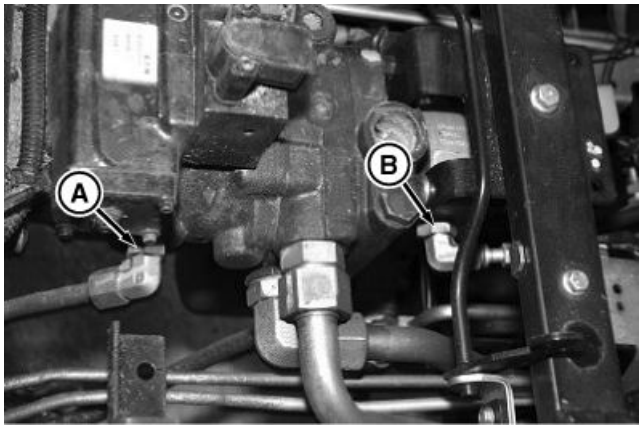
Recommended or Required Tools

- Pressure Gauge 0—50 Bar or (0—600 psi)
- Fittings

Procedure

1. Park machine safely. (See “Park Machine Safely” in Safety Section.)
2. Thoroughly clean area around hydrostatic and hydraulic pumps and pump fittings.
3. Install appropriate fittings and gauges where needed for specific pressure tests as called for in test procedures.
4. Start engine and set throttle to fast idle (2800 ± 50 rpm).
5. Charge pressure reading on gauge must be to specification.

Specification	
Charge Pressure—Pressure (minimum)	1240 kPa (180 psi)



TCT010861 —UN—01APR14

A—Pressure Port A, to Wheel Motors (Reverse)

B—Pressure Port B, to Wheel Motors (Forward)

Results

If charge pressure is not reached, remove and inspect relief valves and check valves, and replace as necessary.

BS62576,0000CF0 -19-27MAR14-1/1

Section 260
Hydraulics Operation, Tests, and Adjustments
Contents

Page

Group 10—Component Location
Summary of References 260-10-1
Hydraulic System Component Location 260-10-1

Group 20—Theory of Operation
Summary of References 260-20-1
Lift System 260-20-1

Group 30—Diagnosis
Diagnose Lift System 260-30-1
Front and Rear Lift Arms Will Not Rise 260-30-1
Front and Rear Lift Arms Will Not Lower 260-30-2
Front and Rear Lift Arms Will Not Stay in Raised Position 260-30-2

Group 40—Tests and Adjustments
Summary of References 260-40-1
Warm Up Hydraulic Oil 260-40-1
Bleed Hydraulic System 260-40-1
Test Lift System Relief Pressure 260-40-2
Test Lift Pump Flow 260-40-2
Test Steering—Charge Pump Flow 260-40-3
Test Lift System Leakage 260-40-3

Group 50—Hydraulic Schematics
Summary of References 260-50-1
Main Hydraulic Schematic, 7500A E-Cut 260-50-1
Main Hydraulic Schematic, 8000A E-Cut 260-50-4

Summary of References

- Hydraulic System Component Location

BS62576,000104F -19-05MAR13-1/1

Hydraulic System Component Location

For **Power Train** hydraulic components see:

- Hydrostatic Power Train—7500A
- Hydrostatic Power Train—8000A

For **Steering** hydraulic components see:

- Steering Components—7500A
- Steering Components—8000A

OUMX258,0000727 -19-27MAR14-1/1

Summary of References

- Lift System

BS62576,0001050 -19-27MAR14-1/1

Lift System

Function

Provides a means to raise or lower the cutting units for three operating modes:

- Transport
- Mowing and Backlapping (Reel Mowers Only)
- Service

Steering/Lift Pump

The steering/lift pump is the front pump section of the triple pump assembly. The triple pump operates in an “open center” type hydraulic system consisting of the steering, lift, down pressure (if equipped), and hydrostatic charging systems. Each system has a controlling valve with an open center that allows fluid flow, in series, to operate each system in the order mentioned above. Also, in this type of circuit, the first controlling valve (steering) takes priority over the next valve downstream in the circuit.

Lift Valve

The lift valve is a solenoid-operated, spring-returned valve. The raise solenoid, when energized in mow mode, will hold the valve in the raise position for 3 seconds, then release it. When the raise solenoid is de-energized, the lift cylinders will stay in the raised position. When the lower solenoid valve is energized, the lift cylinders will go to the lower (cutting) position.

Down Pressure Valve (Optional Equipment)

The down pressure valve is used to maintain downward force on the cutting units when mowing. The valve is operated by the rear mow solenoid. Hydraulic pressure is routed through the neutral position of the lift valve and to the down pressure valve. The down pressure valve regulates pressure to the fixed end of the lift cylinder. Pressure is set at the factory to 1724 kPa (250 psi) and can be adjusted to a maximum of 4826 kPa (700 psi). Pressure must be adjusted while the system is pressurized.

Lift System Theory

The lift system receives pressure from the charge pump through the steering valve. The steering valve will take first priority, and limited pressure will be available to the lift system during steering operations.

The lift system has two different raised positions, which are controlled by the PTO switch as follows:

- With the PTO switch up in the MOW position, the raise/lower lever will raise the cutting units to the crosscut position, to allow for turning the machine during mowing operations.
- With the PTO switch in the TRANSPORT position, the raise/lower lever will raise the cutting units to the full up position for transport or servicing operations.

The lower position is the same for both of the above conditions, and the cutting units will be lowered completely to the ground for cutting or backlapping operations.

The lift valve is solenoid-operated and timed to allow lift for 3 seconds before disengaging. This allows the operator to only tap the lift lever before entering a turn during mow operation.

The lift system is timed to allow a “clean-up cut” transition off the fairway. As the mower leaves the fairway and the operator moves the raise/lower lever to the raise position, the front cutting units rise first. This allows the rear cutting units to continue cutting until the end of the fairway. Conversely, when the operator is approaching the fairway to begin cutting and moves the raise/lower lever to the lower position, the front cutting units lower first, keeping the rear cutting units raised until they are over the fairway.

Delay of the rear lift arms is accomplished by the use of orifices on the rod end of the rear lift cylinder, which limits flow and slows the lowering and raising of the rear lift arm.

An orifices is used on the rod end of the center lift cylinder, to time its movement with the wing lift cylinder.

BS62576,00015A6 -19-17DEC13-1/1

Diagnose Lift System

BS62576,00015A7 -19-17DEC13-1/16

1 Front and Rear Lift Arms Will Not Rise

BS62576,00015A7 -19-17DEC13-2/16

1A Test Procedure	Is 12 V present at SV1 lift solenoid?	**YES:** Go to next step. **NO:** Check control module for proper function.

BS62576,00015A7 -19-17DEC13-3/16

1B Continued	With key switch on, operate the lift lever. Is SV1 lift solenoid poppet moving?	**YES:** Go to next step. **NO:** Remove and inspect SV1 solenoid cartridge. Replace if necessary.

BS62576,00015A7 -19-17DEC13-4/16

1C Continued	Is steering system working?	**YES:** Go to next step. **NO:** Perform lift and steering pump flow test. (See “Test Steering Pump Flow”.)

BS62576,00015A7 -19-17DEC13-5/16

1D Continued	Is lift system free of air?	**YES:** Go to next step. **NO:** Start engine and cycle lift arms to purge air from system.

BS62576,00015A7 -19-17DEC13-6/16

1E Continued	Are lift system hydraulic fittings tight and free from leaks?	**YES:** Go to next step. **NO:** Tighten fittings and replace O-rings as needed.

BS62576,00015A7 -19-17DEC13-7/16

1F Continued	Is lift valve operating properly?	**NO:** Repair or replace as needed.

Continued on next page

BS62576,00015A7 -19-17DEC13-8/16

❷ Front and Rear Lift Arms Will Not Lower

BS62576,00015A7 -19-17DEC13-9/16

2A Test Procedure	Is 12 V present at SV2 lift solenoid?	**YES:** Go to next step. **NO:** Check control module for proper function.

BS62576,00015A7 -19-17DEC13-10/16

2B Continued	Is lift valve operating properly?	**YES:** Go to next step. **NO:** Repair or replace lower cartridge (SV2) as required.

BS62576,00015A7 -19-17DEC13-11/16

2C Continued	Is down pressure valve operating properly?	**NO:** Perform down pressure valve test.

BS62576,00015A7 -19-17DEC13-12/16

❸ Front and Rear Lift Arms Will Not Stay in Raised Position

BS62576,00015A7 -19-17DEC13-13/16

3A Test Procedure	Are lift system hydraulic fittings tight and free from leaks?	**YES:** Go to next step. **NO:** Tighten fittings and replace O-rings as needed.

BS62576,00015A7 -19-17DEC13-14/16

3B Continued	Is lift valve operating properly?	**YES:** Go to next step. **NO:** Perform lift system leakage test.

BS62576,00015A7 -19-17DEC13-15/16

3C Continued	Is down pressure valve operating properly?	**NO:** Perform down pressure valve test.

BS62576,00015A7 -19-17DEC13-16/16

Summary of References

- Warm Up Hydraulic Oil
- Bleed Hydraulic System
- Test Lift System Relief Pressure
- Test Lift Pump Flow
- Test Steering—Charge Pump Flow
- Test Lift System Leakage

BS62576,0001051 -19-18JUN14-1/1

Warm Up Hydraulic Oil

Reason

When performing hydraulic system tests, the oil must be heated to a specified temperature for the tests to be accurate.

Procedure

1. Park machine on a level surface.
2. Move forward and reverse travel pedals to neutral position.
3. Lower cutting units to the ground.
4. Move mow-transport lever to the transport position.
5. Turn key switch to stop position.
6. Lock park brake.
7. Install JDG282 Temperature Gauge on hydraulic pump assembly.
8. Start and run engine at fast idle.

NOTE: Periodically cycle all hydraulic functions to distribute heated oil.

9. Run engine until oil temperature reaches operating temperature (reservoir warm to the touch).

Specification

Hydraulic Oil Operating Temperature—Temperature..... 43 °C (110 °F)

BS62576,0000371 -19-12JUN14-1/1

Bleed Hydraulic System

Reason

To ensure that air is purged from hydraulic system after the hoses or lines have been disconnected.

Procedure

1. Park machine on a level surface.
2. Move forward and reverse travel pedals to neutral position.
3. Lower cutting units to the ground.
4. Move mow-transport lever to the transport position.
5. Turn key switch to stop position.
6. Lock park brake.
7. Check level of hydraulic oil. Fill as needed.

CAUTION: Avoid Injury! Engine exhaust fumes contain carbon monoxide and can cause serious illness or death.

Move the machine to an outside area before running the engine.

Do not run an engine in an enclosed area without adequate ventilation.

- **Connect a pipe extension to the engine exhaust pipe to direct the exhaust fumes out of the area.**
- **Allow fresh outside air into the work area to clear out the exhaust fumes.**

8. Start engine and run at slow idle.
9. Turn steering wheel full left and hold for 5 seconds.
10. Turn steering wheel straight forward and hold for 10 seconds.
11. Turn steering wheel full right and hold for 5 seconds.
12. Cycle cutting units up and down ten times.
13. Return steering wheel to straight forward position.
14. Drive machine straight forward for 6 m (20 ft.) then make two hard left turns, then make two hard right turns.
15. Drive machine in reverse approximately 3 m (10 ft.).
16. Turn key switch to stop position.
17. Check all hoses and connections for leaks. Tighten connections and replace hoses as needed.
18. Check oil level on the hydraulic expansion tank. Add oil as needed.

OUMX258,0000728 -19-31MAR14-1/1

Test Lift System Relief Pressure

Reason

To verify triple pump (front gear set) pressure is maintained at correct level for steering and lift systems without causing damage to the system.

Procedure

1. Operate hydraulic system until fluid is at a minimum temperature of 43°C (110°F).
2. Park machine safely.
3. Lower cutting units to the ground.
4. Relieve system pressure by operating the lift system.
5. Disconnect steering supply hose from front section of triple pump. Install a tee fitting and reconnect supply hose to fitting.
6. Connect components from JDG2033 Pressure Gauge Kit to tee fitting.
7. Apply park brake, start engine, and run at FAST idle.
8. Pull lift lever back to raise cutting units and hold. Record steady pressure reading.

Results

Pressure should be to specification. If pressure is not within specification, replace steering valve.

Item	Measurement	Specification
Lift System Relief Valve	Pressure	117—137 Bar (1700—2000 psi)

OUMX258,000055D -19-18JUN14-1/1

Test Lift Pump Flow

Reason

To determine if lift pump is worn by testing hydraulic flow at pump.

Procedure

1. Park machine safely.
2. Lower cutting units to the ground.
3. Disconnect steering supply hose from front section of triple pump.
4. Connect hose from inlet side of flow gauge to triple pump.
5. Connect hose from outlet side of D01074AA Flow Meter to steering supply hose.
6. Turn tester control knob fully open (counterclockwise).
7. Apply park brake, start engine, and set throttle to FAST Idle.

CAUTION: DO NOT fully close tester control knob while running test.

8. Slowly turn tester control knob clockwise until pressure reading is 6895 kPa (1000 psi).
9. Record flow reading.

Results

Flow must be a minimum of 16.25 L/min (4.3 gpm). If flow is not within specification, repair or replace pump as necessary.

Item	Measurement	Specification
Lift Pump	Flow Rate at 6 895 kPa (1000 psi)	16.25 L/min (4.3 gpm)

OUMX258,000055E -19-18JUN14-1/1

Test Steering—Charge Pump Flow

Reason

To determine if steering charge pump is worn by testing hydraulic flow at pump.

Procedure

1. Park machine safely.
2. Lower cutting units to the ground.
3. Disconnect steering supply hose from front section of triple pump.
4. Connect hose from inlet side of flow gauge to triple pump.
5. Connect hose from outlet side of D01074AA Flow Meter to steering supply hose.
6. Turn tester control knob fully open (counterclockwise).
7. Apply park brake, start engine, and set throttle to FAST Idle.

CAUTION: DO NOT fully close tester control knob while running test.

8. Slowly turn tester control knob clockwise until pressure reading is 6895 kPa (1000 psi).
9. Record flow reading.

Results

Flow must be a minimum of 16.25 L/min (4.3 gpm). If flow is not within specification, repair or replace pump as necessary.

Item	Measurement	Specification
Steering and Charge Pump	Flow Rate at 6 895 kPa (1000 psi)	16.25 L/min (4.3 gpm)

OUMX258,000055F -19-18JUN14-1/1

Test Lift System Leakage

Reason

To determine cause of lift arm drift.

Procedure

1. Raise lift arms.
2. Support lift arms and mowers with a block or hoist.
3. Remove hose from rod end of cylinder. Close end of hose and cylinder fitting using caps or plugs.
4. Remove block or hoist from lift arms.
5. If within 5 minutes any of the lift arms drift down, replace the corresponding lift cylinder.
6. If no lift arms drift down;
   a. Connect cylinder hose, and lower lift arms to the ground.
   b. Remove SV2 (Red) and SV3 (Yellow) solenoid cartridges from lift valve, see Disassemble and Assemble Lift Valve.
   c. Clean and inspect components and seals, and install in lift valve.
   d. Raise lift arms and check for drift.
   e. If front lift arms continue to drift, replace SV2 solenoid cartridge. If the rear lift arms continue to drift, replace SV3 solenoid cartridge.
   f. Raise lift arms and check for drift.

Results

Faulty component identified and replaced. Lift arms no longer drift.

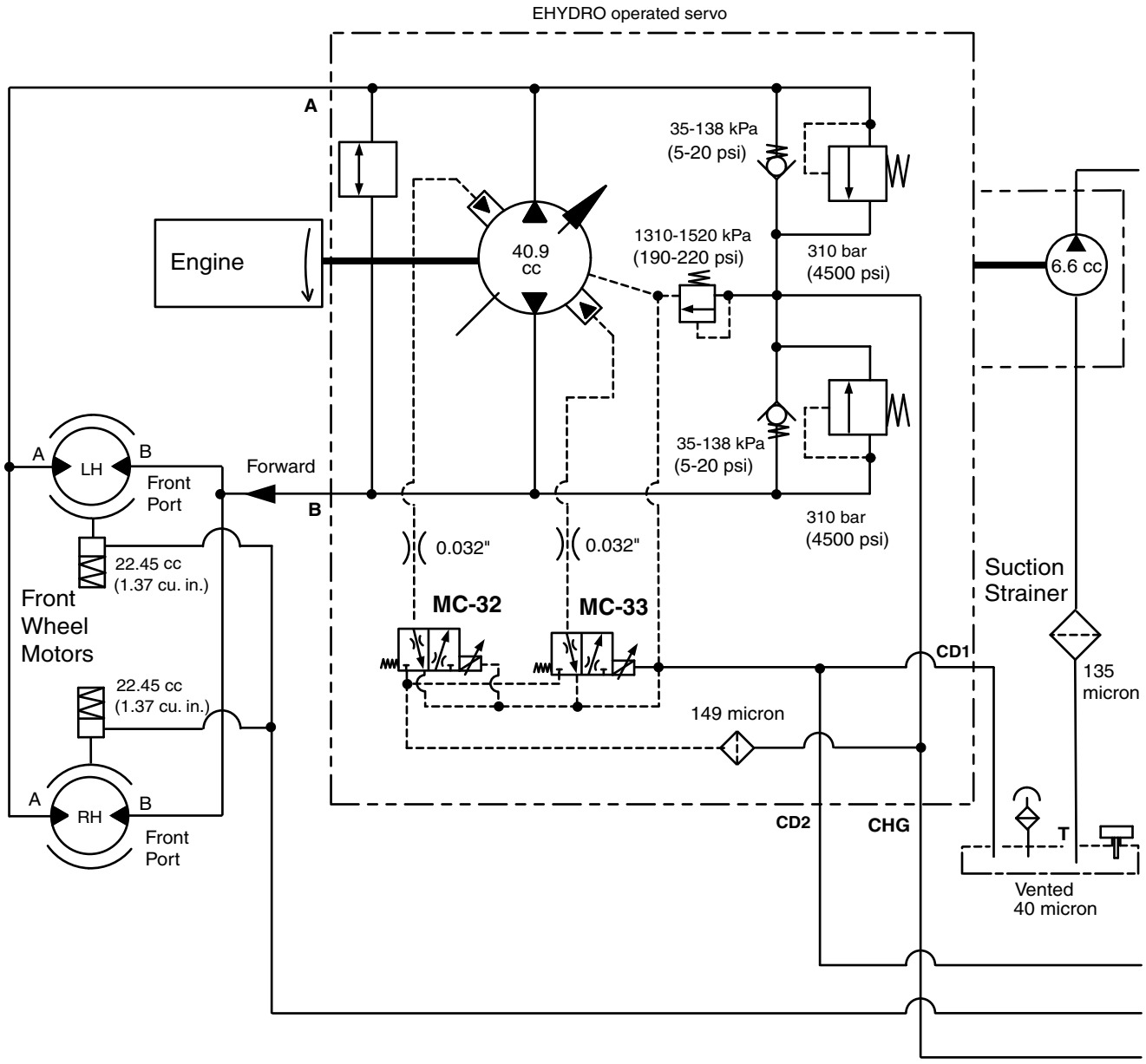
OUMX258,0000560 -19-18JUN14-1/1

Summary of References

- Main Hydraulic Schematic, 7500A E-Cut
- Main Hydraulic Schematic, 8000A E-Cut

OUMX258,0000722 -19-01MAR13-1/1

Main Hydraulic Schematic, 7500A E-Cut



Hydraulic Drive System

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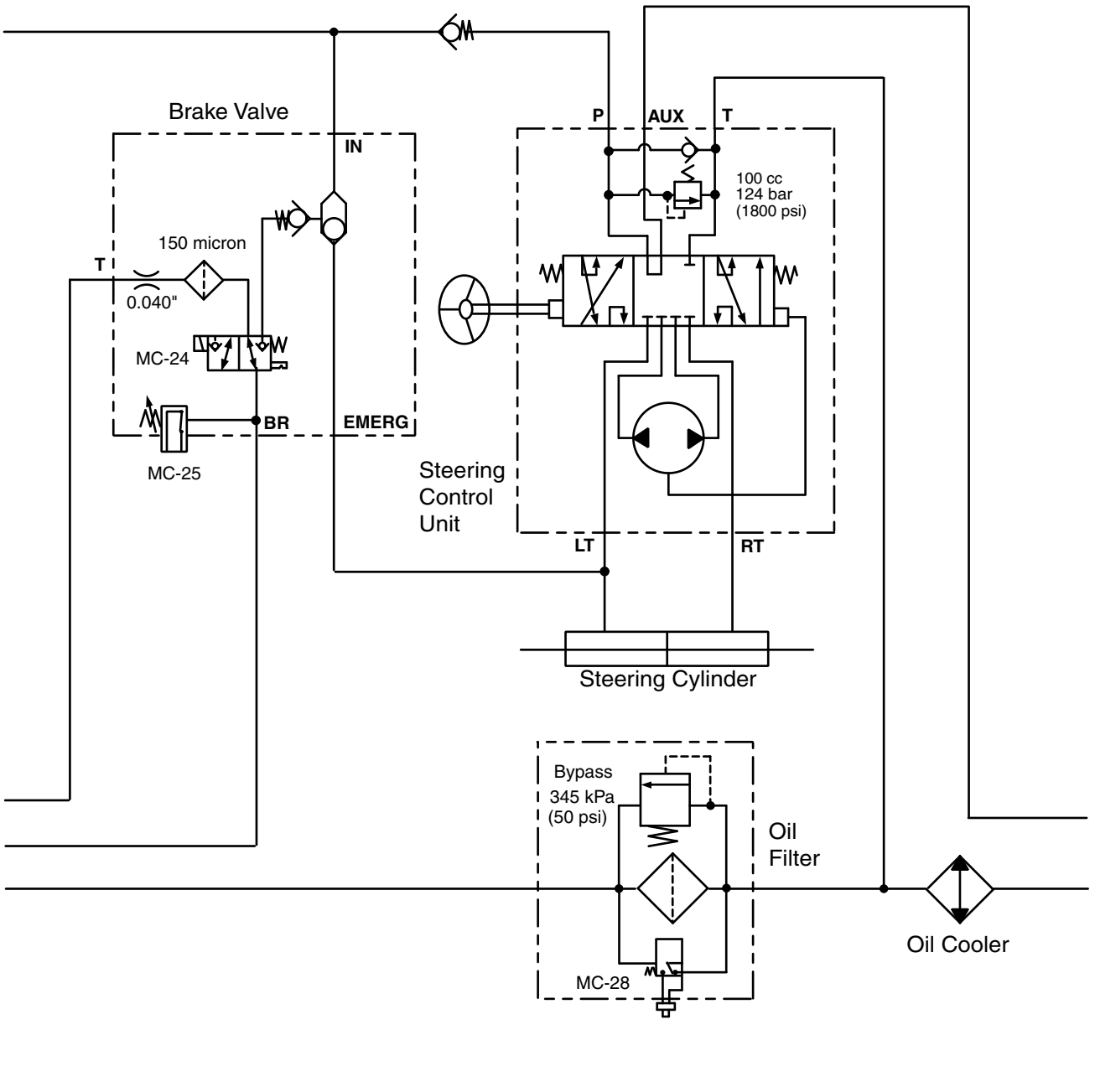
OUMX258,0000721 -19-13AUG14-1/3

Main Hydraulic Schematic, 7500A E-Cut (2 of 3)



Brake Valve and Steering Unit

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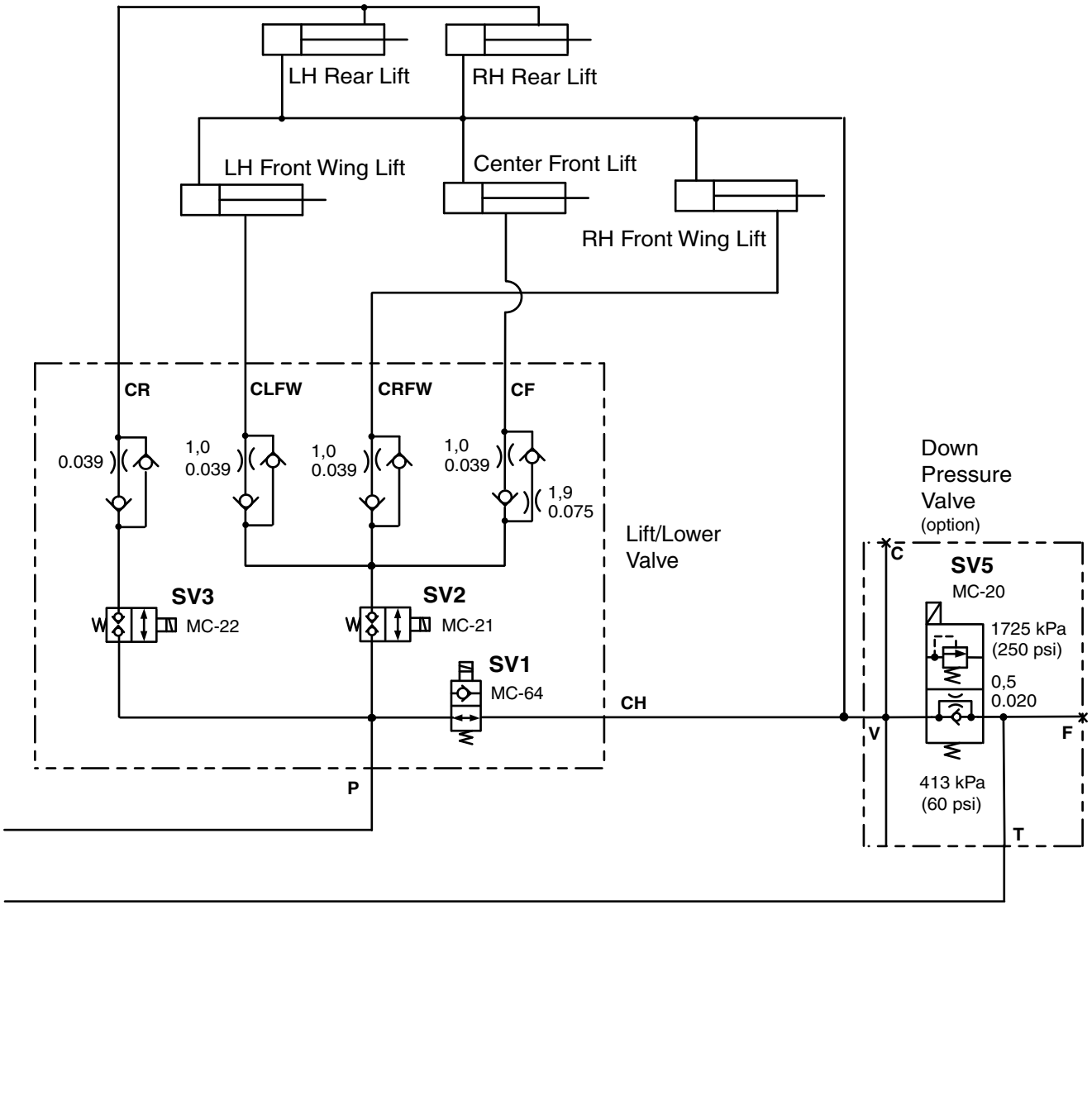
OUMX258,0000721 -19-13AUG14-2/3

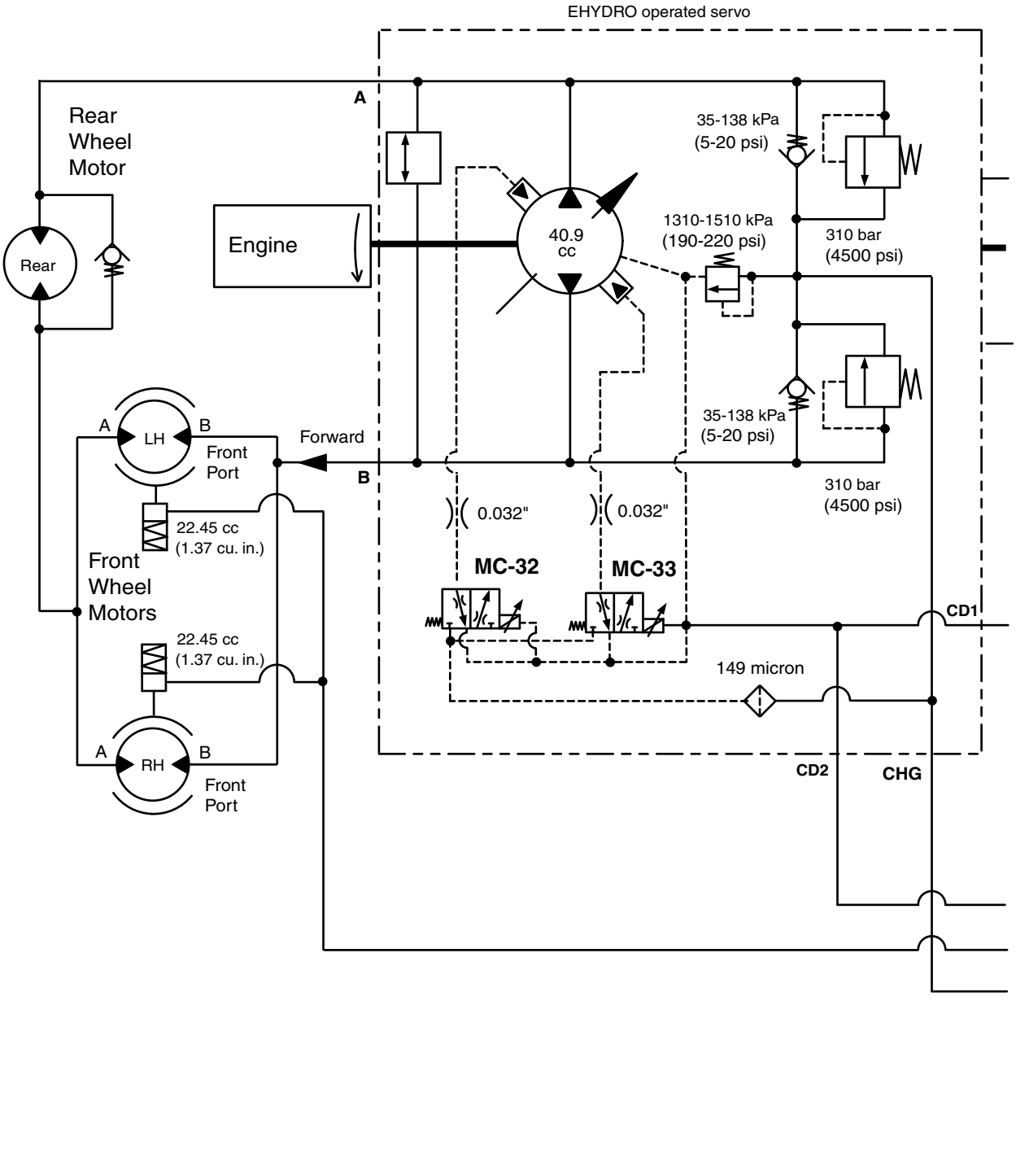
Main Hydraulic Schematic, 7500A E-Cut (3 of 3)



Lift System

OUMX258,0000721 -19-13AUG14-3/3

Main Hydraulic Schematic, 8000A E-Cut



Hydraulic Drive System

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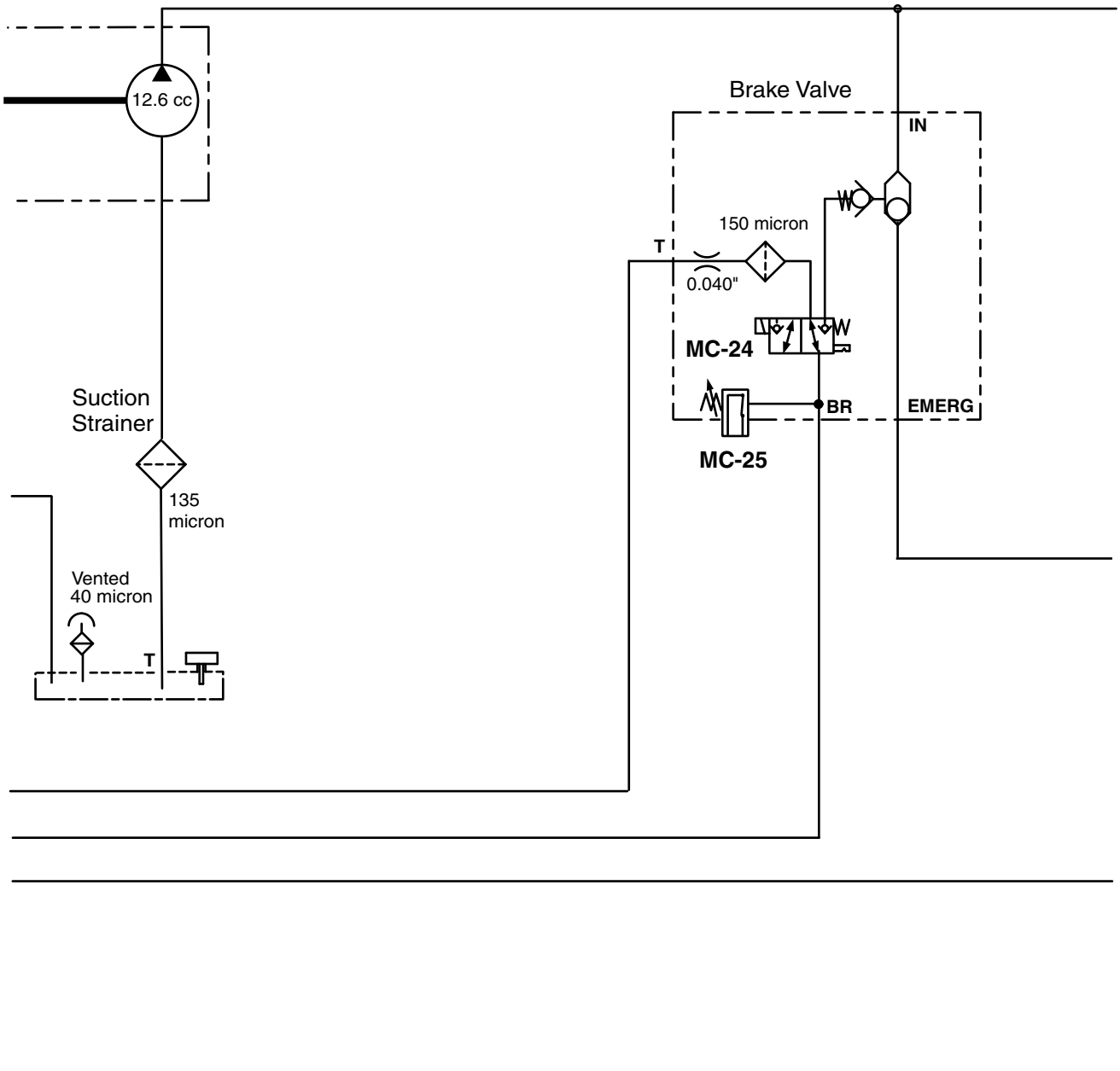
OUMX258,0000A49 -19-13AUG14-1/4

Main Hydraulic Schematic, 8000A E-Cut (2 of 4)



Brake Valve

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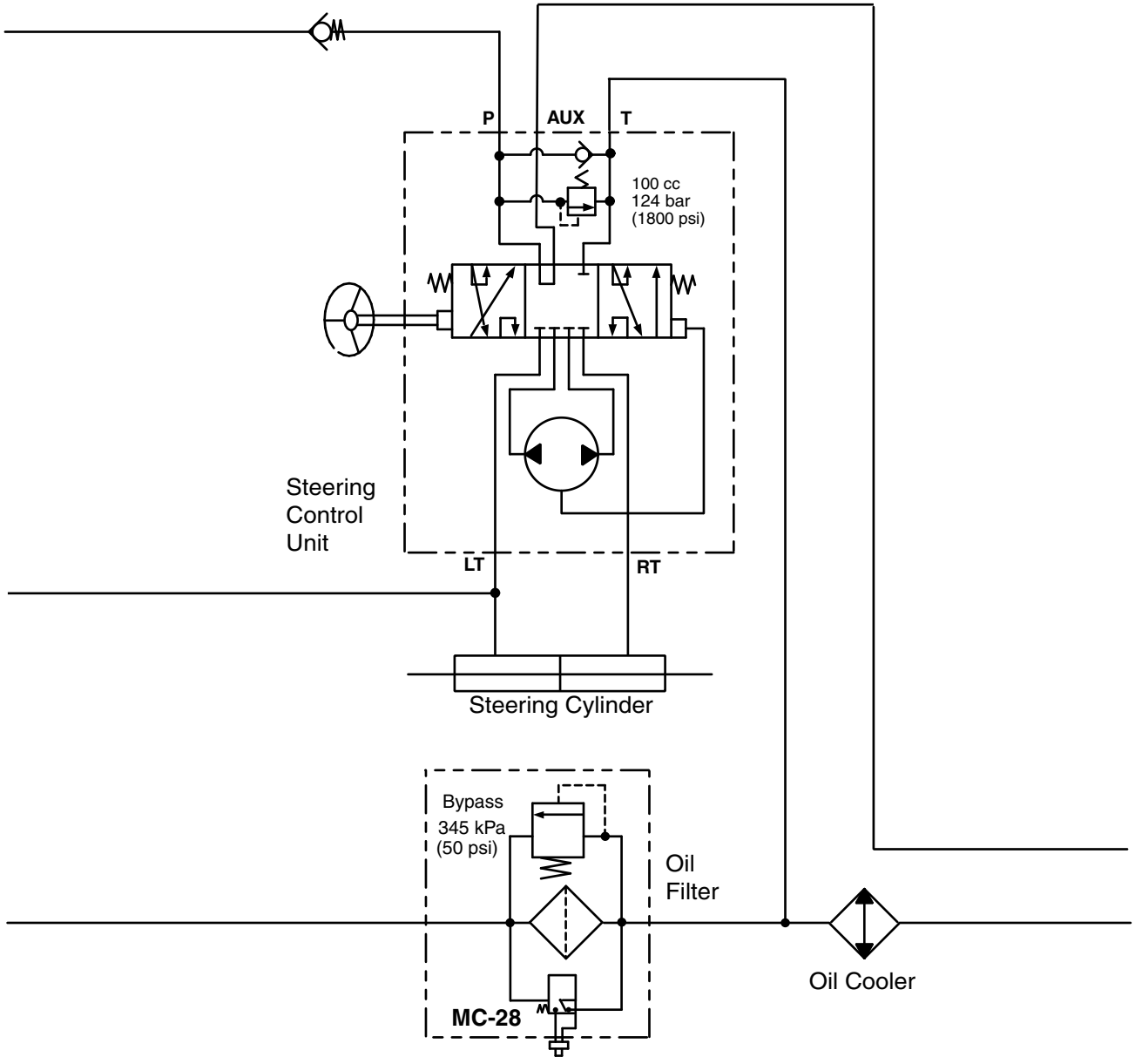
OUMX258,0000A49 -19-13AUG14-2/4

Main Hydraulic Schematic, 8000A E-Cut (3 of 4)



Steering System and Filter

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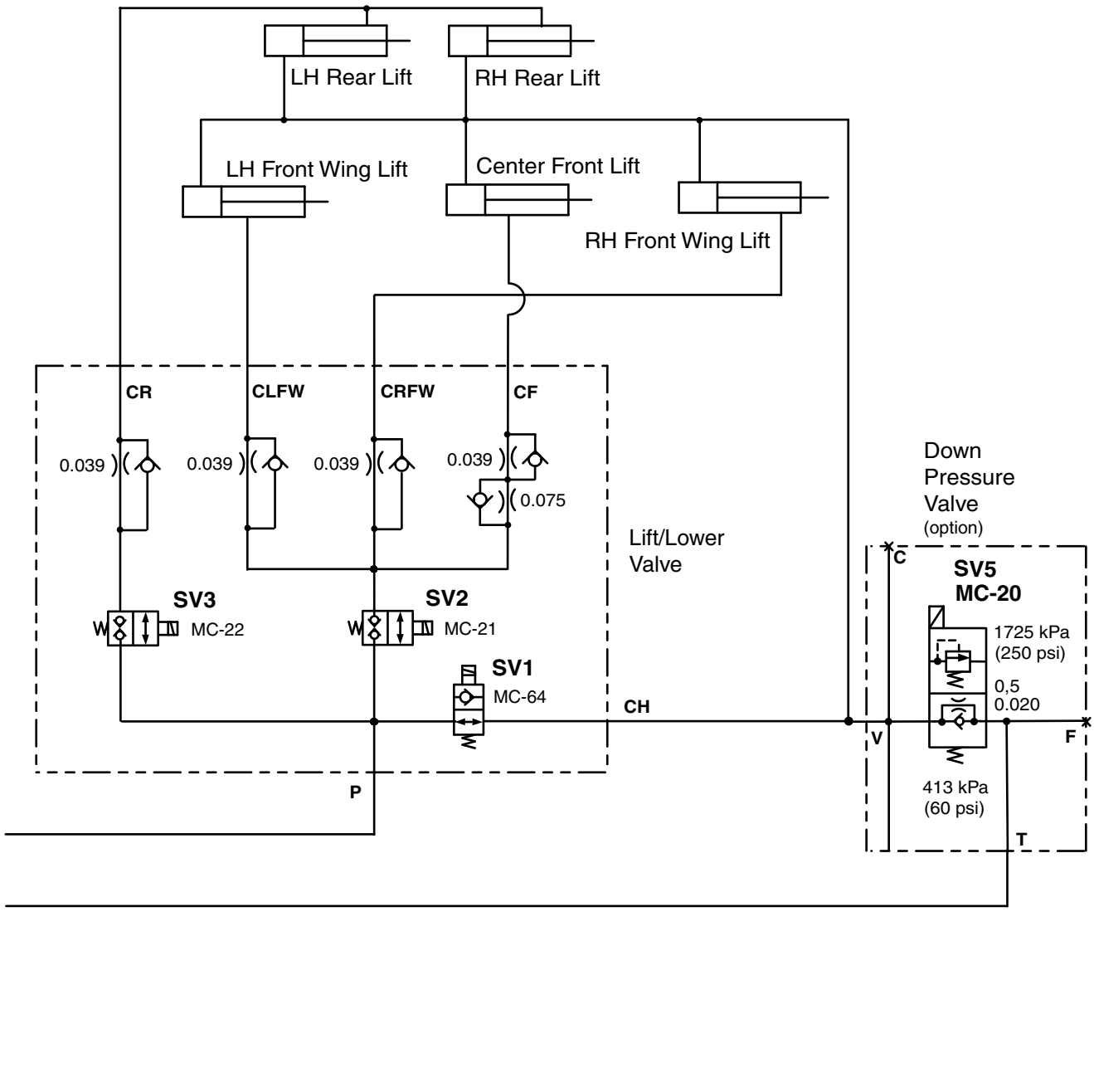
OUMX258,0000A49 -19-13AUG14-3/4

Main Hydraulic Schematic, 8000A E-Cut (4 of 4)



Lift System

OUMX258,0000A49 -19-13AUG14-4/4

Section 270
Steering and Brake Operation, Tests, and Adjustments
Contents

Page

Group 10—Component Location
Summary of References 270-10-1
Steering Components—7500A 270-10-1
Steering Components—8000A 270-10-2

Group 20—Theory of Operation
Summary of References 270-20-1
Brake Operation 270-20-2

Group 30—Diagnosis
Diagnose Steering Wanders 270-30-1
Steering Wanders 270-30-1
Diagnose Steering Shimmy 270-30-1
Steering Shimmy 270-30-1
Diagnose Sluggish Steering Response 270-30-2
Sluggish Steering Response 270-30-2
Diagnose Excessive Steering Wheel Free Play 270-30-3
Excessive Steering Wheel Free Play 270-30-3
Diagnose High Steering Effort in One Direction 270-30-4
High Steering Effort in One Direction 270-30-4
Diagnose High Steering Effort in Both Directions 270-30-4
High Steering Effort in Both Directions 270-30-4
Diagnose Steering Cylinder Will Not Fully Extend or Retract 270-30-5
Steering Cylinder Will Not Fully Extend or Retract 270-30-5

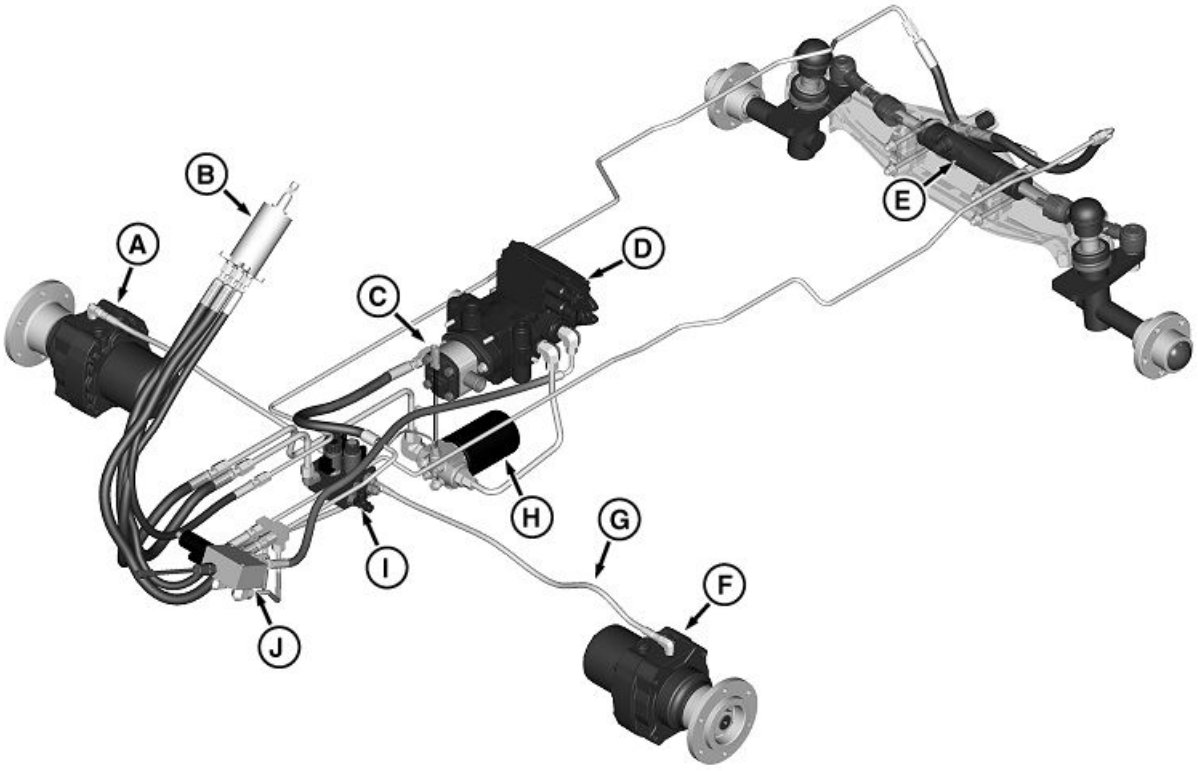
Group 40—Tests and Adjustments
Summary of References 270-40-1
Test Steering System Leakage 270-40-1
Test Steering Control Unit (SCU) Leakage 270-40-2
Test Steering System Relief Pressure 270-40-3
Adjust Steering Toe-In 270-40-4

Summary of References

- Steering Components—7500A
- Steering Components—8000A

BS62576,0000FEE -19-21FEB13-1/1

Steering Components—7500A

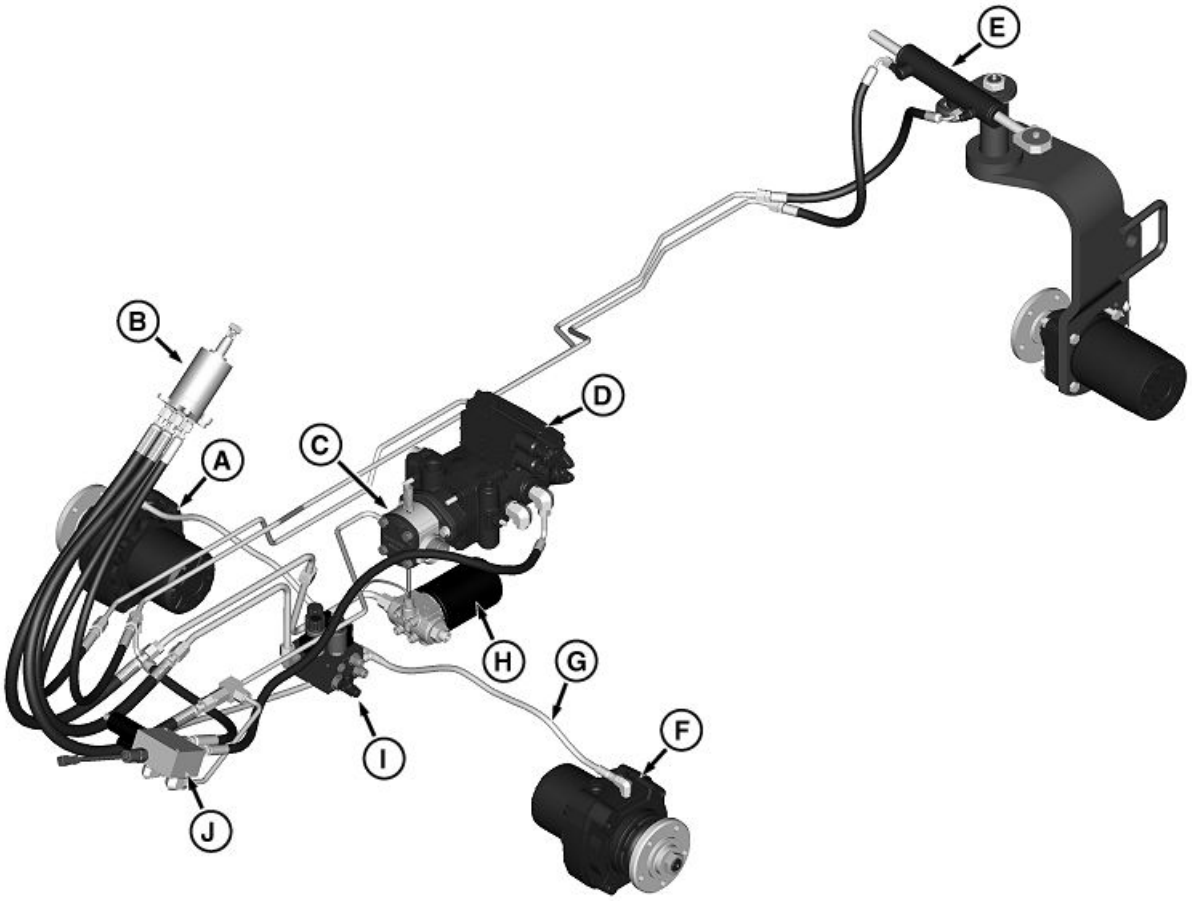


TCT009822 —UN—18DEC13

A—Wheel Motor, Right Front
B—Valve, Steering
C—Pump Assembly
D—Hydrostatic Pump
E—Cylinder, Steering
F—Wheel Motor, Left Front
G—Brake Release Line
H—Hydraulic Oil Filter
I— Valve, Lift
J— Valve, Brake Release

BS62576,0000FED -19-21MAY14-1/1

Steering Components—8000A



TCT009823 —UN—18DEC13

A—Wheel Motor, Right Front
B—Valve, Steering
C—Pump Assembly
D—Hydrostatic Pump
E—Cylinder, Steering
F—Wheel Motor, Left Front
G—Brake Release Line
H—Hydraulic Oil Filter
I— Valve, Lift
J— Valve, Brake Release

BS62576,0000FFC -19-18DEC13-1/1

Summary of References

- Brake Operation

BS62576,0000FEF -19-12MAR13-1/1

Brake Operation

The brake system is used for parking the machine. The brakes are internal wet discs in the front wheel motors. The brakes are spring loaded and are engaged unless released by hydraulic pressure (engine running).

Charge pressure is routed to the wheel brakes through a brake valve when the engine is running and the brake switch is released. The charge pressure pushes the brake piston in each front wheel motor back against the spring pressure, compressing the springs to release the brakes. The charge pressure also closes a pressure switch, providing power to the vehicle control unit (VCU) to enable machine functions.

A park brake switch on the command console operates the brake valve solenoid through the VCU. When the park brake switch is engaged, switched power is sent to the vehicle control unit (VCU). The VCU then energizes the brake valve solenoid. When the solenoid spool shifts the pressurized oil in the wheel motor brake piston is released to the hydraulic reservoir and spring pressure engages the brakes.

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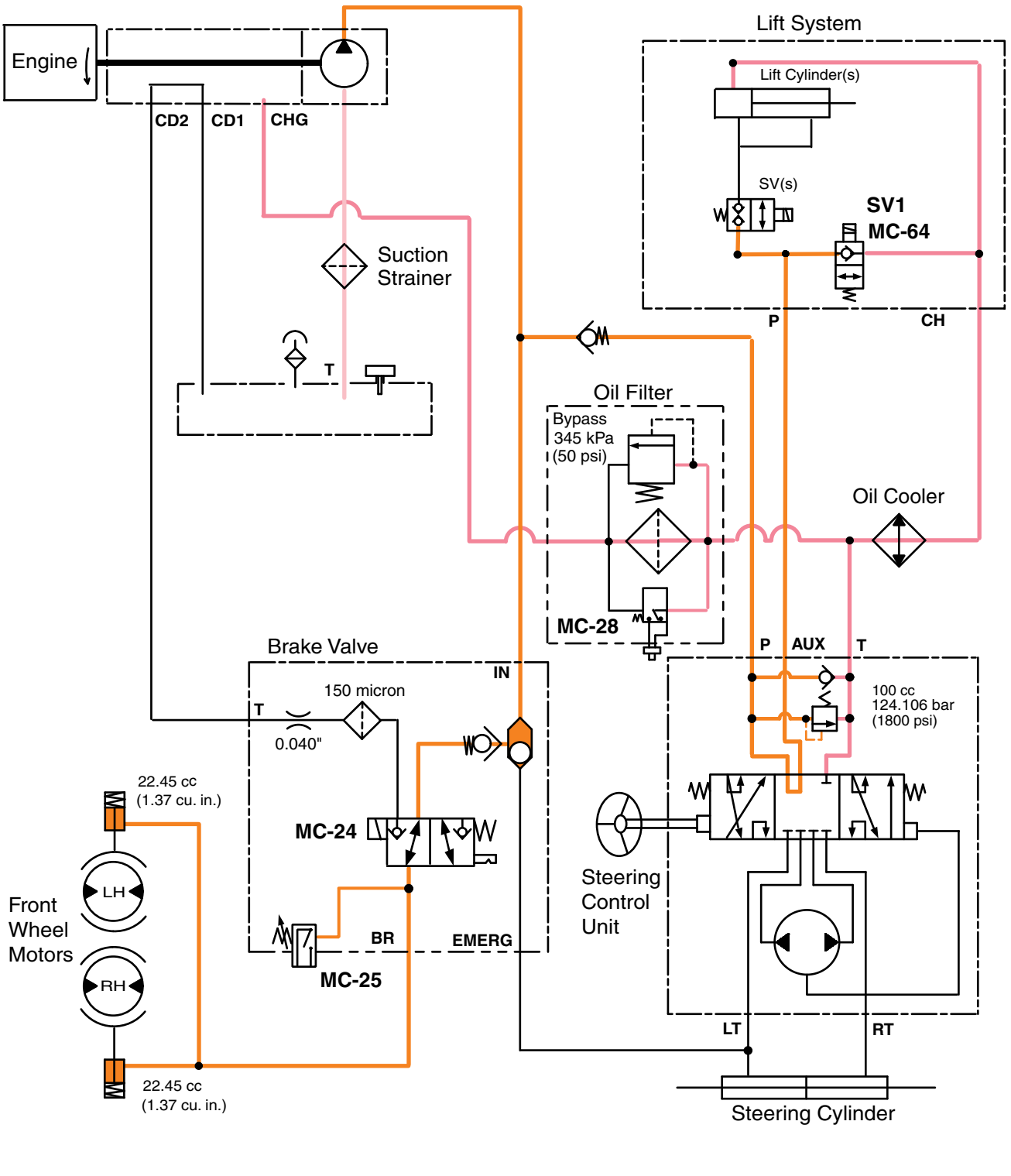


Brake Hydraulic Schematic

MC-24—Brake Valve Solenoid **MC-25—Brake Pressure Switch**

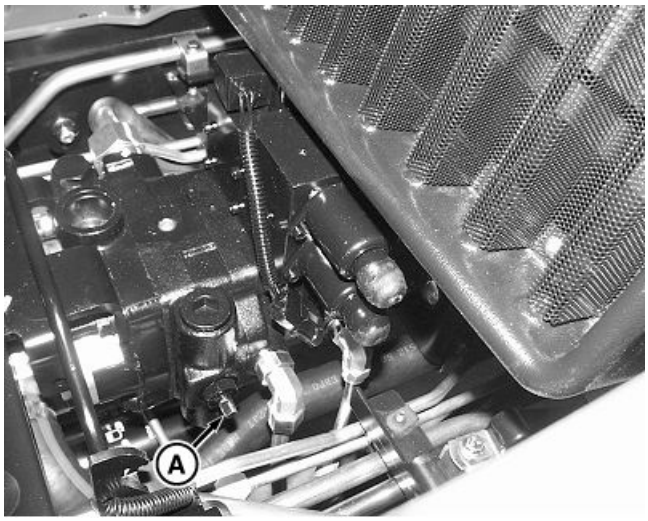
Continued on next page

BS62576,0001140 -19-13AUG14-2/4

If a problem occurs that the brakes cannot be released in the normal way and the machine needs to be moved;

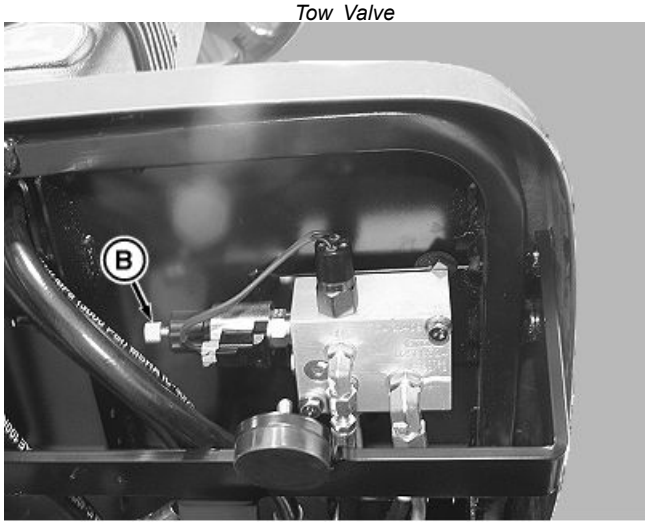
- Locate brake valve under left footrest.
- Raise seat and turn tow valve (A) on hydrostatic pump 90 degrees to release the traction drive motors.
- Turn knurled screw (B) on the brake valve 'in' fully.
- Turn the steering wheel to the left 1-2 rotations to pressurize the brake line and release the brakes.

When the problem has been repaired, be sure to turn screw on brake valve back out. Machine will not start with pressure trapped in brake system.



TCT006700 —UN—01MAR13

Tow Valve



TCT006701 —UN—01MAR13

Park Brake Valve

A—Tow Valve **B—Bypass Screw**

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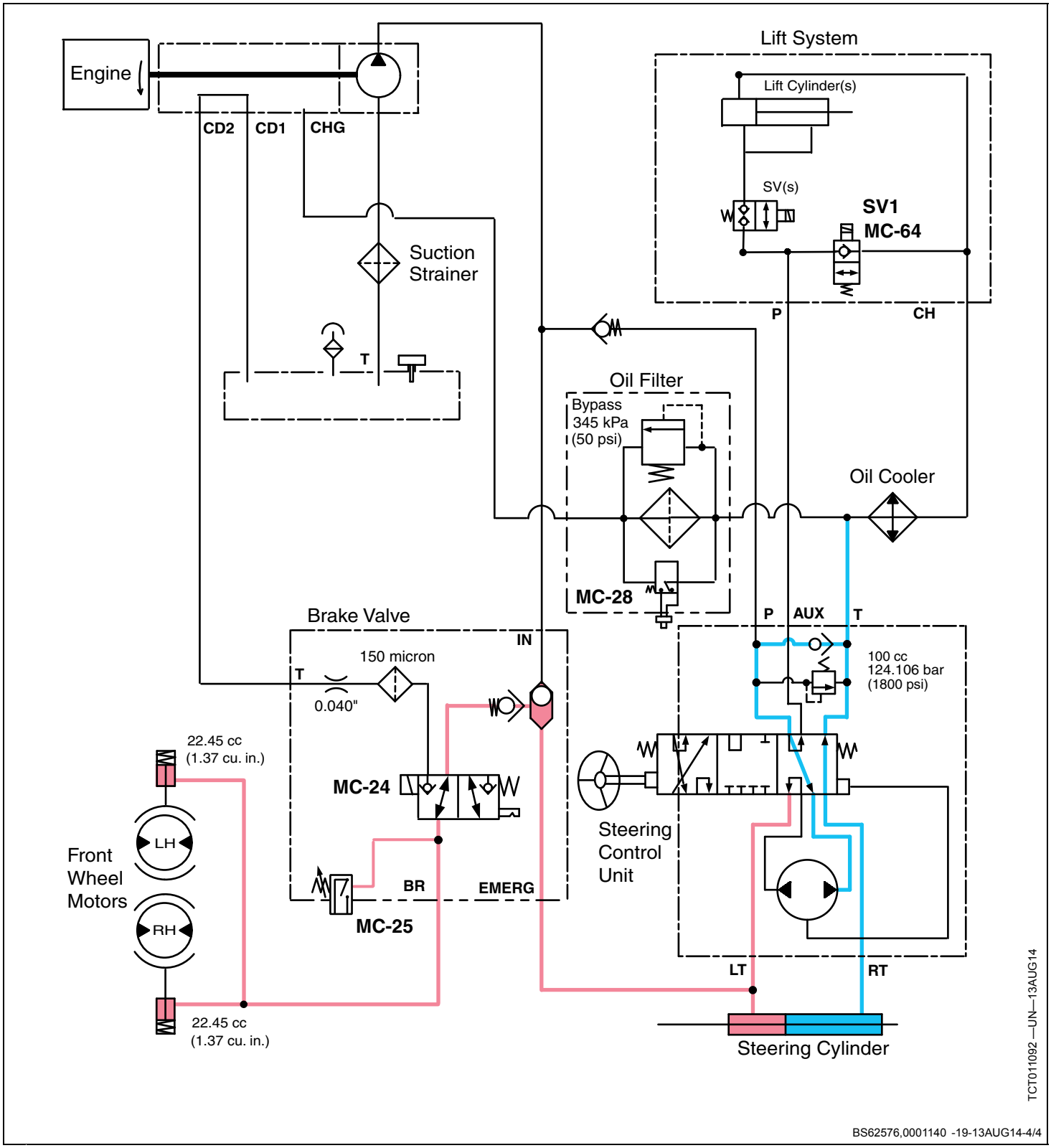
BS62576,0001140 -19-13AUG14-3/4



BS62576,0001140 -19-13AUG14-4/4

Diagnose Steering Wanders

BS62576,0000FF0 -19-20DEC13-1/8

Steering Wanders

BS62576,0000FF0 -19-20DEC13-2/8

1 Test Procedure	Are tires of proper type and inflated to proper pressure?	**YES:** Go to next step. **NO:** Replace tires with tires of proper type. Inflate tires to proper pressure.

BS62576,0000FF0 -19-20DEC13-3/8

2 Continued	Is hydraulic system free of air? Hydraulic fluid not aerated?	**YES:** Go to next step. **NO:** Purge air from system. Check suction line to charge pump for air leaks.

BS62576,0000FF0 -19-20DEC13-4/8

3 Continued	Are the hydraulic fittings tight, preventing fluid loss?	**YES:** Go to next step. **NO:** Tighten hydraulic fittings.

BS62576,0000FF0 -19-20DEC13-5/8

4 Continued	Are the steering cylinder ball joints in good condition, not worn?	**YES:** Go to next step. **NO:** Replace parts as needed.

BS62576,0000FF0 -19-20DEC13-6/8

5 Continued	Is the steering linkage in good condition, not damaged or worn?	**YES:** Go to next step. **NO:** Repair or replace parts as necessary.

BS62576,0000FF0 -19-20DEC13-7/8

6 Continued	Perform steering system leakage test. (See Test Steering System Leakage.) Is test within specifications?	**NO:** Perform steering control unit leakage test. (See Test Steering Control Unit (SCU) Leakage.)

BS62576,0000FF0 -19-20DEC13-8/8

Diagnose Steering Shimmy

BS62576,0000FF1 -19-20DEC13-1/7

Steering Shimmy

Continued on next page

BS62576,0000FF1 -19-20DEC13-2/7

1 Test Procedure	Are the steering cylinder ball joints in good condition, not worn?	**YES:** Go to next step. **NO:** Replace parts as needed.

BS62576,0000FF1 -19-20DEC13-3/7

2 Continued	Is the steering linkage in good condition, not damaged or worn?	**YES:** Go to next step. **NO:** Repair or replace parts as necessary.

BS62576,0000FF1 -19-20DEC13-4/7

3 Continued	Are the hydraulic fittings tight, preventing fluid loss?	**YES:** Go to next step. **NO:** Tighten hydraulic fittings.

BS62576,0000FF1 -19-20DEC13-5/7

4 Continued	Is hydraulic system free of air? Hydraulic fluid not aerated?	**YES:** Go to next step. **NO:** Purge air from system. Check suction line to charge pump for air leaks.

BS62576,0000FF1 -19-20DEC13-6/7

5 Continued	Check hydraulic fluid. Is fluid free of contamination?	**NO:** Remove contaminated fluid, flush system, and find source of contamination.

BS62576,0000FF1 -19-20DEC13-7/7

Diagnose Sluggish Steering Response

BS62576,0000FF2 -19-20DEC13-1/9

Sluggish Steering Response

BS62576,0000FF2 -19-20DEC13-2/9

1 Test Procedure	Is the steering linkage in good condition, not damaged or worn?	**YES:** Go to next step. **NO:** Repair or replace parts as necessary.

BS62576,0000FF2 -19-20DEC13-3/9

2 Continued	Are the hydraulic fittings tight, preventing fluid loss?	**YES:** Go to next step. **NO:** Tighten hydraulic fittings.

Continued on next page

BS62576,0000FF2 -19-20DEC13-4/9

3 Continued	Is hydraulic system free of air? Hydraulic fluid not aerated?	**YES:** Go to next step. **NO:** Purge air from system. Check suction line to charge pump for air leaks.

BS62576,0000FF2 -19-20DEC13-5/9

4 Continued	Check hydraulic fluid. Is fluid free of contamination?	**YES:** Go to next step. **NO:** Remove contaminated fluid, flush system, and find source of contamination.

BS62576,0000FF2 -19-20DEC13-6/9

5 Continued	Is hydraulic filter clean and free from restrictions?	**YES:** Go to next step. **NO:** Replace filter as needed.

BS62576,0000FF2 -19-20DEC13-7/9

6 Continued	Are hydraulic lines and oil cooler free from any restrictions?	**YES:** Go to next step. **NO:** Clear lines or cooler of restrictions. Replace parts as needed.

BS62576,0000FF2 -19-20DEC13-8/9

7 Continued	Perform steering system leakage test. (See Test Steering System Leakage.) Is test within specifications?	**NO:** Perform steering control unit (SCU) leakage test. (See Test Steering Control Unit (SCU) Leakage.)

BS62576,0000FF2 -19-20DEC13-9/9

Diagnose Excessive Steering Wheel Free Play

BS62576,0000FF3 -19-20DEC13-1/5

Excessive Steering Wheel Free Play

BS62576,0000FF3 -19-20DEC13-2/5

1 Test Procedure	Is the steering linkage in good condition, not damaged or worn?	**YES:** Go to next step. **NO:** Repair or replace parts as necessary.

Continued on next page

BS62576,0000FF3 -19-20DEC13-3/5

❷ **Continued**	Is hydraulic system free of air? Hydraulic fluid not aerated?	**YES:** Go to next step. **NO:** Purge air from system. Check suction line to charge pump for air leaks.

BS62576,0000FF3 -19-20DEC13-4/5

❸ **Continued**	Is steering valve mounted securely?	**NO:** Secure steering valve.

BS62576,0000FF3 -19-20DEC13-5/5

Diagnose High Steering Effort in One Direction

BS62576,0000FF4 -19-20DEC13-1/4

High Steering Effort in One Direction

BS62576,0000FF4 -19-20DEC13-2/4

❶ **Test Procedure**	Are the steering cylinder ball joints in good condition, not worn?	**YES:** Go to next step. **NO:** Replace parts as needed.

BS62576,0000FF4 -19-20DEC13-3/4

❷ **Continued**	Perform steering system leakage test. (See Test Steering System Leakage.) Is test within specifications?	**NO:** Perform steering control unit (SCU) leakage test. (See Test Steering Control Unit (SCU) Leakage.)

BS62576,0000FF4 -19-20DEC13-4/4

Diagnose High Steering Effort in Both Directions

BS62576,0000FF5 -19-17JUN14-1/8

High Steering Effort in Both Directions

BS62576,0000FF5 -19-17JUN14-2/8

❶ **Test Procedure**	Are tires of proper type and inflated to proper pressure?	**YES:** Go to next step. **NO:** Replace tires with tires of proper type. Inflate tires to proper pressure.

Continued on next page

BS62576,0000FF5 -19-17JUN14-3/8

2 Continued	Are the steering cylinder ball joints in good condition, not worn?	**YES:** Go to next step. **NO:** Replace parts as needed.

BS62576,0000FF5 -19-17JUN14-4/8

3 Continued	Is the steering linkage in good condition, not damaged or worn?	**YES:** Go to next step. **NO:** Repair or replace parts as necessary.

BS62576,0000FF5 -19-17JUN14-5/8

4 Continued	Is hydraulic filter clean and free from restrictions?	**YES:** Go to next step. **NO:** Replace filter as needed.

BS62576,0000FF5 -19-17JUN14-6/8

5 Continued	Test hydraulic pump (front gear set). Is pump flow within specifications?	**YES:** Go to next step. **NO:** Repair or replace pump as necessary.

BS62576,0000FF5 -19-17JUN14-7/8

6 Continued	Perform steering system leakage test. (See Test Steering System Leakage.) Follow results of test.	**NO:** Perform steering control unit (SCU) leakage test. (See Test Steering Control Unit (SCU) Leakage.)

BS62576,0000FF5 -19-17JUN14-8/8

Diagnose Steering Cylinder Will Not Fully Extend or Retract

BS62576,0000FF6 -19-17JUN14-1/8

Steering Cylinder Will Not Fully Extend or Retract

BS62576,0000FF6 -19-17JUN14-2/8

1 Test Procedure	Is the steering linkage in good condition, not damaged or worn?	**YES:** Go to next step. **NO:** Repair or replace parts as necessary.

Continued on next page

BS62576,0000FF6 -19-17JUN14-3/8

2 Continued	Is hydraulic system free of air? Hydraulic fluid not aerated?	**YES:** Go to next step. **NO:** Purge air from system. Check suction line to charge pump for air leaks.

BS62576,0000FF6 -19-17JUN14-4/8

3 Continued	Are the hydraulic fittings tight, preventing fluid loss?	**YES:** Go to next step. **NO:** Tighten hydraulic fittings.

BS62576,0000FF6 -19-17JUN14-5/8

4 Continued	Is steering rod free of damage, not bent?	**YES:** Go to next step. **NO:** Replace steering cylinder.

BS62576,0000FF6 -19-17JUN14-6/8

5 Continued	Test hydraulic pump (front gear set). Is pump flow within specifications?	**YES:** Go to next step. **NO:** Repair or replace pump as necessary.

BS62576,0000FF6 -19-17JUN14-7/8

6 Continued	Perform steering system leakage test. (See Test Steering System Leakage.) Is test within specifications?	**NO:** Perform steering control unit (SCU) leakage test. (See Test Steering Control Unit (SCU) Leakage.) Follow results of test.

BS62576,0000FF6 -19-17JUN14-8/8

Summary of References

- Test Steering System Leakage
- Test Steering Control Unit (SCU) Leakage
- Test Steering System Relief Pressure
- Adjust Steering Toe-In

BS62576,0000FFA -19-18DEC13-1/1

Test Steering System Leakage

Procedure

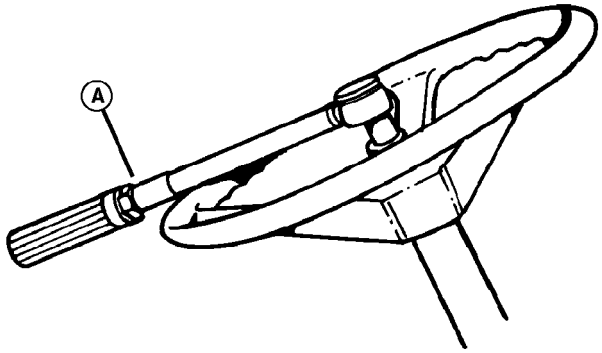
Reason

To check hydraulic steering system for internal leakage.

1. Operate hydraulic system until fluid is at a minimum temperature of 43°C (110°F).
2. Start engine and set throttle to slow idle.
3. With steering wheel at maximum right turn position, use a torque wrench (A) to apply The torque specified and count the number of rotations occurring in one minute.

Specification	
Steering Wheel Turns per Minute at 6 N•m (72 lb.-in.) Constant Torque—Steering Wheel Turns	6 (Maximum) at 6 N·m Constant Torque 6 (Maximum) at (72 lb.-in.) Constant Torque

4. Repeat step 3 with steering wheel at a maximum left turn position.



TCAL25796 —UN—15JUN12

A—Torque Wrench

Results

If rotations per minute exceed specification, perform the steering control unit (SCU) leakage test to isolate the SCU from the steering cylinder. (See Test Steering Control Unit (SCU) Leakage.)

BS62576,0000FF7 -19-12JUN14-1/1

Test Steering Control Unit (SCU) Leakage

Procedure

Reason

The steering system leakage test should be performed first to verify internal steering system leakage. (See Test Steering System Leakage.)

This procedure isolates steering system leakage between the SCU and the steering cylinder.

1. Operate hydraulic system until fluid is at a minimum temperature of 43°C (110°F).

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 Deere & Company Medical Department in Moline, Illinois, U.S.A. Information may be obtained in the United States and Canada only by calling 1-800-822-8262.

IMPORTANT: Install caps or plugs to all openings to avoid contamination.

2. Disconnect and install caps in the lines at the steering cylinder.
3. Start engine and set throttle to slow idle.
4. With steering wheel at a maximum right turn position, apply the torque specified and count the number of rotations occurring in one minute. Repeat with steering wheel at maximum left turn position.

Specification	
Steering Wheel Turns per Minute at 6 N•m (72 lb.-in.) Constant Torque—Steering Wheel Turns	6 (Maximum) at 6 N·m Constant Torque 6 (Maximum) at (72 lb.-in.) Constant Torque

Results

If rotations per minute exceed specification, replace the SCU.

If rotations per minute are less than specification, replace the steering cylinder.

BS62576,0000FF8 -19-12JUN14-1/1

Test Steering System Relief Pressure

Reason

To verify pump (front gear set) pressure is maintained at correct level for steering and lift systems without causing damage to the system.

Special or Required Tools

- JDG2033 Pressure Gauge Kit
- JDG2032 Pressure Diagnostic Kit
- JT05801 Inductive Electronic Tachometer

Procedure

1. Operate hydraulic system until fluid is at a minimum temperature of 43°C (110°F).

CAUTION: Escaping fluid under high pressure can penetrate the skin and cause serious injury. Avoid the hazard by relieving pressure before connecting 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 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.**

2. Relieve system pressure by operating the lift system.
3. Disconnect steering supply hose (A) from steering/charge pump and install a tee fitting and reconnect hose to fitting.

TCT006990 —UN—20FEB13

A—Supply Hose

4. Install a diagnostic fitting on tee fitting.
5. Connect gauge and hose to diagnostic fitting.

NOTE: Check engine rpm with electronic tachometer.

6. Apply park brake, start engine, and run at 3000 ± 50 rpm.
7. Turn steering wheel completely in one direction and hold. Record steady pressure reading.

Results

Pressure should be within specification. If pressure is not within specification, replace steering valve.

Specification

Steering System Relief Valve—Pressure	12410 kPa (1800 psi)

BS62576,0000FF9 -19-12JUN14-1/1

Adjust Steering Toe-In

Reason

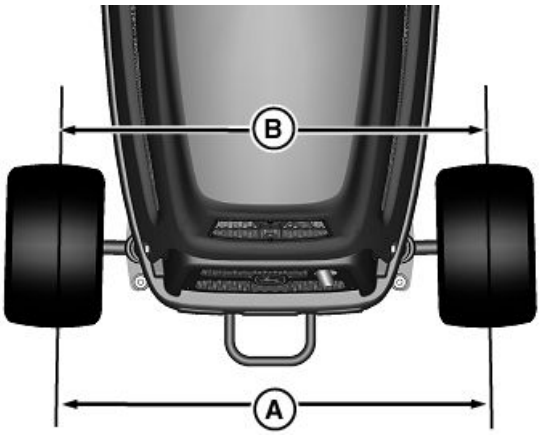
Correct toe-in prevents excessive tire wear and steering wander.

Check Procedure

1. Park machine safely.
2. Measure the distance between the rear tires at the rear of the tires (A).
3. Measure the distance between the rear tires at the front of the tires (B). The distance between tires (toe-in) should be within specification. If adjustment is required, perform adjustment procedure.

Specification

Steering Adjustment (Toe-In)—Distance.....3—9 mm (0.12—0.35 in.) less in the front than the rear



TCT009824 —UN—18DEC13

A—Distance Between the Rear Tires at the Rear of the Tires

B—Distance Between the Rear Tires at the Front of the Tires

BS62576,00015AD -19-18DEC13-1/2

Adjustment Procedure

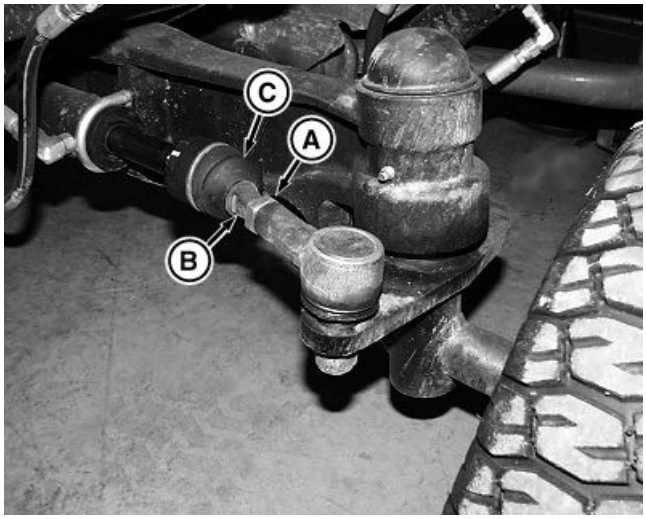
1. Loosen jam nuts (A) on both sides of tie rod.

IMPORTANT: Avoid Damage! Be sure tie rod spins freely inside dust boot (C). Dust boot may rip or tear if binding occurs with tie rod.

2. Use an open end wrench to adjust tie rod (B) on flat surface.
3. Adjust both tie rods to ensure equal distance on both left and right sides of machine.
4. Measure toe-in. If within specification, tighten jam nuts.

Specification

Steering Adjustment (Toe-In)—Distance.....3—9 mm (0.12—0.35 in.) less in the front than the rear



TCT009825 —UN—18DEC13

A—Jam Nut
B—Tie Rod
C—Dust Boot

BS62576,00015AD -19-18DEC13-2/2

Section 280
Attachments Operation, Tests, and Adjustments
Contents

Page

Group 10—Component Location
Summary of References 280-10-1
Cutting Unit - QA5 Component Location 280-10-1
Greens Tender Conditioner (GTC) Component Location 280-10-2
Verticut QA5 Component Location 280-10-3

Group 20—Theory of Operation
Summary of References 280-20-1
Reel and Bed Knife Grinding 280-20-2
Vertical Cutting Unit 280-20-3
Rollers 280-20-3
Performance Variables 280-20-4

Group 30—Diagnosis
Diagnose Marcelling 280-30-1
Diagnose Marcelling 280-30-1
Diagnose Streaking 280-30-1
Diagnose Streaking 280-30-1
Diagnose Height-of-Cut (HOC) Changes 280-30-2
Diagnose Height-of-Cut (HOC) Changes 280-30-2
Diagnose Poor Quality of Cut 280-30-3
Diagnose Poor Quality of Cut 280-30-3
Diagnose Reel Does Not Rotate 280-30-4
Diagnose Reel Does Not Rotate 280-30-4
Diagnose Unit Not Cutting 280-30-4
Diagnose Unit Not Cutting 280-30-4

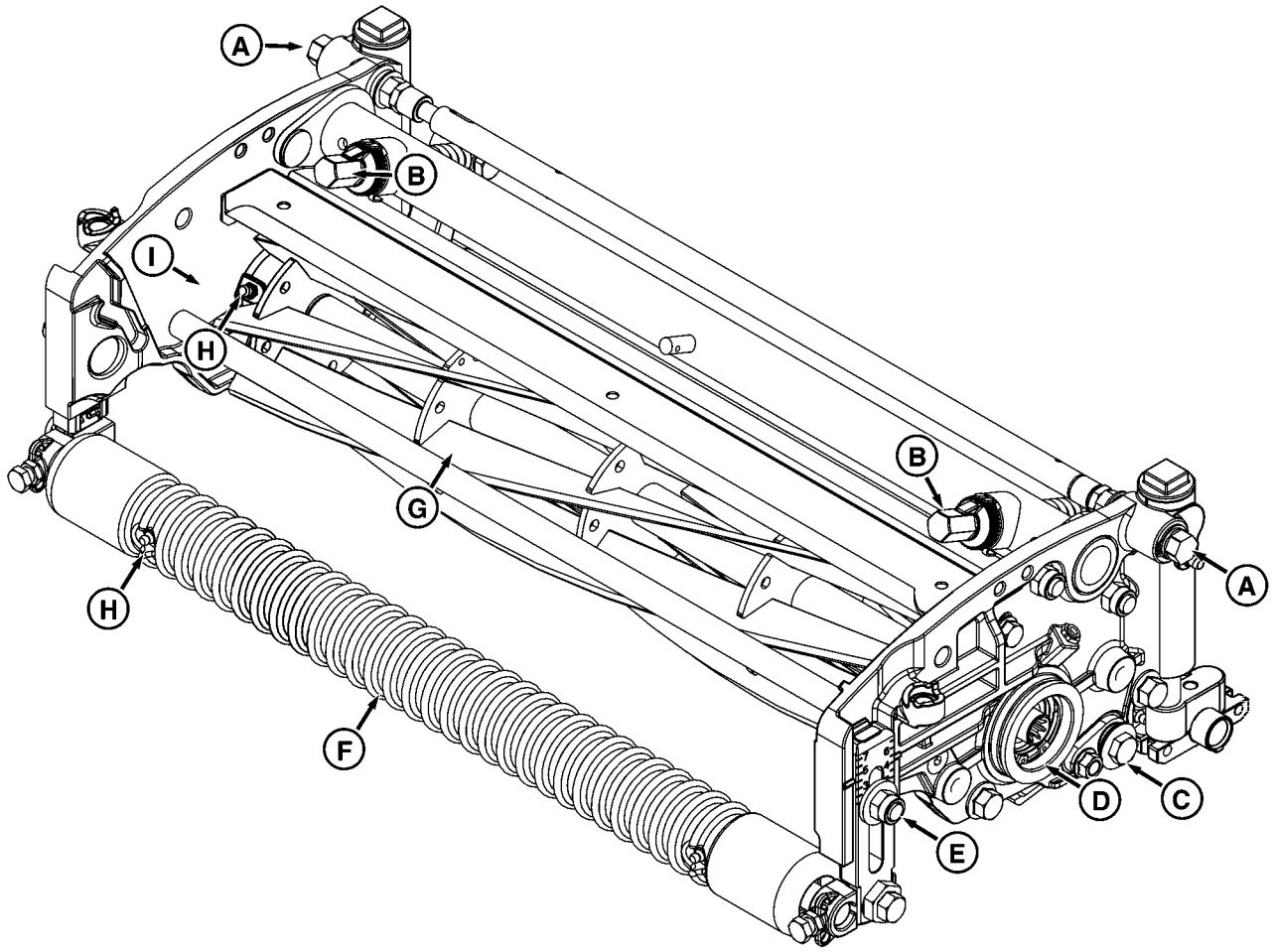
Group 40—Tests and Adjustments
Summary of References 280-40-1
Adjust Bed Knife-to-Reel 280-40-1
Adjust Backlapping and Bed Knife-to-Reel 280-40-2
Backlapping Procedure 280-40-2
Grinding Reel and Bed Knife 280-40-4
Adjust Height-of-Cut Range - QA5 Reel 280-40-6
Adjust Front Roller - QA5 Reel 280-40-6
Adjust Height-of-Cut (HOC) - QA5 Reel 280-40-8
Align Cutting Unit Frame - QA5 Reel 280-40-10
Adjusting Greens Tender Conditioner (GTC) 280-40-13
Adjust Cutting Shield 280-40-14
Adjust Depth-of-Cut - Vertical Cutting Units 280-40-15
Adjust Power Brush 280-40-16
Adjust Lift Arm Cylinder 280-40-16
Adjust Proximity Flag 280-40-18

Summary of References

- Cutting Unit - QA5 Component Location
- Greens Tender Conditioner (GTC) Component Location
- Verticut QA5 Component Location

OUMX258,0000712 -19-08NOV12-1/1

Cutting Unit - QA5 Component Location

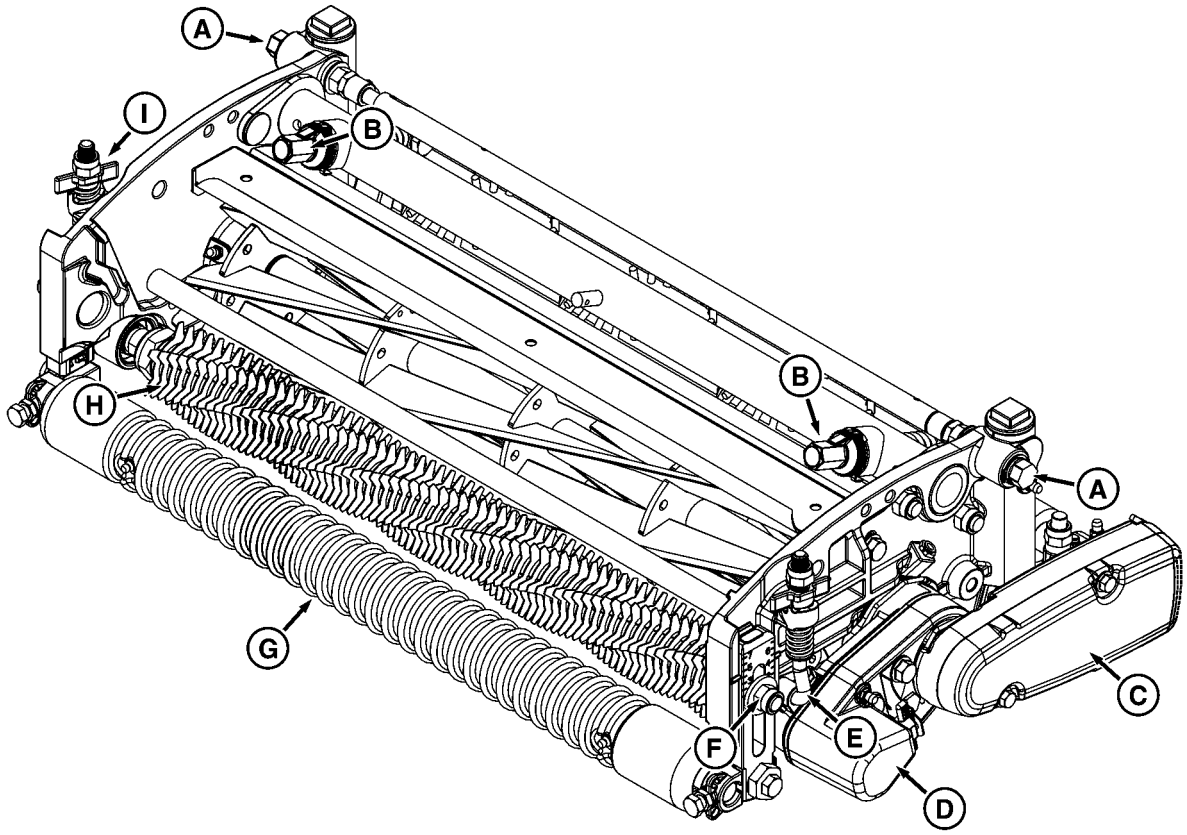


TCT003367 —UN—08JUN12

A—Rear Roller Height Adjuster
B—Bed Knife Adjusters
C—Bed Knife Pivot Cam Plate
D—Bearing Housing / Motor Mount
E—Front Roller Height Adjustment
F—Front Roller
G—Reel
H—Lubrication Fittings
I— Bearing Housing

BS62576,0000354 -19-15MAY12-1/1

Greens Tender Conditioner (GTC) Component Location

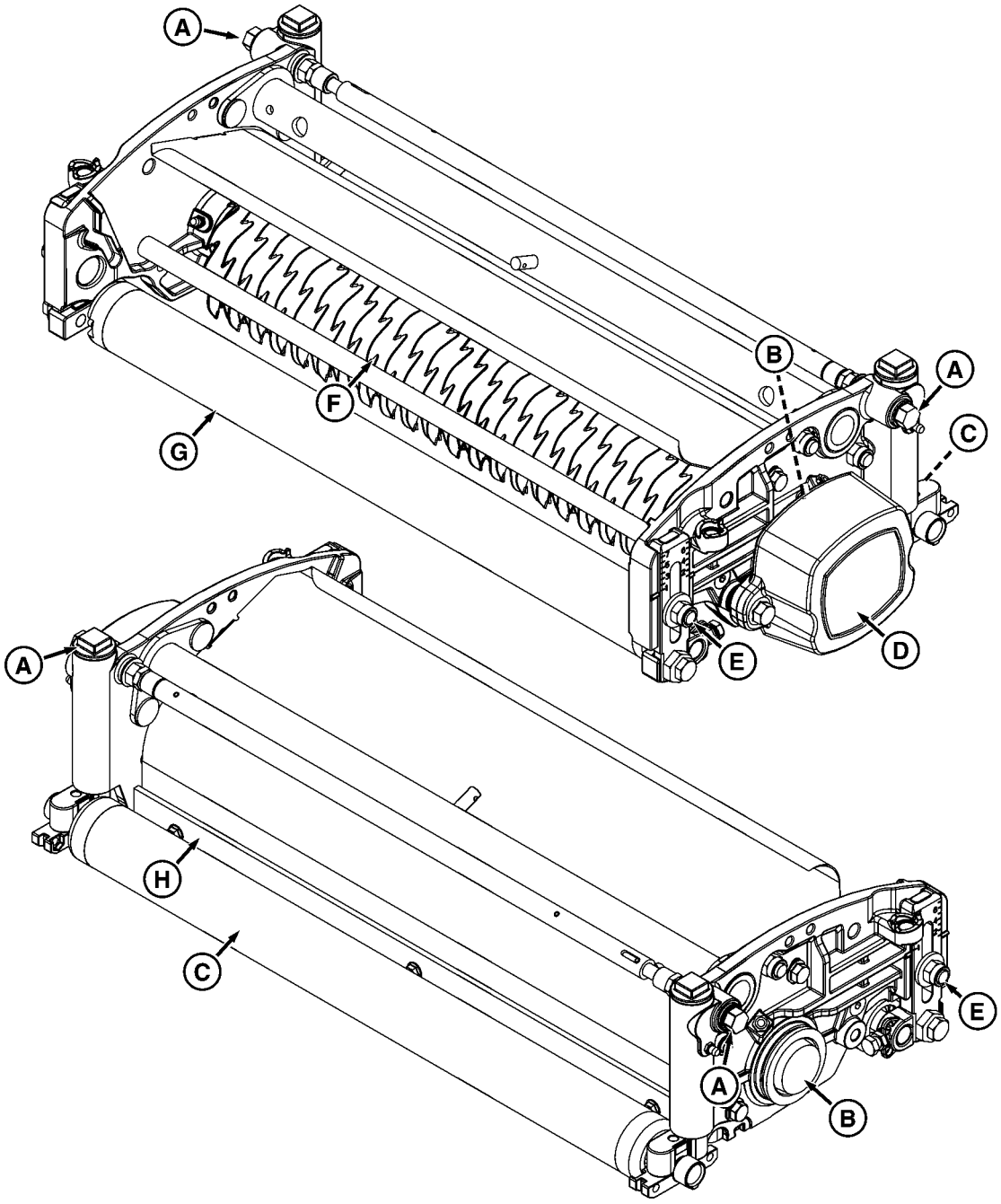


TCT003368 —UN—08JUN12

A—Rear Roller Height Adjuster
B—Bed Knife Adjuster
C—Brush Drive Housing
D—Greens Tender Conditioner Drive Housing
E—Greens Tender Conditioner Shaft Height Adjustment
F—Front Roller Height Adjustment
G—Front Roller
H—Greens Tender Conditioner Shaft and Blades
I— Greens Tender Conditioner Engage/Disengage Wing Nut

BS62576,0000355 -19-15MAY12-1/1

Verticut QA5 Component Location



TCT003369 —UN—08JUN12

A—Rear Roller Height Adjuster
B—Bearing Housing
C—Rear Roller
D—Counterweight
E—Front Roller Height Adjustment
F—Vertical Blades
G—Front Roller
H—Discharge Flap

BS62576,0000356 -19-15MAY12-1/1

Summary of References

- Reel and Bed Knife Grinding
- Vertical Cutting Unit
- Rollers
- Performance Variables

OUMX258,0000714 -19-08NOV12-1/1

Reel and Bed Knife Grinding

Reel and Bed Knife Relationship

Reel mowers are precision machines requiring daily maintenance to maintain the well-groomed appearance of turf. The scissor-like shearing action, which only a reel mower is capable of achieving, is only possible if the reel and bed knife are sharp and the bed knife-to-reel clearance is maintained.

Close examination of the bed knife-to-reel relationship reveals two square edges passing one another with approximately 0.050 mm (0.002 in.) clearance. There are several reasons why this clearance is necessary.

When the reel is allowed to contact the bed knife, the square (sharp) edges of the reel and bed knife will roll over, becoming dull.

Contact between the reel and bed knife generates heat. Heat generated through this contact will distort the shape of the bed knife. Distortion causes the bed knife to draw closer to the reel, resulting in more rollover of the cutting surfaces and more heat generated in the bed knife.

Drag produced by an improperly adjusted cutting unit may result in an unacceptable clip ratio, undue strain on drive mechanisms and premature wear of the cutting unit.

Reasons for Grinding

To restore the cylindrical shape of a reel that has become cone-shaped due to improper adjustment of the bed knife-to-reel clearance or worn reel bearings.

To restore the edge when the grass is not being cut across the entire length of the bed knife, evidenced by streaks of grass left after the mower has passed, usually the result of nicked blades caused by hitting foreign objects in the grass.

To restore the edge when the lack of frequent backlapping allowed the edge to be rounded beyond the capability of the backlapping procedure to restore the edge.

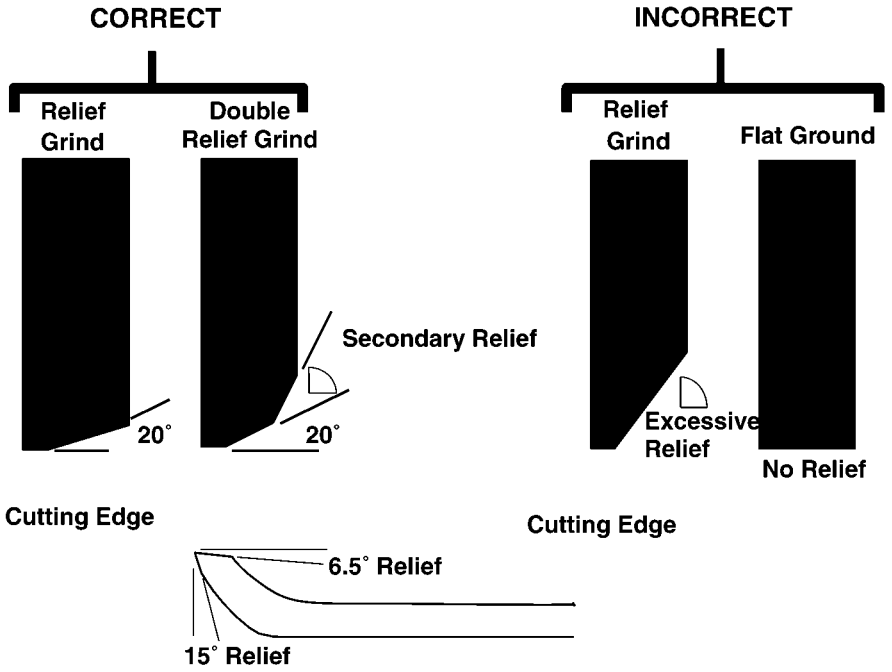
To restore the edge when the bed knife-to-reel clearance has been improperly adjusted (reel contacting bed knife).

Cutting action begins as the bed knife positions the grass to be cut at the cutting edge. The reel then pulls the grass toward the bed knife, where it is sheared by the cutting edges as they pass one another.

In order for the grass to be cut at the proper height, it must contact the bed knife at the cutting edge. This is accomplished by grinding a 15° relief angle on the front face of the bed knife. Without a relief angle, the blade of grass will contact the lower edge of the bed knife and be bent over at too much of an angle prior to being cut. In the case of mowing greens, where very small cuts are being taken, the reel may not capture the grass at all, and no grass will be cut.

Although some spin grinding machine manufacturers say backlapping is not necessary, John Deere recommends backlapping after spin grinding to remove burrs and rough edges left from the spin grinding procedure. Backlapping produces a honed edge that will cut the grass evenly and leave the tops of the grass with clean, straight edges.

It is important to note that dull cutting edges will tear rather than shear the grass drawn into the bed knife. This will shock the grass plant and retard its growth.



TCT003384 —UN—12JUN12

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CB12260,0000103 -19-21MAY14-1/2

John Deere recommends relief grinding the reels before spin grinding for the following reasons:

- Reduces blade contact area, results in less friction, requiring less horsepower to drive the reels.
- Ensures longer wear life.
- Less time is required to backlap.
- Reduces pulling and tearing of the grass as the unit gets dull by use.
- Provides an area for backlapping compound to be trapped to more effectively backlap reels.
- Relief grinding removes metal from the trailing edge of the blade, forming an angle (relief angle) to reduce the contact area of the cutting edges.
- Because of the relief grind it is possible, with backlapping, to true a reel (make it round) if a blade is 0.025-0.050 mm (0.001-0.002 in.) out of round.

Backlapping

See Grinding Reel and Bed Knife.

The backlapping procedure is accomplished by spinning the reel backwards while applying special abrasive compounds to the reel. Usually, coarse compounds are used initially, followed by a finer abrasive for final honing. Recommended grits for fairways and roughs are 60-, 80- and 120-grit. Reel sharpening compounds should not be toxic, oily, or greasy.

The cutting unit should be inspected, backlapped, adjusted and checked daily for a uniform cut along the complete length of the bed knife. It is important that the adjustment allows the reel to turn freely without dragging against the bed knife. Metal-to-metal contact will generate heat, causing the reel to expand and intensifying the dragging that produces more heat. This vicious cycle will quickly “shut down” the mower.

CB12260,0000103 -19-21MAY14-2/2

Vertical Cutting Unit

The vertical cutting unit is a dedicated cutting unit used to de-thatch fairways, greens and tees prior to topdressing. This tends to promote vertical growth for better consistency of play on the golf course.

The vertical blades are positioned in a helix pattern and are placed 3/4 in. apart as shipped from the factory.

Spacing is accomplished by placing three 1/4 in. spacers together between each blade. If a closer spacing is desired, spacers can be removed and blades added.

The helix pattern in the cutters is formed by indexing the center hexagonal cut one additional flat.

BS62576,0000359 -19-15MAY12-1/1

Rollers

Smooth Roller

The roller is used as a ground-sensing device to detect changes in the contour of the turf as the mower moves forward. A smooth roller is generally used on the rear of a cutting unit to establish the cutting height range. (Under certain circumstances, grooved rollers are used on the rear.) A front roller used in conjunction with a rear roller is needed to achieve more exact cutting heights under 25 mm (1 in.).

Grooved Roller

The grooved roller is used as a ground-sensing device to detect changes in the contour of the turf as the mower moves forward. The main advantage in using a grooved roller rather than a smooth one comes when cutting long grass that is very wet. Grass that is wet will tend to stay down rather than spring up after the roller passes.

Grooved rollers will not bend the grass over, allowing it to be cut rather than passed over.

Along with advantages come disadvantages. Because of the reduced contact area inherent with a grooved roller, the roller may penetrate deeper into the soil (especially in wet conditions), lowering the effective cutting height and possibly scalping the turf. Serious consideration should be given to mowing fairways or greens with a grooved roller attached, especially when the turf is very wet.

Spiral Roller

The 3-in. diameter spiral-grooved front roller with spiral end-caps allows more grass to stand up along the entire width of the cutting unit, providing a better quality of cut. This roller is also self-cleaning, reduces material buildup on the ends, and improves the overall appearance of the finished cut.

BS62576,000035A -19-15MAY12-1/1

Performance Variables

Three performance variables that affect the quality of cut are:

- Number of reel blades
- Reel rpm
- Ground speed of machine

NOTE: When discussing performance variables, we must assume that other factors such as rate of growth, mowing frequency, soil fertility and equipment condition have been considered and are not affecting the quality of cut.

To apply performance variables to a formula, we need to understand three terms:

Shear Point - A single point of cutting contact between the cutting unit and the turf. Due to the reel mower design, there are an infinite number of shear points across the bed knife.

Clip Ratio (CR) - The forward distance traveled between successive cutting contacts at any one shear point.

Cutting Height (CH) - The distance above the soil line that grasses are clipped.

The most uniform cut occurs when the Clip Ratio (CR) equals the Cutting Height (CH). If CR is 20% greater than CH, marcelling (a wavy, rib-like appearance) can occur. CR should be within 20% of CH. Therefore, a CH of 13 mm (0.50 in.) requires a CR of 10-15 mm (0.40-0.60 in.). If CH is 20% greater than CR, the rotating blades create a fanning effect that blows the grass down without cutting it.

CR is controlled by the performance variables (the number of blades on the reel, ground speed and reel speed). In most cases, only two of these performance variables (the number of blades on the reel and/or the vehicle ground speed) are changeable for a given cutting height.

Since the number of blades on the reel, the reel speed, the cutting height and the clip ratio (since CR must equal CH) are known, the formula to calculate optimum vehicle ground speed (mph) is:

mph = (reel rpm) x (CR) x (No. of blades) ÷ 1056

Example Using:

- At a tested reel speed of 2100 rpm
- 9-blade reel on a 22-in. cutting unit
- CH = 0.14 (therefore, CR = 0.14)

Optimum vehicle ground speed (mph) is:

(2100) x (0.14) x (9) ÷ 1056 = 2.5 mph

NOTE: To measure vehicle ground speed (mph):

- Measure an 88-ft distance and record the length of time (in seconds) it takes to travel that distance.
- Vehicle ground speed equals 60 divided by that time.

BS62576,000035B -19-15MAY12-1/1

Diagnose Marcelling

Marcelling

BS62576,00015B0 -19-07JUL14-1/6

Diagnose Marcelling

BS62576,00015B0 -19-07JUL14-2/6

1 **Test Procedure**	Are initial reel and ground speeds set correctly?	**YES:** Go to step 2 **NO:** (See the "Owners Manual" and Performance Variables.)

BS62576,00015B0 -19-07JUL14-3/6

2 **(Continued)**	Is engine rpm correct (not too low)?	**YES:** Go to step 3 **NO:** Increase engine speed.

BS62576,00015B0 -19-07JUL14-4/6

3 **(Continued)**	Are the reel and bed knife sharp?	**YES:** Go to step 4 **NO:** Perform backlapping and bed knife-to-reel adjustment. (See Backlapping Procedure.)

BS62576,00015B0 -19-07JUL14-5/6

4 **(Continued)**	Is the correct number of reel blades being used for desired clip ratio (CR)?	**NO:** Install reel with correct number of blades. (See Performance Variables.)

BS62576,00015B0 -19-07JUL14-6/6

Diagnose Streaking

Streaking

BS62576,00015B1 -19-23DEC13-1/4

Diagnose Streaking

BS62576,00015B1 -19-23DEC13-2/4

1 **Test Procedure**	Is the bed knife-to-reel clearance within specification and consistent along the bed knife?	**YES:** Go to step 2 **NO:** Perform bed knife-to-reel adjustment. (See Backlapping Procedure.)

Continued on next page

BS62576,00015B1 -19-23DEC13-3/4

❷ **(Continued)**	Are the reel and bed knife in good condition (no nicks, uneven wear, or distortions)	**NO:** Grind reel and bed knife. (See Grinding Reel and Bed Knife.)

BS62576,00015B1 -19-23DEC13-4/4

Diagnose Height-of-Cut (HOC) Changes

Height-of-Cut (HOC) Changes

BS62576,00015B2 -19-23DEC13-1/9

Diagnose Height-of-Cut (HOC) Changes

BS62576,00015B2 -19-23DEC13-2/9

❶ **Test procedure**	Is the grass dry enough for proper cutting (not too wet)?	**YES:** Go to step ❷ **NO:** Allow sufficient time for grass to dry before cutting.

BS62576,00015B2 -19-23DEC13-3/9

❷ **(Continued)**	Is the roller clean (no grass or dirt collecting on the roller)?	**YES:** Go to step ❸ **NO:** Install scraper or power brush on roller.

BS62576,00015B2 -19-23DEC13-4/9

❸ **(Continued)**	Is the condition of the soil good (not rough or changing)?	**YES:** Go to step ❹ **NO:** Use a smooth roller.

BS62576,00015B2 -19-23DEC13-5/9

❹ **(Continued)**	Is the cutting unit floating properly?	**YES:** Go to step ❺ **NO:** See operator's manual.

BS62576,00015B2 -19-23DEC13-6/9

❺ **(Continued)**	Are the roller clamp bolts tight?	**YES:** Go to step ❻ **NO:** Perform height-of-cut (HOC) Adjustment. (See Adjust Height-of-Cut Range - QA5 Reel.)

Continued on next page

BS62576,00015B2 -19-23DEC13-7/9

Diagnosis

6 (Continued)	Are the rollers concentric (not out-of-round)?	**YES:** Go to step 7 **NO:** Replace roller. (See Remove and Install Front Roller and Remove and Install Rear Roller.)

BS62576,00015B2 -19-23DEC13-8/9

7 (Continued)	Are the roller bearings in good condition (not worn)?	**NO:** Replace roller bearings. (See Repair Front Roller.)

BS62576,00015B2 -19-23DEC13-9/9

Diagnose Poor Quality of Cut

Poor Quality of Cut

BS62576,00015B3 -19-23DEC13-1/6

Diagnose Poor Quality of Cut

BS62576,00015B3 -19-23DEC13-2/6

1 Test Procedure	Is the grass at an acceptable height (not too high)?	**YES:** Go to step 2 **NO:** Mow grass more frequently.

BS62576,00015B3 -19-23DEC13-3/6

2 (Continued)	Are the reel and bed knife sharp?	**YES:** Go to step 3 **NO:** Perform backlapping and bed knife-to-reel adjustment. (See Backlapping Procedure.)

BS62576,00015B3 -19-23DEC13-4/6

3 (Continued)	Is the bed knife-to-reel clearance within specification and consistent along the bed knife?	**YES:** Go to step 4 **NO:** Perform bed knife-to-reel adjustment. (See Adjust Bed Knife-to-Reel and Adjust Backlapping and Bed Knife-to-Reel.)

BS62576,00015B3 -19-23DEC13-5/6

4 (Continued)	Are the roller bearings in good condition (not worn or seized)?	**NO:** Replace roller bearings. (See Remove and Install Front Roller.)

BS62576,00015B3 -19-23DEC13-6/6

Diagnose Reel Does Not Rotate

Reel Does Not Rotate

BS62576,00015B4 -19-21MAY14-1/6

Diagnose Reel Does Not Rotate

BS62576,00015B4 -19-21MAY14-2/6

❶ **Test Procedure**	Is the machine operating properly?	**YES:** Go to step ❷ **NO:** See machine operator's manual.

BS62576,00015B4 -19-21MAY14-3/6

❷ **(Continued)**	Are the reel and bed knife free of debris?	**YES:** Go to step ❸ **NO:** Remove material jammed between reel and bed knife.

BS62576,00015B4 -19-21MAY14-4/6

❸ **(Continued)**	Is bed knife contacting reel?	**YES:** Adjust clearance between the bed knife and reel to proper specification. (See Adjust Bed Knife-to-Reel.) **NO:** Go to step ❹

BS62576,00015B4 -19-21MAY14-5/6

❹ **(Continued)**	Are mower electrical control circuits operating correctly?	**YES:** Go to step ❺ **NO:** See appropriate diagnostics in Electrical and Controller sections.

BS62576,00015B4 -19-21MAY14-6/6

Diagnose Unit Not Cutting

Unit Not Cutting

BS62576,00015B5 -19-17JUN14-1/8

Diagnose Unit Not Cutting

BS62576,00015B5 -19-17JUN14-2/8

❶ **Test Procedure**	Is the grass dry and height of cut not excessive?	**YES:** Go to step ❷ **NO:** Allow sufficient time for grass to dry and mow more frequently.

Continued on next page

BS62576,00015B5 -19-17JUN14-3/8

❷ **(Continued)**	Are the engine and ground speeds correct?	**YES:** Go to step ❸ **NO:** Adjust engine speed and ground speed conditions. (See Performance Variables.)

BS62576,00015B5 -19-17JUN14-4/8

❸ **(Continued)**	Is the correct number of blades used for conditions?	**YES:** Go to step ❹ **NO:** Install reel with correct number of blades. (See Performance Variables.)

BS62576,00015B5 -19-17JUN14-5/8

❹ **(Continued)**	Is the reel speed correct?	**YES:** Go to step ❺ It may be necessary to change to a more aggressive bed knife. **NO:** Adjust reel speed.

BS62576,00015B5 -19-17JUN14-6/8

❺ **(Continued)**	Are the reel and bed knife sharp?	**YES:** Go to step ❻ **NO:** Perform backlapping and bed knife-to-reel adjustment. (See Backlapping Procedure.)

BS62576,00015B5 -19-17JUN14-7/8

❻ **(Continued)**	Is the bed knife-to-reel clearance within specification and consistent along the bed knife?	**NO:** Perform bed knife-to-reel adjustment. (See Adjust Backlapping and Bed Knife-to-Reel and Adjust Bed Knife-to-Reel.)

BS62576,00015B5 -19-17JUN14-8/8

Summary of References

- Adjust Bed Knife-to-Reel
- Adjust Backlapping and Bed Knife-to-Reel
- Backlapping Procedure
- Grinding Reel and Bed Knife
- Adjust Height-of-Cut Range - QA5 Reel
- Adjust Front Roller - QA5 Reel
- Adjust Height-of-Cut (HOC) - QA5 Reel
- Align Cutting Unit Frame - QA5 Reel
- Adjusting Greens Tender Conditioner (GTC)
- Adjust Cutting Shield
- Adjust Depth-of-Cut - Vertical Cutting Units
- Adjust Power Brush
- Adjust Lift Arm Cylinder
- Adjust Proximity Flag

OUMX258,000071C -19-18JUN14-1/1

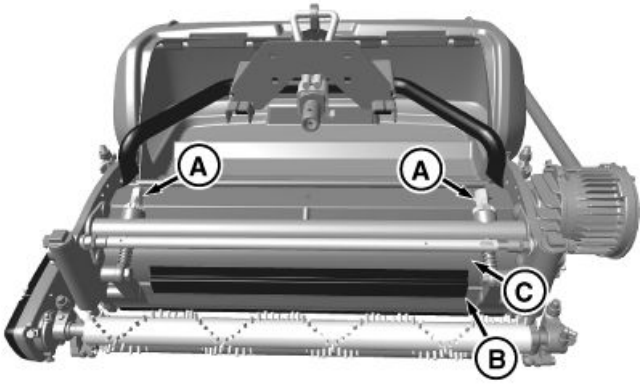
Adjust Bed Knife-to-Reel

Reason

To maintain bed knife-to-reel clearance for clean, consistent cutting.

CAUTION: Avoid Injury! Always wear protective gloves when working on or near the cutting reel or bed knife. Severe personal injury can result from contact with the sharp cutting edges.

1. Remove cutting units from mower.)
2. Position cutting unit upright on workbench as shown.
3. Turn bed knife tower adjuster (A) on both sides of cutting unit counterclockwise until bed knife (B) is tight against cutting reel (C).
4. Slowly tighten tower adjuster (A) clockwise, alternating from side to side until bed knife begins to pull away from the cutting reel. Cutting reel should rotate freely.



TCT003376 —UN—08JUN12

A—Adjuster
B—Knife
C—Reel

OUMX258,000071B -19-21MAY14-1/2

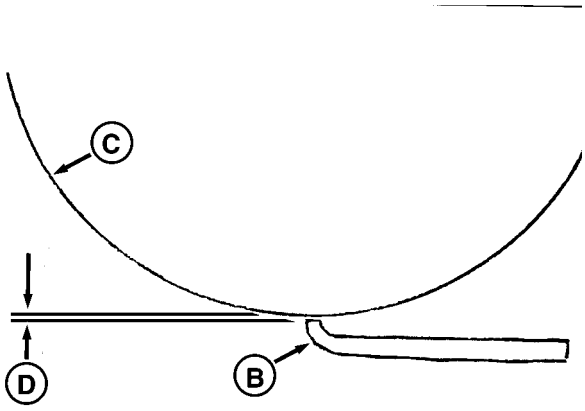
5. Alternately turn adjusters (A) no more than one flat at a time until bed knife (B) to reel (C) clearance (D) is to specification.

Specification

Bed Knife to Reel—Clearance.....0.025—0.050 mm (0.001—0.002 in.)

IMPORTANT: Avoid Damage! Always rotate the cutting wheel backwards to prevent damaging or dulling the cutting edges of the reel and/or bed knife.

6. Slowly rotate the cutting reel backwards and check the gap at several points along the entire length of the bed knife using a **0.050 mm (0.002 in.)** feeler gauge. The feeler gauge should not pass between the bed knife and cutting reel at any point.



TCT003377 —UN—08JUN12

B—Knife
C—Reel
D—Clearance

Results

If the gap is **0.050 mm (0.002 in.)** or greater at the center of the bed knife: Grind the reel and/or bed knife to eliminate the concave surface in the bed knife or the out-of-round condition of the reel.

If there is contact at the center of the bed knife: Grind the reel and/or bed knife to eliminate the convex surface in the bed knife or the out-of-round condition of the reel.

OUMX258,000071B -19-21MAY14-2/2

Adjust Backlapping and Bed Knife-to-Reel

It is best to think of backlapping and bed knife-to-reel adjustments as one procedure. Although backlapping removes only a small amount of metal, the clearance between the reel and bed knife will be increased and must be readjusted.

Another very important point to remember is that adjustments can be successful only if the frame integrity (straightness and strength) is maintained. Attaching bolts must be secure and bearings must be well lubricated and not worn.

BS62576,00004B7 -19-15MAY12-1/1

Backlapping Procedure

Reason

To provide a consistent cutting action and prolong reel life.

Dealer Fabricated Tools

Attach a piece of rubber hose (A) and additional handle (B) to a paint brush (C) to extend its length. This is used to apply lapping compound.

CAUTION: Avoid Injury! Rotating blades are dangerous and can cut fingers and toes. Keep hands and feet away while greensmower is running. Disengage greens and turf conditioner (GTC) before backlapping.

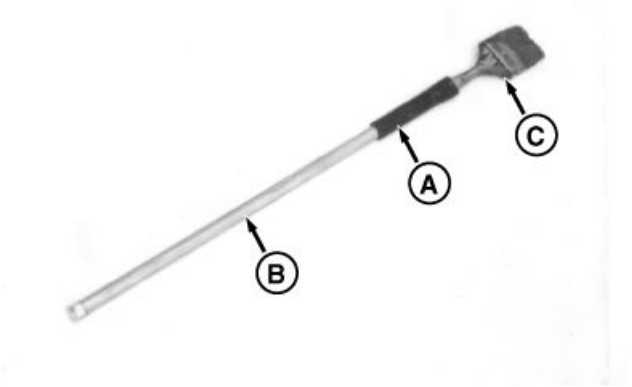
IMPORTANT: Avoid Damage! Backlapping cutting units should be done by trained personnel on a routine basis approximately every 25 hours. Backlap intervals will vary depending on conditions. Backlapping is done to prolong reel life, prevent downtime and provide a consistently sharp cutting action.

NOTE: To help maintain sharp edges required on cutting reels, bed knife-to-reel clearance should be checked before the backlapping function begins. The bed knife must be adjusted properly to ensure correct spacing over the length of the cutting blades.

Cutting reels are all backlapped at the same time.

1. Check bed knife-to-reel clearance on all three cutting reels. Adjust if necessary. (See Adjust Bed Knife-to-Reel.)
2. Move mow-transport lever to the transport position.
3. Lower cutting units to the ground.
4. Lock the park brake.

NOTE: Operator must be off the seat for the backlapping function.



TCT003378 —UN—08JUN12

A—Hose
B—Hande
C—Brush

5. Operator off seat.
6. Turn key switch to the run position.
7. Position throttle lever between mid-range and slow idle.
8. Adjust reel speed. See Backlap Speed.

CAUTION: Avoid Injury! Rotating blades are dangerous. Keep hands and feet away while greensmower is operating. Use a brush with a long handle when performing backlapping procedure to keep fingers and hands from rotating blades.

9. Move the mow-transport lever to the mow position.

NOTE: Adjust reel speed so that reel sharpening compound is not thrown off during the backlapping procedure.

10. Increase reel speed slightly, but not so fast that backlapping compound is thrown off.

Continued on next page

OUMX258,000071D -19-21MAY14-1/2

11. Using a long-handled brush, carefully apply reel sharpening compound, uniformly, from one end of the cutting reel to the other. Repeat application in opposite direction. Allow cutting reel to continue running backwards until reel is quiet.

CAUTION: Avoid Injury! Rotating blades are dangerous and can cut fingers and toes. Keep hands and feet away while mower is operating. Reels can continue to rotate if engine is running.

12. Periodically disengage cutting units.
13. Turn key switch to the stop position.
14. Visually check blade appearance.

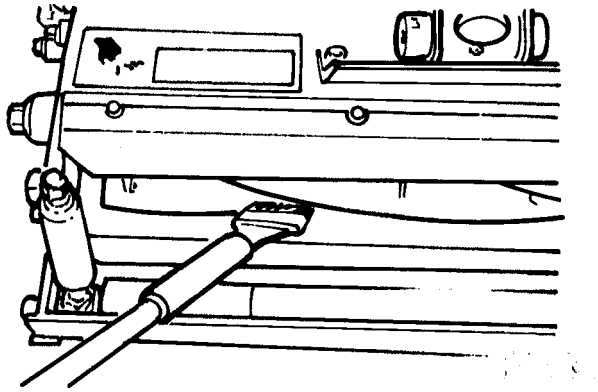
NOTE: 2500B - Forward-reverse control knob must be pushed down to restart engine.

2500E - Mow-backlap switch must be moved to the mow position to restart engine.

15. Check for uniform clearance across entire bed knife. If clearance is not uniform, repeat backlapping procedure until clearance is uniform across entire bed knife.

IMPORTANT: Avoid Damage! Do not operate cutting reels in the forward direction until reel sharpening compound is washed from the unit. Unless properly washed, the reels can be dulled by the compound.

16. Use water to thoroughly wash off all reel sharpening compound while cutting reels are turning in reverse.



TCT003382 —UN—08JUN12

17. Adjust bed knife-to-reel clearance. (See Adjust Bed Knife-to-Reel.)
18. Set machine to the transport position. See Operator's Manual.
19. Adjust cutting reels to desired operating speed. See Backlap Speed.

Results

Reel and bed knife should be sharp and free from minor nicks and scratches.

OUMX258,000071D -19-21MAY14-2/2

Grinding Reel and Bed Knife

Reel and Bed Knife Relationship

Reel mowers are precision machines requiring daily maintenance to maintain the well-groomed appearance of turf. The scissor-like shearing action, which only a reel mower is capable of achieving, is only possible if the reel and bed knife are sharp and the bed knife-to-reel clearance is maintained.

Close examination of the bed knife-to-reel relationship reveals two square edges passing one another with approximately 0.050 mm (0.002 in.) clearance. There are several reasons why this clearance is necessary.

When the reel is allowed to contact the bed knife, the square (sharp) edges of the reel and bed knife will roll over, becoming dull.

Contact between the reel and bed knife generates heat. Heat generated through this contact will distort the shape of the bed knife. Distortion causes the bed knife to draw closer to the reel, resulting in more rollover of the cutting surfaces and more heat generated in the bed knife.

Drag produced by an improperly adjusted cutting unit may result in an unacceptable clip ratio, undue strain on drive mechanisms and premature wear of the cutting unit.

Reasons for Grinding

To restore the cylindrical shape of a reel that has become cone-shaped due to improper adjustment of the bed knife-to-reel clearance or worn reel bearings.

To restore the edge when the grass is not being cut across the entire length of the bed knife, evidenced by streaks of grass left after the mower has passed, usually the result of nicked blades caused by hitting foreign objects in the grass.

To restore the edge when the lack of frequent backlapping allowed the edge to be rounded beyond the capability of the backlapping procedure to restore the edge.

To restore the edge when the bed knife-to-reel clearance has been improperly adjusted (reel contacting bed knife).

Cutting action begins as the bed knife positions the grass to be cut at the cutting edge. The reel then pulls the grass toward the bed knife, where it is sheared by the cutting edges as they pass one another.

In order for the grass to be cut at the proper height, it must contact the bed knife at the cutting edge. This is accomplished by grinding a 5° relief angle on the front face of the bed knife. Without a relief angle, the blade of grass will contact the lower edge of the bed knife and be bent over at too much of an angle prior to being cut. In the case of mowing greens, where very small cuts are being taken, the reel may not capture the grass at all, and no grass will be cut.

Although some spin grinding machine manufacturers say backlapping is not necessary, John Deere recommends backlapping after spin grinding to remove burrs and rough edges left from the spin grinding procedure. Backlapping produces a honed edge that will cut the grass evenly and leave the tops of the grass with clean, straight edges.

It is important to note, dull cutting edges will tear rather than shear the grass drawn into the bed knife. This will shock the grass plant and retard its growth.

Grinding the Bed Knife

NOTE: Bed knife and support assembly must be ground as a complete unit.

1. When grinding the bed knife, it is important to have a 6.5° relief angle on the top surface (A) and a 15° relief angle on the front surface (B).
2. Put entire bed knife support and bed knife in a suitable grinder and grind until material is consistently removed from the entire length of the top and front surfaces of the bed knife.

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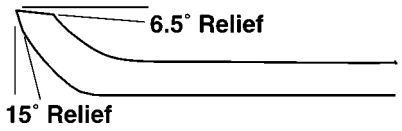
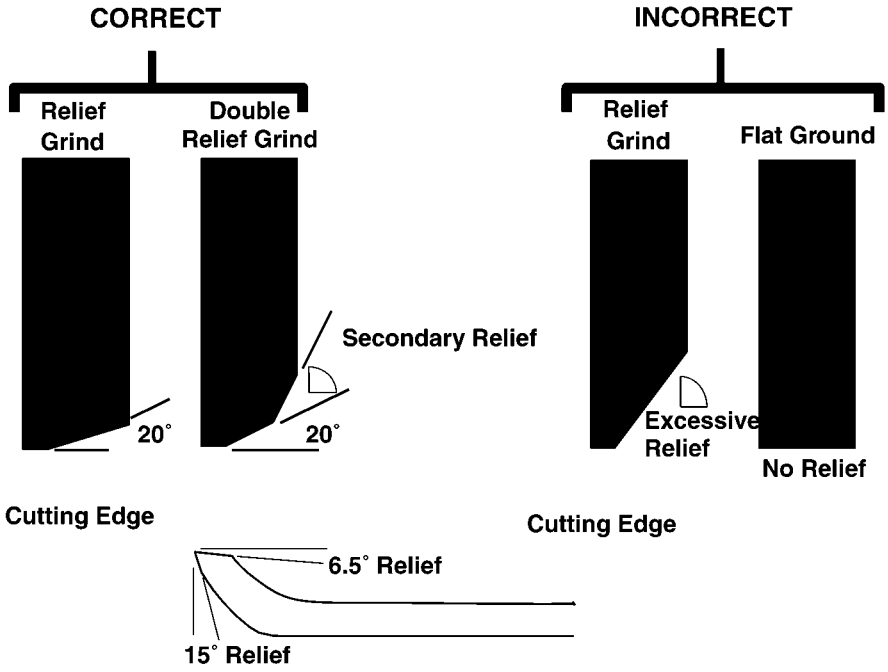
TCT003383 —UN—12JUN12



A—Surface

B—Surface

BS62576,00004B9 -19-17JUL12-2/3



TCT003384 —UN—12JUN12

Grinding the Reel

John Deere recommends relief grinding the reels before spin grinding for these reasons:

- Reduced blade contact area results in less friction, requiring less horsepower to drive the reel and increases fuel efficiency.
- Ensures longer wear life.
- Less time is required to backlap.
- Reduces pulling and tearing of the grass as the unit gets dull by use.
- Provides an area for backlapping compound to be trapped to more effectively backlap reels.
- Relief grinding removes metal from the trailing edge of the blade, forming an angle (relief angle) to reduce the contact area of the cutting edges.
- Because of the relief grind it is possible, with backlapping, to true a reel (make it round) if a blade is 0.025-0.050 mm (0.001-0.002 in.) out of round.

BS62576,00004B9 -19-17JUL12-3/3

Adjust Height-of-Cut Range - QA5 Reel

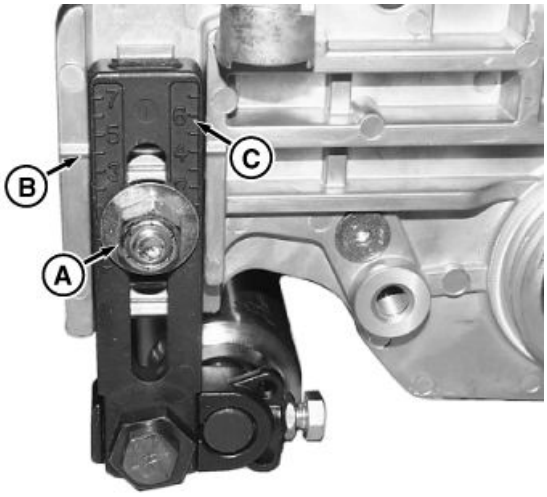
Reason

To set front roller range for proper height-of-cut position.

1. Remove cutting units from mower.
2. Place cutting unit on a stable working surface with the front roller facing up.
3. Loosen nut (A) on each roller bracket.
4. Align desired mark on roller bracket (C) and cutting unit frame marks (B) on each side of the cutting unit to determine the HOC adjustment range. Each mark represents approximately 5mm (0.2 in.) change in height. Make sure brackets on each side are on the same mark.
5. Tighten nuts.
6. Adjust parallelism of front roller. (See Adjust Front Roller - QA5 Reel.)

Results

Front roller range positioned for proper height-of-cut adjustment.



TCT003385 —UN—08JUN12

A—Nut
B—Mark
C—Bracket

OUMX258,000071E -19-08NOV12-1/1

Adjust Front Roller - QA5 Reel

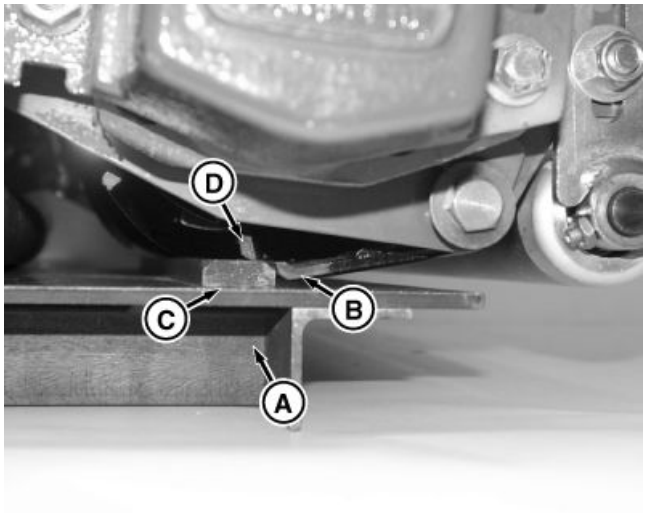
Parallelism Adjustment with Bench Plate

NOTE: Use of a bench plate or a two or three bolt height-of-cut gauge bar is recommended when adjusting front roller parallel with the bed knife.

Always adjust bed knife-to-reel before adjusting front roller for parallelism.

Always make parallelism adjustment after adjusting front roller height of cut range.

1. Position cutting unit upright on flat surface or workbench.
2. Set bench plate (A) on a level surface.
3. Set cutting unit on top of bench plate. The bed knife (B) must rest firmly against the plate stop (C), with the cutting reel blade (D) on top of plate stop.



TCT003386 —UN—08JUN12

A—Plate
B—Knife
C—Plate Stop
D—Blade

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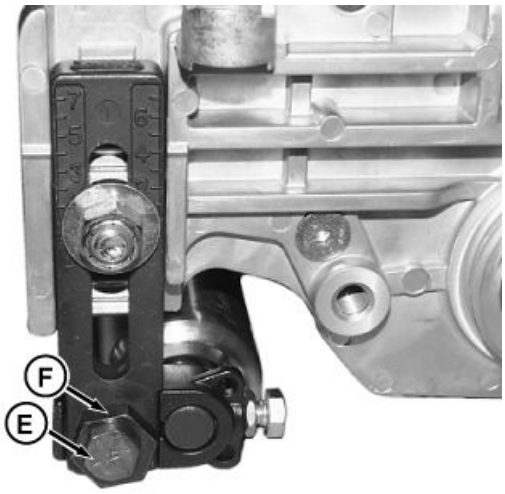
OUMX258,000071F -19-23DEC13-1/3

4. Loosen hex head bolt (E) on one of the roller brackets.
5. Rotate eccentric adjuster (F) until the front roller (G) sits flat and parallel with the bench plate. Gap (H) should not exceed 0.050 mm (0.002 in.) maximum.
6. Hold roller eccentric adjuster (F) and tighten hex head bolt (E).

E—Bolt
F—Adjuster
G—Roller
H—Gap



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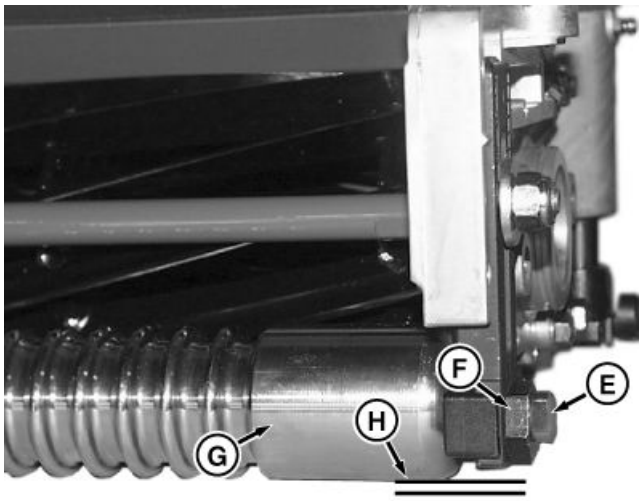

TCT003388 —UN—08JUN12

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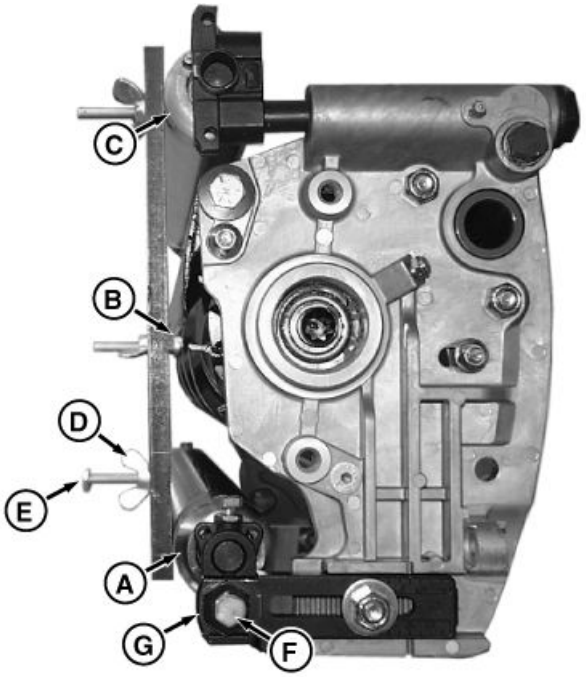
OUMX258,000071F -19-23DEC13-2/3

Parallelism Adjustment with HOC Gauge Bar

1. Position cutting unit upright on flat surface or workbench.
2. Rest HOC gauge bar against front roller (A) approximately 51 mm (2 in.) from the end of the bed knife. Set the inside of the bolt head (B) against the edge of the
3. Hold end of gauge bar against the bottom of front roller (C).
4. Loosen wing nut (D). Turn lower gauge screw (E) clockwise until top of screw makes contact with flat edge of bed knife.
5. Tighten wing nut (D).
6. Adjust position of front roller:
   - Loosen hex head bolt (F) and rotate eccentric adjuster (G) until top of lower gauge screw (E) makes contact with the bed knife.
7. Repeat procedure for opposite side.



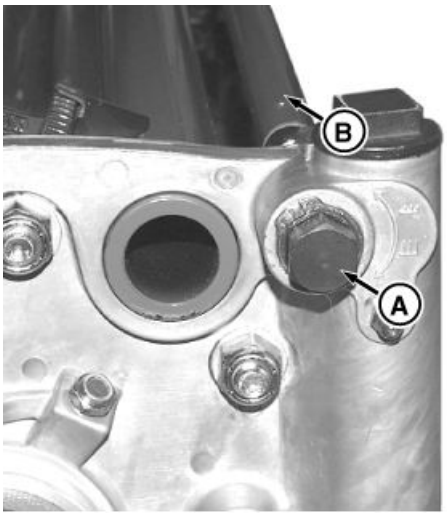
TCT003389 —UN—08JUN12

A—Roller
B—Head
C—Roller
D—Nut
E—Screw
F—Bolt
G—Adjuster

OUMX258,000071F -19-23DEC13-3/3

Adjust Height-of-Cut (HOC) - QA5 Reel

1. Park machine safely on a hard level surface.
2. Locate the height of cut adjuster (A) on top rear of reel side casting (either side).
3. Turn the height of cut adjustment counterclockwise to shorten height of cut or clockwise to lengthen height of cut.



TCT003390 —UN—08JUN12

A—Adjuster
B—Shaft

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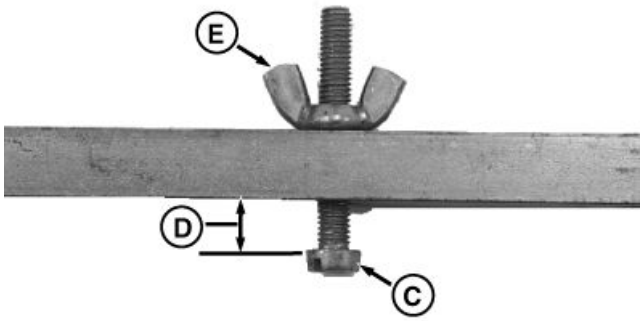
BS62576,00004BC -19-16MAY12-1/4

NOTE: Adjusters are connected with cross shaft (B) so turning one side simultaneously turns the other.

4. On the height-of-cut (HOC) gauge bar, set center adjustment bolt head (C) at the desired height of cut (D). Lock wing nut (E).

C—Bolt
D—Height of Cut
E—Nut

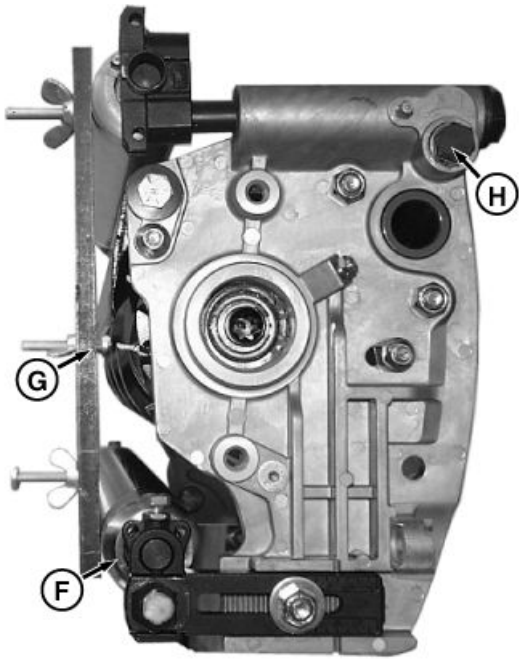


TCT003391 —UN—08JUN12

BS62576,00004BC -19-16MAY12-2/4

5. Rest HOC gauge bar against front roller (F) approximately 51 mm (2 in.) from the end of the bed knife. Set the inside of the bolt head (G) against the edge of the bed knife.
6. Turn adjuster (H) until the rear roller contacts the HOC gauge bar. Repeat for the other side of the cutting reel.
7. Check HOC adjustment setting from side to side and adjust if necessary.

F—Roller
G—Bolt
H—Adjuster



TCT003392 —UN—08JUN12

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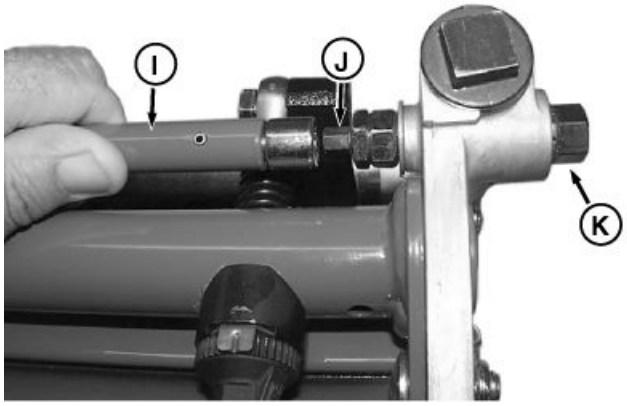
BS62576,00004BC -19-16MAY12-3/4

8. If side to side HOC adjustment is necessary, pull against spring tension on cross shaft (I) to disconnect it from hex coupling (J). Remove the cross shaft.
9. Turn adjuster (K) until side to side HOC is equal, and then reinstall cross shaft.

I— Shaft
J— Coupling
K—Adjuster



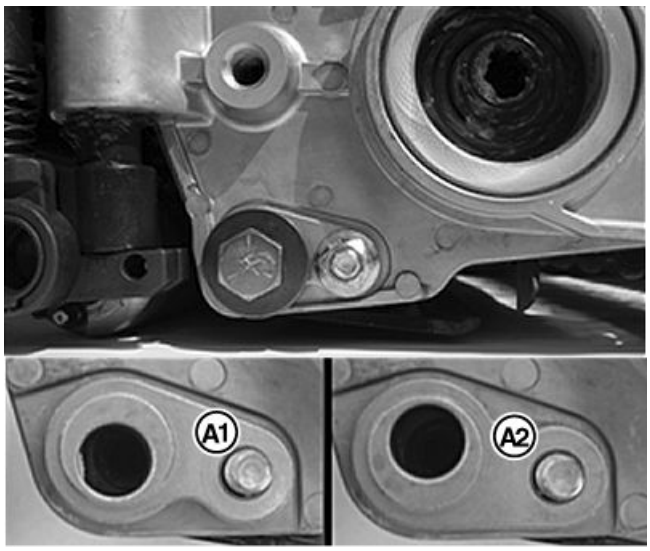
TCT003393 —UN—08JUN12

BS62576,00004BC -19-16MAY12-4/4

Align Cutting Unit Frame - QA5 Reel

CAUTION: Avoid Injury! Blades are sharp and rotate quickly: Keeps hands and feet away from cutting reels while machine is running. Always wear gloves while working on cutting reels. Watch for rotation of cutting reels. Rotating one cutting reel can cause another blade or cutting reel to rotate.

1. Remove cutting unit from machine if attached
2. Place rear of cutting unit on a flat surface or workbench to enable access to bed knife.
3. Inspect bed knife pivot cam (A) on each side of cutting unit. Cams must be oriented in exact same position.
   a. Orient pivot cams with smooth edge facing up (A1) when using new reels.
   b. Orient pivot cams with smooth edge facing down (A2) when reel diameter is 122 mm (4.8 in.) or less. This will promote longer useful life of reel.



TCT003394 —UN—08JUN12

A1—Pivot Cam Up
A2—Pivot Cam Down

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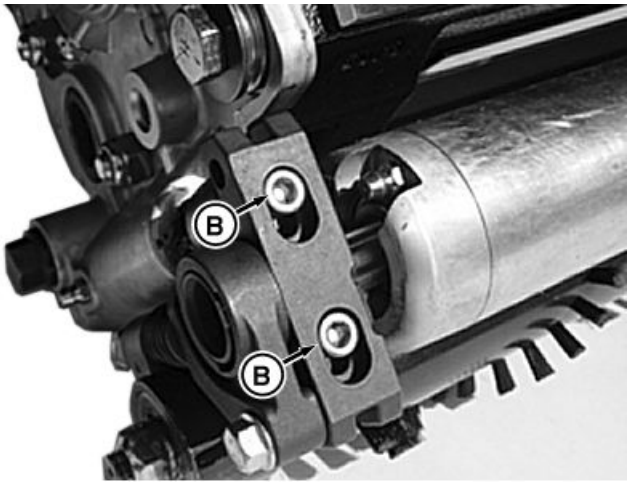
OUMX258,0000720 -19-12JUN14-1/5

4. On either side of cutting unit, loosen, but do not remove rear roller clamp screws (B).

B—Screw

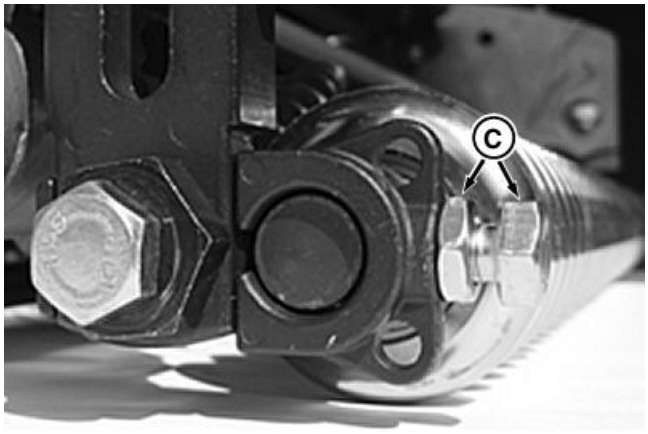


TCT003395 —UN—08JUN12

OUMX258,0000720 -19-12JUN14-2/5

5. On same side of cutting unit, loosen, but do not remove jam nut and screw (C) used to secure front roller to bracket.

C—Screw

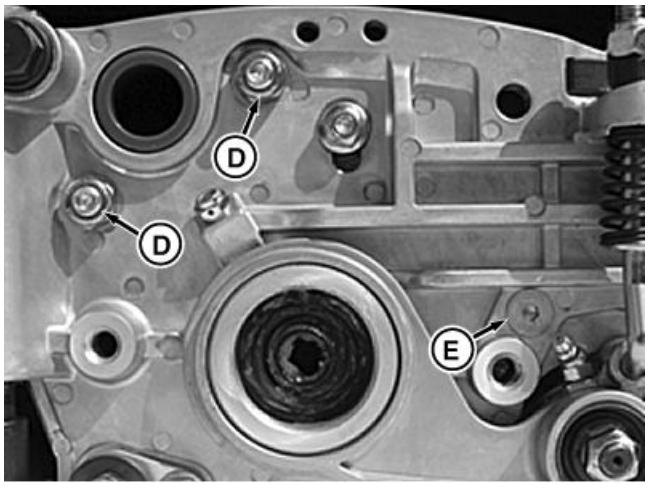


TCT003396 —UN—08JUN12

OUMX258,0000720 -19-12JUN14-3/5

6. On both sides of cutting unit, loosen top cross bar mounting nuts (D). Rotate nuts one-half to three-quarter turn.
7. On either side of cutting unit, loosen front cross rod mounting screw (E).
8. Rotate reel to place maximum number of cutting blades in contact with bed knife during next step.

D—Nut **E—Screw**



TCT003397 —UN—08JUN12

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OUMX258,0000720 -19-12JUN14-4/5

NOTE: Perform bed knife position adjustments gradually and alternately from side to side to prevent bed knife shoe from binding in pivot bushings. Do not rotate bed knife adjustment tower nut (F) more than one half turn per side at one time unless both are no longer contacting bases (H).

9. Rotate bed knife adjustment tower nuts (F) on both sides of cutting unit counterclockwise until they turn freely and bed knife springs (G) are no longer pulling tower nuts against bases (H).
10. Use a 0.025 mm (0.001 in.) gauge to confirm bed knife is now contacting reel across full width of cutting unit.

NOTE: When completing steps 11 and 12, securely support or hold side plate of cutting unit only where hardware is being tightened. Do not support or hold opposite side plate, or efforts to align cutting unit frame may not be successful.

11. Alternately tighten top cross bar mounting nuts (D) incrementally from side to side and on both side of cutting unit to specification. a final torque of 47 N·m (35 lb.-ft).

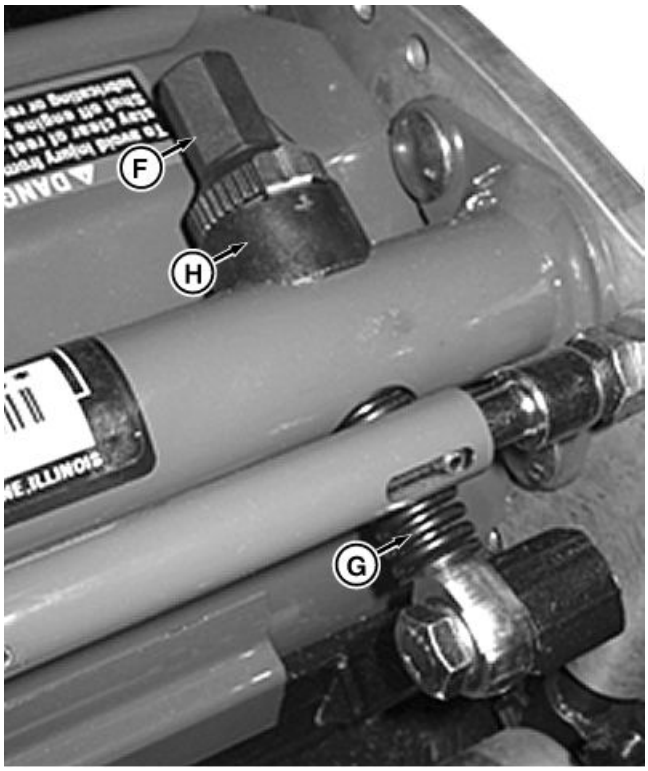
Specification	
Top Cross Bar Mounting Nuts—Torque	47 N·m (35 lb.-ft.)

12. Tighten front cross rod mounting screw (E) to specification.

Specification	
Front Cross Rod Mounting Screw—Torque	20 N·m (177 lb.-in.)

13. Rotate both bed knife adjustment tower nuts clockwise until they contact their base and springs start to compress.

IMPORTANT: Avoid Damage! Once bed knife adjustment tower nuts have contacted their bases, do not rotate tower nuts more than one half turn per side at one time. Ensure final adjustment for clearance is pulling bed knife away from reel.



TCT003398 —UN—08JUN12

F—Nut **H—Base**
G—Spring

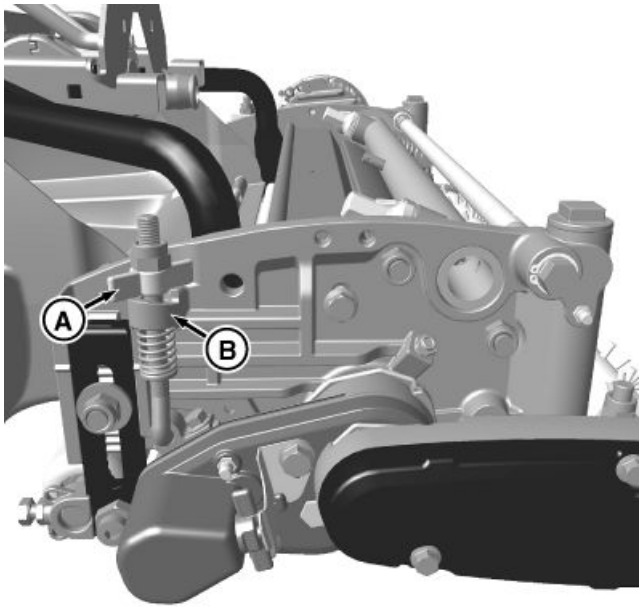
14. Alternating from side to side, gradually rotate bed knife adjustment tower nuts clockwise until bed knife begins to pull away from reel, and reel can be freely rotated by hand.
15. Adjust bed knife to reel clearance. (See Adjust Bed Knife-to-Reel.)
16. Tighten front roller (C) and rear roller (B) clamping hardware.
17. Check front roller parallelism. Adjust as necessary. (See Adjust Front Roller - QA5 Reel.)
18. Check height of cut and rear roller parallelism. Adjust as necessary. (See Adjust Height-of-Cut Range - QA5 Reel.)

OUMX258,0000720 -19-12JUN14-5/5

Adjusting Greens Tender Conditioner (GTC)

1. Rotate GTC adjuster wing nuts (A) to the cutting position. Wings should be at the lowest part of the ramp (B).
2. Position cutting unit to make height of cut adjustment.

A—Nut **B—Ramp**

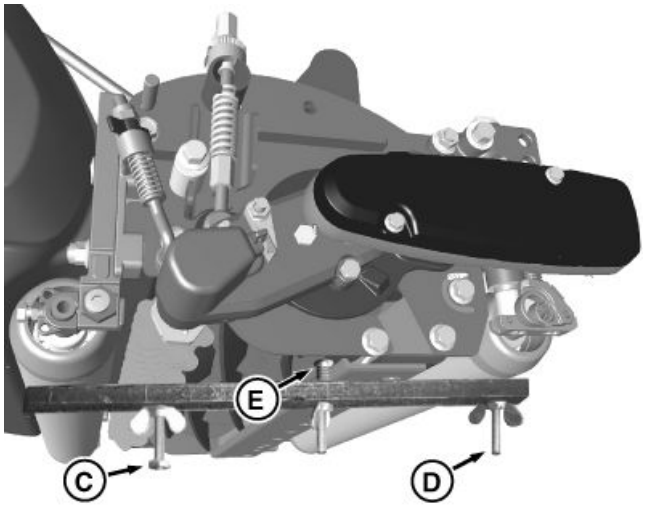


TCT003399 —UN—08JUN12

BS62576,00004BE -19-16MAY12-1/3

3. Set GTC adjustment screw (C) on the gauge bar to the desired operating height.
4. Adjustment screw (D) may need to be loosened so that the gauge bar can rest on both the front and rear rollers.
5. Place preset gauge bar on cutting unit. Hook height of cut screw (E) on bed knife. The ends should rest firmly on the front and rear rollers.

C—Screw **E—Screw**
D—Screw



TCT003400 —UN—08JUN12

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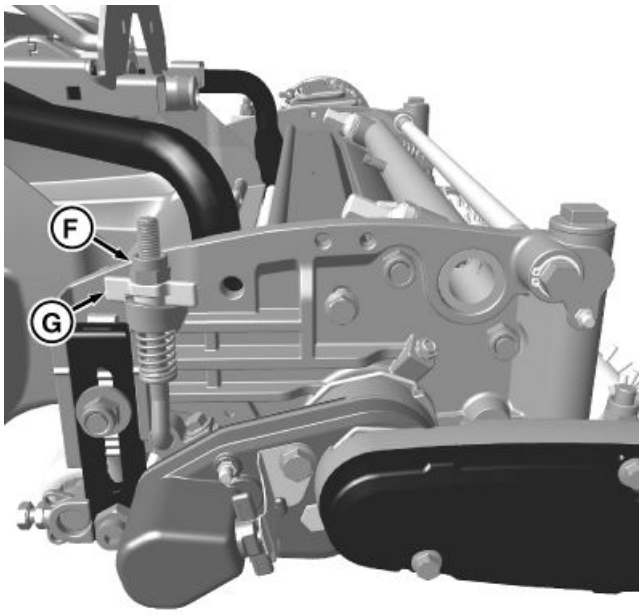
BS62576,00004BE -19-16MAY12-2/3

6. Turn locknut (F) on each side of the cutting unit to raise or lower GTC roller. Alternate from end to end until the cutting teeth touch the screw on the gauge bar on each side.
7. Remove gauge bar.
8. Rotate GTC adjuster wing nuts (G) to raise conditioner.

F—Nut **G—Nut**



TCT003401 —UN—08JUN12

BS62576,00004BE -19-16MAY12-3/3

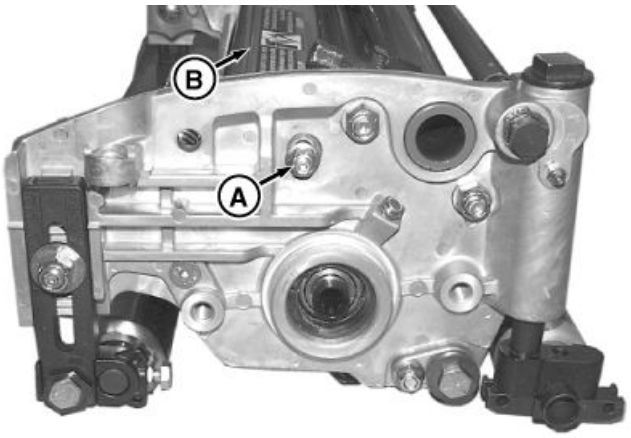
Adjust Cutting Shield

Reason

Correct adjustment of the cutting shield improves the performance of the grass catcher.

1. Remove cutting units from mower.
2. Place cutting unit on a stable working surface.
3. Loosen two bolts (A) and locknuts on each side of cutting unit.
4. Raise or lower shield (B) to desired position.

A—Bolt **B—Shield**



TCT003402 —UN—08JUN12

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BS62576,00004BF -19-16MAY12-1/2

5. Maintain an approximate clearance (C) to specification between the bottom of the shield and the top of the cutting blades.

Specification	
Cutting Shield—Clearance	1.0 mm (0.04 in.)

6. Tighten bolts.

Results

Proper clearance between shield and cutting blades will result in greater grass catching performance.

C—Clearance

TCT003403 —UN—08JUN12

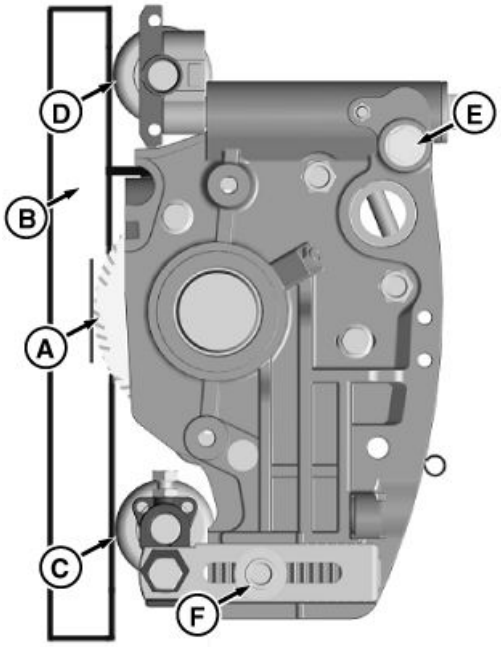
BS62576,00004BF -19-16MAY12-2/2

Adjust Depth-of-Cut - Vertical Cutting Units

Reason

To set the desired cutting depth.

1. Remove cutting units from mower.
2. Place cutting unit on a stable working surface with the front roller facing up.
3. Mark the desired cutting depth (A) on the gauge bar (B).
4. Place gauge bar across the front and rear rollers (C and D) approximately 50 mm (2 in.) in from the end of the rollers.
5. Turn adjuster (E) until the leading edge of the vertical cutting unit blade aligns with the cutting depth on the gauge bar.
6. Rotate the cutting reel back and forth to ensure the tips of the cutting blade do not extend past the mark on the gauge bar.
7. If cutting reel can not be adjusted to correct depth it may be necessary to loosen bolts (F) on each side of front roller height adjuster and set depth-of-cut range.
8. Tighten bolts.



TCT003406 —UN—08JUN12

QA5 Verticut Shown

A—Depth
B—Gauge Bar
C—Roller
D—Roller
E—Adjuster
F—Bolt

Continued on next page

BS62576,00004C0 -19-16MAY12-1/2

NOTE: Adjustment of flap height will depend on turf conditions.

On short turf, lower flap to prevent material from flying out the rear of the cutting unit.

On turf with a lot of thatch, raise flap to allow the removed thatch to exit out the rear of the cutting unit.

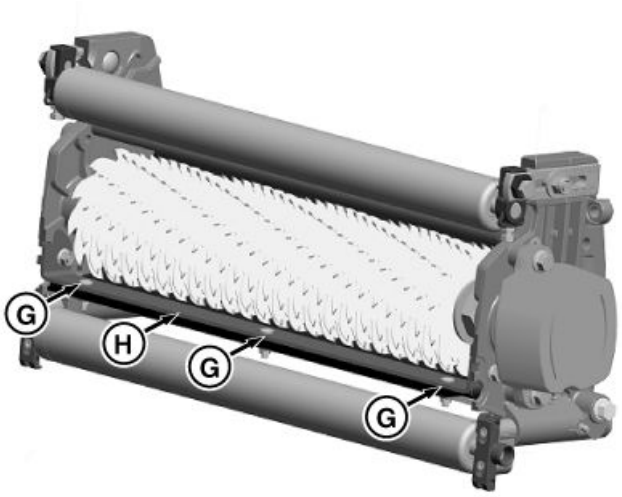
9. Loosen three carriage bolts and hex nuts (G).
10. Adjust flap (H) from the bottom of the rollers to specification.

Specification	
Vertical Cutting Unit Flap Adjustment—Clearance	13 mm (0.50 in.)

11. Tighten hardware.

Results

Height-of-cut should be adjusted to desired level, consistently across cutting unit.



TCT003404 —UN—08JUN12

G—Nut **H—Flap**

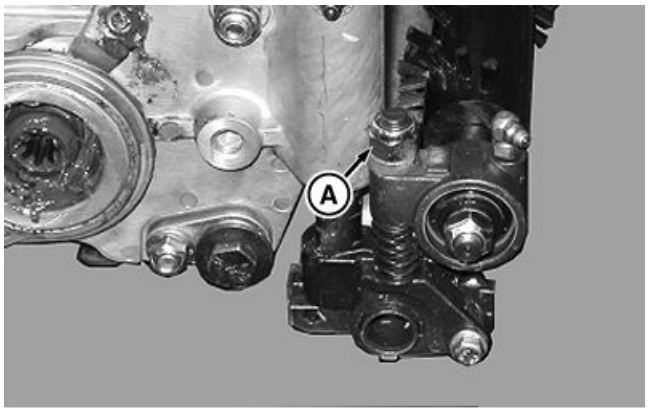
BS62576,00004C0 -19-16MAY12-2/2

Adjust Power Brush

1. Adjust locknuts (A) on both sides of cutting unit to move brush up or down.
2. Adjust both sides evenly and measure between brush and roller until specification is met.

Specification	
Brush to Roller Clearance—Clearance	0-1 mm (0-0.031 in.)

A—Nut



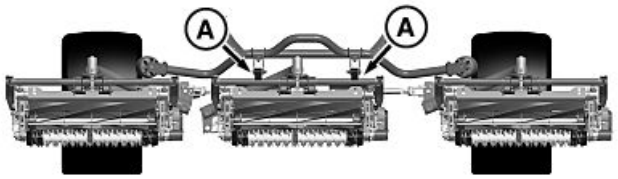
TCT003405 —UN—08JUN12

BS62576,00004C1 -19-16MAY12-1/1

Adjust Lift Arm Cylinder

NOTE: Lift cylinder adjustment is needed to obtain an equal height and angle from vertical when transport position is wanted.

1. Park machine safely. See the “Safety Section”.
2. Raise lift arms to their cross-cut positions.
3. Check center up-stops (A). Attachment should make firm contact with up-stops.



TCT011259 —UN—20MAY14

A—Bump Stops

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CB12260,0000112 -19-02APR15-1/5

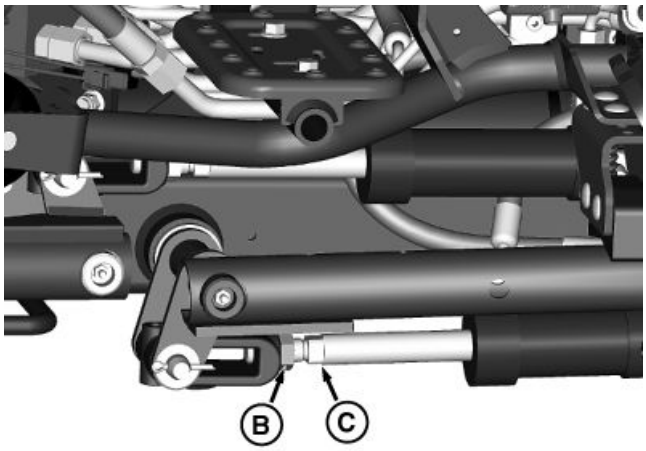
4. If center adjustment is needed, loosen jam nut (B) and turn cylinder flat (C) until attachment makes firm contact with up-stop.
5. Tighten jam nut to specification.

Specification

Lift Arm Cylinder Jam Nut—Torque.....205 N·m (150 lb.-ft.)

6. Check outside reel attachments.

B—Nut **C—Flat**



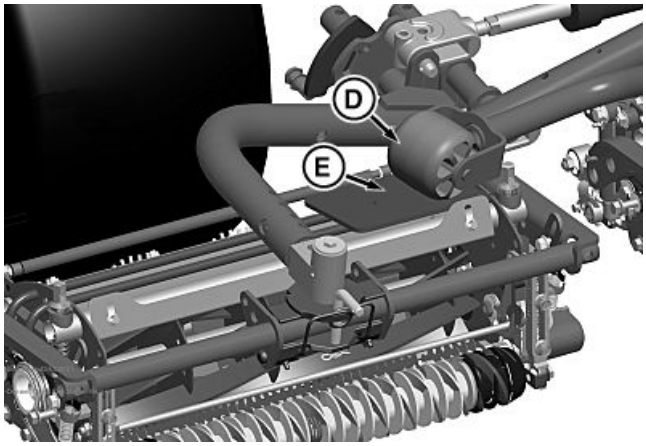
TCT011260 —UN—20MAY14

CB12260,0000112 -19-02APR15-2/5

NOTE: A slight tilt up on the outside of the reel unit is encouraged so the contact between the plates and kick wheel stops is kept even during maneuvering.

7. Kick wheel stops (D) should firmly press against on plate (E).

D—Wheel Stop **E—Plate**



TCT011261 —UN—20MAY14

CB12260,0000112 -19-02APR15-3/5

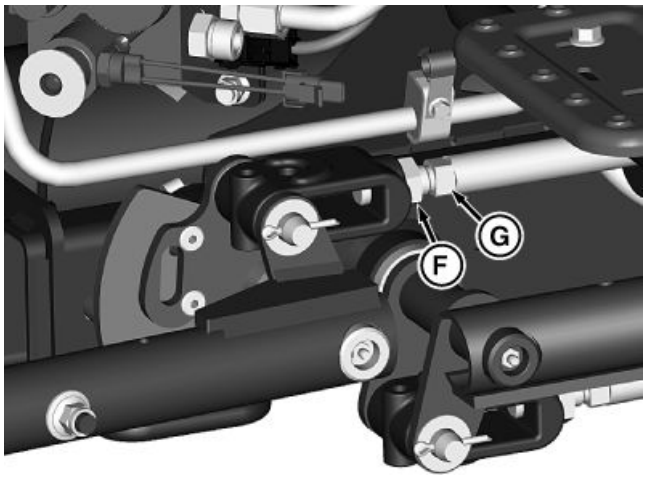
8. If outside adjustment is needed, loosen jam nut (F) and turn cylinder flat (G) until attachment makes firm contact with wheel stop.
9. Tighten jam nut to specification.

Specification

Lift Arm Cylinder Jam Nut—Torque.....205 N·m (150 lb.-ft.)

10. Repeat outside adjustment for opposite side.

F—Nut **G—Flat**



TCT011262 —UN—20MAY14

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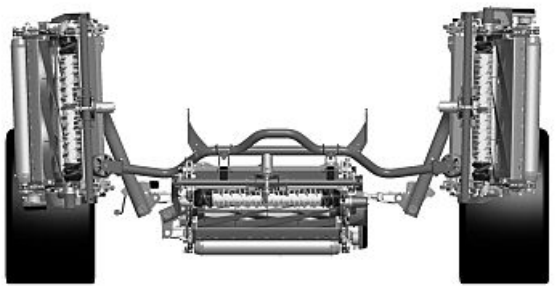
CB12260,0000112 -19-02APR15-4/5

11. Raise lift arms into their transport positions.
12. Outside reels should be close to a vertical position but not over vertical.
13. If reels are over the vertical position, readjust lift arms as covered in previous steps.
14. Adjust proximity flags as necessary. (See Adjust Proximity Flag.)



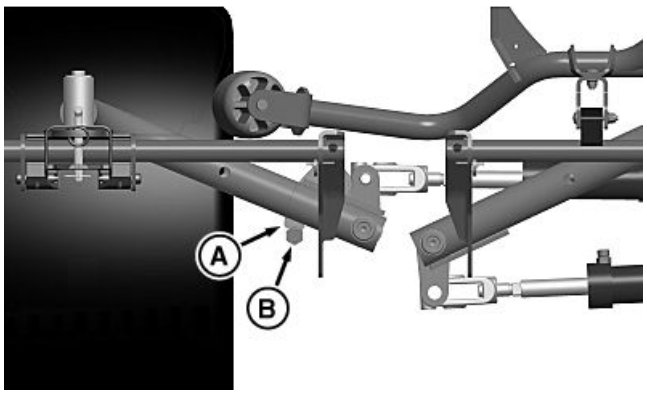
TCT011263 —UN—20MAY14

CB12260,0000112 -19-02APR15-5/5

Adjust Proximity Flag

1. Park machine safely. See the “Safety Section”.
2. Raise reels into there cross cut positions.
3. The bottom of the proximity flag (A) should be positioned just above to top edge of the proximity sensor (B).

A—Proximity Flag **B—Sensor**

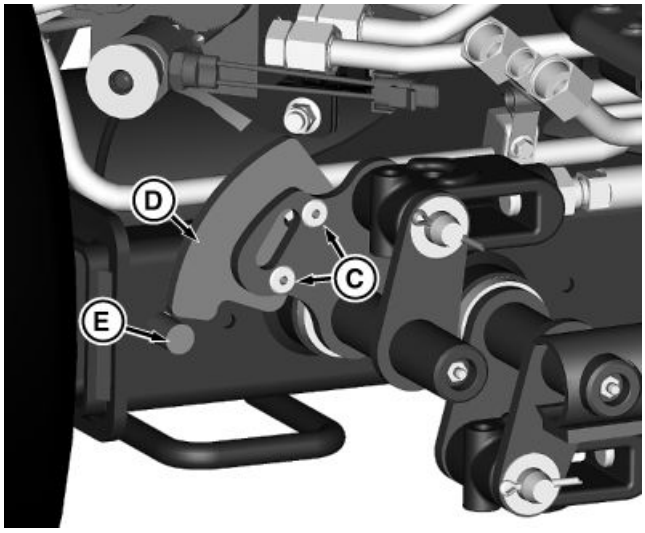


TCT011264 —UN—20MAY14

CB12260,0000113 -19-18JUN14-1/2

4. If adjustment is needed, loosen two screws (C), move proximity flag (D) just above sensor (E),
5. Tighten screws (C) after adjustment.
6. Raise reels to their cross cut and transport positions, determine if lift arm adjustments are needed. (See Adjust Lift Arm Cylinder.)

C—Screws **E—Proximity Sensor**
D—Proximity Flag



TCT011265 —UN—20MAY14

CB12260,0000113 -19-18JUN14-2/2

Section 299
Service Tools

Contents

Page

Group 10—Tools and Kits
Essential or Required Tools 299-10-1
Recommended Tools 299-10-2
Service Equipment and Tools 299-10-4

Essential or Required Tools

NOTE: Order tools from the SERVICEGARD™ Catalog.

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ESSENTIAL TOOLS listed are required to perform the job correctly and are obtainable only from the SERVICEGARD™ Catalog.

OUMX258,0000541 -19-12JUN14-1/16

Cord, Patch..... J-35616-20	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-2/16

Test Box, Diagnostic..... JDG10273	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-3/16

Kit, Flex Probe..... JDG10466	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-4/16

Probe, Flex Male Blue/Gray (3PK).....JDG11233	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-5/16

Probe, Flex (Female) (3PK).....JDG11348	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-6/16

Probe, Flex(Male) (3 PK).....JDG11349	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-7/16

Probe, Flex (3PK).....JDG11524	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-8/16

Probe, Flex (3PK).....JDG11525	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-9/16

Probe, Flex (3PK).....JDG11536	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-10/16

Probe, Flex (3PK).....JDG11537	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-11/16

Probe, Flex (3PK).....JDG11548	Engine Tests and Adjustments

Continued on next page

OUMX258,0000541 -19-12JUN14-12/16

Probe, Flex (3PK) JDG11549	Engine Tests and Adjustments

OUMX258,0000541 -19-12JUN14-13/16

Adaptor, Compression Test JDG11508	Engine Repair

OUMX258,0000541 -19-12JUN14-14/16

Puller JDG10945	Use to remove pulley from reel motor.

OUMX258,0000541 -19-12JUN14-15/16

Tester, Motor JDG10429	Used to test electric reel motor.

OUMX258,0000541 -19-12JUN14-16/16

Recommended Tools

BS62576,0000FFB -19-12JUN14-1/26

Meter, Fluke 88-5/A JT07306	Engine Repair

BS62576,0000FFB -19-12JUN14-2/26

Tool, Valve Guide Removal JDG11461	Engine Repair

BS62576,0000FFB -19-12JUN14-3/26

Installer, Valve Guide JDG11462	Engine Repair

BS62576,0000FFB -19-12JUN14-4/26

Tool, Connecting Rod Bushing JDG11463	Engine Repair

BS62576,0000FFB -19-12JUN14-5/26

Installer, Valve Stem Seal JDG11465A	Engine Repair

BS62576,0000FFB -19-12JUN14-6/26

Tool, Camshaft Remove/Replace JDG11466	Engine Repair

BS62576,0000FFB -19-12JUN14-7/26

Installer, Crankshaft Pulley JDG11467	Engine Repair

BS62576,0000FFB -19-12JUN14-8/26

Set, Bearing and Seal Driver D01045AA	Engine Repair

Continued on next page

BS62576,0000FFB -19-12JUN14-9/26

Tester, Compression D01168AA	Engine Tests and Adjustments

BS62576,0000FFB -19-12JUN14-10/26

Straight Edge, Bevelled Edge D05012ST-A	Engine Repair

BS62576,0000FFB -19-12JUN14-11/26

Kit, Magnetic Follower Holder J-3566-20	Engine Diagnostics

BS62576,0000FFB -19-12JUN14-12/26

Brush, Wire D17024BR	Engine Repair

BS62576,0000FFB -19-12JUN14-13/26

Micrometer, Depth D17511CI	Engine Repair

BS62576,0000FFB -19-12JUN14-14/26

Indicator Dial D17526CI	Engine Repair

BS62576,0000FFB -19-12JUN14-15/26

Expander, Ring JDE135	Engine Repair

BS62576,0000FFB -19-12JUN14-16/26

Compressor, Ring JDE138	Engine Repair

BS62576,0000FFB -19-12JUN14-17/26

Kit, Video Scope JDG11100A	Engine Repair

BS62576,0000FFB -19-12JUN14-18/26

Engine Adaptor JDG11602	Engine Repair

BS62576,0000FFB -19-12JUN14-19/26

Engine Adaptor JDG11648	Engine Repair

BS62576,0000FFB -19-12JUN14-20/26

Fixture, Mounting JDG1676	Engine Repair

BS62576,0000FFB -19-12JUN14-21/26

Ring Compressor, Band JDG1322	Engine Repair

Continued on next page

BS62576,0000FFB -19-12JUN14-22/26

Gage, Piston Liner Height JDG451	Engine Repair

BS62576,0000FFB -19-12JUN14-23/26

Kit, Universal Pressure Test JT05470	Engine Repair

BS62576,0000FFB -19-12JUN14-24/26

Kit, U-Tube Manometer JT05697A	Engine Repair

BS62576,0000FFB -19-12JUN14-25/26

Gun, Non-Contact Temperature Meter JT07253	Engine Repair

BS62576,0000FFB -19-12JUN14-26/26

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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OUMX258,0000542 -19-19AUG14-1/25

Reamer, Valve Guide 8mm.....D20021WI	Used to ream valve guides.

OUMX258,0000542 -19-19AUG14-2/25

Installer, Valve Guide..... JDE118	Used to install new valve guides.

OUMX258,0000542 -19-19AUG14-3/25

Kit, Magnetic Follower Holder.....D15001NU	Used to hold cam followers away from camshaft.

OUMX258,0000542 -19-19AUG14-4/25

Kit, Fuel Injection Nozzle Cleaning..... JDF13	Used to clean fuel injection nozzles.

OUMX258,0000542 -19-19AUG14-5/25

Gauge, Tension JDST28	Measure Belt Deflection to Set Belt Tension

OUMX258,0000542 -19-19AUG14-6/25

Installer, Mower Bushing JDG892	Pressing bushings into housing

OUMX258,0000542 -19-19AUG14-7/25

Kit, Yanmar TNV Diesel Engine Timing Tool JDG10436	Used to adjust fuel injection timing.

Continued on next page

OUMX258,0000542 -19-19AUG14-8/25

Set, Adapter.....D01110AA	Used to test fuel injection nozzles.

OUMX258,0000542 -19-19AUG14-9/25

Tester, Diesel Fuel Injection Nozzle..... D01109AA	Used to test fuel injection nozzles.

OUMX258,0000542 -19-19AUG14-10/25

Straight Adapter.....23622	Used to test fuel injection nozzles.

OUMX258,0000542 -19-19AUG14-11/25

Compression Gauge Assembly.....JT01682	Used to measure cylinder compression.

OUMX258,0000542 -19-19AUG14-12/25

Adapter..... JDG560	Used to measure cylinder compression.

OUMX258,0000542 -19-19AUG14-13/25

Inductive Electronic Tachometer.....JT05801	Used to check engine rpm when setting slow idle speed.

OUMX258,0000542 -19-19AUG14-14/25

Belt Tension Gauge ..... JDG529 or JDST28	Measure Drive Belt Deflection

OUMX258,0000542 -19-19AUG14-15/25

Adapter..... JDG560	Used to pressurize cylinder with compressed air for cylinder leakdown test.

OUMX258,0000542 -19-19AUG14-16/25

Kit, Cooling System Pressure Pump D05104ST	Radiator Pressure Test Kit (Adapters)..... JDG692
Used to measure pressure valve opening pressure.	Used to measure radiator pressure.

OUMX258,0000542 -19-19AUG14-17/25

Hose Assembly.....JT03017	Used to test engine oil pressure.

OUMX258,0000542 -19-19AUG14-18/25

Gauge, Pressure 700 kPa (100 psi) JT07034	Used to test engine oil pressure.

OUMX258,0000542 -19-19AUG14-19/25

Connector 1/8 in. Male BSPT x 7/16-20 UNF 38 ..JT03349	Used to test engine oil pressure.

Continued on next page

OUMX258,0000542 -19-19AUG14-20/25

Tools and Kits

Battery Tester ..... JT05685 or equivalent	To load test battery.

OUMX258,0000542 -19-19AUG14-21/25

Digital Multimeter..... JT05791A	Used for electrical tests.

OUMX258,0000542 -19-19AUG14-22/25

Gauge, Temperature..... JDG282	Used to measure hydraulic system oil temperature.

OUMX258,0000542 -19-19AUG14-23/25

Kit, Pressure Gauge JDG2033	Use to connect pressure gauge for hydraulic relief pressure test.

OUMX258,0000542 -19-19AUG14-24/25

Kit, Diagnostic Flow JDG2032	Use to test steering relief pressure.

OUMX258,0000542 -19-19AUG14-25/25

Index

Page

A

Adjust fuel injection timing 220-30-5
Aftertreatment verification procedure 240-70-16
Alternative lubricants 10-15-4
Alternator, 12 volt
  Install drive belt 20-30-3
  Remove drive belt 20-30-1
Alternator, 48 volt
  Install drive belt 20-30-5
  Remove drive belt 20-30-4
Attachments
  Cutting unit - QA5
    Component location 280-10-1
  Diagnosis
    Diagnose height-of-cut (HOC) changes 280-30-2
    Diagnose marcelling 280-30-1
    Diagnose poor quality of cut 280-30-3
    Diagnose reel does not rotate 280-30-4
    Diagnose streaking 280-30-1
    Diagnose unit not cutting 280-30-4
  Greens tender conditioner (GTC)
    Component location 280-10-2
  Lift arm cylinder, adjust 280-40-16
  Proximity flag, adjust 280-40-18
  Repair
    Greens tender conditioner
      Assemble drive 70-30-9
      Assemble shaft 70-30-14
      Assemble shaft support bracket 70-30-15
      Disassemble drive 70-30-7
      Disassemble shaft 70-30-13
      Disassemble shaft support bracket 70-30-14
      Install 70-30-4
      Remove 70-30-1
    Power brush, install 70-30-19
    Power brush, remove 70-30-16
  Tests and adjustments
    Adjust backlapping and bed knife-to-reel 280-40-2
    Adjust bed knife-to-reel 280-40-1
    Adjust cutting shield 280-40-14
    Adjust depth-of-cut vertical cutting units 280-40-15
    Adjust front roller - QA5 reel 280-40-6
    Adjust height-of-cut (HOC) - QA5 reel 280-40-8
    Adjust height-of-cut ranger - QA5 reel 280-40-6
    Adjust power brush 280-40-16
    Adjusting greens tender conditioner (GTC) 280-40-13
    Align cutting unit frame - QA5 reel 280-40-10
    Backlapping procedure 280-40-2
    Grinding reel and bed knife 280-40-4
    Verticut QA5
      Component location 280-10-3

B

Bolt and screw torque values
  Metric 10-10-1
  Unified inch 10-10-2
Brake release valve
  Remove and install 50-10-4
Brake valve
  Disassemble and Assemble 50-10-5
Brakes
  Theory of operation 270-20-2

C

Cam followers
  Inspection 20-30-44
  Removal and installation 20-30-44
Camshaft
  End play check 220-50-12
  Gear removal and installation 20-30-43
  Inspection 20-30-41
  Removal and installation 20-30-40
CAN Message Not Received 240-70-8
CAN Message Received Error 240-70-9
CAN Message Received Is Incorrect 240-70-10
Cap
  Radiator
    Pressure test 220-50-15
Charge pressure
  Test 250-40-4
Charging circuit
  Diagnose 230-30-1
Component location
  7500A
    Hydrostatic power train 250-10-1
  8000A
    Hydrostatic power train 250-10-2
  Attachments
    Cutting unit - QA5 280-10-1
    Greens tender conditioner (GTC) 280-10-2
    Verticut QA5 280-10-3
  Driveline 250-10-3
  Electrical
    VCU pinout, Non-T4 230-10-6
    VCU pinout, T4 230-10-7
    Wiring harness, command arm 230-10-5
    Wiring harness, non-T4 230-10-1
    Wiring harness, T4 230-10-3
  Hydrostatic assembly 250-10-4
  Hydrostatic back plate assembly 250-10-5
  Steering
    7500A 270-10-1
    8000A 270-10-2

Continued on next page

Page

Compression test, cylinder 220-50-3
Connecting rod
Bearing clearance check..... 220-50-9
Disassemble and assemble..... 20-30-25
Inspect 20-30-27
Remove and install 20-30-23
Side play check..... 220-50-9
Connector
1000 ohm resistor connector 230-40-2
120 ohm resistor connector 230-40-2
Connectors
Alarm connector..... 230-40-17
Brake pressure switch connector..... 230-40-7
Brake solenoid connector 230-40-7
Command arm to main harness connector (red)..... 230-40-4
Command arm to main harness connector (yellow)..... 230-40-5
Crankshaft speed pickup connector..... 230-40-9
Diagnostic connector 230-40-17
Diode connector..... 230-40-16
Display connector 230-40-17
Down pressure kit connector 230-40-9
Forward (inboard) pedal connector..... 230-40-5
Forward hydro solenoid connector..... 230-40-8
Front raise/lower valve connector 230-40-6
Fuel level sensor connector..... 230-40-15
Fuel solenoid connector..... 230-40-15
Fuel transfer pump connector..... 230-40-15
Hyd filter restriction switch connector 230-40-7
Hyd oil temp connector 230-40-8
Key switch connector..... 230-40-2
Kit switched power connector 230-40-9
Lh lift arm position proximity sensor connector 230-40-3
Light switch connector 230-40-1
Main harness to command arm connector (red)..... 230-40-4
Main harness to command arm connector (yellow)..... 230-40-4
Main harness to engine harness connector (gray)..... 230-40-14
Main harness to engine harness connector (red 8-pin)..... 230-40-13
Main harness to engine harness connector (red)..... 230-40-13
Main harness to engine harness connector (yellow)..... 230-40-14
Park brake switch connector..... 230-40-5
Power port connector..... 230-40-17
PTO switch connector..... 230-40-5
Pump angle sensor connector 230-40-8
Raise select valve connector 230-40-7
Rear raise/lower valve connector..... 230-40-6
Reel motor controller connector..... 230-40-16
Reverse (outboard) pedal connector 230-40-6
Reverse hydro solenoid connector 230-40-8

Page

Rh lift arm position proximity sensorr connector 230-40-3
Seat suspension compressor connector 230-40-3
Seat switch connector..... 230-40-3
Starter solenoid connector..... 230-40-2
Vehicle control unit (vcu) connector..... 230-40-10
Work light connectors 230-40-1
Connectos
Raise/lower switch connector 230-40-6
Control Unit Information and Overview..... 240-70-22
Controllers
Adjustments
Engine oil service timer 240-70-4
Hydraulic oil service timer 240-70-5
ECU
Electronic injector Calibration information..... 240-70-16
Theory of operation
CAN Trace..... 240-15-2
Hour meter 240-15-3
Primary display unit - PDU 240-15-3
Coolant
Diesel engine
Light duty..... 10-15-5
John deere COOL-GARD II coolant extender 10-15-6
Coolant pump
Inspection..... 20-30-52
Removal and installation..... 20-30-52
Coolant pump belt tension
Engine..... 220-50-14
Coolant temperature switch test..... 220-50-17
Cooling fan belt tension
Engine
Adjustmen 220-50-13
Cooling system pressure test 220-50-17
Cover, rocker arm
Removal and installation, diesel engine 20-30-9
Cranking circuit, T4
Diagnose..... 230-30-1
Crankshaft
End play check..... 220-50-10
Front oil seal removal and installation..... 20-30-34
Gear removal and installation 20-30-38
Inspection..... 20-30-36
Main bearing clearance..... 220-50-11
Main bearings inspection 20-30-36
Main bearings remove and install 20-30-35
Rear oil seal removal and installation 20-30-33
Remove and install 20-30-35
Cruise control circuit
Diagnose..... 230-30-3
Cruise control screen..... 240-10-8
Cutting unit
Repair
Drive belt, remove and install..... 70-10-4

Continued on next page

Page

Cylinder bore
Inspection 20-30-31
Taper and out- of- round inspection 20-30-33
Cylinder head
Disassembly and assembly 20-30-14
Inspect 20-30-14
Removal and installation 20-30-13
Valve clearance, adjust 220-50-5
Obstucted timing marks 220-50-7
Cylinder leakdown test 220-50-14

D

Diagnosis
Attachments
Diagnose height-of-cut (HOC) changes 280-30-2
Diagnose macelling 280-30-1
Diagnose poor quality of cut 280-30-3
Diagnose reel does not rotate 280-30-4
Diagnose streaking 280-30-1
Diagnose unit not cutting 280-30-4
Engine
Coolant in crankcase 220-20-18
Engine runs rough 220-20-12
Engine starts but does not continue to run 220-20-3
Engine will not start 220-20-1
Excessive fuel consumption 220-20-15
Excessive oil consumption 220-20-16
Exhaust color black under load 220-20-9
Exhaust color white under load 220-20-8
Exhaust temperature too high 220-20-11
Fuel oil in crankcase 220-20-17
Low compression 220-20-20
Low coolant temperature 220-20-20
Low engine output 220-20-4
Low oil pressure 220-20-18
Overheating 220-20-19
Hydraulics
Lift system 260-30-1
Powertrain
Hydrostatic system operating hot 250-30-5
Mower will not move in foward or reverse 250-30-1
Mower will not reach full speed 250-30-2
Noisy pump 250-30-5
Sluggish response to acceleration or deceleration 250-30-4
Trouble shooting hints 250-30-1
Diagnostic trouble codes (DTCs)
ECU
000051.03 240-50-5
000051.04 240-50-7
000100.01 240-50-10
000100.04 240-50-12
000102.03 240-50-14
000102.04 240-50-16

Page

000102.13 240-50-18
000105.03 240-50-20
000105.04 240-50-22
000108.03 240-50-24
000108.04 240-50-25
000108.10 240-50-26
000110.00 240-50-27
000110.03 240-50-29
000110.04 240-50-31
000157.00 240-50-33
000157.03 240-50-35
000157.04 240-50-37
000157.15 240-50-39
000157.16 240-50-41
000157.18 240-50-42
000167.01 240-50-44
000167.05 240-50-45
000173.03 240-50-46
000173.04 240-50-48
000174.00 240-50-50
000174.03 240-50-52
000174.04 240-50-54
000190.00 240-50-56
000412.03 240-51-1
000412.04 240-51-3
000630.12 240-51-5
000633.03 240-51-6
000633.05 240-51-9
000633.06 240-51-12
000651.03 240-51-27
000652.03 240-51-15
000652.05 240-51-17
000652.06 240-51-19
000653.03 240-51-21
000653.05 240-51-23
000653.06 240-51-25
000654.05 240-51-29
000654.06 240-51-31
001209.03 240-52-1
001209.04 240-52-3
001209.13 240-52-6
002791.00 240-53-1
002791.01 240-53-3
002791.07 240-53-6
002791.09 240-53-7
002791.12 240-53-8
002797.06 240-53-9
002798.06 240-53-10
002950.03 240-53-11
002950.04 240-53-13
002950.05 240-53-15
002950.06 240-53-18
002951.03 240-53-21
002951.04 240-53-24
003242.00 240-54-1
003242.03 240-54-3
003242.04 240-54-5
003250.00 240-54-7

Continued on next page

Page

003250.01 240-54-9
003250.03 240-54-11
003250.04 240-54-13
003251.00 240-54-15
003251.03 240-54-17
003251.04 240-54-19
003251.13 240-54-21
003609.03 240-54-23
003609.04 240-54-25
003695.14 240-54-27
003719.00 240-54-28
003719.07 240-54-30
003719.09 240-54-32
003719.16 240-54-33
003720.00 240-54-35
003720.16 240-54-36
004257.12 240-55-1
422571.03 240-55-18
422571.06 240-55-21
422572.06 240-55-24
422572.11 240-55-27
423469.00 240-55-68
423470.00 240-55-70
522243.05 240-55-2
522243.06 240-55-3
522400.02 240-55-5
522400.05 240-55-7
522401.02 240-55-9
522401.05 240-55-12
522401.07 240-55-15
522573.00 240-55-30
522574.00 240-55-31
522575.07 240-55-32
522576.12 240-55-33
522577.11 240-55-34
522579.12 240-55-36
522580.12 240-55-37
522582.07 240-55-38
522583.01 240-55-40
522584.01 240-55-41
522585.12 240-55-42
522588.12 240-55-43
522591.12 240-55-45
522592.12 240-55-48
522596.09 240-55-50
522597.09 240-55-51
522599.09 240-55-51
522600.09 240-55-52
522601.09 240-55-52
522609.09 240-55-53
522610.09 240-55-54
522617.12 240-55-55
522618.09 240-55-56
522619.09 240-55-57
522744.04 240-55-57
522994.04 240-55-58
523249.05 240-55-59
523460.00 240-55-61

Page

523462.13 240-55-63
523463.13 240-55-64
523464.13 240-55-65
523468.09 240-55-66
523473.12 240-55-35
523489.00 240-55-72
523489.12 240-55-44
523491.00 240-55-74
PDU 240-30-1
DPF ash cleaning required 240-20-4
DPF elevated exhaust temperature 240-20-3
DPF filter cleaning required 240-20-5
DPF parked cleaning required (stop level) 240-20-5
DPF parked cleaning required (warning level) 240-20-5
DPF parked regeneration 240-20-4
DPF recovery regeneration 240-20-5
DPF regeneration control 240-20-3
DPF self regeneration — mode select 240-20-3
Machine start status pop-up DTC 240-30-2
Warning icons 240-30-1
RMC
000628.12 240-60-4
002513.03 240-60-5
002513.04 240-60-6
002513.05 240-60-7
002514.03 240-60-8
002514.04 240-60-9
002514.05 240-60-10
002515.03 240-60-11
002515.04 240-60-12
002515.05 240-60-13
003511.00 240-60-14
003511.01 240-60-15
003597.00 240-60-16
003597.01 240-60-17
521153.15 240-60-18
522327.00 240-60-19
522917.00 240-60-21
522917.06 240-60-22
522917.15 240-60-24
522917.16 240-60-25
522918.00 240-60-27
522918.02 240-60-28
522918.15 240-60-30
522919.03 240-60-32
522919.12 240-60-33
523666.00 240-60-34
523666.01 240-60-35
523666.02 240-60-36
VCU
000070.14 240-40-5
000096.01 240-40-6
000096.03 240-40-7
000096.16 240-40-8

Continued on next page

Page

000100.01 240-40-10
000110.00..... 240-40-12
000158.00 240-40-14
000158.01 240-40-16
000168.00 240-40-18
000168.01 240-40-19
000168.16 240-40-21
000168.18 240-40-22
000190.00 240-40-23
000190.01 240-40-24
000190.02 240-40-25
000190.09 240-40-26
000629.12 240-40-27
000639.12 240-40-28
000639.14 240-40-28
000677.03 240-40-29
000677.04 240-40-30
000677.14 240-40-31
000677.31 240-40-31
000920.03 240-40-33
000920.04 240-40-32
000976.14 240-40-34
001504.14 240-40-35
001638.00 240-40-37
001713.00 240-40-38
001713.03 240-40-39
001713.31 240-40-40
003509.03 240-40-41
003509.04 240-40-42
003510.03 240-40-43
003510.04 240-40-44
516124.03 240-40-45
516124.04 240-40-46
516125.03 240-40-47
516125.04 240-40-48
516135.03 240-40-49
516135.04 240-40-50
516183.02 240-40-51
516183.03 240-40-52
516183.04 240-40-53
516184.02 240-40-54
516184.03 240-40-55
516184.04 240-40-56
516199.03 240-40-57
516199.04 240-40-58
516207.03 240-40-59
516207.04 240-40-60
516708.00 240-40-61
520608.14 ..... 240-40-61, 240-40-62
520871.31 240-40-63
520872.31 240-40-64
520873.31 240-40-65
520957.03 240-40-66
520957.04 240-40-67
521427.31 240-40-69
522011.08..... 240-40-70
522405.03 240-40-71
522405.04 240-40-72

Page

522405.31 240-40-73
522771.31 240-40-74
523324.02 240-40-76
523324.03 240-40-77
523324.04 240-40-78
523324.10 240-40-80
523324.13 240-40-81
523324.16 240-40-82
523324.18 240-40-84
523590.03 240-40-85
523590.04 240-40-86
523590.08 240-40-87
523590.13 240-40-88
523590.14 240-40-89
523590.16 240-40-89
523590.18 240-40-90
523590.31 240-40-91
523591.03 240-40-92
523591.04 240-40-93
523591.08 240-40-94
523591.13 240-40-95
523591.14 240-40-96
523591.16 240-40-96
523591.18 240-40-97
523591.31 240-40-98
523652.31 240-40-75
523735.03 240-40-99
523735.04 240-40-100
524069.03 240-40-101
524069.04 240-40-102
Quick reference table 240-40-1
Diesel Fuel
Storage 10-15-1
Diesel Fuel, Using 10-15-1
Diesel particulate filter menu screen 240-10-6
Diesel particulate filter regeneration, TechControl..... 240-10-17
Display setup screen 240-10-9
Driveline
Component location..... 250-10-3
Driveline components
Install..... 40-10-5
Remove..... 40-10-4
DTCs RMC quick reference..... 240-60-1
DTCs, TechControl display of stored codes 240-10-13

E

Electrical
Component location
VCU pinout, Non-T4 230-10-6
VCU pinout, T4..... 230-10-7
Wiring harness, command arm 230-10-5
Wiring harness, non-T4 230-10-1
Wiring harness, T4 230-10-3
Connectors
Engine control unit (ECU), 60 pin..... 230-40-12

Continued on next page

Page

Engine control unit (ECU), 94 pin 230-40-11
Diagnostics
Charging circuit 230-30-1
Cranking circuit, T4 230-30-1
Cruise control circuit 230-30-3
Engine & hydraulic temperature circuit 230-30-2
Engine oil pressure circuit 230-30-2
Forward drive circuit 230-30-2
Lift-lower-mow circuit 230-30-1
Preheater 230-30-2
Reverse drive circuit 230-30-3
Electronic controllers
Accessing diagnostic trouble codes 240-70-17
Fuses and relays, non-T4 30-20-4
Fuses and relays, T4 30-20-5
Repair
12 Volt alternator, install 30-10-4
12 Volt alternator, remove 30-10-3
48 volt alternator 30-10-6
48 Volt alternator, remove 30-10-5
48 volt voltage regulator 30-10-8
48 volt voltage regulator install 30-10-10
Battery, install 30-10-2
Battery, remove 30-10-1
Schematics
48V 230-50-18
Splices 230-50-20
Command arm with Y axis control 230-50-1
Engine connector
Controls and sensors 230-50-25
X5057 230-50-21
X5058 230-50-22
X5059 230-50-23
X5060 230-50-24
Main
Splices, T4 230-50-17
Main schematic, T4 230-50-9
Main, Non-T4 230-50-2
Splices 230-50-8
Reel controllers schematic 230-50-18
Tests and adjustments
Air pre-heater test 230-60-6
Battery charge 230-60-4
Battery load test 230-60-4
Battery voltage and specific gravity test 230-60-3
Brake valve, lift valve solenoid test 230-60-12
CAN resistor test 230-60-11
Common circuit tests 230-60-1
Diode test 230-60-11
Engine oil pressure switch test 230-60-6
Fuel pump test 230-60-9
Fuel shutoff solenoid test 230-60-10
Fuse test 230-60-10
Glow plug test 230-60-7

Page

Ground circuit test 230-60-2
Key switch test 230-60-7
Park brake switch 230-60-8
PTO switch 230-60-8
R-1 resistor test 230-60-11
Regulated voltage output test 230-60-5
Relay test 230-60-9
Test hydraulic filter restriction switch 230-60-15
Test hydraulic temperature switch 230-60-14
Test raise/lower switch 230-60-17
Test reel motor 230-60-13
Test reel motor phase wire 230-60-13
Warning alarm test 230-60-12
Theory of operation
Air preheater circuit, non-T4 230-20-7
CAN bus 240-15-2
CAN bus message structure 240-15-1
Charging circuit 230-20-5
Cranking circuit, non-T4 230-20-4
Cranking circuit, T4 230-20-4
Cruise control circuit 230-20-9
Data bus systems 240-15-2
Engine & hydraulic temperature circuit, T4 230-20-6
Engine and hydraulic temperature circuit, non-T4 230-20-6
Engine oil pressure circuit, non-T4 230-20-5
Engine oil pressure circuit, T4 230-20-6
Glow plug circuit, T4 230-20-7
Lift/lower/mow circuit 230-20-5
Power circuit, non-T4 230-20-2
Power circuit, T4 230-20-3
Traction drive circuit 230-20-8
Wiring harness
Command arm harness 30-20-19
Color codes 30-20-28
Connectors 30-20-2
Load center, non-T4 30-20-4
Load center, T4 30-20-5
Main harness, non-T4 30-20-6
Color codes 30-20-23
Connectors 30-20-1
Main harness, T4 30-20-12
Color codes 30-20-25
Connectors 30-20-2
Reel harness
Color codes 30-20-29
Connectors 30-20-2
Reel motor controller harness
Connectors 30-20-3
Reel power harness, 48V 30-20-21
Electrical connectors
Terminal test 240-70-11
Electrical diagnostic trouble codes overview 240-15-3

Continued on next page

Page

Electrical Electronic Controllers CAN Network Voltage Checks ... 240-70-20
Electronic controllers
CAN communication fault checks ... 240-70-18
Control unit messaging errors ... 240-70-19
Erroneous diagnostic trouble codes ... 240-70-22
Electronic injector
Calibration information ... 240-70-16
Engine
3TNV84T
Remove and install ... 20-30-6
Adjustment
Coolant pump belt tension ... 220-50-14
Cooling fan belt tension ... 220-50-13
Alternator, 12 volt
Install drive belt ... 20-30-3
Remove drive belt ... 20-30-1
Alternator, 48 volt
Install drive belt ... 20-30-5
Remove drive belt ... 20-30-4
Diagnosis
Coolant in crankcase ... 220-20-18
Engine runs rough ... 220-20-12
Engine starts but does not continue to run ... 220-20-3
Engine will not start ... 220-20-1
Excessive fuel consumption ... 220-20-15
Excessive oil consumption ... 220-20-16
Exhaust color black under load ... 220-20-9
Exhaust color white under load ... 220-20-8
Exhaust temperature too high ... 220-20-11
Fuel oil in crankcase ... 220-20-17
Low coolant temperature ... 220-20-20
Low engine output ... 220-20-4
Low oil pressure ... 220-20-18
Overheating ... 220-20-19
Flywheel, remove and install ... 20-30-38
Information ... 20-40-1
Install ... 20-40-10
Oil pan, crankcase extension, and strainer
Remove and install ... 20-30-48
Remove ... 20-40-3
Repair
Install staring motor 3TNV86CT engine ... 20-10-4
Remove starting motor 3TNV86CT engine ... 20-10-1
Tests and adjustments
Valve clearance, adjust ... 220-50-5
Obstucted timing marks ... 220-50-7
Engine & hydraulic temperature circuit
Diagnose ... 230-30-2
Engine oil pressure circuit
Diagnose ... 230-30-2
Engine oil pressure test ... 220-50-19
Engine Repair 3TNV86CT
Fuel Filter
Water Separator ... 20-40-1

Page

Engine rpm, TechControl ... 240-10-12
Engine, diesel
Rocker arm cover removal and installation ... 20-30-9
Exhaust manifold removal and installation ... 20-30-19

F

Filter, Exhaust
Exhaust Filter System ... 240-20-1
Flywheel
Remove and install ... 20-30-38
Forward drive circuit
Diagnose ... 230-30-2
Front oil seal, crankshaft, replacement ... 20-30-34
Fuel injection nozzle test ... 220-30-6
Fuel injection nozzles
Disassembly and assembly ... 20-30-60
Inspect and clean ... 20-30-62
Removal and installation ... 20-30-59
Fuel system
Bleed ... 220-30-10
Leakage test ... 220-30-8
Fuel tank
Install ... 80-30-3
Remove ... 80-30-1
Fuel transfer pump
Flow test ... 220-30-9
Pressure test ... 220-30-9

G

Grind valve seats ... 20-30-20

H

Hardware torque values
Metric ... 10-10-1
Unified inch ... 10-10-2
Hydraulic pump
Assemble ... 50-20-7
Disassemble ... 50-20-4
Install ... 50-20-2
Remove ... 50-20-1
Hydraulics
Brake release valve
Remove and install ... 50-10-4
Brake valve
Disassemble and assemble ... 50-10-5
Diagnosis
Lift system ... 260-30-1
Front lift cylinder, install ... 50-10-8
Front lift cylinder, remove ... 50-10-7
Hydraulic pump
Assemble ... 50-20-7
Disassemble ... 50-20-4

Continued on next page

Page

Install 50-20-2
Remove 50-20-1
Lift arm bushing, install 80-10-3
Lift arm bushing, remove 80-10-3
Lift arm, install 80-10-4
Lift arm, remove 80-10-3
Lift valve
Disassemble and assemble 50-10-3
Remove and install 50-10-2
Schematics
Main, 7500A 260-50-1
Main, 8800A 260-50-4
Tests and adjustments
Bleed hydraulic system 260-40-1
Lift pump flow, test 260-40-2
Lift system leakage, test 260-40-3
Lift system relief pressure, test 260-40-2
Pump flow, steering-charge test 260-40-3
Warm up hydraulic oil 260-40-1
Hydrostatic assembly
Component location 250-10-4
Hydrostatic back plate assembly
Component location 250-10-5
Hydrostatic power train
Component location
7500A 250-10-1
8000A 250-10-2
Hydrostatic pump
Assemble 40-10-22
Disassemble 40-10-12
Inspect 40-10-17
Install 40-10-10
Remove 40-10-7
Hydrostatic system relief pressure
Test 250-40-3
Hydrostatic transmission
Theory of operation 250-20-2
Hydrostatic transmission calibration, TechControl 240-10-16
Hydrostatic valve calibration, TechControl 240-10-17

I

I/O Status Displays, PDU 240-70-1
Idler gear
Inspection 20-30-47
Removal and installation 20-30-46
Injection pump
Timing 220-30-1
Input/Output, TechControl display of status 240-10-13
Intake manifold
Removal and installation 20-30-20

Page

L

Language select 240-10-11
Lap valves 20-30-21
Lift arm bushing
Install 80-10-3
Remove 80-10-3
Lift arm cylinder
Adjust 280-40-16
Lift arm, install 80-10-4
Lift arm, remove 80-10-3
Lift cylinder, front
Install 50-10-8
Remove 50-10-7
Lift pump flow, test 260-40-2
Lift system
Theory of operation 260-20-1
Lift system leakage, test 260-40-3
Lift system relief pressure, test 260-40-2
Lift valve
Disassemble and assemble 50-10-3
Remove and install 50-10-2
Lift-lower-mow circuit
Diagnose 230-30-1
LoadMatch screen 240-10-8
Lubricant
Alternative 10-15-4
Mixing 10-15-5
Storage 10-15-5
Synthetic 10-15-4

M

Metric bolt and screw torque values 10-10-1
Metric torque values (grade 7) 10-10-2
Mixing of lubricants 10-15-5
Mow engine speed screen 240-10-6
Mow speed screen 240-10-7
Mower setup menu screen 240-10-1, 240-10-4

O

O-ring boss fittings 10-10-3
Oil cooler removal and installation 20-30-51
Oil filters 10-15-2
Oil pan, crankcase extension, and strainer
Remove and install 20-30-48
Oil pump
Disassembly/ assembly 20-30-49
Inspect 20-30-49
Removal/ installation 20-30-48
Oil seal
Front crankshaft, removal and installation 20-30-34
Rear crankshaft, removal and installation 20-30-33

Continued on next page

Page

Oil, Engine 10-15-2
Operator's station
  Seat, remove and install 80-20-1

P

Pass codes 240-10-10
Pass codes, changing 240-10-19
Pass codes, reset to factory settings 240-10-20
PDU
  Cruise control screen 240-10-8
  Diesel Particulate Filter (DPF) menu 240-10-6
  Diesel particulate filter regeneration 240-10-17
  Display navigation 240-10-1
  Display setup screen 240-10-9
  Engine rpm 240-10-12
  Hydrostatic transmission calibration 240-10-16
  Hydrostatic valve calibration 240-10-17
  I/O Status Displays 240-70-1
  Input/Output status display 240-10-13
  Language select 240-10-11
  LoadMatch screen 240-10-8
  Mow engine speed screen 240-10-6
  Mow speed screen 240-10-7
  Mower Setup Menu 240-10-4
  Pass code, changing 240-10-19
  Pass codes 240-10-10
  Pass codes, reset 240-10-20
  Pedal calibration 240-10-16
  Reel speed screen 240-10-6
  Service Menu 240-10-5
  Service timer setting 240-10-15
  Stored DTCs 240-10-13
  Text select, on or off 240-10-12
  Transport speed screen 240-10-7
  Turn speed screen 240-10-7
Pedal calibration, TechControl 240-10-16
Piston
  Disassemble and assemble 20-30-25
  Inspect 20-30-27
  Remove and install 20-30-23
Piston- to- cylinder head clearance, measure 20-30-22
Port location
  Test
    Drive train 250-40-1
Power train
  Repair
    Hydrostatic pump, assemble 40-10-22
    Hydrostatic pump, disassemble 40-10-12
    Hydrostatic pump, inspect 40-10-17
    Hydrostatic pump, install 40-10-10
    Hydrostatic pump, remove 40-10-7
    Install driveline components 40-10-5
    Remove driveline components 40-10-4
    Start up procedure 40-10-50
    Wheel motor assembly, front
      Assemble 40-10-38
      Disassemble and inspect 40-10-34
      Install 40-10-33
      Remove 40-10-32
    Wheel motor final checks 40-10-49
    Wheel motor, rear
      Install 40-10-49
      Remove 40-10-48
  Tests and adjustments
    Charge pressure, test 250-40-4
    Hydrostatic system relief pressure, test 250-40-3
    Test port location 250-40-1
Powertrain
  Diagnosis
    Hydrostatic system operating hot 250-30-5
    Mower will not move in foward or reverse 250-30-1
    Mower will not reach full speed 250-30-2
    Noisy pump 250-30-5
    Sluggish response to acceleration or deceleration 250-30-4
    Trouble shooting hints 250-30-1
Preheater circuit
  Diagnose 230-30-2
Problem not found procedure 240-70-25
Proximity flag
  Adjust 280-40-18
Pump flow, steering-charge test 260-40-3
Pump, fuel injection, installation 20-30-57
Pump, fuel injection, removal 20-30-54

R

Rear oil seal, crankshaft, replacement 20-30-33
Reel - QA5
  Bed knife, remove and install 70-20-8
  Front roller, remove and install 70-20-10
  Front roller, repair 70-20-10
  Rear roller, remove and install 70-20-11
  Reel and bed knife, inspect 70-20-7
  Repair
    Remove and install 70-20-3
Reel motor
  Orientation 70-10-3
  Remove and install 70-10-1
Reel motor controller signals 240-15-5
Reel motor safety interlock operating conditions 240-15-5
Reel speed screen 240-10-6
Remove and install
  Starting motor 20-10-1
Repair
  Attachments
    Greens tender conditioner
      Assemble drive 70-30-9
      Assemble shaft 70-30-14
      Assemble shaft support bracket 70-30-15
      Disassemble drive 70-30-7

Continued on next page

Page

Disassemble shaft 70-30-13
Disassemble shaft support bracket 70-30-14
Install 70-30-4
Remove 70-30-1
Power brush, install 70-30-19
Power brush, remove 70-30-16
Cutting unit
Drive belt, remove and install 70-10-4
Reel - QA5
Bed knife, remove and install 70-20-8
Front roller 70-20-10
Front roller, remove and install 70-20-10
Rear roller, remove and install 70-20-11
Reel and bed knife, inspect 70-20-7
Remove and install 70-20-3
Reel motor
Drive belt 70-10-4
Orientation 70-10-3
Remove and install 70-10-1
Steering cylinder--7500A
Install 60-10-6
Reverse drive circuit
Diagnose 230-30-3
Rocker arm assembly
Inspection 20-30-11
Removal and installation 20-30-10
Rocker arm cover
Removal and installation, diesel engine 20-30-9

S

Safety, Avoid High-Pressure Fluids
Avoid High-Pressure Fluids 10-05-4
Schematics
Electrical
48V schematic 230-50-18
Splices 230-50-20
Command arm with Y axis control 230-50-1
Engine connector X5057 230-50-21
Engine connector X5058 230-50-22
Engine connector X5059 230-50-23
Engine connector X5060 230-50-24
Engine controls and sensors 230-50-25
Main schematic
Splices, T4 230-50-17
Main schematic, Non-T4 230-50-2
Splices 230-50-8
Main schematic, T4 230-50-9
Reel controllers schematic 230-50-18
Hydraulic
Main schematic
7500A 260-50-1
8000A 260-50-4
Seat
Remove and install 80-20-1

Page

Service Fuel Filter
Service Water Separator
Engine Repair 3TNV86CT 20-40-1
Service menu screen 240-10-5
Service timer, adjustment 240-10-15
Short to voltage procedure 240-70-15
Slow idle adjustment 220-50-4
Starter gear train disassemble and assemble 20-10-10
Starter motor
Inspect and test 20-10-8
Starter solenoid
Disassemble, inspect and assemble 20-10-13
Starting motor
Disassembly and assembly 20-10-6
Removal and installation 20-10-1
Steering
7500A
Steering cylinder
Remove 60-10-5
8000A
Steering clevis
Remove and install 60-10-11
Steering cylinder
Remove and install 60-10-9
Component location
7500A 270-10-1
8000A 270-10-2
Diagnosis
Excessive steering wheel free play 270-30-3
High steering effort in both directions 270-30-4
High steering effort in one direction 270-30-4
Sluggish steering response 270-30-2
Steering cylinder will not fully extend or retract 270-30-5
Steering shimmy 270-30-1
Steering wanders 270-30-1
Install column cover 60-10-3
Install steering valve 60-10-4
Remove and install steering wheel 60-10-1
Remove column cover 60-10-2
Remove steering valve 60-10-3
Repair
Steering spindle
Install 60-10-7
Remove 60-10-7
Tie rod end
Remove and install 60-10-8
Steering Cylinder
Install 60-10-6
Tests and adjustments
Steering control unit (SCU) leakage, test 270-40-2
Steering system leakage, test 270-40-1

Continued on next page

Page

Steering system relief pressure, test ... 270-40-3
Toe-in, check and adjust ... 270-40-4
Steering clevis
8000A
Remove and install ... 60-10-11
Steering column cover
Install ... 60-10-3
Remove ... 60-10-2
Steering control unit (SCU)
Leakage test ... 270-40-2
Steering cylinder
7500A
Remove ... 60-10-5
8000A
Remove and install ... 60-10-9
Steering spindle
Repair
Install ... 60-10-7
Remove ... 60-10-7
Steering system
Leakage test ... 270-40-1
Relief pressure, test ... 270-40-3
Steering valve
Repair
Install ... 60-10-4
Remove ... 60-10-3
Steering wheel
Remove and install ... 60-10-1
Synthetic lubricants ... 10-15-4

T

Terminal test ... 240-70-11
Tests and adjustments
Attachments
Adjust backlapping and bed knife-to-reel ... 280-40-2
Adjust bed knife-to-reel ... 280-40-1
Adjust cutting shield ... 280-40-14
Adjust depth-of-cut vertical cutting units ... 280-40-15
Adjust front roller - QA5 reel ... 280-40-6
Adjust height-of-cut (HOC) - QA5 reel ... 280-40-8
Adjust height-of-cut ranger - QA5 reel ... 280-40-6
Adjust power brush ... 280-40-16
Adjusting greens tender conditioner (GTC) ... 280-40-13
Align cutting unit frame - QA5 reel ... 280-40-10
Backlapping procedure ... 280-40-2
Grinding reel and bed knife ... 280-40-4
Electrical
Air pre-heater test ... 230-60-6
Battery charge ... 230-60-4
Battery load test ... 230-60-4

Page

Battery voltage and specific gravity test ... 230-60-3
Brake valve, lift valve solenoid test ... 230-60-12
CAN resistor test ... 230-60-11
Common circuit tests ... 230-60-1
Diode test ... 230-60-11
Engine oil pressure switch test ... 230-60-6
Fuel pump test ... 230-60-9
Fuel shutoff solenoid test ... 230-60-10
Fuse test ... 230-60-10
Glow plug test ... 230-60-7
Ground circuit test ... 230-60-2
Key switch test ... 230-60-7
Park brake switch ... 230-60-8
PTO switch ... 230-60-8
R-1 resistor test ... 230-60-11
Regulated voltage output test ... 230-60-5
Relay test ... 230-60-9
Test hydraulic filter restriction switch ... 230-60-15
Test hydraulic temperature switch ... 230-60-14
Test raise/lower switch ... 230-60-17
Test reel motor ... 230-60-13
Test reel motor phase wire ... 230-60-13
Warning alarm test ... 230-60-12
Hydraulics
Bleed hydraulic system ... 260-40-1
Warm up hydraulic oil ... 260-40-1
Turbocharger
Waste gate test ... 220-40-9
Text on or off display ... 240-10-12
Theory of operation
Attachments
Performance variables ... 280-20-4
Reel and bed knife grinding ... 280-20-2
Rollers ... 280-20-3
Vertical cutting unit ... 280-20-3
Brakes ... 270-20-2
Controllers
CAN Trace ... 240-15-2
Hour meter ... 240-15-3
Primary display unit - PDU ... 240-15-3
Electrical
Air preheater circuit, non-T4 ... 230-20-7
CAN bus message structure ... 240-15-1
CAN bus operation ... 240-15-2
Charging circuit ... 230-20-5
Cranking circuit, non-T4 ... 230-20-4
Cranking circuit, T4 ... 230-20-4
Cruise control circuit ... 230-20-9
Data bus systems ... 240-15-2
Engine & hydraulic temperature circuit, T4 ... 230-20-6
Engine and hydraulic temperature circuit, non-T4 ... 230-20-6
Engine oil pressure circuit, non-T4 ... 230-20-5

Continued on next page

Page

Engine oil pressure circuit, T4 230-20-6
Glow plug circuit, T4 230-20-7
Lift/lower/mow circuit 230-20-5
Power circuit, non-T4 230-20-2
Power circuit, T4 230-20-3
Traction drive circuit 230-20-8
Hydrostatic transmission 250-20-2
Lift system 260-20-1
Thermostat
Opening test 220-50-16
Removal and installation 20-30-51
Throttle cable adjustment 220-30-7
Tie rod end
Repair
Remove and install 60-10-8
Timing
Injection pump 220-30-1
Timing gear backlash check 220-50-12
Timing gear cover mounting plate removal and installation 20-30-47
Timing gear cover removal and installation 20-30-45
Toe-in, steering
Check and adjust 270-40-4
Torque charts
Metric 10-10-1
Unified inch 10-10-2
Torque value
Flat face O-ring seal fitting 10-10-4
O-Ring boss fitting 10-10-3
Torque values
Metric (grade 7) 10-10-2
Transport speed screen 240-10-7
Turbocharger
Extending life 220-40-2
Prelube 20-20-2
Removal and installation 20-20-1
Repair 20-20-1
Rotor shaft axial play check 220-40-7
Rotor shaft radial play check 220-40-8
Seven- step inspection 220-40-4

Page

Waste gate test 220-40-9
Turn speed screen 240-10-7

U

Unified inch bolt and screw torque values 10-10-2

V

Valve lift check 220-50-8
Valves
Disassembly and assembly 20-30-14
Inspect 20-30-14
Removal and installation 20-30-13
Verification
Aftertreatment verification procedure 240-70-16
Verification Procedure 240-70-13

W

Water separator
Disassembly and assembly 20-30-53
Wheel motor
Final checks 40-10-49
Wheel motor assembly, front
Assemble 40-10-38
Disassemble and inspect 40-10-34
Install 40-10-33
Remove 40-10-32
Wheel motor, rear
Install 40-10-49
Remove 40-10-48
Wheels
Front, remove and install 80-10-1
Rear, remove and install 80-10-2
Wiggle test
Intermittent diagnostics 240-70-14